GEOPHYSICAL SURVEY
SOUTHERN NYANZA PROVINCE
KENYA

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KENYA

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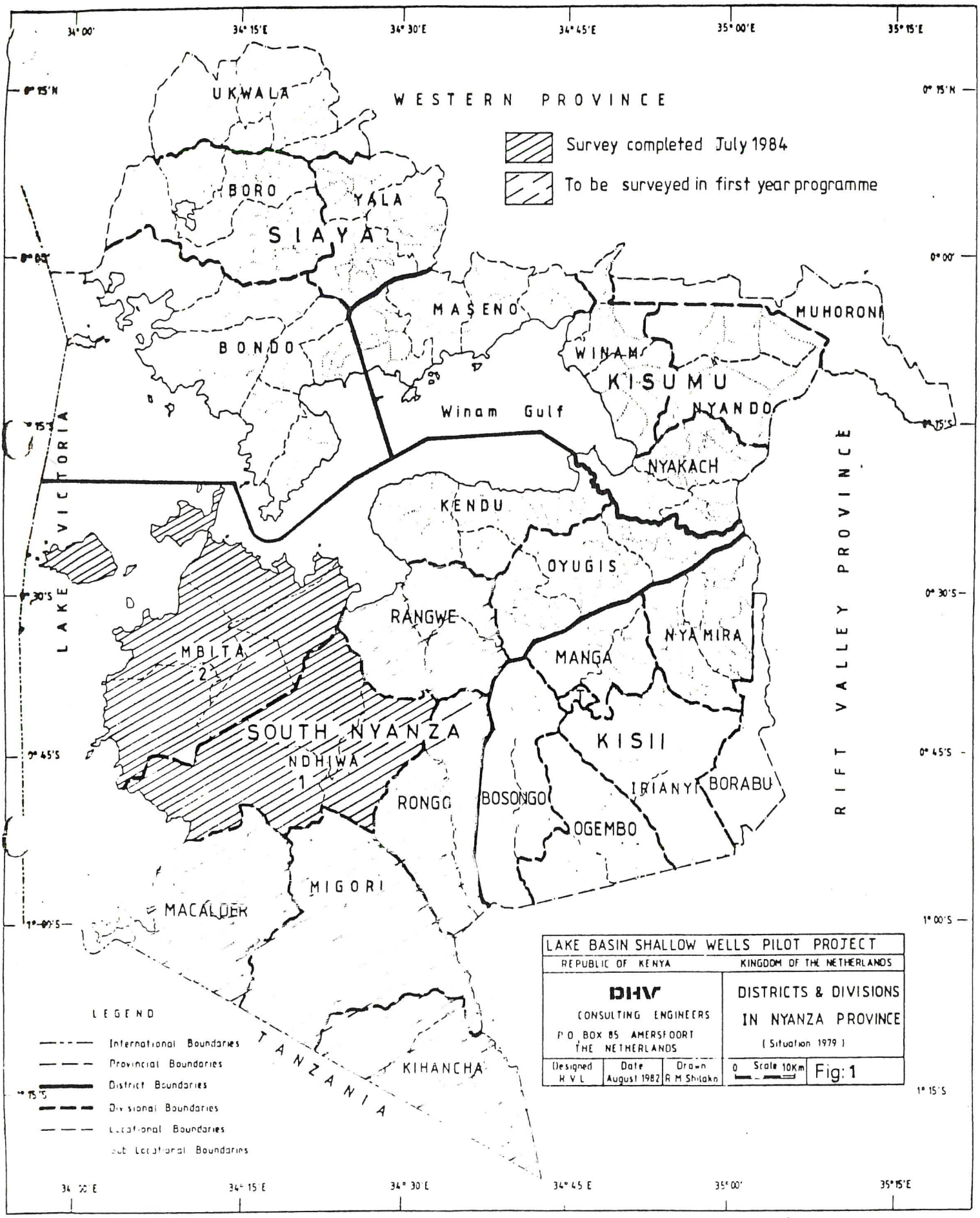
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1. INTRODUCTION

The TNO-DGV Institute of Applied Geoscience, commissioned by DHV Consulting Engineers, has carried out processing and interpretation of geophysical data, recorded at 41 sites in Nyanza Province in Kenya. The sites are located in the Ndhiwa and Mbita Divisions (figure 1). The geophysical investigations are a part of the "Lake Basin Rural Water Supply and Sanitations Programme" participated by LBDA (Lake Basin Development Authority) and DHV. The object of the programme is to provide good water supply (handpumps) and sanitation facilities near schools, markets and villages in the Lake Basin area. The geophysical survey is meant to be a helpful instrument in finding the most favourable location for hand drilling or machine drilling at the sites.

At one site several vertical electrical soundings were carried out along a profile, which location was determined on base of an areal photo-interpretation map of lineaments (DHV). Between the vertical electrical soundings, horizontal electrical and electromagnetic profiling data were collected as well.
The fieldwork was executed from April to July 1984 by a Kenyan survey-crew supervised by DHV. Sixty sites have been investigated in total. Fourty-one sites were selected to be processed and interpreted by TNO-DGV.
Before sending the data to TNO-DGV in The Netherlands, a preliminary interpretation was carried out by DHV. This resulted in several locations for handdug or machine drilled holes. The obtained results are included in the processing and interpretation of the data of the 41 selected sites.
The interpretation has resulted in a hydrogeological description of each site and the most suitable locations and depths for a handdug or machine drilled hole.



Figuur 1. Location map Nyanza Province

2. HYDROGEOLOGY

Ndhiwa and Mbita Division are mainly underlain by Precambrian and Tertiary volcanics or sediments (see figure 2).
The Precambrian series consist of metamorphosed volcanic rocks of the Nyanzian system (Na), small granitic intrusions (G) and a formation of conglomerates and arkosic sandstones of the Kavirondian system (Kc).
In the Tertiary Miocene lake beds (Tm) were sedimented and the Kisingiri (and other) volcano(s) in Mbita Division developed. Large parts of the area were covered with its lava's up to 1000 m thick. At the end of the Tertiary a period of normal faulting resulted in a NW-SW trending graben system, bounded on the SE side by the Kanyamwa Fault Escarpment and on the NW side by the Kisingiri volcano (fig. 2). During the Pleistocene times the graben system was filled with lacustrine sediments (R). At the same time in situ weathering of the rocks and decomposition to clay has taken place (R). At some places a hard lateritic layer or a black cotton soil have developed on top. In some rivervalleys sandy alluvial deposits were formed. In the major part of the area the Precambrian and Tertiary rocks are present within 50 m depth under several layers of different degrees of weathered rock.

Relatively good hydraulic permeabilities can be expected in fractured or weathered volcanic rock and in sandy clay. Pure clay (lake deposits or totally decomposed rock) has a very low permeability. Fresh rock and hard lateritic layers usually do not have any permeability.
The depth to the groundwater table varies widely in the area (5 to 50 m below surface) and is usually unknown at the sites. The depth to the groundwater table with respect to the depth of the potential aquifers determines the possibility to find groundwater at a site.
The clay or sandy clay layers are the most favourable for constructing handdug wells of large diameter, but in many cases the hard lateritic layer and rocks are obstacles for hand digging.
The fractured or weathered volcanic rock and the relative deep sandy clay layers are the most favourable for drilled bore holes.
In the largest part of the area the groundwater will be fresh (EC < 1500 μ S/cm). However in some parts it can be brackish or saline due to locally high evaporation, caused by a relatively shallow groundwater level.

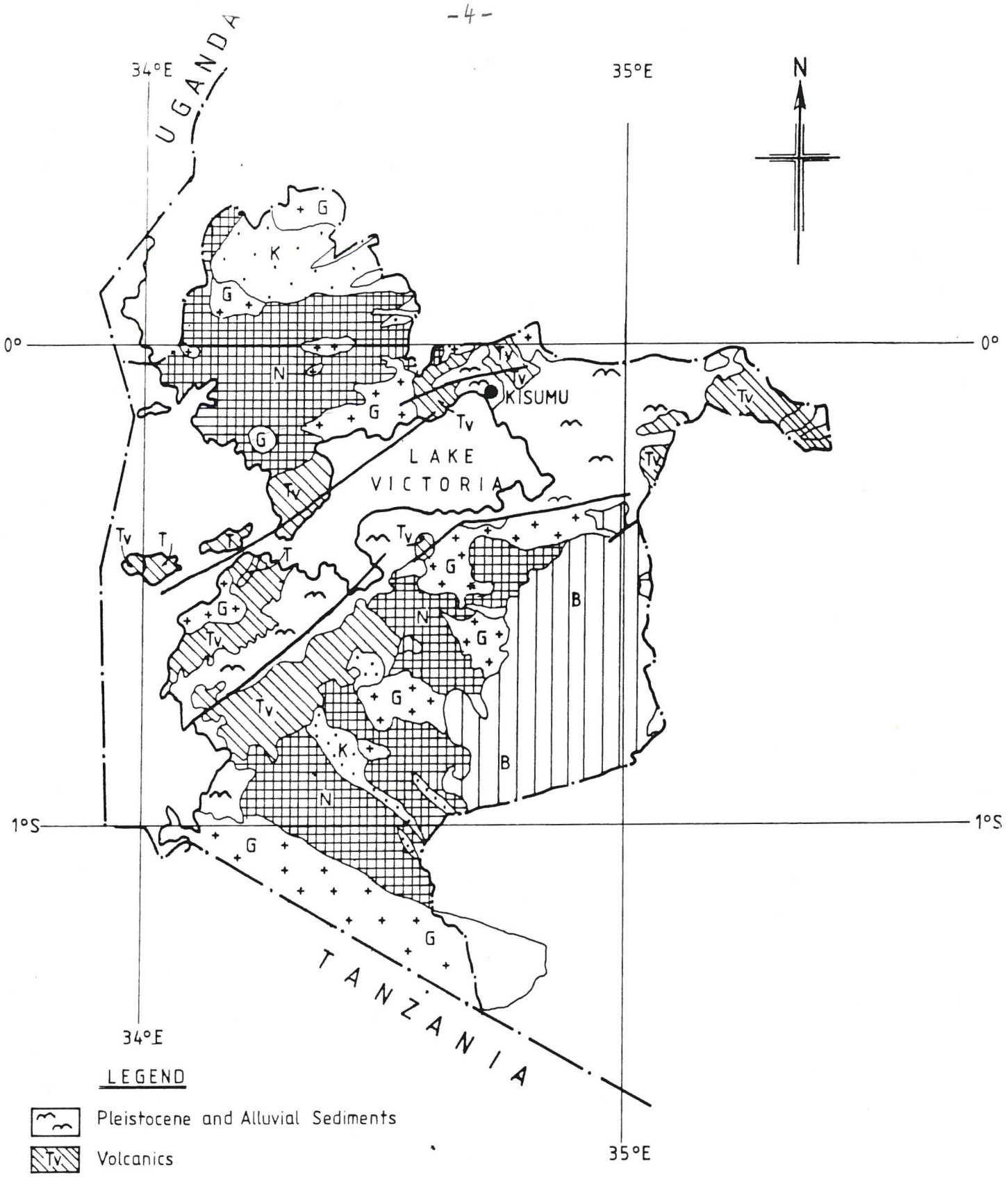


Fig. 2 Simplified Geological Map of Nyanza Province

(After Chief Geologist, Mines & Geological Dept, Nairobi, 1967)

3. GEOPHYSICS

3.1 Electrical resistivities of different lithological units

The earth consists of lithological units with different electrical resistivities. The groundwater quality influences the resistivities of the earth as well. For each area, with specific lithology and groundwater quality, a correlation of lithology (and groundwater quality) and electrical resistivities can be composed. By actually measuring the resistivity of the earth with geophysical equipment, conclusions about the lithology or groundwater quality can be drawn with this knowledge.

The resistivities encountered in the Nyanza Province are given in table 1. The correlation found is obtained by comparing drilling results with the interpretation of the electrical soundings.

Lithology	Electrical resistivity (ohmm)
soil	10 - 40
hard lateritic layer	> 40
sandy clay	8 - 20
clay fresh	5 - 8
clay saline	1.5 - 5
decomposed, altered rock	15 - 25
weathered rock	25 - 50
partly weathered, fractured rock	50 - 150
fresh rock (tertiary volcanic)	> 150 (>80)

Table 1. Correlation between lithology and resistivity in Nyanza Province

3.2 Geophysical survey

During the geophysical survey sixty sites have been investigated. With the help of areal photographs and Landsat images two maps of the lineament patterns of the two Divisions were made by DHV.

These were used to determine the location and direction of the profiles near the main objects at the site like schools, markets, etc.

At each site several vertical electrical soundings have been carried out along the profiles. Half the maximum current electrode distance (AB/2) of a Schlumberger configuration was 100 m. From the vertical electrical soundings the resistivities and thicknesses of the horizontal layers in the earth can be interpreted to a depth of 50 - 75 m, which is probably below the groundwaterlevel at most sites.

Electrical (AB/2 = 30 m) and electromagnetic (S = 20 m) profiles have been executed, with a depth of investigations of about 25 m.

The profiling data reflect lateral changes in electrical resistivities, corresponding with shallow variations in resistivities and thicknesses of the layers.

Fourty-one sites have been selected by DHV for processing and interpreting by DGV-TNO. Twentythree sites lie in Ndhiwa Division, eighteen in Mbita Division. In tables 2 and 3 the measurements are listed for Ndhiwa and Mbita Division respectively.

Annex Nr.	Site	Number of VES	Length of profiles (m) Electrical	Electromagn.	Lithology[1]	Depth holes (m)[2] Drilled	Handdug	EC (µS/cm)[3] Groundwater	Groundwater restlevel (m)
1	Obera	5	1300	-	Kc	(40)	13.2(20),20.8(25)	550,760(f)	8.50,18.40
2	Ndhiwa D.	3	1300	-	Na, Tv	(40)	10 (20)	200(f)	5
3	Ndhiwa IRD.	4	1300	-	Na	(50)	19.1(25)	600(f)	17.1
4	Ndhiwa M.	6	1350	-	Na	(40)	15.2(25)	600(f)	9
5	Ndere	9	570	-	Tv	(50)	9.2 (25)	1100(f)	8
6	Nyarongi	7	700	700	Tv	42(40)	2.5 (-)	810(f)	20.8
7	Osani	6	750	750	Na, Tv	45(40)	(25)	760(f)	9.9
8	Koguta	7	1250	800	Kc	42(45)	(25)	390(f)	10.3
9	Otange	5	600	600	Kc	30,36(80)	(-)	dry(f)	dry
10	Ongeng	7	500	500	Kc	(35)	14 (15)	1400(f)	13.8
11	Kobodo	5	500	500	Tv	(45)	(20)	(f)	-
12	Mirogi SS	5	450	450	Tv	30(35)	(-)	620(f)	12
13	Mirogi PS	5	610	610	Tv	(35)	(-)	(f)	-
14	Ndisi	5	660	660	Tv	40(40)	(15)	600(f)	8.3
15	Sedede	4	360	360	Tv	(40)	(-)	(f)	-
16	Rambusi	5	470	470	R	(>75)	(-)	(f)	-
17	Mifuare	5	980	980	Na, R	30(30)	(22)	2300(s)	24.8
18	Kosiemo PS	5	800	800	Tv	39(35)	(-)	1700(s)	26
19	Kosiemo V.	5	550	550	Tv	(40)	(-)	(s)	-
20	Kodero	5	480	480	Tv, R	(35)	(-)	(s)	-
21	Aora	4	360	360	Tv	(40)	(-)	(f)	-
22	Agolo Muok	4	380	380	Tv, R	64(40)	(-)	790(f)	24
23	Thimlich	10	1070	660	Na	54(75)	(-)	dry(f)	dry
	Total	112	15840	9570		11	8	2(s), 13(f)	4 dry, 15 water

1. Lithology: Precambrian volcanics (Na), Kavirondian Conglomerates (Kc), Tertiary volcanics (Tv), clay, alluvium (R)

2. 30 (40) : Depth hole 30 m (recommended depth 40 m)

3. (f)(s) : Expected salinity: < 1500 µS/cm(f), > 1500 µS/cm (s).

Table 2. List of geophysical data and (recommended) boreholes of Ndhiwa Devision.

Annex Nr.	Site	Number of VES	Length of profiles (m) Electrical	Electromagn.	Lithology[1]	Depth holes (m)[2] Drilled	Handdug	EC (µS/cm)[3] Groundwater	Groundwater restlevel (m)
24	God Jope	5	450	450	R, Tv [1]	(40)	(-)	(f)	-
25	Kamsama	5	540	540	R	(40)	(15)	(f)	-
26	Kamayoge	4	380	380	R, Tv	(50)	(-)	(f)	-
27	Ruri	4	300	300	R	(75)	(-)	(f)	-
28	Gingo	4	300	300	R, Tv	(45)	(20)	(f)	-
29	Makende	4	270	270	Tv	(45)	(30)	(f)	-
30	Onywere	5	510	510	R, Na	(45)	(25)	(f)	-
31	Ongera	6	650	650	R, Na	(55)	(30)	(f, s)	-
32	Game Wardens	4	300	300	R, Tv	(60)	(35)	(f)	-
33	Makende	4	250	250	Tv	(40)	(25)	(f)	-
34	NYC	5	400	400	Tv	(30)	(-)	(f, s)	-
35	Wiga	5	370	370	R, Tv	(60)	(25)	(f)	-
36	Kigoto	4	300	300	Tv	(35)	(-)	(f)	-
37	Tonga	5	400	400	R, Tv	(35)	(20)	(f)	-
38	Magunga	5	400	400	Tv	(45)	(30)	(f)	-
39	Nyenga	4	300	300	R, Tv	(35)	(15)	(f)	-
40	Nyatambe	5	410	410	R, Tv	(50)	(30)	(f)	-
41	Kiabuya	5	410	410	Tv	(40)	(-)	(f)	-
	Total	83	7440	7440				2(s), 16(f)	

1. Lithology : Precambrian volcanics (Na), Tertiary volcanics (Tv), clay, alluvium (R)
2. 30 (40) : Depth hole 30 m (recommended depth 40 m)
3. Expected salinity: (f) : EC < 1500 µS/cm
   (s) : EC > 1500 µS/cm

Table 3. List of geophysical data and (recommended) boreholes of Mbita Division

3.3 Geophysical interpretation

The vertical electrical soundings are interpreted by means of a computer programme written by TNO for the HP 9816. The interpretation of several soundings along a profile results in a layered resistivity section, from which conclusions can be drawn about the hydrogeological set-up of the site. For reasons of convenience the successive layers have been given letter symbols, starting from the deepest layer with A. Horizontal changes in thickness or resistivity of the layers, show up in the resistivity and electromagnetic profiles. The electromagnetic horizontal loop profiles can also reveal small vertical conductive features, like fractured zones or faults. In the case of a vertical conductor an anomaly will be measured, consisting of an apparent resistivity high with two small resistivity lows at both sides.

When all geophysical data are interpreted a drilling or digging location is determined. If the bedrock is shallow (< 10m) or the resistivities of the above lying layers are high (> 50ohmm) no handdug hole or well is recommended. In case of a very thick sediment cover handdigging is dissuaded because the groundwaterlevel is too deep. In most cases the depth of the recommended handdug holes will be between 10-25m below surface. When handdigging for groundwater is too difficult a borehole location and depth should be selected. Fractured zones, faults and places where the resistivities of the rocks are 25 - 100ohmm are favourable conditons to find groundwater. If the clay and sand layers are thick (> 50m), very deep boreholes have to be made to reach the bedrock. The measurements do not reveal information about the groundwater level. An indication of groundwaterquality can be derived from the resistivities of the interpreted clay layers. If the resistivity is less then 4 ohmm, groundwater with an electrical conductivity higher then 1500 µS/cm can be expected. The drilling results up to now are listed in table 2 and 3. They are mainly positive. The three drilled dry holes can be explained by the presence of a very thick clay layer (> 50m). The holes in Otange should have been drilled much deeper. The hole in Thimlich can better be replaced to an other location, where the rocks are at a shallower depth. The 2.5m deep shallow hole in Nyarongi was stopped because of the presence of rocks at shallow depth, as can be seen in the cross-section.

For each site an annex is given, comprising :

- a short description of the hydrogeology and the (recommended) drilled or handdug holes;
- location sketch;
- an interpreted geo-electrical cross-section;
- vertical electric soundings;
- horizontal electrical and electromagnetic profiles.

4. GENERAL CONCLUSIONS AND RECOMMENDATIONS

The geophysical survey executed in Ndhiwa and Mbita Division of Nyanza Province in Kenya appears to be very useful in planning an optimal handdigging and drilling program for the shallow wells project. In fifteen holes groundwater was found. The four dry holes could have been avoided by a better preliminary interpretation. Summarizing it can be concluded that the geophysical measurements provide information about :

- the depth to the rocks;
- the type of rock and its degree of weathering;
- the fractured zones or faults;
- the thicknesses of clay and sandy clay layers;
- the presence of a hard lateritic layer;
- the salinity of the groundwater and the presence of salty clay.

The depth to the groundwater table could not be interpreted from the geophysiscal measurements.

The evaluation of the results of the handdug and machine drilled holes, the geology and the geophysical data give a good insight in the presence of groundwater in the Ndhiwa and Mbita Divisions. It can be divided in to five different areas with specific geological and groundwater prospects:

- The area with rocks of the Nyanzian system and granite (Precambrian). Groundwater can be found in fractured zones and faults and sometimes in the thin transition zone between fresh rock and the in situ weathering product. In between the faults only very small quantities or no groundwater at all are found.
- The area where the Kavirondian conglomeratic rocks (Precambrian) are present. This formation probably possesses a very low permeability, but groundwater can be found in sufficient quantities in fractured zones and faults.
- The area with Tertiary volcanic basalt. The basalt layers are lying subhorizontal over older formations. The upper weathered part of the basalt layers normally are permeable and are suitable aquifers. Probably everywhere groundwater can be found in the upper basalt layer at rather shallow depth. Groundwater can be found as well in the vertical fractured zones or faults.

- Areas with a thick sediment cover (> 50m, Tertiary and Pleistocene), consisting of clay and sandy clay layers. These areas are often thrown down blocks of normal faulting filled with sediment. In this area the groundwater table can be very deep. In those cases drilling to 75 or 100m depth is necessary.
- Small areas with alluvial sand deposits. These can be highly permeable but often do not contain groundwater throughout the year.

The recharge in the first three areas probably takes place in places where the rocks are near the groundsurface. There the permeable weathered zone easily accumulates groundwater. In the fourth area recharge is often prohibited, because of the impermeability of the sediments. It results into a high evaporation rate, causing light salinization of the sediments. In the small alluvial sand deposits the recharge is provided by the streams in the rainy season. In the case the groundwatertable is shallow in the alluvial sediments the groundwater can be saline due to high evaporation.
The depth of the groundwatertable varies in the area. Mostly it is found at a depth between ten and twenty meter below surface. In some cases, where thick sediments are present, it can be as deep as 50m below surface. In most cases the groundwaterlevel is some meters above the groundwater strucklevel, indicating confined aquifers.

It is recommended to proceed the geophysical survey in the same way as is discribed in this report. Drilling results should still be evaluated and compared with geophysical measurements. This can provide a more accurate correlation table between the lithology and electrical resistivities. Beside it is recommended to carry out borehole resistivity measurements to correlate the interpreted resistivities and also to carry out geo-electrical soundings with greater AB/2 distances at some sites with thick sediments.

5. LITERATURE

LBDA-DHV (in concept)

LBDA Rural Domestic Water Supply Programme
Preliminary Survey (Main Report, Ndhiwa Division,
Mbita Division), Kisumu, Kenya

LBDA-DHV (1983)

Proceedings of a shallow wells workshop, Kisumu, Kenya

MINISTRY OF WATER DEVELOPMENT (1984)

Water Resources Assessment Study for the Ndeia & Karai Locations
(Main Report), Nairobi, Kenya

LIST OF ANNEXES

NDHIWA DIVISION

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Site: Obera Secondary School

Hydrogeology

Layers	Resistivity (ohmm)	Remarks
A	500	Fresh conglomorate rock (Kc) (DH)
B	4.5-5	Clay (HH)
C	11-20	Hard Layer groundwater at interface in wet
D	4.5-6	Clay season feeding spring at VES5
E	14-20	Top soil
F	-	-

Fractured zones, faults	Remarks
-	-

Depth to groundwater tabel: 7 - 15 m

Groundwater quality : fresh

(Recommended) drilled (DH) or handdug (HH) holes

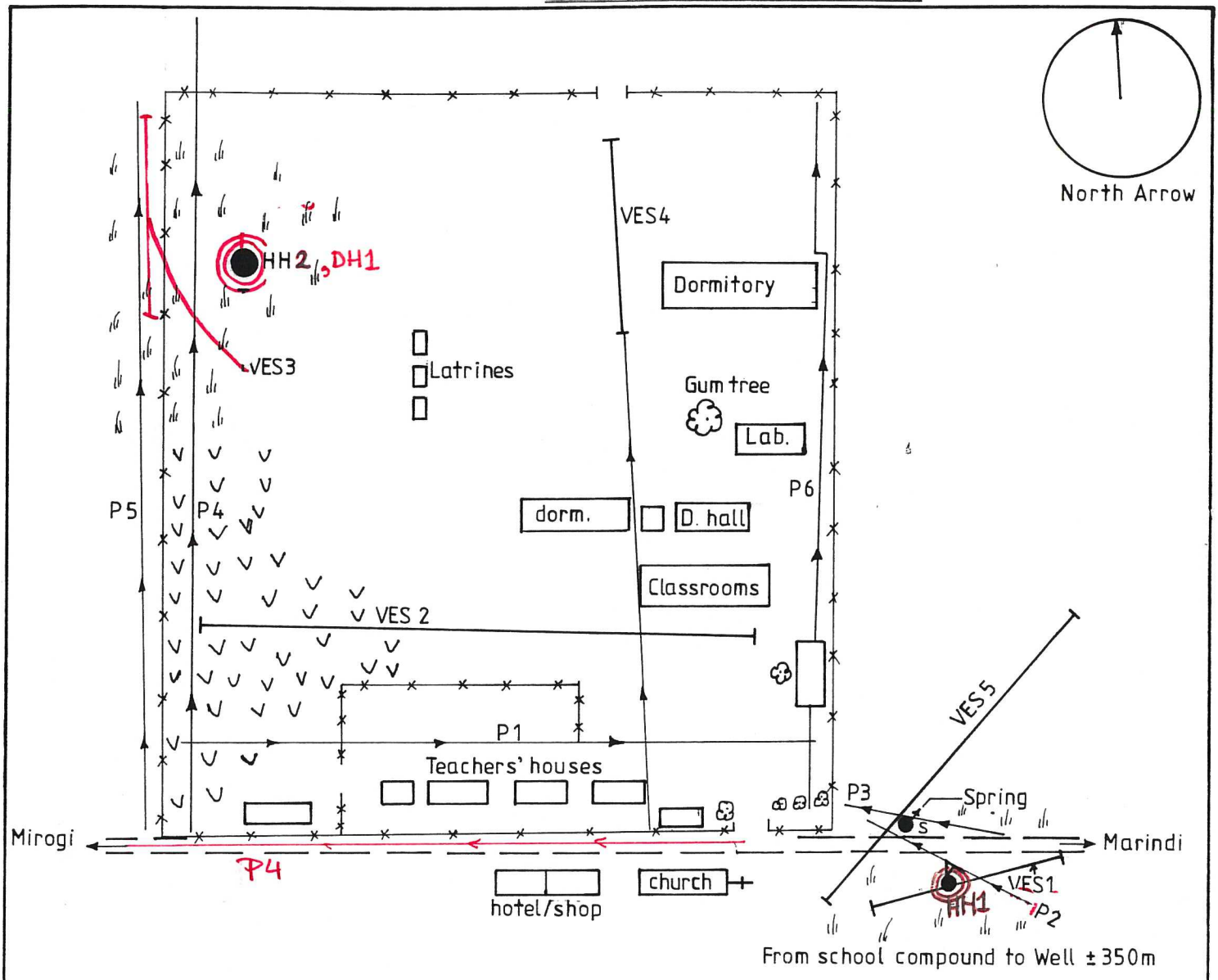
Drilled hole(s)	Remarks
DH1 (VES3, 40 m)	-

Handdug hole(s)	Remarks
HH1 (VES1, 20 m)	groundwater at -8.50 m, EC = 550 µS/cm
HH2 (VES3, 25 m)	groundwater at -18.40 m, EC = 760 µS/cm

OBERA SECONDARY SCHOOL (SKETCH)

SOUTH NYANZA DISTRICT: NDHIWA DIVISION: MAP SHEET

CO-ORDINATES



Murram road

Buildings

Trees

Wire fence

Maize shamba

Long grass

S Spring

SW Shallow Well with Handpump

HH Handdug hole

VES (Vertical Electric Sounding)

P2 Profile line

Slope along profile 1:

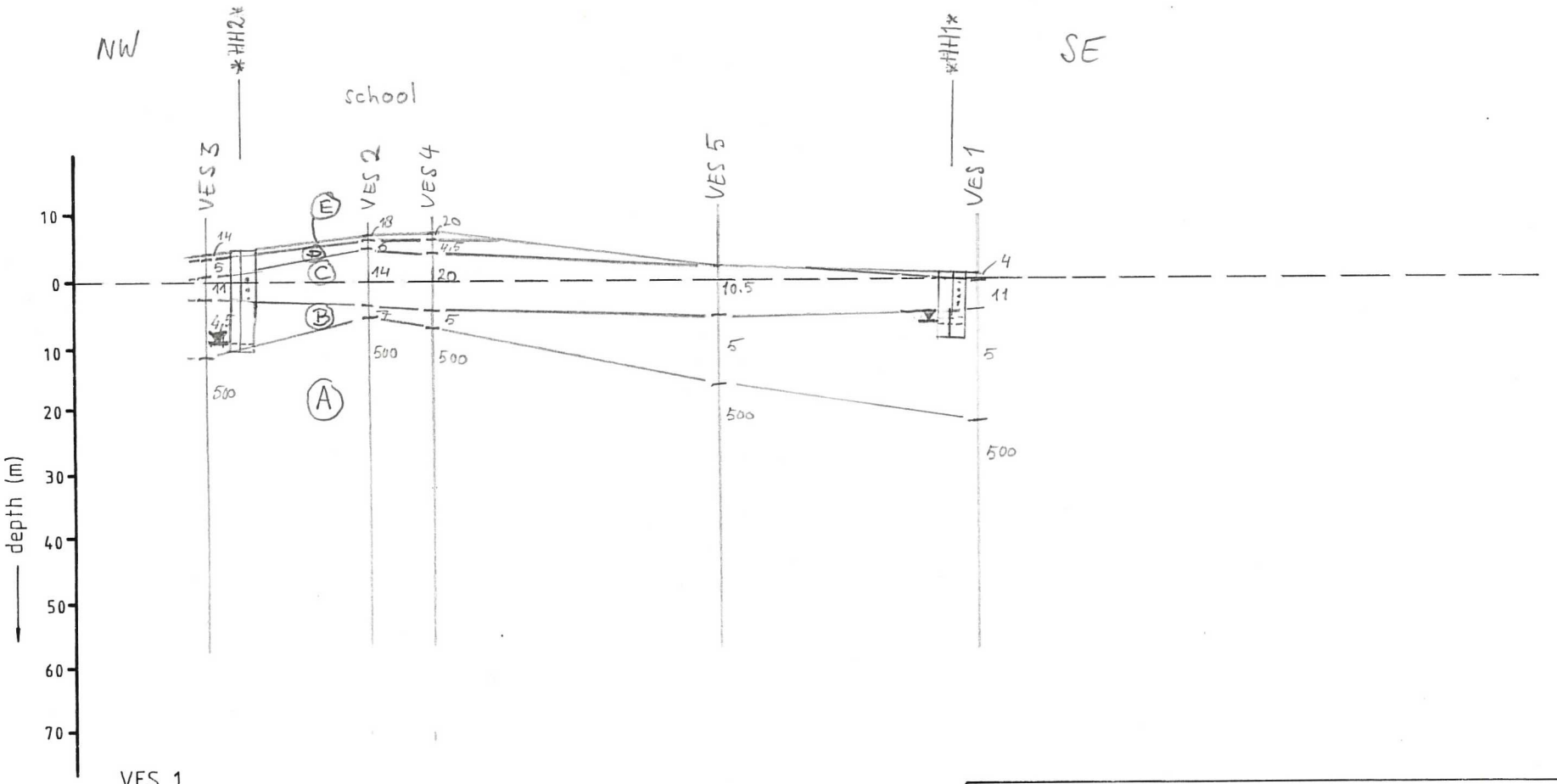
Fence — 100m = 0°

100m – 55m = +0.5°

55m — 80m = -1°

Sketched by R. M. Shilako June 1984

OBERA SECONDARY SCHOOL



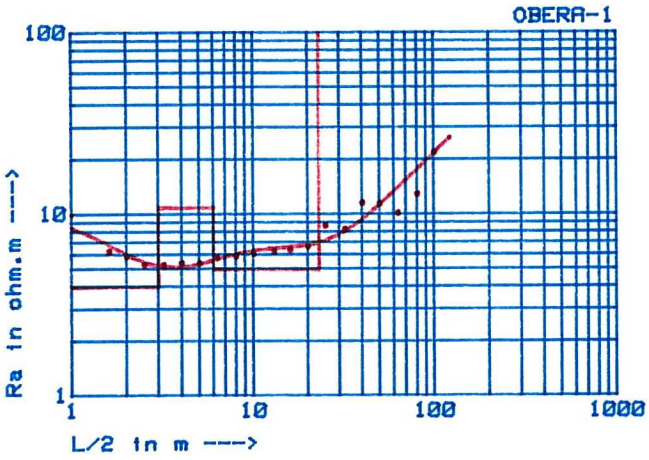
VES 1
5
Vertical Electrical Sounding, interpreted resistivity 5 ohmm

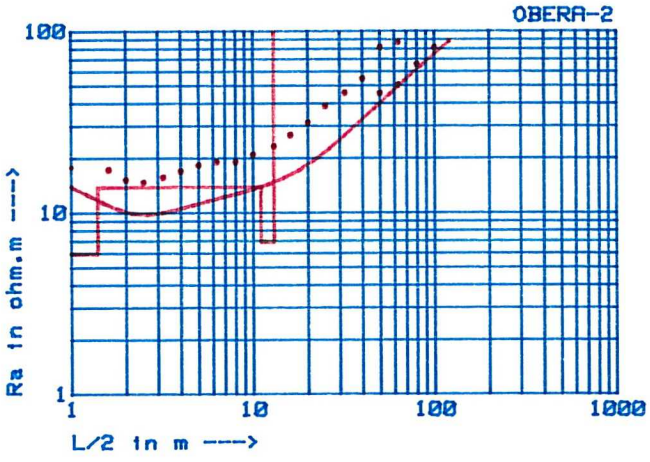
A
geo-electrical layer A

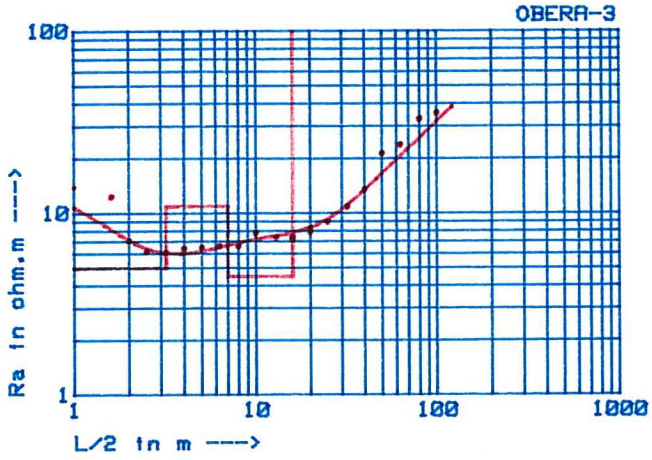
B 1
(recommended) borehole or handdug hole

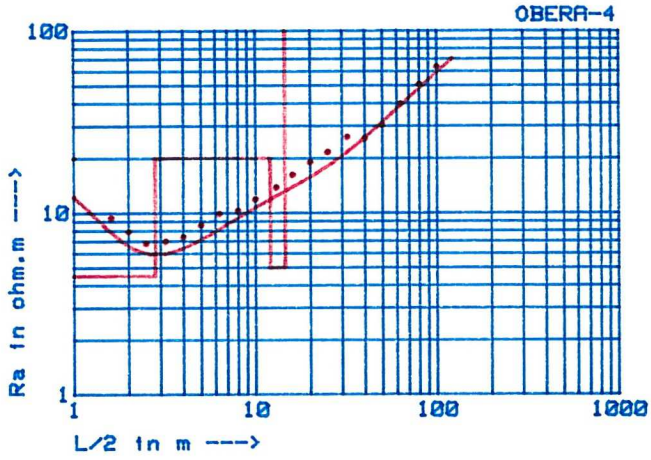
- sandy clay, cemented clay
- lateritic layer
- clay
- a — very decomposed, altered rock
- w — weathered rock
- p — partly weathered, fractured rock
- f — fresh rock

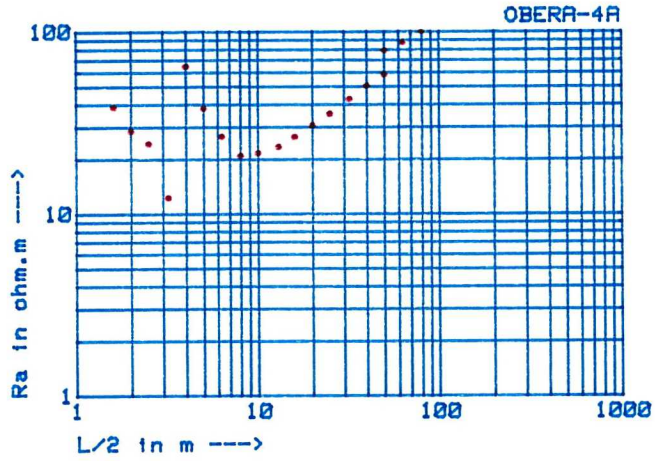
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Annex 1.3	Cross-section Obera Secondary School
Horizontal scale 1 : 5000	Vertical scale 1 : 1000

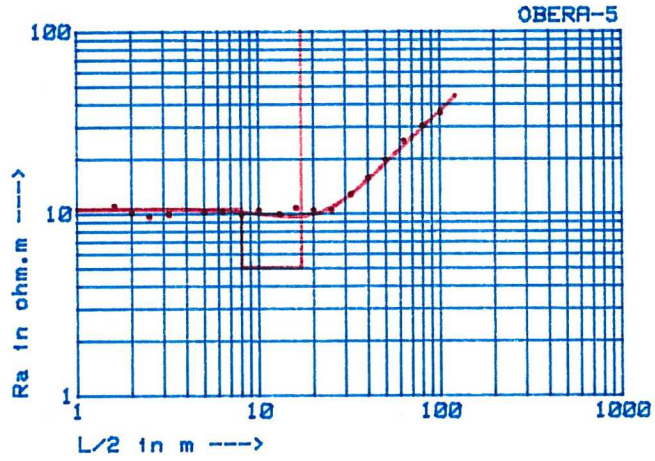

OBERA-1
100
10
1
Ra in ohm.m --->
1
10
100
1000
L/2 in m --->

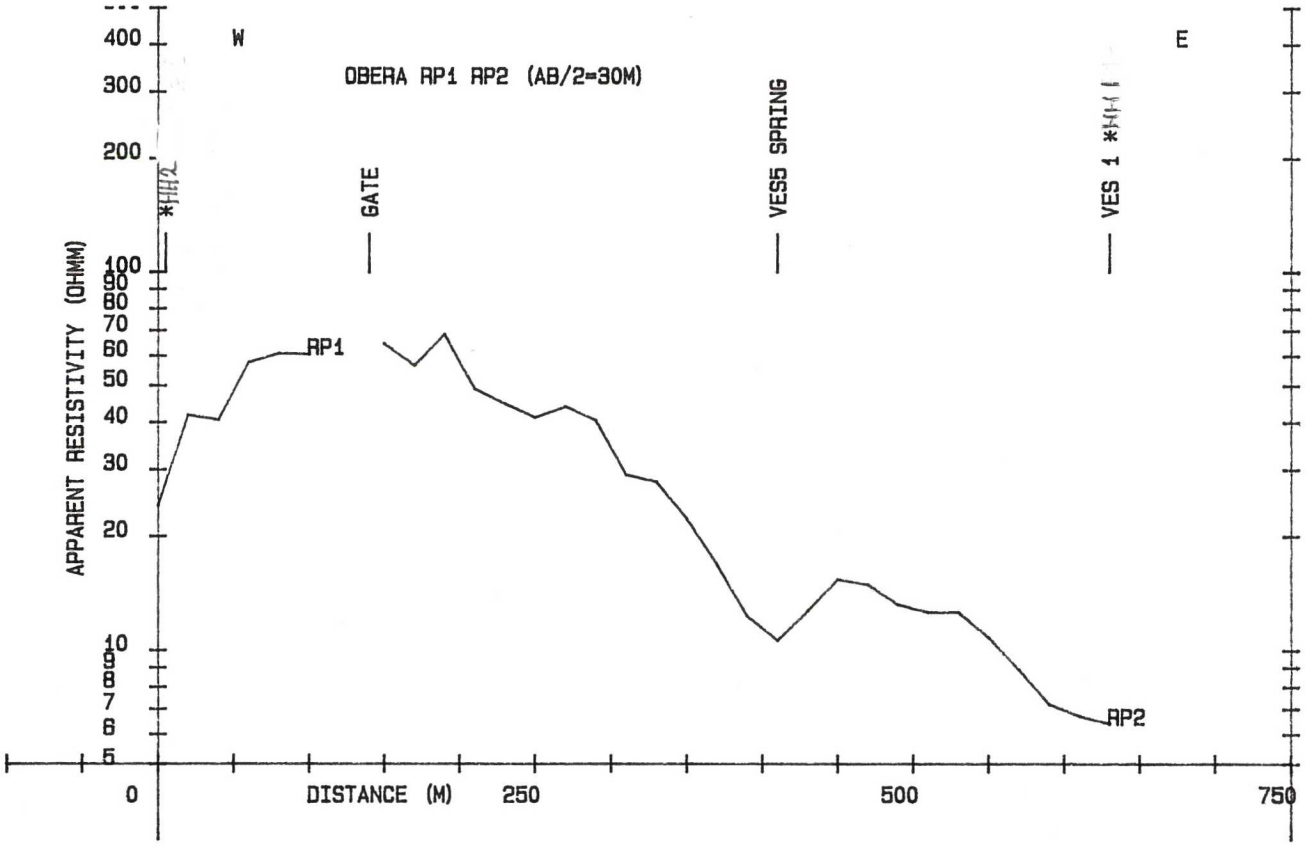

OBERA-2
100
10
1
Ra in ohm.m --->
1
10
100
1000
L/2 in m --->

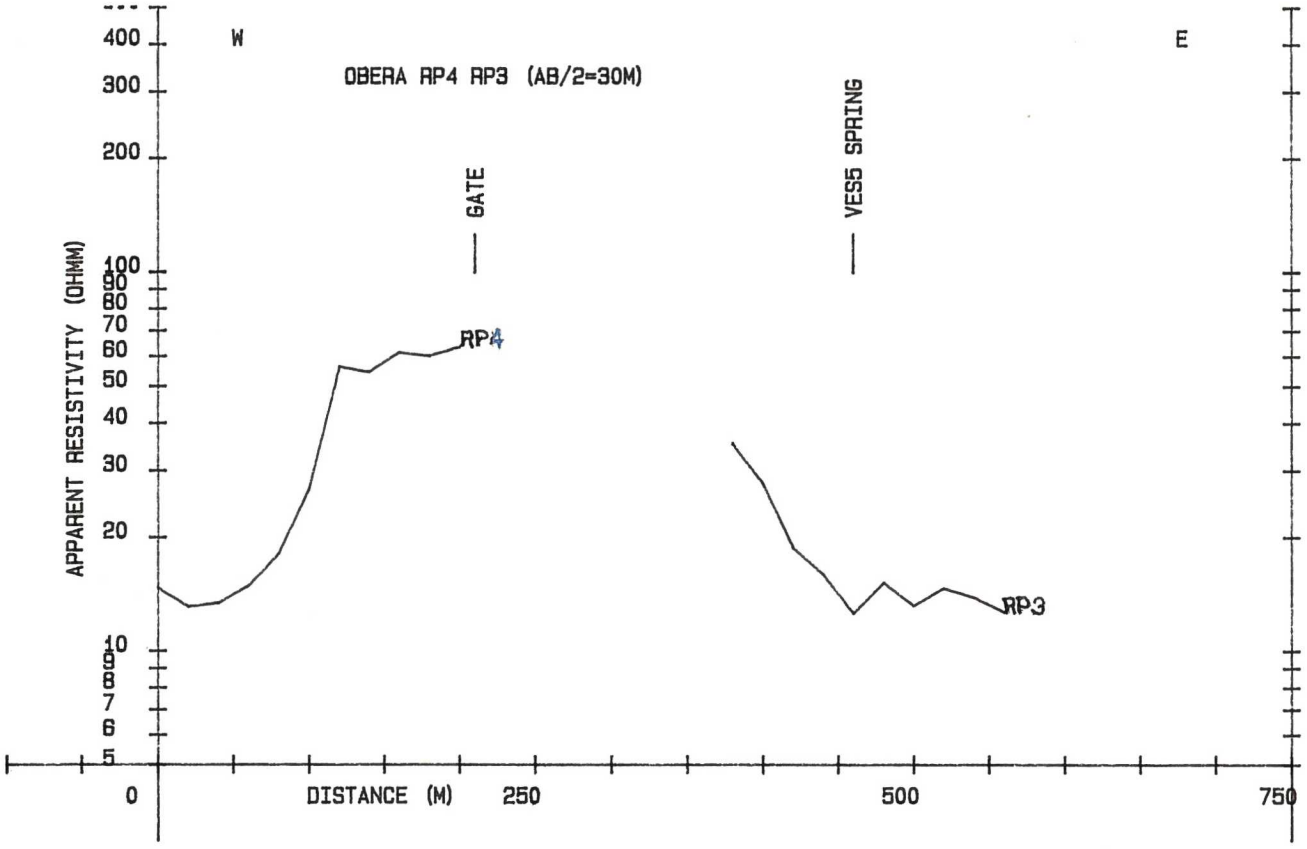

OBERA-3
100
10
1
Ra in ohm.m --->
1
10
100
1000
L/2 in m --->

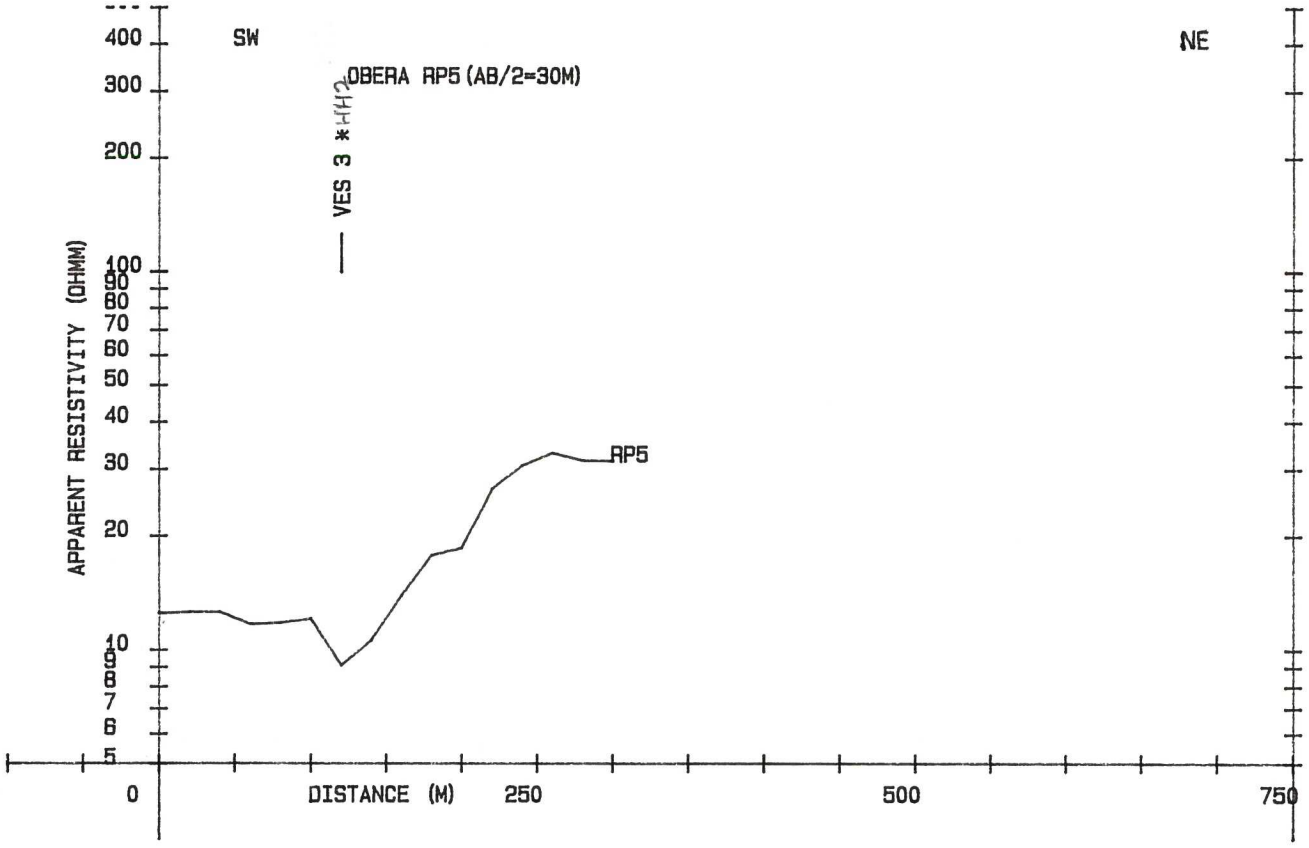

OBERA-4
100
10
1
Ra in ohm.m --->
1
10
100
1000
L/2 in m --->


OBERA-4A
100
10
1
Ra in ohm.m --->
1
10
100
1000
L/2 in m --->


OBERA-5
100
10
1
Ra in ohm.m --->
1
10
100
1000
L/2 in m --->


OBERA RP1 RP2 (AB/2=30M)
W
E
GATE
VES5 SPRING
VES 1
RP1
RP2
APPARENT RESISTIVITY (OHMM)
400
300
200
100
90
80
70
60
50
40
30
20
10
9
8
7
6
5
0
DISTANCE (M)
250
500
750


OBERA RP4 RP3 (AB/2=30M)
W
E
GATE
VES5 SPRING
RP4
RP3
APPARENT RESISTIVITY (OHMM)
400
300
200
100
90
80
70
60
50
40
30
20
10
9
8
7
6
5
0
DISTANCE (M)
250
500
750


SW
NE
OBERA RP5 (AB/2=30M)
VES 3 *HH12
APPARENT RESISTIVITY (OHMM)
400
300
200
100
90
80
70
60
50
40
30
20
10
9
8
7
6
5
RP5
0
DISTANCE (M)
250
500
750

TNO-DGV INSTITUTE OF APPLIED GEOSCIENCE

Site: Ndhiwa Dispensary

Hydrogeology

Layers	Resistivity (ohmm)	Remarks	
A	20-50	Weathered volcanic rock (Tv)	(DH)
B	4.5-5.5	Clay	(DH)
C	8-13	Sandy clay, hard layer	(HH)
D	5	Clay	
E	30	Soil	
F	-	-	

Fractured zones, faults	Remarks	
RP1 (150 m), RP2 (120 m)	Fault, southwestern part shallow rock	(Na)
RP3 (120 m), RP4 (200 m)	Northeastern part at greater depth	(Tr)

Depth to groundwater table: 5 - 10 m

Groundwater quality : Fresh

(Recommended) drilled (DH) or handdug (HH) holes

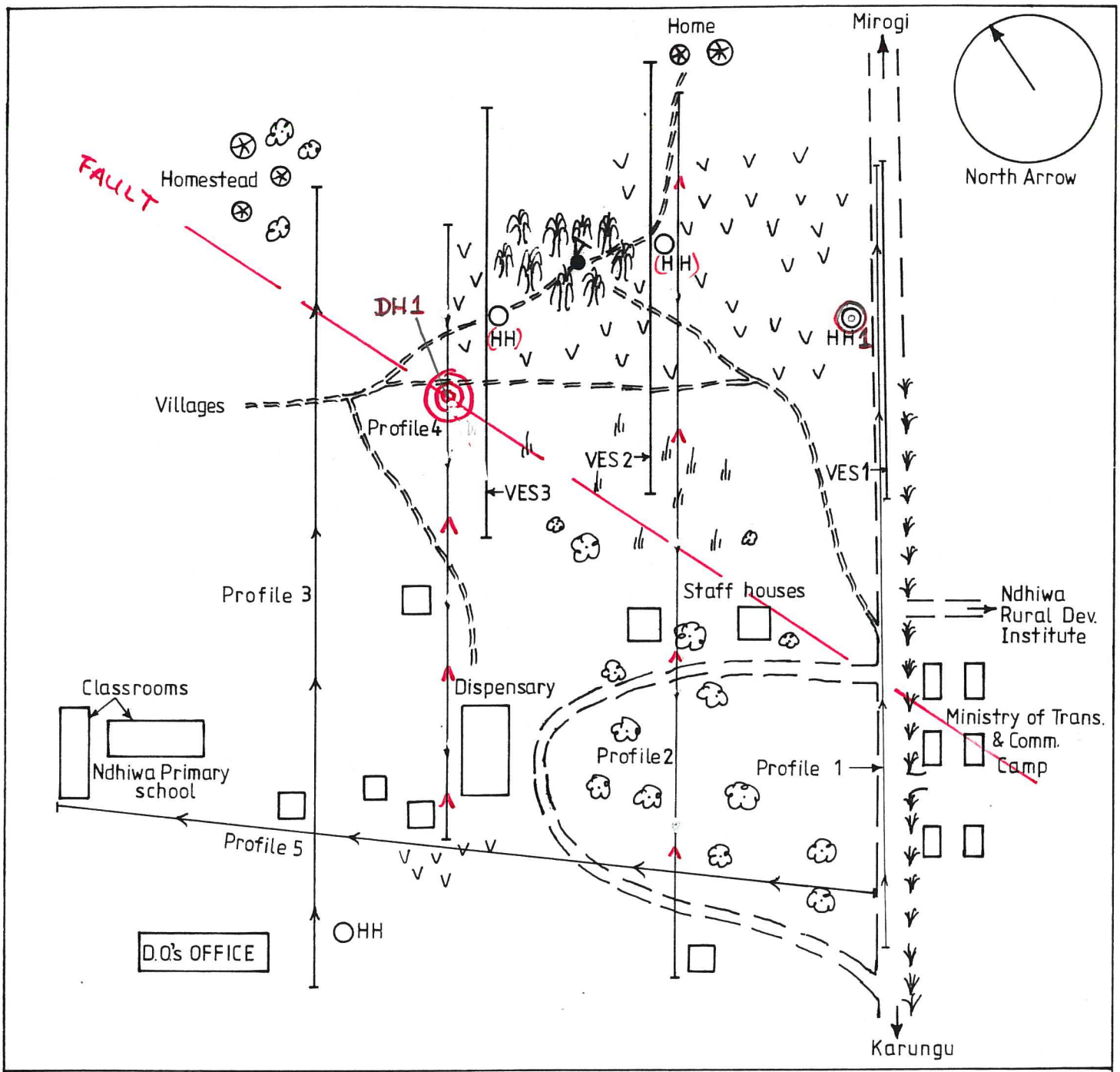
Drilled hole(s)	Remarks
DH1 (50 m SW VES3, 40 m)	-

Handdug hole(s)	Remarks
HH1 (VES1, 10 m)	Groundwater at -5.00 m, EC = 200 µS/cm

NDHIWA DISPENSARY (SKETCH)

SOUTH NYANZA DISTRICT: NDHIWA DIVISION: MAP SHEET 129/2

GRID REFERENCE 651·9 – 9919·9



Murram road
Footpath
Buildings
Houses
Trees
Hedge
Maize shamba
Long grass
Bananas
Shallow Well with handpump

HH Proposed handdugholes

VES (Vertical Electric Sounding) 200m. long

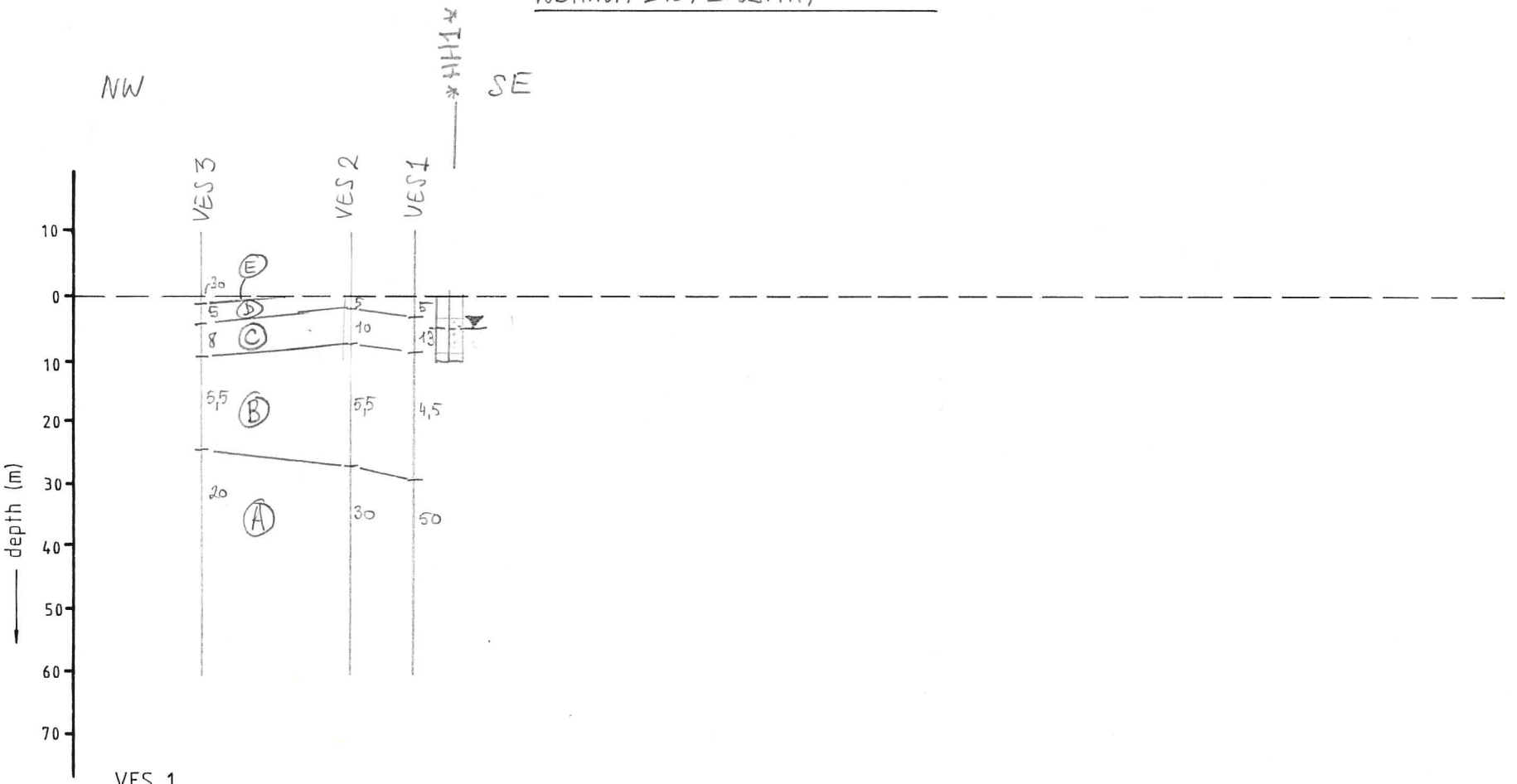
Profile line

Slope: VES1 – VES2 = 0°

VES2 – VES3 = +0·5°

Sketched by R. M Shilako June 1984

NDHIWA DISPENSARY



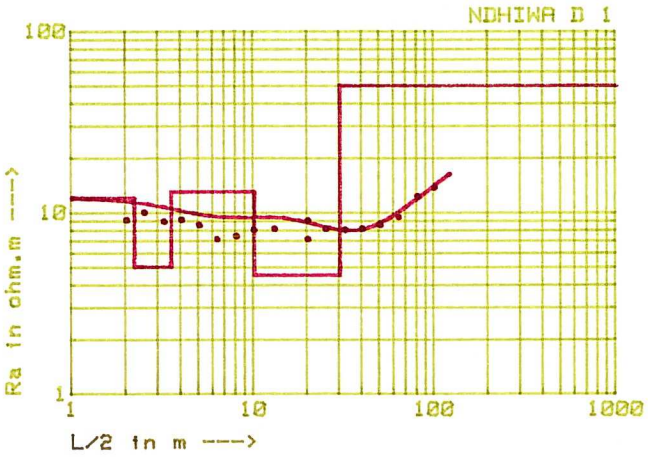
VES 1
5
Vertical Electrical Sounding, interpreted resistivity 5 ohmm

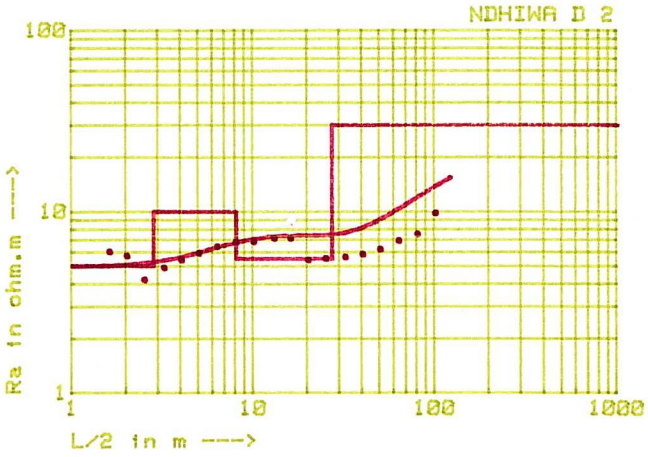
A
geo-electrical layer A

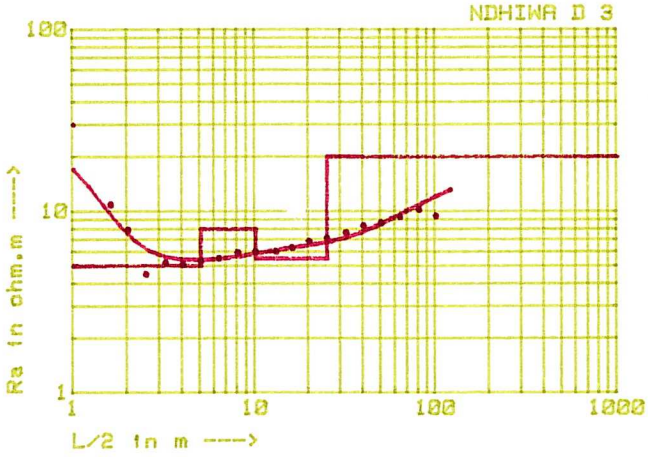
B 1
(recommended) borehole or handdug hole

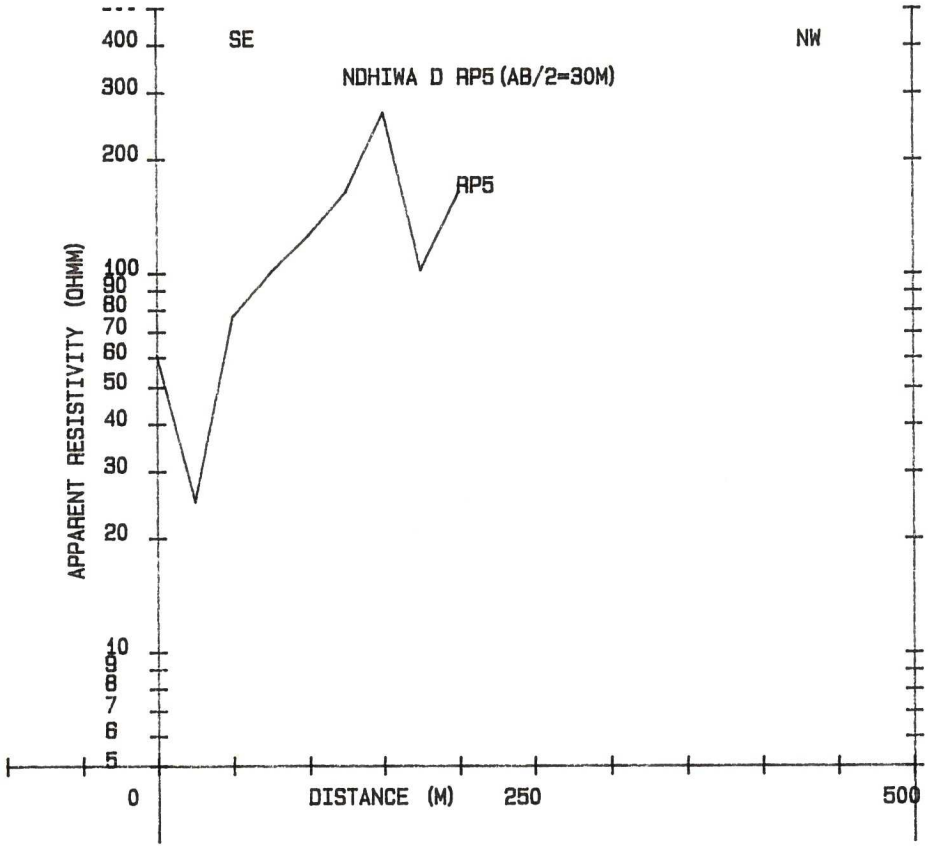
- sandy clay, cemented clay
- lateritic layer
- clay
- a — very decomposed, altered rock
- w — weathered rock
- p — partly weathered, fractured rock
- f — fresh rock

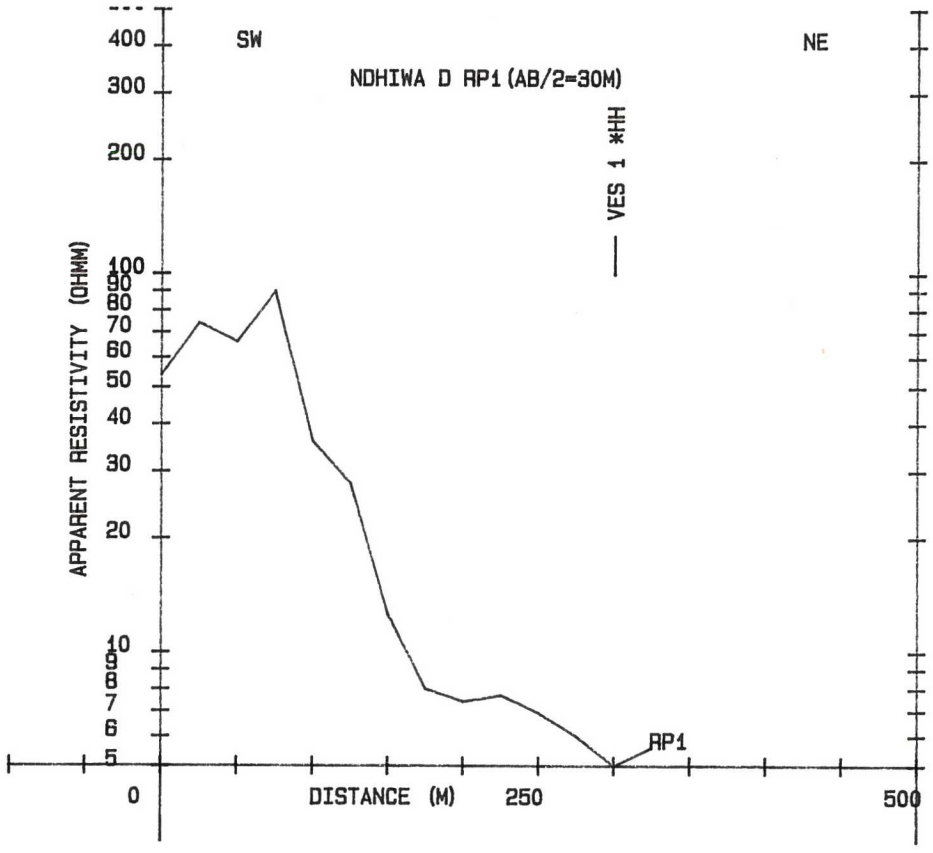
TNO-DGV Institute of Applied Geoscience	
Annex 2.3	Cross-section Ndhiwa Dispensary
Horizontal scale 1 : 5000	Vertical scale 1 : 1000

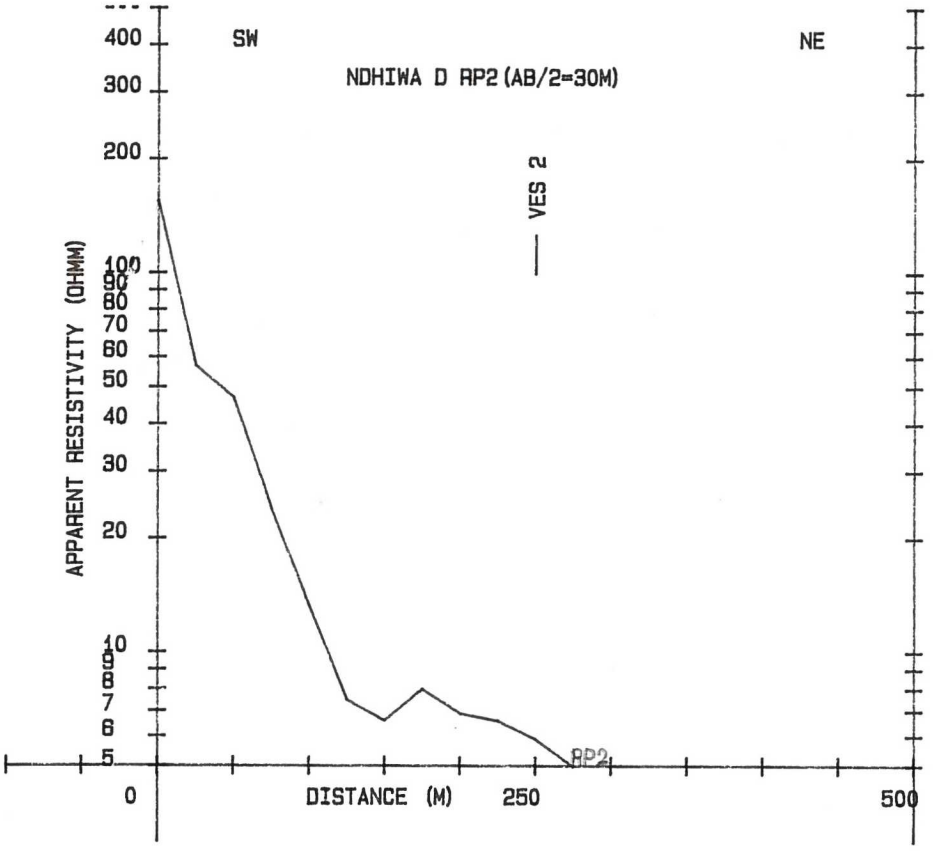

NDHIWA D 1
100
10
1
Ra in ohm.m --->
1
10
100
1000
L/2 in m --->

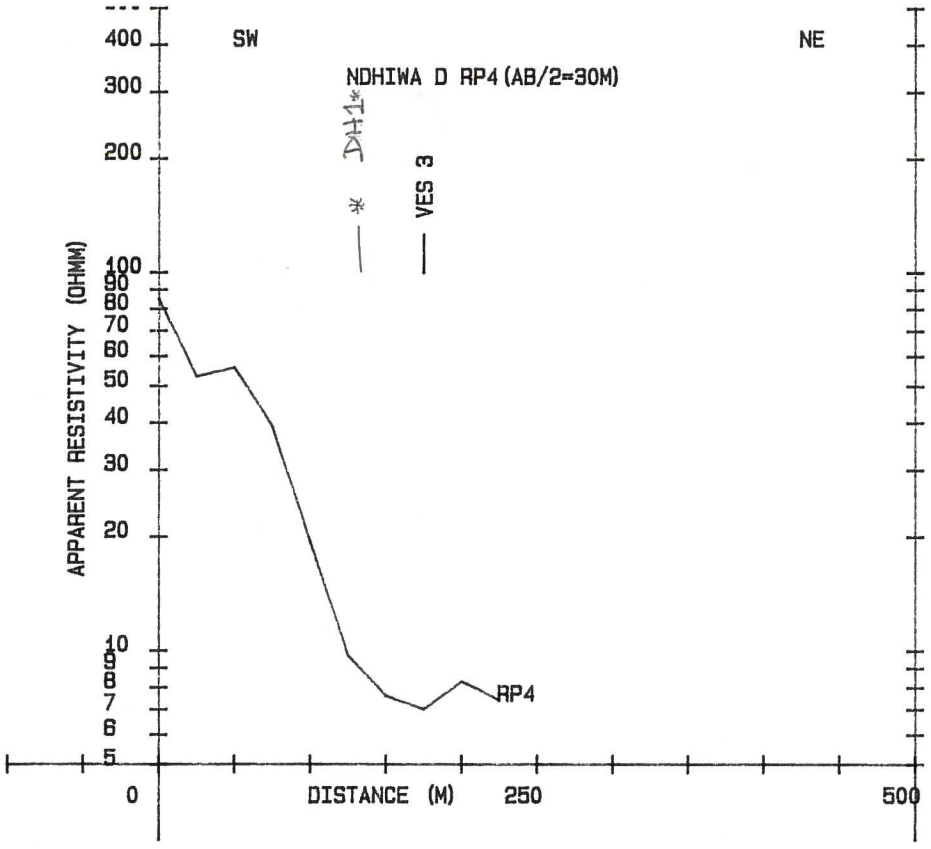

NDHIWA D 2
100
10
1
Ra in ohm.m --->
1
10
100
1000
L/2 in m --->

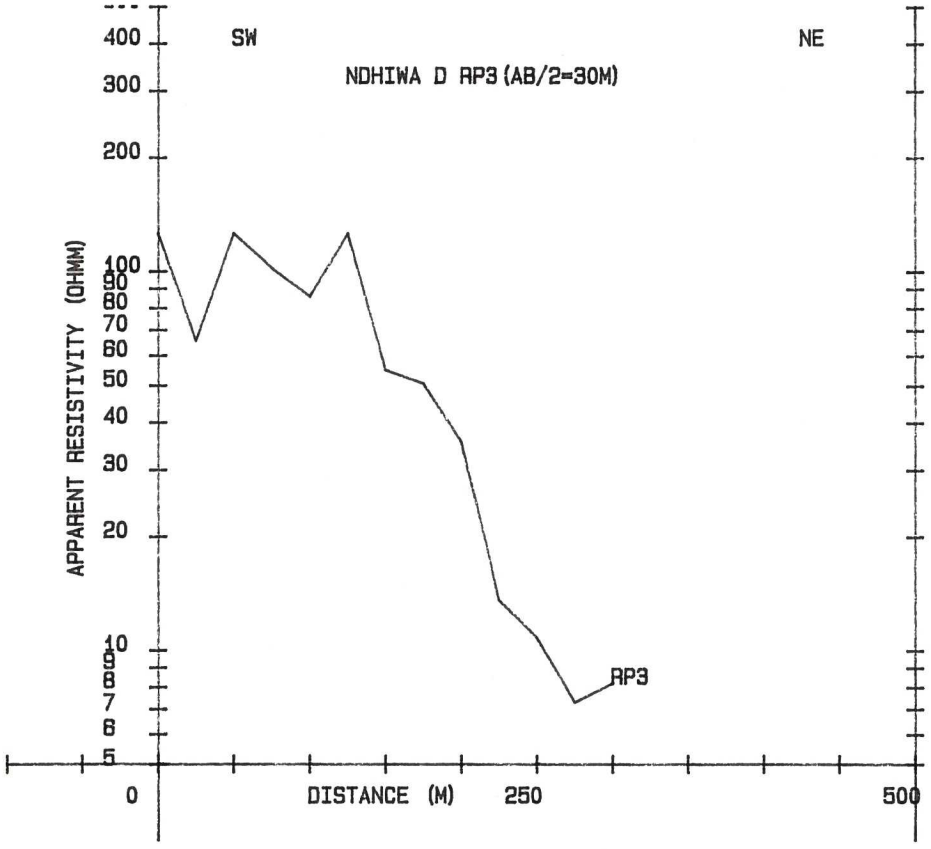

NDHIWA D 3
100
10
1
Ra in ohm.m --->
1
10
100
1000
L/2 in m --->


SE
NW
NDHIWA D RP5 (AB/2=30M)
RP5
APPARENT RESISTIVITY (OHMM)
400
300
200
100
90
80
70
60
50
40
30
20
10
9
8
7
6
5
0
DISTANCE (M)
250
500


SW
NE
NDHIWA D RP1 (AB/2=30M)
VES 1 *HH
APPARENT RESISTIVITY (OHMM)
400
300
200
100
90
80
70
60
50
40
30
20
10
9
8
7
6
5
RP1
0
DISTANCE (M)
250
500


SW
NE
NDHIWA D RP2 (AB/2=30M)
VES 2
APPARENT RESISTIVITY (OHMM)
400
300
200
100
90
80
70
60
50
40
30
20
10
9
8
7
6
5
RP2
0
DISTANCE (M)
250
500


SW
NE
NDHIWA D RP4 (AB/2=30M)
DH1*
VES 3
APPARENT RESISTIVITY (OHMM)
400
300
200
100
90
80
70
60
50
40
30
20
10
9
8
7
6
5
RP4
0
DISTANCE (M)
250
500


SW
NE
NDHIWA D RP3 (AB/2=30M)
APPARENT RESISTIVITY (OHMM)
400
300
200
100
90
80
70
60
50
40
30
20
10
9
8
7
6
5
RP3
0
DISTANCE (M)
250
500

TNO-DGV INSTITUTE OF APPLIED GEOSCIENCE

Site: Ndhiwa Institute for Rural Development

Hydrogeology

Layers	Resistivity (ohmm)	Remarks	
A	500	Fresh volcanic rock (Na)	(DH)
B	5	Clay	(HH)
C	6-12	Sandy Clay, hard layer	
D	50-250	Lateritic soil	
E	-	-	
F	-	-	

Fractured zones, faults	Remarks
VES2,VES4	SW-NE running fault, SE-side shallow rock, NW-side relatively deep

Depth to groundwater table: 15-20 m

Groundwater quality : Fresh

(Recommended) drilled (DH) or handdug (HH) holes

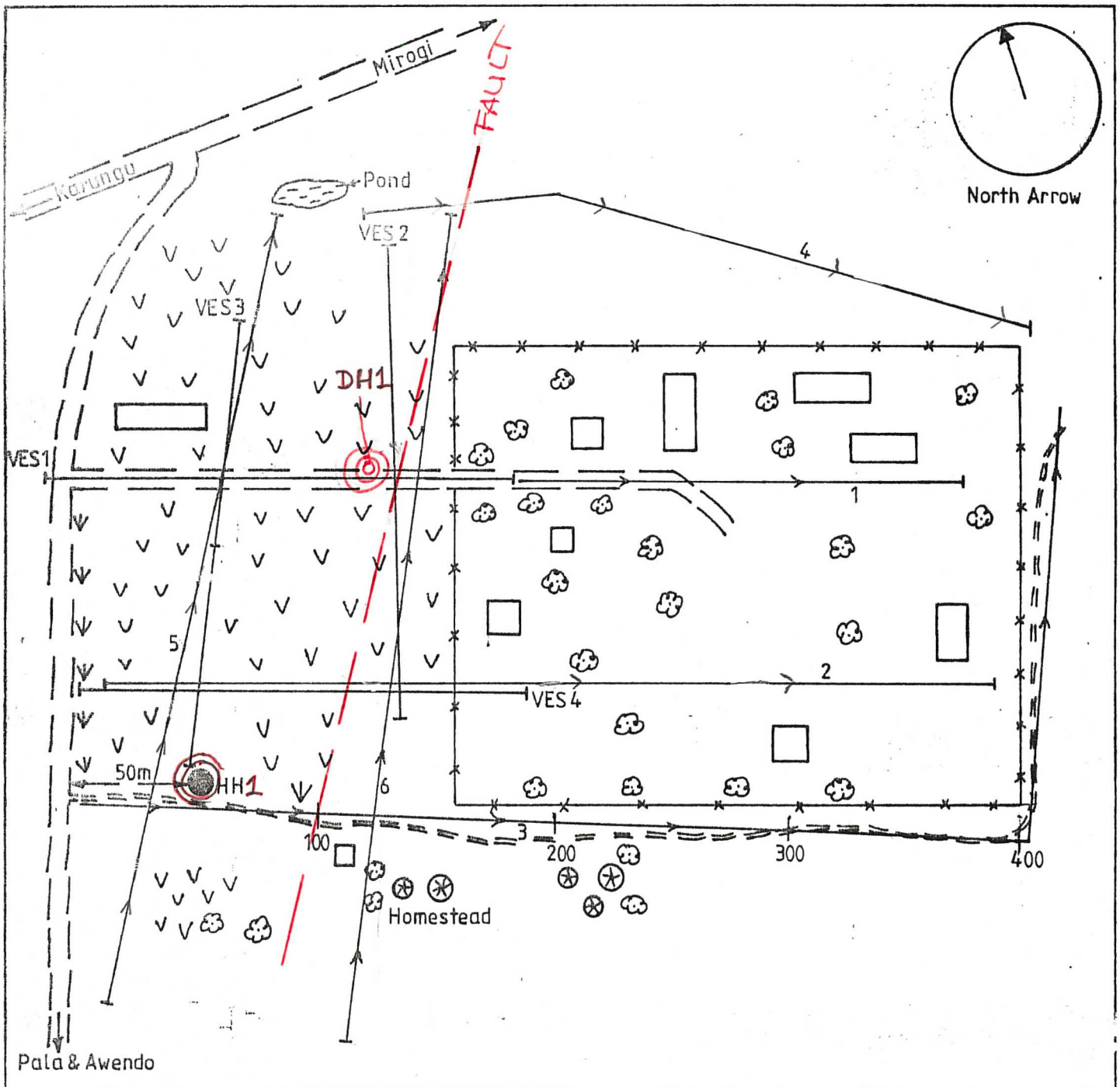
Drilled hole(s)	Remarks
DH1 (VES2,)	-

Handdug hole(s)	Remarks
HH1 (VES3,25)	Groundwater at -17.10, EC = 600 µS/cm

NDHIWA INSTITUTE FOR RURAL DEVELOPMENT (SKETCH)

SOUTH NYANZA DISTRICT: NDHIWA DIVISION: MAP SHEET

CO-ORDINATES



Murram road
Path
Houses
Round huts
Trees
Sisal
Maize shamba
Wire fence
HH Handdug hole

VES (Vertical Electric Sounding)

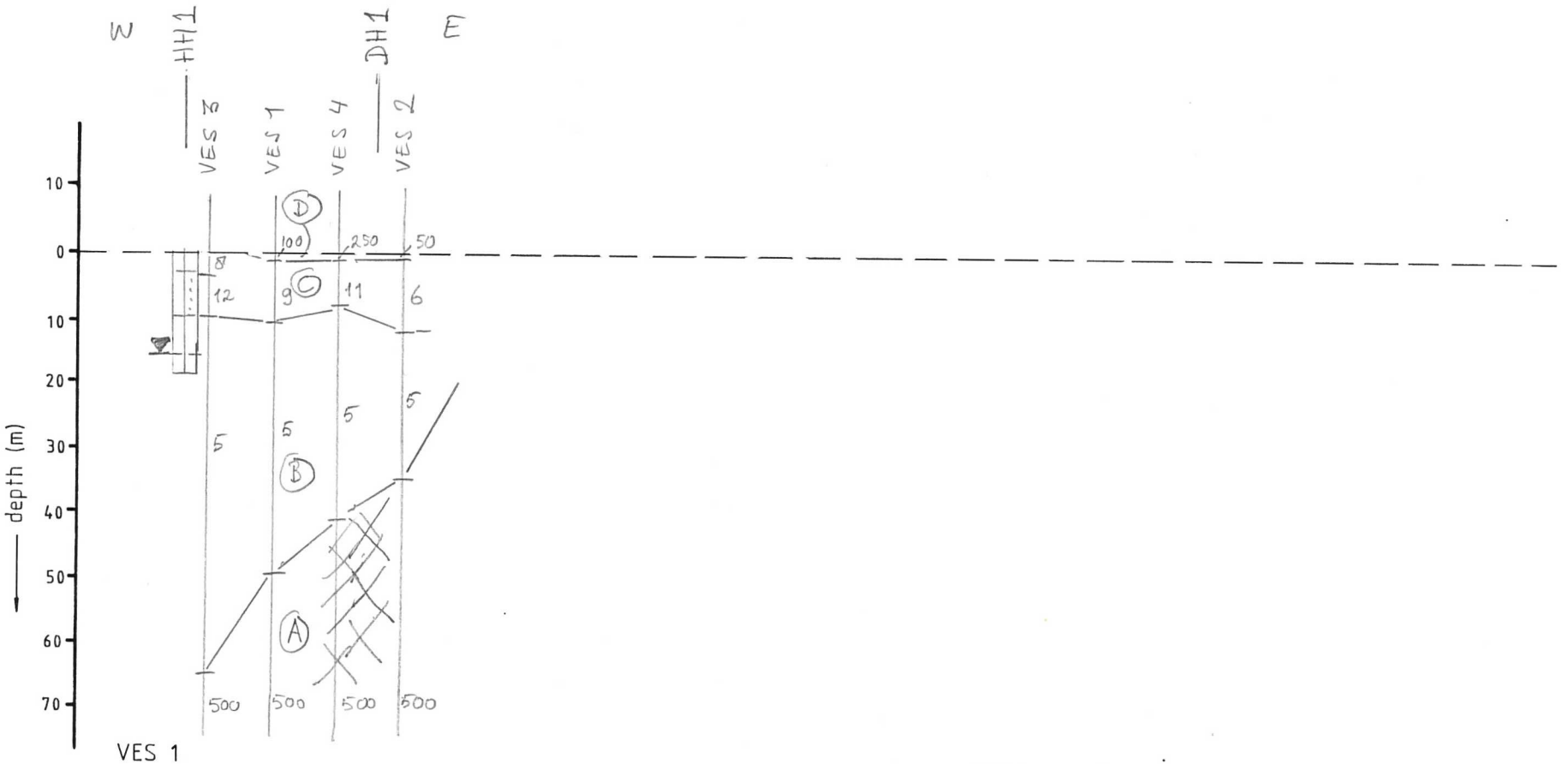
6 Profile

Slope along Profile 3:

Road – 100m = 0°
100 – 200m = +2°
200 – 300m = +3°
300 – 400m = +1°

Sketched by R.M. Shilako June 1984

NDHIWA INSTITUTE FOR RURAL DEVELOPMENT



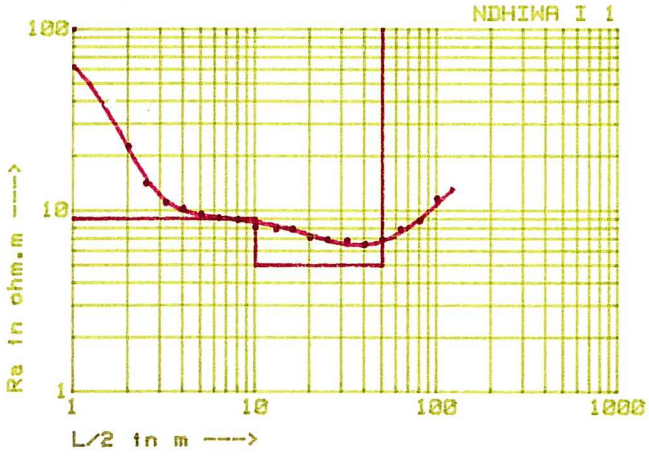
VES 1
5
Vertical Electrical Sounding, interpreted resistivity 5 ohmm

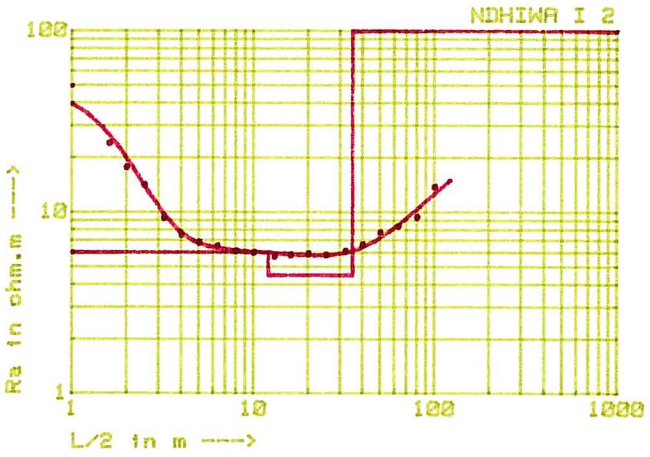
A
geo-electrical layer A

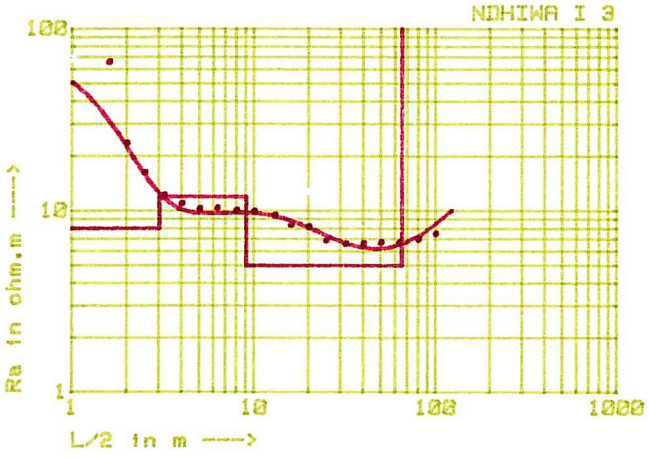
B 1
(recommended) borehole or handdug hole

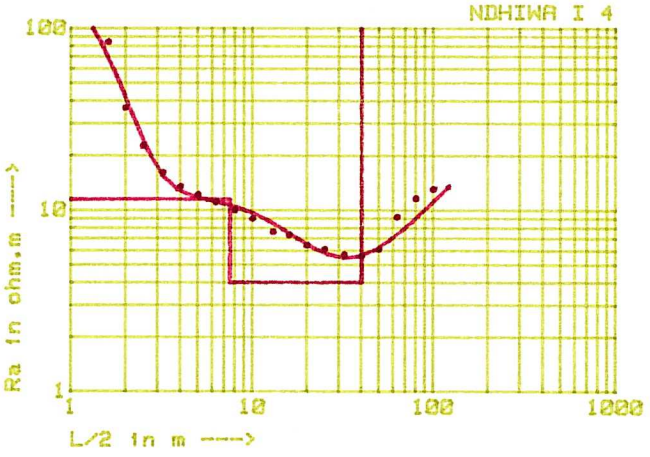
- sandy clay, cemented clay
- lateritic layer
- clay
- a very decomposed, altered rock
- w weathered rock
- p partly weathered, fractured rock
- f fresh rock

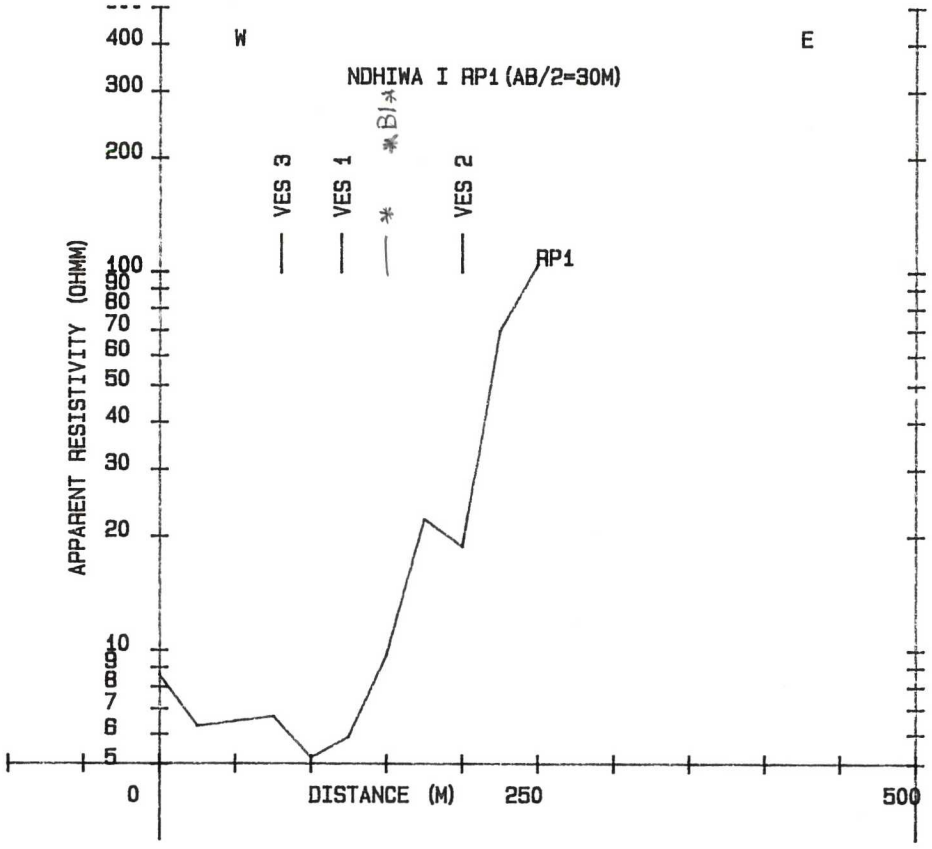
TNO-DGV Institute of Applied Geoscience	
Annex 3.3	Cross-section Ndhiwa IRD
Horizontal scale 1 : 5000	Vertical scale 1 : 1000

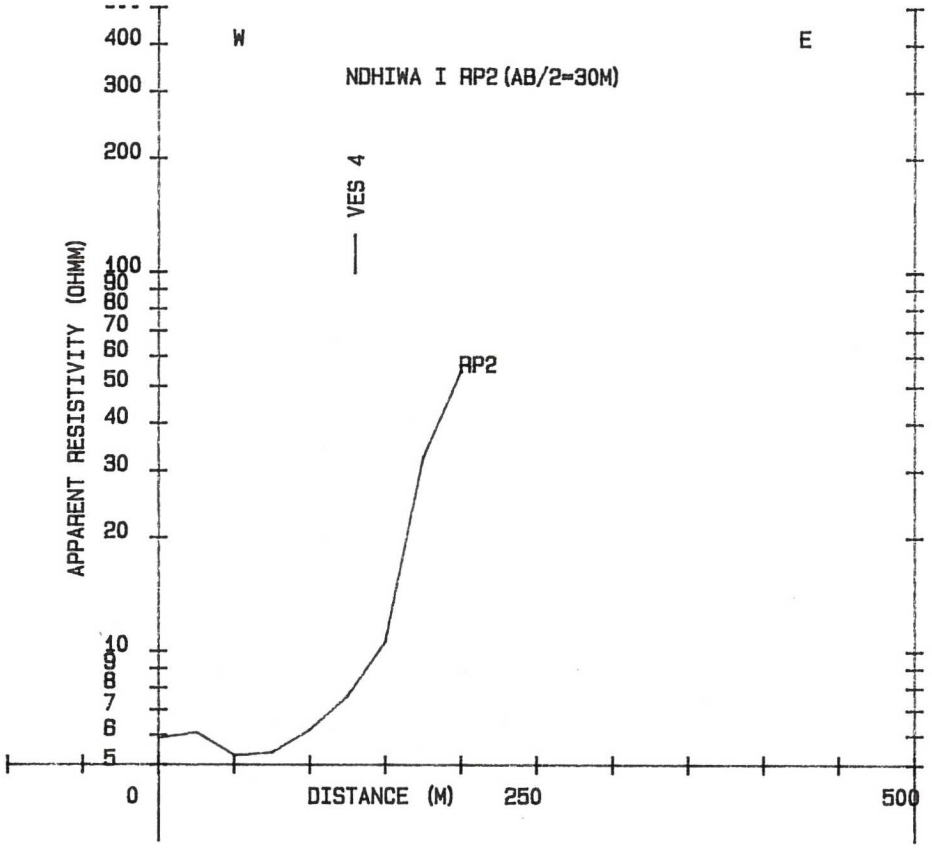

NDHIWA I 1
100
10
1
Ra in ohm.m --->
1
10
100
1000
L/2 in m --->

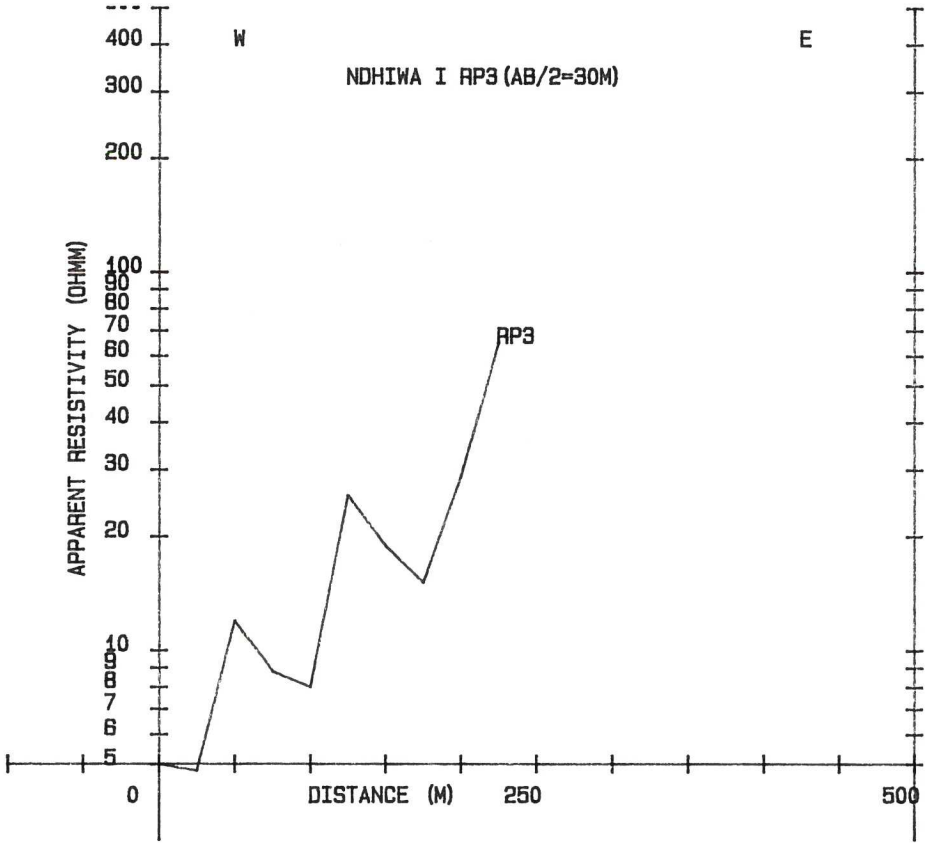

NDHIWA I 2
100
10
1
Ra in ohm.m --->
1
10
100
1000
L/2 in m --->

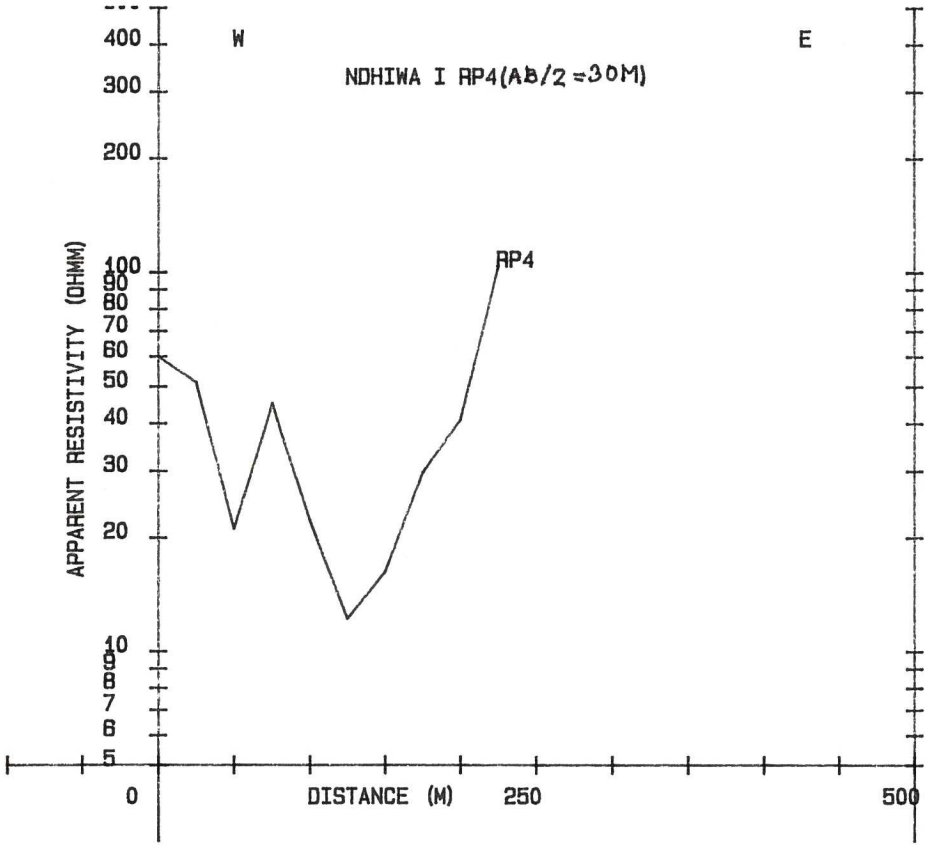

NDHIWA I 3
100
10
1
Ra in ohm.m --->
1
10
100
1000
L/2 in m --->

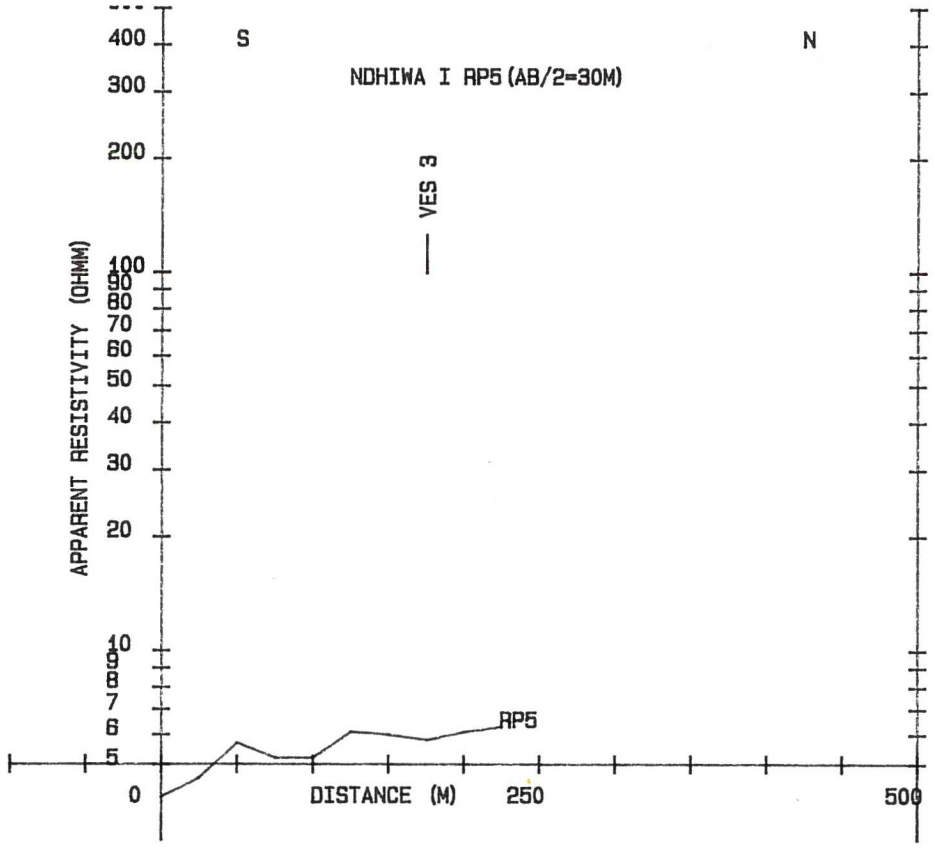

NDHIWA I 4
100
10
1
Ra in ohm.m --->
1
10
100
1000
L/2 in m --->

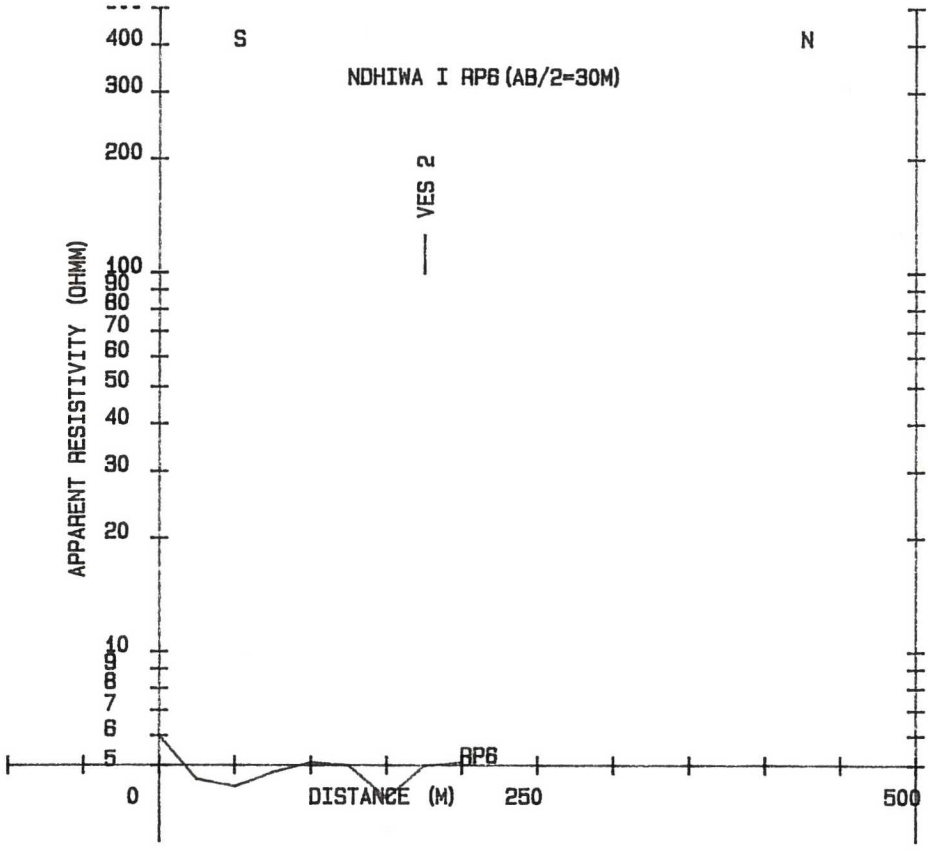

NDHIWA I RP1 (AB/2=30M)
W
E
VES 3
VES 1
BI
VES 2
RP1
APPARENT RESISTIVITY (OHMM)
400
300
200
100
90
80
70
60
50
40
30
20
10
9
8
7
6
5
0
DISTANCE (M)
250
500


NDHIWA I RP2 (AB/2=30M)
W
E
VES 4
RP2
APPARENT RESISTIVITY (OHMM)
400
300
200
100
90
80
70
60
50
40
30
20
10
9
8
7
6
5
0
DISTANCE (M)
250
500


W
E
NDHIWA I RP3 (AB/2=30M)
APPARENT RESISTIVITY (OHMM)
400
300
200
100
90
80
70
60
50
40
30
20
10
9
8
7
6
5
RP3
0
DISTANCE (M)
250
500


W
E
NDHIWA I RP4(AB/2=30M)
APPARENT RESISTIVITY (OHMM)
400
300
200
100
90
80
70
60
50
40
30
20
10
9
8
7
6
5
RP4
0
DISTANCE (M)
250
500


S
N
NDHIWA I RP5 (AB/2=30M)
VES 3
APPARENT RESISTIVITY (OHMM)
400
300
200
100
90
80
70
60
50
40
30
20
10
9
8
7
6
5
RP5
0
DISTANCE (M)
250
500


S
N
NDHIWA I RP6 (AB/2=30M)
VES 2
APPARENT RESISTIVITY (OHMM)
400
300
200
100
90
80
70
60
50
40
30
20
10
9
8
7
6
5
RP6
0
DISTANCE (M)
250
500

TNO-DGV INSTITUTE OF APPLIED GEOSCIENCE

Site: Ndhiwa Market

Hydrogeology

Layers	Resistivity (ohmm)	Remarks	
A	70-100	Partly weathered volcanic rock (Na)	(DH)
B	4.5-5	Clay	(HH)
C	8-20	Sandy clay, hard layer	
D	70-150	Lateritic soil	
E	-	-	
F	-	-	

Fractured zones, faults	Remarks
-	-

Depth to groundwater table: 10 - 20 m

Groundwater quality : Fresh

(Recommended) drilled (DH) or handdug (HH) holes

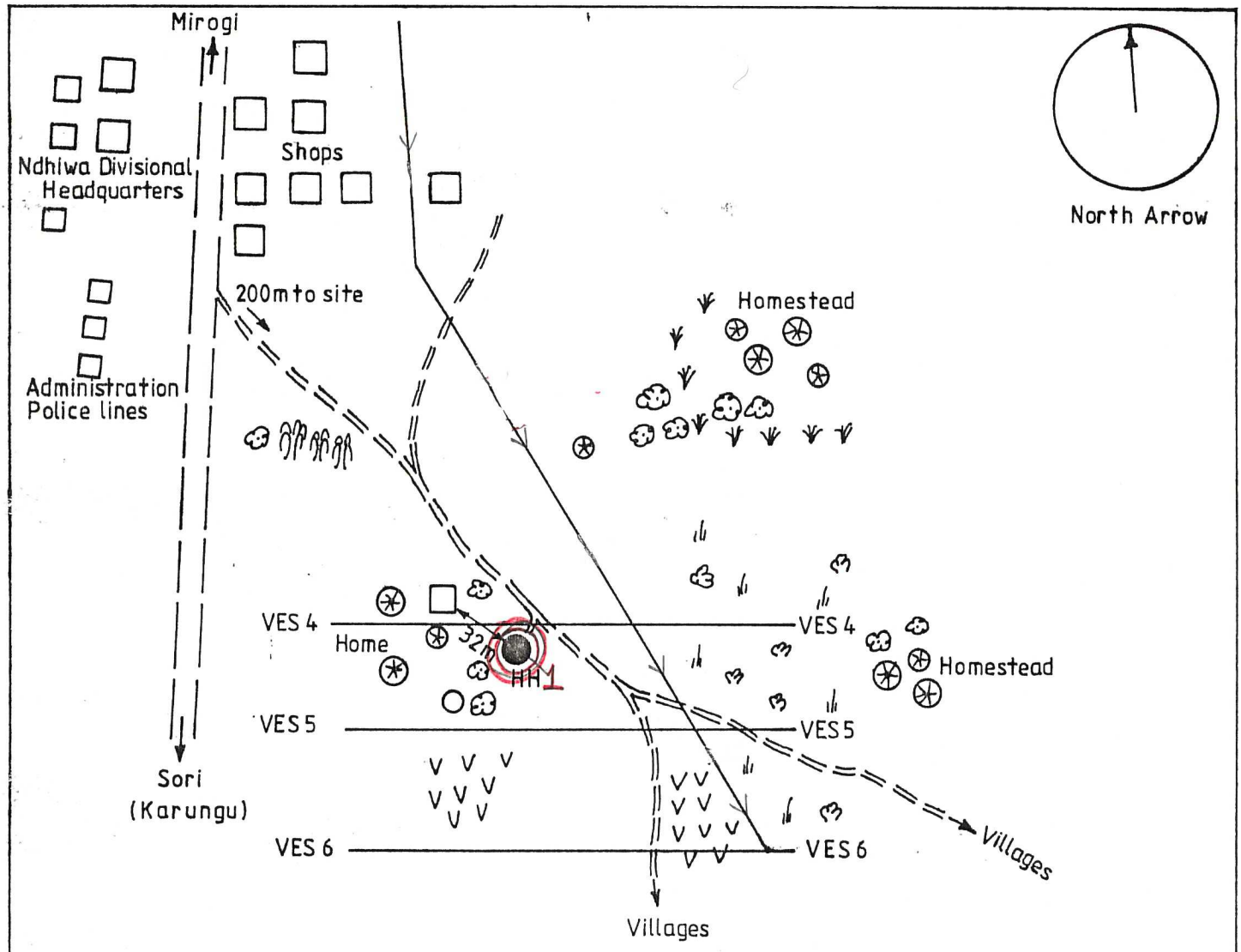
Drilled hole(s)	Remarks
DH1 (VES1, 45 m)	-

Handdug hole(s)	Remarks
HH1 (VES4, 20 m)	Groundwater at -9.00 m, EC = 600 µS/cm

NDHIWA MARKET (SKETCH) 1

SOUTH NYANZA DISTRICT: NDHIWA DIVISION: MAP SHEET

CO-ORDINATES



Murram road
Path
Houses or shops
Round huts
Trees
Shrubs
Hedge
Long grass
Bananas
Maize shamba

VES (Vertical Electric Sounding)
200m long, VES 4-5 = 40m & VES5-6 = 50m.
Profile line
HH Handdug hole
Slope: VES4 — VES5 = -2°
VES5 — VES6 = -1°

Sketched by R.M. Shilako June 1984

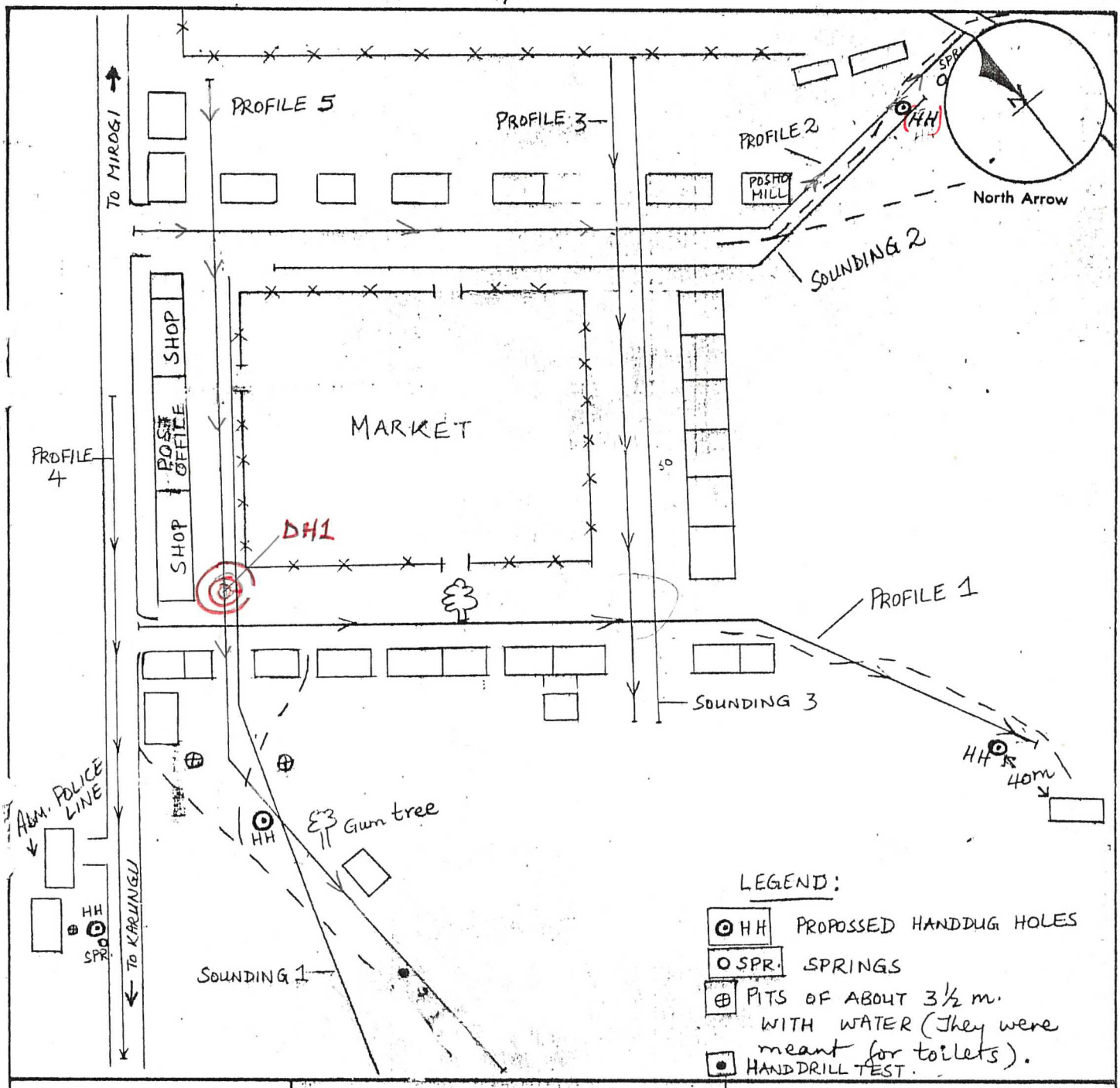
LAKE BASIN SHALLOW WELLS PROJECT

Situation Sketch - Survey Section 2

SITE. NDHIWA ... MARKET .....
SUB-LOCATION. K/KWAMO .....
LOCATION KANYAMWA .....
DIVISION NDHIWA .....
DISTRICT S. NYANZA .....
CO-ORDINATES. 129/2 .....

Date	10.3.1984
Surveyor	H. Mora

Site number(s)	129/2
Number(s) of approved Borehole(s)	



LEGEND:

- HH — PROPOSSED HANDDUG HOLES
- SPR. — SPRINGS
- PITS OF ABOUT 3½ m. WITH WATER (They were meant for toilets).
- HANDDRILL TEST.

- Tarmac Road
- Road
- Track
- Foot path
- Railway
- River
- Dry River bed
- Bridge/culvert
- Telephone or Electricity line
- House
- CCM — CCM Office

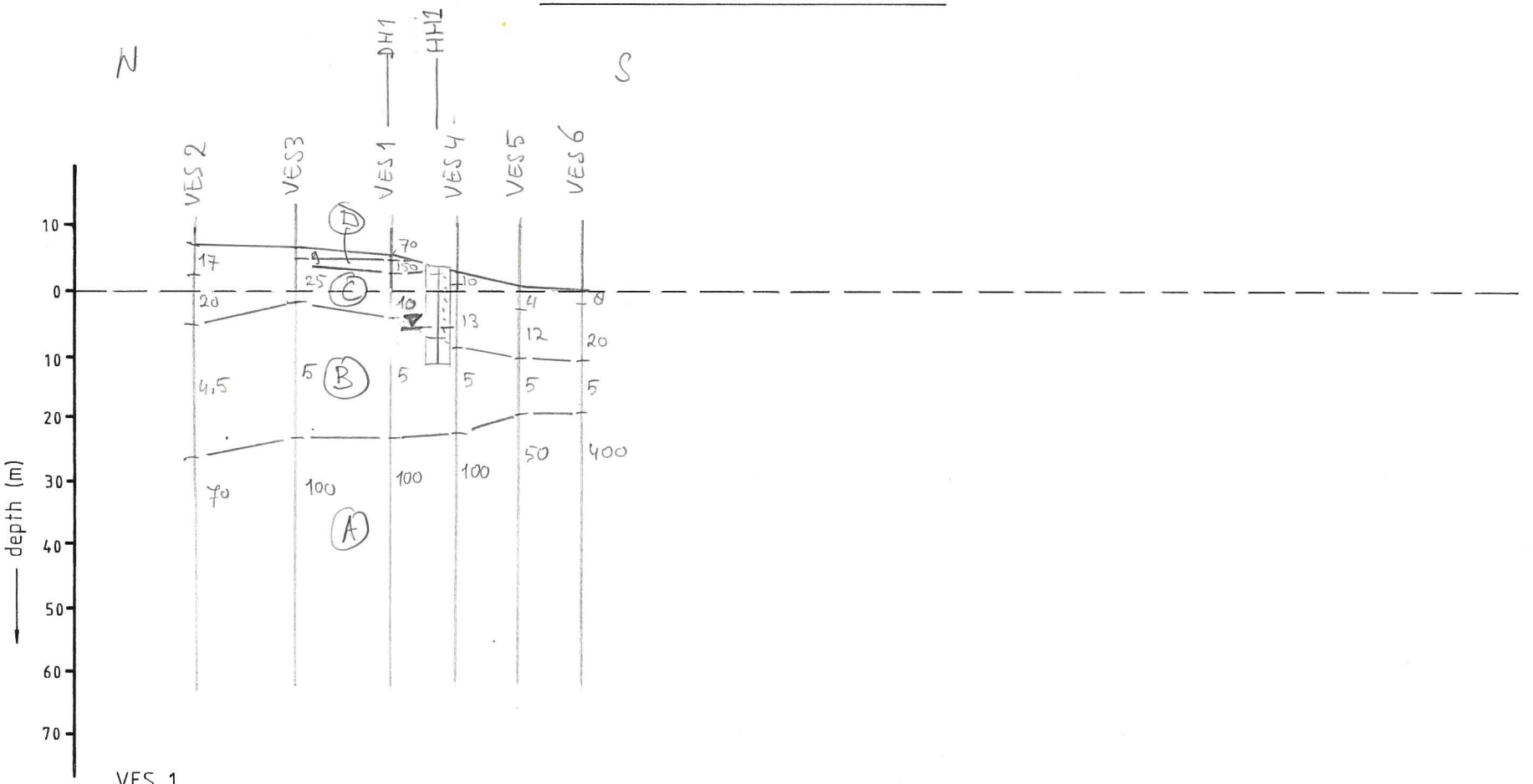
- BH 1 — Survey Borehole, approved
- BH 2 — Survey Borehole, Disapproved
- HH/DW — Handdug Hole/Drumwell
- CW — Concrete lined shallow well
- SW — Shallow well with Handpump
- Domestic Water Point
- Shamba
- Sisal

- Area temporarily flooded
- Steep Hill
- Basement outcrop
- 270 m — Distance in meters

Data Existing Water Holes/Wells

Hole/Well	Depth	W.L.	E.C µS/MC
1	..... m	..... m	.....

NDHIWA MARKET



VES 1
5
Vertical Electrical Sounding, interpreted resistivity 5 ohmm

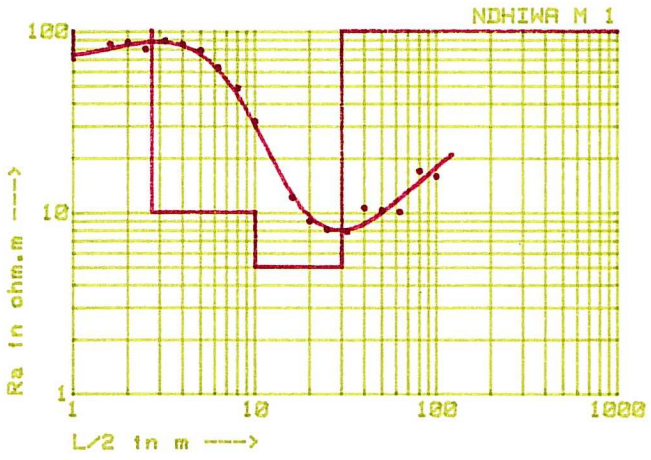
A
geo-electrical layer A

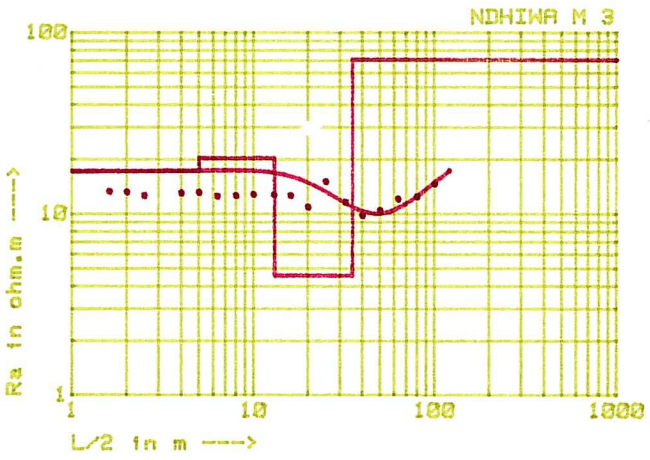
B 1
(recommended) borehole or handdug hole

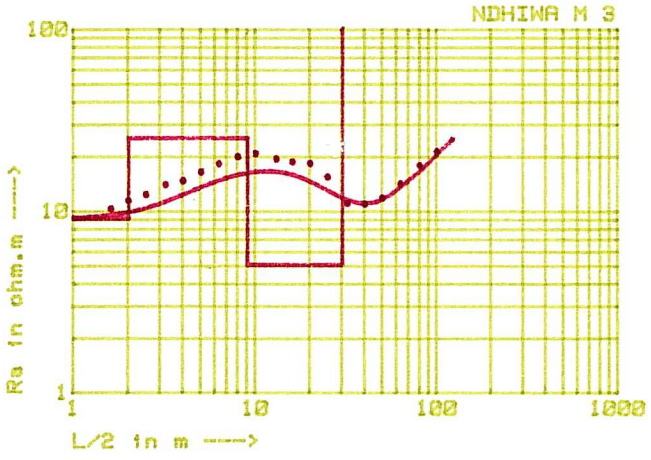
- sandy clay, cemented clay
- lateritic layer
- clay
- a very decomposed, altered rock
- w weathered rock
- p partly weathered, fractured rock
- f fresh rock

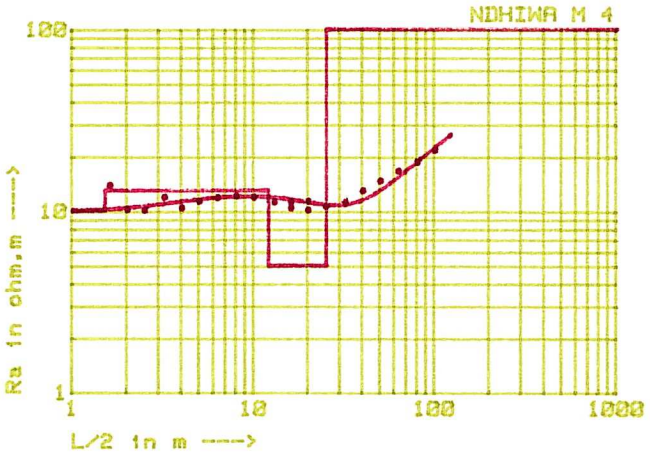
TNO-DGV Institute of Applied Geoscience	
Annex 4.3	Cross-section Ndhiwa Market
Horizontal scale 1 : 5000	Vertical scale 1 : 1000

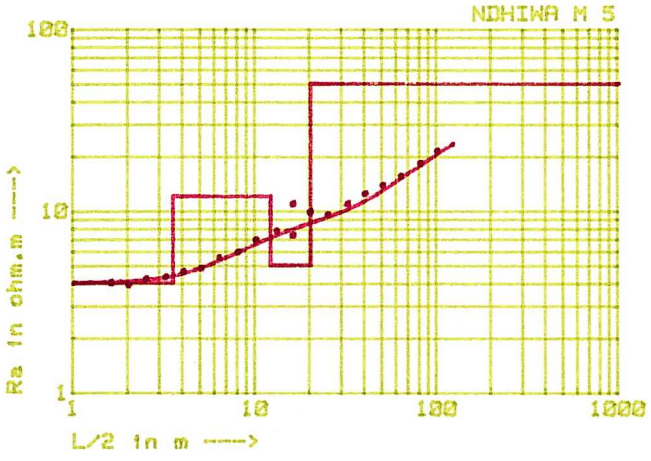
4.3

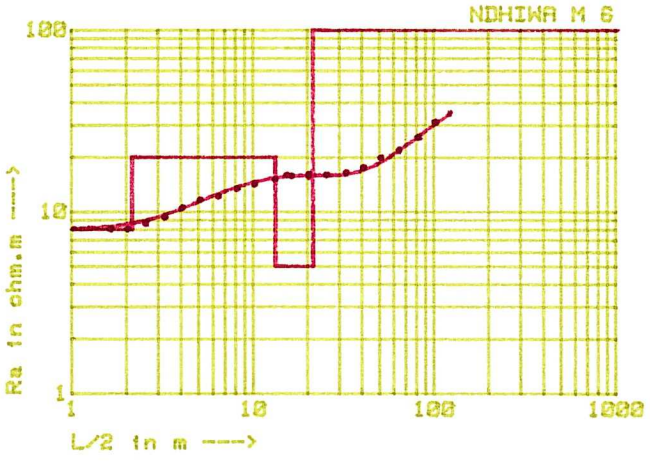

NDHIWA M 1
100
10
1
Ra in ohm.m ---->
1
10
100
1000
L/2 in m --->

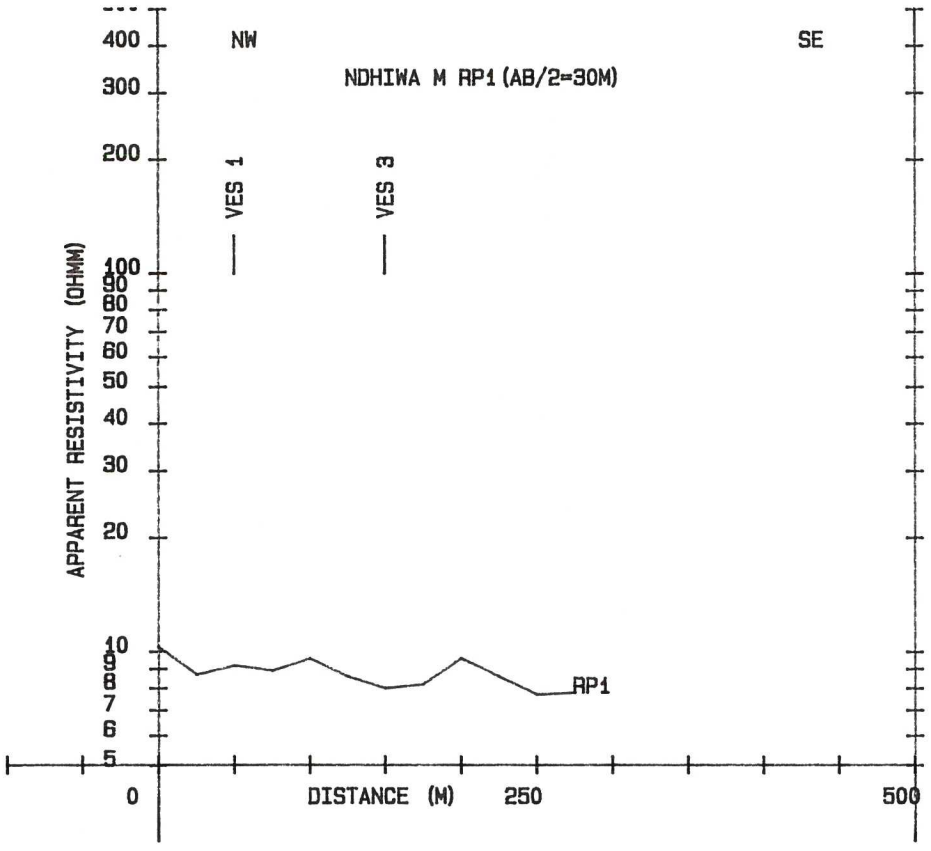

NDHIWA M 3
100
10
1
Ra in ohm.m ---->
1
10
100
1000
L/2 in m ---->

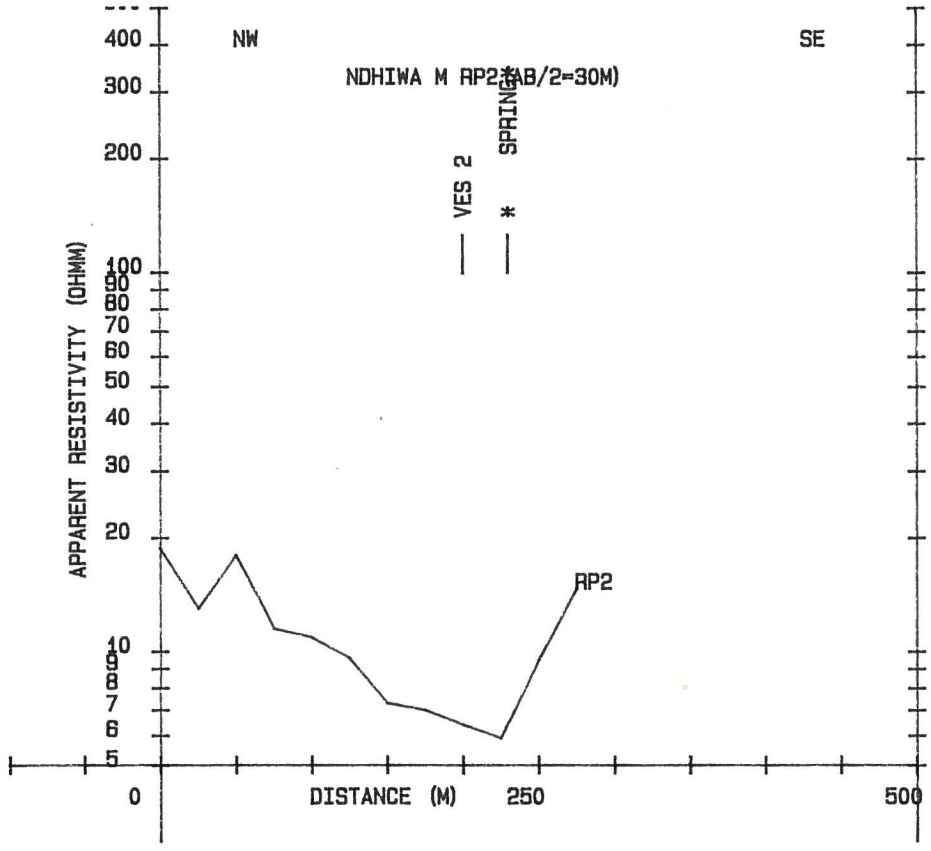

NDHIWA M 3
100
10
1
Ra in ohm.m ---->
1
10
100
1000
L/2 in m ---->

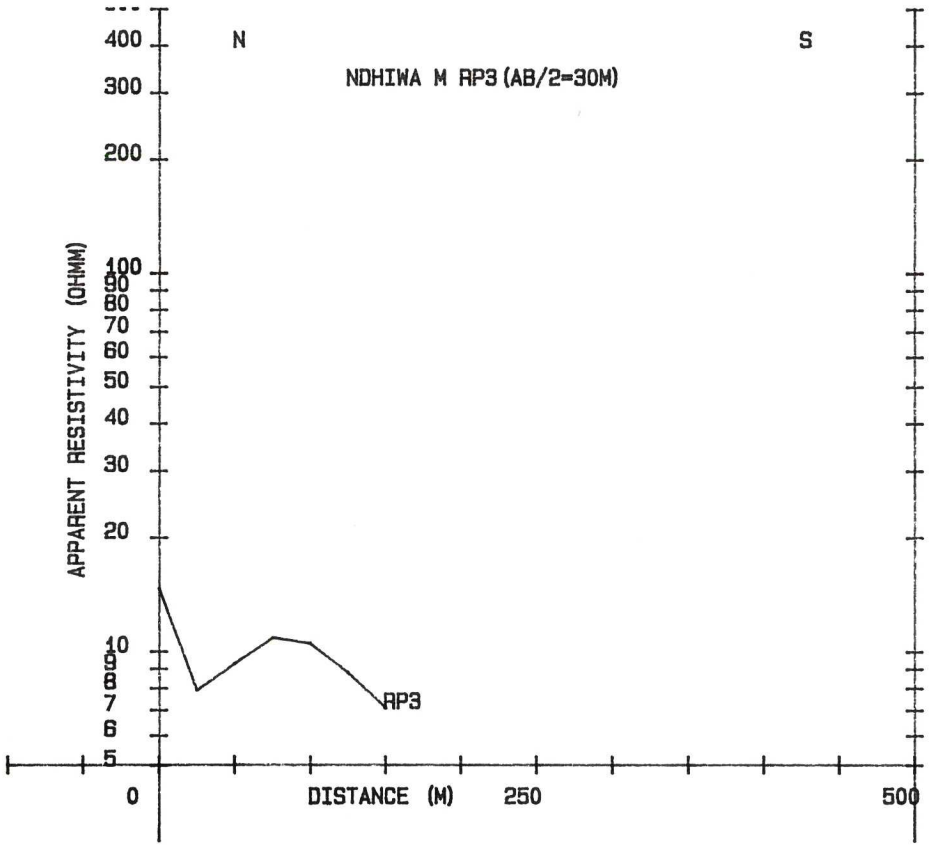

NDHIWA M 4
100
10
1
Ra in ohm.m ---->
1
10
100
1000
L/2 in m ---->

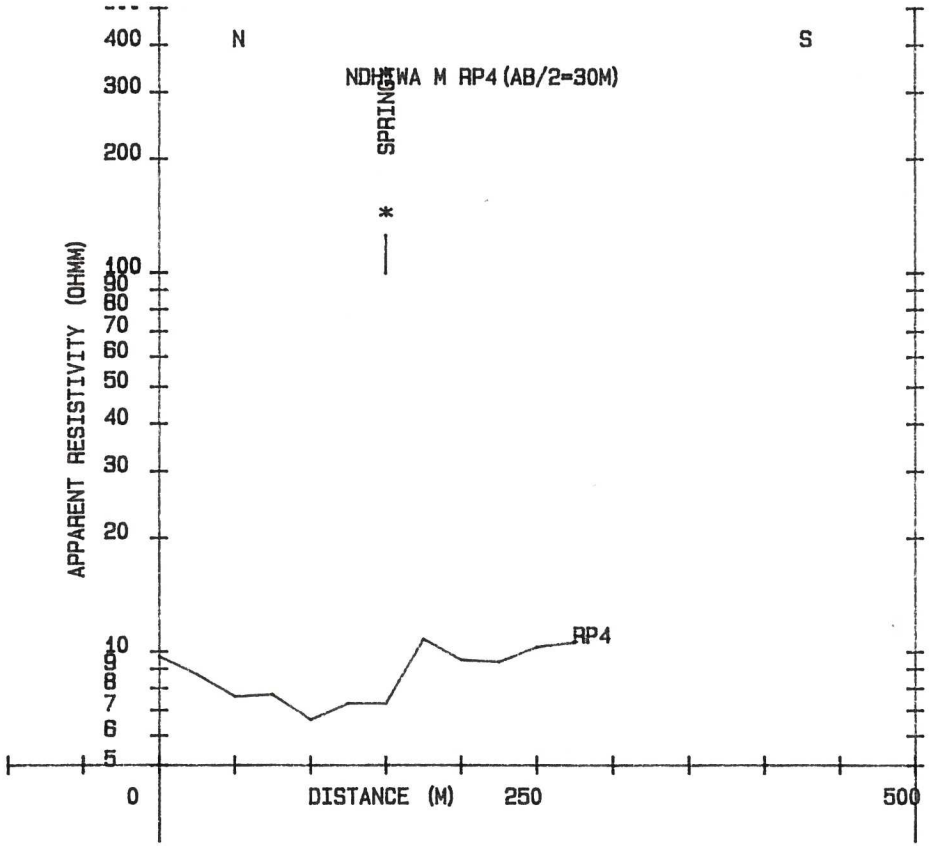

NDHIWA M 5
100
10
1
Ra in ohm.m ---->
1
10
100
1000
L/2 in m ---->

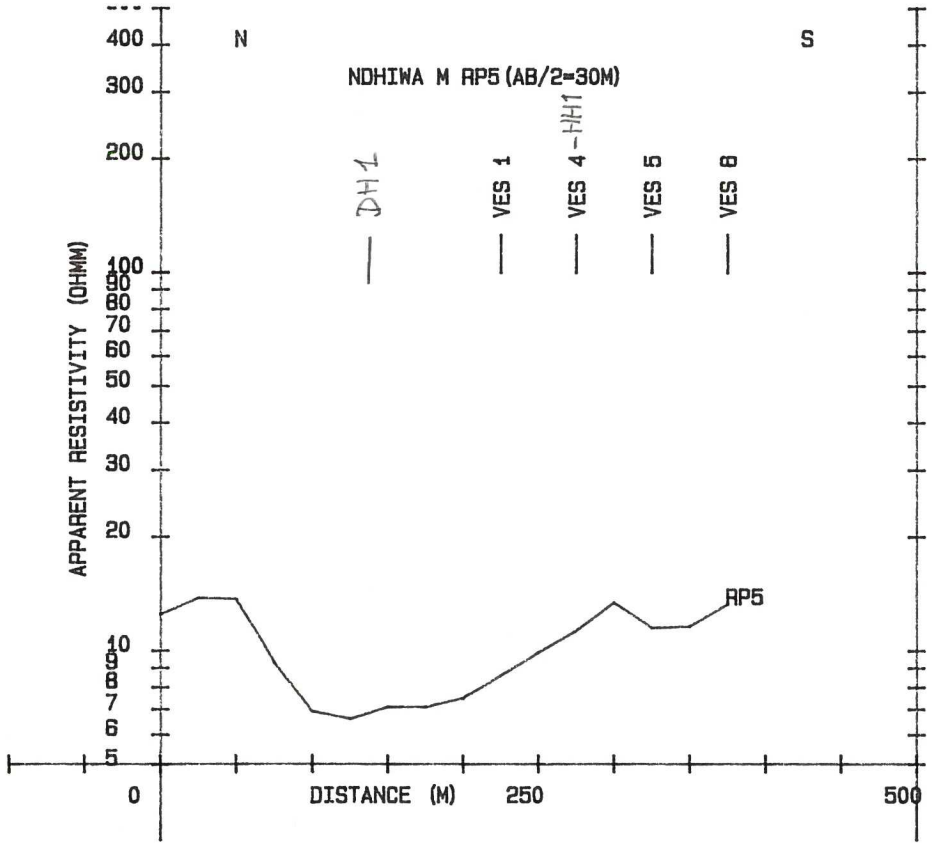

NDHIWA M 6
100
10
1
Ra in ohm.m ---->
1
10
100
1000
L/2 in m ---->


NW
SE
NDHIWA M RP1 (AB/2=30M)
VES 1
VES 3
APPARENT RESISTIVITY (OHMM)
400
300
200
100
90
80
70
60
50
40
30
20
10
9
8
7
6
5
RP1
0
DISTANCE (M)
250
500


NW
SE
NDHIWA M RP2 (AB/2=30M)
VES 2
SPRING
*
APPARENT RESISTIVITY (OHMM)
400
300
200
100
90
80
70
60
50
40
30
20
10
9
8
7
6
5
RP2
0
DISTANCE (M)
250
500


N
S
NDHIWA M RP3 (AB/2=30M)
APPARENT RESISTIVITY (OHMM)
400
300
200
100
90
80
70
60
50
40
30
20
10
9
8
7
6
5
RP3
0
DISTANCE (M)
250
500


N
S
NDHIWA M RP4 (AB/2=30M)
SPRING
APPARENT RESISTIVITY (OHMM)
400
300
200
100
90
80
70
60
50
40
30
20
10
9
8
7
6
5
RP4
0
DISTANCE (M)
250
500


N
S
NDHIWA M RP5 (AB/2=30M)
DH1
VES 1
VES 4-NH1
VES 5
VES 8
APPARENT RESISTIVITY (OHMM)
400
300
200
100
90
80
70
60
50
40
30
20
10
9
8
7
6
5
RP5
0
DISTANCE (M)
250
500

TNO-DGV INSTITUTE OF APPLIED GEOSCIENCE

Site: Ndere Primary School

Hydrogeology

Layers	Resistivity (ohmm)	Remarks
A	20-30	Weathered, decomposed volcanic rock (Tv) (DH)
B	9	Sandy clay (HH)
C	3.3-5.5	Clay + soil
D	-	-
E	-	-
F	-	-

Fractured zones, faults	Remarks
40 m SW of VES3	Centre fractured zone

Depth to groundwater table: 10 - 20 m

Groundwater quality : Fresh, partly saline

(Recommended) drilled (DH) or handdug (HH) holes

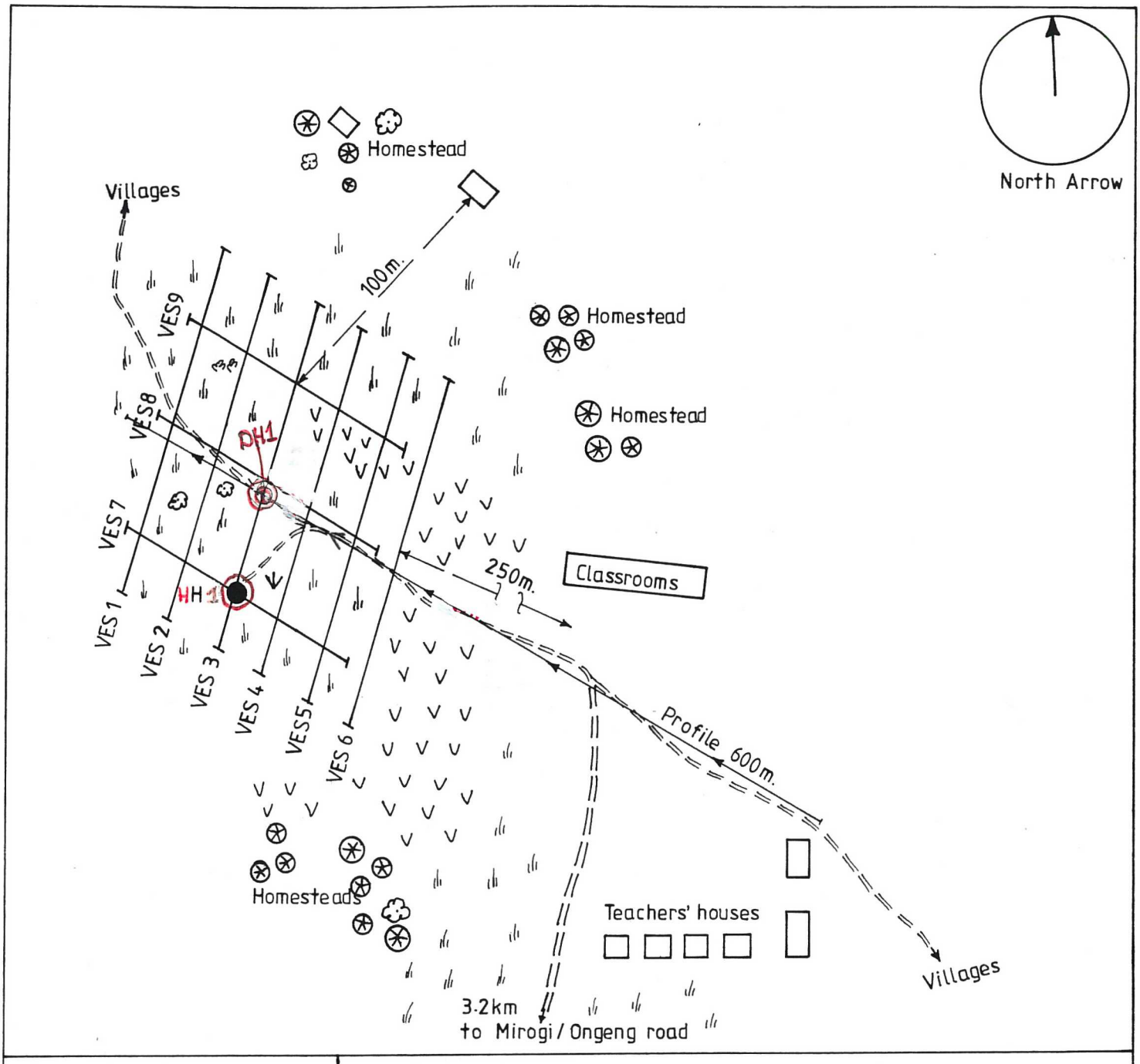
Drilled hole(s)	Remarks
DH1 (40 m SW of VES3, 50 m)	-

Handdug hole(s)	Remarks
HH1 (40 m SW of VES3, 20 m)	Groundwater -8.00 m, EC = 1100 µS/cm

NDERE PRIMARY SCHOOL (SKETCH)

SOUTH NYANZA DISTRICT: NDHIWA DIVISION: MAP SHEET 129/2

GRID REFERENCE 659·0–9929·1



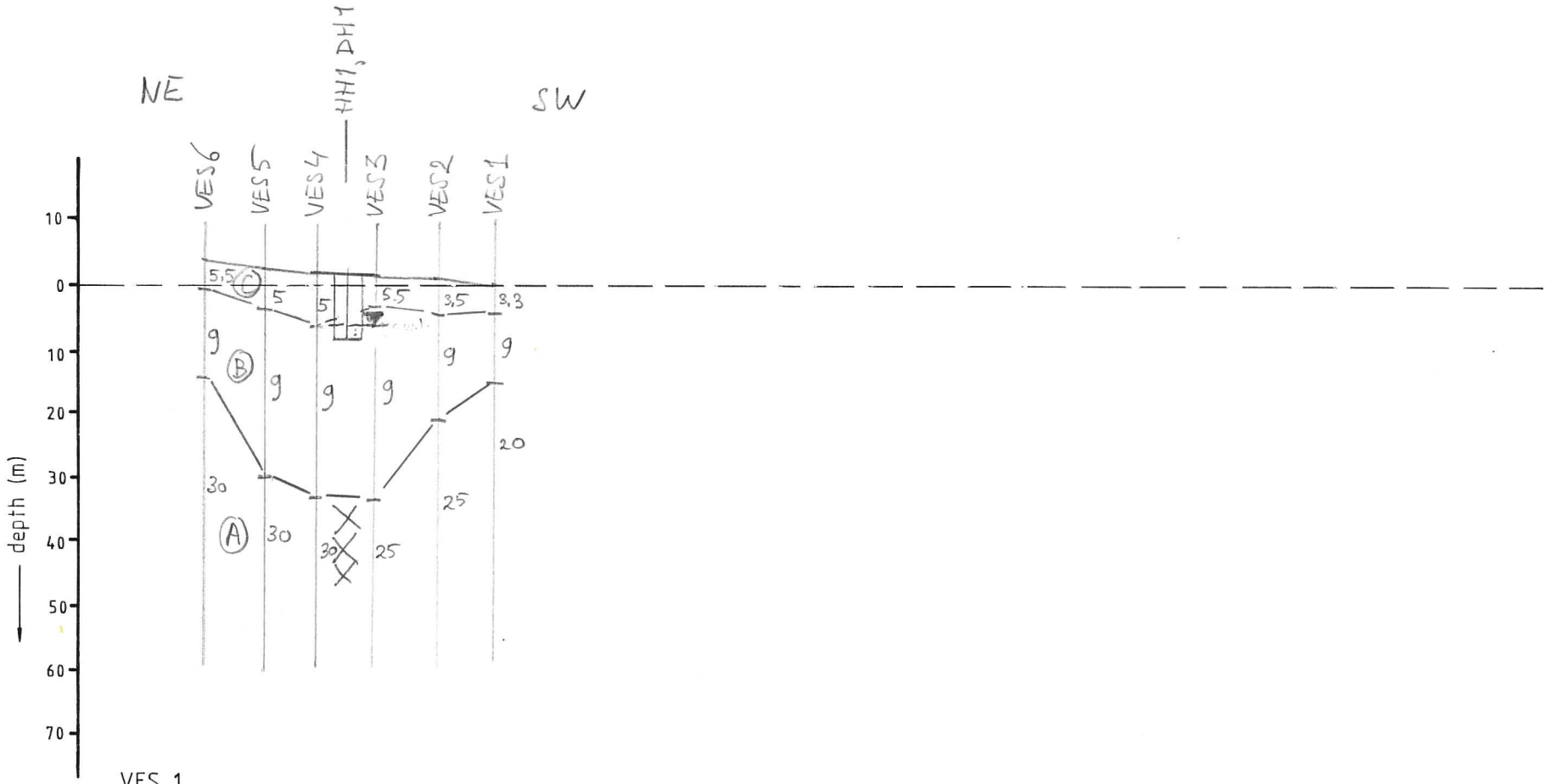
Earth road
Footpath
Classrooms
Houses
Round huts
Trees
Shrubs
Maize shamba
Long grass

VES (Vertical Electric Sounding)
200m long, at ±50m interval
Profile line 600m
HH Handdug hole

Slope :
VES1 – VES2 = +1°
VES2 – VES3 = +0·5°
VES3 – VES4 = +0·5°
VES4 – VES5 = +1°
VES5 – VES6 = +1·5°

Sketched by R. M. Shilako June 1984

NDERE PRIMARY SCHOOL



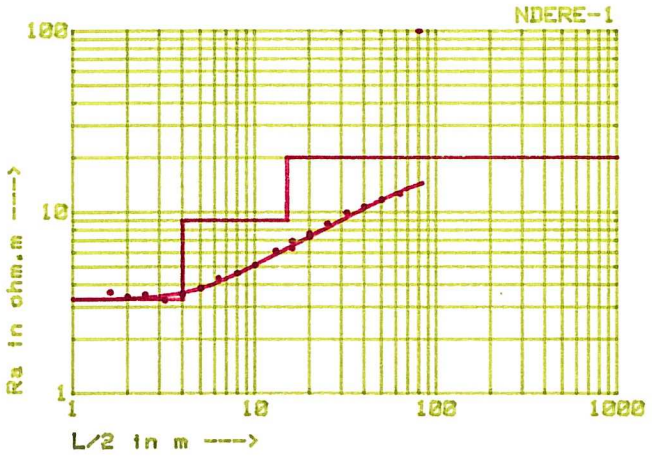
VES 1
5
Vertical Electrical Sounding, interpreted resistivity 5 ohmm

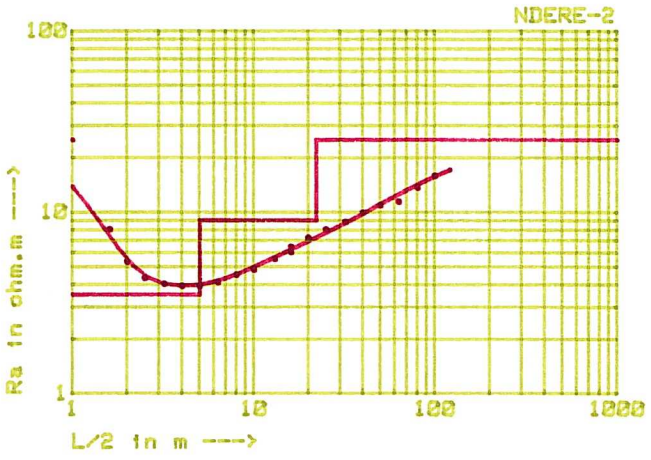
A
geo-electrical layer A

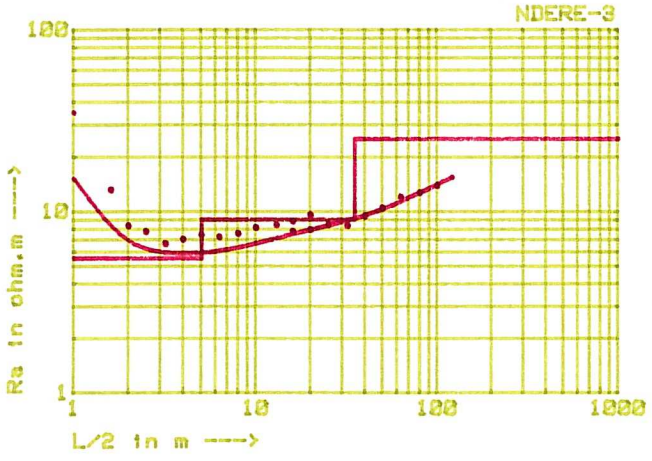
B 1
(recommended) borehole or handdug hole

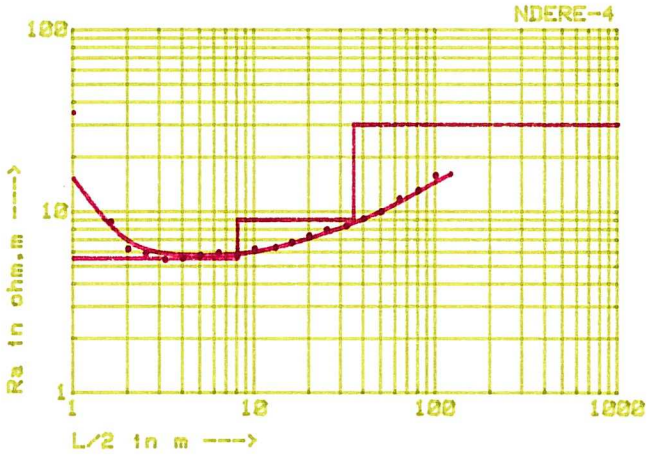
- sandy clay, cemented clay
- lateritic layer
- clay
- a — very decomposed, altered rock
- w — weathered rock
- p — partly weathered, fractured rock
- f — fresh rock

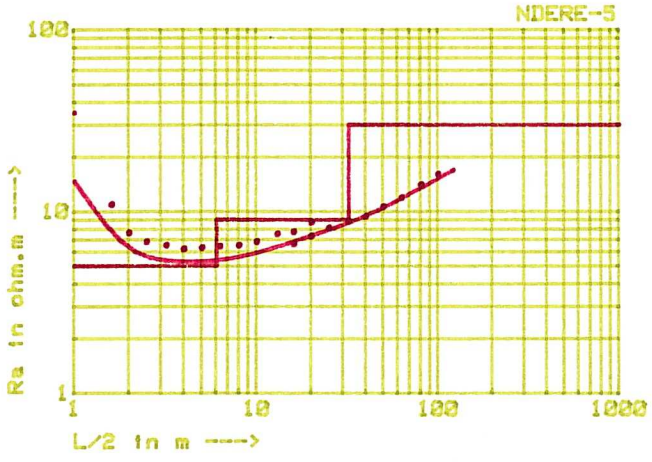
TNO-DGV Institute of Applied Geoscience	
Annex 5,3	Cross-section Ndere Pr. School
Horizontal scale 1 : 5000	Vertical scale 1 : 1000

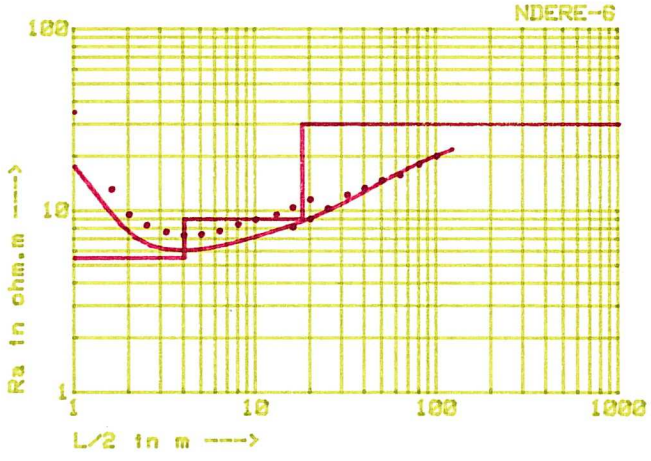

NDERE-1
100
10
1
Ra in ohm.m ---->
1
10
100
1000
L/2 in m --->

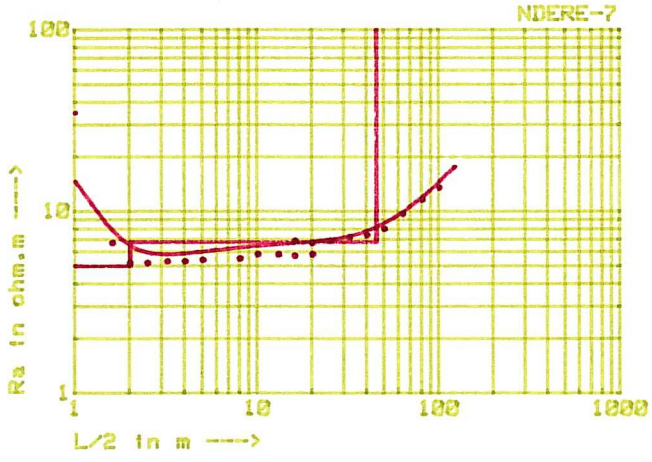

NDERE-2
100
10
1
Ra in ohm.m ---->
1
10
100
1000
L/2 in m ---->

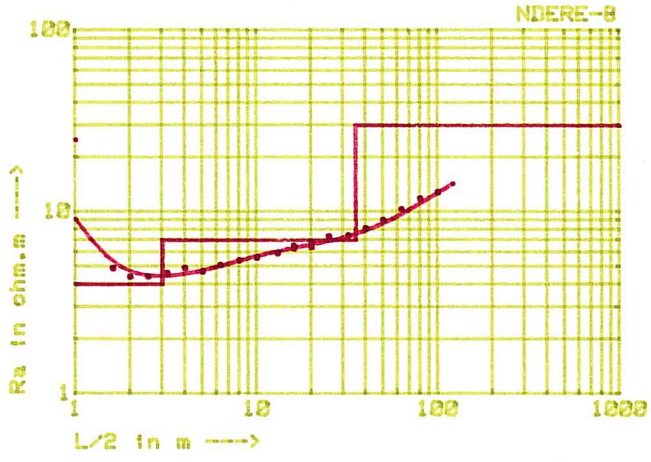

NDERE-3
100
10
1
Ra in ohm.m ---->
1
10
100
1000
L/2 in m ---->

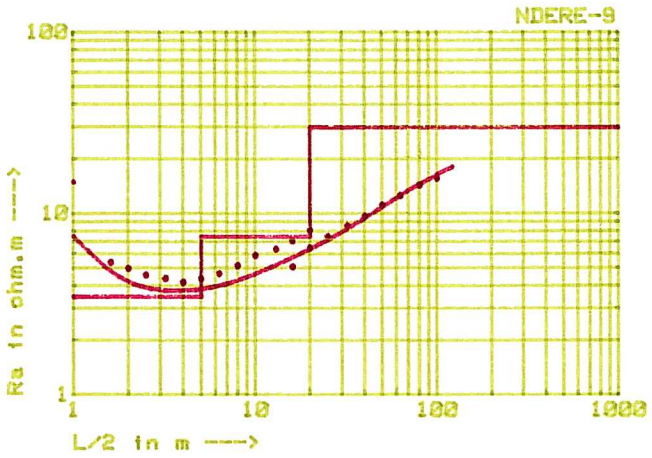

NDERE-4
100
10
1
Ra in ohm.m ---->
1
10
100
1000
L/2 in m ---->

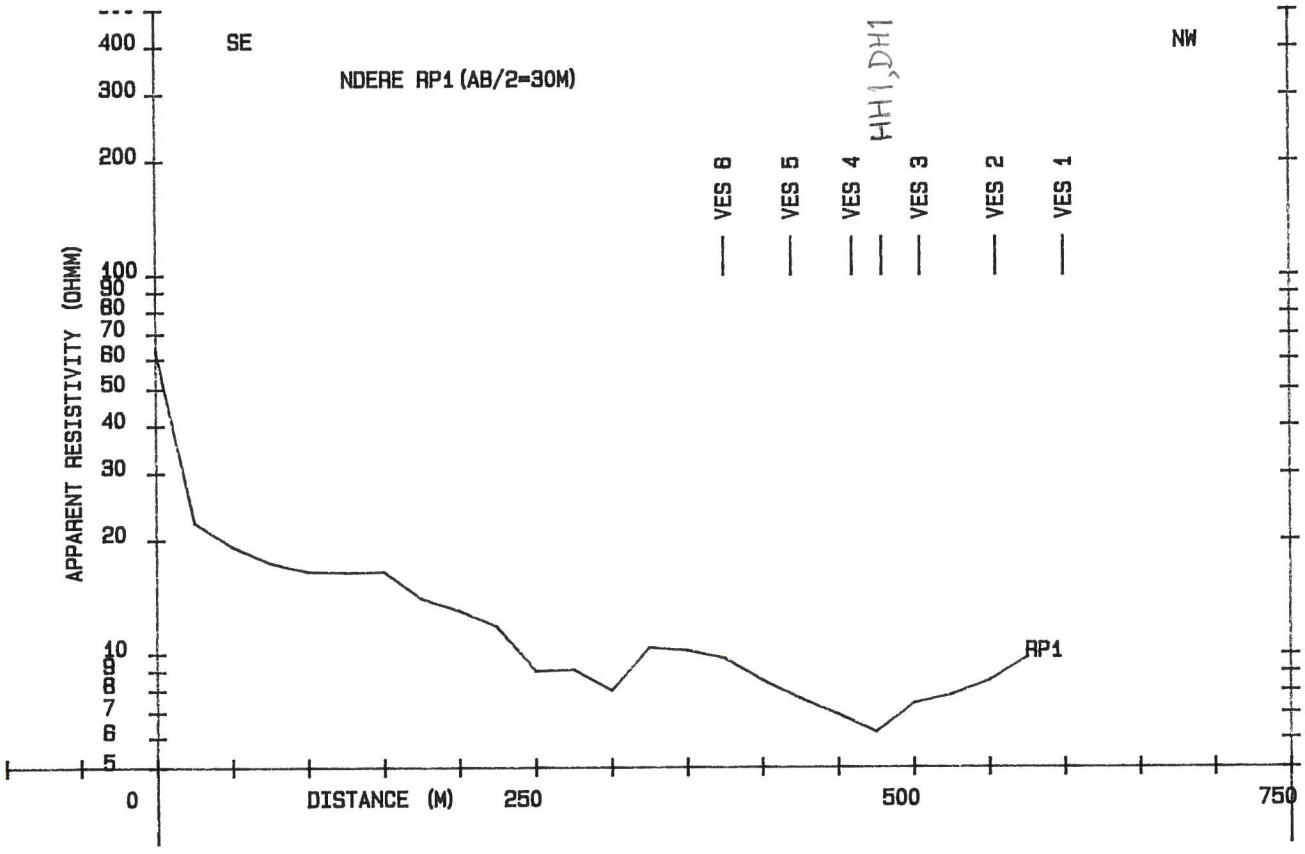

NDERE-5
100
10
1
Ra in ohm.m ---->
1
10
100
1000
L/2 in m ---->


NDERE-6
100
10
1
Ra in ohm.m ---->
1
10
100
1000
L/2 in m ---->


NDERE-7
100
10
1
Ra in ohm.m ---->
1
10
100
1000
L/2 in m ---->


NDERE-8
100
10
1
Ra in ohm.m ---->
1
10
100
1000
L/2 in m ---->


NDERE-9
100
10
1
Ra in ohm.m ---->
1
10
100
1000
L/2 in m --->


SE
NW
NDERE RP1 (AB/2=30M)
VES 6
VES 5
VES 4
VES 3
VES 2
VES 1
HH1,DH1
APPARENT RESISTIVITY (OHMM)
400
300
200
100
90
80
70
60
50
40
30
20
10
9
8
7
6
5
RP1
0
DISTANCE (M)
250
500
750

TNO-DGV INSTITUTE OF APPLIED GEOSCIENCE

Site: Nyarongi Primary School

Hydrogeology

Layers	Resistivity (ohmm)	Remarks	
A	30-80	Weathered volcanic rock (Tv)	(DH)
B	5-8	Clay	
C	15-30	Sandy clay	
D	8-12	Clayey soil	
E	-	-	
F	-	-	

Fractured zones, faults	Remarks
40 m S of VES3	Fractured zone

Depth to groundwater table: 20 - 25 m

Groundwater quality : Fresh

(Recommended) drilled (DH) or handdug (HH) holes

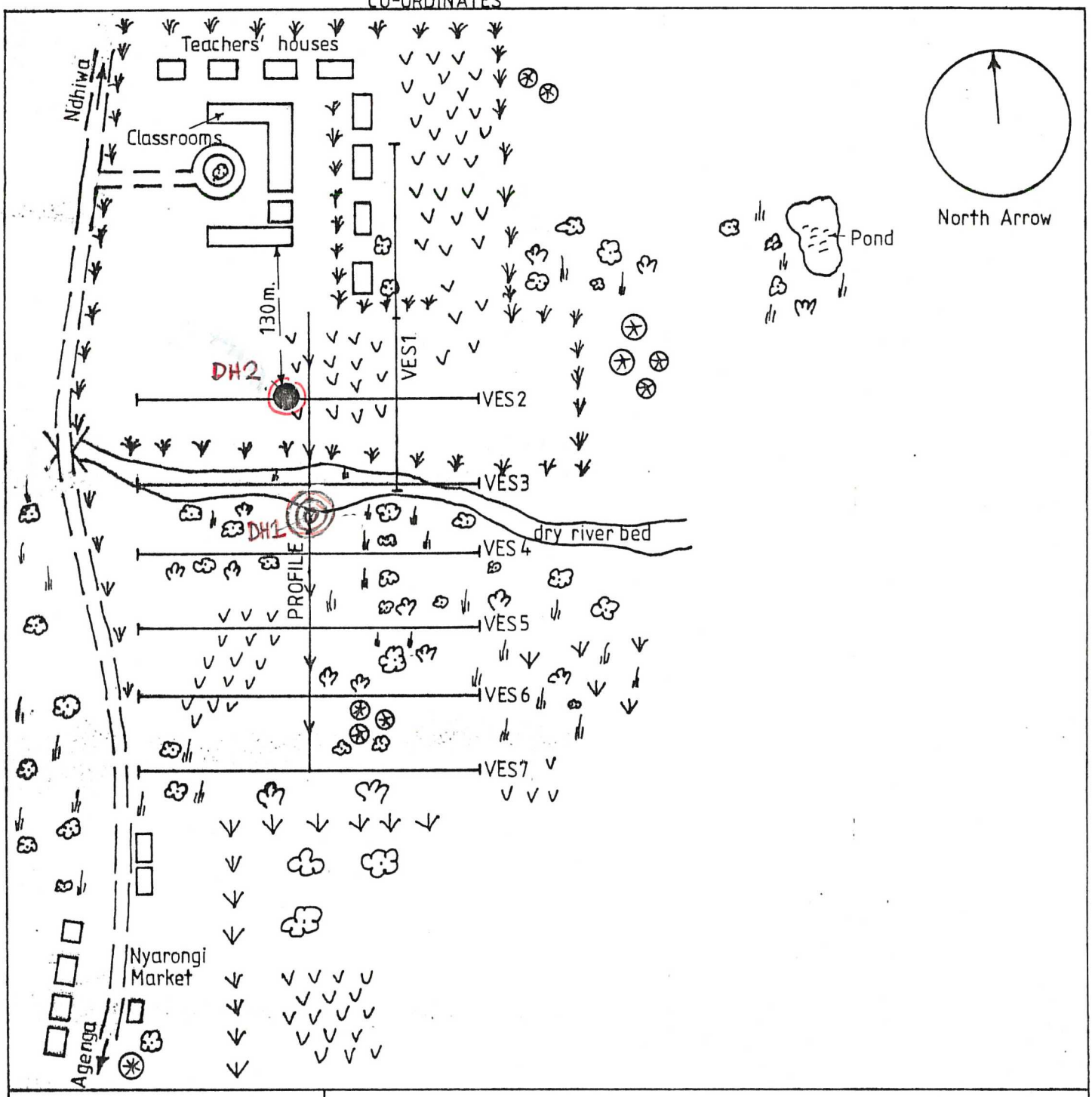
Drilled hole(s)	Remarks
DH1 (40 m S of VES3, 40 m)	-
DH2 (VES2, 42 m)	Groundwater at -21.00 m, EC = 810 µS/cm

Handdug hole(s)	Remarks
-	-

NYARONGI PRIMARY SCHOOL (SKETCH)

SOUTH NYANZA DISTRICT: NDHIWA DIVISION: MAP SHEET

CO-ORDINATES



Murram road

Classrooms

Teachers houses

Round huts

Trees

Shrubs

Maize shamba

Hedge

Sisal

Long grass

BH Borehole – machine drilled

VES (Vertical Electric Sounding) 200m. long, at 100m. interval

Profile line

Slope:– VES2– 92m. = –2°

92m –VES3 = –4°

VES3 – 47m.= +3°

47m. –VES4 = 0°

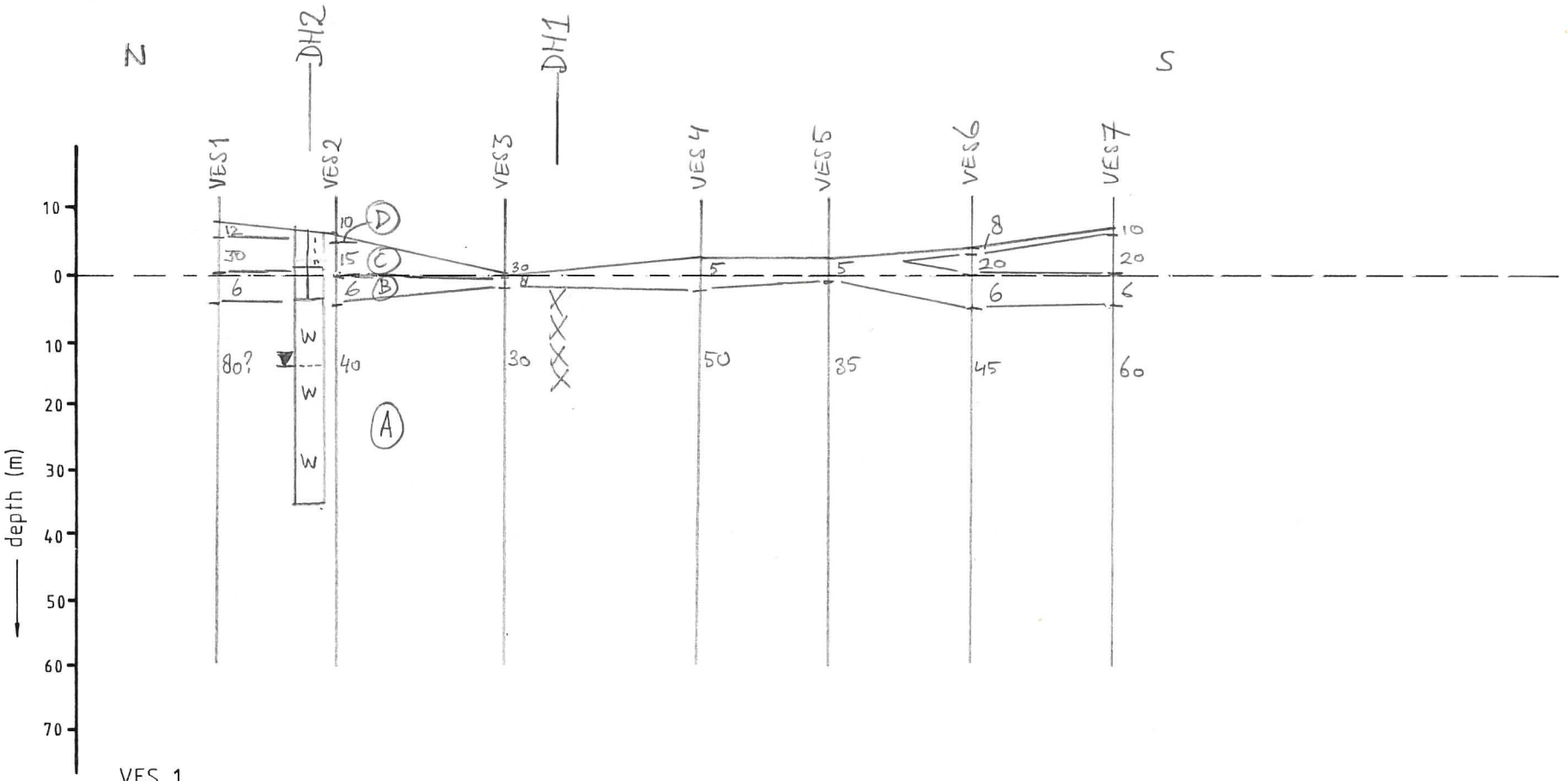
VES4 – VES5 = 0°

VES5 – VES6 = +1°

VES6 – VES7 = +1.5°

Sketched by R. M. Shilaka June 1984

NYARONGI PRIMARY SCHOOL



VES 1
5
Vertical Electrical Sounding, interpreted resistivity 5 ohmm

A
geo-electrical layer A

B 1
(recommended) borehole or handdug hole

sandy clay, cemented clay

lateritic layer

clay

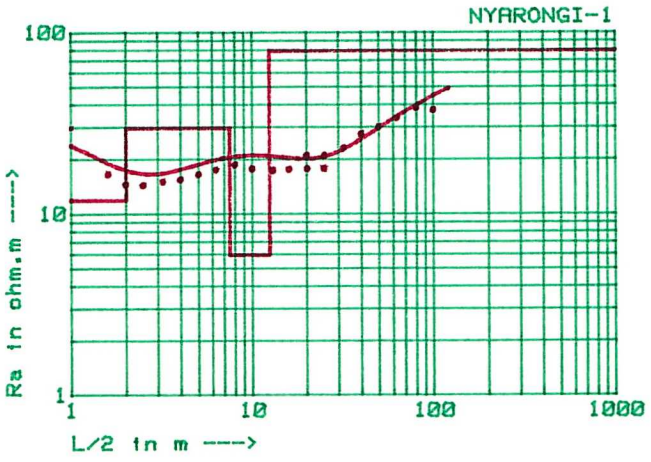
a very decomposed, altered rock

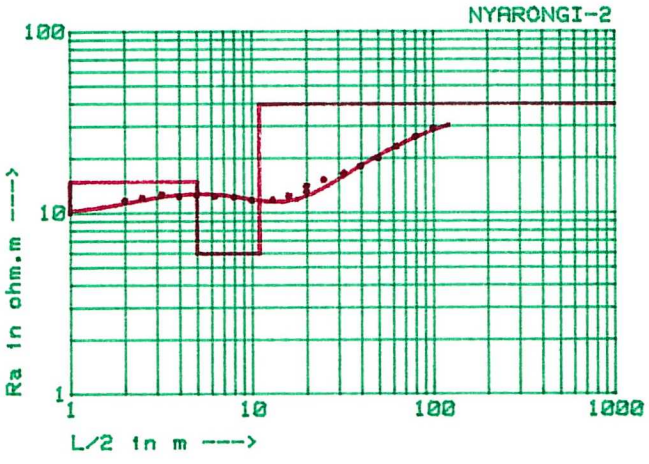
w weathered rock

p partly weathered, fractured rock

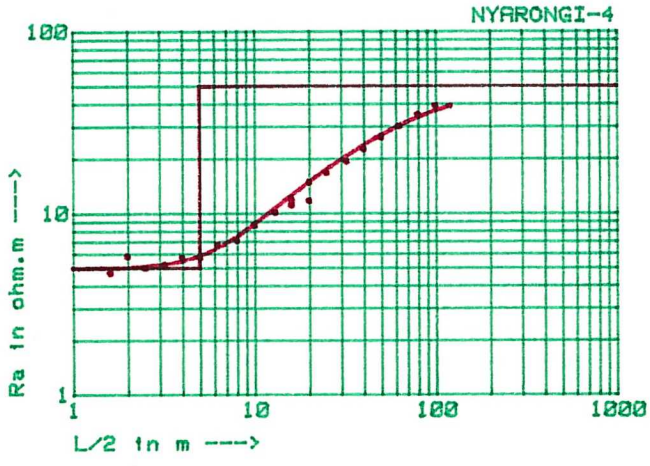
f fresh rock

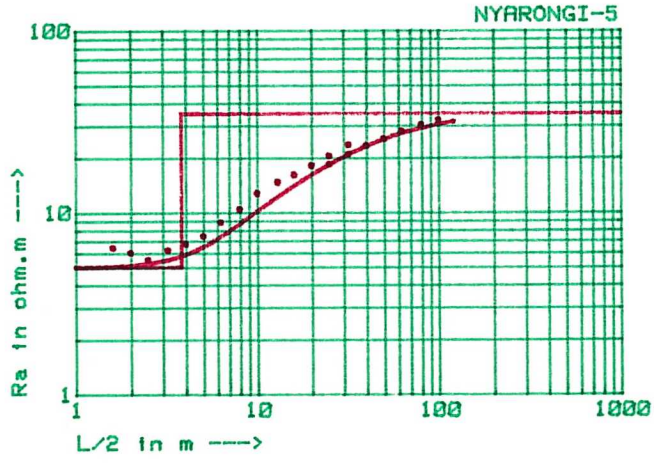
TNO-DGV Institute of Applied Geoscience	
Annex 6.3	Cross-section Nyarongi Pr. School
Horizontal scale 1 : 5000	Vertical scale 1 : 1000

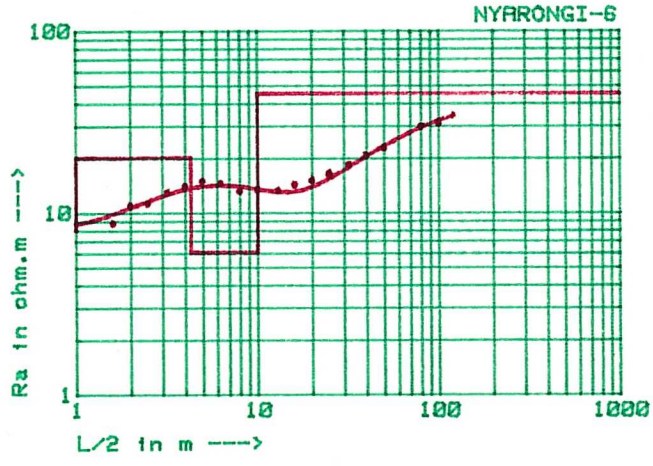

NYARONGI-1
100
10
1
1
10
100
1000
Ra in ohm.m --->
L/2 in m --->

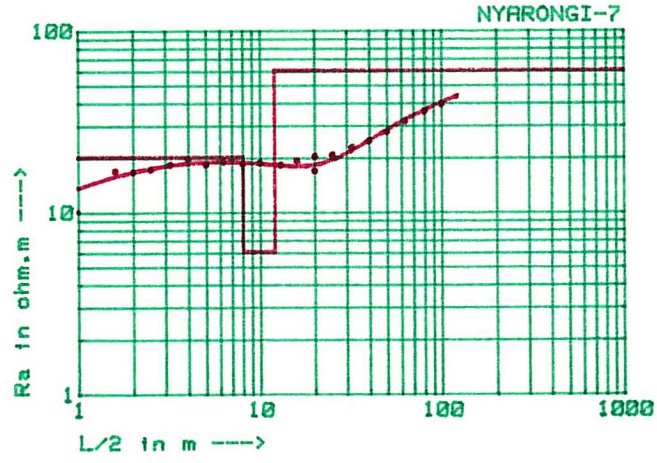

NYARONGI-2
100
10
1
1
10
100
1000
Ra in ohm.m --->
L/2 in m --->

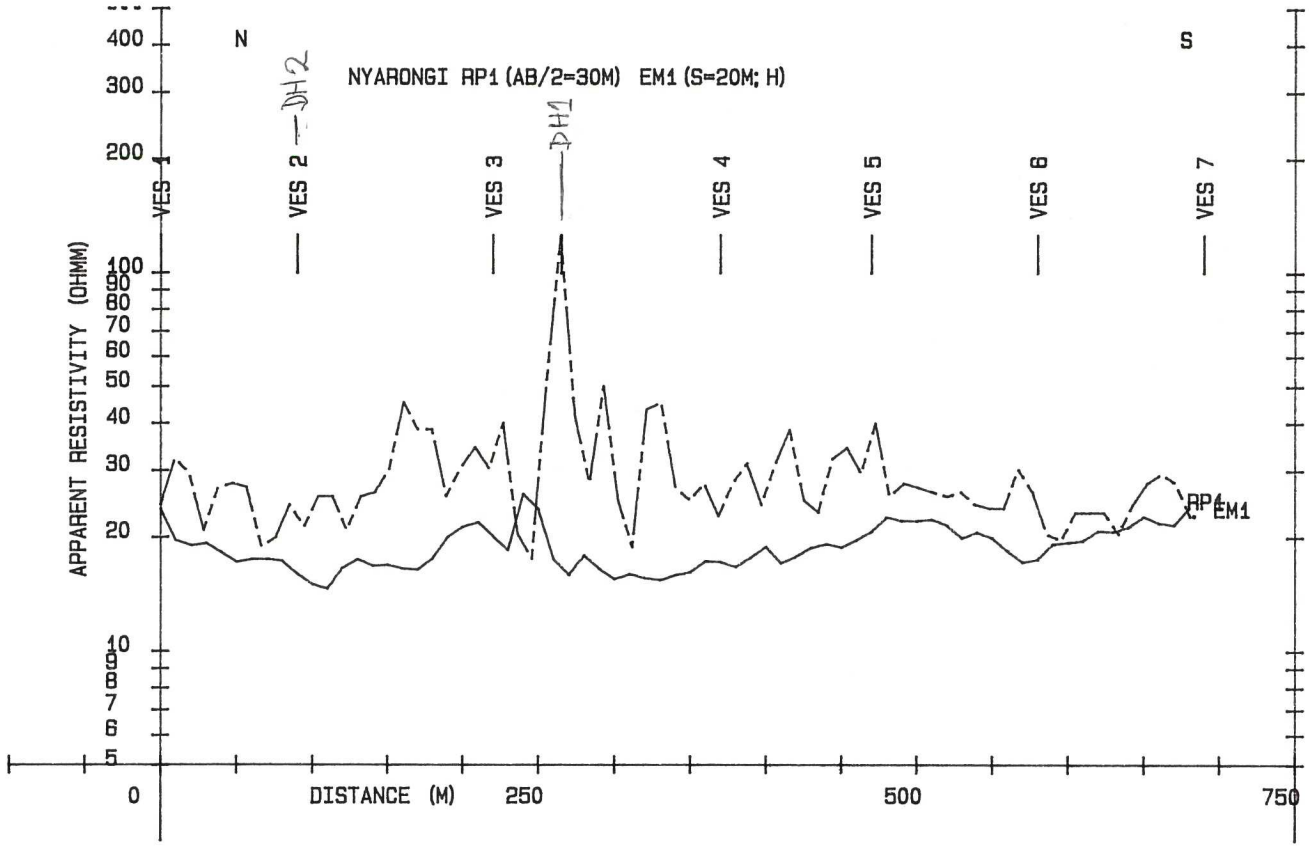

NYARONGI-3
100
10
1
1
10
100
1000
Ra in ohm.m --->
L/2 in m --->


NYARONGI-4
100
10
1
1
10
100
1000
Ra in ohm.m --->
L/2 in m --->


NYARONGI-5
100
10
1
1
10
100
1000
Ra in ohm.m --->
L/2 in m --->


NYARONGI-6
100
10
1
1
10
100
1000
Ra in ohm.m --->
L/2 in m --->


NYARONGI-7
100
10
1
1
10
100
1000
Ra in ohm.m --->
L/2 in m --->


NYARONGI RP1 (AB/2=30M) EM1 (S=20M; H)
N
S
VES 1
VES 2
VES 3
VES 4
VES 5
VES 6
VES 7
DH2
DH1
APPARENT RESISTIVITY (OHMM)
400
300
200
100
90
80
70
60
50
40
30
20
10
9
8
7
6
5
RP1
EM1
0
DISTANCE (M)
250
500
750

TNO-DGV INSTITUTE OF APPLIED GEOSCIENCE

Site: Osani Market

Hydrogeology

Layers	Resistivity (ohmm)	Remarks	
A	80-100	Weathered volcanic rock (Tv)	(DH)
B	3.3-6.5	Clay	(HH)
C	12	Sandy clay	
D	7-12	Clayey soil	
E	100-800	Fresh volcanic rock (Na)	
F	-	-	

Fractured zones, faults	Remarks
VES2	Important fault between Na an Tv

Depth to groundwater table: 10 - 15 m

Groundwater quality : Fresh, lightly saline

(Recommended) drilled (DH) or handdug (HH) holes

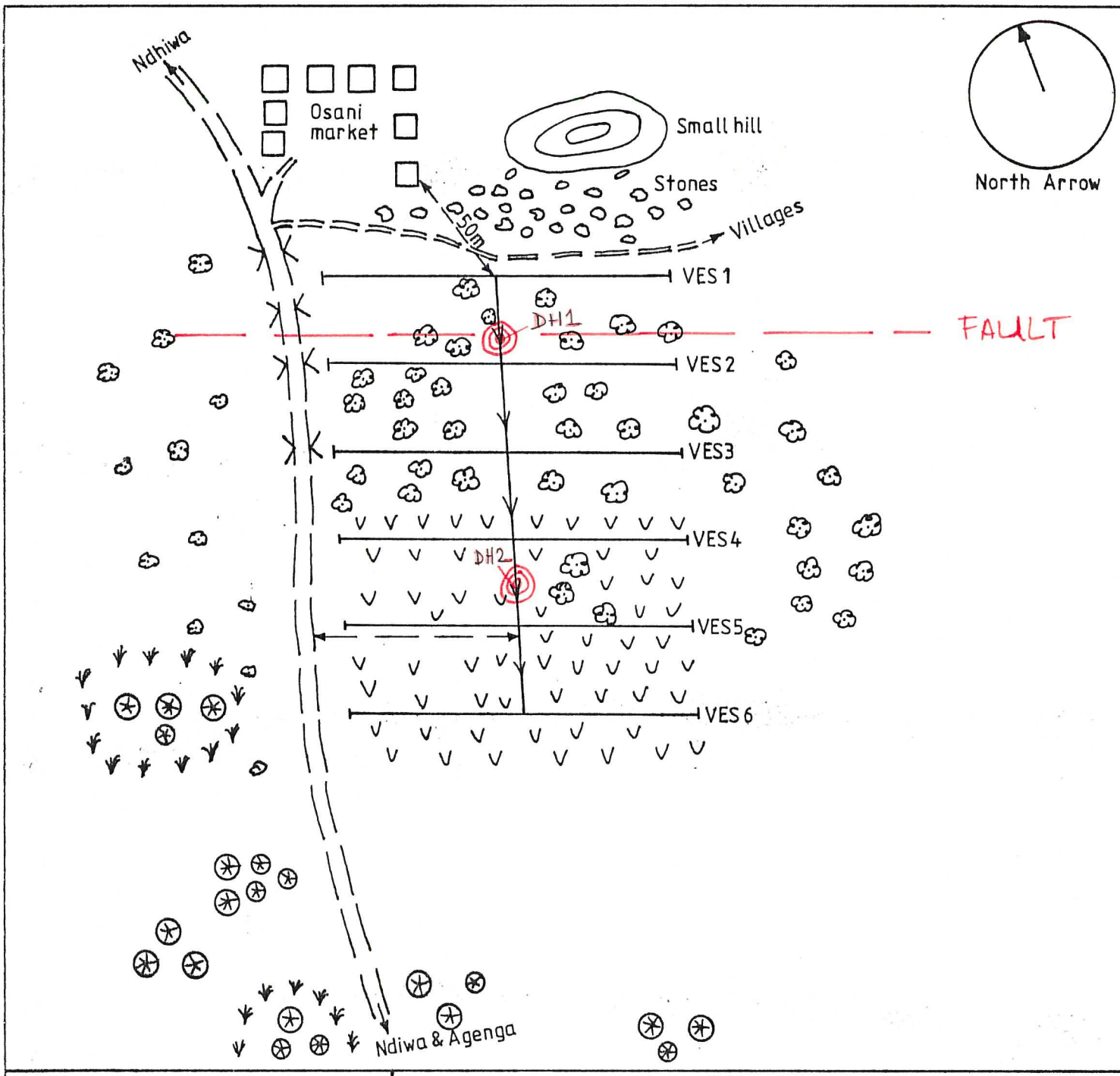
Drilled hole(s)	Remarks
DH1(VES2, 35 m)	Groundwater at -10.00 m, EC = 670 µS/cm

Handdug hole(s)	Remarks
HH1 (60 m N of VES5, 20 m)	-

OSANI MARKET (SKETCH)

SOUTH NYANZA DISTRICT. MIGORI DIVISION: MAPSHEET 129/4

CO-ORDINATES



- Murram road
- Path
- Round huts
- Trees
- Shops
- Maize + Millet shamba
- Stones
- Hedge

VES (Vertical Electric Sounding) 200m. long, at 150m. interval

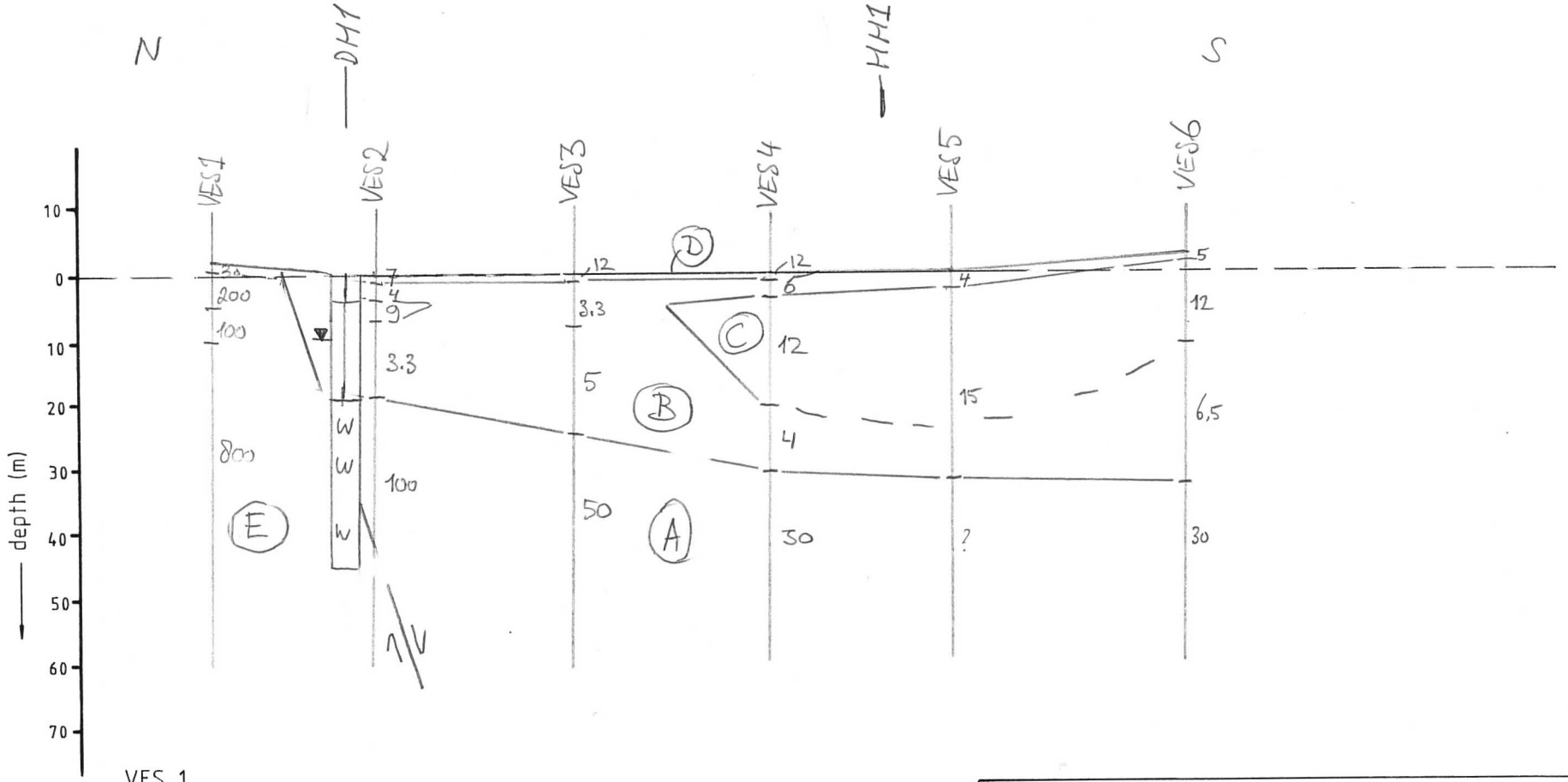
Profile line 400m.

Slope

VES1 – VES2 = -1°
VES2 – VES3 = 0°
VES3 – VES4 = 0°
VES4 – VES5 = 0°
VES5 – VES6 = +1°

Sketched by R.M. Shilaka June 1984

OSANI MARKET



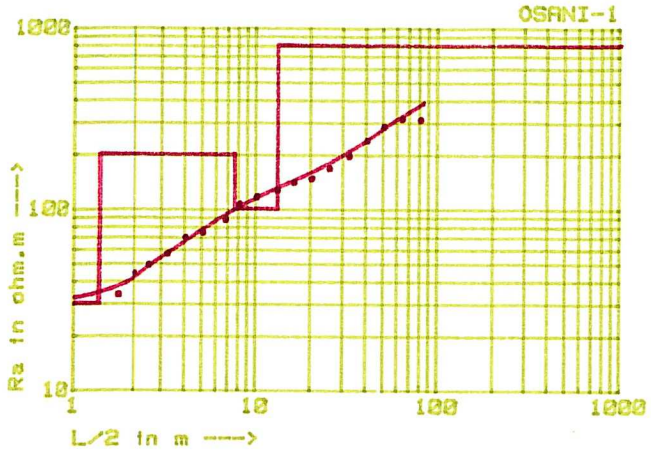
VES 1
5
Vertical Electrical Sounding, interpreted resistivity 5 ohmm

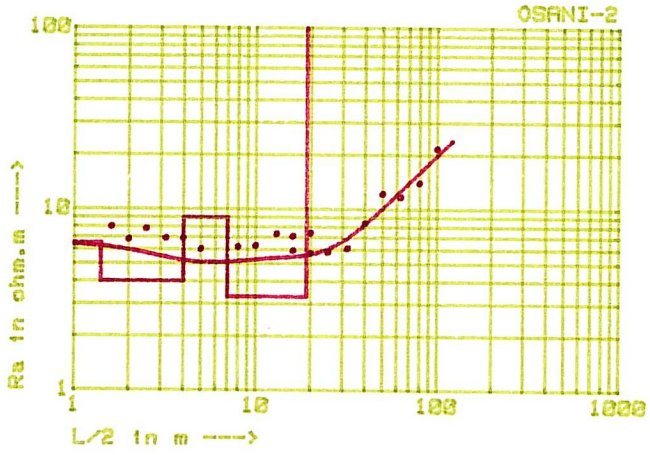
A
geo-electrical layer A

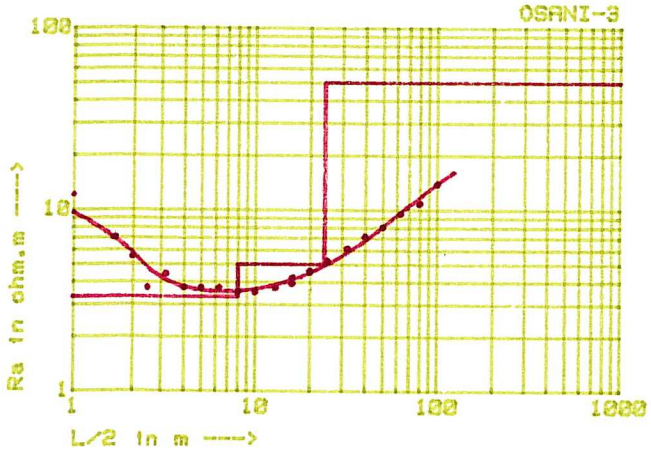
B 1
(recommended) borehole or handdug hole

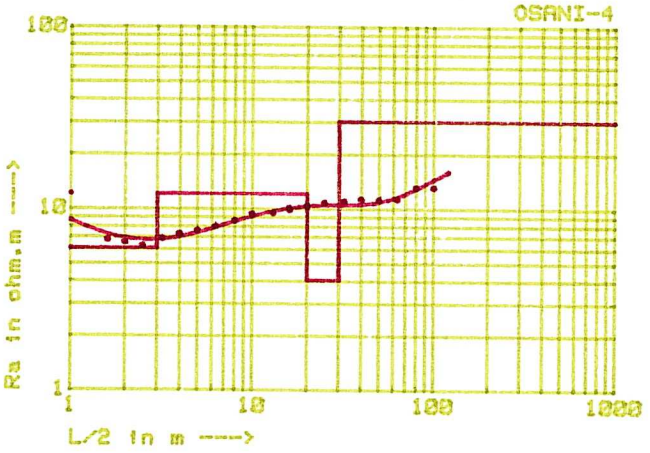
- sandy clay, cemented clay
- lateritic layer
- clay
- a — very decomposed, altered rock
- w — weathered rock
- p — partly weathered, fractured rock
- f — fresh rock

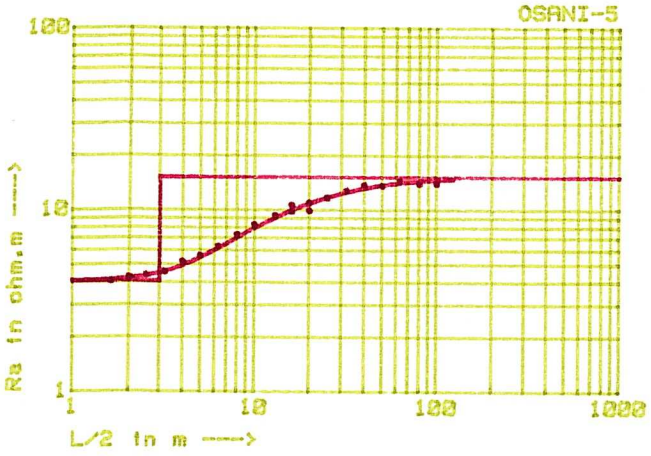
TNO-DGV Institute of Applied Geoscience	
Annex 7.3	Cross-section Osani Market
Horizontal scale 1 : 5000	Vertical scale 1 : 1000

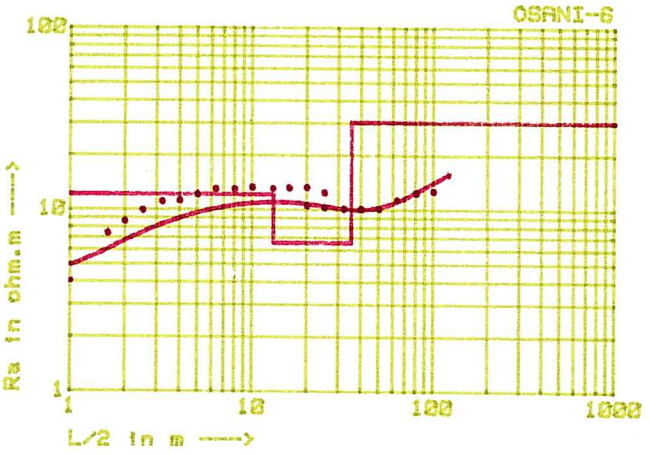

OSANI-1
1000
100
10
1
10
100
1000
Ra in ohm.m ---->
L/2 in m --->

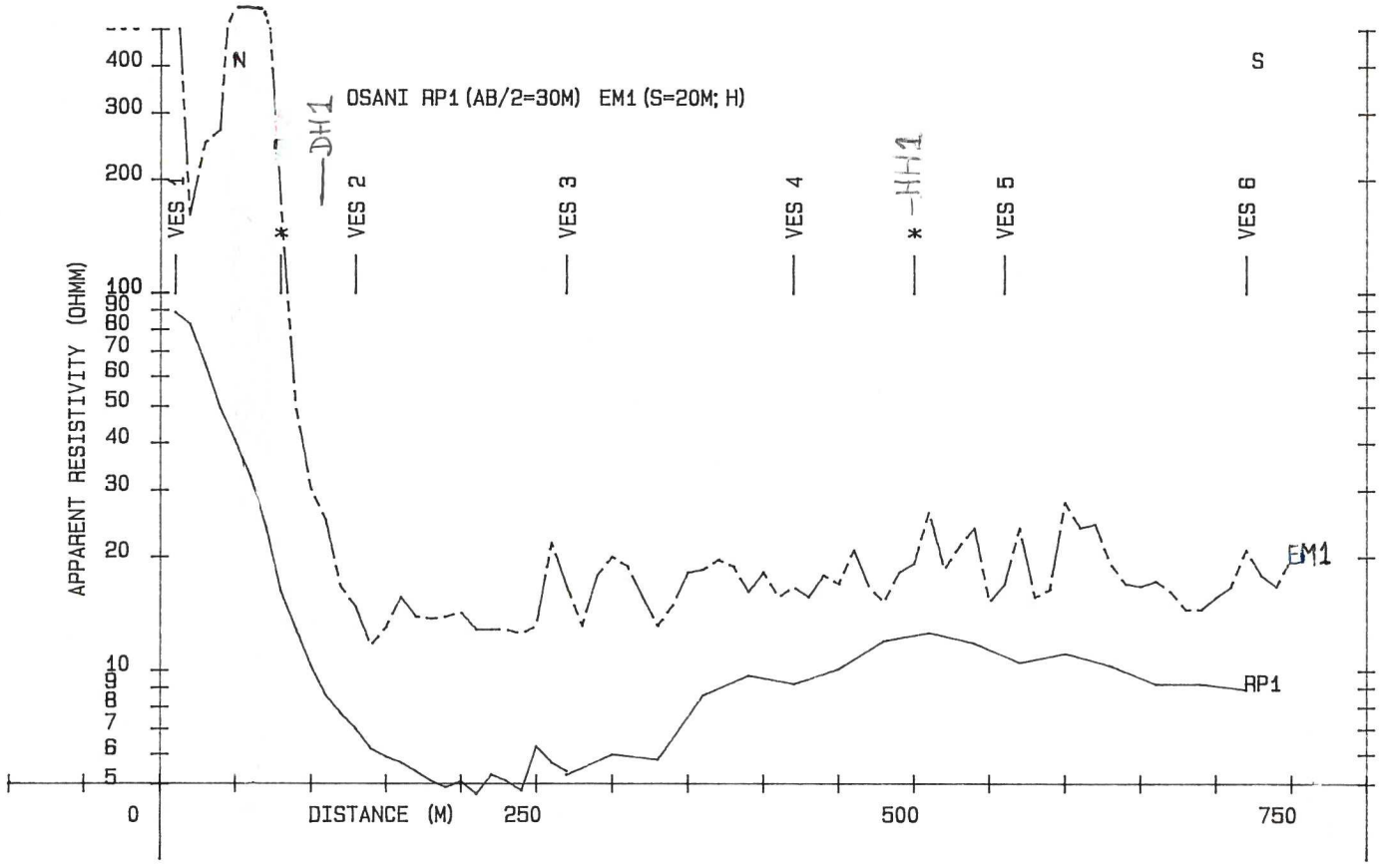

OSANI-2
100
10
1
10
100
1000
Ra in ohm.m ---->
L/2 in m ---->


OSANI-3
100
10
1
10
100
1000
Ra in ohm.m ---->
L/2 in m ---->


OSANI-4
100
10
1
10
100
1000
Ra in ohm.m ---->
L/2 in m ---->


OSANI-5
100
10
1
10
100
1000
Ra in ohm.m ---->
L/2 in m ---->


OSANI-6
100
10
1
10
100
1000
Ra in ohm.m ---->
L/2 in m ---->


OSANI RP1 (AB/2=30M) EM1 (S=20M; H)
N
S
DH1
HH1
VES 1
VES 2
VES 3
VES 4
VES 5
VES 6
APPARENT RESISTIVITY (OHMM)
400
300
200
100
90
80
70
60
50
40
30
20
10
9
8
7
6
5
EM1
RP1
0
DISTANCE (M)
250
500
750

TNO-DGV INSTITUTE OF APPLIED GEOSCIENCE

Site: Koguta Primary School / Market

Hydrogeology

Layers	Resistivity (ohmm)	Remarks	
A	70-100	Weathered sandy rock (Kc)	(DH)
B	5	Clay	(HH)
C	10-22	Sandy Clay	
D	70	Lateritic soil	
E	-	-	
F	-	-	

Fractured zones, faults	Remarks
60 m E of VES3	fault zone, W-side shallow rock

Depth to groundwater table: 10 - 20 m

Groundwater quality : Fresh

(Recommended) drilled (DH) or handdug (HH) holes

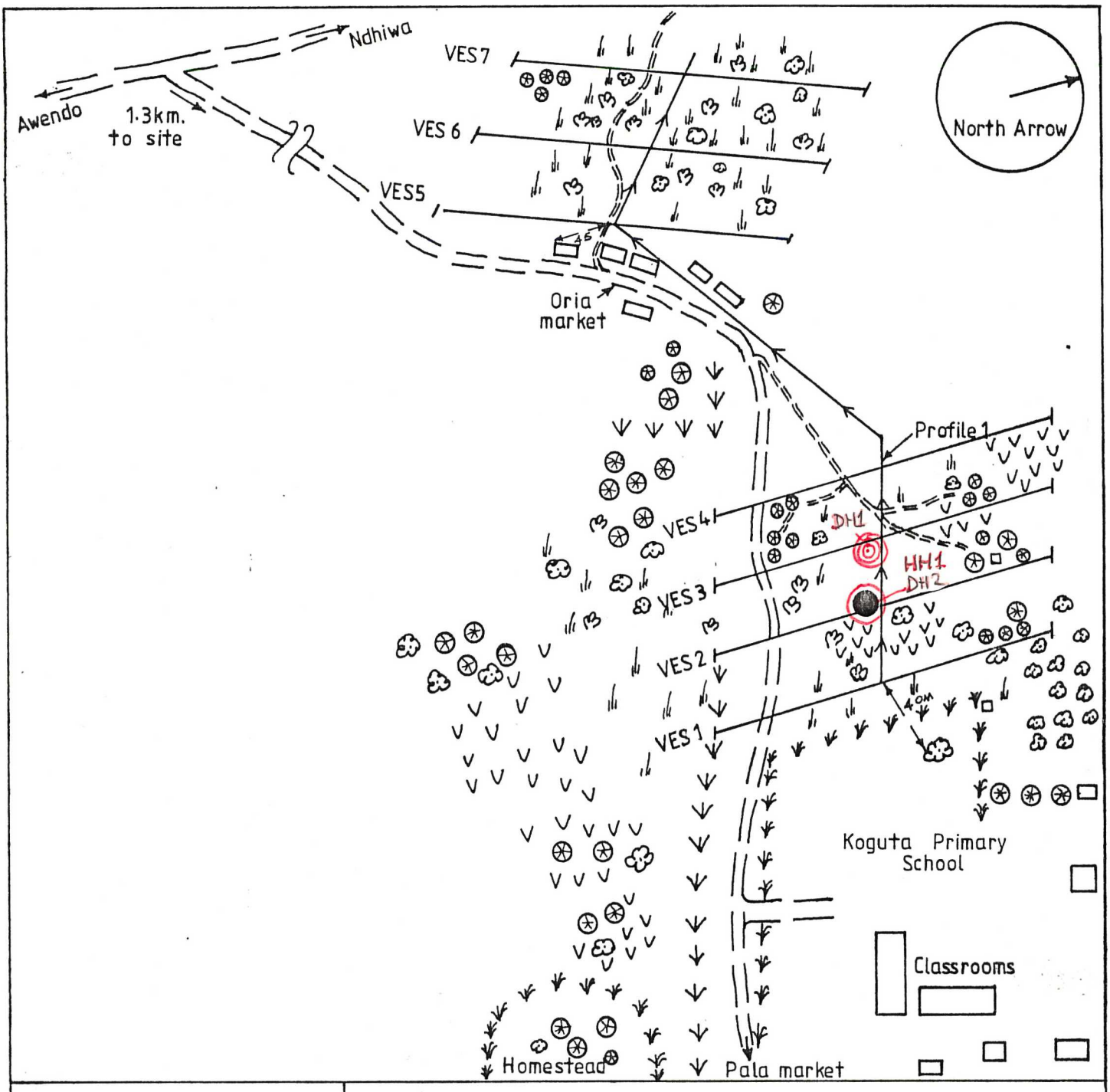
Drilled hole(s)	Remarks
DH1 (60 m E of VES3, 45 m)	-
DH2 (VES2, 45 m)	Groundwater at -10.00 m, EC = 390 µS/cm

Handdug hole(s)	Remarks
HH1 (VES2, 25 m)	-

KOGUTA PRIM. SCHOOL / MARKET (SKETCH)

SOUTH NYANZAA DISTRICT: NDHIWA DIVISION: MAP SHEET

CO-ORDINATES



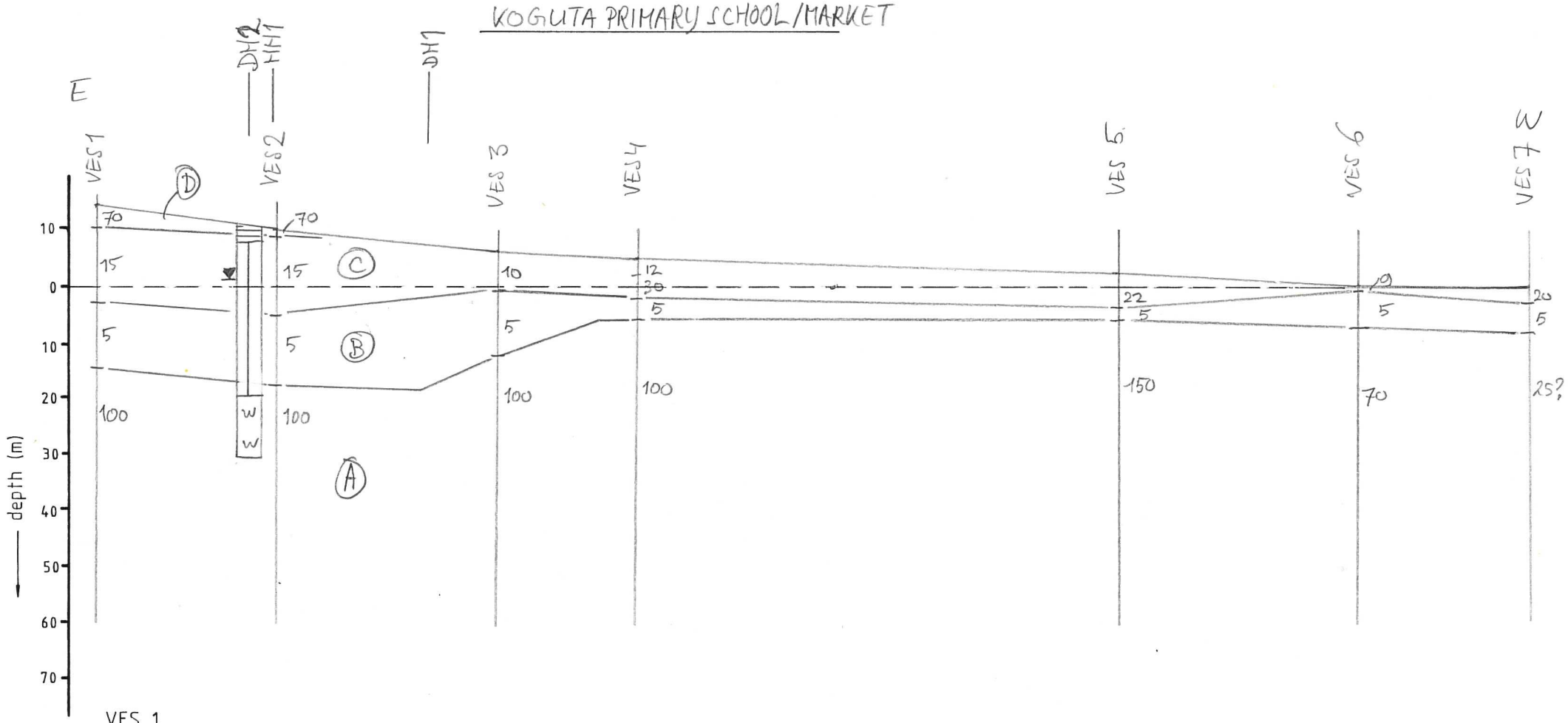
Murram road
Path
Classrooms
Houses
Shops
Round huts
Trees
Shrubs
Maize shamba
Long grass

Hedge
Sisal fence
BH Borehole – machine drilled
VES (Vertical Electric Sounding)
200m long, at 150m interval.
Profile 1 = 450 m

Slope:
VES1 – VES2 = – 1.5°
VES2 – 87m = – 1.0°
87m – VES3 = – 1.5°
VES3 – VES4 = – 0.5°
VES5 – VES6 = – 1.0°
VES6 – VES7 = 0°

Sketched by R.M. Shilako June 1984

KOGUTA PRIMARY SCHOOL/MARKET



VES 1
5
Vertical Electrical Sounding, interpreted resistivity 5 ohmm

A
geo-electrical layer A

B 1
(recommended) borehole or handdug hole

sandy clay, cemented clay

lateritic layer

clay

a very decomposed, altered rock

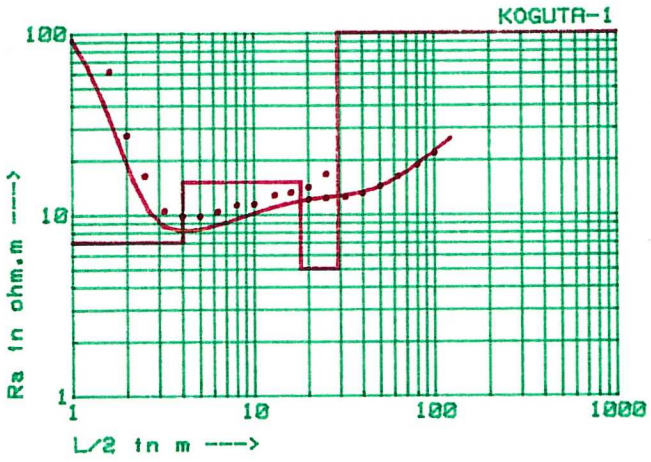
w weathered rock

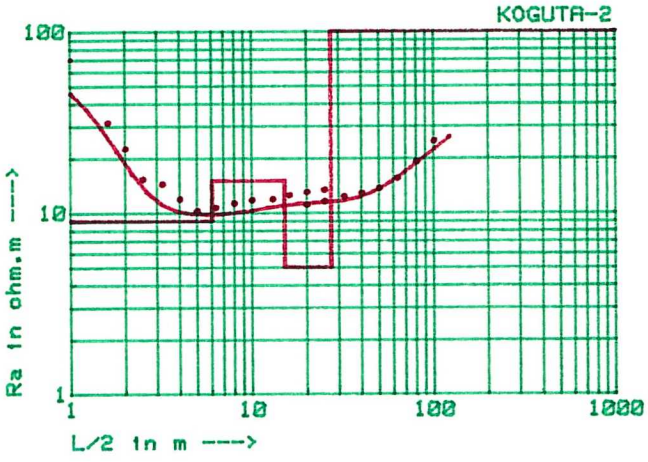
p partly weathered, fractured rock

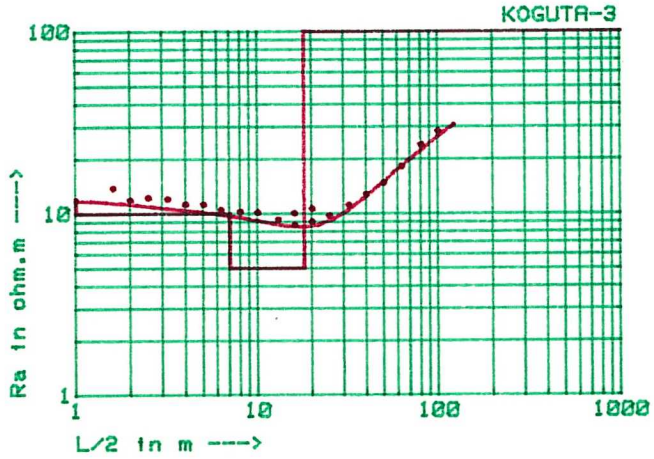
f fresh rock

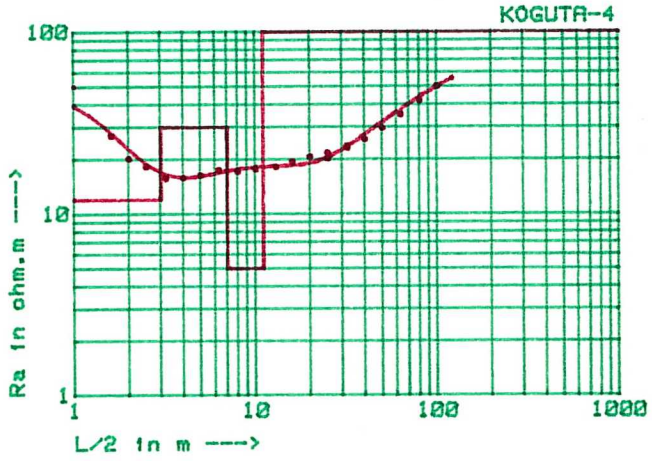
TNO-DGV Institute of Applied Geoscience	
Annex 8.3	Cross-section Koguta Pr. School/market
Horizontal scale 1 : 5000	Vertical scale 1 : 1000

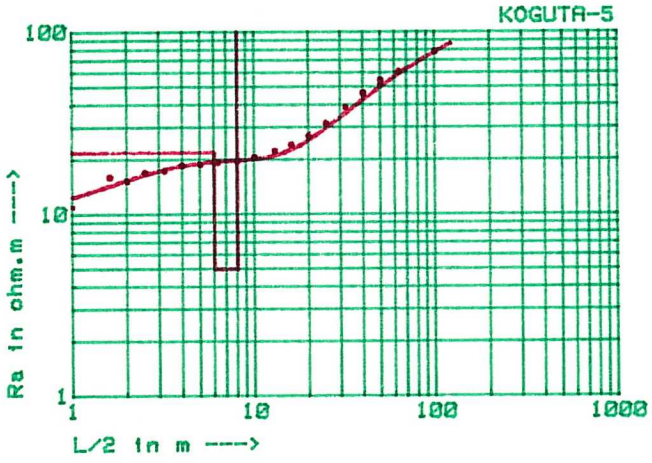
8.3

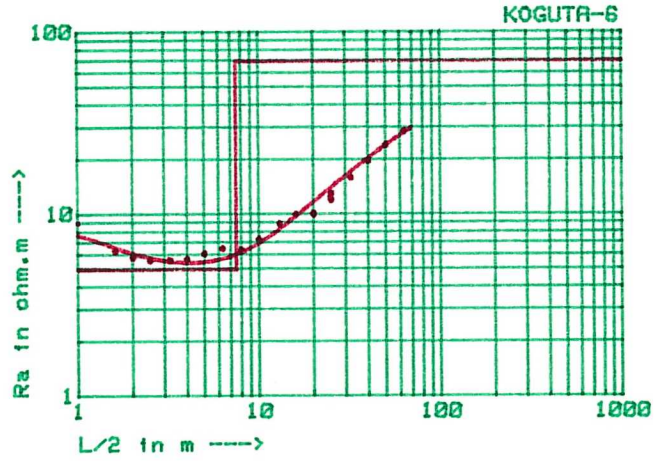

KOGUTA-1
100
10
1
Ra in ohm.m ---->
1
10
100
1000
L/2 in m --->

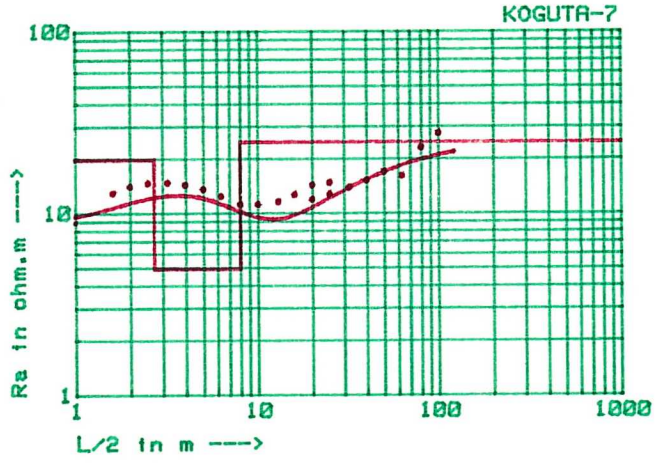

KOGUTA-2
100
10
1
Ra in ohm.m ---->
1
10
100
1000
L/2 in m ---->

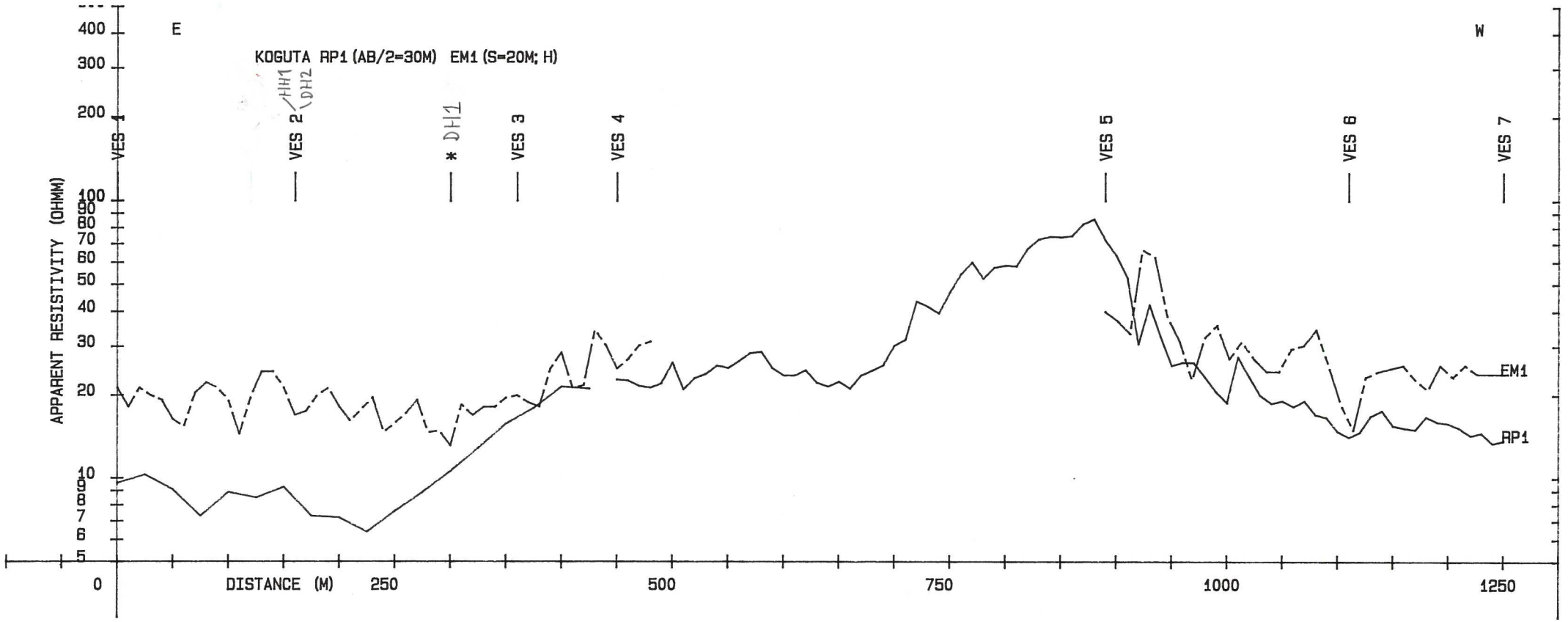

KOGUTA-3
100
10
1
Ra in ohm.m ---->
1
10
100
1000
L/2 in m ---->


KOGUTA-4
100
10
1
Ra in ohm.m ---->
1
10
100
1000
L/2 in m ---->


KOGUTA-5
100
10
1
Ra in ohm.m ---->
1
10
100
1000
L/2 in m ---->


KOGUTA-6
100
10
1
Ra in ohm.m ---->
1
10
100
1000
L/2 in m ---->


KOGUTA-7
100
10
1
Ra in ohm.m ---->
1
10
100
1000
L/2 in m ---->


KOGUTA RP1 (AB/2=30M) EM1 (S=20M; H)
E
W
APPARENT RESISTIVITY (OHMM)
400
300
200
100
90
80
70
60
50
40
30
20
10
9
8
7
6
5
VES 1
VES 2
HH1
DH2
* DH1
VES 3
VES 4
VES 5
VES 6
VES 7
EM1
RP1
0
DISTANCE (M)
250
500
750
1000
1250

8.5

TNO-DGV INSTITUTE OF APPLIED GEOSCIENCE

Site: Otange Primary School

Hydrogeology

Layers	Resistivity (ohmm)	Remarks	
A	50-60	Weathered rock (Kc)	(DH)
B	6-8	Clay (sandy)	
C	15-35	Sandy, cemented clay	
D	4-10	Clay	
E	20-150	Lateritic soil	
F	-	-	

Fractured zones, faults	Remarks
-	-

Depth to groundwater table: Unknown

Groundwater quality : Fresh

(Recommended) drilled (DH) or handdug (HH) holes

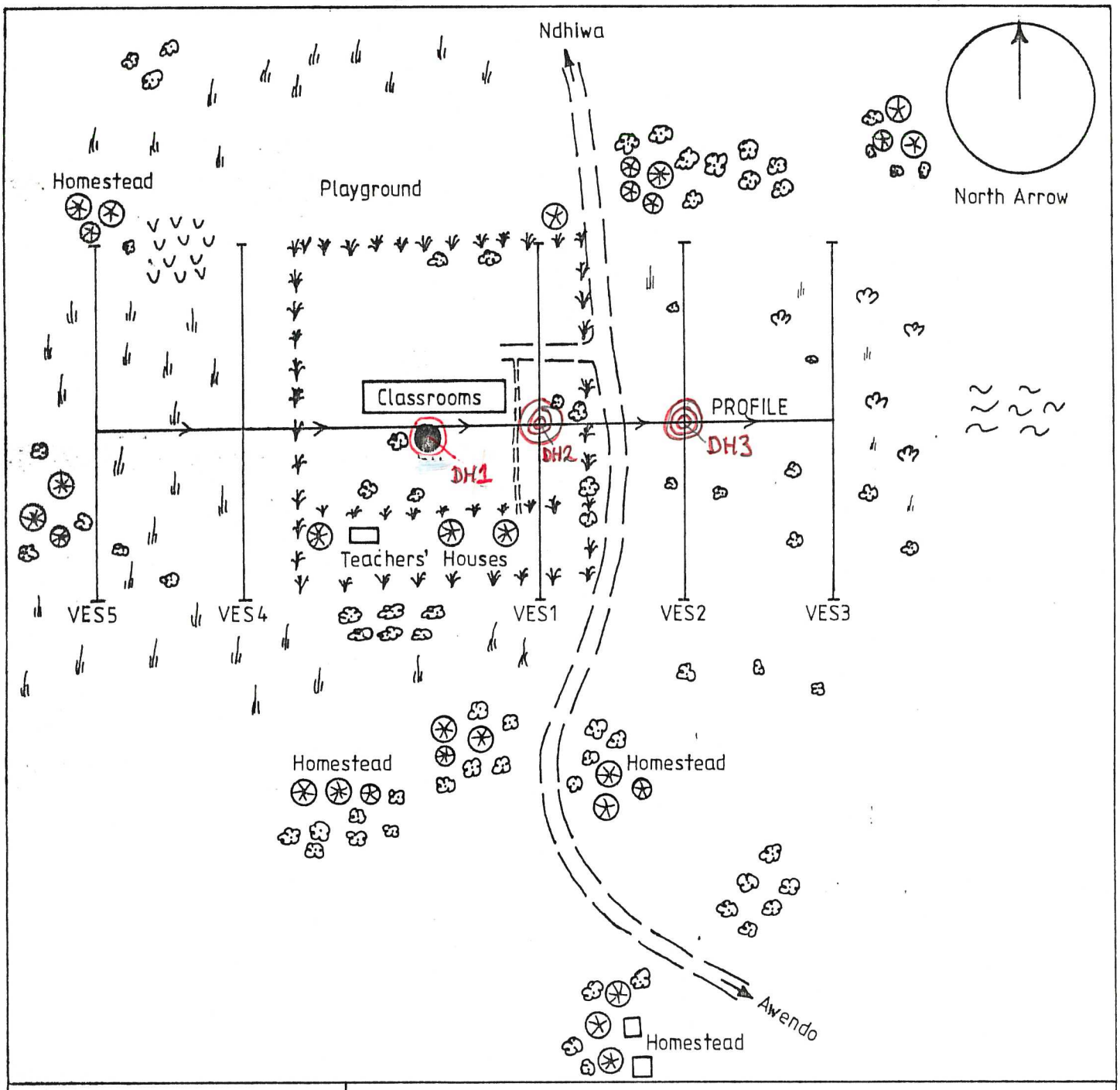
Drilled hole(s)	Remarks
DH1 (between VES4-1, 80 m)	-
DH2 (VES1, 30 m)	Dry (too shallow)
DH3 (VES2, 36 m)	Dry (too shallow)

Handdug hole(s)	Remarks
-	-

OTANGE PRIMARY SCHOOL (SKETCH)

SOUTH NYANZA DISTRICT: NDHIWA DIVISION: MAP SHEET

CO-ORDINATES



Murram road

Classrooms

House

Round huts

Trees

Hedge

Shrubs

Long grass

Area temporarily flooded

Path

BH Borehole - machine drilled

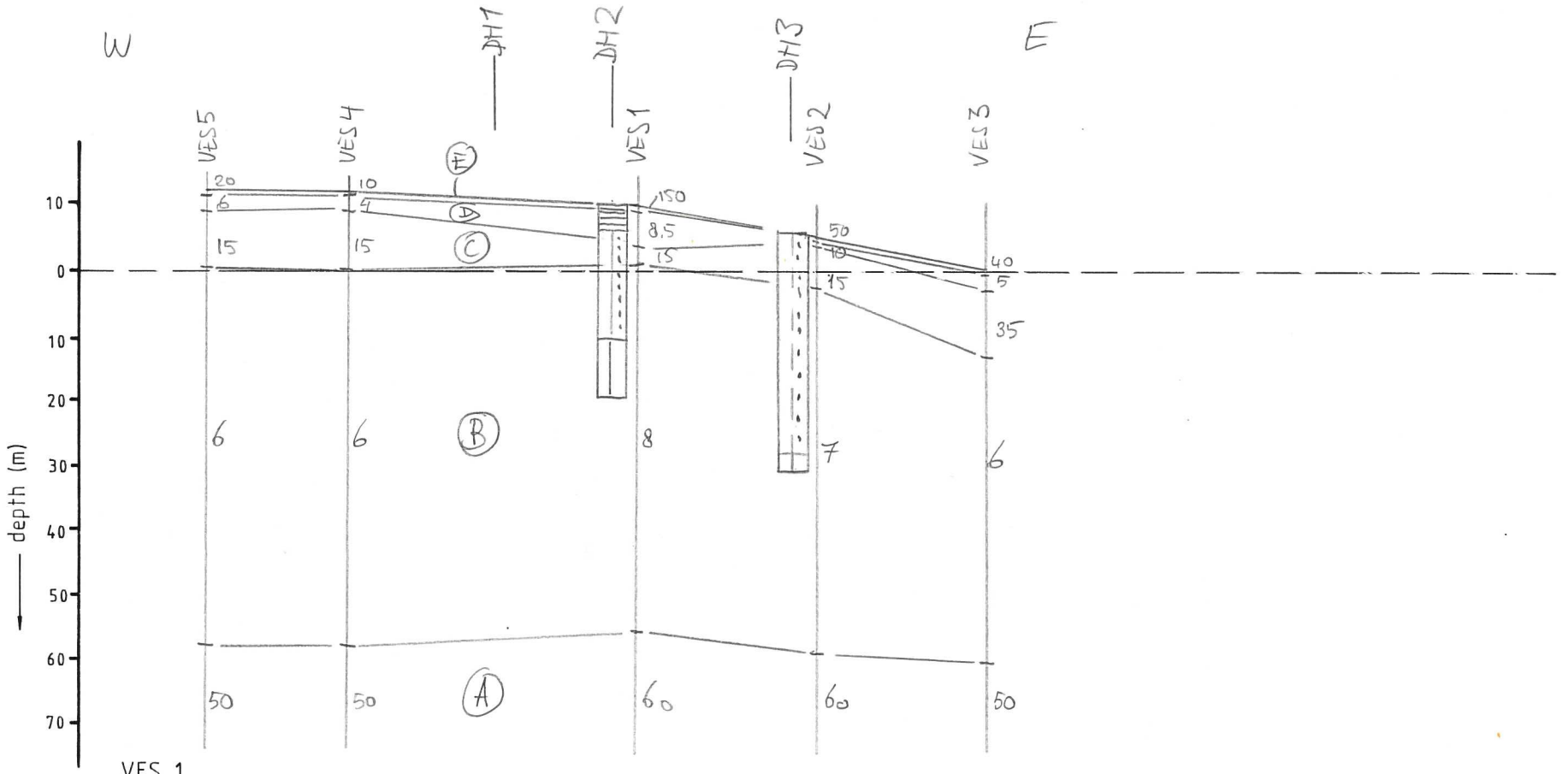
VES (Vertical Electric Sounding)
200m long, at 150m. interval, except between VES1 &VES4

Profile line

Slope:
VES1 – VES2 = -2°
VES2 – VES3 = -2.5°
VES1 – 85m. = +1°
85m. – VES4 = 0°
VES4 – VES5 = -0.5°

Sketched by R.M Shilako June 1984

OTANGE PRIMARY SCHOOL



VES 1
5
Vertical Electrical Sounding, interpreted resistivity 5 ohmm

A
geo-electrical layer A

B 1
(recommended) borehole or handdug hole

sandy clay, cemented clay

lateritic layer

clay

a very decomposed, altered rock

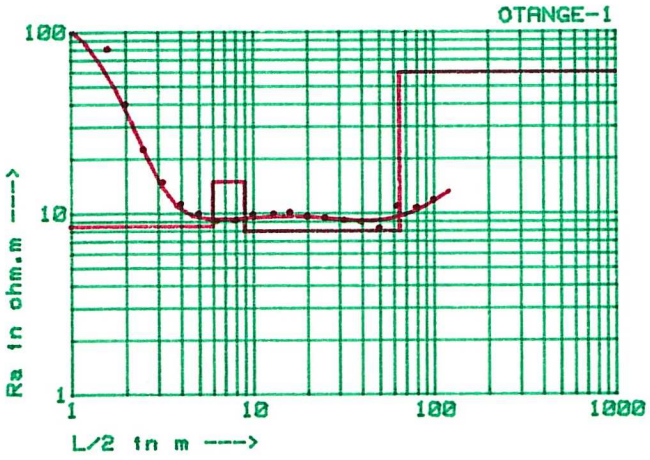
w weathered rock

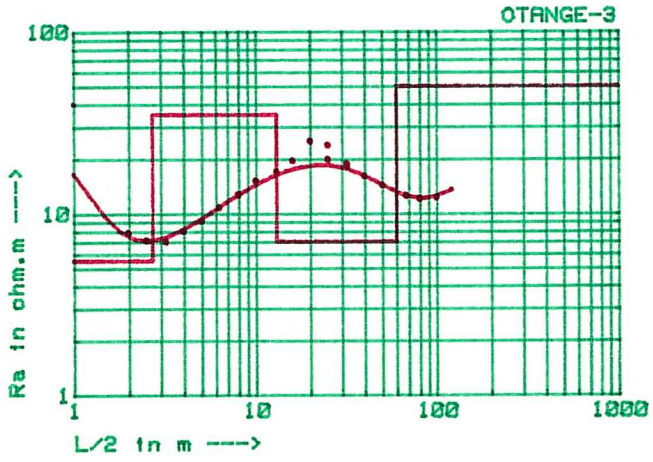
p partly weathered, fractured rock

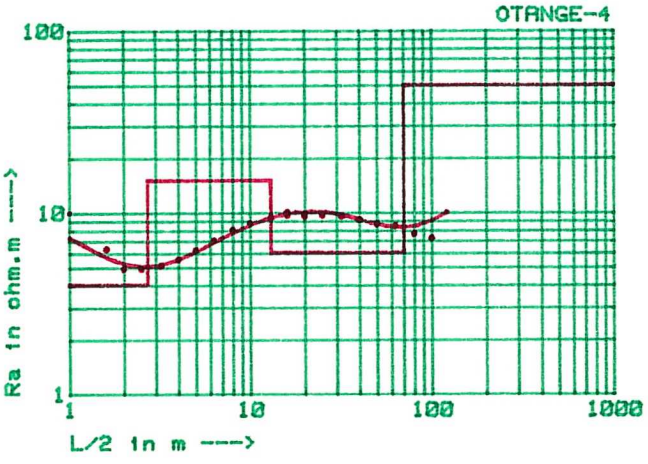
f fresh rock

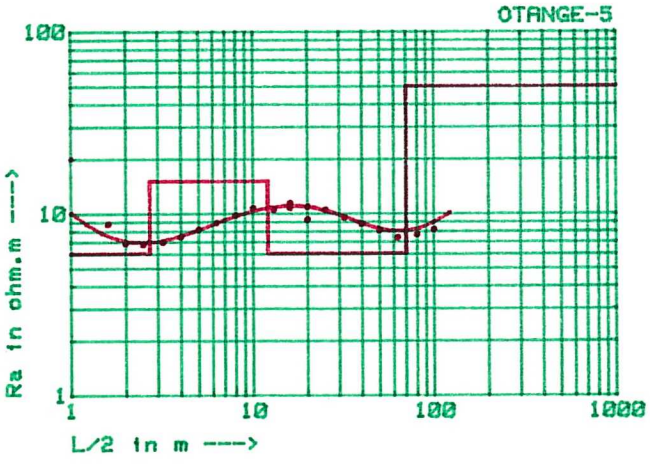
TNO-DGV Institute of Applied Geoscience	
Annex 9.3	Cross-section Otange Pri. School
Horizontal scale 1 : 5000	Vertical scale 1 : 1000

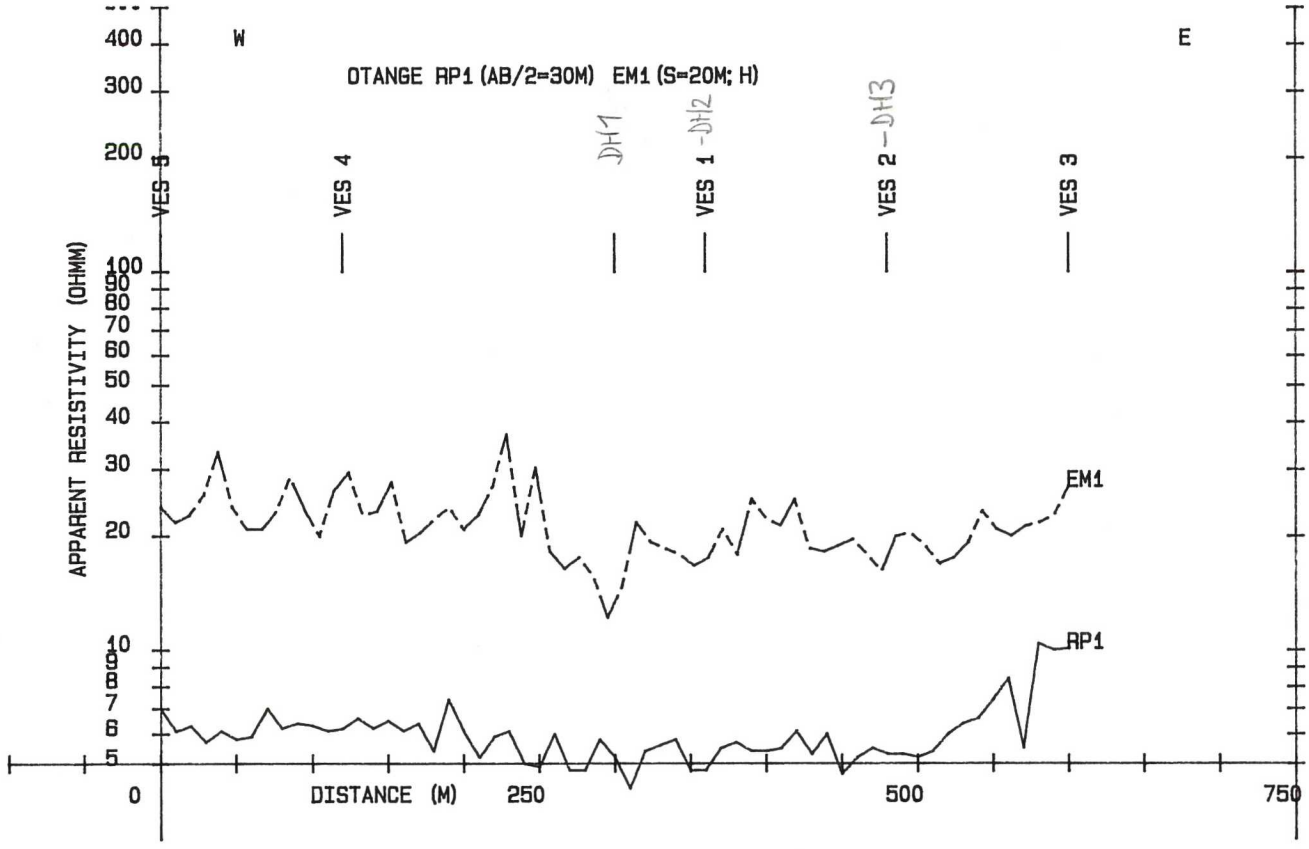
9.3


OTANGE-1
100
10
1
Ra in ohm.m ---->
1
10
100
1000
L/2 in m ---->
OTANGE-2
100
10
1
Ra in ohm.m ---->
1
10
100
1000
L/2 in m ---->


OTANGE-3
100
10
1
Ra in ohm.m ---->
1
10
100
1000
L/2 in m ---->


OTANGE-4
100
10
1
Ra in ohm.m ---->
1
10
100
1000
L/2 in m ---->


OTANGE-5
100
10
1
Ra in ohm.m ---->
1
10
100
1000
L/2 in m ---->


W
E
OTANGE RP1 (AB/2=30M) EM1 (S=20M; H)
VES 5
VES 4
DH1
VES 1 - DH2
VES 2 - DH3
VES 3
APPARENT RESISTIVITY (OHMM)
400
300
200
100
90
80
70
60
50
40
30
20
10
9
8
7
6
5
EM1
RP1
0
DISTANCE (M)
250
500
750

TNO-DGV INSTITUTE OF APPLIED GEOSCIENCE

Site: Ongeng Market

Hydrogeology

Layers	Resistivity (ohmm)	Remarks	
A	100	Partly weathered rock (Kc)	(DH)
B	5-10	Clay	
C	60-80	Lateritic layer	
D	15-20	Sandy soil	
E	6.5-9	Clayey soil	
F	-	-	

Fractured zones, faults	Remarks
30 m N of VES4	Fractured zone
10 m N of VES3	Fractured zone

Depth to groundwater table: 10 - 20 m

Groundwater quality : Fresh

(Recommended) drilled (DH) or handdug (HH) holes

Drilled hole(s)	Remarks
DH1 (30 m N of VES4, 35 m)	-

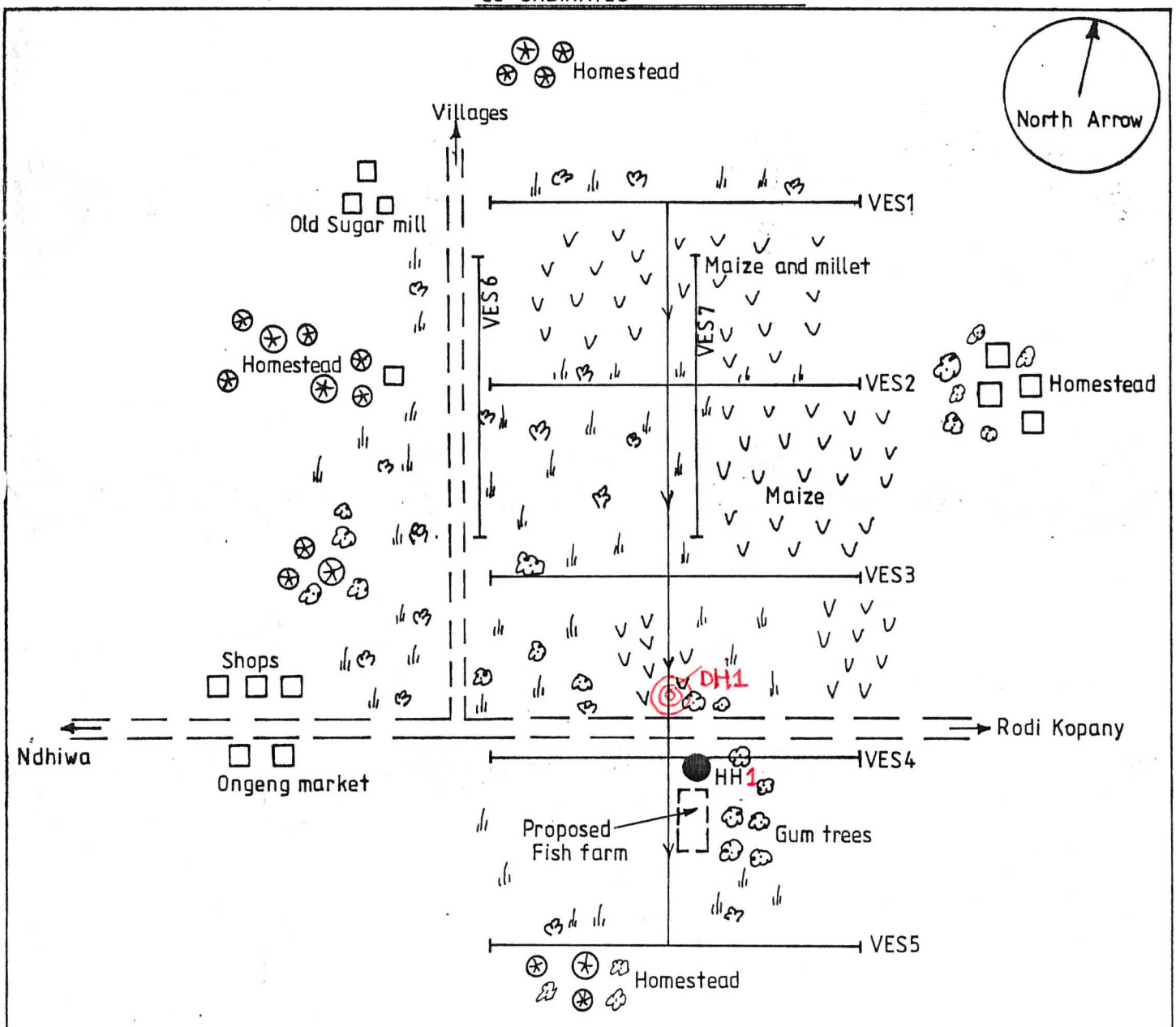
Handdug hole(s)

HH1 (VES 4, 17 m) Groundwater at -13.80 m, EC = 1400 µS/cm

ONGENG MARKET (SKETCH)

SOUTH NYANZA DISTRICT: NDHIWA DIVISION: MAP SHEET

CO-ORDINATES



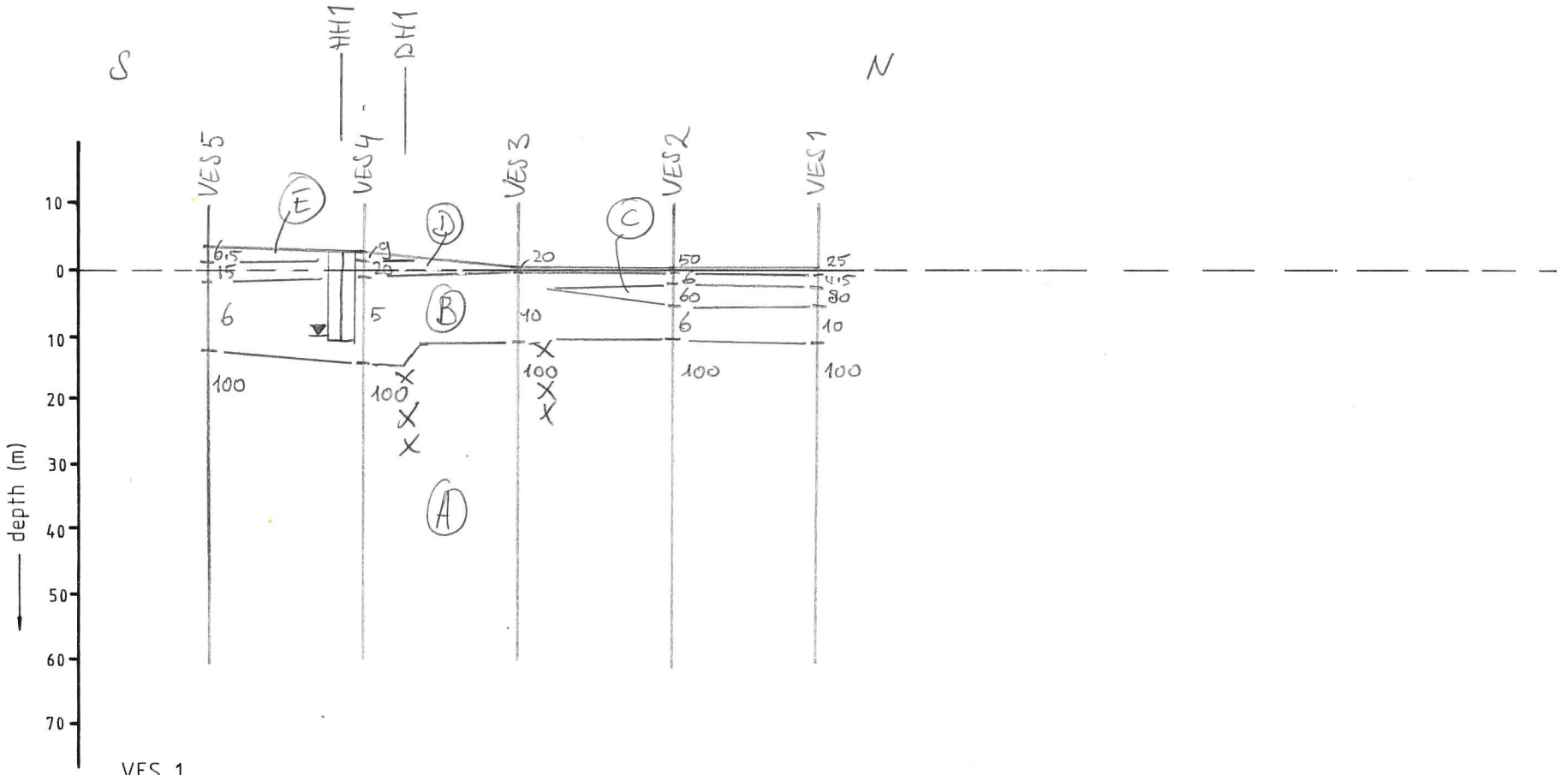
Murram road
Houses
Round huts
Trees
Maize shamba
Long grass
Shrubs
Proposed fish farm

VES (Vertical Electric Sounding)
200m long, at 150m. interval
Profile line 370m
HH Hand dug hole

Slope:
VES1 — VES2 = 0°
VES2 — VES3 = 0°
VES3 — VES4 = +1°
VES4 — VES5 = +0.5°

Sketched by R.M. Shilako June 1984

ONGENG MARKET



VES 1

5

Vertical Electrical Sounding, interpreted resistivity 5 ohmm

A

geo-electrical layer A

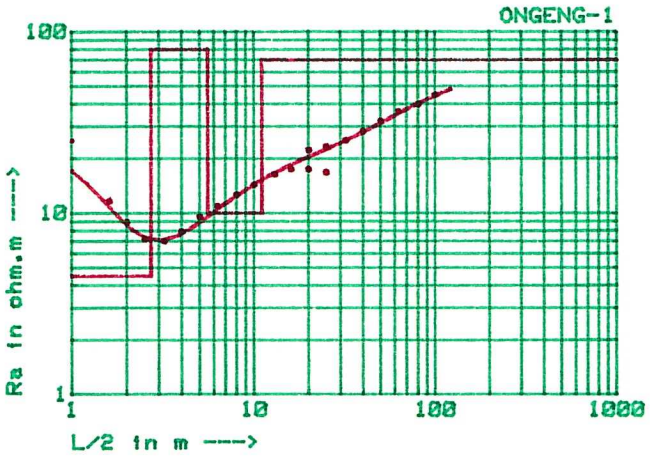
B 1

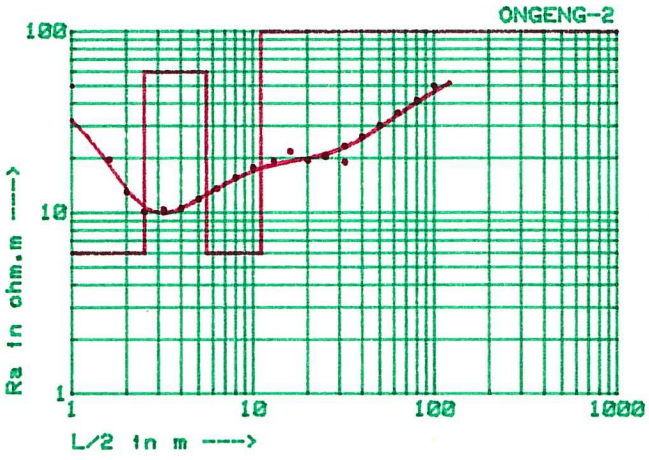
(recommended) borehole or handdug hole

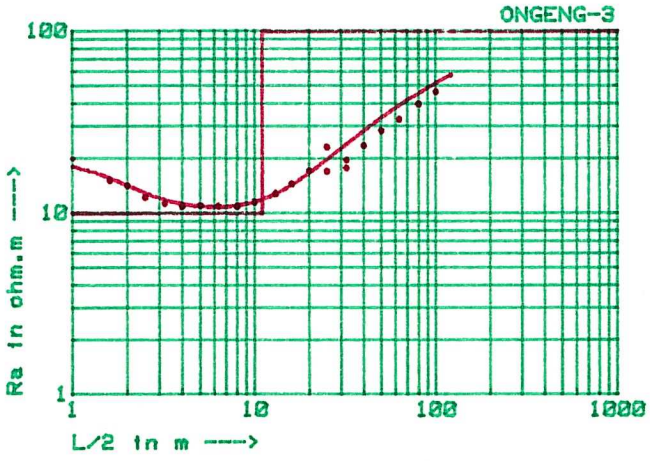
- sandy clay, cemented clay
- lateritic layer
- clay
- a — very decomposed, altered rock
- w — weathered rock
- p — partly weathered, fractured rock
- f — fresh rock

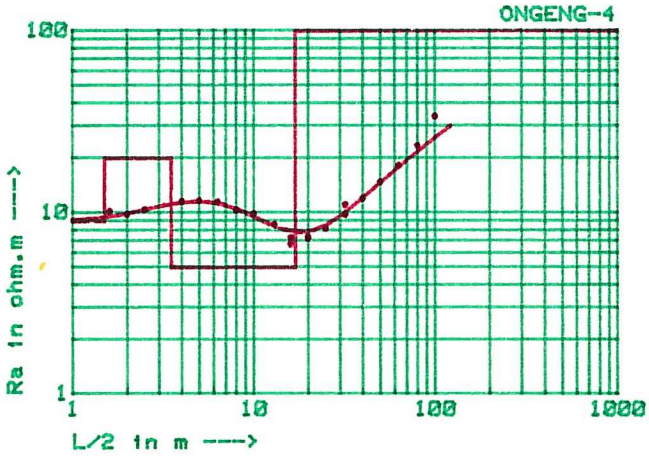
TNO-DGV Institute of Applied Geoscience	
Annex 10.3	Cross-section Ongeng Market
Horizontal scale 1 : 5000	Vertical scale 1 : 1000

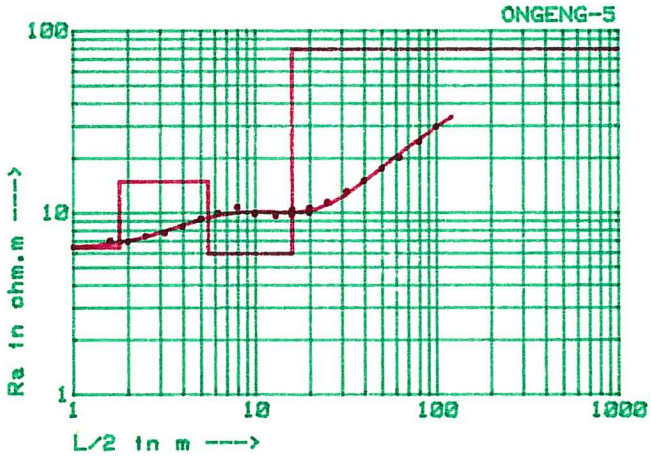
10.3

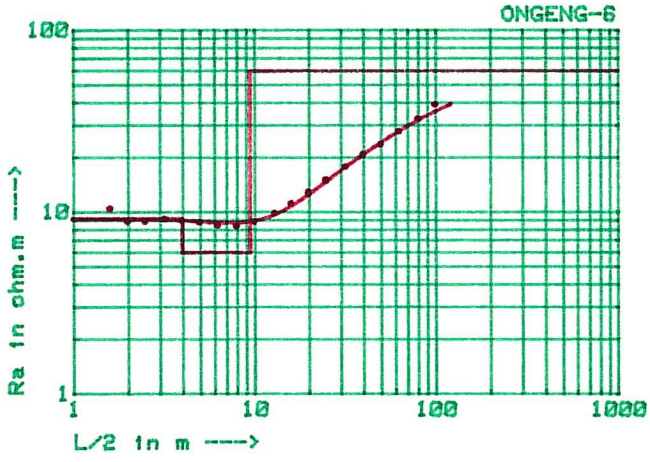

ONGENG-1
100
10
1
Ra in ohm.m ---->
1
10
100
1000
L/2 in m --->

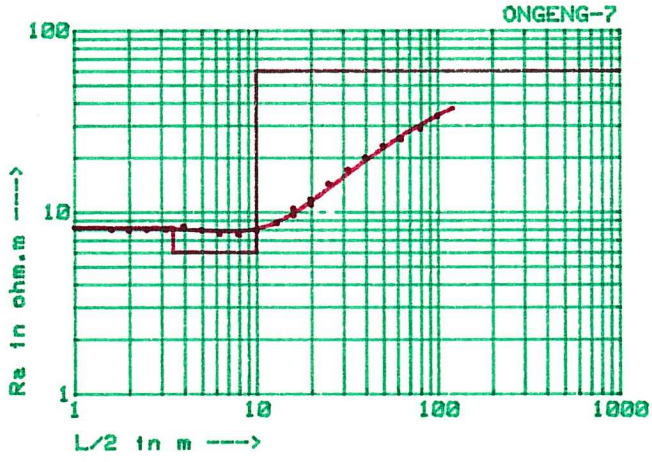

ONGENG-2
100
10
1
Ra in ohm.m ---->
1
10
100
1000
L/2 in m ---->

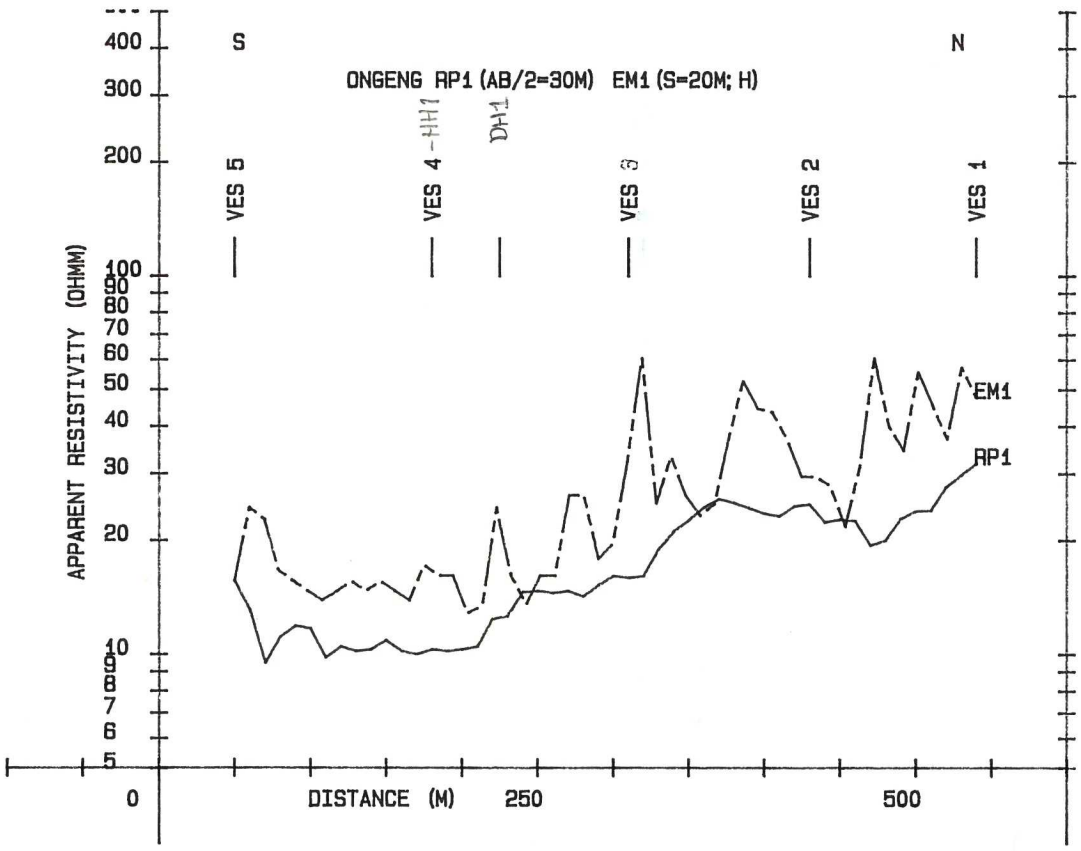

ONGENG-3
100
10
1
Ra in ohm.m ---->
1
10
100
1000
L/2 in m ---->


ONGENG-4
100
10
1
Ra in ohm.m ---->
1
10
100
1000
L/2 in m ---->


ONGENG-5
100
10
1
Ra in ohm.m ---->
1
10
100
1000
L/2 in m ---->


ONGENG-6
100
10
1
Ra in ohm.m ---->
1
10
100
1000
L/2 in m ---->


ONGENG-7
100
10
1
Ra in ohm.m ---->
1
10
100
1000
L/2 in m ---->


S
N
ONGENG RP1 (AB/2=30M) EM1 (S=20M; H)
VES 5
VES 4
VES 3
VES 2
VES 1
EM1
RP1
APPARENT RESISTIVITY (OHMM)
400
300
200
100
90
80
70
60
50
40
30
20
10
9
8
7
6
5
0
DISTANCE (M)
250
500

TNO-DGV INSTITUTE OF APPLIED GEOSCIENCE

Site: Kobodo Youth Centre

Hydrogeology

Layers	Resistivity (ohmm)	Remarks	
A	40-80	Partly weathered volcanic rock (Tv)	(DH)
B	4-8	Clay and soil	(HH)
C	-	-	
D	-	-	
E	-	-	
F	-	-	

Fractured zones, faults	Remarks
75 m NE of VES3	Fractured zone
50 m NE of VES4	Fractured zone

Depth to groundwater table: Unknown

Groundwater quality : Fresh

(Recommended) drilled (DH) or handdug (HH) holes

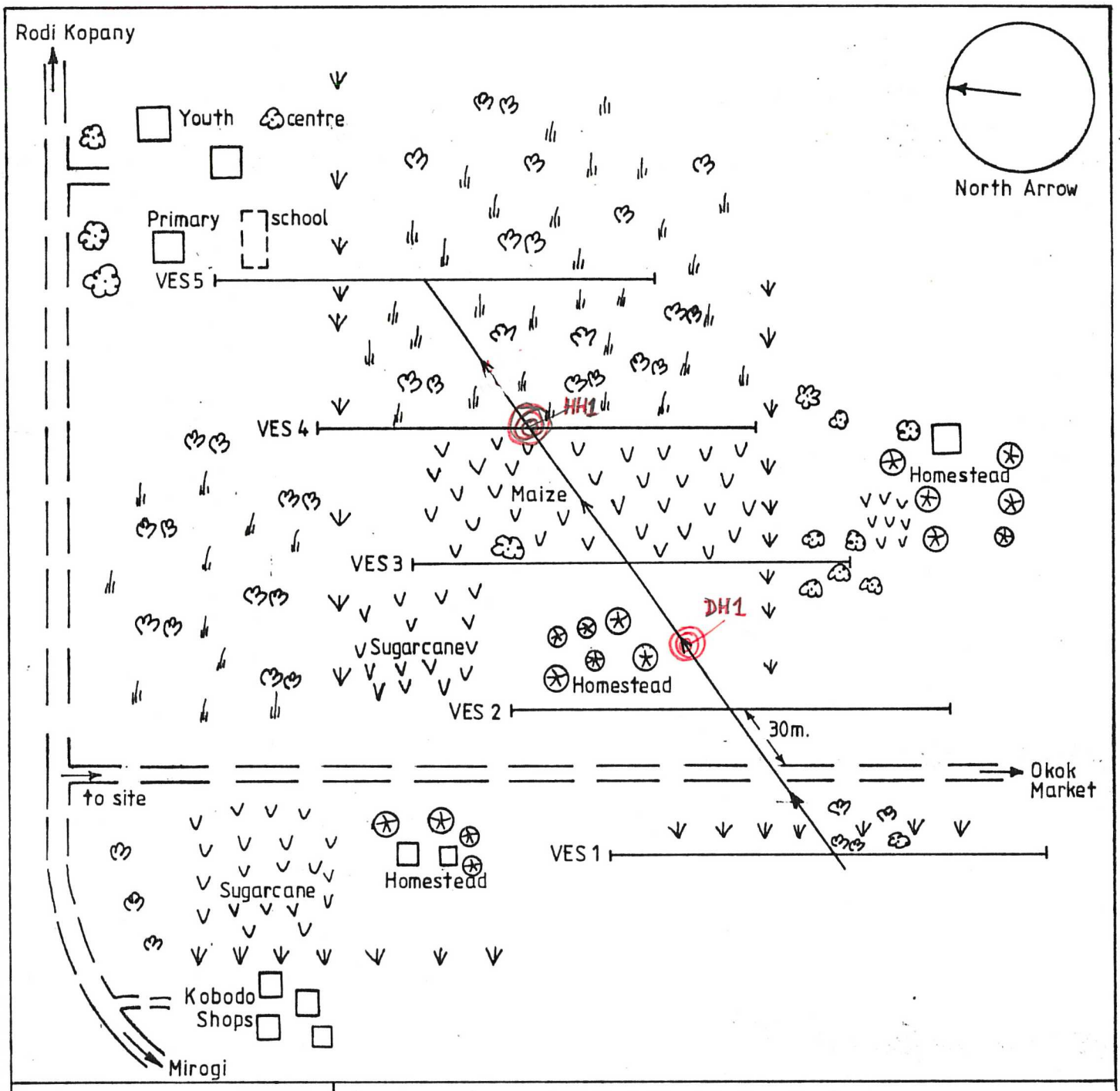
Drilled hole(s)	Remarks
DH1 (75 m NE of VES3, 45)	-

Handdug hole(s)	Remarks
HH1 (VES4, 22 m)	-

KOBODO YOUTH CENTRE (SKETCH)

SOUTH NYANZA DISTRICT NDHIWA DIVISION: MAP SHEET

CO-ORDINATES



Murram road
Houses
Round huts
Trees
Shrubs
Shamba
Sisal fence

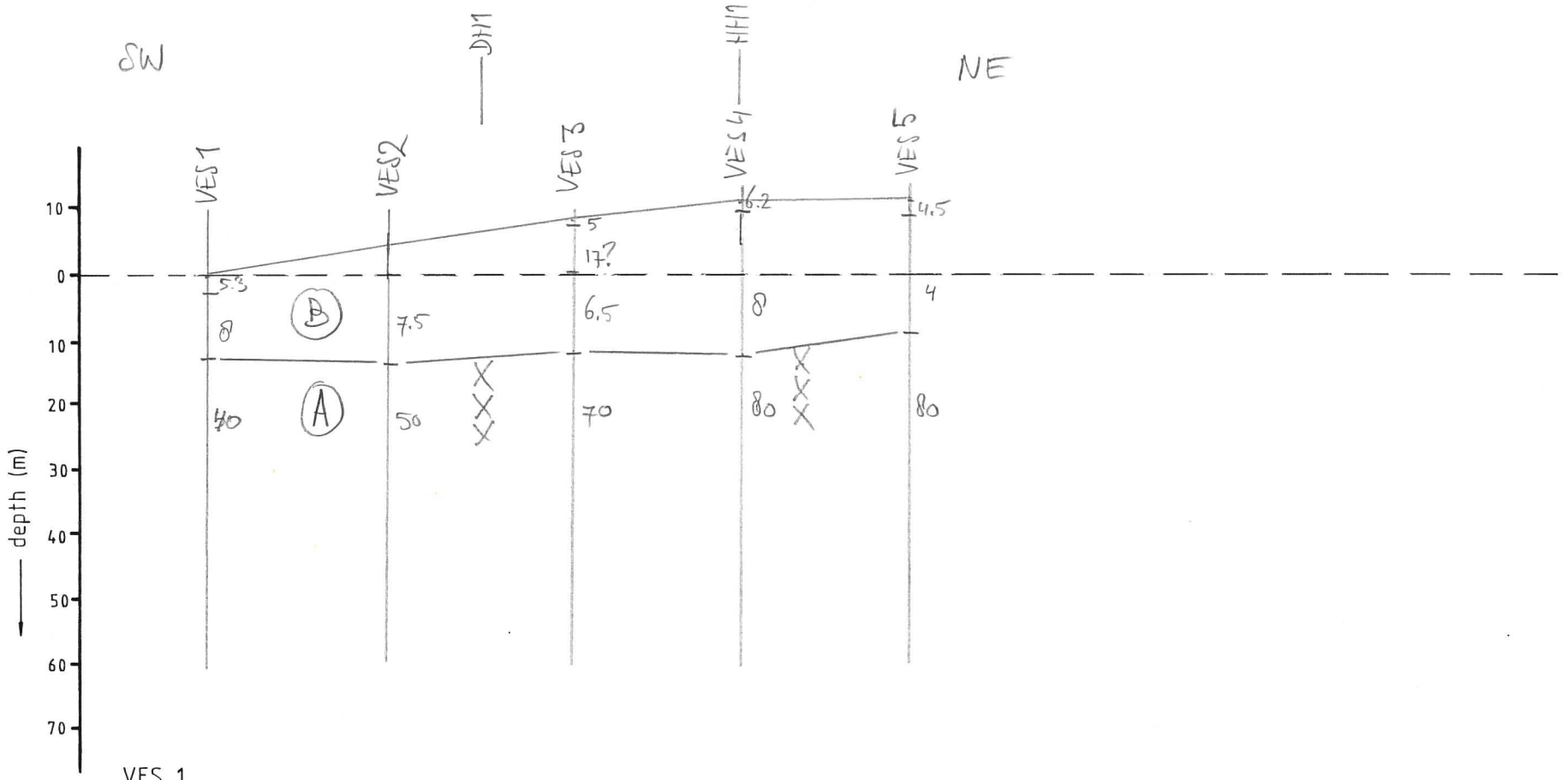
VES (Vertical Electric Sounding)
200m long, at 150m interval

Profile line

Slope: VES1 – 40m = −1°
40m – VES2 = +2°
VES2 – VES3 = +2°
VES3 – VES4 = +1°
VES4 – VES5 = 0°

Sketched by R.M. Shilako June 1984

KOBODO YOUTH CENTRE



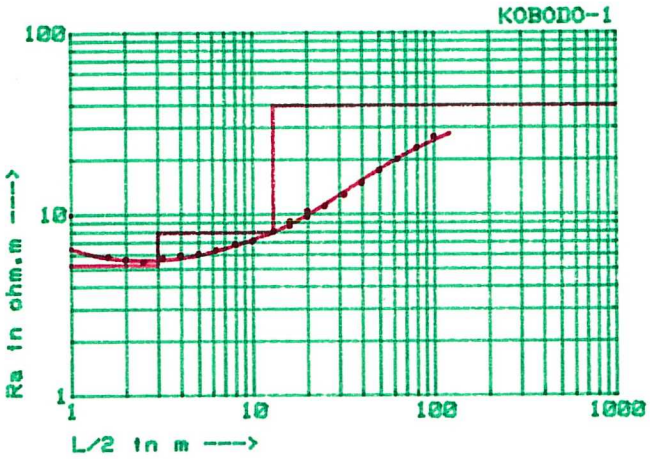
VES 1
5
Vertical Electrical Sounding, interpreted resistivity 5 ohmm

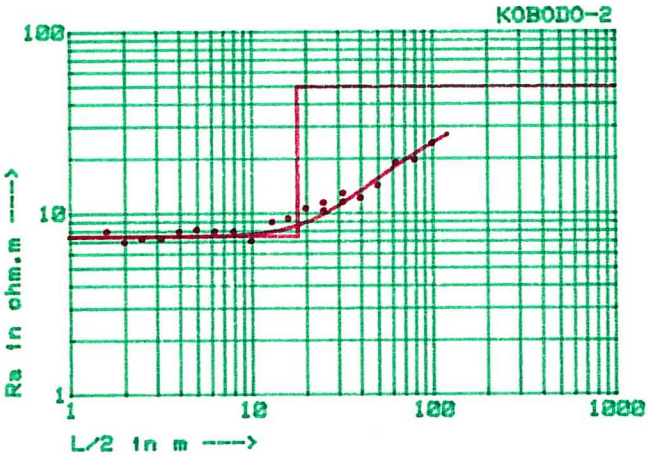
A
geo-electrical layer A

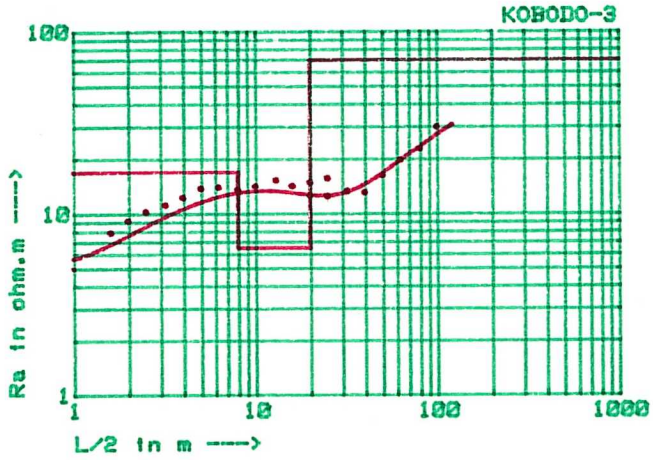
B 1
(recommended) borehole or handdug hole

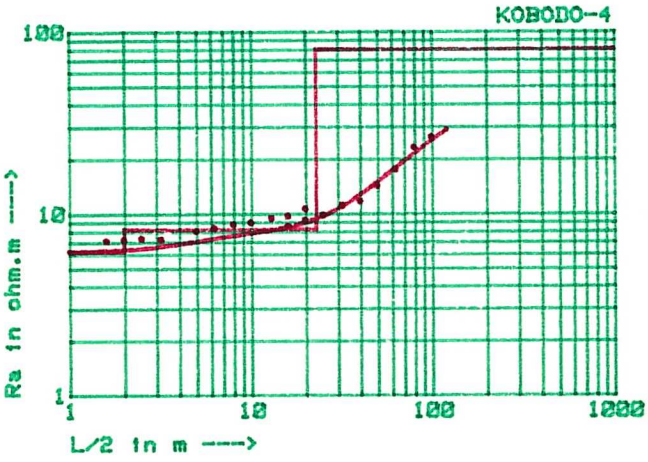
- sandy clay, cemented clay
- lateritic layer
- clay
- a — very decomposed, altered rock
- w — weathered rock
- p — partly weathered, fractured rock
- f — fresh rock

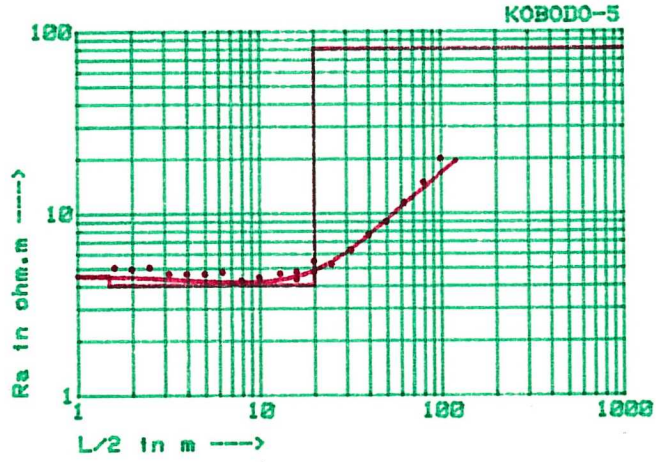
TNO-DGV Institute of Applied Geoscience	
Annex 17.3	Cross-section Kobodo Youth Centre
Horizontal scale 1 : 5000	Vertical scale 1 : 1000

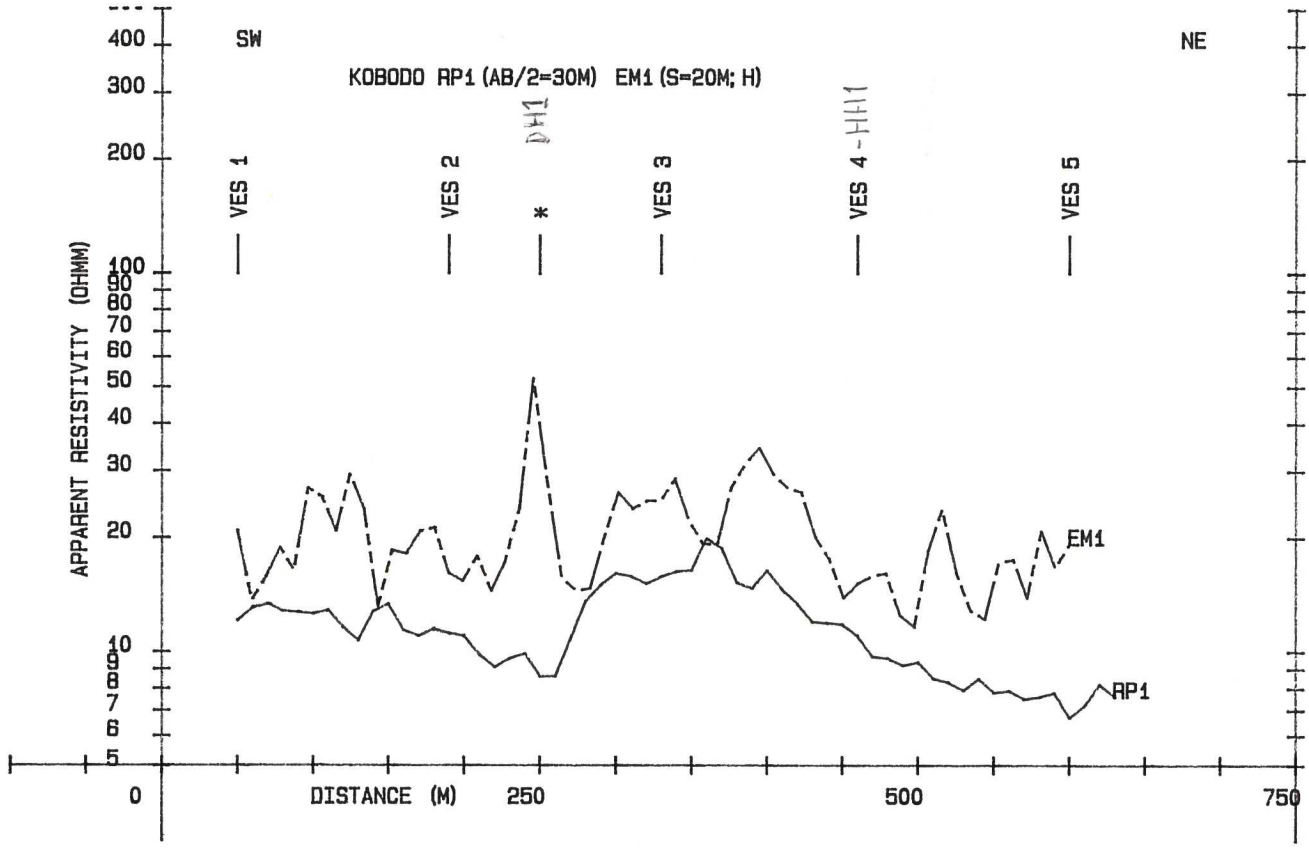

KOBODO-1
100
10
1
Ra in ohm.m ---->
1
10
100
1000
L/2 in m --->


KOBODO-2
100
10
1
Ra in ohm.m ---->
1
10
100
1000
L/2 in m ---->


KOBODO-3
100
10
1
Ra in ohm.m ---->
1
10
100
1000
L/2 in m ---->


KOBODO-4
100
10
1
Ra in ohm.m ---->
1
10
100
1000
L/2 in m ---->


KOBODO-5
100
10
1
Ra in ohm.m ---->
1
10
100
1000
L/2 in m ---->


KOBODO RP1 (AB/2=30M) EM1 (S=20M; H)
SW
NE
VES 1
VES 2
VES 3
VES 4
VES 5
DH1
HH1
APPARENT RESISTIVITY (OHMM)
400
300
200
100
90
80
70
60
50
40
30
20
10
9
8
7
6
5
EM1
RP1
0
DISTANCE (M)
250
500
750

TNO-DGV INSTITUTE OF APPLIED GEOSCIENCE

Site: Mirogi Boys Secondary School

Hydrogeology

Layers	Resistivity (ohmm)	Remarks	
A	20-30	Weathered, decomposed volcanic rock (Tv)	(DH)
B	4.7-7	Clay	(HH)
C	25	Sandy clay	
D	27-55	Lateritic soil	
E	-	-	
F	-	-	

Fractured zones, faults	Remarks
40 m SE of VES3	Fractured zone

Depth to groundwater table: 10 - 20 m

Groundwater quality : Fresh

(Recommended) drilled (DH) or handdug (HH) holes

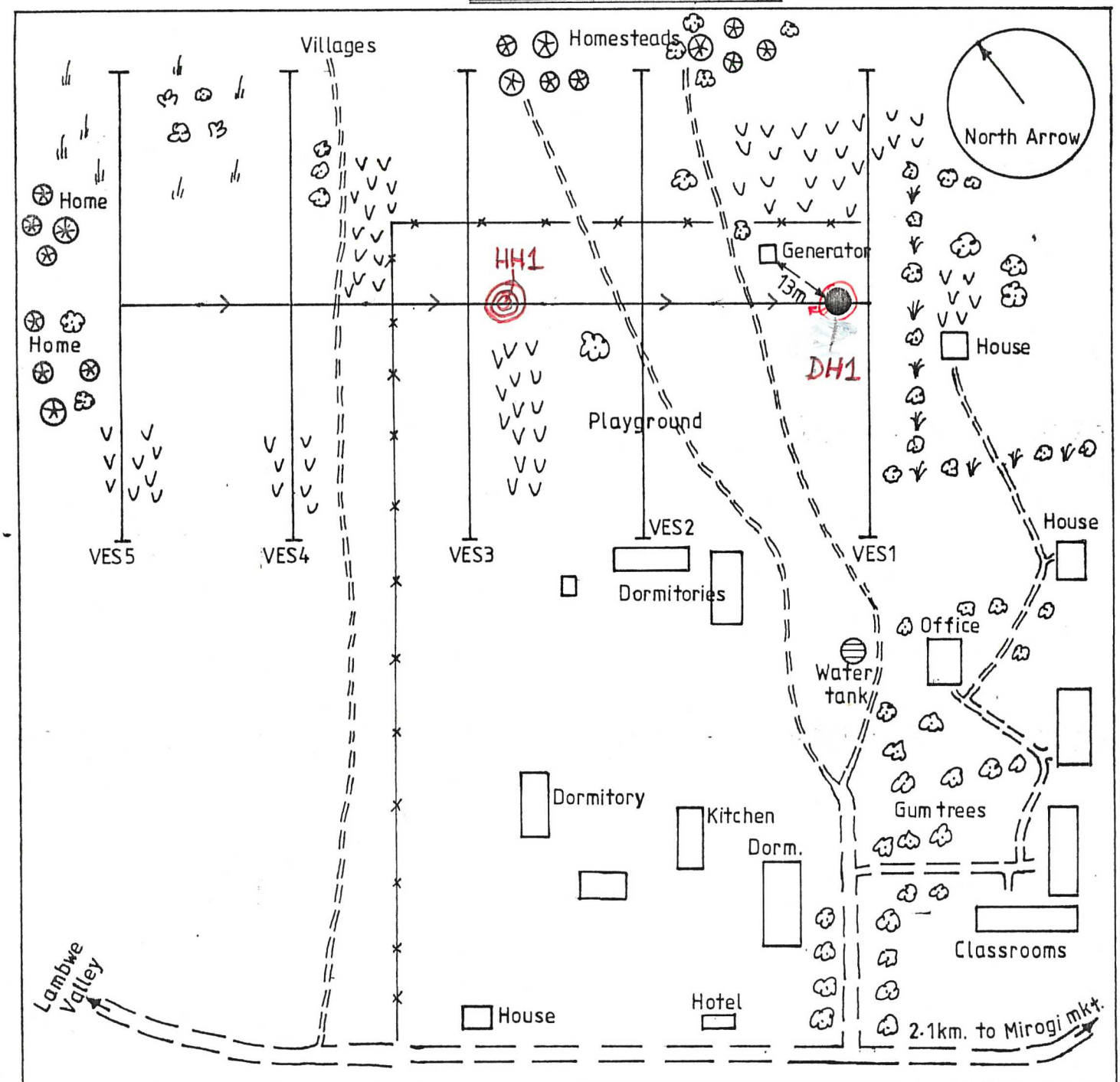
Drilled hole(s)	Remarks
DH1 (VES1, 35 m)	Groundwater at -12.00 m, EC = 620 µ/cm

Handdug hole(s)	Remarks
HH1 (40 m SE of VES3, 15 m)	-

MIROGI BOYS' SECONDARY SCHOOL (SKETCH)

SOUTH NYANZA DISTRICT: NDHIWA DIVISION: MAP SHEET

CO-ORDINATES

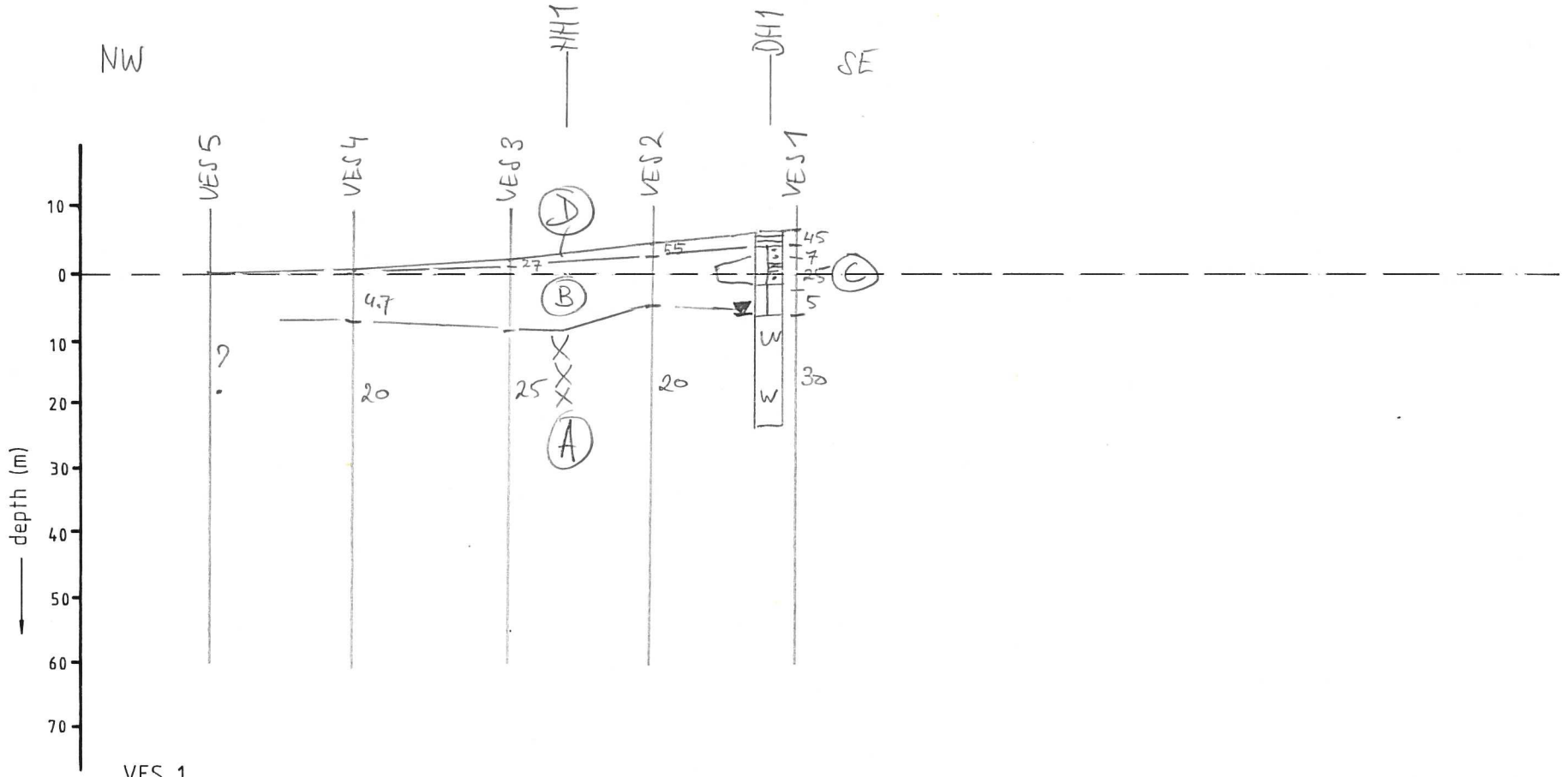


Murram road
Path
Buildings
Round huts
Trees
Wire fence
Maize shamba

VES (Vertical Electric Sounding)
200 m long, at 150 m interval except VES1–2 = 175m
Profile line
BH Borehole – machine drilled

Slope: VES1–VES2 = -1°
VES2–VES3 = -1°
VES3–VES4 = -1.5°
VES4–VES5 = 0°

MIROGI SECONDARY SCHOOL



VES 1
5
Vertical Electrical Sounding, interpreted resistivity 5 ohmm

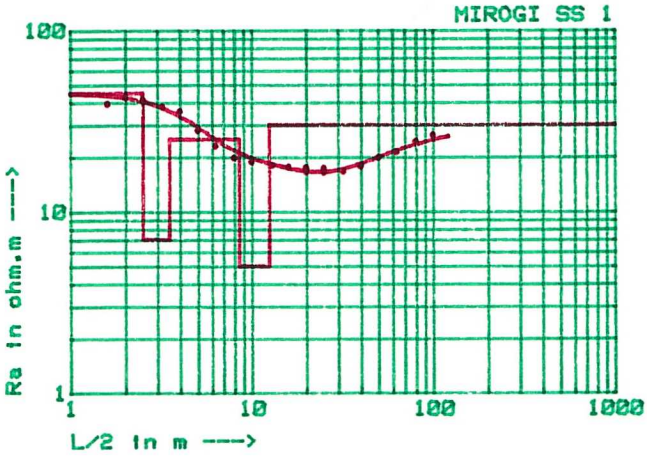
A
geo-electrical layer A

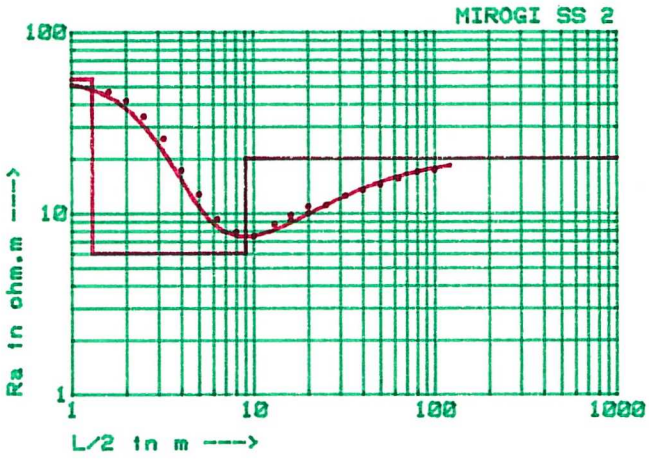
B 1
(recommended) borehole or handdug hole

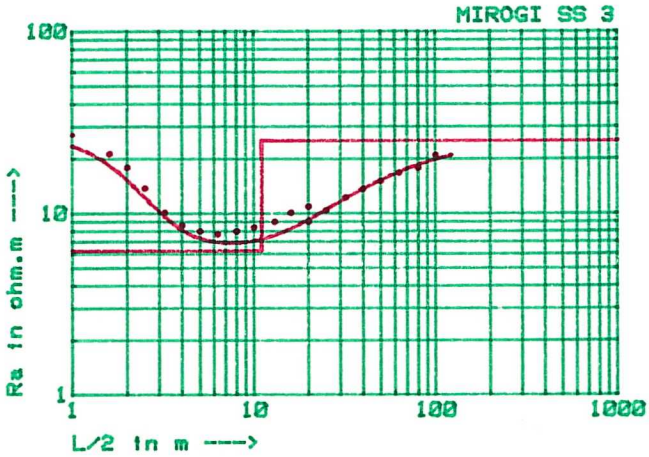
- sandy clay, cemented clay
- lateritic layer
- clay
- a — very decomposed, altered rock
- w — weathered rock
- p — partly weathered, fractured rock
- f — fresh rock

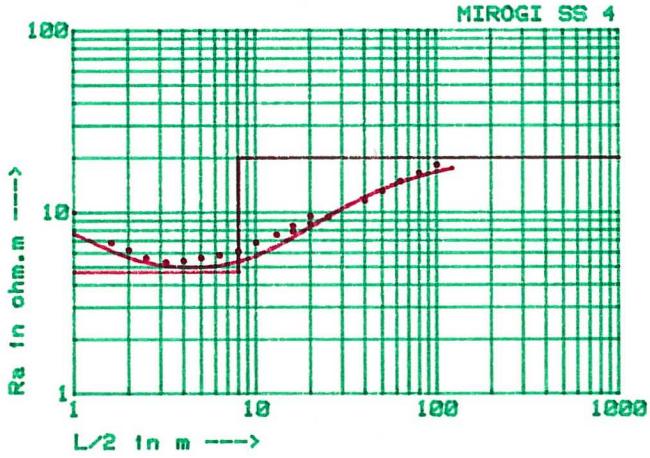
TNO-DGV Institute of Applied Geoscience	
Annex 12.3	Cross-section Mirogi Sec. School
Horizontal scale 1 : 5000	Vertical scale 1 : 1000

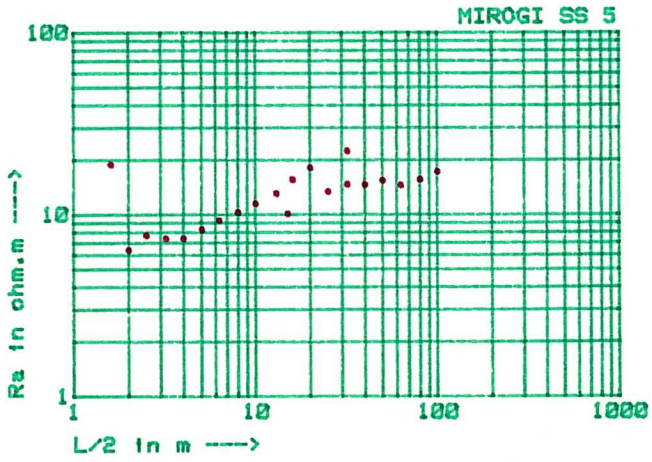
12.3

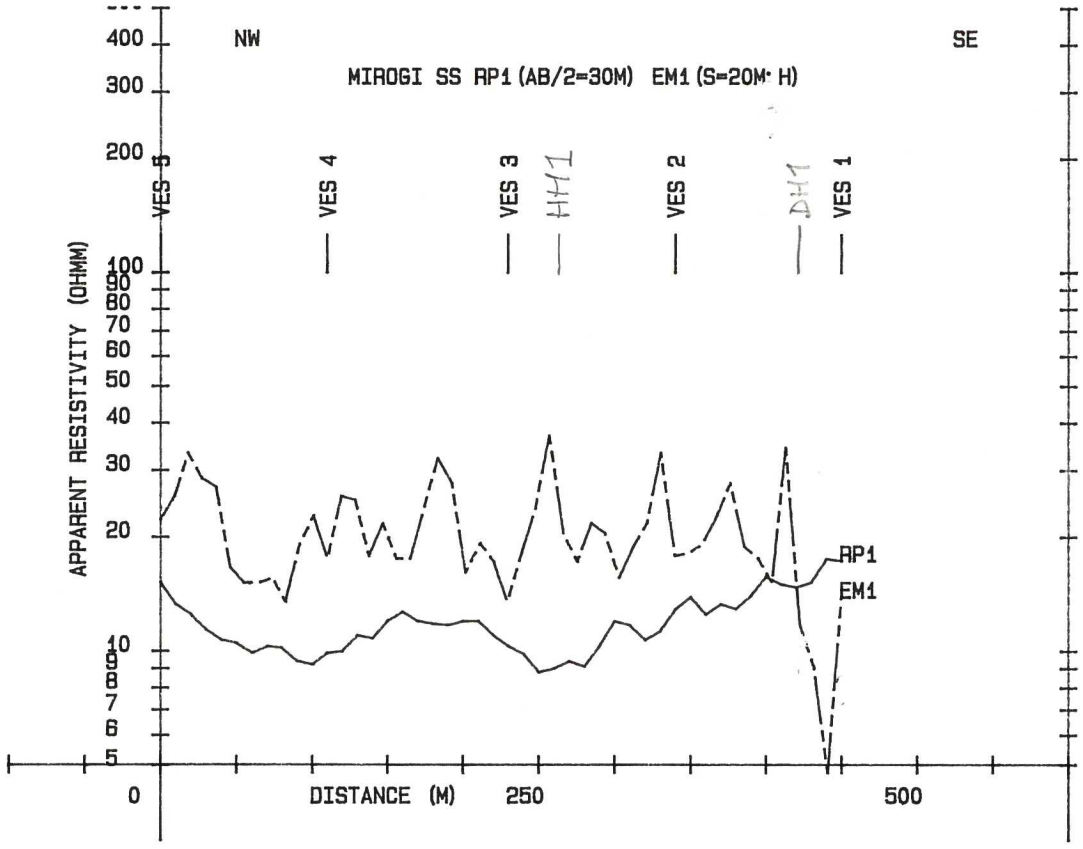

MIROGI SS 1
100
10
1
Ra in ohm.m ---->
1
10
100
1000
L/2 in m --->


MIROGI SS 2
100
10
1
Ra in ohm.m ---->
1
10
100
1000
L/2 in m ---->


MIROGI SS 3
100
10
1
Ra in ohm.m ---->
1
10
100
1000
L/2 in m ---->


MIROGI SS 4
100
10
1
Ra in ohm.m ---->
1
10
100
1000
L/2 in m ---->


MIROGI SS 5
100
10
1
Ra in ohm.m ---->
1
10
100
1000
L/2 in m ---->


NW
SE
MIROGI SS RP1 (AB/2=30M) EM1 (S=20M· H)
VES 5
VES 4
VES 3
HH1
VES 2
DH1
VES 1
APPARENT RESISTIVITY (OHMM)
400
300
200
100
90
80
70
60
50
40
30
20
10
9
8
7
6
5
RP1
EM1
0
DISTANCE (M)
250
500

TNO-DGV INSTITUTE OF APPLIED GEOSCIENCE

Site: Mirogi Primary School

Hydrogeology

Layers	Resistivity (ohmm)	Remarks
A	21-35	Weathered, decomposed volcanic rock (Tv) (DH)
B	6-12	Clay
C	60-250	Lateritic soil
D	-	-
E	-	-
F	-	-

Fractured zones, faults	Remarks
60 m S of VES2	Fractured zone

Depth to groundwater table: 10 - 20 m

Groundwater quality : Fresh

(Recommended) drilled (DH) or handdug (HH) holes

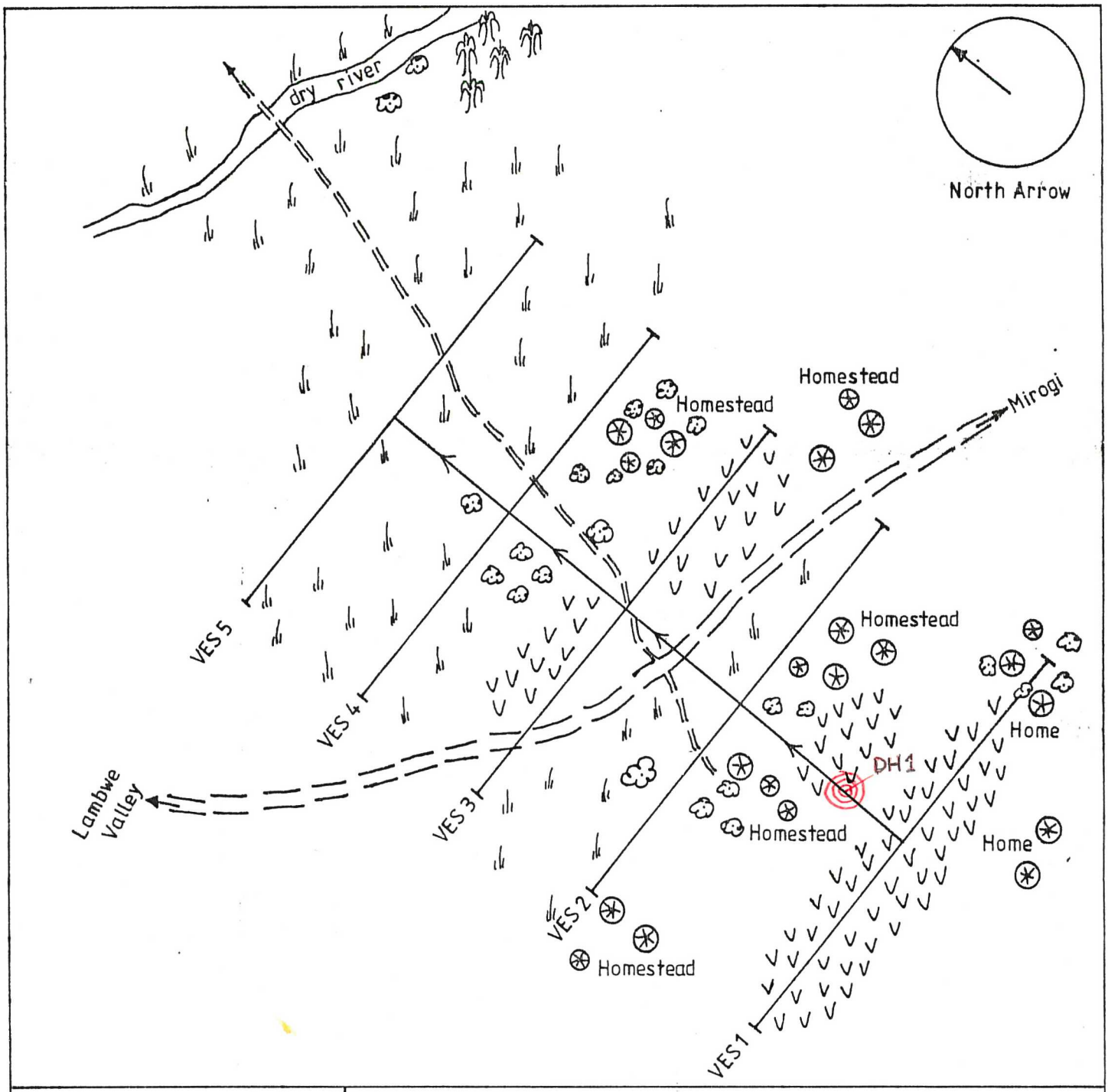
Drilled hole(s)	Remarks
DH1 (60 m S of VES2, 35 m)	-

Handdug hole(s)	Remarks
-	-

MIROGI PRIMARY SCHOOL (SKETCH)

SOUTH NYANZA DISTRICT: NDHIWA DIVISION: MAP SHEET 115/4

CO-ORDINATES



Murram road
Footpath
Round huts
Trees
Long grass
Maize shamba
Bananas

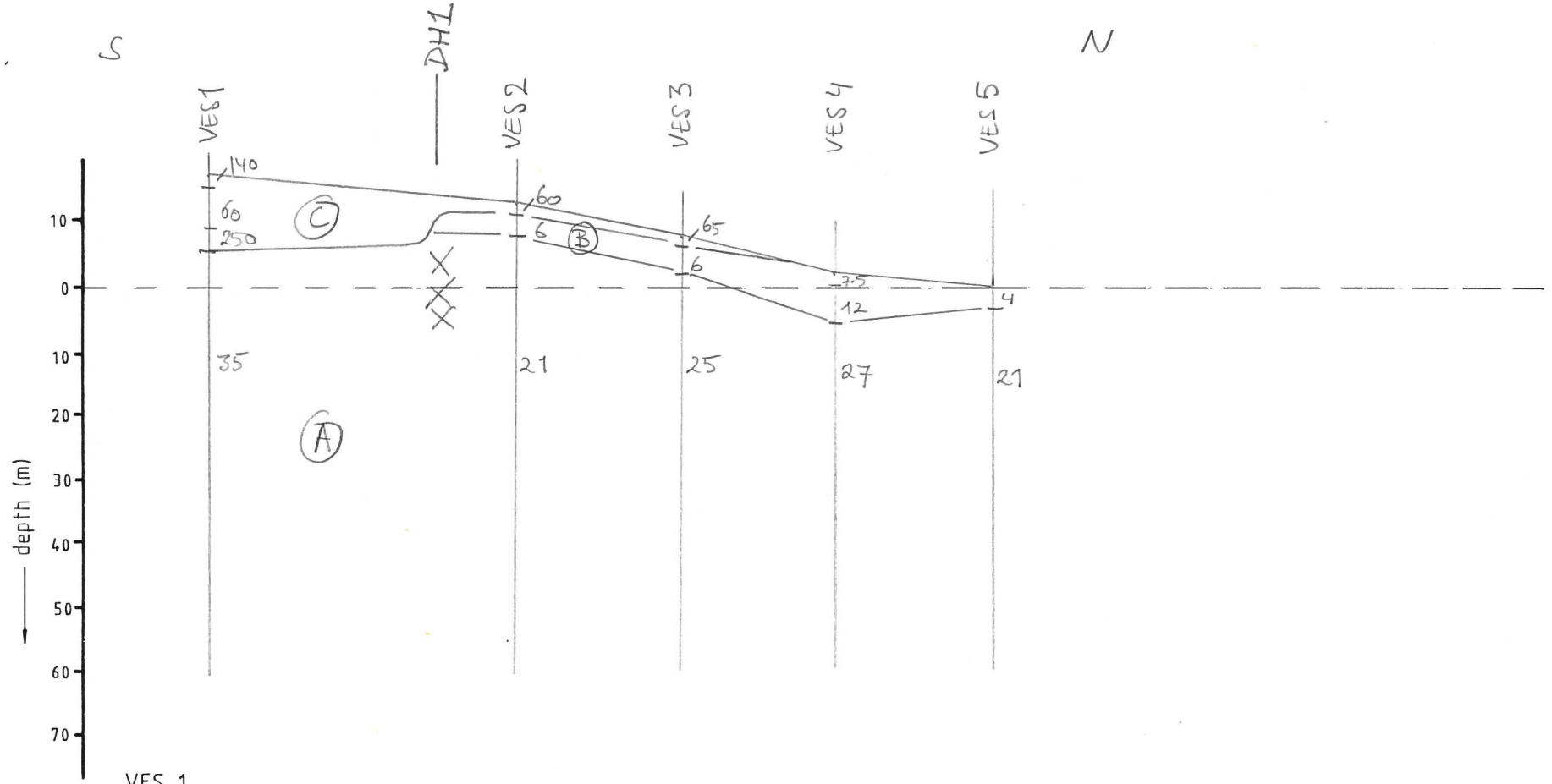
VES (Vertical Electric Sounding)
200m. long, at 150m interval except between VES1 & 2=200

Profile line

Slope :
VES1 – 75m = 0°
75m – VES2 = -1°
VES2 – VES3 = -2°
VES3 – VES4 = -3°
VES4 – VES5 = -1°

Sketched by R M Shilnko June 1984

MIROGI PRIMARY SCHOOL



VES 1
5
Vertical Electrical Sounding, interpreted resistivity 5 ohmm

A
geo-electrical layer A

B 1
(recommended) borehole or handdug hole

sandy clay, cemented clay

lateritic layer

clay

a very decomposed, altered rock

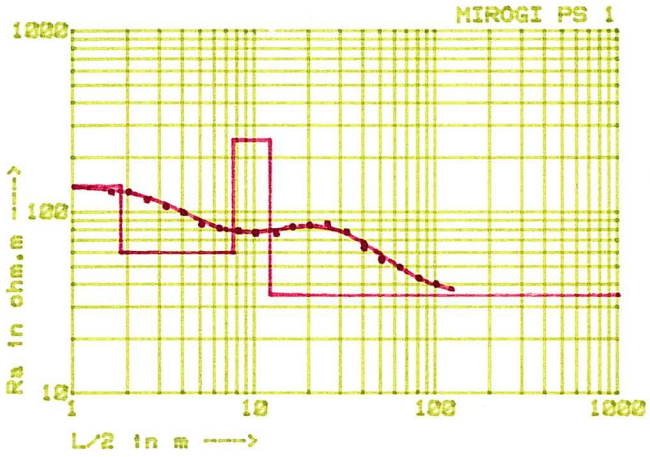
w weathered rock

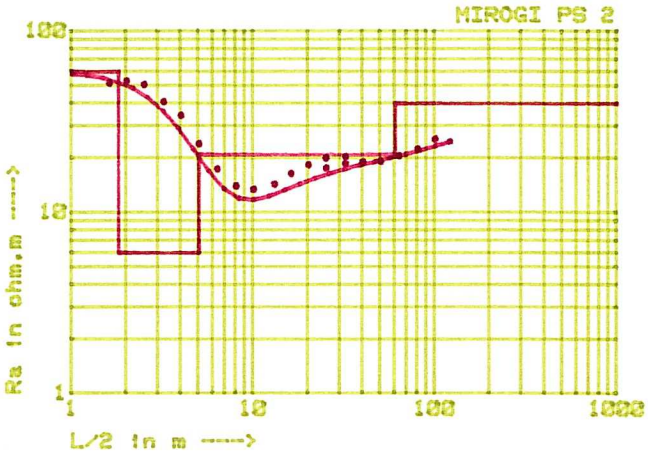
p partly weathered, fractured rock

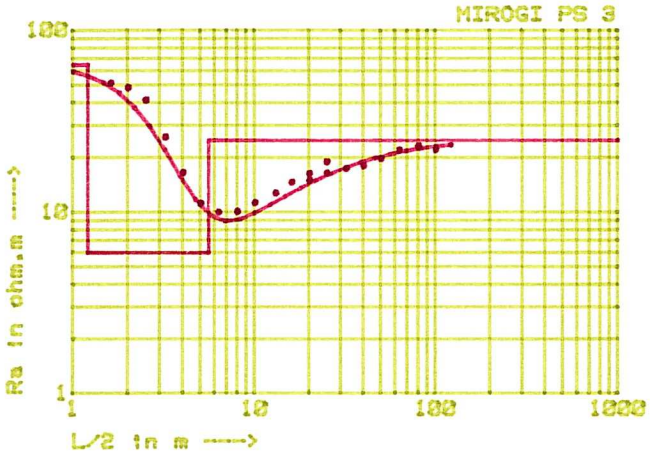
f fresh rock

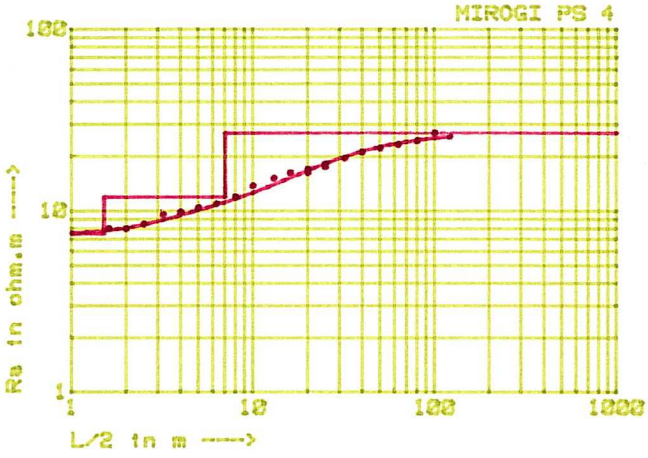
TNO-DGV Institute of Applied Geoscience	
Annex 13.3	Cross-section Mirogi Pr. School
Horizontal scale 1 : 5000	Vertical scale 1 : 1000

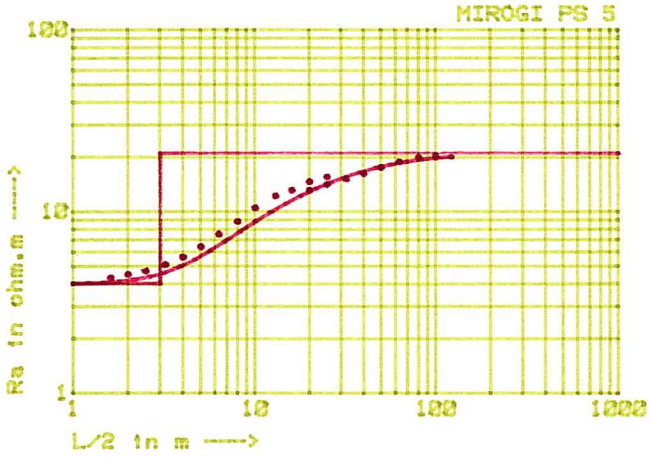
13.3

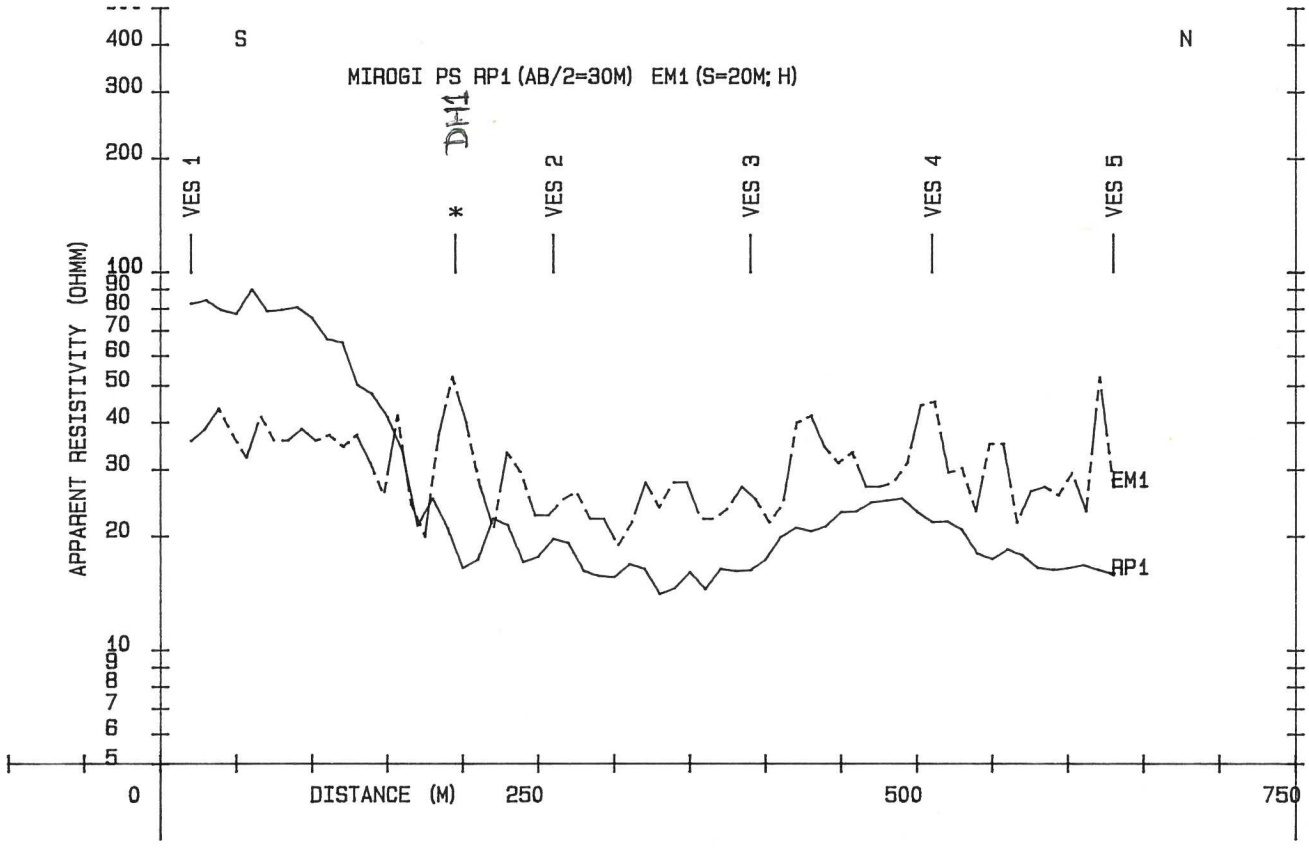

MIROGI PS 1
1000
100
10
1
Ra in ohm.m ——>
1
10
100
1000
L/2 in m ——>


MIROGI PS 2
100
10
1
Ra in ohm.m ——>
1
10
100
1000
L/2 in m ——>


MIROGI PS 3
100
10
1
Ra in ohm.m ——>
1
10
100
1000
L/2 in m ——>


MIROGI PS 4
100
10
1
Ra in ohm.m ——>
1
10
100
1000
L/2 in m ——>


MIROGI PS 5
100
10
1
Ra in ohm.m ——>
1
10
100
1000
L/2 in m ——>


MIROGI PS RP1 (AB/2=30M) EM1 (S=20M; H)
S
N
VES 1
VES 2
VES 3
VES 4
VES 5
DH1
APPARENT RESISTIVITY (OHMM)
400
300
200
100
90
80
70
60
50
40
30
20
10
9
8
7
6
5
EM1
RP1
0
DISTANCE (M)
250
500
750

TNO-DGV INSTITUTE OF APPLIED GEOSCIENCE

Site: Ndisi Primary School

Hydrogeology

Layers	Resistivity (ohmm)	Remarks
A	30-100	(Partly) weathered volcanic rock (Tv) (DH)
B	4-9	Sandy Clay
C	45-75	Lateritic soil
D	-	-
E	-	-
F	-	-

Fractured zones, faults	Remarks
50 m W of VES3	Fractured zone
40 m E of VES3	Fractured zone

Depth to groundwater table: 10 - 20 m

Groundwater quality : Fresh

(Recommended) drilled (DH) or handdug (HH) holes

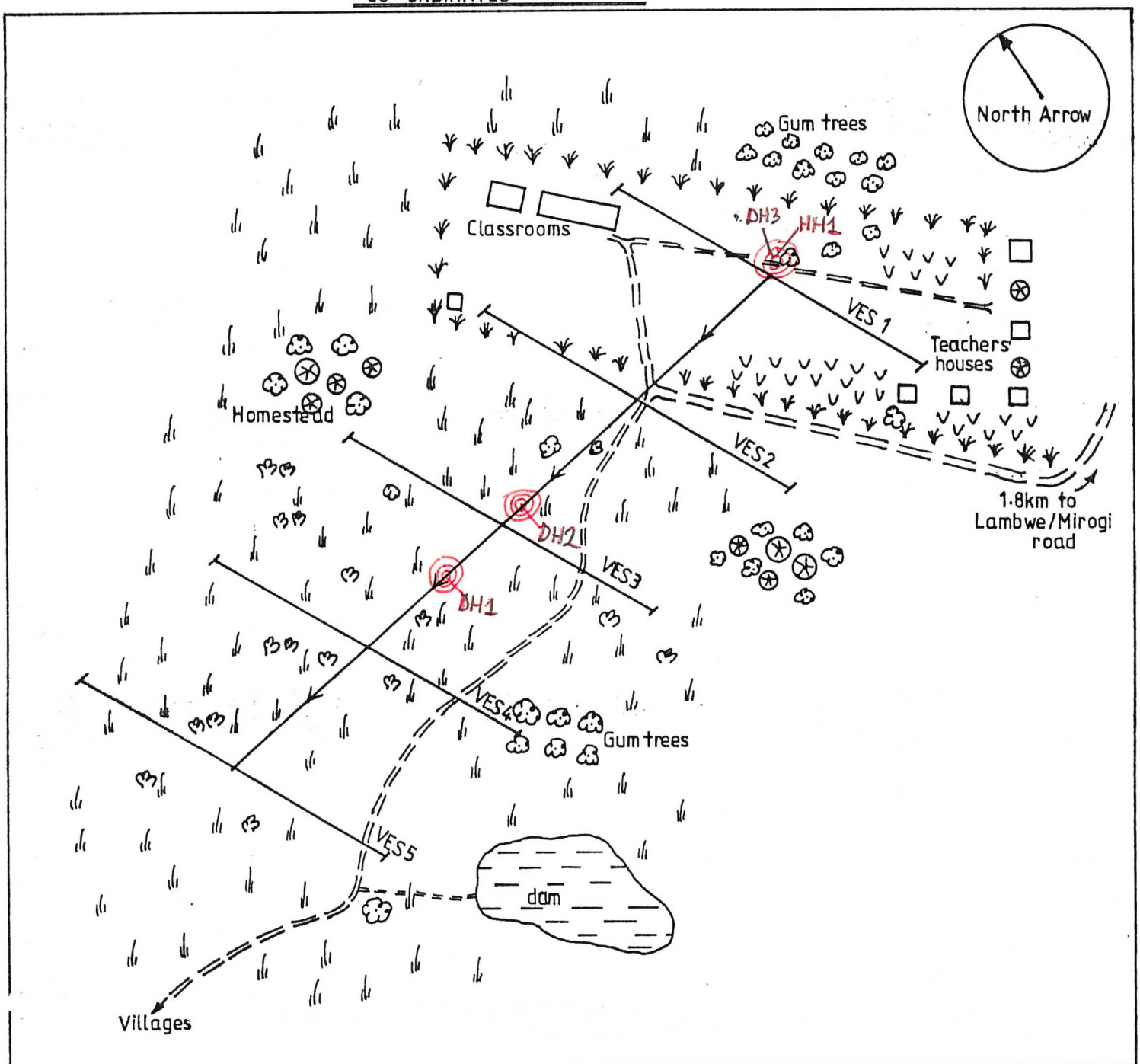
Drilled hole(s)	Remarks
D1(50 m W of VES3, 40 m)	-
D2(40 m E of VES3, 40 m)	-
D3(VES1, 40 m)	Groundwater at -8.30 m, EC = 600 S/cm

Handdug hole(s)	Remarks
HH1(VES1, 80 m)	-

NDISI PRIMARY SCHOOL (SKETCH)

SOUTH NYANZA DISTRICT: NDHIWA DIVISION: MAP SHEET

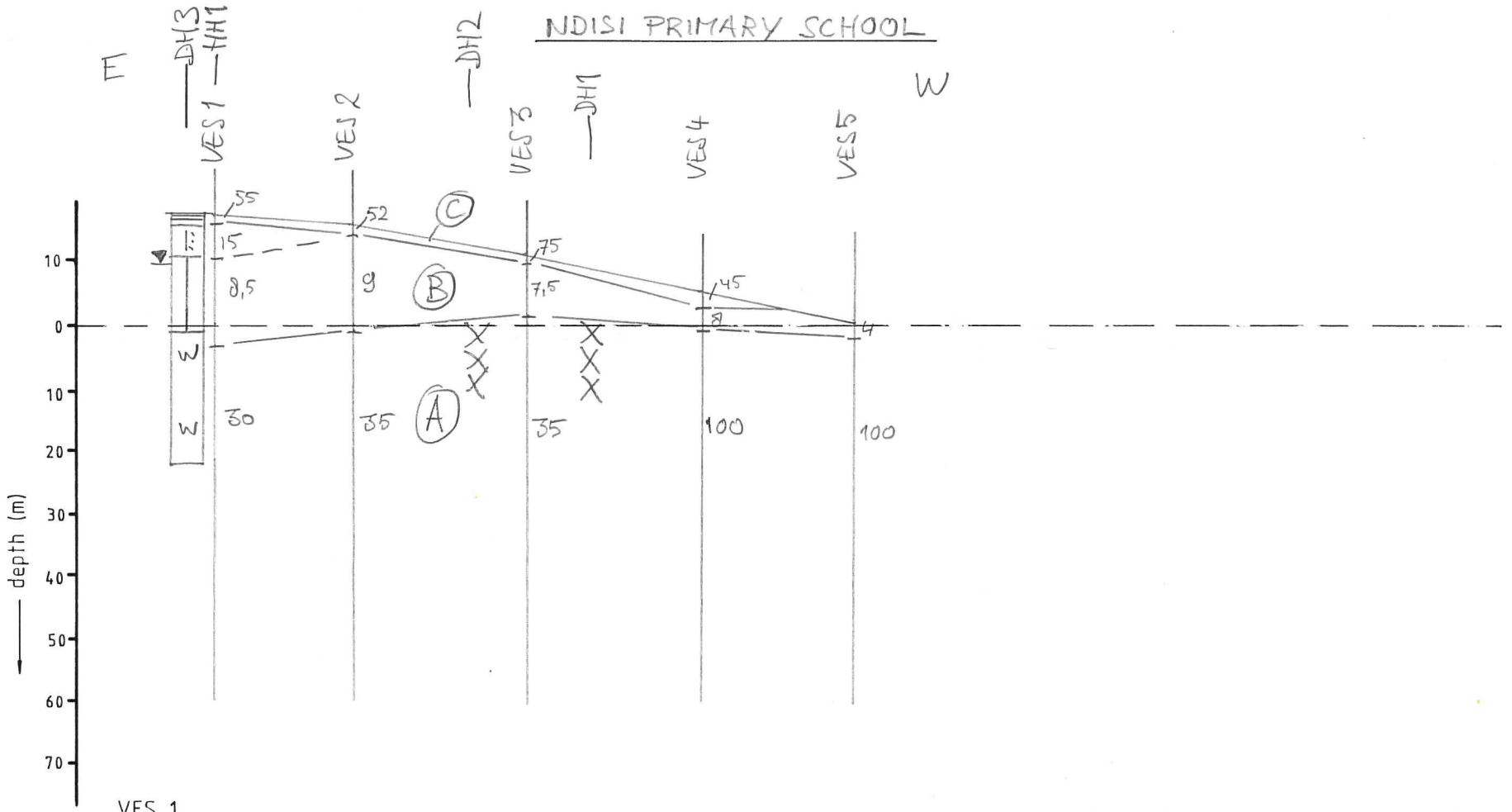
CO-ORDINATES



Earth road
Path
Classrooms
Houses
Round huts
Trees
Shrubs
Maize shamba
Hedge
Long grass

VES (Vertical Electric Sounding)
200m long, at 150m interval
Profile line

Slope:
VES1 – VES2 = -1°
VES2 – VES3 = -2°
VES3 – VES4 = -2·5°
VES4 – VES5 = -2·5°



VES 1
5
Vertical Electrical Sounding, interpreted resistivity 5 ohmm

A
geo-electrical layer A

B 1
(recommended) borehole or handdug hole

sandy clay, cemented clay

lateritic layer

clay

a very decomposed, altered rock

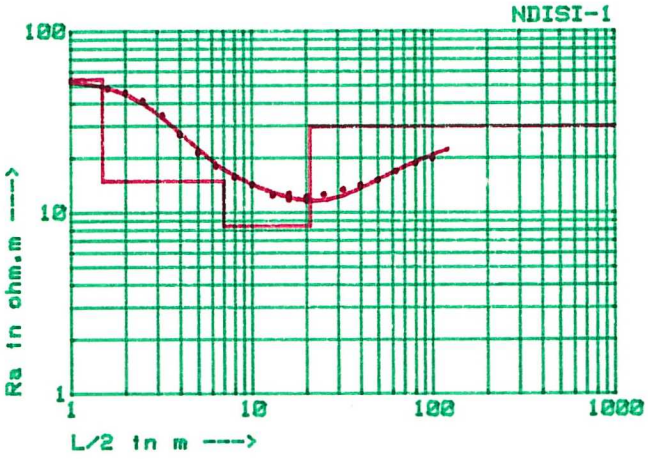
w weathered rock

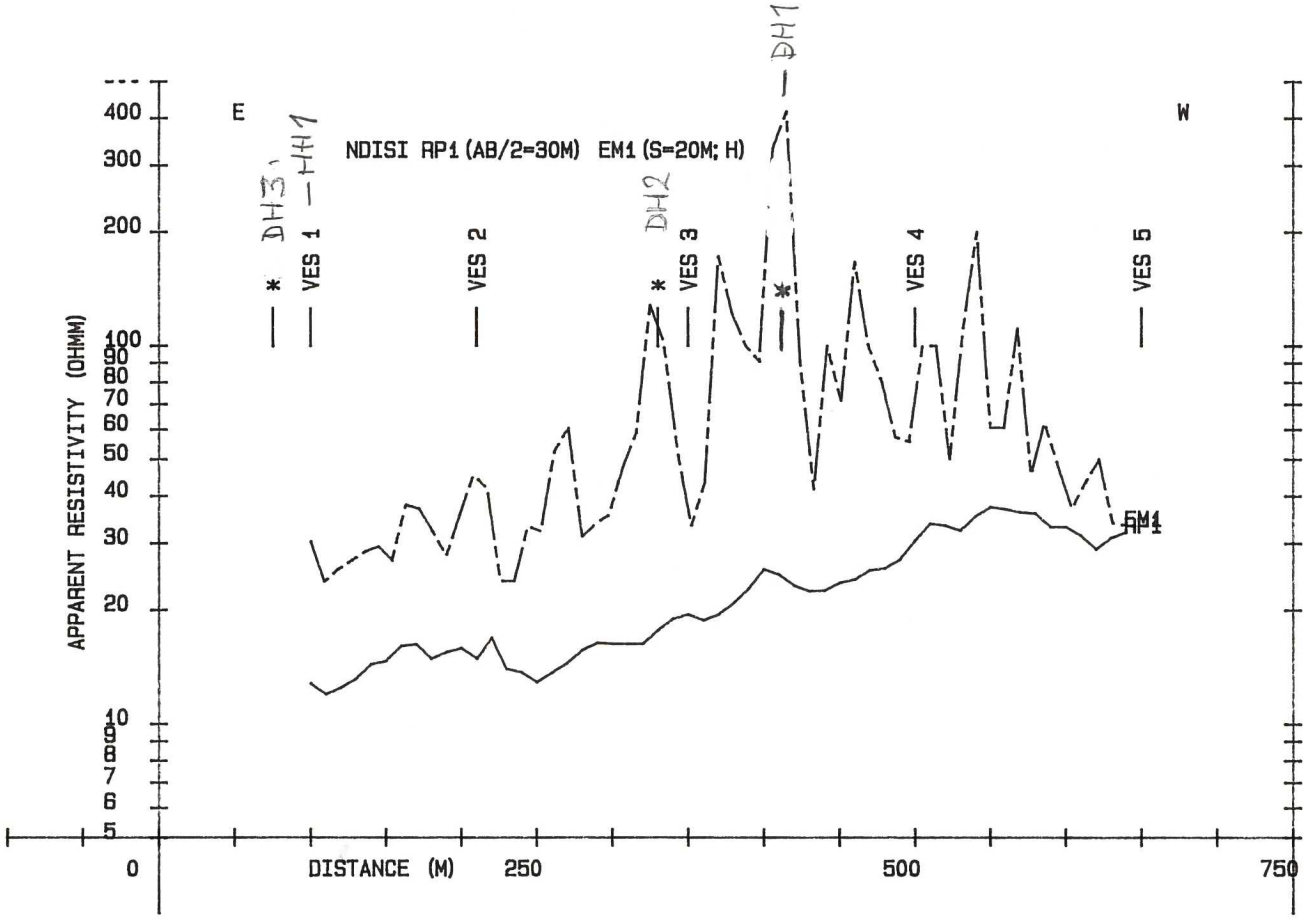
p partly weathered, fractured rock

f fresh rock

TNO-DGV Institute of Applied Geoscience	
Annex 14.3	Cross-section Ndisi Pr. School
Horizontal scale 1 : 5000	Vertical scale 1 : 1000

14.3


NDISI-1
100
10
1
1
10
100
1000
Ra in ohm.m ---->
L/2 in m ---->
NDISI-2
100
10
1
1
10
100
1000
Ra in ohm.m ---->
L/2 in m ---->
NDISI-3
100
10
1
1
10
100
1000
Ra in ohm.m ---->
L/2 in m ---->
NDISI-4
100
10
1
1
10
100
1000
Ra in ohm.m ---->
L/2 in m ---->
NDISI-5
100
10
1
1
10
100
1000
Ra in ohm.m ---->
L/2 in m ---->


NDISI RP1 (AB/2=30M) EM1 (S=20M; H)
E
W
DH3
DH1
DH2
VES 1
VES 2
VES 3
VES 4
VES 5
EM1
RP1
APPARENT RESISTIVITY (OHMM)
400
300
200
100
90
80
70
60
50
40
30
20
10
9
8
7
6
5
0
DISTANCE (M)
250
500
750

TNO-DGV INSTITUTE OF APPLIED GEOSCIENCE

Site: Sidede Village

Hydrogeology

Layers	Resistivity (ohmm)	Remarks	
A	15	Decomposed volcanic rock (Tv)	
B	35-55	Weathered volcanic rock (Tv)	(DH)
C	7-15	Sandy clay	
D	-	-	
E	-	-	
F	-	-	

Fractured zones, faults	Remarks
VES3	Fractured zone

Depth to groundwater table: Unknown

Groundwater quality : Fresh

(Recommended) drilled (DH) or handdug (HH) holes

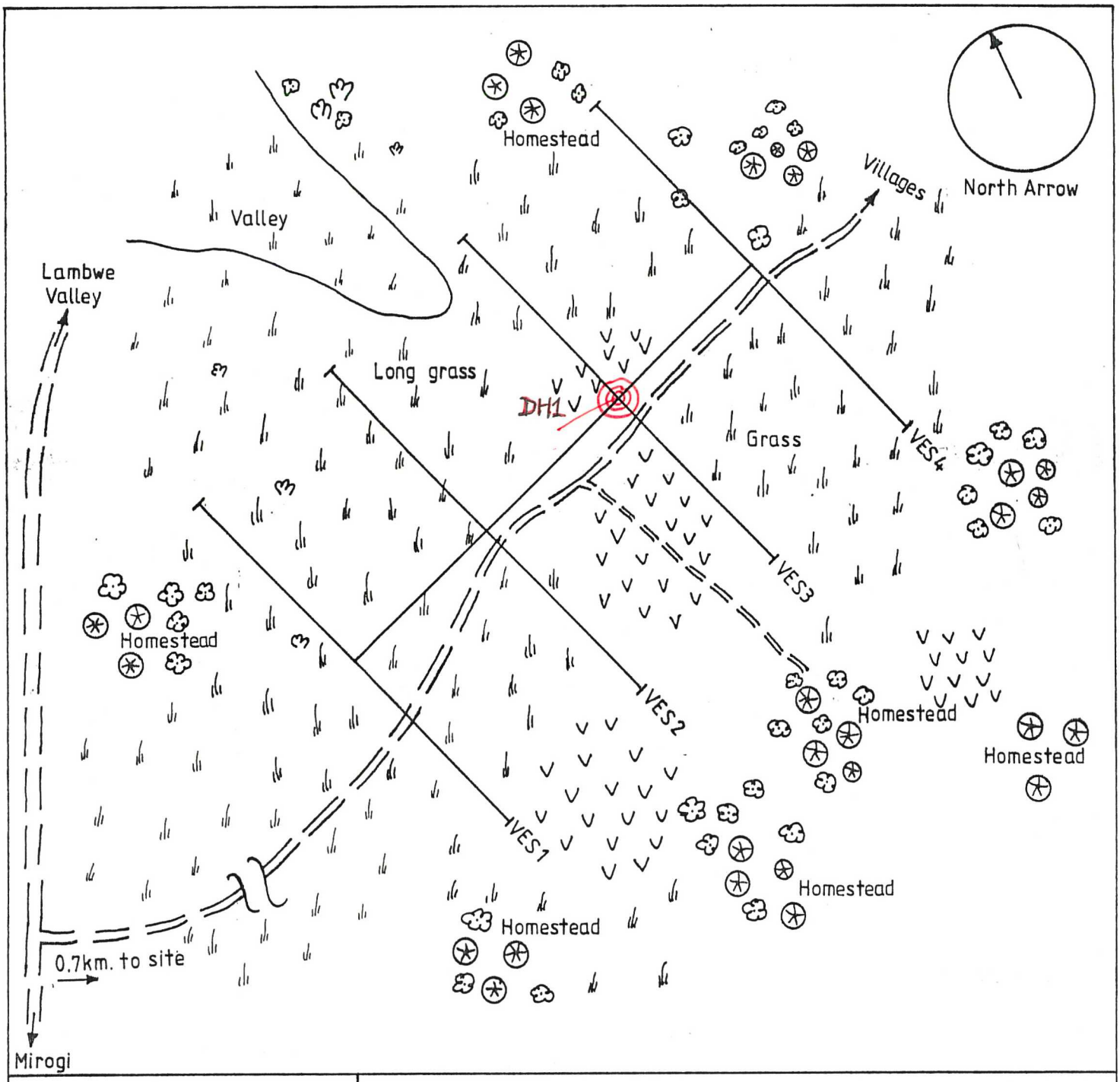
Drilled hole(s)	Remarks
D1(VES3, 40 m)	-

Handdug hole(s)	Remarks
-	-

SIDEDE VILLAGE (SKETCH)

SOUTH NYANZA DISTRICT: NDHIWA DIVISION: MAP SHEET 129/2

CO-ORDINATES



Murram road

Path - motorable

Round huts

Trees

Maize shamba

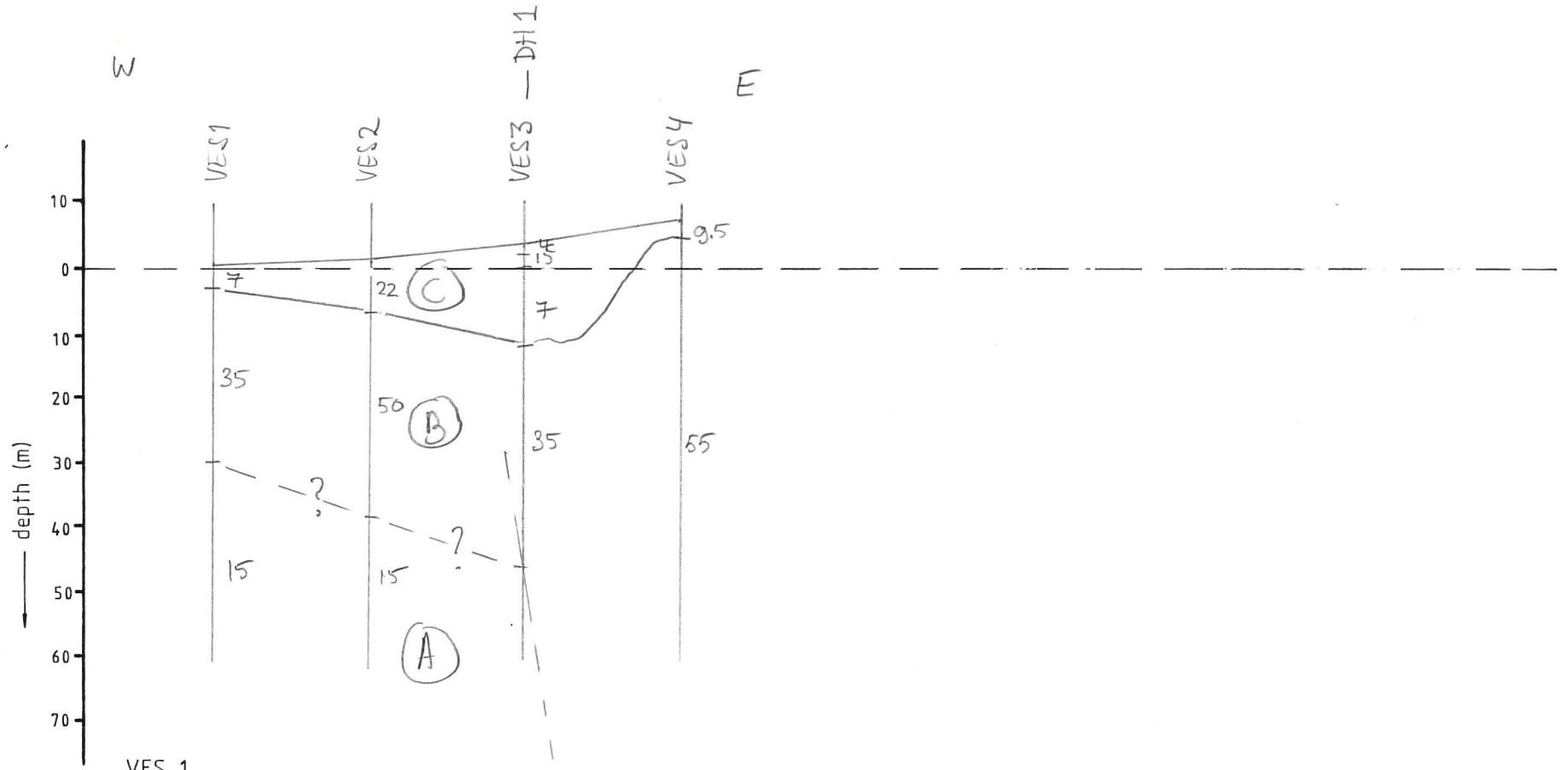
Long grass

VES (Vertical Electric Sounding)
200m. long, at 150m. interval

Profile line

Slope: VES1 – VES2 = +0·5°
VES2 – VES3 = +1°
VES3 – VES4 = +2°

SIDEDE VILLAGE



VES 1
5
Vertical Electrical Sounding, interpreted resistivity 5 ohmm

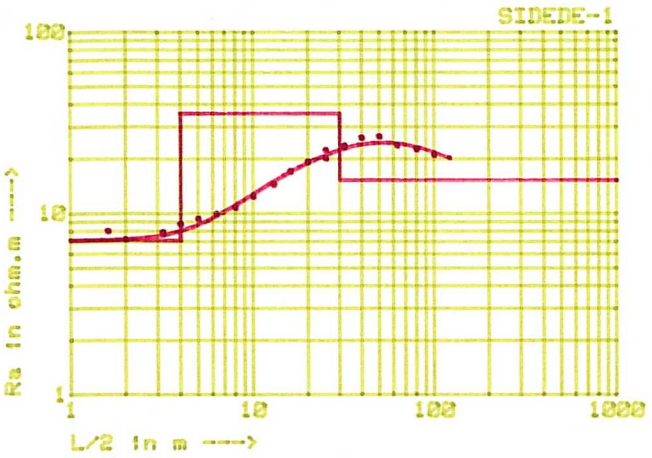
A
geo-electrical layer A

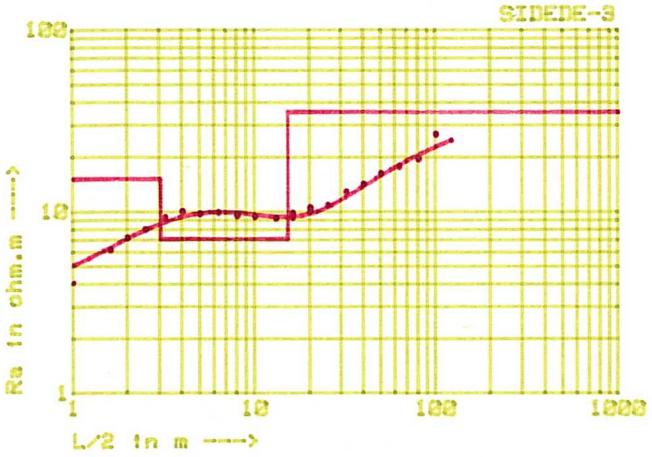
B 1
(recommended) borehole or handdug hole

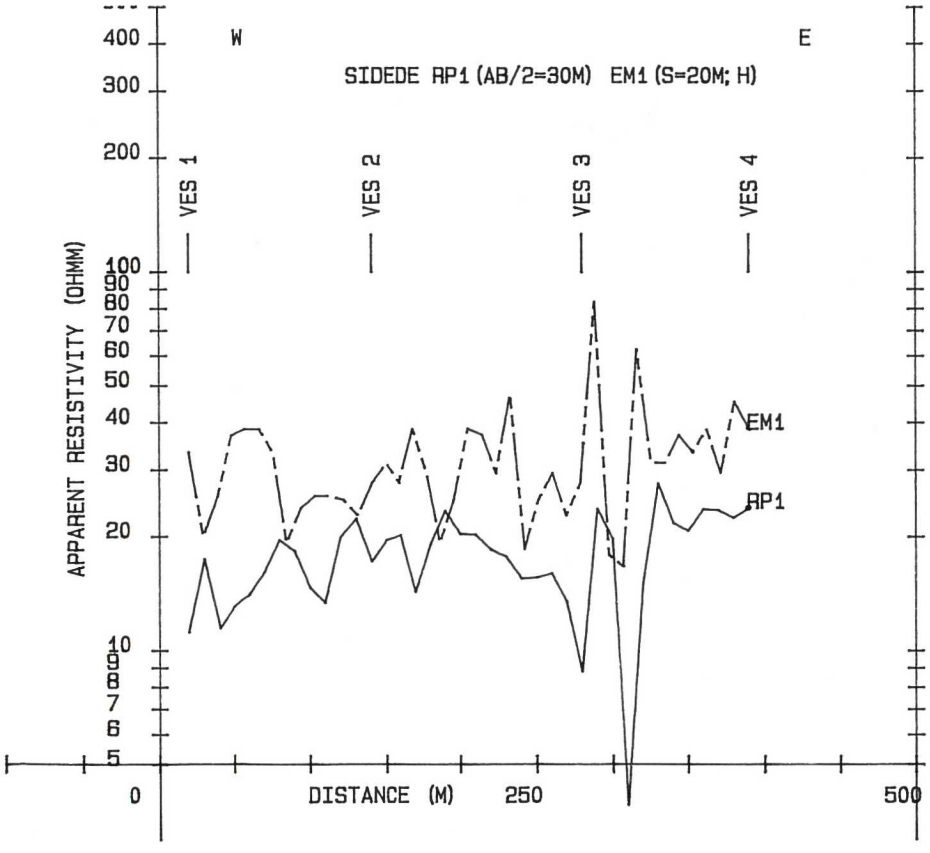
- sandy clay, cemented clay
- lateritic layer
- clay
- a — very decomposed, altered rock
- w — weathered rock
- p — partly weathered, fractured rock
- f — fresh rock

TNO-DGV Institute of Applied Geoscience	
Annex 15.3	Cross-section Sidede Village
Horizontal scale 1 : 5000	Vertical scale 1 : 1000

15.3


SIDEDE-1
100
10
1
Ra in ohm.m ---->
1
10
100
1000
L/2 in m ---->
SIDEDE-2
100
10
1
Ra in ohm.m ---->
1
10
100
1000
L/2 in m ---->


SIDEDE-3
100
10
1
Ra in ohm.m ---->
1
10
100
1000
L/2 in m ---->
SIDEDE-4
100
10
1
Ra in ohm.m ---->
1
10
100
1000
L/2 in m ---->


W
E
SIDEDE RP1 (AB/2=30M) EM1 (S=20M; H)
VES 1
VES 2
VES 3
VES 4
APPARENT RESISTIVITY (OHMM)
400
300
200
100
90
80
70
60
50
40
30
20
10
9
8
7
6
5
EM1
RP1
0
DISTANCE (M)
250
500

TNO-DGV INSTITUTE OF APPLIED GEOSCIENCE

Site: Rambusi Village

Hydrogeology

Layers	Resistivity (ohmm)	Remarks
A	5.3-7.5	Clay (R)
B	10-11	Sandy clay
C	3.8-5.8	Clay
D	-	-
E	-	-
F	-	-

Fractured zones, faults	Remarks
50 m NE of VES4	Maybe fractured zone

Depth to groundwater table: Probably very deep

Groundwater quality : Unknown

(Recommended) drilled (DH) or handdug (HH) holes

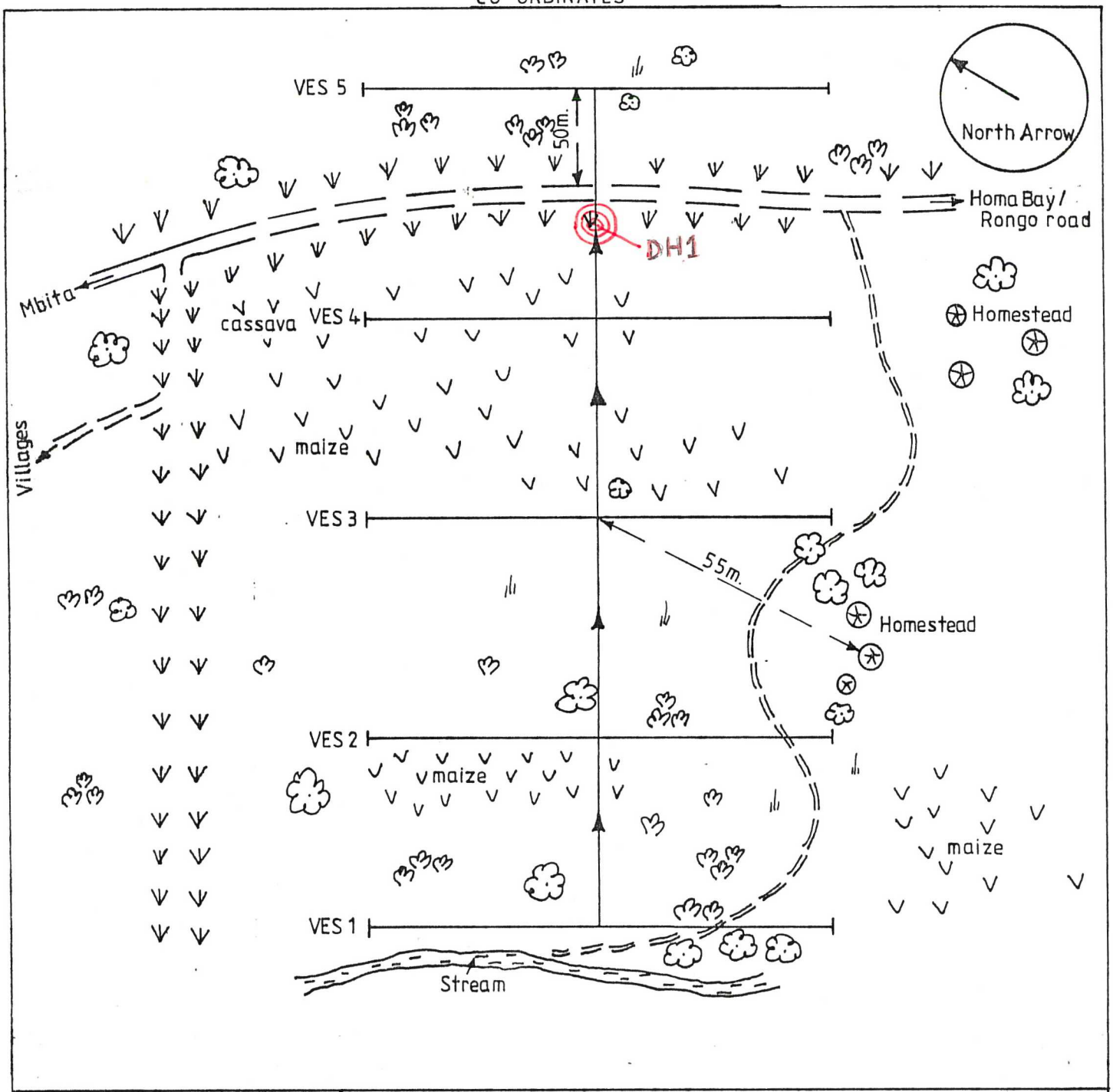
Drilled hole(s)	Remarks
DH1 (50 m NE of VES4, <75 m)	-

Handdug hole(s)	Remarks
-	-

RAMBUSI VILLAGE (SKETCH)

SOUTH NYANZA DISTRICT: NDHIWA DIVISION: MAP SHEET

CO-ORDINATES



Murram road

Footpath

Round huts

Trees

Shrubs

Shamba

Sisal fence

Long grass

VES (Vertical Electric Sounding) 200m long, at 150m. interval

Profile line

Slope: VES1 – VES2 = +1°

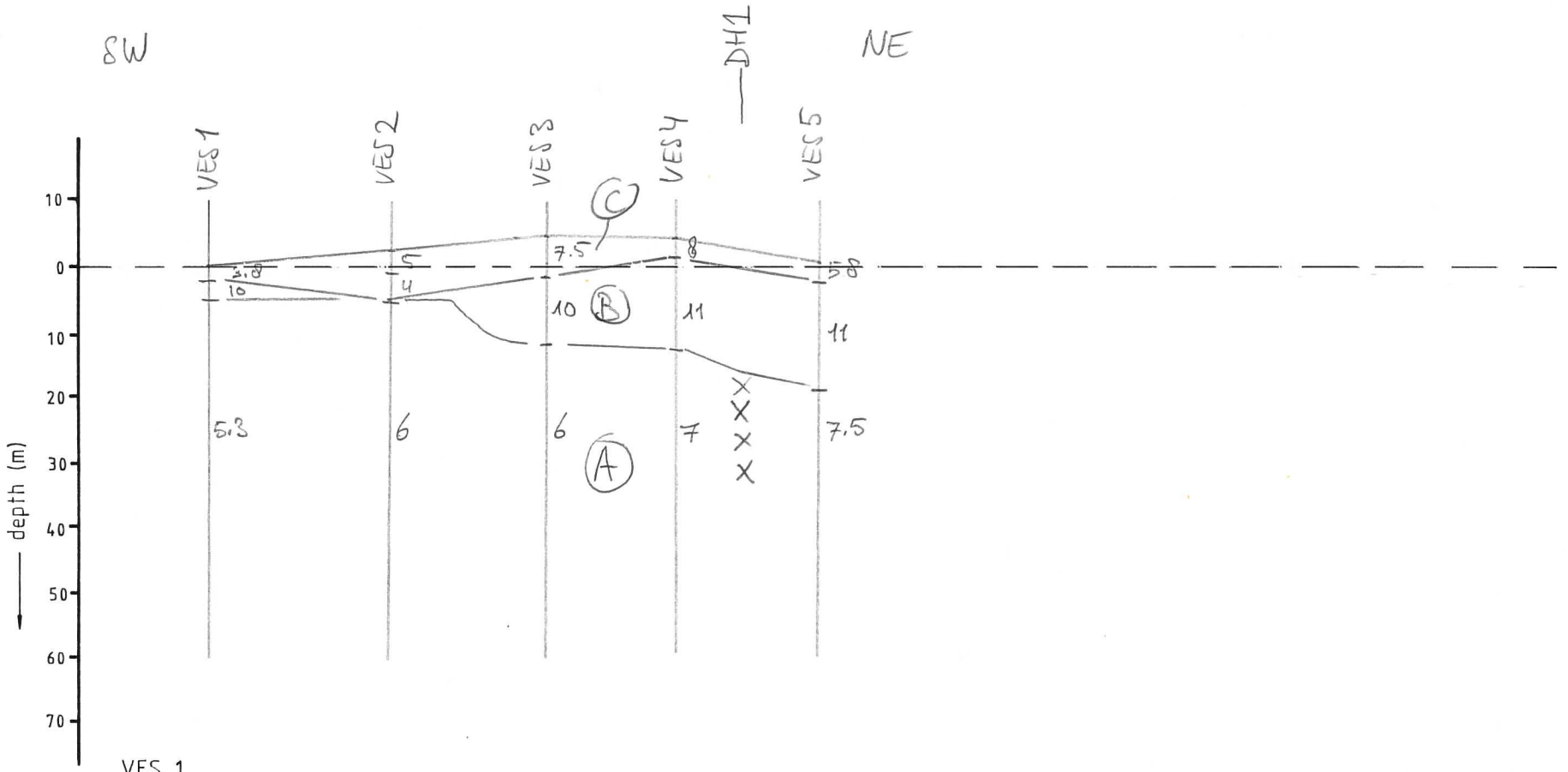
VES2 – VES3 = +1°

VES3 – VES4 = 0°

VES4 – VES5 = – 2°

Sketched by R. M. Shilako June 1984

RAMBUSI VILLAGE



VES 1
5
Vertical Electrical Sounding, interpreted resistivity 5 ohmm

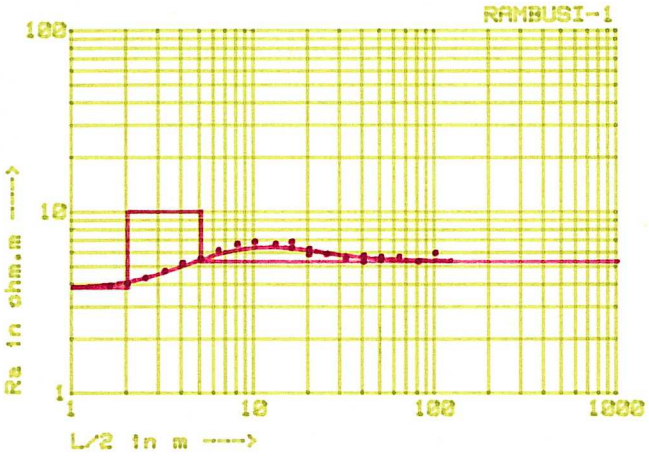
A
geo-electrical layer A

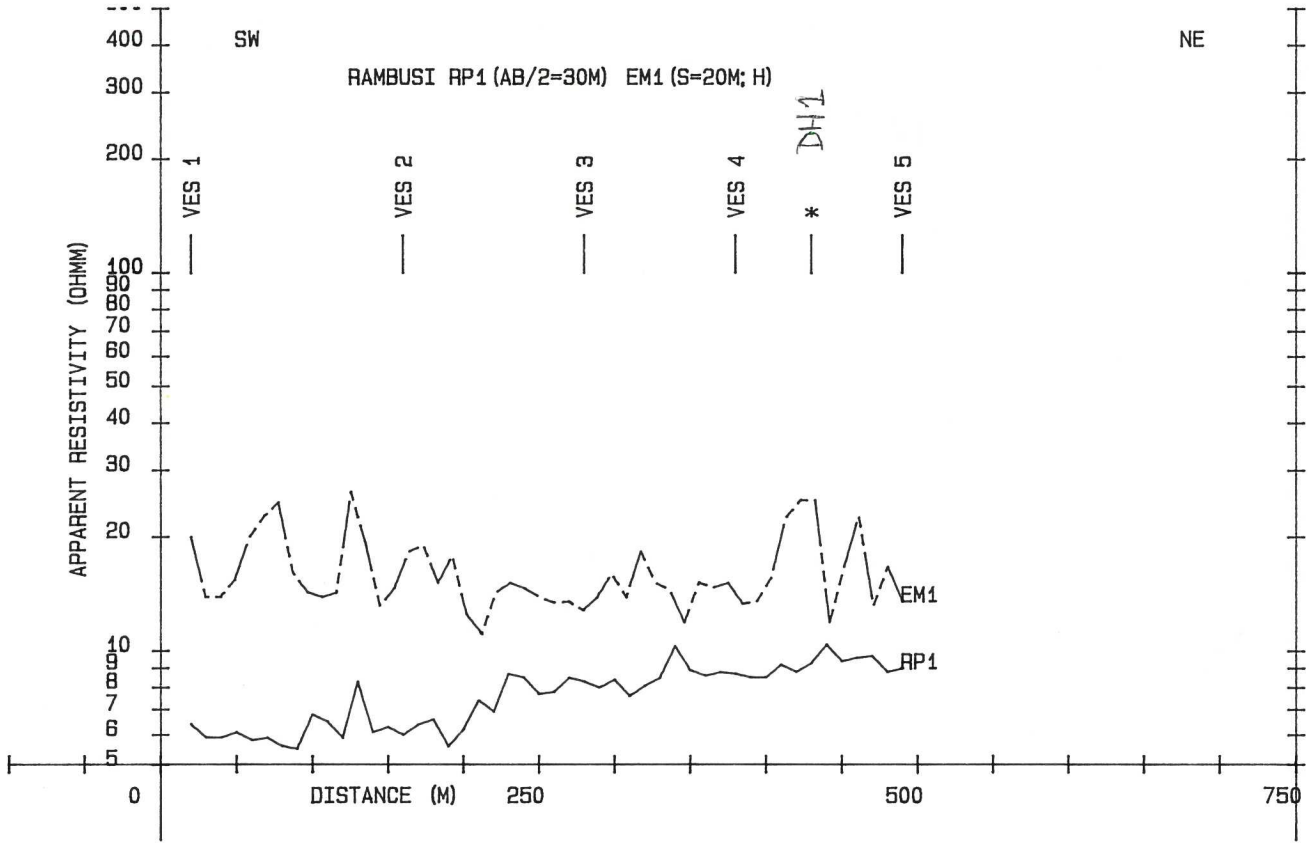
B 1
(recommended) borehole or handdug hole.

- sandy clay, cemented clay
- lateritic layer
- clay
- a — very decomposed, altered rock
- w — weathered rock
- p — partly weathered, fractured rock
- f — fresh rock

TNO-DGV Institute of Applied Geoscience	
Annex 16.3	Cross-section Rambusi Village
Horizontal scale 1 : 5000	Vertical scale 1 : 1000

16.3


RAMBUSI-1
100
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1
Ra in ohm.m ----->
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L/2 in m ----->
RAMBUSI-2
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L/2 in m ----->
RAMBUSI-4
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Ra in ohm.m ----->
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100
1000
L/2 in m ----->
RAMBUSI-5
100
10
1
Ra in ohm.m ----->
1
10
100
1000
L/2 in m ----->


SW
NE
RAMBUSI RP1 (AB/2=30M) EM1 (S=20M; H)
VES 1
VES 2
VES 3
VES 4
DH1
VES 5
APPARENT RESISTIVITY (OHMM)
400
300
200
100
90
80
70
60
50
40
30
20
10
9
8
7
6
5
EM1
RP1
0
DISTANCE (M)
250
500
750

TNO-DGV INSTITUTE OF APPLIED GEOSCIENCE

Site: Mifuare Village

Hydrogeology

Layers	Resistivity (ohmm)	Remarks	
A	60-100	Weathered volcanic rock (Na)	(DH)
B	3.5-8	Clay	
C	18-20	Sandy (clay) (R)	
D	10-30	Clayey soil	
E	-	-	
F	-	-	

Fractured zones, faults	Remarks
100 m W of VES3	Fractured zone

Depth to groundwater table: 20 - 25 m

Groundwater quality : Partly saline

(Recommended) drilled (DH) or handdug (HH) holes

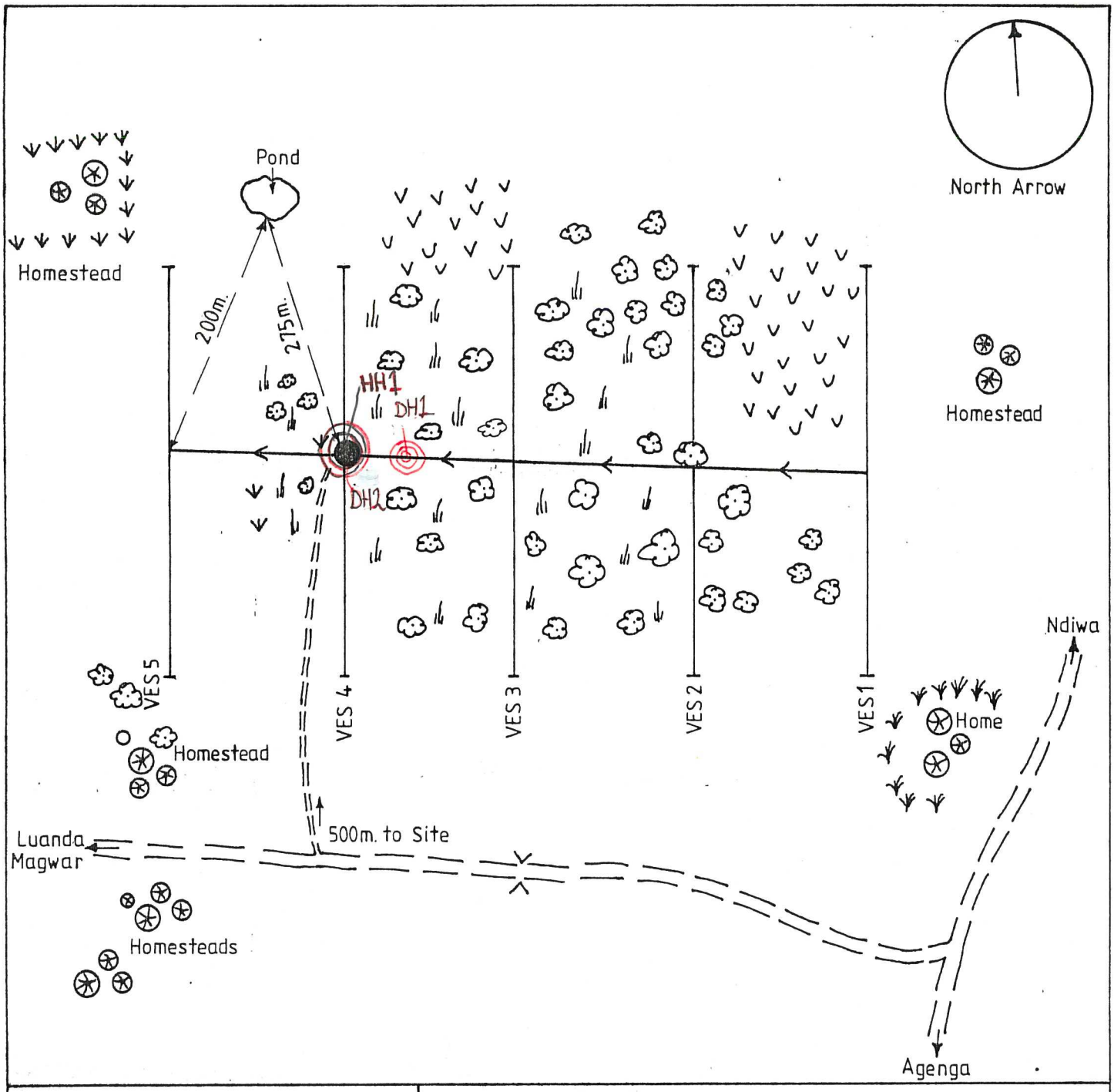
Drilled hole(s)	Remarks
DH1 (100 m W of VES3, 30 m)	-
DH2 (VES4, 30 m)	Groundwater at -24.80 m, EC = 2300 µS/cm

Handdug hole(s)	Remarks
HH1 (VES4, 25 m)	

MIFUARE VILLAGE (SKETCH)

SOUTH NYANYA DISTRICT: NDHIWA DIVISION: MAP SHEET

CO-ORDINATES



Murram road
Path
Round huts
Trees
BH Borehole - machine drilled
Long grass
Maize shamba
Hedge
Sisal

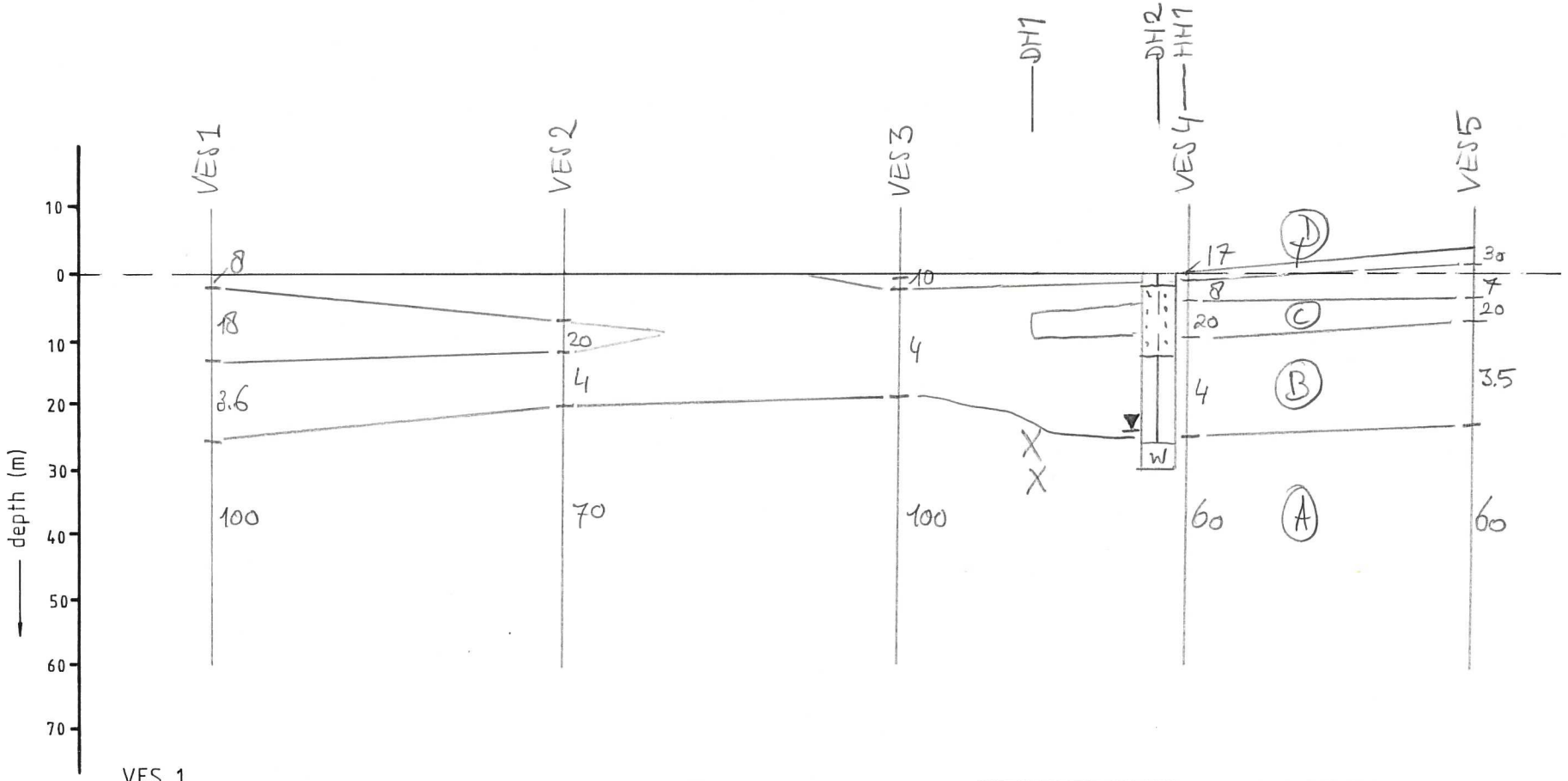
VES (Vertical Electric Sounding)
200m. long, at 200m. interval

Profile line = 980m.

Slope: VES1–VES2 = 0°
VES2–VES3 = 0°
VES3–VES4 = 0°
VES4–VES5 = +1°

Sketched by R.M. Shilako Jun.1984

MIFUARE VILLAGE



VES 1
5
Vertical Electrical Sounding, interpreted resistivity 5 ohmm

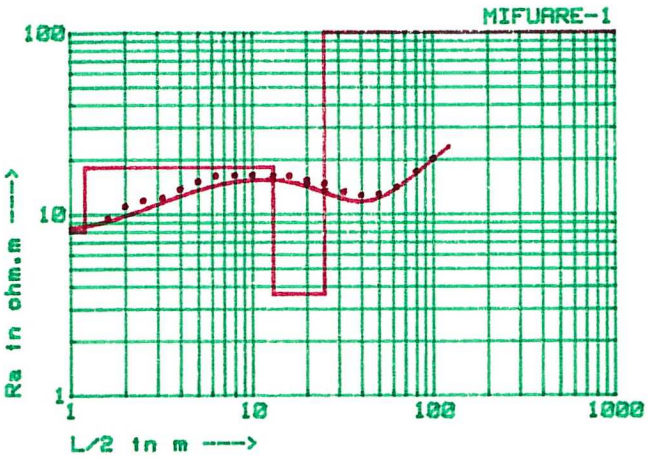
A
geo-electrical layer A

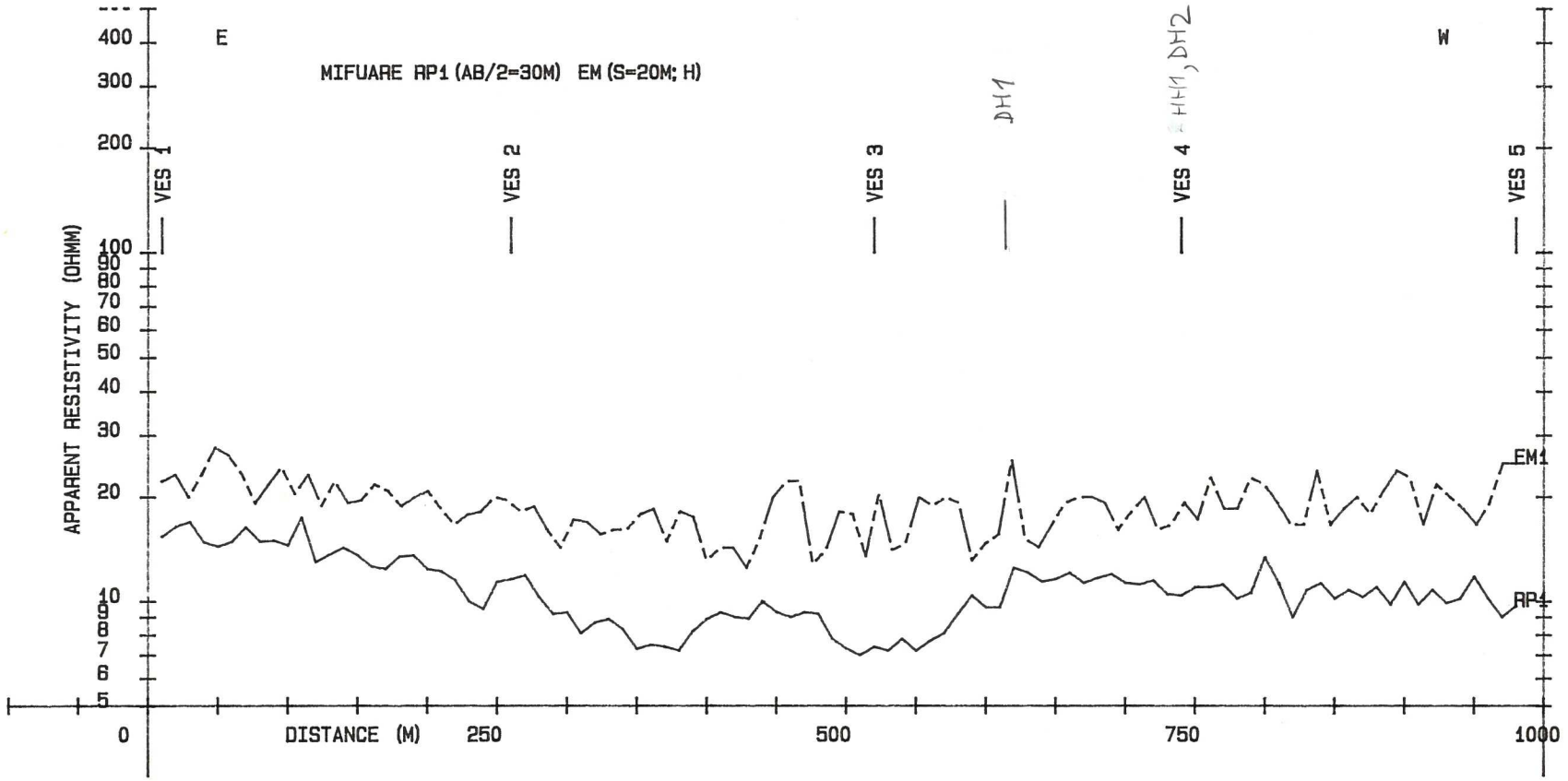
B 1
(recommended) borehole or handdug hole

- sandy clay, cemented clay
- lateritic layer
- clay
- a — very decomposed, altered rock
- w — weathered rock
- p — partly weathered, fractured rock
- f — fresh rock

TNO-DGV Institute of Applied Geoscience	
Annex 17.3	Cross-section Mifuare Village
Horizontal scale 1 : 5000	Vertical scale 1 : 1000

17.3


MIFUARE-1
100
10
1
Ra in ohm.m ---->
1
10
100
1000
L/2 in m ---->
MIFUARE-2
100
10
1
Ra in ohm.m ---->
1
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100
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L/2 in m ---->
MIFUARE-3
100
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Ra in ohm.m ---->
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L/2 in m ---->
MIFUARE-4
100
10
1
Ra in ohm.m ---->
1
10
100
1000
L/2 in m ---->
MIFUARE-5
100
10
1
Ra in ohm.m ---->
1
10
100
1000
L/2 in m ---->


E
W
MIFUARE RP1 (AB/2=30M) EM (S=20M; H)
VES 1
VES 2
VES 3
DH1
VES 4 HH1, DH2
VES 5
APPARENT RESISTIVITY (OHMM)
400
300
200
100
90
80
70
60
50
40
30
20
10
9
8
7
6
5
EM1
RP1
0
DISTANCE (M)
250
500
750
1000

TNO-DGV INSTITUTE OF APPLIED GEOSCIENCE

Site: Kosiemo Primary School

Hydrogeology

Layers	Resistivity (ohmm)	Remarks
A	29-50	Weathered volcanic rock (Tv) (DH)
B	5-20	Sandy clay
C	80-100	Lateritic layer
D	-	-
E	-	-
F	-	-

Fractured zones, faults	Remarks
50 m S of VES2	Fractured zone

Depth to groundwater table: 20 - 30 m

Groundwater quality : Fresh

(Recommended) drilled (DH) or handdug (HH) holes

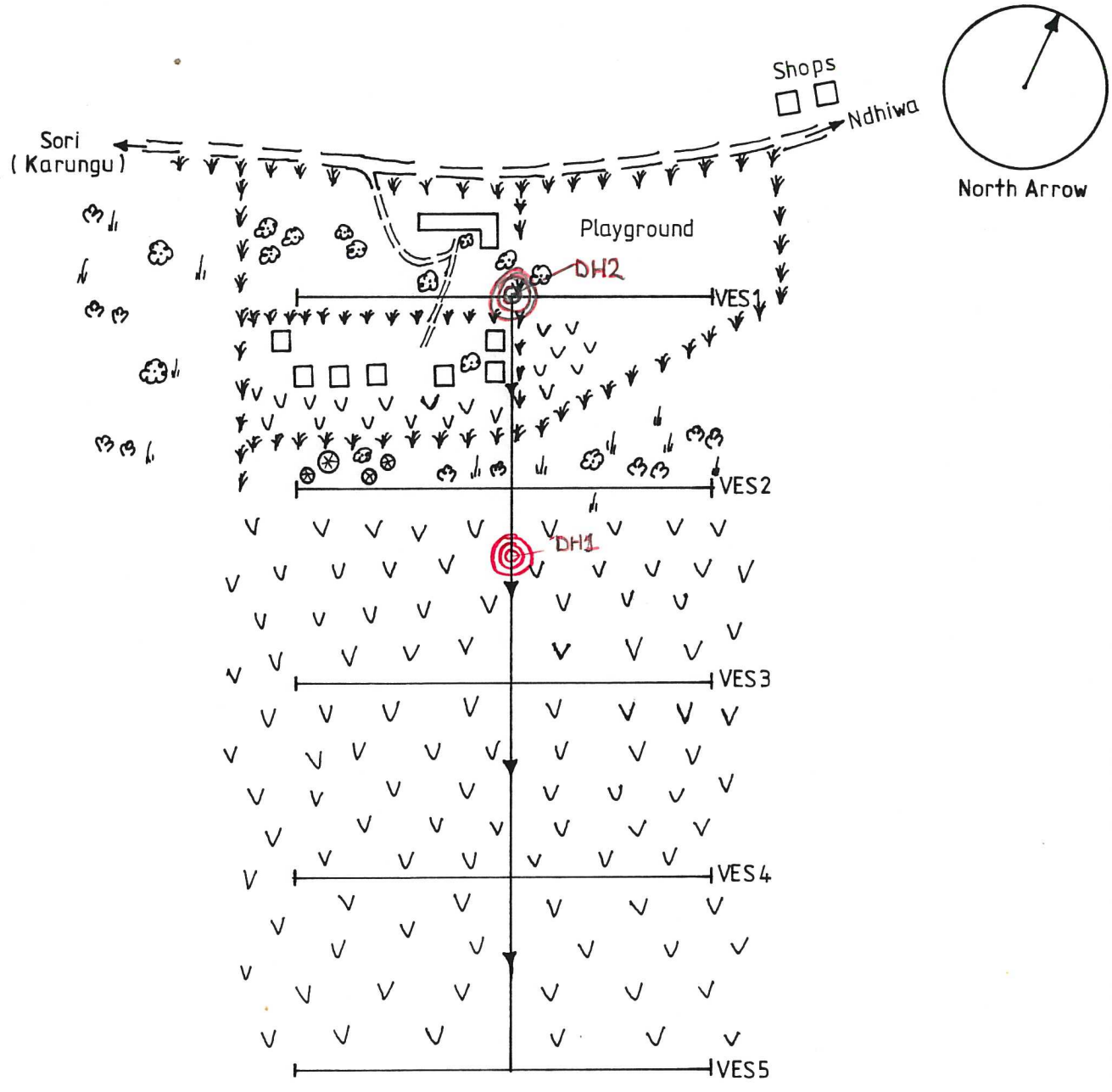
Drilled hole(s)	Remarks
DH1 (50 m S of VES2, 40 m)	-
DH2 (VES1, 40 m)	Groundwater at -26.00 m, EC = 1700 µS/cm

Handdug hole(s)	Remarks
-	-

KOSIEMO PRIMARY SCHOOL (SKETCH)

SOUTH NYANZA DISTRICT: NDHIWA DIVISION: MAP SHEET

CO-ORDINATES



Murram road

Classrooms

Teachers' houses

Trees

Shrubs

Long grass

Maize shamba

Round huts

Hedge

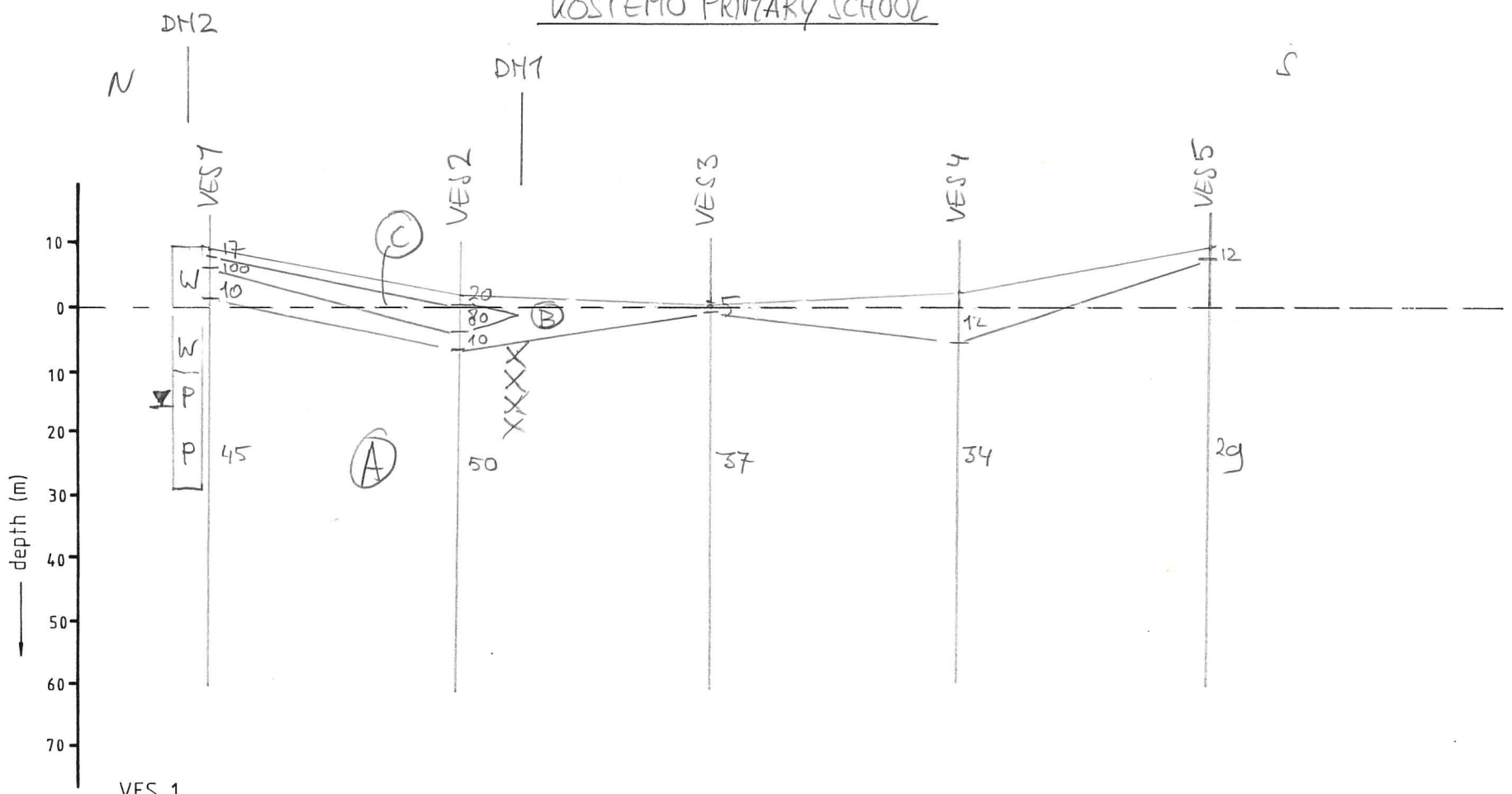
VES (Vertical Electric Sounding)
200m long, at 150m interval

Profile line

Slope: VES1 – VES2 = −2·5°
VES2 – VES3 = −0·5°
VES3 – VES4 = +0·5°
VES4 – VES5 = 2°

Sketched by R. M. Shilako June 1984

KOSIEMO PRIMARY SCHOOL



VES 1
5
Vertical Electrical Sounding, interpreted resistivity 5 ohmm

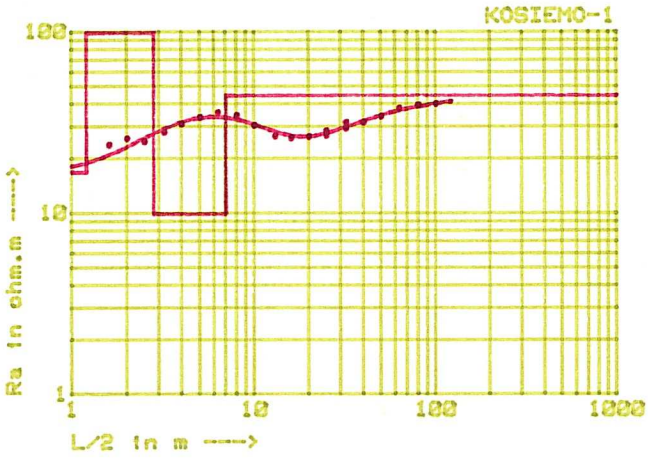
A
geo-electrical layer A

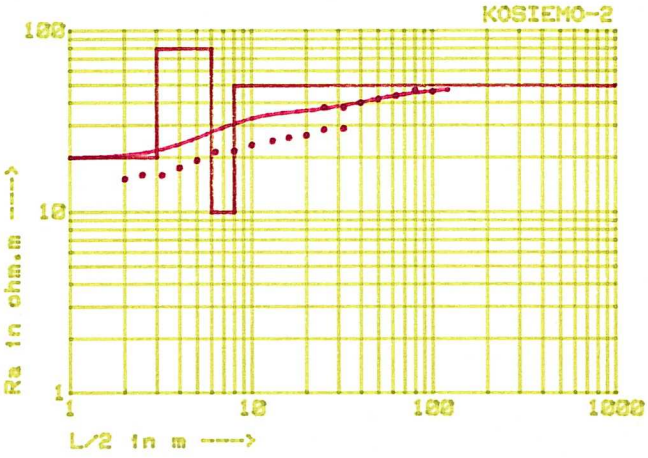
B 1
(recommended) borehole or handdug hole

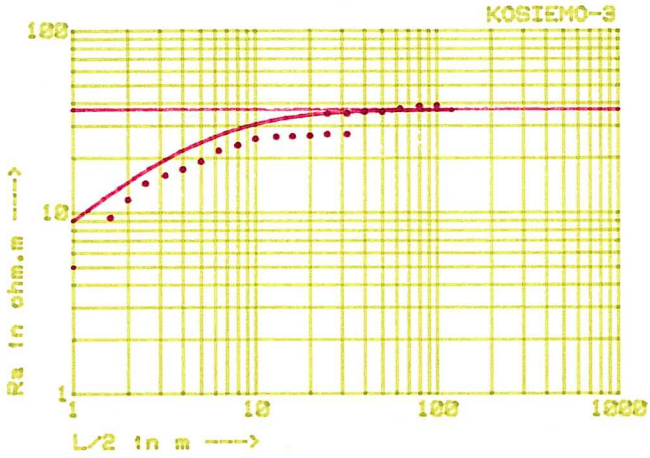
- sandy clay, cemented clay
- lateritic layer
- clay
- a — very decomposed, altered rock
- w — weathered rock
- p — partly weathered, fractured rock
- f — fresh rock

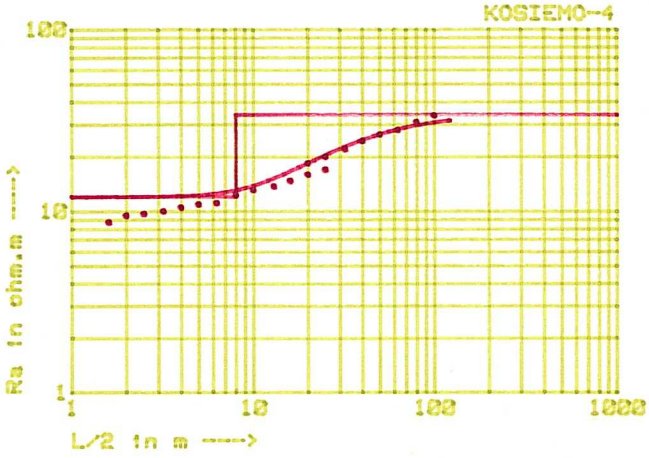
TNO-DGV Institute of Applied Geoscience	
Annex 18.3	Cross-section Kosiemo Pr. School
Horizontal scale 1 : 5000	Vertical scale 1 : 1000

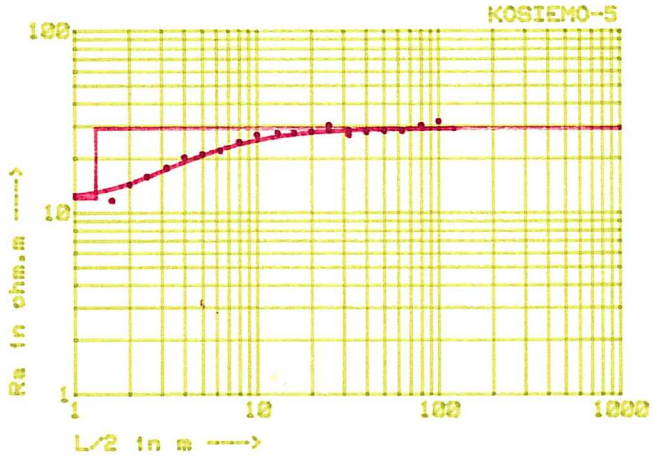
18.3

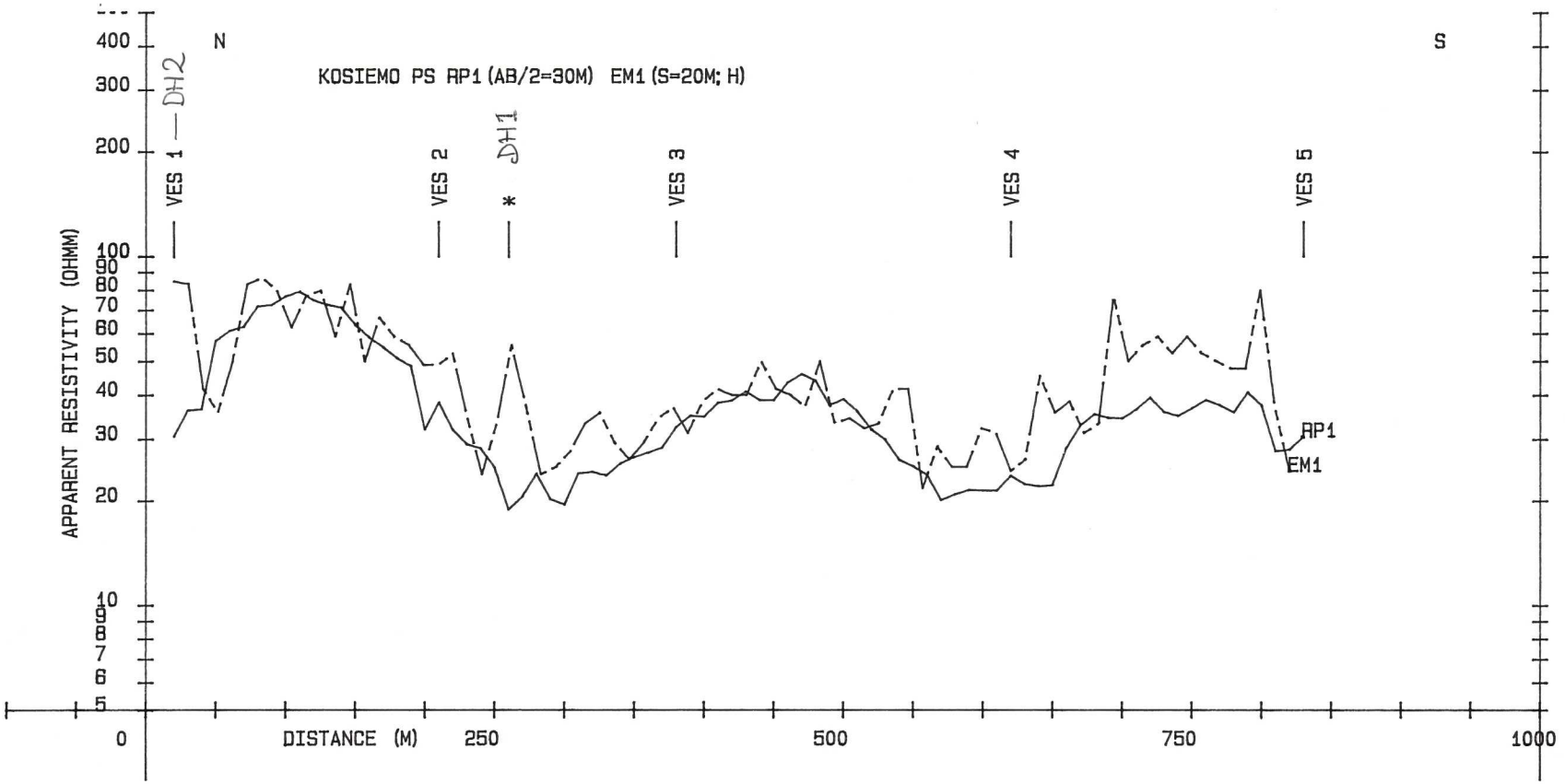

KOSIEMO-1
100
10
1
Ra in ohm.m ---->
1
10
100
1000
L/2 in m ---->


KOSIEMO-2
100
10
1
Ra in ohm.m ---->
1
10
100
1000
L/2 in m ---->


KOSIEMO-3
100
10
1
Ra in ohm.m ---->
1
10
100
1000
L/2 in m ---->


KOSIEMO-4
100
10
1
Ra in ohm.m ---->
1
10
100
1000
L/2 in m ---->


KOSIEMO-5
100
10
1
Ra in ohm.m ---->
1
10
100
1000
L/2 in m ---->


KOSIEMO PS RP1 (AB/2=30M) EM1 (S=20M; H)
N
S
VES 1 — DH2
VES 2
* DH1
VES 3
VES 4
VES 5
APPARENT RESISTIVITY (OHMM)
400
300
200
100
90
80
70
60
50
40
30
20
10
9
8
7
6
5
RP1
EM1
0
DISTANCE (M)
250
500
750
1000

TNO-DGV INSTITUTE OF APPLIED GEOSCIENCE

Site: Kosiemo Village

Hydrogeology

Layers	Resistivity (ohmm)	Remarks
A	22-100	(Partly) weathered volcanic rock (Tv) (DH)
B	2-2.1	Clay, saline
C	6-30	Sandy clay
D	-	-
E	-	-
F	-	-

Fractured zones, faults	Remarks
50 m W of VES1	Fractured zone, maybe fresh groundwater

Depth to groundwater table: 20 - 25 m

Groundwater quality : saline

(Recommended) drilled (DH) or handdug (HH) holes

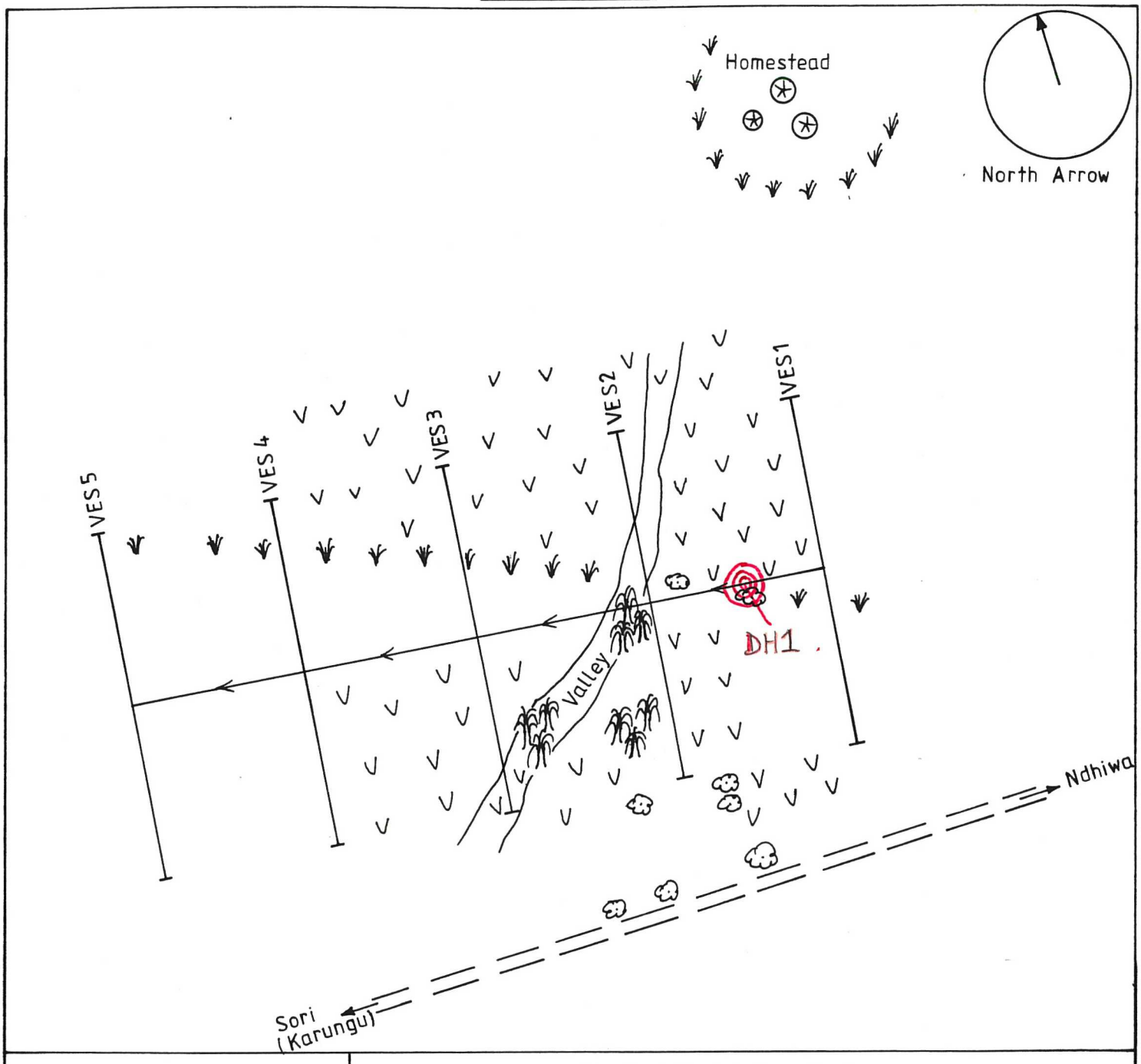
Drilled hole(s)	Remarks
DH1 (50 m W of VES1, 40 m)	-

Handdug hole(s)	Remarks
-	-

BONDO KOSIEMO (SKETCH)

SOUTH NYANZA DISTRICT: NDHIWA DIVISION: MAP SHEET

CO-ORDINATES



Murram road

Round huts

Trees

Hedge

Maize shamba

Bananas

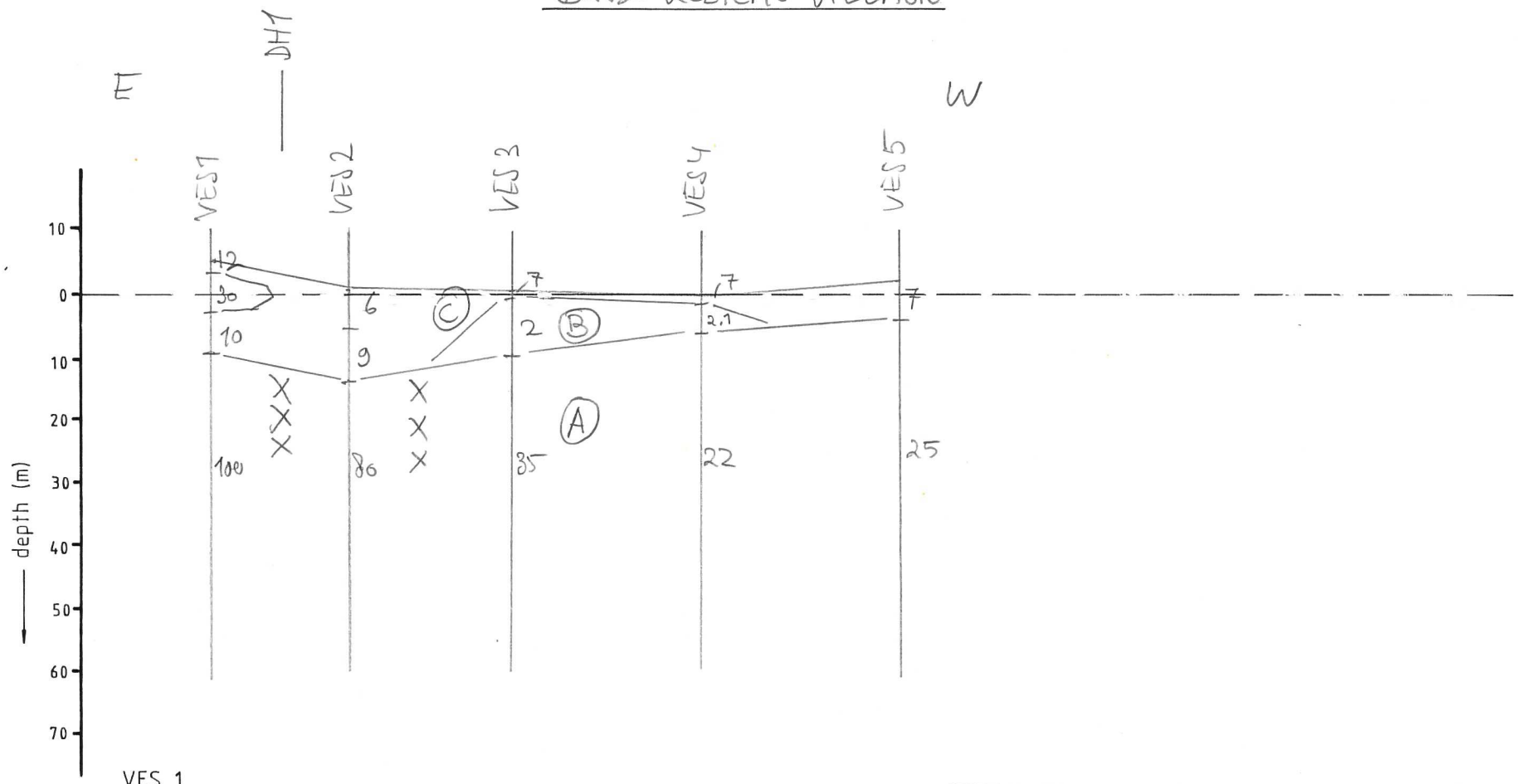
VES (Vertical Electric Sounding)
200m. long, at 150m interval

Profile line

Slope: VES1 — VES2 = +3°
VES2 — VES3 = 0°
VES3 — VES4 = +0·5°
VES4 — VES5 = −0·5°

Sketched by R.M. Shilako June 1984

BONDO KOSIEMO VILLAGE



VES 1
5
Vertical Electrical Sounding, interpreted resistivity 5 ohmm

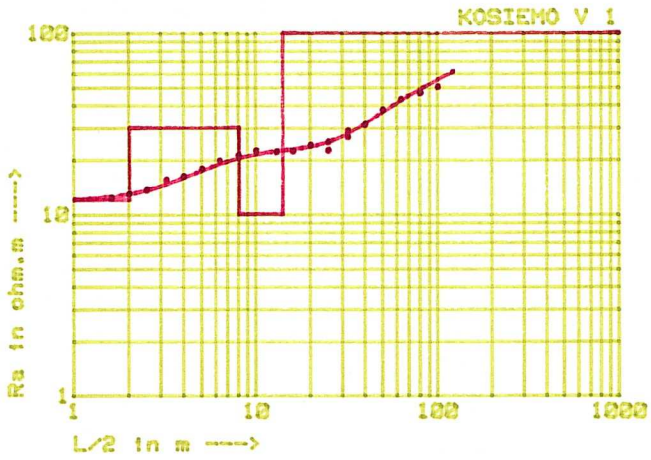
A
geo-electrical layer A

B 1
(recommended) borehole or handdug hole

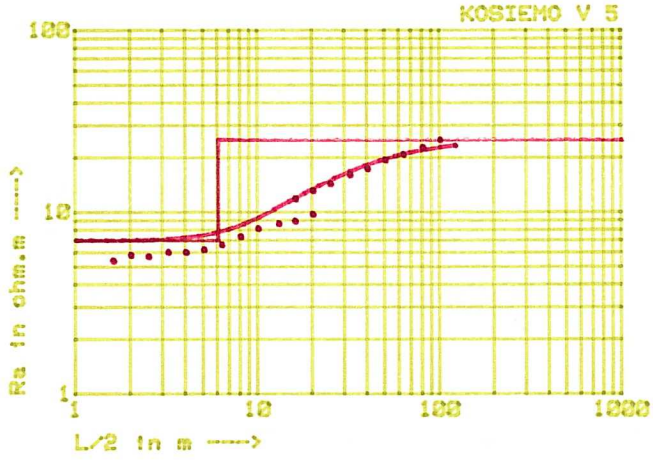
- sandy clay, cemented clay
- lateritic layer
- clay
- a — very decomposed, altered rock
- w — weathered rock
- p — partly weathered, fractured rock
- f — fresh rock

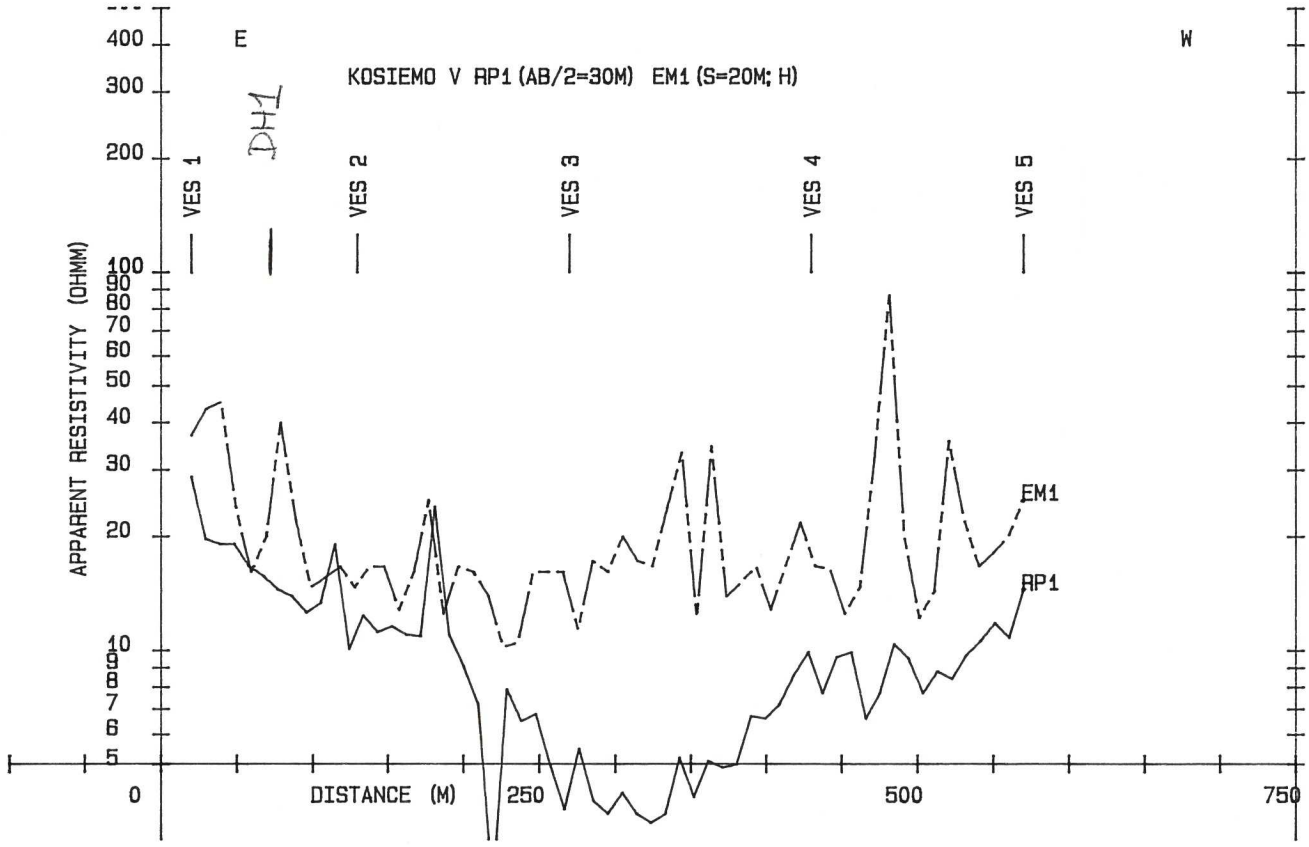
TNO - DGV Institute of Applied Geoscience	
Annex 19.3	Cross-section Kosiemo Village
Horizontal scale 1 : 5000	Vertical scale 1 : 1000

19.3


KOSIEMO V 1
100
10
1
Ra in ohm.m ---->
1
10
100
1000
L/2 in m ---->
KOSIEMO V 2
100
10
1
Ra in ohm.m ---->
1
10
100
1000
L/2 in m ---->


KOSIEMO V 3
100
10
1
Ra in ohm.m ---->
1
10
100
1000
L/2 in m ---->
KOSIEMO V 4
100
10
1
Ra in ohm.m ---->
1
10
100
1000
L/2 in m ---->


KOSIEMO V 5
100
10
1
Ra in ohm.m ---->
1
10
100
1000
L/2 in m ---->


E
W
KOSIEMO V RP1 (AB/2=30M) EM1 (S=20M; H)
DH1
VES 1
VES 2
VES 3
VES 4
VES 5
APPARENT RESISTIVITY (OHMM)
400
300
200
100
90
80
70
60
50
40
30
20
10
9
8
7
6
5
EM1
RP1
0
DISTANCE (M)
250
500
750

TNO-DGV INSTITUTE OF APPLIED GEOSCIENCE

Site: Kodero Village

Hydrogeology

Layers	Resistivity (ohmm)	Remarks	
A	15-29	Weathered volcanic rock (Tv)	(DH)
B	1.8-3	Clay, saline	
C	9-16	Clayey soil	
D	-	-	
E	-	-	
F	-	-	

Fractured zones, faults	Remarks
-	-

Depth to groundwater table: Unknown, probably shallow

Groundwater quality : Saline

(Recommended) drilled (DH) or handdug (HH) holes

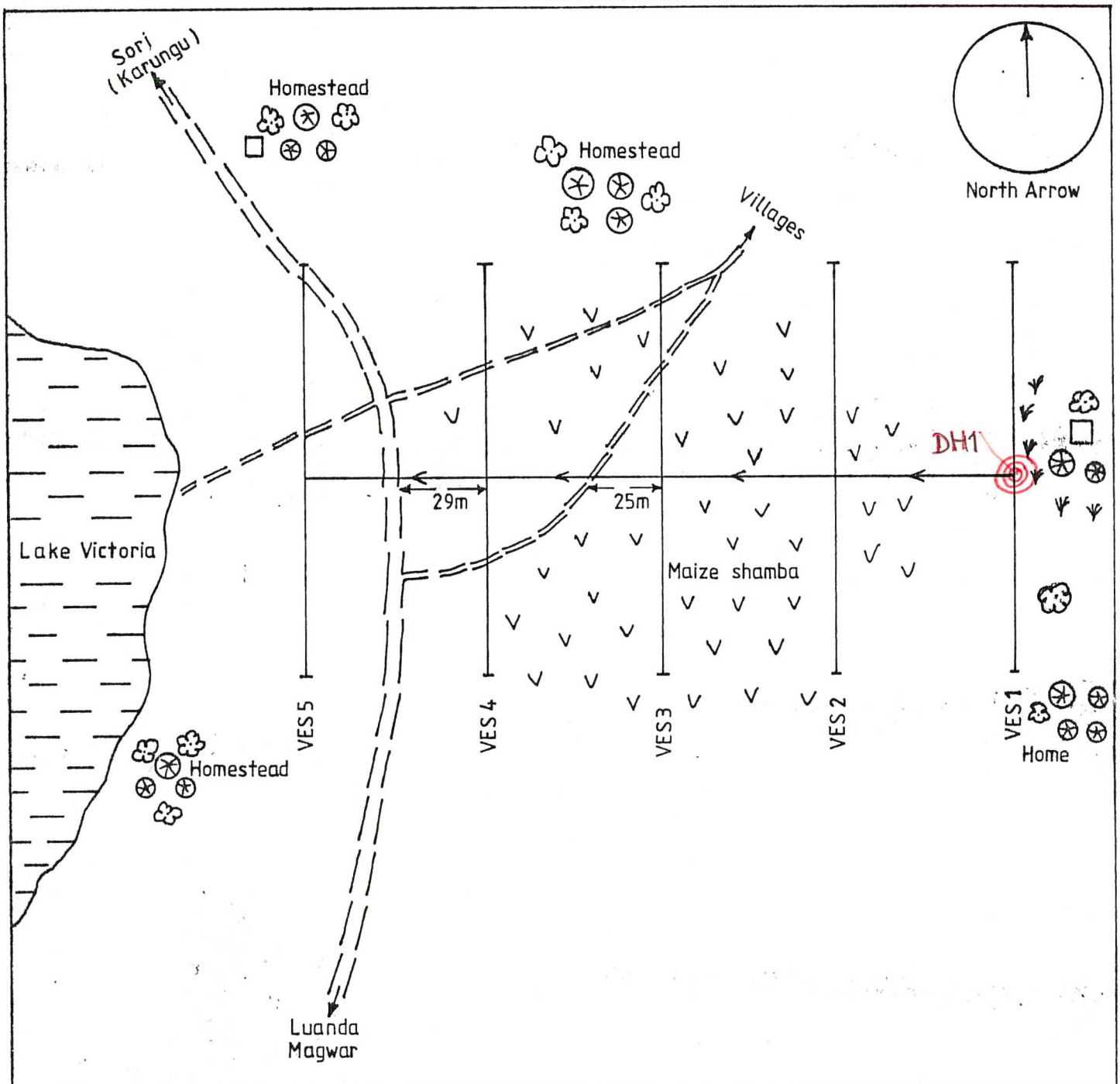
Drilled hole(s)	Remarks
DH1 (VES1, 35 m)	-

Handdug hole(s)	Remarks
-	-

KODERO VILLAGE (SKETCH)

SOUTH NYANZA DISTRICT: NDHIWA DIVISION: MAP SHEET

CO-ORDINATES



Murram road
Footpath
Round huts
Houses
Trees
Maize shamba
Hedge
Lake Victoria

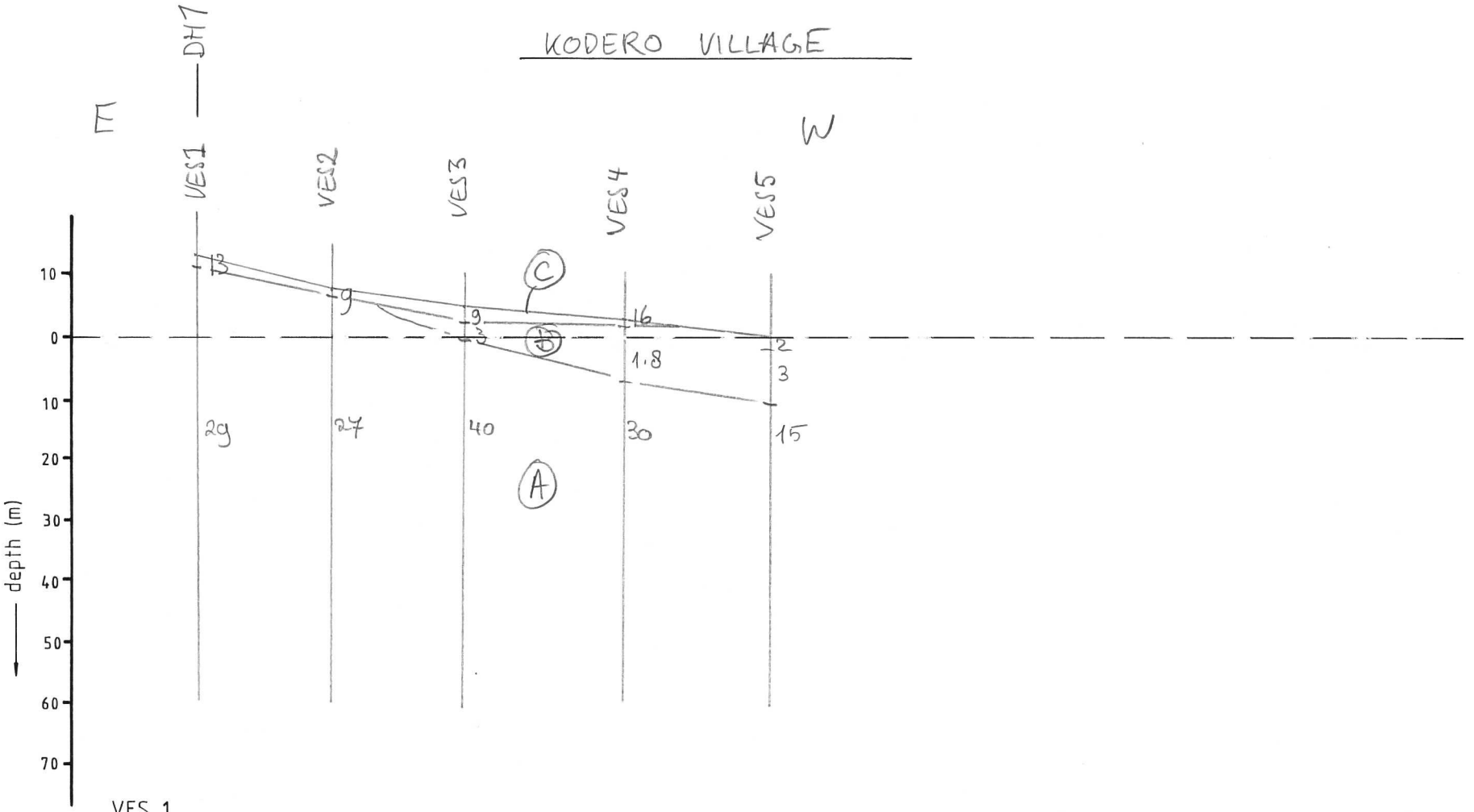
VES (Vertical Electric Sounding)
200m. long, at 100m. interval

Profile line - 480m.

Slope:
VES1 – VES2 = -2.5°
VES2 – VES3 = -1.5°
VES3 – VES4 = -1.0°
VES4 – VES5 = -1.5°

Sketched by R. M. Shilako June 1984

KODERO VILLAGE



VES 1
5
Vertical Electrical Sounding, interpreted resistivity 5 ohmm

A
geo-electrical layer A

B 1
(recommended) borehole or handdug hole

sandy clay, cemented clay

lateritic layer

clay

a very decomposed, altered rock

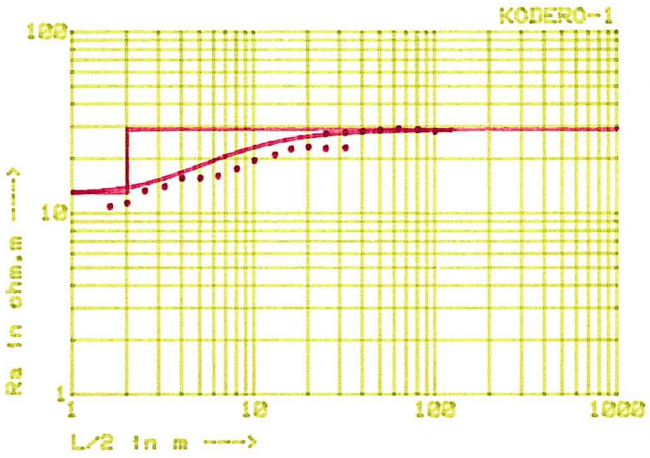
w weathered rock

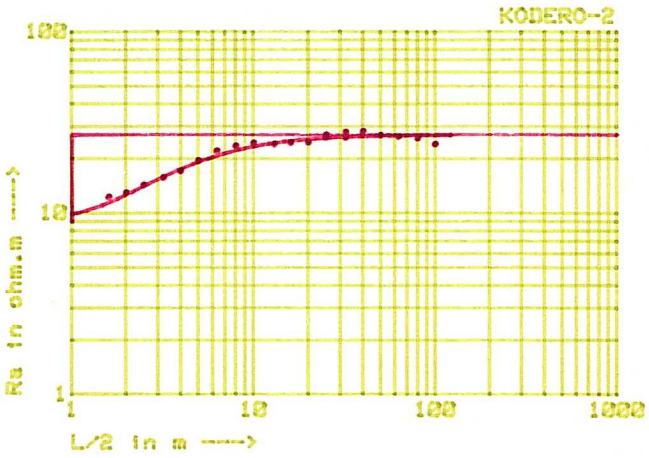
p partly weathered, fractured rock

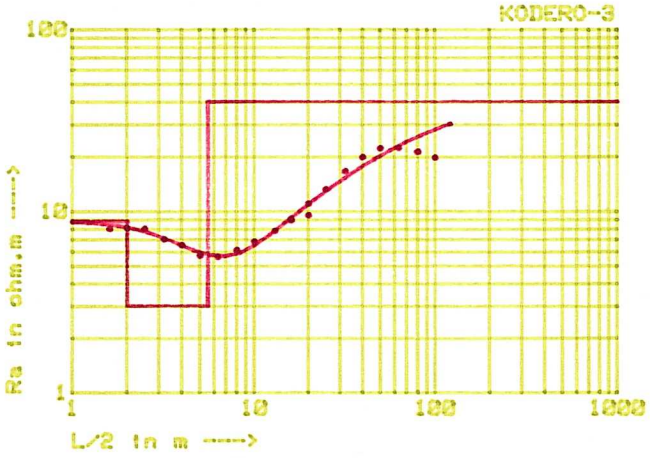
f fresh rock

TNO-DGV Institute of Applied Geoscience	
Annex 20.3	Cross-section Kodero Village
Horizontal scale 1 : 5000	Vertical scale 1 : 1000

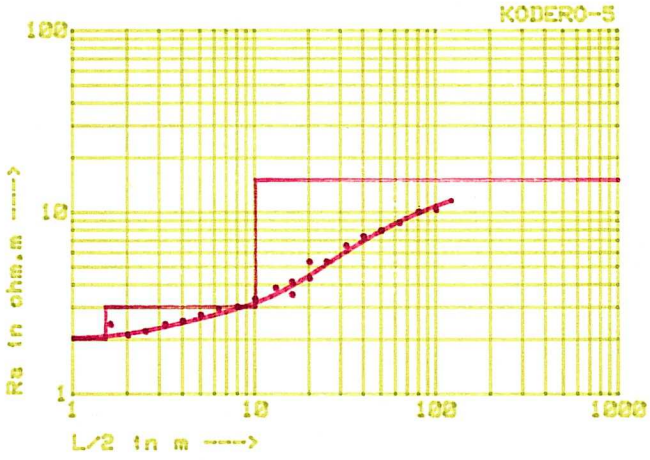
20.3

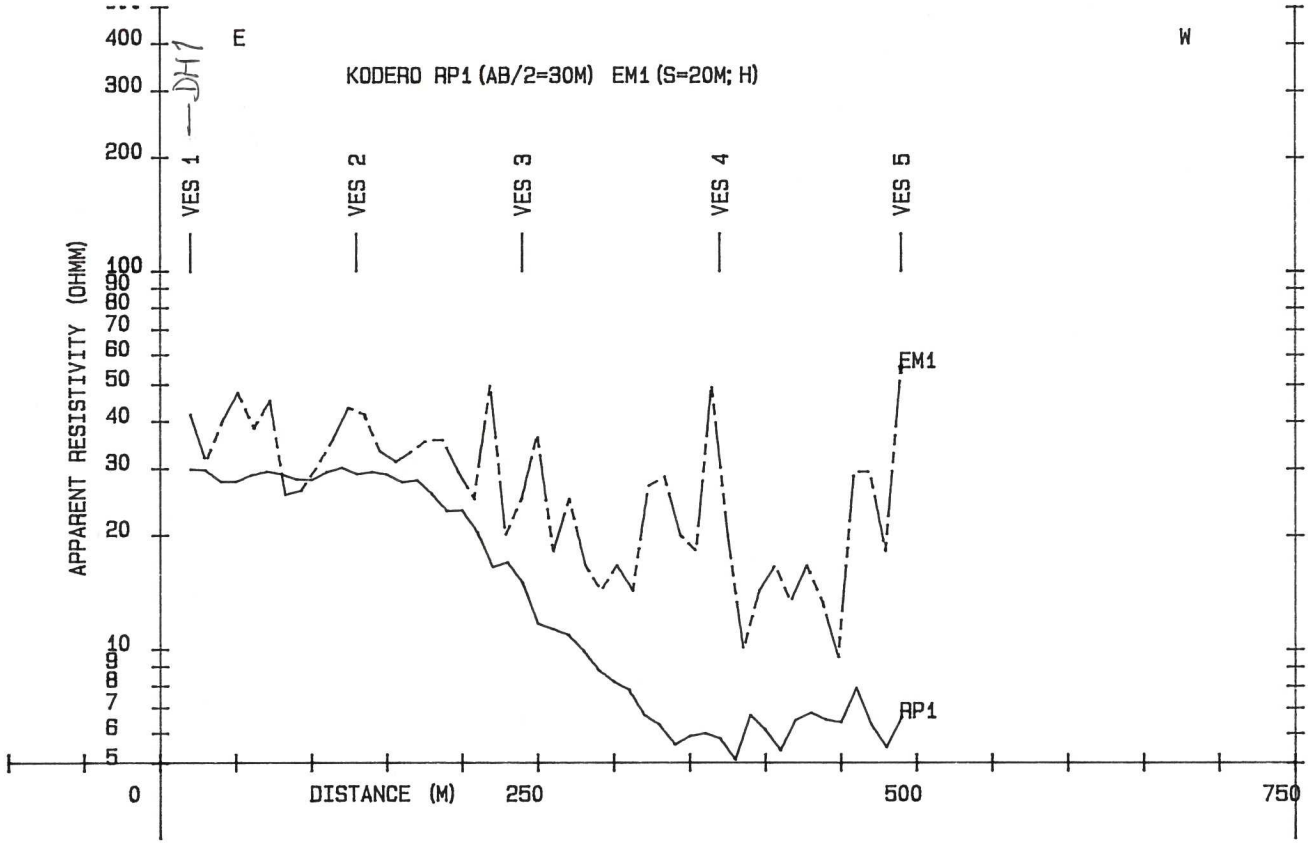

KODERO-1
100
10
1
Ra in ohm.m ---->
1
10
100
1000
L/2 in m --->


KODERO-2
100
10
1
Ra in ohm.m ---->
1
10
100
1000
L/2 in m ---->


KODERO-3
100
10
1
Ra in ohm.m ---->
1
10
100
1000
L/2 in m ---->


KODERO-4
100
10
1
Ra in ohm.m ---->
1
10
100
1000
L/2 in m ---->


KODERO-5
100
10
1
Ra in ohm.m ---->
1
10
100
1000
L/2 in m ---->


E
W
KODERO RP1 (AB/2=30M) EM1 (S=20M; H)
VES 1
VES 2
VES 3
VES 4
VES 5
EM1
RP1
APPARENT RESISTIVITY (OHMM)
400
300
200
100
90
80
70
60
50
40
30
20
10
9
8
7
6
5
0
DISTANCE (M)
250
500
750

TNO-DGV INSTITUTE OF APPLIED GEOSCIENCE

Site: Aora Chuodho Market

Hydrogeology

Layers	Resistivity (ohmm)	Remarks
A	10-100	(Partly) weathered volcanic rock (Tv) (DH)
B	5.3-11	Clayey soil
C	-	-
D	-	-
E	-	-
F	-	-

Fractured zones, faults	Remarks
50 m SW of VES2	Fractured zone

Depth to groundwater table: Unknown

Groundwater quality : Fresh

(Recommended) drilled (DH) or handdug (HH) holes

Drilled hole(s)	Remarks
DH1 (50 m SW of VES2, 40 m)	-

Handdug hole(s)	Remarks
-	-

AORA CHUODHO MARKET (SKETCH)

SOUTH NYANZA DISTRICT: NDHIWA DIVISION: MAP SHEET

CO-ORDINATES



Murram road
Path
Shops
Round huts
Trees
Sisal fence
Maize shamba
Hedge
Long grass
Bananas

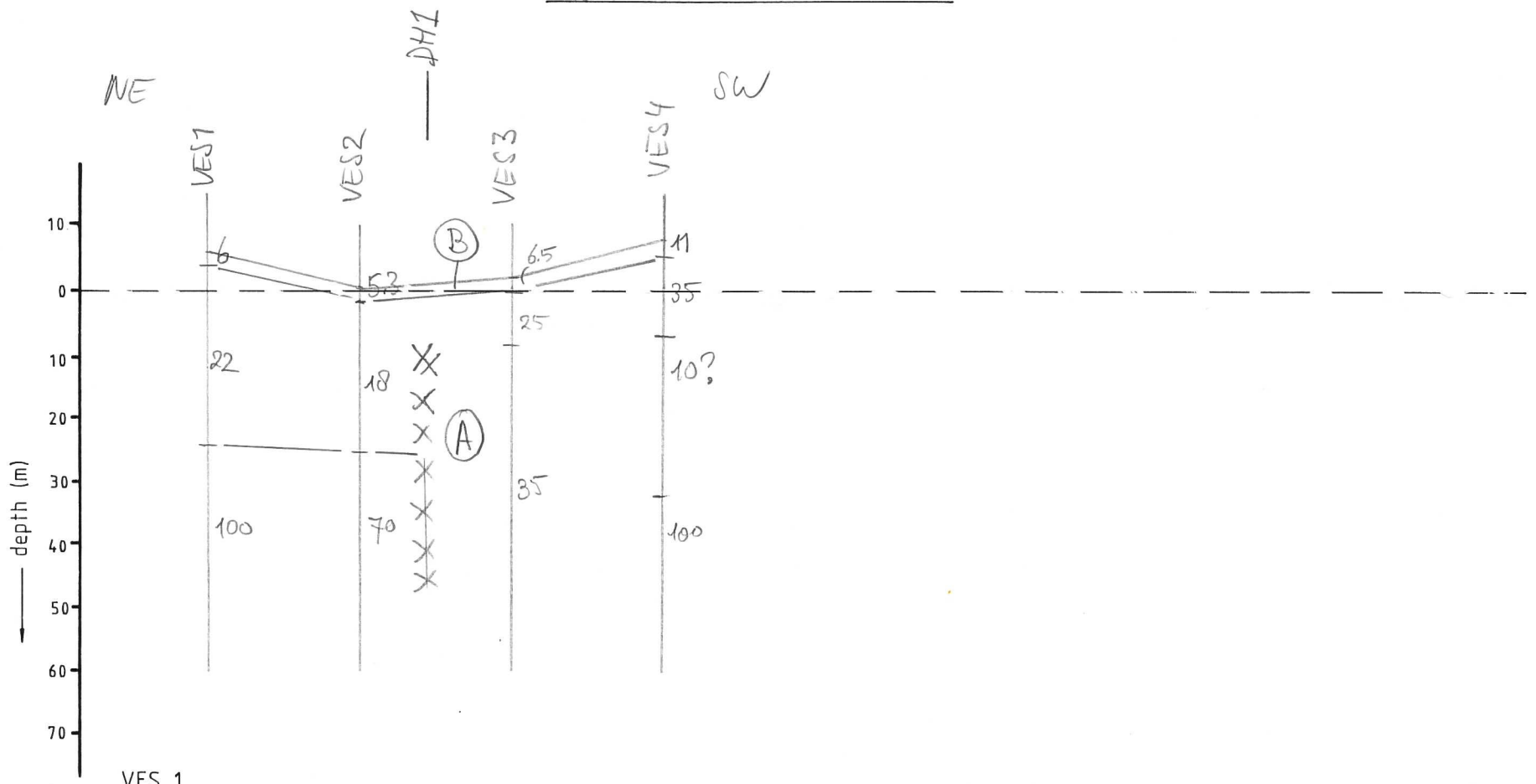
VES (Vertical Electric Sounding)
200m long, at 150m interval

Profile line

Slope:
VES1 – VES2 = −3°
VES2 – VES3 = +1°
VES3 – VES4 = +3°

Sketched by R.M. Shilako June 1984

AORA CHUCODHO MARKET



VES 1
5
Vertical Electrical Sounding, interpreted resistivity 5 ohmm

A
geo-electrical layer A

B 1
(recommended) borehole or handdug hole

sandy clay, cemented clay

lateritic layer

clay

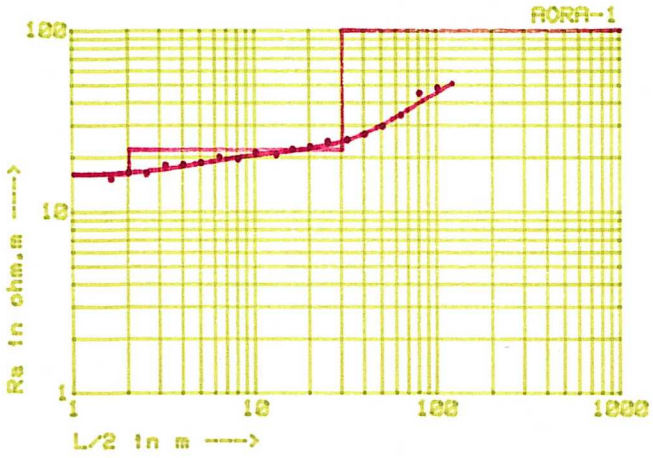
a very decomposed, altered rock

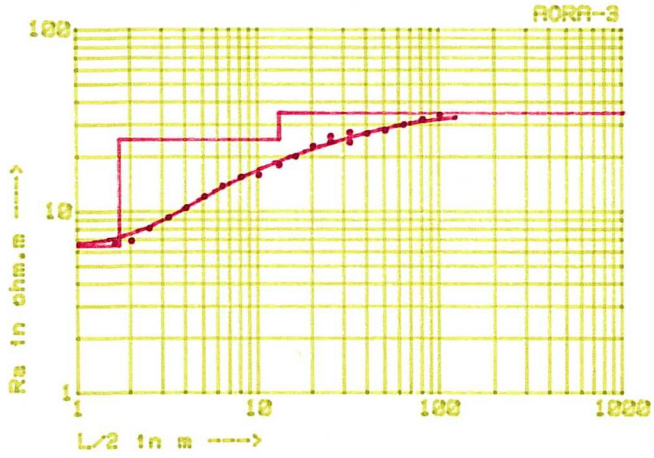
w weathered rock

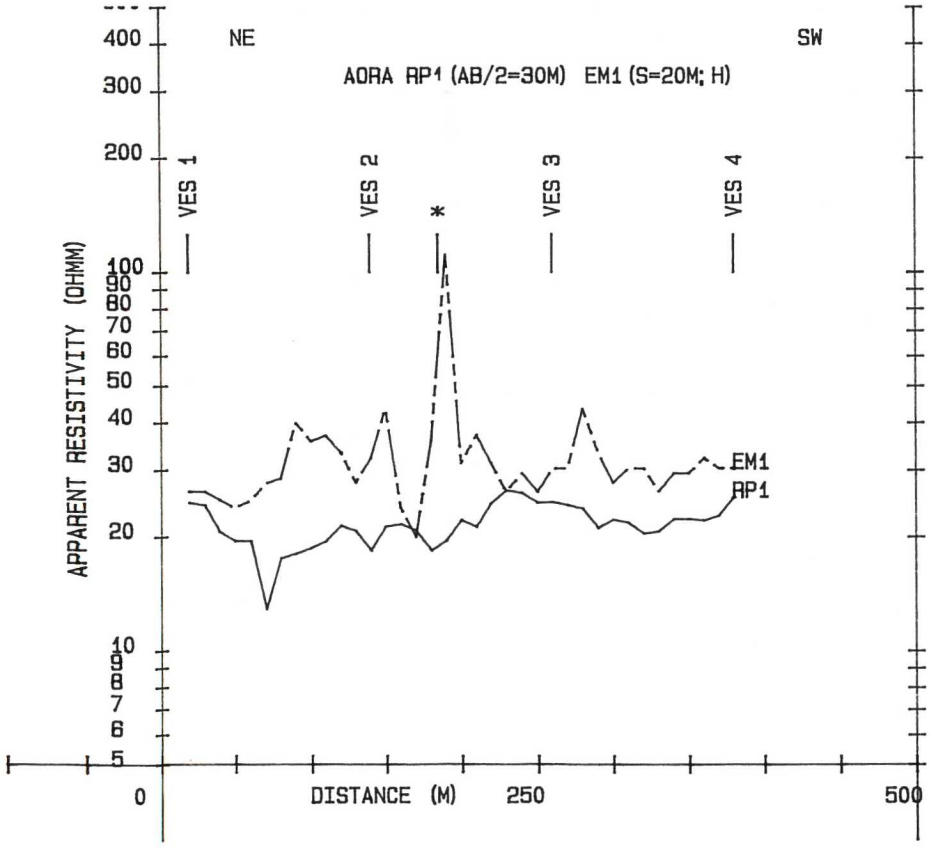
p partly weathered, fractured rock

f fresh rock

TNO-DGV Institute of Applied Geoscience	
Annex 21.3	Cross-section Aora Chucodho Market
Horizontal scale 1 : 5000	Vertical scale 1 : 1000


AORA-1
100
10
1
Ra in ohm.m ---->
1
10
100
1000
L/2 in m ---->
AORA-2
100
10
1
Ra in ohm.m ---->
1
10
100
1000
L/2 in m ---->


AORA-3
100
10
1
Ra in ohm.m ---->
1
10
100
1000
L/2 in m ---->
AORA-4
?
100
10
1
Ra in ohm.m ---->
1
10
100
1000
L/2 in m ---->


NE
SW
AORA RP1 (AB/2=30M) EM1 (S=20M; H)
VES 1
VES 2
VES 3
VES 4
*
APPARENT RESISTIVITY (OHMM)
400
300
200
100
90
80
70
60
50
40
30
20
10
9
8
7
6
5
EM1
RP1
0
DISTANCE (M)
250
500

TNO-DGV INSTITUTE OF APPLIED GEOSCIENCE

Site: Agolo Muok Village

Hydrogeology

Layers	Resistivity (ohmm)	Remarks	
A	28-50	Weathered volcanic rock (Tv)	(DH)
B	4-13	Sandy clay	
C	23-55	Soil	
D	-	-	
E	-	-	
F	-	-	

Fractured zones, faults	Remarks
40 m W of VES2	Shallow step in depth of weahtered rock

Depth to groundwater table: 20 - 25 m

Groundwater quality : Fresh

(Recommended) drilled (DH) or handdug (HH) holes

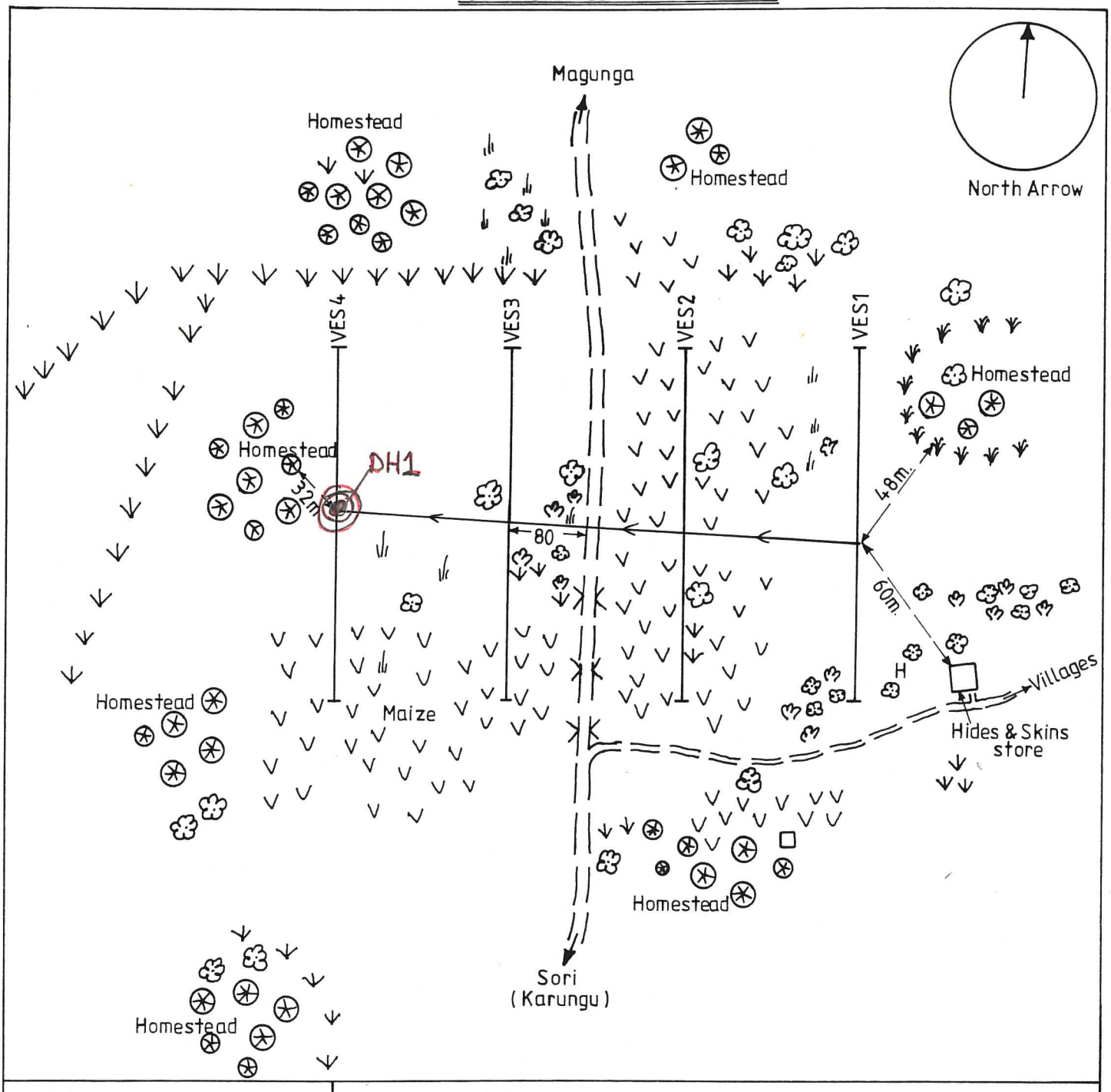
Drilled hole(s)	Remarks
DH1 (VES4, 40 m)	Groundwater at -24.00 m, EC = 790 µS/cm

Handdug hole(s)	Remarks
-	-

AGOLO MUOK VILLAGE (SKETCH)

SOUTH NYANZA DISTRICT: -DIVISION: MAP SHEET

CO-ORDINATES



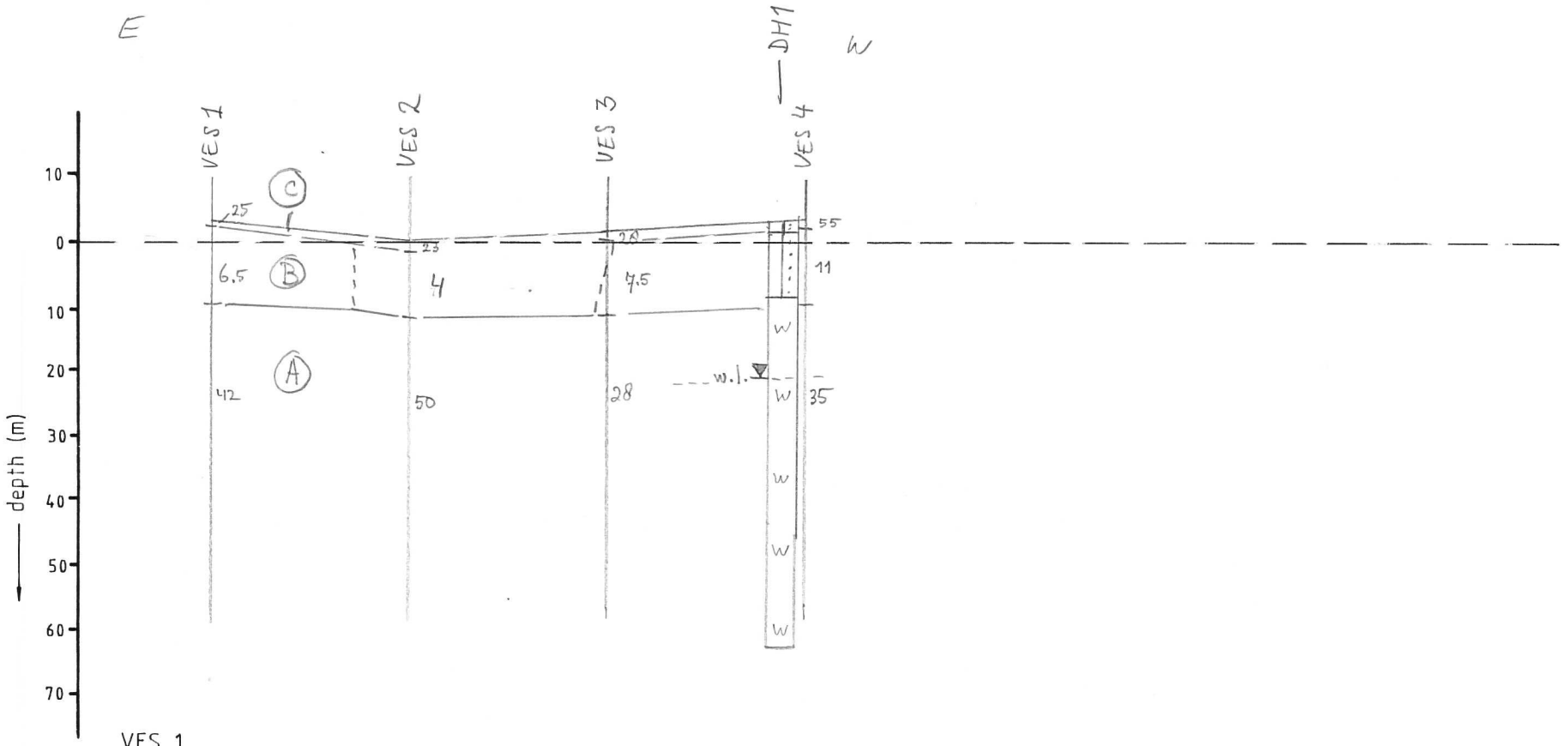
Murram road
Small earth road
House
Round huts
Trees
Shrubs
Hedge
Sisal fence
Maize shamba
Long grass
Culverts

VES (Vertical Electric Sounding)
200m. long, at 150m. interval
Profile line – 390m

Slope: VES1 – VES2 = -5°
VES2 – VES3 = +2°
VES3 – VES4 = +3°

Sketched by R.M. Shilako June 1984

AGOLO MUOK VILLAGE



VES 1
5
Vertical Electrical Sounding, interpreted resistivity 5 ohmm

A
geo-electrical layer A

B 1
(recommended) borehole or handdug hole

sandy clay, cemented clay

lateritic layer

clay

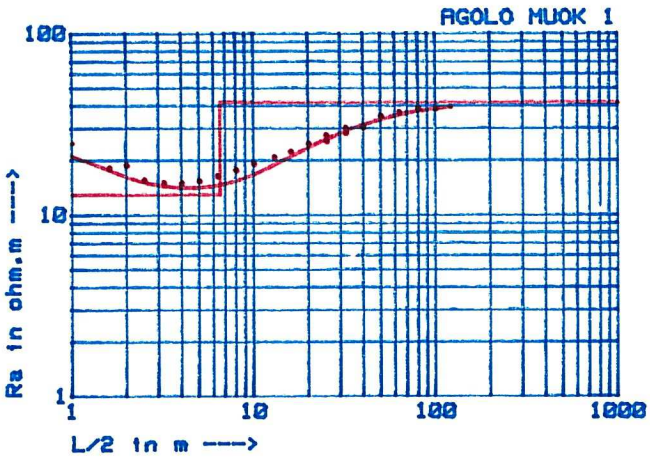
a very decomposed, altered rock

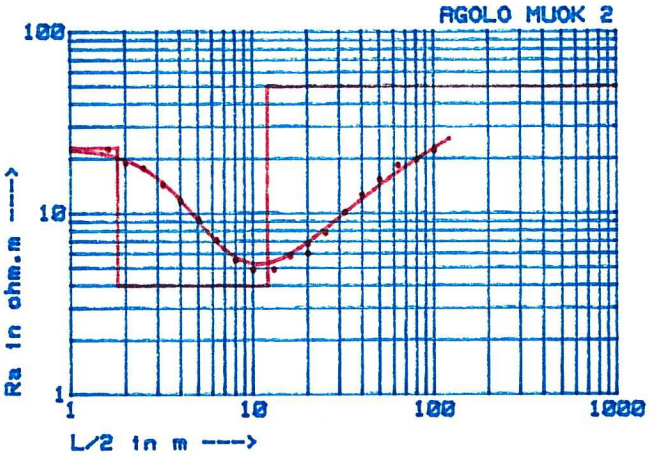
w weathered rock

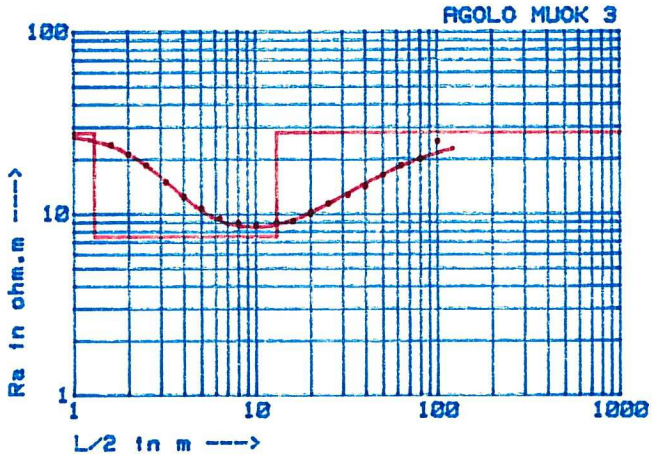
p partly weathered, fractured rock

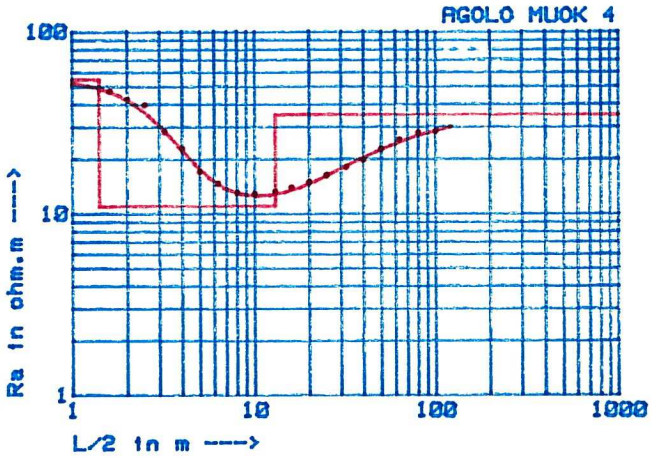
f fresh rock

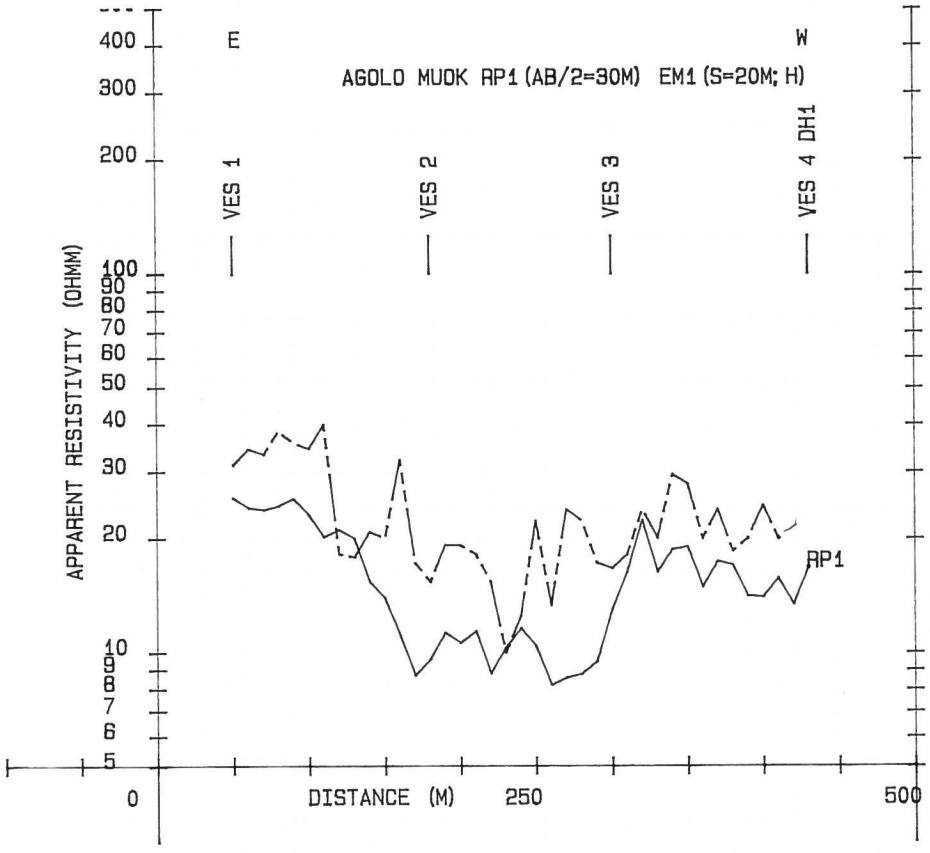
TNO - DGV Institute of Applied Geoscience	
Annex 22.3	Cross-section Agolo Muok Village
Horizontal scale 1 : 5000	Vertical scale 1 : 1000


AGOLO MUOK 1
Ra in ohm.m --->
100
10
1
1
10
100
1000
L/2 in m --->


AGOLO MUOK 2
Ra in ohm.m --->
100
10
1
1
10
100
1000
L/2 in m --->


AGOLO MUOK 3
Ra in ohm.m --->
100
10
1
1
10
100
1000
L/2 in m --->


AGOLO MUOK 4
Ra in ohm.m --->
100
10
1
1
10
100
1000
L/2 in m --->


E
W
AGOLO MUOK RP1 (AB/2=30M) EM1 (S=20M; H)
VES 1
VES 2
VES 3
VES 4 DH1
APPARENT RESISTIVITY (OHMM)
400
300
200
100
90
80
70
60
50
40
30
20
10
9
8
7
6
5
RP1
0
DISTANCE (M)
250
500

TNO-DGV INSTITUTE OF APPLIED GEOSCIENCE

Site: Thimlich Primary School

Hydrogeology

Layers	Resistivity (ohmm)	Remarks	
A	100-500	Precambrian rocks (Na)	(DH)
B	5-12	Clay	(HH)
C	17-28	Clayey sand	(HH)
D	10-13	Sandy clay	
E	14-50	Soil	
F	-	-	

Fractured zones, faults	Remarks
50 m W of VES9	Fractured zone

Depth to groundwater table: Unknown

Groundwater quality : Unknown

(Recommended) drilled (DH) or handdug (HH) holes

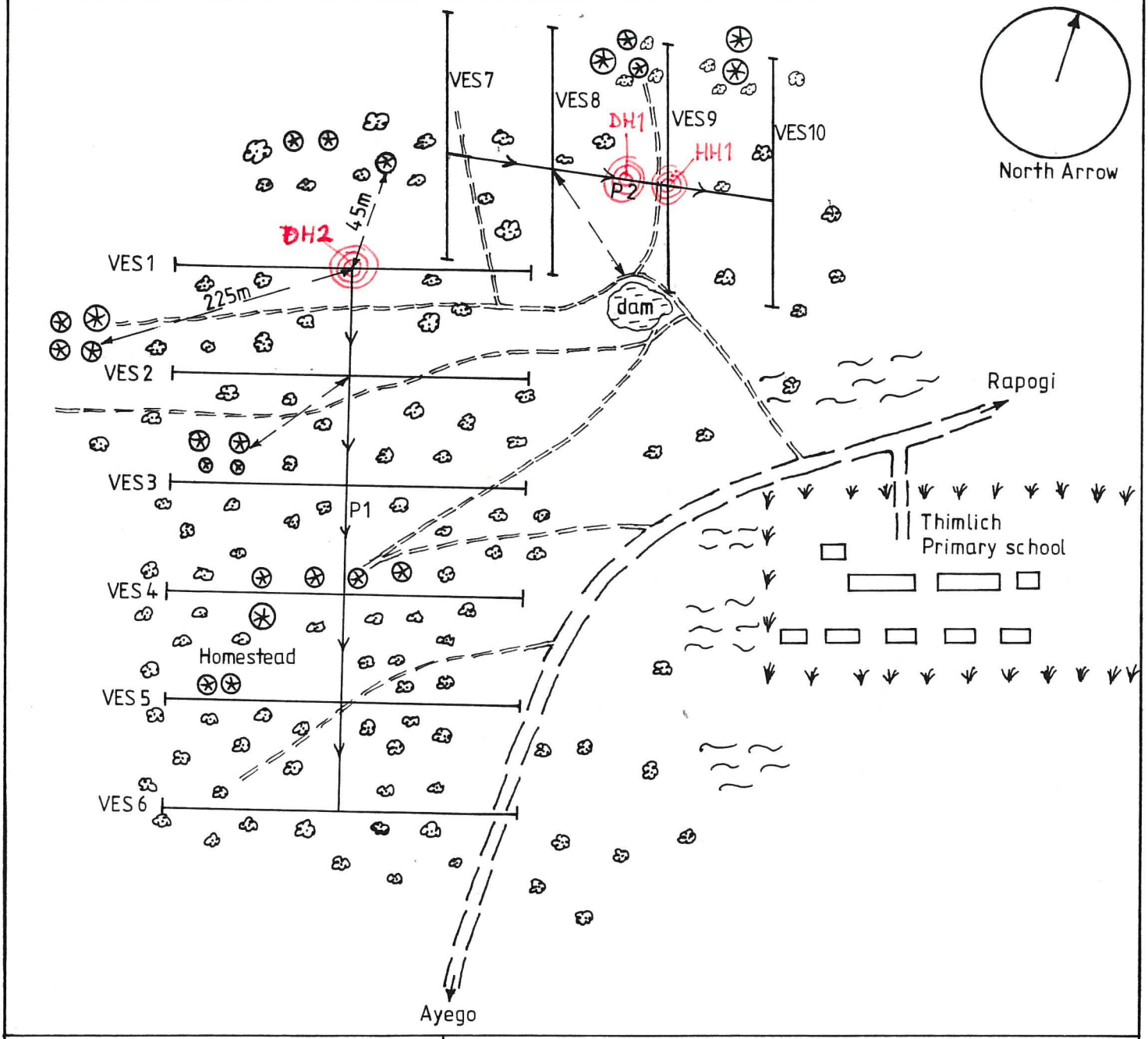
Drilled hole(s)	Remarks
DH1 (50 m W of VES9, 50 m)	-
DH2 (VES1, <75 m)	dray (too shallow)

Handdug hole(s)
HH1 (VES9, 25 m)

THIMLICH PRIMARY SCHOOL (SKETCH)

SOUTH NYANZA DISTRICT: MACALDER DIVISION: MAP SHEET 129/4

GRID REFERENCE 647·2 – 9903·2



Murram road
Foot paths
Buildings
Round huts
Trees
Hedge
Area temporarily flooded

VES (Vertical Electric Sounding)
200m long, at 150m interval

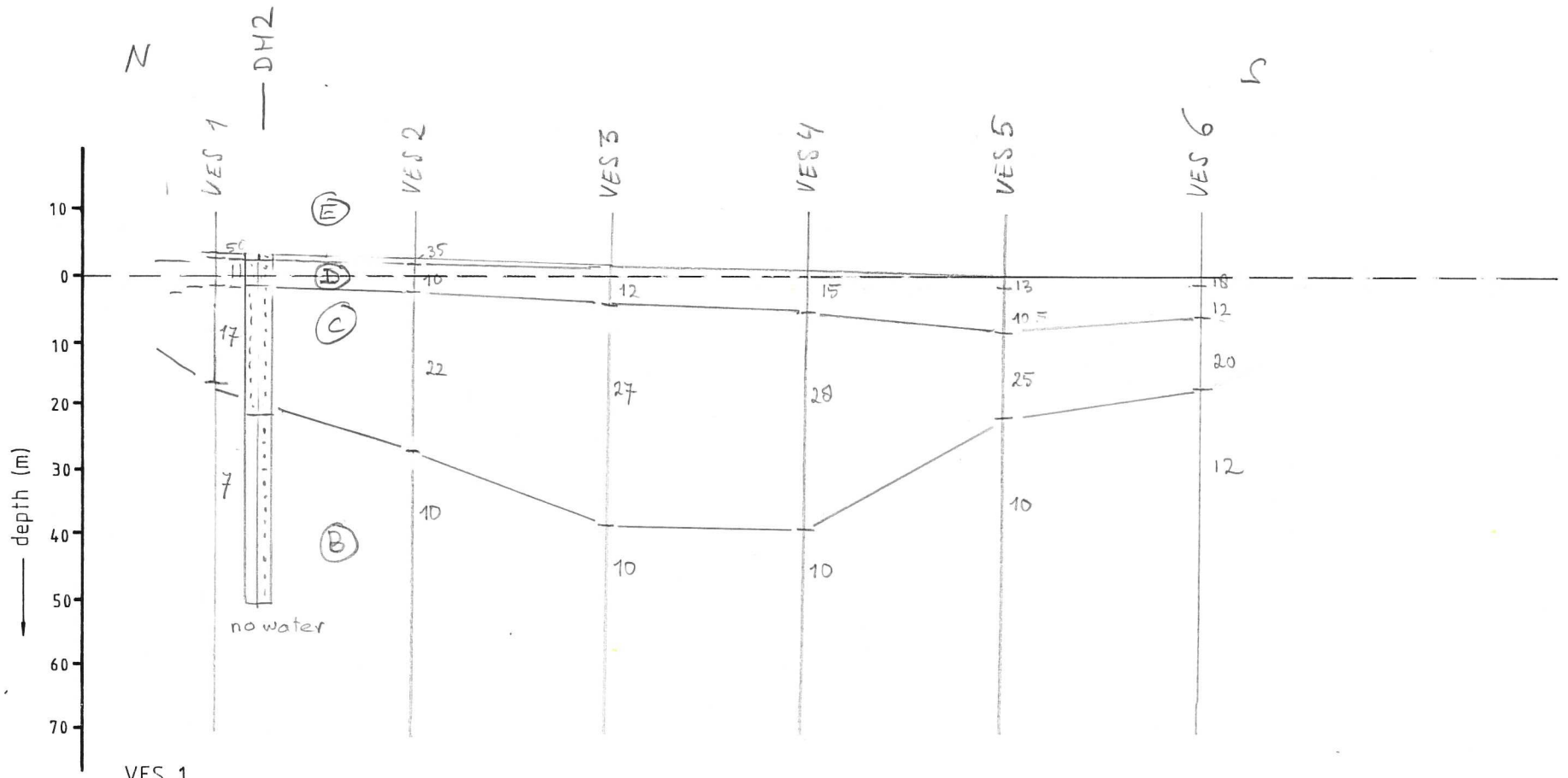
P1 Profile line

Slope:
VES1 – VES2 = – 1°
VES2 – VES3 = – 1·5°
VES3 – VES4 = – 1°
VES4 – VES5 = – 1°
VES5 – VES6 = 0°

VES7 – VES8 = – 1°
VES8 – VES9 = 0°
VES9 – VES10 = – 1°

Sketched by R. M. Shilako June 1984

THIMLICH PRIMARY SCHOOL P1



VES 1
5
Vertical Electrical Sounding, interpreted resistivity 5 ohmm

A
geo-electrical layer A

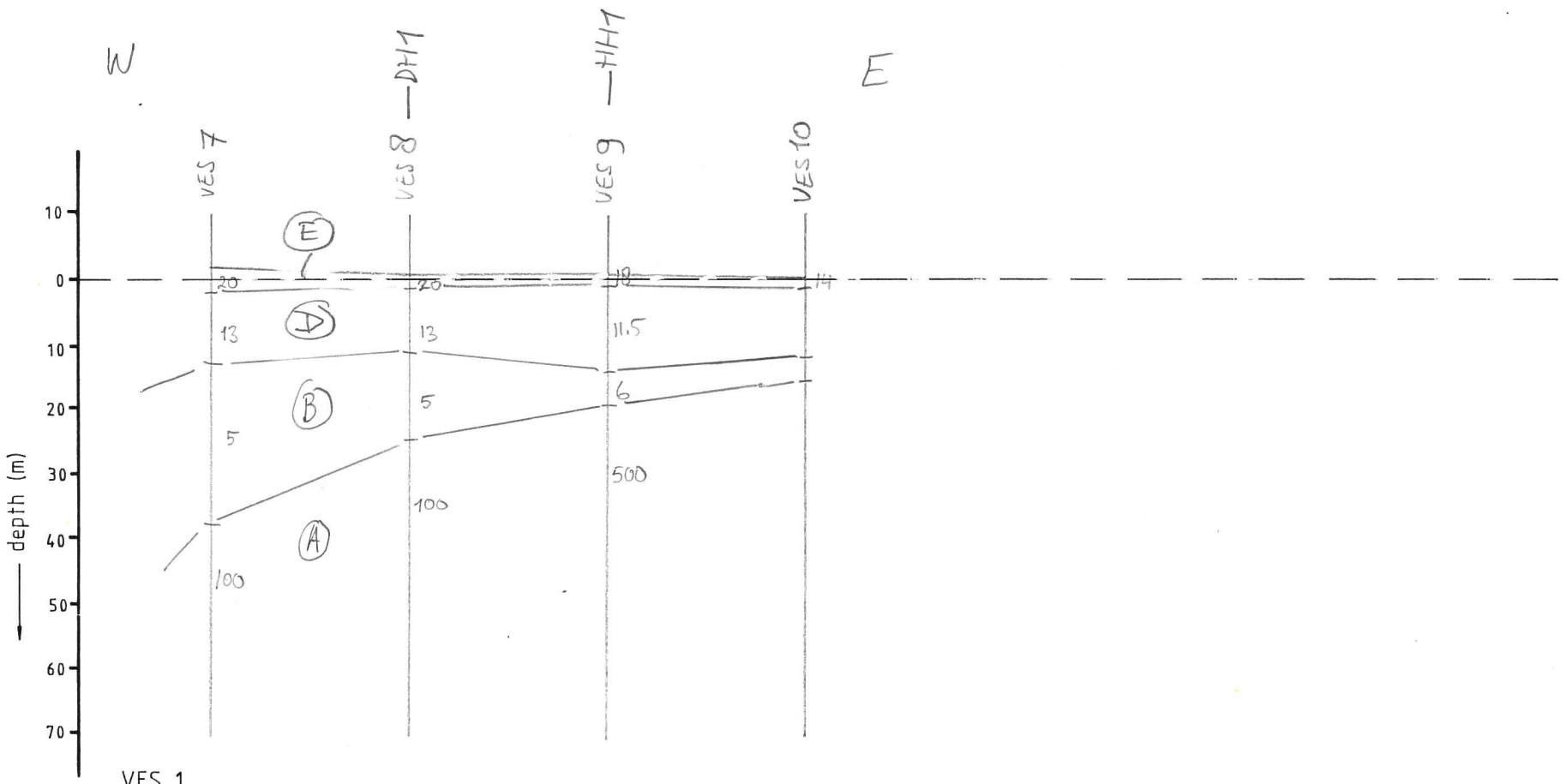
B 1
(recommended) borehole or handdug hole

- sandy clay, cemented clay
- lateritic layer
- clay
- [a] very decomposed, altered rock
- [w] weathered rock
- [p] partly weathered, fractured rock
- [f] fresh rock

TNO-DGV Institute of Applied Geoscience	
Annex 23.3a	Cross-section Thimlich Primary School P1
Horizontal scale 1 : 5000	Vertical scale 1 : 1000

23.3

THIMLICH PRIMARY SCHOOL P2



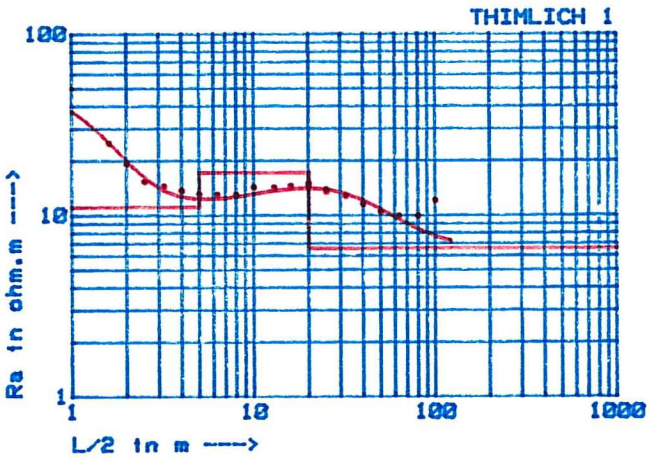
VES 1
5
Vertical Electrical Sounding, interpreted resistivity 5 ohmm

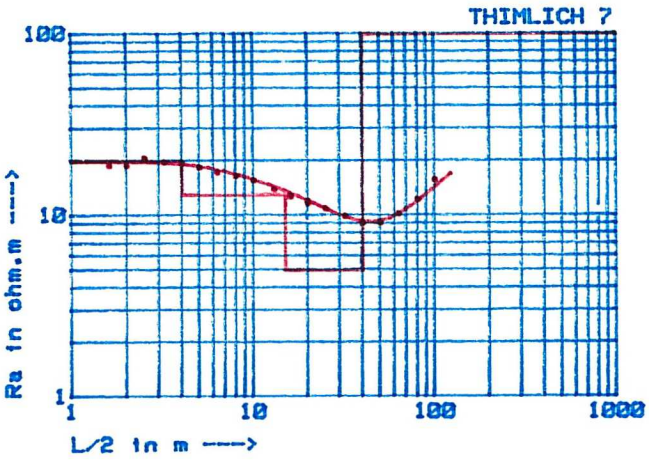
A
geo-electrical layer A

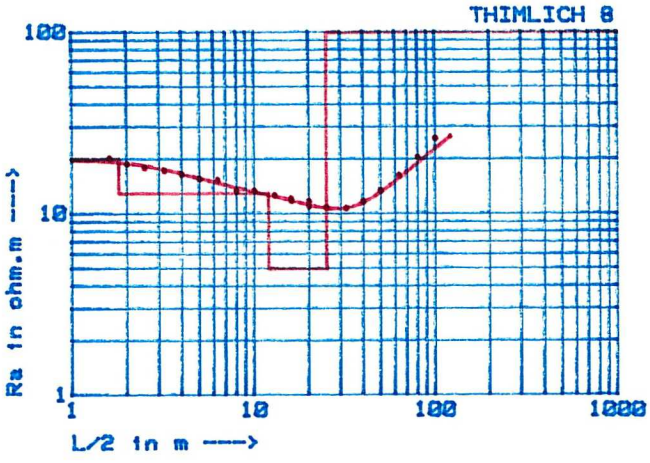
B 1
(recommended) borehole or handdug hole

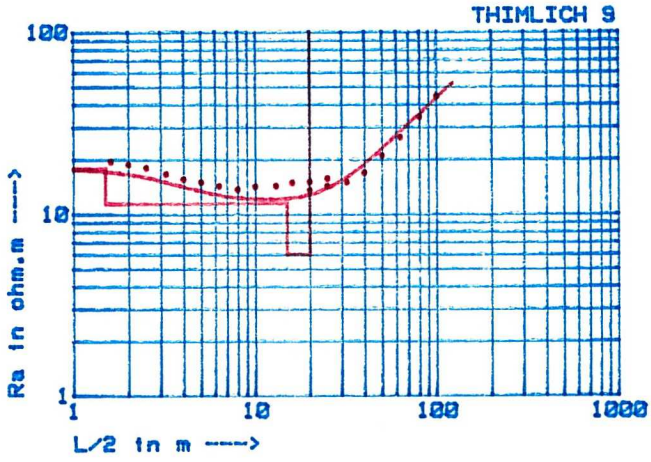
- sandy clay, cemented clay
- lateritic layer
- clay
- a — very decomposed, altered rock
- w — weathered rock
- p — partly weathered, fractured rock
- f — fresh rock

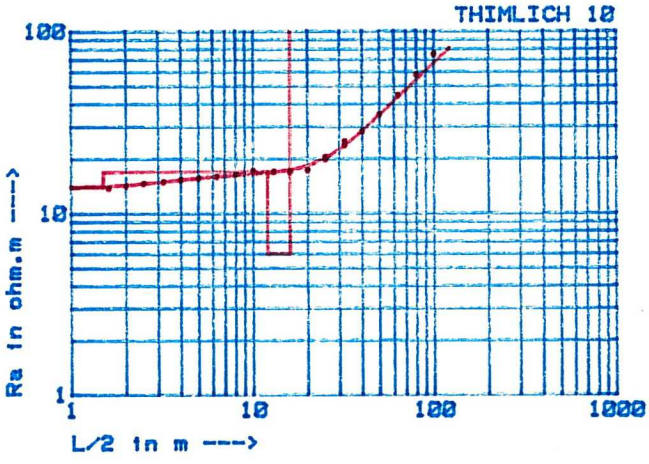
TNO-DGV Institute of Applied Geoscience	
Annex 23.3b	Cross-section Thimlich Primary School P2
Horizontal scale 1 : 5000	Vertical scale 1 : 1000

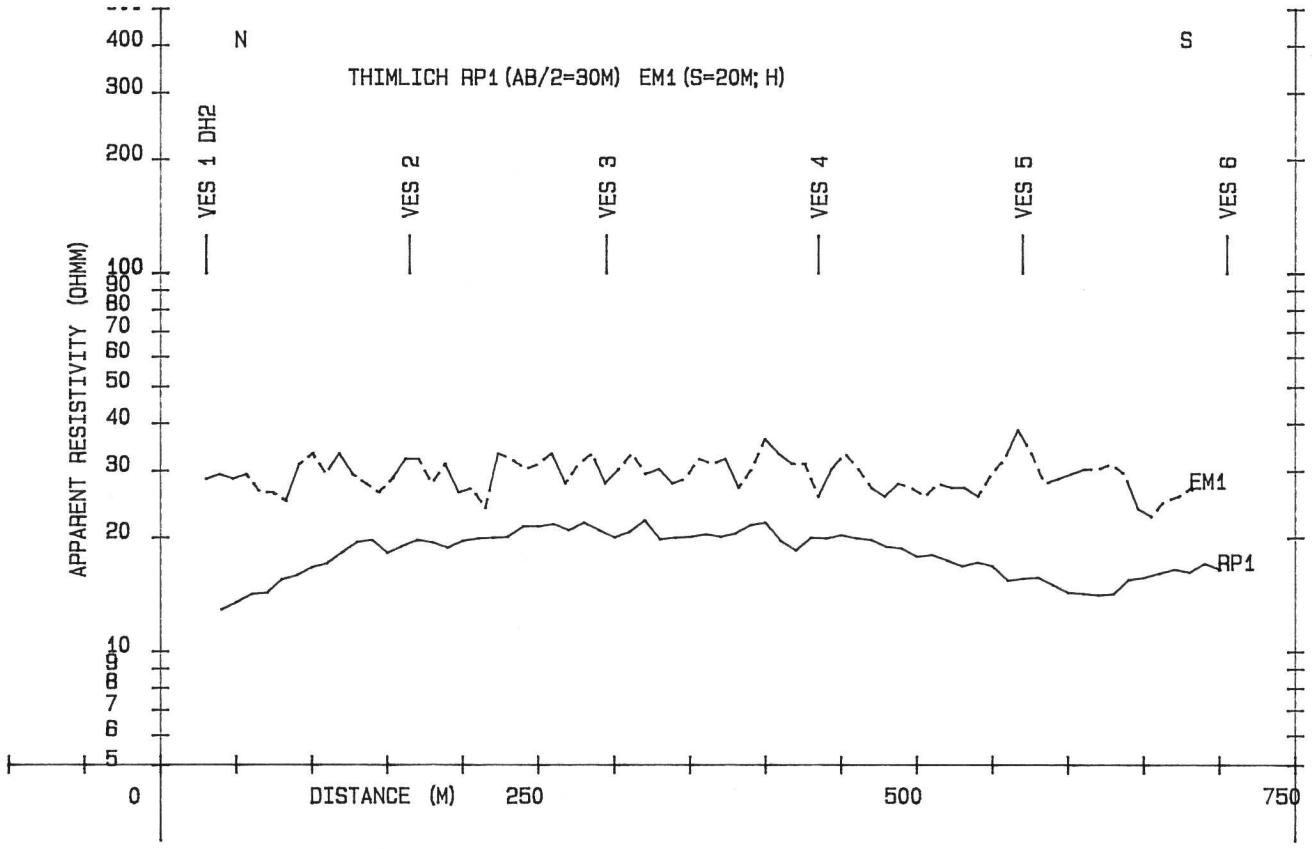

THIMLICH 1
100
10
1
Ra in ohm.m ---->
1
10
100
1000
L/2 in m ---->
THIMLICH 2
100
10
1
Ra in ohm.m ---->
1
10
100
1000
L/2 in m ---->
THIMLICH 3
100
10
1
Ra in ohm.m ---->
1
10
100
1000
L/2 in m ---->
THIMLICH 4
100
10
1
Ra in ohm.m ---->
1
10
100
1000
L/2 in m ---->
THIMLICH 5
100
10
1
Ra in ohm.m ---->
1
10
100
1000
L/2 in m ---->
THIMLICH 6
100
10
1
Ra in ohm.m ---->
1
10
100
1000
L/2 in m ---->

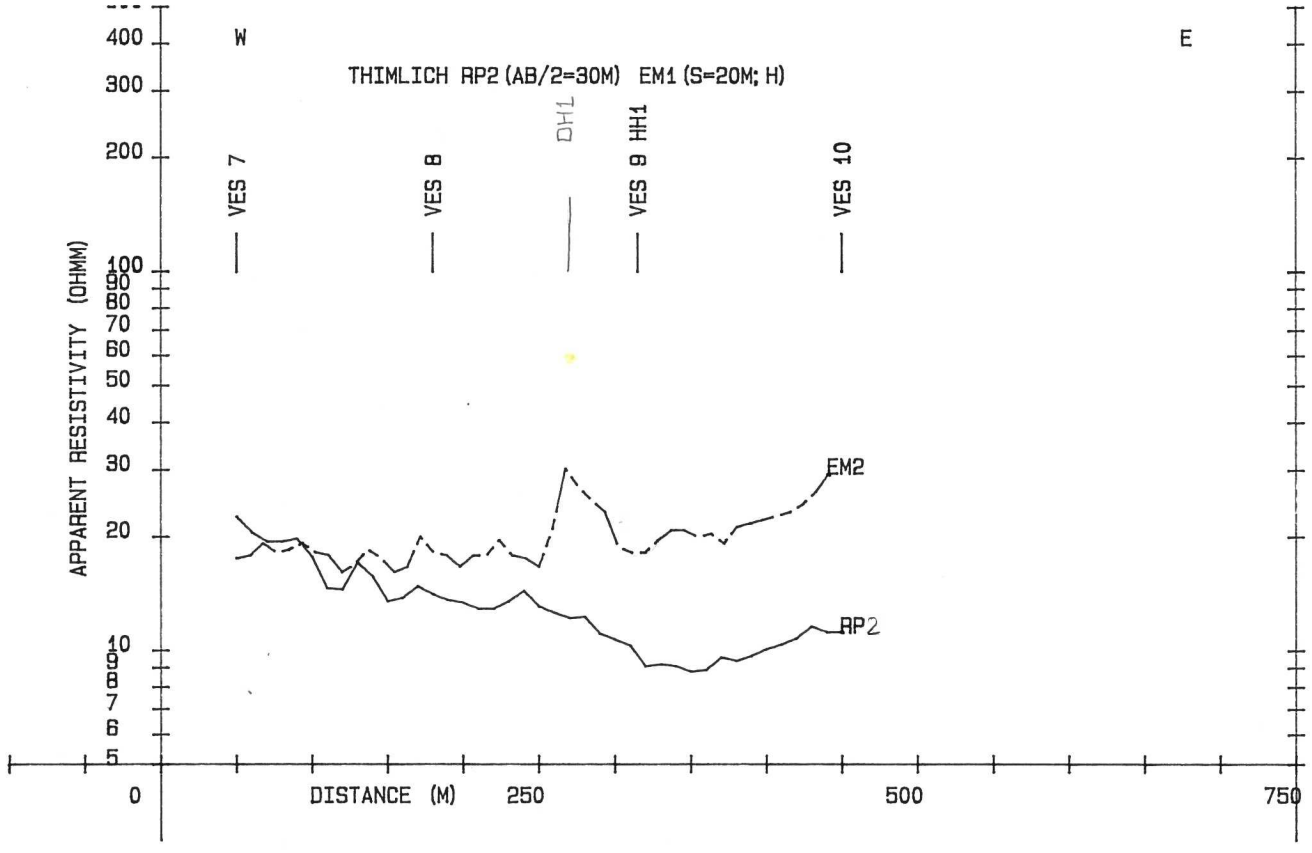

THIMLICH 7
100
10
1
Ra in ohm.m ---->
1
10
100
1000
L/2 in m --->


THIMLICH 8
100
10
1
Ra in ohm.m ---->
1
10
100
1000
L/2 in m ---->


THIMLICH 9
100
10
1
Ra in ohm.m ---->
1
10
100
1000
L/2 in m ---->


THIMLICH 10
100
10
1
Ra in ohm.m ---->
1
10
100
1000
L/2 in m ---->


N
S
THIMLICH RP1 (AB/2=30M) EM1 (S=20M; H)
VES 1 DH2
VES 2
VES 3
VES 4
VES 5
VES 6
APPARENT RESISTIVITY (OHMM)
400
300
200
100
90
80
70
60
50
40
30
20
10
9
8
7
6
5
EM1
RP1
0
DISTANCE (M)
250
500
750


W
E
THIMLICH RP2 (AB/2=30M) EM1 (S=20M; H)
VES 7
VES 8
DH1
VES 9 HH1
VES 10
APPARENT RESISTIVITY (OHMM)
400
300
200
100
90
80
70
60
50
40
30
20
10
9
8
7
6
5
EM2
RP2
0
DISTANCE (M)
250
500
750

TNO-DGV INSTITUTE OF APPLIED GEOSCIENCE

Site: God Jope Village

Hydrogeology

Layers	Resistivity (ohmm)	Remarks	
A	100-200	Fresh Phonolithic rock (Tv)	(DH)
B	5-20	(Sandy) clay	
C	-	-	
D	-	-	
E	-	-	
F	-	-	

Fractured zones, faults	Remarks
VES3	Important fault South deep sediments North phonolithic rocks VES3 is disturbed by fault

Depth to groundwater table: Unknown

Groundwater quality : Fresh

(Recommended) drilled (DH) or handdug (HH) holes

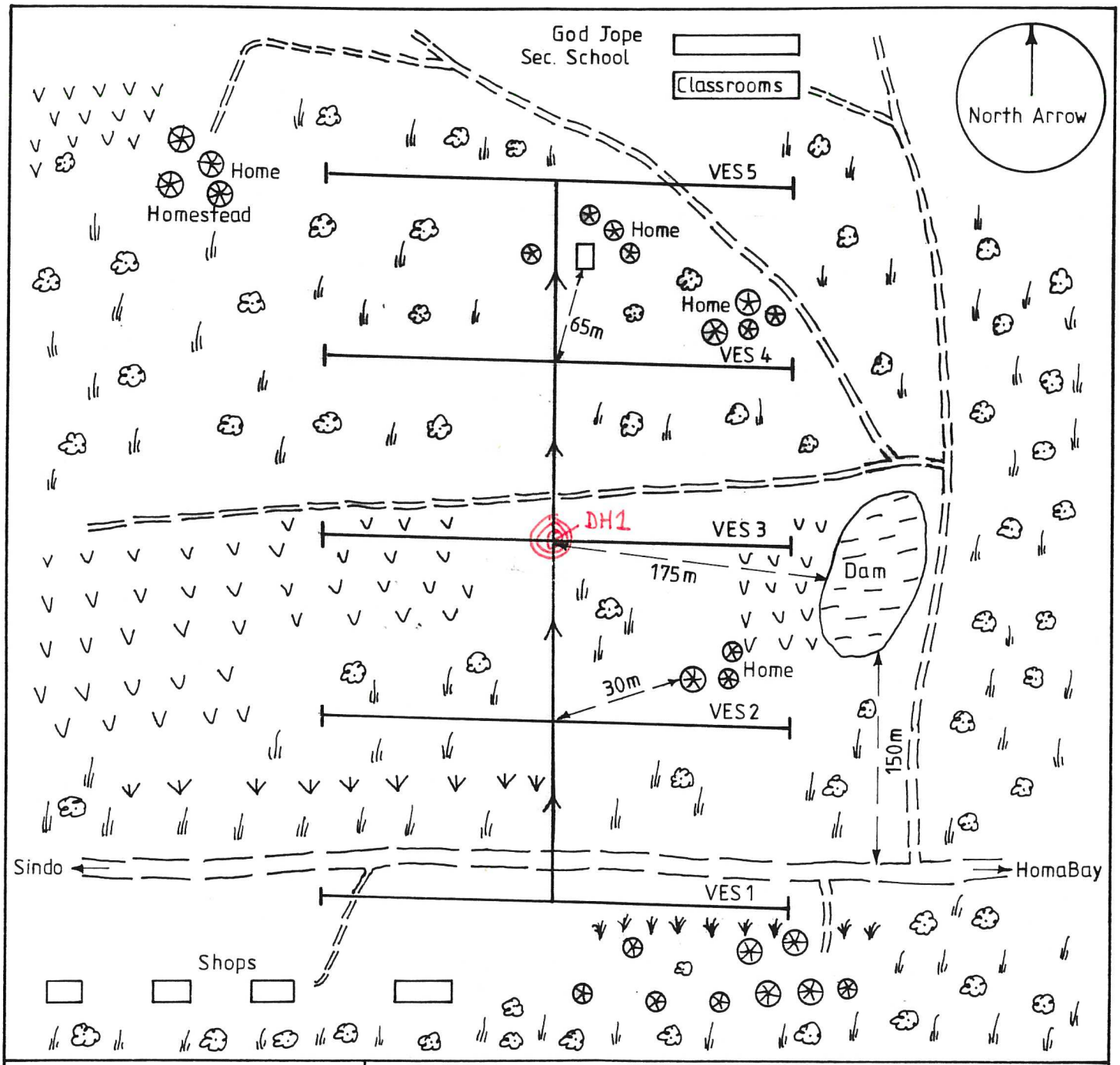
Drilled hole(s)	Remarks
DH1 (VES3, 40 m)	-

Handdug hole(s)	Remarks
-	-

GOD JOPE VILLAGE (SKETCH)

SOUTH NYANZA DISTRICT: MBITA DIVISION: MAP SHEET 129/2

GRID REFERENCE 647·4 - 9938·4

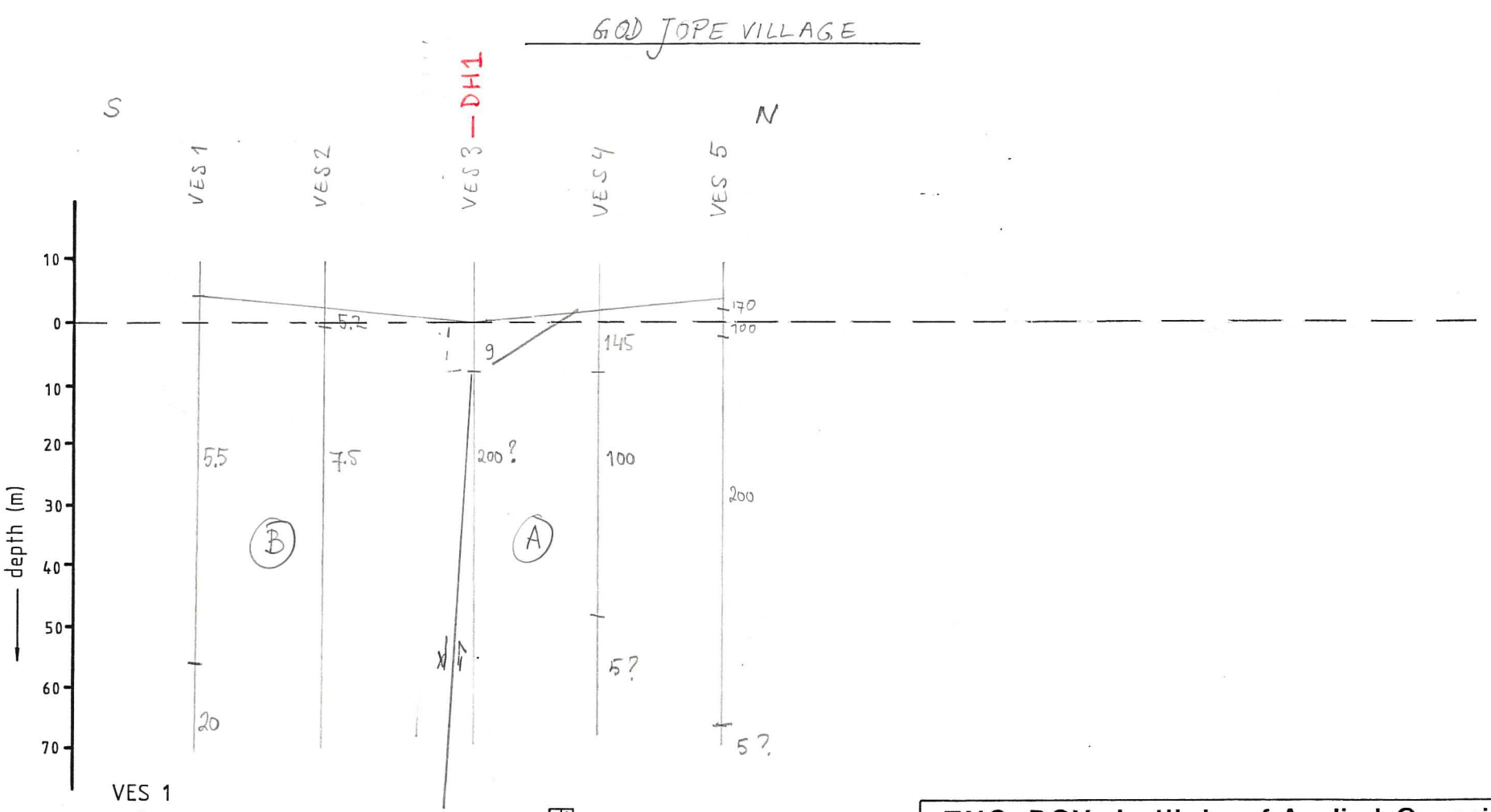


Murram road
Path
Classrooms
Shops
Houses
Round huts
Trees
Sisal
Hedge
M

VES(Vertical Electric Sounding)
200m long, at 100m interval except VES2-3=120m

Profile line = 420m

Slope:
VES1 — VES2 = -5°
VES2 — VES3 = -5°
VES3 — VES4 = +5°
VES4 — 59m. = +5°
59m — VES5 = +5°



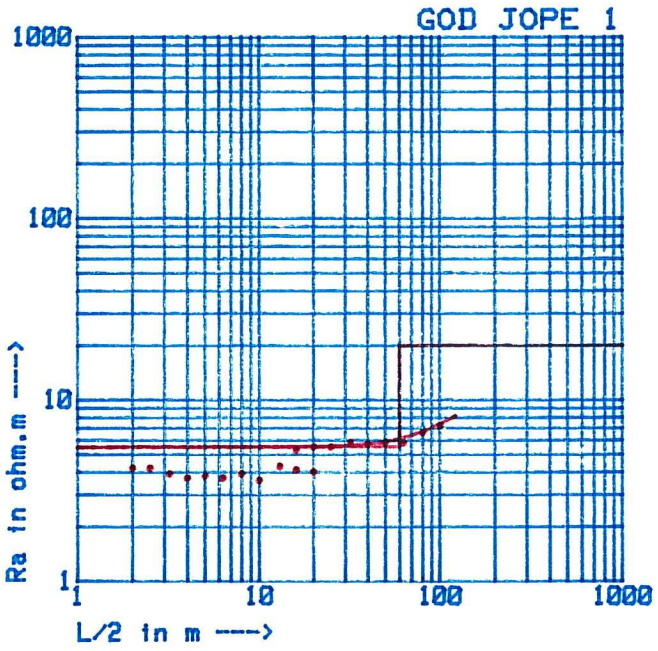
VES 1 — Vertical Electrical Sounding, interpreted resistivity 5 ohmm

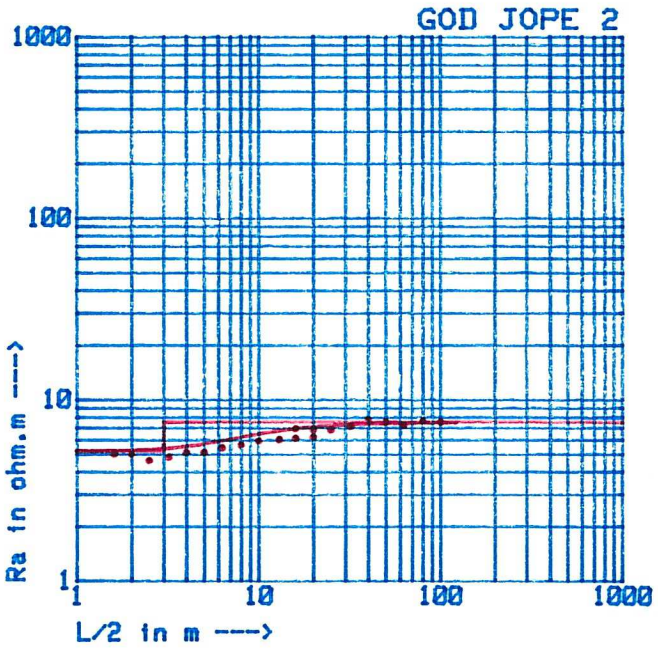
A — geo-electrical layer A

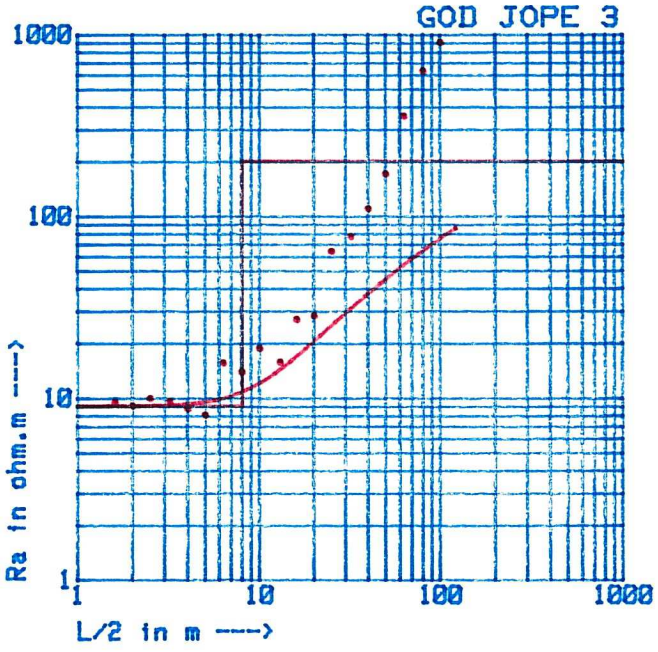
B 1 — (recommended) borehole or handdug hole

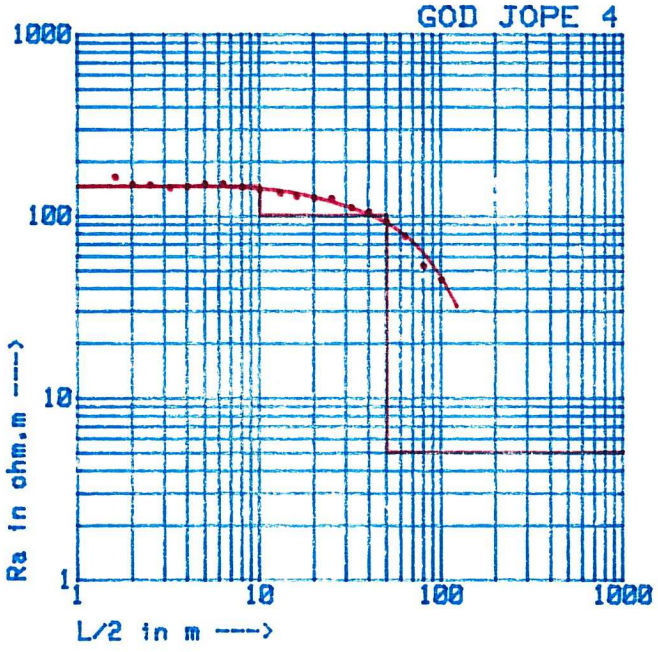
- sandy clay, cemented clay
- lateritic layer
- clay
- a — very decomposed, altered rock
- w — weathered rock
- p — partly weathered, fractured rock
- f — fresh rock

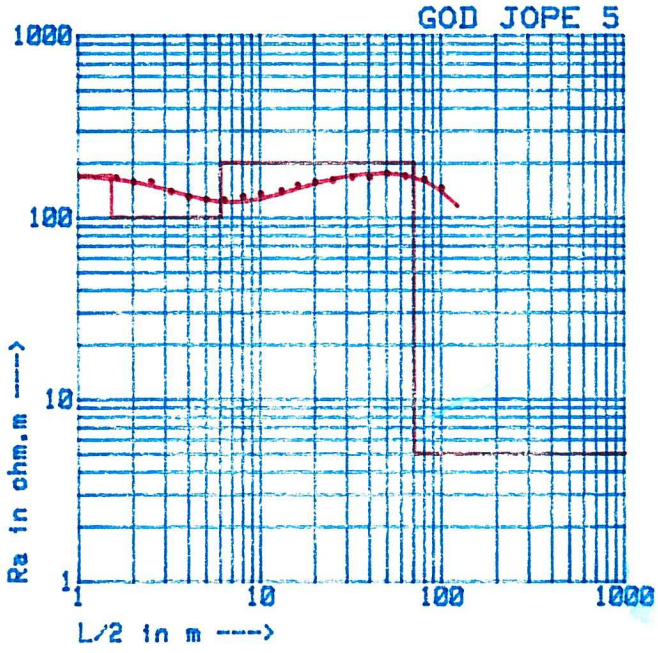
TNO-DGV Institute of Applied Geoscience	
Annex 24.3	Cross-section God Jope Village
Horizontal scale 1 : 5000	Vertical scale 1 : 1000

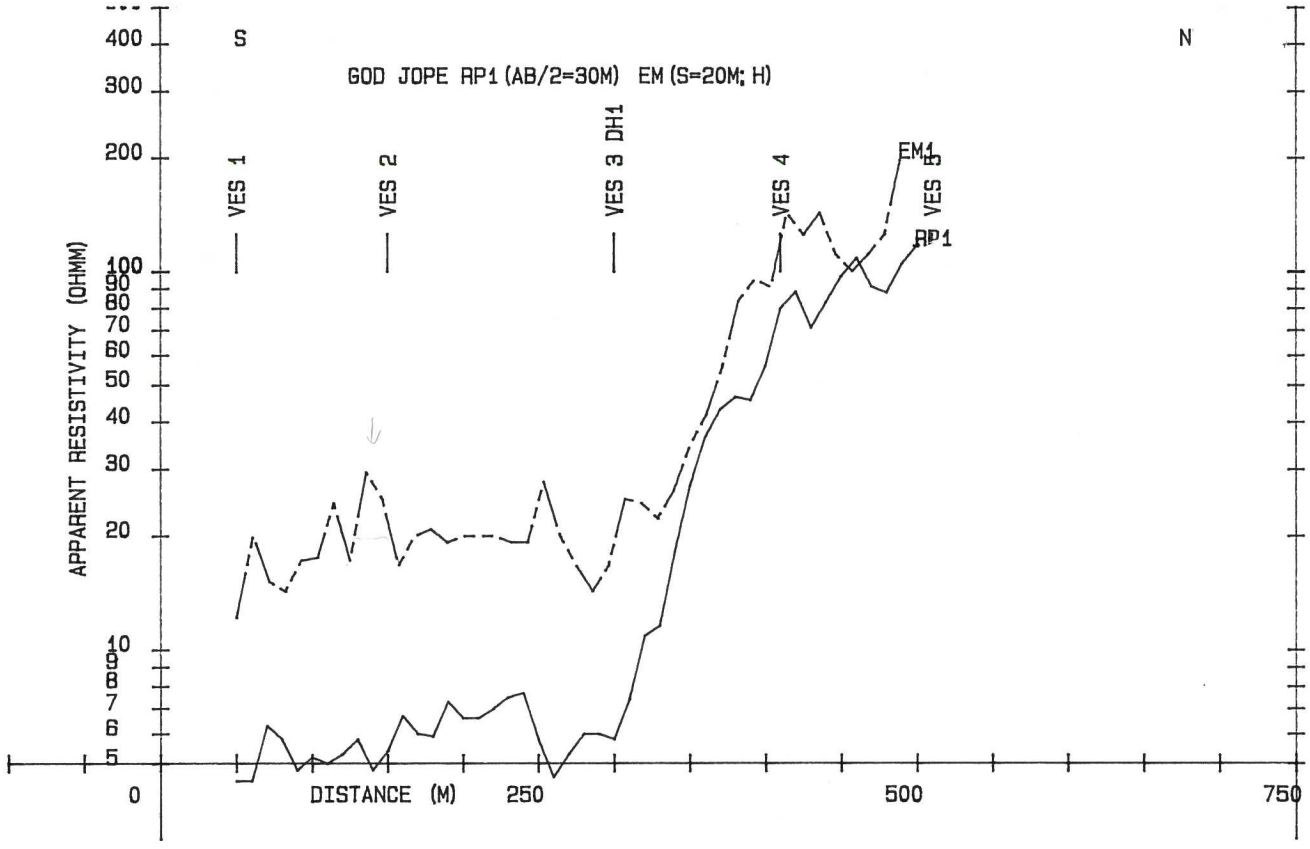

GOD JOPE 1
1000
100
10
1
Ra in ohm.m ---->
1
10
100
1000
L/2 in m --->


GOD JOPE 2
1000
100
10
1
Ra in ohm.m ---->
1
10
100
1000
L/2 in m ---->


GOD JOPE 3
1000
100
10
1
Ra in ohm.m ---->
1
10
100
1000
L/2 in m ---->


GOD JOPE 4
1000
100
10
1
Ra in ohm.m ---->
1
10
100
1000
L/2 in m ---->


GOD JOPE 5
1000
100
10
1
Ra in ohm.m ---->
1
10
100
1000
L/2 in m ---->


GOD JOPE RP1 (AB/2=30M) EM (S=20M; H)
S
N
VES 1
VES 2
VES 3 DH1
VES 4
VES 5
EM1
RP1
APPARENT RESISTIVITY (OHMM)
400
300
200
100
90
80
70
60
50
40
30
20
10
9
8
7
6
5
0
DISTANCE (M)
250
500
750

TNO-DGV INSTITUTE OF APPLIED GEOSCIENCE

Site: Kamsama School

Hydrogeology

Layers	Resistivity (ohmm)	Remarks
A	13-28	Weathered, decomposed rock or sediment (Tv, R) (DH)
B	4.2-10	Clay (HH)
C	12-24	Soil
D	-	-
E	-	-
F	-	-

Fractured zones, faults	Remarks
40 m NE of VES1	Fractured zone

Depth to groundwater table: Unknown

Groundwater quality : Fresh

(Recommended) drilled (DH) or handdug (HH) holes

Drilled hole(s)	Remarks
DH1 (40 m NE of VES1, 35 m)	-

Handdug hole(s)	Remarks
HH1 (40 m NE of VES1, 15 m)	-

KAMSAMA SCHOOL (SKETCH)

SOUTH NYANZA DISTRICT: MBITA DIVISION: MAP SHEET 129/2

GRID REFERENCE 647·0 - 9943·6



Murram road

Path

Houses

Round huts

Trees

Maize shamba

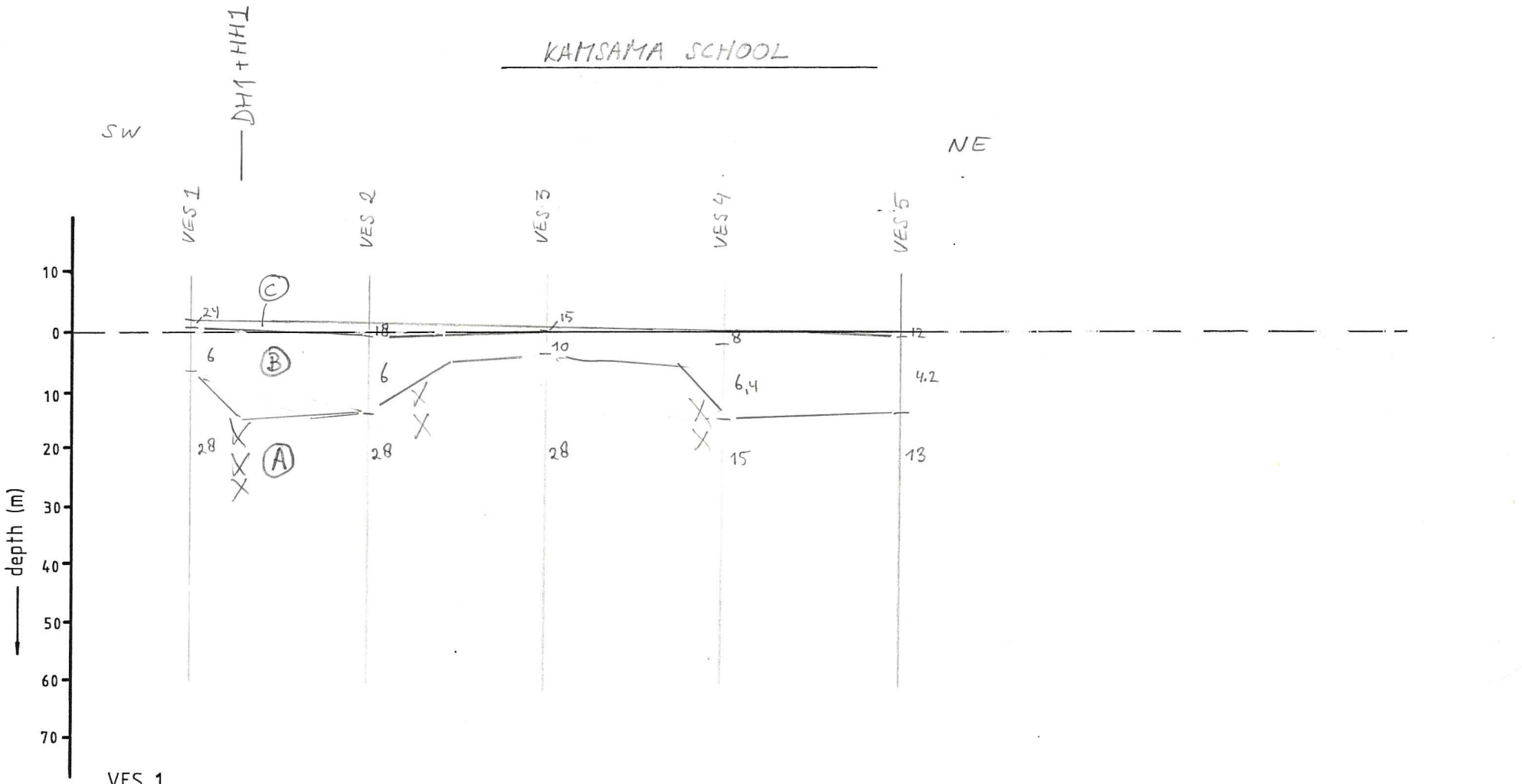
Hedge

Long grass

VES (Vertical Electric Sounding)
200m long, at 150m interval

Profile 550m.

Slope: VES1 – VES2 = - 1°
VES2 – VES3 = - 1°
VES3 – VES4 = - 1°
VES4 – VES5 = 0°



VES 1
5
Vertical Electrical Sounding, interpreted resistivity 5 ohmm

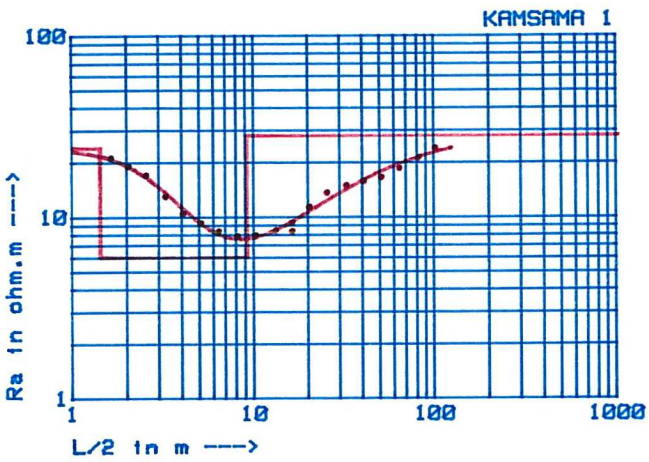
A
geo-electrical layer A

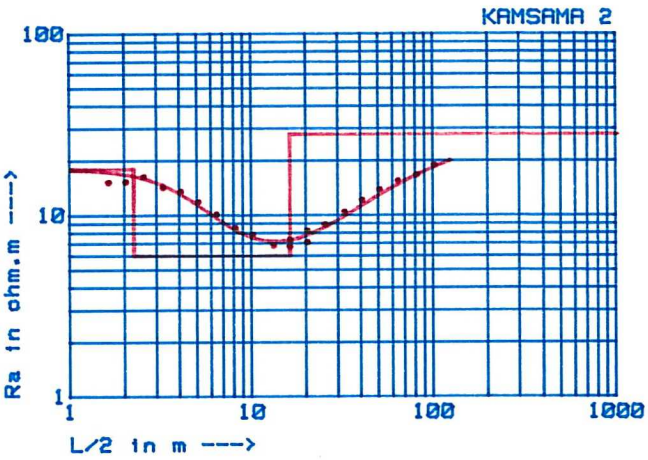
B 1
(recommended) borehole or handdug hole

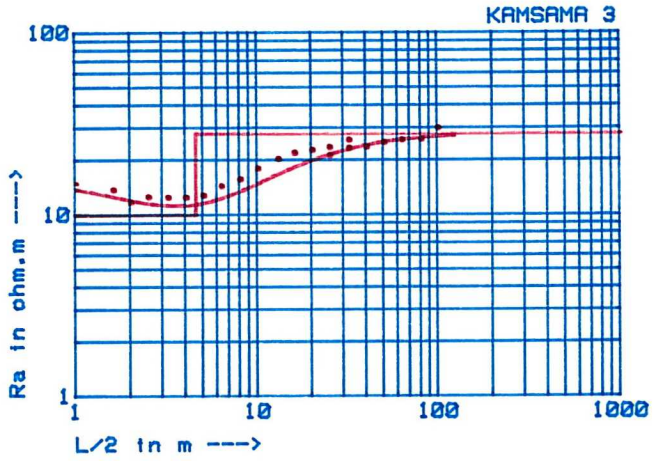
sandy clay, cemented clay
lateritic layer
clay
a very decomposed, altered rock
w weathered rock
p partly weathered, fractured rock
f fresh rock

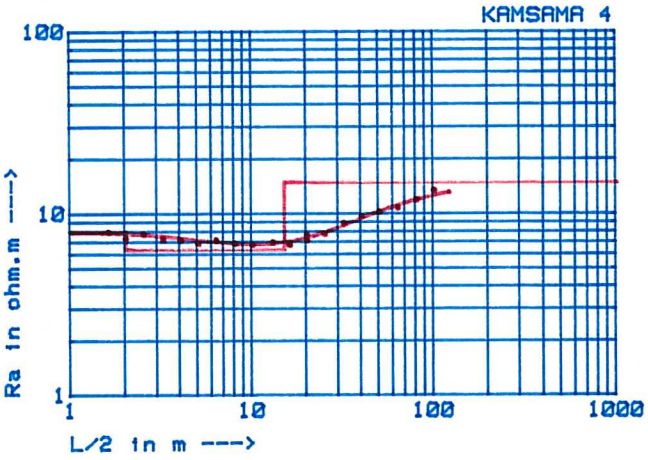
TNO-DGV Institute of Applied Geoscience	
Annex 25.3	Cross-section Kamsama
Horizontal scale 1 : 5000	Vertical scale 1 : 1000

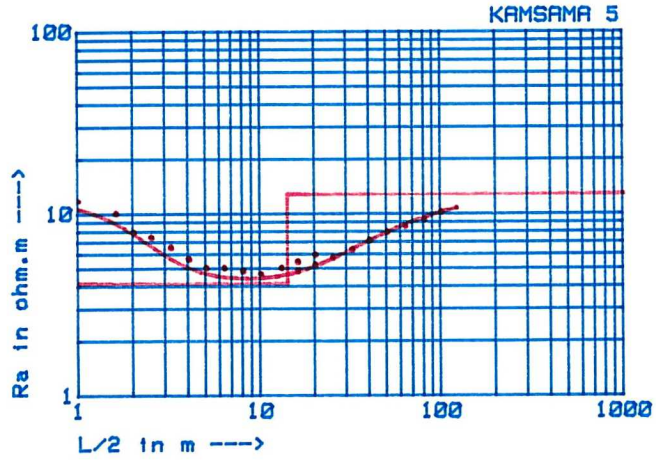
25.3

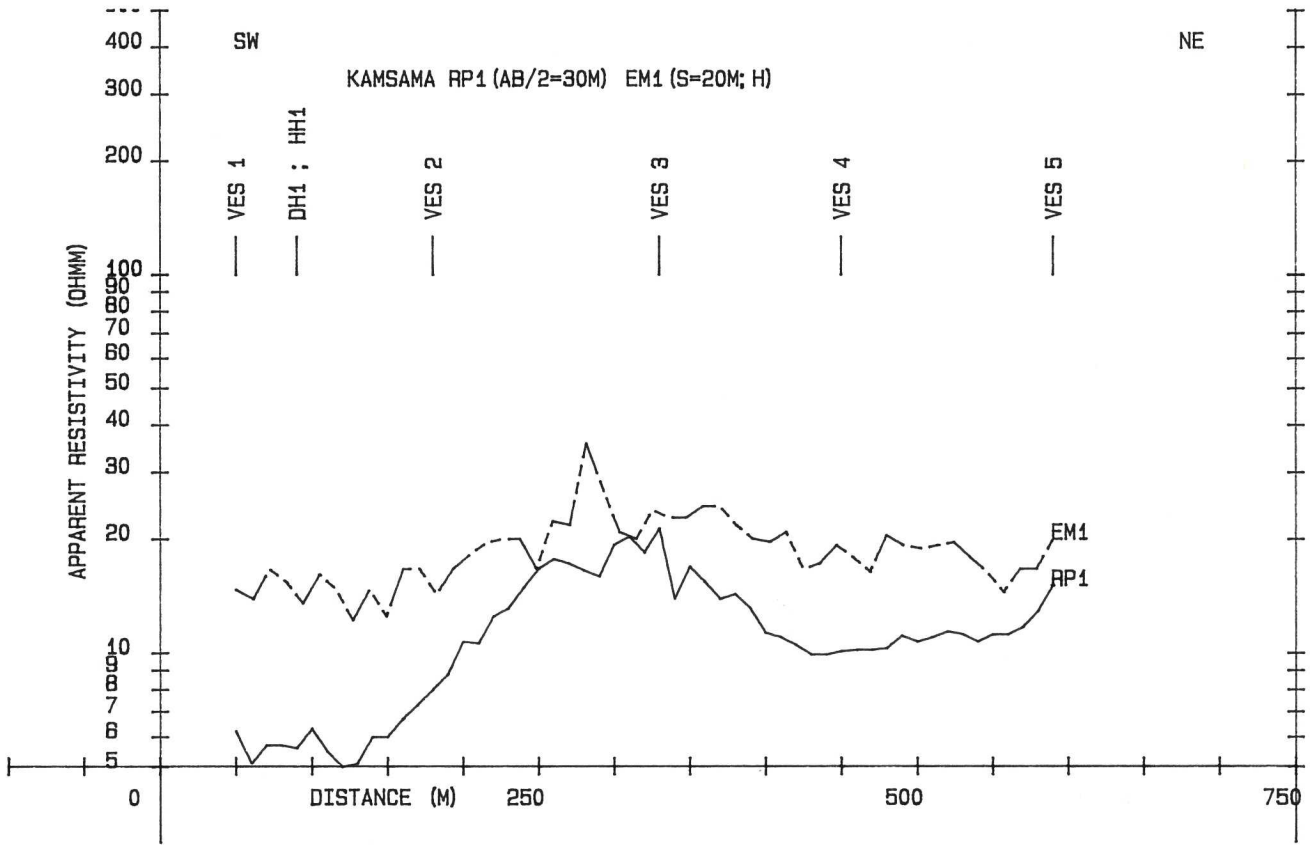

KAMSAMA 1
100
10
1
Ra in ohm.m --->
1
10
100
1000
L/2 in m --->


KAMSAMA 2
100
10
1
Ra in ohm.m --->
1
10
100
1000
L/2 in m --->


KAMSAMA 3
100
10
1
Ra in ohm.m --->
1
10
100
1000
L/2 in m --->


KAMSAMA 4
100
10
1
Ra in ohm.m --->
1
10
100
1000
L/2 in m --->


KAMSAMA 5
100
10
1
Ra in ohm.m --->
1
10
100
1000
L/2 in m --->


SW
NE
KAMSAMA RP1 (AB/2=30M) EM1 (S=20M; H)
VES 1
DH1 ; HH1
VES 2
VES 3
VES 4
VES 5
APPARENT RESISTIVITY (OHMM)
400
300
200
100
90
80
70
60
50
40
30
20
10
9
8
7
6
5
EM1
RP1
0
DISTANCE (M)
250
500
750

TNO-DGV INSTITUTE OF APPLIED GEOSCIENCE

Site: Kamayoge School

Hydrogeology

Layers	Resistivity (ohmm)	Remarks	
A	13-18	Decomposed rock (Tv)	(DH)
B	23-25	Weathered rock	
C	6-15	Clay	
D	3	Clay (saline)	
E	30-130	Lateritic soil	
F	-	-	

Fractured zones, faults	Remarks
10m NW of VES2	Important fault, SE side shallow rocks

Depth to groundwater table: Unknown

Groundwater quality : Fresh and saline

(Recommended) drilled (DH) or handdug (HH) holes

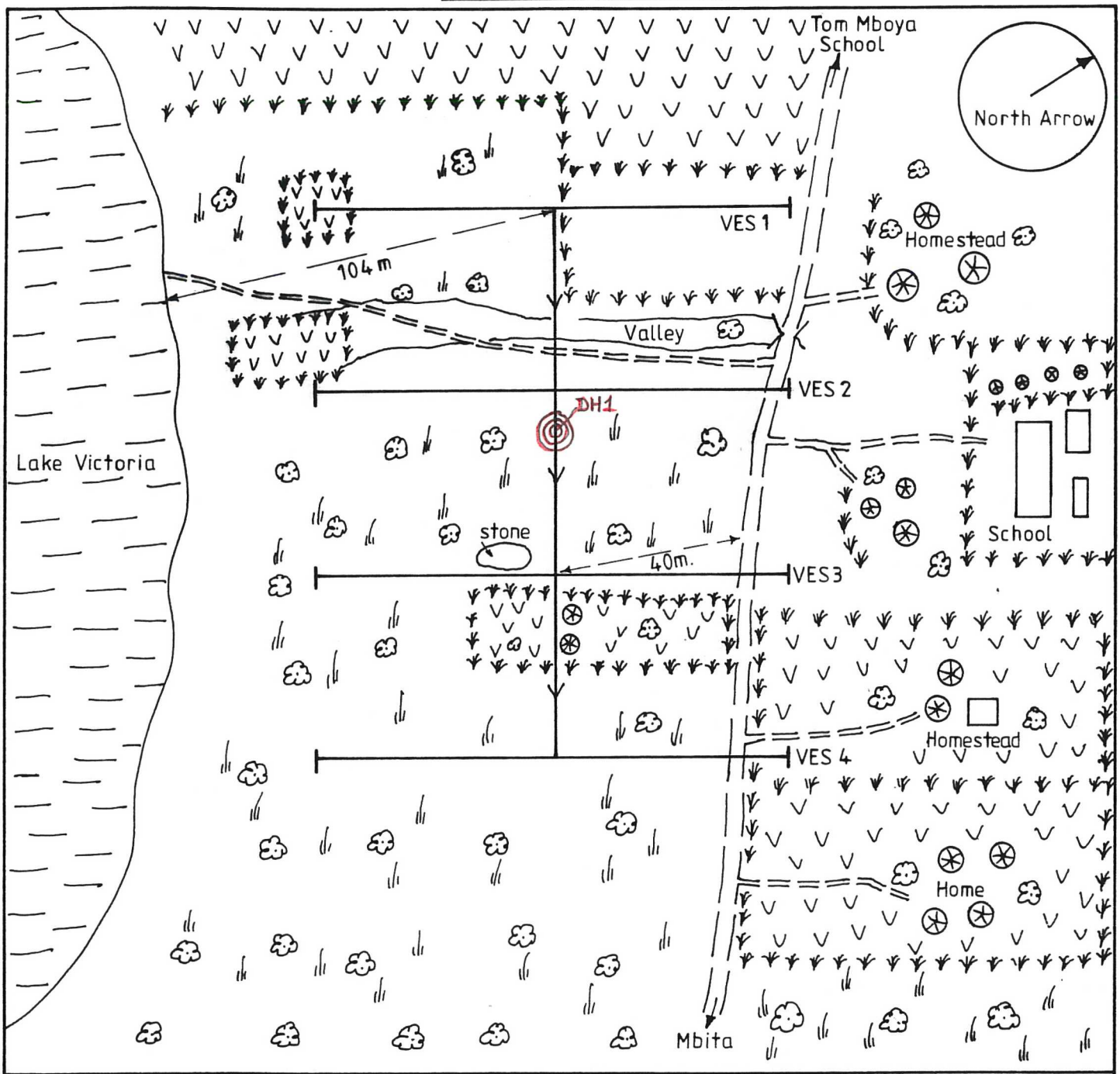
Drilled hole(s)	Remarks
DH1 (10 m NW of VES2, 50 m)	-

Handdug hole(s)	Remarks
-	-

KAMAYOGE SCHOOL (SKETCH)

SOUTH NYANZA DISTRICT: MBITA DIVISION: MAP SHEET 115/3

GRID REFERENCE 628·8-9952·4



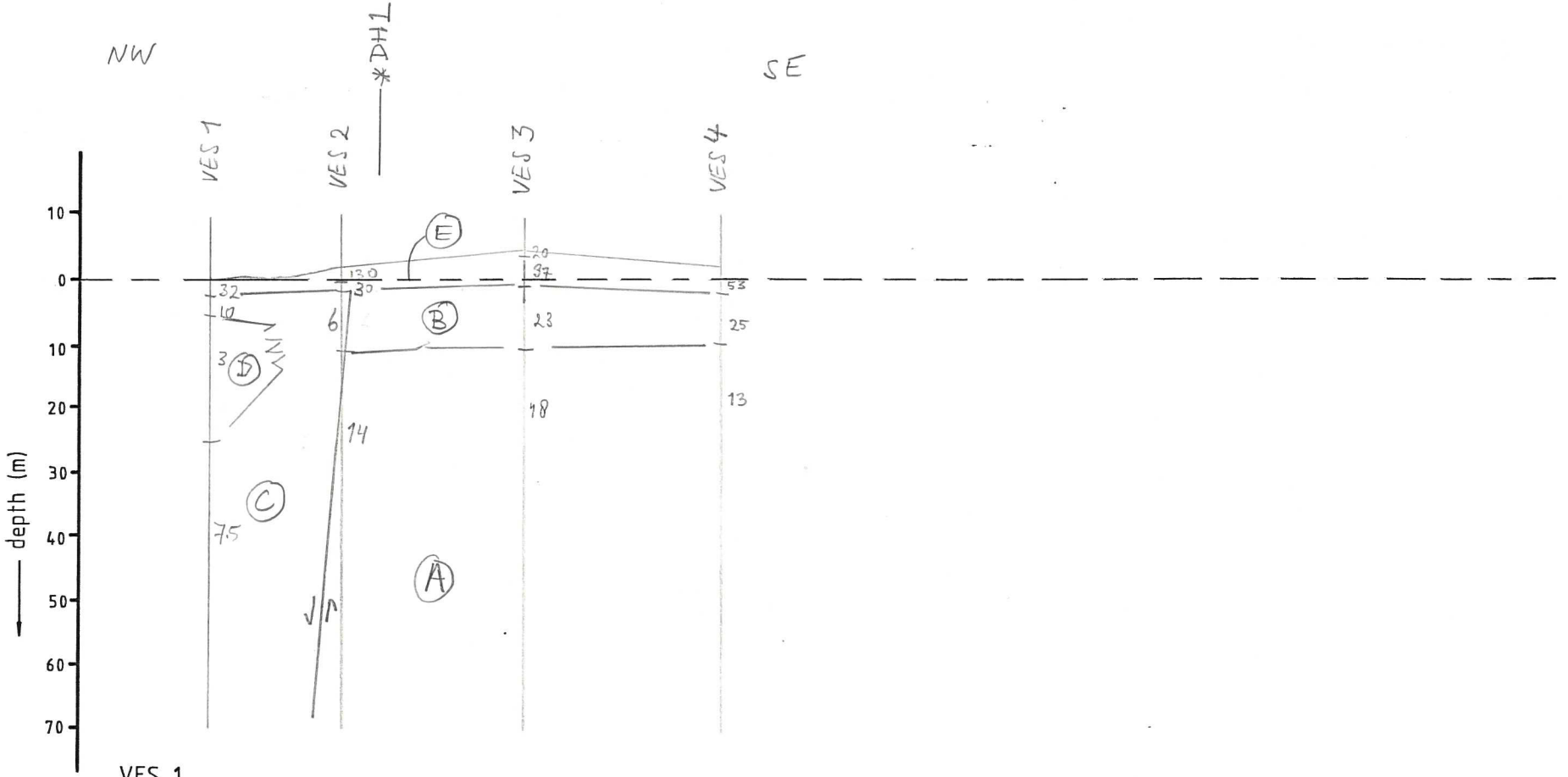
Murram road
Path
Classrooms
Houses
Round huts
Trees
Maize shamba
Hedge
Long grass

VES (Vertical Electric Sounding)
200m long, VES1-2=100m, VES2-3=140m
VES3-4=150m

Profile line = 390m

Slope:
VES1 — VES2 = +5°
VES2 — VES3 = +5°
VES3 — 56m = -5°
56m — VES4 = -5°

KAMAYOGE SCHOOL



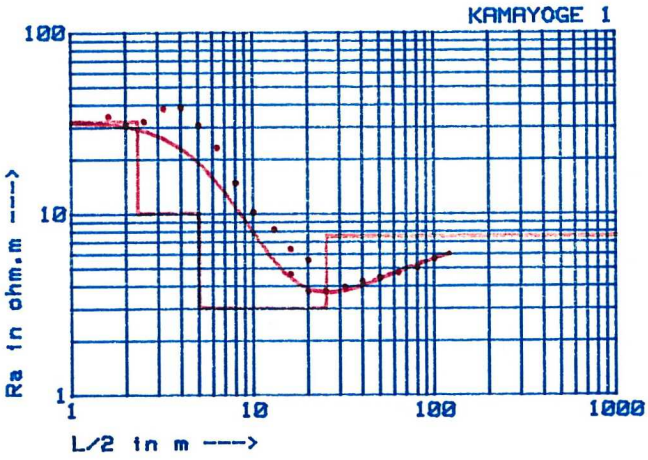
VES 1
5
Vertical Electrical Sounding, interpreted resistivity 5 ohmm

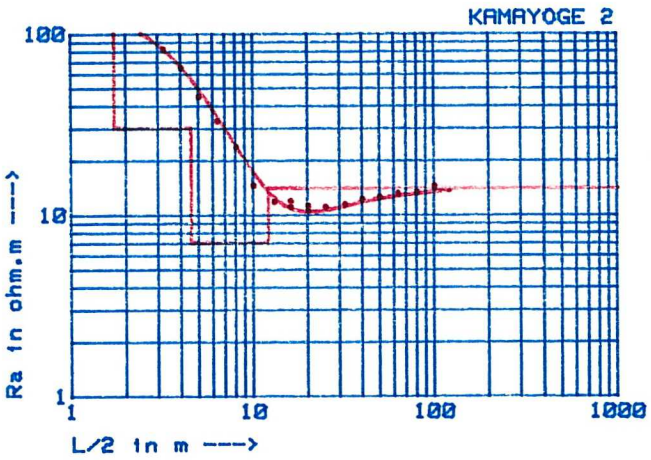
A
geo-electrical layer A

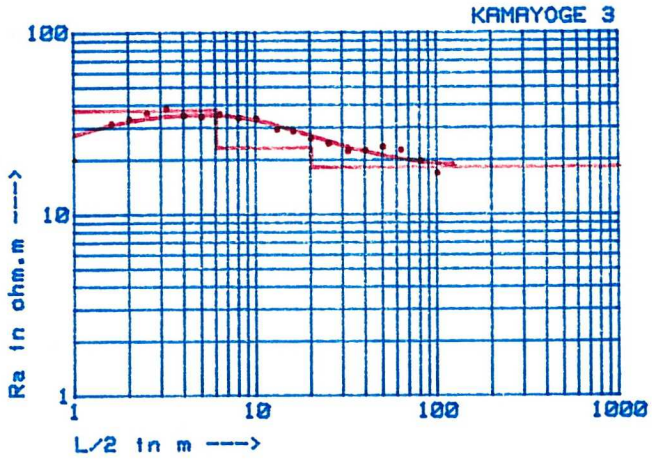
B 1
(recommended) borehole or handdug hole

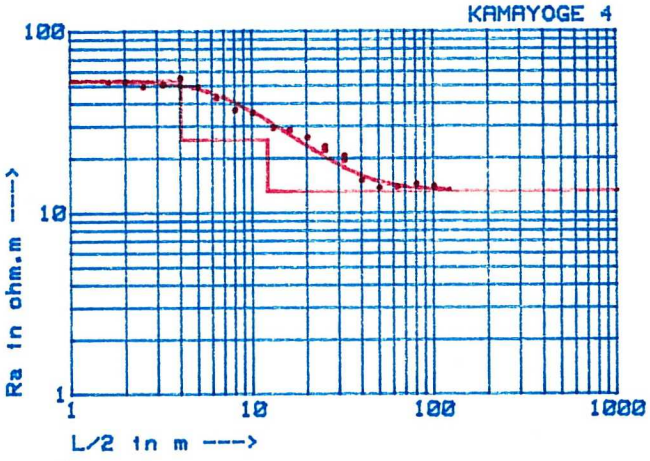
- sandy clay, cemented clay
- lateritic layer
- clay
- a very decomposed, altered rock
- w weathered rock
- p partly weathered, fractured rock
- f fresh rock

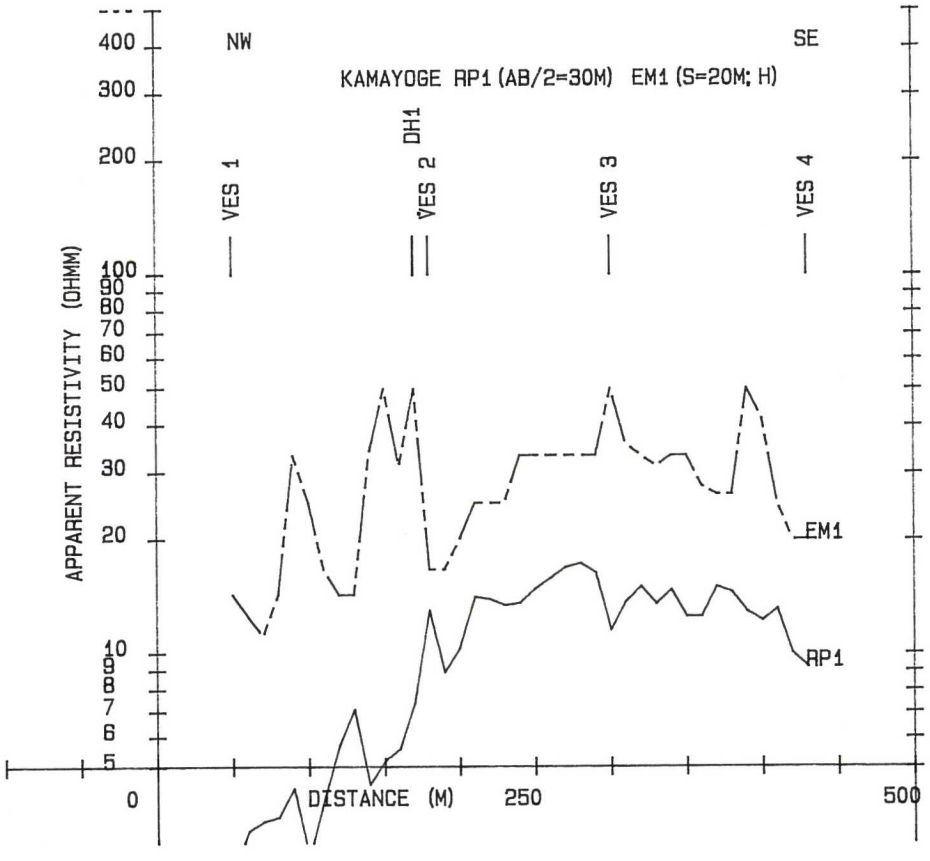
TNO-DGV Institute of Applied Geoscience	
Annex 26.2	Cross-section Kamayoge School
Horizontal scale 1 : 5000	Vertical scale 1 : 1000


KAMAYOGE 1
100
10
1
Ra in ohm.m --->
1
10
100
1000
L/2 in m --->


KAMAYOGE 2
100
10
1
Ra in ohm.m --->
1
10
100
1000
L/2 in m --->


KAMAYOGE 3
100
10
1
Ra in ohm.m --->
1
10
100
1000
L/2 in m --->


KAMAYOGE 4
100
10
1
Ra in ohm.m --->
1
10
100
1000
L/2 in m --->


NW
SE
KAMAYOGE RP1 (AB/2=30M) EM1 (S=20M; H)
DH1
VES 1
VES 2
VES 3
VES 4
APPARENT RESISTIVITY (OHMM)
400
300
200
100
90
80
70
60
50
40
30
20
10
9
8
7
6
5
EM1
RP1
0
DISTANCE (M)
250
500

TNO-DGV INSTITUTE OF APPLIED GEOSCIENCE

Site: North Ruri Market

Hydrogeology

Layers	Resistivity (ohmm)	Remarks	
A	-	Decomposed rock	(DH)
B	-	Clay (R)	
C	-	Top soil	
D	-	-	
E	-	-	
F	-	-	

Fractured zones, faults	Remarks
-	-

Depth to groundwater table: Unknown, probably very deep

Groundwater quality : Fresh

(Recommended) drilled (DH) or handdug (HH) holes

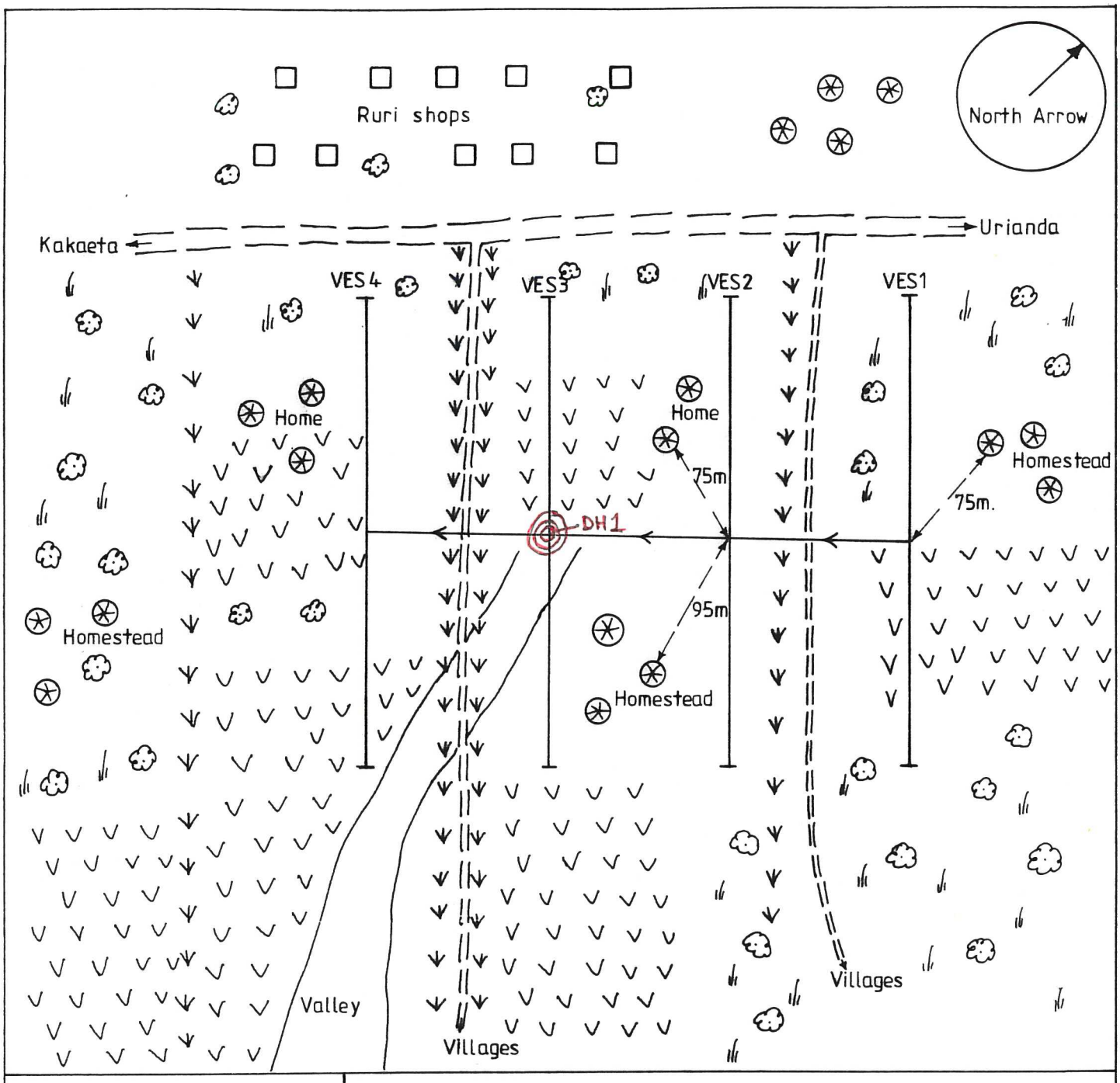
Drilled hole(s)	Remarks
DH1 (VES3, 75 m)	-

Handdug hole(s)	Remarks
-	-

NORTH RURI MARKET (SKETCH)

SOUTH NYANZA DISTRICT: MBITA DIVISION: MAP SHEET 129/2

GRID REFERENCE 653·9-9942·3



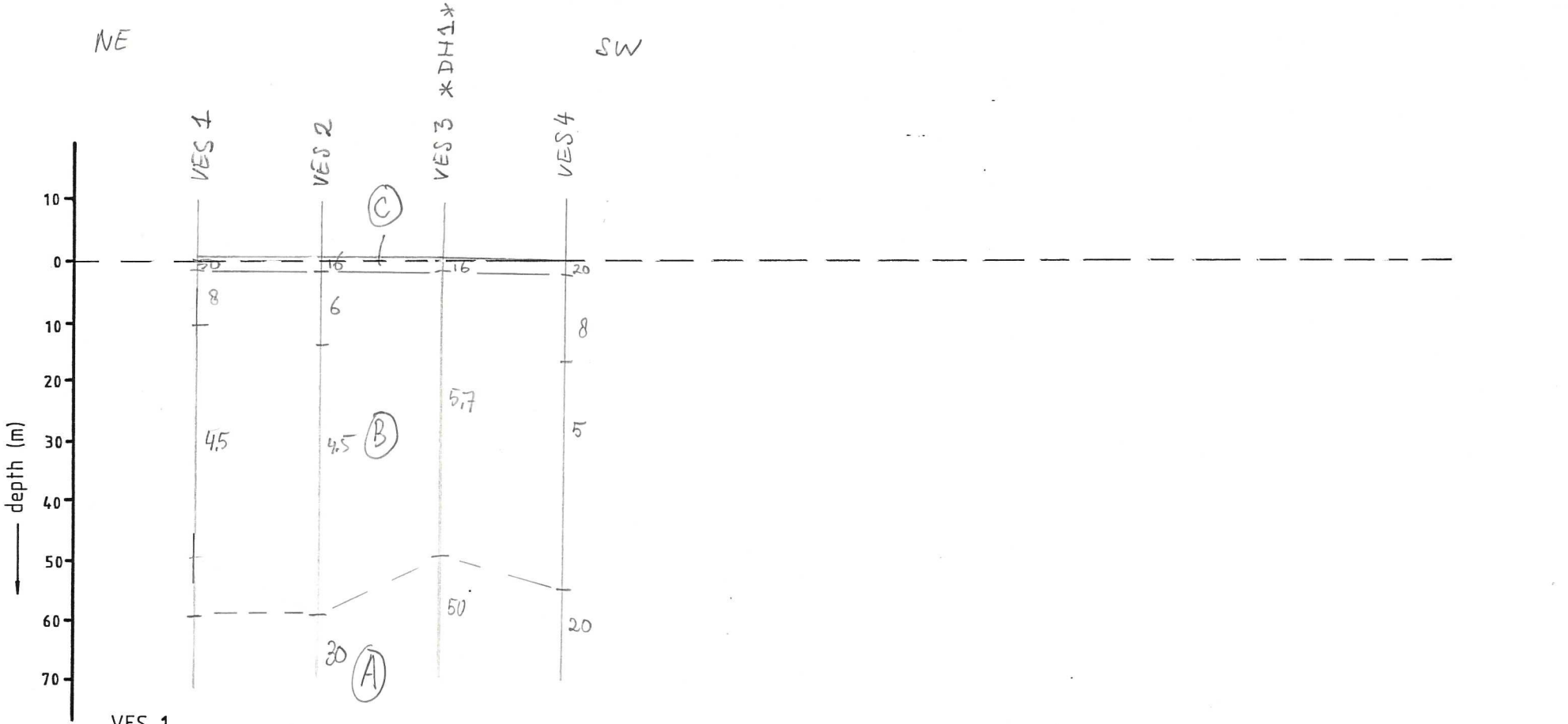
Murram road
Path
Shops
Round huts
Trees
Sisal
Maize shamba

VES (Vertical Electric Sounding)
200m. long, at 100 m interval

Profile line = 300m

Slope: VES1–VES2 = 0°
VES2–VES3 = 0°
VES3–VES4 = -1°

RURI MARKET



VES 1
5
Vertical Electrical Sounding, interpreted resistivity 5 ohmm

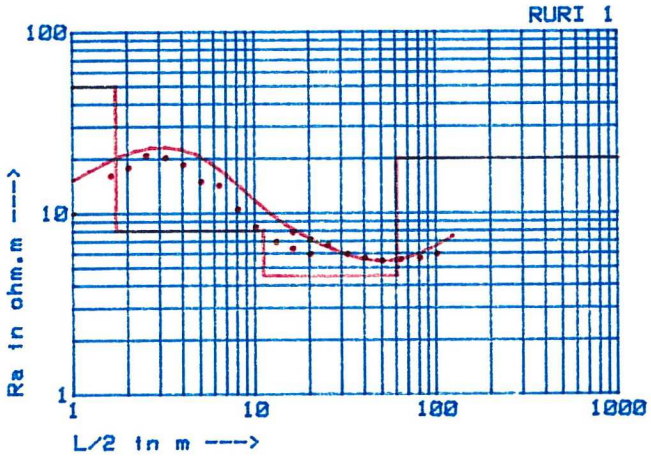
A
geo-electrical layer A

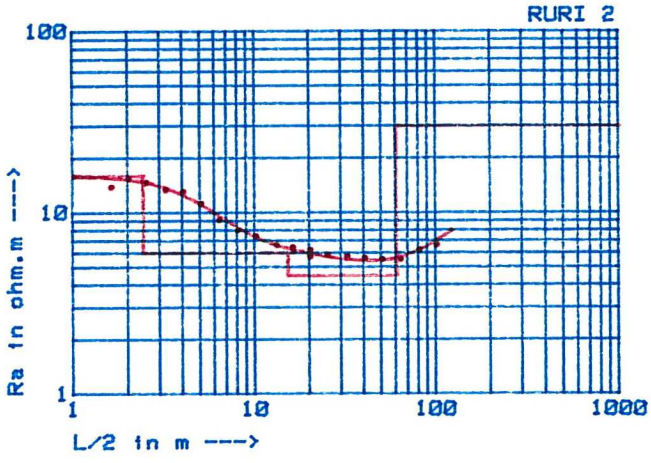
B 1
(recommended) borehole or handdug hole

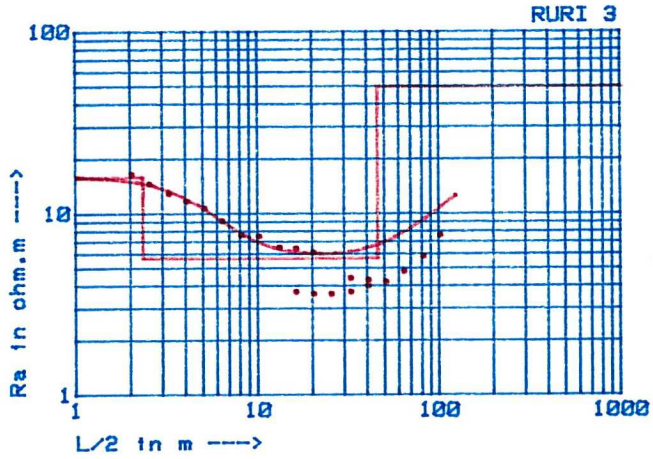
- sandy clay, cemented clay
- lateritic layer
- clay
- a — very decomposed, altered rock
- w — weathered rock
- p — partly weathered, fractured rock
- f — fresh rock

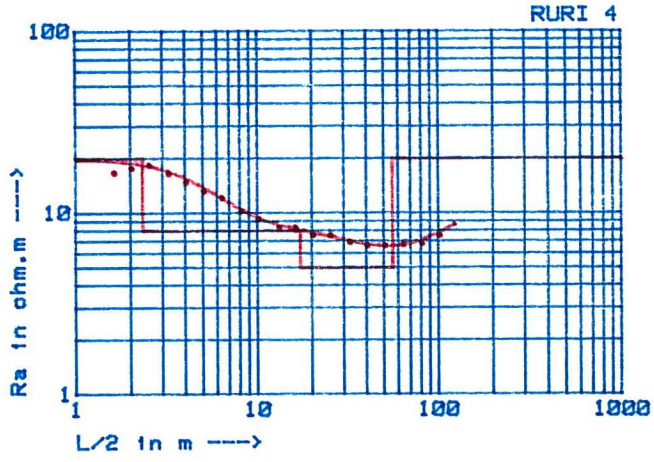
TNO-DGV Institute of Applied Geoscience	
Annex 27.3	Cross-section Ruri Market
Horizontal scale 1 : 5000	Vertical scale 1 : 1000

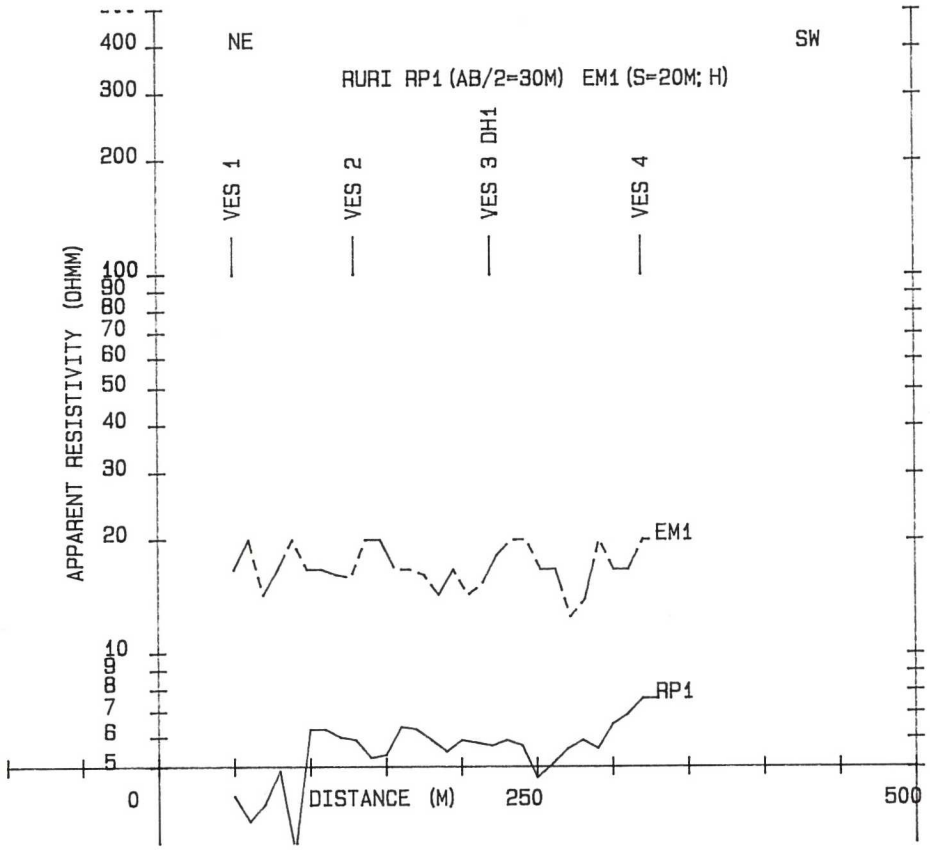
27.3


RURI 1
Ra in ohm.m --->
L/2 in m --->
100
10
1
1
10
100
1000


RURI 2
Ra in ohm.m --->
L/2 in m --->
100
10
1
1
10
100
1000


RURI 3
Ra in ohm.m --->
L/2 in m --->
100
10
1
1
10
100
1000


RURI 4
Ra in ohm.m --->
L/2 in m --->
100
10
1
1
10
100
1000


NE
SW
RURI RP1 (AB/2=30M) EM1 (S=20M; H)
VES 1
VES 2
VES 3 DH1
VES 4
APPARENT RESISTIVITY (OHMM)
400
300
200
100
90
80
70
60
50
40
30
20
10
9
8
7
6
5
EM1
RP1
0
DISTANCE (M)
250
500

TNO-DGV INSTITUTE OF APPLIED GEOSCIENCE

Site: Gingo Primary School

Hydrogeology

Layers	Resistivity (ohmm)	Remarks	
A	60-150	Partly weathered volcanic rock (Tv)	(DH)
B	10-11	(Sandy) clay (R)	(HH)
C	25-50	Sandy clay or weathered rock (R)	
D	20-200	Lateritic soil	
E	-	-	
F	-	-	

Fractured zones, faults	Remarks
-	-

Depth to groundwater table: Unknown

Groundwater quality : Fresh

(Recommended) drilled (DH) or handdug (HH) holes

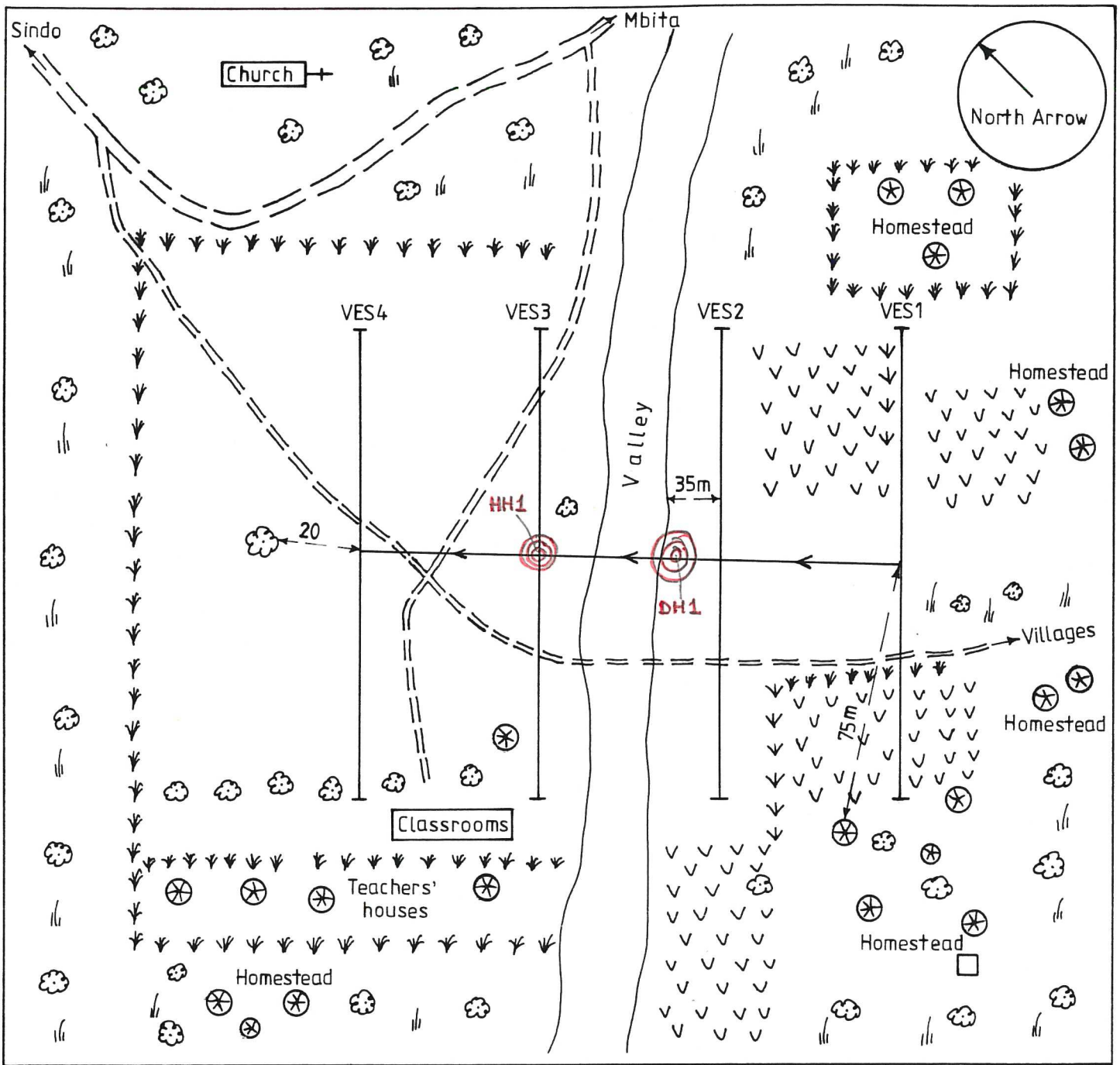
Drilled hole(s)	Remarks
DH1 (50 m NW VES2, 45 m)	-

Handdug hole(s)	Remarks
HH1 (VES3, 20 m)	-

GINGO PRIMARY SCHOOL

SOUTH NYANZA DISTRICT: MBITA DIVISION: MAP SHEET 115/3

GRID REFERENCE 632·0 – 9946·5

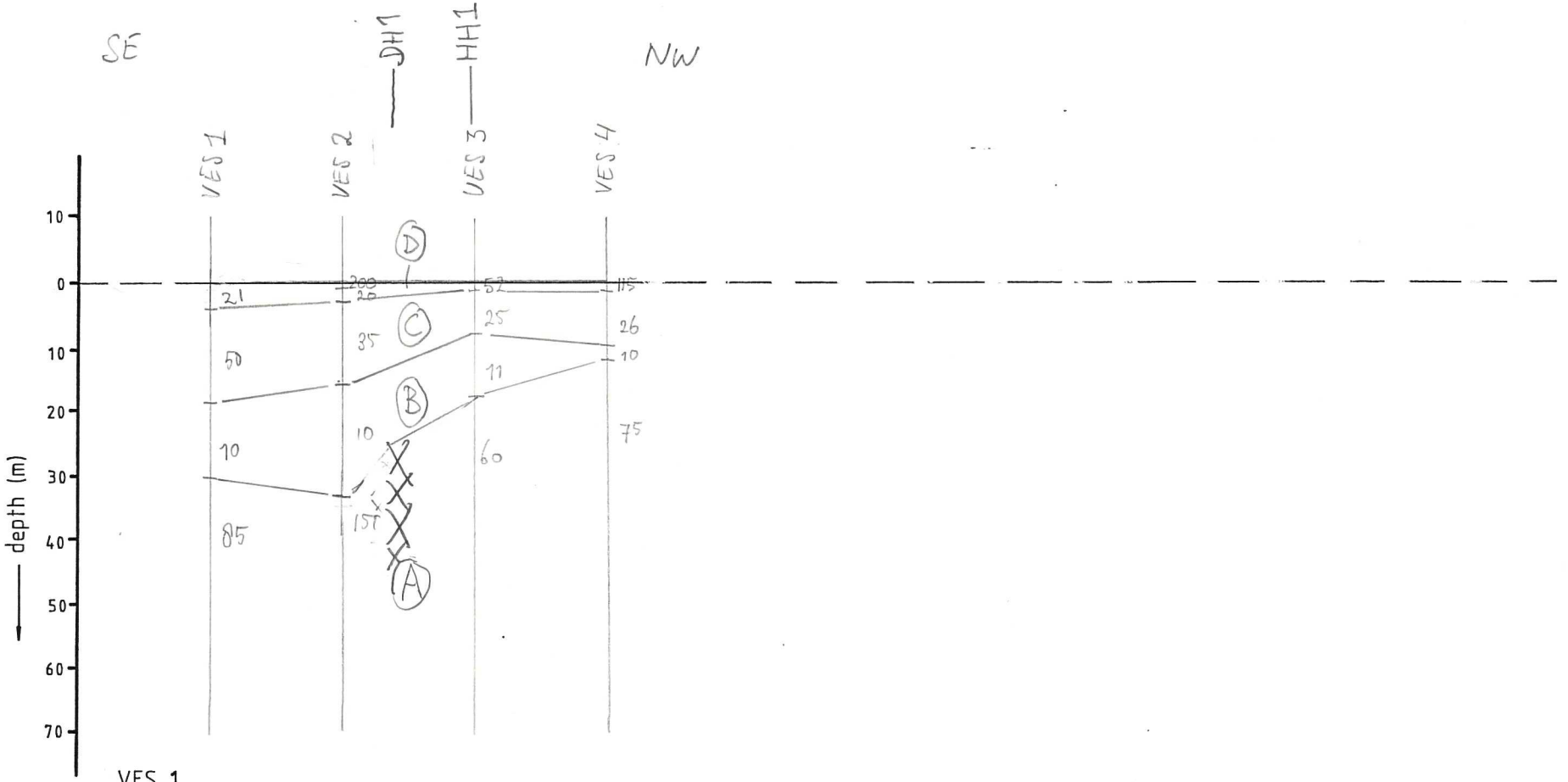


Murram road
Path
Classrooms
Houses
Round huts
Trees
Hedge
Maize
Long grass
Sisal

VES Vertical Electric Sounding
200m long at 100m interval
Profile line = 300m.

Slope : VES1 – VES2 = 0°
VES2 – VES3 = 0°
VES3 – VES4 = 0°

GINGO PRIMARY SCHOOL



VES 1

5

Vertical Electrical Sounding, interpreted resistivity 5 ohmm

A

geo-electrical layer A

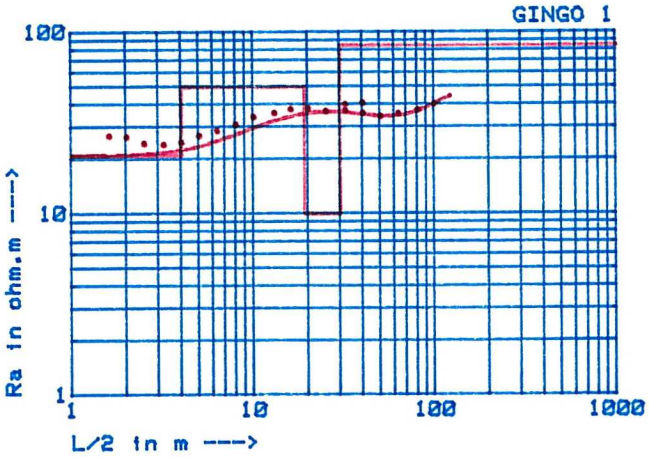
B 1

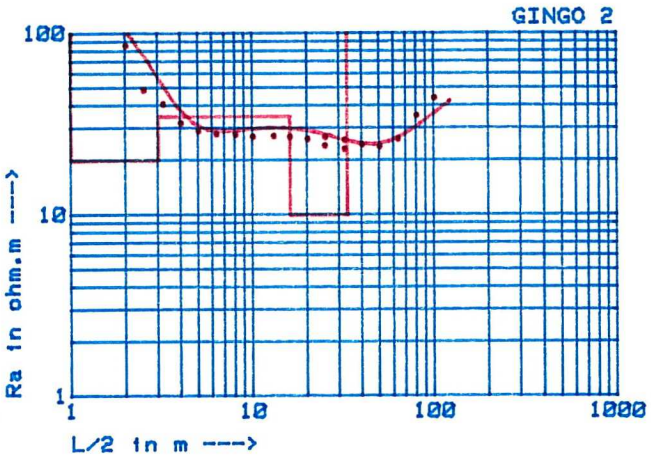
(recommended) borehole or handdug hole

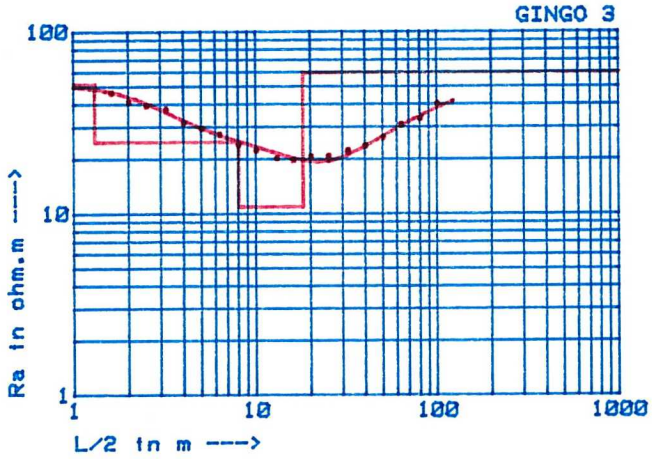
- sandy clay, cemented clay
- lateritic layer
- clay
- a — very decomposed, altered rock
- w — weathered rock
- p — partly weathered, fractured rock
- f — fresh rock

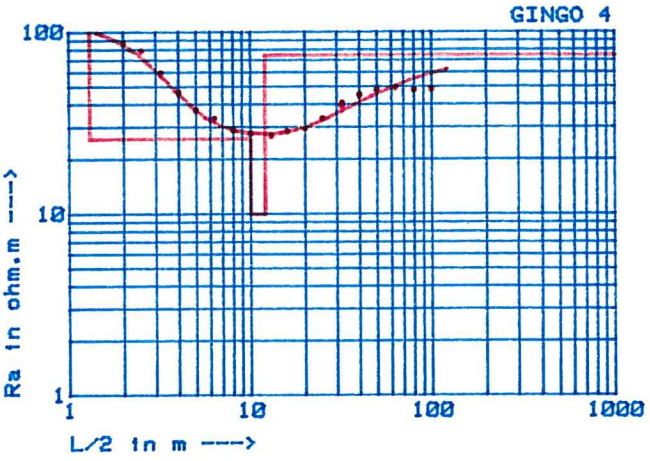
TNO-DGV Institute of Applied Geoscience	
Annex 28.3	Gross-section Gingo Pr. School
Horizontal scale 1 : 5000	Vertical scale 1 : 1000

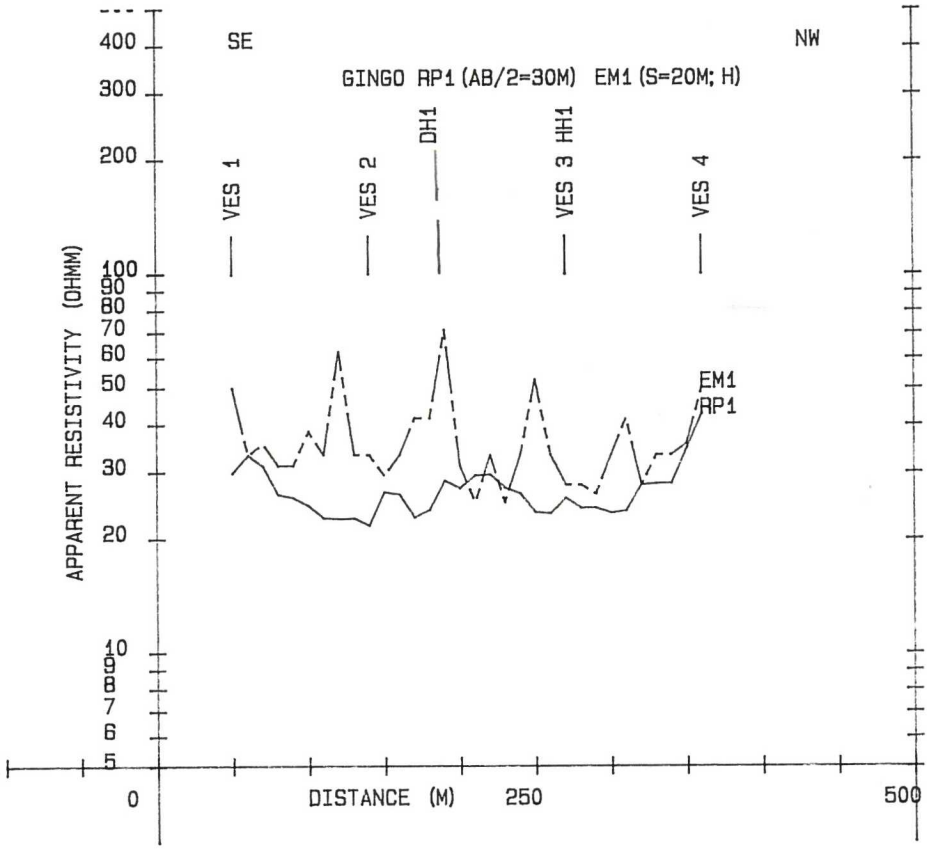
28.3


GINGO 1
Ra in ohm.m --->
100
10
1
1
10
100
1000
L/2 in m --->


GINGO 2
Ra in ohm.m --->
100
10
1
1
10
100
1000
L/2 in m --->


GINGO 3
Ra in ohm.m --->
100
10
1
1
10
100
1000
L/2 in m --->


GINGO 4
Ra in ohm.m --->
100
10
1
1
10
100
1000
L/2 in m --->


SE
NW
GINGO RP1 (AB/2=30M) EM1 (S=20M; H)
VES 1
VES 2
DH1
VES 3 HH1
VES 4
EM1
RP1
APPARENT RESISTIVITY (OHMM)
400
300
200
100
90
80
70
60
50
40
30
20
10
9
8
7
6
5
0
DISTANCE (M)
250
500

TNO-DGV INSTITUTE OF APPLIED GEOSCIENCE

Site: Makende Village

Hydrogeology

Layers	Resistivity (ohmm)	Remarks
A	50-75	Partly weathered volcanic rock (Tv) (DH)
B	12-23	Decomposed, weathered rock or sandy clay (HH)
C	8-14	Clayey top soil
D	-	-
E	-	-
F	-	-

Fractured zones, faults	Remarks
30 m SW from VES2	Small fractured zone, different depth of weathering at both sides

Depth to groundwater table: Unknown

Groundwater quality : Fresh

(Recommended) drilled (DH) or handdug (HH) holes

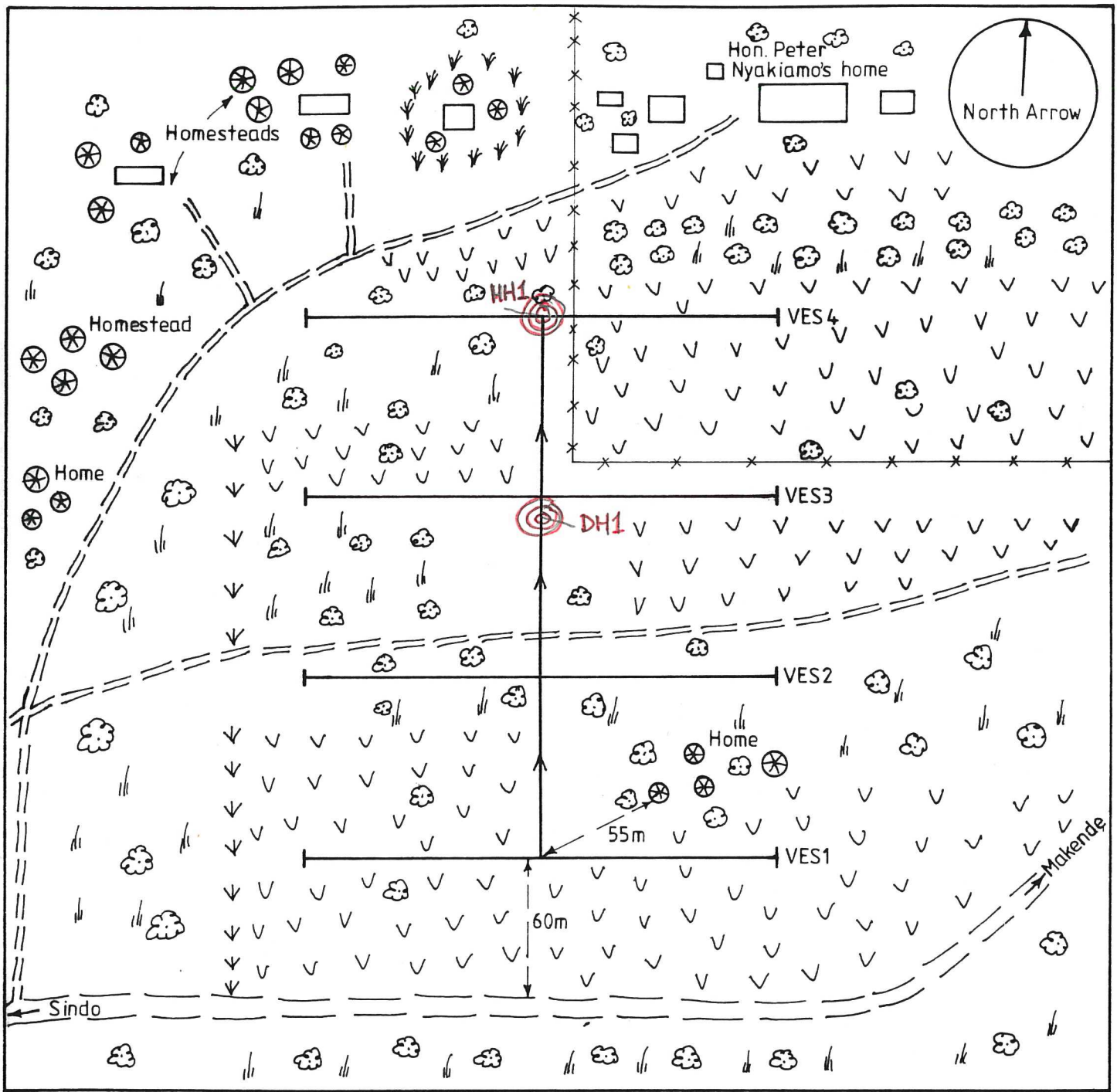
Drilled hole(s)	Remarks
DH1 (30m S from VES2, 45 m	-

Handdug hole(s)	Remarks
HH1 (VES4, 30 m)	-

MAKENDE VILLAGE (SKETCH)

SOUTH NYANZA DISTRICT: MBITA DIVISION : MAP SHEET 129/1

GRID REFERENCE 638·5 – 9940·0



Murram road

Small earth road

Houses

Round huts

Trees

Maize shamba

Sisal

Long grass

VES (Vertical Electric Sounding) 200m long, at 100m interval

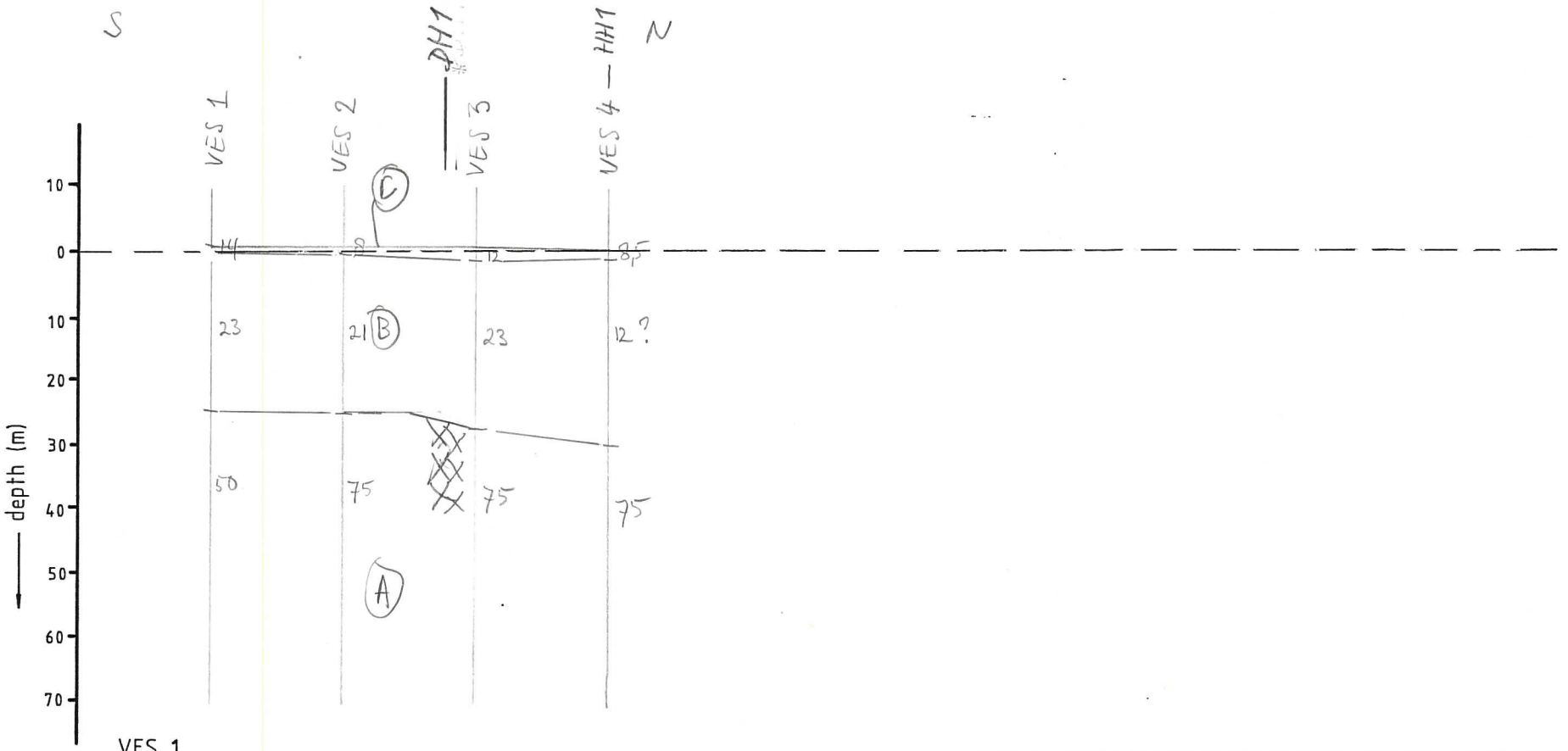
Profile line = 280m

Slope: VES1 – VES2 = 0°

VES2 – VES3 = 0°

VES3 – VES4 = -1°

MAKENDE VILLAGE



VES 1
5
Vertical Electrical Sounding, interpreted resistivity 5 ohmm

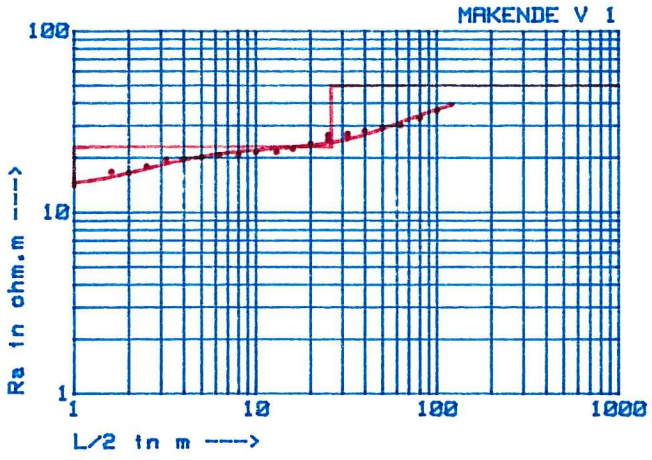
A
geo-electrical layer A

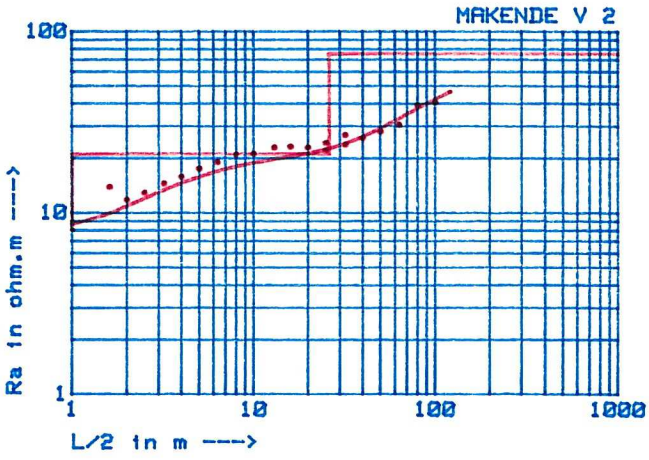
B 1
(recommended) borehole or handdug hole

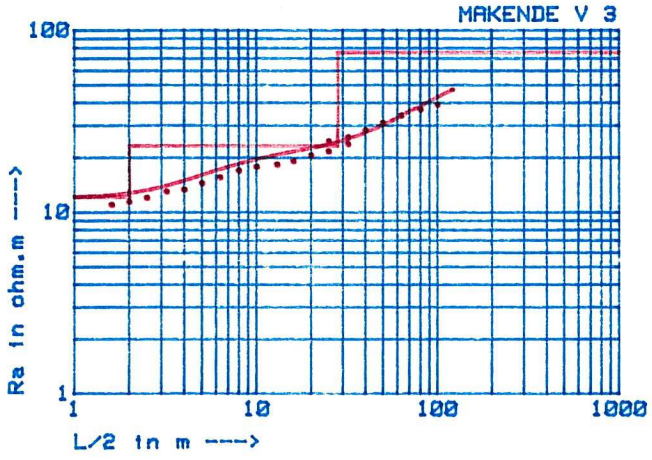
- sandy clay, cemented clay
- lateritic layer
- clay
- a — very decomposed, altered rock
- w — weathered rock
- p — partly weathered, fractured rock
- f — fresh rock

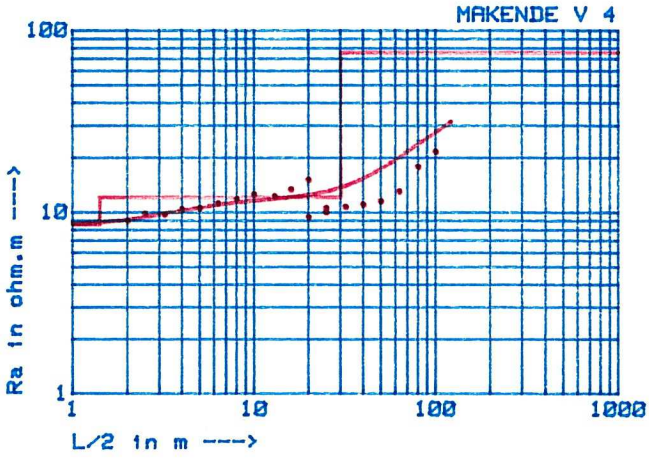
TNO-DGV Institute of Applied Geoscience	
Annex 29.3	Cross-section Makende Village
Horizontal scale 1 : 5000	Vertical scale 1 : 1000

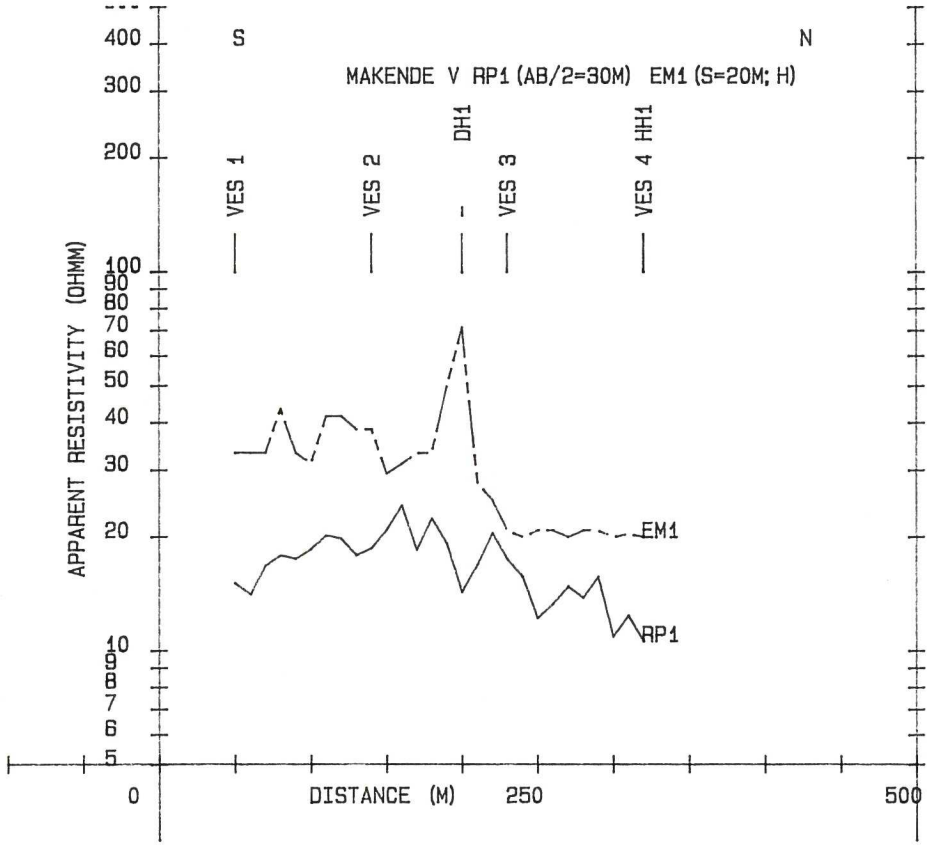
29.3


MAKENDE V 1
Ra in ohm.m --->
100
10
1
1
10
100
1000
L/2 in m --->


MAKENDE V 2
Ra in ohm.m --->
100
10
1
1
10
100
1000
L/2 in m --->


MAKENDE V 3
Ra in ohm.m --->
100
10
1
1
10
100
1000
L/2 in m --->


MAKENDE V 4
Ra in ohm.m --->
100
10
1
1
10
100
1000
L/2 in m --->


S
N
MAKENDE V RP1 (AB/2=30M) EM1 (S=20M; H)
VES 1
VES 2
DH1
VES 3
VES 4 HH1
APPARENT RESISTIVITY (OHMM)
400
300
200
100
90
80
70
60
50
40
30
20
10
9
8
7
6
5
EM1
RP1
0
DISTANCE (M)
250
500

TNO-DGV INSTITUTE OF APPLIED GEOSCIENCE

Site: Onywera Primary School

Hydrogeology

Layers	Resistivity (ohmm)	Remarks
A	80-100	Partly weathered precambrian volcanic rocks (DH)
B	7.5-10	Clay (HH)
C	20-60	Alluvial sandy clay and soil
D	-	-
E	-	-
F	-	-

Fractured zones, faults	Remarks
30 m E of VES4	Transition zone thick to thin sandy clay

Depth to groundwater table: Unknown

Groundwater quality : Fresh

(Recommended) drilled (DH) or handdug (HH) holes

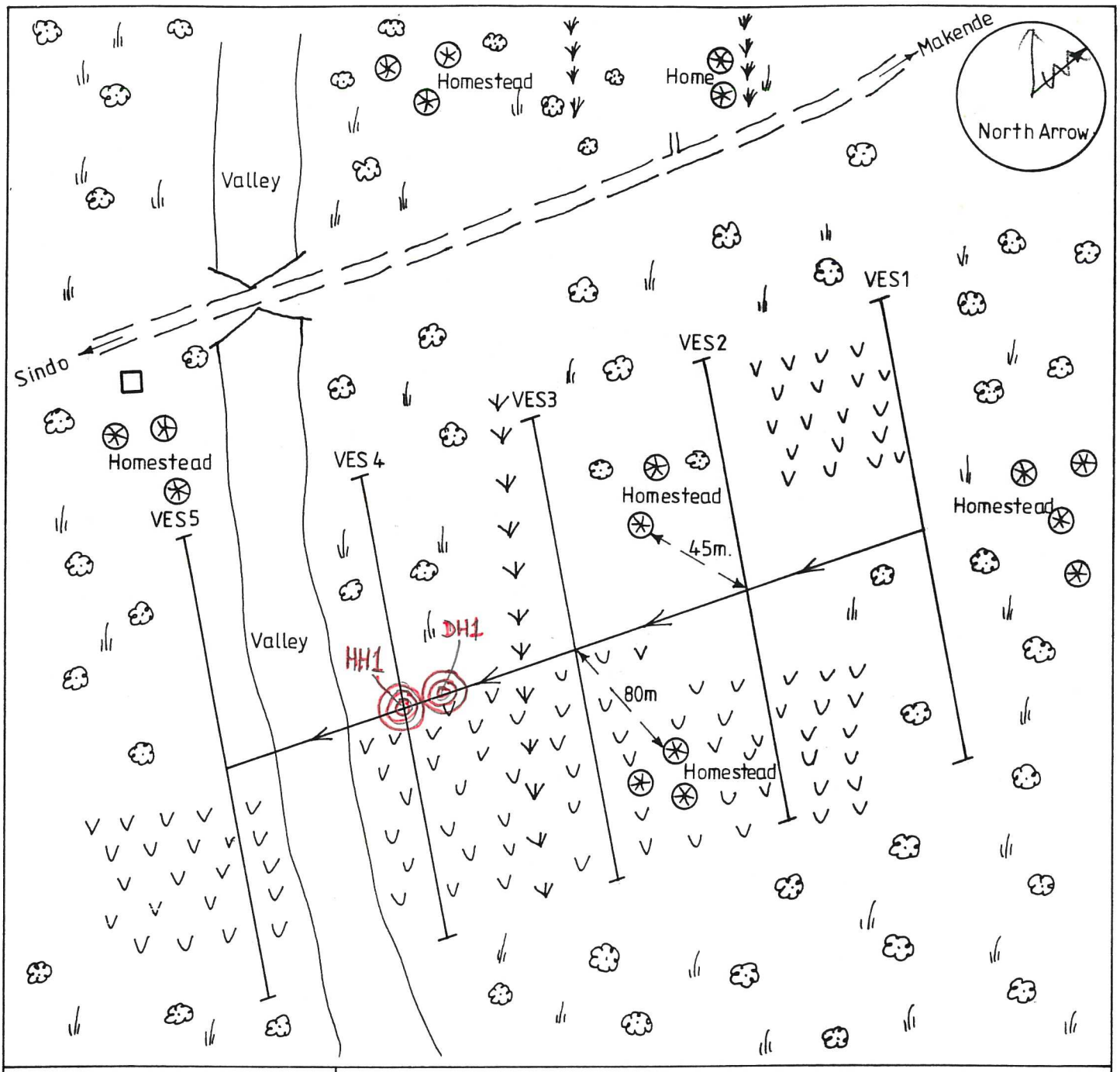
Drilled hole(s)	Remarks
DH1 (VES4,45m)	-

Handdug hole(s)	Remarks
HH1 (30 m E of VES4, 25 m)	-

ONYWERA PRIMARY SCHOOL

SOUTH NYANZA DISTRICT: MBITA DIVISION: MAP SHEET 115/3

GRID REFERENCE 634.3-9939.4



Murram road

House

Round huts

Trees

Maize shamba

Hedge

Long grass

Sisal

VES (Vertical Electric Sounding)
200m long, at 150m interval

Profile line = 600m

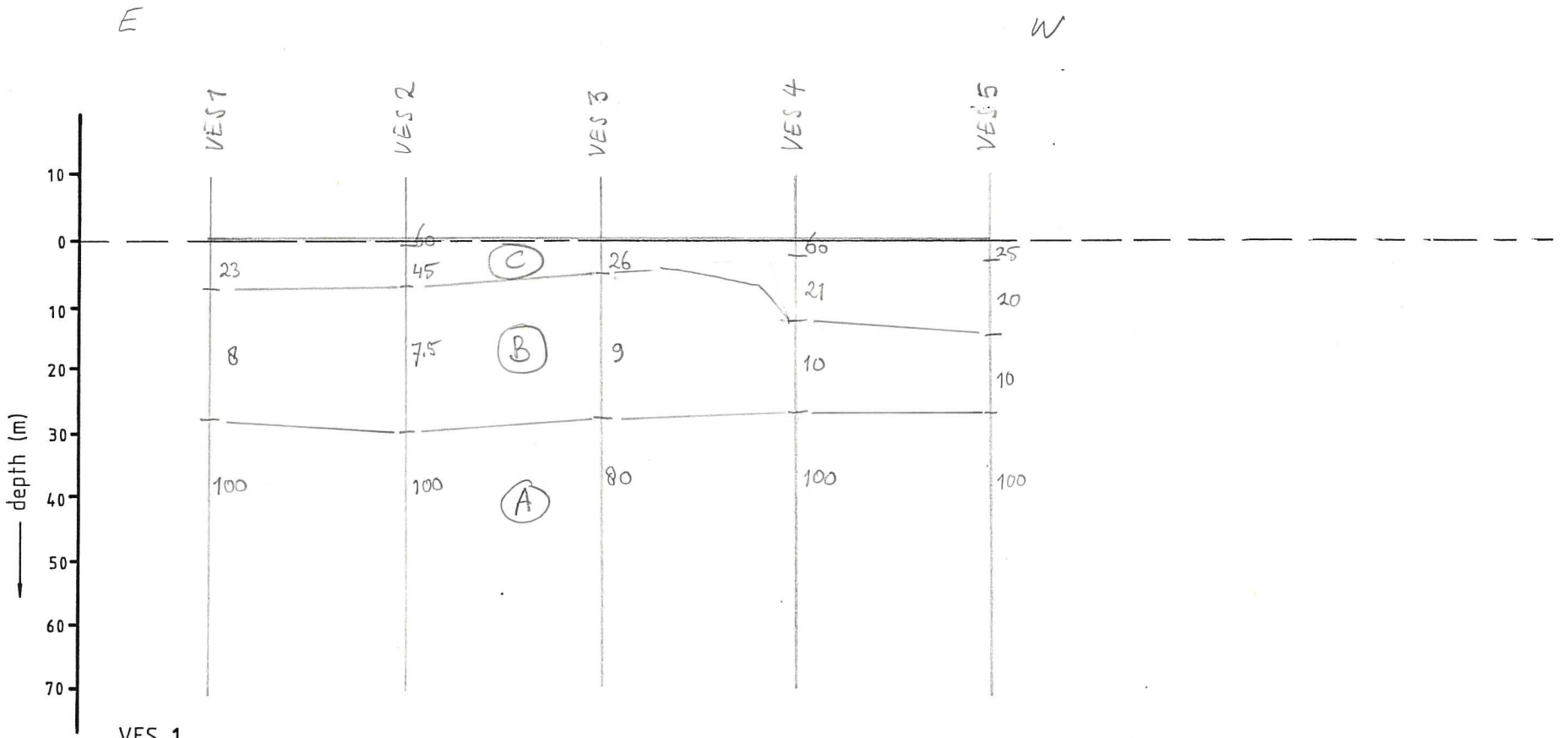
VES1 – VES2 = 0°

VES2 – VES3 = 0°

VES3 – VES4 = 0°

VES4 – VES5 = 0°

ONYWERA PRIMARY SCHOOL



VES 1

5 — Vertical Electrical Sounding, interpreted resistivity 5 ohmm

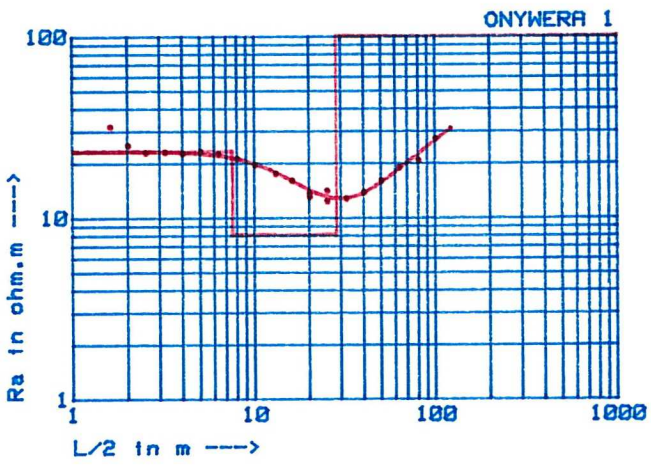
A — geo-electrical layer A

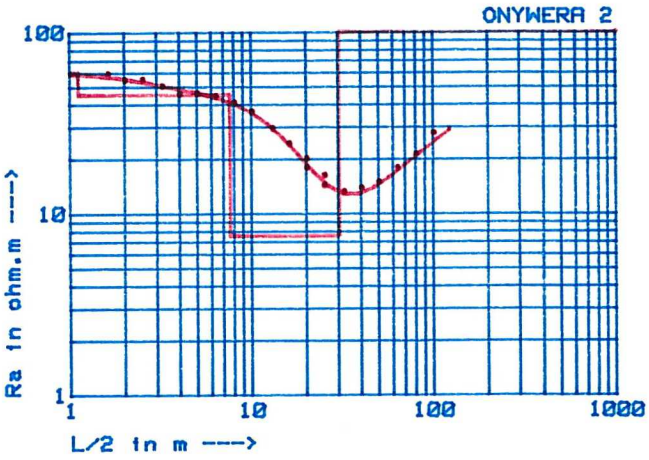
B 1 — (recommended) borehole or handdug hole

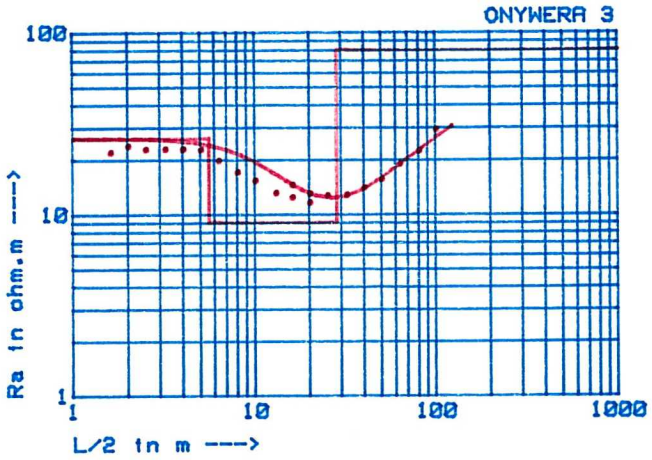
- sandy clay, cemented clay
- lateritic layer
- clay
- a — very decomposed, altered rock
- w — weathered rock
- p — partly weathered, fractured rock
- f — fresh rock

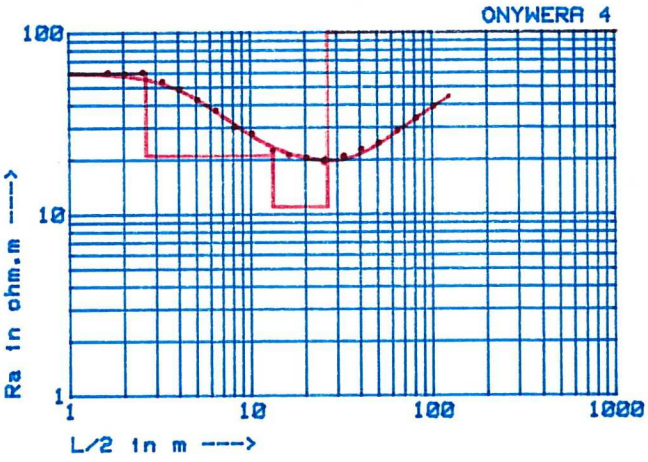
TNO-DGV Institute of Applied Geoscience	
Annex 30,3	Cross-section Onywera Pr. School
Horizontal scale 1 : 5000	Vertical scale 1 : 1000

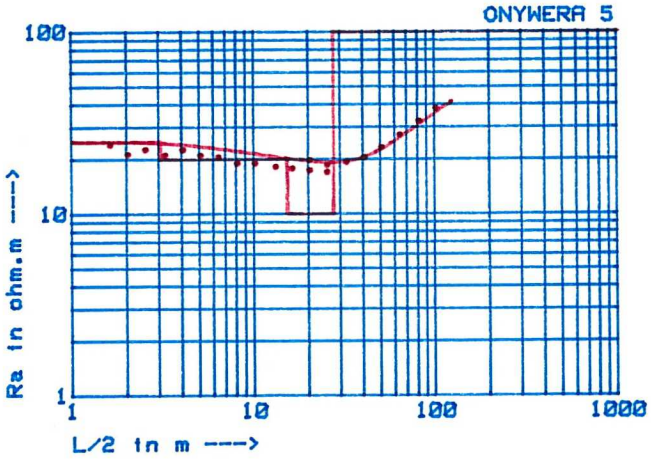
30,3

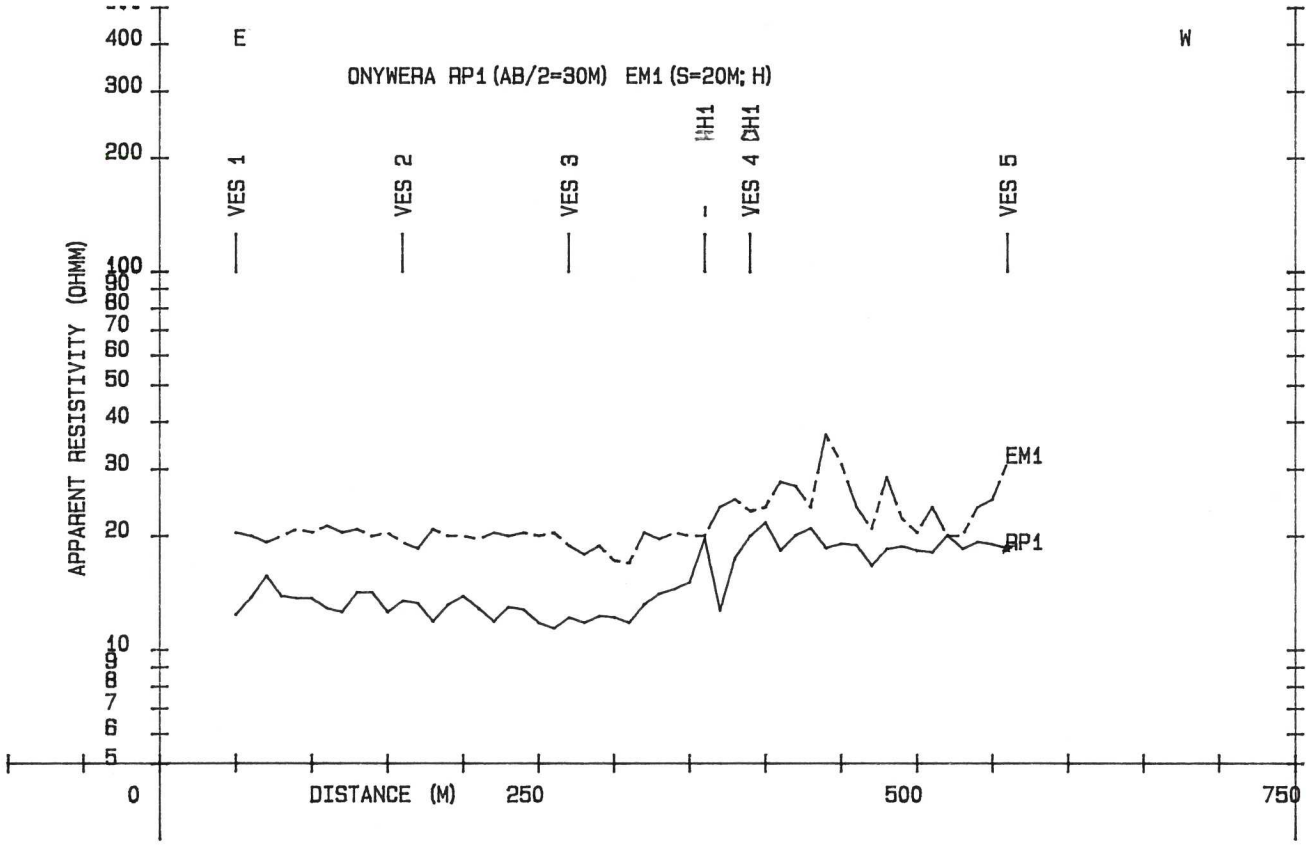

ONYWERA 1
100
10
1
Ra in ohm.m --->
1
10
100
1000
L/2 in m --->


ONYWERA 2
100
10
1
Ra in ohm.m --->
1
10
100
1000
L/2 in m --->


ONYWERA 3
100
10
1
Ra in ohm.m --->
1
10
100
1000
L/2 in m --->


ONYWERA 4
100
10
1
Ra in ohm.m --->
1
10
100
1000
L/2 in m --->


ONYWERA 5
100
10
1
Ra in ohm.m --->
1
10
100
1000
L/2 in m --->


E
W
ONYWERA RP1 (AB/2=30M) EM1 (S=20M; H)
VES 1
VES 2
VES 3
HH1
VES 4 DH1
VES 5
APPARENT RESISTIVITY (OHMM)
400
300
200
100
90
80
70
60
50
40
30
20
10
9
8
7
6
5
EM1
RP1
0
DISTANCE (M)
250
500
750

TNO-DGV INSTITUTE OF APPLIED GEOSCIENCE

Site: Ongera Village

Hydrogeology

Layers	Resistivity (ohmm)	Remarks	
A	100	Fresh rock (granite, Na)	(DH)
B	3-7.5	Clay (partly saline) (R)	(HH)
C	17-40	Sandy clayey soil	
D	-	-	
E	-	-	
F	-	-	

Fractured zones, faults	Remarks
50 m N of VES2	Fractured zone
60 m S of VES2	Fractured zone
60 m S of VES 5	Fractured zone

Depth to groundwater table: Unknown

Groundwater quality : Fresh at VES 1,2 , saline at VES3-6

(Recommended) drilled (DH) or handdug (HH) holes

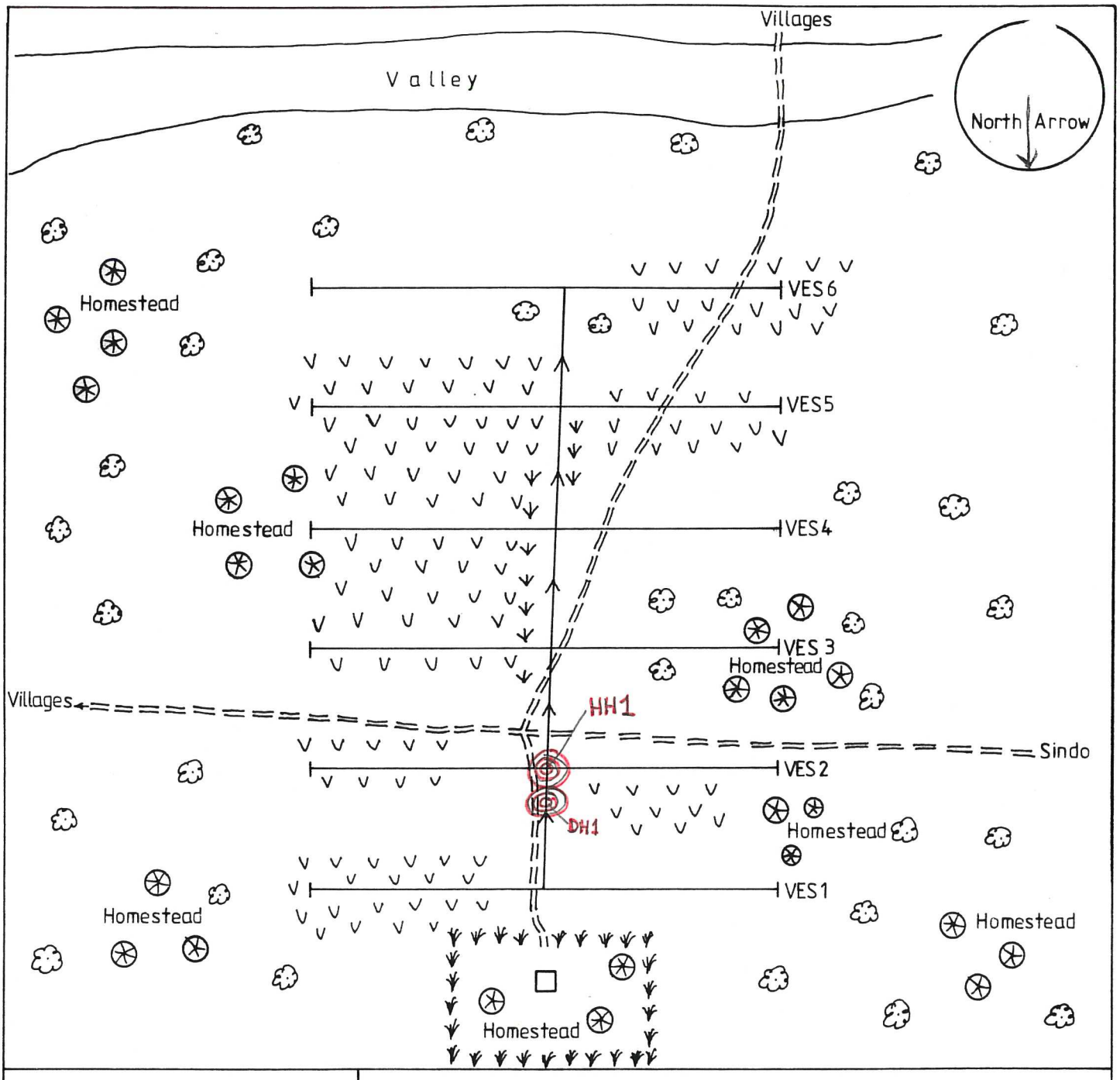
Drilled hole(s)	Remarks
DH1 (50 m N of VES2, 55 m)	-

Handdug hole(s)	Remarks
HH1 (VES2, 30 m)	-

ONGERA VILLAGE (SKETCH)

SOUTH NYANZA DISTRICT: MBITA DIVISION: MAP SHEET 115/3

GRID REFERENCE 631·9 – 9939·5



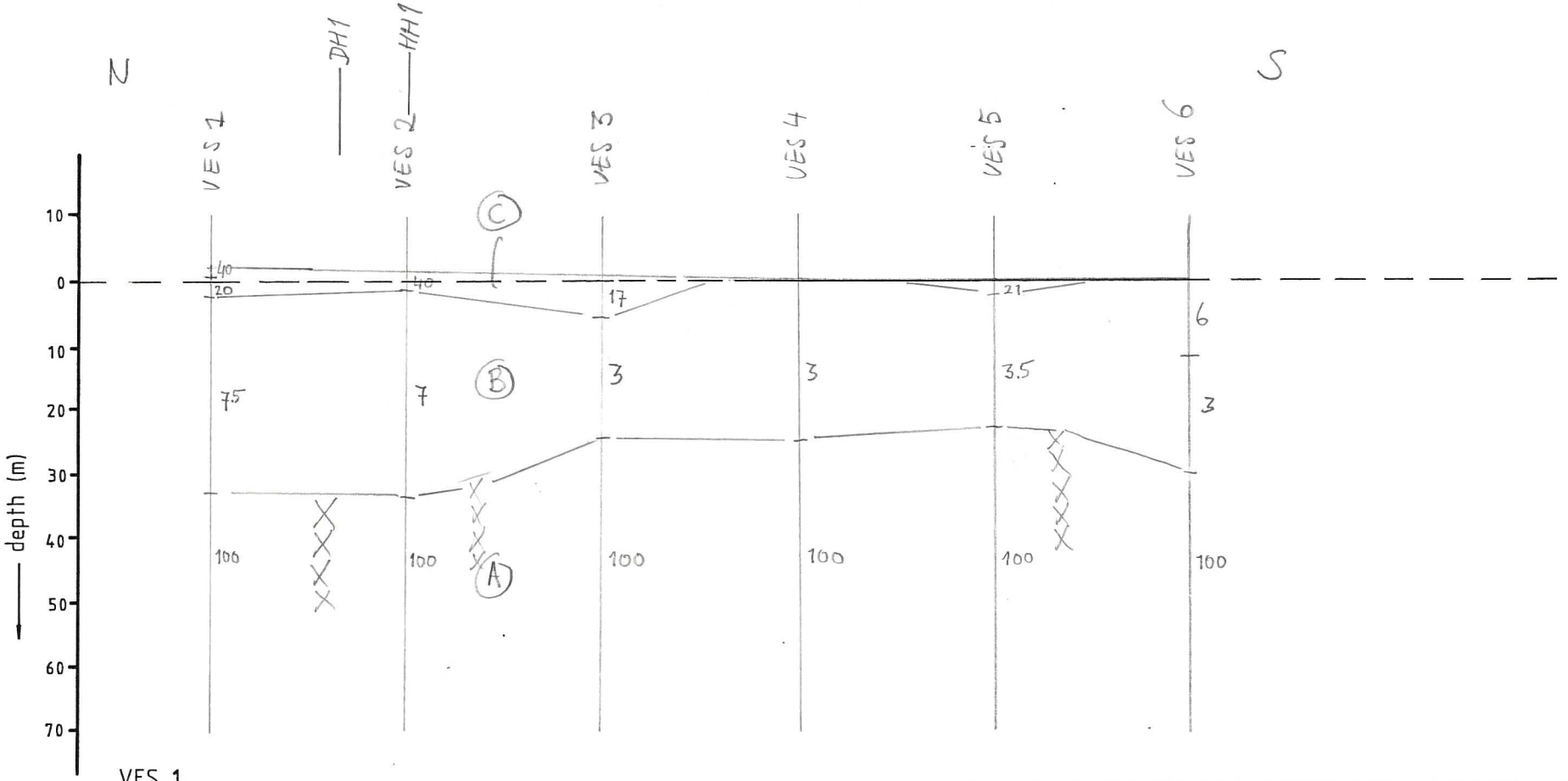
Path
House
Round huts
Trees
Maize shamba
Hedge
Sisal

VES (Vertical Electric Sounding)
200m long, at 150m interval

Profile line = 750m

Slope:
VES1 – VES2 = -1°
VES2 – VES3 = -1°
VES3 – VES4 = -1°
VES4 – VES5 = 0°
VES5 – VES6 = 0°

ONGERA VILLAGE



VES 1
5
Vertical Electrical Sounding, interpreted resistivity 5 ohmm

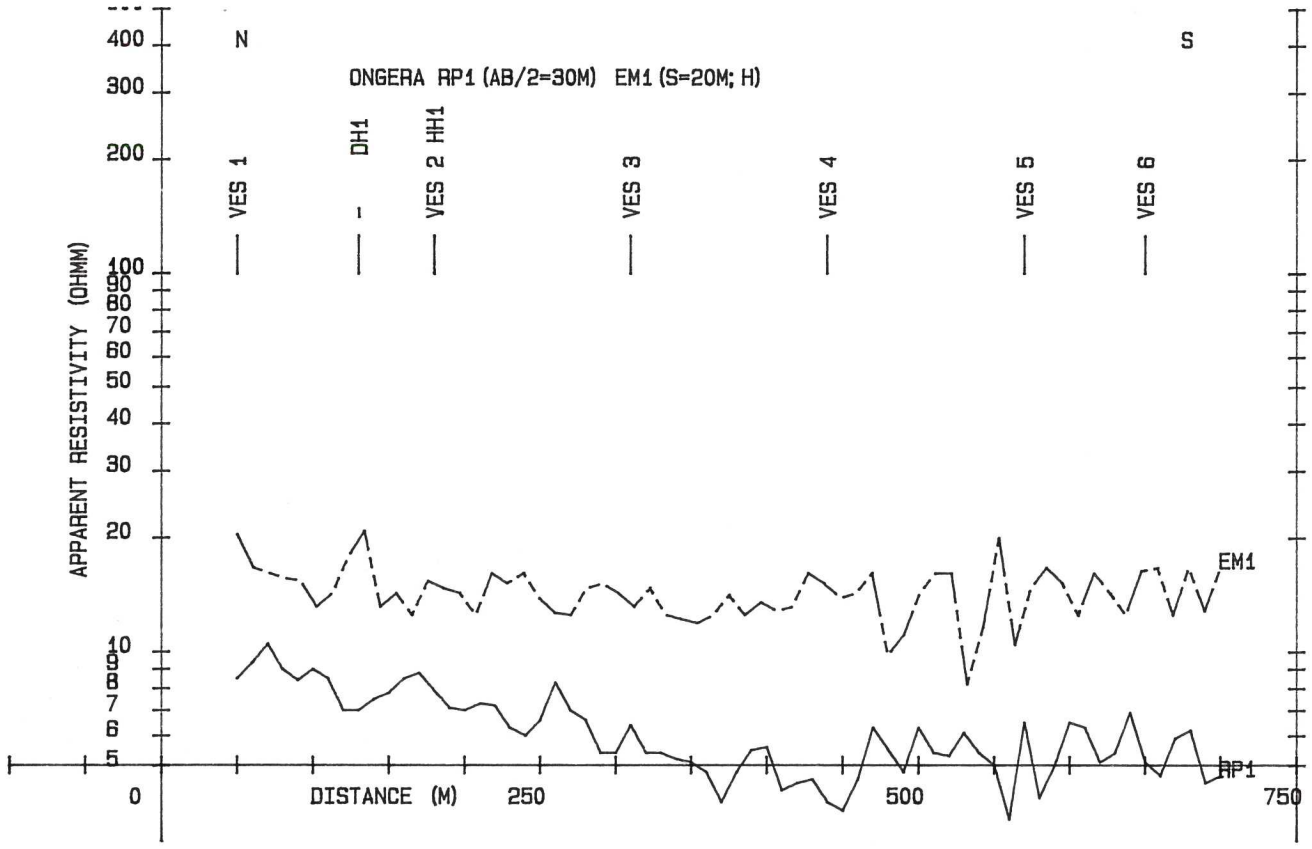
A
geo-electrical layer A

B 1
(recommended) borehole or handdug hole

- sandy clay, cemented clay
- lateritic layer
- clay
- a very decomposed, altered rock
- w weathered rock
- p partly weathered, fractured rock
- f fresh rock

TNO-DGV Institute of Applied Geoscience	
Annex 31.3	Cross-section Ongera Village
Horizontal scale 1 : 5000	Vertical scale 1 : 1000


ONGERA 1
100
10
1
Ra in ohm.m ---->
1
10
100
1000
L/2 in m ---->
ONGERA 2
100
10
1
Ra in ohm.m ---->
1
10
100
1000
L/2 in m ---->
ONGERA 3
100
10
1
Ra in ohm.m ---->
1
10
100
1000
L/2 in m ---->
ONGERA 3
100
10
1
Ra in ohm.m ---->
1
10
100
1000
L/2 in m ---->
ONGERA 4
100
10
1
Ra in ohm.m ---->
1
10
100
1000
L/2 in m ---->
ONGERA 6
100
10
1
Ra in ohm.m ---->
1
10
100
1000
L/2 in m ---->


ONGERA RP1 (AB/2=30M) EM1 (S=20M; H)
N
S
VES 1
DH1
VES 2 HH1
VES 3
VES 4
VES 5
VES 6
APPARENT RESISTIVITY (OHMM)
400
300
200
100
90
80
70
60
50
40
30
20
10
9
8
7
6
5
EM1
RP1
0
DISTANCE (M)
250
500
750

TNO-DGV INSTITUTE OF APPLIED GEOSCIENCE

Site: Game Wardens' Camp

Hydrogeology

Layers	Resistivity (ohmm)	Remarks	
A	40-100	Partly weathered volcanic rock (Tv)	(DH)
B	7.5-8	Clay (R)	(HH)
C	15-60	Sandy clay	
D	75	Lateritic soil	
E	-	-	
F	-	-	

Fractured zones, faults	Remarks
20m SW of VES3	Fault

Depth to groundwater table: Unknown

Groundwater quality : Fresh

(Recommended) drilled (DH) or handdug (HH) holes

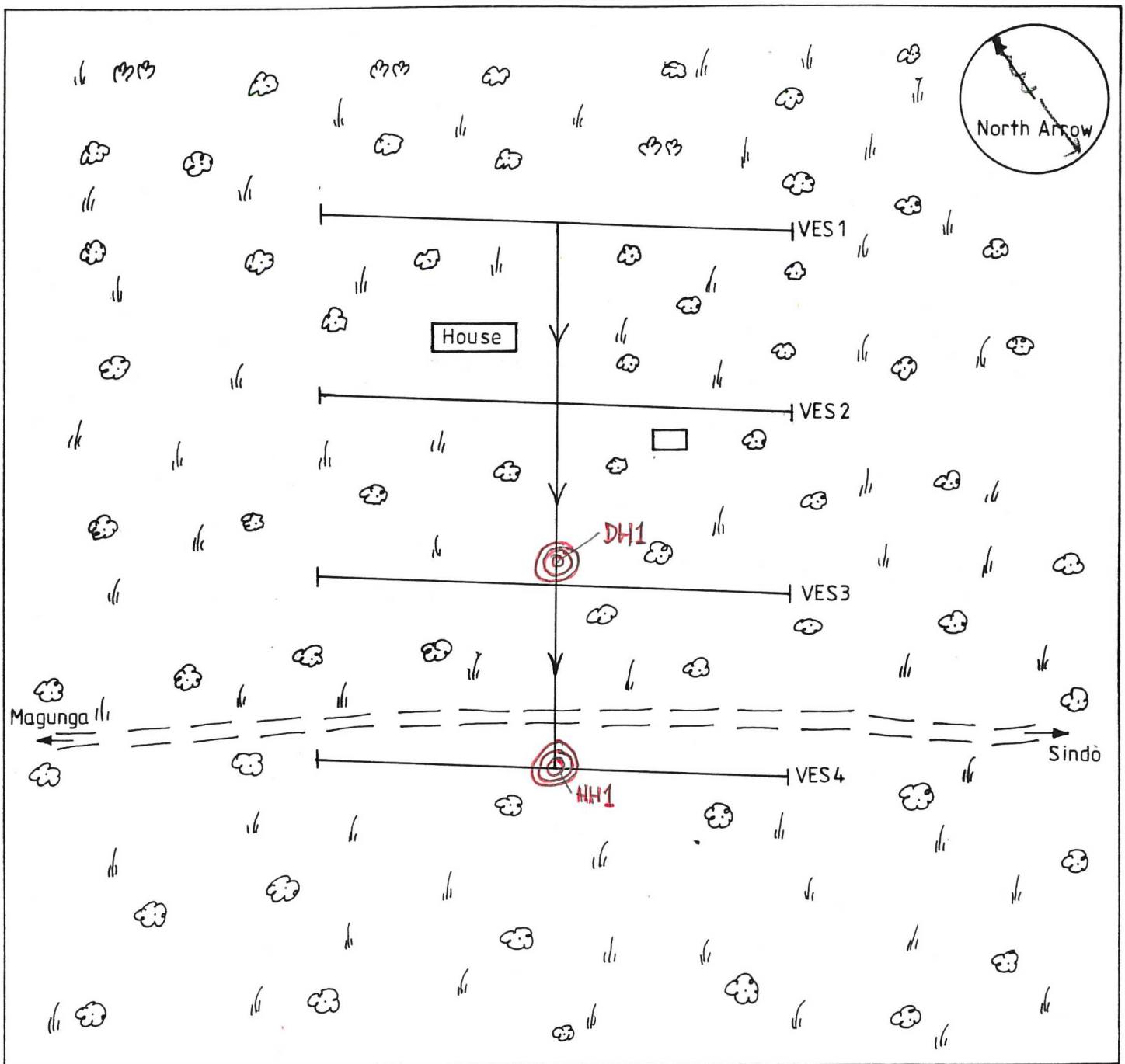
Drilled hole(s)	Remarks
DH1 (20m SW of VES3, 60)	-

Handdug hole(s)	Remarks
HH1 (VES4, 35m)	-

GAME WARDENS' CAMP (SKETCH)

SOUTH NYANZA DISTRICT: MBITA DIVISION: MAP SHEET 129/1

GRID REFERENCE 641·0-9935·9



Murram road

Game wardens' House

Trees

Shrubs

Long grass

VES (Vertical Electric Sounding)
200m long, at 100m interval

Profile line = 300m

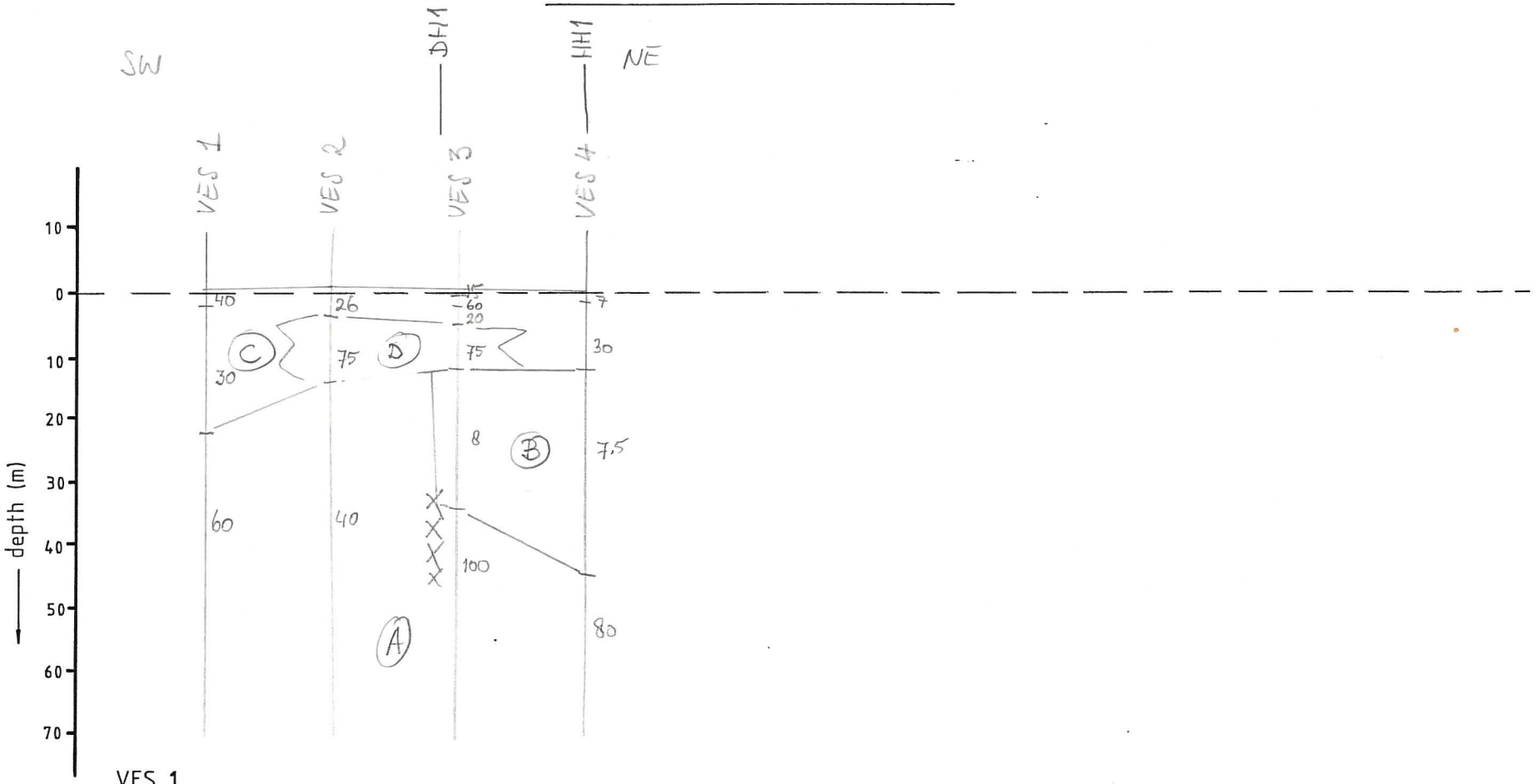
Slope

VES1–VES2 = +1°

VES2–VES3 = -1°

VES3–VES4 = -1°

GAME WARDENS' CAMP



VES 1
5
Vertical Electrical Sounding, interpreted resistivity 5 ohmm

A
geo-electrical layer A

B 1
(recommended) borehole or handdug hole

sandy clay, cemented clay

lateritic layer

clay

a very decomposed, altered rock

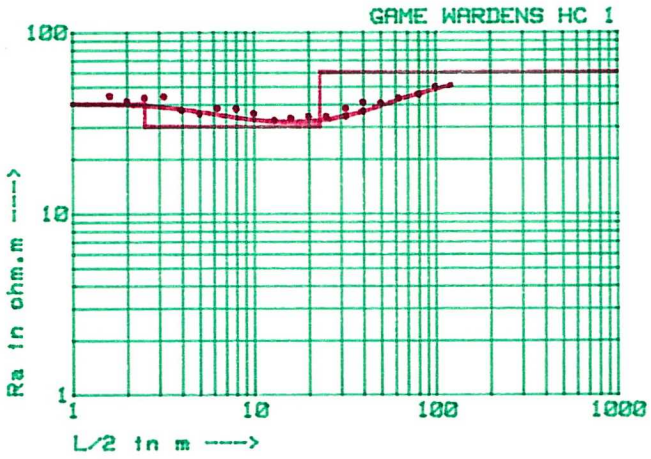
w weathered rock

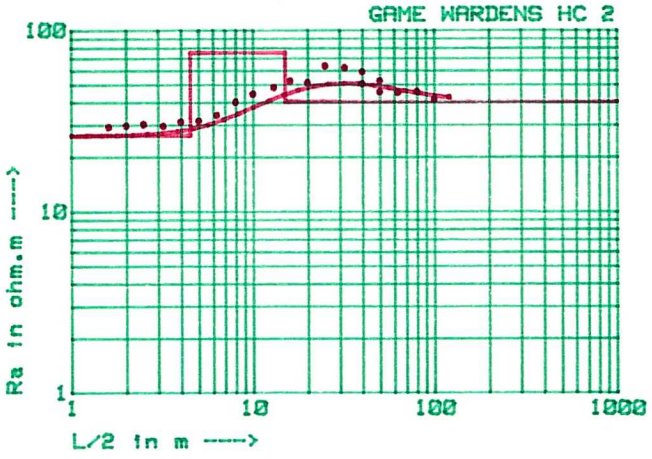
p partly weathered, fractured rock

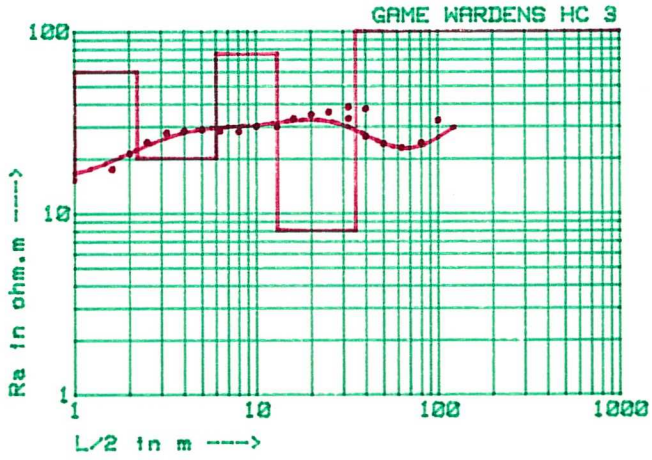
f fresh rock

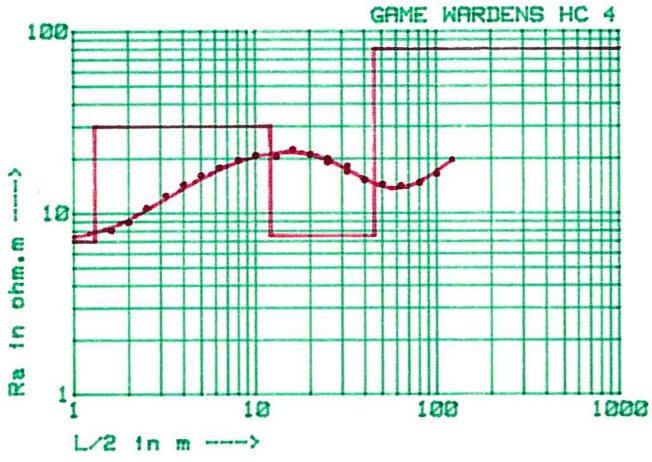
TNO-DGV Institute of Applied Geoscience	
Annex 32.2	Cross-section Game Wardens' Camp
Horizontal scale 1 : 5000	Vertical scale 1 : 1000

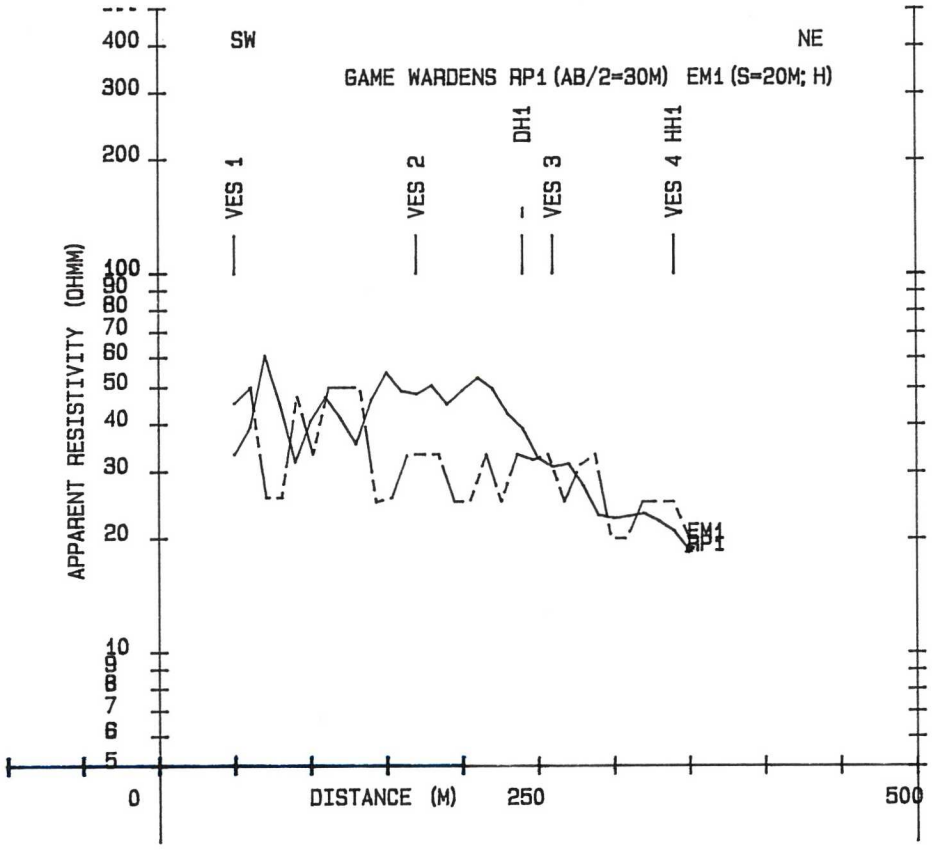
32.2


GAME WARDENS HC 1
Ra in ohm.m ---->
L/2 in m ---->
100
10
1
1
10
100
1000


GAME WARDENS HC 2
Ra in ohm.m ---->
L/2 in m ---->
100
10
1
1
10
100
1000


GAME WARDENS HC 3
Ra in ohm.m ---->
L/2 in m ---->
100
10
1
1
10
100
1000


GAME WARDENS HC 4
Ra in ohm.m ---->
L/2 in m ---->
100
10
1
1
10
100
1000


SW
NE
GAME WARDENS RP1 (AB/2=30M) EM1 (S=20M; H)
VES 1
VES 2
DH1
VES 3
VES 4 HH1
APPARENT RESISTIVITY (OHMM)
400
300
200
100
90
80
70
60
50
40
30
20
10
9
8
7
6
5
EM1
RP1
0
DISTANCE (M)
250
500

TNO-DGV INSTITUTE OF APPLIED GEOSCIENCE

Site: Makende Ministers' Home

Hydrogeology

Layers	Resistivity (ohmm)	Remarks	
A	60-100	Partly weathered volcanics (Tv)	(DH1)
B	23-45	Sandy clay	
C	-	-	
D	-	-	
E	-	-	
F	-	-	

Fractured zones, faults	Remarks
30m W of VES2	Fractured fault

Depth to groundwater table: Unknown

Groundwater quality : Fresh

(Recommended) drilled (DH) or handdug (HH) holes

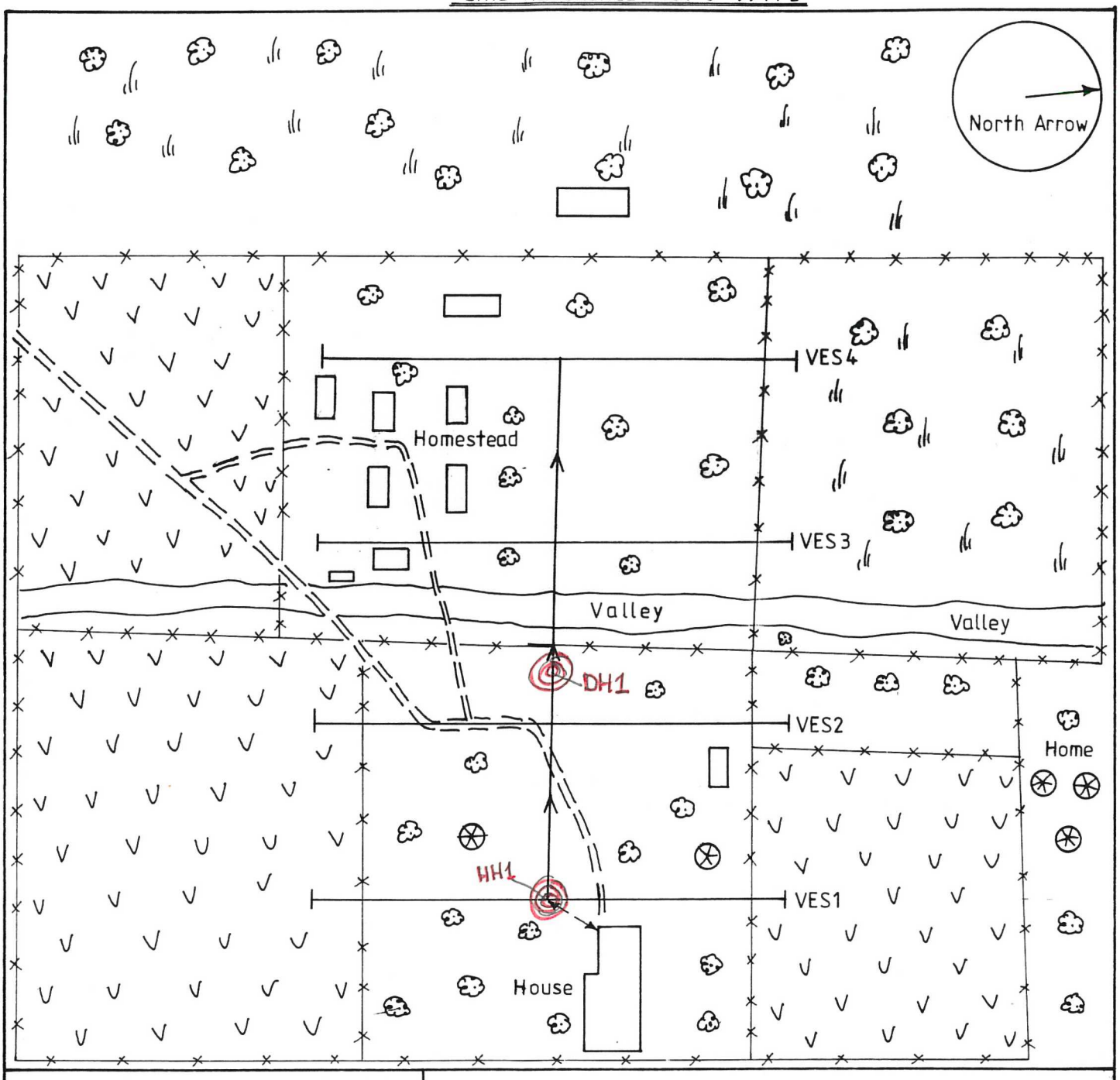
Drilled hole(s)	Remarks
DH1 (30m W of VES2, 40m)	-

Handdug hole(s)	Remarks
HH1 (VES1, 25m)	-

MAKENDE MINISTER'S HOME (SKETCH)

SOUTH NYANZA DISTRICT: MBITA DIVISION: MAP SHEET 129/1

GRID REFERENCE 637.8-9941.2



Small murram road

Houses

Round huts

Trees

Wire fence

Maize shamba

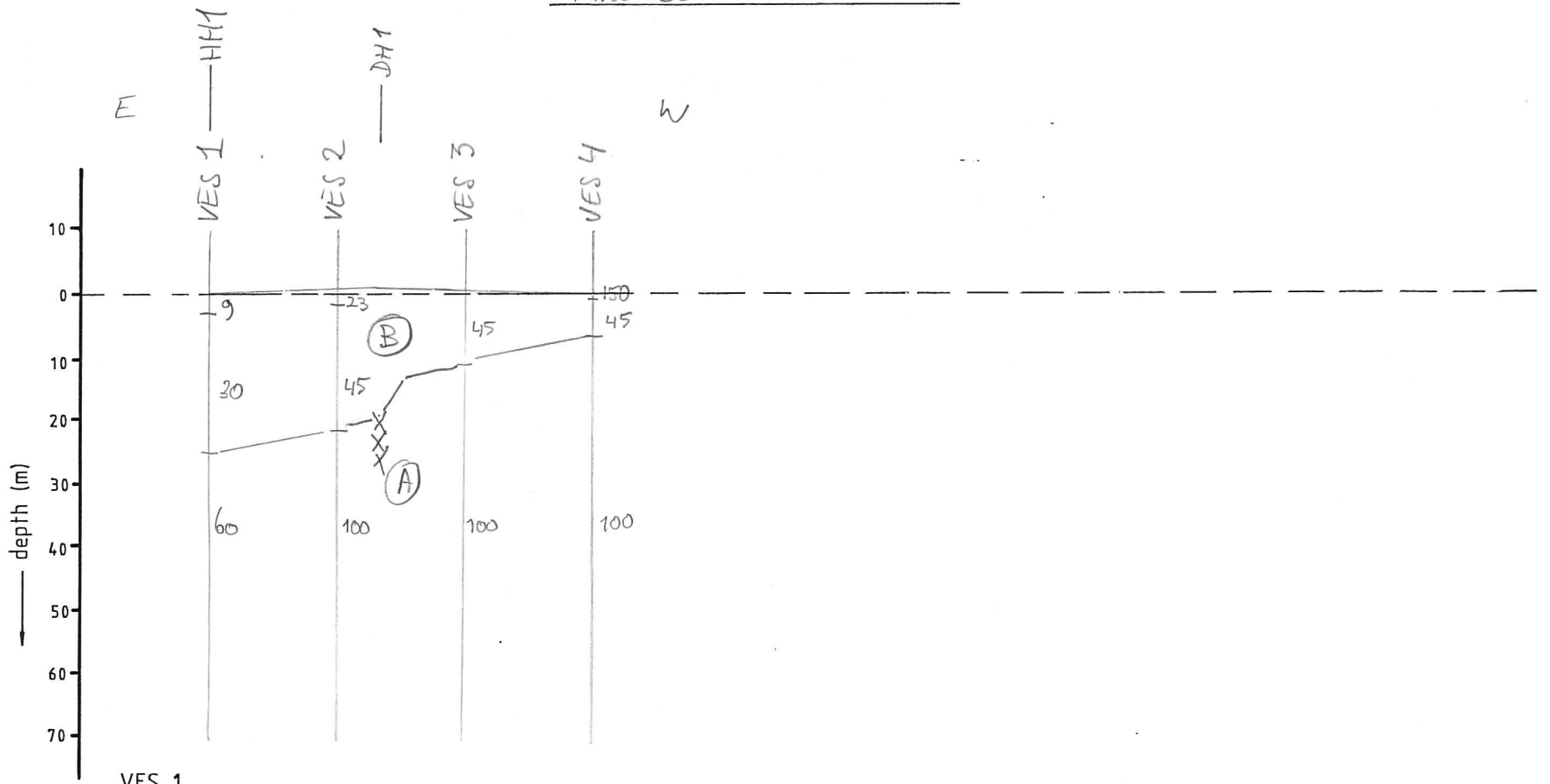
Long grass

VES (Vertical Electric Sounding)
200m long, at 100m interval

Profile line = 300m

Slope:
VES1 — VES2 = +1°
VES2 — 30m. = +1°
30m. — VES3 = −1°
VES3 — VES4 = −1°

MAKENDE MINISTERS' HOME



VES 1
5
Vertical Electrical Sounding, interpreted resistivity 5 ohmm

A
geo-electrical layer A

B 1
(recommended) borehole or handdug hole

sandy clay, cemented clay

lateritic layer

clay

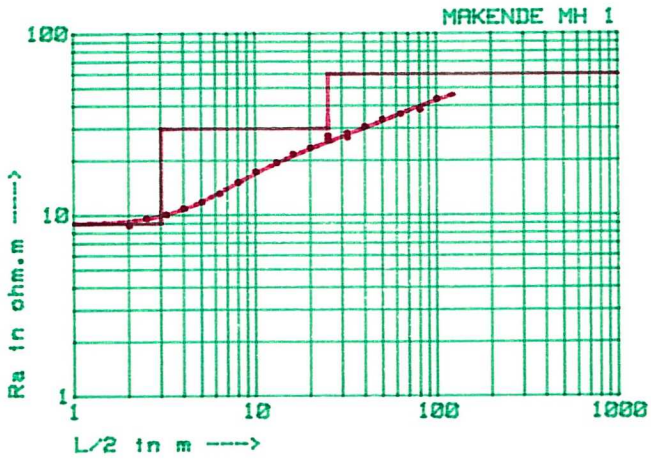
a very decomposed, altered rock

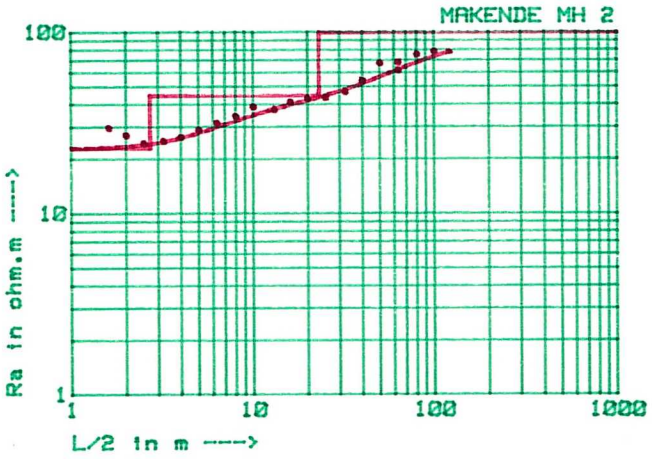
w weathered rock

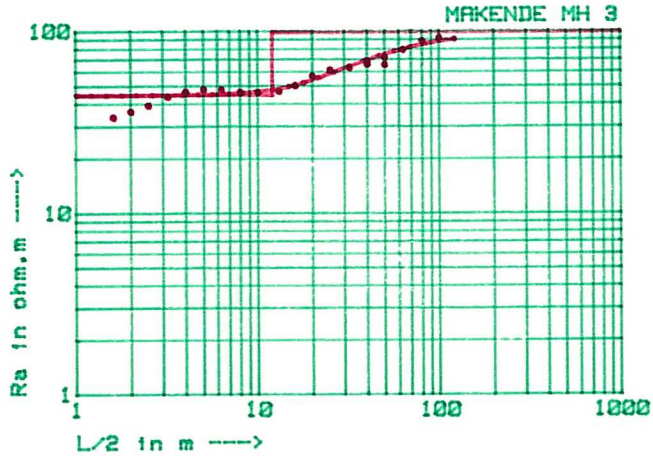
p partly weathered, fractured rock

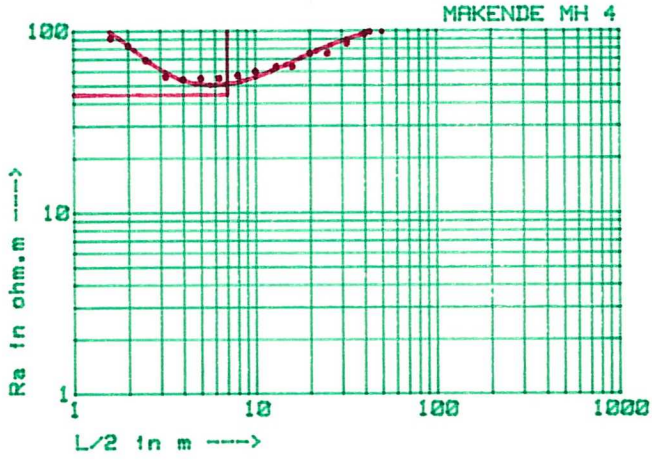
f fresh rock

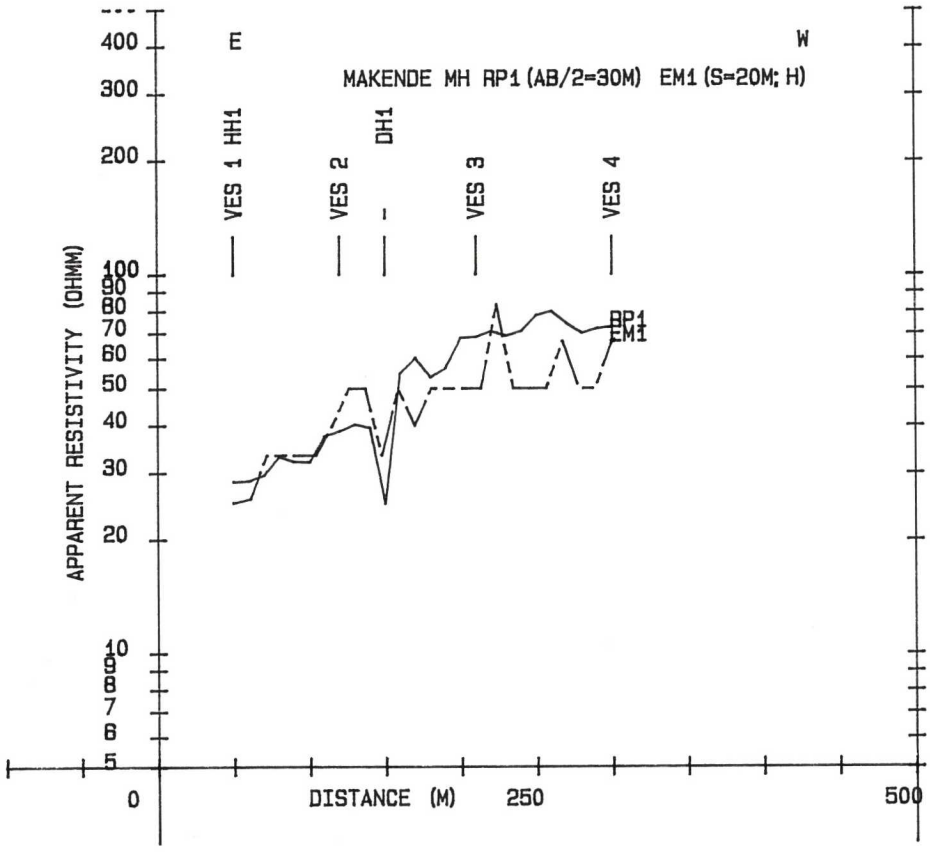
TNO-DGV Institute of Applied Geoscience	
Annex 33.3	Cross-section Makende Ministers' Home
Horizontal scale 1 : 5000	Vertical scale 1 : 1000


MAKENDE MH 1
100
10
1
Ra in ohm.m ---->
1
10
100
1000
L/2 in m --->


MAKENDE MH 2
100
10
1
Ra in ohm.m ---->
1
10
100
1000
L/2 in m ---->


MAKENDE MH 3
100
10
1
Ra in ohm.m ---->
1
10
100
1000
L/2 in m ---->


MAKENDE MH 4
100
10
1
Ra in ohm.m ---->
1
10
100
1000
L/2 in m ---->


E
W
MAKENDE MH RP1 (AB/2=30M) EM1 (S=20M; H)
VES 1 HH1
VES 2
DH1
VES 3
VES 4
RP1
EM1
APPARENT RESISTIVITY (OHMM)
400
300
200
100
90
80
70
60
50
40
30
20
10
9
8
7
6
5
0
DISTANCE (M)
250
500

TNO-DGV INSTITUTE OF APPLIED GEOSCIENCE

Site: National Youth Centre

Hydrogeology

Layers	Resistivity (ohmm)	Remarks	
A	10-32	Decomposed volcanic rock or sandy clay (TV)	(DH)
B	3.5-9	Clay (partly saline)	(HH)
C	-	-	
D	-	-	
E	-	-	
F	-	-	

Fractured zones, faults	Remarks
40m SW of VES2	Fractured zone

Depth to groundwater table: Unknown

Groundwater quality : Fresh at VES1 and 5, saline at VES2, 3, 4

(Recommended) drilled (DH) or handdug (HH) holes

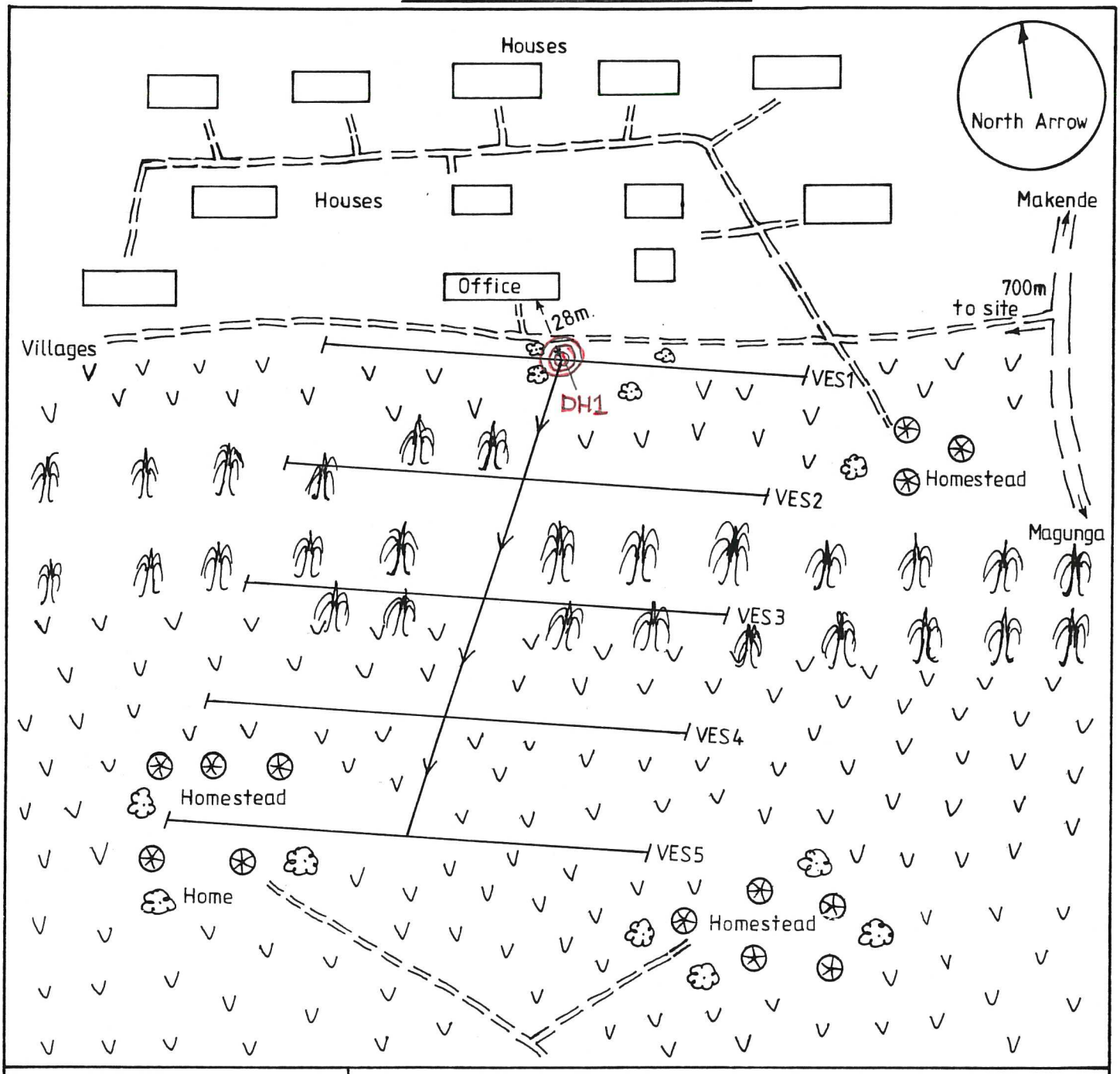
Drilled hole(s)	Remarks
DH1 (VES1, 30m)	-

Handdug hole(s)	Remarks
-	-

NATIONAL YOUTH CENTRE (SKETCH)

SOUTH NYANZA DISTRICT: MBITA DIVISION: MAP SHEET 129/1

GRID REFERENCE 640·3 – 9947·9



Murram road
Path
Houses
Trees
Round huts
Maize shamba
Bananas

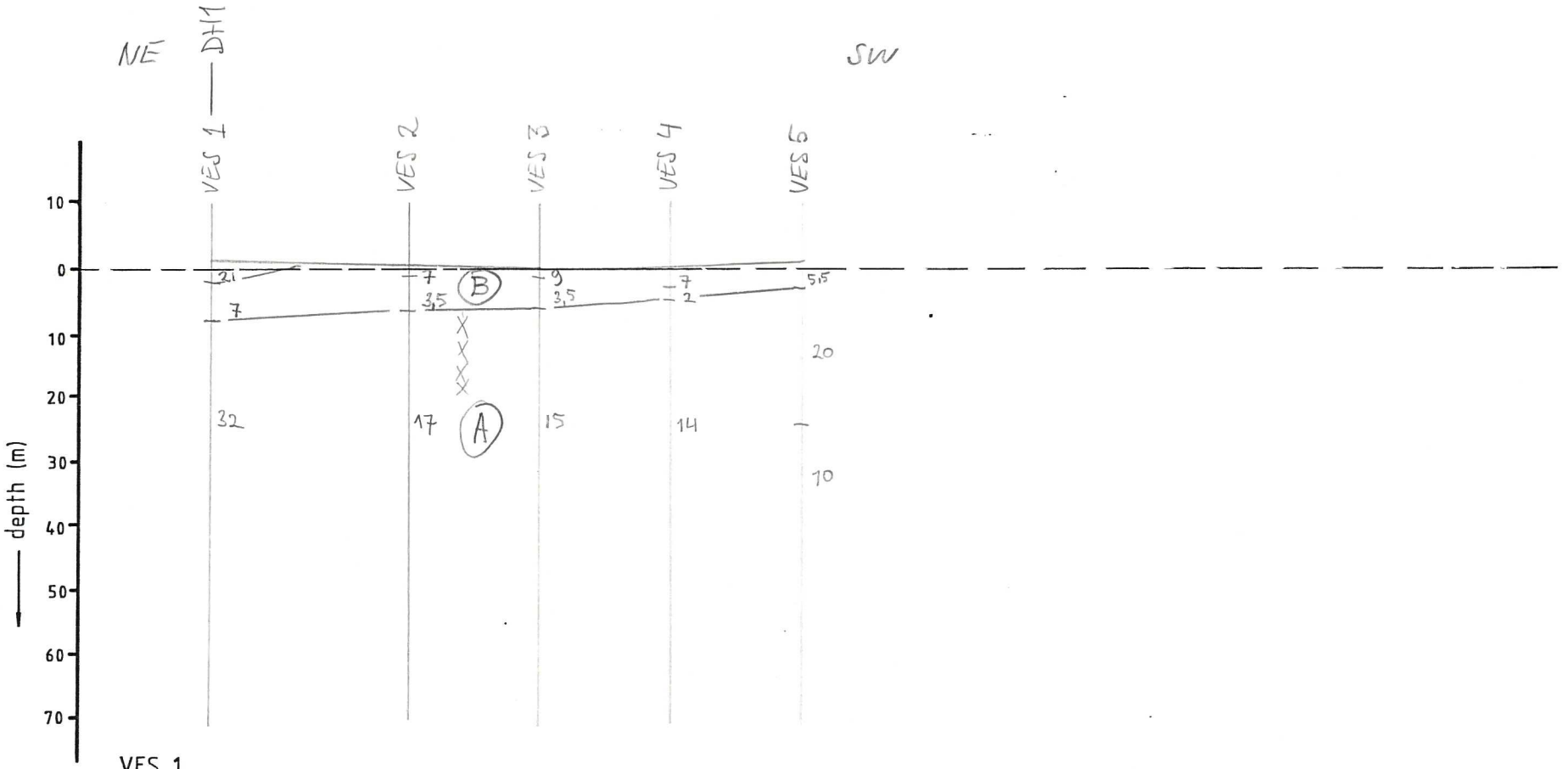
VES (Vertical Electric Sounding)
200m. long, at 100m interval except VES1&2 = 150m

Profile line = 390m

Slope

VES1 – VES 2 = + 1°
VES2 – VES3 = + 1°
VES3 – VES4 = – 1°
VES4 – VES5 = – 1°

NATIONAL YOUTH CENTRE



VES 1
5
Vertical Electrical Sounding, interpreted resistivity 5 ohmm

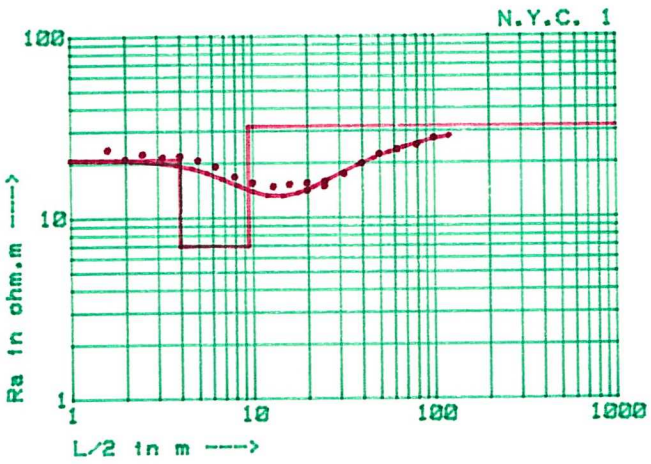
A
geo-electrical layer A

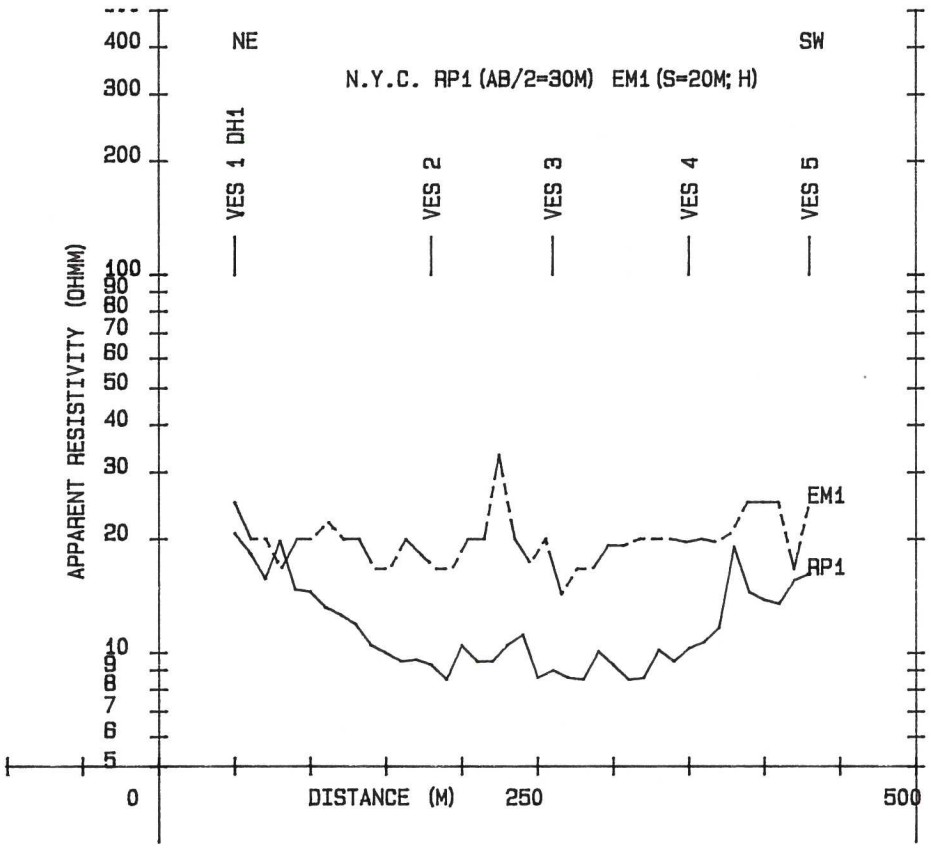
B 1
(recommended) borehole or handdug hole

- sandy clay, cemented clay
- lateritic layer
- clay
- a very decomposed, altered rock
- w weathered rock
- p partly weathered, fractured rock
- f fresh rock

TNO-DGV Institute of Applied Geoscience	
Annex 34.3	Cross-section National Youth Centre
Horizontal scale 1 : 5000	Vertical scale 1 : 1000

34.3


N.Y.C. 1
100
10
1
Ra in ohm.m ---->
1
10
100
1000
L/2 in m ---->
N.Y.C. 2
100
10
1
Ra in ohm.m ---->
1
10
100
1000
L/2 in m ---->
N.Y.C. 3
100
10
1
Ra in ohm.m ---->
1
10
100
1000
L/2 in m ---->
N.Y.C. 4
100
10
1
Ra in ohm.m ---->
1
10
100
1000
L/2 in m ---->
N.Y.C. 5
100
10
1
Ra in ohm.m ---->
1
10
100
1000
L/2 in m ---->


NE
SW
N.Y.C. RP1 (AB/2=30M) EM1 (S=20M; H)
VES 1 DH1
VES 2
VES 3
VES 4
VES 5
APPARENT RESISTIVITY (OHMM)
400
300
200
100
90
80
70
60
50
40
30
20
10
9
8
7
6
5
EM1
RP1
0
DISTANCE (M)
250
500

TNO-DGV INSTITUTE OF APPLIED GEOSCIENCE

Site: Wiga Village

Hydrogeology

Layers	Resistivity (ohmm)	Remarks		
A	30-50	Weathered volcanic rock	(Tv)	(DH)
B	10	Clay	(R)	(HH)
C	28-30	Sandy clay, hard layer	(R)	
D	5-7.5	Clayey soil		
E	-	-		
F	-	-		

Fractured zones, faults	Remarks
20m SE of VES2	Fault

Depth to groundwater table: Unknown

Groundwater quality : Fresh

(Recommended) drilled (DH) or handdug (HH) holes

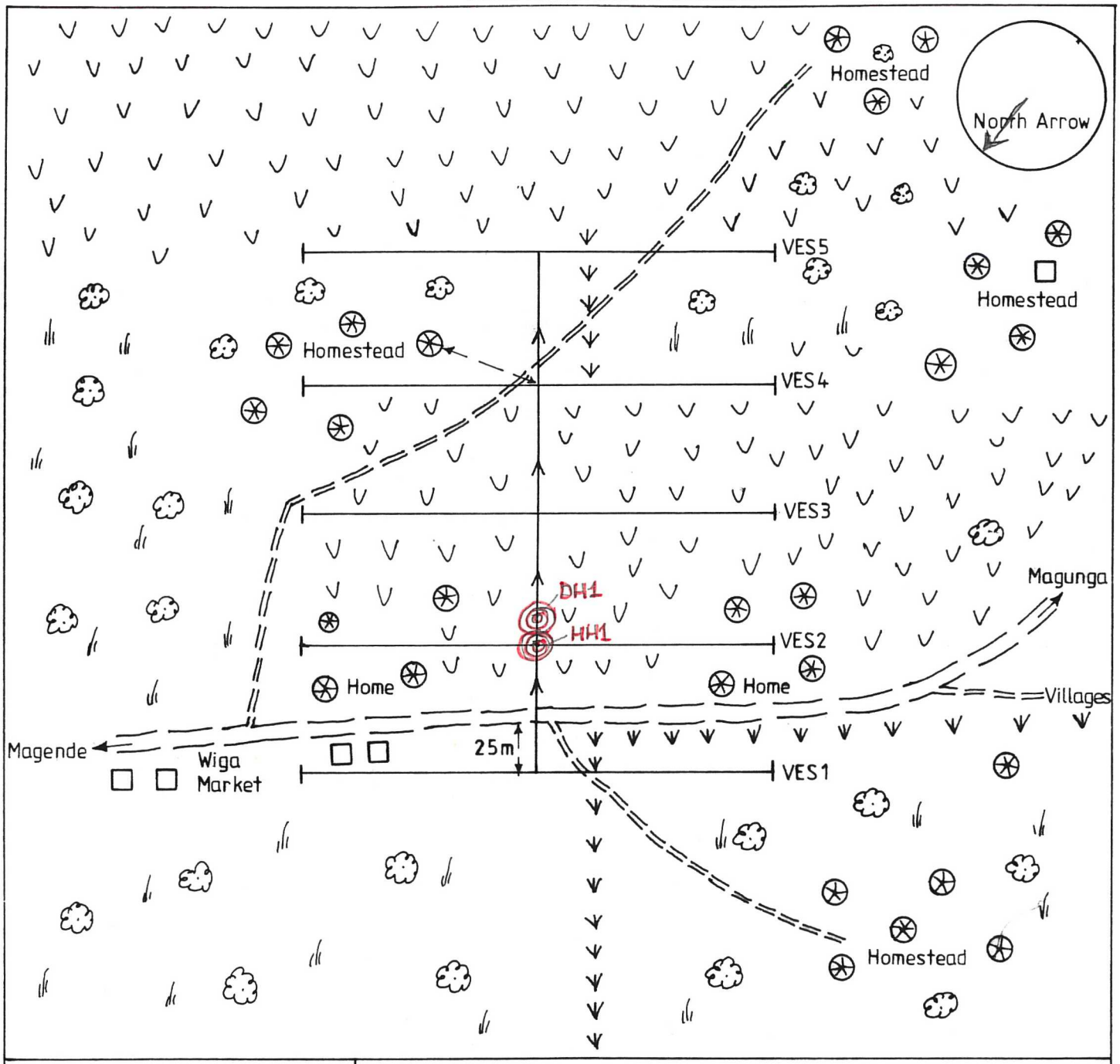
Drilled hole(s)	Remarks
DH1 (20m SE of VES2, 60m)	-

Handdug hole(s)	Remarks
HH1 (VES 2, 25m)	-

WIGA VILLAGE (SKETCH)

SOUTH NYANZA DISTRICT: MBITA DIVISION: MAP SHEET 129/1

GRID REFERENCE 634·0 – 9925·4



Murram road

Path

Shops

Round huts

Trees

Maize shamba

Long grass

Sisal

VES (Vertical Electric Sounding)
200m long, at 100m interval

Profile line = 400 m

Slope:

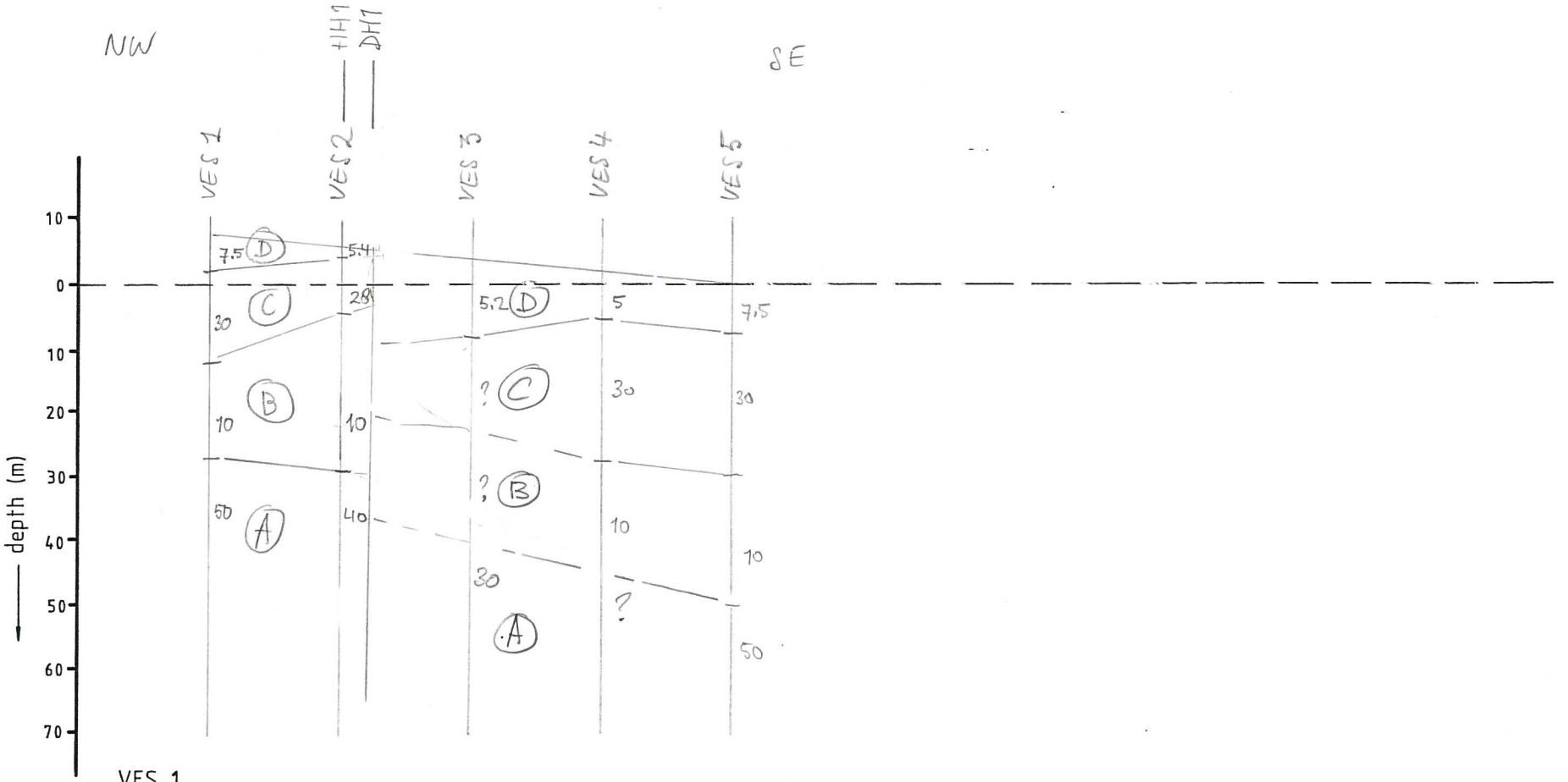
VES1 – VES2 = -5°

VES2 – VES3 = -5°

VES3 – VES4 = -5°

VES4 – VES5 = -5°

WIGA VILLAGE



VES 1

5 — Vertical Electrical Sounding, interpreted resistivity 5 ohmm

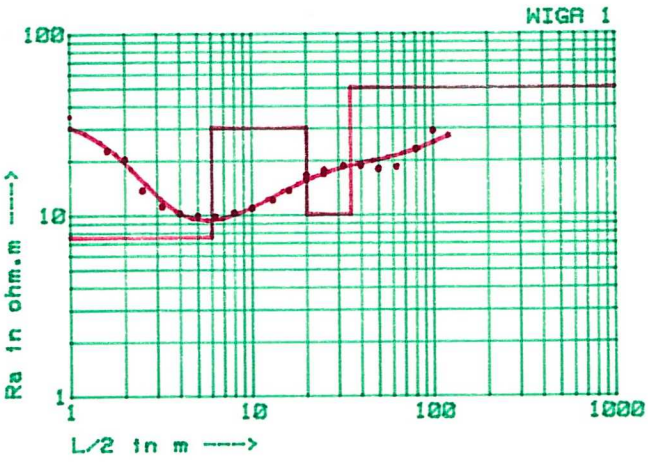
A — geo-electrical layer A

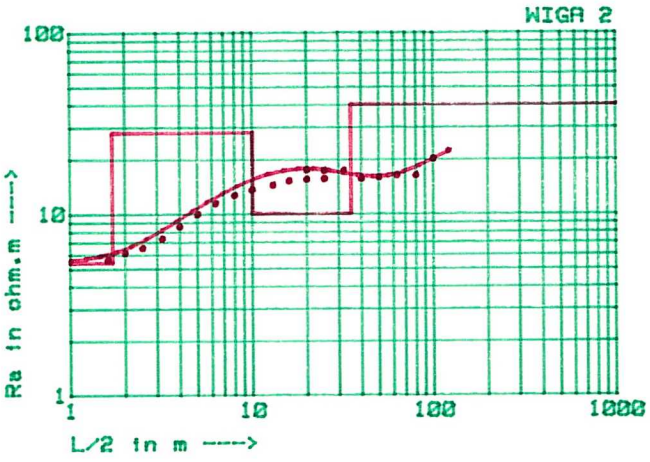
B 1 — (recommended) borehole or handdug hole

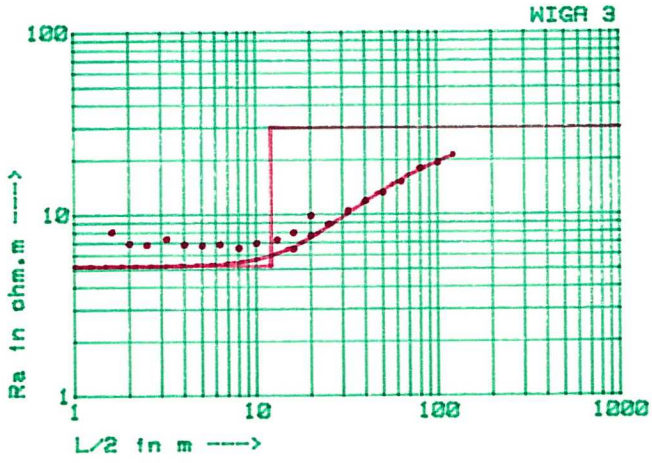
- sandy clay, cemented clay
- lateritic layer
- clay
- a — very decomposed, altered rock
- w — weathered rock
- p — partly weathered, fractured rock
- f — fresh rock

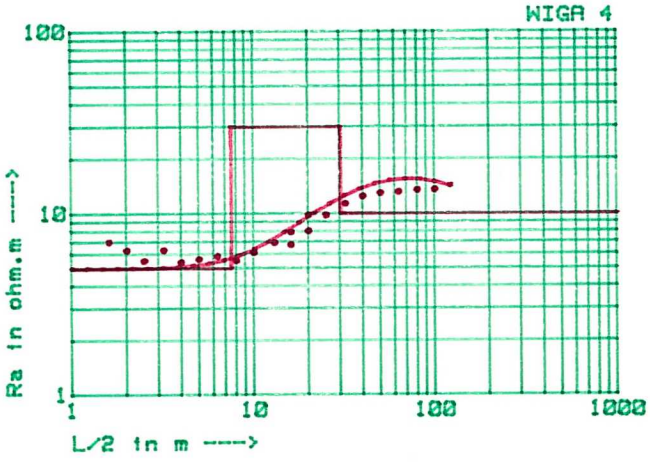
TNO - DGV Institute of Applied Geoscience	
Annex 35,3	Cross-section Wiga Village
Horizontal scale 1 : 5000	Vertical scale 1 : 1000

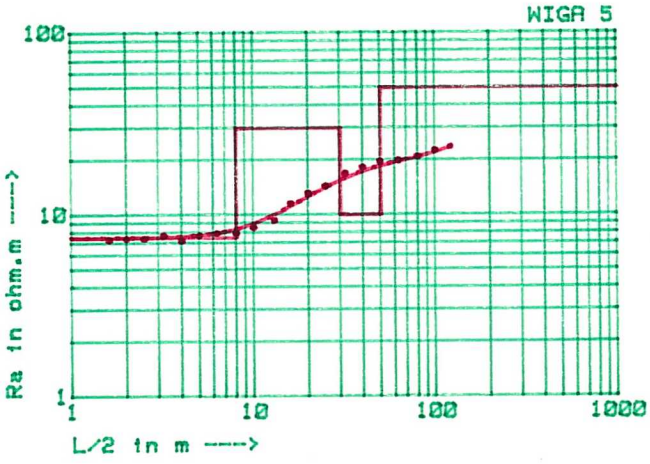
35,3

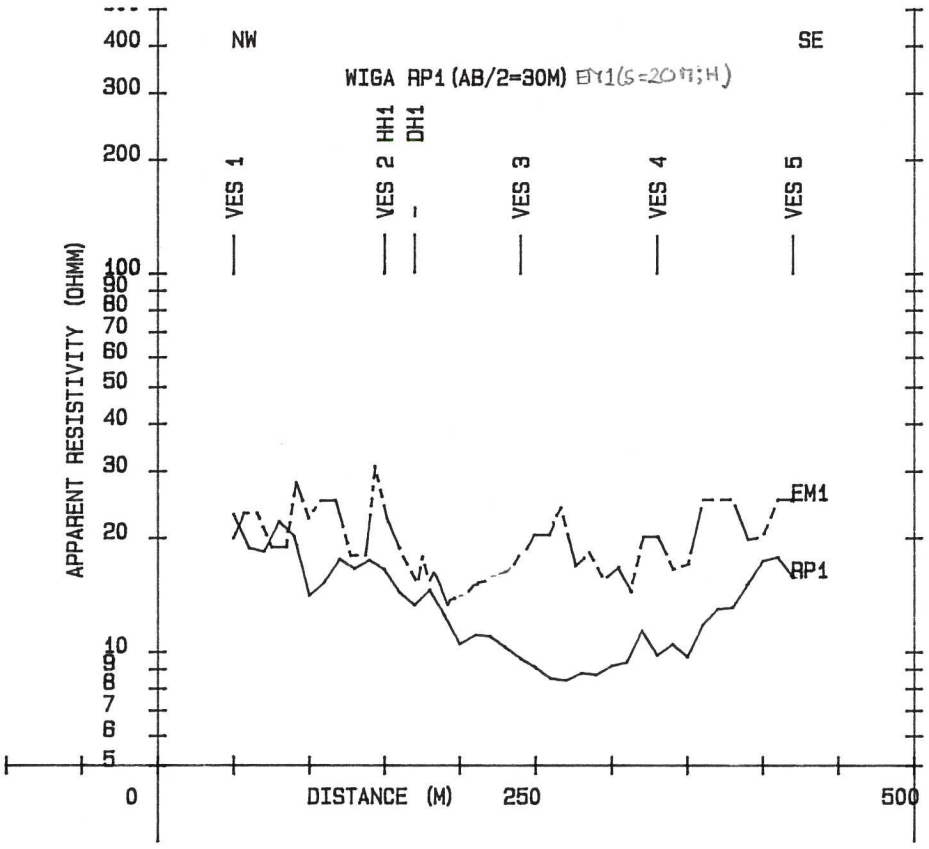

WIGA 1
100
10
1
Ra in ohm.m ---->
1
10
100
1000
L/2 in m ---->


WIGA 2
100
10
1
Ra in ohm.m ---->
1
10
100
1000
L/2 in m ---->


WIGA 3
100
10
1
Ra in ohm.m ---->
1
10
100
1000
L/2 in m ---->


WIGA 4
100
10
1
Ra in ohm.m ---->
1
10
100
1000
L/2 in m ---->


WIGA 5
100
10
1
Ra in ohm.m ---->
1
10
100
1000
L/2 in m ---->


NW
SE
WIGA RP1 (AB/2=30M) EM1(S=20M;H)
VES 1
VES 2
HH1
DH1
VES 3
VES 4
VES 5
APPARENT RESISTIVITY (OHMM)
400
300
200
100
90
80
70
60
50
40
30
20
10
9
8
7
6
5
EM1
RP1
0
DISTANCE (M)
250
500

TNO-DGV INSTITUTE OF APPLIED GEOSCIENCE

Site: Kigoto Village

Hydrogeology

Layers	Resistivity (ohmm)	Remarks	
A	32-55	Weathered volcanic rock (Tv)	(DH)
B	5	Clay	
C	7-30	Sandy clay	
D	-	-	
E	-	-	
F	-	-	

Fractured zones, faults	Remarks
25m S of VES3	Fractured zone

Depth to groundwater table: Unknown

Groundwater quality : Fresh

(Recommended) drilled (DH) or handdug (HH) holes

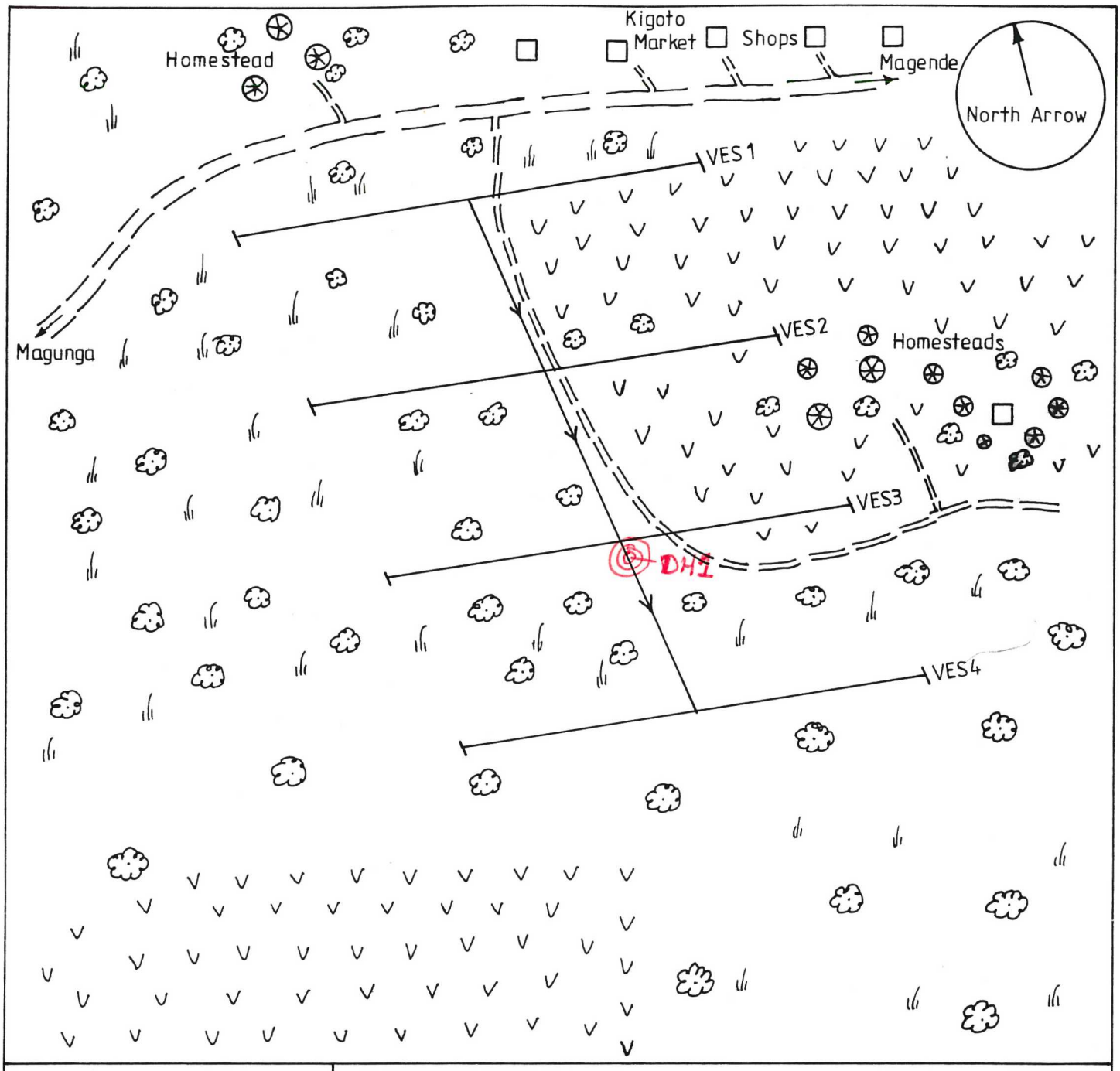
Drilled hole(s)	Remarks
DH1 (25m S of VES3, 35m)	-

Handdug hole(s)	Remarks
-	-

KIGOTO VILLAGE (SKETCH)

SOUTH NYANZA DISTRICT: MBITA DIVISION: MAP SHEET 129/1

GRID REFERENCE 631.9–9924.4



Murram road

Path

Shops

Round huts

Trees

Shamba

Long grass

VES (Vertical Electric Sounding) 200m long, at 100m interval

Profile line = 300m.

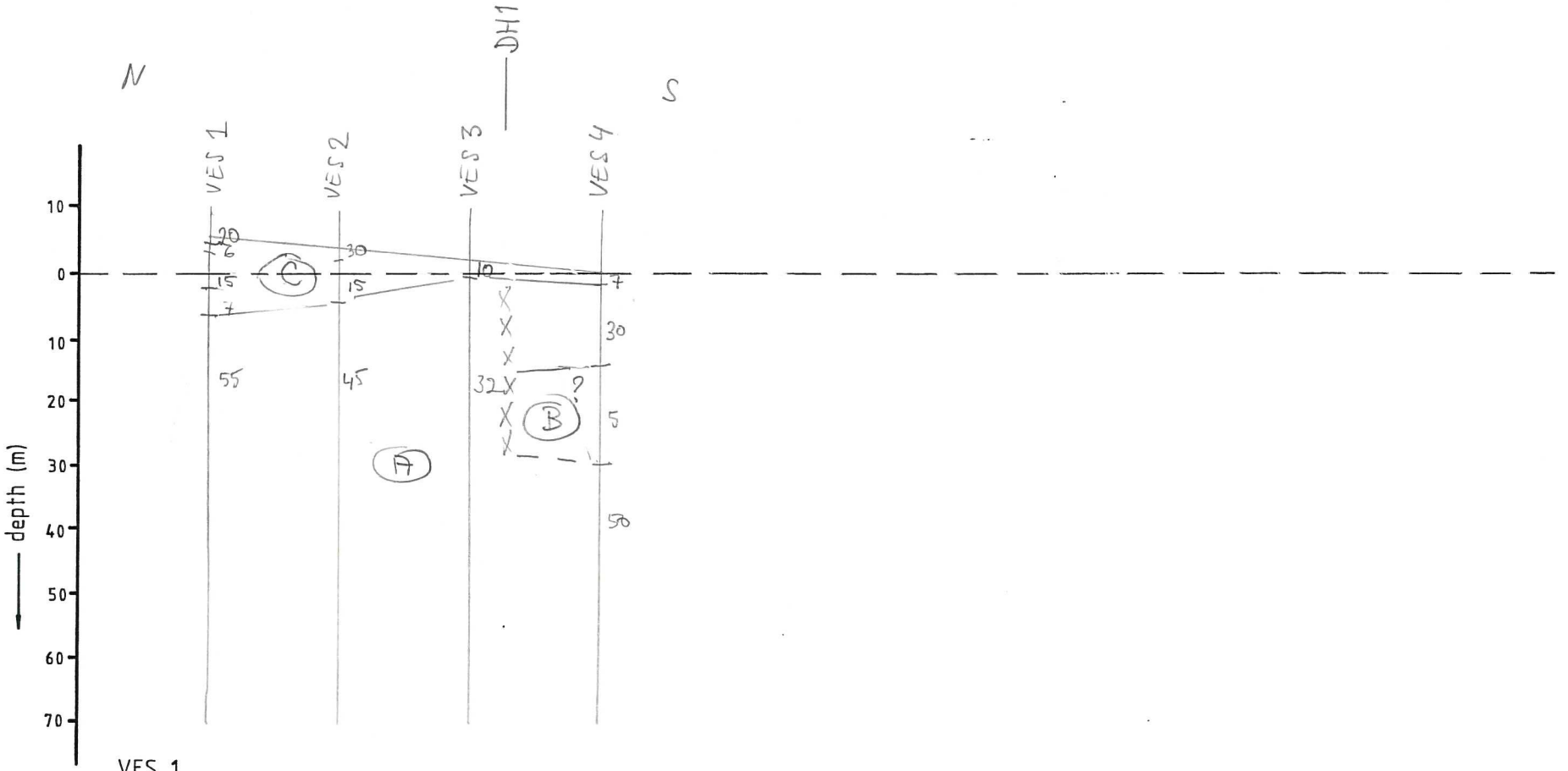
Slope

VES1–VES2 = –5°

VES2–VES3 = –5°

VES3–VES4 = –5°

KIGOTO VILLAGE



VES 1
5
Vertical Electrical Sounding, interpreted resistivity 5 ohmm

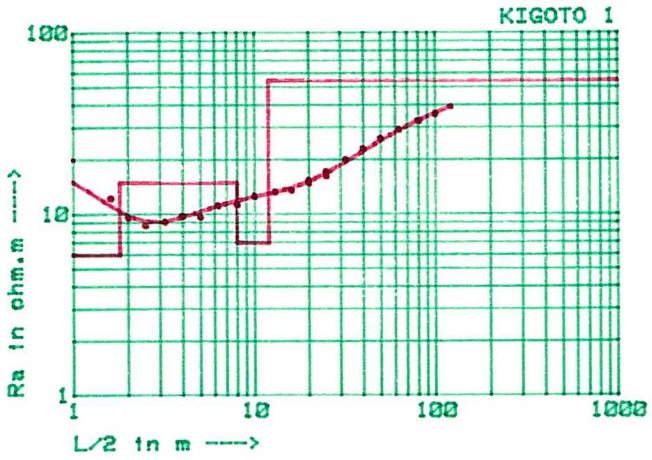
A
geo-electrical layer A

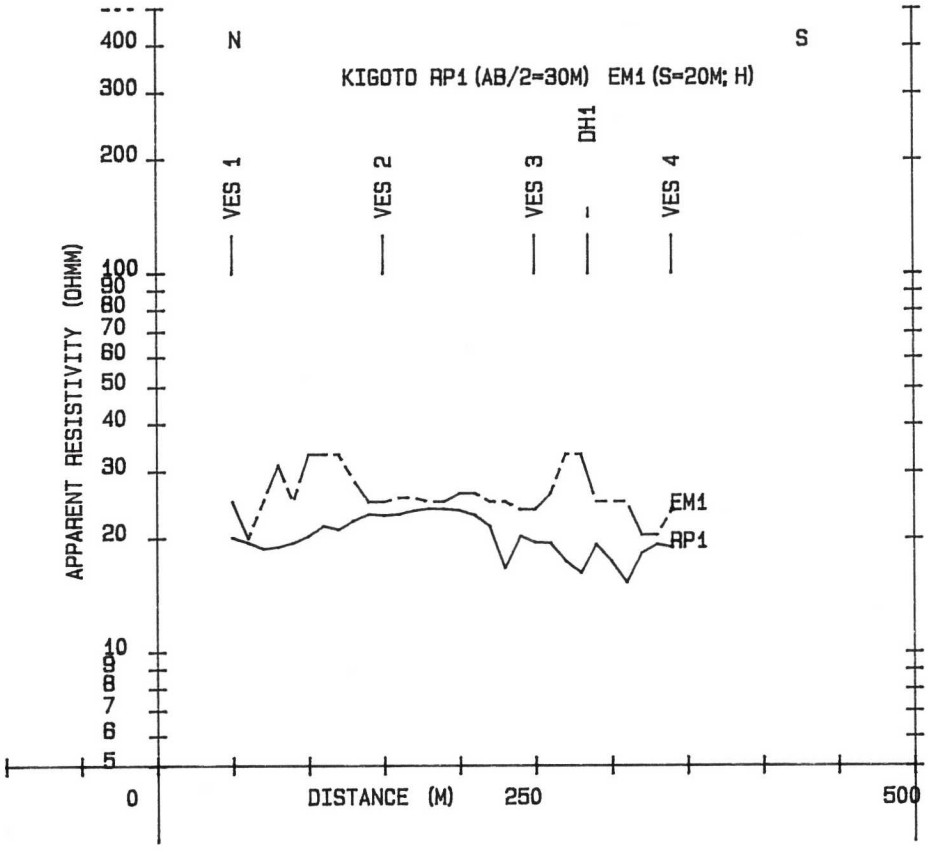
B 1
(recommended) borehole or handdug hole

- sandy clay, cemented clay
- lateritic layer
- clay
- a — very decomposed, altered rock
- w — weathered rock
- p — partly weathered, fractured rock
- f — fresh rock

TNO-DGV Institute of Applied Geoscience	
Annex 36.3	Cross-section Kigoto Village
Horizontal scale 1 : 5000	Vertical scale 1 : 1000

36.3


KIGOTO 1
Ra in ohm.m ---->
100
10
1
1
10
100
1000
L/2 in m ---->
KIGOTO 2
Ra in ohm.m ---->
100
10
1
1
10
100
1000
L/2 in m ---->
KIGOTO 3
Ra in ohm.m ---->
100
10
1
1
10
100
1000
L/2 in m ---->
KIGOTO 4
Ra in ohm.m ---->
100
10
1
1
10
100
1000
L/2 in m ---->


KIGOTO RP1 (AB/2=30M) EM1 (S=20M; H)
N
S
VES 1
VES 2
VES 3
DH1
VES 4
APPARENT RESISTIVITY (OHMM)
400
300
200
100
90
80
70
60
50
40
30
20
10
9
8
7
6
5
EM1
RP1
0
DISTANCE (M)
250
500

TNO-DGV INSTITUTE OF APPLIED GEOSCIENCE

Site: Tonga Valley

Hydrogeology

Layers	Resistivity (ohmm)	Remarks		
A	22-45	Weathered volcanic rock	(Tv)	(DH)
B	6-9	Clay	(R)	(HH)
C	15	Sandy clay	(R)	
D	11-25	Soil		
E	-	-		
F	-	-		

Fractured zones, faults	Remarks
50m SW of VES3	Fractured zone

Depth to groundwater table: Unknown

Groundwater quality : Fresh

(Recommended) drilled (DH) or handdug (HH) holes

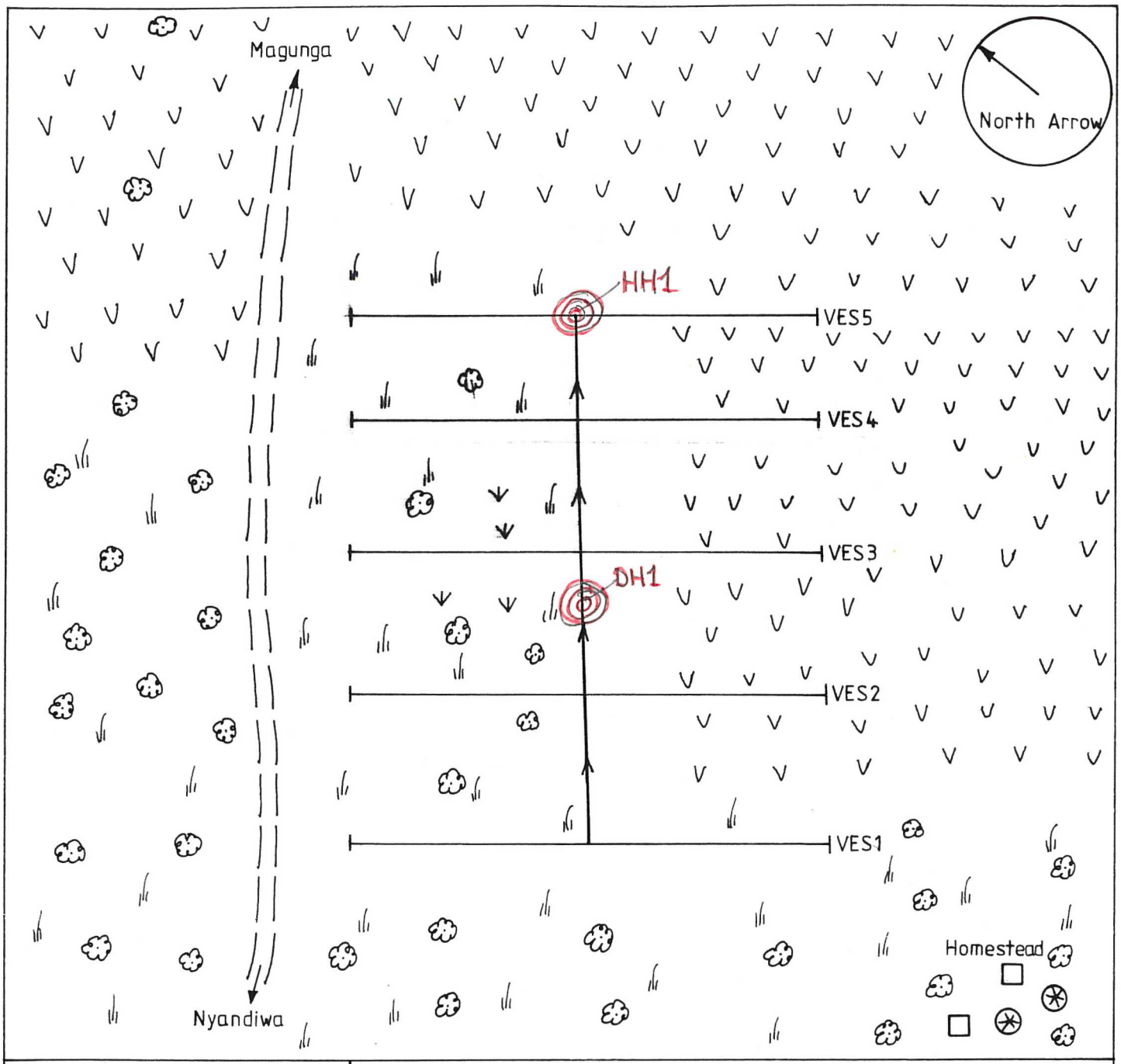
Drilled hole(s)	Remarks
DH1 (50m SW of VES3, 35m)	-

Handdug hole(s)	Remarks
-	-

TONGA VALLEY (SKETCH)

SOUTH NYANZA DISTRICT: MBITA DIVISION: MAP SHEET 129/1

GRID REFERENCE 626·1 – 9923·1



Murram road

Houses

Round huts

Trees

Maize shamba

Long grass

Sisal fence

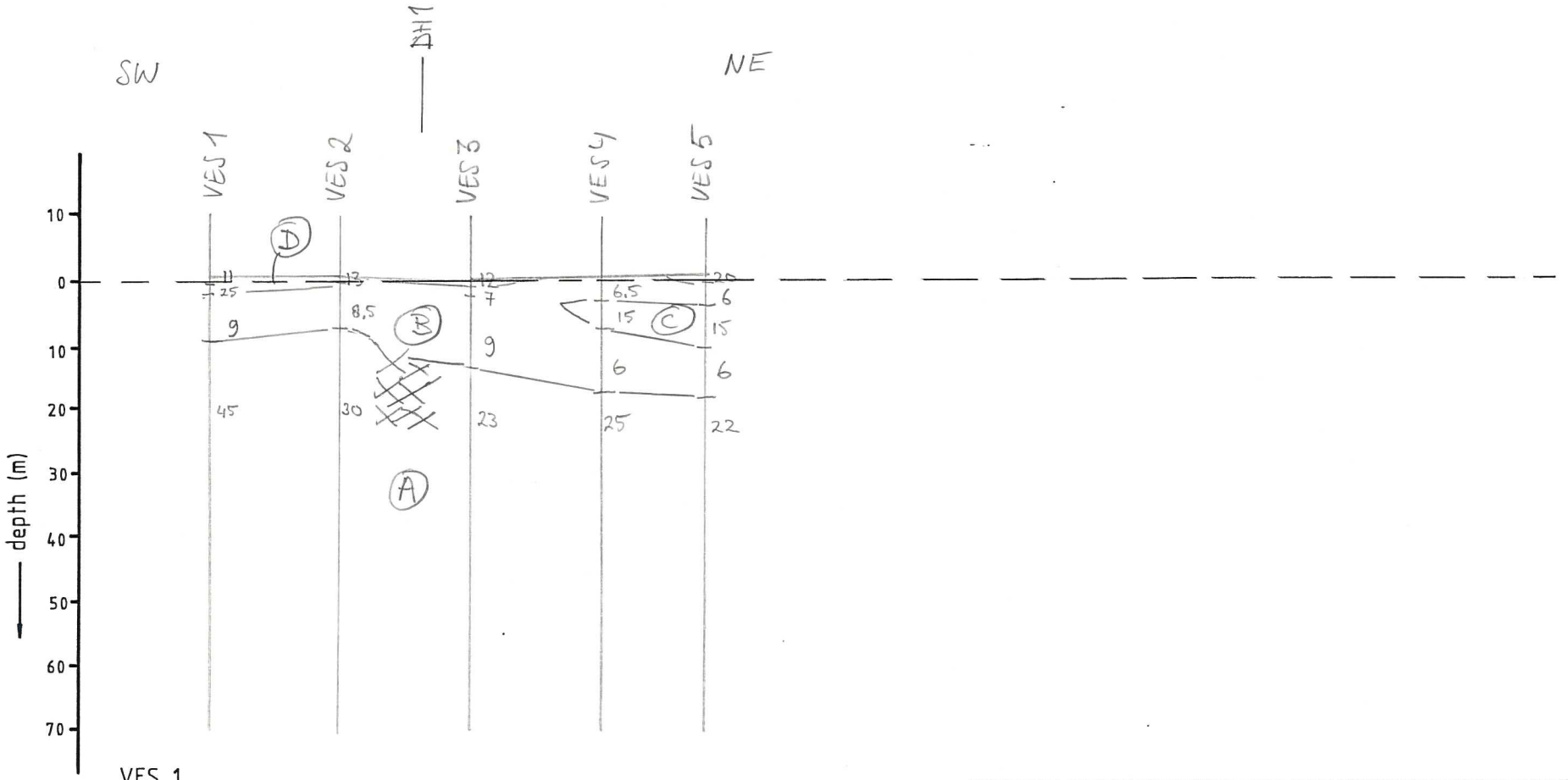
VES (Vertical Electric Sounding)
200m long, at 100m interval except VES4–5 = 80m.

Profile line = 380

Slope

VES 1 – VES 2 = 0°
VES 2 – VES 3 = –1°
VES 3 – VES 4 = +1°
VES 4 – VES 5 = +1°

TONGA VALLEY



VES 1
5
Vertical Electrical Sounding, interpreted resistivity 5 ohmm

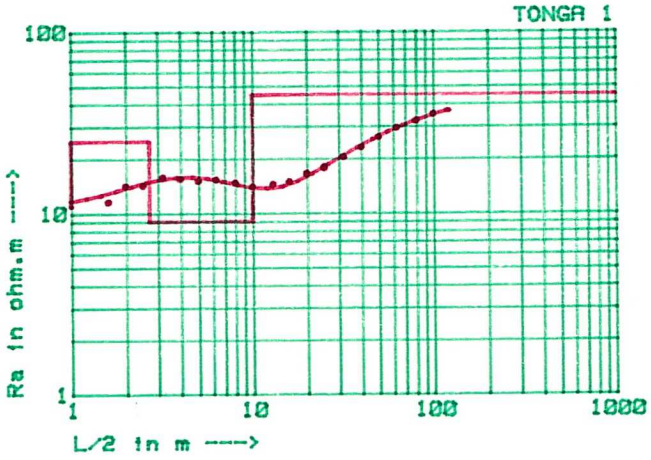
A
geo-electrical layer A

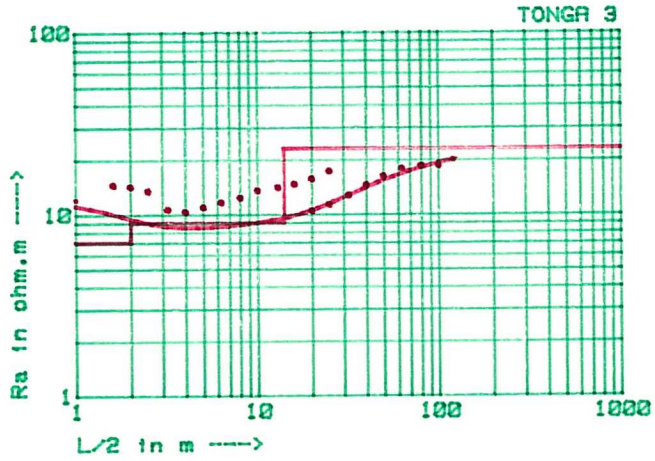
B 1
(recommended) borehole or handdug hole

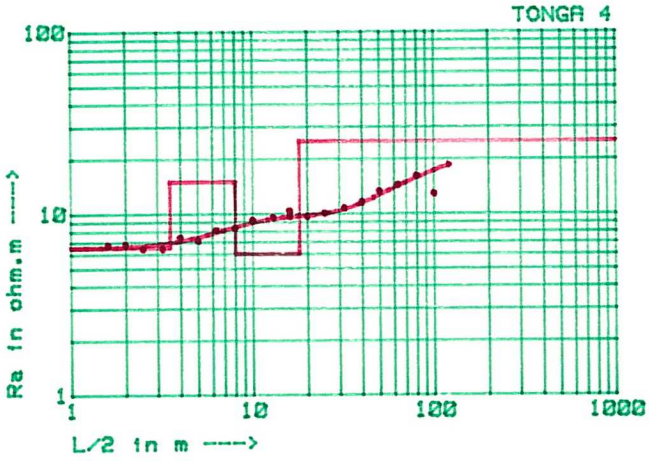
- sandy clay, cemented clay
- lateritic layer
- clay
- a — very decomposed, altered rock
- w — weathered rock
- p — partly weathered, fractured rock
- f — fresh rock

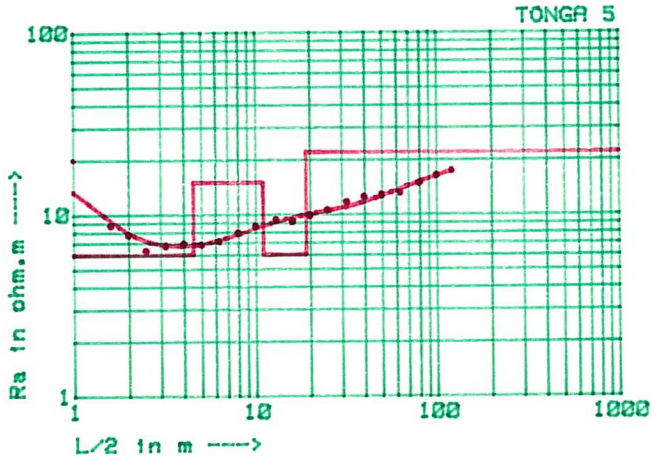
TNO-DGV Institute of Applied Geoscience	
Annex 37.3	Cross-section Tonga Valley
Horizontal scale 1 : 5000	Vertical scale 1 : 1000

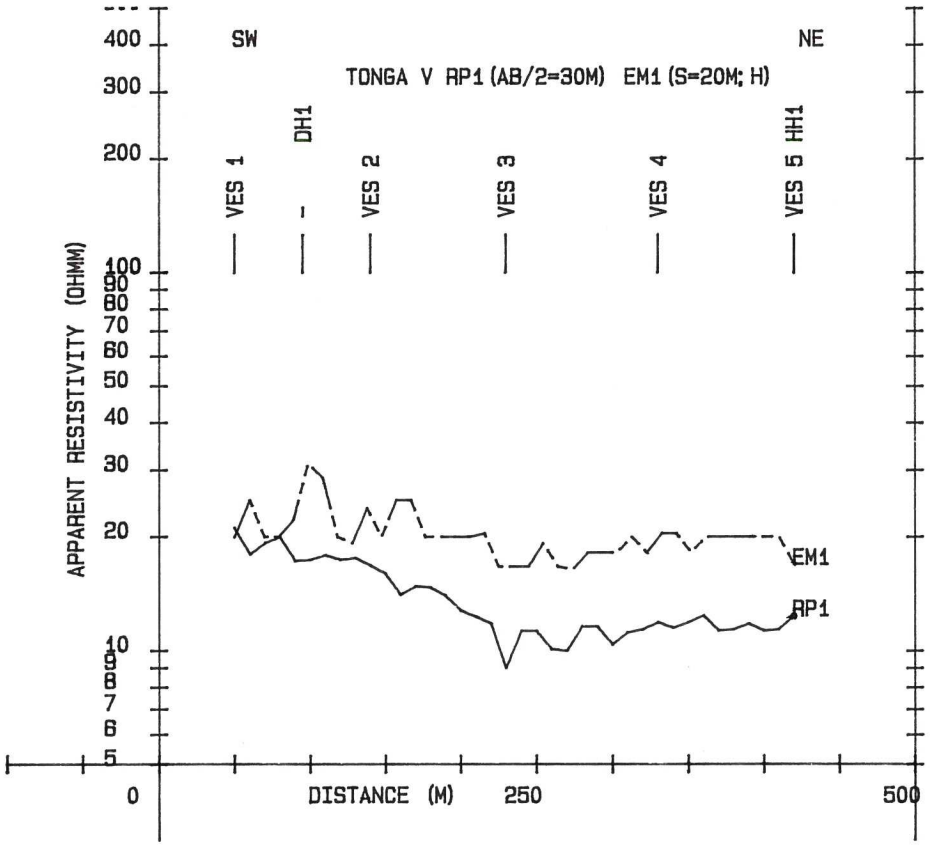
37.3


TONGA 1
100
10
1
Ra in ohm.m ---->
1
10
100
1000
L/2 in m ---->
TONGA 2
100
10
1
Ra in ohm.m ---->
1
10
100
1000
L/2 in m ---->


TONGA 3
100
10
1
Ra in ohm.m ---->
1
10
100
1000
L/2 in m ---->


TONGA 4
100
10
1
Ra in ohm.m ---->
1
10
100
1000
L/2 in m ---->


TONGA 5
100
10
1
Ra in ohm.m ---->
1
10
100
1000
L/2 in m ---->


SW
NE
TONGA V RP1 (AB/2=30M) EM1 (S=20M; H)
VES 1
DH1
VES 2
VES 3
VES 4
VES 5 HH1
APPARENT RESISTIVITY (OHMM)
400
300
200
100
90
80
70
60
50
40
30
20
10
9
8
7
6
5
EM1
RP1
0
DISTANCE (M)
250
500

TNO-DGV INSTITUTE OF APPLIED GEOSCIENCE

Site: Magunga Market

Hydrogeology

Layers	Resistivity (ohmm)	Remarks	
A	25-100	Weathered volcanic rock (Tv)	(DH)
B	6-10	Clay	(HH)
C	15-35	Sandy clay or hard layer	
D	8	Clayey soil	
E	-	-	
F	-	-	

Fractured zones, faults	Remarks
30m S of VES2	Fractured zone
between VES 3 and 4	Several fractured zones at shallow depth

Depth to groundwater table: Unknown

Groundwater quality : Fresh

(Recommended) drilled (DH) or handdug (HH) holes

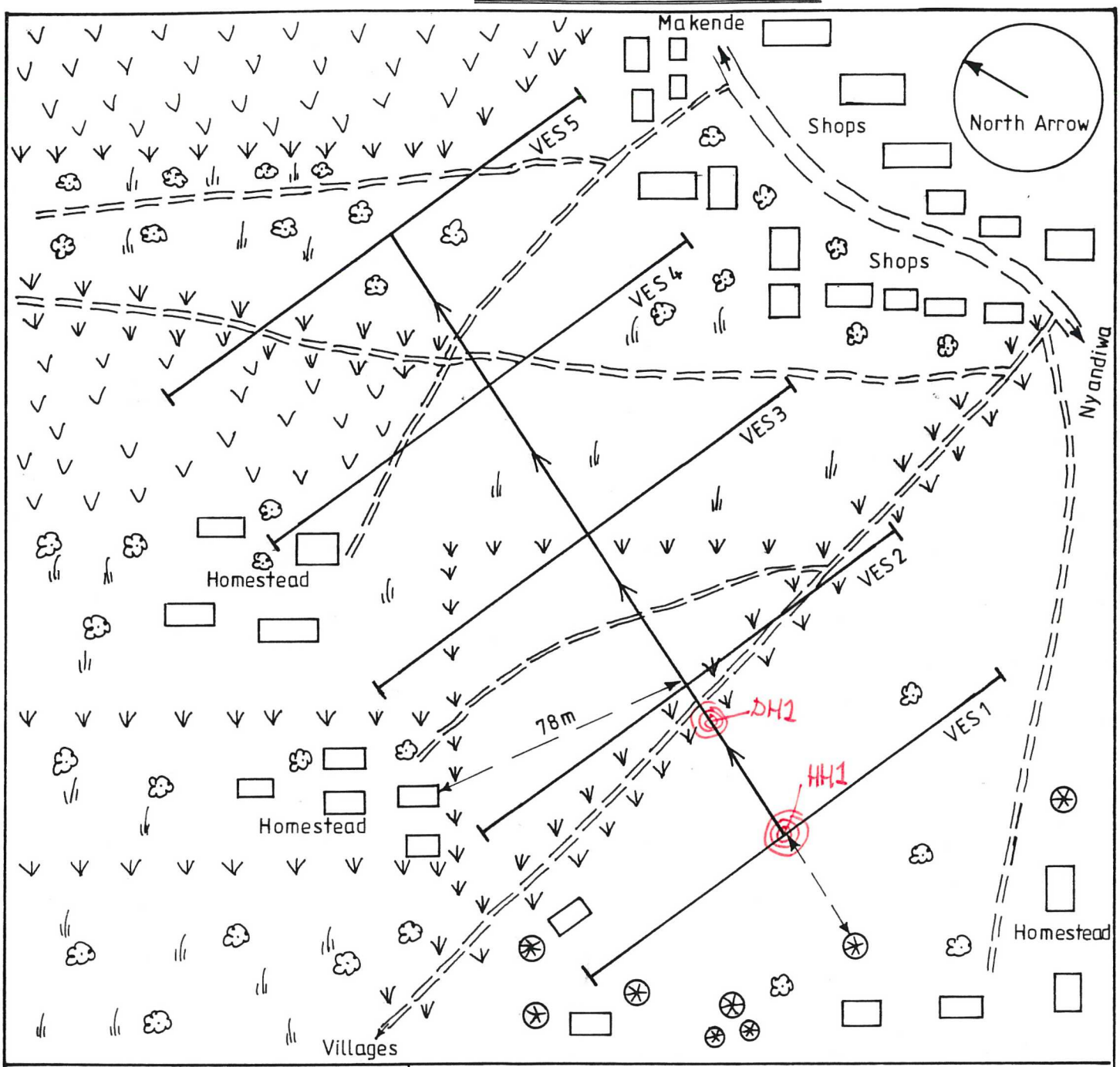
Drilled hole(s)	Remarks
DH1 (40m S of VES2, 45m)	-

Handdug hole(s)	Remarks
HH1 (VES1, 30m)	-

MAGUNGA MARKET (SKETCH)

SOUTH NYANZA DISTRICT: MBITA DIVISION: MAPSHEET 129/1

GRID REFERENCE 627·9 – 9924·8



Murram road

Path

Houses or shops

Round huts

Trees

Sisal fence

Long grass

Maize shamba

VES (Vertical Electric Sounding)
200m long, at 100m interval

Profile line = 400m

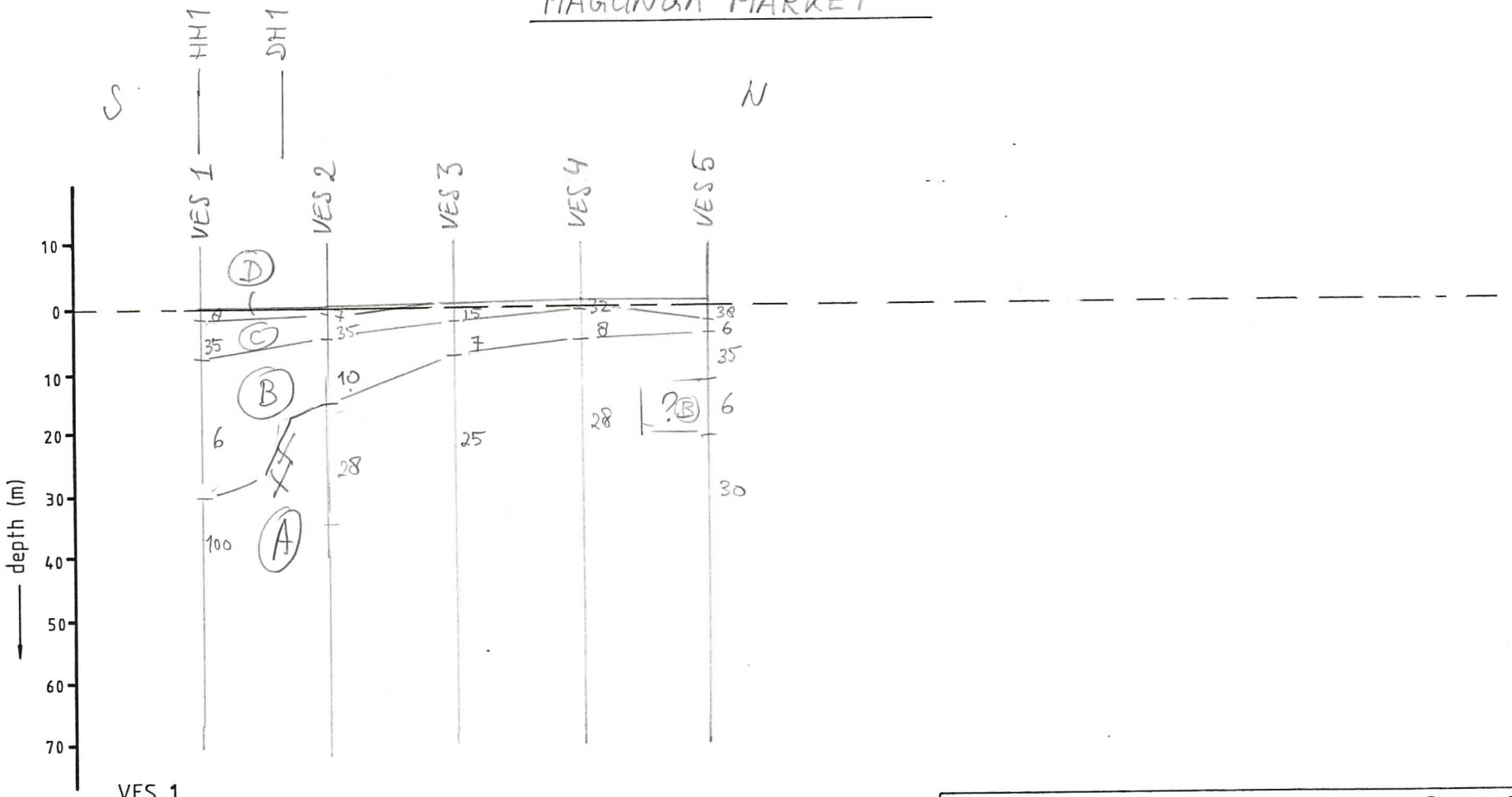
Slope: VES1 – VES2 = 0°

VES2 – VES3 = +1°

VES3 – VES4 = +1°

VES4 – VES5 = 0°

MAGUNGA MARKET



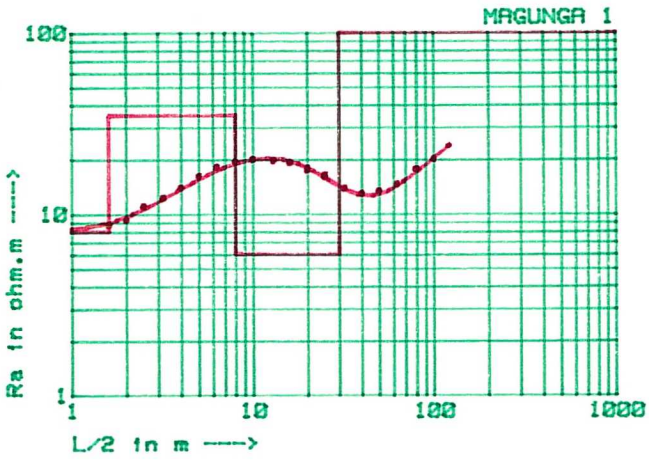
VES 1
5
Vertical Electrical Sounding, interpreted resistivity 5 ohmm

A
geo-electrical layer A

B 1
(recommended) borehole or handdug hole

- sandy clay, cemented clay
- lateritic layer
- clay
- a — very decomposed, altered rock
- w — weathered rock
- p — partly weathered, fractured rock
- f — fresh rock

TNO-DGV Institute of Applied Geoscience	
Annex 38.3	Cross-section Magunga Market
Horizontal scale 1 : 5000	Vertical scale 1 : 1000


MAGUNGA 1
100
10
1
Ra in ohm.m ---->
1
10
100
1000
L/2 in m ---->
MAGUNGA 2
100
10
1
Ra in ohm.m ---->
1
10
100
1000
L/2 in m ---->
MAGUNGA 3
100
10
1
Ra in ohm.m ---->
1
10
100
1000
L/2 in m ---->
MAGUNGA 4
100
10
1
Ra in ohm.m ---->
1
10
100
1000
L/2 in m ---->
MAGUNGA 5
100
10
1
Ra in ohm.m ---->
1
10
100
1000
L/2 in m ---->

TNO-DGV INSTITUTE OF APPLIED GEOSCIENCE

Site: Nyenga Valley

Hydrogeology

Layers	Resistivity (ohmm)	Remarks	
A	60-150	Partly weathered volcanic rock (Tv)	(DH)
B	6.5-21	Sandy clay (R)	(HH)
C	-	-	
D	-	-	
E	-	-	
F	-	-	

Fractured zones, faults	Remarks
15m W of VES1	Fractured zone
30m S of VES2	Fractures zone

Depth to groundwater table: Unknown

Groundwater quality : Fresh

(Recommended) drilled (DH) or handdug (HH) holes

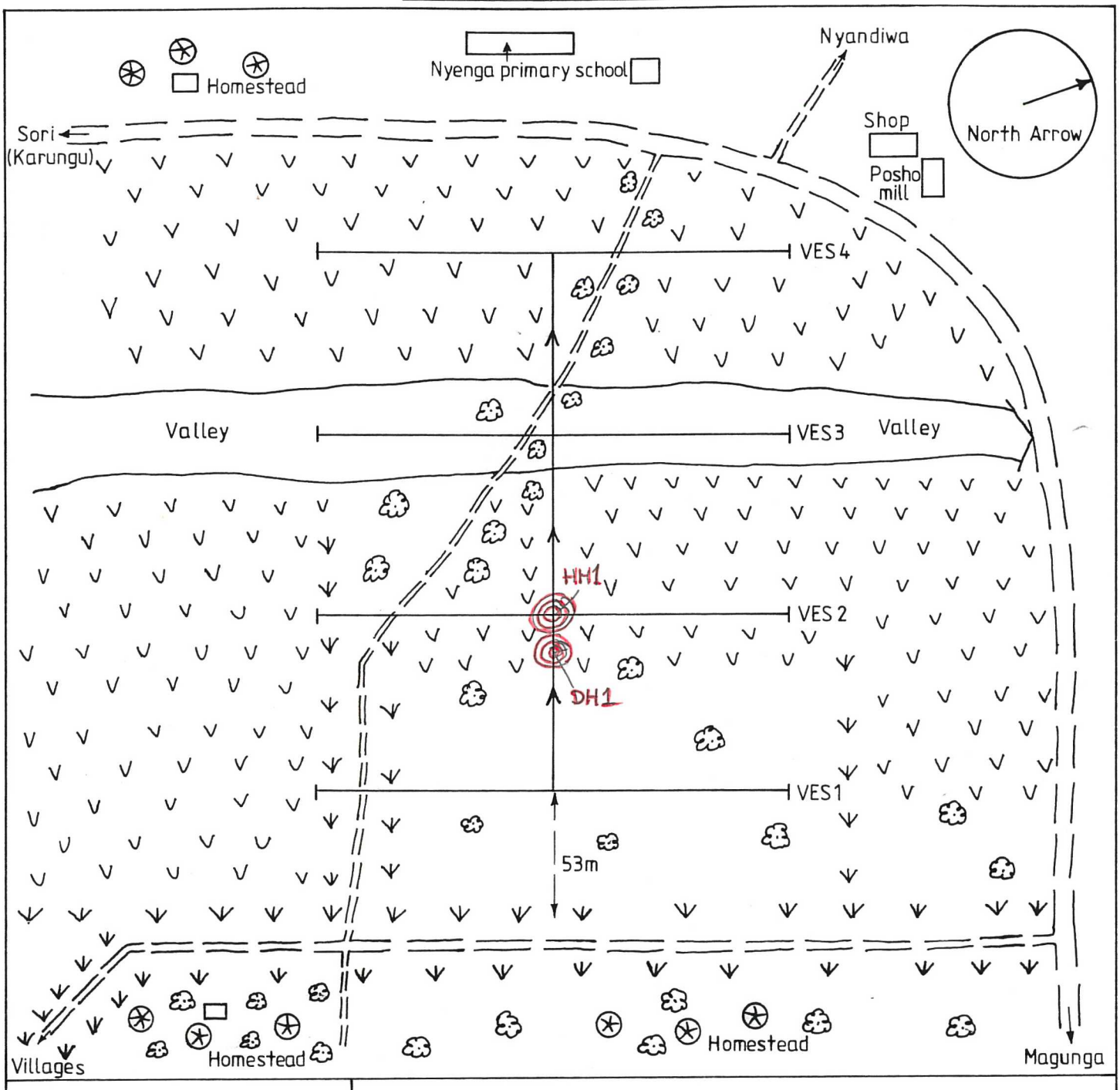
Drilled hole(s)	Remarks
DN1 (15m E of VES2, 35m)	-

Handdug hole(s)	Remarks
HH1 (VES2, 15m)	-

NYENGA VALLEY

SOUTH NYANZA DISTRICT: MBITA DIVISION: MAP SHEET 129/1

GRID REFERENCE 623·5 – 9921·7

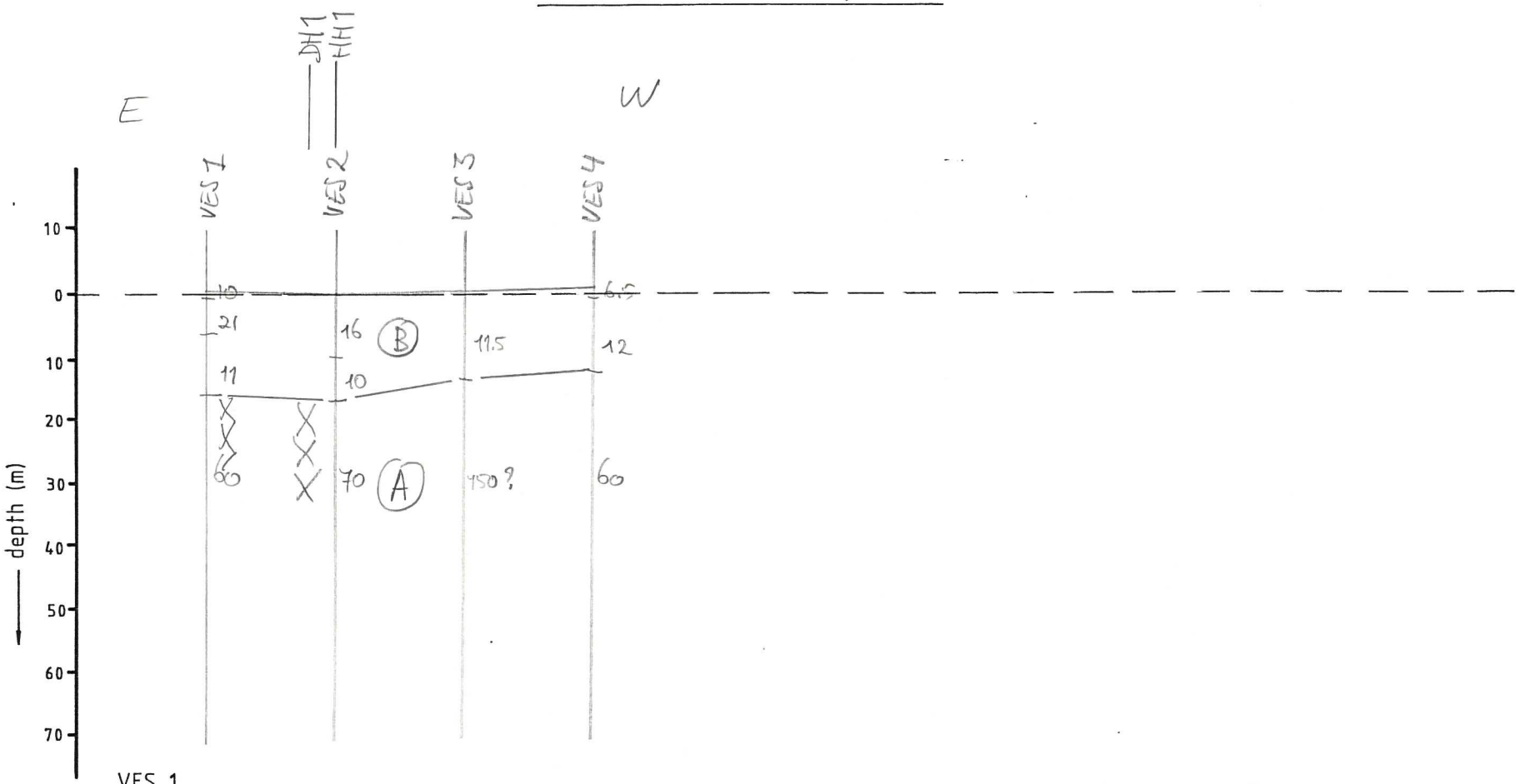


Murram road
Path
Houses
Round huts
Trees
Maize shamba
Sisal fence

VES (Vertical Electric Sounding)
200m long, at 100m interval
Profile line = 290m

Slope:
VES1 – VES2 = -1°
VES2 – VES3 = +1°
VES3 – VES4 = +1°

NYENGA VALLEY



VES 1

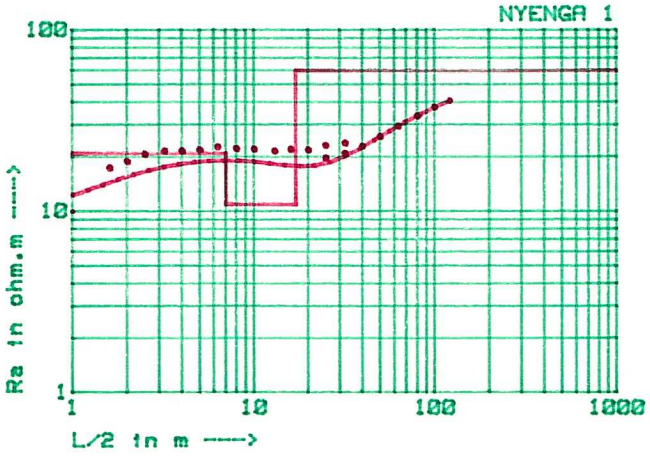
5 — Vertical Electrical Sounding, interpreted resistivity 5 ohmm

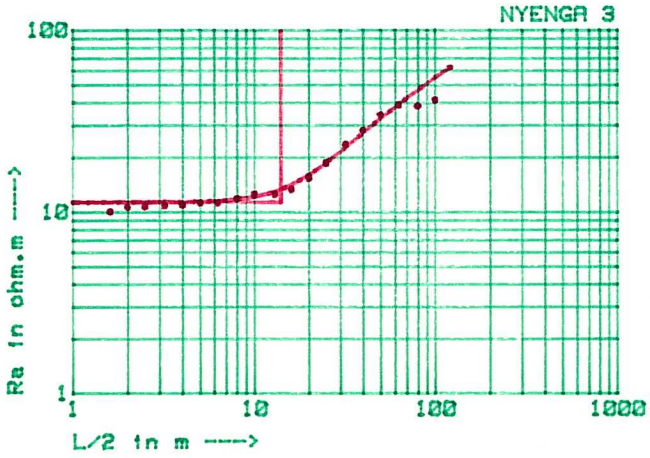
A — geo-electrical layer A

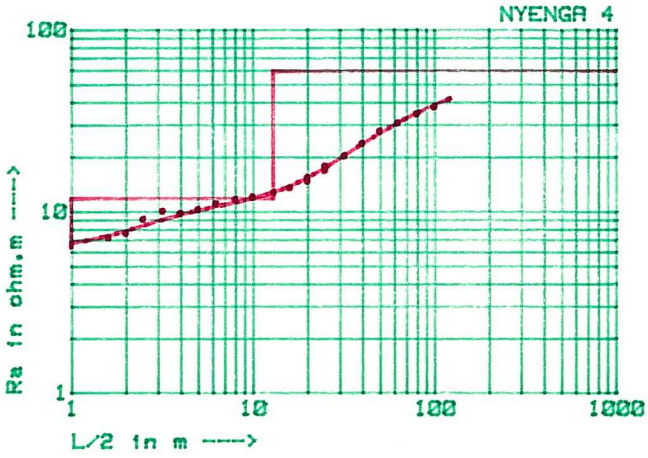
B 1 — (recommended) borehole or handdug hole

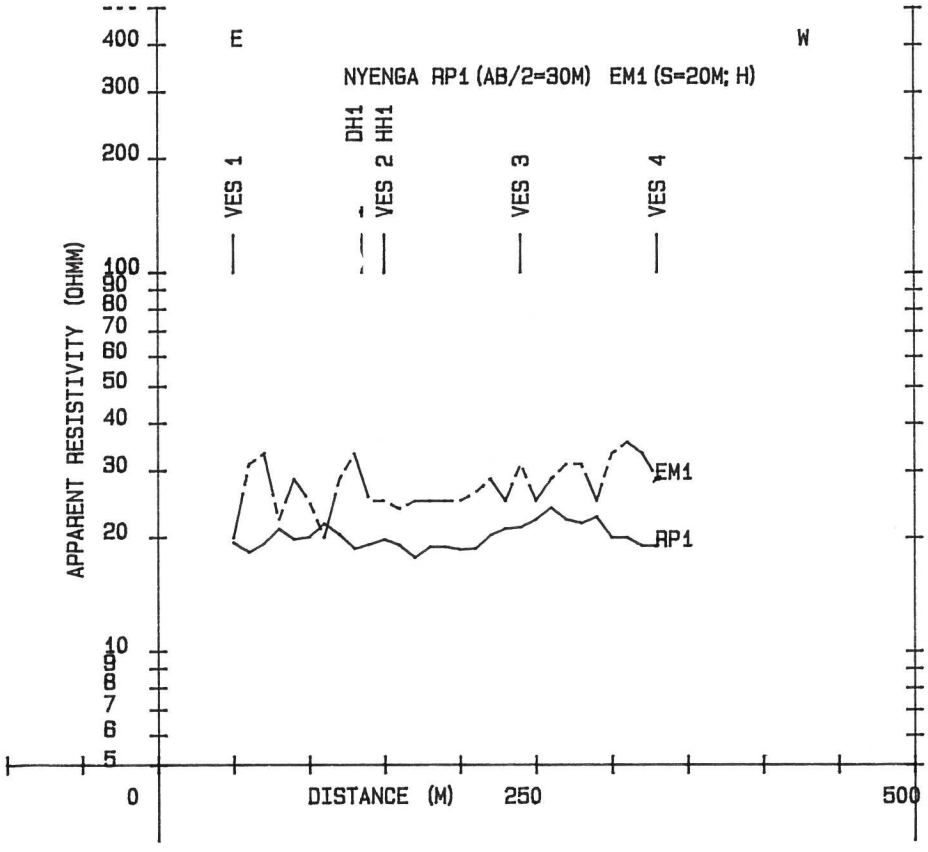
- sandy clay, cemented clay
- lateritic layer
- clay
- a — very decomposed, altered rock
- w — weathered rock
- p — partly weathered, fractured rock
- f — fresh rock

TNO-DGV Institute of Applied Geoscience	
Annex 39.3	Cross-section Nyenga Village
Horizontal scale 1 : 5000	Vertical scale 1 : 1000


NYENGA 1
100
10
1
Ra in ohm.m ---->
1
10
100
1000
L/2 in m ---->
NYENGA 2
100
10
1
Ra in ohm.m ---->
1
10
100
1000
L/2 in m ---->


NYENGA 3
100
10
1
Ra in ohm.m ---->
1
10
100
1000
L/2 in m ---->


NYENGA 4
100
10
1
Ra in ohm.m ---->
1
10
100
1000
L/2 in m ---->


E
W
NYENGA RP1 (AB/2=30M) EM1 (S=20M; H)
DH1
HH1
VES 1
VES 2
VES 3
VES 4
APPARENT RESISTIVITY (OHMM)
400
300
200
100
90
80
70
60
50
40
30
20
10
9
8
7
6
5
EM1
RP1
0
DISTANCE (M)
250
500

TNO-DGV INSTITUTE OF APPLIED GEOSCIENCE

Site: Nyatambe Valley

Hydrogeology

Layers	Resistivity (ohmm)	Remarks		
A	35-75	Partly weathered volcanic rock	(Tv)	(DH)
B	18-20	Sandy clay	(R)	(HH)
C	27-120	Sand, hard layer	(R)	
D	6.2-8.5	Clay		
E	-	-		
F	-	-		

Fractured zones, faults	Remarks
-	-

Depth to groundwater table: Unknown

Groundwater quality : Fresh

(Recommended) drilled (DH) or handdug (HH) holes

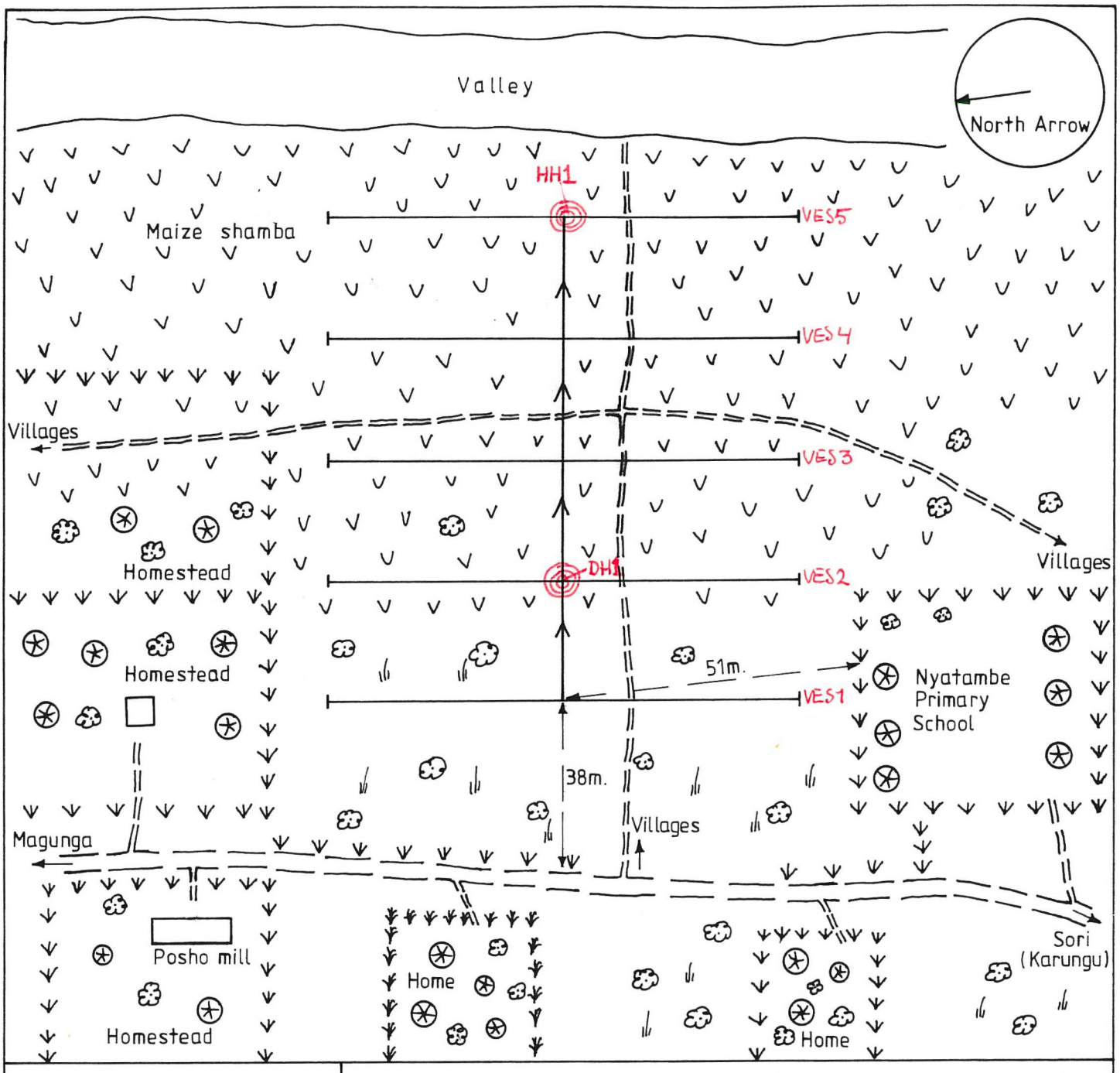
Drilled hole(s)	Remarks
DH1 (VES2, 50m)	-

Handdug hole(s)	Remarks
HH1 (VES5, 30m)	-

NYATAMBE VALLEY SKETCH

SOUTH NYANZA DISTRICT: MBITA DIVISION: MAP SHEET 129/1

GRID REFERENCE 621·9 – 9916·4



Murram road

Path

House

Round huts

Trees

Maize shamba

Long grass

Sisal fence

VES Vertical Electric Sounding
200m long, at 100m interval

Profile line = 410m.

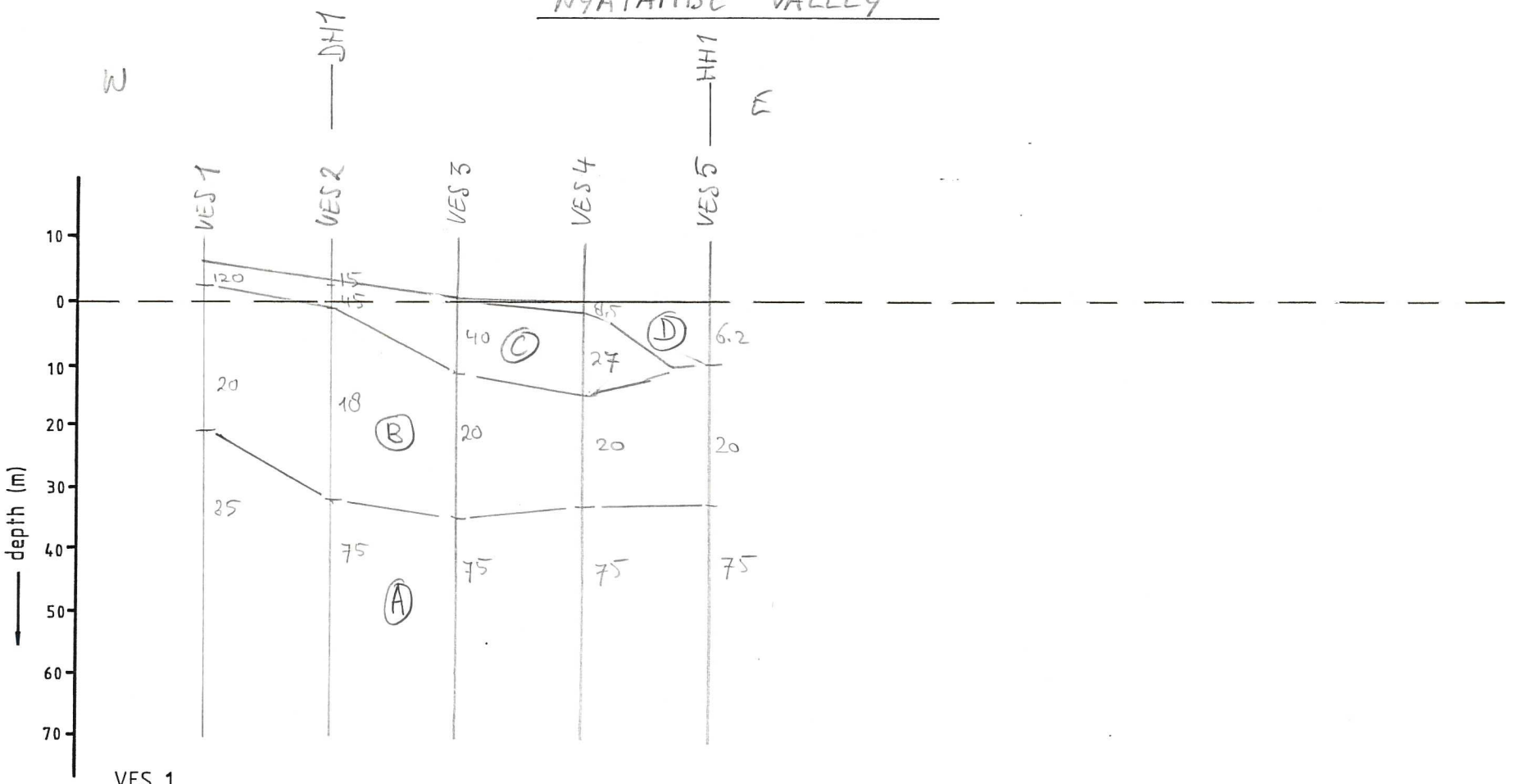
VES1 – VES2 = -5°

VES2 – VES3 = -5°

VES3 – VES4 = -1°

VES4 – VES5 = 0°

NYATAMBE VALLEY



VES 1 — Vertical Electrical Sounding, interpreted resistivity 5 ohmm

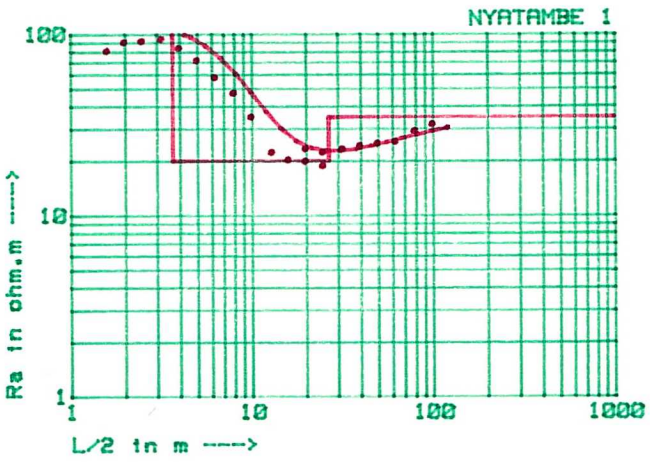
A — geo-electrical layer A

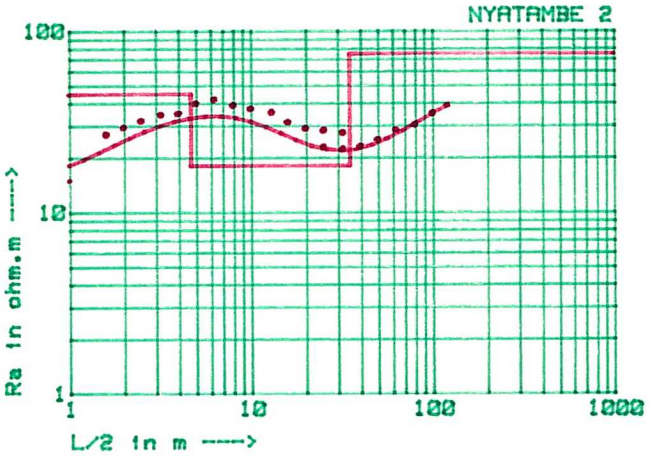
B 1 — (recommended) borehole or handdug hole

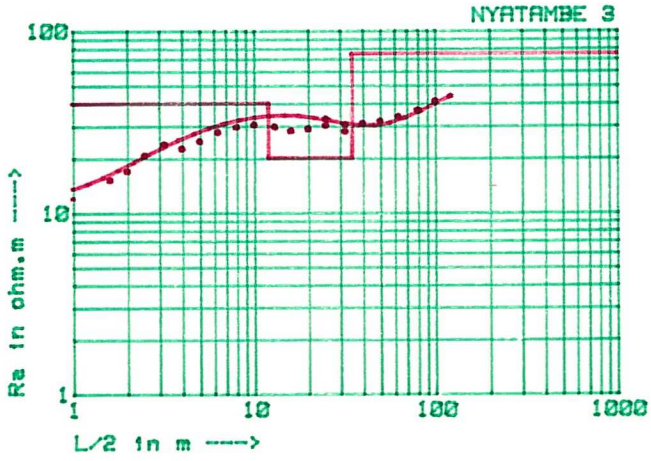
- sandy clay, cemented clay
- lateritic layer
- clay
- a — very decomposed, altered rock
- w — weathered rock
- p — partly weathered, fractured rock
- f — fresh rock

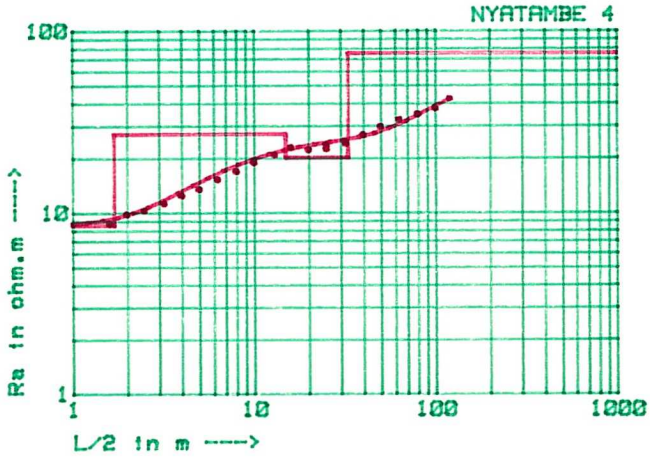
TNO-DGV Institute of Applied Geoscience	
Annex 40.3	Cross-section Nyatambe Valley
Horizontal scale 1 : 5000	Vertical scale 1 : 1000

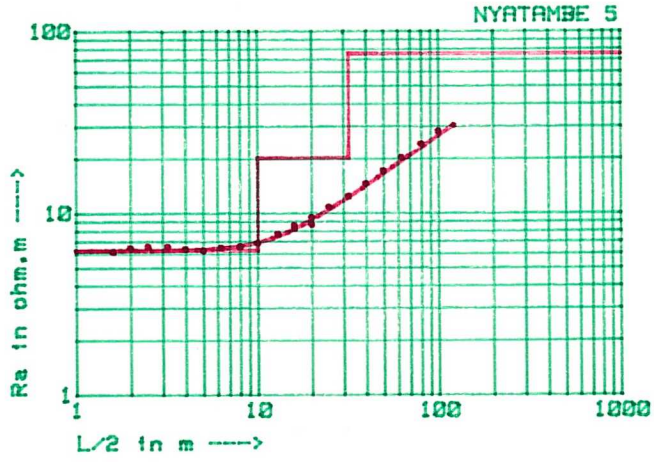
40.3

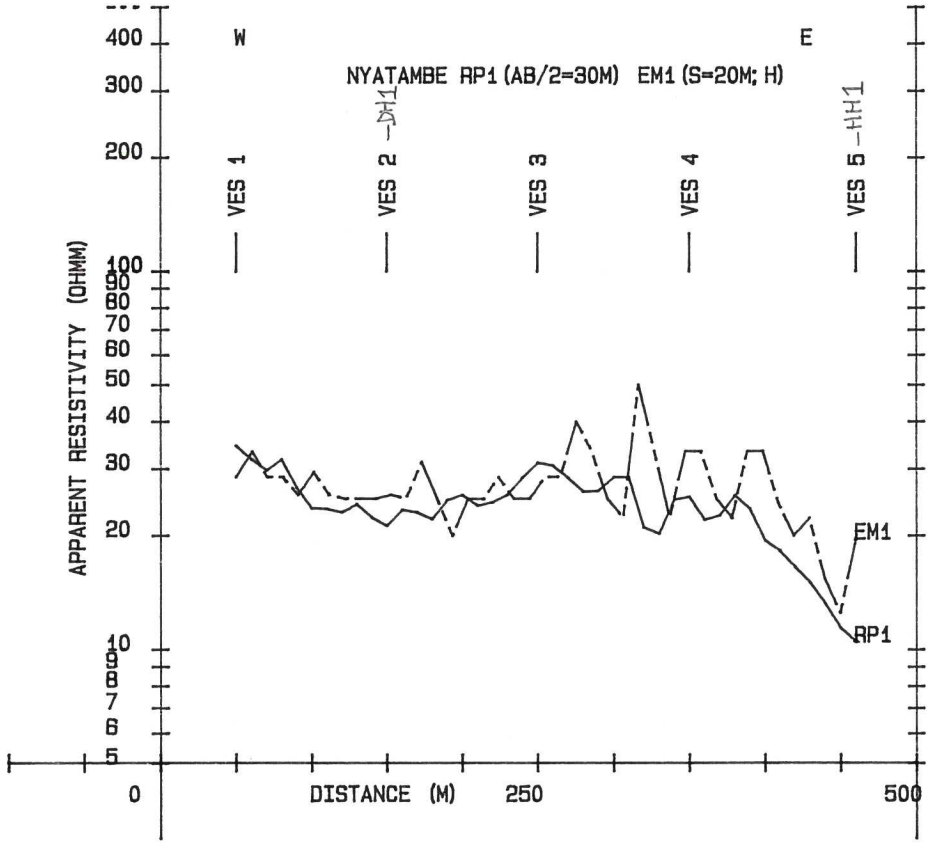

NYATAMBE 1
100
10
1
Ra in ohm.m ---->
1
10
100
1000
L/2 in m --->


NYATAMBE 2
100
10
1
Ra in ohm.m ---->
1
10
100
1000
L/2 in m ---->


NYATAMBE 3
100
10
1
Ra in ohm.m ---->
1
10
100
1000
L/2 in m ---->


NYATAMBE 4
100
10
1
Ra in ohm.m ---->
1
10
100
1000
L/2 in m ---->


NYATAMBE 5
100
10
1
Ra in ohm.m ---->
1
10
100
1000
L/2 in m ---->


NYATAMBE RP1 (AB/2=30M) EM1 (S=20M; H)
W
E
VES 1
VES 2
VES 3
VES 4
VES 5
APPARENT RESISTIVITY (OHMM)
400
300
200
100
90
80
70
60
50
40
30
20
10
9
8
7
6
5
EM1
RP1
0
DISTANCE (M)
250
500

TNO-DGV INSTITUTE OF APPLIED GEOSCIENCE

Site: Kiabuya Market

Hydrogeology

Layers	Resistivity (ohmm)	Remarks	
A	40-50	Weathered volcanic rock (Tv)	(DH)
B	12-28	Decomposed volcanic rock (Tv)	
C	35-300	Lateritic soil	
D	-	-	
E	-	-	
F	-	-	

Fractured zones, faults	Remarks
30m N of VES3	Fractured zone

Depth to groundwater table: Unknown

Groundwater quality : Fresh

(Recommended) drilled (DH) or handdug (HH) holes

Drilled hole(s)	Remarks
DH1 (50m N of VES3, 40m)	-

Handdug hole(s)	Remarks
-	-

KIABUYA MARKET (SKETCH)

SOUTH NYANZA DISTRICT: MBITA DIVISION: MAP SHEET 129/1

GRID REFERENCE 622·0 – 9918·3



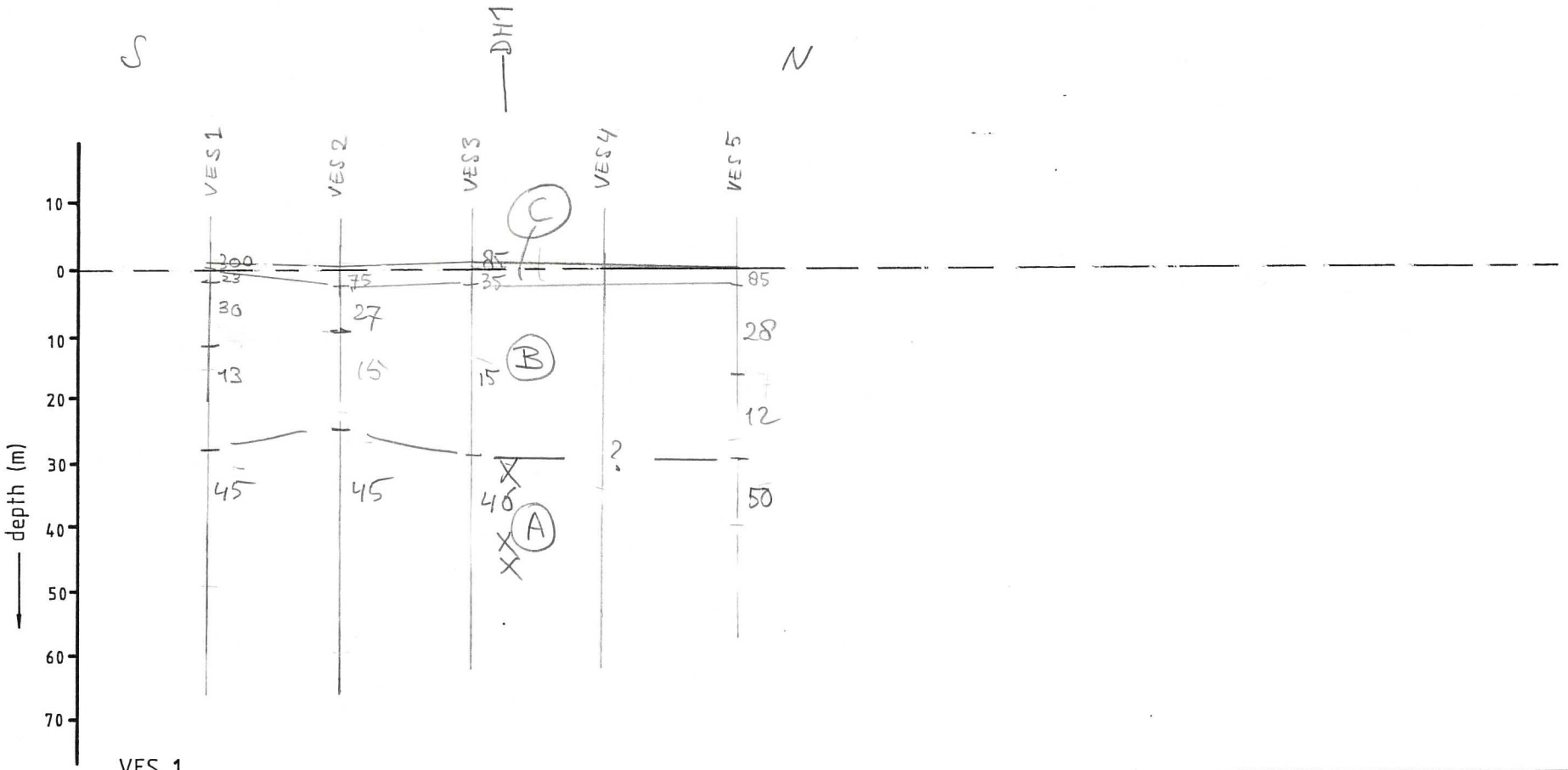
Murram road
Path
Houses and shops
Round huts
Trees
Sisal
Hedge
Long grass
Maize shamba

VES (Vertical Electric Sounding)
200m long, at 100m interval

Profile line = 400m

Slope :
VES1–VES2 = -1°
VES2–VES3 = +1°
VES3–VES4 = -1°
VES4–VES5 = -1°

KIABUYA MARKET



VES 1
5
Vertical Electrical Sounding, interpreted resistivity 5 ohmm

A
geo-electrical layer A

B 1
(recommended) borehole or handdug hole

sandy clay, cemented clay

lateritic layer

clay

a very decomposed, altered rock

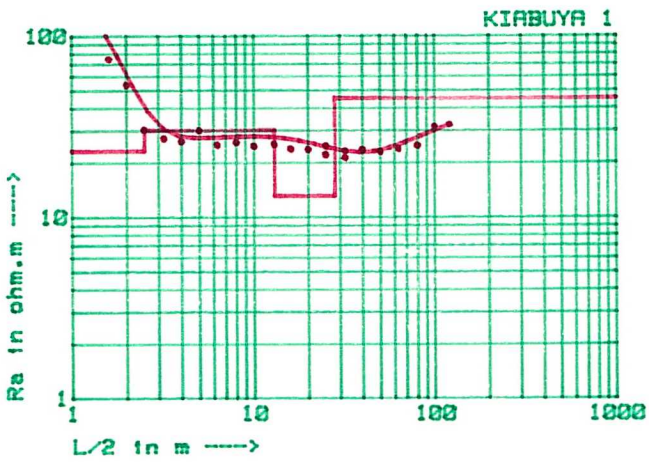
w weathered rock

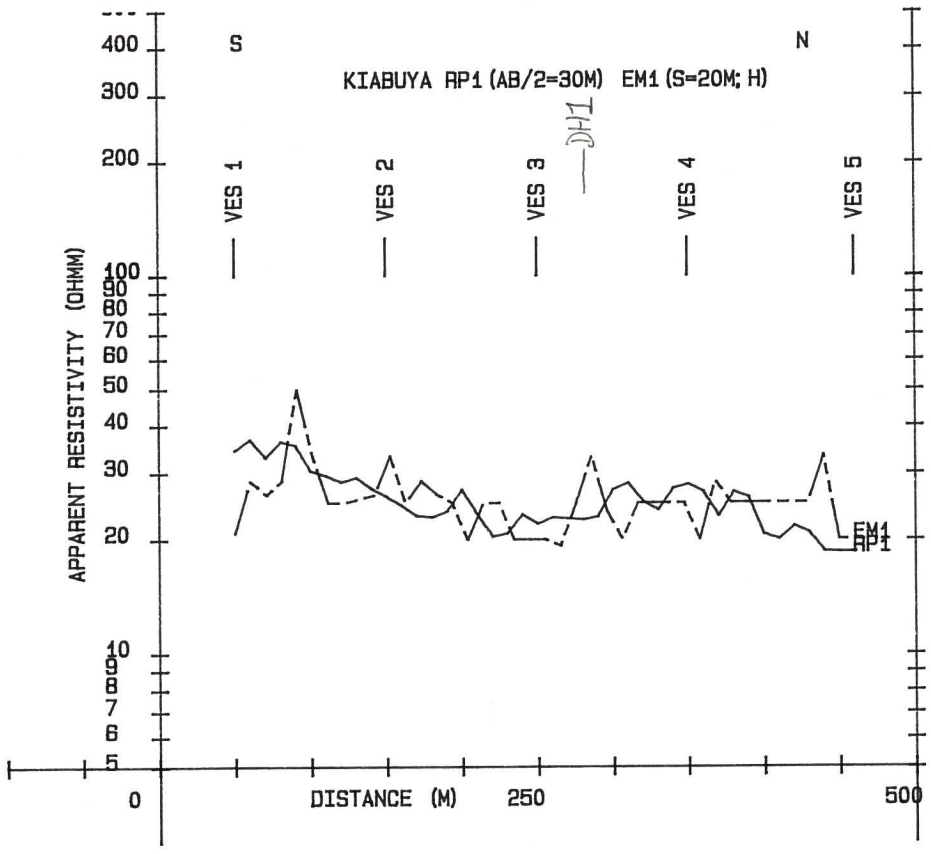
p partly weathered, fractured rock

f fresh rock

TNO-DGV Institute of Applied Geoscience	
Annex 41.3	Cross-section Kiabuya Market
Horizontal scale 1 : 5000	Vertical scale 1 : 1000

41.3


KIABUYA 1
100
10
1
Ra in ohm.m ---->
1
10
100
1000
L/2 in m ---->
KIABUYA 2
100
10
1
Ra in ohm.m ---->
1
10
100
1000
L/2 in m ---->
KIABUYA 3
100
10
1
Ra in ohm.m ---->
1
10
100
1000
L/2 in m ---->
KIABUYA 5
100
10
1
Ra in ohm.m ---->
1
10
100
1000
L/2 in m ---->


KIABUYA RP1 (AB/2=30M) EM1 (S=20M; H)
S
N
VES 1
VES 2
VES 3
VES 4
VES 5
DH1
APPARENT RESISTIVITY (OHMM)
400
300
200
100
90
80
70
60
50
40
30
20
10
9
8
7
6
5
EM1
RP1
0
DISTANCE (M)
250
500