

DIRECT-CURRENT VERTICAL ELECTRICAL-RESISTIVITY SOUNDINGS
IN THE LOWER PENINSULA OF MICHIGAN

By D. B. Westjohn and P. J. Carter, Jr.

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CONVERSION TABLE

For those readers who prefer inch-pound units rather than the metric (International System) units used in this report, the following conversion factors may be used:

<u>Multiply Metric Unit</u>	<u>By</u> <u>Length</u>	<u>To Obtain Inch-Pound Unit</u>
meter (m)	3.281	foot (ft)
kilometer (km)	0.6214	mile (mi)
<u>Area</u>		
square kilometer (km ²)	0.3861	square mile (mi ²)

Sea level: In this report "sea level" refers to the National Geodetic Vertical Datum of 1929 (NGVD of 1929)--a geodetic datum derived from a general adjustment of the first-order level nets of both the United States and Canada, formerly called "Datum Sea Level of 1929."

CONTENTS

	Page
Abstract.....	1
Introduction.....	1
Data collection.....	1
General characteristics of vertical electrical-resistivity soundings.....	3
Summary.....	5
References cited.....	6
Appendix: Vertical electrical-resistivity sounding data, shifted data, and calculated electric layers for locations in the Lower Peninsula of Michigan.....	10

ILLUSTRATION

Figure	1.	Map showing location of study area and vertical electrical-resistivity soundings.....	2
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TABLE

Table	1.	Summary of observations for vertical electrical-resistivity soundings.....	7
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IN THE LOWER PENINSULA OF MICHIGAN**

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ABSTRACT

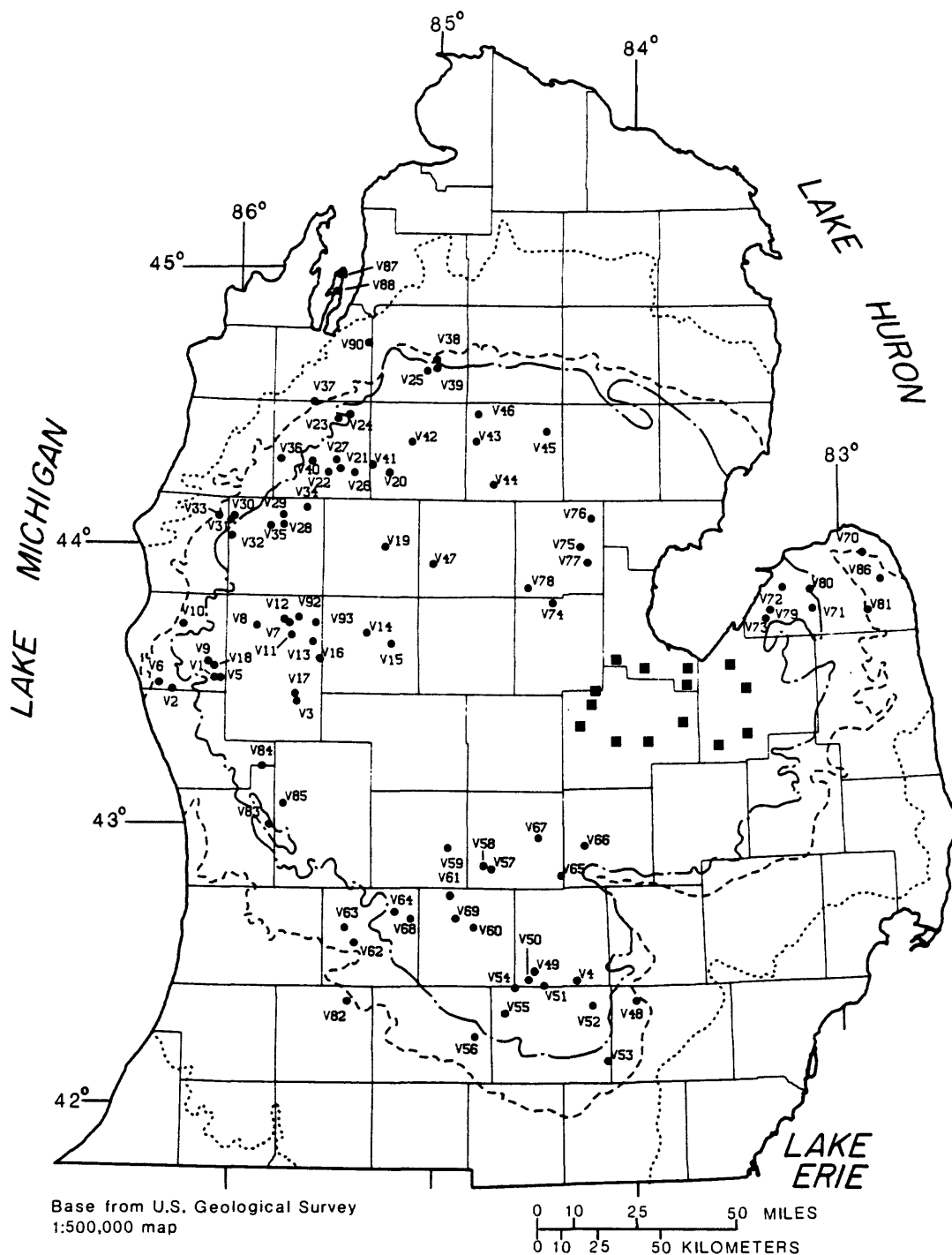
Ninety-three direct-current vertical electrical-resistivity soundings were conducted in the Lower Peninsula of Michigan from June through October 1987. These soundings were made to assist in mapping the depth to brine in areas where borehole resistivity logs and water-quality data are sparse or lacking. The Schlumberger array for placement of current and potential electrodes was used for each sounding. Vertical electrical-resistivity sounding field data, shifted and smoothed sounding data, and electric layers calculated using inverse modeling techniques are presented. Also included is a summary of the near-surface conditions and depths to conductors and resistors for each sounding location.

INTRODUCTION

This report provides geophysical data and inverse model results for 93 direct-current vertical electrical-resistivity soundings conducted in the Lower Peninsula of Michigan from June through October 1987. The Schlumberger electrode array (Zohdy and others, 1974) was used for all soundings. These soundings were made by U.S. Geological Survey personnel as part of the Michigan Basin Regional Aquifer System Analysis (MRASA) project. The geophysical surveys provide data that can be interpreted to indicate the presence of brine in bedrock units below glacial drift, and to investigate areas where freshwater contained in bedrock and glacial aquifers extends to depths that exceed 300 m (meters) (Westjohn, 1989). Vertical electrical-resistivity soundings completed in Michigan in 1986 are summarized by Mandle and Westjohn (1987). Westjohn (1989) provides interpretations for 18 soundings; data for these surveys are included in this report. The purpose of this report is to release the vertical electrical-resistivity sounding data and to provide preliminary inverse models for each sounding.

DATA COLLECTION

The location of each survey site (Figure 1) was selected to provide resistivity data for areas within the MRASA study area where borehole geophysical data are sparse or lacking. Surveys were located in areas that lack obvious cultural interference (powerlines, buried pipelines, and so



EXPLANATION

- | | | | |
|---|--|-----------|--|
| ■ | LOCATION OF SCHLUMBERGER
SOUNDING CONDUCTED IN 1986 | --- | CONTACT BETWEEN MARSHALL
SANDSTONE AND MICHIGAN FORMATION |
| ● | LOCATION AND NUMBER OF
SCHLUMBERGER SOUNDING
CONDUCTED IN 1987 | - - - - - | CONTACT BETWEEN MARSHALL
SANDSTONE AND COLDWATER SHALE |
| | | | CONTACT BETWEEN COLDWATER
SHALE AND ANTRIM SHALE |

Figure 1.--Location of study area and vertical electrical-resistivity soundings.

forth). Current electrodes for all surveys were expanded to the maximum distance (600 to 2,800 m) permitted by cultural disturbances and equipment limitations. Equipment used included a Sintrex TSQ-3 square wave transmitter, and RDC-10 receiver¹. This equipment has a maximum current output of 10 amperes, with a voltage output range of 300 to 1,500 volts. Near-surface geological conditions consisting of well-drained sandy soils constitute the most significant limitation for direct-current electrical-resistivity soundings in the MRASA study area. These soils are very poor conductors, and the amount of current that could be applied to current electrodes under these conditions (43 milliamperes to 100 milliamperes) was insufficient to produce a clean signal. Electrical potentials recorded by the receiver in cases where applied current ranged from 43 to 100 milliamperes were often aberrant when compared to the overall shape of the field curve. Apparent resistivity data that were not consistent with the general curve shape were not included with field data processed using the shift program of Zohdy (1973).

GENERAL CHARACTERISTICS OF VERTICAL ELECTRICAL-RESISTIVITY SOUNDINGS

Field data from surveys were processed using programs provided by Zohdy (1973), and Zohdy and Bisdorf (written commun., 1987). Inverse models were generated for each sounding. An inverse program written by Zohdy (1973) provides digital computer interpretation of layer thicknesses and calculates electrical-resistivities that correspond to modeled layers.

Most of the sounding curves for these surveys have forms that are consistent with simple three- or four-layer models. Zohdy and others (1974, p. 25-26) assign single-letter designations for three-layer models, and two-letter designations for four-layer models. The criteria for assigning letter designations to hypothetical three-layer curves are as follows:

<u>Model</u>	<u>Curve Type</u>
$r_1 > r_2 < r_3$	H-type curve
$r_1 < r_2 < r_3$	A-type curve
$r_1 < r_2 > r_3$	K-type curve
$r_1 > r_2 > r_3$	Q-type curve

where r is the resistivity of the layer, and the subscript refers to the layer number. For hypothetical four-layer models, the following eight relations exist:

1. Use of trade names in this report is for identification purposes only and does not constitute endorsement by the U.S. Geological Survey.

<u>Model</u>	<u>Curve Type</u>
$r_1 > r_2 < r_3 < r_4$	HA-type curve
$r_1 > r_2 < r_3 > r_4$	HK-type curve
$r_1 < r_2 < r_3 < r_4$	AA-type curve
$r_1 < r_2 < r_3 > r_4$	AK-type curve
$r_1 < r_2 > r_3 < r_4$	KH-type curve
$r_1 < r_2 > r_3 > r_4$	KQ-type curve
$r_1 > r_2 > r_3 < r_4$	QH-type curve
$r_1 > r_2 > r_3 > r_4$	QQ-type curve.

Most of the soundings are consistent with three- or four-layer models, but there are cases where shifted-field curves are more complex (Table 1). Where the curve form cannot be assigned a letter designation consistent with a three- or four-layer model, a numerical value is used in the table to describe the minimum number of layers necessary to explain fluctuations in curve shape. The general shape of each curve is a function of many factors, the most important of which are: (1) surface conditions and depth to water table at the survey site, (2) abrupt deviations in apparent resistivity (cusps, as described by Zohdy and others, 1974, p. 39), and (3) substantial vertical or horizontal resistivity contrasts in subsurface layers. Significant contrasts in resistivity for lithologies in the Michigan basin have been reported by Westjohn (1989). Three rock units are assumed to control the bulk of the vertical electrical-resistivity soundings (pronounced conductors and resistors) are (1) anhydrite and dense dolomite in the Michigan Formation with measured resistivities greater than 2,000 ohm-m (ohm-meters), (2) brine-bearing Marshall Sandstone with measured resistivities less than 5 ohm-m, and (3) the Coldwater Shale with measured resistivities ranging from 9 to 14 ohm-m. The station number, near-surface conditions, curve type, maximum spread between current electrodes (AB/2), number of apparent resistivity values deleted from the models, and estimated depths to resistors and conductors are listed in Table 1.

The following items for each sounding are included in the Appendix:

- 1) A log-log plot of output from the inverse-model program, that shows the digitized data points, curve trace that corresponds to calculated layers, and a trace that shows resistivity and modeled depth for each model layer;
- 2) A tabulation of raw field data, with location for each survey site listed in the township and range subdivision system;
- 3) A designation of data points that were excluded before processing field data (denoted by *); these data points are "spikes" or "troughs" (Zohdy and others, 1974) that are interpreted to reflect cultural interferences, current leaks, equipment malfunctions, or abrupt lateral subsurface heterogeneities; and

4) A tabulation of values for voltage (V), current (I), and calculated apparent resistivity for each current electrode spacing ($ab/2$); note where potential electrodes ($mn/2$) were expanded at individual current electrode stations, there are two V, I, and apparent resistivity values separated by a slash to denote two readings recorded at these stations.

SUMMARY

Ninety-three vertical electrical-resistivity soundings were made in the Lower Peninsula of Michigan from June through October 1987. The direct-current electrical-resistivity method employing the Schlumberger-electrode array was used for all soundings. These sounding data were modeled using programs developed by Zohdy (1973) and Zohdy and Bisdorf (written commun., 1987). Raw sounding data, smoothed field data, and results of inverse models are presented. The inverse-model results are generalized using various three- and four-layer models. These generalizations, a summary of near-surface conditions and depths to geologic units (subsurface resistors and conductors) are presented for all soundings.

REFERENCES CITED

- Mandle, R. J., and Westjohn, D. B., 1987, Preliminary interpretation of vertical electrical-resistivity soundings in the Saginaw Valley, Michigan: U.S. Geological Survey Open-File Report, 87-474, 45 p.
- Westjohn, D. B., 1989, Application of geophysics in the delineation of the freshwater/saline-water interface in the Michigan basin: Symposium volume, 24th Annual American Water Resources Association (in press).
- Zohdy, A. A. R., Eaton, G. P., and Mabey, D. R., 1974, Application of surface geophysics to ground-water investigations: U.S. Geological Survey Techniques of Water-Resources Investigations, book 2, chap. D1; p. 5-66.
- Zohdy, A. A. R., 1973, A computer program for the automatic interpretation of Schlumberger sounding curves over horizontally stratified media: available only from U.S. Department of Commerce, National Technical Information Service, Springfield, VA 22161, as U.S. Geological Survey Report USGS-GD-74-017, PB232 703, 25 p.

Table 1.--Summary of observations for vertical
electrical-resistivity soundings

Survey: The prefix, VES should be added to all survey numbers listed in this table.

Near-surface conditions: D, dry, sandy, well drained soil; W, partially or fully-saturated till or lacustrine materials.

Curve type: See text for explanation of different curve types.

Maximum AB/2: Distance, in meters, between a current electrode and center of Schlumberger electrode arrangement.

Stations deleted: The number of apparent resistivity values that were deleted before computer processing of data.

Depth to geologic unit: In meters below land surface.

Geologic unit: Mmf, Mississippian Michigan Formation; Mmss, Mississippian Marshall Sandstone; Mcws, Mississippian Coldwater Shale; NP, not present; no entry in column for geologic unit indicates data not available.

Survey number	Near- surface conditions	Curve type	Maximum AB/2	Number of apparent resistivity values deleted	Depth to geologic unit		
					Mmf	Mmss	Mcws
1	D	KH	800	1	129	164	
2	D	KQ	800	2	NP	87	
3	D	K	800	1	154	253	
4	W	KH	1,200	0	112	158	
5	D	HA	1,200	2	97	165	
6	D	K	1,000	3	NP	83	
7	D	5	1,000	8	213	295	
8	D	5	1,200	0	137	195	
9	D	KH	1,200	0	144	200	
10	D	KH	800	0	NP	143	
11	W	5	1,000	2	216	277	
12	D	KH	800	3	213	296	
13	W	K	1,200	0	265	364	
14	W	K	1,200	3	336	435	
15	W	KQ	600		NP	NP	

Table 1.--Summary of observations for vertical
electrical-resistivity soundings--Continued

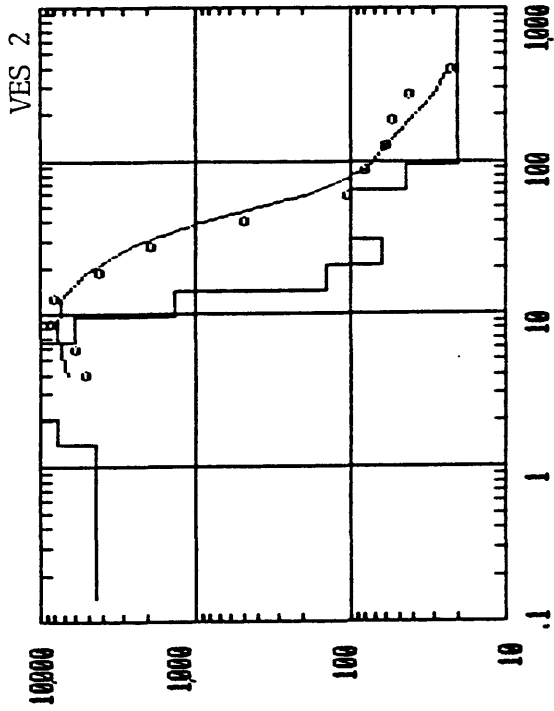
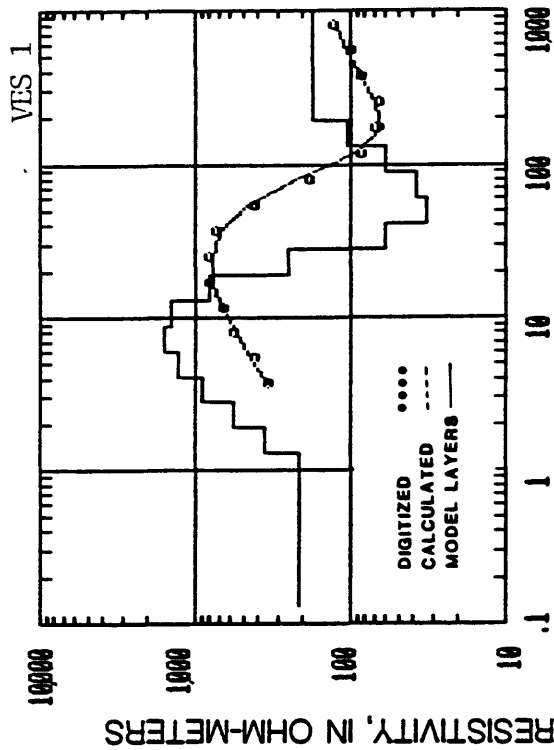
Survey number	Near- surface conditions	Curve type	Maximum AB/2	Number of apparent resistivity values deleted	Depth to geologic unit		
					Mmf	Mmss	Mcws
16	D	K	600	0	259	371	
17	D	HK	1,200	3	259	371	
18	W	5	1,200	4	128	161	
19	W	HK	1,000	1	314	543	
20	D	5	1,400	3	291	456	
21	W	HA	1,400	0	272	370	
22	W	5	1,200	0	274	382	
23	D	QH	1,000	1	196	250	
24	W	6	1,000	1	197	250	
25	W	KH	1,200	0	NP	117	
26	W	5	600	2	266	399	
27	D	KH	1,200	2	272	370	
28	D	5	1,000	11	156	259	
29	D	H	1,200	2	131	222	
30	D	6	800	0	NP	146	
31	W	HK	800	0	NP	93	
32	W	5	1,200	0	124	142	
33	D	HK	600	0	NP	NP	189
34	D	KH	1,200	3	275	454	
35	D	KH	1,000	2	136	199	
36	D	HK	800	3	NP	NP	148
37	W	HK	800	0	NP	NP	213
38	D	6	1,000	0	NP	NP	167
39	W	6	1,400	1	NP	NP	167
40	W	K	600	2	184	269	
41	D	6	1,000	3	298	437	
42	D	5	600	3	219	410	
43	W	5	1,200	0	133	201	
44	W	KH	1,200	0	296	444	
45	D	HA	1,200	3	NP	115	
46	D	QH	1,200	0	NP	109	
47	W	5	1,200	0	344	NP	
48	D	HK	800	2	NP	21	
49	W	5	800	3	104	169	
50	W	KH	1,200	0	104	169	
51	W	5	800	0	27	92	
52	W	HK	600	5	20	90	
53	W	K	800	0	NP	73	
54	W	K	400	0	NP	42	
55	W	HK	600	1	NP	15	

Table 1.--Summary of observations for vertical
electrical-resistivity soundings--Continued

Survey number	Near- surface conditions	Curve type	Maximum AB/2	Number of apparent resistivity values deleted	Depth to geologic unit		
					Mmf	Mmss	Mcws
56	W	K	1,000	4	NP	24	
57	W	AK	800	1	149	236	
58	W	A	800	0	149	236	
59	W	AA	1,000	0	127	186	
60	W	KH	1,000	0	144	149	
61	W	5	1,200	0	136	201	
62	D	K	800	0	NP	100	
63	D	K	800	0	NP	100	
64	W	K	800	0	77	154	
65	W	AA	800	2	166	247	
66	W	K	800	0	NP	84	
67	W	6	1,200	0	176	300	
68	W	6	1,200	1	70	122	
69	W	KH	1,200	0	137	171	
70	W	KH	800	0	NP	39	
71	W	KQ	1,000	0	13	45	
72	W	HK	1,200	0	14	41	
73	W	K	1,000	0	31	35	
74	D	HK	1,000	2	277	398	
75	W	5	1,200	1	239	323	
76	W	5	1,200	0	89	143	
77	D	HK	1,200	0	187	277	
78	W	5	1,200	0	301	450	
79	W	K	1,000	0	NP	29	
80	W	HK	1,200	0	137	147	
81	W	K	800	0	NP	19	
82	W	K	300	0	NP	NP	48
83	W	K	1,200	5	NP	85	
84	W	HK	1,200	0	112	137	
85	W	AA	1,200	0	94	160	
86	W	Q	800	0	NP	NP	30
87	D	KH	800	3	NP	NP	
88	D	KH	1,200	3	NP	NP	
89	D	KH	1,200	0	NP	NP	
90	D	KQ	600	2	NP	NP	
91	D	KQ	800	3	NP	NP	
92	D	K	400	3	213	295	
93	D	HK	800	1	256	400	

APPENDIX

Vertical electrical-resistivity sounding data, shifted data, and calculated electric layers for locations in the Lower Peninsula of Michigan.



ELECTRODE SPACING (AB/2), OR DEPTH, IN METERS

SOUNDING NUMBER AND LOCATION VES1 Oceana Co., 184th Ave.
AZIMUTH OF SURVEY AND DATE Sections 9 10, 15, 16, T13N R15W
North, 6-15-87

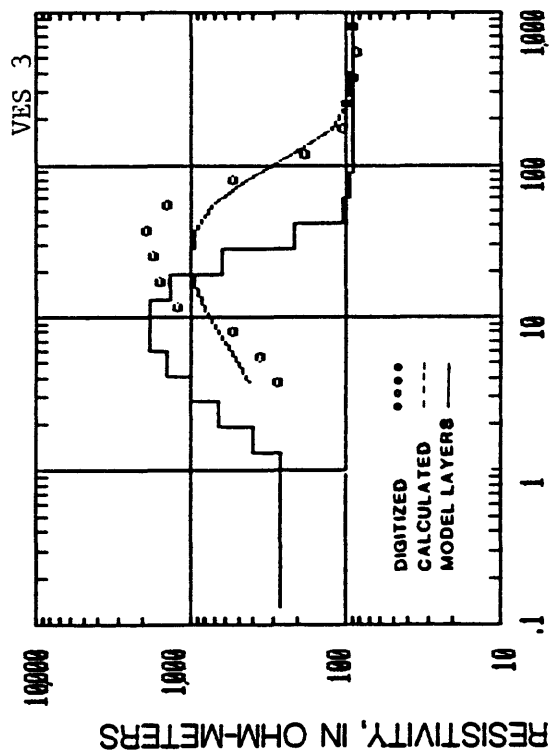
ab/2 (meters)	mn/2 (meters)	V (millivolts)	I (milliamperes)	apparent resistivity (ohm-meters)
3	0.5	7.900	522	416
4	0.5	5.500	567	480
5	0.5	4.160 / 8.900	578 / 608	560 / 552
6	0.5	3.380 / 7.000	662 / 638	610 / 603
8	1	5.300	672	780
10	1	3.460 / 6.000	623 / 642	864 / 705
14	2	1.930 / 3.590	620 / 636	954 / 851
20	2	2.530	792	994
30	4	1.780 / 1.550	583 / 588	942 / 915
40	4	4.22 / 7.60	639 / 629	828 / 752
60	4	67.4	250	379
80	4	22.4	283	198
100	4	26.0 / 121	883 / 847	115 / 108
140	4	8.10 / 42.8	751 / 806	83 / 80
200	20	18.4	817	71
300	20	8.00 / 15.8	713 / 735	79 / 75
400	20	4.74 / 9.00	631 / 621	94 / 90
600	40	5.16	621	209*
800	40	3.00	582	130

* Denotes "spike" or "trough" in apparent resistivity, station removed before data run through "SHIFT" program.

SOUNDING NUMBER AND LOCATION VES2 Oceana Co., McKinley Road
AZIMUTH OF SURVEY AND DATE Sections 22 & 23, T13N R17W
West, 6-15-87

ab/2 (meters)	mn/2 (meters)	V (millivolts)	I (milliamperes)	apparent resistivity (ohm-meters)
3	0.5	21.400	65	9.054
4	0.5	11.200	56	9.900
5	0.5	8.500 / 15.900	61 / 62	10.834 / 9.668
6	0.5	5.600 / 10.200	51 / 51	12.331 / 11.000
8	1	14.700	106	13.729
10	1	7.870 / 14.700	70 / 69	17.482 / 16.064
14	2	2.840 / 6.130	72 / 77	12.082 / 12.005
20	2	2.280	108	6.566
30	4	4.16 / 5.86	112 / 93	2.614 / 2.187
40	4	39.3 / 61.0	59 / 59	635 / 643
60	4	8.1	88	130
80	4	4.33	97	112
100	4	10.6	81	99
140	4	4.8	98	74
200	20	2.28	99	72
300	20	0.72 / 1.2	102 / 103	50 / 40
400	20	0.324 / 0.49	131 / 135	31 / 23
600	40	0.6	181	47*
800	40	0.220	175	74*

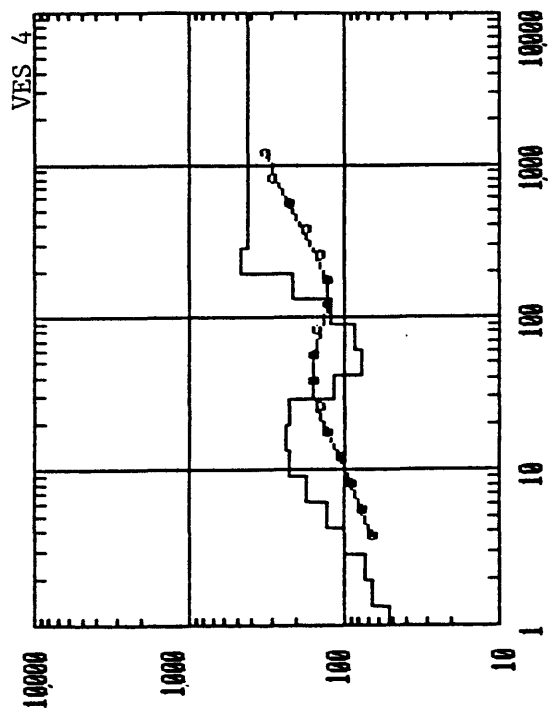
* Denotes "spike" or "trough" in apparent resistivity, station removed before data run through "SHIFT" program.



SOUNDING NUMBER AND LOCATION VES3 Newaygo Co., 56th Ave.
Sections 1, 2, 11, 12, T12N R12W
AZIMUTH OF SURVEY AND DATE West, 7-1-87

ab/2 (meters)	mv/2 (meters)	V (millivolts)	I (milliamperes)	apparent resistivity (ohm-meters)
3	0.5	9,300	1,260	203
4	0.5	6,550	1,450	226
5	0.5	4,770	1,410	263
6	0.5	2,690	1,040	290
8	1	5,080	1,160	433
10	1	5,130	1,100	725
14	2	4,480	1,170	1,030
20	2	5,130	1,230	1,173
30	4	2,470	1,080	1,297
40	4	1,460	1,400	1,410
60	4	115	170	952
80	4	85	470	453
100	4	27.1	420	253
140	4	8.0	45.3	105
200	4	27.7	587	588
300	20	11.8	33.9	89
400	20	21.5	33.7	84
600	40	0.89	50	250*
800	40	1.89	519	91

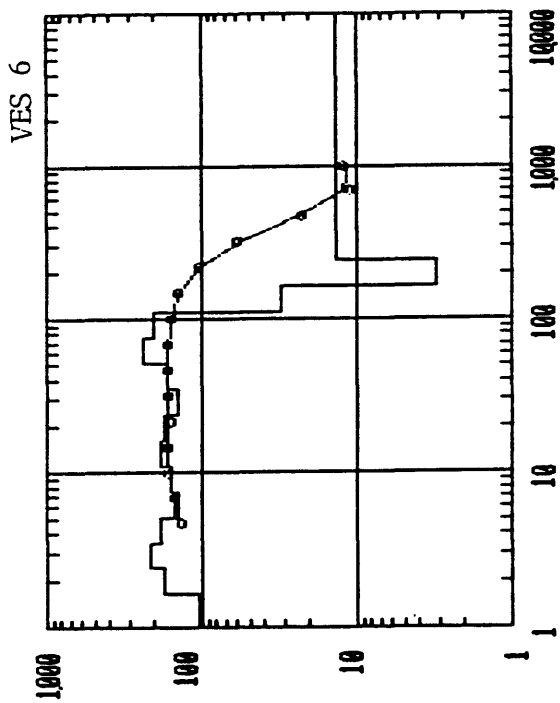
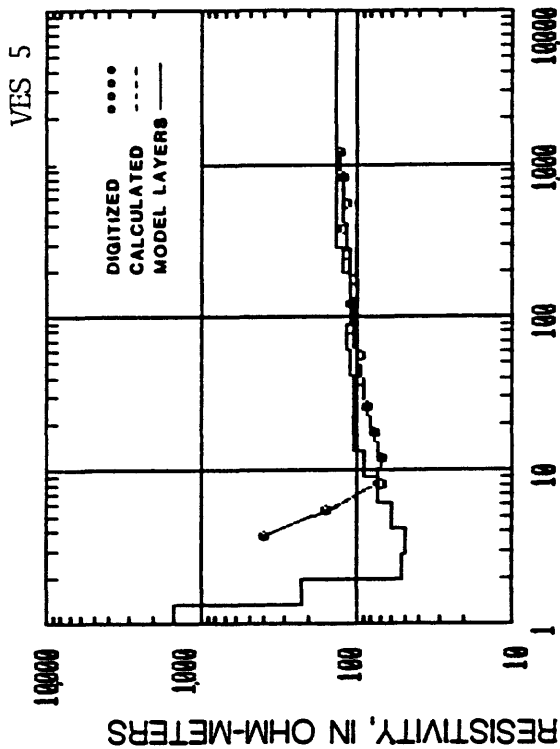
* Denotes "spike" or "trough" in apparent resistivity, station removed before data run through "SHIFT" program.



SOUNDING NUMBER AND LOCATION VES4 Ingham Co., Haynes Road
Sections 22, 23, 26, 27, T1N R1E
AZIMUTH OF SURVEY AND DATE North, 7-1-87

ab/2 (meters)	mv/2 (meters)	V (millivolts)	I (milliamperes)	apparent resistivity (ohm-meters)
3	0.5	1,420	775	50
4	0.5	1,000	817	61
5	0.5	627	963	67
6	0.5	347	536	71
8	1	428	309	83
10	1	207	338	95
14	2	152	499	107
20	2	303	435	123
30	4	158	766	139
40	4	100	849	148
60	4	77.1	756	143
80	4	37.9	687	138
100	4	21.3	672	124
140	4	10.9	710	118
200	20	35.8	836	133
300	20	25.1	51.9	159
400	20	18.6	1,247	187
600	40	14.9	1,239	239
800	40	10.5	897	293
1,000	40	8.80	1,122	308
1,200	40	4.70	858	324
		11.6	821	317

ELECTRODE SPACING (AB/2), OR DEPTH, IN METERS



ELECTRODE SPACING (AB/2), OR DEPTH, IN METERS

SOUNDING NUMBER AND LOCATION VES6 Oceana Co., 192nd Ave.
AZIMUTH OF SURVEY AND DATE Sections 10, 11, 14, 15, T13N R15W
North, 7-6-87

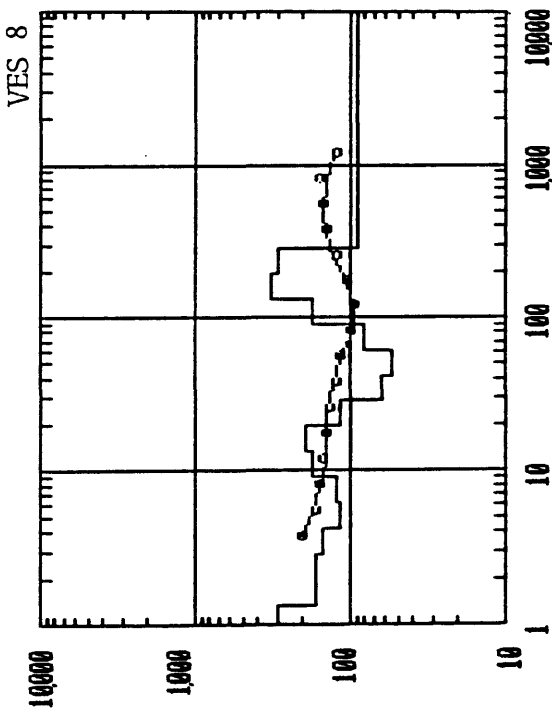
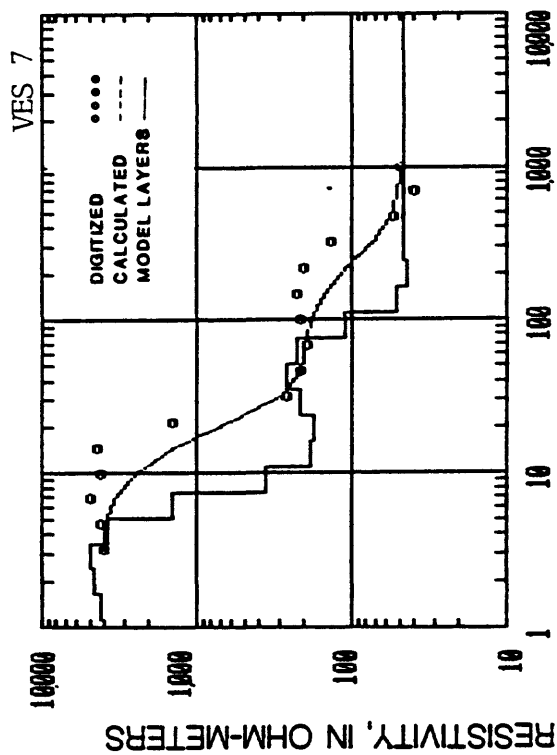
ab/2 (meters)	mn/2 (meters)	V (millivolts)	I (milliamperes)	apparent resistivity (ohm-meters)
3	0.5	4,710	157	825
4	0.5	1,430	164	432
5	0.5	1,477	156	238
6	0.5	335	228	165
8	1	263	298	87
10	1	112	210	81
14	2	47.1	128	91
20	2	76.4	262	91
30	4	30.0	216	98
40	4	81.2	979	93
60	4	40.3	563	104
80	4	33.3	726	101
100	4	19.2	654	115
140	4	2.95	207	115
200	20	39.6	1,359	110
300	20	6.41	420	91
400	20	1.43	170	107
600	40	2.29	253	105
800	40	6.48	1,083	127*
1,000	40	3.41	1,690	150*
1,200	40	2.48	1,196	114
1,400	40	6.87	1,181	117
1,600	40			131

* Denotes "spike" or "trough" in apparent resistivity, station removed before data run through "SHIFT" program.

SOUNDING NUMBER AND LOCATION VES6 Oceana Co., Winston Road
AZIMUTH OF SURVEY AND DATE Sections 19 & 20 T13N R17W
West, 7-6-87

ab/2 (meters)	mn/2 (meters)	V (millivolts)	I (milliamperes)	apparent resistivity (ohm-meters)
3	0.5	1,410	186	209*
4	0.5	1,480	496	148
5	0.5	1,360	746	142
6	0.5	490	374	148
8	1	739	458	160
10	1	467	335	217*
14	2	325	572	254*
20	2	241	572	174
30	4	125	515	171
40	4	66.3	483	158
60	4	52.1	453	172
80	4	37.4	574	159
100	4	22.3	571	162
140	4	10.1	564	163
200	20	13.2	382	153
300	20	4.10	450	138
400	20	8.50	630	140
600	40	1.72	987	108
800	40	0.88	1,065	64
1,000	40	0.47	1,035	35
1,200	40	0.32	1,065	13
1,400	40			11
1,600	40			12

* Denotes "spike" or "trough" in apparent resistivity, station removed before data run through "SHIFT" program.



ELECTRODE SPACING (AB/2), OR DEPTH, IN METERS

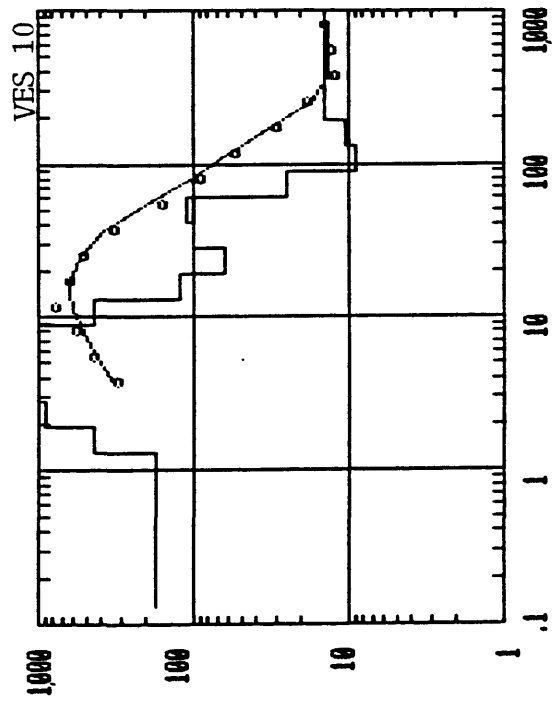
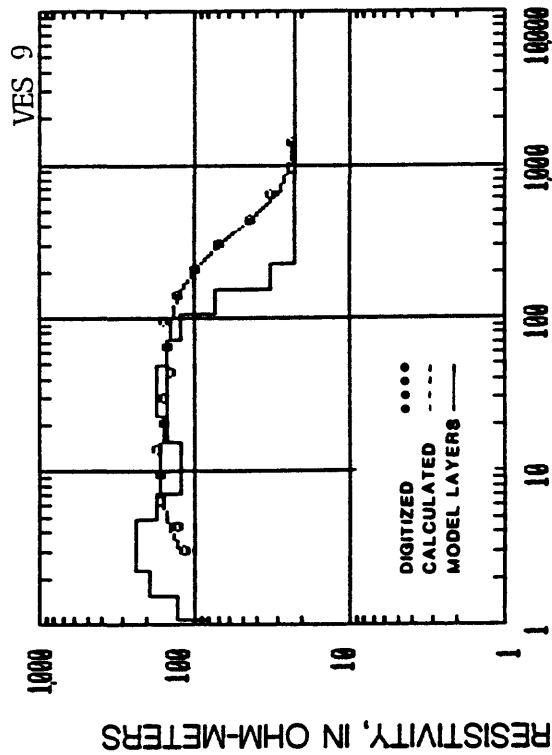
SOUNDING NUMBER AND LOCATION VES7 Newaygo Co., 12 Mile Road
Sections 33 & 34, T15N R12W
AZIMUTH OF SURVEY AND DATE West, 7-7-87

ab/2 (meters)	mv/2 (meters)	V (millivolts)	I (milliamperes)	apparent resistivity (ohm-meters)
3	0.5	11,900	56	5,844
4	0.5	8,430	66	6,323
5	0.5	3,620 / 6,960	44 / 45	6,397 / 5,831
6	0.5	3,520 / 6,750	55 / 55	7,187 / 6,750
8	1	1,540	51	6,872
10	1	1,790 / 3,930	54 / 48	5,798 / 6,173
14	2	1,311 / 1,550	58 / 59	3,880 / 3,962
20	2	281	53	1,859
30	2	29.0 / 50.3	72 / 71	274 / 246
40	2	7.1 / 14.8	47 / 51	189 / 181
60	4	29.0	226	181
80	4	7.9	124	160
100	4	17.6 / 76.9	371 / 325	186 / 178
140	4	2.1 / 12.2	82 / 81	197 / 227
200	20	4.43	101	136*
300	20	1.71 / 11.0	78 / 75	154 / 509*
400	20	0.64 / 4.64	113 / 126	71 / 229*
600	40	3.86	125	435*
800	40	3.21	156	516*
1,000	40	5.27 / 0.81	261 / 261	792* / 48
1,200	40	4.79 / 0.203	78 / 72	3,369* / 63*

* Denotes "spike" or "trough" in apparent resistivity, station removed before data run through "SHIFT" program.

SOUNDING NUMBER AND LOCATION VES8 Newaygo Co., Crosswell Road
Sections 5, 6, 7 & 8, T15N R13W
AZIMUTH OF SURVEY AND DATE West, 7-7-87

ab/2 (meters)	mv/2 (meters)	V (millivolts)	I (milliamperes)	apparent resistivity (ohm-meters)
3	0.5	1,890	227	229
4	0.5	980	239	203
5	0.5	708 / 1,330	306 / 305	180 / 164
6	0.5	495 / 920	333 / 330	167 / 153
8	1	350	232	149
10	1	318 / 761	348 / 404	142 / 142
14	2	182 / 381	396 / 391	141 / 147
20	2	157	350	140
30	2	34.4 / 72.2	184 / 182	132 / 138
40	2	36.4 / 76.6	384 / 383	119 / 124
60	4	34.8	434	113
80	4	15.4	375	103
100	4	10.1 / 54.9	410 / 409	97 / 101
140	4	4.67 / 23.7	358 / 354	100 / 101
200	20	11.9	331	112
300	20	10.5 / 21.5	548 / 549	135 / 136
400	20	4.81 / 9.70	411 / 408	147 / 148
600	40	5.20	455	161
800	40	3.88	590	165
1,000	40	1.50 / 3.99	387 / 398	152 / 156
1,200	40	1.86 / 4.63	843 / 857	125 / 121



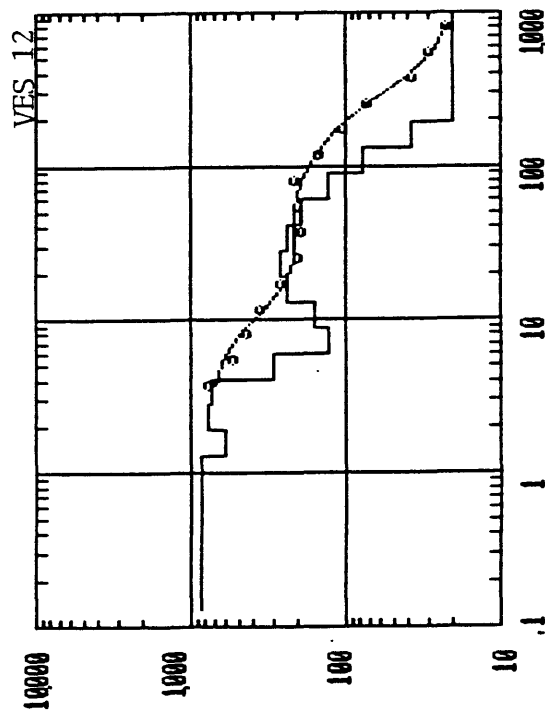
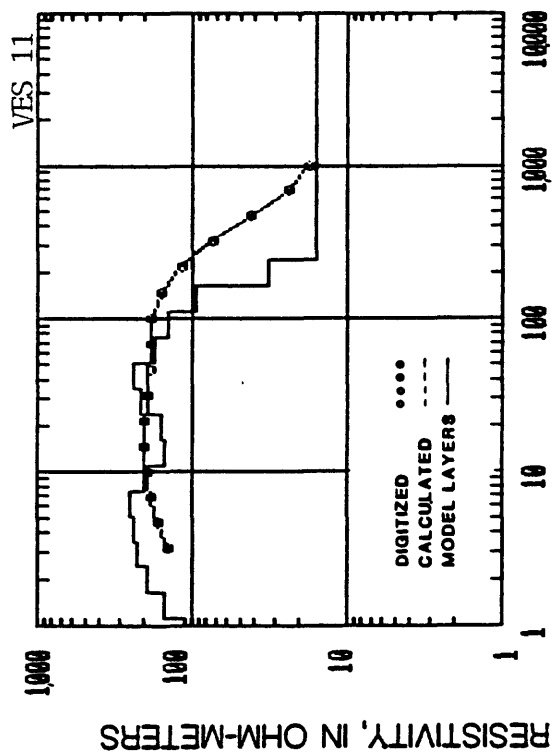
ELECTRODE SPACING (AB/2), OR DEPTH, IN METERS

SOUNDING NUMBER AND LOCATION VES9 Oceana Co., 168th Road
AZIMUTH OF SURVEY AND DATE Sections 19, 20, 29, 30, T15N R15W
North, 7-7-87

ab/2 (meters)	mm/2 (meters)	V (millivolts)	I (milliamperes)	apparent resistivity (ohm-meters)
3	0.5	2,230	334	184
4	0.5	1,540	411	198
5	0.5	1,580 / 2,210	429 / 425	214 / 196
6	0.5	1,310 / 613	140 / 153	249 / 220
8	1	1,010	442	226
10	1	775 / 1,680	508 / 501	237 / 252
14	1	316 / 762	405 / 413	239 / 256
20	2	235	312	234
30	2	353 / 632	1,095 / 1,081	227 / 203
40	2	158 / 291	931 / 934	212 / 194
60	4	171	1,236	195
80	4	120	1,473	204
100	4	78 / 398	1,464 / 1,505	209 / 199
140	4	8.2 / 40	1,62 / 372	174 / 162
200	20	109	2,720	125
300	20	10.4 / 21.3	854 / 866	86 / 85
400	20	4.12 / 8.6	823 / 856	63 / 63
600	40	1.76	604	41
800	40	0.443	300	37
1,000	40	1.41 / 2.65	1,596 / 1,632	28 / 25
1,200	40	0.90 / 2.06	1,862 / 1,888	27 / 25
1,400	40	0.389 / 0.79	1,014 / 1,024	30 / 24

SOUNDING NUMBER AND LOCATION VES10 Oceana Co., Clock Road
AZIMUTH OF SURVEY AND DATE Sections
North, 7-8-87

ab/2 (meters)	mm/2 (meters)	V (millivolts)	I (milliamperes)	apparent resistivity (ohm-meters)
3	0.5	9,370	858	300
4	0.5	6,850	844	401
5	0.5	4,680 / 9,250	746 / 771	488 / 452
6	0.5	5,580 / 10,900	1,145 / 1,165	547 / 515
8	1	2,310	359	637
10	1	3,720 / 7,870	773 / 736	824 / 891
14	1	1,760 / 3,930	740 / 733	757 / 808
20	2	2,340	1,078	675
30	2	721 / 1,170	977 / 979	519 / 414
40	2	70 / 86.3	260 / 164	337 / 327
60	4	95	868	154
80	4	68.9	1,679	103
100	4	39.6 / 176	1,990 / 1,904	78 / 70
140	4	5.40 / 25.7	867 / 914	48 / 42
200	20	11.3	1,462	24
300	20	5.73 / 11.6	2,570 / 2,520	16 / 16
400	20	1.43 / 2.88	1,477 / 1,442	12 / 12
600	40	0.264	268	14
800	40	0.204	352	14



ELECTRODE SPACING (AB/2), OR DEPTH, IN METERS

SOUNDING NUMBER AND LOCATION VES11 Newaygo Co., Buchanan Road
Sections 22 & 23 T15N R12W
AZIMUTH OF SURVEY AND DATE West, 7-8-87

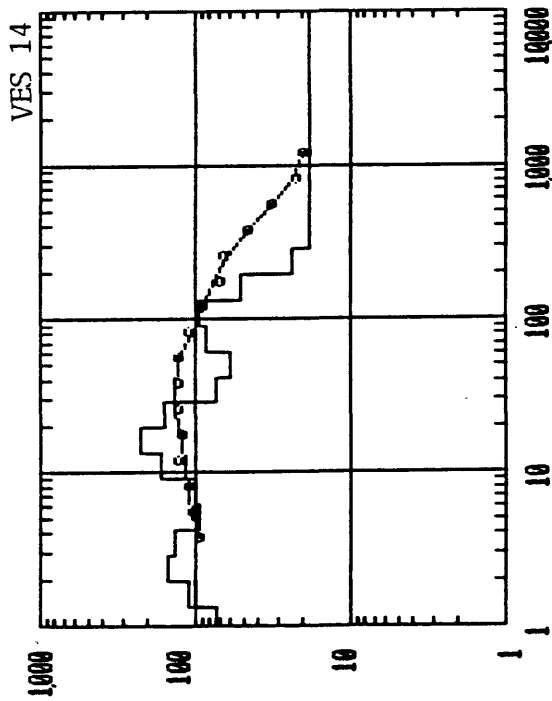
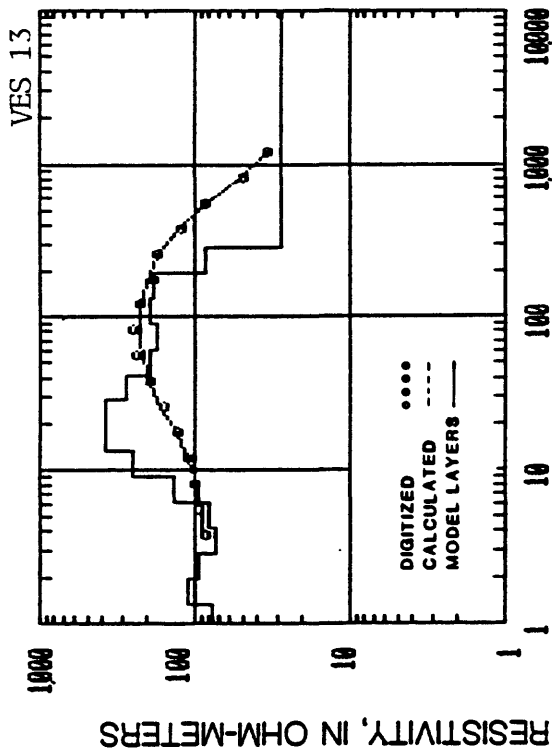
ab/2 (meters)	mn/2 (meters)	V (millivolts)	I (milliamperes)	apparent resistivity (ohm-meters)
3	0.5	3.960	874	125
4	0.5	4.090	1,525	133
5	0.5	1,570 / 3,190	827 / 811	148 / 148
6	0.5	1,580 / 3,160	1,143 / 1,122	155 / 154
8	1	1,850	1,111	165
10	1	1,110 / 2,110	1,009 / 986	171 / 161
14	1	429 / 827	741 / 740	177 / 168
20	2	478	874	170
30	2	185 / 363	792 / 743	164 / 169
40	2	200 / 388	1,592 / 1,484	158 / 163
60	4	158	1,415	157
80	4	68.2	1,089	157
100	4	37.7 / 193	954 / 974	155 / 149
140	4	16.2 / 84.0	899 / 899	139 / 141
200	4	43.5	1,224	110
300	20	20.2 / 44.2	2,090 / 2,060	68 / 74
400	20	4.6 / 11.1	1,160 / 1,191	50 / 58
600	40	2.93	1,531	27
800	40	967	967	60*
1,000	40 / 100	0.72 / 1.27	962 / 1079	29* / 18

* Denotes "spike" or "trough" in apparent resistivity, station removed before data run through "SHIFT" program.

SOUNDING NUMBER AND LOCATION VES12 Newaygo Co., Walnut Road
Sections 4 & 5, T15N R12W,
28, 29, 32, 33, T16N R12W,
AZIMUTH OF SURVEY AND DATE North, 7-8-87

ab/2 (meters)	mn/2 (meters)	V (millivolts)	I (milliamperes)	apparent resistivity (ohm-meters)
3	0.5	4.750	130	1,005
4	0.5	2,620	167	777
5	0.5	1,740 / 3,150	207 / 174	654 / 682
6	0.5	1,270 / 2,370	251 / 232	568 / 562
8	1	960	193	492
10	1	446 / 960	165 / 162	420 / 447
14	1	110 / 397	93 / 56	362 / 384
20	2	186	221	261
30	2	61.2 / 121	181 / 181	238 / 232
40	2	37.4 / 78.3	205 / 211	229 / 231
60	4	35.9	213	237*
80	4	18.2	183	249*
100	4	11.3 / 47.9	178 / 174	262* / 208
140	4	3.44 / 16.0	175 / 177	151 / 136
200	20	11.1	347	99
300	20	6.15 / 12.1	744 / 727	58 / 59
400	20	0.60 / 1.10	203 / 195	37 / 35
600	40	2.93	1,445	28
800	40	0.263	290	23

* Denotes "spike" or "trough" in apparent resistivity, station removed before data run through "SHIFT" program.



ELECTRODE SPACING (AB/2), OR DEPTH, IN METERS

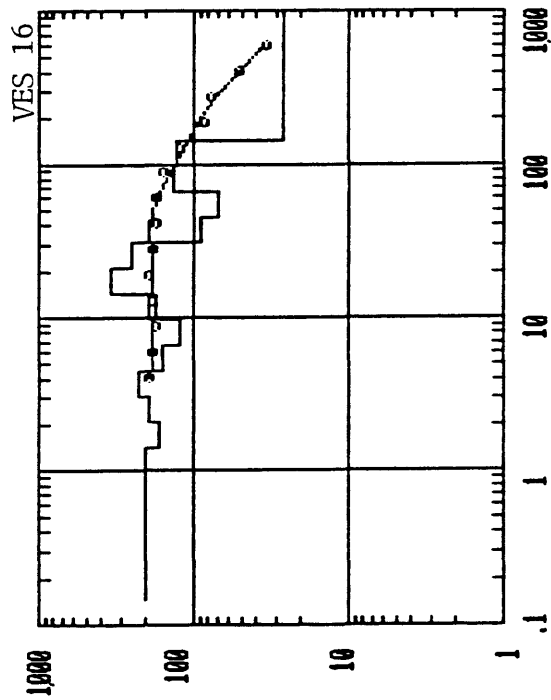
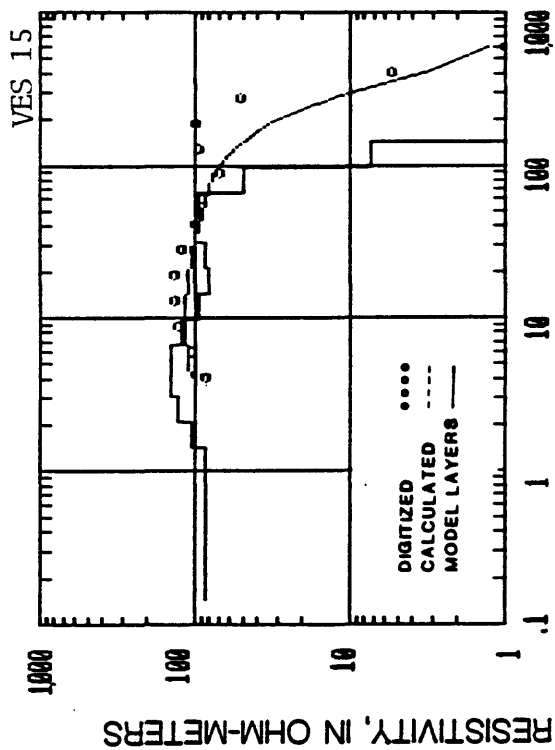
SOUNDING NUMBER AND LOCATION VES13 Newaygo Co., Cypress Road
 Sections 26, 27, 34, 35, T15N R11W
 AZIMUTH OF SURVEY AND DATE North, 7-9-87

	ab/2 (meters)	mv/2 (meters)	Y (millivolts)	I (milliamperes)	apparent resistivity (ohm-meters)
3	0.5	1,550	695	59	59
4	0.5	1,180	880	96	72
5	0.5	1,040	392	406	74
6	0.5	208	317	309	76
8	1	409	512	466	79
10	1	242	464	466	81
14	2	184	623	90	84
20	2	376	1,032	824	113
30	4	165	827	164	147
40	4	101	772	759	164
60	4	43.2	300	202	167
80	4	28.4	587	207	207
100	4	21.5	412	408	205
140	4	18.9	844	807	172
200	20	30.2	577	163	181
300	20	7.78	395	420	139
400	20	4.87	613	605	190
600	40	1.35	575	78	113
800	40	1.93	977	1,766	50
1,000	40	2.04	831	875	45
1,200	40	0.504	1.34	34	48

SOUNDING NUMBER AND LOCATION VES14 Mecosta Co., 130th Road
 Sections 13, 14, 23, 24, T15N R9W
 AZIMUTH OF SURVEY AND DATE North, 7-10-87

	ab/2 (meters)	mv/2 (meters)	Y (millivolts)	I (milliamperes)	apparent resistivity (ohm-meters)
3	0.5	1,230	476	71	71
4	0.5	871	558	77	77
5	0.5	601	567	577	82
6	0.5	377	519	512	82
8	1	844	858	608	97
10	1	399	591	656	105
14	2	227	642	108	117
20	2	384	955	125	123
30	4	147	819	793	126
40	4	79.3	782	749	126
60	4	37.4	435	120	124
80	4	19.6	450	109	120
100	4	11.1	429	423	101
140	4	10.4	1,071	1,061	112*
200	20	46.4	1,053	75	112*
300	20	14.9	1,841	1,833	57
400	20	1.96	573	569	65
600	40	1.03	470	31	47
800	40	0.80	823	24	47
1,000	40	0.501	839	844	23
1,200	40	0.428	1.05	1,160	23

* Denotes "spike" or "trough" in apparent resistivity.
 station removed before data run through "SIFT" program.



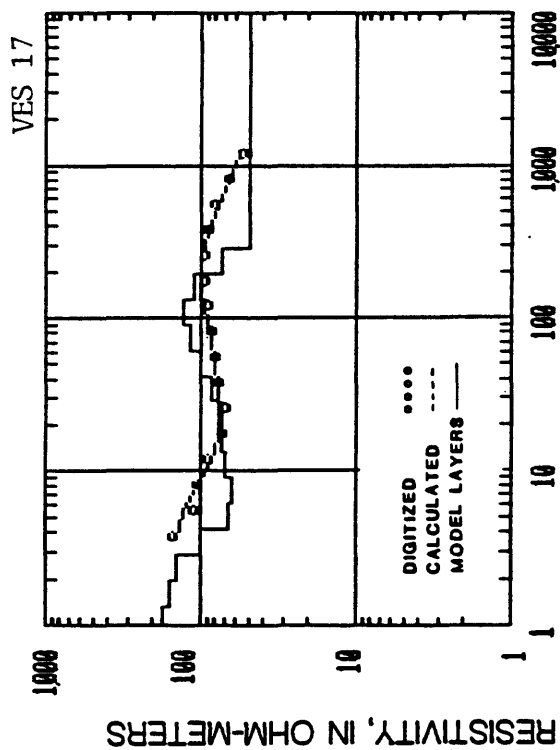
ELECTRODE SPACING (AB/2), OR DEPTH, IN METERS

SOUNDING NUMBER AND LOCATION VES15 Mecosta Co., pipeline survey
AZIMUTH OF SURVEY AND DATE Sections 25, 26, 35, 36, T15N R8W
North, 7-10-87

ab/2 (meters)	mn/2 (meters)	Y (millivolts)	I (milliamperes)	apparent resistivity (ohm-meters)
3	0.5	1,450	1,350	30
4	0.5	1,110	1,609	34
5	0.5	675	1,746	39
6	0.5	416	1,114	42
8	1	735	1,439	51
10	2	432	1,133	59
14	2	393	2,120	57
20	4	395	2,080	59
30	4	148	2,060	51
40	4	43.9	1,241	44
60	4	58.5	2,080	44
80	4	29.6	2,130	35
100	4	9.60	1,370	28
140	4	5.35	912	29
200	20	14.9	1,507	46
300	20	1.30	1,759	31
400	20	0.312	1,666	12
600	20	0.073	2,080	15
				6

SOUNDING NUMBER AND LOCATION VES16 Newaygo Co., Pickarel Lake Road
AZIMUTH OF SURVEY AND DATE Sections 13, 14, 23, 24, T14N R11W
West, 7-10-87

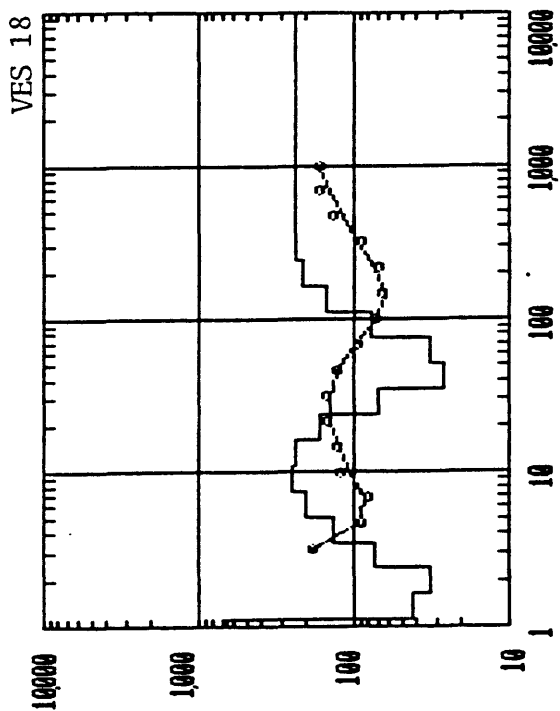
ab/2 (meters)	mn/2 (meters)	Y (millivolts)	I (milliamperes)	apparent resistivity (ohm-meters)
3	0.5	2,830	400	195
4	0.5	1,470	400	182
5	0.5	1,570	710	172
6	0.5	900	570	177
8	1	820	490	166
10	2	516	470	170
14	2	188	340	169
20	4	142	260	170
30	4	144	303	158
40	4	40.3	320	158
60	4	19.5	170	161
80	4	8.5	140	152
100	4	5.43	160	133
140	4	2.17	160	104
200	20	12.0	440	85
300	20	2.49	240	73
400	20	1.65	380	54
600	40	1.03	410	35



SOUNDING NUMBER AND LOCATION VES17 Newaygo Co., Beech Road
Sections 1 & 2, T12N R11W
35 & 36, T13N R11W
AZIMUTH OF SURVEY AND DATE North, 7-11-87

ab/2 (meters)	mv/2 (meters)	Y (millivolts)	I (milliamperes)	apparent resistivity (ohm-meters)
3	0.5	1,280	204	172
4	0.5	755	267	140
5	0.5	225 / 474	149 / 146	117 / 122
6	0.5	203 / 322	216 / 161	106 / 110
8	1	441	322	136*
10	1	392 / 592	390 / 424	156* / 105
14	1	152 / 267	459 / 481	101* / 84
20	2	242	1,022	74
30	2	119 / 241	1,142 / 1,189	73 / 70
40	2	55.7 / 191	668 / 1,561	80 / 76
60	4	92.2	1,580	83
80	4	53	1,558	85
100	4	59.5 / 435	2,720 / 2,850	86 / 115
140	4	36.4 / 212	3,100 / 2,730	90 / 117
200	20	23.0	590	121
300	20	23.3 / 43.7	1,384 / 1,350	118 / 112
400	20	9.40 / 18.7	1,038 / 1,143	114 / 102
600	40	6.75	1,069	89
800	40	2.98	971	77
1,000	40	3.83 / 9.60	2,240 / 2,590	62 / 58
1,200	40	3.96 / 8.80	3,610 / 3,620	62 / 55

* Denotes "spike" or "trough" in apparent resistivity, station removed before data run through "SHIFT" program.

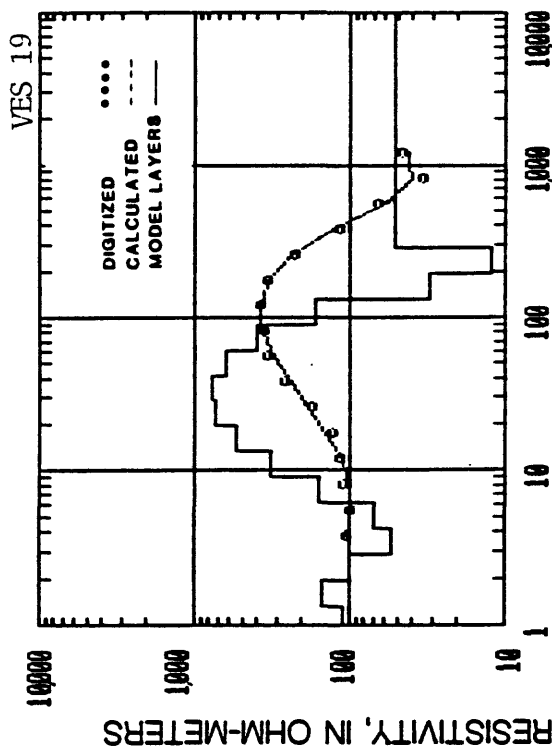
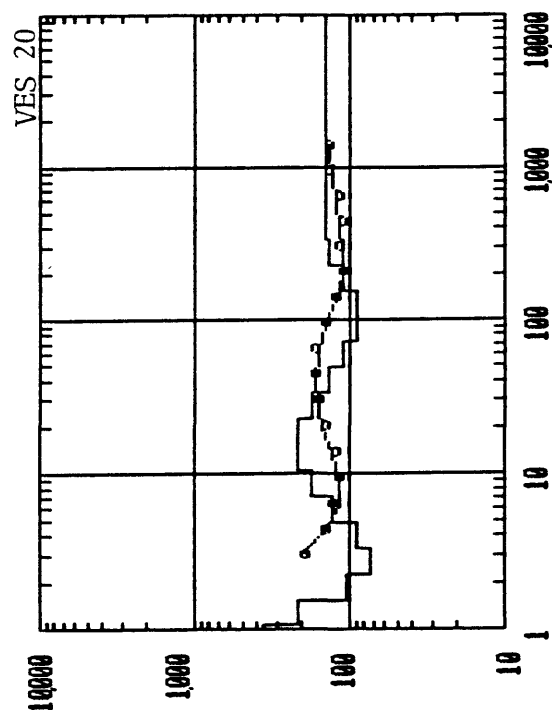


SOUNDING NUMBER AND LOCATION VES18 Oceana Co., N-20
Sections 27, 28, 33, 34, T14N R15W
AZIMUTH OF SURVEY AND DATE West, 7-13-87

ab/2 (meters)	mv/2 (meters)	Y (millivolts)	I (milliamperes)	apparent resistivity (ohm-meters)
3	0.5	1,070	148	199
4	0.5	360	150	119
5	0.5	240 / 504	228 / 218	82 / 87
6	0.5	136 / 278	194 / 188	79 / 81
8	1	154	171	89
10	1	184 / 437	233 / 222	123 / 148
14	1	109 / 231	252 / 257	132 / 135
20	2	195	394	154
30	2	74.3 / 137	328 / 310	159 / 153
40	2	31.3 / 62.7	292 / 285	143 / 137
60	4	24.7	334	104
80	4	10.7	317	85
100	4	10.7 / 55.1	576 / 549	73 / 76
140	4	5.0 / 25.3	569 / 560	68 / 68
200	20	26.6	1,249	66
300	20	12.0 / 25.1	967 / 952	87 / 92
400	20	8.9 / 18.0	985 / 984	113 / 114
600	40	9.2	800	162
800	40	1.0	604	42*
1,000	40	4.65 / 16.4	1,576 / 1,509	116* / 169
1,200	40	1.0 / 2.90	1,285 / 1,487	44* / 44*

* Denotes "spike" or "trough" in apparent resistivity, station removed before data run through "SHIFT" program.

ELECTRODE SPACING (AB/2), OR DEPTH, IN METERS



ELECTRODE SPACING (AB/2), OR DEPTH, IN METERS

SOUNDING NUMBER AND LOCATION

HAZIMUTH OF SURVEY AND DATE

ab/2 (meters)	mm/2 (meters)	Y (millivolts)	I (milliamperes)	apparent resistivity (ohm-meters)
3	0.5	1.260	485	71
4	0.5	1.99	309	64
5	0.5 / 1	238 / 520	296 / 308	62 / 64
6	0.5 / 1	175 / 373	309 / 301	64 / 68
8	1	617	854	72
10	1 / 2	231 / 513	489 / 546	74 / 71
14	1 / 2	299 / 576	1,138 / 1,138	80 / 76
20	2	297	1,018	91
30	2 / 4	186 / 348	1,017 / 1,017	129 / 119
40	2 / 4	124 / 227	912 / 912	170 / 155
60	4	40.9	274	210
80	4	41.8	401	261*
100	4 / 20	70.0 / 345	1,273 / 1,269	216 / 205
140	4 / 20	17.2 / 80.7	599 / 557	221 / 218
200	4	13.1	239	170
300	20 / 40	5.09 / 9.85	350 / 325	102 / 105
400	20 / 40	6.34 / 15.6	1,274 / 1,510	62 / 64
600	40	2.02	851	33
800	40	0.624	739	21
1,000	40 / 100	0.589 / 2.36	1,314 / 1,280	18 / 29
1,200	40 / 100	1.04 / 4.39	2,200 / 2,160	27 / 46

* Denotes "spike" or "trough" in apparent resistivity, before data run through "SHIFT" program.

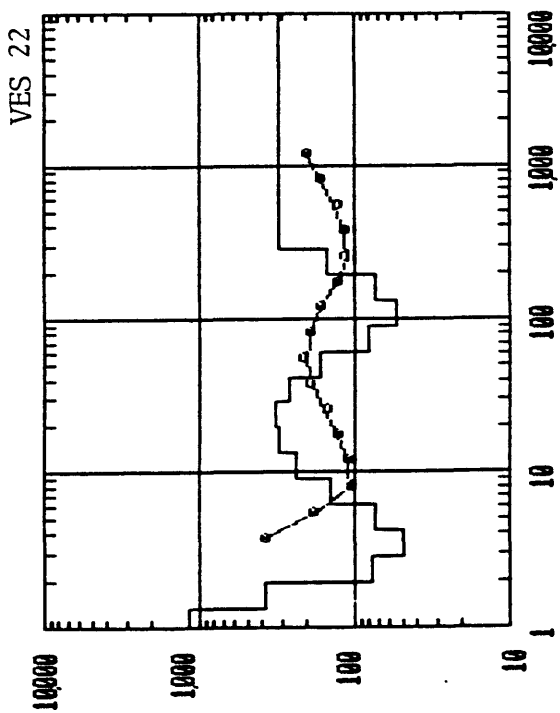
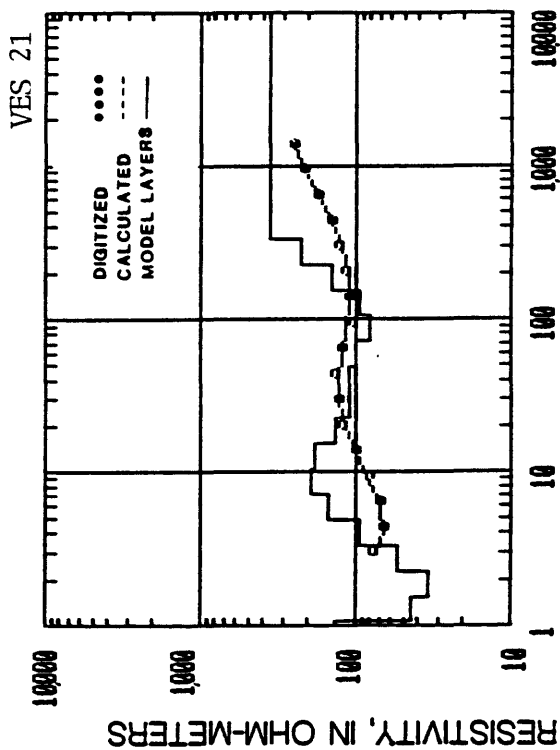
VES20 Missaukee Co., M-55
Sections 33 & 34, T22N R8W
West, 7-14-87

COORDINATING NUMBER AND LOCATION

AZIMUTH OF SURVEY AND DATE

ab/2 (meters)	mm/2 (meters)	V (millivolts)	I (milliamperes)	apparent resistivity (ohm-meters)
3	0.5	940	193	134
4	0.5	406	183	110
5	0.5 / 1	219 / 517	187 / 183	91 / 107
6	0.5 / 1	113 / 275	142 / 147	89 / 103
8	1	243	168	143*
10	1 / 2	197 / 275	212 / 215	142* / 96
14	1 / 2	119 / 198	316 / 305	115* / 98
20	2	142	386	114
30	2 / 4	50.7 / 95.0	279 / 265	128 / 124
40	2 / 4	27.7 / 56.0	273 / 271	127 / 129
60	4	26.1	273	135
80	4	11.4	232	123
100	4 / 20	6.46 / 35.7	226 / 226	112 / 119
140	4 / 20			
200	20	66.6	2190	96
300	20 / 40	2.72 / 5.51	191 / 185	99 / 103
400	20 / 40	1.52 / 3.74	168 / 249	91 / 93
600	40	8.75	1222	101
800	40	0.497	126	99
1,000	40 / 100	1.31 / 3.17	433 / 395	119 / 125
1,200	40 / 100	1.77 / 4.52	779 / 737	128 / 138
1,400	40 / 100	0.383 / 1.14	256 / 258	115 / 135

* Denotes "spike" or "trough" in apparent resistivity, station removed before data run through "SHIFT" program.



ELECTRODE SPACING (AB/2), OR DEPTH, IN METERS

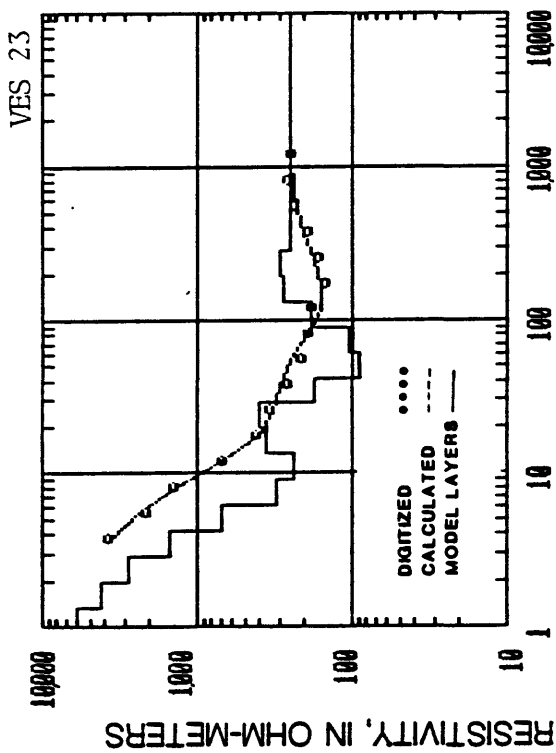
SOUNDING NUMBER AND LOCATION VES21 Wexford Co., Boon Road
Sections 22, 23, 26, 27, T22N R10W
AZIMUTH OF SURVEY AND DATE West, 7-15-67

ab/2 (meters)	mn/2 (meters)	V (millivolts)	I (milliamperes)	apparent resistivity (ohm-meters)
3	0.5	2.560	875	81
4	0.5	1.310	881	74
5	0.5	796 / 1.570	882 / 882	70 / 67
6	0.5	567 / 1.090	880 / 879	72 / 68
8	1	643	881	72
10	1	462 / 960	880 / 881	82 / 82
14	1	287 / 597	867 / 864	101 / 104
20	2	342	852	125
30	2	158 / 324	855 / 866	130 / 130
40	2	71.9 / 136	654 / 652	138 / 130
60	4	17.5	195	126
80	4	6.4	214	110
100	4	10.8 / 59.3	410 / 391	103 / 114
140	4	13.9 / 77.1	975 / 992	110 / 117
200	20	27.2	717	118
300	20	11.0 / 22.4	598 / 598	130 / 130
400	20	7.8 / 15.7	688 / 688	142 / 142
600	40	6.73	565	168
800	40	4.98	624	200
1,000	40	3.66 / 9.88	625 / 673	230 / 266
1,200	40	3.21 / 8.2	770 / 759	236 / 243
1,400	40	1.88 / 4.45	551 / 537	262 / 254

SOUNDING NUMBER AND LOCATION VES22 Wexford Co., #27 Road
Sections 29, 30, 31, 32, T22N R10W
AZIMUTH OF SURVEY AND DATE North, 7-15-67

ab/2 (meters)	mn/2 (meters)	V (millivolts)	I (milliamperes)	apparent resistivity (ohm-meters)
3	0.5	1.680	116	398
4	0.5	818	142	285
5	0.5	481 / 990	190 / 427	197 / 203
6	0.5	207 / 427	175 / 170	133 / 138
8	1	205	215	94
10	1	124 / 225	219 / 218	88 / 78
14	1	124 / 278	358 / 355	106 / 118
20	2	297	705	131
30	2	121 / 228	515 / 504	165 / 157
40	2	82.0 / 157	543 / 543	189 / 180
60	4	117	874	117
80	4	37.9	517	177
100	4	9.70 / 58.5	238 / 261	160 / 169
140	4	6.30 / 35.1	371 / 371	143 / 143
200	20	2.39	289	108
300	20	2.65 / 6.35	171 / 197	109 / 112
400	20	1.64 / 3.52	191 / 190	108 / 115
600	40	2.01	212	133
800	40	0.472	74	160
1,000	40	0.436 / 1.16	100 / 94	171 / 192
1,200	40	1.84 / 4.50	770 / 759	202 / 206

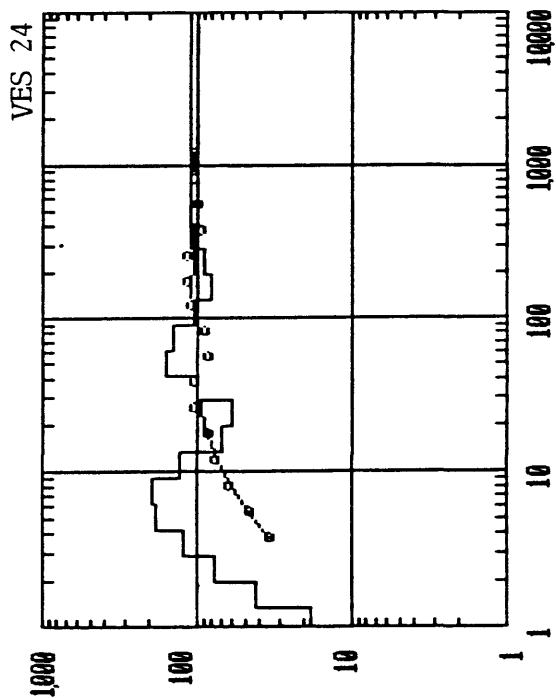
* Denotes "spike" or "trough" in apparent resistivity, station removed before data run through "SHIFT" program.



SOUNDING NUMBER AND LOCATION VES23 Wexford Co., btw. #8 and #14
roads
Sections 21, 22, 27, 28, T24N R10W
AZIMUTH OF SURVEY AND DATE North, 7-16-87

ab/2 (meters)	mn/2 (meters)	V (millivolts)	I (milliamperes)	apparent resistivity (ohm-meters)
3	0.5	6,590	46	3,940
4	0.5	4,110	62	3,281
5	0.5	1,420	47	2,349
6	0.5	980	60	1,853
8	1	283	57	1,541
10	1	283	44	1,541
14	2	103	45	1,000
20	2	171	55	574
30	4	26.6	128	415
40	4	16.9	57	328
60	4	3.40	77	275
80	4	5.15	79	61*
100	4	5.02	62	208
140	4	3.18	89	221
200	4	1.68	126	136
300	20	1.55	94	180
400	20	8.90	175	159
600	40	3.71	177	183
800	40	12.3	367	174
1,000	40	8.65	210	209
1,200	40	4.08	481	253
	40	2.65	366	280
	100	6.21	389	267
	100	2.07	455	248
	100	5.20	476	257
	100			245

* Denotes "spike" or "trough" in apparent resistivity.
station removed before data run through "SHIF" program.

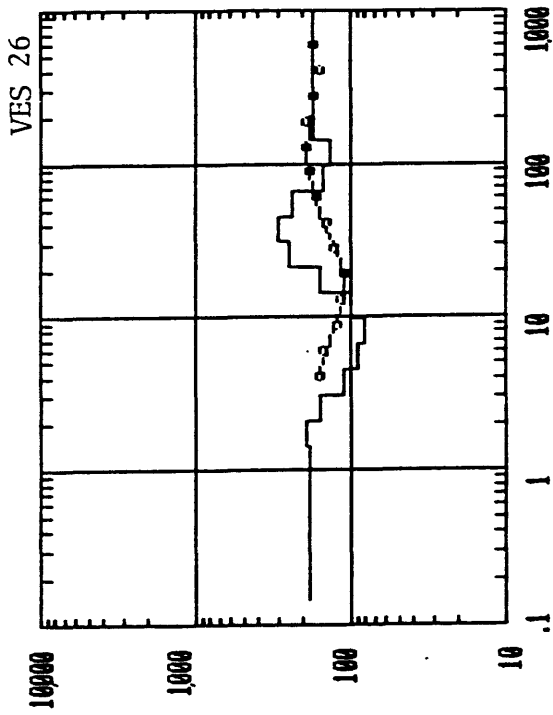
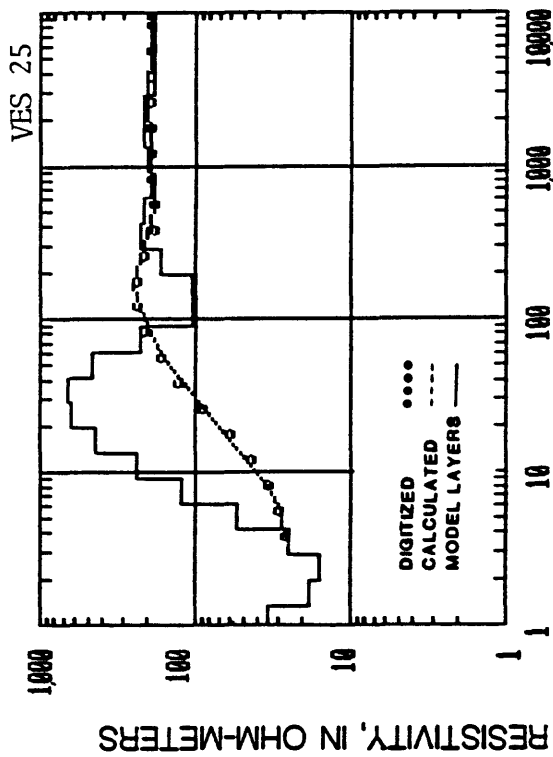


SOUNDING NUMBER AND LOCATION VES24 Wexford Co., #37 Road
Sections 13 & 24 T24N R10W
AZIMUTH OF SURVEY AND DATE North, 7-17-87

ab/2 (meters)	mn/2 (meters)	V (millivolts)	I (milliamperes)	apparent resistivity (ohm-meters)
3	0.5	1,930	2,510	21
4	0.5	1,440	2,510	28
5	0.5	1,120	2,530	34
6	0.5	890	2,490	34
8	1	1,250	2,500	40
10	1	890	2,490	50
14	2	528	2,490	56
20	2	617	2,490	65
30	4	339	2,560	75
40	4	184	2,640	93
60	4	52.1	2,640	87
80	4	20.9	1,032	71
100	4	38.8	664	79
140	4	20.9	1,620	94
200	20	62.8	1,616	99
300	20	3.33	1,618	121*
400	20	7.57	2,36	99
600	40	26.6	1,942	103
800	40	5.98	834	92
1,000	40	1.95	475	101
1,200	40	0.29	110	103
	100	0.72	128	106
	100	0.21		94

* Denotes "spike" or "trough" in apparent resistivity.
station removed before data run through "SHIF" program.

ELECTRODE SPACING (AB/2), OR DEPTH, IN METERS

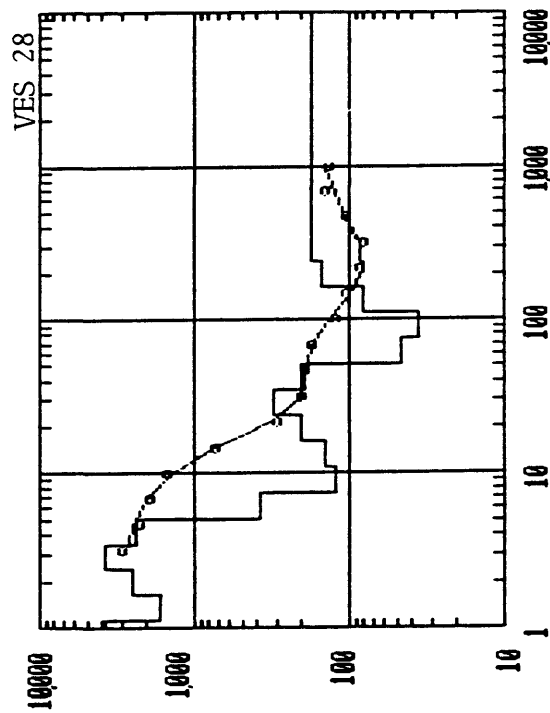
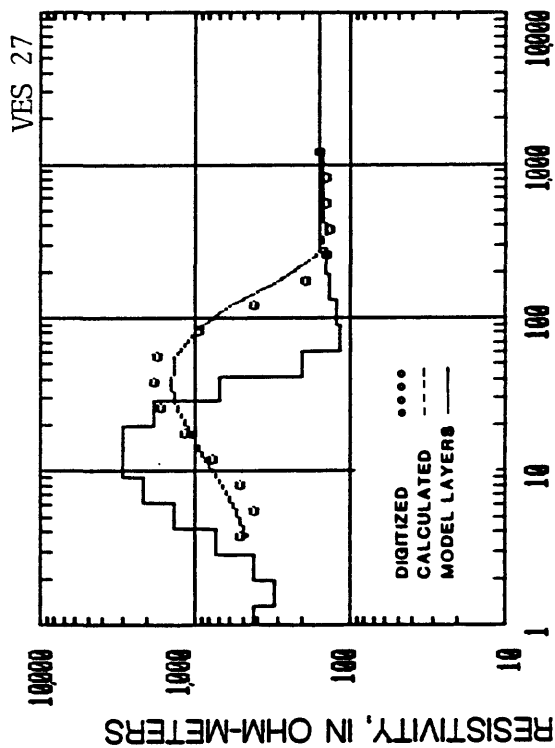


ELECTRODE SPACING (AB/2), OR DEPTH, IN METERS

SOUNDING NUMBER AND LOCATION		VES25 Kalkaska Co., Sharon Road		VES26 Wexford Co., 13th Street	
AZIMUTH OF SURVEY AND DATE		Sections 19, 20, 26, 30, T26N R6W		Sections 29 & 32, T22N R9W	
		North, 7-17-87		West, 7-18-87	
ab/2 (meters)	mn/2 (meters)	V (millivolts)	I (milliamperes)	apparent resistivity (ohm-meters)	apparent resistivity (ohm-meters)
3	0.5	1,610	1,469	30	130*
4	0.5	820	1,484	27	145*
5	0.5	538	1,469	29	150
6	0.5	382	1,460	29	134
8	1	488	1,460	33	122
10	1	368	1,465	39	123
14	1	230	1,402	50	112
20	2	310	1,370	70	119
30	2	201	1,370	103	134
40	2	143	1,370	131	144
60	4	171	1,370	176	159
80	4	112	1,350	208	174
100	4	68.5	1,176	228	189
140	4	63.0	1,054	236	187
200	20	105.6	1,740	233	193
300	20	39.6	1,430	225	169
400	20	20.1	1,419	196	160
600	40	11.3	1,422	177	162
800	40	16.3	845	188	174
1,000	40	11.2	2,110	194	
1,200	40	1.38	2,220	198	
	100	3.47	412	406	

SOUNDING NUMBER AND LOCATION		VES25 Kalkaska Co., Sharon Road		VES26 Wexford Co., 13th Street	
AZIMUTH OF SURVEY AND DATE		Sections 19, 20, 26, 30, T26N R6W		Sections 29 & 32, T22N R9W	
		North, 7-17-87		West, 7-18-87	
ab/2 (meters)	mn/2 (meters)	V (millivolts)	I (milliamperes)	apparent resistivity (ohm-meters)	apparent resistivity (ohm-meters)
3	0.5	910	193	193	130*
4	0.5	564	193	193	145*
5	0.5	371	200	193	150
6	0.5	239	165	200	134
8	1	204	165	165	122
10	1	130	164	301	123
14	1	217	595	575	112
20	2	221	576	119	119
30	2	108	568	562	134
40	2	49.4	430	430	144
60	4	103	914	159	159
80	4	36.1	519	174	174
100	4	24.8	514	512	189
140	4	28.0	1,153	1,114	187
200	20	55.2	889	193	193
300	20	23.0	964	963	169
400	20	23.7	1,856	1,786	160
600	40	6.40	517	174	162

* Denotes "spike" or "trough" in apparent resistivity.
station removed before data run through "SHIFT" program.



ELECTRODE SPACING (AB/2), OR DEPTH, IN METERS

SOUNDING NUMBER AND LOCATION VES27 Wexford Co., #31 Road
AZIMUTH OF SURVEY AND DATE Sections 9, 10, 15, 16, T22N R10W
North, 7-19-87

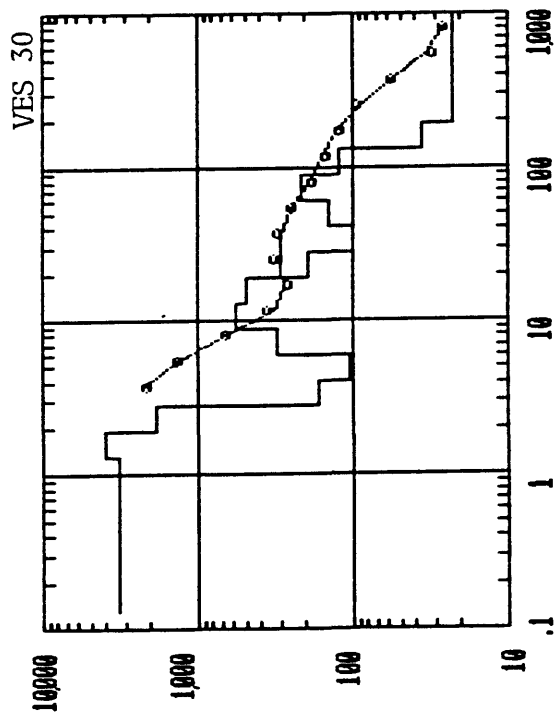
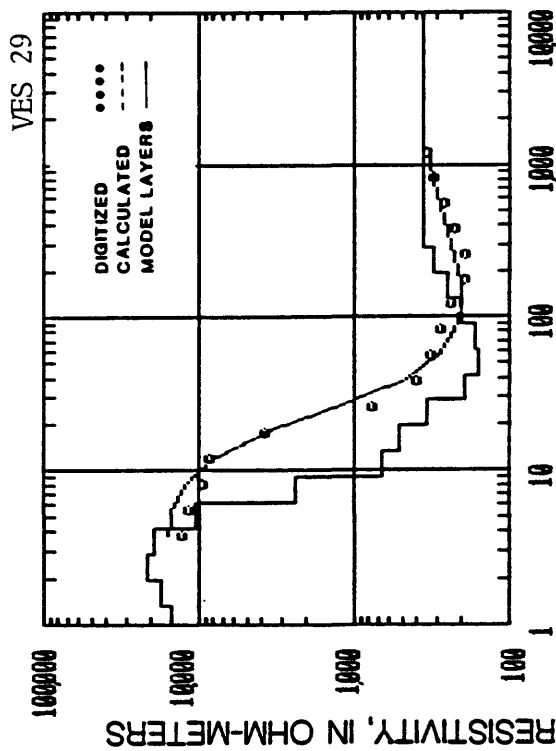
ab/2 (meters)	mn/2 (meters)	V (millivolts)	I (milliamperes)	apparent resistivity (ohm-meters)
3	0.5	3,700	105	969
4	0.5	1,550	123	624
5	0.5	880	124	552
6	0.5	633	124	573
8	1	900	140	636
10	1	788	145	845
14	1	502	131	1,156
20	2	702	139	1,571
30	2	624	209	2,752
40	2	415	233	2,833
60	4	203	153	1,843
80	4	99	224	1,108
100	4	68.2	271	677
140	4	9.47	200	336
200	20	9.50	152	194
300	20	8.40	433	137*
400	20	6.18	492	158
600	40	2.36	211	159
800	40	1.27	201	158
1,000	40	0.76	179	167
1,200	40	0.28	93	171
			89	156

* Denotes "spike" or "trough" in apparent resistivity, station removed before data run through "SHIF" program.

SOUNDING NUMBER AND LOCATION VES28 Lake Co., Twin Creek Road
AZIMUTH OF SURVEY AND DATE Sections 5 & 6, T19N R12W
North, 7-27-87

ab/2 (meters)	mn/2 (meters)	V (millivolts)	I (milliamperes)	apparent resistivity (ohm-meters)
3	0.5	8,490	70	3,335
4	0.5	9,430	158	2,954
5	0.5	5,450	174	2,435
6	0.5	3,340	176	2,156*
8	1	4,540	181	2,483
10	1	2,610	181	2,243*
14	1	425	141	623
20	2	431	111	367
30	2	19.6	76	182*
40	2	8.8	81	136*
60	4	3.3	82	57*
80	4	12.0	186	162
100	4	3.45	106	128
140	4	1.09	75	112
200	20	9.09	333	85
300	20	2.75	263	74
400	20	1.30	197	83
600	40	2.60	268	137
800	40	1.54	267	145
1,000	40	1.96	553	139
1,200	40	0.261	259	57*
				83*

* Denotes "spike" or "trough" in apparent resistivity, station removed before data run through "SHIF" program.



ELECTRODE SPACING (AB/2), OR DEPTH, IN METERS

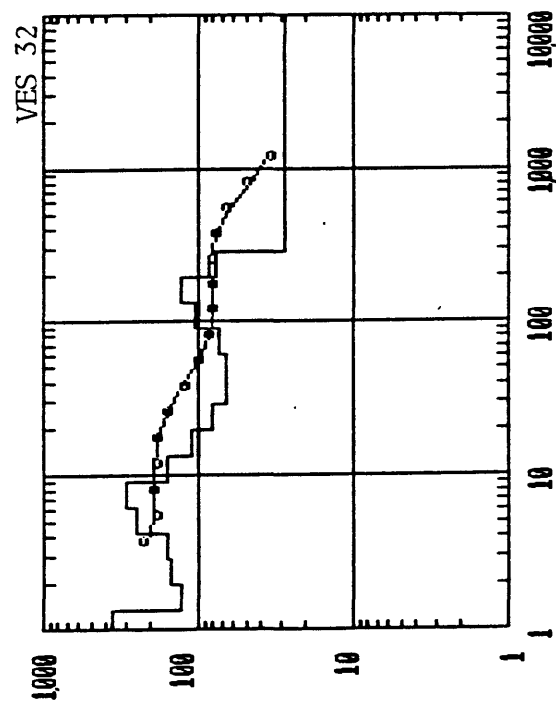
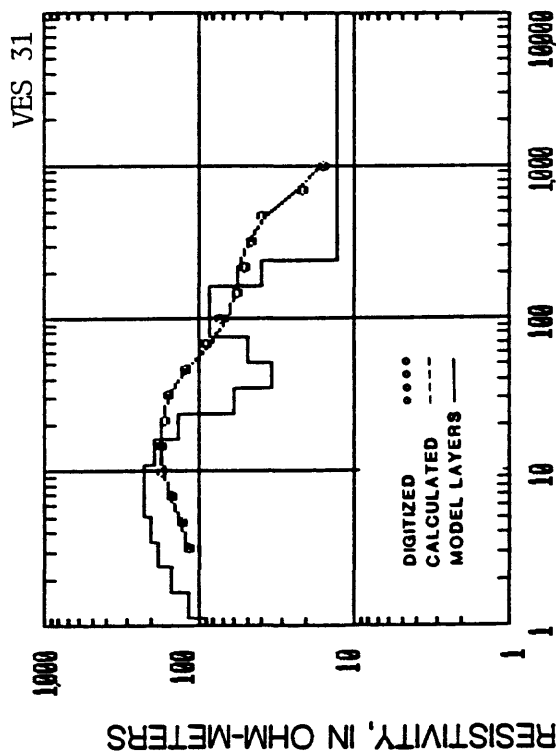
SOUNDING NUMBER AND LOCATION VES29 Lake Co., Twin Creek Road
Sections 17, 18, 19, 20, 29, 30,
T20N R12W
AZIMUTH OF SURVEY AND DATE North, 7-27-87

ab/2 (meters)	mv/2 (meters)	V (millivolts)	I (milliamperes)	apparent resistivity (ohm-meters)
3	0.5	35,100	59	16,360
4	0.5	20,100	61	17,455
5	0.5	11,200/23,500	53	16,430
6	0.5	7,270/14,900	55	14,844
8	1	6,710	51	13,025
10	1	8,350/14,400	55	23,608*
14	1	1,700/3,060	56	9,298
20	2	474	57	2,586
30	2	106/179	117	637
40	2	35.9/63.3	98	459
60	4	16.5	71	327
80	4	10.3	88	281
100	4	4.89/21.8	67	286
140	4	2.87/13.3	97	288
200	20	5.88	100	283
300	20	4.14/8.30	152	192
400	20	4.72/9.10	161	227
600	40	3.02	167	255
800	40	4.41	381	290
1,000	40	2.36/6.56	290	317
1,200	40	1.85/4.74	322	324
			314	339

* Denotes "spike" or "trough" in apparent resistivity,
station removed before data run through "SHIFT" program.

SOUNDING NUMBER AND LOCATION VES30 Lake Co., Freesoil Road
Sections 19, 20, 29, 30, T20N R14W
AZIMUTH OF SURVEY AND DATE West, 7-27-87

ab/2 (meters)	mv/2 (meters)	V (millivolts)	I (milliamperes)	apparent resistivity (ohm-meters)
3	0.5	9,310	102	2,510
4	0.5	2,840	78	1,802
5	0.5	2,540/5,390	140	1,411
6	0.5	1,150/2,250	129	1,001
8	1	845	140	1,023
10	1	206/447	76	597
14	1	60.3/116	72	421
20	2	106	77	257
30	2	110/217	129	256
40	2	34.1/65.8	268	289
60	4	15.0	157	272
80	4	10.8	103	205
100	4	9.2	159	170
140	4	50.2	245	147
200	20	3.69/18.6	235	121
300	20	6.51	202	121
400	20	2.05/4.14	210	69
600	40	0.67/1.55	187	50
800	40	2.02	1,014	28
		0.473	440	27



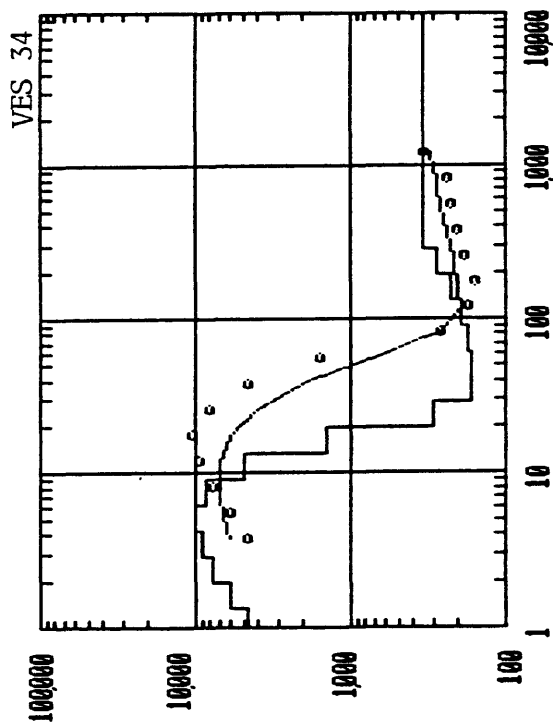
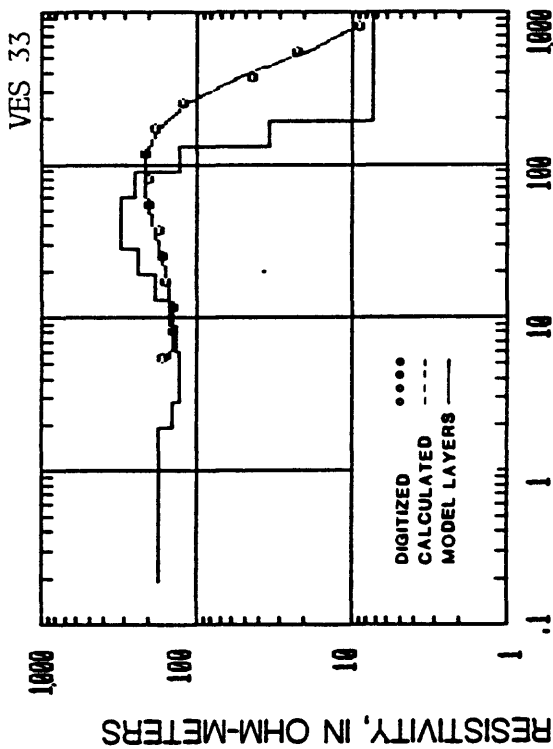
ELECTRODE SPACING (AB/2), OR DEPTH, IN METERS

SOUNDING NUMBER AND LOCATION VES31 Mason and Lake Co., Elk Hwy.
Sections 31, T20N, R14W
AZIMUTH OF SURVEY AND DATE 23 & 36, T20N, R15W
Northwest, 7-28-87

ab/2 (meters)	mn/2 (meters)	V (millivolts)	I (milliamperes)	apparent resistivity (ohm-meters)
3	0.5	950	233	112
4	0.5	565	240	117
5	0.5	328 / 651	196 / 194	130 / 127
6	0.5	171 / 349	140 / 137	137 / 140
8	1	328	208	156
10	1	154 / 322	141 / 141	170 / 172
14	2	152 / 299	261 / 256	178 / 176
20	2	226	412	163
30	4	78.9 / 155	350 / 345	158 / 156
40	4	31.0 / 59.2	289 / 277	135 / 133
60	4	54.8	804	96
80	4	32.9	1,083	76
100	4	35.5 / 191	2,010 / 2,020	69 / 71
140	4	9.0 / 46.6	1,211 / 1,212	57 / 58
200	20	4.99	269	52
300	20	2.62 / 5.35	406 / 401	45 / 46
400	20	2.54 / 5.59	760 / 817	42 / 43
600	40	1.42	700	29
800	40	0.079	128	16
1,000	40	0.040	101	16

SOUNDING NUMBER AND LOCATION VES32 Mason and Lake Co., 3 Mile Road
Sections 17, 18, 19, 20, T19N, R14W
AZIMUTH OF SURVEY AND DATE West, 7-28-87

ab/2 (meters)	mn/2 (meters)	V (millivolts)	I (milliamperes)	apparent resistivity (ohm-meters)
3	0.5	2,560	266	266
4	0.5	1,170	265	219
5	0.5	822 / 1,620	328 / 327	195 / 187
6	0.5	617 / 1,110	348 / 317	199 / 193
8	1	772	400	191
10	1	462 / 954	370 / 370	189 / 194
14	2	184 / 403	298 / 306	189 / 199
20	2	151	246	191
30	4	76.8 / 141	357 / 339	151 / 144
40	4	33.5 / 73.7	328 / 383	121 / 120
60	4	38.8	565	87
80	4	26.8	768	88
100	4	15.5 / 85.1	727 / 752	84 / 85
140	4	10.0 / 52.4	918 / 987	84 / 80
200	20	30.3	1,187	79
300	20	18.0 / 36.2	1,642 / 1,554	77 / 81
400	20	9.10 / 18.9	1,538 / 1,539	74 / 76
600	40	8.20	1,876	62
800	40	3.91	2,020	49
1,000	40	2.11 / 5.43	1,990 / 2,020	42 / 42
1,200	40	1.36 / 3.36	2,210 / 2,160	35 / 35



ELECTRODE SPACING (AB/2), OR DEPTH, IN METERS

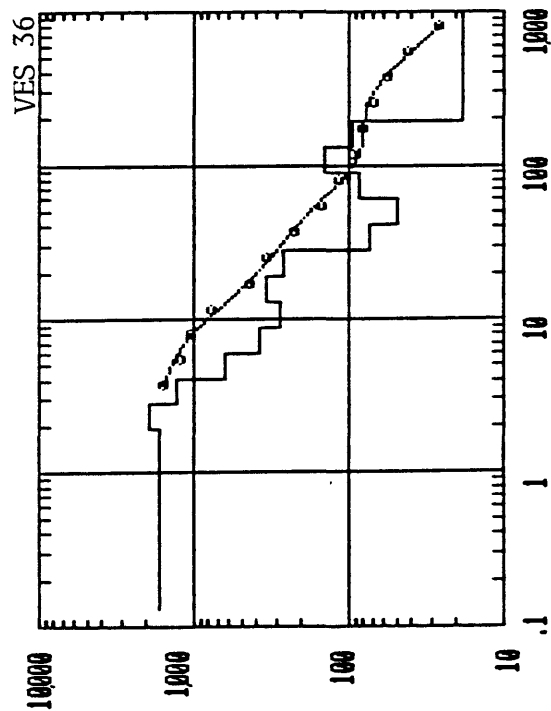
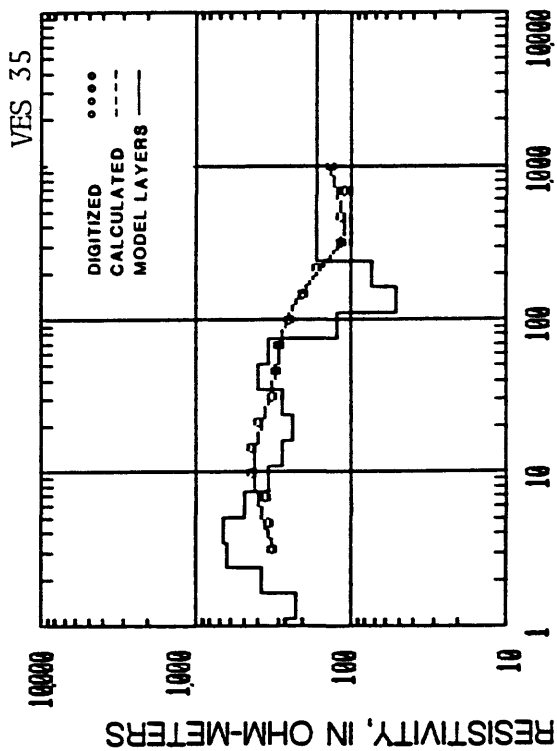
SOUNDING NUMBER AND LOCATION VES33 Mason Co., Freesoil Road
AZIMUTH OF SURVEY AND DATE Sections 21, 22, 27, 28, T20N R15W
West, 7-28-87

ab/2 (meters)	mv/2 (millivolts)	I (milliamperes)	apparent resistivity (ohm-meters)
3	0.5	206	426
4	0.5	201	303
5	0.5	189	184
6	0.5	168	153
8	1	169	127
10	1	160	158
14	2	157	156
20	2	178	172
30	4	167	198
40	4	295	202
60	4	247	233
80	4	153	238
100	4	236	218
140	4	501	246
200	20	232	201
300	20	278	265
400	20	235	185
600	40	177	19
800	40	0.173	9

SOUNDING NUMBER AND LOCATION VES34 Lake Co., 10 Mile Road
AZIMUTH OF SURVEY AND DATE Sections 7, 8, 17, 18, T20N R11W
West, 7-29-87

ab/2 (meters)	mv/2 (millivolts)	I (milliamperes)	apparent resistivity (ohm-meters)
3	0.5	26,900	187
4	0.5	23,600	236
5	0.5	15,000	204
6	0.5	10,600	181
8	1	12,900	155
10	1	8,400	154
14	2	2,360	152
20	2	5,100	154
30	4	1,930	189
40	4	797	227
60	4	154	192
80	4	19.2	165
100	4	11.1	205
140	4	6.84	209
200	20	13.5	75
300	20	14.0	259
400	20	4.13	430
600	40	6.10	267
800	40	5.79	381
1,000	40	4.88	607
1,200	40	3.41	752
			551
			740
			254
			350
			244*

* Denotes "spike" or "trough" in apparent resistivity, station removed before data run through "SHIFI" program.



ELECTRODE SPACING (AB/2), OR DEPTH, IN METERS

SOUNDING NUMBER AND LOCATION VES35 Lake Co., Forest Boundary Road
Sections 2, 3, 10, 11, T19N R13W
AZIMUTH OF SURVEY AND DATE 34 & 35, 120N R13W
North, 7-29-87

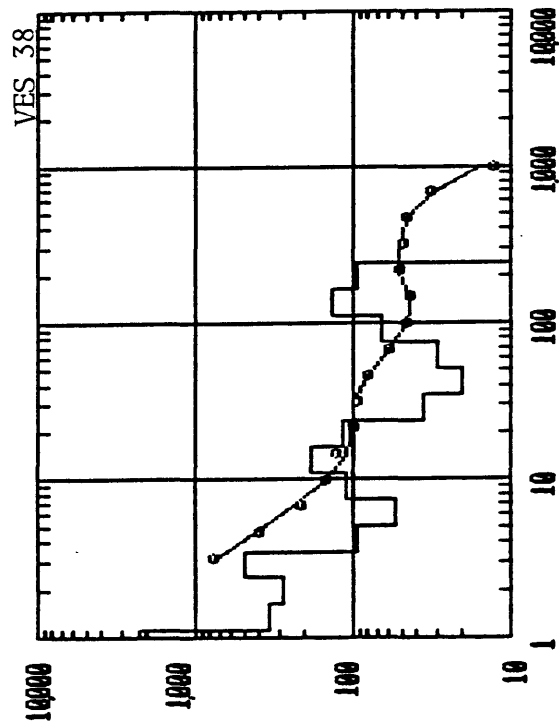
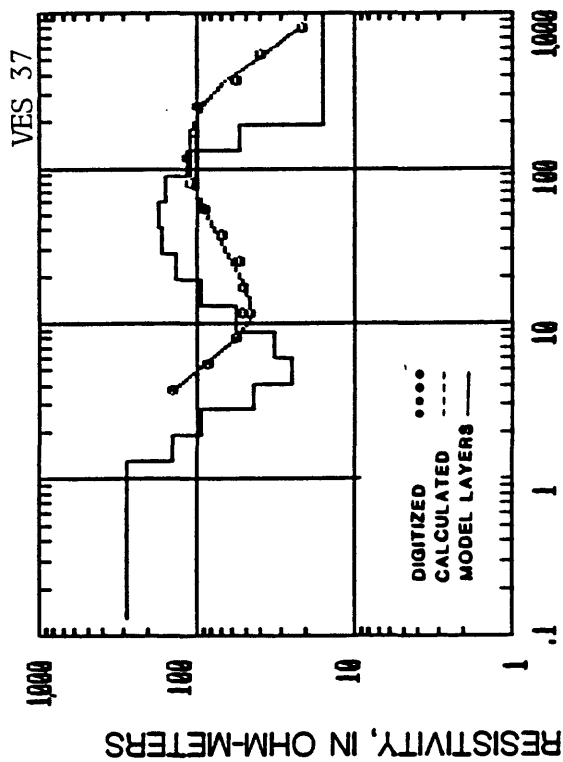
ab/2 (meters)	mv/2 (meters)	Y (millivolts)	I (milliamperes)	apparent resistivity (ohm-meters)
3	0.5	1,750	176	273
4	0.5	1,490	267	276
5	0.5	638/ 1,400	173 / 163	287 / 324
6	0.5	614/ 1,400	234 / 234	295 / 329
8	1	6,940	777	884*
10	1	2,120/ 4,640	783 / 778	421 / 449
14	2	1,85/ 1,630	586 / 569	410 / 432
20	2	690	534	401
30	2	223/ 473	471 / 470	333 / 349
40	2	106	352 / 335	321 / 325
60	4	41.3	505	295
80	4	22.7/ 106	353	293
100	4	7.73/ 37.0	347 / 322	257 / 248
140	4	10.9	280 / 270	212 / 207
200	20	2.37	189	179
300	20	1.18/ 2.37	69 / 68	120 / 121
400	20	2.80/ 5.77	314 / 314	112 / 114
600	40	1.22	242	126
800	40	0.69/ 0.96	194 / 191	139 / 78*
1,000	40 / 100			

* Denotes "spike" or "trough" in apparent resistivity,
station removed before data run through "SHIFT" program.

SOUNDING NUMBER AND LOCATION VES36 Wexford Co., #30 Road
Sections 7, 8, 17, 18, T22N R12W
AZIMUTH OF SURVEY AND DATE West, 7-29-87

ab/2 (meters)	mv/2 (meters)	Y (millivolts)	I (milliamperes)	apparent resistivity (ohm-meters)
3	0.5	4,000	46	2,391
4	0.5	1,530	40	1,893
5	0.5	3,620 / 7,500	162 / 160	1,737 / 1,767
6	0.5	1,260 / 2,600	100 / 99	1,415 / 1,444
8	1	1,460	130	1,112*
10	1	1,210 / 2,740	151 / 151	1,246 / 1,368
14	2	344 / 715	147 / 144	717 / 749
20	2	252	143	548
30	2	37.6 / 79.0	67 / 69	395 / 397
40	2	42.9 / 87.9	190 / 192	283 / 285
60	4	20.6	155	187
80	4	9.80	153	161
100	4	7.50 / 40.4	204 / 198	144 / 154
140	4	2.99 / 15.6	195 / 195	118 / 121
200	20	7.09	176	125*
300	20	2.43 / 4.70	187 / 183	91 / 89
400	20	1.29 / 1.82	211 / 206	77* / 55
600	40	0.77	287	38
800	40	0.53	504	26

* Denotes "spike" or "trough" in apparent resistivity,
station removed before data run through "SHIFT" program.



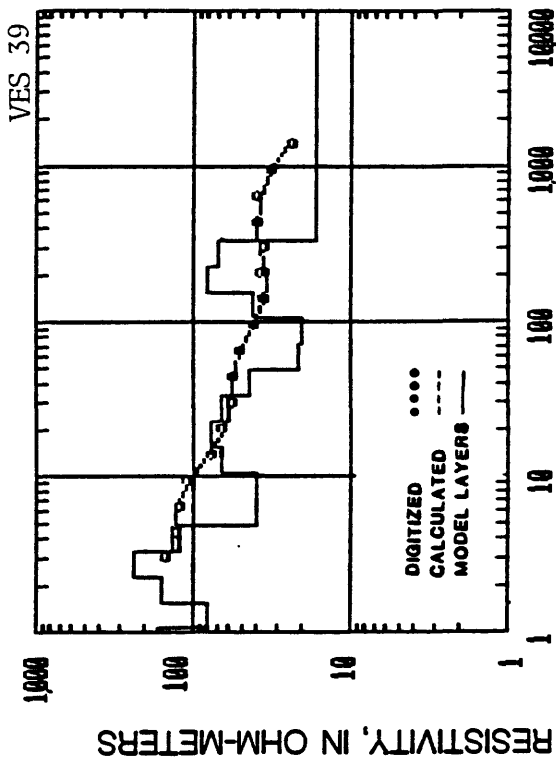
ELECTRODE SPACING (AB/2), OR DEPTH, IN METERS

SOUNDING NUMBER AND LOCATION VES37 Wexford Co., County Line Road
Sections 33 & 34, T25N R11W
AZIMUTH OF SURVEY AND DATE 3 & 4, T24N R11W
West, 7-30-87

ab/2 (meters)	mv/2 (meters)	Y (millivolts)	I (milliamperes)	apparent resistivity (ohm-meters)
3	0.5	2.100	282	205
4	0.5	1.110	409	137
5	0.5	1.459 / 980	342 / 330	104 / 112
6	0.5	1.35 / 437	269 / 271	81 / 89
8	1	182	265	68
10	1	136 / 263	340 / 335	62 / 59
14	1	44.4 / 79.0	224 / 213	61 / 56
20	2	182	992	57
30	2	42.4 / 81.5	448 / 440	67 / 64
40	2	50.4 / 97.0	792 / 806	80 / 75
60	4	49.3	714	97
80	4	15.0	312	113
100	4	16.6 / 83.2	511 / 497	127 / 126
140	4	6.23 / 31.0	432 / 425	111 / 110
200	20	15.3	437	109
300	20	2.05 / 4.10	176 / 176	82 / 81
400	20	1.58 / 3.06	374 / 364	53 / 52
600	40	2.17	825	37
800	40	0.181	208	22

SOUNDING NUMBER AND LOCATION VES38 Kalkaska Co., Kniss-Angling Road
Sections 2, 3, 4, 9, 10, 11, T26N R6W
AZIMUTH OF SURVEY AND DATE West, 7-30-87

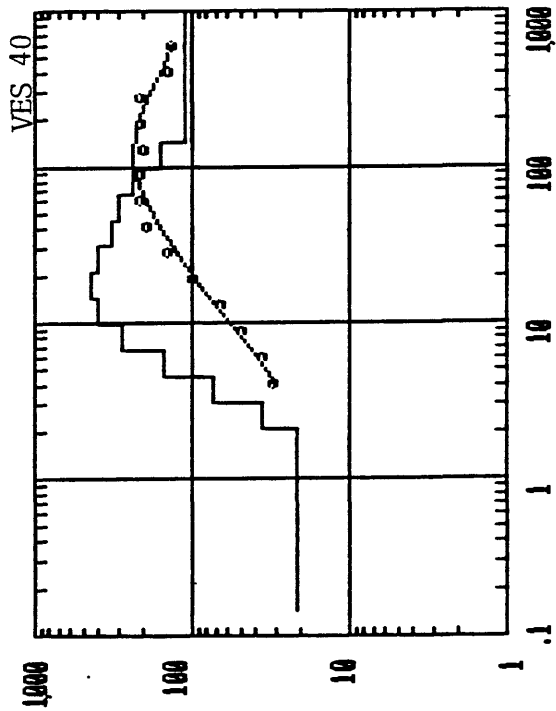
ab/2 (meters)	mv/2 (meters)	Y (millivolts)	I (milliamperes)	apparent resistivity (ohm-meters)
3	0.5	5.540	208	732
4	0.5	1.300	115	560
5	0.5	1.46 / 1,090	108 / 108	321 / 381
6	0.5	322 / 767	150 / 148	241 / 285
8	1	472	220	212
10	1	272 / 581	242 / 240	175 / 183
14	1	193 / 408	390 / 395	152 / 156
20	2	148	387	119
30	2	32.3 / 57.0	209 / 193	109 / 103
40	2	14.1 / 33.2	170 / 217	104 / 95
60	4	27.0	555	69
80	4	2.33	101	58
100	4	0.86 / 4.29	167 / 67	50 / 48
140	4	0.91 / 4.56	152 / 154	46 / 45
200	20	5.83	342	53
300	20	1.70 / 3.01	230 / 226	52 / 46
400	20	8.20 / 15.4	2,040 / 2,010	50 / 48
600	40	2.96	1,107	38
800	40	1.47	1,439	26
1,000	40 / 100	0.217	662	13



SOUNDING NUMBER AND LOCATION VES39 Kalkaska Co., Mecum Road
Sections 14, 15, 16, 21,
22, 23, 126N R6W
AZIMUTH OF SURVEY AND DATE West, 7-30-87

ab/2 (meters)	mv/2 (meters)	(millivolts)	(milliamps)	apparent resistivity (ohm-meters)
3	0.5	1,490	199	206
4	0.5	684	186	182
5	0.5	399/ 844	184/ 184	169 / 172
6	0.5	408/ 841	271/ 269	169 / 172
8	1	371	219	168
10	1	196/ 397	212/ 210	148 / 143
14	1	93/ 180	252/ 253	111 / 107
20	2	23.3	162	45*
30	2	31.1/ 63.7	278/ 277	79 / 80
40	2	32.7/ 66.5	519/ 515	79 / 80
60	4	43.4	843	73
80	4	37.9	1,475	64
100	4	20.2/ 130	1,420/ 1,642	56 / 60
140	4	13.1/ 99.2	2,100/ 2,980	48 / 50
200	20	25.8	1,482	54
300	20	6.44/ 12.6	678/ 879	52 / 50
400	20	7.80/ 15.3	1,783/ 1,782	55 / 53
600	40	7.01	1,802	55
800	40	5.69	2,840	50
1,000	40	2.31/ 5.28	2,060/ 2,060	44 / 39
1,200	40	1.16/ 2.42	1,706/ 1,699	38 / 32
1,400	40	0.778/ 1.43	1,824/ 1,806	33 / 24

* Denotes "spike" or "trough" in apparent resistivity, station removed before data run through "SHIFT" program.

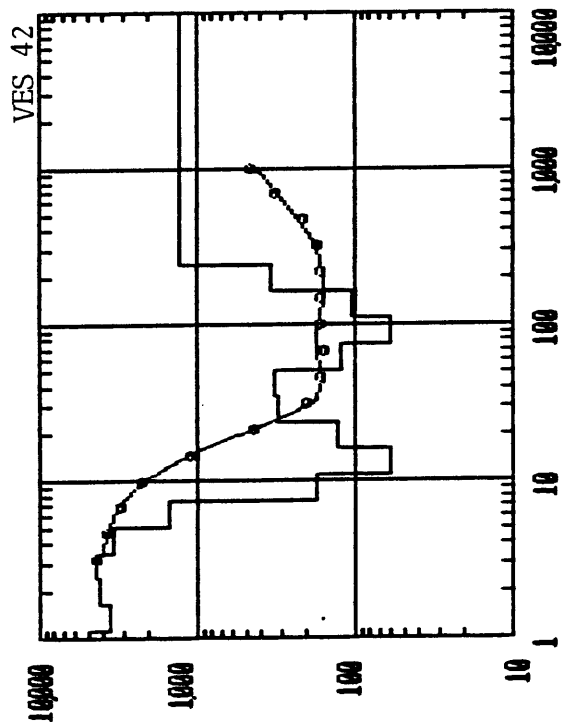
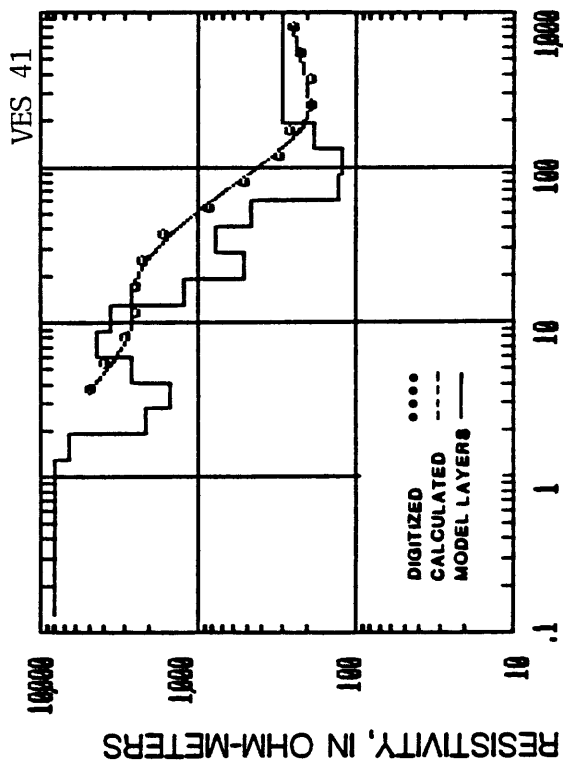


SOUNDING NUMBER AND LOCATION VES40 Wexford Co., Harietta Road
Sections 15, 16, 122N R11W
AZIMUTH OF SURVEY AND DATE West, 7-31-87

ab/2 (meters)	mv/2 (meters)	(millivolts)	(milliamps)	apparent resistivity (ohm-meters)
3	0.5	1,040	1,220	23
4	0.5	370 / 715	1,460	26
5	0.5	219 / 449	982 / 910	29 / 30
6	0.5	590	805 / 781	31 / 32
8	1	282 / 568	1,490	39
10	1	251 / 517	941 / 893	47 / 48
14	1	478	1,226 / 1,251	63 / 62
20	2	166 / 335	1,636	91
30	2	41.5 / 81.3	917 / 901	127 / 129
40	2	44.8	321 / 314	162 / 161
60	4	26.0	334	189
80	4	42.1 / 221	336	194
100	4	27.1 / 143	909 / 929	182 / 179
140	4	139	1,180 / 1,195	177 / 180
200	20	44.9 / 100	2,120	204*
300	20	12.5 / 27.6	1,866 / 1,820	169 / 191
400	20	2.99	1,224 / 1,186	127 / 145
600	40	1.89	316	131
800	40	1.89	353	237*

* Denotes "spike" or "trough" in apparent resistivity, station removed before data run through "SHIFT" program.

ELECTRODE SPACING (AB/2), OR DEPTH, IN METERS



ELECTRODE SPACING (AB/2), OR DEPTH, IN METERS

SOUNDING NUMBER AND LOCATION VES41 Wexford Co., No. 49 Road
Sections 18 & 19, T22N R8W
AZIMUTH OF SURVEY AND DATE 13 & 24, T22N R8W
North, 7-31-87

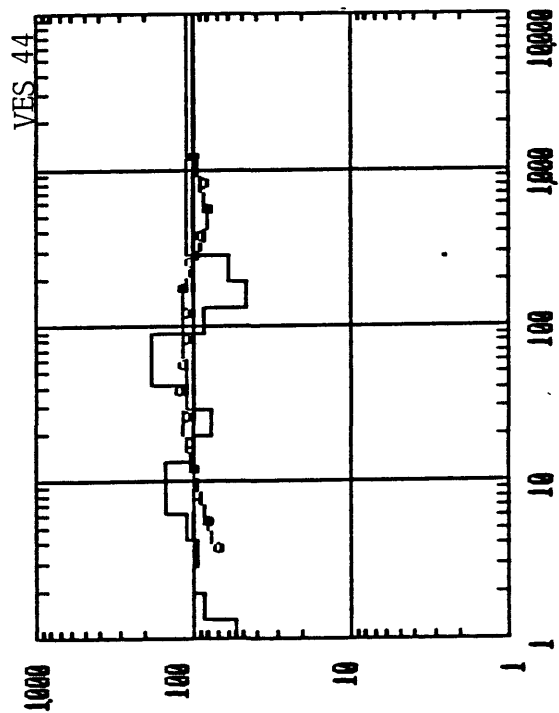
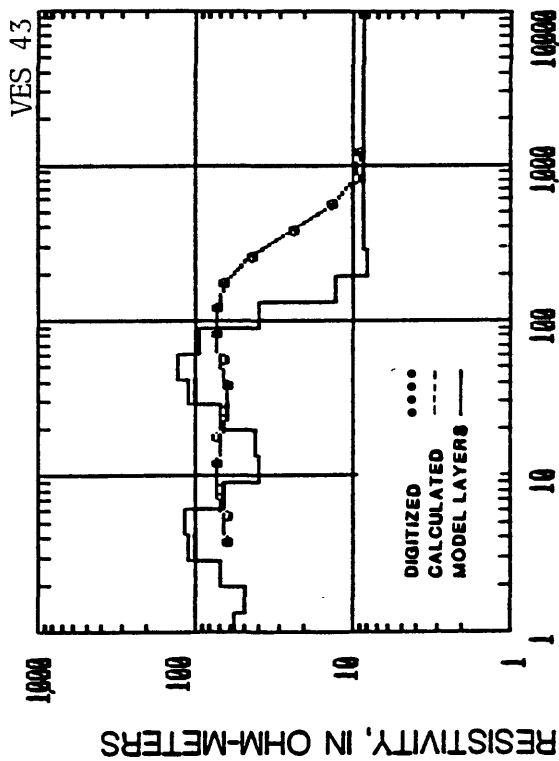
	ab/2 (meters)	mn/2 (meters)	Y (millivolts)	I (milliamperes)	apparent resistivity (ohm-meters)
3	0.5	0.5	13,200	56	6,482
4	0.5	0.5	5,670	55	5,283
5	0.5	1	3,220 / 7,230	53 / 55	4,724 / 4,956
6	0.5	1	2,100 / 4,700	56 / 56	4,211 / 4,616
8	1	2	1,590	43	3,651
10	1	2	1,080 / 2,290	51 / 51	3,251 / 3,386
14	1	2	553 / 1,040	54 / 54	3,137 / 2,904
20	2	4	704	76	2,881
30	2	4	241 / 484	74 / 74	2,292 / 2,270
40	2	4	134 / 256	97 / 97	1,732 / 1,642
60	4	4	44.6	79	795
80	4	4	18.5	81	573
100	4	20	11.8 / 52.0	115 / 110	402 / 356
140	4	20	88.3 / 35.0	227 / 226	299 / 233
200	20	40	11.3	170	207
300	20	40	1.57 / 7.90	165 / 157	152 / 175
400	20	40	1.12 / 2.70	80 / 82	176 / 205
600	40	40	1.84	89	251*
800	40	40	1.92	189	255
1,000	40	100	1.28 / 1.20	100 / 107	501* / 174*

* Denotes "spike" or "trough" in apparent resistivity, station removed before data run through "SHIFT" program.

SOUNDING NUMBER AND LOCATION VES42 Missaukee Co., Van Dornillen
Road
Sections 14, 15, 22, 23, 26, 27, T22N
R7W
AZIMUTH OF SURVEY AND DATE North, 8-3-87

	ab/2 (meters)	mn/2 (meters)	Y (millivolts)	I (milliamperes)	apparent resistivity (ohm-meters)
3	0.5	0.5	6,860	45	4,180
4	0.5	0.5	4,450	55	4,005
5	0.5	1	6,520 / 14,500	146 / 144	3,472 / 3,796
6	0.5	1	3,920 / 9,090	138 / 141	2,247 / 3,546
8	1	2	5,070	169	2,970
10	1	2	2,840 / 5,590	184 / 161	2,400 / 2,618
14	1	2	386 / 828	89 / 89	1,328 / 1,403
20	2	4	140	71	613
30	2	4	18.5 / 35.3	52 / 52	250 / 236
40	2	4	6.9 / 12.0	44 / 44	197 / 170
60	4	4	4.75	44	152
80	4	4	3.74	60	156
100	4	20	2.84 / 15.0	69 / 70	161 / 162
140	4	20	3.10 / 5.23	58 / 59	133* / 134*
200	20	40	3.19	61	163
300	20	40	1.74 / 3.56	73 / 73	168 / 169
400	20	40	1.11 / 2.35	77 / 78	181 / 187
600	40	40	1.67	80	294
800	40	40	3.67	97	949*
1,000	40	100	0.99	83	468

* Denotes "spike" or "trough" in apparent resistivity, station removed before data run through "SHIFT" program.



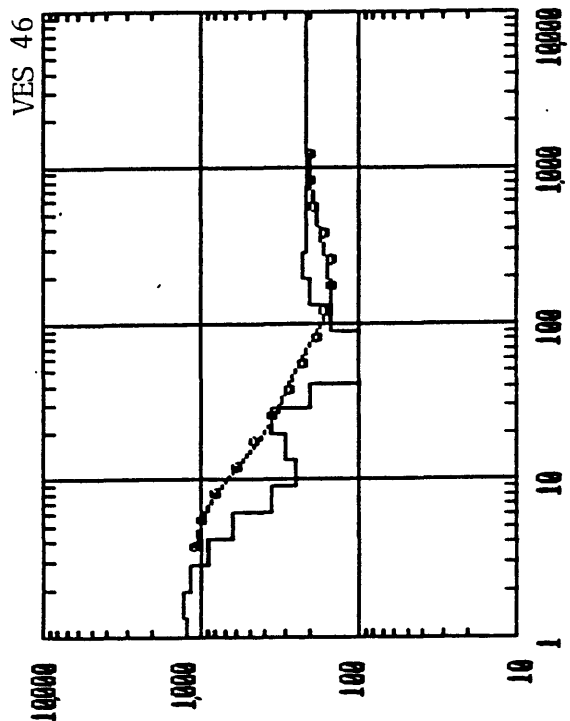
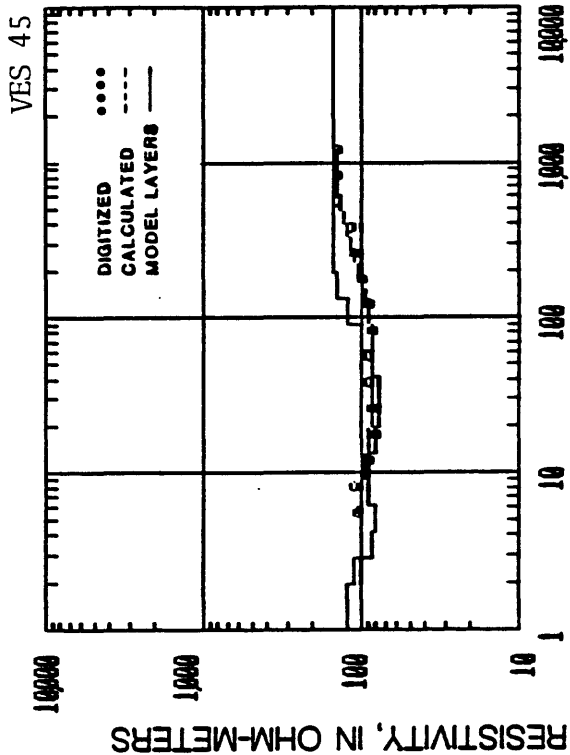
ELECTRODE SPACING (AB/2), OR DEPTH, IN METERS

SOUNDING NUMBER AND LOCATION VES43 Roscommon Co., Higgins Lake Road
Sections 16, 17, 20, 21, T23N R4W
AZIMUTH OF SURVEY AND DATE North, 8-3-87

ab/2 (meters)	mm/2 (meters)	V (millivolts)	I (milliamperes)	apparent resistivity (ohm-meters)
3	0.5	3,260	958	94
4	0.5	1,780	920	96
5	0.5	1,080 / 2,380	884 / 869	95 / 103
6	0.5	1,773 / 1,890	862 / 961	101 / 108
8	1	1,020	882	115
10	1	818 / 1,550	1,083 / 998	117 / 117
14	1	470 / 970	1,254 / 1,273	115 / 115
20	2	442	1,212	113
30	2	126 / 250	869 / 857	102 / 101
40	2	95 / 184	1,165 / 1,137	102 / 101
60	4	102	1,316	109
80	4	60.6	1,274	119
100	4	39.4 / 184	1,264 / 1,184	122 / 117
140	4	17.7 / 124	1,182 / 1,632	115 / 115
200	20	62.7	2,050	95
300	20	12.2 / 26.8	1,488 / 1,670	58 / 56
400	20	6.54 / 11.7	2,340 / 2,160	35 / 34
600	40	2.96	2,240	19
800	40	0.85	2,880	15
1,000	40	0.85 / 2.03	2,370 / 2,350	14 / 13
1,200	40	0.237 / 0.403	974 / 975	14 / 9

SOUNDING NUMBER AND LOCATION VES44 Roscommon Co., Waco Road
Sections 7 & 18, T21N R3W
12 & 13, T21N R4W
AZIMUTH OF SURVEY AND DATE North, 8-4-87

ab/2 (meters)	mm/2 (meters)	V (millivolts)	I (milliamperes)	apparent resistivity (ohm-meters)
3	0.5	709	259	75
4	0.5	446	252	88
5	0.5	237 / 470	198 / 209	91 / 85
6	0.5	385 / 691	443 / 435	98 / 87
8	1	227	222	101
10	1	154 / 308	236 / 218	102 / 107
14	1	54.1 / 100	151 / 137	110 / 110
20	2	84.1	233	112
30	2	57.1 / 104	335 / 323	120 / 112
40	2	19.9 / 37.1	195 / 181	128 / 128
60	4	12.2	150	115
80	4	8.90	190	117
100	4	5.53 / 27.9	187 / 163	116 / 130
140	4	7.30 / 38.1	469 / 454	120 / 127
200	20	44.9	1,120	125
300	20	26.1 / 50.1	1,648 / 1,670	111 / 112
400	20	11.5 / 25.1	1,428 / 1,497	101 / 104
600	40	1.86	551	93
800	40	1.99	521	96
1,000	40	1.03 / 2.43	350 / 400	115 / 95
1,200	40	0.636 / 2.04	322 / 460	112 / 98



ELECTRODE SPACING (AB/2), OR DEPTH, IN METERS

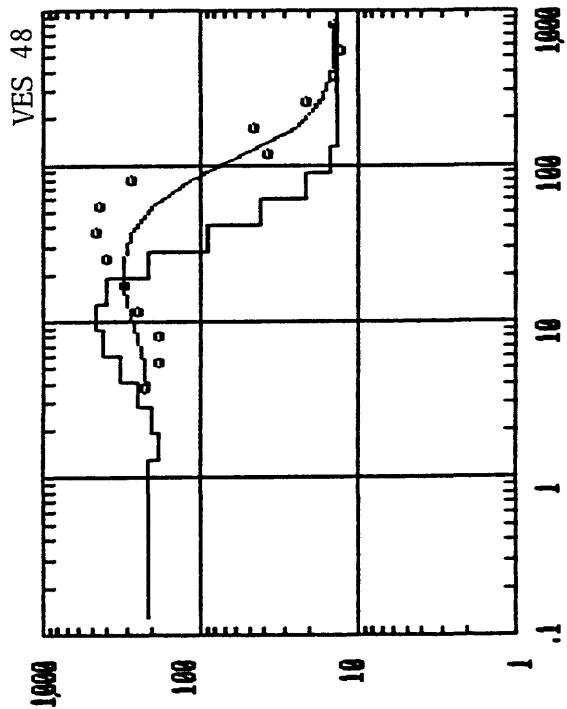
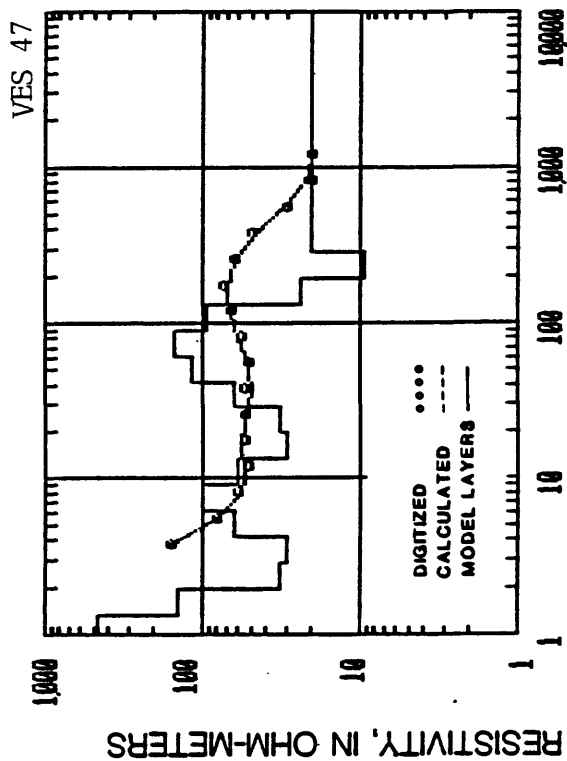
SOUNDING NUMBER AND LOCATION VES45 Roscommon Co. M-76
Sections 5 & 6, T23N R1W
AZIMUTH OF SURVEY AND DATE Northwest, 8-4-87

	ab/2 (meters)	mn/2 (meters)	V (millivolts)	I (milliamperes)	apparent resistivity (ohm-meters)
3	0.5	0.5	7.440	1.120	183*
4	0.5	0.5	4.760	1.110	212*
5	0.5	1	1.330 / 3.150	965 / 1.040	107 / 114
6	0.5	1	980 / 2.050	985 / 1.031	112 / 109
8	1	1	1.160	1.038	111
10	1	2	414 / 830	612 / 609	105 / 103
14	1	2	166 / 347	600 / 609	85 / 86
20	2	2	112	188	185*
30	2	4	37.8 / 83.1	301 / 314	88 / 92
40	2	4	33.9 / 69.4	468 / 464	89 / 93
60	4	4	29.8	450	93
80	4	4	9.50	264	90
100	4	20	16.4 / 86.5	720 / 681	89 / 96
140	4	20	8.30 / 41.7	680 / 628	94 / 100
200	20	20	14.7	409	112
300	20	40	6.92 / 13.7	425 / 401	115 / 119
400	20	40	3.63 / 7.13	363 / 347	125 / 128
600	40	40	5.74	521	155
800	40	40	2.15	354	152
1,000	40	100	7.33 / 16.9	1,790 / 1,717	151 / 153
1,200	40	100	4.75 / 10.6	1,740 / 1,650	154 / 144

* Denotes "spike" or "trough" in apparent resistivity, station removed before data run through "SHIF" program.

SOUNDING NUMBER AND LOCATION VES46 Roscommon Co., West of Old 27
Sections 16, 17, 20, 21, T24N R4W
AZIMUTH OF SURVEY AND DATE West, 8-4-87

	ab/2 (meters)	mn/2 (meters)	V (millivolts)	I (milliamperes)	apparent resistivity (ohm-meters)
3	0.5	0.5	7.860	196	1.103
4	0.5	0.5	3.750	176	1.055
5	0.5	1	2.130 / 4.390	163 / 153	1.016 / 1.082
6	0.5	1	1.330 / 3.820	159 / 217	940 / 968
8	1	1	2.610	324	798
10	1	2	950 / 1.910	212 / 201	697 / 716
14	1	2	497 / 1.030	290 / 295	525 / 527
20	2	2	357	266	417
30	2	4	164 / 333	355 / 330	324 / 350
40	2	4	174 / 375	809 / 805	270 / 290
60	4	4	74.1	447	233
80	4	4	37.3	466	201
100	4	20	13.6 / 61.8	282 / 261	189 / 179
140	4	20	7.80 / 39.0	343 / 360	175 / 163
200	20	20	13.4	283	147
300	20	40	5.64 / 9.60	256 / 214	155 / 156
400	20	40	4.80 / 8.70	351 / 324	171 / 167
600	40	40	4.62	330	197
800	40	40			
1,000	40	100	2.80 / 6.76	536 / 500	205 / 210
1,200	40	100	1.96 / 5.10	547 / 550	202 / 208



ELECTRODE SPACING (AB/2), OR DEPTH, IN METERS

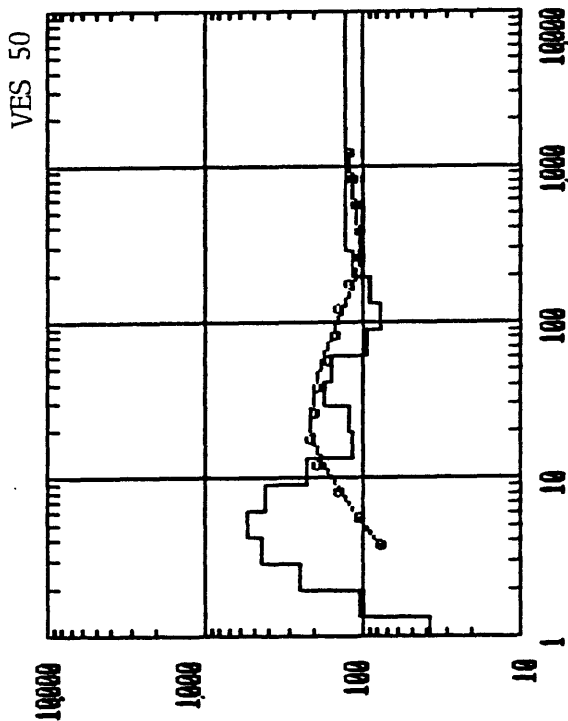
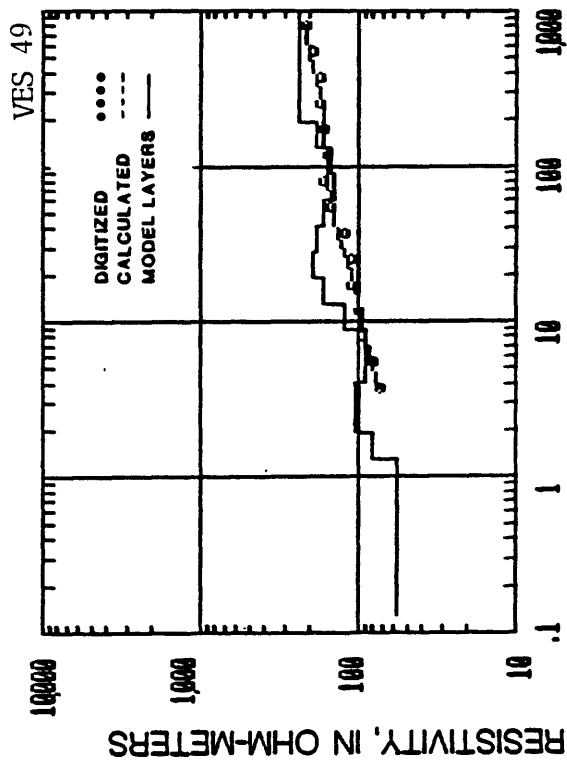
SOUNDING NUMBER AND LOCATION VES47 Clare Co., M-115
Sections 21 & 22, T18N R6W
AZIMUTH OF SURVEY AND DATE Northwest, 8-5-87

ab/2 (meters)	mv/2 (meters)	V (millivolts)	I (milliamperes)	apparent resistivity (ohm-meters)
3	0.5	4.190	392	294
4	0.5	1.360	394	171
5	0.5	509 / 1,070	337 / 311	117 / 130
6	0.5	477 / 1,040	568 / 564	94 / 101
8	1	370	457	80
10	1	150 / 298	327 / 312	71 / 72
14	1	67.2 / 124	295 / 281	70 / 67
20	2	71	412	68
30	2	28.2 / 74	407	67
40	2	28.0 / 53.6	523 / 503	67 / 66
60	4	68.3	1,454	66
80	4	49.2	1,751	77
100	4	42.3 / 198	2,160 / 2,100	77 / 71
140	4	8.50 / 38.9	769 / 726	85 / 81
200	20	5.60	208	84
300	20	9.10 / 16.2	941 / 835	68 / 67
400	20	5.51 / 9.90	1,263 / 1,124	55 / 55
600	40	1.12	466	32
800	40	1.19	1,198	25
1,000	40	0.93 / 2.20	1,536 / 1,502	24 / 23
1,200	40	0.462 / 0.95	1,050 / 1,016	25 / 21

SOUNDING NUMBER AND LOCATION VES48 Washtenaw Co., Lindley Road
Sections 23, 24, 25, 26, T1S R3E
AZIMUTH OF SURVEY AND DATE West, 8-12-87

ab/2 (meters)	mv/2 (meters)	V (millivolts)	I (milliamperes)	apparent resistivity (ohm-meters)
3	0.5	6.950	303	611
4	0.5	1.950	235	419
5	0.5	1,160 / 2,230	240 / 240	376 / 350
6	0.5	1,861 / 1,630	261 / 258	370 / 347
8	1	1,570	430	361
10	1	970 / 1,840	349 / 350	432 / 396
14	1	598 / 1,110	348 / 349	526 / 480
20	2	657	349	585
30	2	568 / 960	506 / 488	790 / 683
40	2	695 / 1,200	1,085 / 1,080	803 / 691
60	4	382	826	653
80	4	135	818	413
100	4	16.3 / 48.6	829 / 806	77 / 46*
140	4	24.5 / 82.2	1,801 / 1,762	105* / 70
200	20	14.9	892	52
300	20	1.54 / 2.24	428 / 425	25 / 18
400	20	0.82 / 1.16	502 / 501	21 / 14
600	40	0.257	269	13
800	40	0.743	1,313	14

* Denotes "spike" or "trough" in apparent resistivity, station removed before data run through "SHIFT" program.



ELECTRODE SPACING (AB/2), OR DEPTH, IN METERS

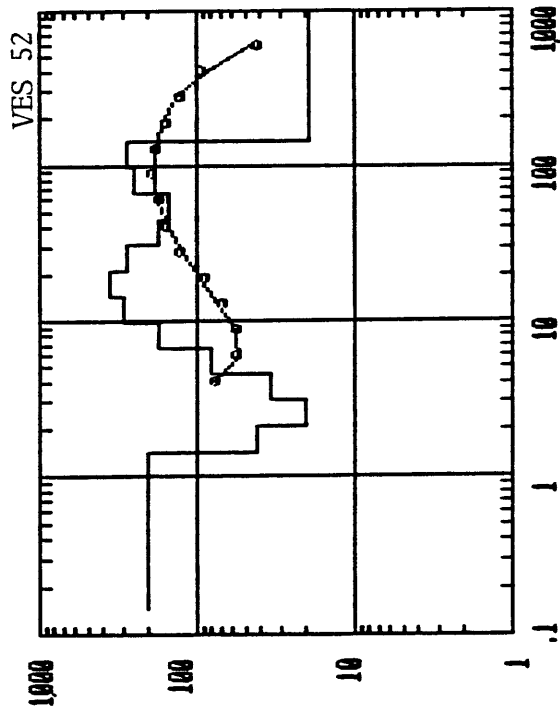
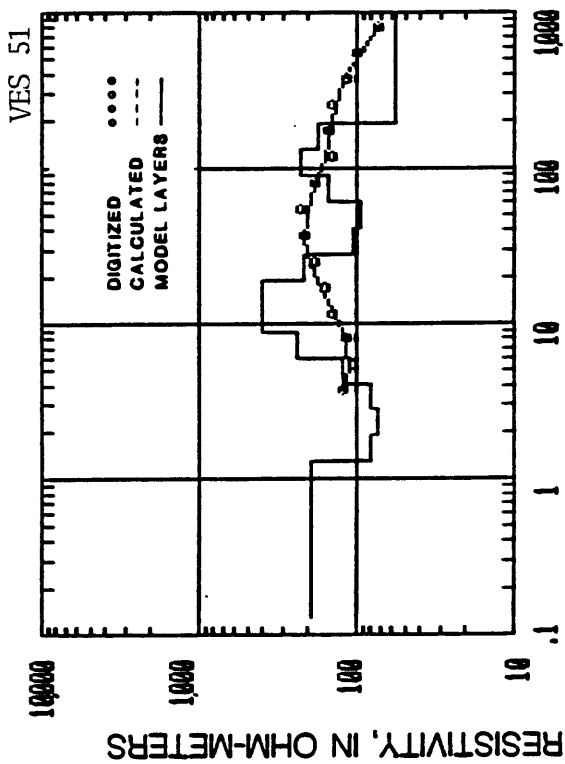
SOUNDING NUMBER AND LOCATION VES49 Ingham Co., Edgarr Road
Sections 11 & 12, T2N R1W
AZIMUTH OF SURVEY AND DATE North, 8-12-87

ab/2 (meters)	mn/2 (meters)	V (millivolts)	I (milliamperes)	apparent resistivity (ohm-meters)
3	0.5	1.750	666	72
4	0.5	1.980	656	74
5	0.5	683 / 1.740	821	81 / 80
6	0.5	672 / 1.330	916 / 904	82 / 81
8	1	688	748	91
10	1	463 / 930	731 / 725	99 / 97
14	2	172 / 340	521 / 501	101 / 102
20	2	170	472	112
30	4	153 / 306	942 / 943	114 / 113
40	4	99 / 190	979 / 974	127 / 121
60	4	97	919	149
80	4	49.7	729	171*
100	4	41.5 / 221	916 / 903	178* / 185*
140	4	53.6 / 262	2,680 / 2,570	154 / 154
200	20	101	1,940	162
300	20	51.0 / 104	2,220 / 2,200	163 / 164
400	20	28.0 / 58.7	2,100 / 2,060	167 / 177
600	40	39.1	2,630	209
800	40	28.2	3,260	217

* Denotes "spike" or "trough" in apparent resistivity, station removed before data run through "SHIFT" program.

SOUNDING NUMBER AND LOCATION VES50 Ingham Co., Elfert Road
Sections 21, 22, 27, 28, T1N R2W
AZIMUTH OF SURVEY AND DATE North, 8-17-87

ab/2 (meters)	mn/2 (meters)	V (millivolts)	I (milliamperes)	apparent resistivity (ohm-meters)
3	0.5	2.890	1.583	50
4	0.5	2.660	2.110	62
5	0.5	1.310 / 2.770	1.361 / 1.310	75 / 80
6	0.5	1.900 / 1.930	1.152 / 1.156	88 / 92
8	1	1.740	1.551	114
10	1	1.320 / 2.690	1.508 / 1.466	136 / 138
14	2	1.71 / 1.460	1.436 / 1.370	164 / 161
20	2	628 / 698	1.157 / 1.157	169 / 169
30	4	379 / 414	1.488 / 1.477	160 / 164
40	4	178	1.512 / 1.555	148 / 155
60	4	241	2.560	133
80	4	127	2.530	126
100	4	76.1 / 450	2.450 / 2.320	122 / 146
140	4	52.4 / 314	3.630 / 3.630	111 / 130
200	20	86.4	2.470	109
300	20	44.3 / 91.0	3.080 / 3.060	101 / 103
400	20	22.4 / 47.5	2.800 / 2.800	100 / 106
600	40	11.6	1.425	115
800	40	10.1	2.090	121
1,000	40	5.14 / 12.3	1.609 / 1.571	125 / 122
1,200	40	3.77 / 9.10	1.694 / 1.657	126 / 123



ELECTRODE SPACING (AB/2), OR DEPTH, IN METERS

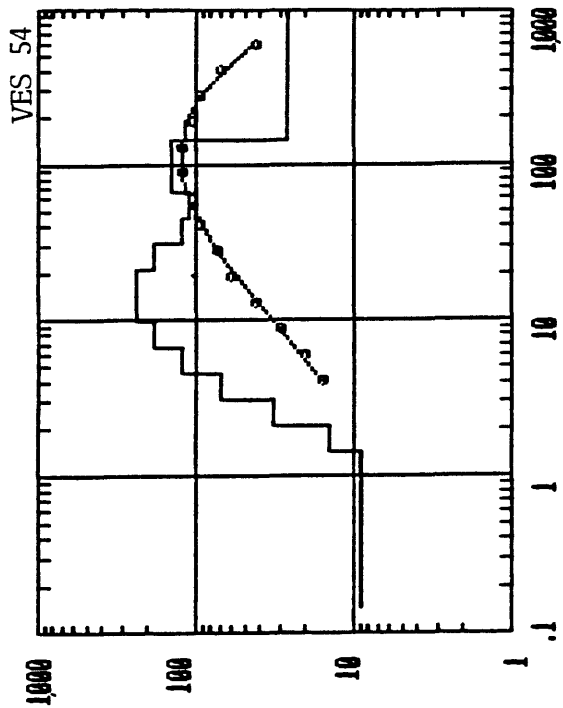
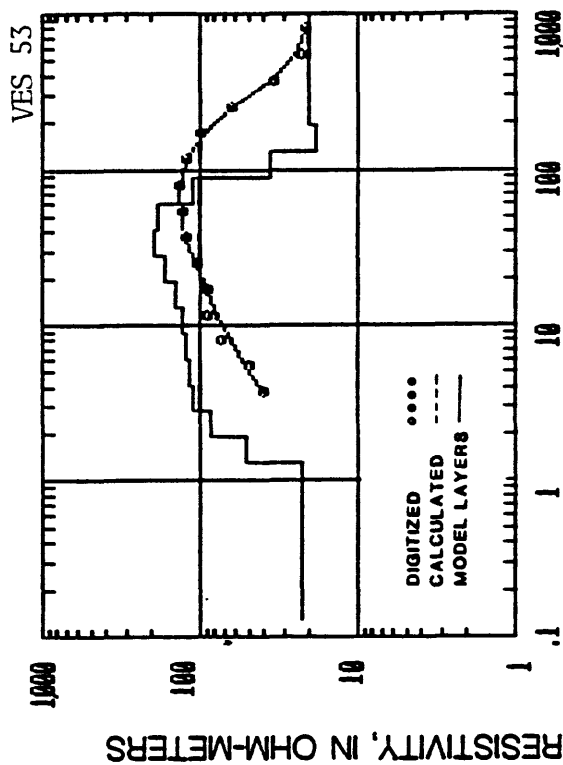
SOUNDING NUMBER AND LOCATION VES51 Ingham Co., Blackmore Road
AZIMUTH OF SURVEY AND DATE Sections 31 & 32, T1N R1W
North, 8-17-87

ab/2 (meters)	mn/2 (meters)	V (millivolts)	I (milliamperes)	apparent resistivity (ohm-meters)
3	0.5	2,950	681	119
4	0.5	1,460	657	110
5	0.5	640	649	643
6	0.5	562	638	643
8	1	712	631	112
10	1	787	940	896
14	1	555	1,150	1,038
20	2	264	472	139
30	2	205	719	702
40	2	98	559	536
60	4	81	531	215
80	4	52.8	729	182
100	4	51.8	1,386	1,267
140	4	31.3	1,754	1,643
200	20	39.6	867	146
300	20	20.9	1,120	1,104
400	20	12.0	1,267	1,218
600	40	5.06	752	95
800	40	6.56	2,250	73

SOUNDING NUMBER AND LOCATION VES52 Jackson Co., Portage Lake Road
AZIMUTH OF SURVEY AND DATE Sections 29, 30, 31, 32, T1S R2E
North, 8-18-87

ab/2 (meters)	mn/2 (meters)	V (millivolts)	I (milliamperes)	apparent resistivity (ohm-meters)
3	0.5	1,200	456	72
4	0.5	696	444	78
5	0.5	472	518	532
6	0.5	281	552	534
8	1	298	512	347
10	1	131	347	361
14	1	57.2	182	156
20	2	91	274	103
30	2	94.7	465	482
40	2	86.6	647	611
60	4	73.3	562	184
80	4	88.7	830	722
100	4	26.2	404	380
140	4	9.6	439	183
200	20	22.5	690	159
300	20	12.5	575	125
400	20	3.9	1,605	99
600	40	4.68		41

* Denotes "spike" or "trough" in apparent resistivity,
station removed before data run through "SHIFT" program.



ELECTRODE SPACING (AB/2), OR DEPTH, IN METERS

SOUNDING NUMBER AND LOCATION				VES53 Jackson Co. Pierce Road			
AZIMUTH OF SURVEY AND DATE				Sections 36, T3S R2E, 1, T4S R2E			
				North, 8-18-87			
ab/2 (meters)	mn/2 (meters)	V (millivolts)	I (milliamperes)	apparent resistivity (ohm-meters)			
3	0.5	803	580	38			
4	0.5	387	464	41			
5	0.5	436	701	48	47		
6	0.5	283	586	54	52		
8	1	557	793	70			
10	1	401	723	710	93		
14	2	133	499	497	82	86	
20	2	155	496		97		
30	4	137	860	851	112	112	
40	4	86	835	838	129	127	
60	4	126	1382	128			
80	4	52.4	978	134			
100	4	91.5	2,840	2,720	129	115	
140	4	59.1	4,060	3,890	112	112	
200	20	99.7	1,560		87		
300	20	11.8	1,729	1,633	48	49	
400	20	2.31	928	958	31	31	
600	40	2.14	1,438		21		
800	40	1.04	1,168		22		

SOUNDING NUMBER AND LOCATION

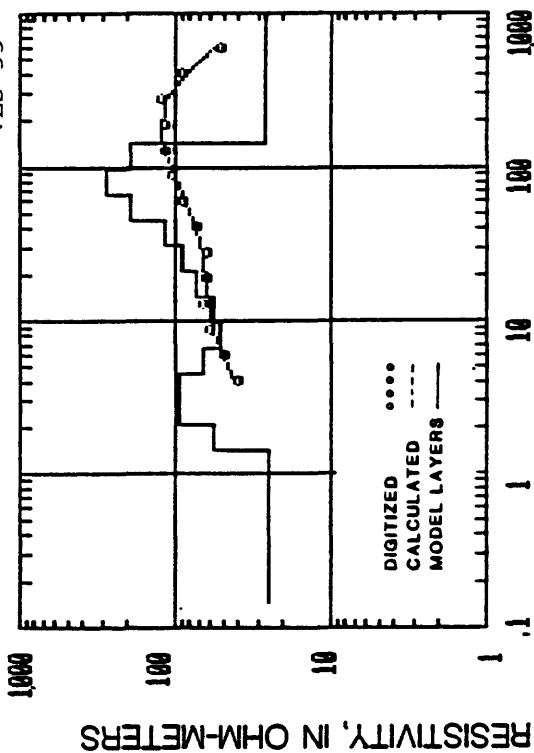
VES54 Jackson and Eaton Co.
Fuller Road Sections 36, T1N R3W,
1, T1S R3W

AZIMUTH OF SURVEY AND DATE

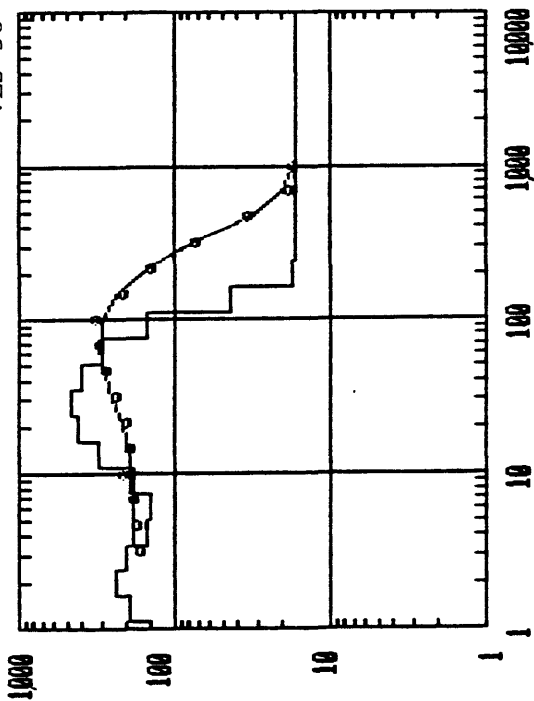
North, 8-18-87

ab/2 (meters)	mn/2 (meters)	V (millivolts)	I (milliamperes)	apparent resistivity (ohm-meters)
3	0.5	1,990	4,820	11
4	0.5	1,090	4,210	13
5	0.5 / 1	840 / 1,730	4,350 / 4,330	15 / 15
6	0.5 / 1	612 / 1,280	3,980 / 4,080	17 / 17
8	1 / 2	477 / 717	2,180 / 2,050	22 / 26
10	1 / 2	365 / 771	3,250 / 3,190	26 / 36
14	1 / 2	286 / 771	3,860 / 3,790	36 / 51
20	2 / 4	628 / 539	2,800 / 2,800	65 / 67
30	2 / 4	259 / 475	4,080 / 3,790	75 / 78
40	2 / 4	245 / 166	2,570 / 3,240	91 / 99
60	4 / 20	128 / 81.0	2,990 / 2,870	106 / 117
80	4 / 20	36.2 / 199	2,800 / 2,810	99 / 107
100	4 / 20	66.0 / 62.0	2,120 / 2,340	97 / 92
200	20 / 40	30.3 / 35.1	2,480 / 3,060	86 / 71
300	20 / 40	16.5 / 10.7	3,190 / 3,630	65 / 42
400	20 / 40			
600	40			

VES 55



VES 56



ELECTRODE SPACING (AB/2), OR DEPTH, IN METERS

SOUNDING NUMBER AND LOCATION VES55 Jackson Co. Bangham Road
Sections 34, T1S R3W, J, T2S R3W
AZIMUTH OF SURVEY AND DATE West, 8-19-87

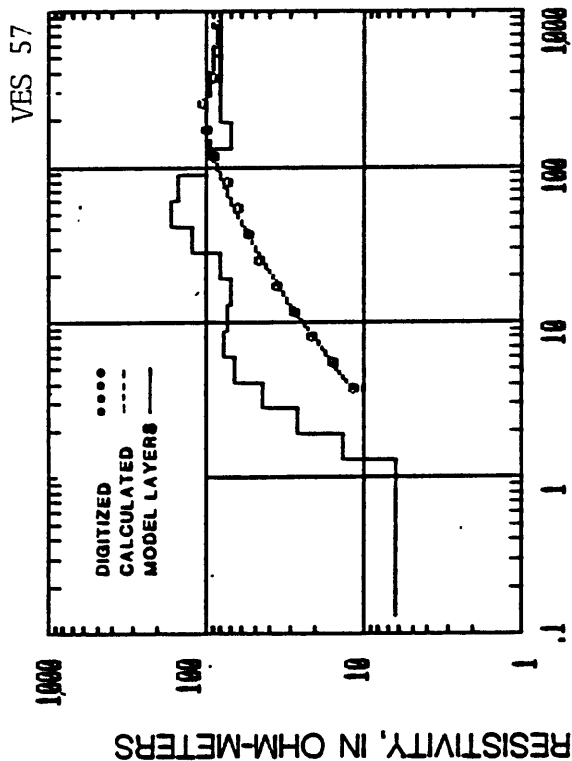
ab/2 (meters)	mn/2 (meters)	Y (millivolts)	Y (milliamperes)	apparent resistivity (ohm-meters)
3	0.5	1,730	1,202	40
4	0.5	620	954	43
5	0.5	589	927	48
6	0.5	435	941	53
8	1	589	937	54
10	1	546	1,252	62
14	1	225	1,030	68
20	2	331	982	63
30	2	133	1,473	70
40	2	85	1,311	71
60	4	58.9	1,329	80
80	4	35.3	921	75
100	4	39.5	870	90
140	4	11.9	1,377	102*
200	20	49.8	785	113
300	20	34.5	1,325	117
400	20	12.2	2,100	117
600	40	4.13	1,670	115
	40		1,115	92
	40			52

* Denotes "spike" or "trough" in apparent resistivity, station removed before data run through "SHIFT" program.

SOUNDING NUMBER AND LOCATION VES56 Calhoun Co. 25 1/2 Mile Road
Sections 32, T2S R4W, 5, T3S R4W
AZIMUTH OF SURVEY AND DATE North, 8-19-87

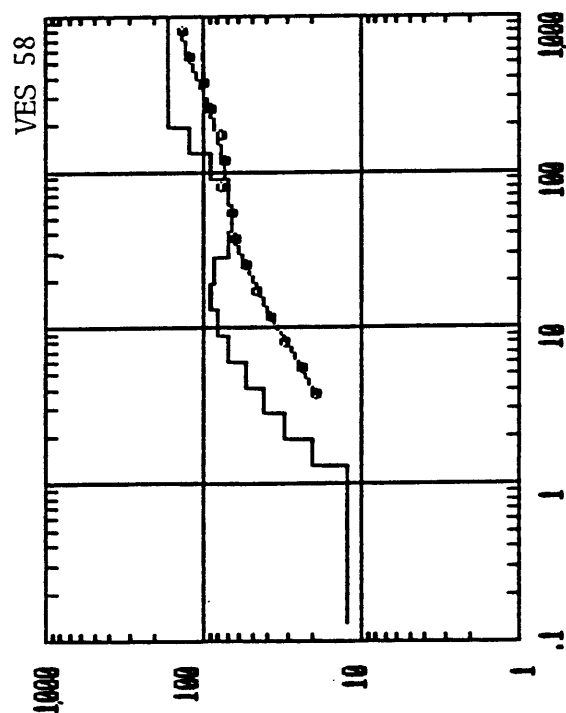
ab/2 (meters)	mn/2 (meters)	Y (millivolts)	Y (milliamperes)	apparent resistivity (ohm-meters)
3	0.5	1,550	292	146
4	0.5	1,050	339	153
5	0.5	644	276	153
6	0.5	359	284	142
8	1	108	278	139*
10	1	451	378	186
14	1	204	368	170
20	2	388	604	200
30	2	110	340	228
40	2	113	556	255
60	4	92	429	260
80	4	71.4	462	302
100	4	79.8	954	387*
140	4	77.1	2,570	328
200	20	135	2,620	231
300	20	17.7	1,499	160
400	20	30.5	2,020	83
600	40	7.96	2,020	82
800	40	3.46	2,47	49
1,000	40	1.19	1,747	20
	40	1.26	2,870	17
	40	3.19		17

* Denotes "spike" or "trough" in apparent resistivity, station removed before data run through "SHIFT" program.



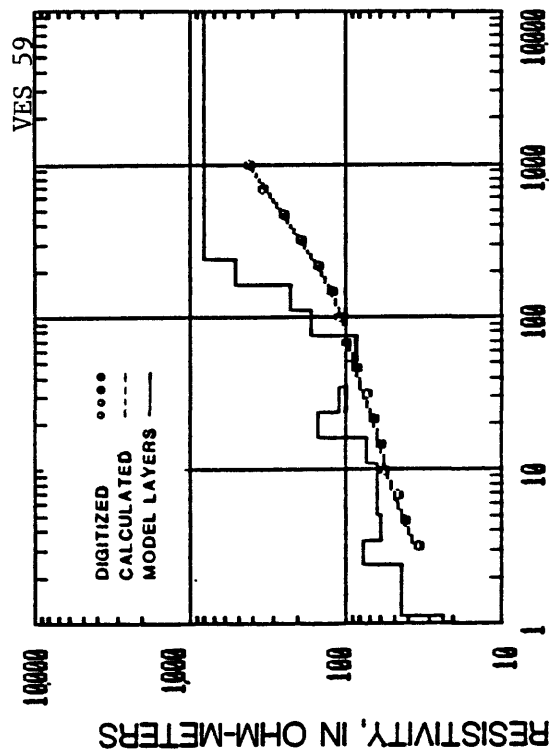
SOUNDING NUMBER AND LOCATION		VES57 Clinton Co., Bauer Road	
AZIMUTH OF SURVEY AND DATE		Sections 1, T5N R4W, 6, T5N R3W	
		North, 8-20-87	
ab/2 (meters)	mn/2 (meters)	V (millivolts)	apparent resistivity (ohm-meters)
3	0.5	1,750	3,760
4	0.5	1,110	3,710
5	0.5	798 / 1,570	3,560 / 3,450
6	0.5	611 / 1,240	3,480 / 3,510
8	1	489	859
10	1	826 / 1,700	4,530 / 4,780
14	1	510 / 1,010	4,470 / 4,580
20	2	615	4,530
30	2	281 / 541	3,750 / 3,610
40	2	193 / 392	4,050 / 4,050
60	4	170	3,470
80	4	149	4,880
100	4	93 / 471	4,260 / 4,190
140	4	39.6 / 251	2,980 / 3,850
200	20	168	5,060
300	20	50.7 / 94	3,480 / 3,360
400	20	21.7 / 43.6	3,150 / 3,150
600	40	25.6	4,320
800	40	14.3	4,200

* Denotes "spike" or "trough" in apparent resistivity, station removed before data run through "SHIFT" program.



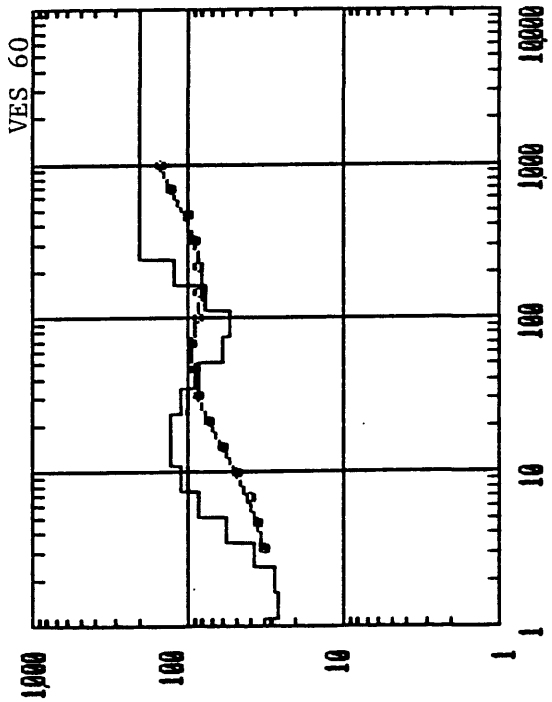
ELECTRODE SPACING (AB/2), OR DEPTH, IN METERS

SOUNDING NUMBER AND LOCATION		VES58 Clinton Co., Outler Road	
AZIMUTH OF SURVEY AND DATE		Sections 3, T5N R4W, 34, T6N R4W	
		West, 8-20-87	
ab/2 (meters)	mn/2 (meters)	V (millivolts)	apparent resistivity (ohm-meters)
3	0.5	1,570	2,310
4	0.5	890	2,050
5	0.5	473 / 1,060	1,491 / 1,524
6	0.5	543 / 1,210	2,220 / 2,310
8	1	781	2,190
10	1	540 / 970	2,070 / 1,840
14	1	269 / 559	1,713 / 1,757
20	2	436	2,440
30	2	180 / 339	1,952 / 1,871
40	2	85 / 138	1,459 / 1,258
60	4	290	5,500
80	4	63.1	1,930
100	4	65.4 / 296	2,980 / 2,860
140	4	37.1 / 180	3,580 / 3,600
200	20	96.2 / 76.4	3,610
300	20	39.6 / 61.1	2,990 / 2,840
400	20	31.1 / 61.1	3,820 / 3,720
600	40	27.1	3,090
800	40	16.4	3,030



SOUNDING NUMBER AND LOCATION VES59 Ionia Co., Goodwin Road
Sections 7, 8, 17, 18, T6N R5W
AZIMUTH OF SURVEY AND DATE 12, 13 T6N R6W
West, 8-20-87

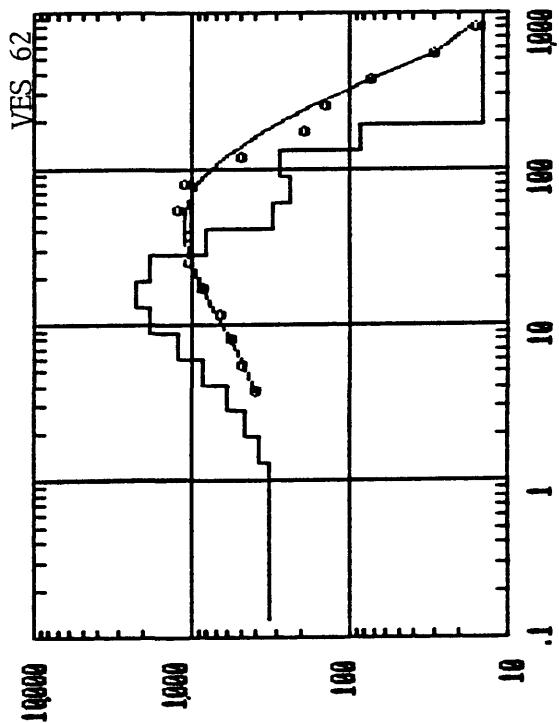
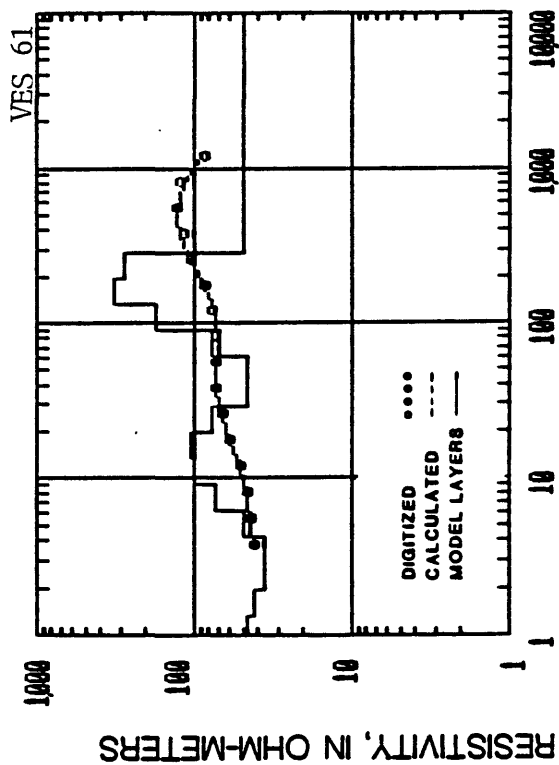
	ab/2 (meters)	mn/2 (meters)	V (millivolts)	I (milliamperes)	apparent resistivity (ohm-meters)
3	0.5	1,190	830	39	39
4	0.5	1,707	787	45	45
5	0.5	1	734	719	49
6	0.5	1	1,043	991	51
8	1	534	1,976	54	54
10	1	537	1,421	59	58
14	1	213	1,032	63	65
20	2	381	1,655	72	88
30	2	170	1,499	80	82
40	2	120	1,701	88	88
60	4	110	1,530	101	116
80	4	87.9	1,804	118	117
100	4	92	2,050	132	127
140	4	40.8	2,370	147	147
200	20	108	2,250	195	189
300	20	56.1	2,020	238	229
400	20	41.6	2,190	270	300
600	40	74.5	3,500	370	370
800	40	49.9	3,380	423	422
1,000	40	17.6	1,632	1,575	423



SOUNDING NUMBER AND LOCATION VES60 Eaton Co., Gresham Road
Sections 17 & 26, T3N R4W
AZIMUTH OF SURVEY AND DATE West, 8-31-87

	ab/2 (meters)	mn/2 (meters)	V (millivolts)	I (milliamperes)	apparent resistivity (ohm-meters)
3	0.5	1,850	1,797	28	28
4	0.5	1,050	1,697	31	31
5	0.5	1	1,290	32	31
6	0.5	1	1,876	33	34
8	1	693	1,812	38	44
10	1	378	1,351	44	44
14	1	342	2,030	52	53
20	2	505	2,430	65	65
30	2	234	2,160	76	79
40	2	114	1,724	83	84
60	4	95	1,535	87	87
80	4	63.1	1,851	86	86
100	4	36.8	1,790	81	83
140	4	29.2	2,000	78	77
200	20	59.7	2,350	79	79
300	20	36.9	2,150	82	84
400	20	14.3	3,020	87	88
600	40	25.6	2,060	110	110
800	40	21.6	2,760	128	128
1,000	40	14.9	4,170	140	151

ELECTRODE SPACING (AB/2), OR DEPTH, IN METERS



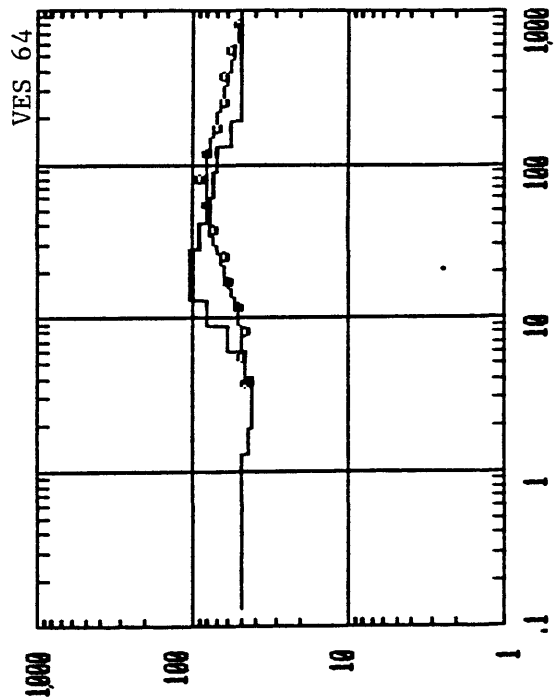
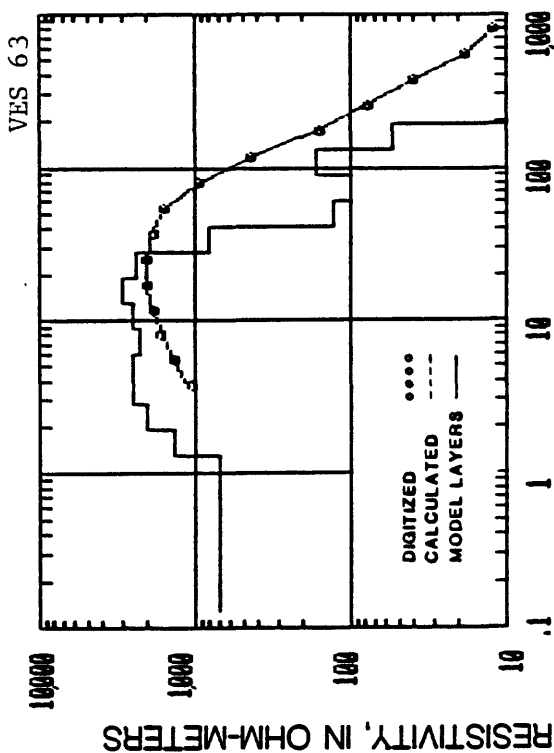
ELECTRODE SPACING (AB/2), OR DEPTH, IN METERS

SOUNDING NUMBER AND LOCATION VES61 Eaton Co., Gates Road
 AZIMUTH OF SURVEY AND DATE Sections 17 & 16, T4N R5W
 North, 8-31-87

ab/2 (meters)	mn/2 (meters)	V (millivolts)	I (milliamperes)	apparent resistivity (ohm-meters)
3	0.5	3,300	2,020	45
4	0.5	1,520	1,880	43
5	0.5	1,150	2,020	44
6	0.5	1,850	2,070	45
8	1	971	1,846	49
10	1	632	1,842	53
14	2	315	1,690	57
20	2	354	1,576	66
30	4	166	1,254	74
40	4	78.8	1,795	75
60	4	96	1,513	77
80	4	46.6	1,484	81
100	4	30.6	1,409	81
140	20	38.8	3,430	82
200	20	39.8	3,260	91
300	20	40.5	2,590	110
400	20	31.8	3,300	121
600	40	26.8	2,950	125
800	40	16.8	3,380	109
1,000	40	12.0	4,320	84
1,200	100	5.92	3,990	107

SOUNDING NUMBER AND LOCATION VES62 Barry Co., Erway Road
 AZIMUTH OF SURVEY AND DATE Section 29, T3N R5W
 North, 9-1-87

ab/2 (meters)	mn/2 (meters)	V (millivolts)	I (milliamperes)	apparent resistivity (ohm-meters)
3	0.5	5,230	273	527
4	0.5	2,480	196	626
5	0.5	1,460	163	696
6	0.5	1,160	170	766
8	1	3,240	364	881
10	1	2,010	325	962
14	2	2,470	643	1,177
20	2	3,550	714	1,246
30	4	1,310	510	1,508
40	4	1,557	398	1,754
60	4	1,240	862	1,807
80	4	610	846	1,265
100	4	213	660	427
140	20	68.9	1,241	311
200	20	205	3,040	210
300	20	27.3	1,529	126
400	20	8.70	1,481	74
600	40	4.68	2,870	23
800	40	1.69	2,790	16



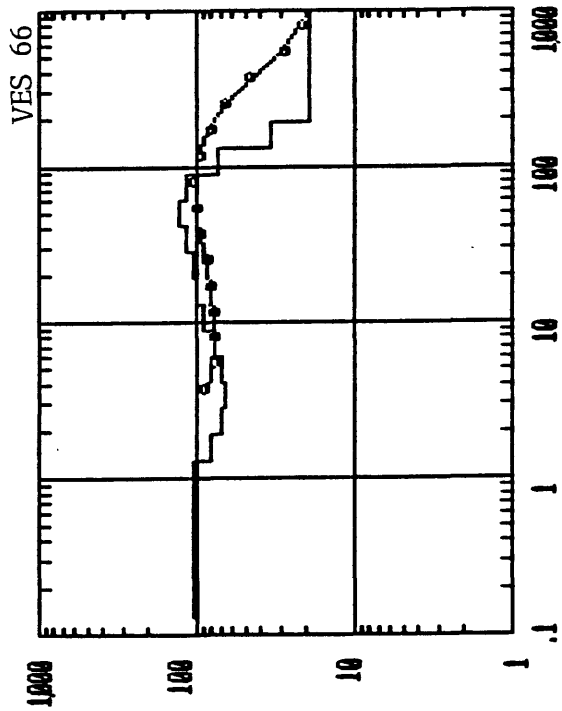
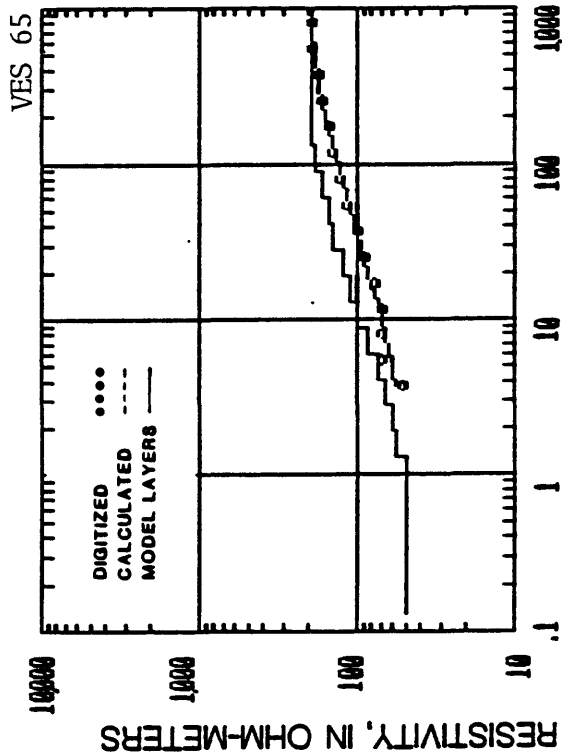
ELECTRODE SPACING (AB/2), OR DEPTH, IN METERS

SOUNDING NUMBER AND LOCATION VES63 Barry Co., Chief Noorday Road
Sections 13 & 24, T3N R10W
AZIMUTH OF SURVEY AND DATE West, 9-1-87

ab/2 (meters)	mn/2 (meters)	V (millivolts)	I (milliamperes)	apparent resistivity (ohm-meters)
3	0.5	7,250	267	747
4	0.5	6,230	335	921
5	0.5	3,970	285	1,083
6	0.5	3,200	305	1,178
8	1	3,180	245	1,285
10	1	1,990	230	1,345
14	2	900	192	1,468
20	2	607	170	1,646
30	4	327	277	1,542
40	4	314	295	1,389
60	4	154	401	1,102
80	4	59.1	515	750
100	4	17.5	458	506
140	4	40.0	685	197
200	20	6.87	1,224	102
300	20	1.90	647	51
400	20	1.09	830	29
600	40	0.299	997	51
800	40		644	12

SOUNDING NUMBER AND LOCATION VES64 Barry Co., Durkee Road
Sections 31, T4N R7W, 36, T4N R8W
AZIMUTH OF SURVEY AND DATE North, 9-1-87

ab/2 (meters)	mn/2 (meters)	V (millivolts)	I (milliamperes)	apparent resistivity (ohm-meters)
3	0.5	3,770	2,290	45
4	0.5	2,750	2,900	47
5	0.5	1,350	2,170	48
6	0.5	1,880	2,170	48
8	1	960	2,080	49
10	1	746	1,962	48
14	2	397	2,270	51
20	2	423	2,180	50
30	4	162	2,200	56
40	4	92	2,140	55
60	4	108	1,645	62
80	4	36.4	1,505	72
100	4	29.6	1,790	69
140	4	25.8	1,037	77
200	20	37.2	1,332	85
300	20	19.8	2,66	88
400	20	10.0	1,773	81
600	40	8.02	2,300	87
800	40	5.07	2,100	75
			2,480	65
				61
				62
				52
				51



ELECTRODE SPACING (AB/2), OR DEPTH, IN METERS

SOUNDING NUMBER AND LOCATION VES65 Clinton Co., Clark Road
Sections 13, 14, 23, 24, T5N R1W
AZIMUTH OF SURVEY AND DATE West, 9-2-87

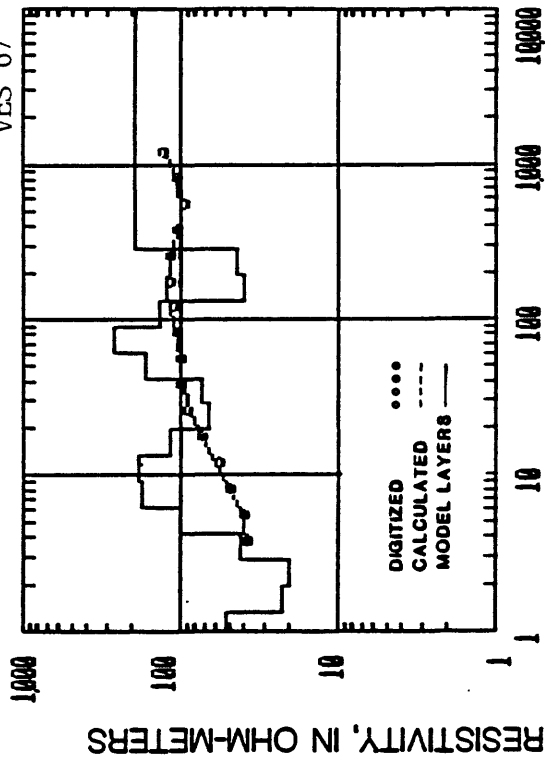
	ab/2 (meters)	mv/2 (meters)	V (millivolts)	I (milliamperes)	apparent resistivity (ohm-meters)
3	0.5	0.5	880	414	59
4	0.5	1	1,510	1,050	76
5	0.5	1	405	561	108*
6	1	1	432	369	123*
8	1	2	237	446	96
10	1	2	237	403	91
14	2	2	149	465	80
20	2	4	134	438	98
30	2	4	261	1,616	95
40	4	4	180	1,777	114
60	4	4	85.1	615	112
80	4	4	47.1	870	131
100	4	20	112	3,010	136
140	4	20	37.5	1,830	146
200	20	20	53.6	1,695	151
300	20	40	46.3	1,860	162
400	20	40	34.0	2,370	175
600	40	40	40.8	2,910	180
800	40	40	26.8	3,520	197
					191

* Denotes "spike" or "trough" in apparent resistivity, station removed before data run through "SHIF1" program.

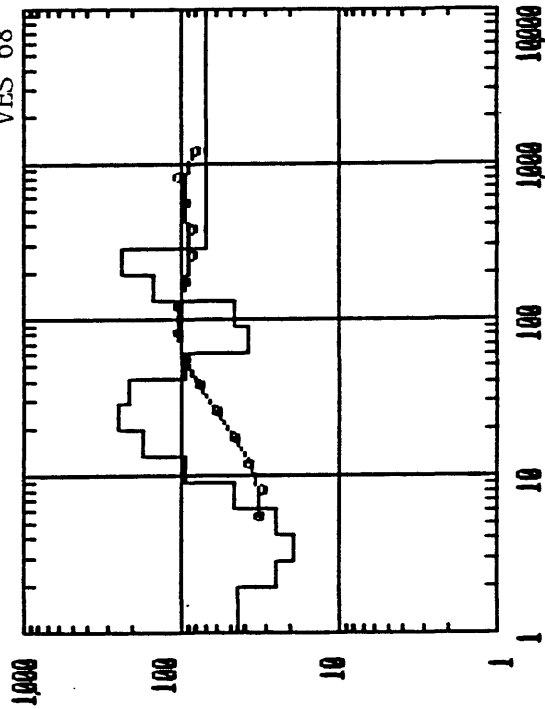
SOUNDING NUMBER AND LOCATION VES66 Shiawassee Co., old rail grade
Sections 7 & 8, T6N R2E
AZIMUTH OF SURVEY AND DATE Northeast, 9-2-87

	ab/2 (meters)	mv/2 (meters)	V (millivolts)	I (milliamperes)	apparent resistivity (ohm-meters)
3	0.5	0.5	8,940	2,980	83
4	0.5	1	2,850	2,360	81
5	0.5	1	1,950	2,270	73
6	1	1	1,500	1,521	70
8	1	2	665	1,150	69
10	1	2	186	1,544	67
14	2	2	299	1,870	66
20	2	4	82.5	1,227	69
30	2	4	114	698	76
40	2	4	68.7	1,672	83
60	4	4	35.5	1,078	86
80	4	20	28.5	573	90
100	4	20	35.5	1,357	89
140	4	20	28.6	2,510	92
200	20	20	17.7	2,350	76
300	20	40	8.12	2,350	69
400	20	40	3.86	2,650	53
600	40	40	2.63	2,090	38
800	40	40		3,050	26
					22

VES 67



VES 68



ELECTRODE SPACING (AB/2), OR DEPTH, IN METERS

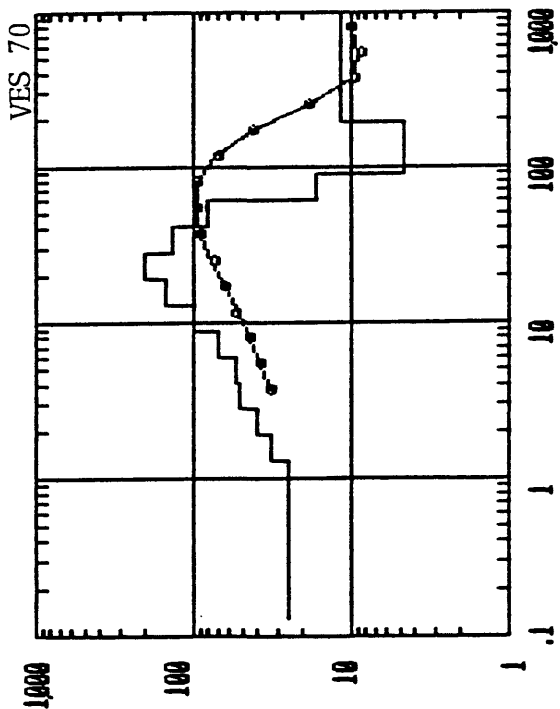
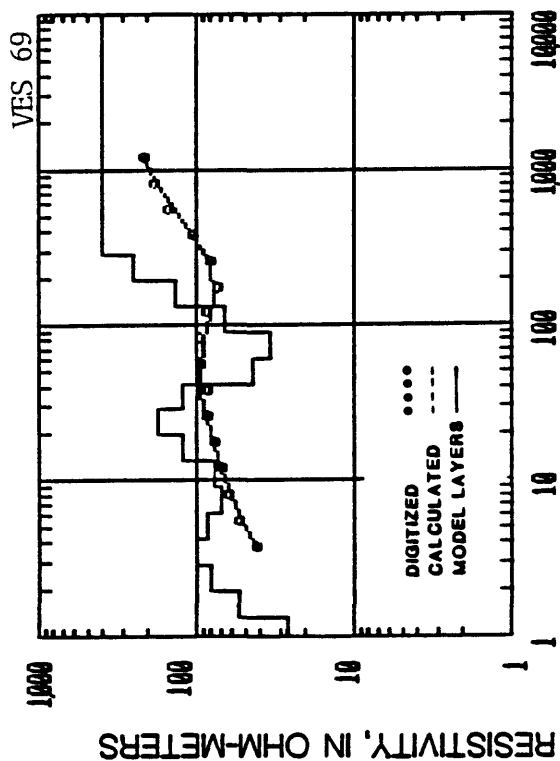
SOUNDING NUMBER AND LOCATION VES67 Clinton Co., Krepps Road
Sections 25, 26, 35, 36, T7N R2W
AZIMUTH OF SURVEY AND DATE North, 9-2-87

ab/2 (meters)	mv/2 (meters)	(millivolts)	(milliamperes)	apparent resistivity (ohm-meters)
3	0.5	4,860	5,100	26
4	0.5	2,590	4,510	28
5	0.5	1,780	4,730	29
6	0.5	1,120	4,060	33
8	1	2,000	5,230	30
10	1	1,300	4,780	38
14	2	1,650	4,660	42
20	2	1,040	3,820	41
30	4	384	3,690	52
40	4	157	5,160	50
60	4	198	3,630	63
80	4	111	3,850	74
100	4	68.1	2,540	75
140	4	47.1	3,370	81
200	20	106	3,290	83
300	20	55.2	3,050	88
400	20	28.1	4,020	85
600	40	19.1	3,530	90
800	40	16.7	4,260	93
1,000	40	9.7	4,080	91
1,200	40	7.89	4,280	96
			4,070	91
			3,260	81
			4,460	91
			3,840	92
			3,760	99
			3,880	115
			3,420	130

SOUNDING NUMBER AND LOCATION VES68 Barry Co., Bayne Road
Sections 3 & 10, T3N R7W
AZIMUTH OF SURVEY AND DATE West, 9-3-87

ab/2 (meters)	mv/2 (meters)	(millivolts)	(milliamperes)	apparent resistivity (ohm-meters)
3	0.5	1,630	874	51*
4	0.5	452	781	29
5	0.5	302	794	31
6	0.5	245	928	30
8	1	172	899	32
10	1	236	542	31
14	2	157	1,040	35
20	2	130	927	35
30	4	48.5	1,161	41
40	4	69.0	818	41
60	4	60.9	524	49
80	4	47.1	1,107	65
100	4	53.1	926	78
140	4	18.0	1,189	93
200	20	51.6	1,941	107
300	20	12.8	1,472	94
400	20	14.9	1,934	83
600	40	11.7	1,163	77
800	40	11.7	2,310	81
1,000	40	5.14	2,220	88
1,200	40	3.56	3,150	93
			2,390	83
			2,760	97
			2,680	73
			2,270	82

* Denotes "spike" or "trough" in apparent resistivity, station removed before data run through "SHIFT" program.



ELECTRODE SPACING (AB/2), OR DEPTH, IN METERS

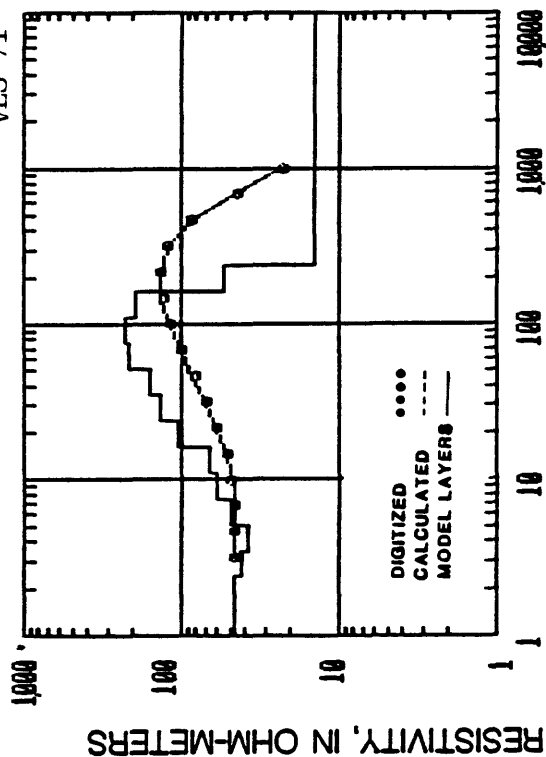
SOUNDING NUMBER AND LOCATION VES69 Eaton Co., Durkee Road
AZIMUTH OF SURVEY AND DATE Sections 3 & 4, T3N R5W
North, 9-3-87

ab/2 (meters)	mn/2 (meters)	V (millivolts)	I (milliamperes)	apparent resistivity (ohm-meters)
3	0.5	1,210	905	37
4	0.5	1,190	1,387	43
5	0.5	1,508	798	50
6	0.5	443	902	55
8	1	858	1,359	63
10	1	860	2,040	66
14	2	1,590	1,325	72
20	2	568	2,160	81
30	4	324	1,571	87
40	4	105	1,508	87
60	4	71.5	1,102	91
80	4	62.4	1,693	92
100	4	32.7	1,364	94
140	4	24.6	2,420	78
200	20	72.0	3,040	74
300	20	26.5	2,260	83
400	20	14.2	1,654	108
600	40	31.0	2,820	155
800	40	15.4	2,100	184
1,000	40	17.4	3,220	212
1,200	40	13.5	3,460	220
				221

SOUNDING NUMBER AND LOCATION VES70 Huron Co., Carpenter Road
AZIMUTH OF SURVEY AND DATE Sections 26 & 35, T18N R13E
West, 9-9-87

ab/2 (meters)	mn/2 (meters)	V (millivolts)	I (milliamperes)	apparent resistivity (ohm-meters)
3	0.5	1,530	1,492	28
4	0.5	790	1,290	30
5	0.5	608	1,443	33
6	0.5	375	1,214	35
8	1	582	1,402	41
10	1	392	1,328	46
14	2	231	1,332	53
20	2	298	1,429	65
30	4	163	1,486	77
40	4	89	1,294	86
60	4	82.3	1,224	95
80	4	52.1	1,452	90
100	4	55.0	2,720	79
140	4	21.4	3,130	53
200	20	34.4	3,350	32
300	20	5.51	3,090	13
400	20	2.79	3,970	9
600	40	2.08	3,410	9
800	40	1.10	2,800	10

VES 71

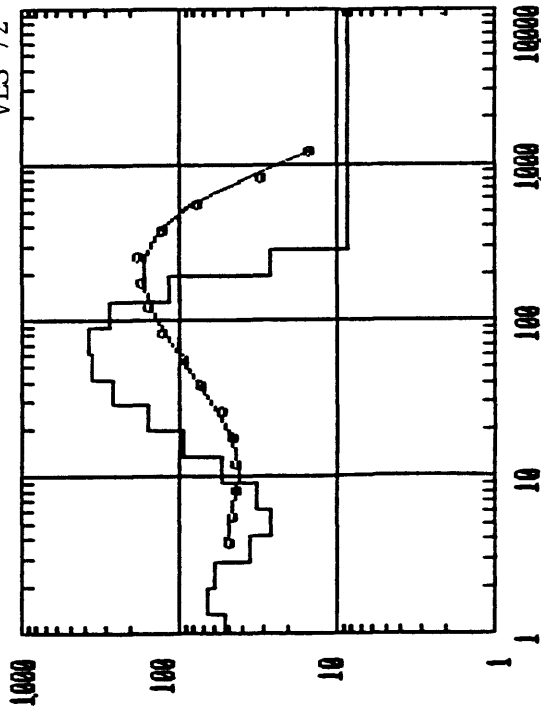


SOUNDING NUMBER AND LOCATION VES71 Huron Co., Stein Road
Sections 25, 26, 35, 36, T16N R11E
AZIMUTH OF SURVEY AND DATE West, 9-9-87

ab/2 (meters)	mv/2 (meters)	V (millivolts)	I (milliamperes)	apparent resistivity (ohm-meters)
3	0.5	2,480	1,645	42
4	0.5	1,320	1,617	42
5	0.5	900	1,645	42
6	0.5	530	1,408	42
8	1	346	1,238	43
10	1	346	1,230	44
14	2	184	1,230	46
20	2	205	1,230	52
30	4	110	1,230	63
40	4	124	1,210	70
60	4	98	1,590	87
80	4	51	1,330	100
100	4	37	1,330	110
140	4	23	1,513	119
200	20	73	1,742	130
300	20	58	3,490	118
400	20	19	2,470	97
600	40	10	2,470	58
800	40	3	2,590	35
1,000	40	1	2,580	23

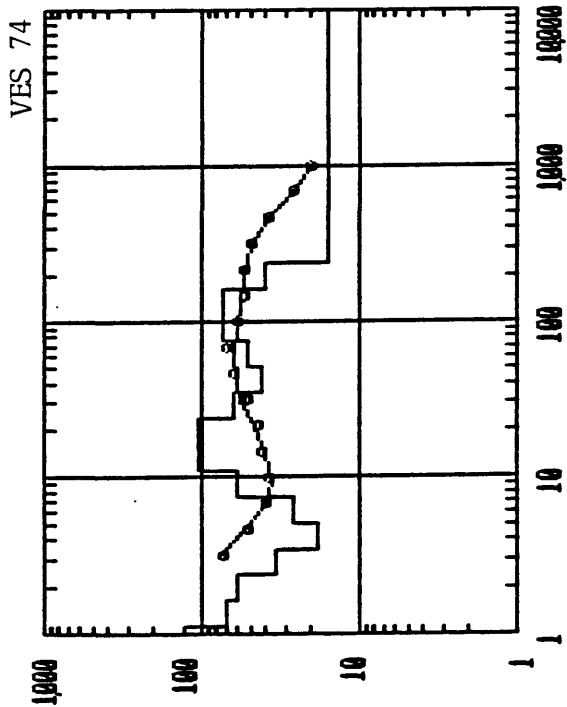
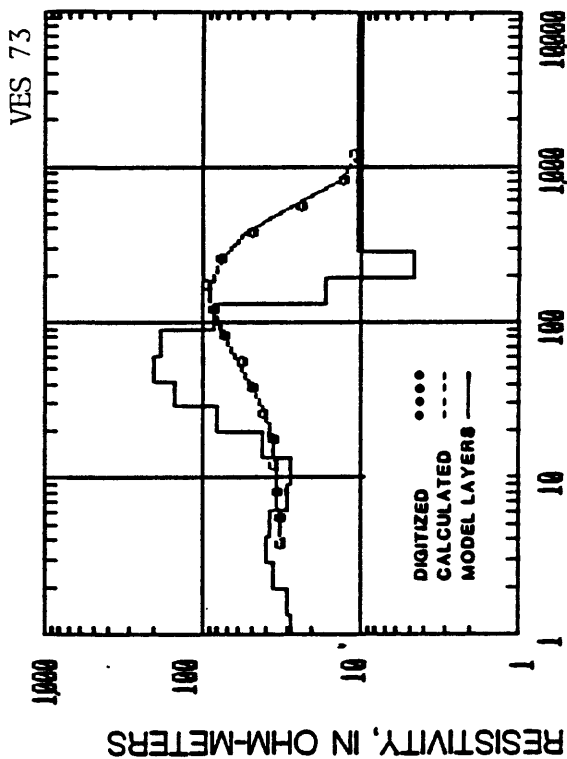
ELECTRODE SPACING (AB/2), OR DEPTH, IN METERS

VES 72



SOUNDING NUMBER AND LOCATION VES72 Huron Co., Brown Road
Sections 3 & 4, T16N R10E
AZIMUTH OF SURVEY AND DATE North, 9-9-87

ab/2 (meters)	mv/2 (meters)	V (millivolts)	I (milliamperes)	apparent resistivity (ohm-meters)
3	0.5	2,470	1,431	48
4	0.5	1,160	1,271	45
5	0.5	638	1,138	44
6	0.5	427	1,135	42
8	1	385	943	40
10	1	429	1,662	40
14	2	278	2,110	40
20	2	271	1,900	44
30	4	103	1,300	57
40	4	67	1,230	69
60	4	86	1,300	94
80	4	59	1,300	114
100	4	45	1,350	133
140	4	41	2,300	146
200	20	63	2,213	162
300	20	46	2,200	148
400	20	16	2,220	150
600	40	7	1,780	113
800	40	2	1,780	60
1,000	40	0.87	1,780	30
1,200	40	0.45	1,780	19



ELECTRODE SPACING (AB/2), OR DEPTH, IN METERS

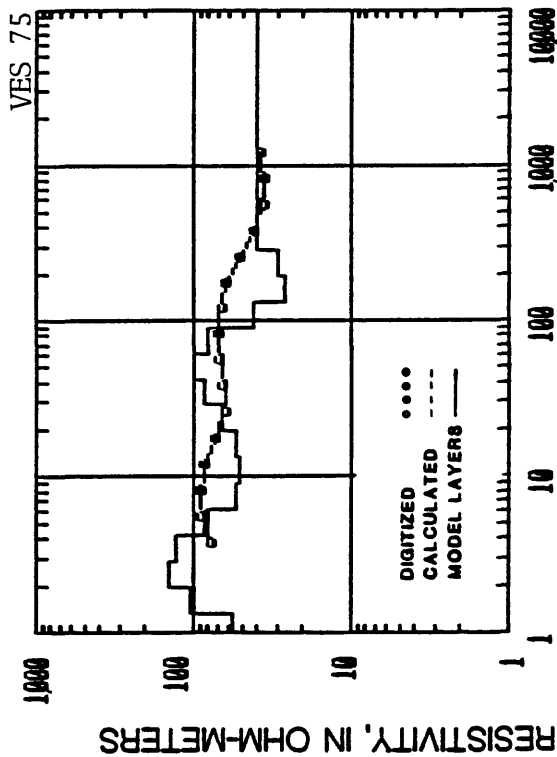
SOUNDING NUMBER AND LOCATION VES73 Huron Co., Bolk Road
Sections 1, 2, 11, 12, T15N R9E
AZIMUTH OF SURVEY AND DATE North, 9-10-87

	ab/2 (meters)	mv/2 (meters)	Y (millivolts)	I (milliamperes)	apparent resistivity (ohm-meters)
3	0.5	1,250	1,038	1,185	33
4	0.5	649	1,190	1,528	33
5	0.5	283	562	940	33
6	0.5	478	511	1,302	34
8	1	288	511	1,213	36
10	1	175	331	1,399	37
14	2	157	168	1,196	38
20	2	92	120	1,184	38
30	2	57.7	120	1,171	41
40	2	59.4	120	1,301	46
60	4	32.8	106	1,090	53
80	4	22.8	132	1,021	51
100	4	22.1	132	1,801	75
140	4	76.3	45.2	2,610	84
200	20	22.2	21.0	2,350	84
300	20	10.5	21.0	2,960	91
400	20	4.05	21.0	2,720	67
600	40	1.50	2.51	3,540	45
800	40	1.00	2.51	3,540	45
1,000	40	1.00	2.51	3,540	11

SOUNDING NUMBER AND LOCATION VES74 Midland Co., Curtis Road
Sections 3, 4, 5, 8, 9, 10, T16N R1W
AZIMUTH OF SURVEY AND DATE West, 9-10-87

	ab/2 (meters)	mv/2 (meters)	Y (millivolts)	I (milliamperes)	apparent resistivity (ohm-meters)
3	0.5	826	356	356	64
4	0.5	471	482	391	48
5	0.5	201	455	391	40
6	0.5	121	296	202	35
8	1	68.9	200	396	34
10	1	85.5	119	414	38
14	1	48.9	119	534	34
20	2	79.0	106	742	36
30	2	55.3	43.5	479	46
40	2	24.2	43.5	489	53
60	4	17.9	62.4	725	63
80	4	10.9	25.8	517	57
100	4	5.13	25.8	778	83
140	4	10.4	12.6	633	86
200	20	6.59	12.6	963	51
300	20	7.53	14.6	2,250	48
400	20	5.77	14.6	2,860	49
600	40	0.442	1.82	1,607	42
800	40	0.442	1.82	1,607	28
1,000	40	0.442	1.82	1,607	23
1,607	40	0.442	1.82	1,607	19
2,409	40	0.442	1.82	1,607	20

* Denotes "spike" or "trough" in apparent resistivity, station removed before data run through "SHIFT" program.

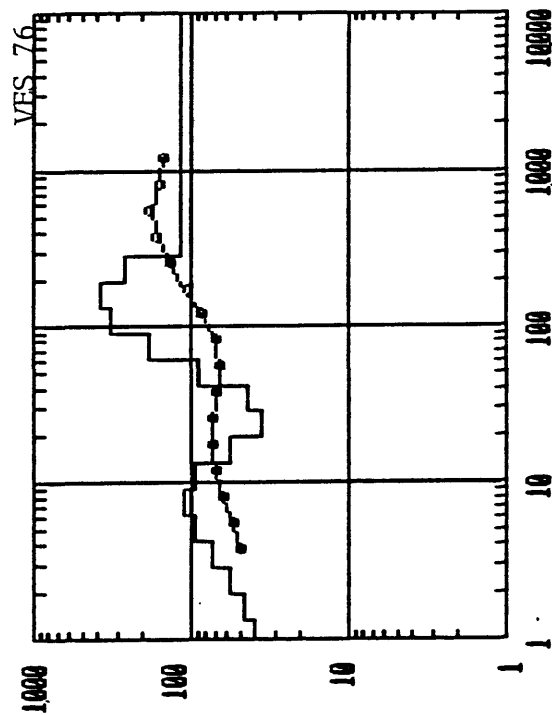


ELECTRODE SPACING (AB/2), OR DEPTH, IN METERS

SOUNDING NUMBER AND LOCATION VES75 Gladwin Co., 3 Rivers Road
 Sections 1, T18N R1E, 36, T19N R1E
 AZIMUTH OF SURVEY AND DATE North, 9-10-87

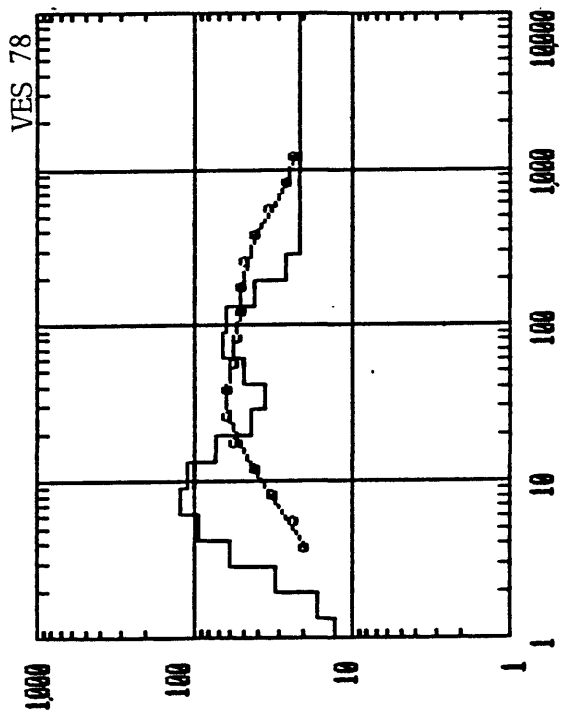
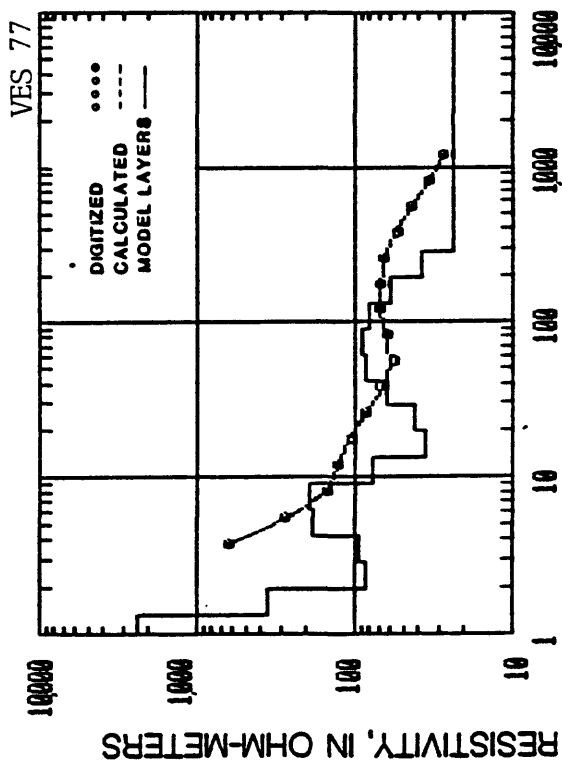
ab/2 (meters)	mn/2 (meters)	V (millivolts)	I (milliamperes)	apparent resistivity (ohm-meters)
3	0.5	2,550	804	87
4	0.5	2,050	1,109	92
5	0.5	1,160	891	101
6	0.5	1,776	836	104
8	1	826	795	103
10	1	455	721	101
14	2	248	822	94
20	2	257	921	91
30	4	96	948	71
40	4	55.5	927	75
60	4	48.4	849	80
80	4	22.2	697	80
100	4	23.7	1,187	78
140	4	13.8	1,400	76
200	20	12.0	558	67
300	20	11.2	1,471	54
400	20	6.05	1,640	46
600	40	8.25	1,850	41
800	40	1.13	1,870	15*
1,000	40	2.89	2,740	41
1,200	40	1.82	2,410	43
				38

* Denotes "spike" or "trough" in apparent resistivity, station removed before data run through "SHIFT" program.



SOUNDING NUMBER AND LOCATION VES76 Gladwin Co., Harner Road
 Sections 21, 22, 26, 27, T20N R2E
 AZIMUTH OF SURVEY AND DATE North, 9-11-87

ab/2 (meters)	mn/2 (meters)	V (millivolts)	I (milliamperes)	apparent resistivity (ohm-meters)
3	0.5	5,440	2,870	52
4	0.5	2,860	3,430	41
5	0.5	1,640	2,920	44
6	0.5	1,100	2,630	47
8	1	1,340	2,350	57
10	1	900	2,260	62
14	2	441	2,040	66
20	2	669	3,010	69
30	4	281	2,960	67
40	4	152	3,060	64
60	4	79.5	1,729	65
80	4	45.0	1,653	68
100	4	47.8	2,550	74
140	4	40.2	3,480	89
200	20	92.3	2,520	114
300	20	27.6	1,335	146
400	20	57.8	4,360	166
600	40	19.8	1,664	153
800	40	4.19	1,685	153
1,000	40	8.38	2,210	149
1,200	40	3.06	1,237	140
				156



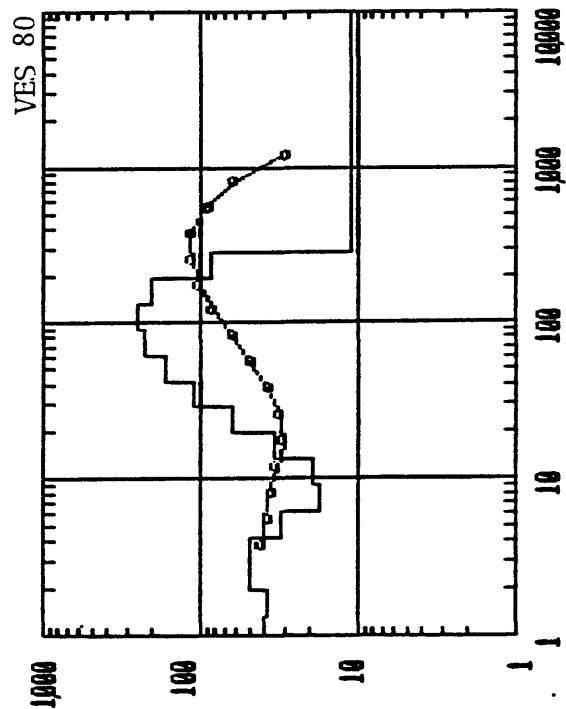
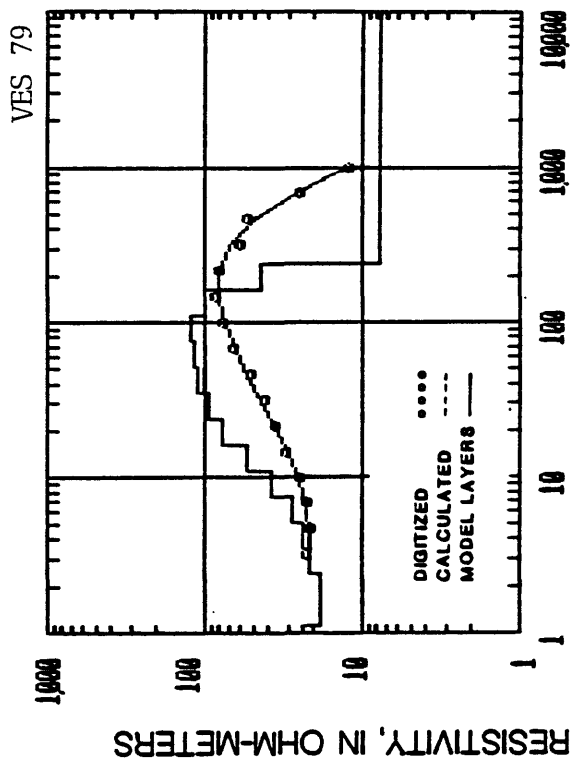
ELECTRODE SPACING (AB/2), OR DEPTH, IN METERS

SOUNDING NUMBER AND LOCATION VES77 Gladwin Co., Grim Road
 Sections 19, 20, 29, 30, T18N R2E
 AZIMUTH OF SURVEY AND DATE West, 9-11-87

ab/2 (meters)	mn/2 (meters)	V (millivolts)	I (milliamperes)	apparent resistivity (ohm-meters)
3	0.5	5,290	166	876
4	0.5	1,800	163	547
5	0.5	1,806	187	335
6	0.5	364	164	372
8	1	395	176	232
10	1	208	237	253
14	1	208	219	165
14	2	159	196	148
20	2	228	384	166
20	4	66.7	631	127
30	4	129	497	141
40	4	197	1,576	112
40	8	41.4	1,642	96
60	4	61.8	884	79
80	4	22.7	2,200	75
100	4	111	1,227	66
140	4	66.1	1,170	73
200	20	16.1	1,435	72
300	20	20.9	691	73
400	20	11.4	1,244	65
400	40	7.63	1,123	65
600	40	3.61	1,741	54
800	40	4.01	1,233	55
800	80	4.01	2,970	42
1,000	40	1.65	2,120	34
1,000	100	3.74	3,470	21
1,200	40	4.16	2,000	28
1,200	100		3,350	28

SOUNDING NUMBER AND LOCATION VES78 Gladwin Co., Dale Road
 Sections 15, 16, 21, 22, T17N R2W
 AZIMUTH OF SURVEY AND DATE West, 9-11-87

ab/2 (meters)	mn/2 (meters)	V (millivolts)	I (milliamperes)	apparent resistivity (ohm-meters)
3	0.5	2,550	3,980	18
4	0.5	1,810	4,490	20
5	0.5	1,020	3,990	20
6	0.5	1,746	3,220	26
8	1	1,100	3,300	27
10	1	930	3,880	33
14	1	730	3,750	37
14	2	481	4,640	36
20	2	304	580	48
30	2	658	3,450	47
40	4	252	3,450	62
40	8	115	2,370	64
60	4	95.0	2,290	61
80	4	41.2	1,846	58
100	4	20.6	4,500	56
140	4	67.3	2,190	53
200	20	39.8	2,190	51
300	20	6.60	2,590	48
400	20	8.20	540	48
400	40	6.27	1,209	44
600	40	3.53	1,331	46
800	40	1.65	2,950	38
800	80	4.28	3,580	30
1,000	40	0.98	2,800	25
1,000	100	2.48	2,390	23
1,200	40		2,340	24



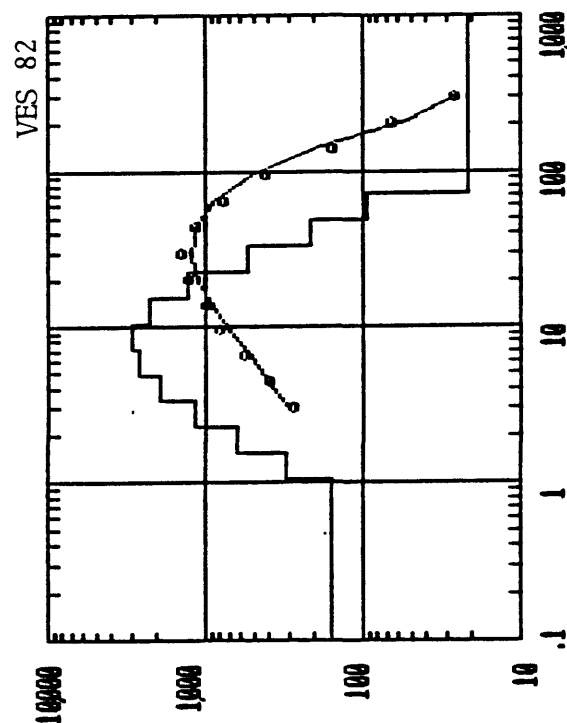
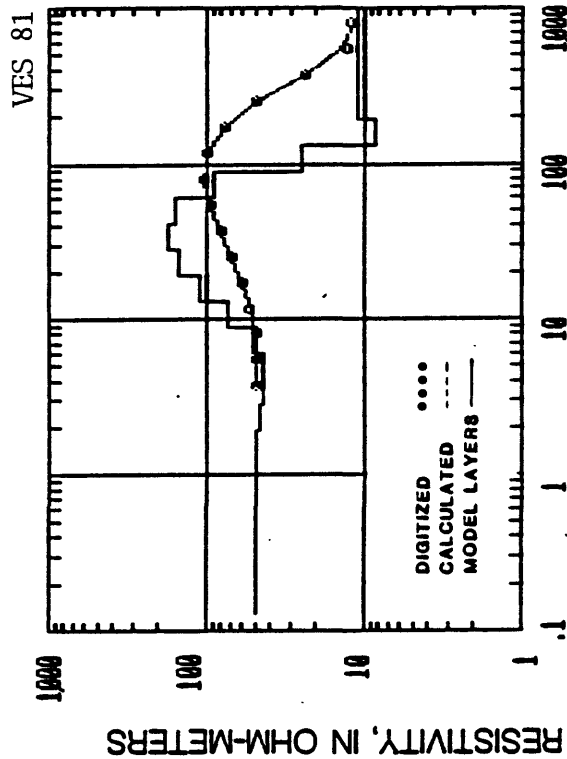
ELECTRODE SPACING (AB/2), OR DEPTH, IN METERS

SOUNDING NUMBER AND LOCATION VES79 Huron Co., Stein Road
Sections 30 & 31, T16N R10E
AZIMUTH OF SURVEY AND DATE West, 9-11-87

ab/2 (meters)	mv/2 (meters)	(millivolts)	(milliamperes)	apparent resistivity (ohm-meters)
3	0.5	2,080	2,800	20
4	0.5	1,060	2,740	19
5	0.5	1,830	3,130	19
6	0.5	658	3,820	21
8	1	983	4,250	23
10	1	560	3,470	25
14	2	293	3,130	29
20	2	358	3,290	34
30	4	147	2,580	40
40	4	96	2,580	47
60	4	58.6	1,350	61
80	4	38.4	1,340	72
100	4	26.9	1,350	78
140	4	34.2	1,120	84
200	20	63.5	2,350	84
300	20	20.5	2,210	85
400	40	7.77	2,130	65
600	40	5.23	3,010	48
800	40	1.01	1,828	14
1,000	40	1.10	3,580	12

SOUNDING NUMBER AND LOCATION VES80 Huron Co., Berne Road
Sections 2, T16N R10E, 35, T17N R10E
AZIMUTH OF SURVEY AND DATE West, 9-11-87

ab/2 (meters)	mv/2 (meters)	(millivolts)	(milliamperes)	apparent resistivity (ohm-meters)
3	0.5	1,910	1,243	42
4	0.5	307	1,207	38
5	0.5	221	656	36
6	0.5	258	712	35
8	1	163	760	34
10	1	113	760	33
14	2	106	1,107	31
20	2	51.7	1,088	30
30	4	37.3	1,084	33
40	4	39.5	1,259	37
60	4	27.9	1,164	48
80	4	22.5	1,127	59
100	4	20.1	1,279	69
140	4	109	2,600	89
200	20	49.7	3,280	103
300	20	22.9	3,080	114
400	40	14.7	2,670	108
600	40	7.50	2,430	85
800	40	2.48	3,050	62
1,000	40	1.37	2,400	40
1,200	40	5.99	2,690	29



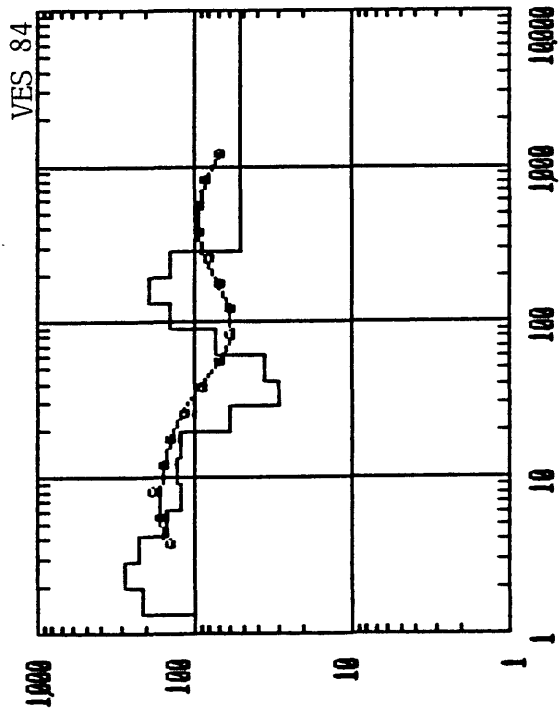
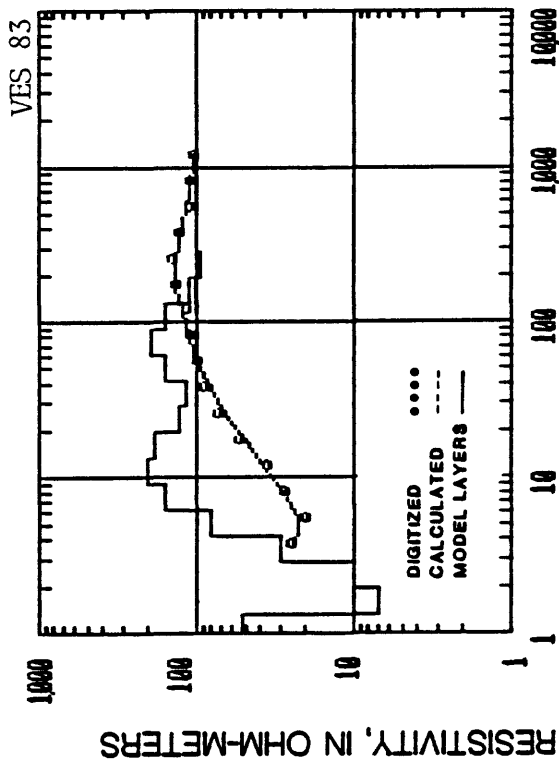
ELECTRODE SPACING (AB/2), OR DEPTH, IN METERS

SOUNDING NUMBER AND LOCATION VES81 Huron Co., Helena Road
Sections 5 & 6, T15N R14E
AZIMUTH OF SURVEY AND DATE 31 & 32, T16N R14E
West, 9-11-87

ab/2 (meters)	mv/2 (meters)	Y (millivolts)	apparent resistivity (ohm-meters)
3	0.5	1,170	730
4	0.5	640	725
5	0.5	409	725
6	0.5	284	725
8	1	345	725
10	1	230	725
14	1	128	741
20	2	332	1,659
30	2	90.0	872
40	2	60.1	905
60	2	45.6	672
80	4	27.3	672
100	4	27.3	1,065
140	4	15.7	1,411
200	20	11.9	2,492
300	20	11.8	2,310
400	20	4.95	2,880
600	40	2.01	2,420
800	40	1.24	2,710

SOUNDING NUMBER AND LOCATION VES82 Kalamazoo Co.,
field road off M-89
AZIMUTH OF SURVEY AND DATE Section 24, T15 R10W
West, 9-11-87

ab/2 (meters)	mv/2 (meters)	Y (millivolts)	apparent resistivity (ohm-meters)
3	0.5	8,200	802
4	0.5	3,870	766
5	0.5	3,790	696
6	0.5	4,930	825
8	1	3,810	719
10	1	2,170	709
14	1	2,170	645
20	2	3,260	806
30	2	1,570	783
40	2	1,810	726
60	2	608	929
80	4	183	704
100	4	259	2,570
140	4	39.2	1,748
200	20	36.1	1,635
300	20	6.23	1,564
	40	12.4	1,630



ELECTRODE SPACING (AB/2), OR DEPTH, IN METERS

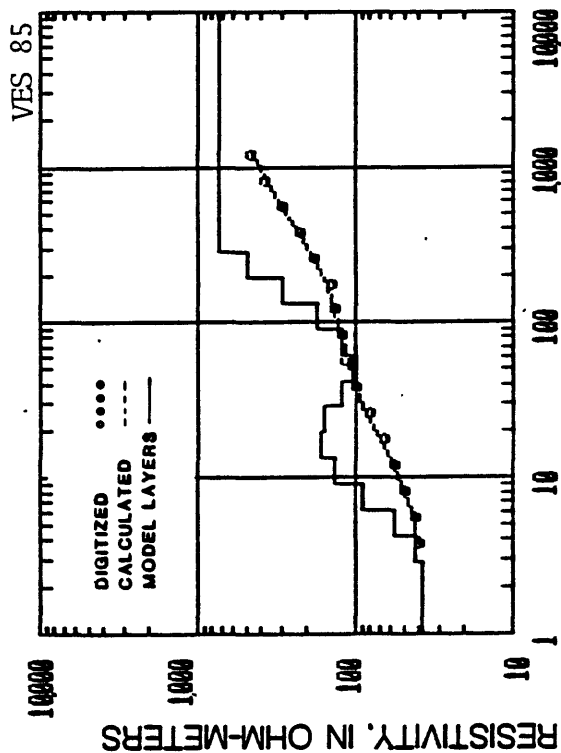
SOUNDING NUMBER AND LOCATION VES83 Ottawa Co., 14th Ave.
Sections 11 & 14, T9N R13W
AZIMUTH OF SURVEY AND DATE North, 9-16-87

ab/2 (meters)	mv/2 (meters)	V (millivolts)	I (milliamperes)	apparent resistivity (ohm-meters)
3	0.5	844	779	30
4	0.5	527	1,010	26
5	0.5 / 1	408 / 840	1,447 / 1,372	22 / 23
6	0.5 / 1	157 / 328	745 / 711	24 / 25
8	1	226	731	31
10	1 / 2	144 / 286	617 / 587	36 / 37
14	1 / 2	74.6 / 163	470 / 516	49 / 48
20	2	51.9	2,410	67
30	2 / 4	27.0 / 530	2,150 / 2,070	88 / 89
40	2 / 4	132 / 328	1,576 / 1,931	105 / 106
60	4	178	2,200	114
80	4	37.9	787	121
100	4 / 20	104 / 530	3,410 / 3,360	120 / 119
140	4 / 20	75.3 / 358	4,140 / 4,020	140 / 134
200	20	196	3,880	157
300	20 / 40	72.3 / 135	2,820 / 2,800	180* / 167*
400	20 / 40	10.7 / 19.8	980 / 953	137 / 129
600	40	11.0	1,031	150*
800	40	12.8	2,910	110
1,000	40 / 100	9.32 / 24.1	1,844 / 1,902	198* / 197*
1,200	40 / 100	3.49 / 9.60	1,856 / 2,120	106 / 105

* Denotes "spike" or "trough" in apparent resistivity, station removed before data run through "SHIFT" program.

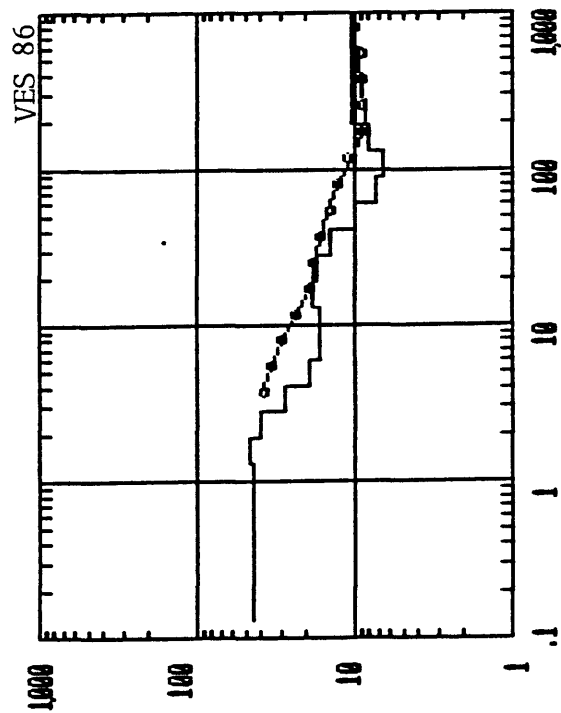
SOUNDING NUMBER AND LOCATION VES84 Muskegon and Ottawa Co.,
Sherman Road, Sections 4 & 5,
T9N R13W
AZIMUTH OF SURVEY AND DATE West, 9-16-87

ab/2 (meters)	mv/2 (meters)	V (millivolts)	I (milliamperes)	apparent resistivity (ohm-meters)
3	0.5	1,200	226	146
4	0.5	386	126	152
5	0.5 / 1	489	236 / 231	161 / 162
6	0.5 / 1	331	215 / 213	173 / 176
8	1	251	129	193
10	1 / 2	271	244 / 233	173 / 181
14	1 / 2	88	174	172 / 161
20	2	210	462	141
30	4	35.4	67.8	227 / 217
40	4	42.5	81.7	110 / 108
60	4	30.3	593	95 / 93
80	4	8.5	338	72
100	4 / 20	13.7	878 / 853	63
140	4 / 20	8.4	946 / 929	61 / 64
200	20	27.5	1,023	68 / 75
300	20 / 40	10.5	1,741 / 731	84
400	20 / 40	15.1	1,729 / 1,674	100 / 96
600	40	4.5	590	110 / 108
800	40	3.13	795	107
1,000	40 / 100	3.66	1,603	99
1,200	40 / 100	2.11	1,504 / 1,468	90 / 76
				79 / 70



SOUNDING NUMBER AND LOCATION VES85 Kent Co., Sherman Road
Sections 16 & 17, T8N R12W
AZIMUTH OF SURVEY AND DATE North, 9-16-87

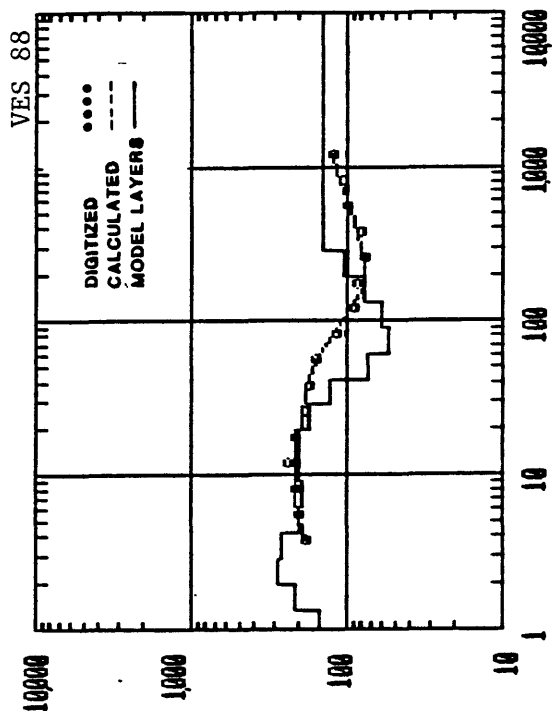
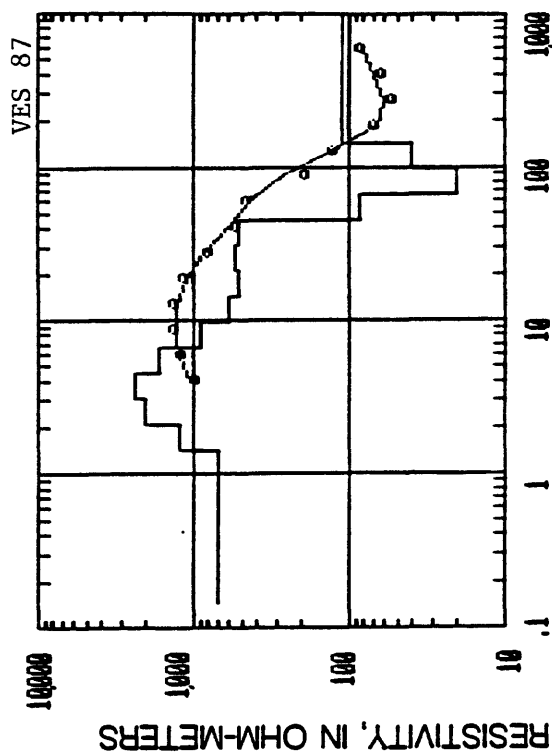
	ab/2 (meters)	mn/2 (meters)	Y (millivolts)	I (milliamperes)	apparent resistivity (ohm-meters)
3	0.5	0.5	1,260	1,101	32
4	0.5	0.5	590	844	35
5	0.5	1	613	1,364	35
6	0.5	1	426	1,297	37
8	1	1	492	1,166	42
10	1	2	342	1,134	47
14	1	2	178	1,056	54
20	2	4	213	1,034	64
30	2	4	99	871	80
40	2	4	70.1	945	93
60	4	4	57.9	745	109
80	4	4	54.9	1,243	111
100	4	20	69.9	4,450	121
140	4	20	159	3,400	145
200	20	40	78.1	2,910	189
300	20	40	38.9	2,240	218
400	20	40	54.1	2,500	305
600	40	40	73.5	4,960	371
800	40	100	34	3,090	431
1,000	40	100	15.4	1,950	446
1,200	40	100	37.9	1,870	455



SOUNDING NUMBER AND LOCATION VES86 Huron Co., Minnick Road
Sections 26, 27, 34 & 35, T17N R14E
AZIMUTH OF SURVEY AND DATE West, 10-15-87

	ab/2 (meters)	mn/2 (meters)	Y (millivolts)	I (milliamperes)	apparent resistivity (ohm-meters)
3	0.5	0.5	1,940	1,410	38
4	0.5	0.5	1,200	1,723	37
5	0.5	1	788	1,758	35
6	0.5	1	384	1,353	32
8	1	1	431	1,467	33
10	1	2	227	1,385	29
14	1	2	116	1,346	26
20	2	4	123	1,643	22
30	2	4	33.0	1,975	19
40	2	4	21.6	1,326	18
60	4	4	10.4	1,697	16
80	4	4	5.19	1,025	14
100	4	20	3.19	1,056	13
140	4	20	3.08	1,044	12
200	20	40	15.1	2,320	10
300	20	40	5.73	1,960	12
400	20	40	3.10	2,510	9
600	20	40	1.33	2,400	9
800	40	40	1.22	1,920	9
	40	40	1.17	1,826	9
				2,820	10

ELECTRODE SPACING (AB/2), OR DEPTH, IN METERS



ELECTRODE SPACING (AB/2), OR DEPTH, IN METERS

SOUNDING NUMBER AND LOCATION VES87 Grand Traverse Co., Tomkins Rd.
SECTIONS 23 & 26, T30N R10W
AZIMUTH OF SURVEY AND DATE North, 10-15-87

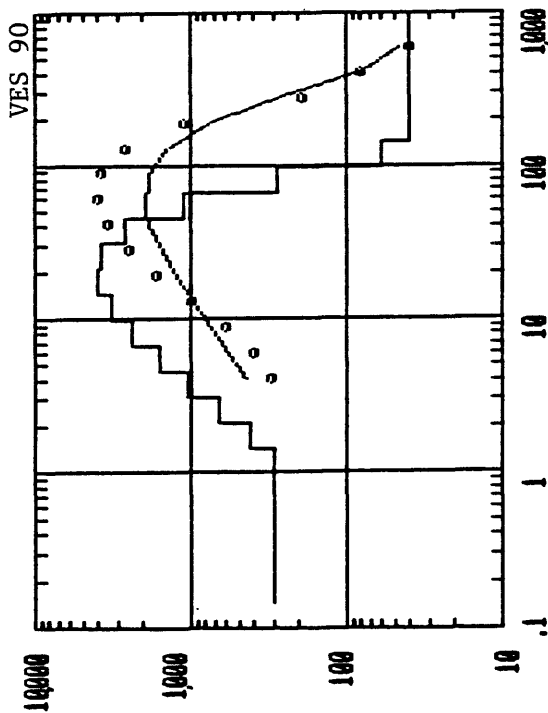
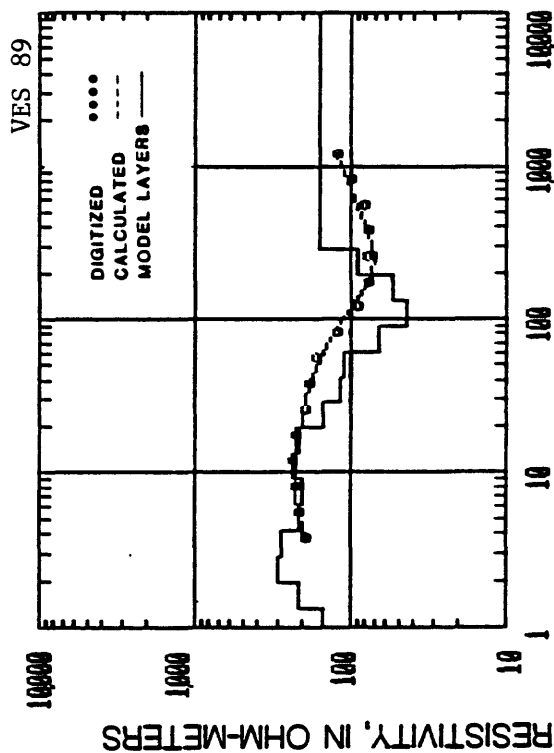
ab/2 (meters)	mv/2 (meters)	V (millivolts)	I (milliamperes)	apparent resistivity (ohm-meters)
3	0.5	7.110	241	811
4	0.5	5.500	295	923
5	0.5	3.580	268	1,093
6	0.5	2.720	276	1,107
8	1	2,720	229	1,176
10	1	1,500	245	1,206
14	1	1,500	205	1,206
20	2	998	277	1,191
30	2	185	179	1,120
40	2	80	192	727
60	4	85.5	159	769
80	4	14.9	254	522
100	4	13.2	316	540
140	4	8.9	583	235
200	20	15.6	740	164
300	20	4.27	517	303
400	20	4.18	808	537
600	40	8.16	1,325	117
800	40	7.24	803	176*

* Denotes "spike" or "trough" in apparent resistivity, station removed before data run through "SHIFT" program.

SOUNDING NUMBER AND LOCATION VES88 Grand Traverse Co., Kroupa Rd.
SECTIONS 15 & 16, T29N R10W
AZIMUTH OF SURVEY AND DATE North, 10-16-87

ab/2 (meters)	mv/2 (meters)	V (millivolts)	I (milliamperes)	apparent resistivity (ohm-meters)
3	0.5	3,660	524	192
4	0.5	2,030	500	201
5	0.5	1,280	473	210
6	0.5	1,920	472	219
8	1	1,003	436	228
10	1	1,642	429	233
14	1	256	313	232
20	2	383	332	251
30	2	109	384	224
40	2	89.0	385	200
60	4	31.9	585	187
80	4	40.3	290	191
100	4	20.5	820	155
140	4	12.2	1,590	123
200	20	24.1	1,134	102
300	20	6.32	944	89
400	20	12.6	1008	88
600	40	8.05	1309	78
800	40	1.97	491	83
1000	40	2.77	939	83
1200	40	1.79	811	106

* Denotes "spike" or "trough" in apparent resistivity, station removed before data run through "SHIFT" program.



ELECTRODE SPACING (AB/2), OR DEPTH, IN METERS

SOUNDING NUMBER AND LOCATION VES89 Grand Traverse Co., Kropa Rd.
Sections 15 & 16, T29N R10W
AZIMUTH OF SURVEY AND DATE North, 10-16-87

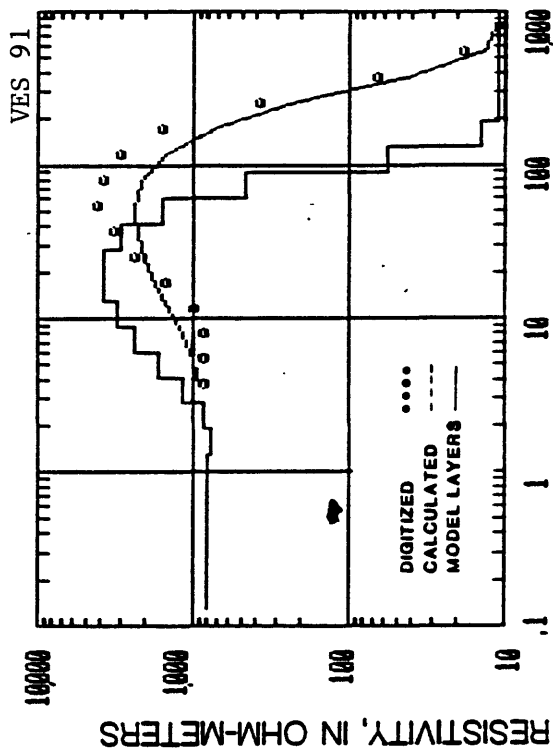
ab/2 (meters)	mv/2 (meters)	(millivolts)	(milliamps)	apparent resistivity (ohm-meters)
3	0.5	3,660	524	192
4	0.5	2,030	500	201
5	0.5	1,280	473	210
6	0.5	1,920	472	219
8	1	1,003	436	228
10	1	642	429	232
14	2	256	448	233
20	2	383	313	254
30	4	109	384	224
40	4	89.0	398	200
60	4	31.9	585	187
80	4	40.3	290	191
100	4	10.4	820	155
140	4	12.2	1,552	123
200	20	24.1	1,530	100
300	20	6.32	1,134	83
400	20	12.6	1,220	86
600	40	8.05	944	79
800	40	6.32	1,008	81
1,000	40	1.97	1,309	79
1,200	40	2.77	491	87
	100	6.42	939	101
	100	1.79	811	116
	100	4.26	811	125
	100			124

The "S" symbol after the calculated apparent resistivity values are for stations where data from VES 88 is used.

SOUNDING NUMBER AND LOCATION VES90 Grand Traverse Co., Broomhead Rd.
Sections 14, 15, 22 & 23, T27N R9W
AZIMUTH OF SURVEY AND DATE North, 10-16-87

ab/2 (meters)	mv/2 (meters)	(millivolts)	(milliamps)	apparent resistivity (ohm-meters)
3	0.5	4,600	146	296
4	0.5	2,770	193	292
5	0.5	3,440	379	340
6	0.5	2,800	346	387
8	1	2,310	319	516
10	1	1,450	298	703
14	2	2,120	644	710
20	2	1,190	245	1,101
30	4	830	286	1,712
40	4	356	156	2,558
60	4	356	174	3,314
80	4	146	210	3,880
100	4	46.7	110	3,837
140	4	25.7	92	3,293
200	20	126	217	2,220
300	20	4.86	417	818
400	20	9.20	215	151
600	20	0.88	243	158
	40	0.125	118	363*
	40			372*

* Denotes "spike" or "trough" in apparent resistivity. station removed before data run through "SHIFT" program.

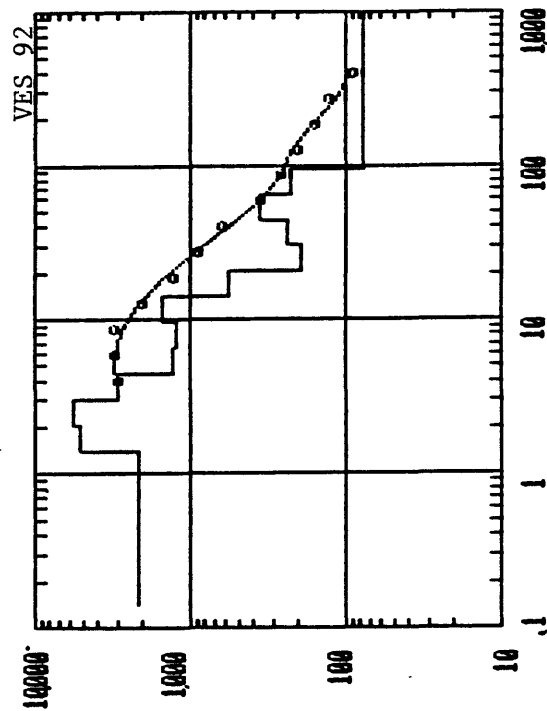


ELECTRODE SPACING (AB/2), OR DEPTH, IN METERS

SOUNDING NUMBER AND LOCATION VES91 Grand Traverse Co. Broomhead Rd.
Sections 14, 15, 22 & 23, T27N R9W
AZIMUTH OF SURVEY AND DATE North, 10-16-87

ab/2 (meters)	mn/2 (meters)	V (millivolts)	I (milliamperes)	apparent resistivity (ohm-meters)
3	0.5	4,600	146	866
4	0.5	2,770	193	710
5	0.5	3,440	379	360
6	0.5	2,800	346	296
8	1	2,310	319	750
10	1	1,450	298	378
14	2	2,120	644	632
20	2	1,190	245	282
30	4	930	156	174
40	4	356	210	110
60	4	146	110	92
80	4	46.7	387	217
100	4	257	298	207
140	4	126	417	940
200	20	4.86	9.20	215
300	20	0.88	1.75	243
400	20	0.125	118	229
600	40	0.164	370	15
800	40			48

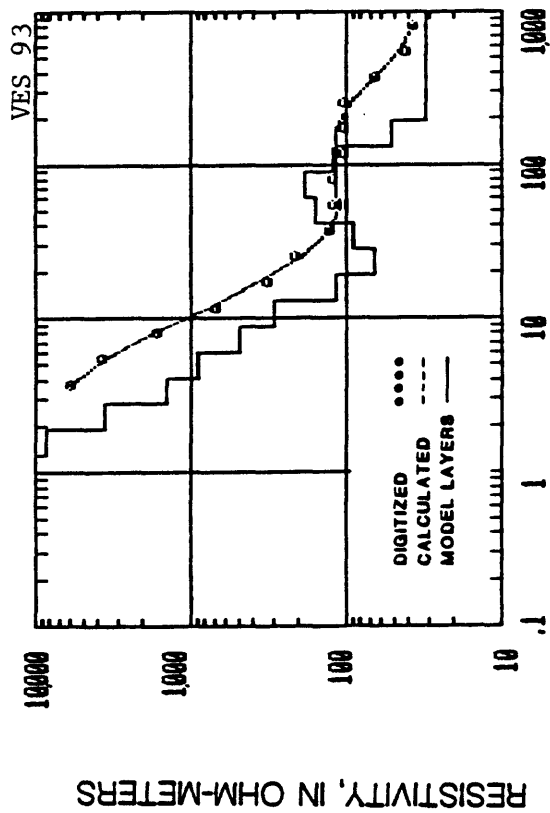
* Denotes "spike" or "trough" in apparent resistivity,
station removed before data run through "SHIFT" program.



SOUNDING NUMBER AND LOCATION VES92 Newaygo Co., 13 Mile Road
Sections 25 & 36, T16N R12W
AZIMUTH OF SURVEY AND DATE West, 10-22-87

ab/2 (meters)	mn/2 (meters)	V (millivolts)	I (milliamperes)	apparent resistivity (ohm-meters)
3	0.5	16.0	175	2,514
4	0.5	9.6	174	2,731
5	0.5	6.51	174	2,909
6	0.5	4.57	175	2,937
8	1	5.52	174	3,140
10	1	3.76	174	3,360*
14	2	1.02	174	1,796
20	2	2.23	174	1,282
30	4	221	168	926
40	4	55.3	111	670
60	4	41.3	174	334
80	4	21.9	210	261
100	4	4.07	604	85
140	20	8.80	604	281*

* Denotes "spike" or "trough" in apparent resistivity,
station removed before data run through "SHIFT" program.



ELECTRODE SPACING (AB/2), OR DEPTH, IN METERS

SOUNDING NUMBER AND LOCATION VES93 Newaygo Co., 12 Mile Rd.
 AZIMUTH OF SURVEY AND DATE Sections 3, T15N R11W & 34, T16N R11W
 West, 10-23-87

ab/2 (meters)	mv/2 (meters)	V (millivolts)	I (milliamperes)	apparent resistivity (ohm-meters)
3	0.5	17,300	58	8,203
4	0.5	6,180	54	5,665
5	0.5	3,000	52	4,486
6	0.5	1,660	51	3,517
8	1	1,980	53	1,797
10	1	369	54	1,083
14	2	85	53	1,491
20	2	56	55	311
30	4	20.2	72	197
40	4	7.8	71	138
60	4	9.7	98	139
80	4	4.9	94	131
100	4	5.06	163	122
140	4	3.4	101	259*
200	20	12.7	376	105
300	20	1.50	124	85
400	20	0.68	147	58
600	40	0.97	342	40
800	40	0.36	246	37

* Denotes "spike" or "trough" in apparent resistivity,
 station removed before data run through "SHFT" program.