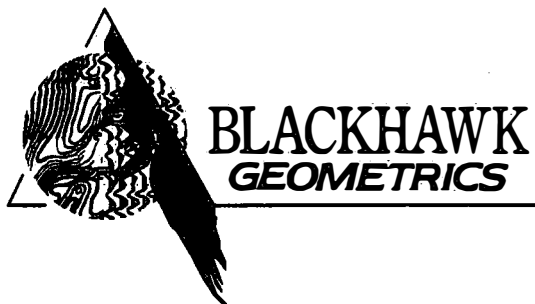


**GEOPHYSICAL SURVEYS FOR
ASSISTING IN DETERMINING THE
GROUND WATER RESOURCES
NEAR THE POOKELA WATER TANK
ISLAND OF MAUI, HAWAII**

Blackhawk Geometrics Project Number 9810TMG

Prepared For:
THE MALAMA GROUP



Corporate Center
301 Commercial Road, Suite B,
Golden, Colorado 80401, USA
Tel: (303) 278-8700
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98193TMG
June 9, 1998

Mr. Bob Diffley, President
The Malama Group
915 Fort Street, Suite 702
Honolulu, HI 96813

RE: Geophysical Surveys for Assisting in Determining Ground Water Resources
Near the Pookela Water Tank, Makawao, Maui, Hawaii
Blackhawk Geometrics Project Number 9810TMG

Dear Bob:

Enclosed are three (3) copies of our final report for the above referenced surveys. A copy of the report is being sent to Tom Nance. We appreciate the opportunity to work for you on this project.

If you have any questions, please give Mark or myself a call.

Sincerely,
BLACKHAWK GEOMETRICS

Richard J. Blohm
Geologist

RJB:lm

Enclosures

cc: Tom Nance

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Prepared For:

THE MALAMA GROUP
915 Fort Street, Suite 702
Honolulu, Hawaii 96813
808-539-7175 • Fax 808-539-7176

Prepared By:

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June 9, 1998

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1.0 INTRODUCTION

This report contains the results of geophysical surveys conducted to assist in determining the ground water resources near the Pookela Water Tank located in Makawao, Maui, Hawaii. The surveys were performed by Blackhawk Geometrics (Blackhawk) for the Malama Group (Malama) during May 4 to May 14, 1998. The geophysical method employed during this survey was Time Domain Electromagnetic (TDEM) soundings. The TDEM soundings were positioned in the vicinity of the town of Makawao as shown in Figure 1-1.

The main objective of the geophysical survey was to assist in characterizing the hydrologic regime in the study area for a proposed ground water well. Ground water resources can occur on the Island of Maui basically in two modes:

- In a basal mode where a lens of fresh water floats on saline water, and
- In a high-level mode where the ground water occurrence is controlled by subsurface damming structures.

These two types of ground water occurrences are illustrated in Figure 1-2. The volcanic rocks are generally highly permeable and this allows rainwater to infiltrate directly downward through the island mass. In the Makawao area, ground water was expected to occur as both a deep fresh/brackish water interface and possible high-level water at locations above subsurface damming structures. From extensive TDEM studies in the North Kona area on Hawaii, a main ground water boundary has been located that generally parallels the coast line. From well production data near the Keauhou area, it is now postulated that other secondary damming structures exist both upslope and perpendicular to the main damming structure. A schematic geologic model that can help further explain these two types of damming structures is shown in Figure 1-3. A major ring fracture developed from a caldera is outlined, which is upslope and near parallel to the coast line with radial fractures which form near perpendicular to the major ring fracture. It is thought that the fractures are zones of weakness where intrusive dikes preferentially form, and these dikes can act as vertical ground water barriers. The radial fractures could divide the high-level water behind the ring fractures into different compartments. The water production from a single compartment will be determined by several factors; including permeability, porosity, size of and recharge to the compartment.

Previous TDEM surveys on the Hawaiian Islands have reliably mapped the boundary between fresh water in the basal mode and high-level water occurrences. Geophysical surveys, combined with other hydrogeologic information, are used to provide optimum locations for well placement and completion depths.

2.0 DATA ACQUISITION AND LOGISTICS

The geophysical equipment used for the TDEM surveys was the Geonics EM37 TDEM System. TDEM measurements were acquired using a central-loop sounding array at each site. With this array, measurements are recorded with a receiver coil at the center of transmitter loops laid on the ground surface. The transmitter loops are constructed with 12-gauge insulated copper wire. The dimensions of the square and sometimes rectangular loops at the Pookela Water Tank Site varied from about 1000 ft by 1000 ft to 1500 ft by 1500 ft. A 2.8 kW transmitter was placed in each sounding loop to drive current ranging between 13 and 15 amperes at base frequencies of 3 Hz and 30 Hz. At the center of each transmitter loop, the time derivative of the vertical magnetic field was recorded with a receiver coil with an effective area of 100 m². The data acquired at each sounding consisted of measurements at several receiver gain settings and two transmitter frequencies in order to assure data quality and to obtain data over the largest time interval possible. Data quality was generally very good. Sounding 6 was influenced by numerous water pipes in the area and the data was distorted and therefore deemed unusable. The data from each sounding was stored in the field on an Omnidata polycorder and, subsequently, transferred to a PC-486 for nightly processing. A brief technical note describing the principles of TDEM is given in Appendix A.

During the five days of field work, a total of seven soundings were completed over the survey site. A daily log of field activity is given in Table 2-1. The elevation of each sounding center was measured using an Avocet Vertech Altimeter/Barometer. The altimeter was adjusted during the course of a day at known landmarks (i.e., road junctions) with altitudes from a 7.5 minute series topographic map of the Makawao area. Sounding loop locations were measured by compass and hip-chain from known landmarks (i.e., roads, rock walls). The loop locations were selected by representatives of The Malama Group and Blackhawk Geometrics. The locations were based on property ownership, available open land, and exploration objectives.

**TABLE 2-1
DAILY LOG OF FIELD ACTIVITIES**

DATE, 1998	ACTIVITY
May 1	Mobilize geophysical equipment from Golden, CO, to Maui, HI
May 4	Mobilize Blackhawk Geometrics personnel from Golden, CO, to Maui, HI
May 5	Meet with Maui Land & Pineapple Company representatives and their consulting hydrologist to discuss project. Pickup geophysical equipment from airport & organize into field vehicles. Begin survey with data acquisition on Sound 4, makia Makawao, Maui.
May 6	TDEM data taken on Soundings 3 & 1, mauka Makawao.
May 7	Acquire data on Sounding 2, across from the water tank on Piiholo Road.
May 8-10	Data on other Maui projects.
May 11	TDEM data taken on Soundings 5 & 6, polo grounds and Haleakala Dairy.
May 12 & 13	Data on other Maui projects.
May 14	Acquire data on Sounding 7, Haleakala Ranch Property.
May 15	Demobilize geophysical equipment from Maui, HI, to Golden, CO.
May 23	Demobilize Blackhawk Geometrics personnel from Maui, HI, to Golden, CO.

3.0 DATA PROCESSING

The TDEM field data acquired each day was transferred from the Omnidata polycorder to a PC-486. The first step in processing the TDEM data is to average the electromotive forces (emfs) recorded at positive and negative receiver polarities. Next, the recordings made at different amplifier gains and frequencies were combined to give one transient decay curve with the program TEMIXXL (Interpex LTD). With this program, voltages measured with the 20 channels of the Geonics EM37 receiver are transformed into apparent resistivity verses time gate. The apparent resistivity curve is interpreted by inversion to a one dimensional (1-D) geoelectric section that matches the observed decay curve.

The inversion program requires an initial estimate of the geoelectric section, including the number of layers and the thicknesses and resistivities of each of the layers. The program then adjusts these parameters so that the model curve converges to best fit the curve formed by the field data. The inversion program does not change the number of layers within the model, but allows all other parameters to change freely, or they can optionally be fixed constant. To determine the influence and best fit of the number of layers on the solution, separate inversions with different numbers of layers are run. Normally, the model with the fewest number of layers which best fits the data is used.

An example of the output of the inversion program (Sounding Mala-1) is shown on Figures 3-1 and 3-2. Figure 3-1 shows the measured data points (in terms of apparent resistivity) superimposed on a solid line. The solid line represents the computed forward model of the geoelectric section shown on the right. Tabulated inversion parameters and results consisting of measured field data, computed data for best match solution, and inversion errors are given on Figure 3-2. The apparent resistivity curves and data sheets for all of the TDEM soundings are given in Appendix B.

4.0 INTERPRETATION RESULTS

4.1 General

The main objective of TDEM soundings is to derive the resistivity layering (gEOelectric section) of the subsurface. The translation of resistivity layering into hydrologic information is generally accomplished by two methods. These include:

- 1) Using available knowledge about the relation between resistivity values and local hydrology. From more than twenty previous TDEM surveys on the Hawaiian Islands, it has been observed that volcanic rocks saturated with salt water exhibit resistivities typically less than 5 ohm-m. Conversely, volcanic rocks that are dry unweathered and fresh water saturated exhibit high resistivities, generally greater than 500 ohm-m. Weathered volcanics or ash flows and intrusives often exhibit intermediate resistivities (about 10 ohm-m to 100 ohm-m).

Applying this knowledge, characteristic ranges of resistivities expected for local hydrogeologic units for the Makawao study area are shown in Figure 4-1. It should be noted that some overlap in resistivity values occur. In these cases, other factors are used to infer the geologic/hydrologic unit in question. For example, a low resistivity unit (i.e., less than 10 ohm-m) occurring at an elevation above sea level is assumed to be caused by either weathered rock units or intrusives instead of salt water saturated formations.

- 2) Another method is to calibrate the geophysical interpretation at a well. Unfortunately, there was no well information available for comparison to the TDEM data in the immediate vicinity of Makawao.

Where a very conductive layer (less than 5 ohm-m) is detected below sea level in the TDEM measurement, this layer is interpreted to be caused by salt water saturated volcanics. Static fresh water levels can be calculated from these soundings. However, hydrostatic equilibrium is assumed for these soundings and this relation is not expected to apply to soundings in close proximity to major geologic structures (i.e., rift zones, dikes) which act to alter ground water flow. Typically, rift zones can contain vertical fractures and faults which parallel the main rift corridor for hundreds to sometimes thousands of feet on either side of the central zone. These rift zones generally contain a series of cones which trend linearly away from a caldera.

4.2 Goelectric Cross Sections

The results of the inversion of the individual TDEM soundings is the 1-D resistivity layering as a function of depth. The TDEM results from individual soundings can be linked together to produce a 2-D goelectric cross section along a survey transect. The goelectric cross section can be correlated to geologic units by comparison with available geologic information. Two goelectric cross sections were constructed from the Pookela Water Tank Site data. The directions of the goelectric cross sections are shown on Figure 1-1.

Cross Section A-A'

Figure 4-2 shows the results of five TDEM soundings presented as a Northwest to South trending geoelectric cross section, in which layers that exhibit similar resistivity values have been linked together.

The uppermost layer of the cross section (green), displays resistivities ranging from 52 ohm-m to 140 ohm-m. This layer is interpreted to represent weathered surficial volcanics beneath and ranges in thickness of about 100 to 200 ft. The middle layer, with resistivities ranging from 300 ohm-m to >5000 ohm-m, is interpreted to represent dry unweathered volcanics above sea level and where it occurs below sea level, it is expected to be saturated with fresh/brackish basal mode water. The lower layer beneath Sounding 4 (Blue) exhibits a resistivity of 2.5 ohm-m and is interpreted to represent salt water saturated volcanics. The approximate thickness of the fresh/brackish water lens is 155 ft beneath Sounding 4.

Soundings 1, 2, 3, and 7 are located in a structurally complex area of the site. A North Rift Zone (Fiske and Jackson, 1972) is mapped in the vicinity of these soundings, approximately parallel to the Piihola Road (See Figure 1-1). In these soundings, a salt water interface is not interpreted. Both low and intermediate resistivity values are exhibited above and below sea level (green). Beneath Soundings 2 and 3, resistivity values range from 4.1 ohm-m to 6.1 ohm-m and these values are expected to be caused by influences from lateral discontinuities (e.g., faults, dikes). Because of rapid lateral variations in resistivities, the interpreted resistivity stratification may not represent true formation resistivities, and the exact position and width of the discontinuous layers is uncertain. Since the salt water interface was not interpreted beneath these four soundings (1, 2, 3, and 7), the elevation of the ground water table cannot be estimated.

From the geoelectric cross section, it appears that the depth to the intermediate resistivity boundary is increasing from Sounding 2 (760 ft ASL) to Sounding 7 (72 ft BSL). This suggests that the location of the upper (inland) hydrogeologic boundary (possible high-level water) may be located above Sounding 7. However, with the existing TDEM information, it is not possible to interpret the location of the upper high-level water boundary.

Cross Section B-B'

The geoelectric cross section results for B-B' are shown in Figure 4-3. The upper surface layer (green) of the section exhibits resistivities from 99 ohm-m to 117 ohm-m. This layer is interpreted to be weathered volcanics which vary in thickness from about 100 ft beneath Sounding 5, to 150 ft beneath Sounding 2. The second layer exhibits resistivities from 296 ohm-m to 2145 ohm-m. This layer is interpreted to represent dry unweathered volcanics above sea level. The lower layer beneath both soundings (green) with resistivities ranging from 4.1 ohm-m to 9.8 ohm-m is interpreted to be influenced by lateral discontinuities (i.e., dikes, faults). The salt water interface was not interpreted beneath these two soundings; and therefore, the elevation of the water table cannot be estimated. These soundings are expected to be located in the vicinity of a ground water damming structure.

4.3 Hydrogeologic Interpretation

The results of the TDEM soundings are further summarized on the interpretation summary map shown in Figure 4-4. The soundings are separated into two main types and are color coded:

- 1) Sounding 4 (blue), beneath which a layer of low resistivity (2.5 ohm-m) was detected below sea level. A fresh-brackish water lens is expected to exist in the basal mode below this sounding. The approximate thickness of the fresh/brackish water lens floating on sea water is 155 ft.
- 2) A group of five soundings (1, 2, 3, 5, and 7) in which subsurface resistivities are influenced by lateral discontinuities (i.e., faults, dikes) and geologic/hydrologic ground water damming structures are inferred (green). Intermediate resistivity values occur both above and below sea level. Ground water levels, well production and water quality are expected to be highly variable in these areas.

From the summary map, it appears that the width of the North Rift Zone is larger than projected by Fiske and Jackson. The Rift Zone extends further to the west and this mapped subsurface feature may be a combination of the Rift Zone and a ring fracture. This feature could have a large influence on ground water flow in the Makawao area. The width and exact direction of the Rift Zone is not fully mapped with the existing TDEM data. Additional TDEM soundings are recommended to map the extent of this structure.

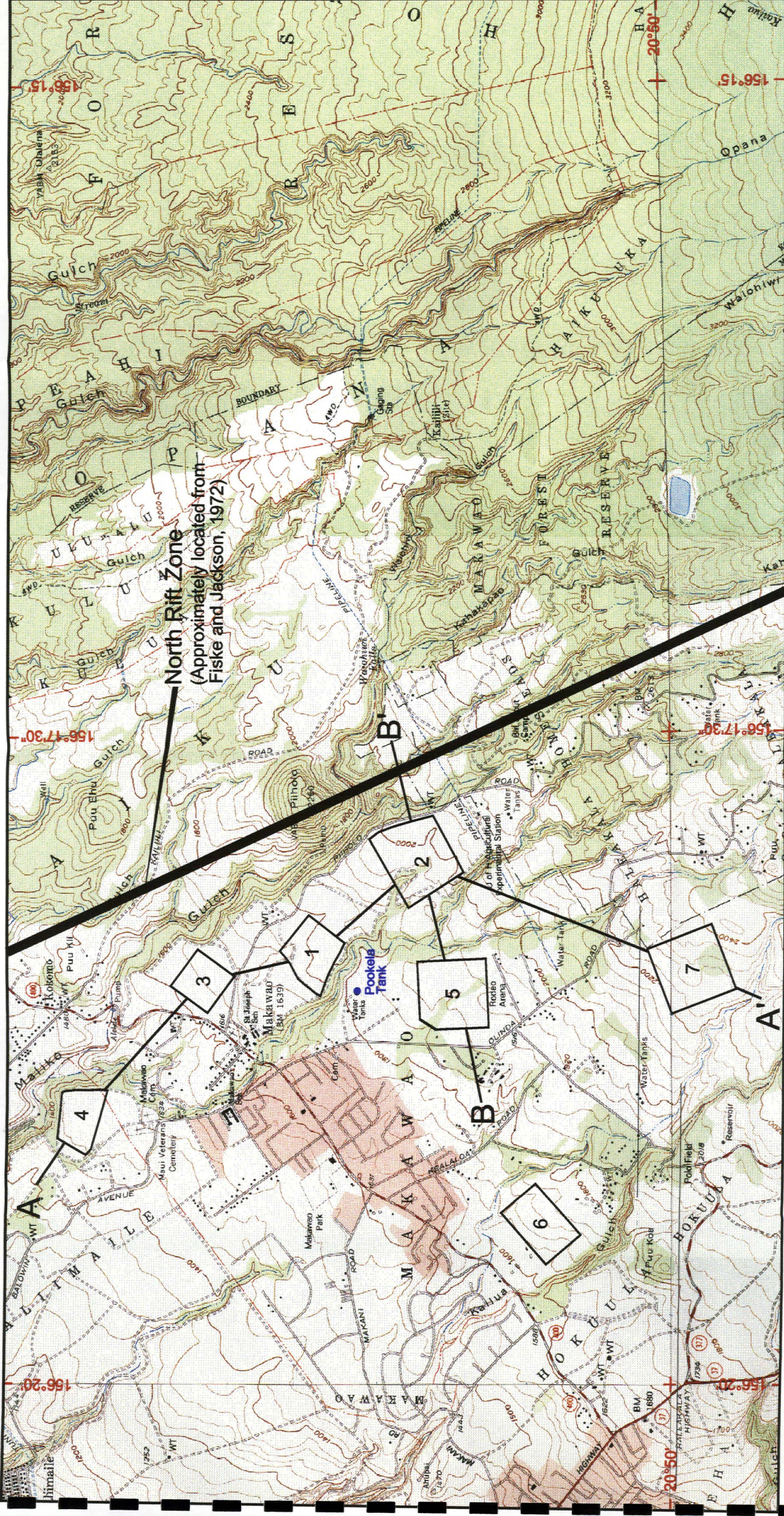
5.0 CONCLUSIONS AND RECOMMENDATIONS

The results of the TDEM surveys near the Pookela Water Tank at Makawao, Maui, indicate that beneath Sounding 4, a thin lens of fresh/brackish water occurs. This lens is estimated to be about 155 ft thick (see Figure 4-4). Upslope from Sounding 4, subsurface structures that appear to be related to the west flank of the North Rift Zone are interpreted beneath the remaining soundings (1, 2, 3, 5, and 7). The North Rift Zone from Haleakala Crater cuts through the north portion of the survey area at about a N 24° W bearing through Puu Piiholo. In this portion of the survey area, the ground water regime is expected to be extremely complicated, and it is interpreted to be influenced by structures (rift zone, faults, etc.) and ground water yield and quality in this area may be highly variable.

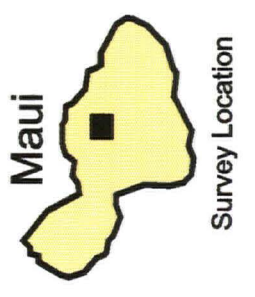
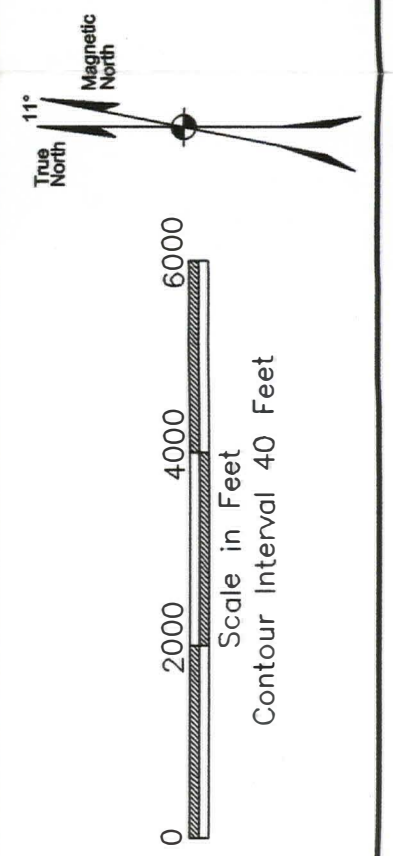
Above Sounding 7, the potential for high-level ground water may exist if a main ground water damming structure (ring fracture, which normally parallels the coast line) is present in the subsurface upslope towards Haleakala Crater. To help confirm the existence of a main ground water damming structure, additional soundings upslope of Sounding 7 and east of Sounding 2 to define the structure are recommended.

References

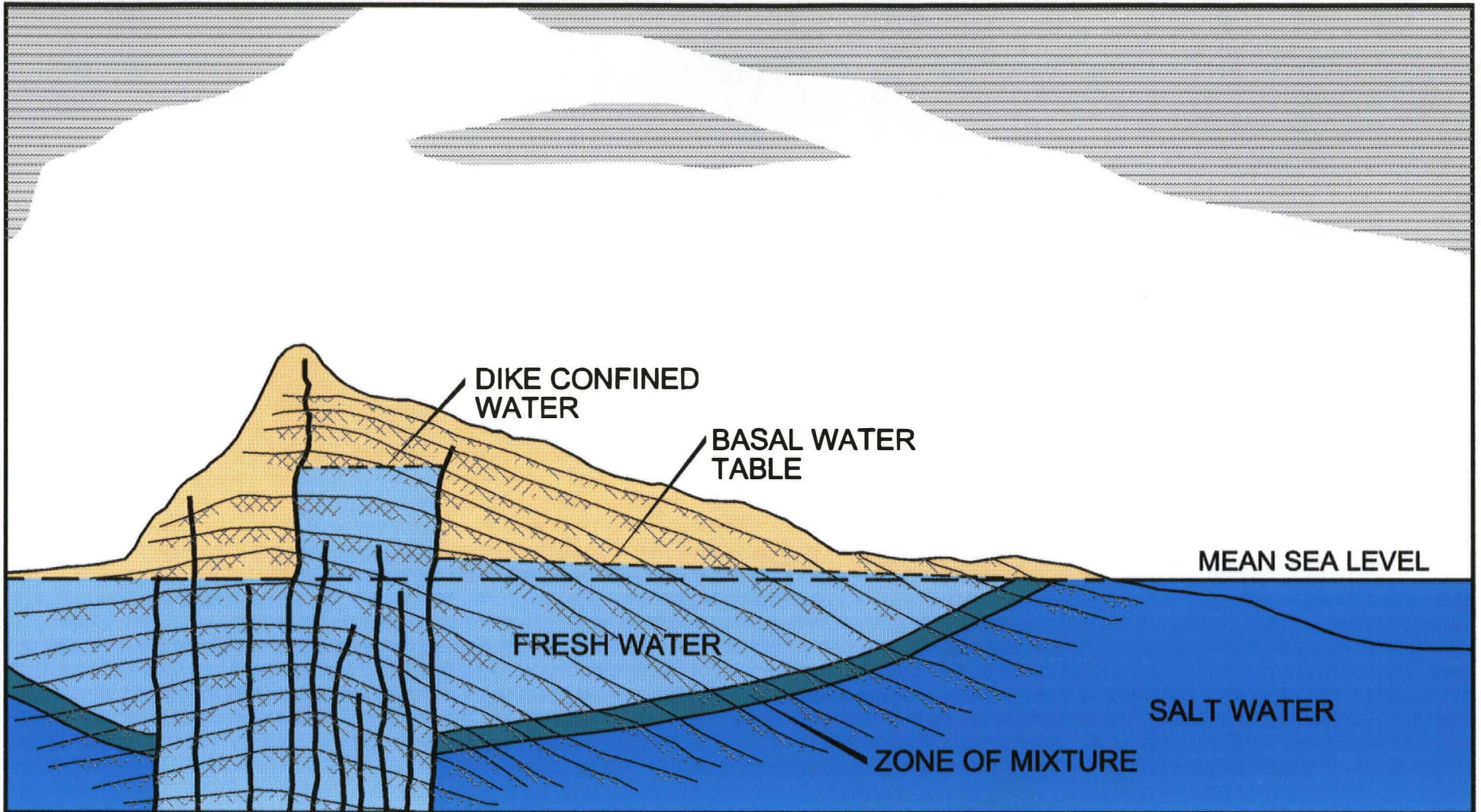
1. Davis, S. N., DeWiest, R. J. M., 1966. Hydrogeology, ground water in igneous rocks. pp. 333-343.
2. Fiske, R. S., and Jackson, E. D., 1972. Orientation and growth of Hawaiian volcanic rifts: the effect of regional structure and gravitational stresses: Proceedings of the Royal Society of London, ser. A. v. 329, pp. 299-326.
3. Professional Paper 1350, 1987. Volcanism in Hawaii, Volume 1, pp. 63-65.
4. Stearns, H. T., Macdonald, G. A., 1942. Geology and ground-water resources of the Island of Maui, Hawaii. pp. 61-115.
5. Wilt, M. J., 1991. Interpretation of time domain electromagnetic soundings near geologic contacts, Ph.D. Thesis, Lawrence Berkeley Laboratory, University of California Earth Sciences Division. pp. 185.




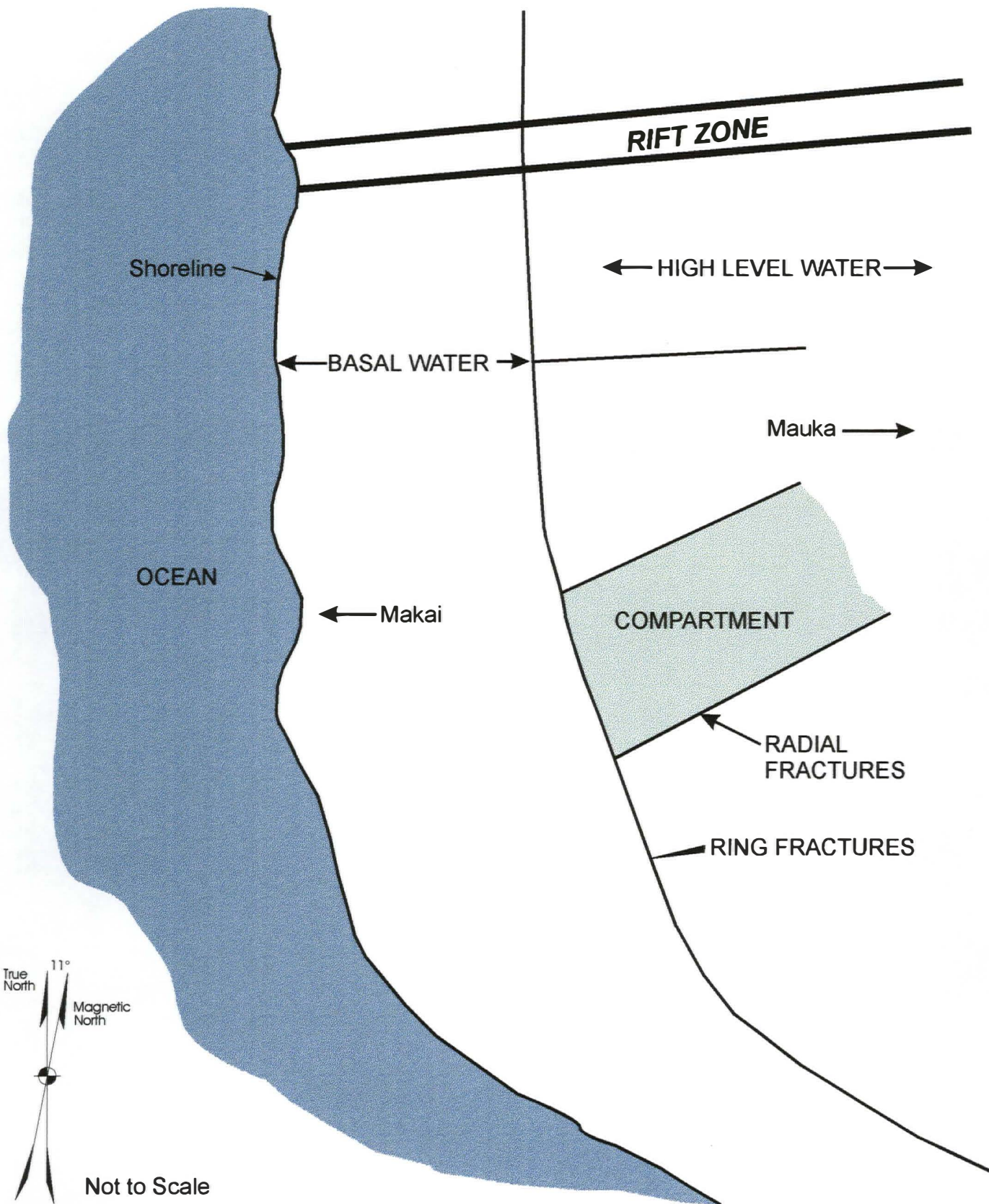
North Rift Zone
 (Approximately located from
 Fiske and Jackson, 1972)



- Explanation**
- 1 TDEM Soundings
 - A-A' Section Line




BLACKHAWK GEOMETRICS
 Schematic
 Hydrogeologic Cross Section
*The Malama Group
 Makawao, Maui, Hawaii*
 Project No. 9810 Figure: 1-2
\\projects\Maui\98\9810TGM\WtrXsec.dwg



True North
11°
Magnetic North

Not to Scale



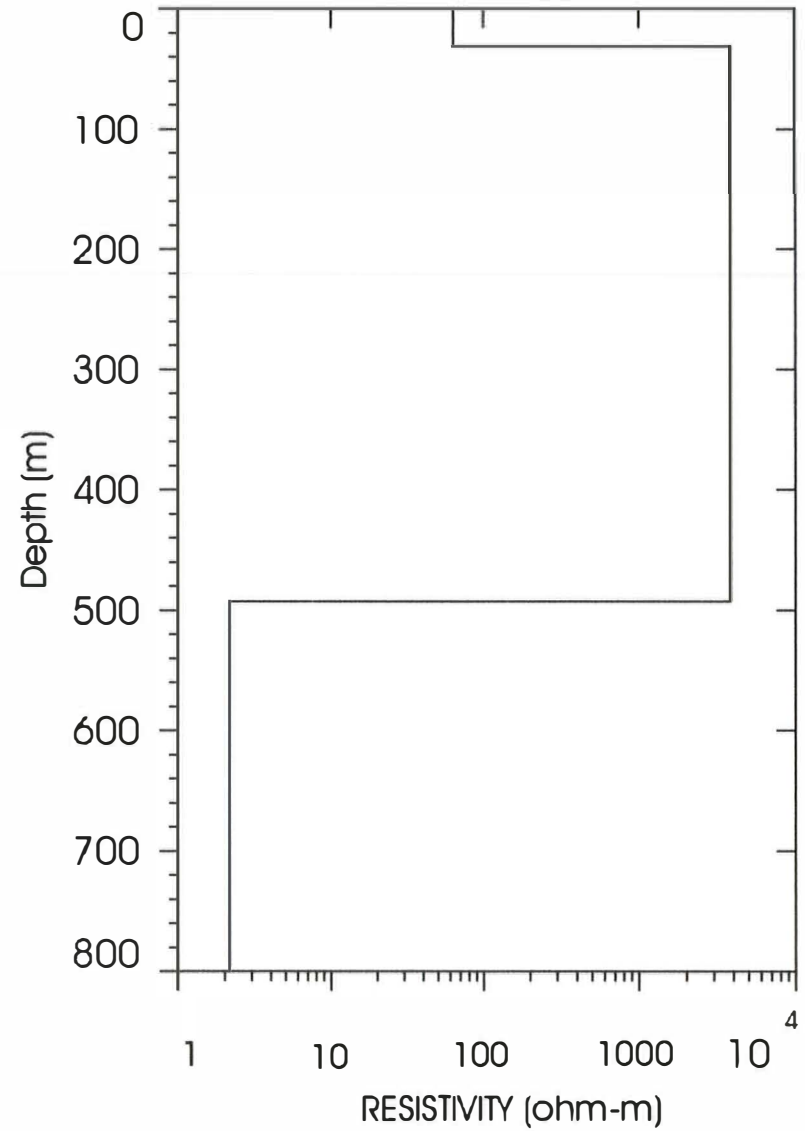
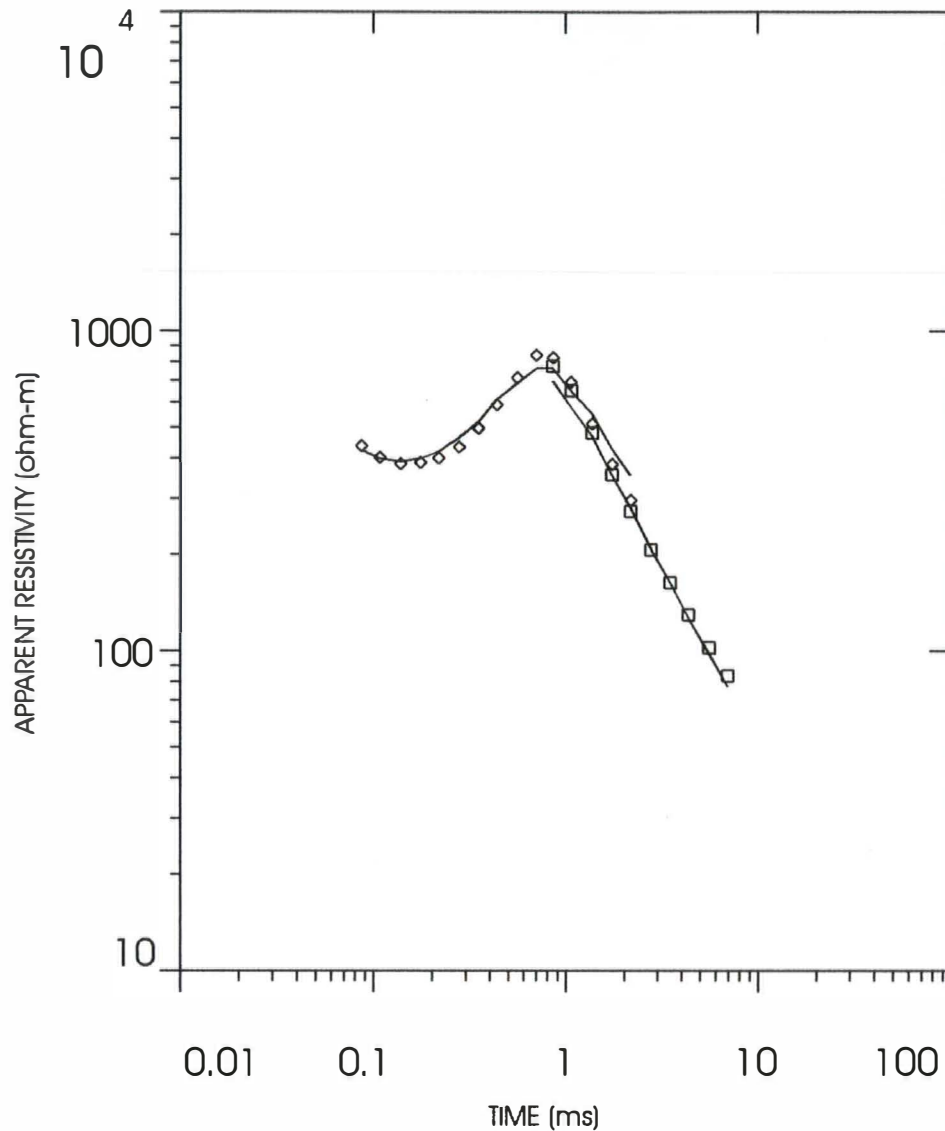
Plan View of Schematic Geologic Model Ring and Radial Fracture System
The Malama Group
Makawao, Maui, Hawaii

Figure: 1-3

Project No. 9810

projects\maui98\9810tgm\FracSys.cdr

MALA-1

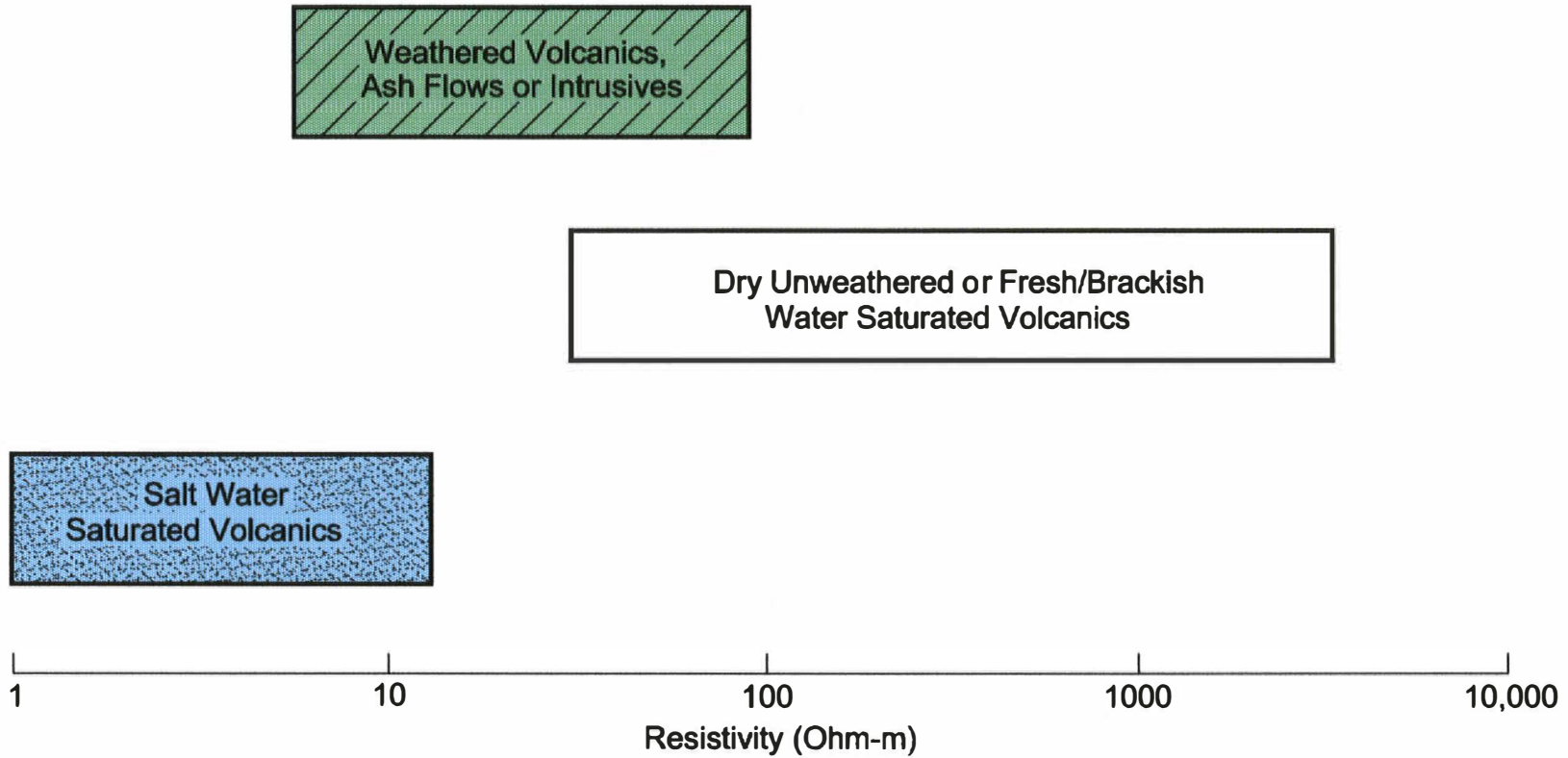


TDEM Inversion Results Sounding MALA-1 *The Malama Group Makawao, Maui, Hawaii*

Figure: 3-1

Project No. 9810

projects\maui98\9810TGM\Results1.cdr



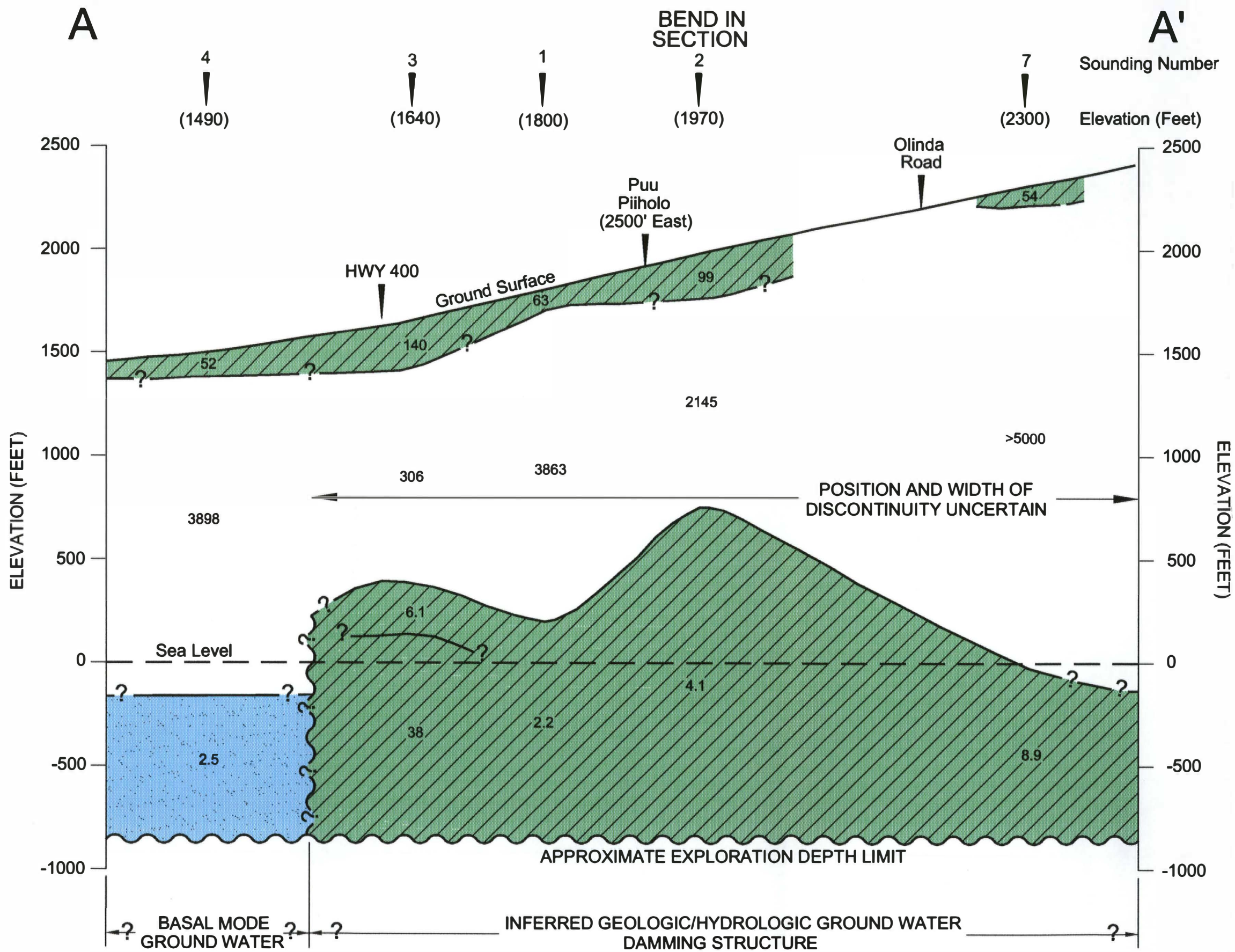
BLACKHAWK GEOMETRICS

Characteristic Resistivity Ranges
The Malama Group
Makawao, Maui, Hawaii

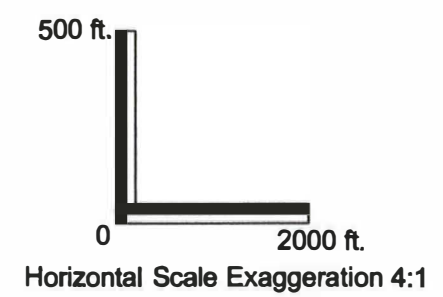
Project No. 9810

Figure: 4-1

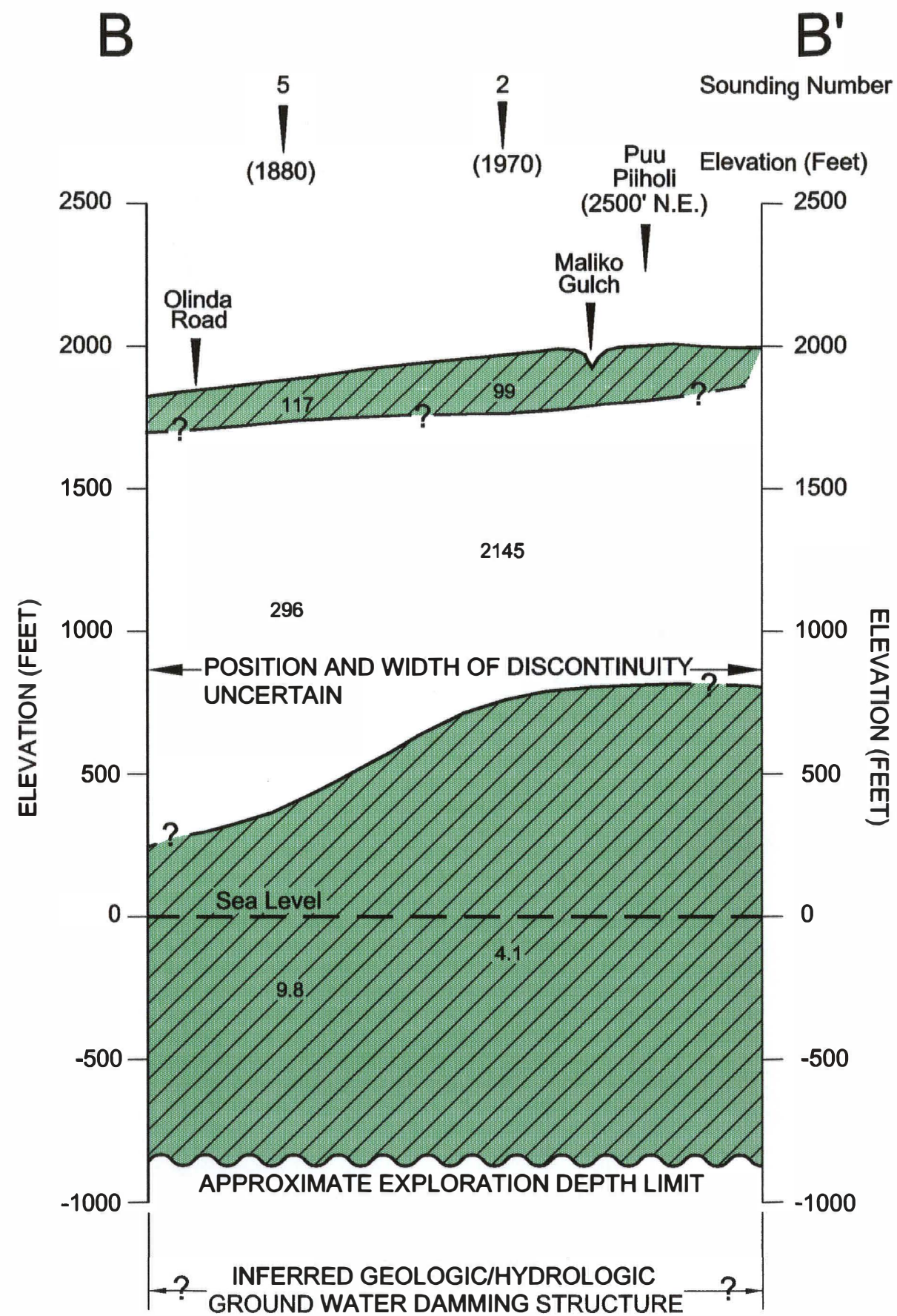
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


- Explanation**
- 38 Resistivity in ohm-m
 - Dry unweathered or fresh-brackish water saturated volcanics
 - Weathered volcanics at surface or inferred structure (possible ash flows, or intrusives) at depth
 - Salt water saturated volcanics
 - Inferred geologic/hydrologic discontinuity

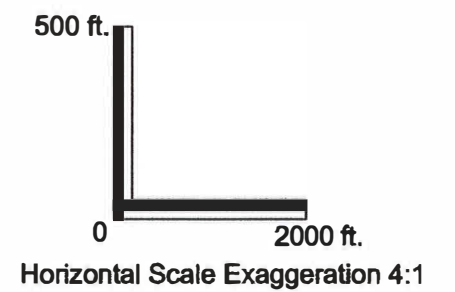


BLACKHAWK GEOMETRICS
Geoelectric
Cross Section A-A'
Pookela Tank Site
The Malama Group
Makawao, Maui, Hawaii

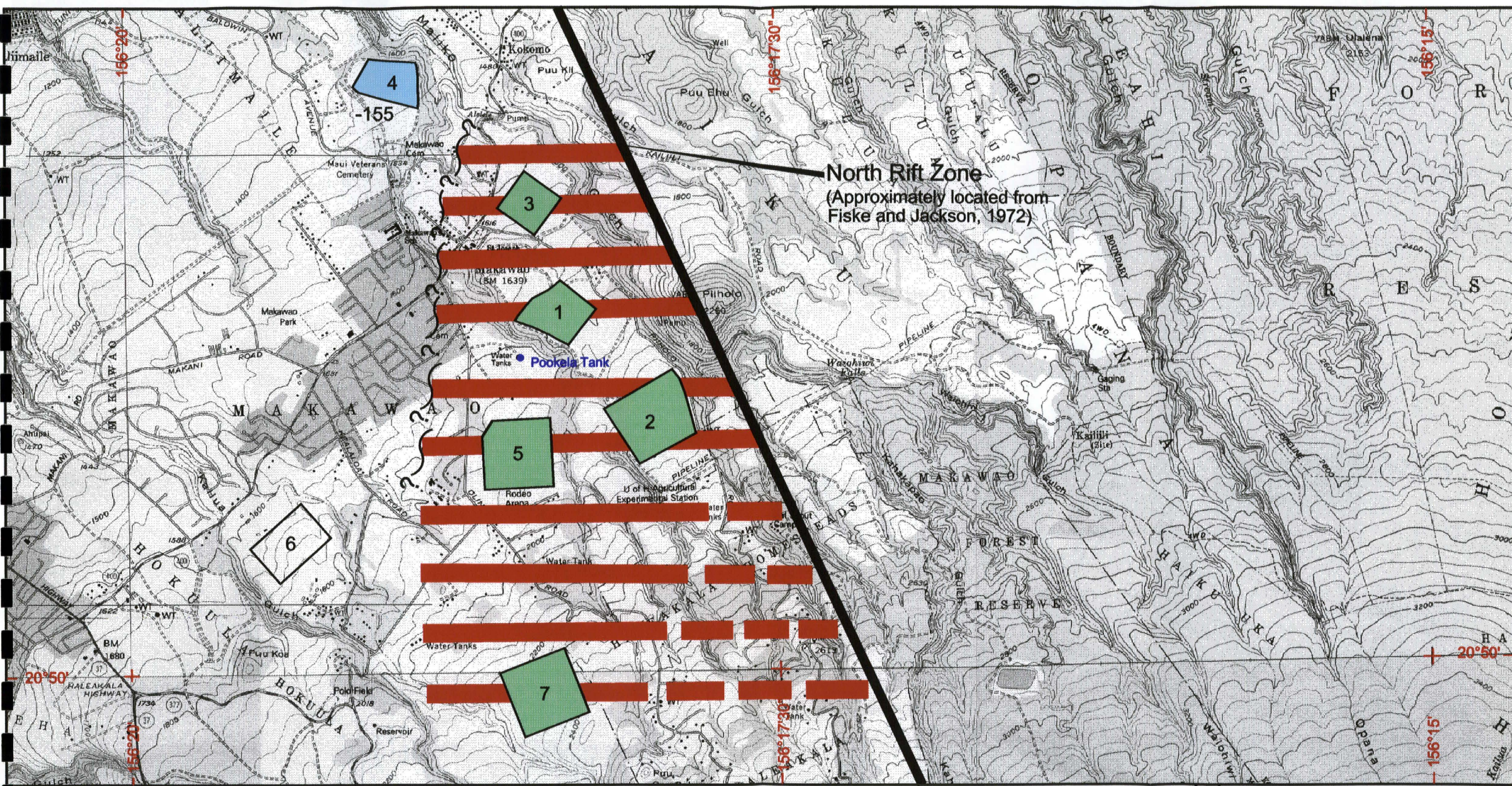


Explanation

- 38 Resistivity in ohm-m
-  Dry unweathered or fresh-brackish water saturated volcanics
-  Weathered volcanics at surface or inferred structure (possible ash flows, or intrusives) at depth
-  Salt water saturated volcanics
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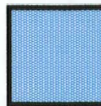
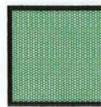




BLACKHAWK GEOMETRICS
 Goelectric
 Cross Section B-B'
 Pookela Tank Site
The Malama Group
 Makawao, Maui, Hawaii

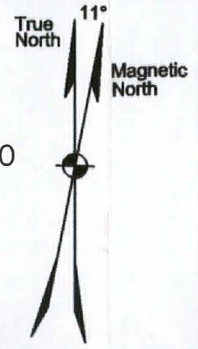
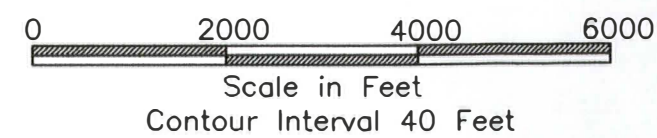
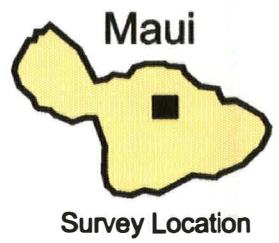


North Rift Zone
 (Approximately located from
 Fiske and Jackson, 1972)

Explanation

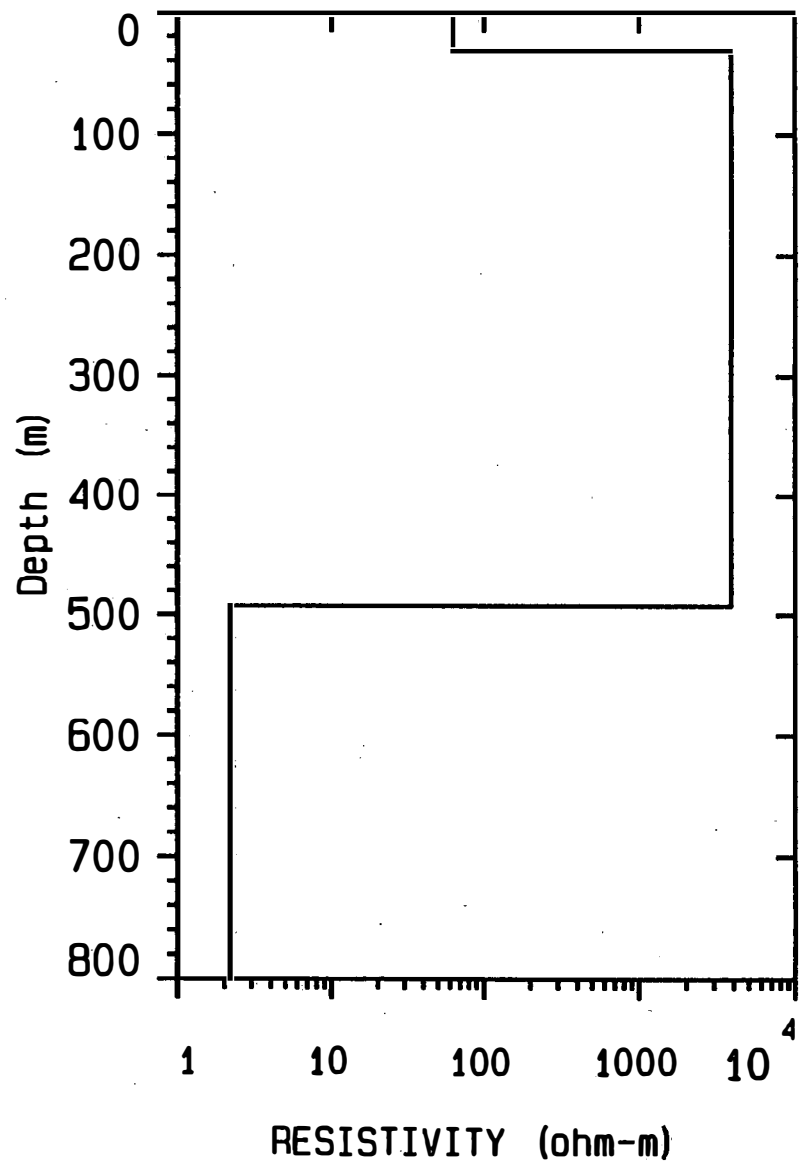
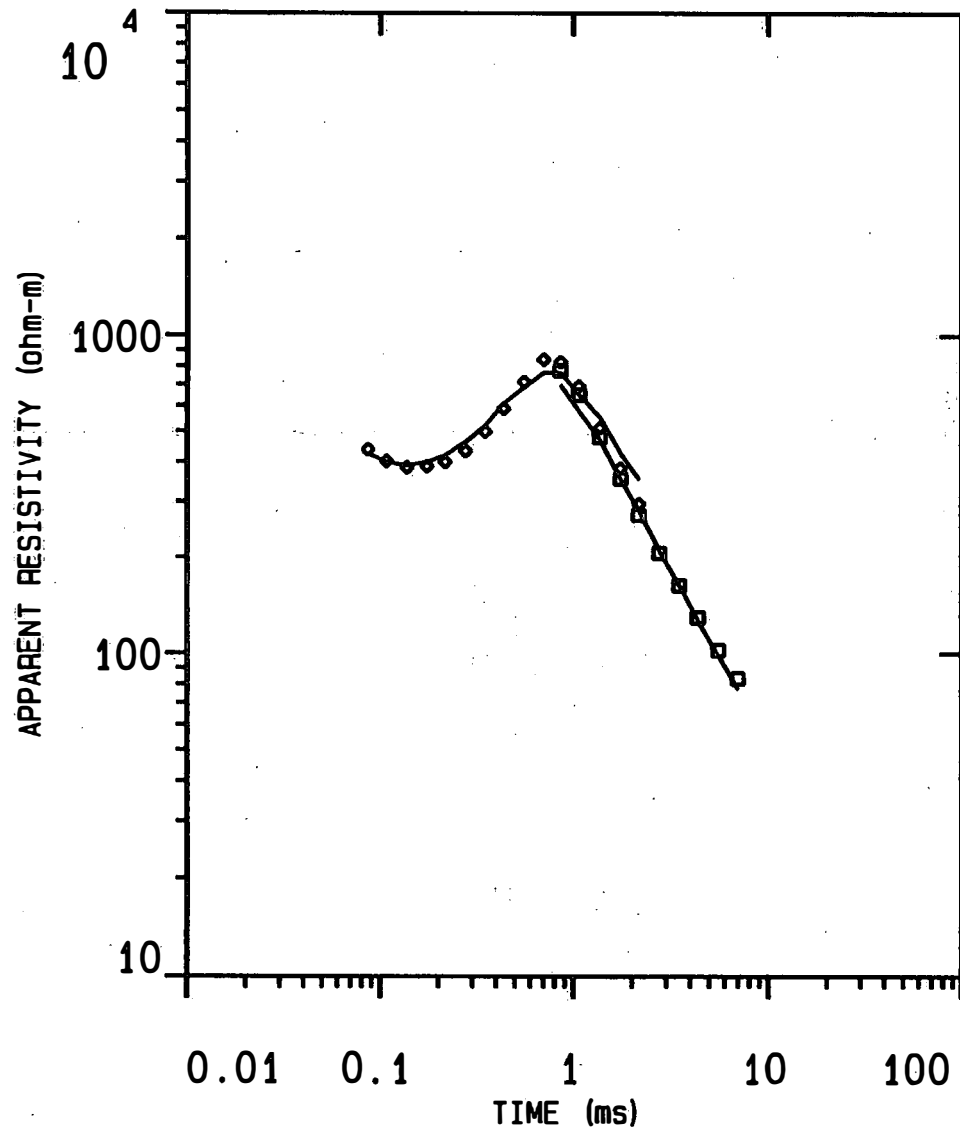
-  Sounding in which ground water is expected in basal mode
-  Sounding interpreted to be located within ground water barrier zone

-  -155
Approximate elevation of top of salt water interface in feet
-  Inferred geologic/hydrologic discontinuity (exact position uncertain)



BLACKHAWK GEOMETRICS
Summary Map
Pookela Tank Site
The Malama Group
Makawao, Maui, Hawaii

MALA-1



DATA SET: MALA-1

CLIENT: THE MALAMA GROUP	DATE: 05-06-98
LOCATION: MAKAWAO, MAUI	SOUNDING: 1
COUNTY: MAUI	ELEVATION: 549.00 m
PROJECT: POOKELA TANK SITE	EQUIPMENT: Geonics PROTEM
LOOP SIZE: 396.000 m by 305.000 m	AZIMUTH:
COIL LOC: 0.000 m (X), 0.000 m (Y)	TIME CONSTANT: NONE
SOUNDING COORDINATES: E: -1.0000 N: 100.0000	SLOPE: NONE

Central Loop Configuration
Geonics PROTEM System

FITTING ERROR: 10.755 PERCENT

L #	RESISTIVITY (ohm-m)	THICKNESS (meters)	ELEVATION (meters)	(FT)	CONDUCTANCE (Siemens)
1	63.17	31.52	549.0	1800	0.498
2	3863.1	461.3	517.4	1697	0.119
3	2.17		56.14	184	

ALL PARAMETERS ARE FREE

CURRENT: 13.00 AMPS	EM-37	COIL AREA: 100.00 sq m.
FREQUENCY: 3.00 Hz	GAIN: 7	RAMP TIME: 160.00 muSEC

No.	TIME (ms)	emf (nV/m sqrd) DATA	SYNTHETIC	DIFFERENCE (percent)
1	0.857	54.30	63.35	-16.65
2	1.06	40.93	48.56	-18.62
3	1.37	34.58	35.51	-2.68
4	1.74	29.79	29.84	-0.182
5	2.17	25.49	24.29	4.68
6	2.77	20.96	20.58	1.84
7	3.50	16.66	16.58	0.495
8	4.37	13.52	13.96	-3.25
9	5.56	10.54	11.18	-6.09
10	6.98	8.09	9.08	-12.16

CURRENT: 13.00 AMPS	EM-37	COIL AREA: 100.00 sq m.
FREQUENCY: 30.00 Hz	GAIN: 7	RAMP TIME: 160.00 muSEC

No.	TIME (ms)	emf (nV/m sqrd)		DIFFERENCE (percent)
		DATA	SYNTHETIC	
11	0.0867	39134.5	41037.1	-4.86
12	0.108	25639.5	25960.0	-1.25
13	0.138	14886.9	14541.0	2.32
14	0.175	8109.2	7775.4	4.11
15	0.218	4468.5	4157.6	6.95
16	0.278	2155.8	1952.4	9.43
17	0.351	981.7	915.7	6.72
18	0.438	437.9	414.4	5.36
19	0.558	178.4	189.5	-6.18
20	0.702	78.84	91.34	-15.85
21	0.858	49.10	55.17	-12.38
22	1.06	37.30	40.63	-8.92
23	1.37	31.18	27.85	10.68
24	1.74	26.53	22.47	15.30
25	2.17	22.57	17.24	23.62

PARAMETER RESOLUTION MATRIX:

"F" INDICATES FIXED PARAMETER

P 1 0.98

P 2 0.02 0.04

P 3 0.00 -0.07 0.39

T 1 -0.02 -0.03 0.03 0.97

T 2 0.00 0.00 -0.06 0.00 0.99

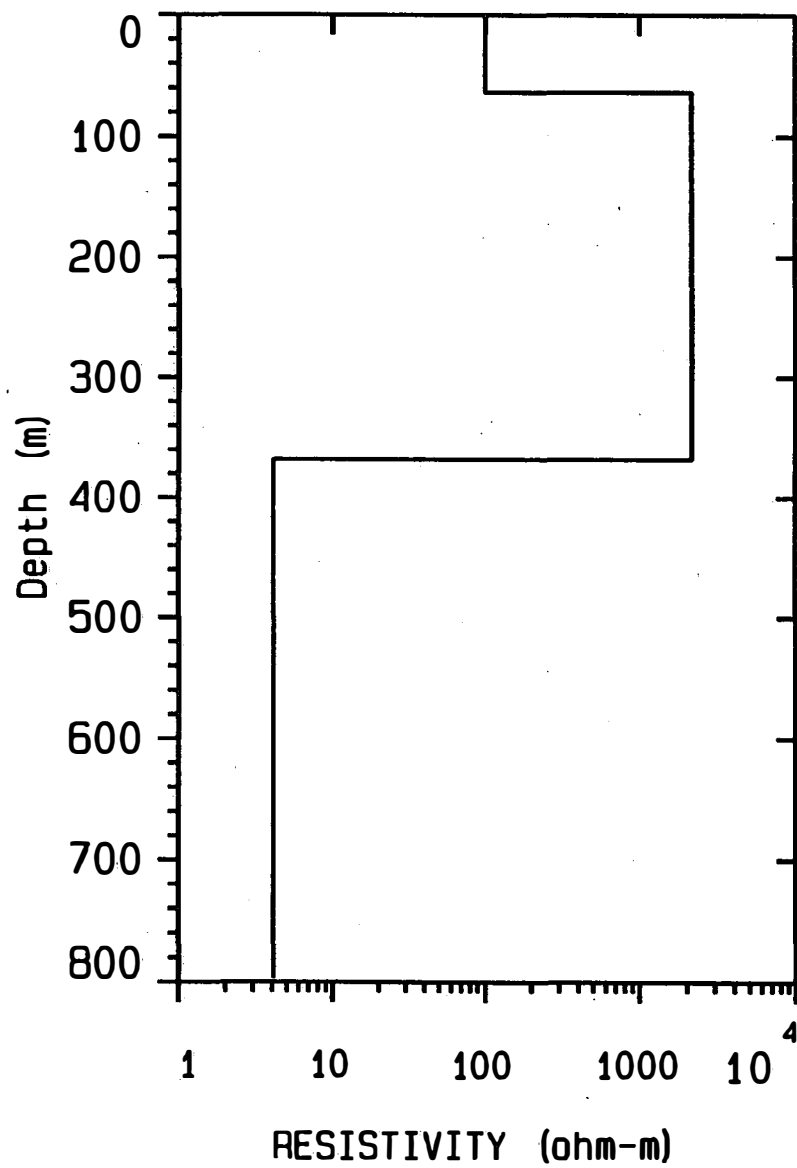
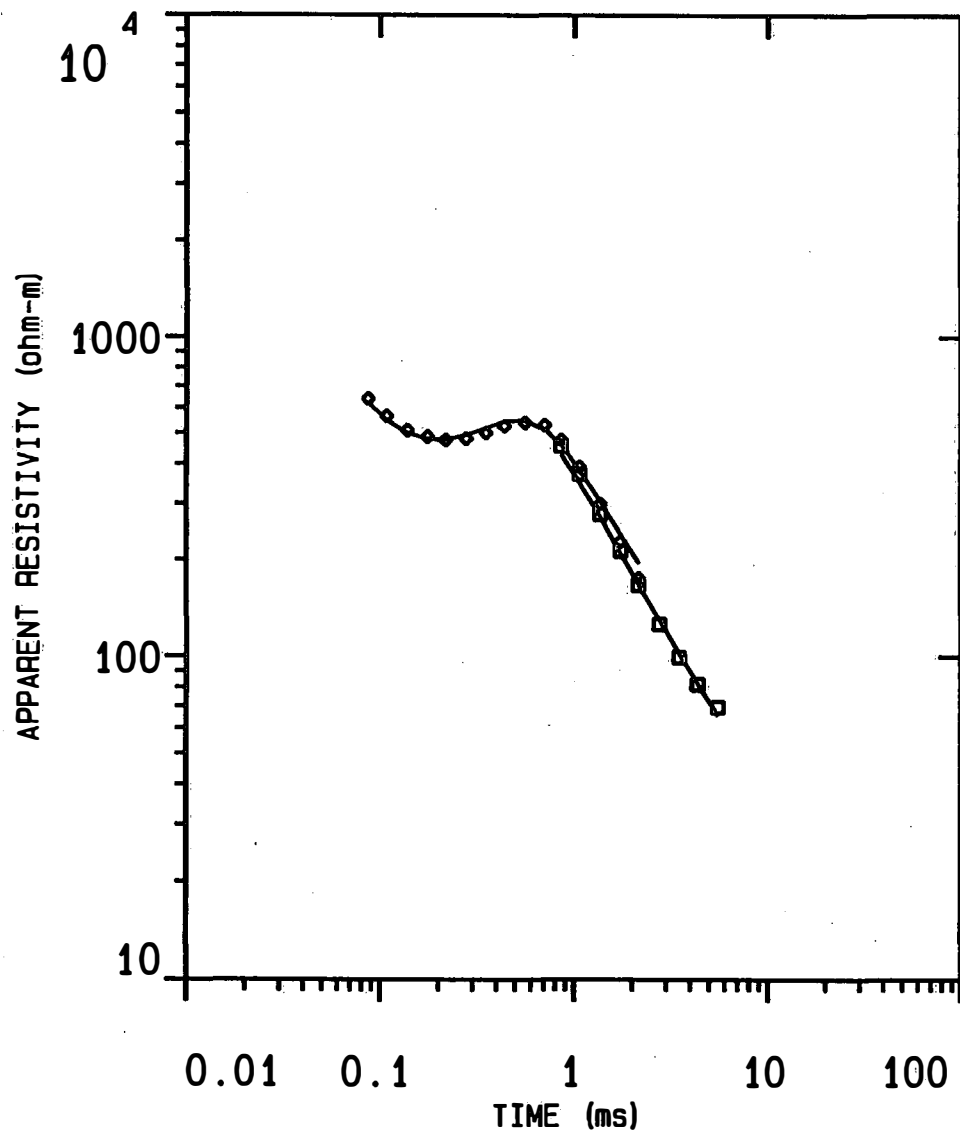
	P 1	P 2	P 3	T 1	T 2
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Blackhawk Geometrics, Inc.

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MALA-2



DATA SET: MALA-2

CLIENT: THE MALAMA GROUP	DATE: 05-07-98
LOCATION: MAKAWAO, MAUI	SOUNDING: 2
COUNTY: MAUI	ELEVATION: 600.00 m
PROJECT: POOKELA TANK SITE	EQUIPMENT: Geonics PROTEM
LOOP SIZE: 472.000 m by 472.000 m	AZIMUTH:
COIL LOC: 0.000 m (X), 0.000 m (Y)	TIME CONSTANT: NONE
SOUNDING COORDINATES: E: -2.0000 N: 200.0000	SLOPE: NONE

Central Loop Configuration
Geonics PROTEM System

FITTING ERROR: 6.072 PERCENT

L #	RESISTIVITY (ohm-m)	THICKNESS (meters)	ELEVATION (meters)	(FT)	CONDUCTANCE (Siemens)
1	99.19	63.31	600.0	1970	0.638
2	2144.8	304.5	536.6	1760	0.142
3	4.07		232.0	761	

ALL PARAMETERS ARE FREE

CURRENT: 13.00 AMPS	EM-37	COIL AREA: 100.00 sq m.
FREQUENCY: 3.00 Hz	GAIN: 7	RAMP TIME: 210.00 muSEC

No.	TIME (ms)	emf (nV/m sqrd) DATA	SYNTHETIC	DIFFERENCE (percent)
1	0.857	219.7	241.3	-9.87
2	1.06	173.1	189.7	-9.60
3	1.37	143.0	147.2	-2.93
4	1.74	116.9	119.2	-2.03
5	2.17	96.94	96.90	0.0389
6	2.77	80.84	77.09	4.64
7	3.50	64.07	61.13	4.58
8	4.37	49.00	48.60	0.830
9	5.56	34.36	37.39	-8.81

CURRENT: 13.00 AMPS	EM-37	COIL AREA: 100.00 sq m.
FREQUENCY: 30.00 Hz	GAIN: 7	RAMP TIME: 210.00 muSEC

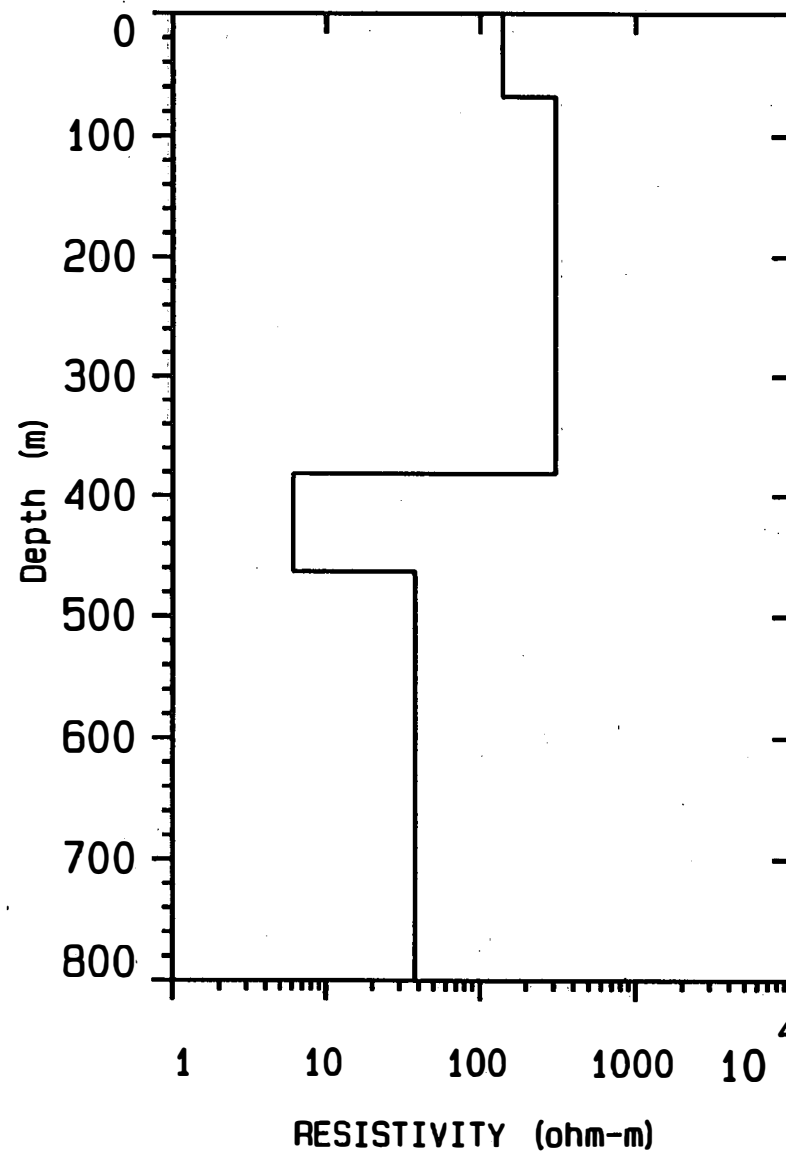
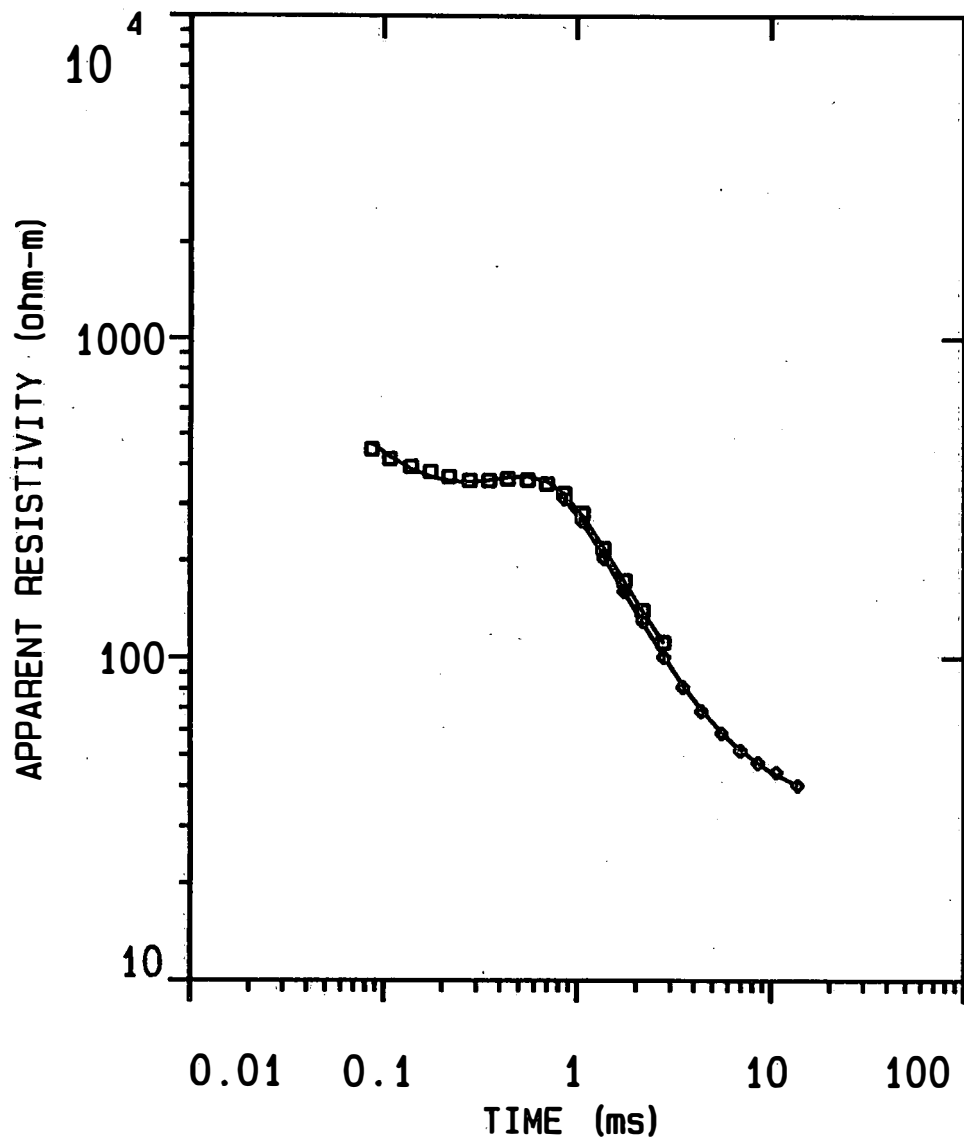
No.	TIME (ms)	emf (nV/m sqrd)		DIFFERENCE (percent)
		DATA	SYNTHETIC	
10	0.0867	40531.8	42379.4	-4.55
11	0.108	28287.2	29548.5	-4.45
12	0.138	17895.9	18385.2	-2.73
13	0.175	10568.3	10834.2	-2.51
14	0.218	6310.9	6298.1	0.202
15	0.278	3399.2	3265.1	3.94
16	0.351	1783.0	1691.4	5.13
17	0.438	950.7	902.7	5.04
18	0.558	499.1	487.3	2.37
19	0.702	289.7	302.4	-4.36
20	0.858	205.5	216.8	-5.50
21	1.06	159.5	166.2	-4.24
22	1.37	127.7	124.6	2.42
23	1.74	105.9	97.75	7.71
24	2.17	90.12	76.50	15.11

PARAMETER RESOLUTION MATRIX:

"F" INDICATES FIXED PARAMETER

P 1	0.90				
P 2	0.00	0.01			
P 3	0.06	-0.03	0.57		
T 1	-0.13	-0.06	0.11	0.82	
T 2	0.03	0.02	-0.05	0.04	0.99
	P 1	P 2	P 3	T 1	T 2

MALA-3



DATA SET: MALA-3

CLIENT: THE MALAMA GROUP	DATE: 05-06-98
LOCATION: MAKAWAO, MAUI	SOUNDING: 3
COUNTY: MAUI	ELEVATION: 500.00 m
PROJECT: POOKELA TANK SITE	EQUIPMENT: Geonics PROTEM
LOOP SIZE: 305.000 m by 305.000 m	AZIMUTH:
COIL LOC: 0.000 m (X), 0.000 m (Y)	TIME CONSTANT: NONE
SOUNDING COORDINATES: E: -3.0000 N: 300.0000	SLOPE: NONE

Central Loop Configuration
Geonics PROTEM System

FITTING ERROR: 2.568 PERCENT

L #	RESISTIVITY (ohm-m)	THICKNESS (meters)	ELEVATION (meters)	(FT)	CONDUCTANCE (Siemens)
1	140.3	67.86	500.0	1640	0.483
2	305.8	313.5	432.1	1418	1.02
3	6.10	81.22	118.6	389	13.30
4	37.86		37.38	123	

ALL PARAMETERS ARE FREE

CURRENT: 14.00 AMPS	EM-37	COIL AREA: 100.00 sq m.
FREQUENCY: 30.00 Hz	GAIN: 7	RAMP TIME: 160.00 muSEC

No.	TIME (ms)	emf (nV/m sqrd) DATA	SYNTHETIC	DIFFERENCE (percent)
1	0.0867	31195.8	29125.7	6.63
2	0.108	19999.3	19576.2	2.11
3	0.138	11760.0	12087.5	-2.78
4	0.175	6868.0	7288.1	-6.11
5	0.218	4207.8	4403.5	-4.65
6	0.278	2381.5	2424.0	-1.78
7	0.351	1336.6	1326.7	0.737
8	0.438	751.0	737.8	1.75
9	0.558	414.7	399.0	3.77
10	0.702	244.0	237.5	2.65
11	0.858	163.6	164.6	-0.664
12	1.06	118.3	121.2	-2.45
13	1.37	92.15	91.91	0.258

No.	TIME (ms)	emf (nV/m sqrd)		DIFFERENCE (percent)
		DATA	SYNTHETIC	
14	1.74	71.79	72.52	-1.01
15	2.17	56.98	57.77	-1.37
16	2.77	43.43	43.66	-0.532

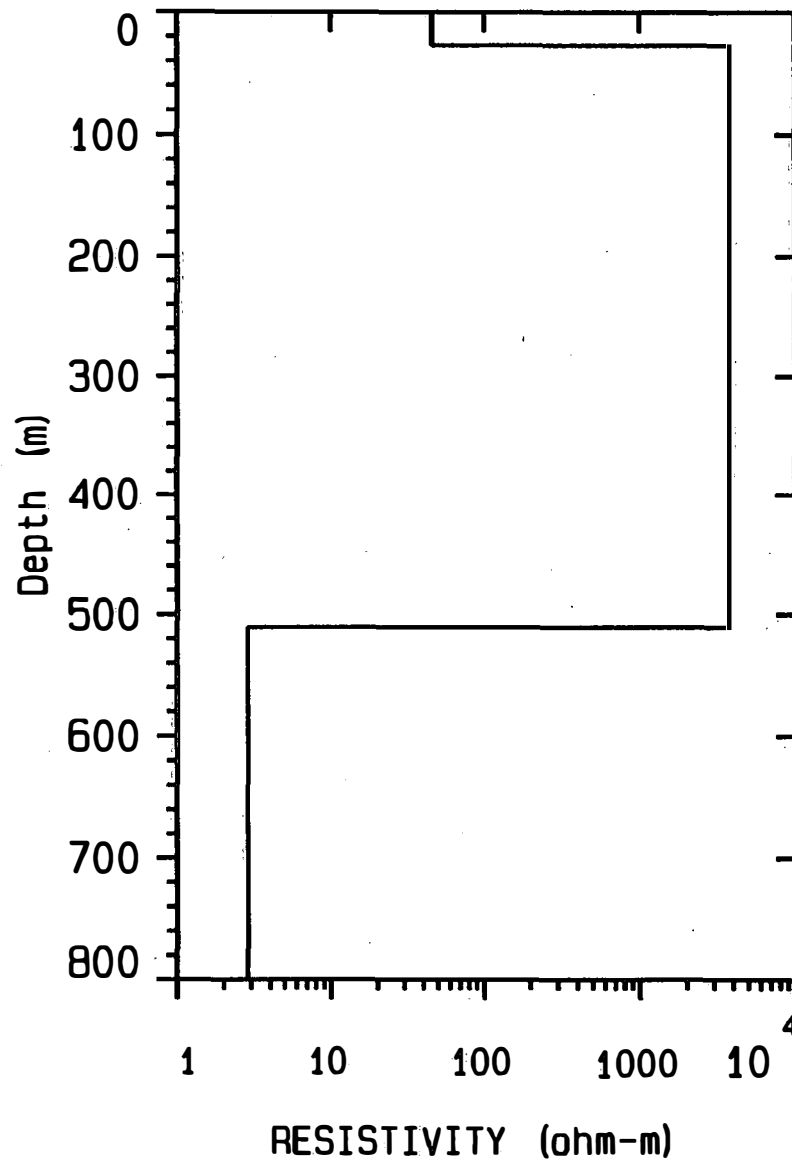
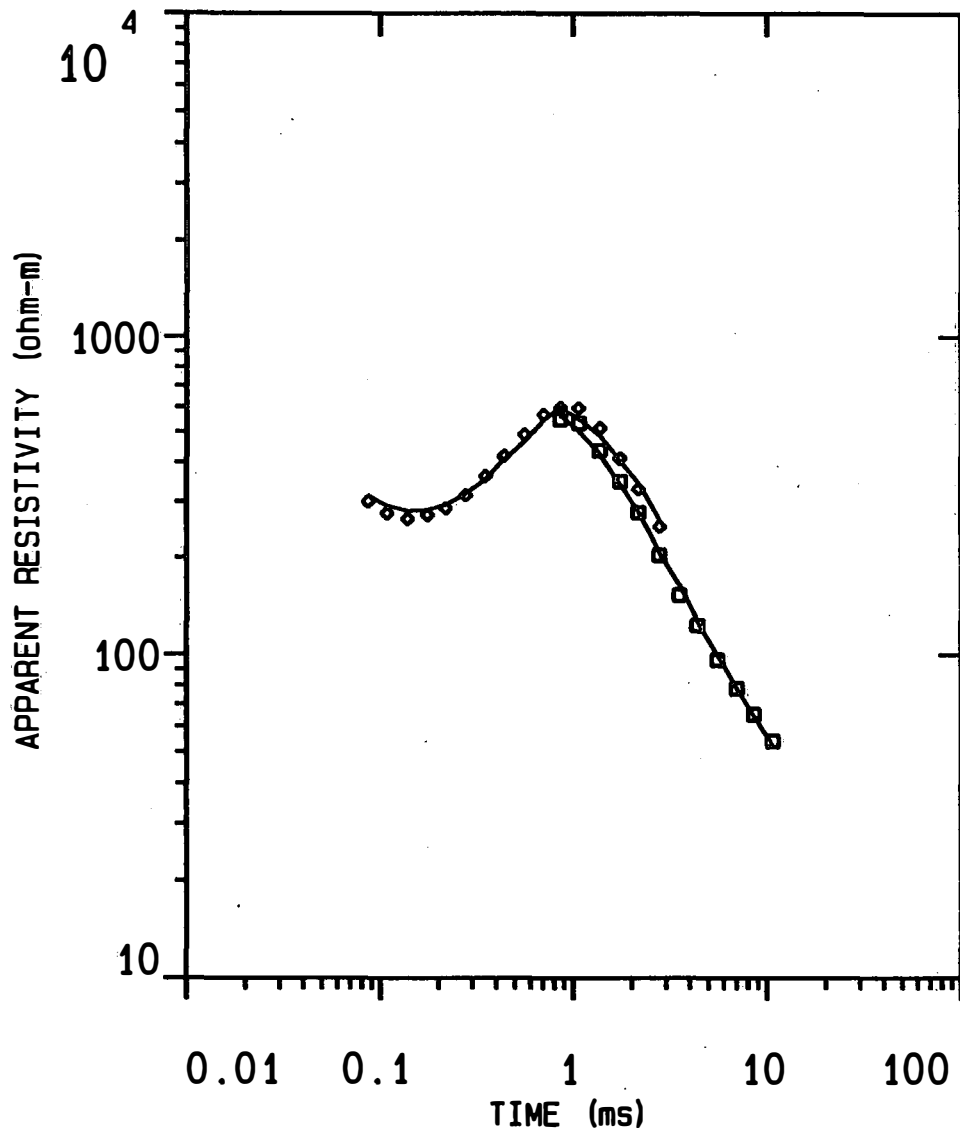
CURRENT: 14.00 AMPS EM-37 COIL AREA: 100.00 sq m.
 FREQUENCY: 3.00 Hz GAIN: 7 RAMP TIME: 160.00 muSEC

No.	TIME (ms)	emf (nV/m sqrd)		DIFFERENCE (percent)
		DATA	SYNTHETIC	
17	0.857	173.6	174.5	-0.511
18	1.06	129.0	130.4	-1.09
19	1.37	102.8	100.5	2.22
20	1.74	80.67	80.56	0.138
21	2.17	63.76	65.18	-2.22
22	2.77	50.72	50.31	0.793
23	3.50	38.87	38.05	2.11
24	4.37	28.86	28.25	2.10
25	5.56	19.98	19.72	1.29
26	6.98	13.68	13.54	1.01
27	8.56	9.34	9.39	-0.501
28	10.64	6.00	6.18	-2.99
29	13.70	3.67	3.67	-0.0927

PARAMETER RESOLUTION MATRIX:
 "F" INDICATES FIXED PARAMETER

P 1	0.88							
P 2	0.00	0.80						
P 3	0.02	-0.07	0.72					
P 4	-0.01	0.02	-0.03	0.20				
T 1	-0.25	-0.20	0.00	0.00	0.24			
T 2	0.05	0.06	0.03	-0.01	0.18	0.95		
T 3	0.03	-0.07	-0.35	-0.17	0.00	0.04	0.50	
	P 1	P 2	P 3	P 4	T 1	T 2	T 3	

MALA-4



DATA SET: MALA-4

CLIENT: THE MALAMA GROUP	DATE: 05-05-98
LOCATION: MAKAWAO, MAUI	SOUNDING: 4
COUNTY: MAUI	ELEVATION: 454.00 m
PROJECT: POOKELA TANK SITE	EQUIPMENT: Geonics PROTEM
LOOP SIZE: 366.000 m by 274.000 m	AZIMUTH:
COIL LOC: 0.000 m (X), 0.000 m (Y)	TIME CONSTANT: NONE
SOUNDING COORDINATES: E: 100.0000 N: 4.0000	SLOPE: NONE

Central Loop Configuration
Geonics PROTEM System

FITTING ERROR: 6.137 PERCENT

L #	RESISTIVITY (ohm-m)	THICKNESS (meters)	ELEVATION (meters)	CONDUCTANCE (Siemens)
1	45.55	27.14	454.0 <i>(FT)</i> 1490	0.595
2	3804.5	483.2	426.8 1400	0.127
3	2.85		-56.43 -185	

ALL PARAMETERS ARE FREE

CURRENT: 13.00 AMPS	EM-37	COIL AREA: 100.00 sq m.
FREQUENCY: 3.00 Hz	GAIN: 7	RAMP TIME: 160.00 muSEC

No.	TIME (ms)	emf (nV/m sqrd)		DIFFERENCE (percent)
		DATA	SYNTHETIC	
1	0.857	76.10	72.75	4.39
2	1.06	45.77	49.96	-9.15
3	1.37	32.95	34.20	-3.78
4	1.74	25.52	26.18	-2.57
5	2.17	20.54	20.55	-0.0444
6	2.77	17.84	17.47	2.07
7	3.50	15.29	13.68	10.54
8	4.37	12.10	11.59	4.22
9	5.56	9.59	9.09	5.22
10	6.98	7.38	7.34	0.496
11	8.56	5.83	5.94	-1.97
12	10.64	4.50	4.71	-4.74

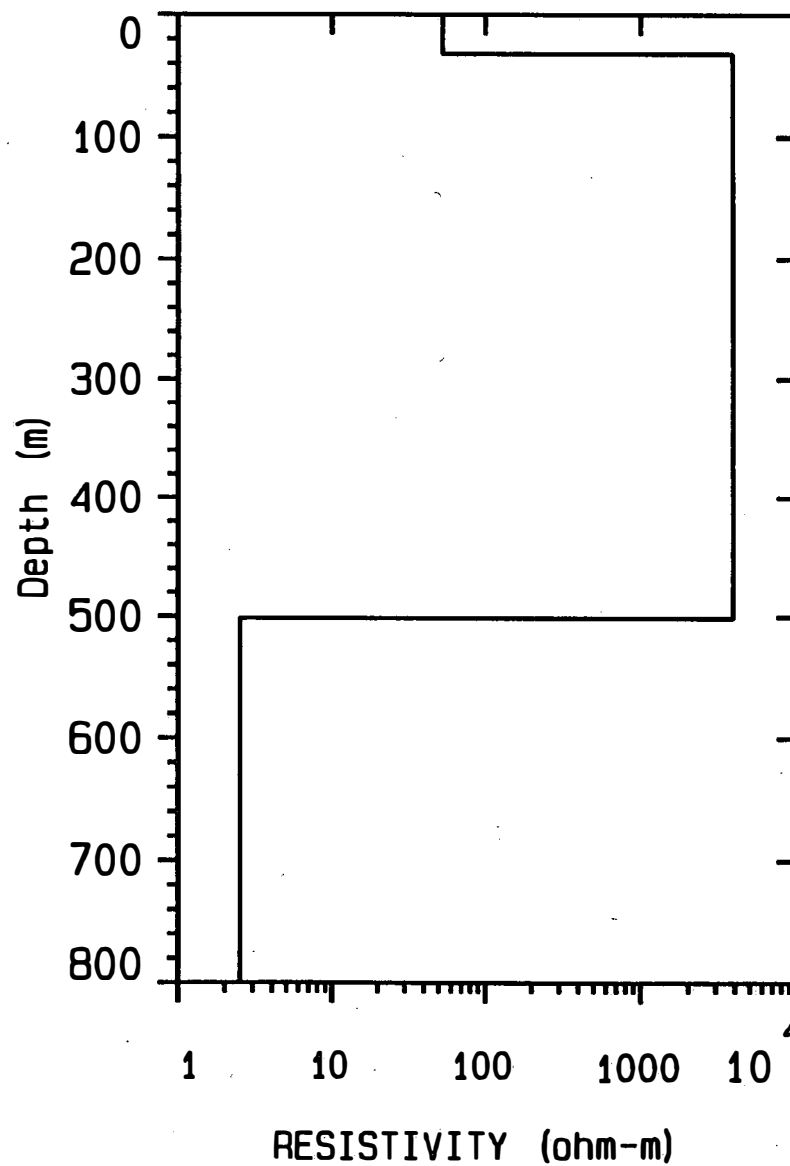
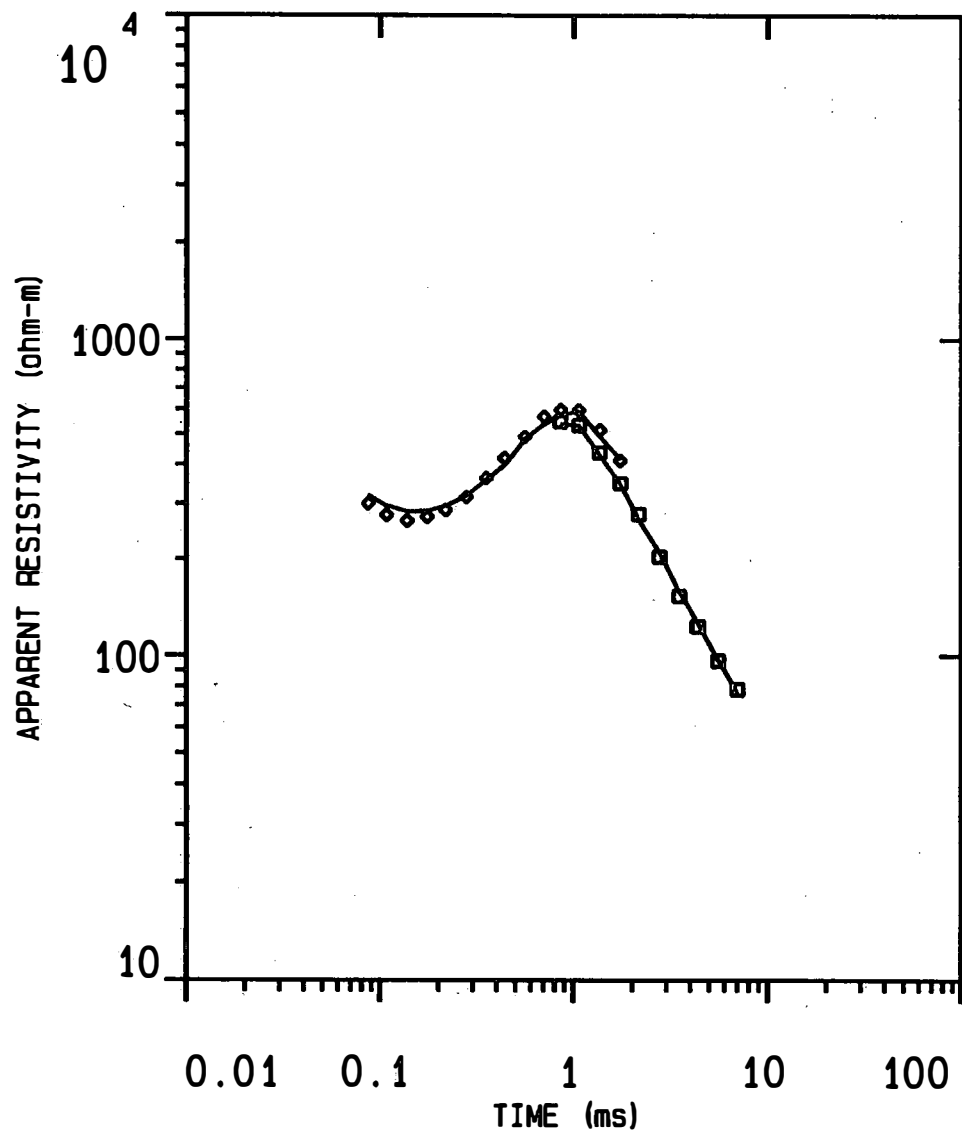
CURRENT: 13.00 AMPS EM-37 COIL AREA: 100.00 sq m.
 FREQUENCY: 30.00 Hz GAIN: 7 RAMP TIME: 160.00 muSEC

No.	TIME (ms)	emf (nV/m sqrd)		DIFFERENCE (percent)
		DATA	SYNTHETIC	
13	0.0867	57437.3	53499.5	6.85
14	0.108	37706.7	34680.7	8.02
15	0.138	21757.5	19908.1	8.49
16	0.175	11526.6	10886.5	5.55
17	0.218	6176.8	5937.5	3.87
18	0.278	2910.0	2854.2	1.91
19	0.351	1318.3	1367.2	-3.70
20	0.438	604.3	629.5	-4.16
21	0.558	261.8	281.7	-7.60
22	0.702	118.2	125.4	-6.14
23	0.858	66.42	66.15	0.402
24	1.06	38.80	43.63	-12.44
25	1.37	25.79	28.08	-8.89
26	1.74	19.76	20.31	-2.79
27	2.17	15.94	14.94	6.24
28	2.77	13.05	12.21	6.43

PARAMETER RESOLUTION MATRIX:
 "F" INDICATES FIXED PARAMETER

P 1	0.53				
P 2	0.02	0.00			
P 3	-0.04	0.00	0.08		
T 1	-0.30	-0.02	0.00	0.53	
T 2	0.03	0.00	-0.08	0.02	0.81
	P 1	P 2	P 3	T 1	T 2

MALA-4A



DATA SET: MALA-4A

CLIENT: THE MALAMA GROUP	DATE: 05-05-98
LOCATION: MAKAWAO, MAUI	SOUNDING: 4
COUNTY: MAUI	ELEVATION: 454.00 m
PROJECT: POOKELA TANK SITE	EQUIPMENT: Geonics PROTEM
LOOP SIZE: 366.000 m by 274.000 m	AZIMUTH:
COIL LOC: 0.000 m (X), 0.000 m (Y)	TIME CONSTANT: NONE
SOUNDING COORDINATES: E: 100.0000 N: 4.0000	SLOPE: NONE

Central Loop Configuration
Geonics PROTEM System

FITTING ERROR: 5.567 PERCENT

L #	RESISTIVITY (ohm-m)	THICKNESS (meters)	ELEVATION (meters)	CONDUCTANCE (Siemens)
1	52.60	31.87	454.0 <i>(F1)</i> 1490	0.605
2	3898.4	469.4	422.1 1384	0.120
3	2.50	*	-47.36 -155	

"*" INDICATES FIXED PARAMETER

CURRENT: 13.00 AMPS	EM-37	COIL AREA: 100.00 sq m.
FREQUENCY: 3.00 Hz	GAIN: 7	RAMP TIME: 160.00 muSEC

No.	TIME (ms)	emf (nV/m sqrd) DATA	SYNTHETIC	DIFFERENCE (percent)
1	0.857	76.10	77.68	-2.07
2	1.06	45.77	45.90	-0.280
3	1.37	32.95	33.96	-3.06
4	1.74	25.52	25.62	-0.367
5	2.17	20.54	21.94	-6.80
6	2.77	17.84	17.14	3.91
7	3.50	15.29	14.56	4.79
8	4.37	12.10	11.68	3.50
9	5.56	9.59	9.51	0.864
10	6.98	7.38	7.62	-3.28

CURRENT: 13.00 AMPS	EM-37	COIL AREA: 100.00 sq m.
FREQUENCY: 30.00 Hz	GAIN: 7	RAMP TIME: 160.00 muSEC

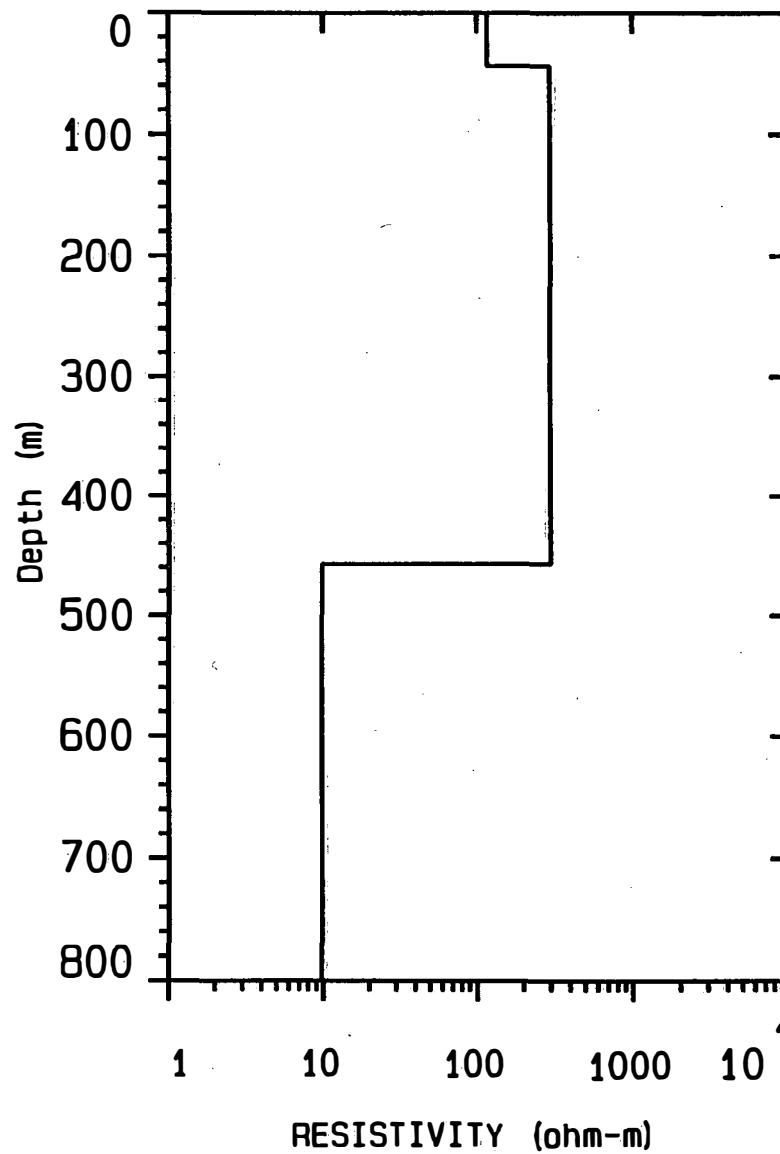
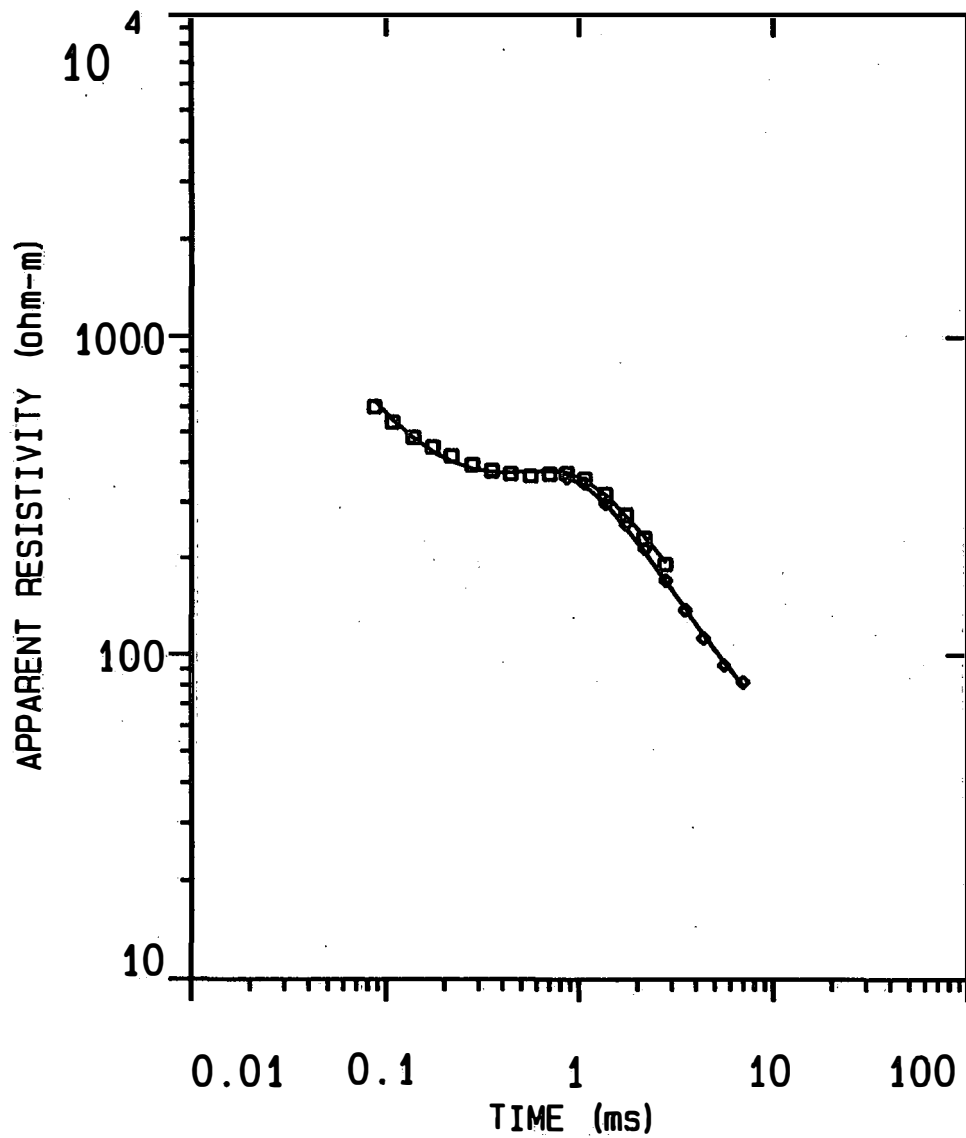
No.	TIME (ms)	emf (nV/m sqrd)		DIFFERENCE (percent)
		DATA	SYNTHETIC	
11	0.0867	57437.3	52424.2	8.72
12	0.108	37706.7	33993.5	9.84
13	0.138	21757.5	19624.8	9.80
14	0.175	11526.6	10808.6	6.22
15	0.218	6176.8	5894.5	4.56
16	0.278	2910.0	2864.1	1.57
17	0.351	1318.3	1345.5	-2.06
18	0.438	604.3	650.5	-7.64
19	0.558	261.8	268.3	-2.50
20	0.702	118.2	128.4	-8.69
21	0.858	66.42	70.62	-6.31
22	1.06	38.80	39.30	-1.29
23	1.37	25.79	27.58	-6.96
24	1.74	19.76	19.49	1.35

PARAMETER RESOLUTION MATRIX:

"F" INDICATES FIXED PARAMETER

P 1	0.56				
P 2	0.02	0.00			
F 3	0.00	0.00	0.00		
T 1	-0.32	-0.02	0.00	0.50	
T 2	0.01	0.01	0.00	0.00	0.80
	P 1	P 2	F 3	T 1	T 2

MALA-5



DATA SET: MALA-5

CLIENT: THE MALAMA GROUP	DATE: 05-11-98
LOCATION: MAKAWAO, MAUI	SOUNDING: 5
COUNTY: MAUI	ELEVATION: 573.00 m
PROJECT: POOKELA TANK SITE	EQUIPMENT: Geonics PROTEM
LOOP SIZE: 442.000 m by 442.000 m	AZIMUTH:
COIL LOC: 0.000 m (X), 0.000 m (Y)	TIME CONSTANT: NONE
SOUNDING COORDINATES: E: -5.0000 N: 500.0000	SLOPE: NONE

Central Loop Configuration
Geonics PROTEM System

FITTING ERROR: 3.301 PERCENT

L #	RESISTIVITY (ohm-m)	THICKNESS (meters)	ELEVATION (meters)	CONDUCTANCE (Siemens)
1	117.2	43.67	573.0 <i>(Fl) 1880</i>	0.372
2	296.3	413.3	529.3 <i>1736</i>	1.39
3	9.76		116.0 <i>380</i>	

ALL PARAMETERS ARE FREE

CURRENT: 13.50 AMPS	EM-37	COIL AREA: 100.00 sq m.
FREQUENCY: 30.00 Hz	GAIN: 7	RAMP TIME: 200.00 muSEC

No.	TIME (ms)	emf (nV/m sqrd) DATA	SYNTHETIC	DIFFERENCE (percent)
1	0.0867	40578.6	37809.9	6.82
2	0.108	27655.0	26975.0	2.45
3	0.138	17660.9	17786.3	-0.710
4	0.175	10855.9	11421.2	-5.20
5	0.218	6913.4	7339.9	-6.16
6	0.278	4153.2	4320.0	-4.01
7	0.351	2469.9	2505.0	-1.42
8	0.438	1466.7	1445.1	1.47
9	0.558	820.5	779.7	4.97
10	0.702	449.6	435.2	3.20
11	0.858	271.7	268.8	1.05
12	1.06	167.8	169.6	-1.06
13	1.37	105.7	106.5	-0.747
14	1.74	72.92	73.66	-1.01

* Blackhawk Geometrics, Inc. *

No.	TIME (ms)	emf (nV/m sqrd)		DIFFERENCE (percent)
		DATA	SYNTHETIC	
15	2.17	54.23	53.33	1.65
16	2.77	39.10	38.14	2.44

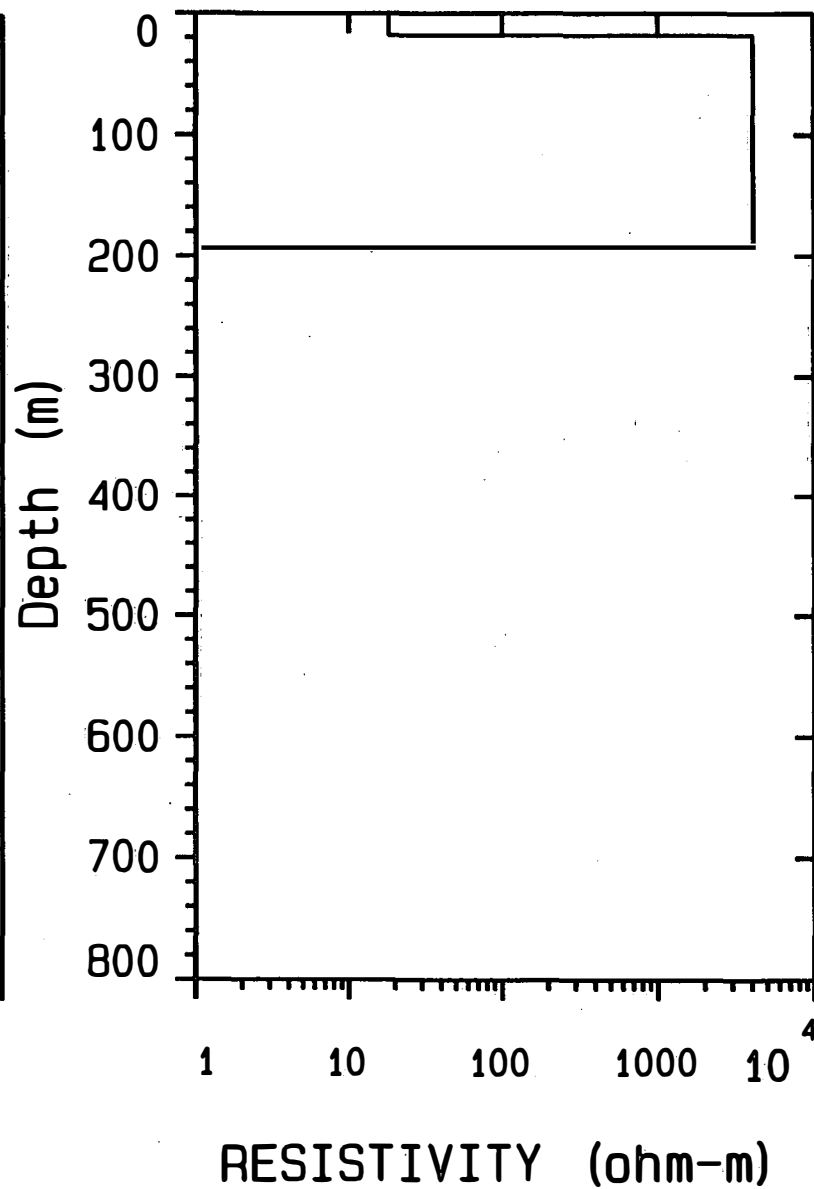
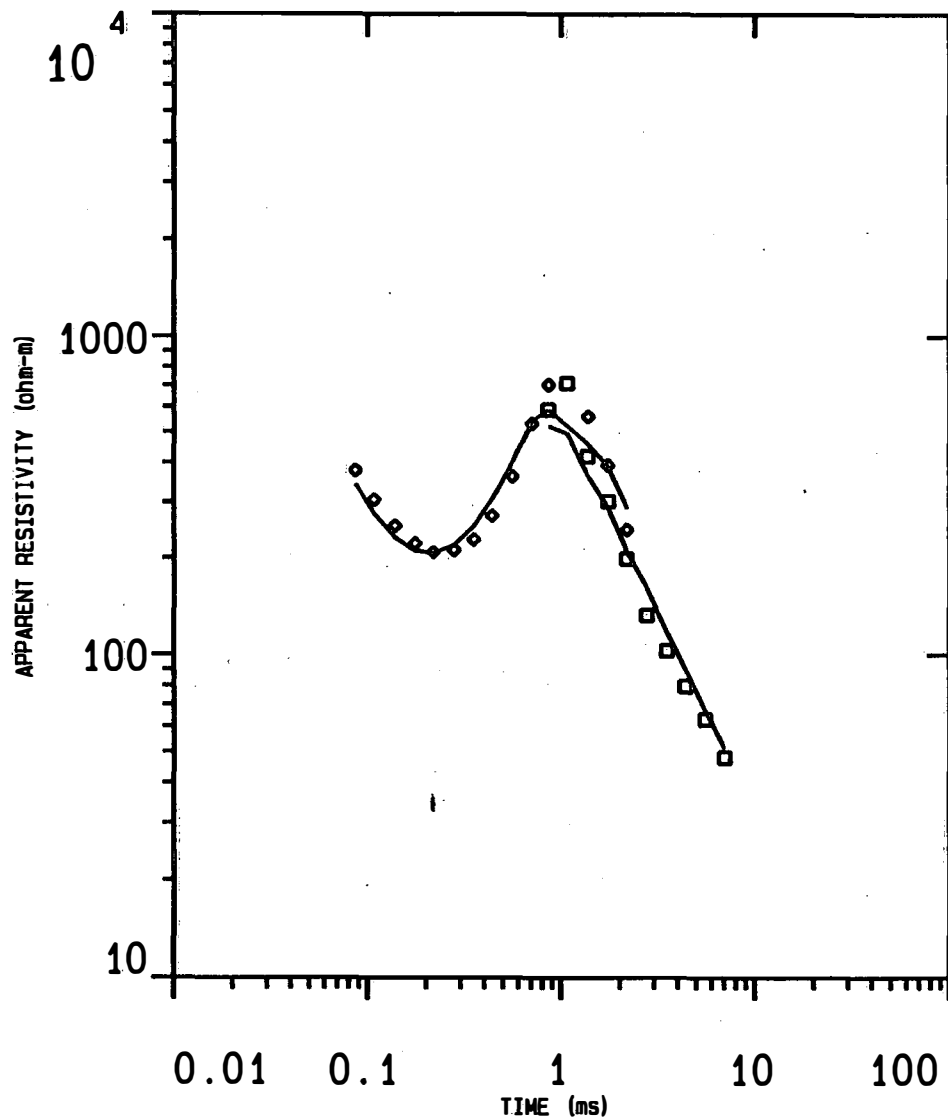
CURRENT: 13.50 AMPS EM-37 COIL AREA: 100.00 sq m.
 FREQUENCY: 3.00 Hz GAIN: 6 RAMP TIME: 200.00 muSEC

No.	TIME (ms)	emf (nV/m sqrd)		DIFFERENCE (percent)
		DATA	SYNTHETIC	
17	0.857	285.6	281.0	1.60
18	1.06	175.8	180.7	-2.77
19	1.37	117.1	117.1	-0.0477
20	1.74	80.64	83.73	-3.82
21	2.17	60.78	62.80	-3.32
22	2.77	46.70	46.86	-0.330
23	3.50	35.76	35.10	1.85
24	4.37	27.74	26.70	3.71
25	5.56	20.31	19.55	3.75
26	6.98	13.79	14.41	-4.50

PARAMETER RESOLUTION MATRIX:
 "F" INDICATES FIXED PARAMETER

P 1	0.85				
P 2	0.01	0.94			
P 3	0.02	-0.07	0.78		
T 1	-0.22	-0.07	-0.04	0.52	
T 2	0.02	0.01	0.00	0.06	0.99
	P 1	P 2	P 3	T 1	T 2

MALA-6



DATA SET: MALA-6

CLIENT: THE MALAMA GROUP	DATE: 05-11-98
LOCATION: MAKAWAO, MAUI	SOUNDING: 6
COUNTY: MAUI	ELEVATION: 521.00 m
PROJECT: POOKELA TANK SITE	EQUIPMENT: Geonics PROTEM
LOOP SIZE: 457.000 m by 336.000 m	AZIMUTH:
COIL LOC: 0.000 m (X), 0.000 m (Y)	TIME CONSTANT: NONE
SOUNDING COORDINATES: E: -6.0000 N: 600.0000	SLOPE: NONE

Central Loop Configuration
Geonics PROTEM System

FITTING ERROR: 21.793 PERCENT

L #	RESISTIVITY (ohm-m)	THICKNESS (meters)	ELEVATION (meters)	CONDUCTANCE (Siemens)
1	18.21	17.93	521.0	0.984
2	4082.7	174.4	503.0	0.0427
3	0.00730		328.5	

ALL PARAMETERS ARE FREE

CURRENT: 15.00 AMPS	EM-37	COIL AREA: 100.00 sq m.
FREQUENCY: 3.00 Hz	GAIN: 7	RAMP TIME: 205.00 muSEC

No.	TIME (ms)	emf (nV/m sqrd)		DIFFERENCE (percent)
		DATA	SYNTHETIC	
1	0.857	121.2	144.5	-19.21
2	1.06	52.30	90.61	-73.22
3	1.37	62.15	76.65	-23.32
4	1.74	55.93	59.81	-6.95
5	2.17	59.90	55.67	7.06
6	2.77	60.15	45.54	24.29
7	3.50	48.95	40.15	17.98
8	4.37	41.11	34.32	16.51
9	5.56	32.16	29.28	8.96
10	6.98	27.36	24.75	9.55

CURRENT: 15.00 AMPS	EM-37	COIL AREA: 100.00 sq m.
FREQUENCY: 30.00 Hz	GAIN: 7	RAMP TIME: 205.00 muSEC

No.	TIME (ms)	emf (nV/m sqrd)		DIFFERENCE (percent)
		DATA	SYNTHETIC	
11	0.0867	72003.0	84047.5	-16.72
12	0.108	57118.8	66722.5	-16.81
13	0.138	41159.5	46868.8	-13.87
14	0.175	27543.0	29840.3	-8.34
15	0.218	17525.5	17694.0	-0.961
16	0.278	9322.1	8819.5	5.39
17	0.351	4642.3	4000.0	13.83
18	0.438	2058.8	1707.3	17.06
19	0.558	728.6	618.6	15.09
20	0.702	231.1	225.6	2.34
21	0.858	91.68	120.6	-31.61
22	1.37	40.21	54.13	-34.63
23	1.74	37.62	38.00	-1.00
24	2.17	43.79	34.64	20.88

PARAMETER RESOLUTION MATRIX:

"F" INDICATES FIXED PARAMETER

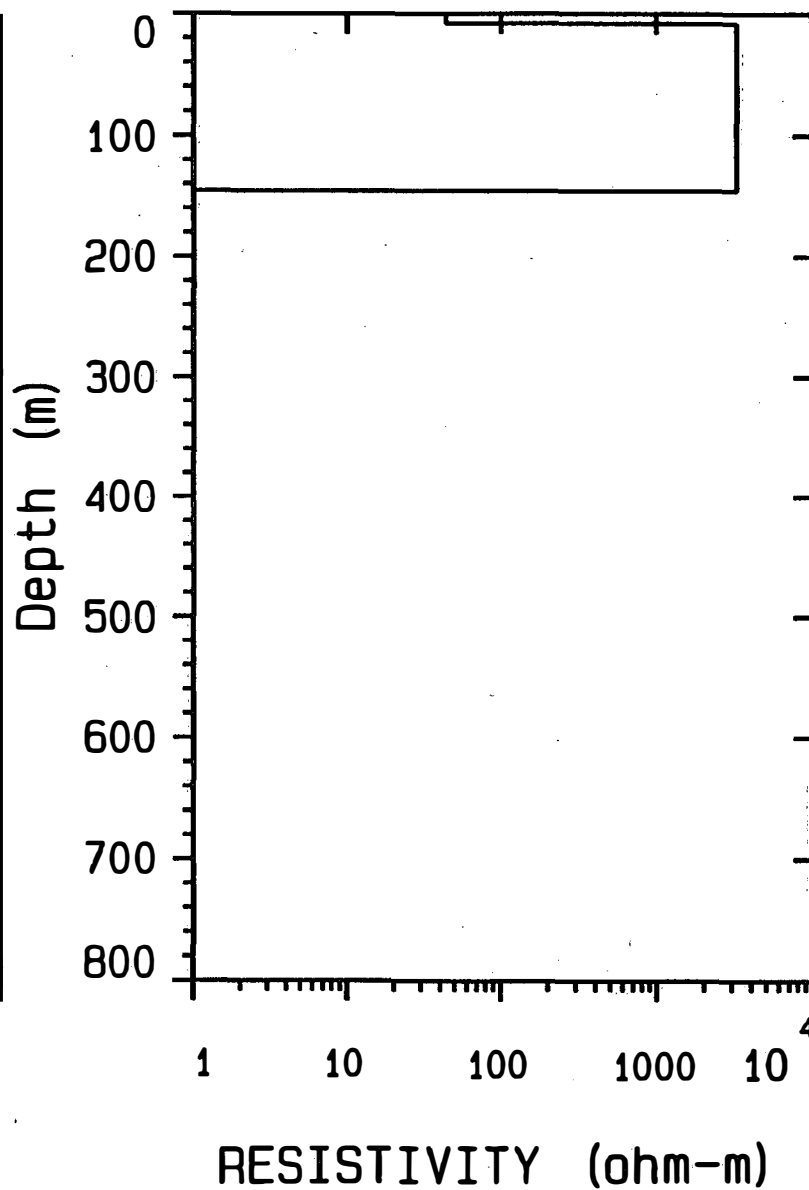
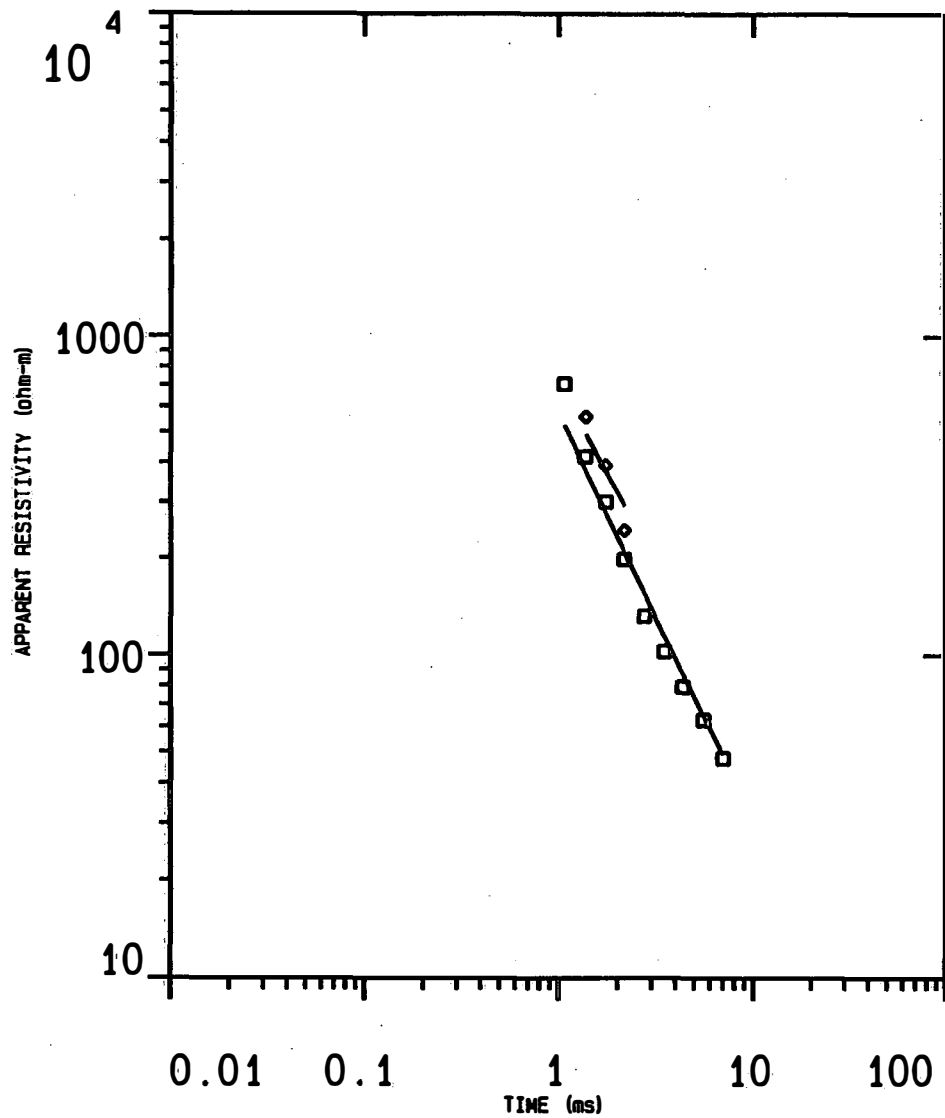
P 1	0.95				
P 2	0.01	0.00			
P 3	-0.04	-0.02	0.32		
T 1	-0.05	0.00	0.02	0.95	
T 2	-0.01	0.00	-0.14	0.01	0.97
	P 1	P 2	P 3	T 1	T 2

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Blackhawk Geometrics, Inc.

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MALA-6A



DATA SET: MALA-6A

CLIENT: THE MALAMA GROUP	DATE: 05-11-98
LOCATION: MAKAWAO, MAUI	SOUNDING: 6
COUNTY: MAUI	ELEVATION: 521.00 m
PROJECT: POOKELA TANK SITE	EQUIPMENT: Geonics PROTEM
LOOP SIZE: 457.000 m by 336.000 m	AZIMUTH:
COIL LOC: 0.000 m (X), 0.000 m (Y)	TIME CONSTANT: NONE
SOUNDING COORDINATES: E: -6.0000 N: 600.0000	SLOPE: NONE

Central Loop Configuration
Geonics PROTEM System

FITTING ERROR: 21.890 PERCENT

L #	RESISTIVITY (ohm-m)	THICKNESS (meters)	ELEVATION (meters)	CONDUCTANCE (Siemens)
			521.0	
1	43.78	8.04	512.9	0.183
2	3255.1	137.6	375.3	0.0422
3	0.00250			

ALL PARAMETERS ARE FREE

CURRENT: 15.00 AMPS	EM-37	COIL AREA: 100.00 sq m.
FREQUENCY: 3.00 Hz	GAIN: 7	RAMP TIME: 205.00 muSEC

No.	TIME (ms)	emf (nV/m sqrd) DATA	SYNTHETIC	DIFFERENCE (percent)
1	1.06	52.30	83.02	-58.72
2	1.37	62.15	72.53	-16.69
3	1.74	55.93	63.03	-12.70
4	2.17	59.90	55.83	6.79
5	2.77	60.15	47.81	20.52
6	3.50	48.95	41.65	14.92
7	4.37	41.11	35.92	12.62
8	5.56	32.16	30.74	4.39
9	6.98	27.36	26.26	4.00

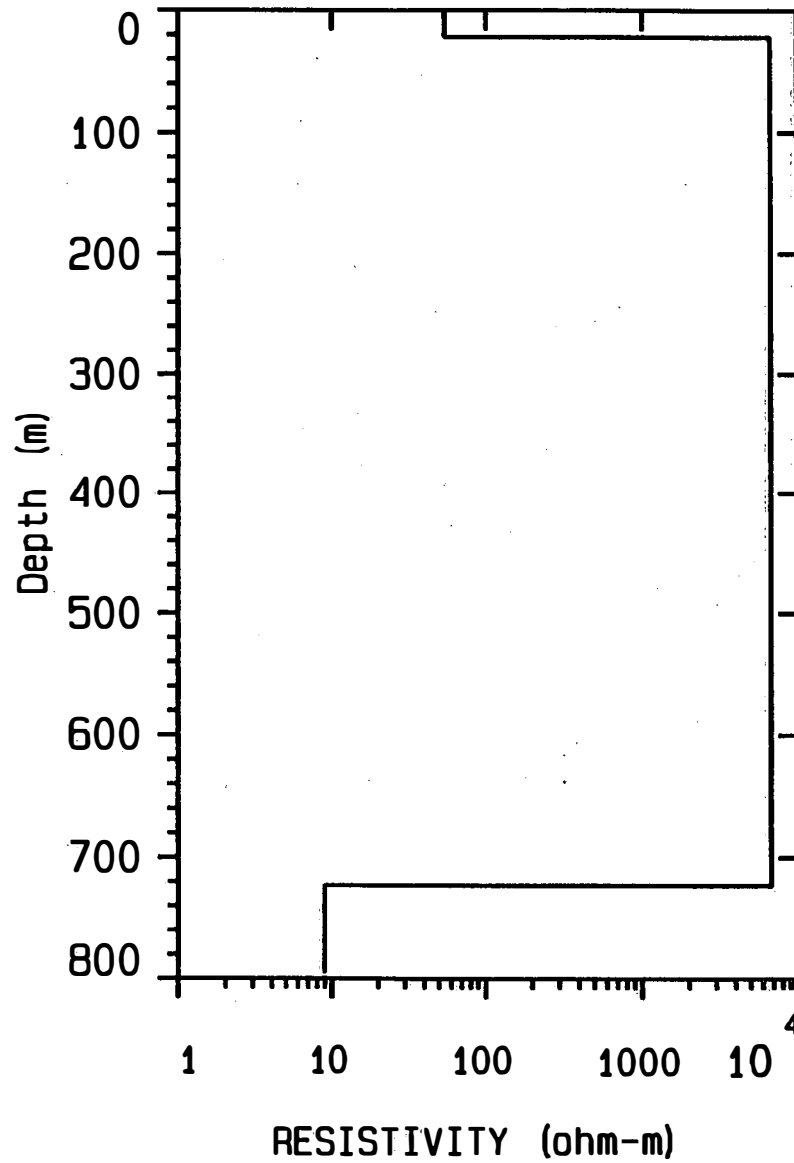
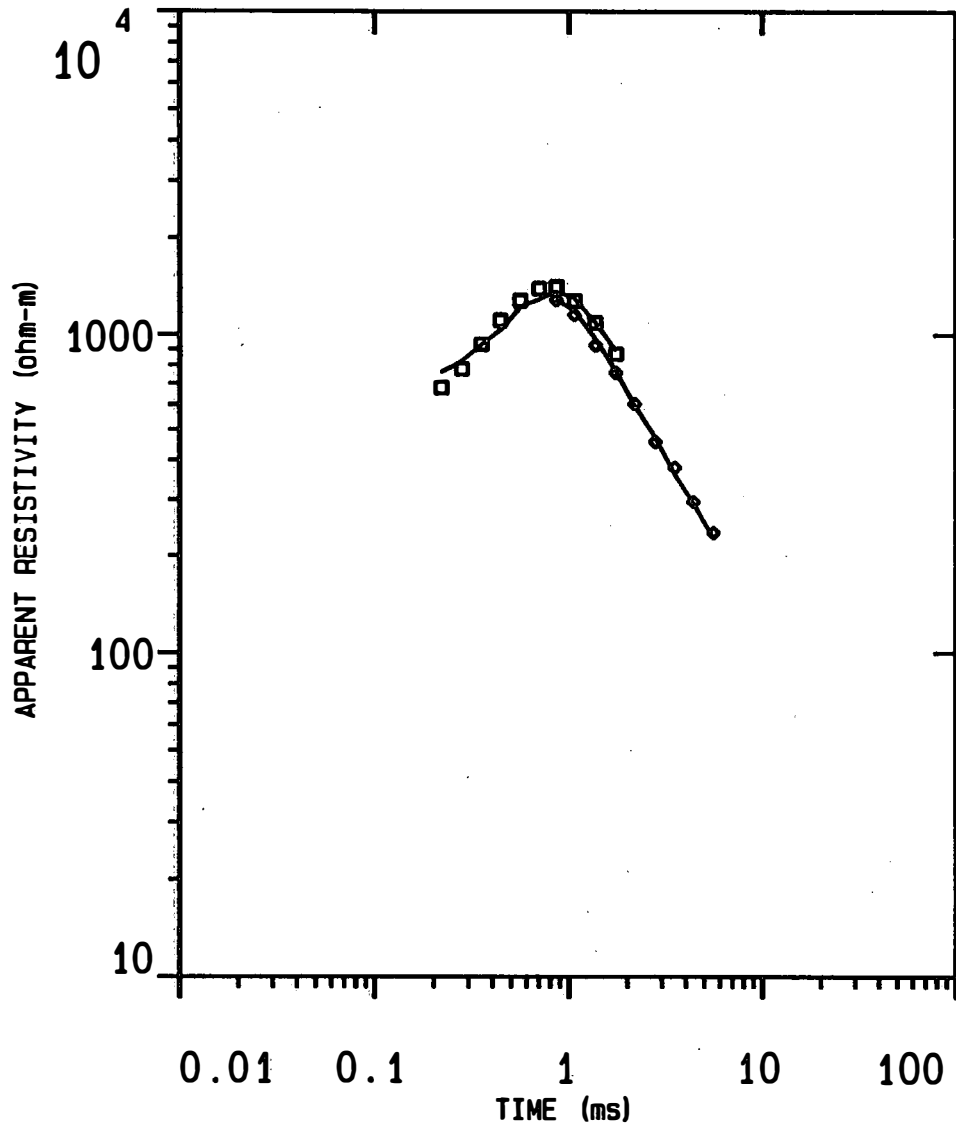
CURRENT: 15.00 AMPS	EM-37	COIL AREA: 100.00 sq m.
FREQUENCY: 30.00 Hz	GAIN: 7	RAMP TIME: 205.00 muSEC

No.	TIME (ms)	emf (nV/m sqrd)		DIFFERENCE (percent)
		DATA	SYNTHETIC	
10	1.37	40.21	48.77	-21.28
11	1.74	37.62	39.95	-6.17
12	2.17	43.79	33.48	23.54

PARAMETER RESOLUTION MATRIX:
"F" INDICATES FIXED PARAMETER

P 1	0.24				
P 2	0.00	0.00			
P 3	0.00	0.00	0.07		
T 1	-0.25	0.00	-0.01	0.29	
T 2	0.02	0.00	-0.25	0.04	0.93
	P 1	P 2	P 3	T 1	T 2

MALA-7



DATA SET: MALA-7

CLIENT: THE MALAMA GROUP
 LOCATION: MAKAWAO, MAUI
 COUNTY: MAUI
 PROJECT: POOKELA TANK SITE
 LOOP SIZE: 457.000 m by 457.000 m
 COIL LOC: 0.000 m (X), 0.000 m (Y)
 SOUNDING COORDINATES: E: 700.0000 N: -7.0000

DATE: 05-14-98
 SOUNDING: 7
 ELEVATION: 701.00 m
 EQUIPMENT: Geonics PROTEM
 AZIMUTH:
 TIME CONSTANT: NONE
 SLOPE: NONE

Central Loop Configuration
 Geonics PROTEM System

FITTING ERROR: 7.061 PERCENT

L #	RESISTIVITY (ohm-m)	THICKNESS (meters)	ELEVATION (meters)		CONDUCTANCE (Siemens)
1	54.21	21.86	701.0	(FT) 2300	0.403
2	6722.8	701.1	679.1	2228	0.104
3	8.95		-21.97	-72	

ALL PARAMETERS ARE FREE

CURRENT: 13.00 AMPS EM-37 COIL AREA: 100.00 sq m.
 FREQUENCY: 30.00 Hz GAIN: 5 RAMP TIME: 200.00 muSEC

No.	TIME (ms)	emf (nV/m sqrd) DATA	SYNTHETIC	DIFFERENCE (percent)
1	0.218	3455.4	2922.1	15.43
2	0.278	1539.1	1408.4	8.49
3	0.351	656.6	657.4	-0.119
4	0.438	290.9	322.5	-10.89
5	0.558	128.0	136.6	-6.67
6	0.702	63.27	71.15	-12.44
7	0.858	37.70	39.60	-5.04
8	1.06	25.41	24.79	2.42
9	1.37	17.26	17.27	-0.0390
10	1.74	13.33	12.83	3.72

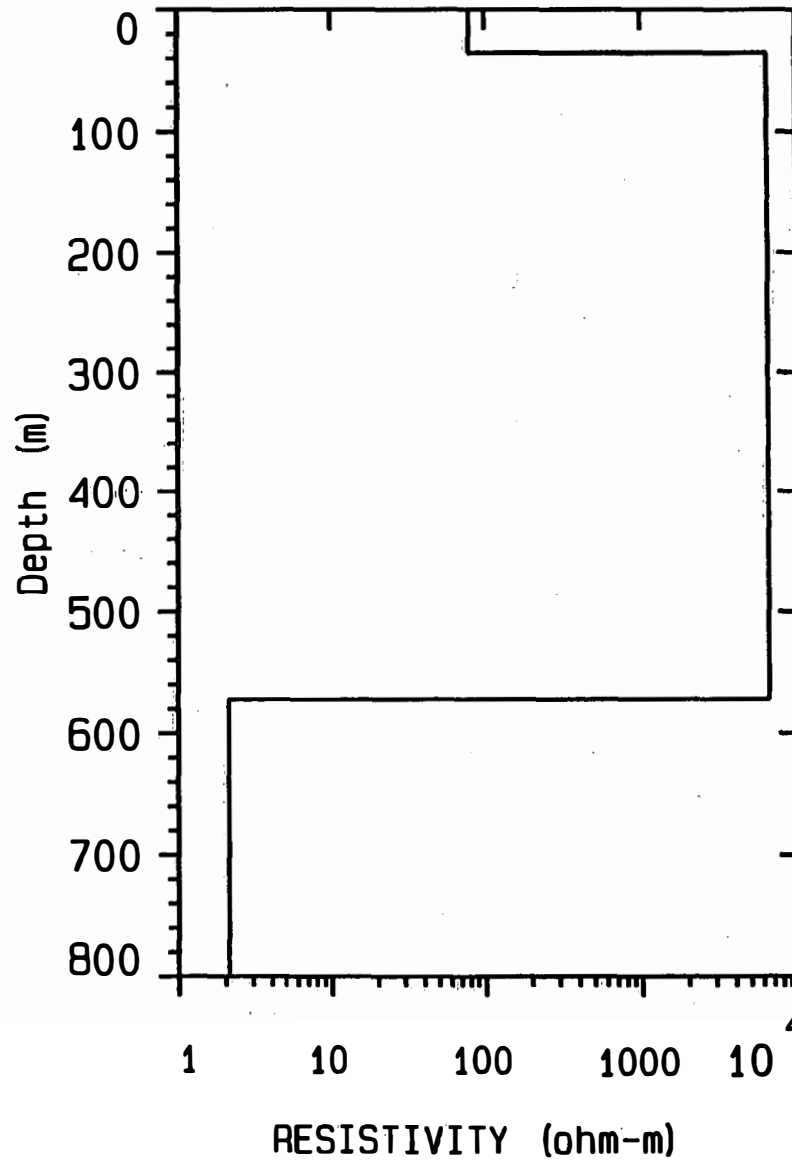
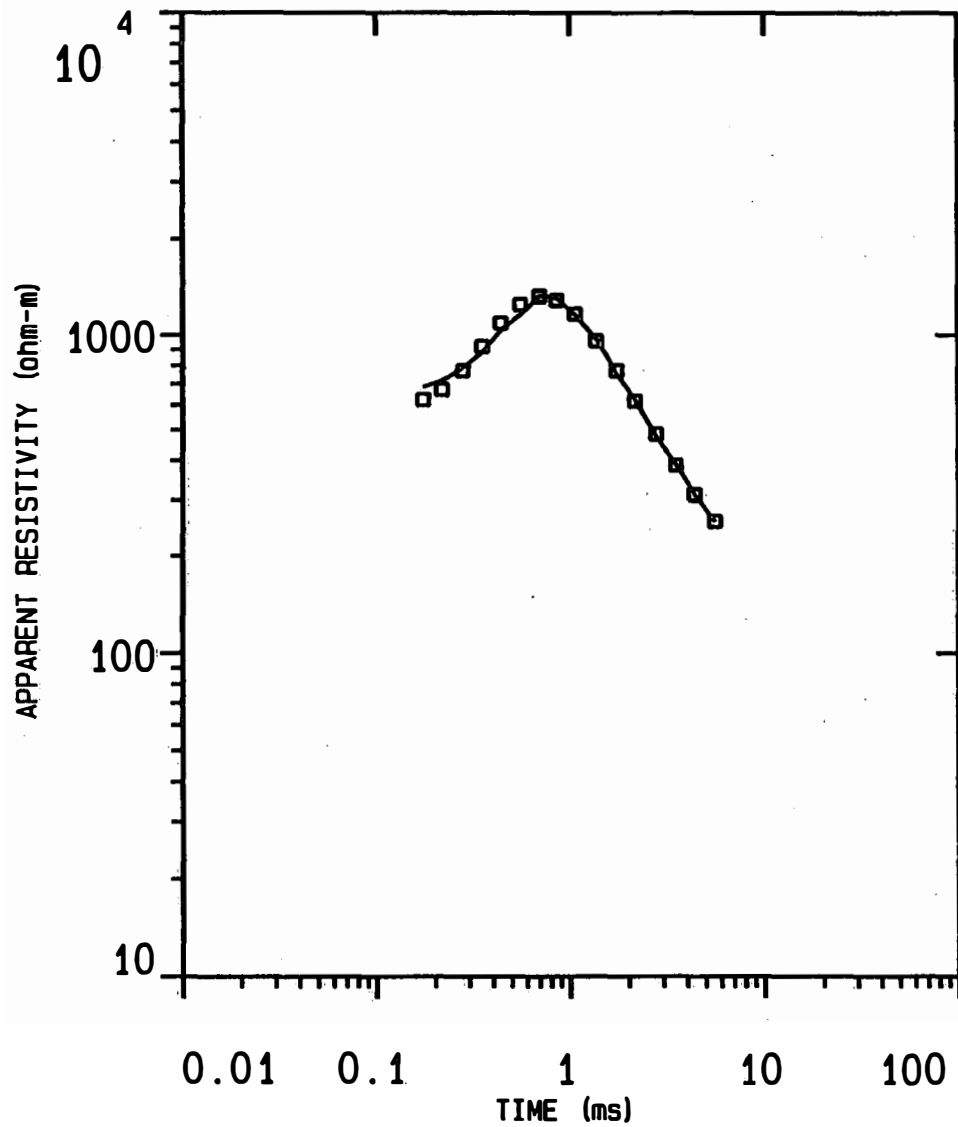
CURRENT: 13.00 AMPS EM-37 COIL AREA: 100.00 sq m.
 FREQUENCY: 3.00 Hz GAIN: 7 RAMP TIME: 200.00 muSEC

No.	TIME (ms)	emf (nV/m sqrd)		DIFFERENCE (percent)
		DATA	SYNTHETIC	
11	0.857	43.41	43.35	0.124
12	1.06	29.66	28.27	4.68
13	1.37	22.01	20.62	6.32
14	1.74	16.34	16.05	1.78
15	2.17	13.24	13.43	-1.43
16	2.77	10.87	10.41	4.18
17	3.50	8.02	8.68	-8.22
18	4.37	6.69	6.80	-1.57
19	5.56	5.12	5.45	-6.49

PARAMETER RESOLUTION MATRIX:
"F" INDICATES FIXED PARAMETER

P 1	0.50				
P 2	0.02	0.00			
P 3	-0.01	0.00	0.01		
T 1	-0.33	-0.03	0.03	0.50	
T 2	-0.01	0.01	-0.05	-0.03	0.82
	P 1	P 2	P 3	T 1	T 2

MALA-7A



DATA SET: MALA-7A

CLIENT: THE MALAMA GROUP
LOCATION: MAKAWAO OFFSET 76M FROM CENTER
COUNTY: MAUI
PROJECT: POOKELA TANK SITE
LOOP SIZE: 457.000 m by 457.000 m
COIL LOC: 76.000 m (X), 0.000 m (Y)
SOUNDING COORDINATES: E: 700.0000 N: -777.0000

DATE: 05-14-98
SOUNDING: 7
ELEVATION: 701.00 m
EQUIPMENT: Geonics PROTEM
AZIMUTH:
TIME CONSTANT: NONE
SLOPE: NONE

Central Loop Configuration
Geonics PROTEM System

FITTING ERROR: 7.476 PERCENT

L #	RESISTIVITY (ohm-m)	THICKNESS (meters)	ELEVATION (meters)	CONDUCTANCE (Siemens)
			701.0	
1	79.88	35.36	665.6	0.442
2	6558.4	536.8	128.8	0.0818
3	2.09			

ALL PARAMETERS ARE FREE

CURRENT: 13.00 AMPS EM-37 COIL AREA: 100.00 sq m.
FREQUENCY: 30.00 Hz GAIN: 5 RAMP TIME: 200.00 muSEC

No.	TIME (ms)	emf (nV/m sqrd)		DIFFERENCE (percent)
		DATA	SYNTHETIC	
1	0.175	6850.8	5949.0	13.16
2	0.218	3518.3	3205.7	8.88
3	0.278	1563.2	1516.2	3.00
4	0.351	668.9	712.4	-6.49
5	0.438	298.2	324.5	-8.81
6	0.558	133.3	148.0	-11.03
7	0.702	68.22	67.87	0.513
8	0.858	43.23	42.25	2.25
9	1.06	29.36	29.39	-0.115
10	1.37	20.91	20.50	1.95
11	1.74	15.96	16.39	-2.63
12	2.17	12.76	12.64	0.886
13	2.77	9.98	10.30	-3.19
14	3.50	7.82	7.71	1.48

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Blackhawk Geometrics, Inc.

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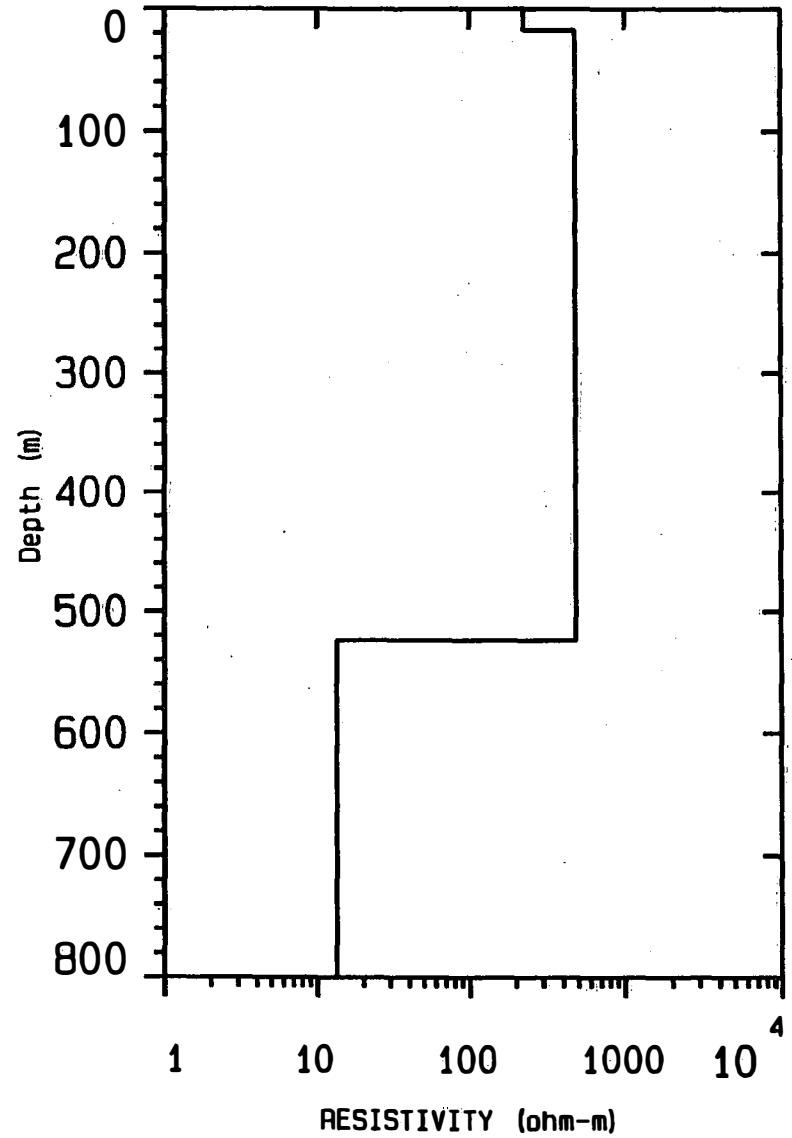
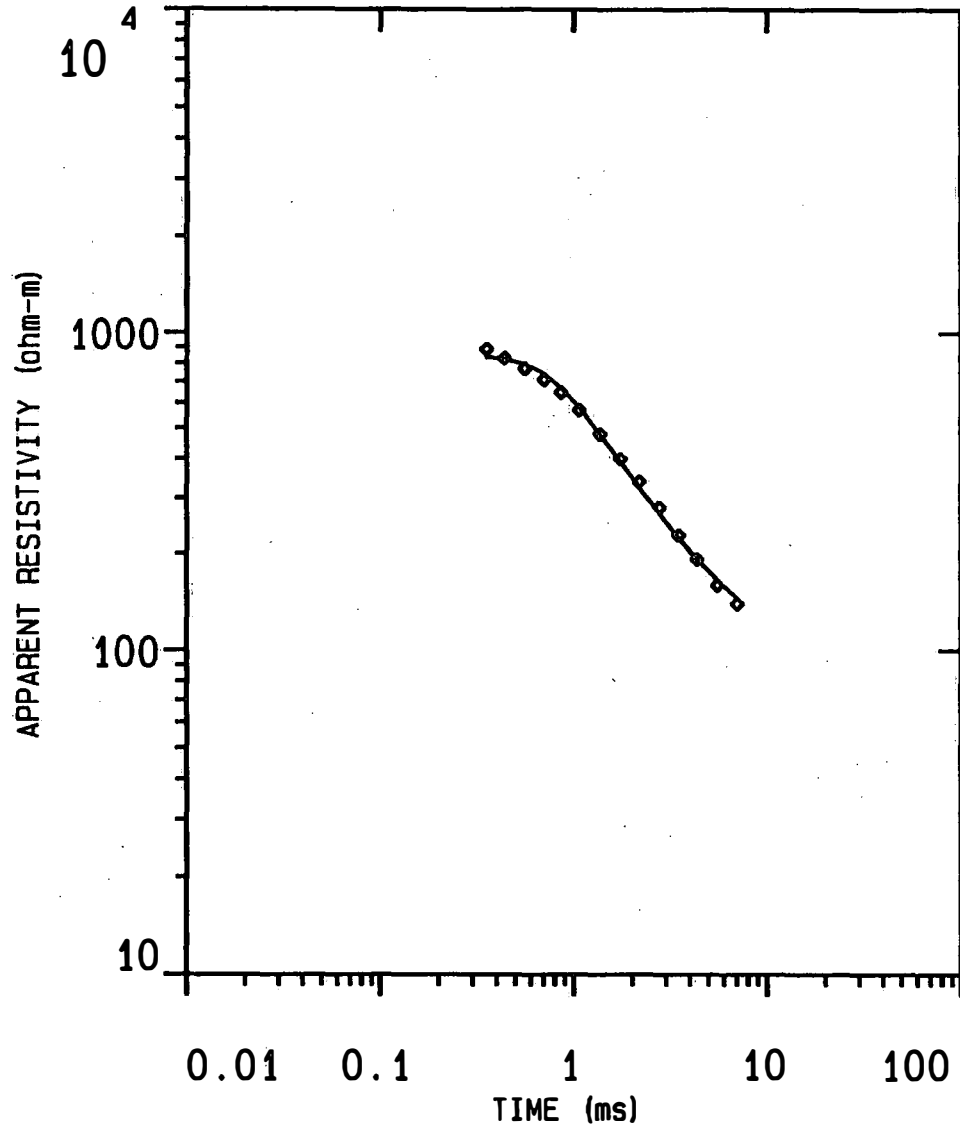
No.	TIME (ms)	emf (nV/m sqrd)		DIFFERENCE (percent)
		DATA	SYNTHETIC	
15	4.37	6.17	6.14	0.540
16	5.56	4.51	4.51	-0.0836

PARAMETER RESOLUTION MATRIX:

"F" INDICATES FIXED PARAMETER

P 1	0.95				
P 2	0.01	0.03			
P 3	0.04	-0.06	0.41		
T 1	-0.05	-0.04	0.06	0.94	
T 2	0.01	0.00	-0.06	0.01	0.99
	P 1	P 2	P 3	T 1	T 2

MALA-70



DATA SET: MALA-70

CLIENT: THE MALAMA GROUP
 LOCATION: MAKAWAO, MAUI OUTSIDE LOOP
 COUNTY: MAUI
 PROJECT: POOKELA TANK SITE
 LOOP SIZE: 457.000 m by 457.000 m
 COIL LOC: 288.000 m (X), 0.000 m (Y)
 SOUNDING COORDINATES: E: 700.0000 N: -7777.0000

DATE: 05-14-98
 SOUNDING: 7
 ELEVATION: 701.00 m
 EQUIPMENT: Geonics PROTEM
 AZIMUTH:
 TIME CONSTANT: NONE
 SLOPE: NONE

Fixed Loop, Hz receiver
 Geonics PROTEM System

FITTING ERROR: 5.124 PERCENT

L #	RESISTIVITY (ohm-m)	THICKNESS (meters)	ELEVATION (meters)	CONDUCTANCE (Siemens)
			701.0	
1	224.7	17.25	683.7	0.0768
2	478.9	506.6	177.1	1.05
3	13.37			

ALL PARAMETERS ARE FREE

CURRENT: 13.00 AMPS EM-37 COIL AREA: 100.00 sq m.
 FREQUENCY: 30.00 Hz GAIN: 6 RAMP TIME: 200.00 muSEC

No.	TIME (ms)	emf (nV/m sqrd) DATA	SYNTHETIC	DIFFERENCE (percent)
1	0.351	-705.1	767.7	8.87
2	0.438	-446.6	452.7	1.35
3	0.558	-274.2	261.2	-4.75
4	0.702	-173.8	163.1	-6.13
5	0.858	-121.2	115.2	-4.95
6	1.06	-85.21	83.03	-2.55
7	1.37	-59.17	59.59	0.724
8	1.74	-42.65	43.98	3.12
9	2.17	-31.39	33.43	6.48
10	2.77	-22.69	24.30	7.07
11	3.50	-17.12	17.64	3.04
12	4.37	-12.84	12.77	-0.482
13	5.56	-9.31	8.78	-5.69
14	7.03	-6.31	5.93	-6.07

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PARAMETER RESOLUTION MATRIX:
"F" INDICATES FIXED PARAMETER

P 1	0.07					
P 2	0.14	0.96				
P 3	0.02	-0.05	0.72			
T 1	-0.01	-0.09	-0.05	0.03		
T 2	0.00	0.00	0.00	0.04	1.00	
	P 1	P 2	P 3	T 1	T 2	

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