Previous

APPENDIX G

AQUIFER TESTING PROGRAM

1.0 INTRODUCTION

There are several acceptable methods for determining aquifer hydraulic properties. Determination of the hydraulic properties of an aquifer is commonly referred to as evaluating the "mechanics" of the aquifer. Developing an understanding of the aquifer mechanics is an important component of the site characterization. These data provide a means of quantifying aquifer properties, and therefore may be used subsequently for evaluation of the environmental fate and transport mechanisms for potential contaminants of concern. The three most common aquifer testing methods are:

- slug testing
- step-drawdown testing
- pumping tests

These methods are considered "in-situ" methods as each method involves determining the hydraulic characteristics of the aquifer by applying a "stress" to the aquifer and recording the response to that stress through time. Because the methods involve testing a relatively representative portion of the aquifer, they are generally considered more accurate than "ex-situ" (laboratory) soil permeability testing.

The hydraulic properties of interest include:

- Hydraulic conductivity - this property is a constant of proportionality that describes fluid flow through a porous media. Hydraulic conductivity ("K" by convention) is a function of the permeability of the media and of the physical properties of the fluid. In a groundwater setting, the physical properties of the water are considered relatively constant, and therefore hydraulic conductivity can be considered a function of the porous media. For this reason, the terms permeability and hydraulic conductivity are commonly used interchangably for groundwater settings. It is important to note that hydraulic conductivity varies over 13 orders of magnitude for earth materials. For this reason, order-of-magnitude approximations are generally considered appropriate for evaluation of aquifer mechanics.

  The Darcy flow velocity of groundwater is directly proportional to the hydraulic conductivity of the aquifer and of the hydraulic gradient. Quantification of the hydraulic conductivity is therefore significant in terms of evaluating solute transport mechanisms associated with advection.

- Transmissivity - this term ("T" by convention) is simply the product of the hydraulic conductivity and the aquifer thickness ("b" by convention). Transmissivity typically varies

significantly due to spatial variations in both the thickness and conductivity of the aquifer.

In this study, the curve-matching Cooper et al. method was used to calculate a transmissivity value. To obtain a hydraulic conductivity value, the following equation is used:

$$K = T/b$$

Where:

T = transmissivity
K = hydraulic conductivity
b = aquifer thickness.

- Storativity - this term represents the volume of water that an aquifer can release from storage per unit of aquifer storage area to a unit change in head ("S" by convention). Typically used for confined aquifer settings.

The three aquifer testing methods, slug testing, step-drawdown testing, and pumping tests have different applications and limitations. In general, step-drawdown tests and pumping tests are most feasible for relatively high transmissivity zones, such as sand and gravel aquifers. In these types of aquifers, the pumping test is the most accurate means of evaluating aquifer mechanics. With transmissive zones, groundwater can be removed at a rate that will stress the aquifer, and therefore water level changes will be noted in observation wells. Pumping tests are less effective for lower transmissivity zones because of difficulties in removing sufficient groundwater to stress the aquifer and measure a response in observation wells without dewatering the pumping well. These tests are typically infeasible or impractical for low yield aquifers. For low to moderately transmissive zones, a more viable aquifer test method is slug testing, described below.

2.0 SLUG TESTING

The slug withdrawal test requires the removal of a known volume from a well. A slug withdrawal test is commonly referred to as a "rising head" test. Water levels are monitored during recovery, and the rate at which a well recovers is a function of the hydraulic properties of the water-bearing stratum and of the well itself.

Because of the relatively small stress applied to the water-bearing zone, slug tests are best suited for low to moderately conductive aquifers. Slug tests are representative of the aquifer material in the area relatively close to the well. However, the tests provide a cost-effective means of determining "point" transmissivities over a large area such as the NAS Alameda facility.

3.0 SLUG TESTING METHODS

Rising head slug tests were conducted in 70 monitoring wells at the NAS Alameda facility to evaluate in-situ permeabilities of the first and second water-bearing zones. There are 40 "A" and 14 "E" wells in the unconfined first water-bearing zone and 10 "B" and six "C" wells in the confined second water-bearing zone. These wells partially penetrate each of the zones.

This slug test data were analyzed using the methods of Bouwer and Rice for unconfined aquifers and Cooper et al. for confined aquifers. The commercially available software program "AQTESOLV" was used for data reduction.

The rising head field data, result output, and graphs are included in this Appendix and hydraulic conductivity values are summarized in Table G-1. Field procedures to obtain slug test data from the monitoring wells on the NAS Alameda facility are discussed in Appendix C of this report.

4.0 UNCONFINED SLUG TEST METHODOLOGY

The Bouwer and Rice equation was used for the unconfined aquifer slug tests. Monitoring wells whose screen intervals straddle the water table require a well borehole radius adjustment to compensate for water storage in the filter pack (Bouwer, 1989; Kruseman & deRidder, 1990; Schafer, 1992). The Bouwer and Rice article and Bouwer's update article are attached for reference. The equation used to adjust for the borehole radius is:

$$r_{w\,adj} = [(1-n)r_c^2 + nr_w^2]^{1\backslash 2}$$

where:

n	=	porosity
r_c	=	radius of well casing
r_w	=	radius of well (including filter pack)
$r_{w\,adj}$	=	adjusted radius of well (including filter pack)

A porosity of 0.3 was used in this study and is within the range for sands and silts (Freeze & Cherry, 1979).

For evaluation of slug tests in unconfined aquifers, the following conditions and assumptions are applied (Bouwer & Rice, 1976; Kruseman & deRidder, 1990):

- The aquifer is unconfined and has an apparent infinite areal extent;
- The aquifer if homogeneous, isotropic, and of uniform thickness over the area influenced by the slug test;
- Prior to the test, the water table is (nearly) horizontal over the area that will be influenced by the test;
- The head in the well is lowered instantaneously at $t_o = 0$; the drawdown in the water table around the well is negligible; there is no flow above the water table;
- The inertia of the water column in the well and the linear and non-linear well losses are negligible;
- The well either partially or fully penetrates the saturated thickness of the aquifer;
- The well diameter is finite; hence storage in the well cannot be neglected;
- The flow to the well is in a steady state.

Data are plotted on a time versus drawdown graph. The x- and y- axis intersections from a late time, flat slope line are used to calculate the hydraulic conductivity (K) value in wells which the screen or open intervals are fully submerged (Figure G-1). However, in wells which the screen or open interval straddle the water-table, a double flat slope line effect is typically observed (Figure G-2). The first steep slope (early time) line shows the filter pack or developed zone drainage. The second flat slope (late time) line is representative of flow from the undisturbed saturated screened aquifer zone (Bouwer, 1989; Schafer, 1992). The second slope line is used to calculate the K value.

The knowns and constants listed in the result output, as shown on Figure G-3, correspond to the Bouwer and Rice equation. Field data were measured in feet and minutes. Results, listed under the type curve data, are in SI units of centimeters per second. The y_o on the result output refers to the drawdown value where the slope line intersects the y axis.

5.0 CONFINED SLUG TEST METHODOLOGY

Slug tests for monitoring wells screened within the confined zones were analyzed using the curve-matching methods of Cooper et al. The Cooper et al. article is attached for reference.

For evaluation of slug tests within the confined zone, the following conditions and assumptions are applied (Cooper et al., 1967; Kruseman and deRidder, 1990):

- The aquifer is confined and has an apparently infinite areal extent;
- The aquifer is homogeneous, isotropic, and of uniform thickness over the area influenced by the slug test;
- Prior to the test, the piezometric surface is (nearly) horizontal over the area that will be influenced by the test;
- The head in the well is changed instantaneously at time to = 0;
- The rate of flow to the well is in an unsteady state;
- The rate at which the water flows from the aquifer into the well is equal to the rate at which the volume of water stored in the well changes as the head in the well rises;
- The inertia of the water column in the well and the non-linear well losses are negligible;
- The well diameter is finite; hence storage in the well cannot be neglected;
- The well penetrates the entire aquifer.

Complications resulting from partial penetration are not considered significant due to the slug testing method exerting relatively small stresses on the confined aquifer and the hydrogeologic setting that predicts predominantly horizontal groundwater flow for the confined aquifer.

A change in head versus time data was plotted on a semi-log graph (Figure G-4). The result output lists the knowns and constants as shown on Figure G-5. The transmissivity (T) value obtained from the curve-matching was used to calculate the hydraulic conductivity (K) value (see equation in Introduction). Field data were measured in feet and minutes. However, results are presented in SI units of centimeters per second. The S value on the result output refers to storativity.

6.0 DISCUSSION

Hydraulic conductivities determined from the aquifer testing program ranged from 5.5E-02 cm/s to 2.5E-05 cm/s. The range of hydraulic conductivity values is consistent with the conceptual hydrogeologic model for the site that indicates heterogenous soils within the first and second water-bearing zones. The K values determined from the aquifer testing program were consistent with published conductivity values for similar soils (Freeze & Cherry, 1979). However, several limitations of all slug testing methods are noted. These limitations include:

- Slug tests only provide aquifer characteristics over a relatively small area of investigation.

Uncertainty between data points (wells) may be significant in heterogeneous hydrogeologic setting.

- Aquifer storage coefficients for unconfined aquifers cannot be determined using slug tests. Storativity values determined for confined aquifers are only approximate values and should not be used for estimating long-term steady state conditions (Cooper et al, 1967).

- Slug tests are incapable of providing data required to evaluate the pumping characteristics of the well, and therefore cannot determine specific capacity or well efficiency. Well efficiency may be compromised by construction details, well development, and borehole skin effects.

TABLE G-1

SUMMARY OF HYDRAULIC CONDUCTIVITIES FROM SLUG TESTS
(Sheet 1 of 2)

Well ID	K (cm/sec)	T (cm^2/sec)	b (cm)	Method	Miscellaneous Comments
M001A	2.2E-03	--	--	B&R	fast recovery
M002A	3.1E-03	--	--	B&R	fast recovery
M003A	2.9E-03	--	--	B&R	fast recovery
M004A	3.0E-04	--	--	B&R	
M005A	3.7E-03	--	--	B&R	fast recovery
M006A	1.7E-03	--	--	B&R	fast recovery
M007A	1.6E-02	--	--	B&R	fast recovery
M008A	1.3E-03	--	--	B&R	
M009A	5.0E-04	--	--	B&R	
M010A	3.5E-03	--	--	B&R	fast recovery
M011A	2.6E-03	--	--	B&R	fast recovery
M012A	4.1E-04	--	--	B&R	
M013A	1.0E-03	--	--	B&R	
M014A	5.3E-03	--	--	B&R	fast recovery
M015A	1.1E-02	--	--	B&R	fast recovery
M016A	2.0E-03	--	--	B&R	
M017A	3.1E-03	--	--	B&R	fast recovery
M018A	1.2E-02	--	--	B&R	fast recovery
M019A	4.2E-03	--	--	B&R	fast recovery
M020A	1.1E-03	--	--	B&R	
M021A	9.3E-04	--	--	B&R	
M022A	2.2E-03	--	--	B&R	fast recovery
M023A	6.5E-04	--	--	B&R	
M024A	5.3E-04	--	--	B&R	
M025A	1.4E-03	--	--	B&R	
M026A	2.1E-03	--	--	B&R	
M027A	4.2E-03	--	--	B&R	fast recovery
M028A	1.5E-03	--	--	B&R	
M029A	2.6E-03	--	--	B&R	fast recovery
M101A	6.7E-04	--	--	B&R	
M102A	1.1E-03	--	--	B&R	
M103A	3.9E-04	--	--	B&R	
M104A	3.4E-03	--	--	B&R	fast recovery
M105A	1.5E-03	--	--	B&R	
M106A	1.1E-02	--	--	B&R	fast recovery
M107A	1.0E-03	--	--	B&R	
M108A	1.9E-03	--	--	B&R	fast recovery
M109A	5.5E-03	--	--	B&R	fast recovery
M110A	2.5E-03	--	--	B&R	fast recovery
M111A	1.9E-03	--	--	B&R	
M001E	4.0E-04	--	--	B&R	
M002E	2.3E-03	--	--	B&R	
M018E	8.1E-04	--	--	B&R	
M019E	3.9E-03	--	--	B&R	
M020E	1.2E-03	--	--	B&R	
M021E	5.2E-05	--	--	B&R	

TABLE G-1

SUMMARY OF HYDRAULIC CONDUCTIVITIES FROM SLUG TESTS
(Sheet 2 of 2)

Well ID	K (cm/sec)	T (cm^2/sec)	b (cm)	Method	Miscellaneous Comments
M022E	5.5E-02	--	--	B&R	fast recovery
M023E	2.3E-03	--	--	B&R	
M024E	4.6E-03	--	--	B&R	fast recovery
M025E	1.5E-03	--	--	B&R	fast recovery
M026E	1.7E-03	--	--	B&R	fast recovery
M027E	4.4E-04	--	--	B&R	
M028E	2.7E-03	--	--	B&R	
M029E	1.6E-03	--	--	B&R	
M001B	2.7E-03	3.7	1,371.60	Cooper	fast recovery
M010B	5.2E-05	0.038	731.52	Cooper	
M012B	2.3E-03	3.0	1,341.12	Cooper	
M014B	7.6E-04	1.3	1,706.88	Cooper	
M020B	2.8E-04	0.39	1,371.60	Cooper	
M023B	6.1E-04	0.76	1,249.68	Cooper	
M027B	1.9E-03	2.72	1,463.04	Cooper	
M103B	3.4E-05	0.029	847.34	Cooper	
M105B	1.7E-04	0.24	1,447.80	Cooper	
M108B	1.7E-04	0.28	1,676.40	Cooper	
M007C	2.1E-04	0.50	2,380.49	Cooper	
	6.2E-04			B&R	
M013C	3.8E-04	0.85	2,233.57	Cooper	
	1.9E-03			B&R	
M021C	3.9E-04	0.25	640.08	Cooper	
M025C	7.9E-04	0.69	868.68	Cooper	fast recovery
M027C	1.2E-03	1.81	1,463.04	Cooper	fast recovery
M104C	2.5E-05	0.014	563.88	Cooper	

Note: K - Hydraulic conductivity.
T - Transmissivity.
b - Saturated aquifer thickness.
B&R - Bouwer & Rice unconfined slug test method using AQTESOLV 1.1.
Cooper - Cooper et al. confined slug test method using AQTESOLV 1.1.
fast recovery - Well recovery may be too fast to obtain enough data to produce a good hydraulic conductivity (K) estimate.

SLUG TEST DATA INFORMATION SUMMARY SHEET

This information page summarizes and clarifies information found in the following rising head field data, result output, and graphs. The aquifer testing program description at the beginning of this appendix discusses the following information in greater detail.

Rising Head Field Data*	Measurement Units/Comments
Value (Head)	feet (ft)
Elapsed time**	minutes (min)

* This data was converted in the program to SI units of centimeters and seconds.

** Some values are negative numbers as is a result of the datalogger recording procedures. Based upon initial head readings, the appropriate change in head values were calculated.

Result Output - Bouwer and Rice Method	Measurement Units/Comments
Knowns and Constants:	
Radius of well casing	centimeter (cm)
Radius of well (borehole)*	cm
Aquifer saturated thickness	cm
Well screen length	cm
Static height of water in well	cm
$Log(R_e/R_w)$	Program printout error, should be $\ln(R_e/R_w)$
A,B,C	Dimensionless parameter as a function of L_e/R_w for the calculation of $\ln(R_e/R_w)$ (see Bouwer and Rice, 1989). These parameters are calculated by the program.
R_e	Equivalent radius over which head loss occurs
R_w	Radius of well (including gravel pack)

* This value may have an borehole radius adjustment (see Bouwer and Rice, 1989).

Results from Visual Curve Matching:	
K (hydraulic conductivity)	cm/sec
y_0	cm; intersection of the slope on the y axis
Visual match parameter estimates	The program statistics provide an incorrect K estimation.
Type Curve Data	Correct estimated K produced by visual/manual curve matching. The time and drawdown data following the K and y_0 results are residual program statistics information. This information is not immediately relevant to the calculated K value.

Result Output Graph:

Figures G-1 and G-2 discussed in the aquifer testing program description illustrate the appropriate slopes on a time versus drawdown graph.

Result Output - Cooper et al Method	Measurement Units/Comments
Knowns and Constants:	
Pumping rate	defaulted to 1
Radius (distance) to obs. well	cm
Results from Curve Matching:	
Transmissivity (T)*	cm^2/sec
Storativity (S)	value meaningless for slug tests

* The hydraulic conductivity, K, was calculated using the following equation: $K = T/b$ where b is the saturated aquifer thickness.

Result Output Graph:

Figure G-4 in the aquifer testing program description illustrates the curve-matching method. The program allowed for statistical and manual best-fit curve matching.

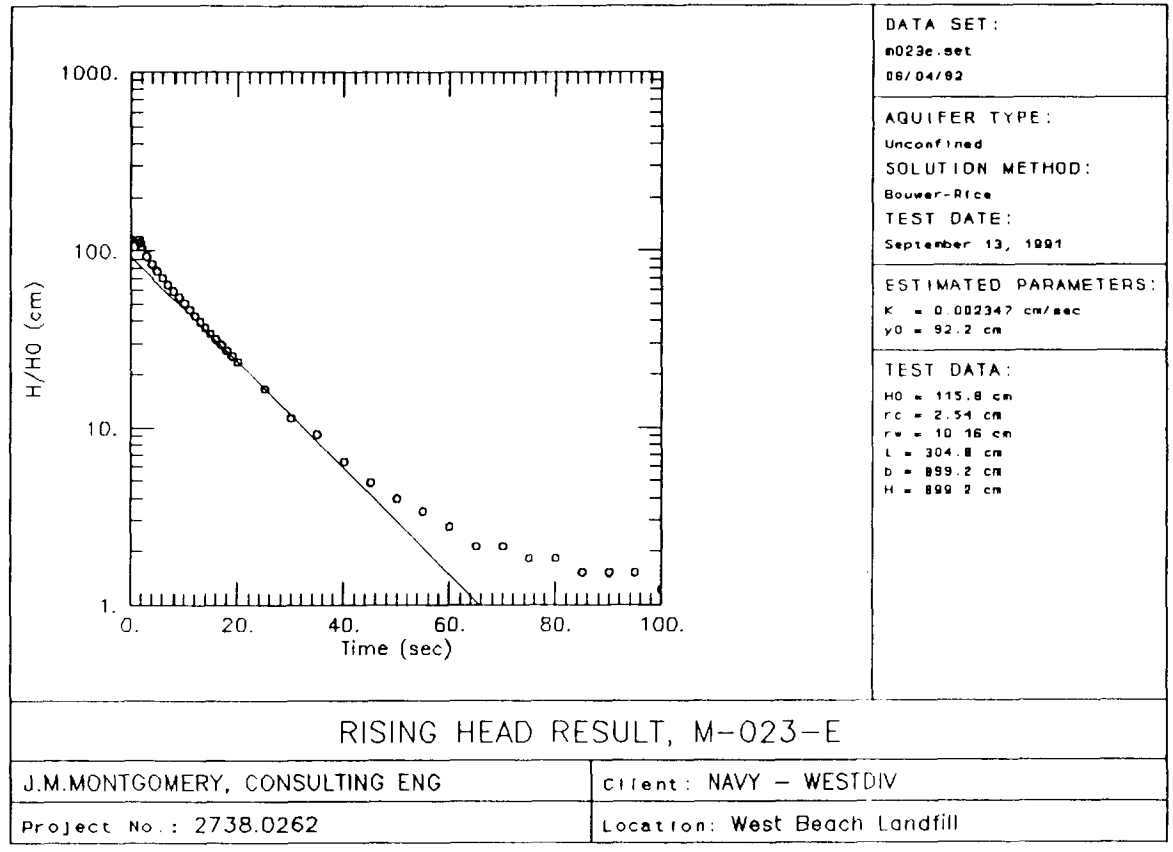

Figure G-1
Example of a typical time versus drawdown graph for unconfined conditions.

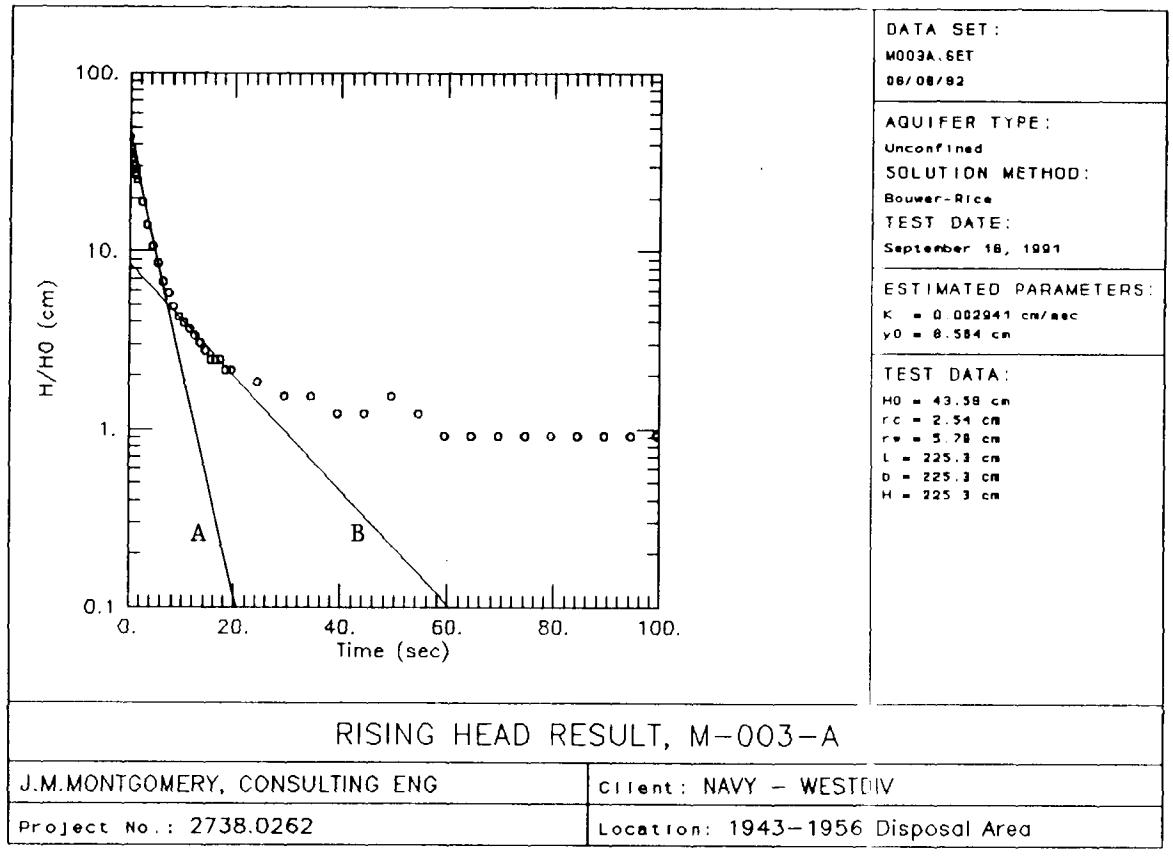

Figure G-2
Example of a time versus drawdown graph illustrating a steep slope, A (early time) and a flat slope, B (late time) for unconfined conditions in which the screen or open interval straddles the water table.

<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<>>

A Q T E S O L V   R E S U L T S

Version 1.10

02/24/92 . 15:30:30

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TEST DESCRIPTION

Data set........... m001a.set
Data set title..... RISING HEAD RESULT, M-001-A
Company............ JAMES M. MONTGOMERY
Project............ 2738.0262
Client............. NAVY - WESTDIV
Location........... 1943-1956 Disposal Area
Test date.......... July 26, 1991

Knowns and Constants:
No. of data points.................. 35
Radius of well casing............... 2.54
Radius of well...................... 5.79
Aquifer saturated thickness......... 274.3
Well screen length.................. 274.3
Static height of water in well...... 274.3
Log(Re/Rw).......................... 2.951
A, B, C............................. 0.000, 0.000, 2.549

==

ANALYTICAL METHOD

Bouwer-Rice (Unconfined Aquifer Slug Test)

==

RESULTS FROM VISUAL CURVE MATCHING

VISUAL MATCH PARAMETER ESTIMATES

Estimate
K = 1.8613E-003 (Incorrect hydraulic conductivity
y0 = -1.3253E+100 estimation)

<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<>>

TYPE CURVE DATA

K = 2.21280E-003 cm/sec (Correct estimated hydraulic
y0 = 7.16778E+000 conductivity)

Time	Drawdown	Time	Drawdown	Time	Drawdown
0.000E+000	7.168E+000	8.000E+001	4.361E-002		

Figure G-3
Example of a result output file using the Bouwer and Rice method.

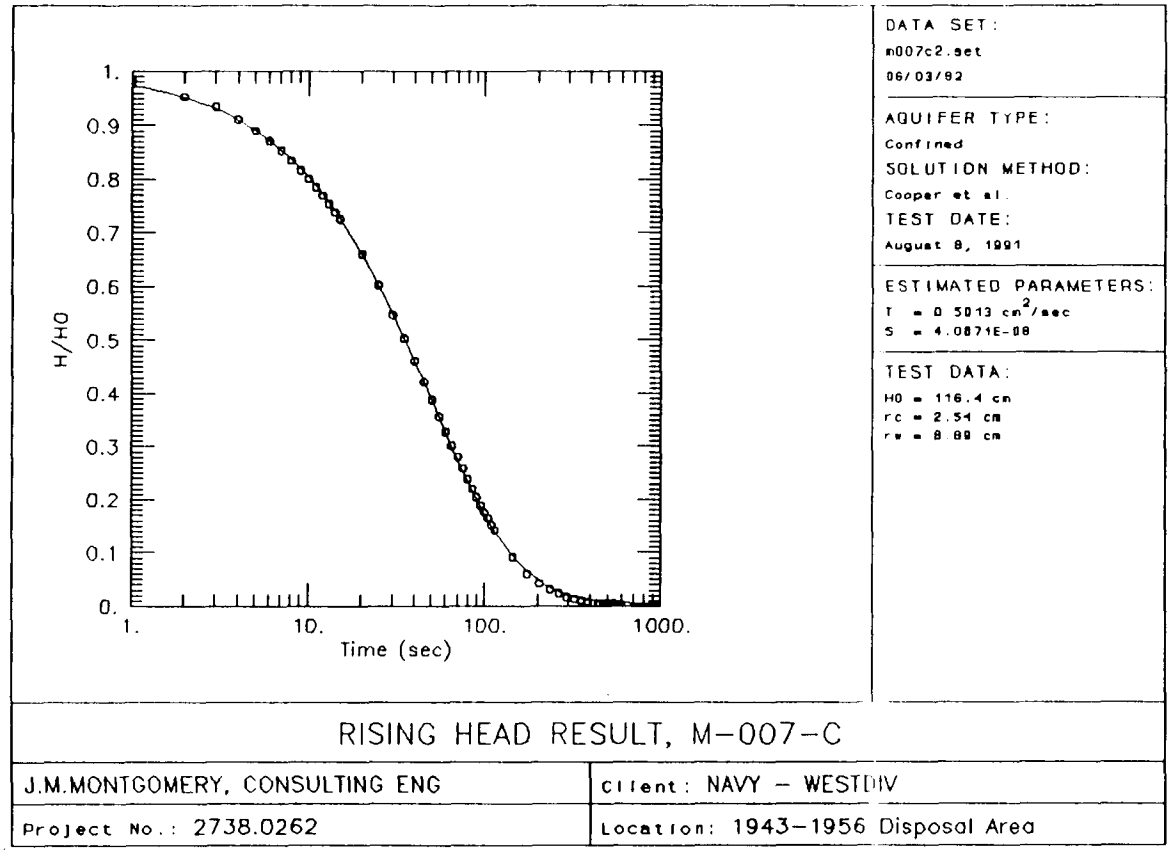

Figure G-4
Example of a change in head versus time semi-log graph using the Cooper et al. curve-matching method.

A Q T E S O L V R E S U L T S
Version 1.10

06/04/92

TEST DESCRIPTION

Data set..... m001b.set
Data set title..... RISING HEAD RESULT, M-001-B
Company..... J.M.MONTGOMERY, CONSULTING ENG
Project..... 2738.0262
Client..... NAVY - WESTDIV
Location..... 1943-1956 Disposal Area
Test date..... July 26, 1991

Knowns and Constants:
No. of data points..... 24
Pumping rate..... 1
Radius (distance) to obs. well..... 2.54

ANALYTICAL METHOD

Cooper et al. (Confined Aquifer Slug Test)

RESULTS FROM CURVE MATCHING

MATCH PARAMETER ESTIMATES

		Estimate	
T	=	3.6670E+000	cm^2/sec
S	=	3.2728E-005	

Figure G-5
Example of a result output file using the Cooper et al. method.

A Slug Test for Determining Hydraulic Conductivity of Unconfined Aquifers With Completely or Partially Penetrating Wells

HERMAN BOUWER AND R. C. RICE

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A procedure is presented for calculating the hydraulic conductivity of an aquifer near a well from the rate of rise of the water level in the well after a certain volume of water is suddenly removed. The calculation is based on the Thiem equation of steady state flow to a well. The effective radius R_e over which the head difference between the equilibrium water table in the aquifer and the water level in the well is dissipated was evaluated with a resistance network analog for a wide range of system geometries. An empirical equation relating R_e to the geometry of the well and aquifer was derived. The technique is applicable to completely or partially penetrating wells in unconfined aquifers. It can also be used for confined aquifers that receive water from the upper confining layer. The method's results are compatible with those obtained by other techniques for overlapping geometries.

With the slug test the hydraulic conductivity or transmissibility of an aquifer is determined from the rate of rise of the water level in a well after a certain volume or 'slug' of water is suddenly removed from the well. The slug test is simpler and quicker than the Theis pumping test because observation wells and pumping the well are not needed. With the slug test the portion of the aquifer 'sampled' for hydraulic conductivity is smaller than that for the pumping test even though with the latter, most of the head loss also occurs within a relatively small distance of the pumped well and the resulting transmissibility primarily reflects the aquifer conditions near the pumped well.

Essentially instantaneous lowering of the water level in a well can be achieved by quickly removing water with a bailer or by partially or completely submerging an object in the water, letting the water level reach equilibrium, and then quickly removing the object. If the aquifer is very permeable, the water level in the well may rise very rapidly. Such rapid rises can be measured with sensitive pressure transducers and fast-response strip chart recorders or x-y plotters. Also it may be possible to isolate portions of the perforated or screened section of the well with special packers for the slug test. This not only reduces the inflow and hence the rate of rise of the water level in the well, but it also makes it possible to determine the vertical distribution of the hydraulic conductivity. Special packer techniques may have to be developed to obtain a good seal, especially for rough casings or perforations. Effective sealing may be achieved with relatively long sections of inflatable stoppers or tubing. The use of long sections of these materials would also reduce leakage flow from the rest of the well to the isolated section between packers. This flow can occur through gravel envelopes or other permeable zones surrounding the casing. Sections of inflatable tubing may have to be long enough to block off the entire part of the well not used for the slug test. High inflation pressures should be used to minimize volume changes in the tubing due to changing water pressures in the isolated section when the head is lowered.

So far, solutions for the slug test have been developed only for completely penetrating wells in confined aquifers. *Cooper et al.* [1967] derived an equation for the rise or fall of the water level in a well after sudden lowering or raising, respectively. Their equation was based on nonsteady flow to a pumped, completely penetrating well, and the solution was expressed as a series of 'type curves' against which observed rates of water level rises were matched. Values for the transmissibility and storage coefficient were then evaluated from the curve parameter and horizontal-scale position of the type curve showing the best fit with the experimental data. *Skibitzke* [1958] developed an equation for calculating transmissibility from the recovery of the water level in a well that was repeatedly bailed. The technique is limited to wells in confined aquifers with sufficiently shallow water levels to permit short time intervals between bailing cycles [*Lohman*, 1972].

To use the slug test for partially penetrating or partially perforated wells in confined or unconfined aquifers, some solutions developed for the auger hole and piezometer techniques to measure soil hydraulic conductivity [*Bouwer and Jackson*, 1974] may be employed. However, the geometry of most groundwater wells is outside the range in geometry covered by the existing equations or tables for the auger hole or piezometer methods. For this reason, theory and equations are presented in this paper for slug tests on partially or completely penetrating wells in unconfined aquifers for a wide range of geometry conditions. The wells may be partially or completely perforated, screened, or otherwise open along their periphery. While the solutions are developed for unconfined aquifers, they may also be used for slug tests on wells in confined aquifers if water enters the aquifer from the upper confining layer through compression or leakage.

THEORY

Geometry and symbols of a well in an unconfined aquifer are shown in Figure 1. For the slug test the water level in the well is suddenly lowered, and the rate of rise of the water level is measured. The flow into the well at a particular value of y can be calculated by modifying the Thiem equation to

$$Q = 2\pi KL \frac{y}{\ln (R_e/r_w)} \qquad (1)$$

where Q is the flow into the well (length³/time), K is the hydraulic conductivity of the aquifer (length/time), L is the height of the portion of well through which water enters (height of screen or perforated zone or of uncased portion of well), y is the vertical distance between water level in well and equilibrium water table in aquifer, R_e is the effective radius over which y is dissipated, and r_w is the horizontal distance

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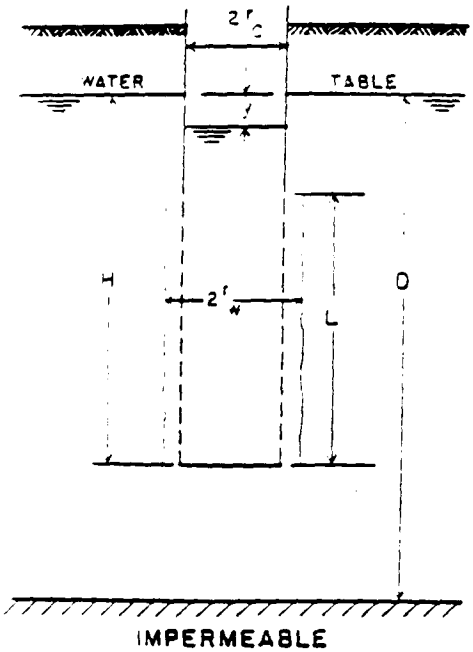

Fig. 1. Geometry and symbols of a partially penetrating, partially perforated well in unconfined aquifer with gravel pack or developed zone around perforated section.

from well center to original aquifer (well radius or radius of casing plus thickness of gravel envelope or developed zone).

The terms L, y, R_e, and r_w are all expressed in units of length. The effective radius R_e is the equivalent radial distance over which the head loss y is dissipated in the flow system. The value of R_e depends on the geometry of the flow system, and it was determined for different values of H, L, D, and r_w (Figure 1) with a resistance network analog, as will be discussed in the next section. Equation (1) is based on the assumptions that (1) drawdown of the water table around the well is negligible, (2) flow above the water table (in the capillary fringe) can be ignored, (3) head losses as water enters the well (well losses) are negligible, and (4) the aquifer is homogeneous and isotropic. These are the usual assumptions in the development of equations for pumped hole techniques [*Bouwer and Jackson*, 1974, and references therein].

The value of r_w in (1) represents the radial distance between the undisturbed aquifer and the well center. Thus r_w should include gravel envelopes or 'developed' zones if they are much more permeable than the aquifer itself (Figure 1).

The rate of rise, dy/dt, of the water level in the well after suddenly removing a slug of water can be related to the inflow Q by the equation

$$dy/dt = -Q/\pi r_c^2 \tag{2}$$

where πr_c^2 is the cross-sectional area of the well where the water level is rising. The minus sign in (2) is introduced because y decreases as t increases.

The term r_c is the inside radius of the casing if the water level is above the perforated or otherwise open portion of the well. If the water level is rising in the perforated section of the well, allowance should be made for the porosity outside the well casing if the hydraulic conductivity of the gravel envelope or developed zone is much higher than that of the aquifer. In that case the (open) porosity in the permeable zone must be included in the cross-sectional area of the well. For example, if the radius of the perforated casing is 20 cm and the casing is surrounded by a 10-cm permeable gravel envelope with a porosity of 30%, r_c should be taken as $[20^2 + 0.30(30^2 - 20^2)]^{1/2} = 23.5$ cm to obtain the cross-sectional area of the well that relates Q to dy/dt. The value of r_c for this well section is 30 cm.

Combining (1) and (2) yields

$$\frac{1}{y}\,dy = -\frac{2KL}{r_c^2 \ln (R_e/r_w)}\,dt \tag{3}$$

which can be integrated to

$$\ln y = -\frac{2KLt}{r_c^2 \ln (R_e/r_w)} + \text{constant} \tag{4}$$

Applying this equation between limits y_0 at $t = 0$ and y_t at t and solving for K yield

$$K = \frac{r_c^2 \ln (R_e/r_w)}{2L}\,\frac{1}{t}\,\ln \frac{y_0}{y_t} \tag{5}$$

This equation enables K to be calculated from the rise of the water level in the well after suddenly removing a slug of water from the well. Since K, r_c, r_w, R_e, and L in (5) are constants, $(1/t)\ln y_0/y_t$ must also be constant. Thus field data should yield a straight line when they are plotted as $\ln y_t$ versus t. The term $(1/t)\ln y_0/y_t$ in (5) is then obtained from the best-fitting straight line in a plot of $\ln y$ versus t (see the example). The value of $\ln R_e/r_w$ is dependent on H, D, L, and r_w and can be evaluated from the analog results presented in the next section. The transmissibility T of the aquifer is calculated by multiplying (5) by the thickness D of the aquifer or

$$T = \frac{Dr_c^2 \ln (R_e/r_w)}{2L}\,\frac{1}{t}\,\ln \frac{y_0}{y_t} \tag{6}$$

This equation is based on the assumption that the aquifer is uniform with depth.

Equations (5) and (6) are dimensionally correct. Thus K and T are expressed in the same units as the length and time parameters in the equations.

EVALUATION OF R_e

Values of R_e, expressed as $\ln R_e/r_w$, were determined with an electrical resistance network analog for different values of r_w, L, H, and D (Figure 1), using the same assumptions as those for (1). An axisymmetric sector of 1 rad was simulated by a network of electrical resistors. The vertical distance between the nodes was constant, but the radial distance between nodes increased with increasing distance from the center line (Figure 2). This yielded a network with the highest node density near the well, where the head loss was greatest, and a decreasing node density toward the outer reaches of the system. For a more detailed discussion of graded networks for representing axisymmetric flow systems, see *Liebmann* [1950] and *Bouwer* [1960].

The radial extent of the medium represented on the analog was more than 60,000 times the largest r_w value used in the analyses. Thus the radial extent of the analog system was essentially infinite, as evidenced by the fact that a reduction in radial extent by several nodes did not have a measurable effect on the observed value of R_e.

The value of R_e for an infinitely deep aquifer ($D = \infty$) was determined by simulating an impermeable and then an infinitely permeable layer at a certain value of D. If this value of D is taken to be sufficiently large, the flow in the system when the layer at D is taken as being impermeable is only slightly

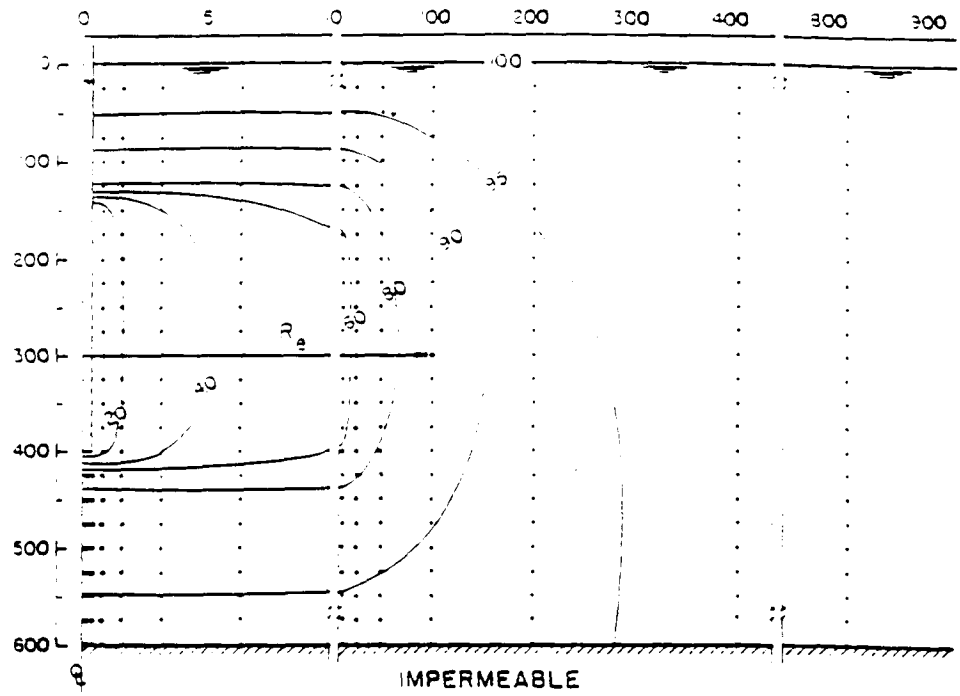

Fig. 2. Node arrangement (dots) for resistance network analog and potential distribution (indicated as percentages on equipotentials) for system with $L/r_w = 625$, $H/r_w = 1000$, and $D/r_w = 1500$. The numbers on the left and at the top of the figure are arbitrary length units (note breaks in horizontal scale).

less than the flow when the layer is taken as being infinitely permeable. The average of the two flows can then be taken as a good estimate of the flow that would occur if the aquifer were represented on the analog as being uniform to infinite depth [*Bouwer*, 1967]. This average flow was used to calculate R_e for $D = \infty$.

The analog analyses were performed by simulating a system with certain values of r_w, H, and D. The electrical current entering the 'well' was then measured for different values of L, ranging from near H to near 0. This was repeated for other values of r_w, H, and D. The condition where $L = H$ could not be simulated on the analog because it would mean a short between the water table as the source and the well as the sink. The electrical current flow in the analog was converted to volume per day, and $\ln R_e/r_w$ was evaluated with (1) for each combination of r_w, H, L, and D used in the analog.

For a given geometry described by r_w, H, and D, the current flow Q_l into the simulated well varied essentially linearly with L and could be described by the equation

$$Q_l = mL + n \tag{7}$$

Because of the linearity between Q_l and L the results of the analyses could be extrapolated to the condition $L = H$. The values of m in (7) appeared to vary inversely with $\ln H/r_w$. The values of n varied approximately linearly with $\ln [(D - H)/r_w]$, the slope A and intercept B in these relations being a function of L/r_w. This enabled the derivation of the following empirical equation relating $\ln R_e/r_w$ to the geometry of the system:

$$\ln \frac{R_e}{r_w} = \left[\frac{1.1}{\ln (H/r_w)} + \frac{A + B \ln [(D - H)/r_w]}{L/r_w}\right]^{-1} \tag{8}$$

In this equation, A and B are dimensionless coefficients that are functions of L/r_w, as shown in Figure 3. If $D >> H$, an increase in D has no measurable effect on $\ln R_e/r_w$. The analog results indicated that the effective upper limit of $\ln [(D - H)/r_w]$ is 6. Thus if D is considered infinity or $(D - H)/r_w$ is so large that $\ln [(D - H)/r_w]$ is greater than 6, a value of 6 should still be used for the term $\ln [(D - H)/r_w]$ in (8).

If $D = H$, the term $\ln [(D - H)/r_w]$ in (8) cannot be used. The analog results indicated that for this condition, which is the case of a fully penetrating well, (8) should be modified to

$$\ln R_e/r_w = \left(\frac{1.1}{\ln (H/r_w)} + \frac{C}{L/r_w}\right)^{-1} \tag{9}$$

where C is a dimensionless parameter that is a function of L/r_w as shown in Figure 3.

Equations (8) and (9) yield values of $\ln R_e/r_w$ that are within 10% of the actual value as evaluated by analog if $L > 0.4H$ and within 25% if $L << H$ (for example, $L = 0.1H$).

The analog analyses were performed for wells that were closed at the bottom. Occasionally, however, wells with open bottoms were also simulated. The flow through the bottom appeared to be negligible for all values of r_w and L used in the analyses. If L is not much greater than r_w (for example, $L/r_w << 4$), the system geometry approaches that of a piezometer cavity [*Bouwer and Jackson*, 1974], in which case the bottom flow can be significant. Equations (8) and (9) can also be used to evaluate $\ln R_e/r_w$ if a portion of the perforated or otherwise open part of the well is isolated with packers for the slug test.

Equipotentials for the flow system around a partially penetrating, partially perforated well in an unconfined aquifer after lowering the water level in the well are shown in Figure 2. The numbers along the symmetry axis and the water table represent arbitrary length units. The numbers on the equipotentials indicate the potential as a percentage of the total head difference between the water table (100%) and the open portion of the well (0%) shown as a dashed line.

The value of R_e for the case in Figure 2 is 96.7 length units. As shown in the figure, this corresponds approximately to the

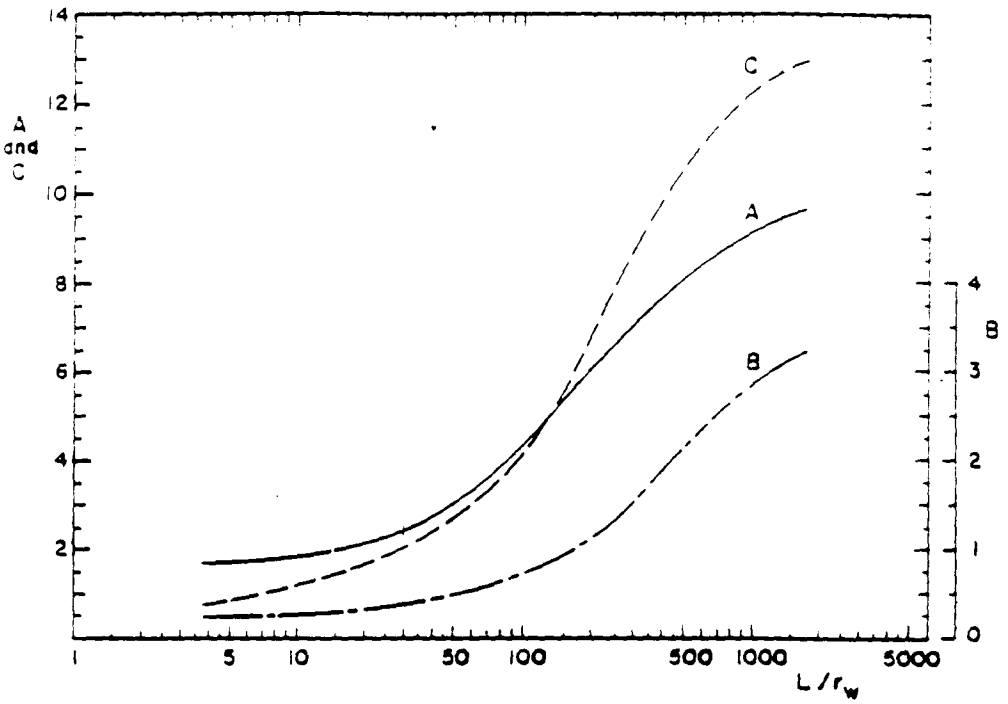

Fig. 3. Curves relating coefficients A, B, and C to L/r_w.

85% equipotential when R_e is laterally extended from the center of the open portion of the well. Thus most of the head loss in the flow system occurs in a cylinder with radius R_e, which is indicative of the horizontal extent of the portion of the aquifer sampled for K or T. The vertical extent is somewhat greater than L, as indicated by, for example, the 80% equipotential in Figure 2.

To estimate the rate of rise of the water level in a well after it is suddenly lowered, (5) can be written as

$$t = \frac{r_c^2}{2KL} \ln \frac{R_e}{r_w} \ln \frac{y_0}{y_t} \tag{10}$$

By taking $y_t = 0.9y_0$, (10) reduces to

$$t_{90\%} = 0.0527 \frac{r_c^2}{KL} \ln \frac{R_e}{r_w} \tag{11}$$

where $t_{90\%}$ is the time that it takes for the water level to rise 90% of the distance to the equilibrium level. By assuming a permeable aquifer with $K = 30$ m/day, a well with $r_c = 0.2$ m and $L = 10$ m, and $\ln (R_e/r_w) = 3$, (11) yields $t_{90\%} = 1.82$ s. Thus if y_0 is taken as 30 cm, it takes 1.8 s for the water level to rise 27 cm, another 1.8 s for the next 2.7 cm (90% of the remaining 3 cm), and another 1.8 s for the next 0.27 cm, or a total of 5.4 s for a rise of 29.97 cm. Measurement of this fast rise requires a sensitive and accurate transducer and a fast-response recorder. The rate of rise can be reduced by allowing groundwater to enter through only a portion of the open section of the well, as can be accomplished with packers.

For a moderately permeable aquifer with, for example, $K = 1$ m/day, a well with $r_c = 0.1$ m and $L = 20$ m, and $\ln (R_e/r_w) = 5$, (11) yields $t = 11.4$ s. In this case, it would take the water level 22.8 s to rise from 30 cm to 0.3 cm below static level.

EXAMPLE

A slug test was performed on a cased well in the alluvial deposits of the Salt River bed west of Phoenix, Arizona. The well, known as the east well, is located about 20 m east of six rapid infiltration basins for groundwater recharge with sewage effluent [*Bouwer*, 1970]. The static water table was at a depth of 3m, $D = 80$ m, $H = 5.5$ m, $L = 4.56$ m, $r_c = 0.076$ m, and r_w was taken as 0.12 m to allow for development of the aquifer around the perforated portion of the casing. A Statham PM131TC pressure transducer was suspended about 1 m below the static water level in the well (when trade names and company names are included, they are for the convenience of the reader and do not imply preferential endorsement of a particular product or company over others by the U.S. Department of Agriculture). A solid cylinder with a volume equivalent to a 0.32-m change in water level in the well was also placed below the water level. When the water level had returned to equilibrium, the cylinder was quickly removed. The transducer output, recorded on a Sargent millivolt recorder, yielded the y-t relationship shown in Figure 4 with y plotted on a logarithmic scale. The straight-line portion is the valid part of the readings. The actual y_0 value of 0.29 m indicated by the straight line is close to the theoretical value of 0.32 m calculated from the displacement of the submerged cylinder.

Extending the straight line in Figure 4 shows that for the arbitrarily selected t value of 20 s, $y = 0.0025$ m. Thus $(1/t) \ln y_0/y_t = 0.238$ s^{-1}. The value of $L/r_w = 38$, for which Figure 3 yields $A = 2.6$ and $B = 0.42$. Substituting these values into (8) and using the maximum value of 6 for $\ln [(D - H)/r_w]$ (since $\ln [(D - H)/r_w]$ for the well exceeds 6) yield $\ln (R_e/r_w) = 2.37$. Equation (5) then gives $K = 0.00036$ m/s $= 31$ m/day. This value agrees with K values of 10 and 53 m/day obtained previously with the tube method on two nearby observation wells [*Bouwer*, 1970]. These K values were essentially point measurements on the aquifer immediately around the well bottoms, which were at depths of 9.1 and 6.1 m, respectively.

COMPARISONS

Piezometer method. The geometry to which (8) and (9) and the coefficients in Figure 3 apply overlaps the geometry of the

piezometer method at the lower values of L/r_w. With the piezometer method a cavity is augered out in the soil below a piezometer tube. The water level in the tube is abruptly lowered, and K of the soil around the cavity is calculated from the rate of rise of the water level in the tube [*Bouwer and Jackson*, 1974]. The equation for K is

$$K = \frac{\pi r_c^2}{A_V} \frac{1}{t} \ln \frac{y_0}{y_t} \tag{12}$$

where A_V is a geometry factor with dimension of length. Values of A_V were evaluated with an electrolytic tank analog by *Youngs* [1968], whose results were expressed in tabular form as A_V/r_w for different values of L/r_w (ranging between 0 and 8), $(H - L)/r_w$, and $(D - H)/r_w$.

Taking a hypothetical case where $L/r_w = 8$, $H/r_w = 12$, and $D/r_w = 16$, K calculated with (5) is 18% below K calculated with (12). This is more than the 10% error normally expected with (8) and (9) for the L/H value of 0.67 in this case. The larger discrepancy may be due to the difference in methodology, or to the fact that the L/r_w value is close to the lower limit of the range covered on the resistance network analog.

An approximate equation for calculating K with the piezometer method was presented by *Hvorslev* [1951]. The equation, which is based on the assumptions of an ellipsoidal cavity or well screen and infinite vertical extent (upward and downward) of the flow system, contains a term $[1 + (L/2r_w)^2]^{1/2}$. For most well-slug-test geometries, $L/2r_w$ will be sufficiently large to permit replacement of this term by $L/2r_w$. In that case, however, Hvorslev's equation for Q yields $R_e = L$, which is not true. In reality, R_e is considerably less than L. For example, if $L = 40$ m, $r_w = 0.4$ m, $H = 80$ m, and $D = \infty$, (8) shows that $R_e = 11.9$ m, which is much less than the value of 40 m indicated by Hvorslev's equation. However, since the calculation of K is based on $\ln (R_e/r_w)$ as shown by (5), the error in K is less than the error in R_e (i.e., 36 and 236%, respectively, in this case).

If, for the above example, the top of the well screen or cavity had been taken at the same level as the water table ($H = 40$ m), R_e would have been 8.6 m and Hvorslev's equation would have yielded a K value that is 50% higher than K given by (5). The larger error is probably due to Hvorslev's assumption of infinite vertical (upward) extent of the flow system, which is not met when the cavity is immediately below the water table. Using Hvorslev's equation for cavities immediately below a confining layer would increase the error to 73%, but this, of course, is due to the fact that a water table is not a solid boundary. Hvorslev's equation for the confining layer case can be shown to yield $R_e = 2L$.

Auger hole method. The analog analyses for (8) and (9) and Figure 3 were performed for $L < H$, because short circuiting between the water table and the well prevented simulation of the case where $L = H$. If the analog results are extrapolated to $L = H$, however, the geometry of the system in Figure 1 becomes similar to that of the auger hole technique, for which a number of equations and graphs have been developed to calculate K from the rise of the water level in the well [*Bouwer and Jackson*, 1974]. *Boast and Kirkham* [1971], for example, developed the equation

$$K = C_{BK} \frac{\Delta y}{\Delta t} \tag{13}$$

where C_{BK} was determined mathematically and expressed in tabular form for various values of L/r_w, $(D - H)/r_w$, and y_0/H. Since the rate of rise of the water level in the hole after

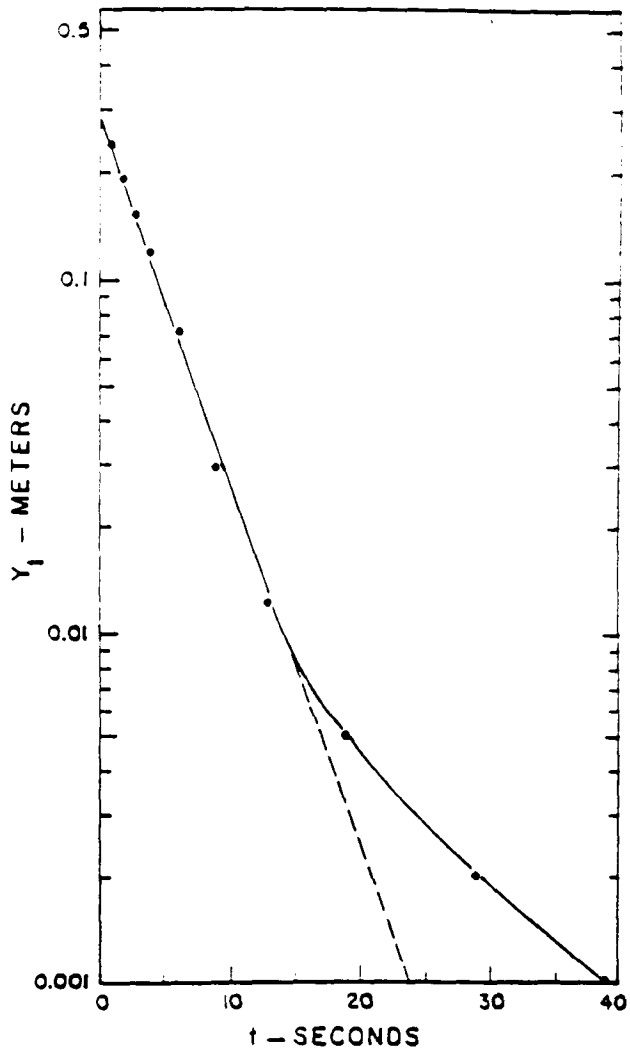

Fig. 4. Plot of y versus t for slug test on east well.

the removal of a slug of water decreases with decreasing y, $\Delta y/\Delta t$ is not a constant and the value of K obtained with this procedure depends on the magnitude of Δy used in the field measurements. The general rule is that Δy should be relatively small.

Taking a hypothetical case where $y_0 = 2.5$ m, $y_t = 2.4$ m, $\Delta t = 10$ s, $L = H = 5$ m, $D = 6$ m, and $r_w = 0.1$ m, (5) yields a K value that is 36% lower than K calculated with (13). However, if y_t is taken as 0.5 m, which should give $\Delta t = 394$ s according to the theory that $(1/t) \ln y_0/y_t$ is constant, the K value yielded by (5) is 26% higher than K obtained with (13). If y_t is taken as 0.9 m, (5) and (13) give identical results.

Slug test on wells in confined aquifers. The confined aquifer for which the slug test by *Cooper et al.* [1967] was developed is an aquifer with an internal water source, for example, recharge through aquitards or compression of confining layers or other material. This situation is similar to that of the unconfined aquifer presented in this paper because the water table is considered horizontal, like the upper boundary of a confined aquifer, and the water table is a plane source. Thus K or T calculated with (5) or (6) should be of the same order as K calculated with the procedure of *Cooper et al.* [1967], which involves plotting the rise of the water level in the well and finding the best fit on a family of type curves. *Cooper et al.* [1967] presented an example of the calculation of T for a well

with $r_c = r_w = 0.076$ m and $L = 98$ m. The resulting value of T was 45.8 m²/day. Values of D and H for this well were not given. However, since the well was 122 m deep and completely penetrating (at least theoretically), D and H must have been between 98 and 122 m. Assuming that both D and H were 100 m, (6) yields $T = 52.8$ m²/day, which is compatible with T obtained by Cooper et al.

CONCLUSIONS

The hydraulic conductivity of an aquifer near a well can be calculated from the rise of the water level in the well after a slug of water is suddenly removed. The calculation is based on the Thiem equation, using an effective radius R_e for the distance over which the head difference between the equilibrium water table in the aquifer and the water level in the well is dissipated. Values of R_e were evaluated by electrical resistance network analog. An empirical equation was then developed to relate R_e to the geometry of the system. This equation is accurate to within 10–25%, depending on how much of the well below the water table is perforated or otherwise open. The technique is applicable to partially or completely penetrating wells in unconfined aquifers. It can also be used to estimate the hydraulic conductivity of confined aquifers that receive water from the upper confining layer through recharge or compression.

The vertical distance between the rising water level in the well and the equilibrium water table in the aquifer must yield a straight line when it is plotted on a logarithmic scale against time. This can be used to check the validity of field measurements and to obtain the best-fitting line for calculating the hydraulic conductivity. Permeable aquifers produce rapidly rising water levels that can be measured with fast-response pressure transducers and strip chart recorders or x-y plotters. The portion of the aquifer sampled for hydraulic conductivity with the slug test is approximately a cylinder with radius R_e and a height somewhat larger than the perforated or otherwise open section of the well.

Hydraulic conductivity values obtained with the proposed slug test are compatible with those yielded by the auger hole and piezometer techniques where the geometries of the systems overlap, and by a slug test for completely penetrating wells in confined aquifers.

REFERENCES

Boast, C. W., and D. Kirkham, Auger hole seepage theory, *Soil Sci. Soc. Amer. Proc.*, *35*(3), 365–374, 1971.

Bouwer, H., A study of final infiltration rates from ring infiltrometers and irrigation furrows with a resistance network analog, in *7th International Congress of Soil Science*, vol. 1, pp. 448–456, International Society of Soil Science, Madison, Wis., 1960.

Bouwer, H., Analyzing subsurface flow systems with electric analogs, *Water Resour. Res.*, *3*(3), 897–907, 1967.

Bouwer, H., Ground water recharge design for renovating waste water, *J. Sanit. Eng. Div. Amer. Soc. Civil Eng.*, *96*(SA1), 59–74, 1970.

Bouwer, H., and R. D. Jackson, Determining soil properties, in *Drainage for Agriculture*, *ASA Monogr. 17*, chap. 23, sect. 10, edited by J. van Schilfgaarde, pp. 611–672, American Society of Agronomy, Madison, Wis., 1974.

Cooper, H. H., Jr., J. D. Bredehoeft, and I. S. Papadopulos, Response of a finite diameter well to an instantaneous charge of water, *Water Resour. Res.*, *3*, 263–269, 1967.

Hvorslev, J. M., Time lag and soil permeability in ground-water observations, *Bull. 36*, 50 pp., U.S. Corps of Eng., Waterways Exp. Sta., Vicksburg, Miss., 1951.

Liebmann, G., Solution of partial differential equations with a resistance network analogue, *Brit. J. Appl. Phys.*, *1*, 92–103, 1950.

Lohman, S. W., Groundwater hydraulics, *U.S. Geol. Surv. Prof. Pap. 708*, 70 pp., 1972.

Skibitzke, H. E., An equation for potential distribution about a well being bailed, open file report, U.S. Geol. Surv., Washington, D. C., 1958.

Youngs, E. G., Shape factors for Kirkham's piezometer method for determining the hydraulic conductivity of soil *in situ* for soils overlying an impermeable floor or infinitely permeable stratum, *Soil Sci.*, *106*(3), 235–237, 1968.

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The Bouwer and Rice Slug Test — An Update[a]

by Herman Bouwer[b]

ABSTRACT

The Bouwer and Rice slug test was developed to measure aquifer hydraulic conductivity around boreholes (production, monitoring, or test wells). The wells can be partially penetrating and partially screened, perforated, or otherwise open. The slug test can be based on quickly withdrawing a volume of water from the well and measuring the subsequent rate of rise of the water level in the well, or by adding a slug of water and measuring the subsequent rate of fall of the water level in the well. While originally developed for unconfined aquifers, the method can also be used for confined or stratified aquifers if the top of the screen or perforated section is some distance below the upper confining layer. Anomalies ("double straight line effect") sometimes observed in the measured rate of rise of the water level in the well are attributed to drainage of a gravel pack or developed zone around the well following lowering of the water level. The effect of this drainage can be eliminated by ignoring the early data points and using the second straight line portion in the data plot for calculation of hydraulic conductivity. The method is applicable to any diameter and depth of the borehole, provided that the dimensions of the system are covered by the ranges for which the geometry factor R_e has been worked out. The smaller the diameter of the hole, however, the more vulnerable the results will be to aquifer heterogeneities and to inaccuracies in estimating effective well diameters. Computer programs for rapid processing of the field data have been developed.

INTRODUCTION

The slug test developed by Bouwer and Rice (1976) permits the measurement of saturated hydraulic conductivity (K) of aquifer materials with a single well. The method consists of quickly lowering or raising the water level in a well or borehole from equilibrium and measuring its subsequent rate of rise or fall, respectively. The method was designed to measure K of the aquifer around the screen or otherwise open portion of the well for fully or partially penetrating wells in unconfined aquifers. Because of its simplicity, the Bouwer and Rice slug test has become a frequently used tool in ground-water investigations. This paper addresses some of the experiences obtained with the method, including the validity of falling level tests, use of the method in confined aquifers, effect of draining gravel packs on the rise of the water level, effect of hole diameter, and computer processing of field data.

METHODOLOGY

Geometry and symbols of a slug-tested well are shown in Figure 1. The rate of flow of ground water into the well when the water level in the well is a distance y lower than the static ground-water table around the well is calculated with the Thiem equation as

$$Q = 2\pi K L_e \frac{y}{\ln(R_e/r_w)} \qquad (1)$$

where Q = volume rate of flow into well; K = hydraulic conductivity of aquifer around well; L_e = length of screened, perforated, or otherwise open section of well; y = vertical difference between water level inside well and static water table outside

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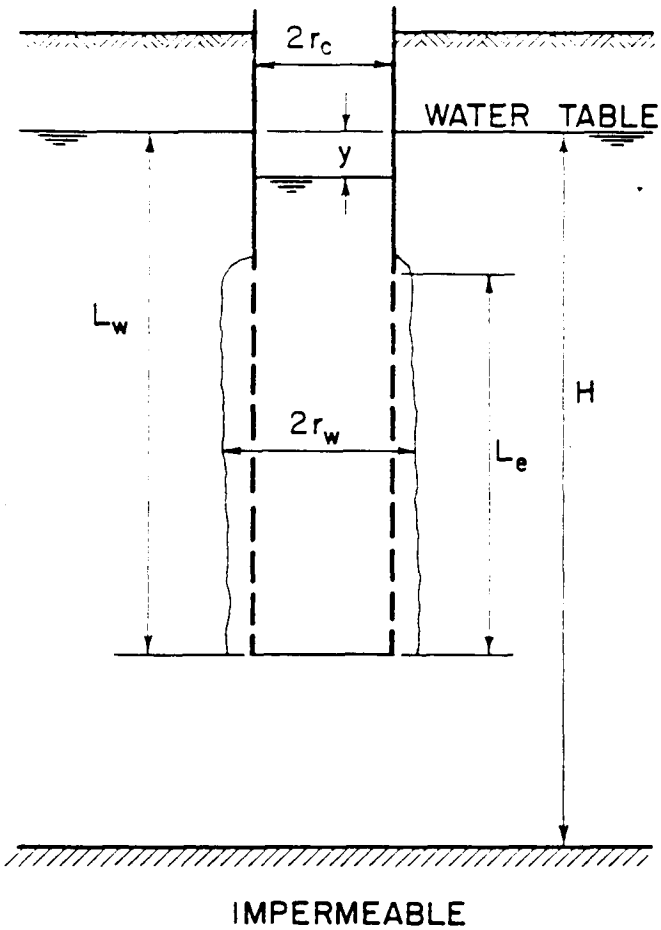

Fig. 1. Geometry and symbols for slug test on partially penetrating, partially screened well in unconfined aquifer with gravel pack and/or developed zone around screen.

well; R_e = effective radial distance over which y is dissipated; and r_w = radial distance of undisturbed portion of aquifer from centerline.

Values of R_e were determined with an electrical resistance network analog for different values of r_w, L_e, L_w, and H (see Figure 1 for meaning of geometry symbols). The value of r_w is the radius of the screened or open section of the well plus the thickness of a sand or gravel pack and/or of the developed zone around the well. Thus, r_w is the radial distance from the center of the well to normal K of the aquifer. Because the thickness of the developed zone is almost never known, the tendency is to ignore it and take only gravel or sand packs into account.

The rate of rise dy/dt of the water level in the well after the water level has been quickly lowered some distance is

$$\frac{dy}{dt} = -\frac{Q}{\pi r_c^2} \qquad (2)$$

where r_c is the radius of the casing or other section of the well where the rise of the water level is measured. If the water level rises in the screened or open section of the well with a gravel pack around it, the thickness and porosity of the gravel envelope should be taken into account when calculating the equivalent value of r_c for the rising water level. This calculation is based on the total free-water surface area in the well and sand or gravel pack, calculated as $\pi r_c^2 + \pi(r_w^2 - r_c^2)n$, where n is the porosity, and $r_w - r_c$ is the thickness of the envelope. The equivalent radius of a circle giving this total area is then calculated as $[(1-n)r_c^2 + nr_w^2]^{1/2}$. For example, if the radius of the screen or perforated casing is 20 cm and there is 8 cm gravel pack with a porosity of 30 percent, r_c should be taken as 25.9 cm, while r_w is 28 cm.

Solving equation (2) for Q, equating the resulting expression to equation (1), integrating, and solving for K yields

$$K = \frac{r_c^2 \ln(R_e/r_w)}{2L_e} \frac{1}{t} \ln \frac{y_0}{y_t} \qquad (3)$$

where y_0 = y at time zero; and y_t = y at time t.

The results of the analog analyses to evaluate R_e for various system geometries were expressed in terms of the dimensionless ratio $\ln(R_e/r_w)$. The data could be fitted into two equations, one for the case where $L_w < H$, and one where $L_w = H$. The resulting equations were, respectively,

$$\ln \frac{R_e}{r_w} = \left[\frac{1.1}{\ln(L_w/r_w)} + \frac{A + B\ln[(H-L_w)/r_w]}{L_e/r_w}\right]^{-1} \qquad (4)$$

and

$$\ln \frac{R_e}{r_w} = \left[\frac{1.1}{\ln(L_w/r_w)} + \frac{C}{L_e/r_w}\right]^{-1} \qquad (5)$$

where A, B, and C are dimensionless numbers plotted in Figure 2 as a function of L_e/r_w.

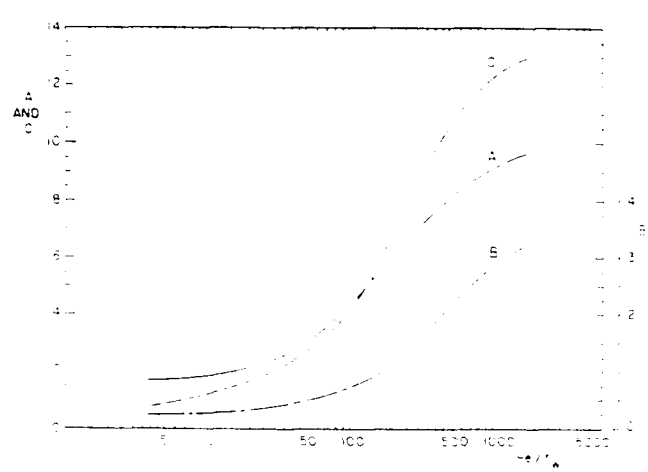

Fig. 2. Dimensionless parameters A, B, and C as a function of L_e/r_w for calculation of $\ln(R_e/r_w)$.

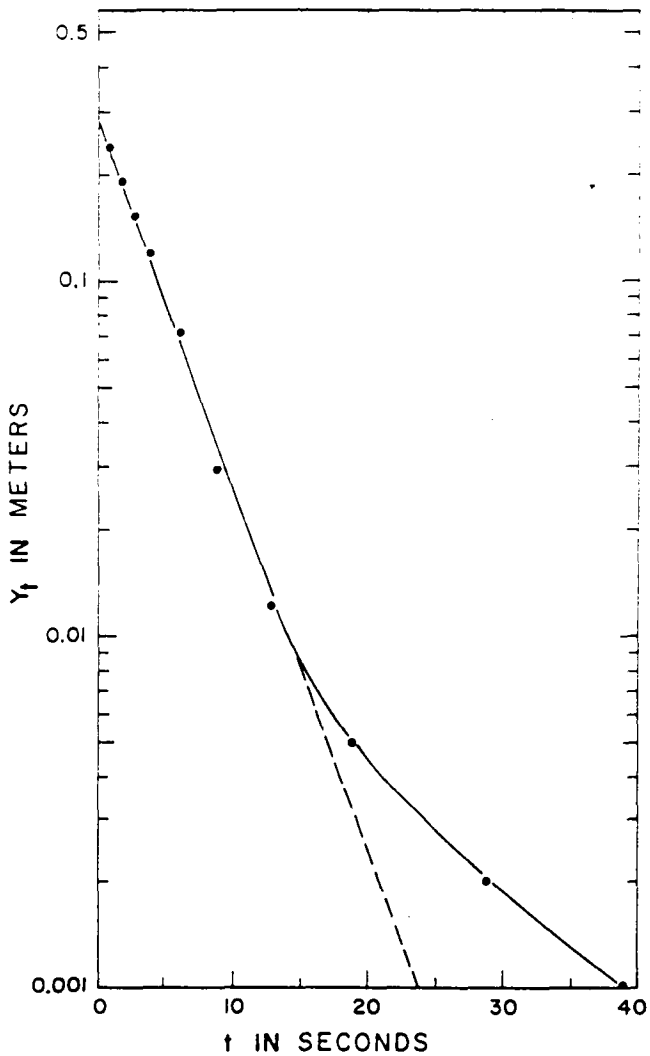

Fig. 3. Graph of log y_t versus t for slug test on well in Salt River Bed, 27th Avenue, Phoenix, Arizona.

Because y and t are the only variables in equation (3), a plot of ln y_t versus t must show a straight line. Thus, instead of calculating K on the basis of two measurements of y and t (y_0 at t = 0 and y_t at t), a number of y and t measurements can be taken and $[\ln(y_0/y_t)]/t$ determined as the slope of the best-fitting line through the y versus t points on semilogarithmic paper (Figure 3). The straight line through the data points can also be used to select two values of y, namely, y_0 and y_t, along with the time interval t between them for substitution into equation (3). Because drawdown of the ground-water table around the well becomes increasingly significant as the test progresses, the points as in Figure 3 begin to deviate from the straight line for large t and small y. Thus, only the straight line portion of the data points should be used to evaluate $[\ln(y_0/y_t)]/t$ for calculation of K with equation (3).

The slug test can be used on production wells, test wells, observation wells, and monitoring wells. Objectives for the measurements include characterization of aquifer hydraulic conductivity for modeling, ground-water recharge studies, and ground-water pollution studies. The method is particularly useful in ground-water contamination studies because the slug test can be carried out on the same wells used for ground-water quality monitoring. Also, combining the resulting values of hydraulic conductivity with the porosity of the aquifer and slopes of the ground-water table or piezometric surface permits the prediction of pore-water velocities and, hence, the rate of movement of pollution plumes and transport of contaminants. The slug test can also be useful in determining vertical distribution of hydraulic conductivities in an aquifer system and other spatial variability of hydraulic conductivity in studies of macrodispersion and movement of contaminants.

Over the years, a number of questions and comments about the slug test have been received. These questions and comments are addressed in the following sections.

DOUBLE STRAIGHT LINE EFFECT

Users of the slug test have observed that when plotting log y_t versus t as in Figure 3, they sometimes get a double straight line as shown schematically in Figure 4. The first part (AB) is straight and steep, whereas the next part (BC) is straight and less steep. Then, at point C, the points begin their expected deviation from the straight line as

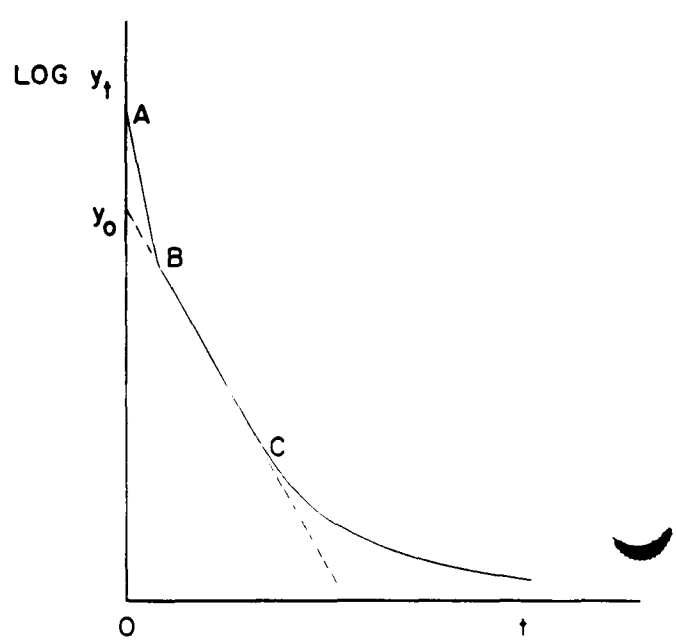

Fig. 4. Schematic of double straight line effect.

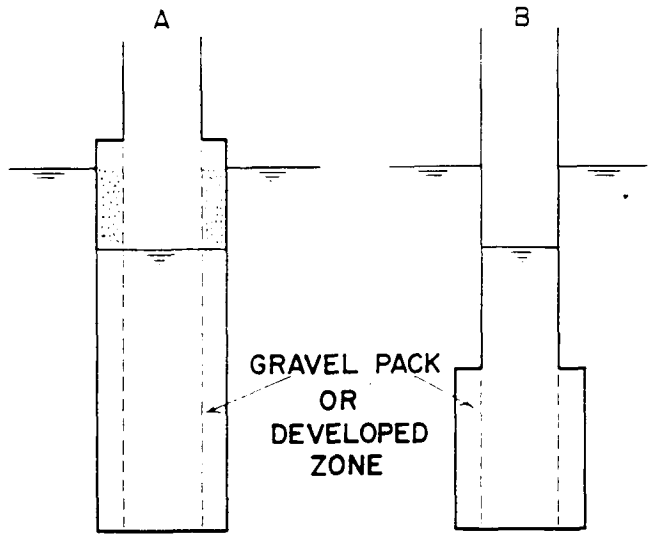

Fig. 5. Slug test for borehole with ground-water level below (A), and above (B) top of screen or perforated section.

the drawdown around the hole becomes significant relative to y_t. The first straight line portion in Figure 4 is probably due to a highly permeable zone around the well (gravel pack or developed zone), which quickly sends water into the well immediately after the water level in the well has been lowered (Figure 5A). Then, when the water level in the permeable zone around the well has drained to the water level in the well itself, the flow into the well slows down and the points begin to form a second, less steep, straight line (BC in Figure 4). This second straight line is more indicative of the flow from the undisturbed aquifer into the well. Hence, segment BC should be used in calculating K of the aquifer with equation (3). In the original 1976 article, gravel envelopes or developed zones were assumed to drain at the same rate as the water level in the borehole when it is lowered for the slug test, i.e., essentially instantaneously. However, some gravel packs or developed zones apparently are not permeable enough to give such instantaneous drainage.

If the ground-water table is above the screened or open section of the borehole, and the water level in the hole is not lowered so far that it drops below the top of the open section (Figure 5B), the gravel envelope or developed zone around the open section cannot drain. The inflow into the hole then is immediately controlled by the aquifer, and the double straight line effect should not occur. If it still occurs, it could indicate leakage around the casing or grouting above the gravel pack.

Where the double straight line is due to a gravel pack around the well, the effective well radius r_w should be taken as the radial distance from the center of the well to the outer surface of the gravel pack. Where the double straight line is due to a naturally developed zone around the well, r_w is harder to evaluate and an "intelligent" estimate must be made. It may also be possible to estimate r_w from the value of y at point B in Figure 4. Considering the volume of water in the well between y_A and y_B in Figure 4 to be due to the drainage of the gravel pack or developed zone, and knowing or estimating the drainable porosity of the gravel pack or developed zone, the radial extent of this zone can be calculated for evaluation of r_w. Capillary fringe effects do not have to be considered, since the capillary fringe was also present in the pack or in the developed zone before the water level was lowered. Because the rising water level in the hole during the slug test will also fill up the drained pore space of the gravel pack or developed zone, the value of r_c in the equation for calculation of K should be adjusted to take this effect into account, as discussed earlier in this article.

Conceivably, a well could have a gravel pack surrounded by a less permeable developed zone before the original aquifer material is reached. This could lead to a triple straight line effect, with an intermediate straight line portion at point B, or a curved transition zone at B if the hydraulic conductivity of the developed zone gradually decreases until K of the original aquifer material is reached. By the same token, portion AB in Figure 4 could also be curved if the hydraulic conductivity of the gravel pack or developed zone immediately around the well decreases with radial distance from the well.

FALLING WATER LEVEL TEST

The slug test was developed for a rising water level in the borehole, as obtained by quick removal of a certain volume or slug of water. This can be achieved by bailing, (quick) pumping, or by immersing a section of pipe filled with sand or other ballast and closed with caps on both ends, or other submersible object, in the borehole, letting the water level in the borehole return to equilibrium, and quickly removing the submerged object. The question is often raised: can the method also be used when a volume of water is quickly added to the hole and the subsequent rate of fall of the water level in the hole is measured for calculation of K? The answer is yes, provided that the equilibrium water level is above the screened or open section of the borehole (Figures 1 and 5B). In this

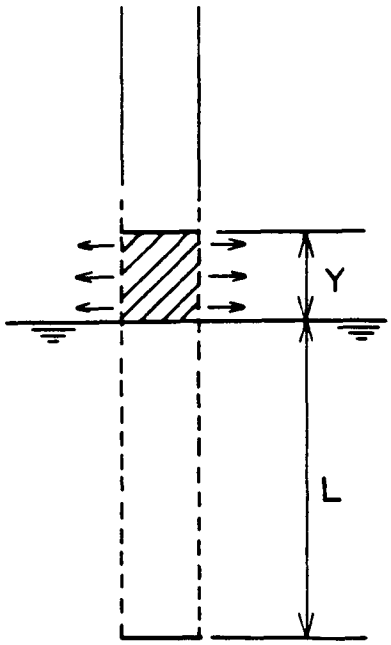

Fig. 6. Schematic of addition of water (hatched section) to borehole with equilibrium water level below top of screen or perforated section, with outflow of water into vadose zone (horizontal arrows).

case, the outflow from the well due to the falling water level occurs only through the screened or open section of the well, and the flow system in the aquifer is a true reverse of the flow system for the rising water level after a slug of water has been removed (ignoring, of course, eventual rises and drawdowns of the ground-water table immediately around the borehole if the aquifer is unconfined). Thus, equations (3), (4), and (5) are also applicable to the addition of a slug of water and measuring the subsequent rate of fall of the water level in the borehole for calculation of K of the aquifer around the hole.

If the equilibrium water level in the borehole is below the top of the screen or open section (Figure 6), and water is added (hatched section in Figure 6), the subsequent flow of water into the aquifer due to the falling water level not only takes place through the screen or perforations below the original water table, but also through the vadose zone above the original water table (arrows in Figure 6). This increases the rate of fall of the water level in the borehole beyond that caused by inflow into the aquifer and leads to an overestimation of K. The greater the ratio of y/L (Figure 6) in this case, the more the slug test will overestimate K if the measurement is based on adding water to the hole and measuring the subsequent rate of fall of the water level.

APPLICATION OF SLUG TEST TO CONFINED AQUIFERS

Theoretically, the slug test (Bouwer and Ri 1976) applies to aquifers where the upper boundary is a plane source (rising water-level test) or sink (falling water-level test), as in an unconfined aquifer. However, because most of the head difference y between the static water table and the water level in the well is dissipated in the vicinity of the well around the screen or perforated section, the method should also be applicable to situations where the upper boundary of the aquifer is an impermeable or semipermeable plane, i.e., an impermeable or semipermeable upper confining layer. Thus the slug test should also give reasonable values for K in confined, semiconfined, or stratified aquifers. Theoretically, the larger the distance between the top of the screened or open section of the well and the upper confining layer (like $L_w - L_e$ in Figure 1), the more accurate the resulting values of K will be. In actuality, however, source boundaries of ground water flowing into the well in response to lowering the water level are hard to define because of elastic deformation of aquifer material and confining and interbedded fine-textured layers, and because of leakage through semiconfining layers.

EFFECT OF WELL DIAMETER

Theoretically, the Bouwer and Rice slug test applies to any diameter of the borehole. Practically, the hole dimensions should be selected so that the geometry parameters are covered by Figure 2. The larger r_w and L_e (Figure 1), the larger the portion of the aquifer on which K is determined. For layered aquifers, smaller values of L_e may sometimes be preferable because they give more resolution and more information about the vertical distribution of K when the slug test is carried out at different depths. Very small hole diameters (for example 2 in. or 5 cm) should still give accurate values for K, but the values apply to only a small region around the well and, hence, are more sensitive to spatial variability. Also, inaccuracies in the estimates of the thickness of gravel envelopes and developed zones have a greater effect on the calculated values of K where r_c is small than where r_c is large.

PROCESSING OF y VERSUS t MEASUREMENTS

To calculate $1/t \ln(y_0/y_t)$ for the appropriate straight line portion of curves as in Figure 3 or 4, two values of y on the straight line and their

corresponding values of t are read from the graph. The natural logarithm of the ratio y_0/y_t is then taken and divided by the difference between the two values of t. For example, Figure 3 shows that at y is 0.28 m and 0.001 m, t is 0 and 24 seconds, respectively. This yields

$1/t \ln(y_0/y_t) = 1/24 \ln(0.28/0.001) = 0.23$ m/sec.

If $1/t \ln(y_0/y_t)$ is calculated from the slope of the curve, the number of log cycles on the vertical scale between the two points is divided by the time increment and multiplied by 2.3 to convert to natural logarithm. For example, Figure 3 shows that the straight line from $y_0 = 0.28$ m to $y_t = 0.001$ m covers 2.4 log cycles. The time increment between the two points is again 24 seconds, yielding $1/t \ln(y_0/y_t) = 2.3 \times 2.4/24 = 0.23$ m/sec, which is the same as calculated earlier. Because of different coordinate scales in plots of log y versus t, the value of $1/t \ln(y_0/y_t)$ cannot be taken as the actual slope of the straight line portion!

ESTIMATING RATE OF RISE OR FALL OF WATER LEVEL IN WELL

If the water level in a slug-tested well rises or falls at a relatively slow rate, simple water-level measuring devices and a stop watch may be all that is needed to do the test. Fast-moving water levels, however, require the use of a pressure transducer and a fast-acting x-y plotter. To get some idea about the rate of water-level movement that can be expected in a slug-tested well and what equipment to use, equation (3) can be solved for t and $\ln(y_0/y_t)$ can be taken as ln 10 to calculate the time $t_{90\%}$ required for the water level in the well to rise or fall 90% of the initial lowering or raising, respectively, of the water level in the well. This yields the equation

$$t_{90\%} = 1.15 \frac{r_c^2}{KL_e} \ln \frac{R_e}{r_w} \qquad (6)$$

where K must be taken as the estimated or expected value of K of the aquifer. Equation (6) yields values of t that are 22 times greater than the t values calculated by the $t_{90\%}$ equation in the original article (Bouwer and Rice, 1976), where $\ln(y_0/y_t)$ was erroneously taken as ln 0.9, thus yielding the time required for only 10% of the water-level rise or fall to occur.

COMPUTER PROGRAMS

Where the Bouwer and Rice slug test is routinely used, time for calculating K with equation (3) is saved by developing a computer program in which values of L_e/r_w are stored for direct calculation of $\ln(R_e/r_w)$ and K from the field data. Such programs have been developed by several users (see, for example, Pandit and Miner, 1986; and Kemblowski and Klein, 1988). Also, a number of users have designed forms for easy and systematic recording of field data.

REFERENCES

Bouwer, H. and R. C. Rice. 1976. A slug test for determining hydraulic conductivity of unconfined aquifers with completely or partially penetrating wells. Water Resources Research, v. 12, pp. 423-428.

Kemblowski, M. W. and C. L. Klein. 1988. An automated numerical evaluation of slug test data. Ground Water, v. 26, pp. 435-438.

Pandit, N. S. and R. F. Miner. 1986. Interpretation of slug test data. Ground Water, v. 24, pp. 743-749.

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Response of a Finite-Diameter Well to an Instantaneous Charge of Water[1]

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Abstract. A solution is presented for the change in water level in a well of finite diameter after a known volume of water is suddenly injected or withdrawn. A set of type curves computed from this solution permits a determination of the transmissibility of the aquifer. (Key words: Aquifer tests; groundwater; hydraulics; permeability)

INTRODUCTION

Ferris and Knowles [1954] introduced a method for determining the transmissibility of an aquifer from observations of the water level in a well after a known volume of water is suddenly injected into the well. (See also *Ferris et al.* [1962]). They reasoned that for practical purposes the well may be approximated by an instantaneous line source in the infinite region, for which the residual head differences due to the injection are described by

$$h = (V/4\pi Tt)e^{-r^2S/4Tt} \qquad (1)$$

where

- h = change in head at distance r and time t due to the injection;
- r = distance from the line source or center of well;
- t = time since instantaneous injection;
- V = volume of water injected;
- T = transmissibility of aquifer;
- S = coefficient of storage of aquifer.

They reasoned further that the head H in the injected well would be described closely by (1) when r is set equal to the effective radius r_e [*Jacob*, 1947, p. 1049] of the screen or open hole. Then, since r_e is small, the exponential approaches unity quickly, so that the equation approaches $H = V/4\pi Tt$, which can be written

$$T = V(1/t)/4\pi H \qquad (2)$$

To the extent that the equation is valid for a well of finite diameter, a determination of the transmissibility can be obtained from the slope of a plot of head H versus the reciprocal of time $(1/t)$.

Since the volume of water injected into the well is $\pi r_e^2 H_0$, where r_e is the radius of the casing in the interval over which the water level fluctuates and H_0 is the initial head increase in the well, equation 1 can be written

$$h/H_0 = (r_e^2/4Tt)e^{-r^2S/4Tt} \qquad (3)$$

and equation 2 can be written

$$H/H_0 = r_e^2/4Tt \qquad (4)$$

Recently *Bredehoeft et al.* [1966] demonstrated by means of an electrical analog model of a well-aquifer system that equation 3 gives a satisfactory approximation of the head in an injected well only after the time t is large enough for the ratio H/H_0 to be very small (see Figure 1). The observed discrepancy appears to arise from the assumption that the injected well can be approximated by a line source.

We present here an exact solution for the head in and around a well of finite diameter after the well is instantaneously charged with a known volume of water.

ANALYSIS

Consider a nonflowing well cased to the top of a homogeneous isotropic artesian aquifer of uniform thickness, and screened (or open) throughout the thickness of the aquifer (Figure 2). Suppose that the well is instantaneously charged with a volume V of water. (We will consider

[1] Publication authorized by the Director, U. S. Geological Survey.

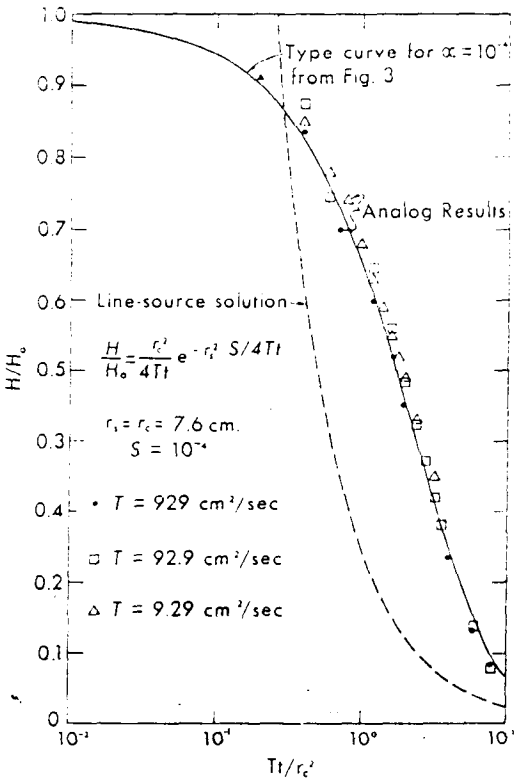

Fig. 1. Comparison of analog results with curve representing line-source solution.

an injection as a positive charge and a withdrawal as a negative one.) The water level in the well instantaneously moves to the height $H_0 = V/\pi r_c^2$ above or below its initial level and immediately begins to return to its initial level according to some function of time $H(t)$. Meanwhile the head in the surrounding aquifer varies according to $h(r, t)$. Our objective is to find a solution for $h(r, t)$ and $H(t)$. The inertia of the column of water in the well will be neglected. (See, in this connection, *Bredehoeft et al.* [1966]). Since the solution to be obtained can be superposed on any initial condition, we can simplify the problem without loss of generality by assuming that the head is initially uniform and constant.

The problem is described mathematically by

$$\partial^2 h/\partial r^2 + 1/r(\partial h/\partial r) = S/T(\partial h/\partial t) \qquad (r > r_s) \qquad (5)$$

$$h(r_s + 0, t) = H(t) \qquad (t > 0) \qquad (5a)$$

$$h(\infty, t) = 0 \qquad (t > 0) \qquad (5b)$$

$$2\pi r_s T[\partial h(r_s + 0, t)]/\partial r = \pi r_c^2(\partial H(t)/\partial t) \qquad (t > 0) \qquad (5c)$$

$$h(r, 0) = 0 \qquad (r > r_s) \qquad (5d)$$

$$H(0) = H_0 = V/\pi r_c^2 \qquad (5e)$$

Equation 5 is the differential equation governing nonsteady radial flow of confined groundwater. (See, for example, *Jacob*, 1950, p. 333.) Boundary condition 5*a* states that after the first instant the head in the aquifer at the face of the well is equal to that in the well. Boundary condition 5*b* states that as r approaches infinity the change in head approaches zero. Equation 5*c* expresses the fact that the rate of flow of water into (or out of) the aquifer is equal to the rate of decrease (or increase) in volume of water within the well. The conditions 5*d* and 5*e* state that initially the change in head is zero everywhere outside the well and equal to H_0 inside the well.

By applying the Laplace transform with respect to time the problem is reduced to

$$\partial^2\bar{h}/\partial r^2 + 1/r\,(\partial\bar{h}/\partial r) = (S/T)\,(p\bar{h}) \qquad (6)$$

$$\bar{h}(\infty, p) = 0 \qquad (6a)$$

$$[\partial\bar{h}(r_s + 0, p)]/\partial r = (r_c^2/2r_sT)[p\bar{h}(r_s + 0, p) - H_0] \qquad (6b)$$

for which the solution is

$$\bar{h}(r, p) = \frac{r_s S H_0 K_0(rq)}{Tq[r_s q K_0(r_s q) + 2\alpha K_0(r_s q)]} \qquad (7)$$

where $q = (pS/T)^{\frac{1}{2}}$, and $\alpha = r_s^2 S/r_c^2$. The solution $h(r, t)$ is the inverse transform, which is available from the analogous problem in heat flow [*Carslaw and Jaeger*, 1959, p. 342]

$$h = \frac{2H_0}{\pi}\int_0^\infty e^{-\beta u^2/\alpha}\{J_0(ur/r_s)\cdot[uY_0(u) - 2\alpha Y_1(u)] - Y_0(ur/r_s)\cdot[uJ_0(u) - 2\alpha J_1(u)]\}\frac{du}{\Delta(u)} \qquad (8)$$

where $\beta = Tt/r_c^2$ and

$$\Delta(u) = [uJ_0(u) - 2\alpha J_1(u)]^2 + [uY_0(u) - 2\alpha Y_1(u)]^2$$

Fig. 2. Idealized

The head $H(t)$ inside
stituting $r = r_s$ in eq

$$H = (8H_0\alpha/\tau \int^\infty$$

Values of H/H_0 co
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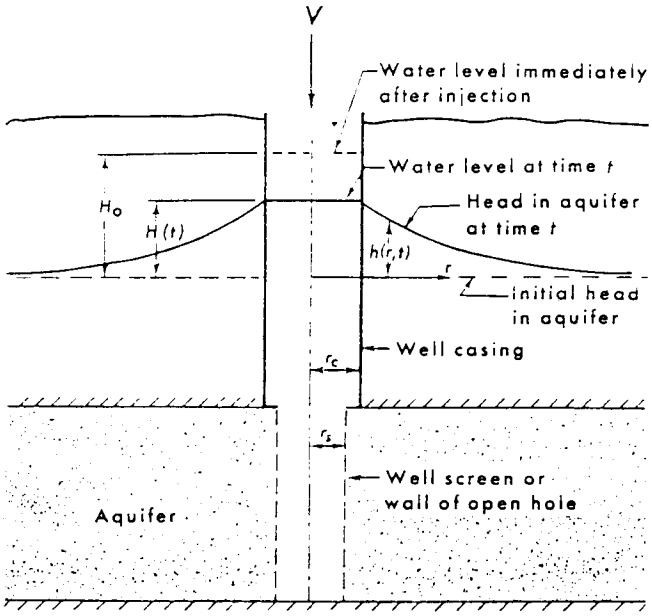

Fig. 2. Idealized representation of a well into which a volume V of water is suddenly injected.

The head $H(t)$ inside the well, obtained by substituting $r = r_s$ in equation 8, is

$$H = (8H_0\alpha/\pi^2) \int_0^\infty e^{-\beta u^2/\alpha}\, du/(u\,\Delta(u)) \qquad (9)$$

Values of H/H_0 computed by numerically integrating equation 9 are given in Table 1. Values computed from the line-source solutions, equations 3 and 4, are given in Table 2. In Figure 3 the values from Table 1 are represented as a family of five curves of H/H_0 versus the dimensionless time parameter $\beta = Tt/r_c^2$, one curve for each of five values of the parameter $\alpha = r_s^2S/r_c^2$. Also represented, by a dashed curve, are the values computed from equation 4.

It is apparent from Tables 1 and 2 and from Figure 3 that the line-source solutions 3 and 4 proposed by *Ferris and Knowles* [1954] give a close approximation of the finite-source solution 9 only for large values of the time parameter Tt/r_c^2. The approximation seems to be acceptable for Tt/r_c^2 greater than 100 (or, equivalently, for H/H_0 less than about 0.0025). (In the test at Speedway City, Indiana, used by Ferris and Knowles to exemplify their method, H/H_0 ranged from 0.01 to 0.001, and the value of transmissibility determined from these data agreed fairly well with one obtained by another method.)

A family of type curves plotted on semilogarithmic paper, as in Figure 3, permits a determination of the transmissibility. The method is similar to the Theis graphical method [*Wenzel*, 1942]. A test on a well near Dawsonville, Georgia, will be used to demonstrate the method. This well is cased to 24 m with 15.2-cm (6-inch) casing and drilled as a 15.2-cm open hole to a depth of 122 m. Figure 4 is a reproduction of a chart showing the hydrograph of the well after the sudden withdrawal of a long weighted float from the well. The weight of the float was 10.16 kilograms, and hence by the principle of Archimedes it had displaced a volume of 0.01016 m³ of water when floating in the well. Its withdrawal was therefore equivalent to a negative charge of $V = 0.01016$ m³. From the relation $H_0 = V/\pi r_c^2$ the initial head change is found to be $H_0 = 0.560$ m.

The hydrograph in Figure 4 was recorded electrically from a pressure transducer, which was suspended below the water surface in the well. Table 3 lists data from this chart. To determine the aquifer constants the data are

TABLE 1. Values of H/H_0 for a Well of Finite Diameter (computed from equation 9)

Tt/r_c^2	H/H_0				
	$\alpha = 10^{-1}$	$\alpha = 10^{-2}$	$\alpha = 10^{-3}$	$\alpha = 10^{-4}$	$\alpha = 10^{-5}$
1.00×10^{-3}	0.9771	0.9920	0.9969	0.9985	0.9992
2.15×10^{-3}	0.9658	0.9876	0.9949	0.9974	0.9985
4.64×10^{-3}	0.9490	0.9807	0.9914	0.9954	0.9970
1.00×10^{-2}	0.9238	0.9693	0.9853	0.9915	0.9942
2.15×10^{-2}	0.8860	0.9505	0.9744	0.9841	0.9888
4.64×10^{-2}	0.8293	0.9187	0.9545	0.9701	0.9781
1.00×10^{-1}	0.7460	0.8655	0.9183	0.9434	0.9572
2.15×10^{-1}	0.6289	0.7782	0.8538	0.8935	0.9167
4.64×10^{-1}	0.4782	0.6436	0.7436	0.8031	0.8410
1.00×10^{0}	0.3117	0.4598	0.5729	0.6520	0.7080
2.15×10^{0}	0.1665	0.2597	0.3543	0.4364	0.5038
4.64×10^{0}	0.07415	0.1086	0.1554	0.2082	0.2620
7.00×10^{0}	0.04625	0.06204	0.08519	0.1161	0.1521
1.00×10^{1}	0.03065	0.03780	0.04821	0.06355	0.08378
1.40×10^{1}	0.02092	0.02414	0.02844	0.03492	0.04426
2.15×10^{1}	0.01297	0.01414	0.01545	0.01723	0.01999
3.00×10^{1}	0.009070	0.009615	0.01016	0.01083	0.01169
4.64×10^{1}	0.005711	0.005919	0.006111	0.006319	0.006554
7.00×10^{1}	0.003722	0.003809	0.003884	0.003962	0.004046
1.00×10^{2}	0.002577	0.002618	0.002653	0.002688	0.002725
2.15×10^{2}	0.001179	0.001187	0.001194	0.001201	0.001208

plotted on semilogarithmic paper of the same scale as that of the type curves in Figure 3, and this plot is superposed on the type curves. With the arithmetic axes coincident, the data plot is translated horizontally to a position where the data best fit the type curves, as

TABLE 2. Values of H/H_0 for Line-source Approximation of a Well

Tt/r_c^2	H/H_0 from equation 3					H/H_0 from eq. 4
	$\alpha = 10^{-1}$	$\alpha = 10^{-2}$	$\alpha = 10^{-3}$	$\alpha = 10^{-4}$	$\alpha = 10^{-5}$	
1.00×10^{-3}	0.000000	20.52	194.7	243.8	249.4	250.0
2.15×10^{-3}	0.001035	36.35	103.5	115.0	116.2	116.3
4.64×10^{-3}	0.2463	31.44	51.05	53.59	53.85	53.88
1.00×10^{-2}	2.052	19.47	24.38	24.94	24.99	25.00
2.15×10^{-2}	3.635	10.35	11.50	11.62	11.63	11.63
4.64×10^{-2}	3.144	5.105	5.359	5.385	5.388	5.388
1.00×10^{-1}	1.947	2.438	2.494	2.499	2.500	2.500
2.15×10^{-1}	1.035	1.150	1.162	1.163		1.163
4.64×10^{-1}	0.5105	0.5359	0.5385	0.5388		0.5388
1.00×10^{0}	0.2438	0.2494	0.2499	0.2500		0.2500
2.15×10^{0}	0.1150	0.1162	0.1163			0.1163
4.64×10^{0}	0.05359	0.05385	0.05388			0.05388
7.00×10^{0}	0.03558	0.03570	0.03571			0.03571
1.00×10^{1}	0.02494	0.02499	0.02500			0.02500
1.40×10^{1}	0.01783	0.01786				0.01786
2.15×10^{1}	0.01162	0.01163				0.01163
3.00×10^{1}	0.008326	0.008333				0.008333
4.64×10^{1}	0.005385	0.005388				0.005388
7.00×10^{1}	0.003570	0.003571				0.003571
1.00×10^{2}	0.002499	0.002500				0.002500
2.15×10^{2}	0.001163					0.001163

shown in F
$t = 11$ sec
overlie the
coordinates.
puted to be

$$T = \frac{1.0r}{t}$$

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for $\alpha = 10^{-3}$.
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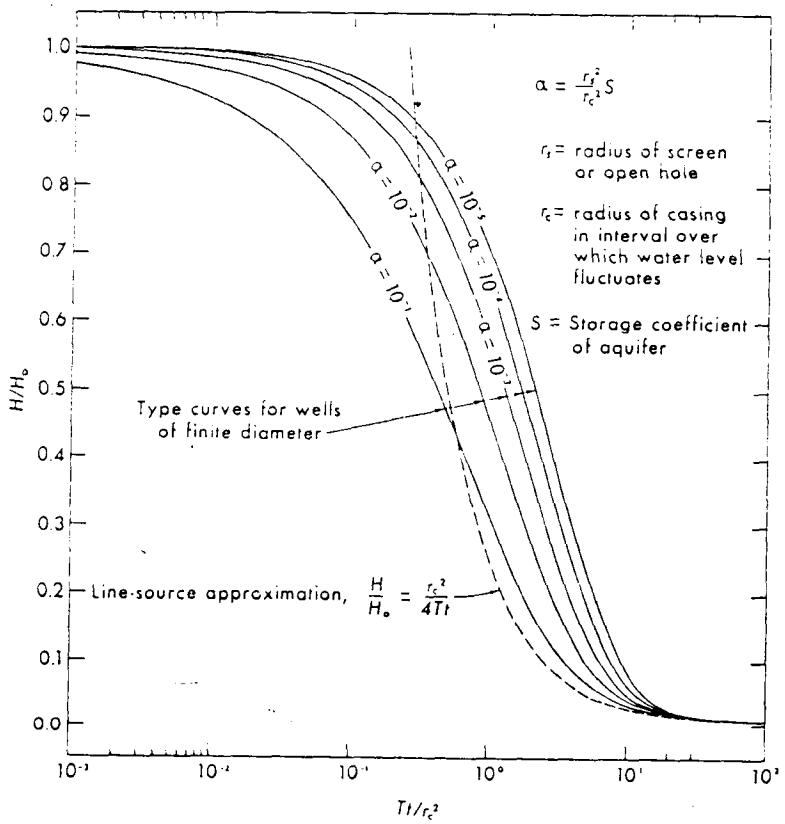

Fig. 3. Type curves for instantaneous charge in well of finite diameter.

shown in Figure 5. In this position the time $t = 11$ sec on the data coordinates is found to overlie the value $Tt/r_c^2 = 1.0$ on the type-curve coordinates. Hence the transmissibility is computed to be

$$T = \frac{1.0 r_c^2}{t} = \frac{(1.0)(7.6)^2}{(11)} = 5.3 \text{ cm}^2/\text{sec}$$

In principle the coefficient of storage can be determined by interpolating from its values for the curves that lie on either side of the data plot in the matched position. Thus, in the example just described, the coefficient of storage would be $S = 10^{-3}$, since for this well $r_o = r_s$, so that $\alpha = S$, and the points fall on the curve for $\alpha = 10^{-3}$. However, because the matching of data plot to the type curves depends upon the shapes of the type curves, which differ only slightly when α differs by an order of magnitude, a determination of S by this method has questionable reliability.

The determination of T is not so sensitive to the choice of the curves to be matched. Whereas the determined value of S will change by an

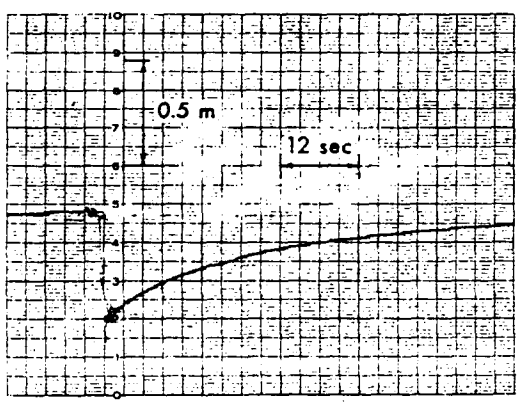

Fig. 4. Hydrograph of well at Dawsonville, Georgia, showing response of water level to the sudden withdrawal of a weighted float.

TABLE 3. Rise of Water Level in Dawsonville Well after Instantaneous Withdrawal of Weighted Float

t (sec)	$1/t$	Head (m)	H (m)	H/H_0
−1		0.896		
0		0.336	0.560	1.000
3	0.333	0.439	0.457	0.816
6	0.167	0.504	0.392	0.700
9	0.111	0.551	0.345	0.616
12	0.0833	0.588	0.308	0.550
15	0.0667	0.616	0.280	0.500
18	0.0556	0.644	0.252	0.450
21	0.0476	0.672	0.224	0.400
24	0.0417	0.691	0.205	0.366
27	0.0370	0.709	0.187	0.334
30	0.0333	0.728	0.168	0.300
33	0.0303	0.747	0.149	0.266
36	0.0278	0.756	0.140	0.250
39	0.0256	0.765	0.131	0.234
42	0.0238	0.784	0.112	0.200
45	0.0222	0.788	0.108	0.193
48	0.0208	0.803	0.093	0.166
51	0.0196	0.807	0.089	0.159
54	0.0185	0.814	0.082	0.146
57	0.0175	0.821	0.075	0.134
60	0.0167	0.825	0.071	0.127
63	0.0159	0.831	0.065	0.116

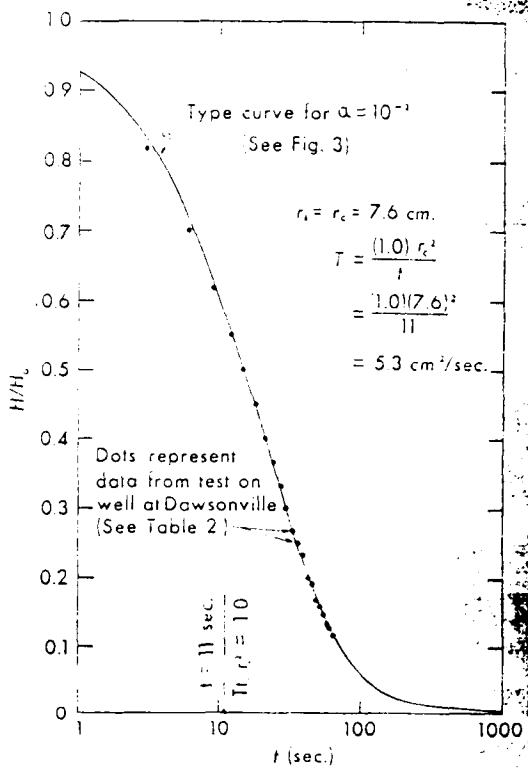

Fig. 5. Plot of data from test at Dawsonville, Georgia, superposed on type curve.

order of magnitude when the data plot is moved from one type curve to another, that of T will change much less. From a knowledge of the geologic conditions and other considerations one can ordinarily estimate S within an order of magnitude and thereby eliminate some of the doubt as to what value of α is to be used for matching the data plot.

Figure 6 shows the data from the test on the Dawsonville well plotted according to the Ferris-Knowles method. The points do not fall along a straight line as postulated in this method but, instead, fall along the trace of the type curve for $\alpha = 10^{-3}$, which has been transferred from Figure 5. Also shown is a straight line through the origin whose slope, when used according to the Ferris-Knowles method, will yield the transmissibility of 5.3 cm²/sec obtained by matching the data to the type curves.

CONCLUSION

The judgment of an experienced hydrologist is needed to decide the significance, if any, of a determination of T by the method of instantaneous charge. As *Ferris et al.* [1962] properly warned

> the duration of a 'slug' test is very short, hence the estimated transmissibility determined from the test will be representative only of the water-bearing material close to the well. Serious errors will be introduced unless the . . . well is fully developed and completely penetrates the aquifer.

Few wells completely penetrate an aquifer, but it is nevertheless possible under some circumstances for a hydrologist to derive useful information from a test on a partially penetrating well. Since the vertical permeabilities of most stratified aquifers are only small fractions of the horizontal permeabilities, the induced flow within the small radius of the cone that develops during the short period of observation is likely to be essentially 2-dimensional. Therefore, the determined value of T would represent approximately the transmissibility of that part

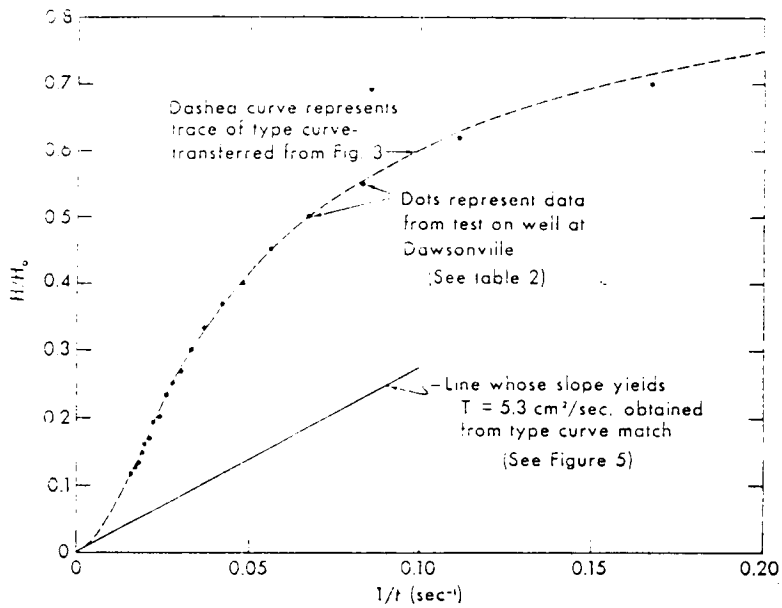

Fig. 6. Data from test on well of Dawsonville, Georgia, plotted according to the Ferris-Knowles method.

of the aquifer in which the well is screened or open, provided that the aquifer is reasonably homogeneous and isotropic in planes parallel to the bedding and provided that the effective radius r_e can be estimated closely.

REFERENCES

Bredehoeft, J. D., H. H. Cooper, Jr., and I. S. Papadopulos, Inertial and storage effects in well-aquifer systems: An analog investigation, *Water Resources Res.*, *2*(4), 697–707, 1966.

Carslaw, H. S., and J. C. Jaeger, *Conduction of Heat in Solids*, 510 pp., Oxford University Press, London, 1959.

Ferris, J. G., and D. B. Knowles, The slub test for estimating transmissibility, *U. S. Geol. Surv. Ground Water Note 26*, 1954.

Ferris, J. G., D. B. Knowles, R. H. Brown, and R. W. Stallman, Theory of aquifer tests, *U. S. Geol. Surv. Water-Supply Paper 1536-E*, 1962.

Jacob, C. E., Drawdown test to determine effective radius of artesian well, *Trans. Am. Soc. Civil Engrs.*, *112*, 1047–1064, 1947.

Jacob, C. E., Flow of groundwater, in *Engineering Hydraulics*, edited by H. Rouse, John Wiley & Sons, New York, 1950.

Wenzel, L. K., Methods for determining permeability of water bearing materials, *U. S. Geol. Surv. Water-Supply Paper 887*, 1942.

(Manuscript received May 12, 1966.)

M-001-A
RISING HEAD FIELD DATA
NAS ALAMEDA, CTO-107
1991

SE1000B
Environmental Logger
07/29 15:27

Unit# 00515 Test# 5

INPUT 1: Level (F) TOC

Reference 0.00
Scale factor 10.09
Offset 0.00

Step# 0 07/26 13:22

Elapsed Time (min)	Value (ft)
0.0000	-5.49
0.0033	-5.03
0.0066	-7.92
0.0099	-8.71
0.0133	-8.61
0.0166	-8.89
0.0200	-8.91
0.0233	-9.03
0.0266	-9.09
0.0300	-9.17
0.0333	-9.21
0.0500	-9.44
0.0666	-9.59
0.0833	-9.70
0.1000	-9.80
0.1166	-9.87
0.1333	-9.92
0.1500	-9.96
0.1666	-9.99
0.1833	-10.01
0.2000	-10.02
0.2166	-10.04
0.2333	-10.05
0.2500	-10.06
0.2666	-10.06
0.2833	-10.07
0.3000	-10.07
0.3166	-10.08
0.3333	-10.08
0.4167	-10.10
0.5000	-10.11
0.5833	-10.11
0.6667	-10.12
0.7500	-10.12
0.8333	-10.12
0.9167	-10.13
1.0000	-10.13
1.0833	-10.13
1.1667	-10.13
1.2500	-10.14
1.3333	-10.14
1.4166	-10.13
1.5000	-10.13
1.5833	-10.13
1.6667	-10.13
1.7500	-10.14
1.8333	-10.14
1.9167	-10.14
2.0000	-10.14
2.5000	-10.14
3.0000	-10.14
3.5000	-10.15
4.0000	-10.14
4.5000	-10.15
5.0000	-10.15
5.5000	-10.15

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A Q T E S O L V   R E S U L T S

Version 1.10

02/24/92 15:30:30

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TEST DESCRIPTION

Data set........... m001a.set
Data set title..... RISING HEAD RESULT, M-001-A
Company............ JAMES M. MONTGOMERY
Project............ 2738.0262
Client............. NAVY - WESTDIV
Location........... 1943-1956 Disposal Area
Test date.......... July 26, 1991

Knowns and Constants:
No. of data points.................. 35
Radius of well casing............... 2.54
Radius of well...................... 5.79
Aquifer saturated thickness......... 274.3
Well screen length.................. 274.3
Static height of water in well...... 274.3
Log(Re/Rw).......................... 2.951
A, B, C............................. 0.000, 0.000, 2.549

==

ANALYTICAL METHOD

Bouwer-Rice (Unconfined Aquifer Slug Test)

==

RESULTS FROM VISUAL CURVE MATCHING

VISUAL MATCH PARAMETER ESTIMATES

	Estimate
K =	1.8613E-003
y0 =	-1.3253E+100

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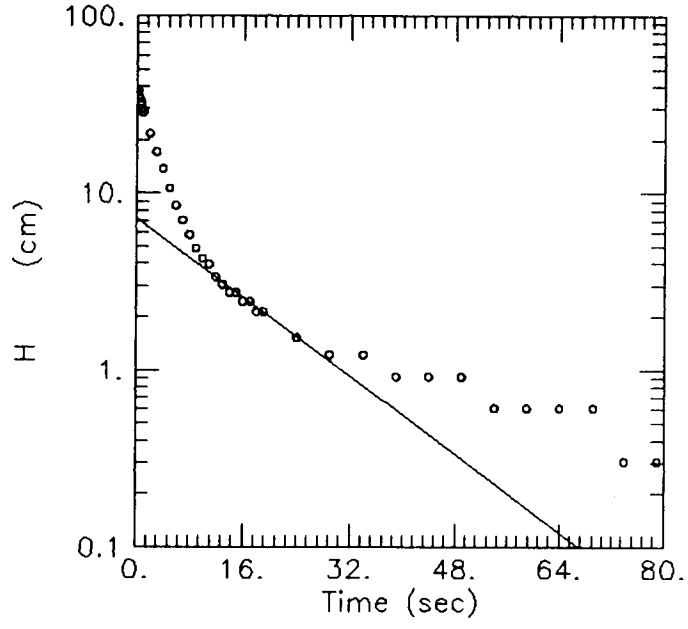
TYPE CURVE DATA

K = 2.21280E-003
y0 = 7.16778E+000

Time	Drawdown	Time	Drawdown	Time	Drawdown
0.000E+000	7.168E+000	8.000E+001	4.361E-002		



DATA SET:
m001a.aet
02/24/92

AQUIFER TYPE:
Unconfined

SOLUTION METHOD:
Bouwer-Rice

TEST DATE:
July 28, 1991

ESTIMATED PARAMETERS:
K = 0.002213 cm/sec
y0 = 7.188 cm

TEST DATA:
H0 = 38.4 cm
rc = 2.54 cm
rw = 5.78 cm
L = 274.3 cm
D = 274.3 cm
H = 274.3 cm

RISING HEAD RESULT, M-001-A

JAMES M. MONTGOMERY	Client: NAVY - WESTDIV
Project No.: 2738.0262	Location: 1943-1956 Disposal Area

M-002-A
RISING HEAD FIELD DATA
NAS ALAMEDA, CTO-107
1991

SE1000B
Environmental Logger
09/13 12:45

Unit# 00515 Test# 9

INPUT 1: Level (F) TOC

Reference 0.00
Scale factor 10.09
Offset 0.00

Step# 0 09/13 10:58

Elapsed Time (min)	Value (ft)
0.0000	0.00
0.0033	0.00
0.0066	1.79
0.0099	1.24
0.0133	0.97
0.0166	0.92
0.0200	0.90
0.0233	0.87
0.0266	0.86
0.0300	0.82
0.0333	0.80
0.0500	0.68
0.0666	0.58
0.0833	0.49
0.1000	0.41
0.1166	0.35
0.1333	0.29
0.1500	0.25
0.1666	0.22
0.1833	0.19
0.2000	0.17
0.2166	0.15
0.2333	0.14
0.2500	0.12
0.2666	0.10
0.2833	0.09
0.3000	0.09
0.3166	0.08
0.3333	0.07
0.4167	0.06
0.5000	0.04
0.5833	0.04
0.6667	0.03
0.7500	0.02
0.8333	0.02
0.9167	0.02
1.0000	0.02
1.0833	0.02
1.1667	0.01
1.2500	0.01
1.3333	0.01
1.4166	0.01
1.5000	0.01
1.5833	0.01
1.6667	0.01
1.7500	0.01
1.8333	0.01
1.9167	0.01
2.0000	0.01

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A Q T E S O L V   R E S U L T S

Version 1.10

02/24/92 16:06:00

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TEST DESCRIPTION

Data set........... M002A.SET
Data set title..... RISING HEAD RESULT, M-002-A
Company............ J.M.MONTGOMERY, CONSULTING ENG
Project............ 2738.0262
Client............. NAVY - WESTDIV
Location........... 1943-1956 Disposal Area
Test date.......... September 13, 1991

Knowns and Constants:
No. of data points.................. 46
Radius of well casing............... 2.54
Radius of well...................... 5.79
Aquifer saturated thickness......... 73.15
Well screen length.................. 73.15
Static height of water in well...... 73.15
Log(Re/Rw).......................... 1.834
A, B, C............................. 0.000, 0.000, 1.408

==

ANALYTICAL METHOD

Bouwer-Rice (Unconfined Aquifer Slug Test)

==

RESULTS FROM VISUAL CURVE MATCHING

VISUAL MATCH PARAMETER ESTIMATES

	Estimate
K =	3.2909E-003
y0 =	-1.3253E+100

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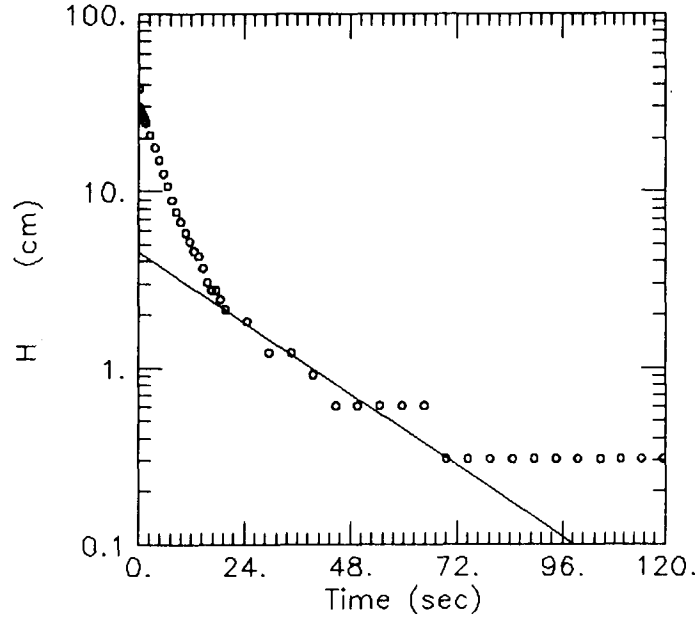
TYPE CURVE DATA

K = 3.11689E-003
y0 = 4.50557E+000

Time	Drawdown	Time	Drawdown	Time	Drawdown
0.000E+000	4.506E+000	1.200E+002	4.423E-002		



DATA SET:
M002A.SET
02/24/92

AQUIFER TYPE:
Unconfined
SOLUTION METHOD:
Bouwer-Rice
TEST DATE:
September 13, 1991

ESTIMATED PARAMETERS:
K = 0.003117 cm/sec
y0 = 4.508 cm

TEST DATA:
H0 = 26.21 cm
rc = 2.54 cm
rw = 5.78 cm
L = 73.15 cm
b = 73.15 cm
H = 73.15 cm

RISING HEAD RESULT, M-002-A

J.M.MONTGOMERY, CONSULTING ENG	Client: NAVY - WESTDIV
Project No.: 2738.0262	Location: 1943-1956 Disposal Area

M-003-A
RISING HEAD FIELD DATA
NAS ALAMEDA, CTO-107
1991

SE1000B
Environmental Logger
09/16 13:26

Unit# 00515 Test# 1

INPUT 1: Level (F) TOC

Reference 0.00
Scale factor 10.09
Offset 0.00

Step# 0 09/16 09:19

Elapsed Time (min)	Value (ft)
0.0000	5.90
0.0033	7.47
0.0066	0.98
0.0099	1.43
0.0133	1.24
0.0166	1.16
0.0200	1.09
0.0233	1.00
0.0266	0.95
0.0300	0.88
0.0333	0.83
0.0500	0.62
0.0666	0.46
0.0833	0.35
0.1000	0.28
0.1166	0.22
0.1333	0.19
0.1500	0.16
0.1666	0.14
0.1833	0.13
0.2000	0.12
0.2166	0.11
0.2333	0.10
0.2500	0.09
0.2666	0.08
0.2833	0.08
0.3000	0.08
0.3166	0.07
0.3333	0.07
0.4167	0.06
0.5000	0.05
0.5833	0.05
0.6667	0.04
0.7500	0.04
0.8333	0.05
0.9167	0.04
1.0000	0.03
1.0833	0.03
1.1667	0.03
1.2500	0.03
1.3333	0.03
1.4166	0.03
1.5000	0.03
1.5833	0.03
1.6667	0.03
1.7500	0.03
1.8333	0.03
1.9167	0.03
2.0000	0.03

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A Q T E S O L V   R E S U L T S

Version 1.10

06/08/92 06:18:01

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TEST DESCRIPTION

Data set........... M003A.SET
Data set title..... RISING HEAD RESULT, M-003-A
Company............ J.M.MONTGOMERY, CONSULTING ENG
Project............ 2738.0262
Client............. NAVY - WESTDIV
Location........... 1943-1956 Disposal Area
Test date.......... September 16, 1991

Knowns and Constants:
No. of data points.................. 45
Radius of well casing............... 2.54
Radius of well...................... 5.79
Aquifer saturated thickness......... 225.3
Well screen length.................. 225.3
Static height of water in well...... 225.3
Log(Re/Rw).......................... 2.789
A, B, C............................. 0.000, 0.000, 2.260

==

ANALYTICAL METHOD

Bouwer-Rice (Unconfined Aquifer Slug Test)

==

RESULTS FROM VISUAL CURVE MATCHING

VISUAL MATCH PARAMETER ESTIMATES

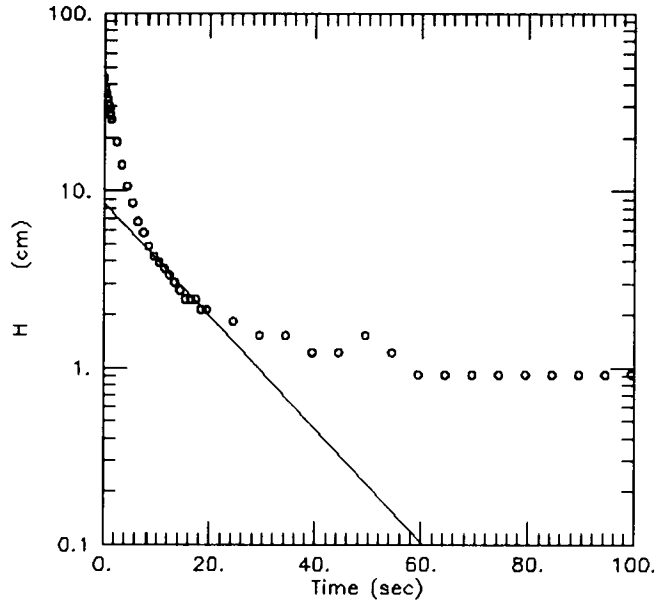
	Estimate
K =	2.9409E-003
y0 =	4.2766E-306

<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<>>

TYPE CURVE DATA

K = 2.94090E-003
y0 = 8.56363E+000

Time	Drawdown	Time	Drawdown	Time	Drawdown
0.000E+000	8.564E+000	1.000E+002	5.432E-003		



DATA SET:
M003A.SET
08/08/92

AQUIFER TYPE:
Unconfined

SOLUTION METHOD:
Bouwer-Rice

TEST DATE:
September 18, 1991

ESTIMATED PARAMETERS:
K = 0.002941 cm/sec
y0 = 8.584 cm

TEST DATA:
H0 = 43.58 cm
rc = 2.54 cm
rw = 5.78 cm
L = 225.3 cm
D = 225.3 cm
H = 225.3 cm

RISING HEAD RESULT, M-003-A

J.M.MONTGOMERY, CONSULTING ENG	Client: NAVY - WESTDIV
Project No.: 2738.0262	Location: 1943-1956 Disposal Area

M-004-A
RISING HEAD FIELD DATA
NAS ALAMEDA, CTO-107
1991

SE1000B
Environmental Logger
09/16 13:35

Unit# 00515 Test# 3

INPUT 1: Level (F) TOC

Reference 0.00
Scale factor 10.09
Offset 0.00

Step# 0 09/16 09:44

Elapsed Time (min)	Value (ft)
0.0000	0.00
0.0033	0.02
0.0066	6.00
0.0099	8.69
0.0133	-2.97
0.0166	4.09
0.0200	0.64
0.0233	2.94
0.0266	1.25
0.0300	2.45
0.0333	1.57
0.0500	1.93
0.0666	1.87
0.0833	1.83
0.1000	1.80
0.1166	1.78
0.1333	1.75
0.1500	1.73
0.1666	1.71
0.1833	1.68
0.2000	1.66
0.2166	1.64
0.2333	1.62
0.2500	1.60
0.2666	1.58
0.2833	1.56
0.3000	1.54
0.3166	1.52
0.3333	1.50
0.4167	1.42
0.5000	1.34
0.5833	1.27
0.6667	1.17
0.7500	1.15
0.8333	1.10
0.9167	1.05
1.0000	1.00
1.0833	0.96
1.1667	0.92
1.2500	0.88
1.3333	0.85
1.4166	0.81
1.5000	0.78
1.5833	0.75
1.6667	0.72
1.7500	0.70
1.8333	0.67
1.9167	0.65
2.0000	0.63
2.5000	0.52
3.0000	0.46
3.5000	0.41
4.0000	0.38
4.5000	0.35
5.0000	0.34
5.5000	0.32
6.0000	0.31
6.5000	0.30
7.0000	0.29
7.5000	0.28
8.0000	0.28
8.5000	0.27

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A Q T E S O L V   R E S U L T S

Version 1.10

06/04/92 . 03:38:44

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TEST DESCRIPTION

Data set........... m004a.set
Data set title..... RISING HEAD RESULT, M-004-A
Company............ J.M.MONTGOMERY, CONSULTING ENG
Project............ 2738.0262
Client............. NAVY - WESTDIV
Location........... 1943-1956 Disposal Area
Test date.......... September 16, 1991

Knowns and Constants:

No. of data points.................. 50
Radius of well casing............... 2.54
Radius of well...................... 5.79
Aquifer saturated thickness......... 228
Well screen length.................. 228
Static height of water in well...... 228
Log(Re/Rw).......................... 2.799
A, B, C............................. 0.000, 0.000, 2.276

===

ANALYTICAL METHOD

Bouwer-Rice (Unconfined Aquifer Slug Test)

===

RESULTS FROM VISUAL CURVE MATCHING

VISUAL MATCH PARAMETER ESTIMATES

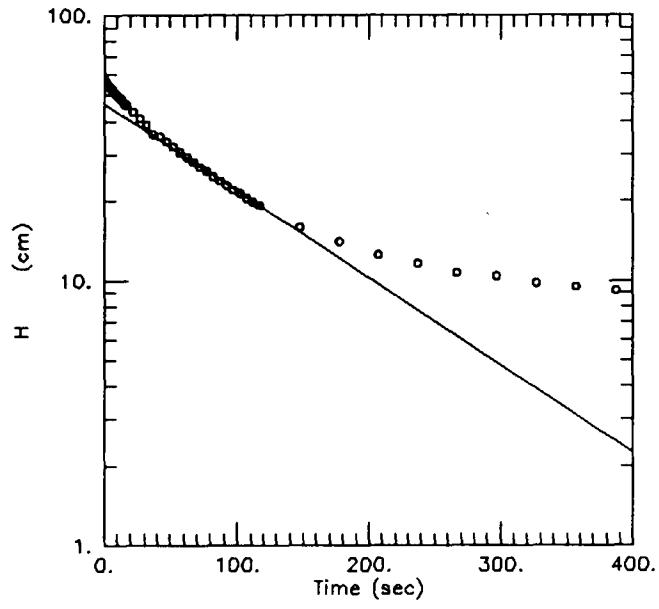
	Estimate
K =	1.6723E-004
y0 =	4.7289E-308

<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<>>

TYPE CURVE DATA

K = 3.00569E-004
y0 = 4.65933E+001

Time	Drawdown	Time	Drawdown	Time	Drawdown
0.000E+000	4.659E+001	4.000E+002	2.238E+000		



DATA SET:
m004a.dat
08/04/92

AQUIFER TYPE:
Unconfined

SOLUTION METHOD:
Bouwer-Rice

TEST DATE:
September 18, 1991

ESTIMATED PARAMETERS:
K = 0.0003008 cm/sec
y0 = 46.58 cm

TEST DATA:
H0 = 58.83 cm
rc = 2.54 cm
rw = 5.78 cm
L = 228. cm
D = 228. cm
H = 228. cm

RISING HEAD RESULT, M-004-A

J.M.MONTGOMERY, CONSULTING ENG	Client: NAVY – WESTDIV
Project No.: 2738.0262	Location: 1943–1956 Disposal Area

M-005-A
RISING HEAD FIELD DATA
NAS ALAMEDA, CTO-107
1991

SE1000B
Environmental Logger
08/08 17:04

Unit# 00515 Test# 9

INPUT 1: Level (F) TOC

Reference 0.00
Scale factor 10.09
Offset 0.00

Step# 0 08/08 14:26

Elapsed Time (min)	Value (ft)
0.0000	-0.00
0.0033	0.00
0.0066	2.61
0.0099	4.07
0.0133	1.25
0.0166	0.42
0.0200	1.62
0.0233	1.53
0.0266	1.33
0.0300	1.25
0.0333	1.19
0.0500	0.80
0.0666	0.56
0.0833	0.38
0.1000	0.27
0.1166	0.20
0.1333	0.16
0.1500	0.13
0.1666	0.11
0.1833	0.10
0.2000	0.09
0.2166	0.08
0.2333	0.07
0.2500	0.06
0.2666	0.06
0.2833	0.06
0.3000	0.05
0.3166	0.05
0.3333	0.05
0.4167	0.04
0.5000	0.03
0.5833	0.03
0.6667	0.03
0.7500	0.03
0.8333	0.02
0.9167	0.02
1.0000	0.02
1.0833	0.02
1.1667	0.02
1.2500	0.02
1.3333	0.02
1.4166	0.02
1.5000	0.02
1.5833	0.02
1.6667	0.02
1.7500	0.02
1.8333	0.02
1.9167	0.02
2.0000	0.02
2.5000	0.01
3.0000	0.01
3.5000	0.00
4.0000	-0.00
4.5000	-0.00
5.0000	0.00
5.5000	0.00
6.0000	0.01
6.5000	0.01
7.0000	0.01
7.5000	0.01
8.0000	0.01
8.5000	0.00

<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<>>

A Q T E S O L V   R E S U L T S

Version 1.10

06/08/92 06:21:22

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TEST DESCRIPTION

Data set........... M005A.SET
Data set title..... RISING HEAD RESULT, M-005-A
Company............ J.M.MONTGOMERY, CONSULTING ENG
Project............ 2738.0262
Client............. NAVY - WESTDIV
Location........... 1943-1956 Disposal Area
Test date.......... August 8, 1991

Knowns and Constants:
No. of data points.................. 44
Radius of well casing............... 2.54
Radius of well...................... 5.79
Aquifer saturated thickness......... 228.6
Well screen length.................. 228.6
Static height of water in well...... 228.6
Log(Re/Rw).......................... 2.801
A, B, C............................. 0.000, 0.000, 2.279

==

ANALYTICAL METHOD

Bouwer-Rice (Unconfined Aquifer Slug Test)

==

RESULTS FROM VISUAL CURVE MATCHING

VISUAL MATCH PARAMETER ESTIMATES

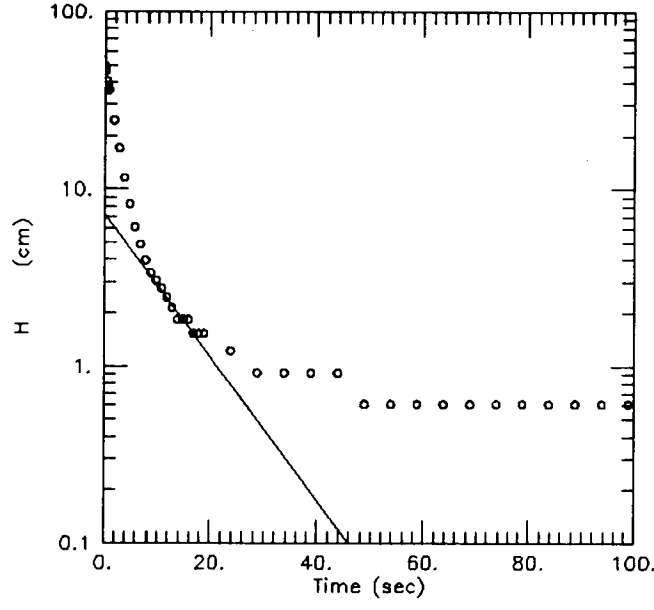
	Estimate
K =	3.6983E-003
y0 =	4.2766E-306

<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<>>

TYPE CURVE DATA

K = 3.69833E-003
y0 = 7.26001E+000

Time	Drawdown	Time	Drawdown	Time	Drawdown
0.000E+000	7.260E+000	1.000E+002	6.276E-004		



DATA SET:
M005A.SET
08/08/92

AQUIFER TYPE:
Unconfined

SOLUTION METHOD:
Bouwer-Rice

TEST DATE:
August 8, 1991

ESTIMATED PARAMETERS:
K = 0.003898 cm/sec
y0 = 7.28 cm

TEST DATA:
H0 = 49.38 cm
rc = 2.54 cm
rw = 5.79 cm
L = 228.6 cm
D = 228.6 cm
H = 228.6 cm

RISING HEAD RESULT, M-005-A

J.M.MONTGOMERY, CONSULTING ENG	Client: NAVY – WESTDIV
Project No.: 2738.0262	Location: 1943–1956 Disposal Area

M-006-A
RISING HEAD FIELD DATA
NAS ALAMEDA, CTO-107
1991

SE1000B
Environmental Logger
08/08 16:58

Unit# 00515 Test# 7

INPUT 1: Level (F) TOC

Reference 0.00
Scale factor 10.09
Offset 0.00

Step# 0 08/08 13:53

Elapsed Time (min)	Value (ft)
0.0000	0.00
0.0033	0.00
0.0066	0.20
0.0099	3.01
0.0133	3.80
0.0166	0.89
0.0200	2.36
0.0233	1.68
0.0266	1.67
0.0300	1.64
0.0333	1.57
0.0500	1.28
0.0666	1.06
0.0833	0.88
0.1000	0.75
0.1166	0.64
0.1333	0.55
0.1500	0.47
0.1666	0.41
0.1833	0.36
0.2000	0.32
0.2166	0.28
0.2333	0.26
0.2500	0.23
0.2666	0.21
0.2833	0.19
0.3000	0.18
0.3166	0.16
0.3333	0.15
0.4167	0.10
0.5000	0.08
0.5833	0.06
0.6667	0.05
0.7500	0.04
0.8333	0.03
0.9167	0.02
1.0000	0.02
1.0833	0.02
1.1667	0.01
1.2500	0.01
1.3333	0.01
1.4166	0.00
1.5000	0.00
1.5833	0.00
1.6667	0.00
1.7500	0.00
1.8333	0.01
1.9167	0.01
2.0000	0.01
2.5000	0.01
3.0000	0.00
3.5000	0.00
4.0000	0.00
4.5000	-0.00
5.0000	0.00
5.5000	0.01
6.0000	0.00
6.5000	0.00
7.0000	-0.00
7.5000	-0.00
8.0000	0.00
8.5000	0.00
9.0000	0.00
9.5000	0.00
10.0000	0.00
12.0000	0.00

<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<>>>

A Q T E S O L V   R E S U L T S

Version 1.10

02/25/92 10:09:57

==

TEST DESCRIPTION

Data set........... m006a.set
Data set title..... RISING HEAD RESULT, M-006-A
Company............ J.M.MONTGOMERY, CONSULTING ENG
Project............ 2738.0262
Client............. NAVY - WESTDIV
Location........... 1943-1956 Disposal Area
Test date.......... August 8, 1991

Knowns and Constants:

No. of data points................... 33
Radius of well casing............... 2.54
Radius of well...................... 5.79
Aquifer saturated thickness......... 283.2
Well screen length.................. 283.2
Static height of water in well...... 283.2
Log(Re/Rw).......................... 2.976
A, B, C............................. 0.000, 0.000, 2.602

==

ANALYTICAL METHOD

Bouwer-Rice (Unconfined Aquifer Slug Test)

==

RESULTS FROM VISUAL CURVE MATCHING

VISUAL MATCH PARAMETER ESTIMATES

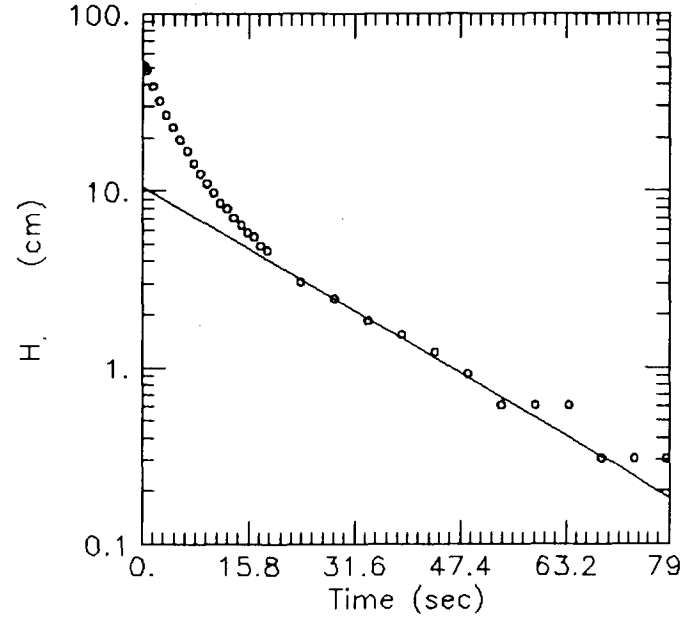
	Estimate
K =	2.1885E-003
y0 =	3.9704E+002

<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<>>>

TYPE CURVE DATA

K = 1.74590E-003
y0 = 1.06311E+001

Time	Drawdown	Time	Drawdown	Time	Drawdown
0.000E+000	1.063E+001	7.900E+001	1.819E-001		



DATA SET:
m006a.aet
02/25/92

AQUIFER TYPE:
Unconfined
SOLUTION METHOD:
Bouwer-Rice
TEST DATE:
August 8, 1991

ESTIMATED PARAMETERS:
K = 0.001748 cm/sec
y0 = 10.83 cm

TEST DATA:
H0 = 51.21 cm
rc = 2.54 cm
rw = 5.78 cm
L = 283.2 cm
b = 283.2 cm
H = 283.2 cm

RISING HEAD RESULT, M-006-A

J.M.MONTGOMERY, CONSULTING ENG	Client: NAVY - WESTDIV
Project No.: 2738.0262	Location: 1943-1956 Disposal Area

M-007-A
RISING HEAD FIELD DATA
NAS ALAMEDA, CTO-107
1991

SE1000B
Environmental Logger
08/08 16:46

Unit# 00515 Test# 3

INPUT 1: Level (F) TOC

Reference 0.00
Scale factor 10.09
Offset 0.00

Step# 0 08/08 12:06

Elapsed Time (min)	Value (ft)
0.0000	-0.60
0.0033	-0.26
0.0066	3.23
0.0099	2.95
0.0133	0.73
0.0166	-0.43
0.0200	1.70
0.0233	1.35
0.0266	1.01
0.0300	1.02
0.0333	0.94
0.0500	0.67
0.0666	0.47
0.0833	0.31
0.1000	0.17
0.1166	0.06
0.1333	-0.02
0.1500	-0.10
0.1666	-0.17
0.1833	-0.22
0.2000	-0.27
0.2166	-0.31
0.2333	-0.35
0.2500	-0.38
0.2666	-0.40
0.2833	-0.43
0.3000	-0.44
0.3166	-0.46
0.3333	-0.48
0.4167	-0.52
0.5000	-0.55
0.5833	-0.56
0.6667	-0.57
0.7500	-0.57
0.8333	-0.57
0.9167	-0.57
1.0000	-0.57
1.0833	-0.57
1.1667	-0.58
1.2500	-0.58
1.3333	-0.57
1.4166	-0.57
1.5000	-0.57
1.5833	-0.58
1.6667	-0.58
1.7500	-0.57
1.8333	-0.58
1.9167	-0.58
2.0000	-0.57
2.5000	-0.59
3.0000	-0.59
3.5000	-0.59
4.0000	-0.59
4.5000	-0.59
5.0000	-0.59
5.5000	-0.59

<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<>>

A Q T E S O L V   R E S U L T S
Version 1.10

06/04/92 03:39:55

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TEST DESCRIPTION

Data set........... m007a.set
Data set title..... RISING HEAD RESULT, M-007-A
Company............ J.M.MONTGOMERY, CONSULTING ENG
Project............ 2738.0262
Client............. NAVY - WESTDIV
Location........... 1943-1956 Disposal Area
Test date.......... August 8, 1991

Knowns and Constants:
No. of data points.................. 9
Radius of well casing............... 2.54
Radius of well...................... 5.79
Aquifer saturated thickness......... 298.7
Well screen length.................. 298.7
Static height of water in well...... 298.7
Log(Re/Rw).......................... 3.019
A, B, C............................. 0.000, 0.000, 2.696

==

ANALYTICAL METHOD

Bouwer-Rice (Unconfined Aquifer Slug Test)

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RESULTS FROM VISUAL CURVE MATCHING

VISUAL MATCH PARAMETER ESTIMATES

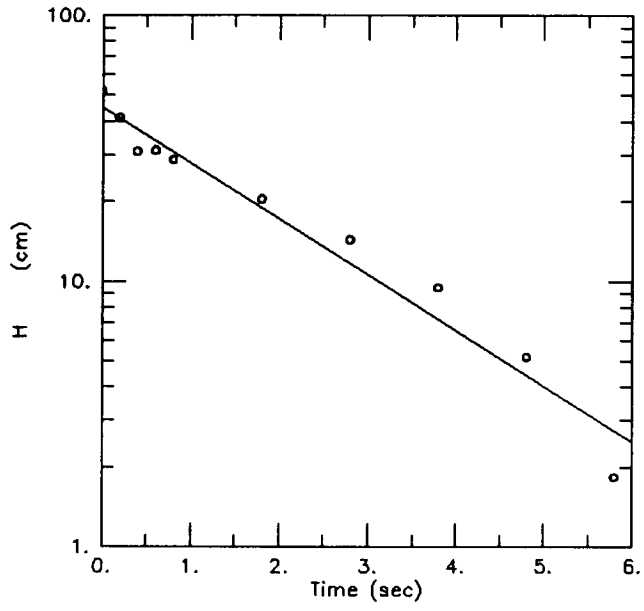
	Estimate
K =	1.5716E-002
y0 =	4.7289E-308

<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<>>

TYPE CURVE DATA

K = 1.57157E-002
y0 = 4.48127E+001

Time	Drawdown	Time	Drawdown	Time	Drawdown
0.000E+000	4.481E+001	6.000E+000	2.486E+000		



DATA SET:
m007a.aet
08/04/92

AQUIFER TYPE:
Unconfined

SOLUTION METHOD:
Bouwer-Rice

TEST DATE:
August 8, 1991

ESTIMATED PARAMETERS:
K = 0.01572 cm/sec
y0 = 44.81 cm

TEST DATA:
H0 = 51.82 cm
rc = 2.54 cm
rw = 5.78 cm
L = 298.7 cm
b = 298.7 cm
H = 298.7 cm

RISING HEAD RESULT, M-007-A

J.M.MONTGOMERY, CONSULTING ENG	Client: NAVY - WESTDIV
Project No.: 2738.0262	Location: 1943-1956 Disposal Area

M-008-A
RISING HEAD FIELD DATA
NAS ALAMEDA, CTO-107
1991

SE1000B
Environmental Logger
08/08 16:40

Unit# 00515 Test# 1

INPUT 1: Level (F) TOC

Reference 0.00
Scale factor 10.09
Offset 0.00

Step# 0 08/08 11:25

Elapsed Time (min)	Value (ft)
0.0000	0.56
0.0033	1.53
0.0066	4.33
0.0099	4.57
0.0133	0.88
0.0166	3.24
0.0200	2.42
0.0233	2.40
0.0266	2.30
0.0300	2.31
0.0333	2.24
0.0500	2.06
0.0666	1.91
0.0833	1.79
0.1000	1.68
0.1166	1.59
0.1333	1.51
0.1500	1.43
0.1666	1.36
0.1833	1.30
0.2000	1.25
0.2166	1.20
0.2333	1.15
0.2500	1.12
0.2666	1.08
0.2833	1.04
0.3000	1.01
0.3166	0.98
0.3333	0.95
0.4167	0.85
0.5000	0.77
0.5833	0.72
0.6667	0.68
0.7500	0.65
0.8333	0.64
0.9167	0.62
1.0000	0.61
1.0833	0.60
1.1667	0.59
1.2500	0.58
1.3333	0.58
1.4166	0.57
1.5000	0.57
1.5833	0.57
1.6667	0.57
1.7500	0.57
1.8333	0.57
1.9167	0.56
2.0000	0.56
2.5000	0.55
3.0000	0.56
3.5000	0.56
4.0000	0.57
4.5000	0.57
5.0000	0.57
5.5000	0.57
6.0000	0.56
6.5000	0.56
7.0000	0.56
7.5000	0.56
8.0000	0.56
8.5000	0.55
9.0000	0.56
9.5000	0.56
10.0000	0.56
12.0000	0.53
14.0000	0.55
16.0000	0.53

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A Q T E S O L V   R E S U L T S

Version 1.10

02/25/92 10:20:22

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TEST DESCRIPTION

Data set........... m008a.set
Data set title..... RISING HEAD RESULT, M-008-A
Company............ J.M.MONTGOMERY, CONSULTING ENG
Project............ 2738.0262
Client............. NAVY - WESTDIV
Location........... 1943-1956 Disposal Area
Test date.......... August 8, 1991

Knowns and Constants:

No. of data points.................. 42
Radius of well casing............... 2.54
Radius of well...................... 5.79
Aquifer saturated thickness......... 298.7
Well screen length.................. 298.7
Static height of water in well...... 298.7
Log(Re/Rw).......................... 3.019
A, B, C............................. 0.000, 0.000, 2.696

===

ANALYTICAL METHOD

Bouwer-Rice (Unconfined Aquifer Slug Test)

===

RESULTS FROM VISUAL CURVE MATCHING

VISUAL MATCH PARAMETER ESTIMATES

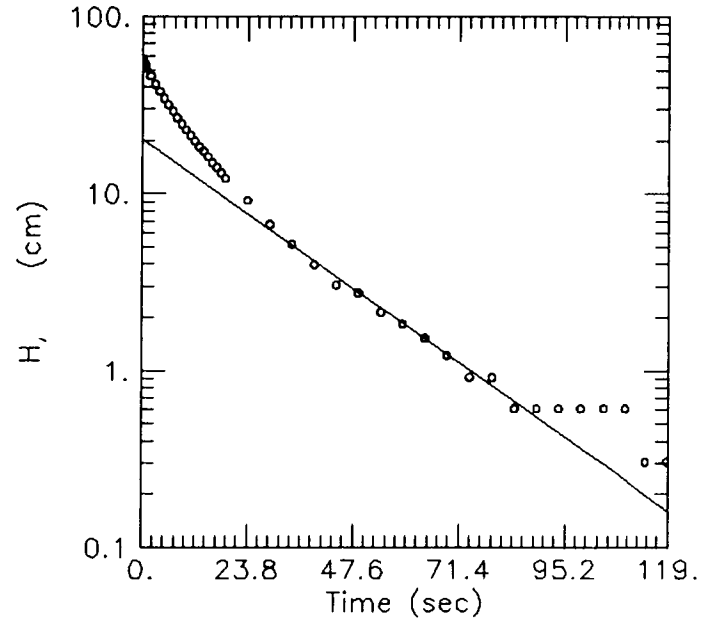
	Estimate
K =	1.4357E-003
y0 =	3.9704E+002

<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<>>

TYPE CURVE DATA

K = 1.32645E-003
y0 = 2.02243E+001

Time	Drawdown	Time	Drawdown	Time	Drawdown
0.000E+000	2.022E+001	1.190E+002	1.598E-001		



DATA SET:
m008a.aet
02/25/92

AQUIFER TYPE:
Unconfined
SOLUTION METHOD:
Bouwer-Rice
TEST DATE:
August 8, 1991

ESTIMATED PARAMETERS:
K = 0.001328 cm/sec
y0 = 20.22 cm

TEST DATA:
H0 = 57. cm
rc = 2.54 cm
rw = 5.78 cm
L = 288.7 cm
D = 298.7 cm
H = 298.7 cm

RISING HEAD RESULT, M-008-A

J.M.MONTGOMERY, CONSULTING ENG	Client: NAVY – WESTDIV
Project No.: 2738.0262	Location: 1943–1956 Disposal Area

M-009-A
RISING HEAD FIELD DATA
NAS ALAMEDA, CTO-107
1991

SE1000B
Environmental Logger
08/06 18:25

Unit# 00515 Test# 5

INPUT 1: Level (F) TOC

Reference 0.00
Scale factor 10.09
Offset 0.00

Step# 0 08/06 14:43

Elapsed Time (min)	Value (ft)
0.0000	2.82
0.0033	3.31
0.0066	2.38
0.0099	-0.14
0.0133	2.56
0.0166	1.70
0.0200	1.98
0.0233	1.75
0.0266	1.85
0.0300	1.74
0.0333	1.78
0.0500	1.67
0.0666	1.60
0.0833	1.54
0.1000	1.49
0.1166	1.44
0.1333	1.39
0.1500	1.35
0.1666	1.30
0.1833	1.27
0.2000	1.23
0.2166	1.19
0.2333	1.16
0.2500	1.13
0.2666	1.09
0.2833	1.06
0.3000	1.04
0.3166	1.00
0.3333	0.98
0.4167	0.86
0.5000	0.76
0.5833	0.67
0.6667	0.60
0.7500	0.54
0.8333	0.48
0.9167	0.43
1.0000	0.39
1.0833	0.36
1.1667	0.33
1.2500	0.30
1.3333	0.28
1.4166	0.26
1.5000	0.24
1.5833	0.23
1.6667	0.21
1.7500	0.20
1.8333	0.19
1.9167	0.17
2.0000	0.16
2.5000	0.13
3.0000	0.11
3.5000	0.09
4.0000	0.08
4.5000	0.07
5.0000	0.07
5.5000	0.07
6.0000	0.07
6.5000	0.07
7.0000	0.07
7.5000	0.07
8.0000	0.06

<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<>>>

A Q T E S O L V   R E S U L T S
Version 1.10

06/08/92 06:23:41

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TEST DESCRIPTION

Data set........... M009A.SET
Data set title..... RISING HEAD RESULT, M-009-A
Company............ J.M.MONTGOMERY, CONSULTING ENG
Project............ 2738.0262
Client............. NAVY - WESTDIV
Location........... 1943-1956 Disposal Area
Test date.......... August 6, 1991

Knowns and Constants:
No. of data points.................. 50
Radius of well casing............... 2.57
Radius of well...................... 5.79
Aquifer saturated thickness......... 357.2
Well screen length.................. 304.8
Static height of water in well...... 357.2
Log(Re/Rw).......................... 3.137
A, B, C............................. 0.000, 0.000, 2.732

==

ANALYTICAL METHOD

Bouwer-Rice (Unconfined Aquifer Slug Test)

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RESULTS FROM VISUAL CURVE MATCHING

VISUAL MATCH PARAMETER ESTIMATES

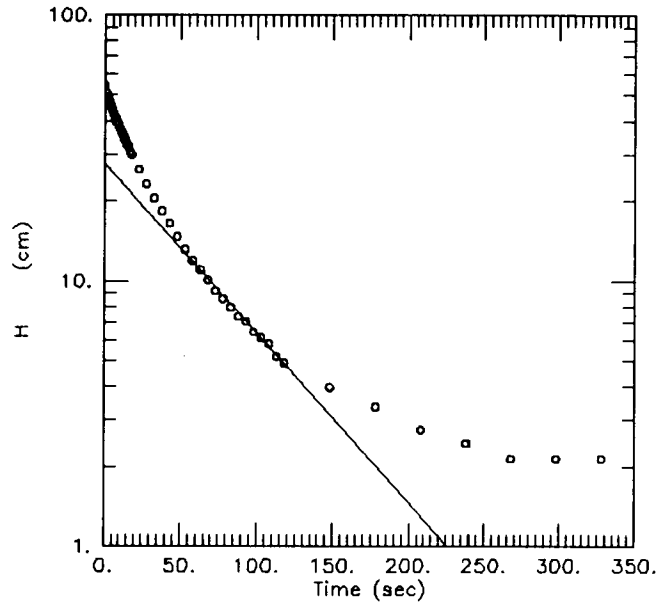
	Estimate
K =	5.0051E-004
y0 =	4.2766E-306

<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<>>>

TYPE CURVE DATA

K = 5.00506E-004
y0 = 2.76938E+001

Time	Drawdown	Time	Drawdown	Time	Drawdown
0.000E+000	2.769E+001	3.500E+002	1.600E-001		



DATA SET:
M009A.SET
06/08/92

AQUIFER TYPE:
Unconfined

SOLUTION METHOD:
Bouwer-Rice

TEST DATE:
August 8, 1991

ESTIMATED PARAMETERS:
K = 0.0005005 cm/sec
y0 = 27.88 cm

TEST DATA:
H0 = 54.25 cm
rc = 2.57 cm
rw = 5.78 cm
L = 304.8 cm
D = 357.2 cm
H = 357.2 cm

RISING HEAD RESULT, M-009-A

J.M.MONTGOMERY, CONSULTING ENG	Client: NAVY - WESTDIV
Project No.: 2738.0262	Location: 1943-1956 Disposal Area

M-010-A
RISING HEAD FIELD DATA
NAS ALAMEDA, CTO-107
1991

SE1000B
Environmental Logger
08/12 09:22

Unit# 00515 Test# 1

INPUT 1: Level (F) TOC

Reference 0.00
Scale factor 10.09
Offset 0.00

Step# 0 08/09 12:43

Elapsed Time (min)	Value (ft)
0.0000	-0.14
0.0033	0.37
0.0066	3.59
0.0099	4.44
0.0133	0.19
0.0166	0.62
0.0200	1.95
0.0233	1.68
0.0266	1.61
0.0300	1.57
0.0333	1.53
0.0500	1.35
0.0666	1.20
0.0833	1.07
0.1000	0.96
0.1166	0.87
0.1333	0.78
0.1500	0.71
0.1666	0.64
0.1833	0.58
0.2000	0.53
0.2166	0.48
0.2333	0.44
0.2500	0.40
0.2666	0.37
0.2833	0.34
0.3000	0.31
0.3166	0.28
0.3333	0.26
0.4167	0.17
0.5000	0.10
0.5833	0.05
0.6667	0.02
0.7500	0.00
0.8333	-0.01
0.9167	-0.03
1.0000	-0.04
1.0833	-0.05
1.1667	-0.06
1.2500	-0.07
1.3333	-0.07
1.4166	-0.08
1.5000	-0.09
1.5833	-0.09
1.6667	-0.09
1.7500	-0.10
1.8333	-0.10
1.9167	-0.10
2.0000	-0.10
2.5000	-0.12
3.0000	-0.12
3.5000	-0.12
4.0000	-0.13
4.5000	-0.13
5.0000	-0.13
5.5000	-0.13
6.0000	-0.13
6.5000	-0.15

<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<>>

A Q T E S O L V   R E S U L T S

Version 1.10

02/25/92 . 11:05:36

==

TEST DESCRIPTION

Data set........... m010a.set
Data set title..... RISING HEAD RESULT, M-010-A
Company............ J.M.MONTGOMERY, CONSULTING ENG
Project............ 2738.0262
Client............. NAVY - WESTDIV
Location........... West Beach Landfill
Test date.......... August 9, 1991

Knowns and Constants:
No. of data points.................. 26
Radius of well casing............... 2.54
Radius of well...................... 5.79
Aquifer saturated thickness......... 374
Well screen length.................. 304.8
Static height of water in well...... 374
Log(Re/Rw).......................... 3.166
A, B, C............................. 0.000, 0.000, 2.732

==

ANALYTICAL METHOD

Bouwer-Rice (Unconfined Aquifer Slug Test)

==

RESULTS FROM VISUAL CURVE MATCHING

VISUAL MATCH PARAMETER ESTIMATES

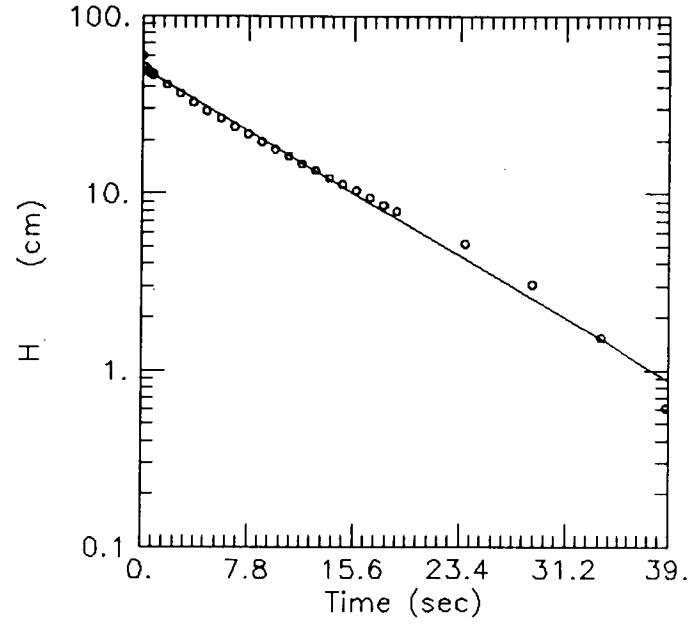
	Estimate
K =	3.5010E-003
y0 =	6.9631E-239

<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<>>

TYPE CURVE DATA

K = 3.50102E-003
y0 = 5.09542E+001

Time	Drawdown	Time	Drawdown	Time	Drawdown
0.000E+000	5.095E+001	3.900E+001	8.663E-001		



DATA SET:
m010a.aet
02/25/92

AQUIFER TYPE:
Unconfined
SOLUTION METHOD:
Bouwer-Rice
TEST DATE:
August 9, 1991

ESTIMATED PARAMETERS:
K = 0.003501 cm/sec
y0 = 50.85 cm

TEST DATA:
H0 = 58.44 cm
rc = 2.54 cm
rw = 5.79 cm
L = 304.8 cm
b = 374. cm
H = 374. cm

RISING HEAD RESULT, M-010-A

J.M.MONTGOMERY, CONSULTING ENG	Client: NAVY – WESTDIV
Project No.: 2738.0262	Location: West Beach Landfill

M-011-A
RISING HEAD FIELD DATA
NAS ALAMEDA, CTO-107
1991

SE2000
Environmental Logger
08/02 07:37

Unit# Test 9

INPUT 1: Level (F) TOC

Reference	0.000
SG	1.000
Linearity	0.000
Scale factor	49.900
Offset	0.010
Delay mSEC	50.000

Step 0 08/01 15:43:27

Elapsed Time (min)	INPUT 1 (ft)
0.0000	0.315
0.0083	4.080
0.0166	1.670
0.0250	1.465
0.0333	1.355
0.0416	1.213
0.0500	1.118
0.0583	1.024
0.0666	0.929
0.0750	0.850
0.0833	0.787
0.1000	0.661
0.1166	0.582
0.1333	0.488
0.1500	0.425
0.1666	0.378
0.1833	0.315
0.2000	0.283
0.2166	0.252
0.2333	0.220
0.2500	0.189
0.2666	0.173
0.2833	0.157
0.3000	0.141
0.3166	0.126
0.3333	0.110
0.4166	0.078
0.5000	0.047
0.5833	0.031
0.6666	0.031
0.7500	0.015
0.8333	0.015
0.9166	0.015
1.0000	0.000
1.0833	0.000
1.1666	0.000
1.2500	0.000
1.3333	0.000
1.4166	0.000
1.5000	-0.015
1.5833	-0.015
1.6666	-0.015
1.7500	-0.015
1.8333	-0.015
1.9166	-0.015
2.0000	-0.015
2.5000	-0.015
3.0000	-0.031
3.5000	-0.031
4.0000	-0.015
4.5000	-0.031
5.0000	-0.031
5.5000	-0.031
6.0000	-0.031
6.5000	-0.031
7.0000	-0.031
7.5000	-0.031
8.0000	-0.031
8.5000	-0.031
9.0000	-0.031

<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>

A Q T E S O L V   R E S U L T S

Version 1.10

02/25/92 10:51:38

==

TEST DESCRIPTION

Data set........... m011a.set
Data set title..... RISING HEAD RESULT, M-011-A
Company............ J.M.MONTGOMERY, CONSULTING ENG
Project............ 2738.0262
Client............. NAVY - WESTDIV
Location........... West Beach Landfill
Test date.......... August 1, 1991

Knowns and Constants:

No. of data points.................. 30
Radius of well casing............... 2.54
Radius of well...................... 5.79
Aquifer saturated thickness......... 301.1
Well screen length.................. 301.1
Static height of water in well...... 301.1
Log(Re/Rw).......................... 3.026
A, B, C............................. 0.000, 0.000, 2.710

==

ANALYTICAL METHOD

Bouwer-Rice (Unconfined Aquifer Slug Test)

==

RESULTS FROM VISUAL CURVE MATCHING

VISUAL MATCH PARAMETER ESTIMATES

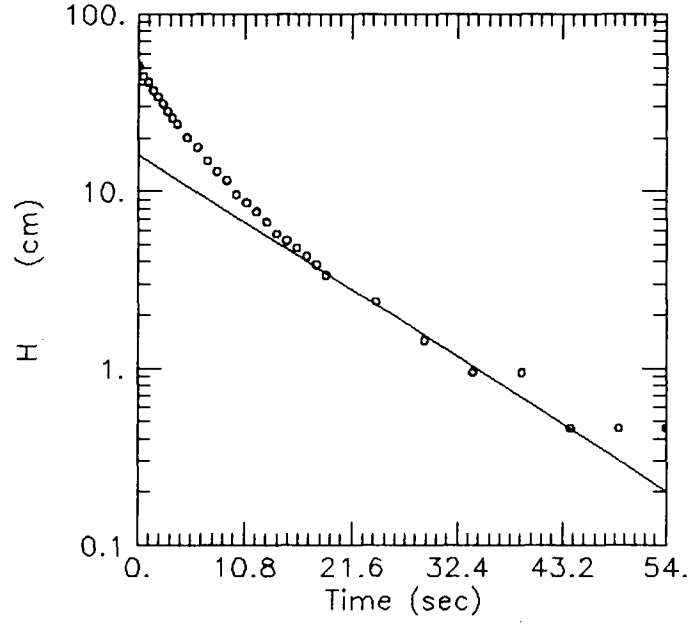
	Estimate
K =	2.9951E-003
y0 =	3.9704E+002

<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>

TYPE CURVE DATA

K = 2.63776E-003
y0 = 1.61601E+001

Time	Drawdown	Time	Drawdown	Time	Drawdown
0.000E+000	1.616E+001	5.400E+001	1.995E-001		



DATA SET:
m011a.aet
02/25/92

AQUIFER TYPE:
Unconfined
SOLUTION METHOD:
Bouwer-Rice
TEST DATE:
August 1, 1991

ESTIMATED PARAMETERS:
K = 0.002638 cm/sec
y0 = 16.16 cm

TEST DATA:
H0 = 50.8 cm
rc = 2.54 cm
rw = 5.78 cm
L = 301.1 cm
D = 301.1 cm
H = 301.1 cm

RISING HEAD RESULT, M-011-A

J.M.MONTGOMERY, CONSULTING ENG	Client: NAVY – WESTDIV
Project No.: 2738.0262	Location: West Beach Landfill

M-012-A
RISING HEAD FIELD DATA
NAS ALAMEDA, CTO-107
1991

SE1000B
Environmental Logger
08/02 07:00

Unit# 00515 Test# 9

INPUT 1: Level (F) TOC

Reference 0.00
Scale factor 10.09
Offset 0.00

Step# 0 08/01 13:48

Elapsed Time (min)	Value (ft)
0.0000	-0.00
0.0033	0.00
0.0066	4.35
0.0099	5.86
0.0133	0.56
0.0166	0.12
0.0200	1.99
0.0233	1.58
0.0266	1.55
0.0300	1.50
0.0333	1.49
0.0500	1.32
0.0666	1.20
0.0833	1.08
0.1000	0.99
0.1166	0.90
0.1333	0.83
0.1500	0.77
0.1666	0.71
0.1833	0.66
0.2000	0.62
0.2166	0.57
0.2333	0.53
0.2500	0.50
0.2666	0.47
0.2833	0.44
0.3000	0.42
0.3166	0.40
0.3333	0.38
0.4167	0.31
0.5000	0.26
0.5833	0.22
0.6667	0.20
0.7500	0.18
0.8333	0.16
0.9167	0.15
1.0000	0.14
1.0833	0.13
1.1667	0.12
1.2500	0.11
1.3333	0.11
1.4166	0.10
1.5000	0.09
1.5833	0.09
1.6667	0.08
1.7500	0.08
1.8333	0.07
1.9167	0.07
2.0000	0.07
2.5000	0.05
3.0000	0.03
3.5000	0.03
4.0000	0.02
4.5000	0.02
5.0000	0.01
5.5000	0.01
6.0000	0.01
6.5000	0.00
7.0000	0.00
7.5000	0.01
8.0000	0.02

<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<>>

A Q T E S O L V R E S U L T S

Version 1.10

02/25/92 13:05:42

TEST DESCRIPTION

Data set........... m012a.set
Data set title..... RISING HEAD RESULT, M-012-A
Company............ J.M.MONTGOMERY, CONSULTING ENG
Project............ 2738.0262
Client............. NAVY - WESTDIV
Location........... West Beach Landfill
Test date.......... August 1, 1991

Knowns and Constants:

No. of data points.................. 50
Radius of well casing............... 2.54
Radius of well...................... 5.79
Aquifer saturated thickness......... 304.8
Well screen length.................. 304.8
Static height of water in well...... 304.8
Log(Re/Rw).......................... 3.036
A, B, C............................. 0.000, 0.000, 2.732

ANALYTICAL METHOD

Bouwer-Rice (Unconfined Aquifer Slug Test)

RESULTS FROM VISUAL CURVE MATCHING

VISUAL MATCH PARAMETER ESTIMATES

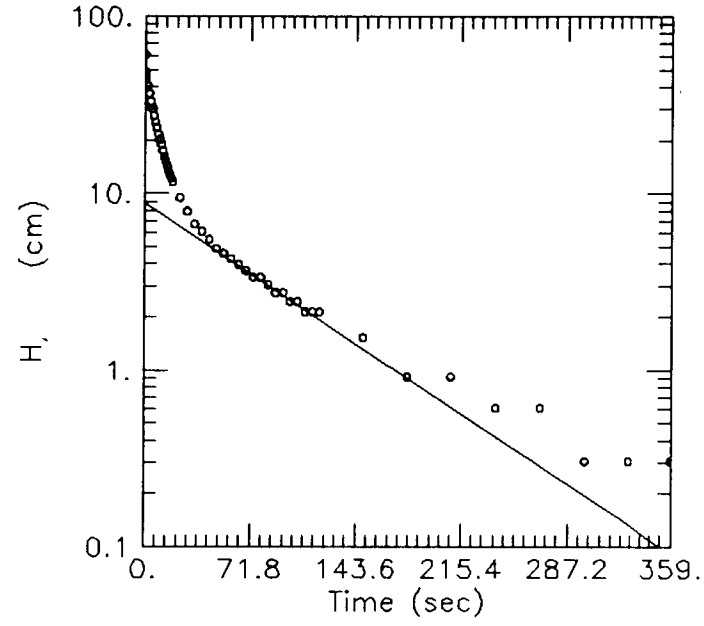
	Estimate
K =	4.6429E-004
y0 =	-1.3253E+100

<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<>>

TYPE CURVE DATA

K = 4.09096E-004
y0 = 8.79321E+000

Time	Drawdown	Time	Drawdown	Time	Drawdown
0.000E+000	8.793E+000	3.590E+002	9.094E-002		



DATA SET:
m012a.aet
02/25/92

AQUIFER TYPE:
Unconfined
SOLUTION METHOD:
Bouwer-Rice
TEST DATE:
August 1, 1991

ESTIMATED PARAMETERS:
K = 0.0004091 cm/sec
y0 = 8.783 cm

TEST DATA:
H0 = 80.86 cm
rc = 2.54 cm
rw = 5.78 cm
L = 304.8 cm
D = 304.8 cm
H = 304.8 cm

RISING HEAD RESULT, M-012-A

J.M.MONTGOMERY, CONSULTING ENG	Client: NAVY - WESTDIV
Project No.: 2738.0262	Location: West Beach Landfill

M-013-A
RISING HEAD FIELD DATA
NAS ALAMEDA, CTO-107
1991

SE2000
Environmental Logger
08/02 07:29

Unit# Test 3

INPUT 1: Level (F) TOC

Reference	0.000
SG	1.000
Linearity	0.000
Scale factor	49.900
Offset	0.010
Delay mSEC	50.000

Step 0 08/01 13:16:44

Elapsed Time (min)	INPUT 1 (ft)
0.0000	3.671
0.0083	1.874
0.0166	2.741
0.0250	2.615
0.0333	2.505
0.0416	2.426
0.0500	2.331
0.0583	2.268
0.0666	2.205
0.0750	2.142
0.0833	2.095
0.1000	2.001
0.1166	1.922
0.1333	1.859
0.1500	1.796
0.1666	1.748
0.1833	1.717
0.2000	1.670
0.2166	1.654
0.2333	1.622
0.2500	1.591
0.2666	1.575
0.2833	1.559
0.3000	1.544
0.3166	1.528
0.3333	1.512
0.4166	1.465
0.5000	1.433
0.5833	1.402
0.6666	1.386
0.7500	1.370
0.8333	1.355
0.9166	1.339
1.0000	1.339
1.0833	1.323
1.1666	1.323
1.2500	1.323
1.3333	1.307
1.4166	1.307
1.5000	1.307
1.5833	1.307
1.6666	1.292
1.7500	1.292
1.8333	1.292
1.9166	1.276
2.0000	1.292
2.5000	1.276
3.0000	1.276
3.5000	1.260
4.0000	1.260
4.5000	1.260
5.0000	1.260
5.5000	1.260
6.0000	1.260
6.5000	1.260
7.0000	1.244
7.5000	1.244
8.0000	1.260

<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<>>

A Q T E S O L V R E S U L T S

Version 1.10

02/25/92 13:14:50

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TEST DESCRIPTION

Data set........... m013a.set
Data set title..... RISING HEAD RESULT, M-013-A
Company............ J.M.MONTGOMERY, CONSULTING ENG
Project............ 2738.0262
Client............. NAVY - WESTDIV
Location........... West Beach Landfill
Test date.......... August 1, 1991

Knowns and Constants:
No. of data points.................. 45
Radius of well casing............... 2.54
Radius of well...................... 5.79
Aquifer saturated thickness......... 273.1
Well screen length.................. 273.1
Static height of water in well...... 273.1
Log(Re/Rw).......................... 2.947
A, B, C............................. 0.000, 0.000, 2.542

==

ANALYTICAL METHOD

Bouwer-Rice (Unconfined Aquifer Slug Test)

==

RESULTS FROM VISUAL CURVE MATCHING

VISUAL MATCH PARAMETER ESTIMATES

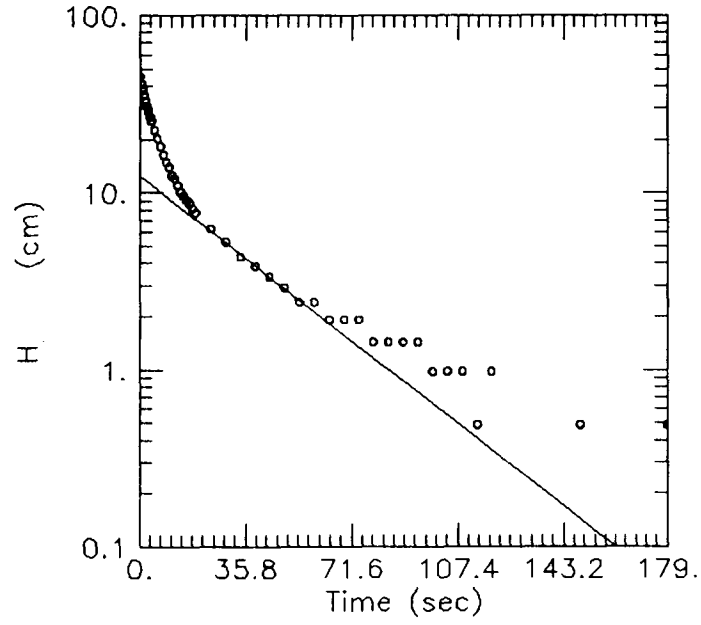
	Estimate
K =	1.0446E-003
y0 =	-1.3253E+100

<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<>>

TYPE CURVE DATA

K = 1.04456E-003
y0 = 1.25740E+001

Time	Drawdown	Time	Drawdown	Time	Drawdown
0.000E+000	1.257E+001	1.790E+002	5.843E-002		



DATA SET:
m013a.aet
02/25/92

AQUIFER TYPE:
Unconfined
SOLUTION METHOD:
Bouwer-Rice
TEST DATE:
August 1, 1991

ESTIMATED PARAMETERS:
K = 0.001045 cm/sec
y0 = 12.57 cm

TEST DATA:
H0 = 45.14 cm
rc = 2.54 cm
rw = 5.78 cm
L = 273.1 cm
D = 273.1 cm
H = 273.1 cm

RISING HEAD RESULT, M-013-A

J.M.MONTGOMERY, CONSULTING ENG	Client: NAVY – WESTDIV
Project No.: 2738.0262	Location: West Beach Landfill

M-014-A
RISING HEAD FIELD DATA
NAS ALAMEDA, CTO-107
1991

SE2000
Environmental Logger
08/02 07:24

Unit# Test 1

INPUT 1: Level (F) TOC

Reference	0.000
SG	1.000
Linearity	0.000
Scale factor	49.900
Offset	0.010
Delay mSEC	50.000

Step 0 08/01 10:00:51

Elapsed Time (min)	INPUT 1 (ft)
0.0000	1.748
0.0083	1.055
0.0166	1.355
0.0250	1.197
0.0333	1.039
0.0416	0.913
0.0500	0.803
0.0583	0.709
0.0666	0.630
0.0750	0.551
0.0833	0.488
0.1000	0.393
0.1166	0.315
0.1333	0.252
0.1500	0.204
0.1666	0.173
0.1833	0.141
0.2000	0.126
0.2166	0.110
0.2333	0.094
0.2500	0.078
0.2666	0.063
0.2833	0.063
0.3000	0.047
0.3166	0.047
0.3333	0.031
0.4166	0.015
0.5000	0.015
0.5833	0.000
0.6666	0.000
0.7500	0.000
0.8333	0.000
0.9166	0.000
1.0000	0.000
1.0833	0.000
1.1666	-0.015
1.2500	-0.015
1.3333	0.000
1.4166	0.000
1.5000	-0.015
1.5833	0.000
1.6666	-0.015
1.7500	-0.015
1.8333	0.000
1.9166	0.000
2.0000	0.000
2.5000	-0.015
3.0000	-0.015
3.5000	-0.015
4.0000	-0.015
4.5000	-0.015
5.0000	-0.015
5.5000	-0.015
6.0000	-0.015
6.5000	-0.015
7.0000	-0.015
7.5000	-0.015
8.0000	-0.015
8.5000	-0.015
9.0000	-0.015
9.5000	-0.015
10.0000	-0.015
12.0000	-0.015

<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<>>

A Q T E S O L V   R E S U L T S

Version 1.10

02/25/92 . 13:22:13

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TEST DESCRIPTION

Data set........... m014a.set
Data set title..... RISING HEAD RESULT, M-014-A
Company............ J.M.MONTGOMERY, CONSULTING ENG
Project............ 2738.0262
Client............. NAVY - WESTDIV
Location........... West Beach Landfill
Test date.......... August 1, 1991

Knowns and Constants:
No. of data points.................. 25
Radius of well casing............... 2.54
Radius of well...................... 5.79
Aquifer saturated thickness......... 288
Well screen length.................. 288
Static height of water in well...... 288
Log(Re/Rw).......................... 2.99
A, B, C............................. 0.000, 0.000, 2.631

==

ANALYTICAL METHOD

Bouwer-Rice (Unconfined Aquifer Slug Test)

==

RESULTS FROM VISUAL CURVE MATCHING

VISUAL MATCH PARAMETER ESTIMATES

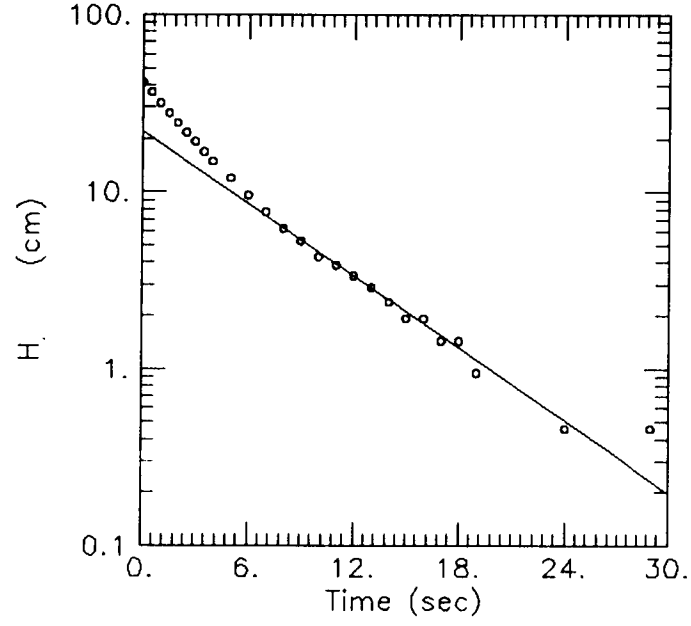
	Estimate
K =	5.6778E-003
y0 =	-1.3253E+100

<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<>>

TYPE CURVE DATA

K = 5.26026E-003
y0 = 2.20814E+001

Time	Drawdown	Time	Drawdown	Time	Drawdown
0.000E+000	2.208E+001	3.000E+001	1.983E-001		



DATA SET:
m014a.aet
02/25/92

AQUIFER TYPE:
Unconfined

SOLUTION METHOD:
Bouwer-Rice

TEST DATE:
August 1, 1991

ESTIMATED PARAMETERS:
K = 0.00526 cm/sec
y0 = 22.08 cm

TEST DATA:
H0 = 41.3 cm
rc = 2.54 cm
rw = 5.79 cm
L = 288. cm
D = 288. cm
H = 288. cm

RISING HEAD RESULT, M-014-A

J.M.MONTGOMERY, CONSULTING ENG	Client: NAVY – WESTDIV
Project No.: 2738.0262	Location: West Beach Landfill

M-015-A
RISING HEAD FIELD DATA
NAS ALAMEDA, CTO-107
1991

SE2000
Environmental Logger
07/31 19:22

Unit# Test 7

INPUT 1: Level (F) TOC

Reference	0.000
SG	1.000
Linearity	0.000
Scale factor	49.900
Offset	0.010
Delay mSEC	50.000

Step 0 07/31 15:24:03

Elapsed Time (min)	INPUT 1 (ft)
0.0000	3.686
0.0083	-0.677
0.0166	1.339
0.0250	1.102
0.0333	0.945
0.0416	0.787
0.0500	0.677
0.0583	0.567
0.0666	0.472
0.0750	0.393
0.0833	0.330
0.1000	0.236
0.1166	0.173
0.1333	0.126
0.1500	0.078
0.1666	0.063
0.1833	0.031
0.2000	0.015
0.2166	0.015
0.2333	0.000
0.2500	-0.015
0.2666	-0.015
0.2833	-0.031
0.3000	-0.031
0.3166	-0.031
0.3333	-0.047
0.4166	-0.063
0.5000	-0.063
0.5833	-0.078
0.6666	-0.078
0.7500	-0.078
0.8333	-0.078
0.9166	-0.078
1.0000	-0.094
1.0833	-0.094
1.1666	-0.094
1.2500	-0.094
1.3333	-0.094
1.4166	-0.094
1.5000	-0.094
1.5833	-0.094
1.6666	-0.094
1.7500	-0.094
1.8333	-0.094
1.9166	-0.094
2.0000	-0.110
2.5000	-0.110
3.0000	-0.110
3.5000	-0.110
4.0000	-0.110
4.5000	-0.126
5.0000	-0.110
5.5000	-0.126
6.0000	-0.126
6.5000	-0.126
7.0000	-0.126
7.5000	-0.126
8.0000	-0.126
8.5000	-0.126
9.0000	-0.189
9.5000	-0.157
10.0000	-0.031
12.0000	-0.110

<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<>>

A Q T E S O L V   R E S U L T S

Version 1.10

06/08/92 06:25:18

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TEST DESCRIPTION

Data set........... M015A.SET
Data set title..... RISING HEAD RESULT, M-015-A
Company............ J.M.MONTGOMERY, CONSULTING ENG
Project............ 2738.0262
Client............. NAVY - WESTDIV
Location........... West Beach Landfill
Test date.......... July 31, 1991

Knowns and Constants:

No. of data points.................. 16
Radius of well casing............... 2.54
Radius of well...................... 5.79
Aquifer saturated thickness......... 295.4
Well screen length.................. 295.4
Static height of water in well...... 295.4
Log(Re/Rw).......................... 3.01
A, B, C............................. 0.000, 0.000, 2.675

==

ANALYTICAL METHOD

Bouwer-Rice (Unconfined Aquifer Slug Test)

==

RESULTS FROM VISUAL CURVE MATCHING

VISUAL MATCH PARAMETER ESTIMATES

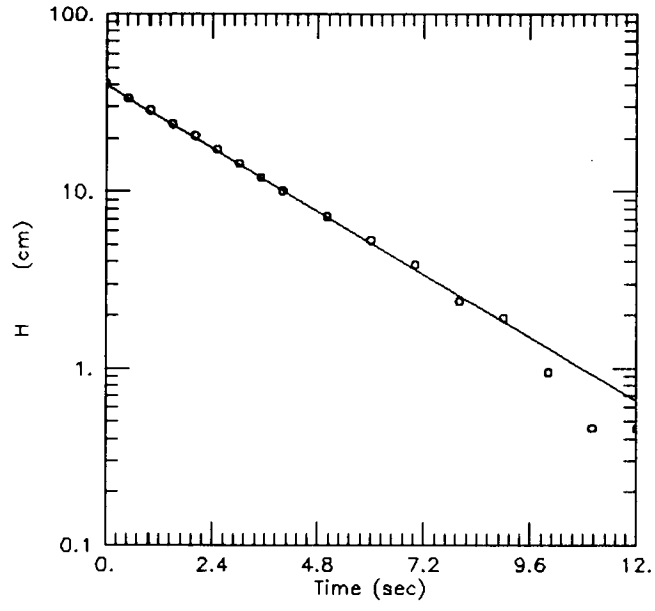
	Estimate
K =	1.3401E-004
y0 =	4.2766E-306

<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<>>

TYPE CURVE DATA

K = 1.12392E-002
y0 = 3.97928E+001

Time	Drawdown	Time	Drawdown	Time	Drawdown
0.000E+000	3.979E+001	1.200E+001	6.580E-001		



DATA SET:
M015A.SET
08/08/92

AQUIFER TYPE:
Unconfined
SOLUTION METHOD:
Bouwer-Rice
TEST DATE:
July 31, 1991

ESTIMATED PARAMETERS:
K = 0.01124 cm/sec
y0 = 38.78 cm

TEST DATA:
H0 = 40.81 cm
rc = 2.54 cm
rw = 5.78 cm
L = 285.4 cm
b = 295.4 cm
H = 295.4 cm

RISING HEAD RESULT, M-015-A

J.M.MONTGOMERY, CONSULTING ENG	Client: NAVY – WESTDIV
Project No.: 2738.0262	Location: West Beach Landfill

M-016-A
RISING HEAD FIELD DATA
NAS ALAMEDA, CTO-107
1991

SE1000B
Environmental Logger
07/31 18:54

Unit# 00515 Test# 7

INPUT 1: Level (F) TOC

Reference 0.00
Scale factor 10.09
Offset 0.00

Step# 0 07/31 15:31

Elapsed Time (min)	Value (ft)
0.0000	3.14
0.0033	4.12
0.0066	10.01
0.0099	2.93
0.0133	5.29
0.0166	5.07
0.0200	4.98
0.0233	4.93
0.0266	4.89
0.0300	4.83
0.0333	4.77
0.0500	4.57
0.0666	4.39
0.0833	4.24
0.1000	4.10
0.1166	3.99
0.1333	3.89
0.1500	3.81
0.1666	3.74
0.1833	3.67
0.2000	3.62
0.2166	3.58
0.2333	3.55
0.2500	3.52
0.2666	3.49
0.2833	3.47
0.3000	3.45
0.3166	3.43
0.3333	3.41
0.4167	3.35
0.5000	3.31
0.5833	3.28
0.6667	3.25
0.7500	3.24
0.8333	3.22
0.9167	3.21
1.0000	3.20
1.0833	3.19
1.1667	3.18
1.2500	3.17
1.3333	3.17
1.4166	3.17
1.5000	3.16
1.5833	3.16
1.6667	3.16
1.7500	3.16
1.8333	3.16
1.9167	3.15
2.0000	3.15
2.5000	3.14
3.0000	3.13
3.5000	3.13
4.0000	3.13
4.5000	3.13
5.0000	3.12
5.5000	3.12
6.0000	3.11
6.5000	3.11
7.0000	3.12
7.5000	3.11
8.0000	3.11
8.5000	3.11
9.0000	3.10
9.5000	3.10
10.0000	3.11
12.0000	3.10
14.0000	3.09
16.0000	3.10
18.0000	3.09
20.0000	3.09
22.0000	3.08
24.0000	3.08
26.0000	3.08
28.0000	3.07
30.0000	3.07
32.0000	3.07
34.0000	3.06
36.0000	3.06
38.0000	3.05

<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<>>

A Q T E S O L V   R E S U L T S
Version 1.10

06/08/92 06:27:49

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TEST DESCRIPTION

Data set........... M016A.SET
Data set title..... RISING HEAD RESULT, M-016-A
Company............ J.M.MONTGOMERY, CONSULTING ENG
Project............ 2738.0262
Client............. NAVY - WESTDIV
Location........... West Beach Landfill
Test date.......... July 31, 1991

Knowns and Constants:
No. of data points.................. 73
Radius of well casing............... 2.54
Radius of well...................... 5.79
Aquifer saturated thickness......... 226.5
Well screen length.................. 226.5
Static height of water in well...... 226.5
Log(Re/Rw).......................... 2.794
A, B, C............................. 0.000, 0.000, 2.267

==

ANALYTICAL METHOD

Bouwer-Rice (Unconfined Aquifer Slug Test)

==

RESULTS FROM VISUAL CURVE MATCHING

VISUAL MATCH PARAMETER ESTIMATES

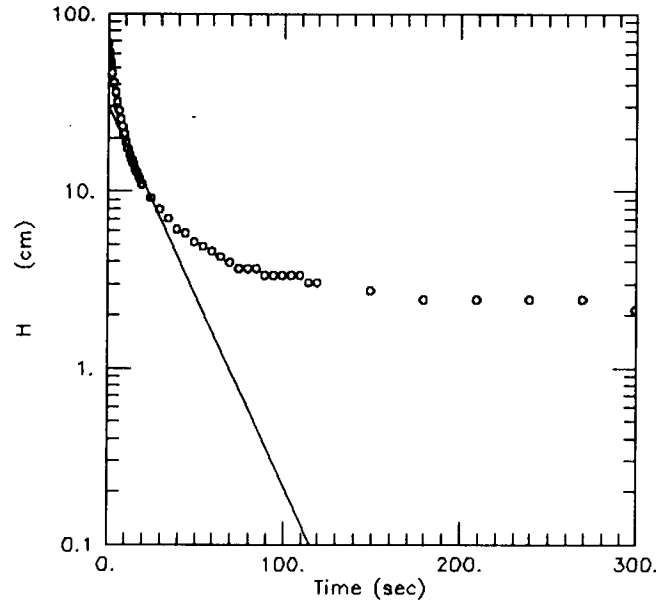
	Estimate
K =	1.2651E-003
y0 =	4.2766E-306

<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<>>

TYPE CURVE DATA

K = 1.97373E-003
y0 = 3.00154E+001

Time	Drawdown	Time	Drawdown	Time	Drawdown
0.000E+000	3.002E+001	3.000E+002	1.034E-005		



DATA SET:
M016A.SET
08/08/92

AQUIFER TYPE:
Unconfined

SOLUTION METHOD:
Bouwer-Rice

TEST DATE:
July 31, 1991

ESTIMATED PARAMETERS:
K = 0.001974 cm/sec
y0 = 30.02 cm

TEST DATA:
H0 = 88.28 cm
rc = 2.54 cm
rw = 5.78 cm
L = 228.5 cm
D = 228.5 cm
H = 228.5 cm

RISING HEAD RESULT, M-016-A

J.M.MONTGOMERY, CONSULTING ENG	Client: NAVY - WESTDIV
Project No.: 2738.0262	Location: West Beach Landfill

M-017-A
RISING HEAD FIELD DATA
NAS ALAMEDA, CTO-107
1991

SE1000B
Environmental Logger
07/31 18:48

Unit# 00515 Test# 5

INPUT 1: Level (F) TOC

Reference 0.00
Scale factor 10.09
Offset 0.00

Step# 0 07/31 13:40

Elapsed Time (min)	Value (ft)
0.0000	3.81
0.0033	3.48
0.0066	4.07
0.0099	10.55
0.0133	4.14
0.0166	5.18
0.0200	5.09
0.0233	5.01
0.0266	4.90
0.0300	4.90
0.0333	4.85
0.0500	4.62
0.0666	4.45
0.0833	4.30
0.1000	4.18
0.1166	4.09
0.1333	4.01
0.1500	3.96
0.1666	3.92
0.1833	3.88
0.2000	3.86
0.2166	3.84
0.2333	3.82
0.2500	3.81
0.2666	3.80
0.2833	3.79
0.3000	3.78
0.3166	3.77
0.3333	3.76
0.4167	3.74
0.5000	3.72
0.5833	3.70
0.6667	3.69
0.7500	3.68
0.8333	3.67
0.9167	3.67
1.0000	3.67
1.0833	3.66
1.1667	3.66
1.2500	3.66
1.3333	3.66
1.4166	3.66
1.5000	3.66
1.5833	3.65
1.6667	3.65
1.7500	3.64
1.8333	3.64
1.9167	3.63
2.0000	3.63
2.5000	3.62
3.0000	3.62
3.5000	3.61
4.0000	3.60
4.5000	3.60
5.0000	3.61
5.5000	3.62
6.0000	3.62
6.5000	3.61
7.0000	3.60
7.5000	3.60
8.0000	3.58
8.5000	3.57
9.0000	3.57
9.5000	3.56
10.0000	3.56
12.0000	3.54
14.0000	3.53
16.0000	3.51
18.0000	3.49
20.0000	3.49
22.0000	3.47
24.0000	3.45
26.0000	3.44
28.0000	3.41
30.0000	3.41
32.0000	3.39
34.0000	3.38
36.0000	3.37
38.0000	3.34
40.0000	3.34
42.0000	3.33
44.0000	3.31
46.0000	3.31
48.0000	3.28
50.0000	3.28
52.0000	3.27

<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<>>

A Q T E S O L V   R E S U L T S
Version 1.10

06/08/92 06:30:26

==

TEST DESCRIPTION

Data set........... M017A.SET
Data set title..... RISING HEAD RESULT, M-017-A
Company............ J.M.MONTGOMERY, CONSULTING ENG
Project............ 2738.0262
Client............. NAVY - WESTDIV
Location........... West Beach Landfill
Test date.......... July 31, 1991

Knowns and Constants:
No. of data points.................. 79
Radius of well casing............... 2.54
Radius of well...................... 5.79
Aquifer saturated thickness......... 161.5
Well screen length.................. 161.5
Static height of water in well...... 161.5
Log(Re/Rw).......................... 2.508
A, B, C............................. 0.000, 0.000, 1.903

==

ANALYTICAL METHOD

Bouwer-Rice (Unconfined Aquifer Slug Test)

==

RESULTS FROM VISUAL CURVE MATCHING

VISUAL MATCH PARAMETER ESTIMATES

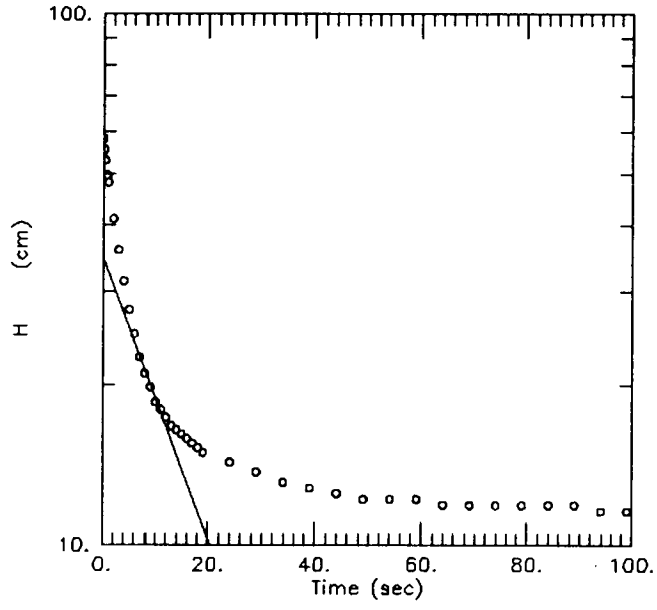
	Estimate
K =	3.0654E-003
y0 =	4.2766E-306

<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<>>

TYPE CURVE DATA

K = 3.06544E-003
y0 = 3.47167E+001

Time	Drawdown	Time	Drawdown	Time	Drawdown
0.000E+000	3.472E+001	1.000E+002	7.632E-002		



DATA SET:
M017A.SET
08/08/92

AQUIFER TYPE:
Unconfined

SOLUTION METHOD:
Bouwer-Rice

TEST DATE:
July 31, 1991

ESTIMATED PARAMETERS:
K = 0.003085 cm/sec
y0 = 34.72 cm

TEST DATA:
H0 = 58.22 cm
rc = 2.54 cm
re = 5.79 cm
L = 161.5 cm
b = 161.5 cm
H = 161.5 cm

RISING HEAD RESULT, M-017-A

J.M.MONTGOMERY, CONSULTING ENG	Client: NAVY – WESTDIV
Project No.: 2738.0262	Location: West Beach Landfill

M-018-A
RISING HEAD FIELD DATA
NAS ALAMEDA, CTO-107
1991

SE2000
Environmental Logger
07/31 19:17

Unit# Test 5

INPUT 1: Level (F) TOC

Reference	0.000
SG	1.000
Linearity	0.000
Scale factor	49.900
Offset	0.010
Delay mSEC	50.000

Step 0 07/31 12:46:48

Elapsed Time (min)	INPUT 1 (ft)
0.0000	2.442
0.0083	1.433
0.0166	1.260
0.0250	1.087
0.0333	0.929
0.0416	0.803
0.0500	0.693
0.0583	0.582
0.0666	0.504
0.0750	0.425
0.0833	0.346
0.1000	0.236
0.1166	0.141
0.1333	0.078
0.1500	0.031
0.1666	0.000
0.1833	-0.015
0.2000	-0.031
0.2166	-0.047
0.2333	-0.063
0.2500	-0.078
0.2666	-0.078
0.2833	-0.094
0.3000	-0.094
0.3166	-0.094
0.3333	-0.110
0.4166	-0.126
0.5000	-0.141
0.5833	-0.141
0.6666	-0.157
0.7500	-0.157
0.8333	-0.157
0.9166	-0.157
1.0000	-0.157
1.0833	-0.157
1.1666	-0.173
1.2500	-0.157
1.3333	-0.157
1.4166	-0.157
1.5000	-0.173
1.5833	-0.157
1.6666	-0.173
1.7500	-0.173
1.8333	-0.173
1.9166	-0.173
2.0000	-0.173
2.5000	-0.173
3.0000	-0.189
3.5000	-0.173
4.0000	-0.189
4.5000	-0.189
5.0000	-0.189
5.5000	-0.189
6.0000	-0.204
6.5000	-0.204
7.0000	-0.204
7.5000	-0.204
8.0000	-0.220
8.5000	-0.220
9.0000	-0.220
9.5000	-0.220
10.0000	-0.220
12.0000	-0.220
14.0000	-0.236
16.0000	-0.252
18.0000	-0.267
20.0000	-0.283
22.0000	-0.299
24.0000	-0.315
26.0000	-0.330
28.0000	-0.346
30.0000	-0.362
32.0000	-0.362
34.0000	-0.378
36.0000	-0.393
38.0000	-0.409
40.0000	-0.425
42.0000	-0.441
44.0000	-0.456
46.0000	-0.488

<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<>>>

A Q T E S O L V   R E S U L T S

Version 1.10

06/04/92 03:50:17

==

TEST DESCRIPTION

Data set........... m018a.set
Data set title..... RISING HEAD RESULT, M-018-A
Company............ J.M.MONTGOMERY, CONSULTING ENG
Project............ 2738.0262
Client............. NAVY - WESTDIV
Location........... West Beach Landfill
Test date.......... July 31, 1991

Knowns and Constants:
No. of data points.................. 13
Radius of well casing............... 2.54
Radius of well...................... 5.79
Aquifer saturated thickness......... 218.9
Well screen length.................. 218.9
Static height of water in well...... 218.9
Log(Re/Rw).......................... 2.765
A, B, C............................. 0.000, 0.000, 2.223

==

ANALYTICAL METHOD

Bouwer-Rice (Unconfined Aquifer Slug Test)

==

RESULTS FROM VISUAL CURVE MATCHING

VISUAL MATCH PARAMETER ESTIMATES

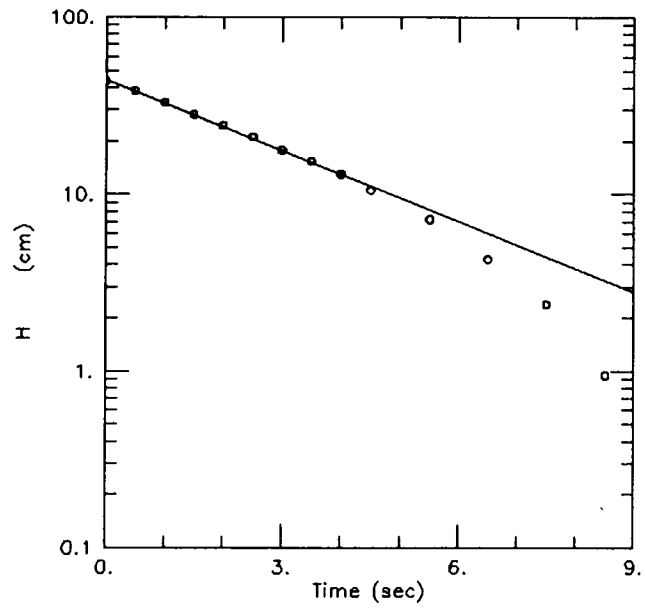
	Estimate
K =	1.7488E-002
y0 =	4.7289E-308

<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<>>>

TYPE CURVE DATA

K = 1.24981E-002
y0 = 4.42087E+001

Time	Drawdown	Time	Drawdown	Time	Drawdown
0.000E+000	4.421E+001	9.000E+000	2.798E+000		



DATA SET:
m018a.aet
06/04/92

AQUIFER TYPE:
Unconfined

SOLUTION METHOD:
Bouwer-Rice

TEST DATE:
July 31, 1991

ESTIMATED PARAMETERS:
K = 0.0125 cm/sec
y0 = 44.21 cm

TEST DATA:
H0 = 43.88 cm
rc = 2.54 cm
rw = 5.78 cm
L = 218.8 cm
D = 218.8 cm
H = 218.8 cm

RISING HEAD RESULT, M-018-A

J.M.MONTGOMERY, CONSULTING ENG	Client: NAVY – WESTDIV
Project No.: 2738.0262	Location: West Beach Landfill

M-019-A
RISING HEAD FIELD DATA
NAS ALAMEDA, CTO-107
1992

SE1000C
Environmental Logger
03/16 21:27

Unit# 01558 Test 5

Setups: INPUT 1
--- ---
Type Level (F)
Mode TOC
I.D. 01901

Reference 0.000
Linearity 0.040
Scale factor 9.990
Offset 0.010
Delay mSEC 50.000

Step 0 03/16 17:03:06

Elapsed Time (min)	INPUT 1 (ft)
0.0000	0.000
0.0033	0.772
0.0066	1.807
0.0100	2.153
0.0133	1.453
0.0166	1.813
0.0200	1.621
0.0233	1.573
0.0266	1.523
0.0300	1.460
0.0333	1.409
0.0500	1.154
0.0666	0.924
0.0833	0.747
0.1000	0.605
0.1166	0.492
0.1333	0.394
0.1500	0.328
0.1666	0.280
0.1833	0.242
0.2000	0.214
0.2166	0.189
0.2333	0.173
0.2500	0.154
0.2666	0.141
0.2833	0.132
0.3000	0.119
0.3166	0.113
0.3333	0.107
0.4166	0.081
0.5000	0.063
0.5833	0.053
0.6666	0.044
0.7500	0.037
0.8333	0.031
0.9166	0.028
1.0000	0.025
1.0833	0.022
1.1666	0.018
1.2500	0.018
1.3333	0.015
1.4166	0.015
1.5000	0.015
1.5833	0.015
1.6666	0.015
1.7500	0.012
1.8333	0.012
1.9166	0.009
2.0000	0.012
2.5000	0.009
3.0000	0.009
3.5000	0.006
4.0000	0.006
4.5000	0.009
5.0000	0.006
5.5000	0.009
6.0000	0.006
6.5000	0.006
7.0000	0.009
7.5000	0.009
8.0000	0.006
8.5000	0.003
9.0000	0.000
9.5000	0.003
10.0000	0.000
12.0000	0.006
14.0000	0.003
16.0000	0.003

<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<>>

A Q T E S O L V   R E S U L T S

Version 1.10

06/04/92 04:42:31

==

TEST DESCRIPTION

Data set........... m019a.set
Data set title..... RISING HEAD RESULT, M-019-A
Company............ J.M.MONTGOMERY, CONSULTING ENG
Project............ 2738.0574
Client............. NAVY - WESTDIV
Location........... West Beach Landfill
Test date.......... March 16, 1992

Knowns and Constants:

No. of data points.................. 60
Radius of well casing............... 2.54
Radius of well...................... 5.96
Aquifer saturated thickness......... 182
Well screen length.................. 182
Static height of water in well...... 182
Log(Re/Rw).......................... 2.585
A, B, C............................. 0.000, 0.000, 1.986

==

ANALYTICAL METHOD

Bouwer-Rice (Unconfined Aquifer Slug Test)

==

RESULTS FROM VISUAL CURVE MATCHING

VISUAL MATCH PARAMETER ESTIMATES

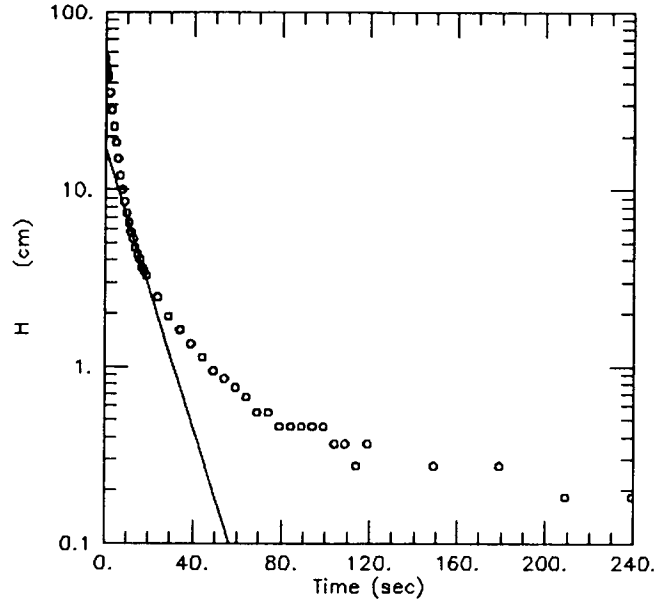
	Estimate
K =	2.6705E-004
y0 =	4.7289E-308

<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<>>

TYPE CURVE DATA

K = 4.17389E-003
y0 = 1.72305E+001

Time	Drawdown	Time	Drawdown	Time	Drawdown
0.000E+000	1.723E+001	2.400E+002	5.549E-009		



DATA SET:
m019a.set
08/04/92

AQUIFER TYPE:
Unconfined

SOLUTION METHOD:
Bouwer-Rice

TEST DATE:
March 18, 1992

ESTIMATED PARAMETERS:
K = 0.004174 cm/sec
y0 = 17.23 cm

TEST DATA:
H0 = 55.28 cm
rc = 2.54 cm
rw = 5.98 cm
L = 182. cm
D = 182. cm
H = 182. cm

RISING HEAD RESULT, M-019-A

J.M.MONTGOMERY, CONSULTING ENG	Client: NAVY – WESTDIV
Project No.: 2738.0574	Location: West Beach Landfill

M-020-A
RISING HEAD FIELD DATA
NAS ALAMEDA, CTO-107
1991

SE2000
Environmental Logger
07/31 19:14

Unit# Test 3

INPUT 1: Level (F) TOC

Reference	0.000
SG	1.000
Linearity	0.000
Scale factor	49.900
Offset	0.010
Delay mSEC	50.000

Step 0 07/31 11:19:05

Elapsed Time (min)	INPUT 1 (ft)
0.0000	2.190
0.0083	2.048
0.0166	2.032
0.0250	1.938
0.0333	1.906
0.0416	1.874
0.0500	1.843
0.0583	1.811
0.0666	1.780
0.0750	1.748
0.0833	1.717
0.1000	1.670
0.1166	1.622
0.1333	1.575
0.1500	1.528
0.1666	1.481
0.1833	1.433
0.2000	1.386
0.2166	1.355
0.2333	1.307
0.2500	1.276
0.2666	1.244
0.2833	1.197
0.3000	1.165
0.3166	1.134
0.3333	1.102
0.4166	0.961
0.5000	0.850
0.5833	0.756
0.6666	0.677
0.7500	0.614
0.8333	0.551
0.9166	0.488
1.0000	0.441
1.0833	0.409
1.1666	0.378
1.2500	0.346
1.3333	0.330
1.4166	0.299
1.5000	0.283
1.5833	0.267
1.6666	0.252
1.7500	0.252
1.8333	0.236
1.9166	0.220
2.0000	0.220
2.5000	0.173
3.0000	0.157
3.5000	0.141
4.0000	0.126
4.5000	0.110
5.0000	0.110
5.5000	0.110
6.0000	0.094
6.5000	0.094
7.0000	0.094
7.5000	0.078
8.0000	0.078
8.5000	0.094
9.0000	0.078
9.5000	0.078
10.0000	0.063
12.0000	0.063
14.0000	0.031
16.0000	0.047
18.0000	0.047
20.0000	0.047
22.0000	0.047
24.0000	0.031
26.0000	0.047
28.0000	0.031
30.0000	0.031
32.0000	0.031
34.0000	0.047

<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>

A Q T E S O L V   R E S U L T S
Version 1.10

06/08/92 06:34:03

===

TEST DESCRIPTION

Data set........... M020A.SET
Data set title..... RISING HEAD RESULT, M-020-A
Company............ J.M.MONTGOMERY, CONSULTING ENG
Project............ 2738.0262
Client............. NAVY - WESTDIV
Location........... West Beach Landfill
Test date.......... July 31, 1991

Knowns and Constants:
No. of data points.................. 63
Radius of well casing............... 2.54
Radius of well...................... 5.79
Aquifer saturated thickness......... 189.9
Well screen length.................. 189.9
Static height of water in well...... 189.9
Log(Re/Rw).......................... 2.646
A, B, C............................. 0.000, 0.000, 2.058

===

ANALYTICAL METHOD

Bouwer-Rice (Unconfined Aquifer Slug Test)

===

RESULTS FROM VISUAL CURVE MATCHING

VISUAL MATCH PARAMETER ESTIMATES

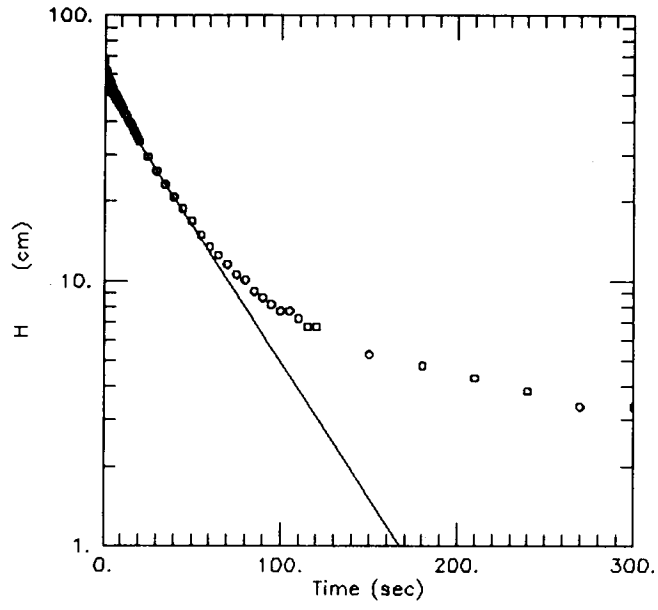
	Estimate
K =	1.0649E-003
y0 =	4.2766E-306

<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>

TYPE CURVE DATA

K = 1.06486E-003
y0 = 5.27730E+001

Time	Drawdown	Time	Drawdown	Time	Drawdown
0.000E+000	5.277E+001	3.000E+002	4.324E-002		



DATA SET:
M020A.SET
08/08/92

AQUIFER TYPE:
Unconfined

SOLUTION METHOD:
Bouwer-Rice

TEST DATE:
July 31, 1991

ESTIMATED PARAMETERS:
K = 0.001085 cm/sec
y0 = 52.77 cm

TEST DATA:
H0 = 60.75 cm
rc = 2.54 cm
rw = 5.70 cm
L = 180.8 cm
D = 189.8 cm
H = 189.8 cm

RISING HEAD RESULT, M-020-A

J.M.MONTGOMERY, CONSULTING ENG	Client: NAVY – WESTDIV
Project No.: 2738.0262	Location: West Beach Landfill

M-021-A
RISING HEAD FIELD DATA
NAS ALAMEDA, CTO-107
1991

SE1000B
Environmental Logger
07/31 18:32

Unit# 00515 Test# 1

INPUT 1: Level (F) TOC

Reference 0.00
Scale factor 10.09
Offset 0.00

Step# 0 07/31 10:12

Elapsed Time (min)	Value (ft)
0.0000	0.04
0.0033	0.04
0.0066	0.69
0.0099	3.75
0.0133	9.63
0.0166	-0.19
0.0200	2.93
0.0233	1.64
0.0266	1.82
0.0300	1.80
0.0333	1.79
0.0500	1.70
0.0666	1.62
0.0833	1.55
0.1000	1.49
0.1166	1.44
0.1333	1.38
0.1500	1.33
0.1666	1.29
0.1833	1.24
0.2000	1.20
0.2166	1.16
0.2333	1.13
0.2500	1.09
0.2666	1.06
0.2833	1.02
0.3000	0.99
0.3166	0.96
0.3333	0.93
0.4167	0.79
0.5000	0.68
0.5833	0.58
0.6667	0.51
0.7500	0.45
0.8333	0.40
0.9167	0.36
1.0000	0.32
1.0833	0.29
1.1667	0.27
1.2500	0.24
1.3333	0.22
1.4166	0.21
1.5000	0.19
1.5833	0.18
1.6667	0.17
1.7500	0.15
1.8333	0.14
1.9167	0.14
2.0000	0.13
2.5000	0.09
3.0000	0.08
3.5000	0.07
4.0000	0.07
4.5000	0.07
5.0000	0.07
5.5000	0.06
6.0000	0.07
6.5000	0.07
7.0000	0.07
7.5000	0.07
8.0000	0.07
8.5000	0.07
9.0000	0.07
9.5000	0.08
10.0000	0.08
12.0000	0.07
14.0000	0.10

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A Q T E S O L V   R E S U L T S
Version 1.10

06/08/92 07:33:46

==

TEST DESCRIPTION

Data set........... M021A.SET
Data set title..... RISING HEAD RESULT, M-021-A
Company............ J.M.MONTGOMERY, CONSULTING ENG
Project............ 2738.0262
Client............. NAVY - WESTDIV
Location........... West Beach Landfill
Test date.......... July 31, 1991

Knowns and Constants:
No. of data points.................. 47
Radius of well casing............... 2.54
Radius of well...................... 5.79
Aquifer saturated thickness......... 282.9
Well screen length.................. 282.9
Static height of water in well...... 282.9
Log(Re/Rw).......................... 2.975
A, B, C............................. 0.000, 0.000, 2.600

==

ANALYTICAL METHOD

Bouwer-Rice (Unconfined Aquifer Slug Test)

==

RESULTS FROM VISUAL CURVE MATCHING

VISUAL MATCH PARAMETER ESTIMATES

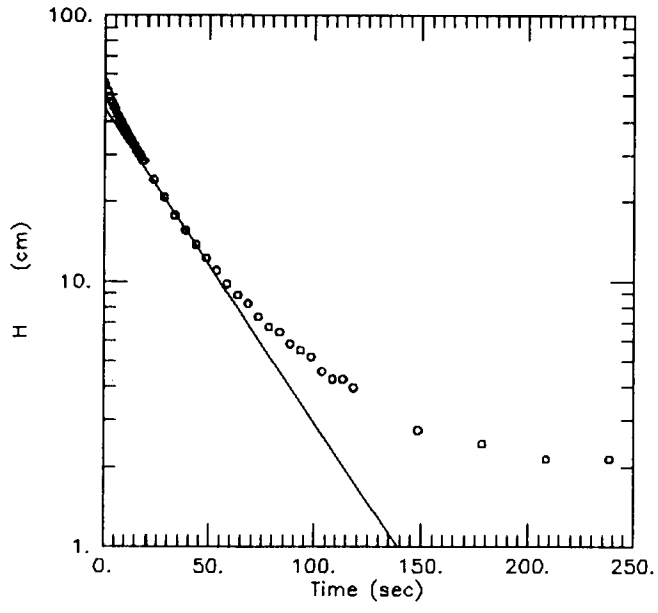
	Estimate
K =	9.2728E-004
y0 =	-1.8615E-278

<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<>>

TYPE CURVE DATA

K = 9.27283E-004
y0 = 4.43972E+001

Time	Drawdown	Time	Drawdown	Time	Drawdown
0.000E+000	4.440E+001	2.500E+002	4.790E-002		



DATA SET:
M021A.SET
06/08/92

AQUIFER TYPE:
Unconfined

SOLUTION METHOD:
Bouwer-Rice

TEST DATE:
July 31, 1991

ESTIMATED PARAMETERS:
K = 0.0009273 cm/sec
y0 = 44.4 cm

TEST DATA:
H0 = 55.47 cm
rc = 2.54 cm
rw = 5.78 cm
L = 282.8 cm
D = 282.8 cm
H = 282.8 cm

RISING HEAD RESULT, M-021-A

J.M.MONTGOMERY, CONSULTING ENG	Client: NAVY - WESTDIV
Project No.: 2738.0262	Location: West Beach Landfill

M-022-A
RISING HEAD FIELD DATA
NAS ALAMEDA, CTO-107
1991

SE2000
Environmental Logger
07/31 19:06

Unit# Test 1

INPUT 1: Level (F) TOC

Reference	0.000
SG	1.000
Linearity	0.000
Scale factor	49.900
Offset	0.010
Delay mSEC	50.000

Step 0 07/31 10:03:31

Elapsed Time (min)	INPUT 1 (ft)
0.0000	1.418
0.0083	2.032
0.0166	1.890
0.0250	1.827
0.0333	1.733
0.0416	1.654
0.0500	1.607
0.0583	1.544
0.0666	1.481
0.0750	1.433
0.0833	1.370
0.1000	1.276
0.1166	1.181
0.1333	1.102
0.1500	1.024
0.1666	0.961
0.1833	0.882
0.2000	0.819
0.2166	0.772
0.2333	0.709
0.2500	0.661
0.2666	0.614
0.2833	0.582
0.3000	0.535
0.3166	0.504
0.3333	0.472
0.4166	0.346
0.5000	0.267
0.5833	0.204
0.6666	0.157
0.7500	0.126
0.8333	0.094
0.9166	0.078
1.0000	0.063
1.0833	0.047
1.1666	0.031
1.2500	0.015
1.3333	0.000
1.4166	0.000
1.5000	-0.015
1.5833	-0.015
1.6666	-0.015
1.7500	-0.015
1.8333	-0.031
1.9166	-0.031
2.0000	-0.031
2.5000	-0.047
3.0000	-0.047
3.5000	-0.063
4.0000	-0.063
4.5000	-0.063
5.0000	-0.063
5.5000	-0.063

<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<>>

A Q T E S O L V   R E S U L T S

Version 1.10

02/25/92 16:09:20

==

TEST DESCRIPTION

Data set........... m022a.set
Data set title..... RISING HEAD RESULT, M-022-A
Company............ J.M.MONTGOMERY, CONSULTING ENG
Project............ 2738.0262
Client............. NAVY - WESTDIV
Location........... West Beach Landfill
Test date.......... July 31, 1991

Knowns and Constants:
No. of data points.................. 34
Radius of well casing............... 2.54
Radius of well...................... 5.79
Aquifer saturated thickness......... 230.7
Well screen length.................. 230.7
Static height of water in well...... 230.7
Log(Re/Rw).......................... 2.809
A, B, C............................. 0.000, 0.000, 2.292

==

ANALYTICAL METHOD

Bouwer-Rice (Unconfined Aquifer Slug Test)

==

RESULTS FROM VISUAL CURVE MATCHING

VISUAL MATCH PARAMETER ESTIMATES

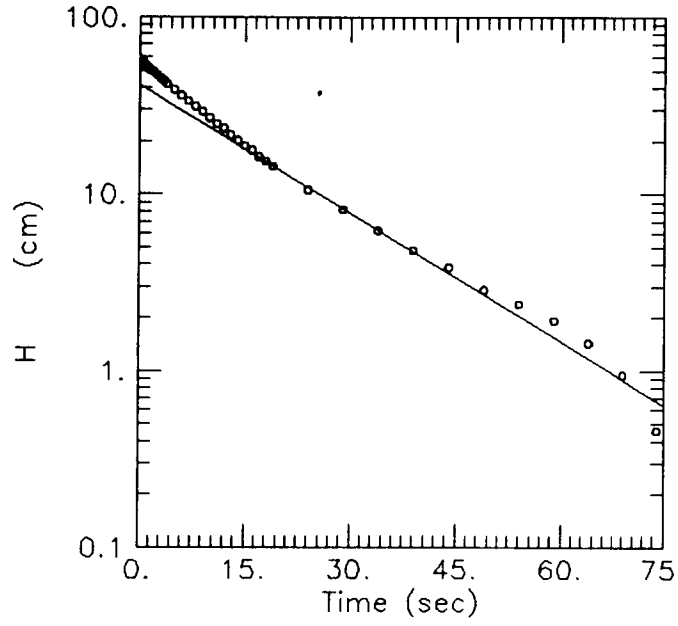
Estimate
K = 2.3225E-003
y0 = -1.3253E+100

<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<>>

TYPE CURVE DATA

K = 2.19017E-003
y0 = 4.16221E+001

Time	Drawdown	Time	Drawdown	Time	Drawdown
0.000E+000	4.162E+001	7.500E+001	6.350E-001		



DATA SET:
m022a.aet
02/25/92

AQUIFER TYPE:
Unconfined
SOLUTION METHOD:
Bouwer-Rice
TEST DATE:
July 31, 1991

ESTIMATED PARAMETERS:
K = 0.00219 cm/sec
y0 = 41.82 cm

TEST DATA:
H0 = 57.81 cm
rc = 2.54 cm
rw = 5.78 cm
L = 230.7 cm
b = 230.7 cm
H = 230.7 cm

RISING HEAD RESULT, M-022-A

J.M.MONTGOMERY, CONSULTING ENG	Client: NAVY - WESTDIV
Project No.: 2738.0262	Location: West Beach Landfill

M-023-A
RISING HEAD FIELD DATA
NAS ALAMEDA, CTO-107
1991

SE1000B
Environmental Logger
07/30 22:16

Unit# 00515 Test# 7

INPUT 1: Level (F) TOC

Reference 0.00
Scale factor 10.09
Offset 0.00

Step# 0 07/30 16:43

Elapsed Time (min)	Value (ft)
0.0000	-10.98
0.0033	-8.96
0.0066	-5.04
0.0099	-5.29
0.0133	-11.39
0.0166	-9.24
0.0200	-9.54
0.0233	-9.88
0.0266	-9.79
0.0300	-9.88
0.0333	-9.92
0.0500	-10.11
0.0666	-10.26
0.0833	-10.37
0.1000	-10.47
0.1166	-10.55
0.1333	-10.61
0.1500	-10.65
0.1666	-10.69
0.1833	-10.72
0.2000	-10.75
0.2166	-10.77
0.2333	-10.79
0.2500	-10.81
0.2666	-10.82
0.2833	-10.83
0.3000	-10.84
0.3166	-10.85
0.3333	-10.86
0.4167	-10.89
0.5000	-10.92
0.5833	-10.94
0.6667	-10.95
0.7500	-10.96
0.8333	-10.97
0.9167	-10.98
1.0000	-10.99
1.0833	-11.00
1.1667	-11.00
1.2500	-11.01
1.3333	-11.01
1.4166	-11.01
1.5000	-11.02
1.5833	-11.02
1.6667	-11.03
1.7500	-11.03
1.8333	-11.03
1.9167	-11.04
2.0000	-11.04
2.5000	-11.05
3.0000	-11.07
3.5000	-11.08
4.0000	-11.08
4.5000	-11.08
5.0000	-11.09
5.5000	-11.09
6.0000	-11.09
6.5000	-11.09
7.0000	-11.09
7.5000	-11.09
8.0000	-11.09
8.5000	-11.09
9.0000	-11.09
9.5000	-11.09
10.0000	-11.09
12.0000	-11.09
14.0000	-11.08
16.0000	-11.08

<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<>>

A Q T E S O L V   R E S U L T S

Version 1.10

02/25/92 16:34:23

==

TEST DESCRIPTION

Data set........... m023a.set
Data set title..... RISING HEAD RESULT, M-023-A
Company............ J.M.MONTGOMERY, CONSULTING ENG
Project............ 2738.0262
Client............. NAVY - WESTDIV
Location........... West Beach Landfill
Test date.......... July 30, 1991

Knowns and Constants:

- No. of data points.................. 45
- Radius of well casing............... 2.54
- Radius of well...................... 5.79
- Aquifer saturated thickness......... 316.4
- Well screen length.................. 304.8
- Static height of water in well...... 316.4
- Log(Re/Rw).......................... 3.06
- A, B, C............................. 0.000, 0.000, 2.732

==

ANALYTICAL METHOD

Bouwer-Rice (Unconfined Aquifer Slug Test)

==

RESULTS FROM VISUAL CURVE MATCHING

VISUAL MATCH PARAMETER ESTIMATES

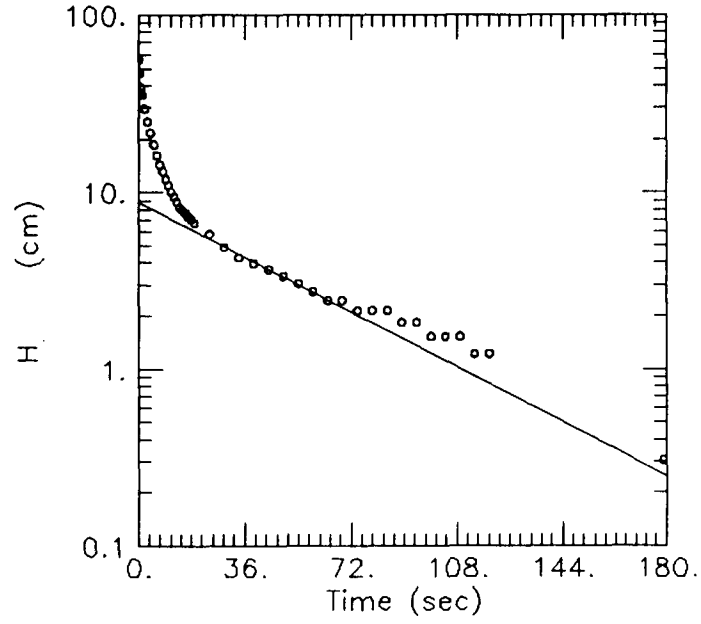
	Estimate
K =	6.4573E-004
y0 =	6.6365E+265

<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<>>

TYPE CURVE DATA

K = 6.45730E-004
y0 = 8.85817E+000

Time	Drawdown	Time	Drawdown	Time	Drawdown
0.000E+000	8.858E+000	1.800E+002	2.446E-001		



DATA SET:
m023a.aet
02/25/92

AQUIFER TYPE:
Unconfined

SOLUTION METHOD:
Bouwer-Rice

TEST DATE:
July 30, 1991

ESTIMATED PARAMETERS:
K = 0.0008457 cm/sec
y0 = 8.858 cm

TEST DATA:
H0 = 58.08 cm
rc = 2.54 cm
rw = 5.78 cm
L = 304.8 cm
D = 316.4 cm
H = 318.4 cm

RISING HEAD RESULT, M-023-A

J.M.MONTGOMERY, CONSULTING ENG	Client: NAVY - WESTDIV
Project No.: 2738.0262	Location: West Beach Landfill

M-024-A
RISING HEAD FIELD DATA
NAS ALAMEDA, CTO-107
1991

SE1000B
Environmental Logger
07/30 22:09

Unit# 00515 Test# 5

INPUT 1: Level (F) TOC

Reference 0.00
Scale factor 10.09
Offset 0.00

Step# 0 07/30 15:29

Elapsed Time (min)	Value (ft)
0.0000	-8.88
0.0033	-9.57
0.0066	-7.22
0.0099	-4.24
0.0133	-8.06
0.0166	-8.86
0.0200	-7.57
0.0233	-8.24
0.0266	-8.33
0.0300	-8.27
0.0333	-8.37
0.0500	-8.52
0.0666	-8.65
0.0833	-8.74
0.1000	-8.80
0.1166	-8.86
0.1333	-8.91
0.1500	-8.96
0.1666	-8.99
0.1833	-9.03
0.2000	-9.06
0.2166	-9.08
0.2333	-9.11
0.2500	-9.14
0.2666	-9.15
0.2833	-9.17
0.3000	-9.19
0.3166	-9.20
0.3333	-9.21
0.4167	-9.26
0.5000	-9.29
0.5833	-9.31
0.6667	-9.32
0.7500	-9.33
0.8333	-9.34
0.9167	-9.35
1.0000	-9.35
1.0833	-9.36
1.1667	-9.36
1.2500	-9.37
1.3333	-9.37
1.4166	-9.37
1.5000	-9.38
1.5833	-9.38
1.6667	-9.38
1.7500	-9.38
1.8333	-9.38
1.9167	-9.39
2.0000	-9.39
2.5000	-9.40
3.0000	-9.40
3.5000	-9.40
4.0000	-9.41
4.5000	-9.40
5.0000	-9.42
5.5000	-9.43
6.0000	-9.43
6.5000	-9.43
7.0000	-9.43
7.5000	-9.43
8.0000	-9.42
8.5000	-9.43
9.0000	-9.43
9.5000	-9.43
10.0000	-9.43
12.0000	-9.43

<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>

A Q T E S O L V   R E S U L T S

Version 1.10

02/25/92 16:44:51

==

TEST DESCRIPTION

Data set........... m024a.set
Data set title..... RISING HEAD RESULT, M-024-A
Company............ J.M.MONTGOMERY, CONSULTING ENG
Project............ 2738.0262
Client............. NAVY - WESTDIV
Location........... West Beach Landfill
Test date.......... July 30, 1991

Knowns and Constants:
No. of data points.................. 46
Radius of well casing............... 2.54
Radius of well...................... 5.79
Aquifer saturated thickness......... 259.7
Well screen length.................. 259.7
Static height of water in well...... 259.7
Log(Re/Rw).......................... 2.906
A, B, C............................. 0.000, 0.000, 2.462

==

ANALYTICAL METHOD

Bouwer-Rice (Unconfined Aquifer Slug Test)

==

RESULTS FROM VISUAL CURVE MATCHING

VISUAL MATCH PARAMETER ESTIMATES

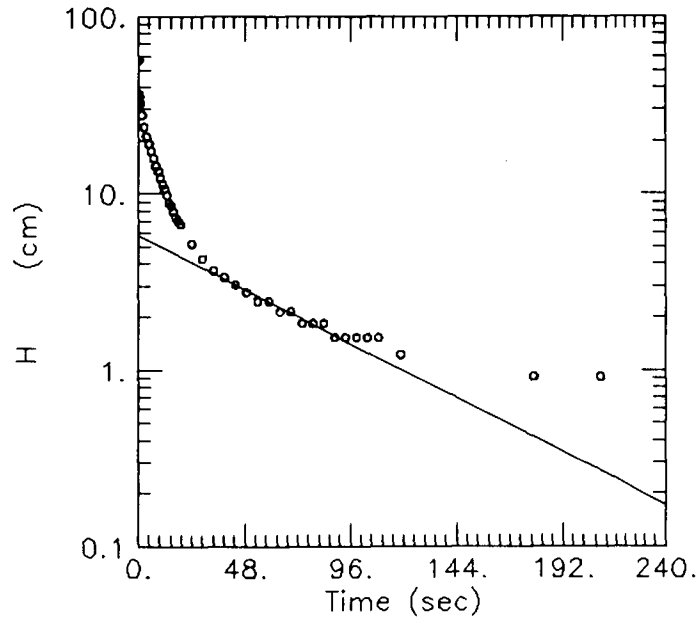
	Estimate
K =	5.2979E-004
y0 =	6.6365E+265

<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>

TYPE CURVE DATA

K = 5.29787E-004
y0 = 5.76843E+000

Time	Drawdown	Time	Drawdown	Time	Drawdown
0.000E+000	5.768E+000	2.400E+002	1.703E-001		



DATA SET:
m024a.eet
02/25/92

AQUIFER TYPE:
Unconfined

SOLUTION METHOD:
Bouwer-Rice

TEST DATE:
July 30, 1991

ESTIMATED PARAMETERS:
K = 0.0005298 cm/sec
y0 = 5.788 cm

TEST DATA:
H0 = 56.68 cm
rc = 2.54 cm
rw = 5.78 cm
L = 258.7 cm
D = 259.7 cm
H = 259.7 cm

RISING HEAD RESULT, M-024-A

J.M.MONTGOMERY, CONSULTING ENG	Client: NAVY – WESTDIV
Project No.: 2738.0262	Location: West Beach Landfill

M-025-A
RISING HEAD FIELD DATA
NAS ALAMEDA, CTO-107
1991

SE1000B
Environmental Logger
07/30 22:02

Unit# 00515 Test# 3

INPUT 1: Level (F) TOC

Reference 0.00
Scale factor 10.09
Offset 0.00

Step# 0 07/30 12:57

Elapsed Time (min)	Value (ft)
0.0000	-9.62
0.0033	-9.05
0.0066	-7.02
0.0099	-5.01
0.0133	-10.09
0.0166	-6.74
0.0200	-8.15
0.0233	-8.00
0.0266	-8.02
0.0300	-8.06
0.0333	-8.10
0.0500	-8.25
0.0666	-8.37
0.0833	-8.48
0.1000	-8.58
0.1166	-8.68
0.1333	-8.76
0.1500	-8.83
0.1666	-8.89
0.1833	-8.94
0.2000	-8.99
0.2166	-9.03
0.2333	-9.07
0.2500	-9.10
0.2666	-9.13
0.2833	-9.16
0.3000	-9.18
0.3166	-9.21
0.3333	-9.22
0.4167	-9.30
0.5000	-9.36
0.5833	-9.39
0.6667	-9.42
0.7500	-9.44
0.8333	-9.46
0.9167	-9.47
1.0000	-9.49
1.0833	-9.50
1.1667	-9.51
1.2500	-9.52
1.3333	-9.53
1.4166	-9.53
1.5000	-9.54
1.5833	-9.55
1.6667	-9.56
1.7500	-9.56
1.8333	-9.57
1.9167	-9.57
2.0000	-9.58
2.5000	-9.62
3.0000	-9.64
3.5000	-9.67
4.0000	-9.69
4.5000	-9.71
5.0000	-9.73
5.5000	-9.74
6.0000	-9.76
6.5000	-9.77
7.0000	-9.78
7.5000	-9.79
8.0000	-9.79
8.5000	-9.81
9.0000	-9.82
9.5000	-9.83
10.0000	-9.82
12.0000	-9.85
14.0000	-9.86

<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<>>

A Q T E S O L V   R E S U L T S
Version 1.10

06/08/92 06:39:23

==

TEST DESCRIPTION

Data set........... M025A.set
Data set title..... RISING HEAD RESULT, M-025-A
Company............ J.M.MONTGOMERY, CONSULTING ENG
Project............ 2738.0262
Client............. NAVY - WESTDIV
Location........... 1943-1956 Disposal Area
Test date.......... July 30, 1991

Knowns and Constants:
No. of data points.................. 55
Radius of well casing............... 2.54
Radius of well...................... 5.79
Aquifer saturated thickness......... 264
Well screen length.................. 264
Static height of water in well...... 264
Log(Re/Rw).......................... 2.919
A, B, C............................. 0.000, 0.000, 2.487

==

ANALYTICAL METHOD

Bouwer-Rice (Unconfined Aquifer Slug Test)

==

RESULTS FROM VISUAL CURVE MATCHING

VISUAL MATCH PARAMETER ESTIMATES

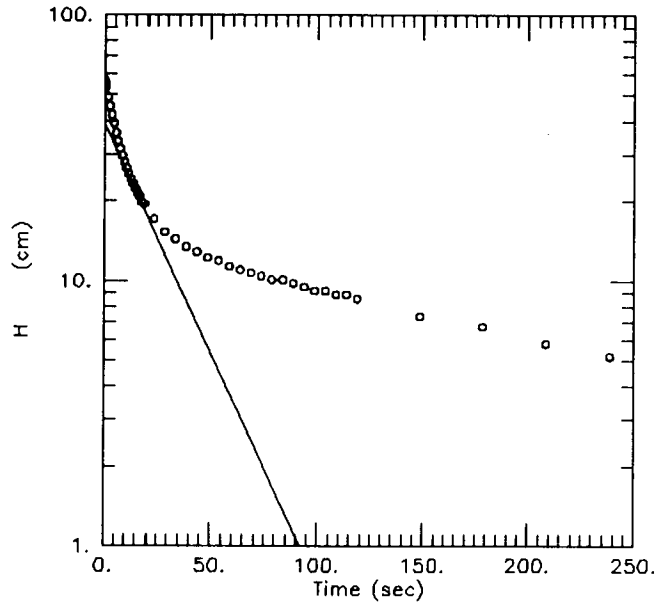
	Estimate
K =	9.2341E-004
y0 =	4.2766E-306

<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<>>

TYPE CURVE DATA

K = 1.41573E-003
y0 = 3.87669E+001

Time	Drawdown	Time	Drawdown	Time	Drawdown
0.000E+000	3.877E+001	2.500E+002	1.905E-003		



DATA SET:
M025A.set
06/08/92

AQUIFER TYPE:
Unconfined

SOLUTION METHOD:
Bouwer-Rice

TEST DATE:
July 30, 1991

ESTIMATED PARAMETERS:
K = 0.001418 cm/sec
y0 = 38.77 cm

TEST DATA:
H0 = 50.88 cm
rc = 2.54 cm
rw = 5.78 cm
L = 264. cm
b = 264. cm
H = 264. cm

RISING HEAD RESULT, M-025-A

J.M.MONTGOMERY, CONSULTING ENG	Client: NAVY - WESTDIV
Project No.: 2738.0262	Location: 1943-1956 Disposal Area

M-026-A
RISING HEAD FIELD DATA
NAS ALAMEDA, CTO-107
1991

SE1000B
Environmental Logger
07/30 21:53

Unit# 00515 Test# 1

INPUT 1: Level (F) TOC

Reference 0.00
Scale factor 10.09
Offset 0.00

Step# 0 07/30 11:37

Elapsed Time (min)	Value (ft)
0.0000	-9.61
0.0033	-8.92
0.0066	-5.67
0.0099	-2.18
0.0133	-11.02
0.0166	-7.78
0.0200	-7.61
0.0233	-7.70
0.0266	-7.77
0.0300	-7.83
0.0333	-7.90
0.0500	-8.15
0.0666	-8.37
0.0833	-8.56
0.1000	-8.72
0.1166	-8.85
0.1333	-8.97
0.1500	-9.07
0.1666	-9.16
0.1833	-9.23
0.2000	-9.28
0.2166	-9.33
0.2333	-9.36
0.2500	-9.39
0.2666	-9.42
0.2833	-9.44
0.3000	-9.45
0.3166	-9.47
0.3333	-9.48
0.4167	-9.53
0.5000	-9.56
0.5833	-9.57
0.6667	-9.59
0.7500	-9.60
0.8333	-9.61
0.9167	-9.62
1.0000	-9.62
1.0833	-9.63
1.1667	-9.63
1.2500	-9.64
1.3333	-9.64
1.4166	-9.64
1.5000	-9.64
1.5833	-9.64
1.6667	-9.65
1.7500	-9.65
1.8333	-9.65
1.9167	-9.65
2.0000	-9.65
2.5000	-9.66
3.0000	-9.67
3.5000	-9.67
4.0000	-9.68
4.5000	-9.68
5.0000	-9.68
5.5000	-9.68
6.0000	-9.68
6.5000	-9.68
7.0000	-9.68
7.5000	-9.69
8.0000	-9.69
8.5000	-9.70
9.0000	-9.71
9.5000	-9.71
10.0000	-9.71
12.0000	-9.72
14.0000	-9.72

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A Q T E S O L V   R E S U L T S

Version 1.10

06/08/92 06:41:54

==

TEST DESCRIPTION

Data set........... m026a.set
Data set title..... RISING HEAD RESULT, M-026-A
Company............ J.M.MONTGOMERY, CONSULTING ENG
Project............ 2738.0262
Client............. NAVY - WESTDIV
Location........... 1943-1956 Disposal Area
Test date.......... July 30, 1991

Knowns and Constants:

- No. of data points.................. 58
- Radius of well casing............... 2.54
- Radius of well...................... 5.79
- Aquifer saturated thickness......... 228.3
- Well screen length.................. 228.3
- Static height of water in well...... 228.3
- Log(Re/Rw).......................... 2.8
- A, B, C............................. 0.000, 0.000, 2.277

==

ANALYTICAL METHOD

Bouwer-Rice (Unconfined Aquifer Slug Test)

==

RESULTS FROM VISUAL CURVE MATCHING

VISUAL MATCH PARAMETER ESTIMATES

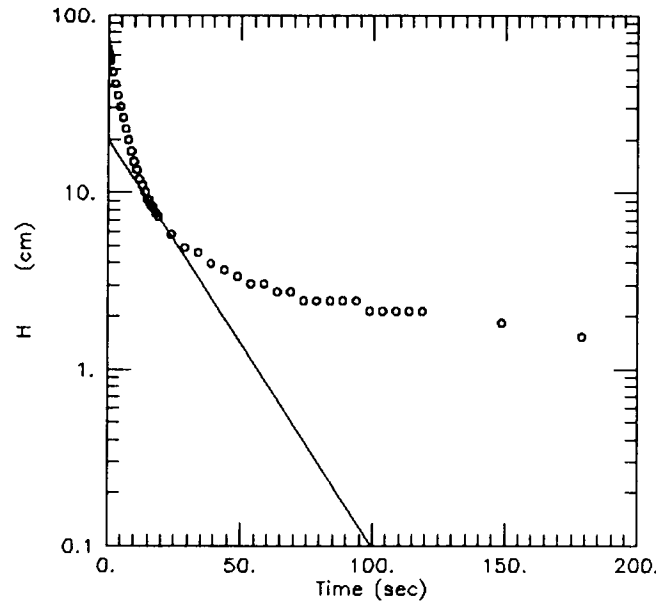
	Estimate
K =	2.1028E-003
y0 =	4.2766E-306

<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<>>

TYPE CURVE DATA

K = 2.10277E-003
y0 = 2.00703E+001

Time	Drawdown	Time	Drawdown	Time	Drawdown
0.000E+000	2.007E+001	2.000E+002	4.857E-004		



DATA SET:
m026a.aet
08/08/92

AQUIFER TYPE:
Unconfined

SOLUTION METHOD:
Bouwer-Rice

TEST DATE:
July 30, 1991

ESTIMATED PARAMETERS:
K = 0.002103 cm/sec
y0 = 20.07 cm

TEST DATA:
H0 = 64.31 cm
rc = 2.54 cm
rw = 5.78 cm
L = 228.3 cm
b = 228.3 cm
H = 228.3 cm

RISING HEAD RESULT, M-026-A

J.M.MONTGOMERY, CONSULTING ENG	Client: NAVY – WESTDIV
Project No.: 2738.0262	Location: 1943–1956 Disposal Area

M-027-A
RISING HEAD FIELD DATA
NAS ALAMEDA, CTO-107
1991

SE1000B
Environmental Logger
07/29 15:19

Unit# 00515 Test# 3

INPUT 1: Level (F) TOC

Reference 0.00
Scale factor 10.09
Offset 0.00

Step# 0 07/26 12:07

Elapsed Time (min)	Value (ft)
0.0000	-3.01
0.0033	-8.41
0.0066	-8.04
0.0099	-8.17
0.0133	-8.28
0.0166	-8.35
0.0200	-8.42
0.0233	-8.49
0.0266	-8.56
0.0300	-8.62
0.0333	-8.67
0.0500	-8.90
0.0666	-9.06
0.0833	-9.18
0.1000	-9.26
0.1166	-9.33
0.1333	-9.37
0.1500	-9.41
0.1666	-9.43
0.1833	-9.46
0.2000	-9.47
0.2166	-9.49
0.2333	-9.50
0.2500	-9.50
0.2666	-9.51
0.2833	-9.52
0.3000	-9.52
0.3166	-9.52
0.3333	-9.53
0.4167	-9.54
0.5000	-9.55
0.5833	-9.55
0.6667	-9.55
0.7500	-9.56
0.8333	-9.56
0.9167	-9.56
1.0000	-9.56
1.0833	-9.56
1.1667	-9.56
1.2500	-9.56
1.3333	-9.57
1.4166	-9.57
1.5000	-9.57
1.5833	-9.57
1.6667	-9.57
1.7500	-9.57
1.8333	-9.57
1.9167	-9.57
2.0000	-9.57
2.5000	-9.57
3.0000	-9.57
3.5000	-9.58
4.0000	-9.58
4.5000	-9.58
5.0000	-9.57
5.5000	-9.58
6.0000	-9.58
6.5000	-9.57
7.0000	-9.57
7.5000	-9.57
8.0000	-9.57
8.5000	-9.57
9.0000	-9.58
9.5000	-9.58
10.0000	-9.58
12.0000	-9.58
14.0000	-9.58
16.0000	-9.59
18.0000	-9.59
20.0000	-9.60

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A Q T E S O L V   R E S U L T S

Version 1.10

06/08/92 06:44:15

==

TEST DESCRIPTION

Data set........... m027a.set
Data set title..... RISING HEAD RESULT, M-027-A
Company............ J.M.MONTGOMERY, CONSULTING ENG
Project............ 2738.0262
Client............. NAVY - WESTDIV
Location........... 1943-1956 Disposal Area
Test date.......... July 26, 1991

Knowns and Constants:

No. of data points................... 51
Radius of well casing............... 2.54
Radius of well...................... 5.79
Aquifer saturated thickness......... 252.4
Well screen length.................. 252.4
Static height of water in well...... 252.4
Log(Re/Rw).......................... 2.883
A, B, C............................. 0.000, 0.000, 2.419

==

ANALYTICAL METHOD

Bouwer-Rice (Unconfined Aquifer Slug Test)

==

RESULTS FROM VISUAL CURVE MATCHING

VISUAL MATCH PARAMETER ESTIMATES

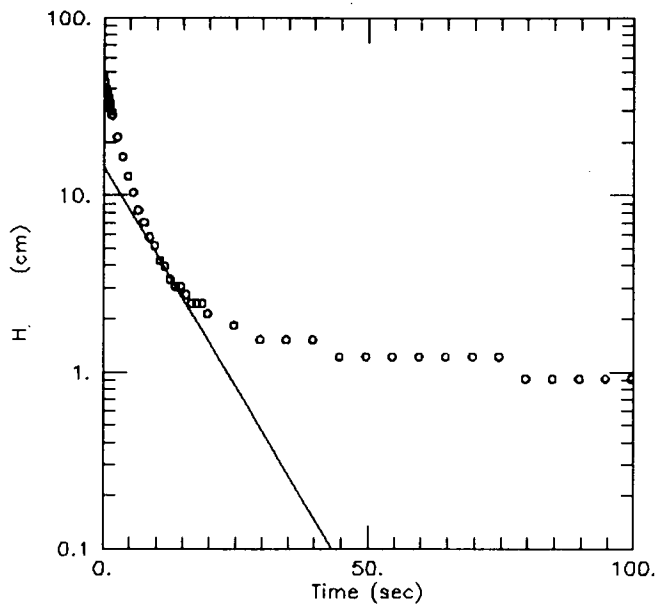
	Estimate
K =	4.4987E-003
y0 =	4.2766E-306

<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<>>

TYPE CURVE DATA

K = 4.24143E-003
y0 = 1.45071E+001

Time	Drawdown	Time	Drawdown	Time	Drawdown
0.000E+000	1.451E+001	1.000E+002	1.453E-004		



DATA SET:
m027a.set
08/08/92

AQUIFER TYPE:
Unconfined

SOLUTION METHOD:
Bouwer-Rice

TEST DATE:
July 28, 1991

ESTIMATED PARAMETERS:
K = 0.004241 cm/sec
y0 = 14.51 cm

TEST DATA:
H0 = 47.55 cm
rc = 2.54 cm
rw = 5.78 cm
L = 252.4 cm
b = 252.4 cm
H = 252.4 cm

RISING HEAD RESULT, M-027-A

J.M.MONTGOMERY, CONSULTING ENG	Client: NAVY – WESTDIV
Project No.: 2738.0262	Location: 1943–1956 Disposal Area

M-028-A
RISING HEAD FIELD DATA
NAS ALAMEDA, CTO-107
1991

SE1000B
Environmental Logger
07/29 15:42

Unit# 00515 Test# 9

INPUT 1: Level (F) TOC

Reference 0.00
Scale factor 10.09
Offset 0.00

Step# 0 07/26 15:57

Elapsed Time (min)	Value (ft)
0.0000	0.82
0.0033	5.06
0.0066	7.97
0.0099	2.89
0.0133	2.96
0.0166	2.49
0.0200	2.53
0.0233	2.47
0.0266	2.46
0.0300	2.30
0.0333	2.25
0.0500	2.01
0.0666	1.82
0.0833	1.68
0.1000	1.54
0.1166	1.45
0.1333	1.37
0.1500	1.30
0.1666	1.25
0.1833	1.21
0.2000	1.18
0.2166	1.15
0.2333	1.12
0.2500	1.10
0.2666	1.08
0.2833	1.06
0.3000	1.04
0.3166	1.02
0.3333	1.00
0.4167	0.96
0.5000	0.93
0.5833	0.91
0.6667	0.90
0.7500	0.89
0.8333	0.88
0.9167	0.88
1.0000	0.88
1.0833	0.87
1.1667	0.87
1.2500	0.87
1.3333	0.87
1.4166	0.86
1.5000	0.86
1.5833	0.86
1.6667	0.86
1.7500	0.86
1.8333	0.86
1.9167	0.86
2.0000	0.86
2.5000	0.84
3.0000	0.85
3.5000	0.85
4.0000	0.85
4.5000	0.84
5.0000	0.84
5.5000	0.84
6.0000	0.84
6.5000	0.85
7.0000	0.85
7.5000	0.85
8.0000	0.84
8.5000	0.84
9.0000	0.84
9.5000	0.84
10.0000	0.84
12.0000	0.84
14.0000	0.86
16.0000	0.86
18.0000	0.84
20.0000	0.84
22.0000	0.85
24.0000	0.85
26.0000	0.85

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A Q T E S O L V   R E S U L T S
Version 1.10

06/04/92 04:03:00

==

TEST DESCRIPTION

Data set........... m028a.set
Data set title..... RISING HEAD RESULT, M-028-A
Company............ J.M.MONTGOMERY, CONSULTING ENG
Project............ 2738.0262
Client............. NAVY - WESTDIV
Location........... 1943-1956 Disposal Area
Test date.......... July 26, 1991

Knowns and Constants:
No. of data points.................. 42
Radius of well casing............... 2.54
Radius of well...................... 5.79
Aquifer saturated thickness......... 224.3
Well screen length.................. 224.3
Static height of water in well...... 224.3
Log(Re/Rw).......................... 2.786
A, B, C............................. 0.000, 0.000, 2.254

==

ANALYTICAL METHOD

Bouwer-Rice (Unconfined Aquifer Slug Test)

==

RESULTS FROM VISUAL CURVE MATCHING

VISUAL MATCH PARAMETER ESTIMATES

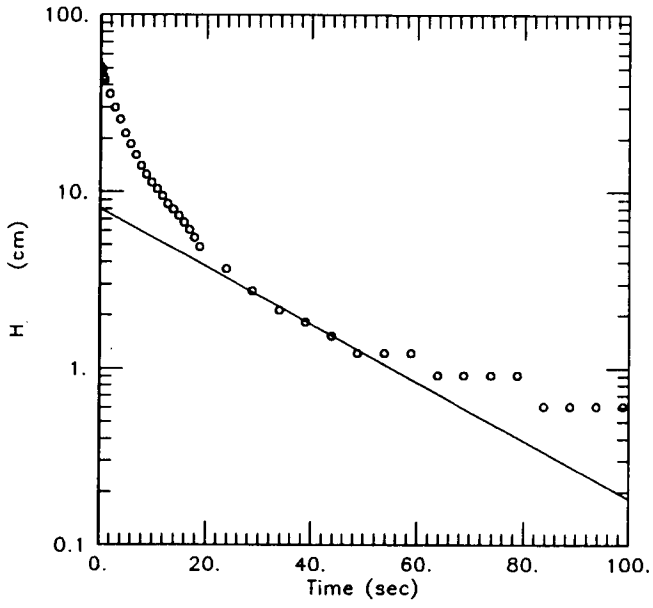
	Estimate
K =	1.5183E-003
y0 =	4.7289E-308

<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<>>

TYPE CURVE DATA

K = 1.51830E-003
y0 = 8.04973E+000

Time	Drawdown	Time	Drawdown	Time	Drawdown
0.000E+000	8.050E+000	1.000E+002	1.818E-001		



DATA SET:
m028a.set
06/04/92

AQUIFER TYPE:
Unconfined

SOLUTION METHOD:
Bouwer-Rice

TEST DATE:
July 26, 1991

ESTIMATED PARAMETERS:
K = 0.001518 cm/sec
y0 = 8.05 cm

TEST DATA:
H0 = 51.51 cm
rc = 2.54 cm
rw = 5.79 cm
L = 224.3 cm
b = 224.3 cm
H = 224.3 cm

RISING HEAD RESULT, M-028-A

J.M.MONTGOMERY, CONSULTING ENG	Client: NAVY - WESTDIV
Project No.: 2738.0262	Location: 1943-1956 Disposal Area

M-029-A
RISING HEAD FIELD DATA
NAS ALAMEDA, CTO-107
1991

SE1000B
Environmental Logger
07/29 15:35

Unit# 00515 Test# 7

INPUT 1: Level (F) TOC

Reference 0.00
Scale factor 10.09
Offset 0.00

Step# 0 07/26 14:41

Elapsed Time (min)	Value (ft)
0.0000	4.91
0.0033	3.86
0.0066	0.38
0.0099	1.73
0.0133	1.44
0.0166	1.36
0.0200	1.31
0.0233	1.24
0.0266	1.19
0.0300	1.15
0.0333	1.11
0.0500	0.92
0.0666	0.78
0.0833	0.68
0.1000	0.59
0.1166	0.52
0.1333	0.47
0.1500	0.42
0.1666	0.37
0.1833	0.34
0.2000	0.31
0.2166	0.28
0.2333	0.27
0.2500	0.25
0.2666	0.23
0.2833	0.22
0.3000	0.21
0.3166	0.20
0.3333	0.19
0.4167	0.14
0.5000	0.12
0.5833	0.10
0.6667	0.09
0.7500	0.08
0.8333	0.07
0.9167	0.07
1.0000	0.06
1.0833	0.06
1.1667	0.06
1.2500	0.06
1.3333	0.06
1.4166	0.05
1.5000	0.05
1.5833	0.04
1.6667	0.04
1.7500	0.02
1.8333	0.03
1.9167	0.04
2.0000	0.04
2.5000	0.02
3.0000	0.00
3.5000	-0.00
4.0000	-0.00
4.5000	0.00
5.0000	-0.00

<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<>>

A Q T E S O L V   R E S U L T S

Version 1.10

06/08/92 06:46:14

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TEST DESCRIPTION

Data set........... m029a.set
Data set title..... RISING HEAD RESULT, M-029-A
Company............ J.M.MONTGOMERY, CONSULTING ENG
Project............ 2738.0262
Client............. NAVY - WESTDIV
Location........... 1943-1956 Disposal Area
Test date.......... July 26, 1991

Knowns and Constants:

No. of data points.................. 42
Radius of well casing............... 2.54
Radius of well...................... 5.79
Aquifer saturated thickness......... 262.1
Well screen length.................. 262.1
Static height of water in well...... 262.1
Log(Re/Rw).......................... 2.914
A, B, C............................. 0.000, 0.000, 2.477

==

ANALYTICAL METHOD

Bouwer-Rice (Unconfined Aquifer Slug Test)

==

RESULTS FROM VISUAL CURVE MATCHING

VISUAL MATCH PARAMETER ESTIMATES

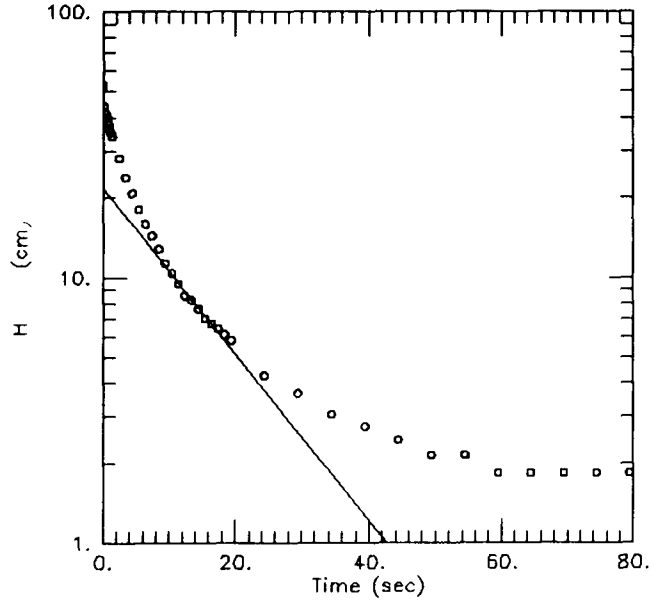
	Estimate
K =	2.5805E-003
y0 =	4.2766E-306

<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<>>

TYPE CURVE DATA

K = 2.58050E-003
y0 = 2.15670E+001

Time	Drawdown	Time	Drawdown	Time	Drawdown
0.000E+000	2.157E+001	8.000E+001	6.813E-002		



DATA SET:
m029a.set
06/08/92

AQUIFER TYPE:
Unconfined

SOLUTION METHOD:
Bouwer-Rice

TEST DATE:
July 28, 1991

ESTIMATED PARAMETERS:
K = 0.00258 cm/sec
y0 = 21.57 cm

TEST DATA:
H0 = 52.73 cm
rc = 2.54 cm
rw = 5.78 cm
L = 262.1 cm
b = 262.1 cm
H = 262.1 cm

RISING HEAD RESULT, M-029-A

J.M.MONTGOMERY, CONSULTING ENG	Client: NAVY - WESTDIV
Project No.: 2738.0262	Location: 1943-1956 Disposal Area

M-101-A
RISING HEAD FIELD DATA
NAS ALAMEDA, CTO-107
1991

SE1000B
Environmental Logger
08/07 17:49

Unit# 00515 Test# 9

INPUT 1: Level (F) TOC

Reference 0.00
Scale factor 10.09
Offset 0.00

Step# 0 08/07 15:23

Elapsed Time (min)	Value (ft)
0.0000	-0.01
0.0033	2.46
0.0066	4.11
0.0099	4.17
0.0133	-0.66
0.0166	2.02
0.0200	2.05
0.0233	1.98
0.0266	2.04
0.0300	1.96
0.0333	1.94
0.0500	1.83
0.0666	1.75
0.0833	1.67
0.1000	1.60
0.1166	1.54
0.1333	1.48
0.1500	1.42
0.1666	1.37
0.1833	1.32
0.2000	1.27
0.2166	1.22
0.2333	1.18
0.2500	1.14
0.2666	1.10
0.2833	1.06
0.3000	1.02
0.3166	0.99
0.3333	0.96
0.4167	0.81
0.5000	0.70
0.5833	0.61
0.6667	0.53
0.7500	0.47
0.8333	0.42
0.9167	0.38
1.0000	0.34
1.0833	0.31
1.1667	0.28
1.2500	0.25
1.3333	0.23
1.4166	0.21
1.5000	0.19
1.5833	0.17
1.6667	0.16
1.7500	0.15
1.8333	0.14
1.9167	0.13
2.0000	0.12
2.5000	0.07
3.0000	0.04
3.5000	0.04
4.0000	0.03
4.5000	0.01
5.0000	0.01
5.5000	0.01
6.0000	0.00
6.5000	0.01
7.0000	-0.00
7.5000	-0.00

<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<>>

A Q T E S O L V   R E S U L T S
Version 1.10

02/26/92 10:06:34

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TEST DESCRIPTION

Data set........... m101a.set
Data set title..... RISING HEAD RESULT, M-101-A
Company............ J.M.MONTGOMERY, CONSULTING ENG
Project............ 2738.0262
Client............. NAVY - WESTDIV
Location........... Background Wells
Test date.......... August 7, 1991

Knowns and Constants:
- No. of data points.................. 44
- Radius of well casing............... 2.54
- Radius of well...................... 5.79
- Aquifer saturated thickness......... 307.2
- Well screen length.................. 304.8
- Static height of water in well...... 307.2
- Log(Re/Rw).......................... 3.041
- A, B, C............................. 0.000, 0.000, 2.732

==

ANALYTICAL METHOD

Bouwer-Rice (Unconfined Aquifer Slug Test)

==

RESULTS FROM VISUAL CURVE MATCHING

VISUAL MATCH PARAMETER ESTIMATES

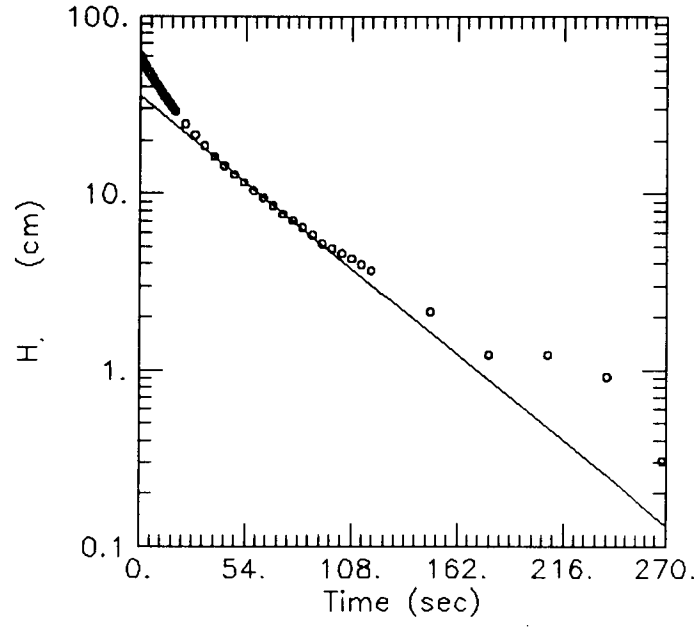
	Estimate
K =	6.1574E-004
y0 =	-1.3253E+100

<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<>>

TYPE CURVE DATA

K = 6.69392E-004
y0 = 3.55803E+001

Time	Drawdown	Time	Drawdown	Time	Drawdown
0.000E+000	3.558E+001	2.700E+002	1.294E-001		



DATA SET:
m101a.set
02/28/92

AQUIFER TYPE:
Unconfined

SOLUTION METHOD:
Bouwer-Rice

TEST DATE:
August 7, 1991

ESTIMATED PARAMETERS:
K = 0.0008894 cm/sec
y0 = 35.58 cm

TEST DATA:
H0 = 59.74 cm
rc = 2.54 cm
rw = 5.78 cm
L = 304.8 cm
b = 307.2 cm
H = 307.2 cm

RISING HEAD RESULT, M-101-A

J.M.MONTGOMERY, CONSULTING ENG	Client: NAVY – WESTDIV
Project No.: 2738.0262	Location: Background Wells

M-102-A
RISING HEAD FIELD DATA
NAS ALAMEDA, CTO-107
1991

SE1000B
Environmental Logger
08/07 17:42

Unit# 00515 Test# 7

INPUT 1: Level (F) TOC

Reference 0.00
Scale factor 10.09
Offset 0.00

Step# 0 08/07 14:40

Elapsed Time (min)	Value (ft)
0.0000	0.58
0.0033	2.57
0.0066	4.85
0.0099	4.69
0.0133	0.24
0.0166	3.09
0.0200	2.51
0.0233	2.43
0.0266	2.36
0.0300	2.33
0.0333	2.30
0.0500	2.13
0.0666	1.97
0.0833	1.84
0.1000	1.72
0.1166	1.61
0.1333	1.51
0.1500	1.41
0.1666	1.33
0.1833	1.26
0.2000	1.20
0.2166	1.14
0.2333	1.09
0.2500	1.05
0.2666	1.01
0.2833	0.98
0.3000	0.96
0.3166	0.93
0.3333	0.91
0.4167	0.84
0.5000	0.79
0.5833	0.77
0.6667	0.74
0.7500	0.72
0.8333	0.70
0.9167	0.69
1.0000	0.67
1.0833	0.66
1.1667	0.66
1.2500	0.65
1.3333	0.64
1.4166	0.64
1.5000	0.63
1.5833	0.63
1.6667	0.62
1.7500	0.62
1.8333	0.61
1.9167	0.61
2.0000	0.61
2.5000	0.60
3.0000	0.60
3.5000	0.61
4.0000	0.61
4.5000	0.60
5.0000	0.60
5.5000	0.60
6.0000	0.61
6.5000	0.61
7.0000	0.61

<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<>>

A Q T E S O L V   R E S U L T S

Version 1.10

02/26/92 10:16:09

==

TEST DESCRIPTION

Data set........... m102a.set
Data set title..... RISING HEAD RESULT, M-102-A
Company............ J.M.MONTGOMERY, CONSULTING ENG
Project............ 2738.0262
Client............. NAVY - WESTDIV
Location........... Background Wells
Test date.......... August 7, 1991

Knowns and Constants:

No. of data points.................. 41
Radius of well casing............... 2.54
Radius of well...................... 5.79
Aquifer saturated thickness......... 298.7
Well screen length.................. 298.7
Static height of water in well...... 298.7
Log(Re/Rw).......................... 3.019
A, B, C............................. 0.000, 0.000, 2.696

==

ANALYTICAL METHOD

Bouwer-Rice (Unconfined Aquifer Slug Test)

==

RESULTS FROM VISUAL CURVE MATCHING

VISUAL MATCH PARAMETER ESTIMATES

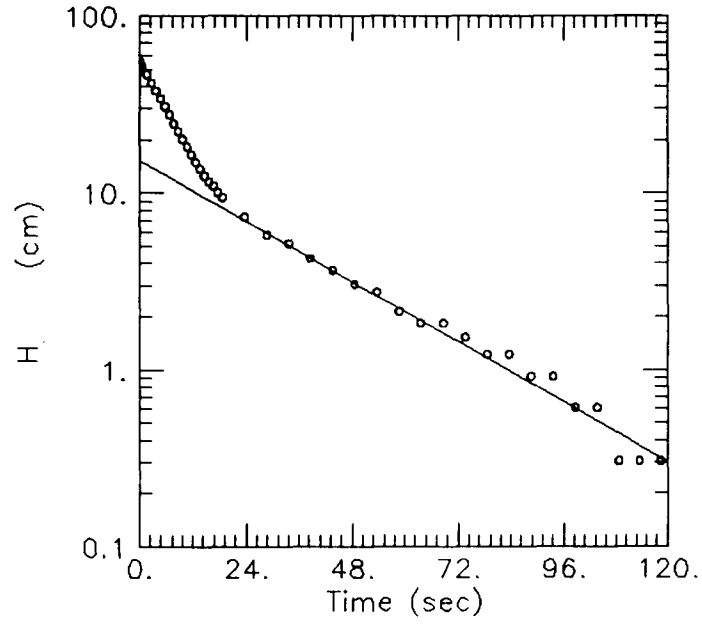
	Estimate
K =	1.3418E-003
y0 =	-1.3253E+100

<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<>>

TYPE CURVE DATA

K = 1.06712E-003
y0 = 1.52023E+001

Time	Drawdown	Time	Drawdown	Time	Drawdown
0.000E+000	1.520E+001	1.200E+002	2.995E-001		



DATA SET:
m102a.aet
02/28/92

AQUIFER TYPE:
Unconfined
SOLUTION METHOD:
Bouwer-Rice
TEST DATE:
August 7, 1991

ESTIMATED PARAMETERS:
K = 0.001087 cm/sec
y0 = 15.2 cm

TEST DATA:
H0 = 55.78 cm
rc = 2.54 cm
rw = 5.78 cm
L = 288.7 cm
D = 298.7 cm
H = 298.7 cm

RISING HEAD RESULT, M-102-A

J.M.MONTGOMERY, CONSULTING ENG	Client: NAVY - WESTDIV
Project No.: 2738.0262	Location: Background Wells

M-103-A
RISING HEAD FIELD DATA
NAS ALAMEDA, CTO-107
1991

SE1000B
Environmental Logger
08/06 18:31

Unit# 00515 Test# 7

INPUT 1: Level (F) TOC

Reference 0.00
Scale factor 10.09
Offset 0.00

Step# 0 08/06 15:34

Elapsed Time (min)	Value (ft)
0.0000	0.83
0.0033	2.54
0.0066	4.94
0.0099	2.44
0.0133	0.38
0.0166	3.07
0.0200	3.17
0.0233	2.50
0.0266	2.60
0.0300	2.63
0.0333	2.60
0.0500	2.49
0.0666	2.41
0.0833	2.32
0.1000	2.24
0.1166	2.17
0.1333	2.11
0.1500	2.04
0.1666	1.99
0.1833	1.93
0.2000	1.87
0.2166	1.82
0.2333	1.77
0.2500	1.73
0.2666	1.68
0.2833	1.64
0.3000	1.60
0.3166	1.56
0.3333	1.53
0.4167	1.36
0.5000	1.23
0.5833	1.13
0.6667	1.05
0.7500	0.98
0.8333	0.93
0.9167	0.89
1.0000	0.85
1.0833	0.82
1.1667	0.80
1.2500	0.79
1.3333	0.77
1.4166	0.76
1.5000	0.75
1.5833	0.75
1.6667	0.74
1.7500	0.74
1.8333	0.73
1.9167	0.73
2.0000	0.72
2.5000	0.70
3.0000	0.69
3.5000	0.70
4.0000	0.70
4.5000	0.70
5.0000	0.70
5.5000	0.71
6.0000	0.71
6.5000	0.71
7.0000	0.71
7.5000	0.71
8.0000	0.71
8.5000	0.71
9.0000	0.71
9.5000	0.72
10.0000	0.72

<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<>>

A Q T E S O L V   R E S U L T S

Version 1.10

02/26/92 10:26:45

==

TEST DESCRIPTION

Data set........... m103a.set
Data set title..... RISING HEAD RESULT, M-103-A
Company............ J.M.MONTGOMERY, CONSULTING ENG
Project............ 2738.0262
Client............. NAVY - WESTDIV
Location........... Background Wells
Test date.......... August 6, 1991

Knowns and Constants:

No. of data points.................. 40
Radius of well casing............... 2.54
Radius of well...................... 5.79
Aquifer saturated thickness......... 366.7
Well screen length.................. 304.8
Static height of water in well...... 366.7
Log(Re/Rw).......................... 3.154
A, B, C............................. 0.000, 0.000, 2.732

==

ANALYTICAL METHOD

Bouwer-Rice (Unconfined Aquifer Slug Test)

==

RESULTS FROM VISUAL CURVE MATCHING

VISUAL MATCH PARAMETER ESTIMATES

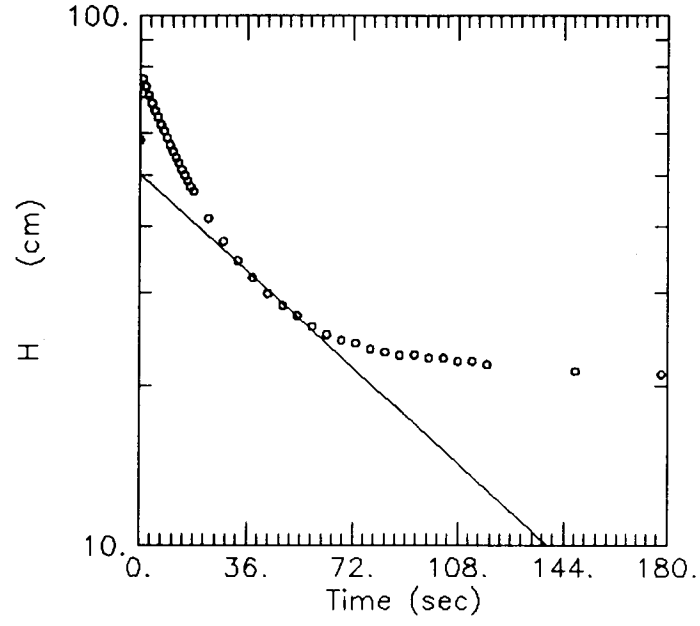
	Estimate
K =	2.9398E-004
y0 =	-1.3253E+100

<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<>>

TYPE CURVE DATA

K = 3.88773E-004
y0 = 5.02183E+001

Time	Drawdown	Time	Drawdown	Time	Drawdown
0.000E+000	5.022E+001	1.800E+002	6.171E+000		



DATA SET:
m103a.aet
02/28/92

AQUIFER TYPE:
Unconfined
SOLUTION METHOD:
Bouwer-Rice
TEST DATE:
August 8, 1991

ESTIMATED PARAMETERS:
K = 0.0003888 cm/sec
y0 = 50.22 cm

TEST DATA:
H0 = 58.22 cm
rc = 2.54 cm
rw = 5.78 cm
L = 304.8 cm
D = 366.7 cm
H = 388.7 cm

RISING HEAD RESULT, M-103-A

J.M.MONTGOMERY, CONSULTING ENG	Client: NAVY - WESTDIV
Project No.: 2738.0262	Location: Background Wells

M-104-A
RISING HEAD FIELD DATA
NAS ALAMEDA, CTO-107
1992

SE1000C
Environmental Logger
03/16 21:20

Unit# 01558 Test 1

Setups: INPUT 1
--- ---
Type Level (F)
Mode TOC
I.D. 10402

Reference 0.000
Linearity 0.040
Scale factor 9.990
Offset 0.010
Delay mSEC 50.000

Step 0 03/16 13:59:04

Elapsed Time (min)	INPUT 1 (ft)
0.0000	0.392
0.0033	3.516
0.0066	6.039
0.0100	5.253
0.0133	3.880
0.0166	2.427
0.0200	3.384
0.0233	3.002
0.0266	2.724
0.0300	2.506
0.0333	2.405
0.0500	1.770
0.0666	1.349
0.0833	1.046
0.1000	0.818
0.1166	0.651
0.1333	0.518
0.1500	0.420
0.1666	0.341
0.1833	0.281
0.2000	0.237
0.2166	0.199
0.2333	0.170
0.2500	0.145
0.2666	0.126
0.2833	0.110
0.3000	0.098
0.3166	0.088
0.3333	0.079
0.4166	0.050
0.5000	0.041
0.5833	0.034
0.6666	0.028
0.7500	0.025
0.8333	0.022
0.9166	0.022
1.0000	0.018
1.0833	0.018
1.1666	0.015
1.2500	0.018
1.3333	0.018
1.4166	0.015
1.5000	0.015
1.5833	0.015
1.6666	0.015
1.7500	0.012
1.8333	0.015
1.9166	0.012
2.0000	0.012
2.5000	0.015
3.0000	0.012
3.5000	0.009
4.0000	0.012
4.5000	0.012
5.0000	0.006
5.5000	0.009
6.0000	0.009

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A Q T E S O L V R E S U L T S

Version 1.10

06/04/92 04:36:57

==

TEST DESCRIPTION

Data set........... M104A.SET
Data set title..... RISING HEAD RESULT, M-104-A
Company............ J.M.MONTGOMERY, CONSULTING ENG
Project............ 2738.0574
Client............. NAVY - WESTDIV
Location........... Background Well
Test date.......... March 16, 1992

Knowns and Constants:
No. of data points.................. 50
Radius of well casing............... 2.54
Radius of well...................... 5.96
Aquifer saturated thickness......... 375.5
Well screen length.................. 304.8
Static height of water in well...... 375.5
Log(Re/Rw).......................... 3.146
A, B, C............................. 0.000, 0.000, 2.680

==

ANALYTICAL METHOD

Bouwer-Rice (Unconfined Aquifer Slug Test)

==

RESULTS FROM VISUAL CURVE MATCHING

VISUAL MATCH PARAMETER ESTIMATES

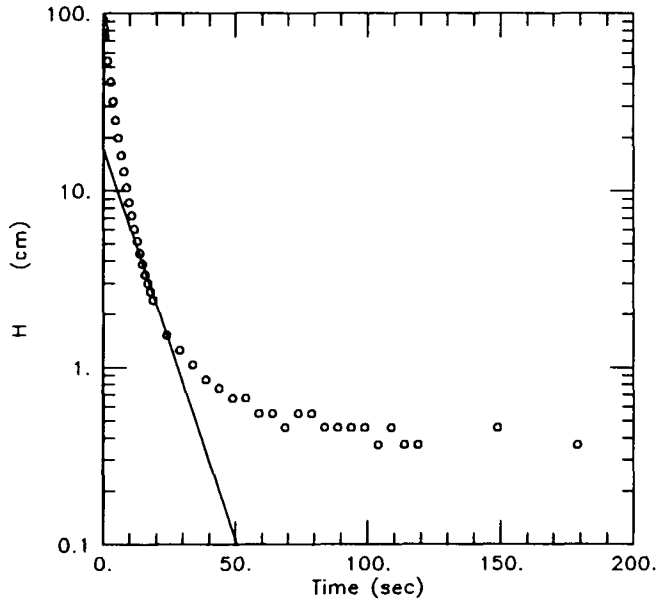
	Estimate
K =	9.5761E-004
y0 =	4.7289E-308

<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<>>

TYPE CURVE DATA

K = 3.37831E-003
y0 = 1.70774E+001

Time	Drawdown	Time	Drawdown	Time	Drawdown
0.000E+000	1.708E+001	2.000E+002	2.620E-008		



DATA SET:
M104A.SET
06/04/92

AQUIFER TYPE:
Unconfined

SOLUTION METHOD:
Bouwer-Rice

TEST DATE:
March 16, 1992

ESTIMATED PARAMETERS:
K = 0.003378 cm/sec
y0 = 17.08 cm

TEST DATA:
H0 = 103.1 cm
rc = 2.54 cm
rw = 5.96 cm
L = 304.8 cm
b = 375.5 cm
H = 375.5 cm

RISING HEAD RESULT, M-104-A

J.M.MONTGOMERY, CONSULTING ENG	Client: NAVY - WESTDIV
Project No.: 2738.0574	Location: Background Well

M-105-A
RISING HEAD FIELD DATA
NAS ALAMEDA, CTO-107
1991

SE1000B
Environmental Logger
08/02 06:37

Unit# 00515 Test# 3

INPUT 1: Level (F) TOC

Reference 0.00
Scale factor 10.09
Offset 0.00

Step# 0 08/01 10:04

Elapsed Time (min)	Value (ft)
0.0000	0.68
0.0033	2.36
0.0066	2.98
0.0099	1.09
0.0133	1.32
0.0166	1.54
0.0200	1.36
0.0233	1.22
0.0266	1.15
0.0300	1.09
0.0333	1.03
0.0500	0.81
0.0666	0.66
0.0833	0.56
0.1000	0.47
0.1166	0.41
0.1333	0.35
0.1500	0.31
0.1666	0.28
0.1833	0.25
0.2000	0.22
0.2166	0.20
0.2333	0.19
0.2500	0.17
0.2666	0.15
0.2833	0.14
0.3000	0.13
0.3166	0.12
0.3333	0.12
0.4167	0.08
0.5000	0.07
0.5833	0.05
0.6667	0.04
0.7500	0.04
0.8333	0.03
0.9167	0.03
1.0000	0.02
1.0833	0.02
1.1667	0.02
1.2500	0.02
1.3333	0.02
1.4166	0.01
1.5000	0.01
1.5833	0.01
1.6667	0.01
1.7500	0.01
1.8333	0.01
1.9167	0.01
2.0000	0.01
2.5000	0.00
3.0000	0.00

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A Q T E S O L V   R E S U L T S

Version 1.10

02/26/92 10:35:35

==

TEST DESCRIPTION

Data set........... m105a.set
Data set title..... RISING HEAD RESULT, M-105-A
Company............ J.M.MONTGOMERY, CONSULTING ENG
Project............ 2738.0262
Client............. NAVY - WESTDIV
Location........... Background Wells
Test date.......... August 1, 1991

Knowns and Constants:
No. of data points.................. 43
Radius of well casing............... 2.54
Radius of well...................... 5.79
Aquifer saturated thickness......... 354.2
Well screen length.................. 304.8
Static height of water in well...... 354.2
Log(Re/Rw).......................... 3.132
A, B, C............................. 0.000, 0.000, 2.732

==

ANALYTICAL METHOD

Bouwer-Rice (Unconfined Aquifer Slug Test)

==

RESULTS FROM VISUAL CURVE MATCHING

VISUAL MATCH PARAMETER ESTIMATES

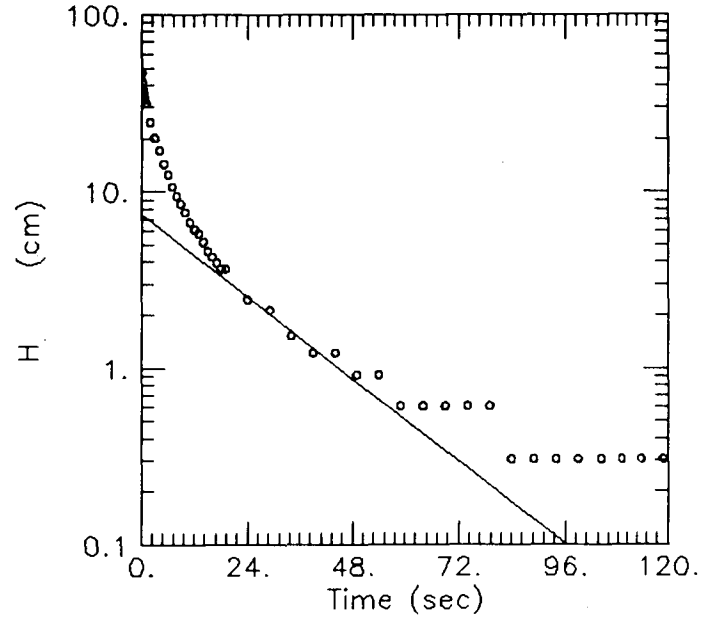
	Estimate
K =	1.3393E-003
y0 =	-1.3253E+100

<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<>>

TYPE CURVE DATA

K = 1.48176E-003
y0 = 7.39305E+000

Time	Drawdown	Time	Drawdown	Time	Drawdown
0.000E+000	7.393E+000	1.200E+002	3.459E-002		



DATA SET:
m105a.eet
02/28/92

AQUIFER TYPE:
Unconfined

SOLUTION METHOD:
Bouwer-Rice

TEST DATE:
August 1, 1991

ESTIMATED PARAMETERS:
K = 0.001482 cm/sec
y0 = 7.383 cm

TEST DATA:
H0 = 48.84 cm
rc = 2.54 cm
rw = 5.78 cm
L = 304.8 cm
D = 354.2 cm
H = 354.2 cm

RISING HEAD RESULT, M-105-A

J.M.MONTGOMERY, CONSULTING ENG	Client: NAVY - WESTDIV
Project No.: 2738.0262	Location: Background Wells

M-106-A
RISING HEAD FIELD DATA
NAS ALAMEDA, CTO-107
1991

SE1000B
Environmental Logger
08/02 06:31

Unit# 00515 Test# 1

INPUT 1: Level (F) TOC

Reference 0.00
Scale factor 10.09
Offset 0.00

Step# 0 08/01 09:25

Elapsed Time (min)	Value (ft)
0.0000	0.16
0.0033	1.99
0.0066	3.15
0.0099	1.73
0.0133	0.74
0.0166	1.30
0.0200	1.17
0.0233	0.98
0.0266	0.91
0.0300	0.81
0.0333	0.76
0.0500	0.49
0.0666	0.33
0.0833	0.23
0.1000	0.17
0.1166	0.13
0.1333	0.09
0.1500	0.07
0.1666	0.05
0.1833	0.04
0.2000	0.03
0.2166	0.02
0.2333	0.02
0.2500	0.01
0.2666	0.01
0.2833	0.00
0.3000	0.00
0.3166	0.00
0.3333	0.00
0.4167	-0.00
0.5000	-0.00
0.5833	-0.00
0.6667	-0.00
0.7500	-0.00
0.8333	-0.00
0.9167	-0.00
1.0000	-0.00
1.0833	-0.00
1.1667	-0.00
1.2500	-0.01
1.3333	-0.01
1.4166	-0.01
1.5000	-0.01
1.5833	-0.01
1.6667	-0.01
1.7500	-0.01
1.8333	-0.01
1.9167	-0.01
2.0000	-0.01
2.5000	-0.01
3.0000	-0.01
3.5000	-0.01
4.0000	-0.01
4.5000	-0.01
5.0000	-0.02
5.5000	-0.01

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A Q T E S O L V   R E S U L T S

Version 1.10

06/08/92 06:48:12

==

TEST DESCRIPTION

Data set........... m106a.set
Data set title..... RISING HEAD RESULT, M-106-A
Company............ J.M.MONTGOMERY, CONSULTING ENG
Project............ 2738.0262
Client............. NAVY - WESTDIV
Location........... Background Wells
Test date.......... August 1, 1991

Knowns and Constants:
No. of data points.................. 19
Radius of well casing............... 2.54
Radius of well...................... 5.79
Aquifer saturated thickness......... 352.4
Well screen length.................. 304.8
Static height of water in well...... 352.4
Log(Re/Rw).......................... 3.129
A, B, C............................. 0.000, 0.000, 2.732

==

ANALYTICAL METHOD

Bouwer-Rice (Unconfined Aquifer Slug Test)

==

RESULTS FROM VISUAL CURVE MATCHING

VISUAL MATCH PARAMETER ESTIMATES

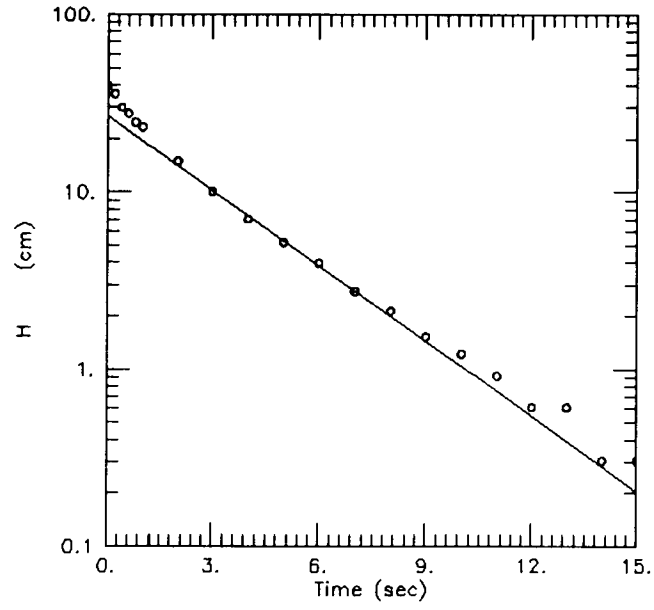
	Estimate
K =	1.0758E-002
y0 =	4.2766E-306

<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<>>

TYPE CURVE DATA

K = 1.07577E-002
y0 = 2.67281E+001

Time	Drawdown	Time	Drawdown	Time	Drawdown
0.000E+000	2.673E+001	1.500E+001	2.044E-001		



DATA SET:
m106a.aet
08/08/92

AQUIFER TYPE:
Unconfined

SOLUTION METHOD:
Bouwer-Rice

TEST DATE:
August 1, 1991

ESTIMATED PARAMETERS:
K = 0.01078 cm/sec
y0 = 26.73 cm

TEST DATA:
H0 = 38.82 cm
rc = 2.54 cm
rw = 5.78 cm
L = 304.8 cm
b = 352.4 cm
H = 352.4 cm

RISING HEAD RESULT, M-106-A

J.M.MONTGOMERY, CONSULTING ENG	Client: NAVY – WESTDIV
Project No.: 2738.0262	Location: Background Wells

M-107-A
RISING HEAD FIELD DATA
NAS ALAMEDA, CTO-107
1992

SE1000C
Environmental Logger
03/16 21:26

Unit# 01558 Test 4

Setups: INPUT 1

Type	Level (F)
Mode	TOC
I.D.	10701
Reference	0.000
Linearity	0.040
Scale factor	9.990
Offset	0.010
Delay mSEC	50.000

Step 0 03/16 16:19:59

Elapsed Time (min)	INPUT 1 (ft)
0.0000	0.009
0.0033	2.760
0.0066	5.853
0.0100	6.297
0.0133	4.102
0.0166	2.659
0.0200	3.294
0.0233	2.880
0.0266	2.688
0.0300	2.590
0.0333	2.463
0.0500	1.977
0.0666	1.608
0.0833	1.323
0.1000	1.105
0.1166	0.928
0.1333	0.786
0.1500	0.669
0.1666	0.575
0.1833	0.505
0.2000	0.429
0.2166	0.382
0.2333	0.338
0.2500	0.297
0.2666	0.265
0.2833	0.237
0.3000	0.214
0.3166	0.192
0.3333	0.176
0.4166	0.116
0.5000	0.082
0.5833	0.060
0.6666	0.050
0.7500	0.041
0.8333	0.034
0.9166	0.031
1.0000	0.025
1.0833	0.025
1.1666	0.018
1.2500	0.018
1.3333	0.012
1.4166	0.015
1.5000	0.012
1.5833	0.012
1.6666	0.009
1.7500	0.006
1.8333	0.009
1.9166	0.006
2.0000	0.006
2.5000	0.003
3.0000	0.003
3.5000	0.003
4.0000	0.003
4.5000	0.003
5.0000	0.003
5.5000	0.003
6.0000	0.003
6.5000	0.003

<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<>>

A Q T E S O L V   R E S U L T S

Version 1.10

06/04/92 04:24:39

==

TEST DESCRIPTION

Data set........... m107a.set
Data set title..... RISING HEAD RESULT, M-107-A
Company............ J.M.MONTGOMERY, CONSULTING ENG
Project............ 2738.0574
Client............. NAVY - WESTDIV
Location........... Background Well
Test date.......... March 16, 1992

Knowns and Constants:

No. of data points.................. 51
Radius of well casing............... 2.54
Radius of well...................... 5.96
Aquifer saturated thickness......... 358.8
Well screen length.................. 304.8
Static height of water in well...... 358.8
Log(Re/Rw).......................... 3.117
A, B, C............................ 0.000, 0.000, 2.680

==

ANALYTICAL METHOD

Bouwer-Rice (Unconfined Aquifer Slug Test)

==

RESULTS FROM VISUAL CURVE MATCHING

VISUAL MATCH PARAMETER ESTIMATES

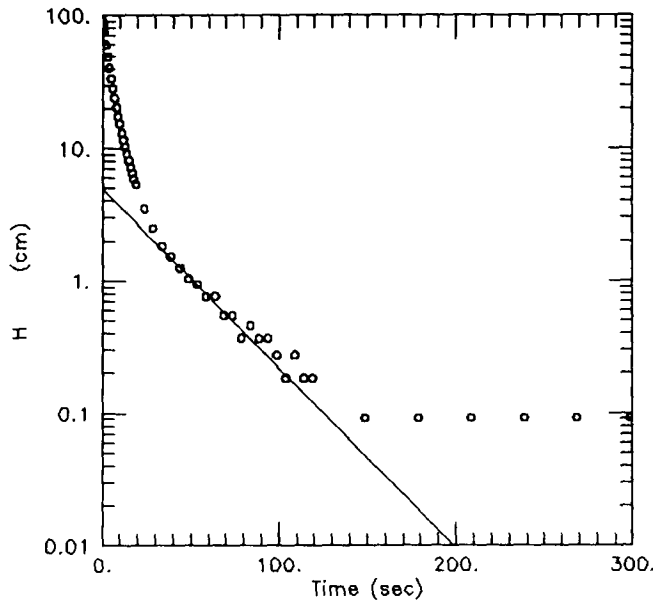
	Estimate
K =	6.0817E-004
y0 =	4.7289E-308

<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<>>

TYPE CURVE DATA

K = 1.02886E-003
y0 = 4.93475E+000

Time	Drawdown	Time	Drawdown	Time	Drawdown
0.000E+000	4.935E+000	3.000E+002	4.259E-004		



DATA SET:
m107a.set
05/04/92

AQUIFER TYPE:
Unconfined

SOLUTION METHOD:
Bouwer-Rice

TEST DATE:
March 18, 1992

ESTIMATED PARAMETERS:
K = 0.001029 cm/sec
y0 = 4.935 cm

TEST DATA:
H0 = 100.4 cm
rc = 2.54 cm
rw = 5.96 cm
L = 304.8 cm
b = 358.8 cm
H = 358.8 cm

RISING HEAD RESULT, M-107-A

J.M.MONTGOMERY, CONSULTING ENG	Client: NAVY - WESTDIV
Project No.: 2738.0574	Location: Background Well

M-108-A
RISING HEAD FIELD DATA
NAS ALAMEDA, CTO-107
1992

SE1000C
Environmental Logger
03/16 21:24

Unit# 01558 Test 3

Setups:	INPUT 1
Type	Level (F)
Mode	TOC
I.D.	10802
Reference	0.000
Linearity	0.040
Scale factor	9.990
Offset	0.010
Delay mSEC	50.000

Step 0 03/16 15:32:00

Elapsed Time (min)	INPUT 1 (ft)
0.0000	-0.012
0.0033	0.660
0.0066	7.047
0.0100	8.796
0.0133	5.129
0.0166	2.527
0.0200	4.416
0.0233	3.216
0.0266	3.655
0.0300	3.200
0.0333	3.197
0.0500	2.758
0.0666	2.480
0.0833	2.227
0.1000	2.013
0.1166	1.823
0.1333	1.662
0.1500	1.513
0.1666	1.387
0.1833	1.270
0.2000	1.166
0.2166	1.074
0.2333	0.989
0.2500	0.923
0.2666	0.844
0.2833	0.783
0.3000	0.727
0.3166	0.679
0.3333	0.629
0.4166	0.436
0.5000	0.316
0.5833	0.230
0.6666	0.177
0.7500	0.132
0.8333	0.101
0.9166	0.079
1.0000	0.072
1.0833	0.053
1.1666	0.044
1.2500	0.038
1.3333	0.034
1.4166	0.028
1.5000	0.025
1.5833	0.019
1.6666	0.019
1.7500	0.019
1.8333	0.012
1.9166	0.012
2.0000	0.009
2.5000	0.003
3.0000	0.006
3.5000	-0.003
4.0000	-0.003
4.5000	0.000
5.0000	-0.003
5.5000	-0.003
6.0000	-0.003
6.5000	-0.003
7.0000	-0.006
7.5000	-0.006
8.0000	-0.003
8.5000	-0.006
9.0000	-0.006
9.5000	-0.003
10.0000	-0.003
12.0000	-0.006
14.0000	-0.006
16.0000	0.000

<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<>>

A Q T E S O L V   R E S U L T S

Version 1.10

06/04/92 04:32:11

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TEST DESCRIPTION

Data set........... M108A.SET
Data set title..... RISING HEAD RESULT, M-108-A
Company............ J.M.MONTGOMERY, CONSULTING ENG
Project............ 2738.0574
Client............. NAVY - WESTDIV
Location........... Background Well
Test date.......... March 16, 1992

Knowns and Constants:
No. of data points.................. 42
Radius of well casing............... 2.54
Radius of well...................... 5.96
Aquifer saturated thickness......... 414.5
Well screen length.................. 304.8
Static height of water in well...... 414.5
Log(Re/Rw).......................... 3.208
A, B, C............................. 0.000, 0.000, 2.680

==

ANALYTICAL METHOD

Bouwer-Rice (Unconfined Aquifer Slug Test)

==

RESULTS FROM VISUAL CURVE MATCHING

VISUAL MATCH PARAMETER ESTIMATES

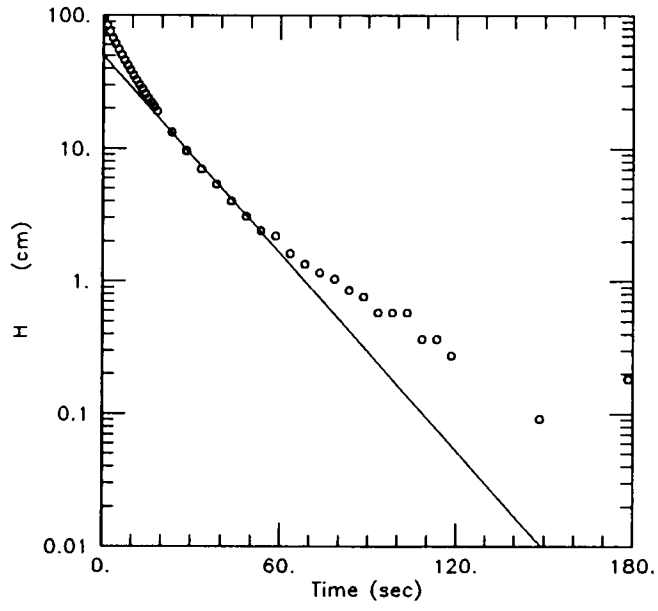
	Estimate
K =	1.9391E-003
y0 =	4.7289E-308

<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<>>

TYPE CURVE DATA

K = 1.93908E-003
y0 = 4.97775E+001

Time	Drawdown	Time	Drawdown	Time	Drawdown
0.000E+000	4.978E+001	1.800E+002	1.708E-003		



DATA SET:
M108A.SET
06/04/92

AQUIFER TYPE:
Unconfined

SOLUTION METHOD:
Bouwer-Rice

TEST DATE:
March 16, 1992

ESTIMATED PARAMETERS:
K = 0.001939 cm/sec
y0 = 49.78 cm

TEST DATA:
H0 = 111.4 cm
rc = 2.54 cm
rw = 5.96 cm
L = 304.8 cm
b = 414.5 cm
H = 414.5 cm

RISING HEAD RESULT, M-108-A

J.M.MONTGOMERY, CONSULTING ENG	Client: NAVY - WESTDIV
Project No.: 2738.0574	Location: Background Well

M-109-A
RISING HEAD FIELD DATA
NAS ALAMEDA, CTO-107
1991

SE1000B
Environmental Logger
08/06 18:10

Unit# 00515 Test# 1

INPUT 1: Level (F) TOC

Reference 0.00
Scale factor 10.09
Offset 0.00

Step# 0 08/06 12:33

Elapsed Time (min)	Value (ft)
0.0000	2.31
0.0033	2.73
0.0066	0.51
0.0099	2.36
0.0133	1.58
0.0166	1.55
0.0200	1.50
0.0233	1.42
0.0266	1.35
0.0300	1.28
0.0333	1.22
0.0500	0.97
0.0666	0.79
0.0833	0.64
0.1000	0.53
0.1166	0.43
0.1333	0.36
0.1500	0.30
0.1666	0.26
0.1833	0.22
0.2000	0.19
0.2166	0.16
0.2333	0.14
0.2500	0.12
0.2666	0.11
0.2833	0.09
0.3000	0.08
0.3166	0.07
0.3333	0.06
0.4167	0.03
0.5000	0.01
0.5833	0.00
0.6667	-0.00
0.7500	-0.00
0.8333	-0.01
0.9167	-0.01
1.0000	-0.02
1.0833	-0.02
1.1667	-0.02
1.2500	-0.02
1.3333	-0.02
1.4166	-0.02
1.5000	-0.02
1.5833	-0.02
1.6667	-0.02
1.7500	-0.02
1.8333	-0.02
1.9167	-0.02
2.0000	-0.02
2.5000	-0.02
3.0000	-0.02
3.5000	-0.02
4.0000	-0.02
4.5000	-0.02
5.0000	-0.02
5.5000	-0.02
6.0000	-0.02
6.5000	-0.02
7.0000	-0.02
7.5000	-0.02
8.0000	-0.03
8.5000	-0.02
9.0000	-0.03
9.5000	-0.02
10.0000	-0.02
12.0000	-0.03
14.0000	-0.03

<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<>>

A Q T E S O L V   R E S U L T S
Version 1.10

02/26/92 10:51:40

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TEST DESCRIPTION

Data set........... m109a.set
Data set title..... RISING HEAD RESULT, M-109-A
Company............ J.M.MONTGOMERY, CONSULTING ENG
Project............ 2738.0262
Client............. NAVY - WESTDIV
Location........... Background Wells
Test date.......... August 6, 1991

Knowns and Constants:
No. of data points.................. 26
Radius of well casing............... 2.54
Radius of well...................... 5.79
Aquifer saturated thickness......... 241.4
Well screen length.................. 241.4
Static height of water in well...... 241.4
Log(Re/Rw).......................... 2.846
A, B, C............................. 0.000, 0.000, 2.354

==

ANALYTICAL METHOD

Bouwer-Rice (Unconfined Aquifer Slug Test)

==

RESULTS FROM VISUAL CURVE MATCHING

VISUAL MATCH PARAMETER ESTIMATES

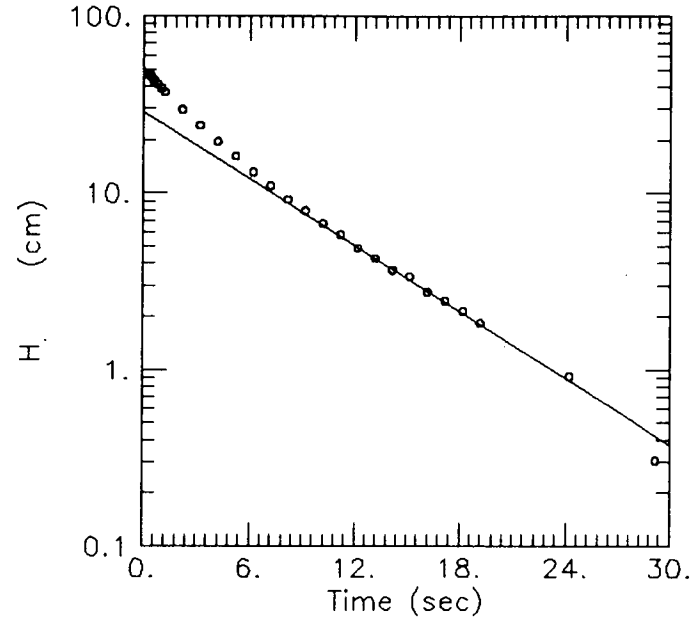
	Estimate
K =	6.4077E-003
y0 =	-1.3253E+100

<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<>>

TYPE CURVE DATA

K = 5.50578E-003
y0 = 2.85924E+001

Time	Drawdown	Time	Drawdown	Time	Drawdown
0.000E+000	2.859E+001	3.000E+001	3.717E-001		



DATA SET:
m109a.aet
02/28/92

AQUIFER TYPE:
Unconfined

SOLUTION METHOD:
Bouwer-Rice

TEST DATE:
August 8, 1991

ESTIMATED PARAMETERS:
K = 0.005508 cm/sec
y0 = 28.58 cm

TEST DATA:
H0 = 48.16 cm
rc = 2.54 cm
rw = 5.78 cm
L = 241.4 cm
D = 241.4 cm
H = 241.4 cm

RISING HEAD RESULT, M-109-A

J.M.MONTGOMERY, CONSULTING ENG	Client: NAVY – WESTDIV
Project No.: 2738.0262	Location: Background Wells

M-110-A
RISING HEAD FIELD DATA
NAS ALAMEDA, CTO-107
1991

SE1000B
Environmental Logger
08/07 17:36

Unit# 00515 Test# 5

INPUT 1: Level (F) TOC

Reference 0.00
Scale factor 10.09
Offset 0.00

Step# 0 08/07 13:50

Elapsed Time (min)	Value (ft)
0.0000	0.07
0.0033	2.15
0.0066	3.21
0.0099	3.70
0.0133	0.03
0.0166	3.27
0.0200	1.74
0.0233	1.68
0.0266	1.59
0.0300	1.55
0.0333	1.50
0.0500	1.28
0.0666	1.12
0.0833	0.99
0.1000	0.87
0.1166	0.77
0.1333	0.69
0.1500	0.62
0.1666	0.55
0.1833	0.50
0.2000	0.45
0.2166	0.41
0.2333	0.37
0.2500	0.34
0.2666	0.31
0.2833	0.29
0.3000	0.27
0.3166	0.25
0.3333	0.23
0.4167	0.17
0.5000	0.13
0.5833	0.11
0.6667	0.09
0.7500	0.08
0.8333	0.07
0.9167	0.07
1.0000	0.07
1.0833	0.06
1.1667	0.06
1.2500	0.06
1.3333	0.06
1.4166	0.06
1.5000	0.06
1.5833	0.06
1.6667	0.06
1.7500	0.06
1.8333	0.06
1.9167	0.05
2.0000	0.05
2.5000	0.05
3.0000	0.04
3.5000	0.05
4.0000	0.05
4.5000	0.05
5.0000	0.04
5.5000	0.04
6.0000	0.03
6.5000	0.04
7.0000	0.04

<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<>>

A Q T E S O L V   R E S U L T S

Version 1.10

06/08/92 06:52:17

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TEST DESCRIPTION

Data set........... m110a.set
Data set title..... RISING HEAD RESULT, M-110-A
Company............ J.M.MONTGOMERY, CONSULTING ENG
Project............ 2738.0262
Client............. NAVY - WESTDIV
Location........... Background Wells
Test date.......... August 7, 1991

Knowns and Constants:
No. of data points.................. 44
Radius of well casing............... 2.54
Radius of well...................... 5.79
Aquifer saturated thickness......... 313
Well screen length.................. 304.8
Static height of water in well...... 313
Log(Re/Rw).......................... 3.053
A, B, C............................. 0.000, 0.000, 2.732

===

ANALYTICAL METHOD

Bouwer-Rice (Unconfined Aquifer Slug Test)

===

RESULTS FROM VISUAL CURVE MATCHING

VISUAL MATCH PARAMETER ESTIMATES

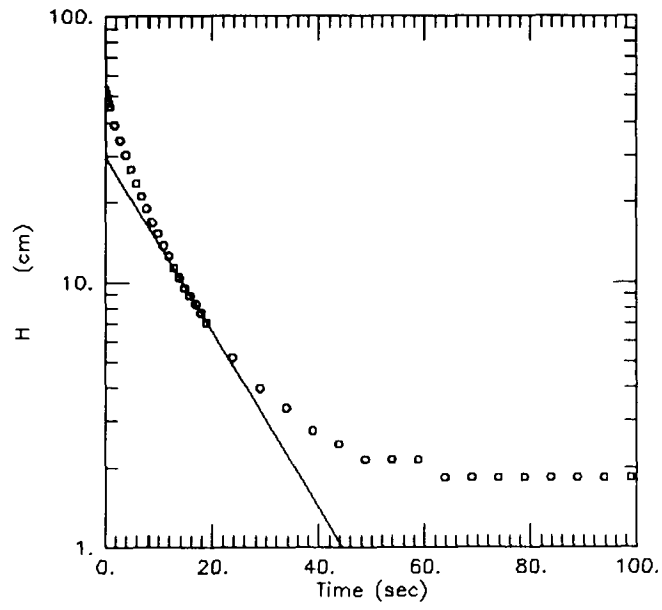
	Estimate
K =	7.4083E-004
y0 =	0.0000E+000

<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<>>

TYPE CURVE DATA

K = 2.45619E-003
y0 = 2.95950E+001

Time	Drawdown	Time	Drawdown	Time	Drawdown
0.000E+000	2.959E+001	1.000E+002	1.477E-002		



DATA SET:
m110a.eet
08/08/92

AQUIFER TYPE:
Unconfined

SOLUTION METHOD:
Bouwer-Rice

TEST DATE:
August 7, 1991

ESTIMATED PARAMETERS:
K = 0.002458 cm/sec
y0 = 28.58 cm

TEST DATA:
H0 = 53.04 cm
rc = 2.54 cm
rw = 5.78 cm
L = 304.8 cm
D = 313. cm
H = 313. cm

RISING HEAD RESULT, M-110-A

J.M.MONTGOMERY, CONSULTING ENG	Client: NAVY – WESTDIV
Project No.: 2738.0262	Location: Background Wells

M-111-A
RISING HEAD FIELD DATA
NAS ALAMEDA, CTO-107
1991

SE1000B
Environmental Logger
08/07 17:29

Unit# 00515 Test# 3

INPUT 1: Level (F) TOC

Reference 0.00
Scale factor 10.09
Offset 0.00

Step# 0 08/07 13:09

Elapsed Time (min)	Value (ft)
0.0000	14.59
0.0033	16.27
0.0066	17.30
0.0099	15.14
0.0133	14.45
0.0166	16.41
0.0200	15.54
0.0233	15.48
0.0266	15.49
0.0300	15.47
0.0333	15.41
0.0500	15.22
0.0666	15.07
0.0833	14.93
0.1000	14.82
0.1166	14.72
0.1333	14.63
0.1500	14.55
0.1666	14.49
0.1833	14.43
0.2000	14.38
0.2166	14.34
0.2333	14.30
0.2500	14.26
0.2666	14.23
0.2833	14.20
0.3000	14.18
0.3166	14.16
0.3333	14.14
0.4167	14.06
0.5000	14.00
0.5833	13.96
0.6667	13.92
0.7500	13.90
0.8333	13.88
0.9167	13.87
1.0000	13.86
1.0833	13.85
1.1667	13.84
1.2500	13.84
1.3333	13.83
1.4166	13.83
1.5000	13.83
1.5833	13.83
1.6667	13.83
1.7500	13.83
1.8333	13.82
1.9167	13.82
2.0000	13.82
2.5000	13.82
3.0000	13.82
3.5000	13.82
4.0000	13.82
4.5000	13.82
5.0000	13.82
5.5000	13.82
6.0000	13.82
6.5000	13.82
7.0000	13.82
7.5000	13.83
8.0000	13.82

<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<>>

A Q T E S O L V   R E S U L T S
Version 1.10

02/26/92 11:04:00

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TEST DESCRIPTION

Data set........... m111a.set
Data set title..... RISING HEAD RESULT, M-111-A
Company............ J.M.MONTGOMERY, CONSULTING ENG
Project............ 2738.0262
Client............. NAVY - WESTDIV
Location........... Background Wells
Test date.......... August 7, 1991

Knowns and Constants:
No. of data points.................. 38
Radius of well casing............... 2.54
Radius of well...................... 5.79
Aquifer saturated thickness......... 264.3
Well screen length.................. 264.3
Static height of water in well...... 264.3
Log(Re/Rw).......................... 2.92
A, B, C............................. 0.000, 0.000, 2.489

==

ANALYTICAL METHOD

Bouwer-Rice (Unconfined Aquifer Slug Test)

==

RESULTS FROM VISUAL CURVE MATCHING

VISUAL MATCH PARAMETER ESTIMATES

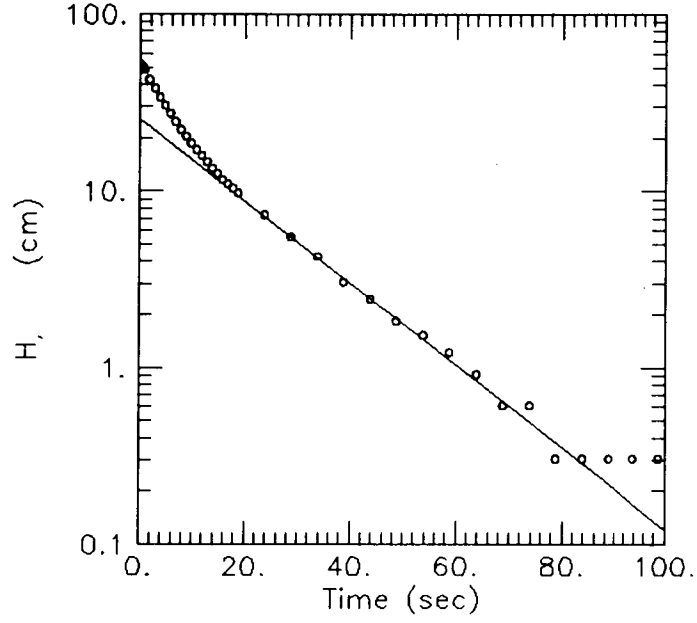
	Estimate
K =	1.9779E-003
y0 =	-1.3253E+100

<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<>>

TYPE CURVE DATA

K = 1.90927E-003
y0 = 2.56327E+001

Time	Drawdown	Time	Drawdown	Time	Drawdown
0.000E+000	2.563E+001	1.000E+002	1.210E-001		



DATA SET:
m111a.set
02/28/92

AQUIFER TYPE:
Unconfined
SOLUTION METHOD:
Bouwer-Rice
TEST DATE:
August 7, 1991

ESTIMATED PARAMETERS:
K = 0.001909 cm/sec
y0 = 25.83 cm

TEST DATA:
H0 = 52.43 cm
rc = 2.54 cm
rw = 5.78 cm
L = 284.3 cm
D = 284.3 cm
H = 284.3 cm

RISING HEAD RESULT, M-111-A

J.M.MONTGOMERY, CONSULTING ENG	Client: NAVY - WESTDIV
Project No.: 2738.0262	Location: Background Wells

M-001-B
RISING HEAD FIELD DATA
NAS ALAMEDA, CTO-107
1991

SE2000
Environmental Logger
07/29 14:09

Unit# Test 7

INPUT 1: Level (F) TOC

Reference	0.000
SG	1.000
Linearity	0.000
Scale factor	49.900
Offset	0.010
Delay mSEC	50.000

Step 0 07/26 16:11:57

Elapsed Time (min)	INPUT 1 (ft)
0.0000	-41.942
0.0083	-41.533
0.0166	-41.990
0.0250	-42.541
0.0333	-42.935
0.0416	-43.045
0.0500	-43.045
0.0583	-43.077
0.0666	-43.171
0.0750	-43.313
0.0833	-43.486
0.1000	-43.770
0.1166	-43.928
0.1333	-44.038
0.1500	-44.132
0.1666	-44.227
0.1833	-44.306
0.2000	-44.369
0.2166	-44.416
0.2333	-44.463
0.2500	-44.511
0.2666	-44.542
0.2833	-44.558
0.3000	-44.589
0.3166	-44.605
0.3333	-44.621
0.4166	-44.684
0.5000	-44.731
0.5833	-44.763
0.6666	-44.779
0.7500	-44.779
0.8333	-44.794
0.9166	-44.794
1.0000	-44.810
1.0833	-44.810
1.1666	-44.810
1.2500	-44.810
1.3333	-44.810
1.4166	-44.810
1.5000	-44.810
1.5833	-44.810
1.6666	-44.810
1.7500	-44.810
1.8333	-44.810
1.9166	-44.826
2.0000	-44.810
2.5000	-44.810
3.0000	-44.810
3.5000	-44.810
4.0000	-44.810
4.5000	-44.810
5.0000	-44.794
5.5000	-44.794
6.0000	-44.794
6.5000	-44.794
7.0000	-44.794
7.5000	-44.794
8.0000	-44.779
8.5000	-44.779
9.0000	-44.779
9.5000	-44.779
10.0000	-44.763
12.0000	-44.763
14.0000	-44.763
16.0000	-44.747
18.0000	-44.731
20.0000	-44.731
22.0000	-44.700
24.0000	-44.684
26.0000	-44.684
28.0000	-44.668
30.0000	-44.668
32.0000	-44.668

A Q T E S O L V R E S U L T S
Version 1.10

06/04/92

TEST DESCRIPTION

Data set..... m001b.set
Data set title..... RISING HEAD RESULT, M-001-B
Company..... J.M.MONTGOMERY, CONSULTING ENG
Project..... 2738.0262
Client..... NAVY - WESTDIV
Location..... 1943-1956 Disposal Area
Test date..... July 26, 1991

Knowns and Constants:
No. of data points..... 24
Pumping rate..... 1
Radius (distance) to obs. well..... 2.54

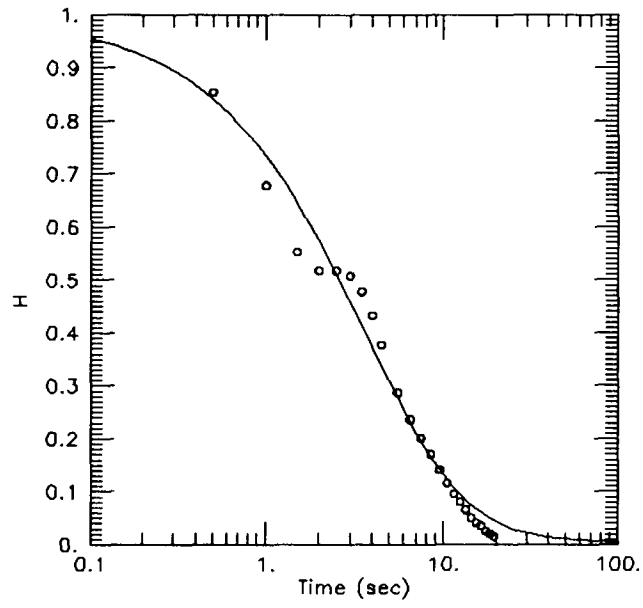
ANALYTICAL METHOD

Cooper et al. (Confined Aquifer Slug Test)

RESULTS FROM CURVE MATCHING

MATCH PARAMETER ESTIMATES

		Estimate
T	=	3.6670E+000
S	=	3.2728E-005



DATA SET:
m001b.set
08/04/92

AQUIFER TYPE:
Confined

SOLUTION METHOD:
Cooper et al.

TEST DATE:
July 28, 1991

ESTIMATED PARAMETERS:
T = 3.887 cm^2/sec
S = 3.2728E-05

TEST DATA:
H0 = 85.55 cm
rc = 2.54 cm
rw = 8.89 cm

RISING HEAD RESULT, M-001-B

J.M.MONTGOMERY, CONSULTING ENG	Client: NAVY - WESTDIV
Project No.: 2738.0262	Location: 1943-1956 Disposal Area

M-010-B
RISING HEAD FIELD DATA
NAS ALAMEDA, CTO-107
1991

SE1000B
Environmental Logger
08/12 09:35

Unit# 00515 Test# 3

INPUT 1: Level (F) TOC

Reference 0.00
Scale factor 10.09
Offset 0.00

Step# 0 08/09 13:39

Elapsed Time (min)	Value (ft)
0.0000	-11.91
0.0033	-11.54
0.0066	-9.26
0.0099	-7.64
0.0133	-7.05
0.0166	-7.18
0.0200	-7.63
0.0233	-8.60
0.0266	-8.55
0.0300	-8.13
0.0333	-7.55
0.0500	-8.14
0.0666	-7.90
0.0833	-7.92
0.1000	-8.06
0.1166	-8.08
0.1333	-8.11
0.1500	-8.16
0.1666	-8.13
0.1833	-8.19
0.2000	-8.21
0.2166	-8.23
0.2333	-8.25
0.2500	-8.27
0.2666	-8.29
0.2833	-8.31
0.3000	-8.32
0.3166	-8.34
0.3333	-8.36
0.4167	-8.44
0.5000	-8.51
0.5833	-8.57
0.6667	-8.64
0.7500	-8.70
0.8333	-8.75
0.9167	-8.80
1.0000	-8.86
1.0833	-8.91
1.1667	-8.96
1.2500	-9.01
1.3333	-9.05
1.4166	-9.10
1.5000	-9.14
1.5833	-9.19
1.6667	-9.23
1.7500	-9.29
1.8333	-9.31
1.9167	-9.35
2.0000	-9.39
2.5000	-9.60
3.0000	-9.78
3.5000	-9.92
4.0000	-10.06
4.5000	-10.18
5.0000	-10.29
5.5000	-10.40
6.0000	-10.50
6.5000	-10.58
7.0000	-10.65
7.5000	-10.72
8.0000	-10.80
8.5000	-10.85
9.0000	-10.90
9.5000	-10.95
10.0000	-10.99
12.0000	-11.13
14.0000	-11.26
16.0000	-11.34
18.0000	-11.41
20.0000	-11.45
22.0000	-11.49
24.0000	-11.52
26.0000	-11.55
28.0000	-11.57
30.0000	-11.59
32.0000	-11.59
34.0000	-11.60
36.0000	-11.61
38.0000	-11.62
40.0000	-11.62
42.0000	-11.63

A Q T E S O L V R E S U L T S
Version 1.10

06/04/92

TEST DESCRIPTION

Data set..... m010b.set
Data set title..... RISING HEAD RESULT, M-010-B
Company..... J.M.MONTGOMERY, CONSULTING ENG
Project..... 2738.0262
Client..... NAVY - WESTDIV
Location..... West Beach Landfill
Test date..... August 9, 1992

Knowns and Constants:
No. of data points..... 67
Pumping rate..... 1
Radius (distance) to obs. well..... 2.54

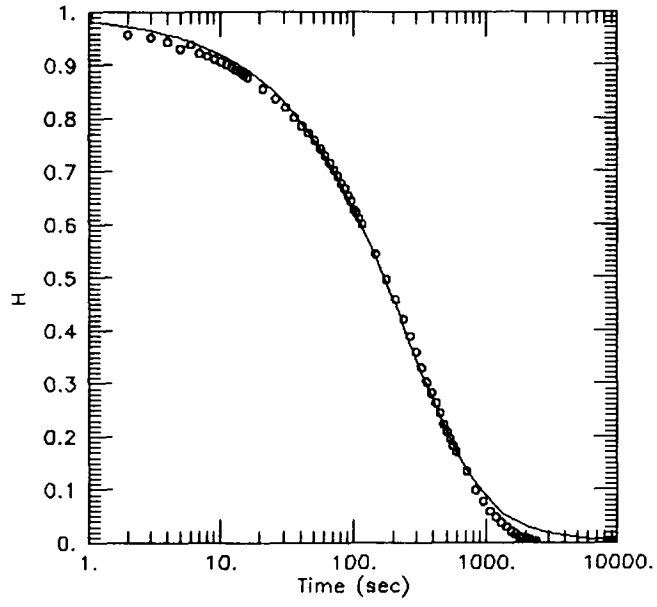
ANALYTICAL METHOD

Cooper et al. (Confined Aquifer Slug Test)

RESULTS FROM CURVE MATCHING

MATCH PARAMETER ESTIMATES

		Estimate
T	=	3.7750E-002
S	=	4.2129E-004



DATA SET:
m010b.aet
08/04/92

AQUIFER TYPE:
Confined

SOLUTION METHOD:
Cooper et al.

TEST DATE:
August 9, 1992

ESTIMATED PARAMETERS:
T = 0.03775 cm^2/sec
S = 0.0004213

TEST DATA:
H0 = 113.7 cm
rc = 2.54 cm
rw = 8.88 cm

RISING HEAD RESULT, M-010-B

J.M.MONTGOMERY, CONSULTING ENG	Client: NAVY - WESTDIV
Project No.: 2738.0262	Location: West Beach Landfill

M-012-B
RISING HEAD FIELD DATA
NAS ALAMEDA, CTO-107
1991

SE2000
Environmental Logger
08/02 07:32

Unit# Test 5

INPUT 1: Level (F) TOC

Reference	0.000
SG	1.000
Linearity	0.000
Scale factor	49.900
Offset	0.010
Delay mSEC	50.000

Step 0 08/01 14:41:14

Elapsed Time (min)	INPUT 1 (ft)
0.0000	-5.845
0.0083	-10.540
0.0166	-10.383
0.0250	-10.477
0.0333	-10.792
0.0416	-11.045
0.0500	-11.249
0.0583	-11.438
0.0666	-11.612
0.0750	-11.769
0.0833	-11.911
0.1000	-12.163
0.1166	-12.384
0.1333	-12.573
0.1500	-12.730
0.1666	-12.872
0.1833	-12.998
0.2000	-13.109
0.2166	-13.203
0.2333	-13.298
0.2500	-13.361
0.2666	-13.440
0.2833	-13.487
0.3000	-13.550
0.3166	-13.597
0.3333	-13.644
0.4166	-13.786
0.5000	-13.881
0.5833	-13.944
0.6666	-13.991
0.7500	-14.022
0.8333	-14.038
0.9166	-14.070
1.0000	-14.070
1.0833	-14.086
1.1666	-14.086
1.2500	-14.101
1.3333	-14.101
1.4166	-14.101
1.5000	-14.101
1.5833	-14.117
1.6666	-14.117
1.7500	-14.117
1.8333	-14.117
1.9166	-14.117
2.0000	-14.133
2.5000	-14.133
3.0000	-14.133
3.5000	-14.149
4.0000	-14.133
4.5000	-14.149
5.0000	-14.149
5.5000	-14.149
6.0000	-14.149
6.5000	-14.149
7.0000	-14.149
7.5000	-14.149

A Q T E S O L V R E S U L T S
Version 1.10

06/04/92

TEST DESCRIPTION

Data set..... m012b.set
Data set title..... RISING HEAD RESULT, M-012-B
Company..... J.M.MONTGOMERY, CONSULTING ENG
Project..... 2738.0262
Client..... NAVY - WESTDIV
Location..... West Beach Landfill
Test date..... August 1, 1991

Knowns and Constants:
No. of data points..... 45
Pumping rate..... 1
Radius (distance) to obs. well..... 2.54

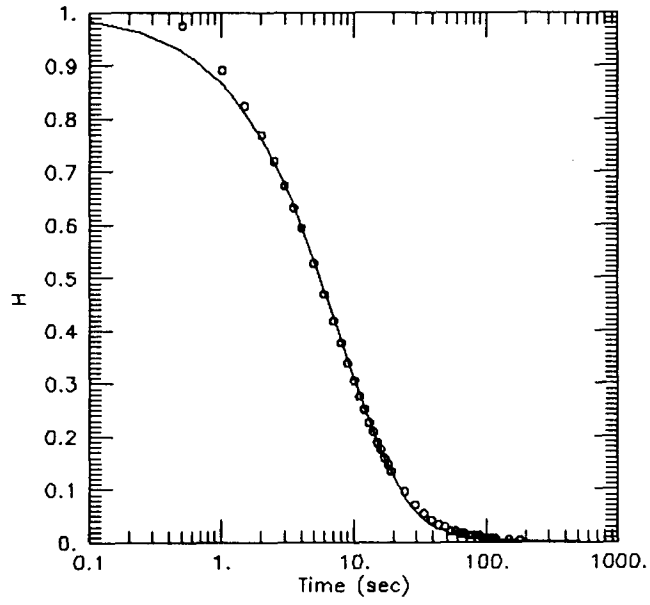
ANALYTICAL METHOD

Cooper et al. (Confined Aquifer Slug Test)

RESULTS FROM CURVE MATCHING

MATCH PARAMETER ESTIMATES

		Estimate
T	=	3.0441E+000
S	=	7.0474E-008



DATA SET:
m012b.set
08/04/92

AQUIFER TYPE:
Confined

SOLUTION METHOD:
Cooper et al.

TEST DATE:
August 1, 1991

ESTIMATED PARAMETERS:
T = 3.044 cm^2/sec
S = 7.0474E-08

TEST DATA:
H0 = 114.8 cm
rc = 2.54 cm
rw = 8.89 cm

RISING HEAD RESULT, M-012-B

J.M.MONTGOMERY, CONSULTING ENG	Client: NAVY – WESTDIV
Project No.: 2738.0262	Location: West Beach Landfill

M-014-B
RISING HEAD FIELD DATA
NAS ALAMEDA, CTO-107
1991

SE1000B
Environmental Logger
08/02 06:53

Unit# 00515 Test# 7

INPUT 1: Level (F) TOC

Reference 0.00
Scale factor 10.09
Offset 0.00

Step# 0 08/01 12:52

Elapsed Time (min)	Value (ft)
0.0000	-0.00
0.0033	0.53
0.0066	0.54
0.0099	6.52
0.0133	9.21
0.0166	5.29
0.0200	2.36
0.0233	2.96
0.0266	4.19
0.0300	4.38
0.0333	4.22
0.0500	3.84
0.0666	3.63
0.0833	3.45
0.1000	3.30
0.1166	3.15
0.1333	3.00
0.1500	2.87
0.1666	2.75
0.1833	2.63
0.2000	2.52
0.2166	2.41
0.2333	2.31
0.2500	2.22
0.2666	2.13
0.2833	2.04
0.3000	1.96
0.3166	1.88
0.3333	1.80
0.4167	1.48
0.5000	1.22
0.5833	1.01
0.6667	0.84
0.7500	0.70
0.8333	0.59
0.9167	0.50
1.0000	0.42
1.0833	0.35
1.1667	0.30
1.2500	0.26
1.3333	0.22
1.4166	0.19
1.5000	0.16
1.5833	0.14
1.6667	0.12
1.7500	0.10
1.8333	0.09
1.9167	0.08
2.0000	0.07
2.5000	0.04
3.0000	0.02
3.5000	0.01
4.0000	0.00
4.5000	0.00
5.0000	0.00
5.5000	0.00
6.0000	0.00
6.5000	-0.00
7.0000	-0.01

A Q T E S O L V R E S U L T S
Version 1.10

06/03/92

TEST DESCRIPTION

Data set..... m014b.set
Data set title..... RISING HEAD RESULT, M-014-B
Company..... J.M.MONTGOMERY, CONSULTING ENG
Project..... 2738.0262
Client..... NAVY - WESTDIV
Location..... West Beach Landfill
Test date..... August 1, 1991

Knowns and Constants:
No. of data points..... 40
Pumping rate..... 1
Radius (distance) to obs. well..... 2.54

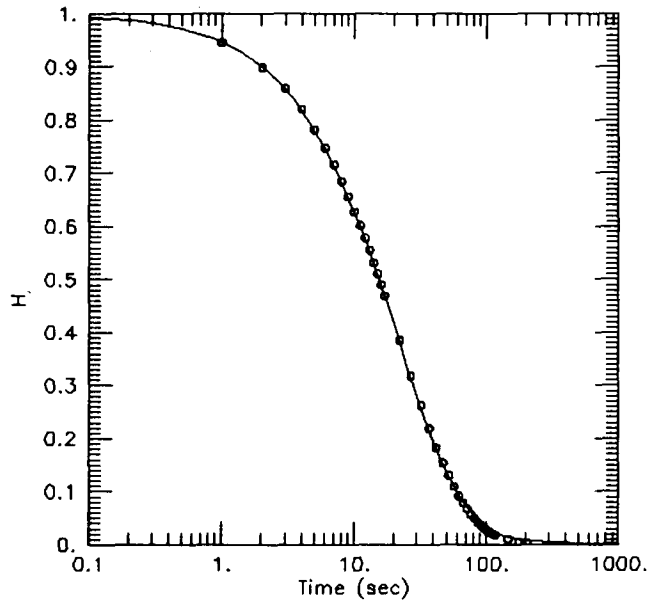
ANALYTICAL METHOD

Cooper et al. (Confined Aquifer Slug Test)

RESULTS FROM CURVE MATCHING

MATCH PARAMETER ESTIMATES

		Estimate
T	=	1.2634E+000
S	=	1.0000E-008



DATA SET:
m014b.set
08/03/92

AQUIFER TYPE:
Confined

SOLUTION METHOD:
Cooper et al.

TEST DATE:
August 1, 1991

ESTIMATED PARAMETERS:
T = 1.283 cm^2/sec
S = 1.E-08

TEST DATA:
H0 = 117. cm
rc = 2.54 cm
rw = 8.89 cm

RISING HEAD RESULT, M-014-B

J.M.MONTGOMERY, CONSULTING ENG	Client: NAVY - WESTDIV
Project No.: 2738.0262	Location: West Beach Landfill

M-020-B
RISING HEAD FIELD DATA
NAS ALAMEDA, CTO-107
1991

SE1000B
Environmental Logger
09/12 15:08

Unit# 00515 Test# 7

INPUT 1: Level (F) TOC

Reference 0.00
Scale factor 10.09
Offset 0.00

Step# 0 09/12 12:52

Elapsed Time (min)	Value (ft)
0.0000	0.00
0.0033	0.00
0.0066	0.00
0.0099	1.44
0.0133	5.23
0.0166	6.93
0.0200	6.46
0.0233	2.38
0.0266	2.25
0.0300	1.95
0.0333	1.94
0.0500	2.49
0.0666	2.93
0.0833	2.67
0.1000	2.53
0.1166	2.42
0.1333	2.31
0.1500	2.21
0.1666	2.12
0.1833	2.04
0.2000	1.96
0.2166	1.89
0.2333	1.82
0.2500	1.75
0.2666	1.69
0.2833	1.64
0.3000	1.58
0.3166	1.53
0.3333	1.48
0.4167	1.26
0.5000	1.09
0.5833	0.95
0.6667	0.83
0.7500	0.73
0.8333	0.65
0.9167	0.58
1.0000	0.52
1.0833	0.47
1.1667	0.43
1.2500	0.39
1.3333	0.36
1.4166	0.33
1.5000	0.30
1.5833	0.28
1.6667	0.27
1.7500	0.25
1.8333	0.23
1.9167	0.22
2.0000	0.21
2.5000	0.15
3.0000	0.11
3.5000	0.08
4.0000	0.07
4.5000	0.06
5.0000	0.05
5.5000	0.05
6.0000	0.04
6.5000	0.04
7.0000	0.03

A Q T E S O L V R E S U L T S
Version 1.10

06/04/92

TEST DESCRIPTION

Data set..... m020b.set
Data set title..... RISING HEAD RESULT, M-020-B
Company..... J.M.MONTGOMERY, CONSULTING ENG
Project..... 2738.0262
Client..... NAVY - WESTDIV
Location..... West Beach Landfill
Test date..... September 12, 1991

Knowns and Constants:
No. of data points..... 46
Pumping rate..... 1
Radius (distance) to obs. well..... 2.54

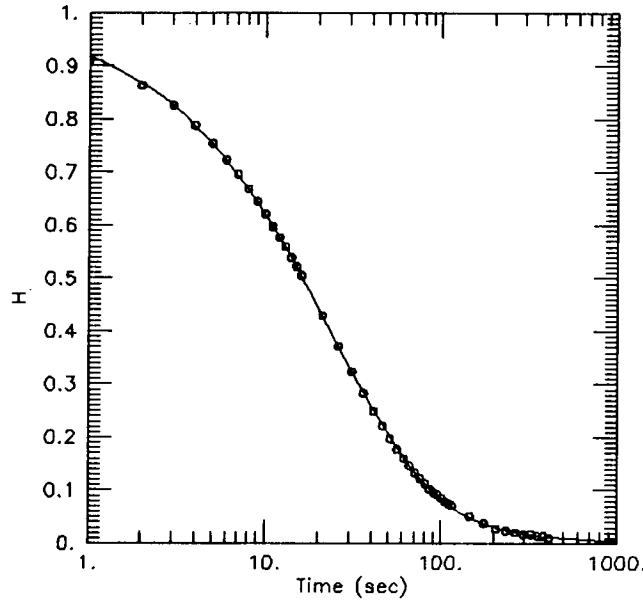
ANALYTICAL METHOD

Cooper et al. (Confined Aquifer Slug Test)

RESULTS FROM CURVE MATCHING

MATCH PARAMETER ESTIMATES

		Estimate
T	=	3.8600E-001
S	=	4.5373E-004



DATA SET:
m020b.est
08/04/92

AQUIFER TYPE:
Confined

SOLUTION METHOD:
Cooper et al.

TEST DATE:
September 12, 1991

ESTIMATED PARAMETERS:
T = 0.388 cm^2/sec
S = 0.0004537

TEST DATA:
H0 = 88.31 cm
rc = 2.54 cm
rw = 8.88 cm

RISING HEAD RESULT, M-020-B

J.M.MONTGOMERY, CONSULTING ENG	Client: NAVY – WESTDIV
Project No.: 2738.0262	Location: West Beach Landfill

M-023-B
RISING HEAD FIELD DATA
NAS ALAMEDA, CTO-107
1991

SE1000B
Environmental Logger
09/13 12:38

Unit# 00515 Test# 3

INPUT 1: Level (F) TOC

Reference 0.00
Scale factor 10.09
Offset 0.00

Step# 0 09/13 09:20

Elapsed Time (min)	Value (ft)
0.0000	0.02
0.0033	0.03
0.0066	1.34
0.0099	3.93
0.0133	3.53
0.0166	4.53
0.0200	3.52
0.0233	1.64
0.0266	4.17
0.0300	4.34
0.0333	1.84
0.0500	3.04
0.0666	2.58
0.0833	2.33
0.1000	2.12
0.1166	1.94
0.1333	1.78
0.1500	1.65
0.1666	1.52
0.1833	1.42
0.2000	1.32
0.2166	1.24
0.2333	1.16
0.2500	1.09
0.2666	1.03
0.2833	0.97
0.3000	0.92
0.3166	0.87
0.3333	0.82
0.4167	0.64
0.5000	0.51
0.5833	0.42
0.6667	0.36
0.7500	0.30
0.8333	0.26
0.9167	0.22
1.0000	0.20
1.0833	0.18
1.1667	0.16
1.2500	0.14
1.3333	0.14
1.4166	0.13
1.5000	0.12
1.5833	0.11
1.6667	0.11
1.7500	0.10
1.8333	0.10
1.9167	0.09
2.0000	0.09
2.5000	0.08
3.0000	0.07

A Q T E S O L V R E S U L T S
Version 1.10

06/04/92

TEST DESCRIPTION

Data set..... m023b.set
Data set title..... RISING HEAD RESULT, M-023-B
Company..... J.M.MONTGOMERY, CONSULTING ENG
Project..... 2738.0262
Client..... NAVY - WESTDIV
Location..... West Beach Landfill
Test date..... September 13, 1991

Knowns and Constants:
No. of data points..... 39
Pumping rate..... 1
Radius (distance) to obs. well..... 2.54

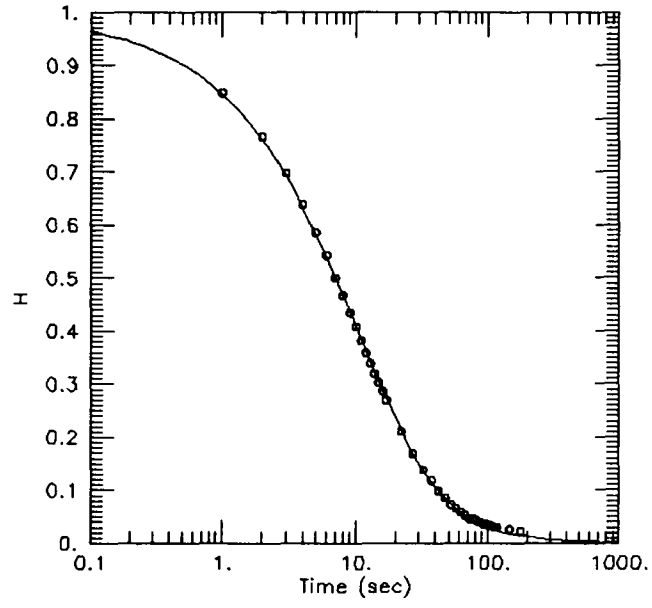
ANALYTICAL METHOD

Cooper et al. (Confined Aquifer Slug Test)

RESULTS FROM CURVE MATCHING

MATCH PARAMETER ESTIMATES

		Estimate
T	=	7.6320E-001
S	=	9.0256E-004



DATA SET:
m023b.aet
08/04/92

AQUIFER TYPE:
Confined

SOLUTION METHOD:
Cooper et al.

TEST DATE:
September 13, 1991

ESTIMATED PARAMETERS:
T = 0.7832 cm^2/sec
S = 0.0008028

TEST DATA:
H0 = 92.88 cm
rc = 2.54 cm
rw = 8.89 cm

RISING HEAD RESULT, M-023-B

J.M.MONTGOMERY, CONSULTING ENG	Client: NAVY - WESTDIV
Project No.: 2738.0262	Location: West Beach Landfill

M-027-B
RISING HEAD FIELD DATA
NAS ALAMEDA, CTO-107
1991

SE2000
Environmental Logger
07/29 14:02

Unit# Test 3

INPUT 1: Level (F) TOC

Reference	0.000
SG	1.000
Linearity	0.000
Scale factor	49.900
Offset	0.010
Delay mSEC	50.000

Step 0 07/26 11:52:03

Elapsed Time (min)	INPUT 1 (ft)
0.0000	-32.914
0.0083	-31.575
0.0166	-30.692
0.0250	-30.283
0.0333	-30.299
0.0416	-30.645
0.0500	-31.086
0.0583	-31.512
0.0666	-31.843
0.0750	-32.079
0.0833	-32.237
0.1000	-32.441
0.1166	-32.599
0.1333	-32.757
0.1500	-32.867
0.1666	-32.946
0.1833	-33.024
0.2000	-33.072
0.2166	-33.119
0.2333	-33.150
0.2500	-33.182
0.2666	-33.213
0.2833	-33.229
0.3000	-33.261
0.3166	-33.277
0.3333	-33.292
0.4166	-33.340
0.5000	-33.371
0.5833	-33.387
0.6666	-33.403
0.7500	-33.403
0.8333	-33.418
0.9166	-33.418
1.0000	-33.434
1.0833	-33.434
1.1666	-33.434
1.2500	-33.434
1.3333	-33.434
1.4166	-33.434
1.5000	-33.434
1.5833	-33.450
1.6666	-33.450
1.7500	-33.450
1.8333	-33.450
1.9166	-33.450
2.0000	-33.450
2.5000	-33.450
3.0000	-33.466
3.5000	-33.466
4.0000	-33.466
4.5000	-33.466
5.0000	-33.466
5.5000	-33.481
6.0000	-33.481
6.5000	-33.481
7.0000	-33.481
7.5000	-33.481
8.0000	-33.497
8.5000	-33.497
9.0000	-33.497
9.5000	-33.497
10.0000	-33.497
12.0000	-33.497
14.0000	-33.513
16.0000	-33.513
18.0000	-33.529
20.0000	-33.529
22.0000	-33.529

A Q T E S O L V R E S U L T S
Version 1.10

06/04/92

TEST DESCRIPTION

Data set..... m027b.set
Data set title..... RISING HEAD RESULT, M-027-B
Company..... J.M.MONTGOMERY, CONSULTING ENG
Project..... 2738.0262
Client..... NAVY - WESTDIV
Location..... 1943-1956 Disposal Area
Test date..... July 26, 1991

Knowns and Constants:
No. of data points..... 60
Pumping rate..... 1
Radius (distance) to obs. well..... 2.54

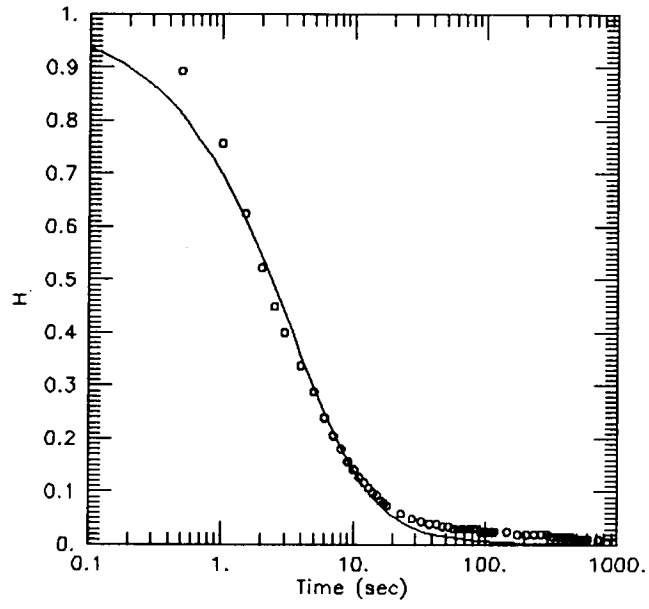
ANALYTICAL METHOD

Cooper et al. (Confined Aquifer Slug Test)

RESULTS FROM CURVE MATCHING

MATCH PARAMETER ESTIMATES

		Estimate
T	=	2.7162E+000
S	=	3.8981E-004



DATA SET:
m027b.set
08/04/92

AQUIFER TYPE:
Confined

SOLUTION METHOD:
Cooper et al.

TEST DATE:
July 28, 1991

ESTIMATED PARAMETERS:
T = 2.718 cm^2/sec
S = 0.0003898

TEST DATA:
H0 = 88.45 cm
rc = 2.54 cm
rw = 8.88 cm

RISING HEAD RESULT, M-027-B

J.M.MONTGOMERY, CONSULTING ENG	Client: NAVY - WESTDIV
Project No.: 2738.0262	Location: 1943-1956 Disposal Area

M-103-B
RISING HEAD FIELD DATA
NAS ALAMEDA, CTO-107
1991

SE1000B
Environmental Logger
09/16 13:37

Unit# 00515 Test# 5

INPUT 1: Level (F) TOC

Reference 0.00
Scale factor 10.09
Offset 0.00

Step# 0 09/16 11:19

Elapsed Time (min)	Value (ft)
0.0000	0.00
0.0033	1.37
0.0066	6.74
0.0099	9.80
0.0133	8.20
0.0166	4.72
0.0200	2.96
0.0233	2.42
0.0266	3.60
0.0300	4.24
0.0333	4.35
0.0500	3.74
0.0666	3.63
0.0833	3.58
0.1000	3.53
0.1166	3.49
0.1333	3.46
0.1500	3.43
0.1666	3.40
0.1833	3.38
0.2000	3.35
0.2166	3.33
0.2333	3.31
0.2500	3.29
0.2666	3.27
0.2833	3.25
0.3000	3.23
0.3166	3.21
0.3333	3.20
0.4167	3.11
0.5000	3.04
0.5833	2.97
0.6667	2.88
0.7500	2.85
0.8333	2.79
0.9167	2.74
1.0000	2.68
1.0833	2.63
1.1667	2.59
1.2500	2.54
1.3333	2.49
1.4166	2.44
1.5000	2.39
1.5833	2.35
1.6667	2.30
1.7500	2.26
1.8333	2.22
1.9167	2.18
2.0000	2.14
2.5000	1.96
3.0000	1.78
3.5000	1.63
4.0000	1.49
4.5000	1.36
5.0000	1.24
5.5000	1.15
6.0000	1.09
6.5000	1.01
7.0000	0.95
7.5000	0.88
8.0000	0.82
8.5000	0.77
9.0000	0.73
9.5000	0.70
10.0000	0.66
12.0000	0.53
14.0000	0.46
16.0000	0.40
18.0000	0.36
20.0000	0.32
22.0000	0.29

A Q T E S O L V R E S U L T S
Version 1.10

06/04/92

TEST DESCRIPTION

Data set..... m103b.set
Data set title..... RISING HEAD RESULT, M-103-B
Company..... J.M.MONTGOMERY, CONSULTING ENG
Project..... 2738.0262
Client..... NAVY - WESTDIV
Location..... Background Well
Test date..... September 16, 1991

Knowns and Constants:
No. of data points..... 59
Pumping rate..... 1
Radius (distance) to obs. well..... 2.54

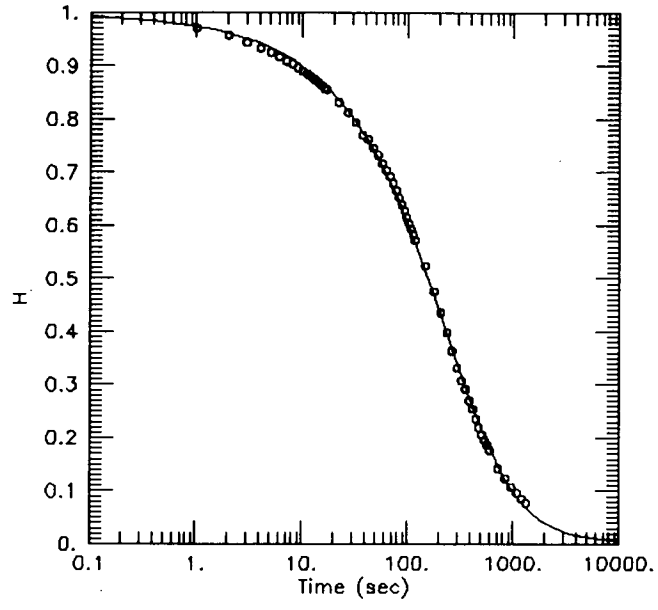
ANALYTICAL METHOD

Cooper et al. (Confined Aquifer Slug Test)

RESULTS FROM CURVE MATCHING

MATCH PARAMETER ESTIMATES

		Estimate
T	=	2.9150E-002
S	=	1.7384E-003



DATA SET:
m103b.set
08/04/92

AQUIFER TYPE:
Confined

SOLUTION METHOD:
Cooper et al.

TEST DATE:
September 18, 1991

ESTIMATED PARAMETERS:
T = 0.02915 cm^2/sec
S = 0.001738

TEST DATA:
H0 = 114. cm
rc = 2.54 cm
rw = 8.88 cm

RISING HEAD RESULT, M-103-B

J.M.MONTGOMERY, CONSULTING ENG	Client: NAVY – WESTDIV
Project No.: 2738.0262	Location: Background Well

M-105-B
RISING HEAD FIELD DATA
NAS ALAMEDA, CTO-107
1991

SE1000B
Environmental Logger
08/02 06:44

Unit# 00515 Test# 5

INPUT 1: Level (F) TOC

Reference 0.00
Scale factor 49.90
Offset 0.01

Step# 0 08/01 11:50

Elapsed Time (min)	Value (ft)
0.0000	1.62
0.0033	3.46
0.0066	4.52
0.0099	4.20
0.0133	2.53
0.0166	3.04
0.0200	3.84
0.0233	4.52
0.0266	4.49
0.0300	4.25
0.0333	4.17
0.0500	4.09
0.0666	3.98
0.0833	3.90
0.1000	3.84
0.1166	3.79
0.1333	3.73
0.1500	3.68
0.1666	3.63
0.1833	3.59
0.2000	3.54
0.2166	3.51
0.2333	3.48
0.2500	3.43
0.2666	3.40
0.2833	3.35
0.3000	3.32
0.3166	3.29
0.3333	3.26
0.4167	3.10
0.5000	2.96
0.5833	2.83
0.6667	2.70
0.7500	2.59
0.8333	2.48
0.9167	2.39
1.0000	2.30
1.0833	2.20
1.1667	2.11
1.2500	2.03
1.3333	1.93
1.4166	1.87
1.5000	1.79
1.5833	1.73
1.6667	1.65
1.7500	1.59
1.8333	1.52
1.9167	1.46
2.0000	1.41
2.5000	1.11
3.0000	0.88
3.5000	0.70
4.0000	0.56
4.5000	0.45
5.0000	0.36
5.5000	0.29
6.0000	0.23
6.5000	0.18
7.0000	0.15
7.5000	0.14
8.0000	0.11
8.5000	0.09
9.0000	0.07
9.5000	0.06
10.0000	0.06
12.0000	0.01
14.0000	0.01
16.0000	0.01
18.0000	0.00

A Q T E S O L V R E S U L T S
Version 1.10

06/04/92

TEST DESCRIPTION

Data set..... m105b.set
Data set title..... RISING HEAD RESULT, M-105-B
Company..... J.M.MONTGOMERY, CONSULTING ENG
Project..... 2738.0262
Client..... NAVY - WESTDIV
Location..... Background Well
Test date..... August 1, 1991

Knowns and Constants:
No. of data points..... 53
Pumping rate..... 1
Radius (distance) to obs. well..... 2.54

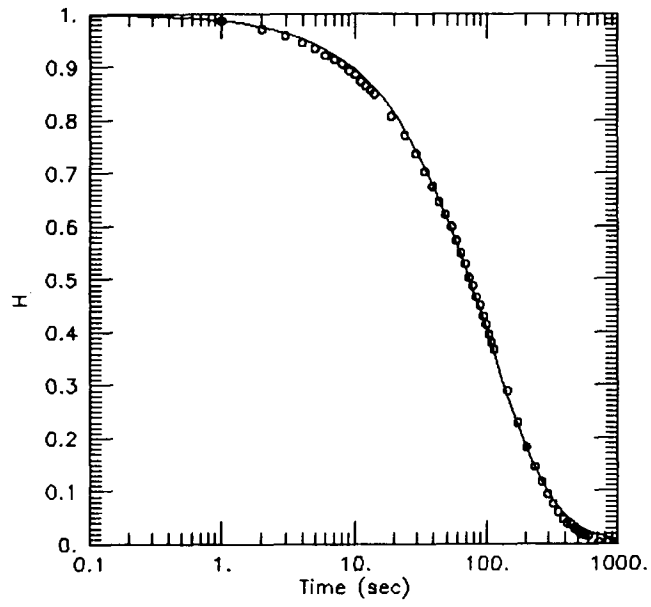
ANALYTICAL METHOD

Cooper et al. (Confined Aquifer Slug Test)

RESULTS FROM CURVE MATCHING

MATCH PARAMETER ESTIMATES

		Estimate
T	=	2.3630E-001
S	=	4.7812E-008



DATA SET:
m105b.aet
08/04/92

AQUIFER TYPE:
Confined

SOLUTION METHOD:
Cooper et al.

TEST DATE:
August 1, 1991

ESTIMATED PARAMETERS:
T = 0.2363 cm^2/sec
S = 4.7812E-08

TEST DATA:
H0 = 117. cm
rc = 2.54 cm
rw = 8.89 cm

RISING HEAD RESULT, M-105-B

J.M.MONTGOMERY, CONSULTING ENG	Client: NAVY - WESTDIV
Project No.: 2738.0262	Location: Background Well

M-108-B
RISING HEAD FIELD DATA
NAS ALAMEDA, CTO-107
1992

SE1000C
Environmental Logger
03/16 21:23

Unit# 01558 Test 2

Setups:	INPUT 1
Type	Level (F)
Mode	TOC
I.D.	10801
Reference	0.000
Linearity	0.040
Scale factor	9.990
Offset	0.010
Delay mSEC	50.000

Step 0 03/16 14:55:53

Elapsed Time (min)	INPUT 1 (ft)
0.0000	2.541
0.0033	5.297
0.0066	5.862
0.0100	4.998
0.0133	5.301
0.0166	4.565
0.0200	4.379
0.0233	4.344
0.0266	4.252
0.0300	4.193
0.0333	4.174
0.0500	4.038
0.0666	3.930
0.0833	3.836
0.1000	3.750
0.1166	3.668
0.1333	3.593
0.1500	3.517
0.1666	3.447
0.1833	3.375
0.2000	3.305
0.2166	3.245
0.2333	3.182
0.2500	3.119
0.2666	3.059
0.2833	3.002
0.3000	2.945
0.3166	2.891
0.3333	2.838
0.4166	2.579
0.5000	2.351
0.5833	2.146
0.6666	1.963
0.7500	1.792
0.8333	1.640
0.9166	1.501
1.0000	1.378
1.0833	1.261
1.1666	1.160
1.2500	1.065
1.3333	0.983
1.4166	0.904
1.5000	0.831
1.5833	0.761
1.6666	0.705
1.7500	0.651
1.8333	0.597
1.9166	0.556
2.0000	0.512
2.5000	0.319
3.0000	0.205
3.5000	0.136
4.0000	0.094
4.5000	0.066
5.0000	0.050
5.5000	0.041
6.0000	0.031
6.5000	0.025
7.0000	0.022
7.5000	0.019
8.0000	0.015
8.5000	0.019
9.0000	0.015
9.5000	0.019
10.0000	0.012
12.0000	0.012
14.0000	0.019
16.0000	0.015
18.0000	0.012

A Q T E S O L V R E S U L T S
Version 1.10

06/03/92

TEST DESCRIPTION

Data set..... m108b.set
Data set title..... RISING HEAD RESULT, M-108-B
Company..... J.M.MONTGOMERY, CONSULTING ENG
Project..... 2738.0574
Client..... NAVY - WESTDIV
Location..... Background Well
Test date..... March 16, 1992

Knowns and Constants:
No. of data points..... 63
Pumping rate..... 1
Radius (distance) to obs. well..... 2.54

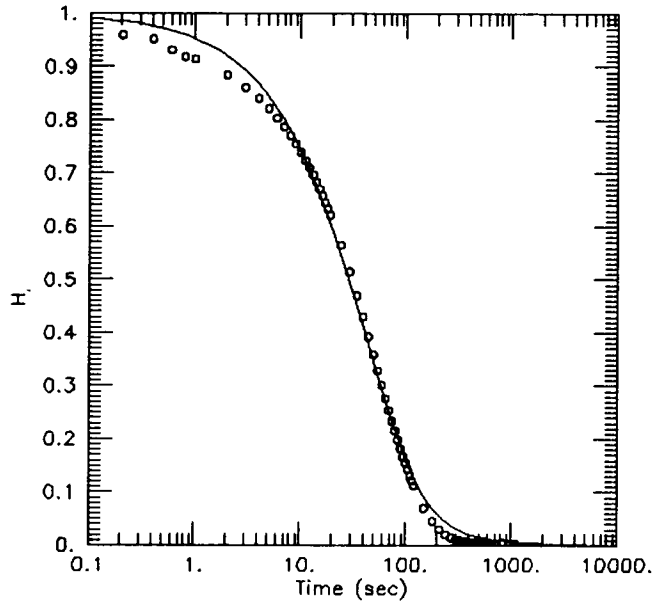
ANALYTICAL METHOD

Cooper et al. (Confined Aquifer Slug Test)

RESULTS FROM CURVE MATCHING

MATCH PARAMETER ESTIMATES

		Estimate
T	=	2.7629E-001
S	=	9.5821E-005



DATA SET:
m108b.set
08/03/92

AQUIFER TYPE:
Confined

SOLUTION METHOD:
Cooper et al.

TEST DATE:
March 18, 1992

ESTIMATED PARAMETERS:
T = 0.2783 cm^2/sec
S = 0.5821E-05

TEST DATA:
H0 = 138.1 cm
rc = 2.54 cm
rw = 10.16 cm

RISING HEAD RESULT, M-108-B

J.M.MONTGOMERY, CONSULTING ENG	Client: NAVY - WESTDIV
Project No.: 2738.0574	Location: Background Well

M-007-C
RISING HEAD FIELD DATA
NAS ALAMEDA, CTO-107
1991

SE1000B
Environmental Logger
08/08 16:52

Unit# 00515 Test# 5

INPUT 1: Level (F) TOC

Reference 0.00
Scale factor 10.09
Offset 0.00

Step# 0 08/08 12:48

Elapsed Time (min)	Value (ft)
0.0000	-10.94
0.0033	-8.02
0.0066	-4.98
0.0099	-6.15
0.0133	-8.04
0.0166	-6.36
0.0200	-7.64
0.0233	-7.01
0.0266	-7.13
0.0300	-6.72
0.0333	-6.58
0.0500	-6.97
0.0666	-7.00
0.0833	-7.12
0.1000	-7.19
0.1166	-7.30
0.1333	-7.37
0.1500	-7.46
0.1666	-7.54
0.1833	-7.61
0.2000	-7.68
0.2166	-7.75
0.2333	-7.82
0.2500	-7.88
0.2666	-7.94
0.2833	-8.00
0.3000	-8.06
0.3166	-8.12
0.3333	-8.17
0.4167	-8.42
0.5000	-8.64
0.5833	-8.85
0.6667	-9.02
0.7500	-9.18
0.8333	-9.33
0.9167	-9.46
1.0000	-9.58
1.0833	-9.69
1.1667	-9.79
1.2500	-9.87
1.3333	-9.95
1.4166	-10.03
1.5000	-10.10
1.5833	-10.16
1.6667	-10.22
1.7500	-10.27
1.8333	-10.31
1.9167	-10.36
2.0000	-10.40
2.5000	-10.59
3.0000	-10.71
3.5000	-10.78
4.0000	-10.82
4.5000	-10.85
5.0000	-10.88
5.5000	-10.89
6.0000	-10.90
6.5000	-10.91
7.0000	-10.92
7.5000	-10.92
8.0000	-10.92
8.5000	-10.92
9.0000	-10.92
9.5000	-10.93
10.0000	-10.93
12.0000	-10.94
14.0000	-10.94
16.0000	-10.94
18.0000	-10.94
20.0000	-10.93
22.0000	-10.94

A Q T E S O L V   R E S U L T S

Version 1.10

06/03/92 14:57:16

TEST DESCRIPTION

Data set........... m007c2.set
Data set title..... RISING HEAD RESULT, M-007-C
Company............ J.M.MONTGOMERY, CONSULTING ENG
Project............ 2738.0262
Client............. NAVY - WESTDIV
Location........... 1943-1956 Disposal Area
Test date.......... August 8, 1991

Knowns and Constants:

No. of data points.................. 51
Radius of well casing............... 2.54
Radius of well...................... 8.89
Aquifer saturated thickness......... 2380
Well screen length.................. 304.8
Static height of water in well...... 2380
Log(Re/Rw).......................... 3.873
A, B, C............................. 0.000, 0.000, 2.107

ANALYTICAL METHOD

Bouwer-Rice (Unconfined Aquifer Slug Test)

RESULTS FROM VISUAL CURVE MATCHING

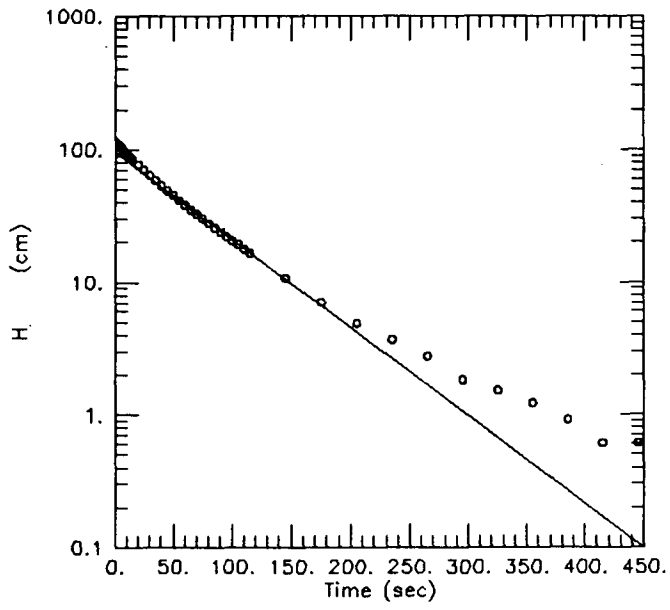
VISUAL MATCH PARAMETER ESTIMATES

	Estimate
K =	6.2418E-004
y0 =	4.7289E-308

TYPE CURVE DATA

K = 6.24184E-004
y0 = 9.46749E+001

Time	Drawdown	Time	Drawdown	Time	Drawdown
0.000E+000	9.467E+001	4.500E+002	9.998E-002		



DATA SET:
m007c2.set
08/03/92

AQUIFER TYPE:
Unconfined

SOLUTION METHOD:
Bouwer-Rice

TEST DATE:
August 8, 1991

ESTIMATED PARAMETERS:
K = 0.0008242 cm/sec
y0 = 84.87 cm

TEST DATA:
H0 = 118.4 cm
rc = 2.54 cm
rw = 8.88 cm
L = 304.8 cm
D = 2380.5 cm
H = 2380.5 cm

RISING HEAD RESULT, M-007-C

J.M.MONTGOMERY, CONSULTING ENG	Client: NAVY - WESTDIV
Project No.: 2738.0262	Location: 1943-1956 Disposal Area

A Q T E S O L V R E S U L T S
Version 1.10

06/03/92

TEST DESCRIPTION

Data set..... m007c2.set
Data set title..... RISING HEAD RESULT, M-007-C
Company..... J.M.MONTGOMERY, CONSULTING ENG
Project..... 2738.0262
Client..... NAVY - WESTDIV
Location..... 1943-1956 Disposal Area
Test date..... August 8, 1991

Knowns and Constants:
No. of data points..... 51
Pumping rate..... 1
Radius (distance) to obs. well..... 2.54

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ANALYTICAL METHOD

Cooper et al. (Confined Aquifer Slug Test)

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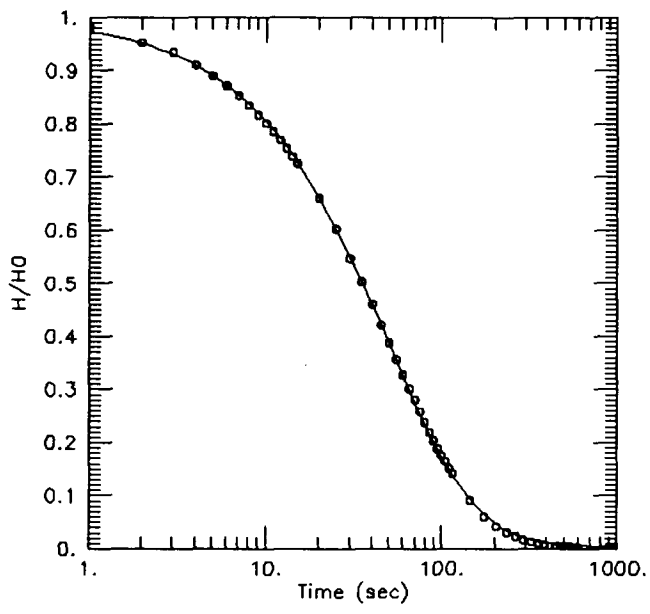
RESULTS FROM CURVE MATCHING

MATCH PARAMETER ESTIMATES

T = 5.01270E-001
S = 4.06708E-008



DATA SET:
m007c2.aet
08/03/92

AQUIFER TYPE:
Confined

SOLUTION METHOD:
Cooper et al.

TEST DATE:
August 8, 1991

ESTIMATED PARAMETERS:
T = 0.5013 cm^2/sec
S = 4.0871E-08

TEST DATA:
HO = 118.4 cm
rc = 2.54 cm
rw = 9.85 cm

RISING HEAD RESULT, M-007-C

J.M.MONTGOMERY, CONSULTING ENG	Client: NAVY - WESTDIV
Project No.: 2738.0262	Location: 1943-1956 Disposal Area

M-013-C
RISING HEAD FIELD DATA
NAS ALAMEDA, CTO-107
1991

SE2000
Environmental Logger
08/02 07:35

Unit# Test 7

INPUT 1: Level (F) TOC

Reference	0.000
SG	1.000
Linearity	0.000
Scale factor	10.090
Offset	0.000
Delay mSEC	50.000

Step 0 08/01 15:11:24

Elapsed Time (min)	INPUT 1 (ft)
0.0000	0.047
0.0083	7.187
0.0166	3.291
0.0250	3.616
0.0333	3.262
0.0416	2.959
0.0500	2.947
0.0583	2.918
0.0666	2.803
0.0750	2.663
0.0833	2.539
0.1000	2.363
0.1166	2.204
0.1333	2.048
0.1500	1.914
0.1666	1.793
0.1833	1.679
0.2000	1.577
0.2166	1.481
0.2333	1.395
0.2500	1.312
0.2666	1.239
0.2833	1.169
0.3000	1.105
0.3166	1.044
0.3333	0.990
0.4166	0.780
0.5000	0.627
0.5833	0.509
0.6666	0.420
0.7500	0.353
0.8333	0.296
0.9166	0.251
1.0000	0.213
1.0833	0.184
1.1666	0.162
1.2500	0.140
1.3333	0.124
1.4166	0.111
1.5000	0.098
1.5833	0.086
1.6666	0.076
1.7500	0.070
1.8333	0.060
1.9166	0.054
2.0000	0.047
2.5000	0.019
3.0000	-0.003
3.5000	-0.006
4.0000	-0.012
4.5000	-0.019
5.0000	-0.028
5.5000	-0.022
6.0000	-0.022
6.5000	-0.025

<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<>>

A Q T E S O L V   R E S U L T S

Version 1.10

06/03/92 15:21:47

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TEST DESCRIPTION

Data set........... m013c.set
Data set title..... RISING HEAD RESULT, M-013-C
Company............ J.M.MONTGOMERY, CONSULTING ENG
Project............ 2738.0262
Client............. NAVY - WESTDIV
Location........... West Beach Landfill
Test date.......... August 1, 1991

Knowns and Constants:
- No. of data points.................. 43
- Radius of well casing............... 2.54
- Radius of well...................... 8.89
- Aquifer saturated thickness......... 2234
- Well screen length.................. 304.8
- Static height of water in well...... 2234
- Log(Re/Rw).......................... 4.889
- A, B, C............................. 2.578, 0.420, 0.000

==

ANALYTICAL METHOD

Bouwer-Rice (Unconfined Aquifer Slug Test)

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RESULTS FROM VISUAL CURVE MATCHING

VISUAL MATCH PARAMETER ESTIMATES

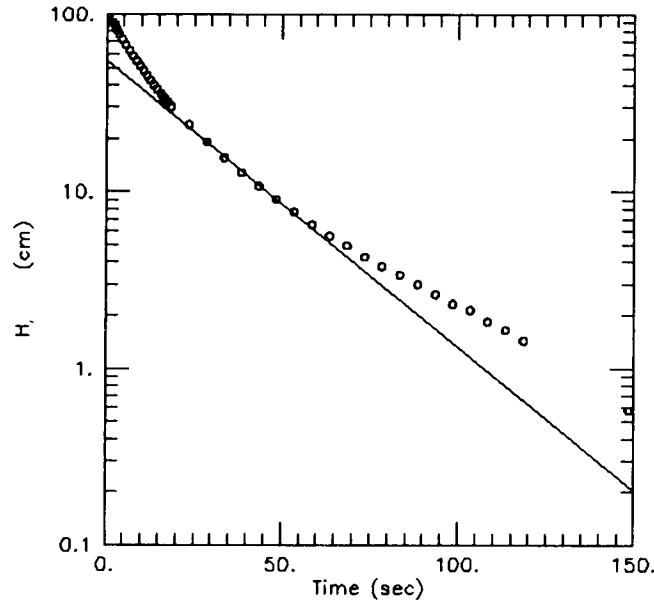
	Estimate
K =	1.9286E-003
y0 =	4.0671E-008

<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<>>

TYPE CURVE DATA

K = 1.92858E-003
y0 = 5.50028E+001

Time	Drawdown	Time	Drawdown	Time	Drawdown
0.000E+000	5.500E+001	1.500E+002	2.051E-001		



DATA SET:
m013c.aet
08/03/92

AQUIFER TYPE:
Unconfined

SOLUTION METHOD:
Bouwer-Rice

TEST DATE:
August 1, 1991

ESTIMATED PARAMETERS:
K = 0.001929 cm/sec
y0 = 55. cm

TEST DATA:
H0 = 110.2 cm
rc = 2.54 cm
rw = 8.88 cm
L = 304.8 cm
b = 2233.6 cm
H = 2233.6 cm

RISING HEAD RESULT, M-013-C

J.M.MONTGOMERY, CONSULTING ENG	Client: NAVY – WESTDIV
Project No.: 2738.0262	Location: West Beach Landfill

A Q T E S O L V R E S U L T S

Version 1.10

03/02/92

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TEST DESCRIPTION

Data set..... m013c.set
Data set title..... RISING HEAD RESULT, M-013-C
Company..... J.M.MONTGOMERY, CONSULTING ENGINEERS
Project..... 2738.0262
Client..... NAVY - WESTDIV
Location..... West Beach Landfill
Test date..... August 1, 1991

Knowns and Constants:
No. of data points..... 43
Pumping rate..... 1
Radius (distance) to obs. well..... 2.54

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ANALYTICAL METHOD

Cooper et al. (Confined Aquifer Slug Test)

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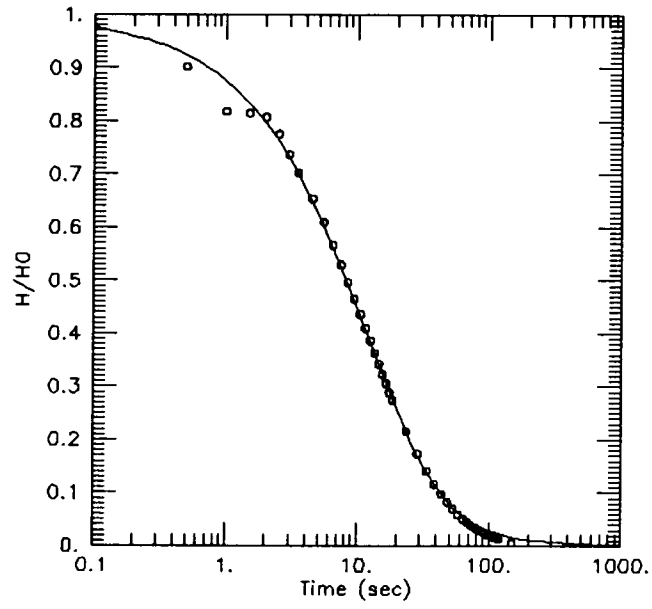
RESULTS FROM CURVE MATCHING

MATCH PARAMETER ESTIMATES

		Estimate
T	=	8.46886E-001
S	=	2.60541E-004



DATA SET:
m013c.aet
08/03/92

AQUIFER TYPE:
Confined

SOLUTION METHOD:
Cooper et al.

TEST DATE:
August 1, 1991

ESTIMATED PARAMETERS:
T = 0.8469 cm^2/sec
S = 0.0002605

TEST DATA:
HO = 110.2 cm
rc = 2.54 cm
rw = 8.89 cm

RISING HEAD RESULT, M-013-C

J.M.MONTGOMERY, CONSULTING ENG	Client: NAVY - WESTDIV
Project No.: 2738.0262	Location: West Beach Landfill

M-021-C
RISING HEAD FIELD DATA
NAS ALAMEDA, CTO-107
1991

SE1000B
Environmental Logger
09/12 14:50

Unit# 00515 Test# 1

INPUT 1: Level (F) TOC

Reference 0.00
Scale factor 10.09
Offset 0.00

Step# 0 09/12 10:21

Elapsed Time (min)	Value (ft)
0.0000	-0.00
0.0033	-0.00
0.0066	-0.00
0.0099	5.18
0.0133	12.31
0.0166	7.85
0.0200	2.15
0.0233	4.01
0.0266	3.07
0.0300	3.87
0.0333	3.42
0.0500	3.07
0.0666	3.10
0.0833	3.02
0.1000	2.83
0.1166	2.74
0.1333	2.66
0.1500	2.56
0.1666	2.47
0.1833	2.40
0.2000	2.32
0.2166	2.25
0.2333	2.18
0.2500	2.11
0.2666	2.05
0.2833	1.99
0.3000	1.94
0.3166	1.88
0.3333	1.83
0.4167	1.60
0.5000	1.41
0.5833	1.25
0.6667	1.12
0.7500	1.01
0.8333	0.91
0.9167	0.82
1.0000	0.75
1.0833	0.68
1.1667	0.62
1.2500	0.57
1.3333	0.52
1.4166	0.48
1.5000	0.44
1.5833	0.40
1.6667	0.37
1.7500	0.35
1.8333	0.32
1.9167	0.30
2.0000	0.28
2.5000	0.21
3.0000	0.16
3.5000	0.13
4.0000	0.11
4.5000	0.08
5.0000	0.07
5.5000	0.06
6.0000	0.06
6.5000	0.05

A Q T E S O L V R E S U L T S

Version 1.10

03/03/92

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TEST DESCRIPTION

Data set..... m021c.set
Data set title..... RISING HEAD RESULT, M-021-C
Company..... J.M.MONTGOMERY, CONSULTING ENGINEERS
Project..... 2738.0262
Client..... NAVY - WESTDIV
Location..... West Beach Landfill
Test date..... September 12, 1991

Knowns and Constants:
No. of data points..... 48
Pumping rate..... 1
Radius to obs. well..... 2.54

==========

ANALYTICAL METHOD

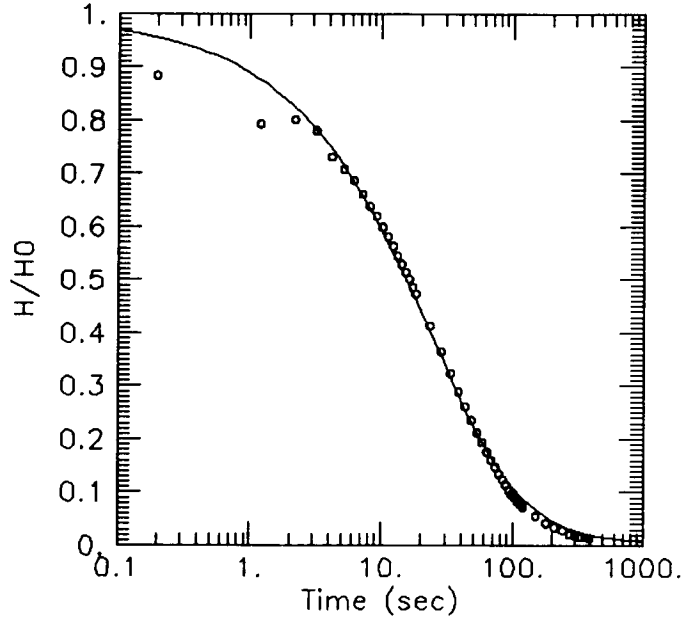
Cooper et al. (Confined Aquifer Slug Test)

==========

RESULTS FROM CURVE MATCHING

MATCH PARAMETER ESTIMATES

		Estimate
T	=	2.51308E-001
S	=	3.05913E-003



DATA SET:
m021c.aet
03/03/92

AQUIFER TYPE:
Confined

SOLUTION METHOD:
Cooper et al.

TEST DATE:
September 12, 1991

ESTIMATED PARAMETERS:
T = 0.2513 cm^2/sec
S = 0.003058

TEST DATA:
HO = 118. cm
rc = 2.54 cm
rw = 8.89 cm

RISING HEAD RESULT, M-021-C

J.M.MONTGOMERY, CONSULTING ENG	Client: NAVY - WESTDIV
Project No.: 2738.0262	Location: West Beach Landfill

M-025-C
RISING HEAD FIELD DATA
NAS ALAMEDA, CTO-107
1991

SE1000B
Environmental Logger
08/12 09:47

Unit# 00515 Test# 7

INPUT 1: Level (F) TOC

Reference 0.00
Scale factor 10.09
Offset 0.00

Step# 0 08/09 16:11

Elapsed Time (min)	Value (ft)
0.0000	0.20
0.0033	0.99
0.0066	1.84
0.0099	1.82
0.0133	5.61
0.0166	3.00
0.0200	2.82
0.0233	3.70
0.0266	3.20
0.0300	4.04
0.0333	3.87
0.0500	3.41
0.0666	3.14
0.0833	2.79
0.1000	2.59
0.1166	2.39
0.1333	2.21
0.1500	2.06
0.1666	1.92
0.1833	1.79
0.2000	1.68
0.2166	1.58
0.2333	1.48
0.2500	1.39
0.2666	1.31
0.2833	1.24
0.3000	1.17
0.3166	1.11
0.3333	1.06
0.4167	0.83
0.5000	0.67
0.5833	0.56
0.6667	0.48
0.7500	0.42
0.8333	0.38
0.9167	0.34
1.0000	0.32
1.0833	0.29
1.1667	0.28
1.2500	0.26
1.3333	0.25
1.4166	0.24
1.5000	0.23
1.5833	0.22
1.6667	0.21
1.7500	0.21
1.8333	0.21
1.9167	0.20
2.0000	0.19
2.5000	0.18
3.0000	0.17
3.5000	0.16
4.0000	0.14
4.5000	0.16
5.0000	0.17
5.5000	0.16
6.0000	0.17
6.5000	0.16
7.0000	0.17

A Q T E S O L V R E S U L T S

Version 1.10

03/03/92

==========

TEST DESCRIPTION

Data set..... m025c.set
Data set title..... RISING HEAD RESULT, M-025-C
Company..... J.M.MONTGOMERY, CONSULTING ENGINEERS
Project..... 2738.0262
Client..... NAVY - WESTDIV
Location..... 1943-1956 Disposal Area
Test date..... August 9, 1991

Knowns and Constants:
No. of data points..... 42
Pumping rate..... 1
Radius to obs. well..... 2.54

==========

ANALYTICAL METHOD

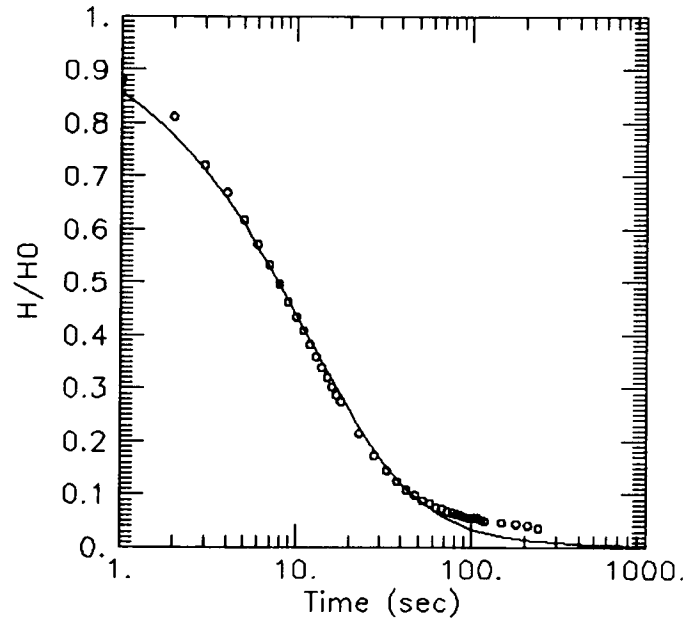
Cooper et al. (Confined Aquifer Slug Test)

==========

RESULTS FROM CURVE MATCHING

MATCH PARAMETER ESTIMATES

		Estimate
T	=	6.85626E-001
S	=	8.93127E-004



DATA SET:
m025c.set
03/03/92

AQUIFER TYPE:
Confined

SOLUTION METHOD:
Cooper et al.

TEST DATE:
August 9, 1991

ESTIMATED PARAMETERS:
T = 0.0858 cm^2/sec
S = 0.0000031

TEST DATA:
HO = 118. cm
rc = 2.54 cm
rw = 8.89 cm

RISING HEAD RESULT, M-025-C

J.M.MONTGOMERY, CONSULTING ENG	Client: NAVY - WESTDIV
Project No.: 2738.0262	Location: 1943-1956 Disposal Area

M-027-C
RISING HEAD FIELD DATA
NAS ALAMEDA, CTO-107
1991

SE2000
Environmental Logger
07/29 13:56

Unit# Test 1

INPUT 1: Level (F) TOC

Reference	0.000
SG	1.000
Linearity	0.000
Scale factor	49.900
Offset	0.010
Delay mSEC	50.000

Step 0 07/26 10:27:34

Elapsed Time (min)	INPUT 1 (ft)
0.0000	-31.370
0.0083	-32.300
0.0166	-31.937
0.0250	-31.874
0.0333	-31.953
0.0416	-32.237
0.0500	-32.504
0.0583	-32.772
0.0666	-32.883
0.0750	-33.072
0.0833	-33.213
0.1000	-33.466
0.1166	-33.670
0.1333	-33.859
0.1500	-34.017
0.1666	-34.143
0.1833	-34.269
0.2000	-34.364
0.2166	-34.458
0.2333	-34.537
0.2500	-34.600
0.2666	-34.663
0.2833	-34.726
0.3000	-34.773
0.3166	-34.821
0.3333	-34.852
0.4166	-34.978
0.5000	-35.073
0.5833	-35.136
0.6666	-35.167
0.7500	-35.199
0.8333	-35.215
0.9166	-35.230
1.0000	-35.246
1.0833	-35.246
1.1666	-35.246
1.2500	-35.262
1.3333	-35.262
1.4166	-35.262
1.5000	-35.278
1.5833	-35.278
1.6666	-35.278
1.7500	-35.278
1.8333	-35.278
1.9166	-35.278
2.0000	-35.278
2.5000	-35.293
3.0000	-35.293
3.5000	-35.309
4.0000	-35.309
4.5000	-35.309
5.0000	-35.309
5.5000	-35.309
6.0000	-35.325
6.5000	-35.325
7.0000	-35.325
7.5000	-35.341
8.0000	-35.341
8.5000	-35.341
9.0000	-35.341
9.5000	-35.341
10.0000	-35.356
12.0000	-35.356
14.0000	-35.372
16.0000	-35.372
18.0000	-35.388
20.0000	-35.388
22.0000	-35.404

A Q T E S O L V R E S U L T S

Version 1.10

06/03/92

==========

TEST DESCRIPTION

Data set..... m027c.set
Data set title..... RISING HEAD RESULT, M-027-C
Company..... J.M.MONTGOMERY, CONSULTING ENGINEERS
Project..... 2738.0262
Client..... NAVY - WESTDIV
Location..... 1943-1956 Disposal Area
Test date..... July 26, 1991

Knowns and Constants:
No. of data points..... 63
Pumping rate..... 1
Radius (distance) to obs. well..... 2.54

==========

ANALYTICAL METHOD

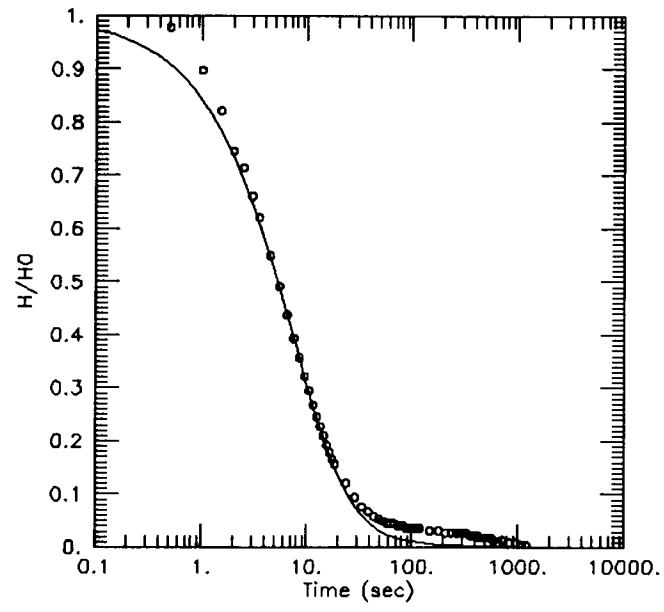
Cooper et al. (Confined Aquifer Slug Test)

==========

RESULTS FROM CURVE MATCHING

MATCH PARAMETER ESTIMATES

		Estimate
T	=	1.81411E+000
S	=	3.50000E-005



DATA SET:
m027c.aet
88/03/02

AQUIFER TYPE:
Confined

SOLUTION METHOD:
Cooper et al.

TEST DATE:
July 28, 1991

ESTIMATED PARAMETERS:
T = 1.814 cm^2/sec
S = 3.5E-05

TEST DATA:
H0 = 107.6 cm
rc = 2.54 cm
rw = 8.89 cm

RISING HEAD RESULT, M-027-C

J.M.MONTGOMERY, CONSULTING ENG	Client: NAVY – WESTDIV
Project No.: 2738.0262	Location: 1943–1956 Disposal Area

M-104-C
RISING HEAD FIELD DATA
NAS ALAMEDA, CTO-107
1991

SE1000B
Environmental Logger
08/07 17:20

Unit# 00515 Test# 1

INPUT 1: Level (F) TOC

Reference 0.00
Scale factor 10.09
Offset 0.00

Step# 0 08/07 11:44

Elapsed Time (min)	Value (ft)
0.0000	-0.05
0.0033	3.00
0.0066	4.23
0.0099	1.17
0.0133	2.33
0.0166	3.69
0.0200	3.33
0.0233	3.78
0.0266	4.11
0.0300	3.88
0.0333	3.69
0.0500	3.40
0.0666	3.93
0.0833	3.44
0.1000	3.38
0.1166	3.45
0.1333	3.35
0.1500	3.32
0.1666	3.33
0.1833	3.28
0.2000	3.28
0.2166	3.24
0.2333	3.23
0.2500	3.22
0.2666	3.21
0.2833	3.18
0.3000	3.17
0.3166	3.15
0.3333	3.14
0.4167	3.07
0.5000	3.00
0.5833	2.94
0.6667	2.91
0.7500	2.89
0.8333	2.87
0.9167	2.85
1.0000	2.82
1.0833	2.79
1.1667	2.74
1.2500	2.71
1.3333	2.67
1.4166	2.64
1.5000	2.60
1.5833	2.57
1.6667	2.53
1.7500	2.50
1.8333	2.47
1.9167	2.44
2.0000	2.41
2.5000	2.24
3.0000	2.09
3.5000	1.96
4.0000	1.84
4.5000	1.73
5.0000	1.63
5.5000	1.53
6.0000	1.45
6.5000	1.37
7.0000	1.30
7.5000	1.24
8.0000	1.18
8.5000	1.12
9.0000	1.07
9.5000	1.02
10.0000	0.97
12.0000	0.81
14.0000	0.69
16.0000	0.59
18.0000	0.52
20.0000	0.46
22.0000	0.40
24.0000	0.35
26.0000	0.33
28.0000	0.30
30.0000	0.27
32.0000	0.25
34.0000	0.23
36.0000	0.21
38.0000	0.19
40.0000	0.19
42.0000	0.18

A Q T E S O L V R E S U L T S

Version 1.10

06/03/92

==========

TEST DESCRIPTION

Data set..... m104c.set
Data set title..... RISING HEAD RESULT, M-104-C
Company..... J.M.MONTGOMERY, CONSULTING ENGINEERS
Project..... 2738.0262
Client..... NAVY - WESTDIV
Location..... Background Well
Test date..... August 7, 1991

Knowns and Constants:
No. of data points..... 71
Pumping rate..... 1
Radius (distance) to obs. well..... 2.54

==========

ANALYTICAL METHOD

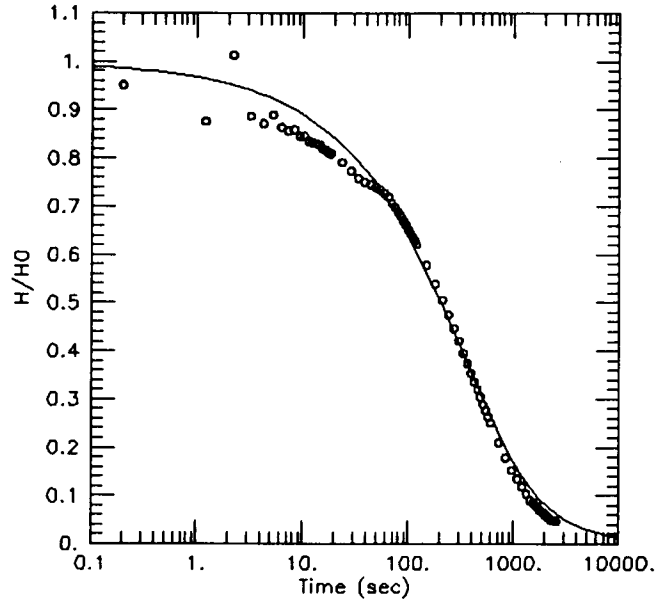
Cooper et al. (Confined Aquifer Slug Test)

==========

RESULTS FROM CURVE MATCHING

MATCH PARAMETER ESTIMATES

		Estimate
T	=	1.38237E-002
S	=	7.50000E-003



DATA SET:
m104c.set
08/03/92

AQUIFER TYPE:
Confined

SOLUTION METHOD:
Cooper et al.

TEST DATE:
August 7, 1991

ESTIMATED PARAMETERS:
T = 0.01382 cm^2/sec
S = 0.0075

TEST DATA:
H0 = 118.3 cm
rc = 2.54 cm
rw = 8.88 cm

RISING HEAD RESULT, M-104-C

J.M.MONTGOMERY, CONSULTING ENG	Client: NAVY - WESTDIV
Project No.: 2738.0262	Location: Background Well

M-001-E
RISING HEAD FIELD DATA
NAS ALAMEDA, CTO-107
1991

SE2000
Environmental Logger
07/29 14:06

Unit# Test 5

INPUT 1: Level (F) TOC

Reference	0.000
SG	1.000
Linearity	0.000
Scale factor	49.900
Offset	0.010
Delay mSEC	50.000

Step 0 07/26 14:58:14

Elapsed Time (min)	INPUT 1 (ft)
0.0000	5.955
0.0083	2.300
0.0166	4.017
0.0250	1.906
0.0333	3.025
0.0416	2.032
0.0500	2.394
0.0583	1.985
0.0666	2.032
0.0750	1.843
0.0833	1.811
0.1000	1.638
0.1166	1.496
0.1333	1.386
0.1500	1.292
0.1666	1.197
0.1833	1.118
0.2000	1.055
0.2166	0.992
0.2333	0.945
0.2500	0.882
0.2666	0.835
0.2833	0.803
0.3000	0.756
0.3166	0.724
0.3333	0.693
0.4166	0.582
0.5000	0.504
0.5833	0.456
0.6666	0.409
0.7500	0.378
0.8333	0.346
0.9166	0.315
1.0000	0.299
1.0833	0.283
1.1666	0.267
1.2500	0.252
1.3333	0.236
1.4166	0.220
1.5000	0.220
1.5833	0.204
1.6666	0.204
1.7500	0.189
1.8333	0.189
1.9166	0.189
2.0000	0.173
2.5000	0.141
3.0000	0.126
3.5000	0.110
4.0000	0.094
4.5000	0.078
5.0000	0.078
5.5000	0.078
6.0000	0.078
6.5000	0.078
7.0000	0.063
7.5000	0.063
8.0000	0.063
8.5000	0.063
9.0000	0.047
9.5000	0.047
10.0000	0.047

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A Q T E S O L V   R E S U L T S

Version 1.10

06/04/92 02:17:51

==

TEST DESCRIPTION

Data set........... m001e.set
Data set title..... RISING HEAD RESULT, M-001-E
Company............ J.M.MONTGOMERY, CONSULTING ENG
Project............ 2738.0262
Client............. NAVY - WESTDIV
Location........... 1943-1956 Disposal Area
Test date.......... July 26, 1991

Knowns and Constants:
No. of data points.................. 53
Radius of well casing............... 2.54
Radius of well...................... 5.79
Aquifer saturated thickness......... 407.8
Well screen length.................. 304.8
Static height of water in well...... 407.8
Log(Re/Rw).......................... 3.221
A, B, C............................. 0.000, 0.000, 2.732

==

ANALYTICAL METHOD

Bouwer-Rice (Unconfined Aquifer Slug Test)

==

RESULTS FROM VISUAL CURVE MATCHING

VISUAL MATCH PARAMETER ESTIMATES

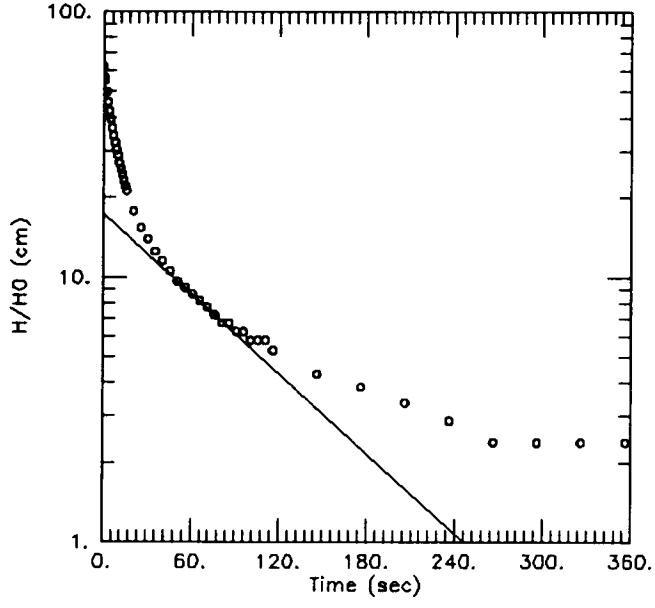
	Estimate
K =	1.8817E-003
y0 =	4.7289E-308

<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<>>

TYPE CURVE DATA

K = 3.95793E-004
y0 = 1.73290E+001

Time	Drawdown	Time	Drawdown	Time	Drawdown
0.000E+000	1.733E+001	3.600E+002	2.652E-001		



DATA SET:
m001e.aet
08/04/92

AQUIFER TYPE:
Unconfined

SOLUTION METHOD:
Bouwer-Rice

TEST DATE:
July 28, 1991

ESTIMATED PARAMETERS:
K = 0.0003958 cm/sec
y0 = 17.33 cm

TEST DATA:
H0 = 81.84 cm
rc = 2.54 cm
rw = 5.78 cm
L = 304.8 cm
b = 407.8 cm
H = 407.8 cm

RISING HEAD RESULT, M-001-E

J.M.MONTGOMERY, CONSULTING ENG	Client: NAVY – WESTDIV
Project No.: 2738.0262	Location: 1943–1956 Disposal Area

M-002-E
RISING HEAD FIELD DATA
NAS ALAMEDA, CTO-107
1991

SE1000B
Environmental Logger
09/11 17:20

Unit# 00515 Test# 9

INPUT 1: Level (F) TOC

Reference 0.00
Scale factor 10.09
Offset 0.00

Step# 0 09/11 15:01

Elapsed Time (min)	Value (ft)
0.0000	-0.00
0.0033	-0.00
0.0066	0.77
0.0099	4.37
0.0133	4.96
0.0166	5.98
0.0200	4.25
0.0233	2.20
0.0266	0.84
0.0300	2.54
0.0333	2.90
0.0500	2.05
0.0666	1.79
0.0833	1.62
0.1000	1.47
0.1166	1.34
0.1333	1.23
0.1500	1.13
0.1666	1.04
0.1833	0.96
0.2000	0.88
0.2166	0.82
0.2333	0.76
0.2500	0.71
0.2666	0.65
0.2833	0.61
0.3000	0.57
0.3166	0.53
0.3333	0.50
0.4167	0.35
0.5000	0.26
0.5833	0.19
0.6667	0.14
0.7500	0.09
0.8333	0.08
0.9167	0.05
1.0000	0.05
1.0833	0.04
1.1667	0.03
1.2500	0.02
1.3333	0.02
1.4166	0.02
1.5000	0.01
1.5833	0.01
1.6667	0.01
1.7500	0.01
1.8333	0.00
1.9167	0.00
2.0000	0.00
2.5000	0.01
3.0000	0.02
3.5000	0.01

<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<>>

A Q T E S O L V   R E S U L T S

Version 1.10

06/04/92 02:19:54

==

TEST DESCRIPTION

Data set........... m002e.set
Data set title..... RISING HEAD RESULT, M-002-E
Company............ J.M.MONTGOMERY, CONSULTING ENG
Project............ 2738.0262
Client............. NAVY - WESTDIV
Location........... 1943-1956 Disposal Area
Test date.......... September 11, 1991

Knowns and Constants:

No. of data points.................. 35
Radius of well casing............... 2.54
Radius of well...................... 5.79
Aquifer saturated thickness......... 474.9
Well screen length.................. 304.8
Static height of water in well...... 474.9
Log(Re/Rw).......................... 3.317
A, B, C............................. 0.000, 0.000, 2.732

==

ANALYTICAL METHOD

Bouwer-Rice (Unconfined Aquifer Slug Test)

==

RESULTS FROM VISUAL CURVE MATCHING

VISUAL MATCH PARAMETER ESTIMATES

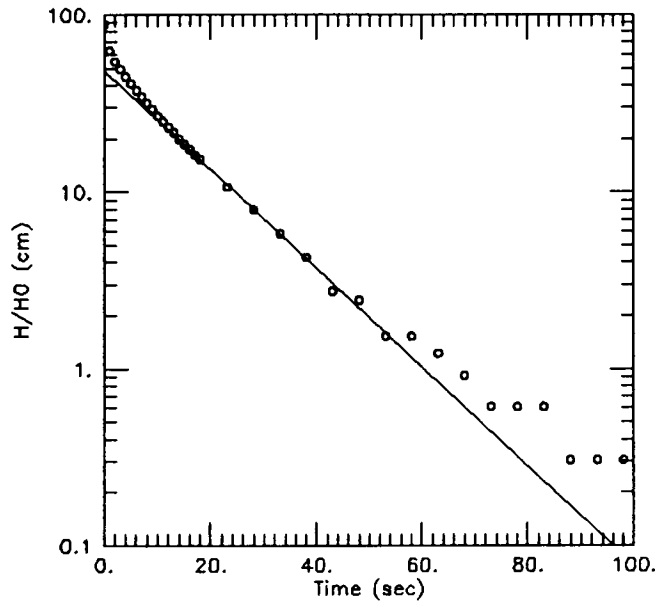
	Estimate
K =	2.2549E-003
y0 =	4.7289E-308

<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<>>

TYPE CURVE DATA

K = 2.25486E-003
y0 = 4.77102E+001

Time	Drawdown	Time	Drawdown	Time	Drawdown
0.000E+000	4.771E+001	1.000E+002	7.740E-002		



DATA SET:
m002e.set
08/04/92

AQUIFER TYPE:
Unconfined

SOLUTION METHOD:
Bouwer-Rice

TEST DATE:
September 11, 1991

ESTIMATED PARAMETERS:
K = 0.082255 cm/sec
y0 = 47.71 cm

TEST DATA:
H0 = 88.38 cm
rc = 2.54 cm
rw = 5.78 cm
L = 304.8 cm
D = 474.8 cm
H = 474.8 cm

RISING HEAD RESULT, M-002-E

J.M.MONTGOMERY, CONSULTING ENG	Client: NAVY – WESTDIV
Project No.: 2738.0262	Location: 1943–1956 Disposal Area

M-018-E
RISING HEAD FIELD DATA
NAS ALAMEDA, CTO-107
1991

SE1000B
Environmental Logger
09/13 12:43

Unit# 00515 Test# 7

INPUT 1: Level (F) TOC

Reference 0.00
Scale factor 10.09
Offset 0.00

Step# 0 09/13 10:14

Elapsed Time (min)	Value (ft)
0.0000	1.35
0.0033	8.14
0.0066	11.09
0.0099	6.54
0.0133	3.18
0.0166	3.58
0.0200	3.72
0.0233	4.51
0.0266	4.13
0.0300	3.83
0.0333	3.85
0.0500	3.73
0.0666	3.58
0.0833	3.46
0.1000	3.35
0.1166	3.24
0.1333	3.15
0.1500	3.05
0.1666	2.95
0.1833	2.87
0.2000	2.79
0.2166	2.71
0.2333	2.63
0.2500	2.55
0.2666	2.48
0.2833	2.41
0.3000	2.35
0.3166	2.29
0.3333	2.22
0.4167	1.94
0.5000	1.70
0.5833	1.46
0.6667	1.29
0.7500	1.14
0.8333	1.01
0.9167	0.92
1.0000	0.81
1.0833	0.72
1.1667	0.64
1.2500	0.57
1.3333	0.51
1.4166	0.46
1.5000	0.41
1.5833	0.37
1.6667	0.33
1.7500	0.29
1.8333	0.26
1.9167	0.25
2.0000	0.22
2.5000	0.13
3.0000	0.07
3.5000	0.04
4.0000	0.03

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A Q T E S O L V   R E S U L T S

Version 1.10

06/04/92 02:21:46

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TEST DESCRIPTION

Data set........... m018e.set
Data set title..... RISING HEAD RESULT, M-018-E
Company............ J.M.MONTGOMERY, CONSULTING ENG
Project............ 2738.0262
Client............. NAVY - WESTDIV
Location........... West Beach Landfill
Test date.......... September 13, 1991

Knowns and Constants:
No. of data points.................. 42
Radius of well casing............... 2.54
Radius of well...................... 10.16
Aquifer saturated thickness......... 1201
Well screen length.................. 304.8
Static height of water in well...... 1201
Log(Re/Rw).......................... 3.377
A, B, C............................. 0.000, 0.000, 1.969

==

ANALYTICAL METHOD

Bouwer-Rice (Unconfined Aquifer Slug Test)

==

RESULTS FROM VISUAL CURVE MATCHING

VISUAL MATCH PARAMETER ESTIMATES

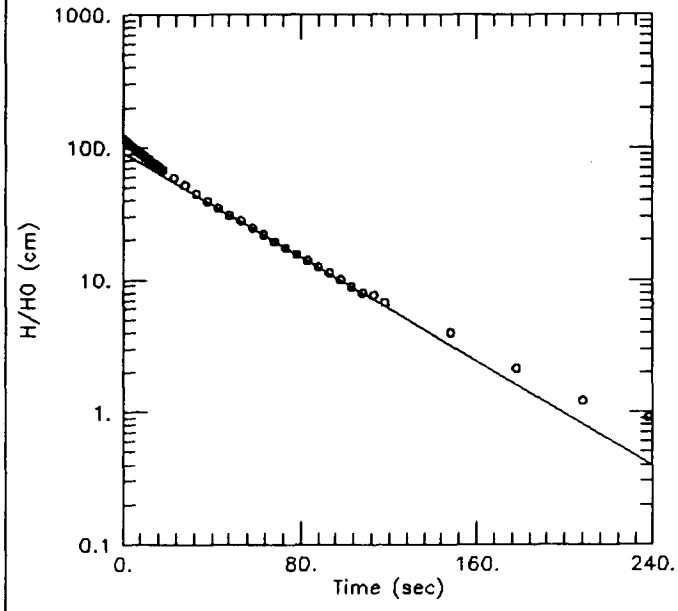
Estimate
K = 8.1049E-004
y0 = 4.7289E-308

<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<>>

TYPE CURVE DATA

K = 8.10494E-004
y0 = 9.16593E+001

Time	Drawdown	Time	Drawdown	Time	Drawdown
0.000E+000	9.166E+001	2.400E+002	3.967E-001		



DATA SET:
m018e.set
08/04/92

AQUIFER TYPE:
Unconfined

SOLUTION METHOD:
Bouwer-Rice

TEST DATE:
September 13, 1991

ESTIMATED PARAMETERS:
K = 0.0008105 cm/sec
y0 = 81.86 cm

TEST DATA:
H0 = 117.4 cm
rc = 2.54 cm
rw = 10.16 cm
L = 304.8 cm
D = 1200.9 cm
H = 1200.9 cm

RISING HEAD RESULT, M-018-E

J.M.MONTGOMERY, CONSULTING ENG	Client: NAVY – WESTDIV
Project No.: 2738.0262	Location: West Beach Landfill

M-019-E
RISING HEAD FIELD DATA
NAS ALAMEDA, CTO-107
1991

SE1000B
Environmental Logger
09/12 15:10

Unit# 00515 Test# 9

INPUT 1: Level (F) TOC

Reference 0.00
Scale factor 10.09
Offset 0.00

Step# 0 09/12 13:20

Elapsed Time (min)	Value (ft)
0.0000	-0.13
0.0033	0.28
0.0066	8.56
0.0099	11.81
0.0133	9.32
0.0166	4.89
0.0200	2.51
0.0233	1.72
0.0266	2.73
0.0300	3.63
0.0333	3.47
0.0500	2.98
0.0666	2.66
0.0833	2.39
0.1000	2.16
0.1166	1.95
0.1333	1.77
0.1500	1.61
0.1666	1.46
0.1833	1.33
0.2000	1.22
0.2166	1.11
0.2333	1.01
0.2500	0.92
0.2666	0.85
0.2833	0.77
0.3000	0.71
0.3166	0.65
0.3333	0.59
0.4167	0.39
0.5000	0.26
0.5833	0.17
0.6667	0.12
0.7500	0.08
0.8333	0.06
0.9167	0.04
1.0000	0.03
1.0833	0.02
1.1667	0.01
1.2500	0.01
1.3333	0.00
1.4166	0.00
1.5000	0.00
1.5833	0.00
1.6667	0.00
1.7500	0.00
1.8333	0.00
1.9167	0.00
2.0000	0.00
2.5000	-0.01
3.0000	-0.01
3.5000	-0.02

<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<>>

A Q T E S O L V R E S U L T S

Version 1.10

06/04/92 02:24:06

==

TEST DESCRIPTION

Data set........... m019e.set
Data set title..... RISING HEAD RESULT, M-019-E
Company............ J.M.MONTGOMERY, CONSULTING ENG
Project............ 2738.0262
Client............. NAVY - WESTDIV
Location........... West Beach Landfill
Test date.......... September 12, 1991

Knowns and Constants:
No. of data points.................. 31
Radius of well casing............... 2.54
Radius of well...................... 10.16
Aquifer saturated thickness......... 1041
Well screen length.................. 304.8
Static height of water in well...... 1041
Log(Re/Rw).......................... 4.398
A, B, C............................. 2.444, 0.397, 0.000

==

ANALYTICAL METHOD

Bouwer-Rice (Unconfined Aquifer Slug Test)

==

RESULTS FROM VISUAL CURVE MATCHING

VISUAL MATCH PARAMETER ESTIMATES

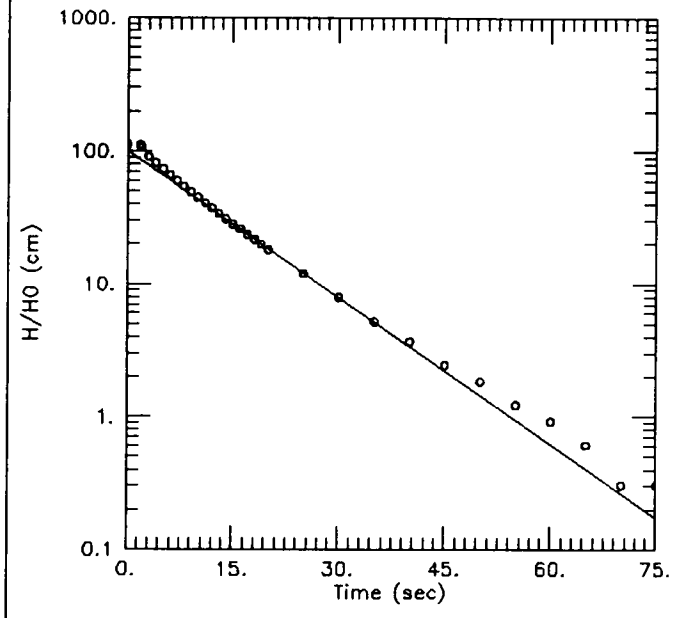
	Estimate
K =	3.7607E-003
y0 =	4.7289E-308

<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<>>

TYPE CURVE DATA

K = 3.94930E-003
y0 = 9.98108E+001

Time	Drawdown	Time	Drawdown	Time	Drawdown
0.000E+000	9.981E+001	7.500E+001	1.720E-001		



DATA SET:
m019e.aet
06/04/92

AQUIFER TYPE:
Unconfined

SOLUTION METHOD:
Bouwer-Rice

TEST DATE:
September 12, 1991

ESTIMATED PARAMETERS:
K = 0.003949 cm/sec
y0 = 89.81 cm

TEST DATA:
H0 = 110.8 cm
rc = 2.54 cm
rw = 10.16 cm
L = 304.8 cm
D = 1040.9 cm
H = 1040.9 cm

RISING HEAD RESULT, M-019-E

J.M.MONTGOMERY, CONSULTING ENG	Client: NAVY – WESTDIV
Project No.: 2738.0262	Location: West Beach Landfill

M-020-E
RISING HEAD FIELD DATA
NAS ALAMEDA, CTO-107
1991

SE1000B
Environmental Logger
09/12 15:05

Unit# 00515 Test# 5

INPUT 1: Level (F) TOC

Reference 0.00
Scale factor 10.09
Offset 0.00

Step# 0 09/12 12:30

Elapsed Time (min)	Value (ft)
0.0000	-0.00
0.0033	-0.00
0.0066	0.11
0.0099	8.16
0.0133	15.09
0.0166	6.54
0.0200	2.96
0.0233	2.16
0.0266	3.48
0.0300	3.33
0.0333	3.62
0.0500	3.72
0.0666	3.51
0.0833	3.34
0.1000	3.19
0.1166	3.06
0.1333	2.93
0.1500	2.80
0.1666	2.69
0.1833	2.58
0.2000	2.47
0.2166	2.38
0.2333	2.28
0.2500	2.19
0.2666	2.11
0.2833	2.03
0.3000	1.95
0.3166	1.88
0.3333	1.81
0.4167	1.50
0.5000	1.24
0.5833	1.04
0.6667	0.85
0.7500	0.73
0.8333	0.62
0.9167	0.52
1.0000	0.44
1.0833	0.37
1.1667	0.31
1.2500	0.26
1.3333	0.21
1.4166	0.18
1.5000	0.14
1.5833	0.12
1.6667	0.10
1.7500	0.08
1.8333	0.07
1.9167	0.05
2.0000	0.04
2.5000	-0.00
3.0000	-0.02
3.5000	-0.01

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A Q T E S O L V   R E S U L T S

Version 1.10

06/04/92 02:26:50

==

TEST DESCRIPTION

Data set........... m020e.set
Data set title..... RISING HEAD RESULT, M-020-E
Company............ J.M.MONTGOMERY, CONSULTING ENG
Project............ 2738.0262
Client............. NAVY - WESTDIV
Location........... West Beach Landfill
Test date.......... September 12, 1991

Knowns and Constants:
No. of data points.................. 37
Radius of well casing............... 2.54
Radius of well...................... 10.16
Aquifer saturated thickness......... 876.7
Well screen length.................. 304.8
Static height of water in well...... 876.7
Log(Re/Rw).......................... 3.201
A, B, C............................. 0.000, 0.000, 1.969

==

ANALYTICAL METHOD

Bouwer-Rice (Unconfined Aquifer Slug Test)

==

RESULTS FROM VISUAL CURVE MATCHING

VISUAL MATCH PARAMETER ESTIMATES

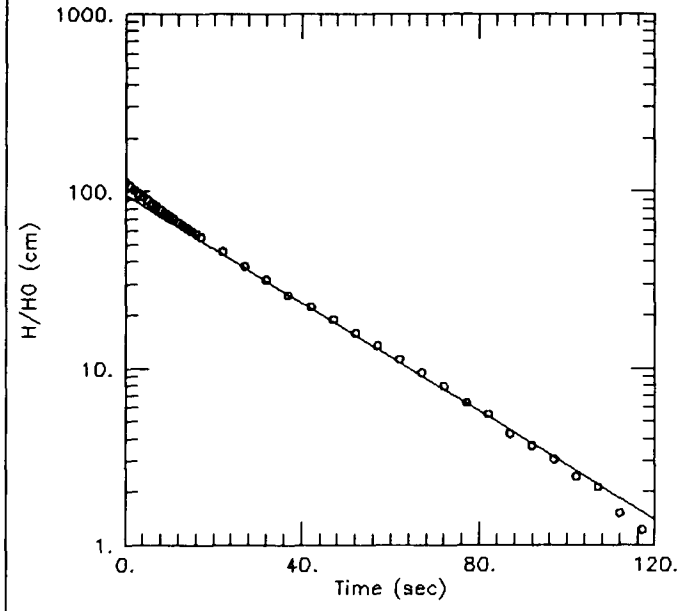
	Estimate
K =	1.1928E-003
y0 =	4.7289E-308

<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<>>

TYPE CURVE DATA

K = 1.19276E-003
y0 = 9.56185E+001

Time	Drawdown	Time	Drawdown	Time	Drawdown
0.000E+000	9.562E+001	1.200E+002	1.399E+000		



DATA SET:
m020e.aet
08/04/92

AQUIFER TYPE:
Unconfined

SOLUTION METHOD:
Bouwer-Rice

TEST DATE:
September 12, 1991

ESTIMATED PARAMETERS:
K = 0.001193 cm/sec
y0 = 85.82 cm

TEST DATA:
H0 = 113.4 cm
rc = 2.54 cm
rw = 10.16 cm
L = 304.8 cm
D = 876.7 cm
H = 878.7 cm

RISING HEAD RESULT, M-020-E

J.M.MONTGOMERY, CONSULTING ENG	Client: NAVY - WESTDIV
Project No.: 2738.0262	Location: West Beach Landfill

M-021-E
RISING HEAD FIELD DATA
NAS ALAMEDA, CTO-107
1991

SE1000B
Environmental Logger
09/12 14:54

Unit# 00515 Test# 2

INPUT 1: Level (F) TOC

Reference 0.00
Scale factor 10.09
Offset 0.00

Step# 0 09/12 11:00

Elapsed Time (min)	Value (ft)
0.0000	-0.00
0.0033	-0.02
0.0066	4.72
0.0099	10.93
0.0133	14.82
0.0166	8.85
0.0200	1.79
0.0233	1.40
0.0266	4.04
0.0300	5.35
0.0333	4.42
0.0500	4.03
0.0666	4.02
0.0833	4.03
0.1000	4.02
0.1166	4.01
0.1333	3.99
0.1500	3.98
0.1666	3.97
0.1833	3.96
0.2000	3.95
0.2166	3.95
0.2333	3.94
0.2500	3.93
0.2666	3.92
0.2833	3.91
0.3000	3.90
0.3166	3.90
0.3333	3.89
0.4167	3.85
0.5000	3.82
0.5833	3.78
0.6667	3.73
0.7500	3.72
0.8333	3.69
0.9167	3.67
1.0000	3.64
1.0833	3.61
1.1667	3.58
1.2500	3.55
1.3333	3.52
1.4166	3.50
1.5000	3.47
1.5833	3.45
1.6667	3.42
1.7500	3.39
1.8333	3.37
1.9167	3.34
2.0000	3.32
2.5000	3.17
3.0000	3.03
3.5000	2.90
4.0000	2.78
4.5000	2.66
5.0000	2.53
5.5000	2.43
6.0000	2.32
6.5000	2.22
7.0000	2.13
7.5000	2.03
8.0000	1.94
8.5000	1.86
9.0000	1.78
9.5000	1.70
10.0000	1.62
12.0000	1.34
14.0000	1.11
16.0000	0.90
18.0000	0.72
20.0000	0.56
22.0000	0.43
24.0000	0.31
26.0000	0.22
28.0000	0.13
30.0000	0.05
32.0000	-0.02
34.0000	-0.09
36.0000	-0.16
38.0000	-0.23
40.0000	-0.28
42.0000	-0.34
44.0000	-0.38

<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<>>

A Q T E S O L V   R E S U L T S

Version 1.10

06/04/92 02:29:29

==

TEST DESCRIPTION

Data set........... m021e.set
Data set title..... RISING HEAD RESULT, M-021-E
Company............ J.M.MONTGOMERY, CONSULTING ENG
Project............ 2738.0262
Client............. NAVY - WESTDIV
Location........... West Beach Landfill
Test date.......... September 12, 1991

Knowns and Constants:

No. of data points.................. 61
Radius of well casing............... 2.54
Radius of well...................... 10.16
Aquifer saturated thickness......... 927.2
Well screen length.................. 304.8
Static height of water in well...... 927.2
Log(Re/Rw).......................... 3.233
A, B, C............................. 0.000, 0.000, 1.969

==

ANALYTICAL METHOD

Bouwer-Rice (Unconfined Aquifer Slug Test)

==

RESULTS FROM VISUAL CURVE MATCHING

VISUAL MATCH PARAMETER ESTIMATES

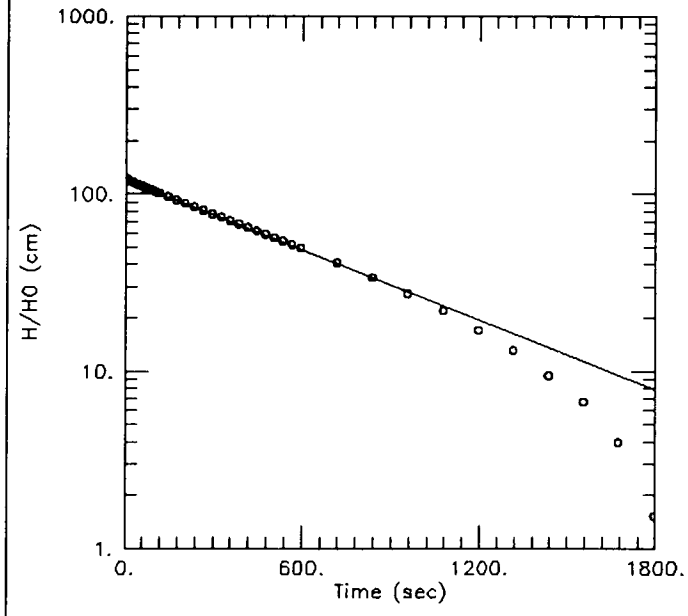
	Estimate
K =	5.1549E-005
y0 =	4.7289E-308

<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<>>

TYPE CURVE DATA

K = 5.15491E-005
y0 = 1.19609E+002

Time	Drawdown	Time	Drawdown	Time	Drawdown
0.000E+000	1.196E+002	1.800E+003	7.942E+000		



DATA SET:
m021e.aet
08/04/92

AQUIFER TYPE:
Unconfined

SOLUTION METHOD:
Bouwer-Rice

TEST DATE:
September 12, 1991

ESTIMATED PARAMETERS:
K = 5.1549E-05 cm/sec
y0 = 119.8 cm

TEST DATA:
H0 = 122.8 cm
rc = 2.54 cm
rw = 10.16 cm
L = 304.8 cm
D = 927.2 cm
H = 927.2 cm

RISING HEAD RESULT, M-021-E

J.M.MONTGOMERY, CONSULTING ENG	Client: NAVY – WESTDIV
Project No.: 2738.0262	Location: West Beach Landfill

M-022-E
RISING HEAD FIELD DATA
NAS ALAMEDA, CTO-107
1991

SE1000B
Environmental Logger
09/13 12:41

Unit# 00515 Test# 5

INPUT 1: Level (F) TOC

Reference 0.00
Scale factor 10.09
Offset 0.00

Step# 0 09/13 09:43

Elapsed Time (min)	Value (ft)
0.0000	0.00
0.0033	1.54
0.0066	4.29
0.0099	3.12
0.0133	1.87
0.0166	1.87
0.0200	1.21
0.0233	0.87
0.0266	0.31
0.0300	0.33
0.0333	0.42
0.0500	-0.27
0.0666	-0.30
0.0833	-0.01
0.1000	0.23
0.1166	0.21
0.1333	0.03
0.1500	-0.10
0.1666	-0.08
0.1833	0.01
0.2000	0.08
0.2166	0.07
0.2333	0.01
0.2500	-0.03
0.2666	-0.02
0.2833	0.01
0.3000	0.03
0.3166	0.03
0.3333	0.00
0.4167	0.01
0.5000	0.00
0.5833	0.00
0.6667	-0.00
0.7500	-0.00
0.8333	0.00
0.9167	0.00
1.0000	0.00
1.0833	0.00
1.1667	0.00
1.2500	-0.00
1.3333	-0.00
1.4166	-0.00
1.5000	-0.00
1.5833	-0.00
1.6667	-0.00
1.7500	-0.00
1.8333	-0.00
1.9167	-0.01
2.0000	-0.00

<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<>>

A Q T E S O L V R E S U L T S

Version 1.10

06/04/92 02:31:59

==

TEST DESCRIPTION

Data set........... m022e.set
Data set title..... RISING HEAD RESULT, M-022-E
Company............ J.M.MONTGOMERY, CONSULTING ENG
Project............ 2738.0262
Client............. NAVY - WESTDIV
Location........... West Beach Landfill
Test date.......... September 13, 1991

Knowns and Constants:

No. of data points.................. 7
Radius of well casing............... 2.54
Radius of well...................... 10.16
Aquifer saturated thickness......... 979
Well screen length.................. 304.8
Static height of water in well...... 979
Log(Re/Rw).......................... 3.263
A, B, C............................. 0.000, 0.000, 1.969

==

ANALYTICAL METHOD

Bouwer-Rice (Unconfined Aquifer Slug Test)

==

RESULTS FROM VISUAL CURVE MATCHING

VISUAL MATCH PARAMETER ESTIMATES

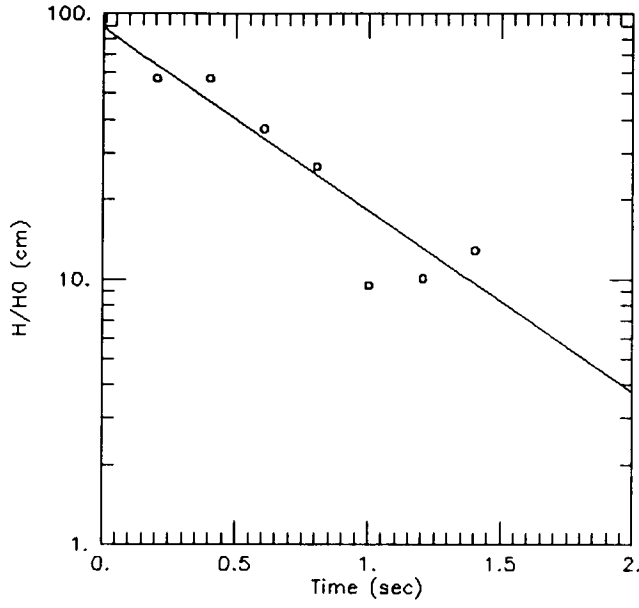
	Estimate
K =	5.4582E-002
y0 =	8.8085E+001

<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<>>>

TYPE CURVE DATA

K = 5.45817E-002
y0 = 8.80850E+001

Time	Drawdown	Time	Drawdown	Time	Drawdown
0.000E+000	8.808E+001	2.000E+000	3.734E+000		



DATA SET:
m022e.aet
08/04/92

AQUIFER TYPE:
Unconfined

SOLUTION METHOD:
Bouwer-Rice

TEST DATE:
September 13, 1991

ESTIMATED PARAMETERS:
K = 0.05458 cm/sec
y0 = 88.08 cm

TEST DATA:
H0 = 85.1 cm
rc = 2.54 cm
rw = 10.16 cm
L = 304.8 cm
D = 879. cm
H = 879. cm

RISING HEAD RESULT, M-022-E

J.M.MONTGOMERY, CONSULTING ENG	Client: NAVY – WESTDIV
Project No.: 2738.0262	Location: West Beach Landfill

N-023-E
RISING HEAD FIELD DATA
NAS ALAMEDA, CTO-107
1991

SE1000B
Environmental Logger
09/13 12:36

Unit# 00515 Test# 1

INPUT 1: Level (F) TOC

Reference 0.00
Scale factor 10.09
Offset 0.00

Step# 0 09/13 08:54

Elapsed Time (min)	Value (ft)
0.0000	-0.05
0.0033	0.29
0.0066	5.74
0.0099	12.40
0.0133	7.84
0.0166	2.94
0.0200	2.12
0.0233	3.09
0.0266	3.80
0.0300	3.64
0.0333	3.43
0.0500	3.04
0.0666	2.75
0.0833	2.51
0.1000	2.30
0.1166	2.11
0.1333	1.94
0.1500	1.79
0.1666	1.65
0.1833	1.52
0.2000	1.40
0.2166	1.30
0.2333	1.20
0.2500	1.11
0.2666	1.03
0.2833	0.96
0.3000	0.89
0.3166	0.83
0.3333	0.77
0.4167	0.54
0.5000	0.37
0.5833	0.30
0.6667	0.21
0.7500	0.16
0.8333	0.13
0.9167	0.11
1.0000	0.09
1.0833	0.07
1.1667	0.07
1.2500	0.06
1.3333	0.06
1.4166	0.05
1.5000	0.05
1.5833	0.05
1.6667	0.04
1.7500	0.04
1.8333	0.05
1.9167	0.05
2.0000	0.05
2.5000	0.06
3.0000	0.06

<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<>>

A Q T E S O L V   R E S U L T S

Version 1.10

06/04/92 02:35:11

==

TEST DESCRIPTION

Data set........... m023e.set
Data set title..... RISING HEAD RESULT, M-023-E
Company............ J.M.MONTGOMERY, CONSULTING ENG
Project............ 2738.0262
Client............. NAVY - WESTDIV
Location........... West Beach Landfill
Test date.......... September 13, 1991

Knowns and Constants:

No. of data points.................. 38
Radius of well casing............... 2.54
Radius of well...................... 10.16
Aquifer saturated thickness......... 899.2
Well screen length.................. 304.8
Static height of water in well...... 899.2
Log(Re/Rw).......................... 3.215
A, B, C............................. 0.000, 0.000, 1.969

==

ANALYTICAL METHOD

Bouwer-Rice (Unconfined Aquifer Slug Test)

==

RESULTS FROM VISUAL CURVE MATCHING

VISUAL MATCH PARAMETER ESTIMATES

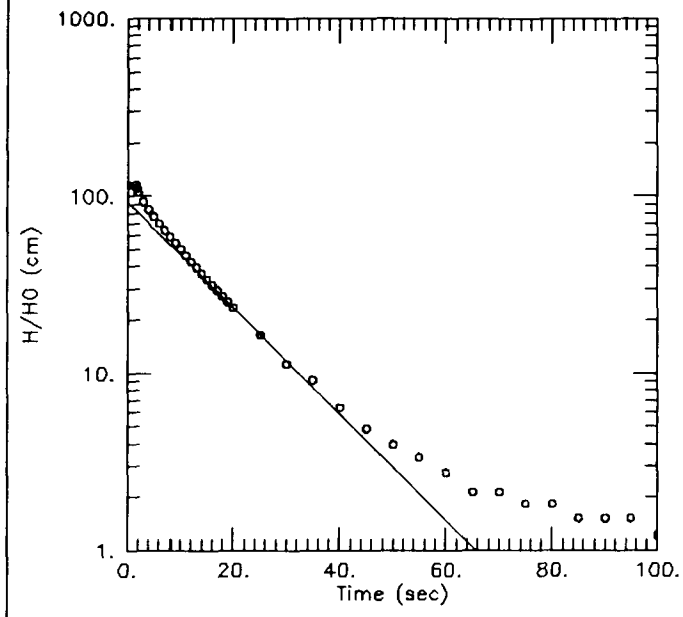
	Estimate
K =	2.3466E-003
y0 =	8.8085E+001

<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<>>

TYPE CURVE DATA

K = 2.34656E-003
y0 = 9.22027E+001

Time	Drawdown	Time	Drawdown	Time	Drawdown
0.000E+000	9.220E+001	1.000E+002	9.333E-002		



DATA SET:
m023e.set
08/04/92

AQUIFER TYPE:
Unconfined

SOLUTION METHOD:
Bouwer-Rice

TEST DATE:
September 13, 1991

ESTIMATED PARAMETERS:
K = 0.002347 cm/sec
y0 = 92.2 cm

TEST DATA:
H0 = 115.8 cm
rc = 2.54 cm
rw = 10.16 cm
L = 304.8 cm
b = 899.2 cm
H = 899.2 cm

RISING HEAD RESULT, M-023-E

J.M.MONTGOMERY, CONSULTING ENG	Client: NAVY – WESTDIV
Project No.: 2738.0262	Location: West Beach Landfill

M-024-E
RISING HEAD FIELD DATA
NAS ALAMEDA, CTO-107
1991

SE1000B
Environmental Logger
09/11 17:12

Unit# 00515 Test# 1

INPUT 1: Level (F) TOC

Reference 0.00
Scale factor 10.09
Offset 0.00

Step# 0 09/11 13:02

Elapsed Time (min)	Value (ft)
0.0000	-0.29
0.0033	-0.29
0.0066	0.07
0.0099	6.19
0.0133	13.70
0.0166	8.33
0.0200	4.57
0.0233	1.47
0.0266	1.04
0.0300	2.72
0.0333	2.86
0.0500	2.36
0.0666	2.03
0.0833	1.78
0.1000	1.56
0.1166	1.36
0.1333	1.20
0.1500	1.05
0.1666	0.92
0.1833	0.81
0.2000	0.71
0.2166	0.62
0.2333	0.54
0.2500	0.47
0.2666	0.40
0.2833	0.35
0.3000	0.29
0.3166	0.25
0.3333	0.21
0.4167	0.05
0.5000	-0.05
0.5833	-0.11
0.6667	-0.16
0.7500	-0.19
0.8333	-0.21
0.9167	-0.22
1.0000	-0.24
1.0833	-0.24
1.1667	-0.25
1.2500	-0.26
1.3333	-0.26
1.4166	-0.27
1.5000	-0.27
1.5833	-0.27
1.6667	-0.28
1.7500	-0.28
1.8333	-0.28
1.9167	-0.28
2.0000	-0.28
2.5000	-0.30
3.0000	-0.30

<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<>>

A Q T E S O L V   R E S U L T S

Version 1.10

06/04/92 02:39:38

==

TEST DESCRIPTION

Data set........... m024e.set
Data set title..... RISING HEAD RESULT, M-024-E
Company............ J.M.MONTGOMERY, CONSULTING ENG
Project............ 2738.0262
Client............. NAVY - WESTDIV
Location........... West Beach Landfill
Test date.......... September 11, 1991

Knowns and Constants:
No. of data points.................. 19
Radius of well casing............... 2.54
Radius of well...................... 10.16
Aquifer saturated thickness......... 801.3
Well screen length.................. 304.8
Static height of water in well...... 801.3
Log(Re/Rw).......................... 3.15
A, B, C............................. 0.000, 0.000, 1.969

==

ANALYTICAL METHOD

Bouwer-Rice (Unconfined Aquifer Slug Test)

==

RESULTS FROM VISUAL CURVE MATCHING

VISUAL MATCH PARAMETER ESTIMATES

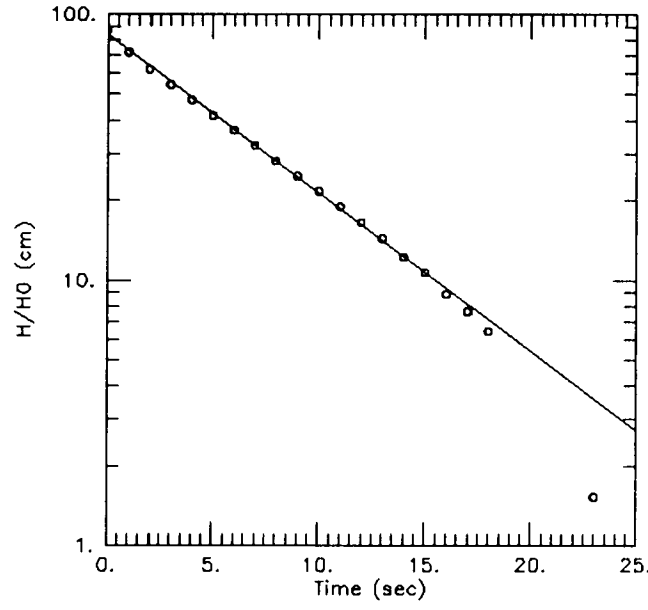
	Estimate
K =	5.1635E-003
y0 =	8.8085E+001

<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<>>

TYPE CURVE DATA

K = 4.57371E-003
y0 = 8.36002E+001

Time	Drawdown	Time	Drawdown	Time	Drawdown
0.000E+000	8.360E+001	2.500E+001	2.708E+000		



DATA SET:
m024e.aet
08/04/92

AQUIFER TYPE:
Unconfined

SOLUTION METHOD:
Bouwer-Rice

TEST DATE:
September 11, 1991

ESTIMATED PARAMETERS:
K = 0.004574 cm/sec
y0 = 83.8 cm

TEST DATA:
H0 = 87.17 cm
rc = 2.54 cm
rw = 10.16 cm
L = 304.8 cm
D = 801.3 cm
H = 801.3 cm

RISING HEAD RESULT, M-024-E

J.M.MONTGOMERY, CONSULTING ENG	Client: NAVY – WESTDIV
Project No.: 2738.0262	Location: West Beach Landfill

M-025-E
RISING HEAD FIELD DATA
NAS ALAMEDA, CTO-107
1991

SE1000B
Environmental Logger
08/12 09:41

Unit# 00515 Test# 5

INPUT 1: Level (F) TOC

Reference 0.00
Scale factor 10.09
Offset 0.00

Step# 0 08/09 15:17

Elapsed Time (min)	Value (ft)
0.0000	0.35
0.0033	0.35
0.0066	0.53
0.0099	4.05
0.0133	6.29
0.0166	4.47
0.0200	1.85
0.0233	1.50
0.0266	2.91
0.0300	3.73
0.0333	3.96
0.0500	3.45
0.0666	3.05
0.0833	2.74
0.1000	2.48
0.1166	2.26
0.1333	2.07
0.1500	1.91
0.1666	1.77
0.1833	1.64
0.2000	1.53
0.2166	1.43
0.2333	1.34
0.2500	1.27
0.2666	1.20
0.2833	1.14
0.3000	1.08
0.3166	1.03
0.3333	0.98
0.4167	0.81
0.5000	0.70
0.5833	0.62
0.6667	0.57
0.7500	0.53
0.8333	0.51
0.9167	0.49
1.0000	0.47
1.0833	0.46
1.1667	0.45
1.2500	0.44
1.3333	0.43
1.4166	0.43
1.5000	0.43
1.5833	0.42
1.6667	0.42
1.7500	0.42
1.8333	0.42
1.9167	0.42
2.0000	0.42
2.5000	0.41
3.0000	0.40
3.5000	0.40
4.0000	0.40
4.5000	0.40
5.0000	0.41
5.5000	0.41
6.0000	0.41
6.5000	0.42
7.0000	0.42
7.5000	0.43
8.0000	0.43
8.5000	0.43
9.0000	0.44
9.5000	0.44
10.0000	0.45
12.0000	0.46
14.0000	0.49
16.0000	0.51

<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<>>

A Q T E S O L V   R E S U L T S

Version 1.10

06/04/92 02:42:46

==

TEST DESCRIPTION

Data set........... m025e.set
Data set title..... RISING HEAD RESULT, M-025-E
Company............ J.M.MONTGOMERY, CONSULTING ENG
Project............ 2738.0262
Client............. NAVY - WESTDIV
Location........... 1943-1956 Disposal Area
Test date.......... August 9, 1991

Knowns and Constants:

No. of data points.................. 43
Radius of well casing............... 2.54
Radius of well...................... 10.16
Aquifer saturated thickness......... 706.8
Well screen length.................. 304.8
Static height of water in well...... 706.8
Log(Re/Rw).......................... 3.078
A, B, C............................. 0.000, 0.000, 1.969

==

ANALYTICAL METHOD

Bouwer-Rice (Unconfined Aquifer Slug Test)

==

RESULTS FROM VISUAL CURVE MATCHING

VISUAL MATCH PARAMETER ESTIMATES

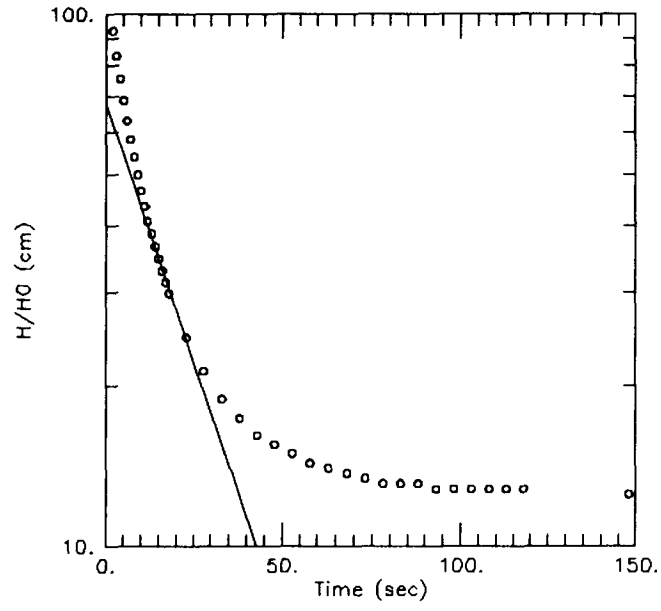
	Estimate
K =	2.5048E-004
y0 =	8.8085E+001

<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<>>

TYPE CURVE DATA

K = 1.45859E-003
y0 = 6.78032E+001

Time	Drawdown	Time	Drawdown	Time	Drawdown
0.000E+000	6.780E+001	1.500E+002	8.205E-002		



DATA SET:
m025e.aet
08/04/92

AQUIFER TYPE:
Unconfined

SOLUTION METHOD:
Bouwer-Rice

TEST DATE:
August 9, 1991

ESTIMATED PARAMETERS:
K = 0.001459 cm/sec
y0 = 67.8 cm

TEST DATA:
H0 = 108.5 cm
rc = 2.54 cm
rw = 10.16 cm
L = 304.8 cm
b = 705.8 cm
H = 708.8 cm

RISING HEAD RESULT, M-025-E

J.M.MONTGOMERY, CONSULTING ENG	Client: NAVY – WESTDIV
Project No.: 2738.0262	Location: 1943–1956 Disposal Area

M-026-E
RISING HEAD FIELD DATA
NAS ALAMEDA, CTO-107
1991

SE1000B
Environmental Logger
09/11 17:14

Unit# 00515 Test# 3

INPUT 1: Level (F) TOC

Reference 0.00
Scale factor 10.09
Offset 0.00

Step# 0 09/11 13:36

Elapsed Time (min)	Value (ft)
0.0000	6.05
0.0033	10.25
0.0066	13.46
0.0099	14.52
0.0133	9.39
0.0166	11.03
0.0200	9.48
0.0233	5.87
0.0266	7.82
0.0300	8.41
0.0333	9.00
0.0500	8.86
0.0666	8.57
0.0833	8.35
0.1000	8.14
0.1166	7.97
0.1333	7.81
0.1500	7.67
0.1666	7.55
0.1833	7.43
0.2000	7.33
0.2166	7.24
0.2333	7.15
0.2500	7.08
0.2666	7.00
0.2833	6.94
0.3000	6.88
0.3166	6.83
0.3333	6.77
0.4167	6.58
0.5000	6.44
0.5833	6.34
0.6667	6.26
0.7500	6.22
0.8333	6.18
0.9167	6.15
1.0000	6.13
1.0833	6.11
1.1667	6.10
1.2500	6.08
1.3333	6.08
1.4166	6.07
1.5000	6.06
1.5833	6.06
1.6667	6.05
1.7500	6.05
1.8333	6.04
1.9167	6.04
2.0000	6.04
2.5000	6.03
3.0000	6.02
3.5000	6.00
4.0000	6.01
4.5000	6.01

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A Q T E S O L V   R E S U L T S

Version 1.10

06/04/92 02:45:11

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TEST DESCRIPTION

Data set........... m026e.set
Data set title..... RISING HEAD RESULT, M-026-E
Company............ J.M.MONTGOMERY, CONSULTING ENG
Project............ 2738.0262
Client............. NAVY - WESTDIV
Location........... September 11, 1991
Test date.......... August 9, 1991

Knowns and Constants:

No. of data points.................. 40
Radius of well casing............... 2.54
Radius of well...................... 10.16
Aquifer saturated thickness......... 541.9
Well screen length.................. 304.8
Static height of water in well...... 541.9
Log(Re/Rw).......................... 2.922
A, B, C............................. 0.000, 0.000, 1.969

==

ANALYTICAL METHOD

Bouwer-Rice (Unconfined Aquifer Slug Test)

==

RESULTS FROM VISUAL CURVE MATCHING

VISUAL MATCH PARAMETER ESTIMATES

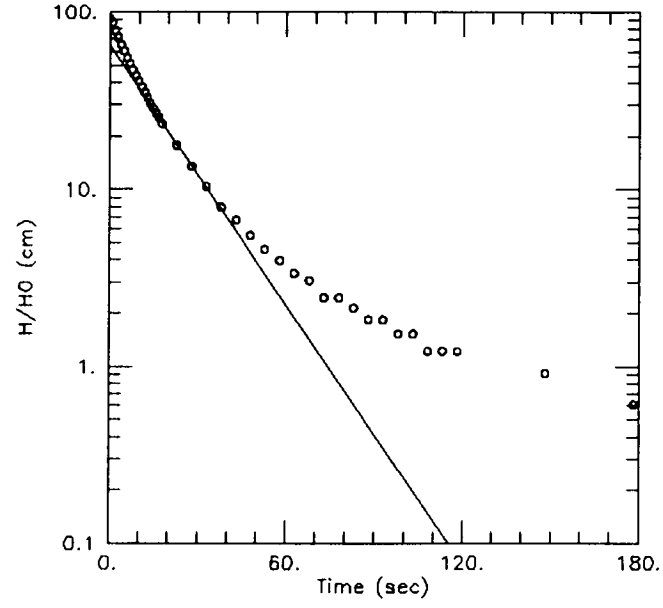
	Estimate
K =	1.7421E-003
y0 =	8.8085E+001

<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<>>

TYPE CURVE DATA

K = 1.74213E-003
y0 = 6.51136E+001

Time	Drawdown	Time	Drawdown	Time	Drawdown
0.000E+000	6.511E+001	1.800E+002	2.568E-003		



DATA SET:
m026e.aet
08/04/92

AQUIFER TYPE:
Unconfined

SOLUTION METHOD:
Bouwer-Rice

TEST DATE:
August 9, 1991

ESTIMATED PARAMETERS:
K = 0.001742 cm/sec
y0 = 65.11 cm

TEST DATA:
H0 = 91.44 cm
rc = 2.54 cm
rw = 10.16 cm
L = 304.8 cm
D = 541.8 cm
H = 541.8 cm

RISING HEAD RESULT, M-026-E

J.M.MONTGOMERY, CONSULTING ENG	Client: NAVY - WESTDIV
Project No.: 2738.0262	Location: September 11, 1991

M-027-E
RISING HEAD FIELD DATA
NAS ALAMEDA, CTO-107
1991

SE1000B
Environmental Logger
07/29 14:56

Unit# 00515 Test# 1

INPUT 1: Level (F) TOC

Reference 0.00
Scale factor 10.09
Offset 0.00

Step# 0 07/26 10:11

Elapsed Time (min)	Value (ft)
0.0000	-17.78
0.0033	-8.82
0.0066	0.00
0.0099	-17.31
0.0133	-12.48
0.0166	-14.60
0.0200	-14.00
0.0233	-14.25
0.0266	-14.33
0.0300	-14.33
0.0333	-14.41
0.0500	-14.68
0.0666	-14.87
0.0833	-15.04
0.1000	-15.19
0.1166	-15.32
0.1333	-15.45
0.1500	-15.56
0.1666	-15.67
0.1833	-15.77
0.2000	-15.87
0.2166	-15.96
0.2333	-16.05
0.2500	-16.13
0.2666	-16.20
0.2833	-16.28
0.3000	-16.35
0.3166	-16.41
0.3333	-16.47
0.4167	-16.74
0.5000	-16.94
0.5833	-17.10
0.6667	-17.23
0.7500	-17.33
0.8333	-17.41
0.9167	-17.48
1.0000	-17.53
1.0833	-17.57
1.1667	-17.61
1.2500	-17.64
1.3333	-17.67
1.4166	-17.69
1.5000	-17.71
1.5833	-17.72
1.6667	-17.74
1.7500	-17.75
1.8333	-17.76
1.9167	-17.77
2.0000	-17.78
2.5000	-17.82
3.0000	-17.84
3.5000	-17.85
4.0000	-17.86
4.5000	-17.87
5.0000	-17.88
5.5000	-17.88
6.0000	-17.88
6.5000	-17.88
7.0000	-17.89
7.5000	-17.90
8.0000	-17.90
8.5000	-17.89
9.0000	-17.89
9.5000	-17.89
10.0000	-17.89
12.0000	-17.90
14.0000	-17.90
16.0000	-17.91
18.0000	-17.90
20.0000	-17.91
22.0000	-17.91

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A Q T E S O L V   R E S U L T S

Version 1.10

06/04/92 02:49:37

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TEST DESCRIPTION

Data set........... m027e.set
Data set title..... RISING HEAD RESULT, M-027-E
Company............ J.M.MONTGOMERY, CONSULTING ENG
Project............ 2738.0262
Client............. NAVY - WESTDIV
Location........... 1943-1956 Disposal Area
Test date.......... July 26, 1991

Knowns and Constants:
No. of data points.................. 59
Radius of well casing............... 2.54
Radius of well...................... 10.16
Aquifer saturated thickness......... 497.1
Well screen length.................. 304.8
Static height of water in well...... 497.1
Log(Re/Rw).......................... 2.87
A, B, C............................. 0.000, 0.000, 1.969

==

ANALYTICAL METHOD

Bouwer-Rice (Unconfined Aquifer Slug Test)

==

RESULTS FROM VISUAL CURVE MATCHING

VISUAL MATCH PARAMETER ESTIMATES

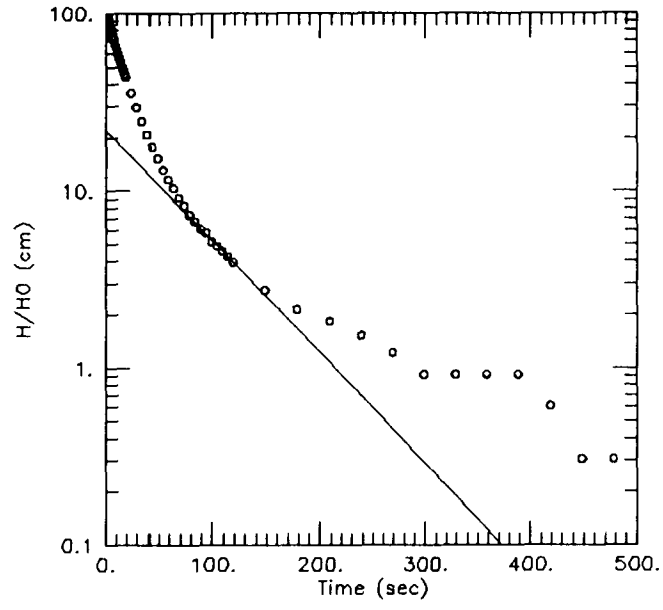
	Estimate
K =	4.3951E-004
y0 =	8.8085E+001

<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<>>

TYPE CURVE DATA

K = 4.39508E-004
y0 = 2.21224E+001

Time	Drawdown	Time	Drawdown	Time	Drawdown
0.000E+000	2.212E+001	5.000E+002	1.597E-002		



DATA SET:
m027e.aet
06/04/92

AQUIFER TYPE:
Unconfined

SOLUTION METHOD:
Bouwer-Rice

TEST DATE:
July 26, 1991

ESTIMATED PARAMETERS:
K = 0.0004395 cm/sec
y0 = 22.12 cm

TEST DATA:
H0 = 111.6 cm
rc = 2.54 cm
rw = 10.16 cm
L = 304.8 cm
D = 497.1 cm
H = 497.1 cm

RISING HEAD RESULT, M-027-E

J.M.MONTGOMERY, CONSULTING ENG	Client: NAVY - WESTDIV
Project No.: 2738.0262	Location: 1943-1956 Disposal Area

M-028-E
RISING HEAD FIELD DATA
NAS ALAMEDA, CTO-107
1991

SE1000B
Environmental Logger
09/11 17:16

Unit# 00515 Test# 5

INPUT 1: Level (F) TOC

Reference 0.00
Scale factor 10.09
Offset 0.00

Step# 0 09/11 14:03

Elapsed Time (min)	Value (ft)
0.0000	11.03
0.0033	18.62
0.0066	16.76
0.0099	11.93
0.0133	12.51
0.0166	13.25
0.0200	13.05
0.0233	12.93
0.0266	12.82
0.0300	12.70
0.0333	12.57
0.0500	12.17
0.0666	11.84
0.0833	11.57
0.1000	11.35
0.1166	11.15
0.1333	10.99
0.1500	10.85
0.1666	10.72
0.1833	10.62
0.2000	10.52
0.2166	10.44
0.2333	10.37
0.2500	10.31
0.2666	10.26
0.2833	10.21
0.3000	10.17
0.3166	10.13
0.3333	10.10
0.4167	9.98
0.5000	9.90
0.5833	9.86
0.6667	9.83
0.7500	9.81
0.8333	9.80
0.9167	9.79
1.0000	9.78
1.0833	9.78
1.1667	9.77
1.2500	9.77
1.3333	9.76
1.4166	9.76
1.5000	9.76
1.5833	9.76
1.6667	9.76
1.7500	9.75
1.8333	9.75
1.9167	9.75
2.0000	9.75
2.5000	9.75

<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<>>

A Q T E S O L V   R E S U L T S
Version 1.10

06/04/92 02:55:21

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TEST DESCRIPTION

Data set........... m028e.set
Data set title..... RISING HEAD RESULT, M-028-E
Company............ J.M.MONTGOMERY, CONSULTING ENG
Project............ 2738.0262
Client............. NAVY - WESTDIV
Location........... 1943-1956 Disposal Area
Test date.......... September 11, 1991

Knowns and Constants:
No. of data points.................. 39
Radius of well casing............... 2.54
Radius of well...................... 10.16
Aquifer saturated thickness......... 453.2
Well screen length.................. 304.8
Static height of water in well...... 453.2
Log(Re/Rw).......................... 2.815
A, B, C............................. 0.000, 0.000, 1.969

==

ANALYTICAL METHOD

Bouwer-Rice (Unconfined Aquifer Slug Test)

==

RESULTS FROM VISUAL CURVE MATCHING

VISUAL MATCH PARAMETER ESTIMATES

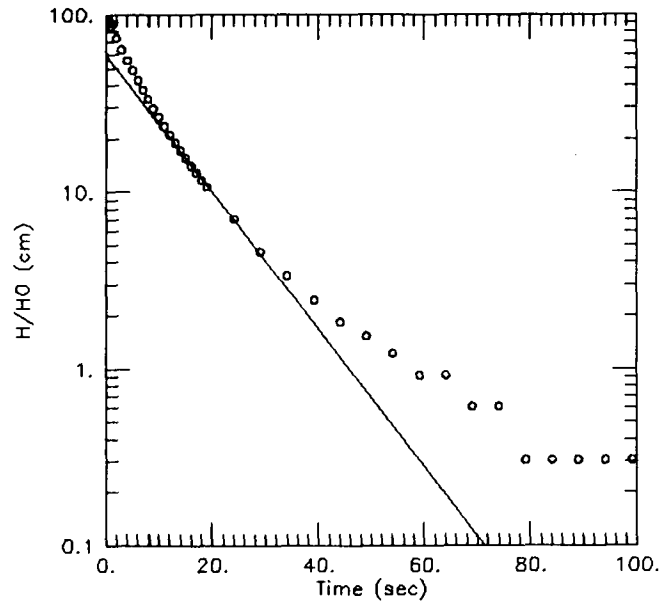
	Estimate
K =	1.8640E-003
y0 =	0.0000E+000

<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<>>

TYPE CURVE DATA

K = 2.65139E-003
y0 = 5.82898E+001

Time	Drawdown	Time	Drawdown	Time	Drawdown
0.000E+000	5.829E+001	1.000E+002	7.949E-003		



DATA SET:
m028e.aet
06/04/92

AQUIFER TYPE:
Unconfined

SOLUTION METHOD:
Bouwer-Rice

TEST DATE:
September 11, 1991

ESTIMATED PARAMETERS:
K = 0.002851 cm/sec
y0 = 58.28 cm

TEST DATA:
H0 = 106.7 cm
rc = 2.54 cm
rw = 10.16 cm
L = 304.8 cm
b = 453.2 cm
H = 453.2 cm

RISING HEAD RESULT, M-028-E

J.M.MONTGOMERY, CONSULTING ENG	Client: NAVY – WESTDIV
Project No.: 2738.0262	Location: 1943–1956 Disposal Area

M-029-E
RISING HEAD FIELD DATA
NAS ALAMEDA, CTO-107
1991

SE1000B
Environmental Logger
09/11 17:19

Unit# 00515 Test# 7

INPUT 1: Level (F) TOC

Reference 0.00
Scale factor 10.09
Offset 0.00

Step# 0 09/11 14:32

Elapsed Time (min)	Value (ft)
0.0000	9.82
0.0033	14.32
0.0066	19.44
0.0099	16.63
0.0133	11.53
0.0166	10.63
0.0200	14.00
0.0233	12.19
0.0266	12.60
0.0300	12.37
0.0333	12.36
0.0500	12.07
0.0666	11.88
0.0833	11.71
0.1000	11.58
0.1166	11.45
0.1333	11.33
0.1500	11.22
0.1666	11.11
0.1833	11.00
0.2000	10.91
0.2166	10.82
0.2333	10.73
0.2500	10.65
0.2666	10.58
0.2833	10.51
0.3000	10.45
0.3166	10.39
0.3333	10.33
0.4167	10.09
0.5000	9.92
0.5833	9.80
0.6667	9.71
0.7500	9.64
0.8333	9.60
0.9167	9.54
1.0000	9.50
1.0833	9.46
1.1667	9.43
1.2500	9.42
1.3333	9.40
1.4166	9.39
1.5000	9.37
1.5833	9.37
1.6667	9.36
1.7500	9.35
1.8333	9.35
1.9167	9.35
2.0000	9.34
2.5000	9.33
3.0000	9.33

<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<>>

A Q T E S O L V   R E S U L T S

Version 1.10

06/04/92 02:57:32

==

TEST DESCRIPTION

Data set........... m029e.set
Data set title..... RISING HEAD RESULT, M-029-E
Company............ J.M.MONTGOMERY, CONSULTING ENG
Project............ 2738.0262
Client............. NAVY - WESTDIV
Location........... 1943-1956 Disposal Area
Test date.......... September 11, 1991

Knowns and Constants:

- No. of data points.................. 40
- Radius of well casing............... 2.54
- Radius of well...................... 5.79
- Aquifer saturated thickness......... 426.1
- Well screen length.................. 304.8
- Static height of water in well...... 426.1
- Log(Re/Rw).......................... 3.249
- A, B, C............................. 0.000, 0.000, 2.732

==

ANALYTICAL METHOD

Bouwer-Rice (Unconfined Aquifer Slug Test)

==

RESULTS FROM VISUAL CURVE MATCHING

VISUAL MATCH PARAMETER ESTIMATES

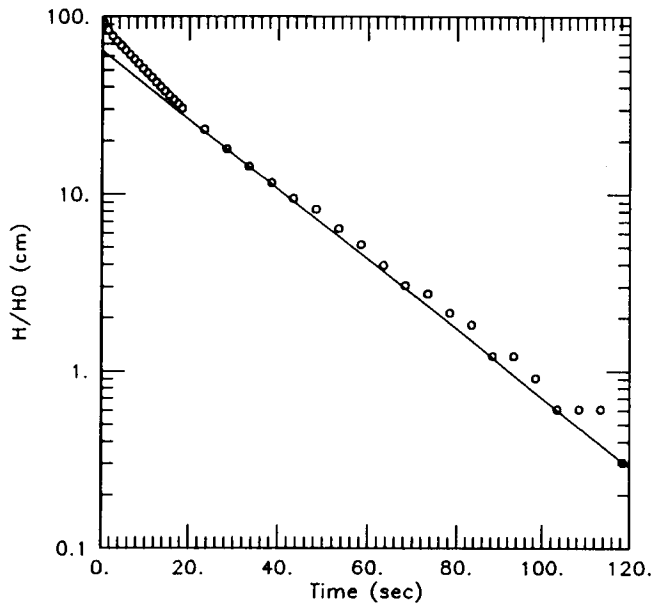
	Estimate
K =	1.5523E-003
y0 =	0.0000E+000

<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<>>

TYPE CURVE DATA

K = 1.55230E-003
y0 = 6.41791E+001

Time	Drawdown	Time	Drawdown	Time	Drawdown
0.000E+000	6.418E+001	1.200E+002	2.848E-001		



DATA SET:
m029e.set
06/04/92

AQUIFER TYPE:
Unconfined

SOLUTION METHOD:
Bouwer-Rice

TEST DATE:
September 11, 1991

ESTIMATED PARAMETERS:
K = 0.001552 cm/sec
y0 = 64.18 cm

TEST DATA:
H0 = 99.67 cm
rc = 2.54 cm
rw = 5.79 cm
L = 304.8 cm
b = 426.1 cm
H = 426.1 cm

RISING HEAD RESULT, M-029-E

J.M.MONTGOMERY, CONSULTING ENG	Client: NAVY - WESTDIV
Project No.: 2738.0262	Location: 1943-1956 Disposal Area

APPENDIX H

GEOPHYSICAL REPORT/DATA

1.0 MAGNETIC SURVEY

Description and Intent

Total magnetic field and vertical gradient magnetic field data were obtained on the ground in two locations in Site 2. Data were obtained on rectangular grids with 20-foot station spacing. The northern one-third of Site 2, an area of approximately 40 acres designated as the North Area, was covered with 4,200 stations. A 4-acre area in the southeastern quadrant of Site 2 designated as the South Area, was covered with 444 stations. The survey was conducted by NORCAL Geophysical Consultants of Petaluma, Califonia.

The purpose of the magnetic survey was to aid in the location of ferrous metal objects, such as chemical drums, that might be buried at shallow depths. The greater the mass of a ferrous object, the greater the depth at which it can be detected. While it would be possible to detect a single drum at a depth of a few feet, the survey was designed to locate larger concentrations of ferrous metal, such as several drums, down to a depth of approximately 20 feet. The vertical magnetic gradient survey is particularly sensitive to near surface objects.

Conclusions

The location of the survey areas is shown in NORCAL Plates 1 and 2, and contour maps providing different presentations of the magnetic data are shown in NORCAL Plates 3, C1 and C2 for the North Area, and Plates 4 and C3 for the South Area. Regardless of the data presentation, these maps define the locations of the same features - numerous concentrations of ferrous metal scattered throughout the survey areas. The shallowest and most significant of these features are clearly defined on Plates 3 and 4, which show the vertical magnetic gradient data with low amplitude anomalies removed.

2.0 TRANSIENT ELECTROMAGNETIC SURVEY

Description and Intent

The transient electromagnetic (TEM) sounding method was used in an effort to help assess the stratigraphy beneath Sites 1 and 2. Soundings were performed at approximately 200-foot intervals along two north-south and two east-west profile lines. The field survey and numerical modeling of the data were conducted by NORCAL Geophysical Consultants of Petaluma, California.

The purpose of this method is to define differences in electrical resistivity as a function of depth in the geologic formations beneath the site. Many geologic units can be differentiated on the basis of their electrical resistivities. With the exception of metals, mineral grains are highly resistive (low electrical conductivity). Saturated geologic formations become more electrically conductive with increased porosity and increased salinity of the pore water. Moist clays are very conductive.

The data for each site are modeled using a numerical algorithm to generate horizontal layers with varying thicknesses and electrical resistivities. The model results for each profile line are displayed as a cross-section, which is then correlated with other data, such as borehole logs, and interpreted in terms of geologic units. The NORCAL report includes such cross-sections, which indicate several horizons differentiated on the basis of their electrical resistivities.

Interpretation

In general, the data indicate that the near surface materials are very resistive, becoming less resistive and then very conductive at depth. At nearly all sites, the very resistive and moderately resistive surface layer extends from the surface to a depth between approximately 20 and 60 feet. This is consistent with dry fill material (very resistive), underlain by fill material partially or fully saturated with water low in dissolved solids (moderate resistivity). Higher conductivity at depth can be associated with clay and/or saline water.

It was hoped that this survey might resolve the top surface of the late Pleistocene/Holocene eolian deposits beneath the Holocene Bay Mud so that the hypothesized existence and location of a paleochannel dissecting the late Pleistocene/Holocene eolian deposits could be established. This feature would be difficult to locate with any geophysical method, and using the TEM method probably represents the most reasonable and cost effective approach. However, we do not feel that the survey has been successful at resolving horizons at depth - at least not horizons consistent with borehole data. This is regrettable, but not surprising as these deeper materials are muds, clays, sands and silts saturated with brackish or salt water, all of which would be expected to be very electrically conductive. This is substantiated by measurements indicating high conductivity of groundwater samples obtained from the second water bearing zone.

Conclusions

At depths beneath near surface fill materials, the TEM survey results display only moderate correlation with lithologic data obtained from boreholes in the survey area. A probable explanation is that these deeper sedimentary units are all saturated with saline water, making them very electrically conductive and indistinguishable to surface

electromagnetic (and probably any other) geophysical techniques. As a result, we have not attempted to incorporate the TEM data in our analysis and interpretation of subsurface conditions.

GEOPHYSICAL INVESTIGATION
WEST BEACH LANDFILL
NAVAL AIR STATION ALAMEDA
ALAMEDA COUNTY, CALIFORNIA

NORCAL Job Number 91-157.10

A report prepared for

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501 Lennon Lane, Suite 200
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by

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Geophysicist GP-843

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Petaluma, California
707/763-1312

June 12, 1992

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Appendix B - Data Acquisition
Appendix C - Data Analysis
Appendix D - Electrical Resistivity Models

DISTRIBUTION

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Plate 2 . . . . . Magnetometer Station Location Map

Plate 3 . . . . . Vertical Magnetic Gradient Anomaly Map (North Area)

Plate 4 . . . . . Vertical Magnetic Gradient Anomaly Map (South Area)

Plate 5 . . . . . Transient Electromagnetic Profile A

Plate 6 . . . . . Transient Electromagnetic Profiles B and C

Plate 7 . . . . . Transient Electromagnetic Profiles D, E, and F

Appendix C

Plate C1 . . . . . Magnetic Total Field Anomaly Map (North Area)

Plate C2 . . . . . Vertical Magnetic Gradient Anomaly Map (North Area)

Plate C3 . . . . . Magnetic Anomaly Maps (South Area)

I EXECUTIVE SUMMARY

Total field and vertical gradient magnetic data were obtained at 20 foot centers in rectangular grids covering two portions of the West Beach landfill at Naval Air Station Alameda, Alameda County, California. One 40 acre portion, designated the North Area, covers the northern one-third of the landfill. A small 4 acre portion, designated the South Area, is located in the southeast quadrant of the landfill.

Anomaly maps produced by contouring the absolute value of the vertical gradient data in excess of 100 gammas per meter, indicates that significant quantities of buried metal are numerous and randomly scattered throughout both survey areas.

The transient electromagnetic method was used to perform vertical electric soundings at 200 foot intervals along six north-south and east-west trending profiles. These profiles comprise 13,600 lineal feet of traverse. These data were used to produce resistivity versus depth cross-sections for each profile. These sections indicate subsurface resistivities ranging from less than 10 ohm-feet to greater than 1000 ohm-feet. We have differentiated this range into four sub-ranges that we refer to as resistivity units. Correlation with a limited number of nearby borings indicates that the lowest resistivity unit represents clays and silts. The highest resistivity unit represents sands, gravels, and fill (possible refuse). The

two intermediate resistivity units correlate with various compositions of interbedded clays, silts, sands and gravels.

The four resistivity units typically occur in a sequence that is characterized by moderately high to high resistivities at the surface and very low resistivities at depths of several hundred feet. At intermediate depths, the subsurface is characterized by low to moderately high resistivity. This includes an alternating sequence that is laterally continuous at depths of 20 - 70 feet. This sequence could be interpreted as two thin layers of clay enclosing a layer of coarser grained material. A zone of high resistivity resolved along the west side, and through the center of the landfill, probably represents refuse.

II INTRODUCTION

This report presents the findings of a geophysical investigation performed by NORCAL Geophysical Consultants, Inc. at Naval Air Station Alameda, in Alameda County, California. The survey was performed during the period May 7 through June 7, 1991 by NORCAL geophysicists William E. Black, Kenneth G. Blom, and geophysical technician Gerald Heft. Mr. Scott Weber of James M. Montgomery, Inc. (JMM) provided site orientation and logistical support.

A. Site Description

The area of investigation is located at the west end of Naval Air Station Alameda. It comprises portions of the West Beach Landfill and the area north of the landfill, as shown on Plate 1. The study area is bounded by San Francisco Bay on the south and west, Oakland Harbor on the north, and the Naval Air Station runways on the east. The landfill, which is abandoned, occupies the south half of the area.

The terrain in the area of investigation outside the landfill is characterized by flat, open, grass covered fields transected by roads, runways, and taxiways. Numerous small wooden structures occupy much of the area bordering the bay and harbor. The landfill itself is surrounded by a 15 foot high earthen berm. Within the berm the ground surface is level but somewhat irregular. Ground cover ranges from barren to locally thick stands of high grass. Several low areas in the south-

west quarter of the landfill contain standing water.

B. Subsurface Conditions

Subsurface information provided by JMM, as stated in our proposal dated April 5, 1991, indicates that the area of investigation is underlain by 20 to 25 feet of hydraulic fill. Beneath the fill is approximately 10 to 100 feet of younger bay mud overlying the Merrit Sand, which is discontinuous. The discontinuities have been attributed to channelization. An undetermined thickness of older bay mud underlies the sequence. Groundwater occurs at depths of 3 to 5 feet, and is fresh to saline.

The landfill reportedly contains refuse such as chemical drums, asbestos, pesticides, waste oil, waste metal, dredge spoils, and inert ordnance. It is also reported that ships may be buried in a portion of the landfill not covered by the geophysical investigation.

C. Purpose

The geophysical investigation has two objectives, as stated in our proposal. The primary objective is to explore two areas within the abandoned landfill for significant quantities of buried metal. These areas were designated by JMM, and are referred to as the North Area and the South Area (Plate 2). The North Area covers approximately 40 acres in the northern one-third of the landfill, and extends as much as 100 feet north of the berm. The South Area covers approximately 4 acres in the southeast quadrant of the landfill. The findings of this investigation

will be used to determine the optimum and safe placement of boreholes, and to guide future remediation work.

An additional objective is to provide information on the extent and thickness of the stratigraphic units to depths in excess of 150 feet beneath the western portion of the site. Of particular interest is the location of a suspected buried stream channel that reportedly dissects the Merrit Sand. This information will be used to supplement JMM's site characterization study.

D. Geophysical Approach

Buried ferrous objects produce variations in the earths magnetic field that can be measured from the surface. Our approach to locating metal was to measure both the total intensity and the vertical gradient of the earths magnetic field in the areas described above. We measured these values at points distributed at 20 foot centers over rectangular survey grids. We obtained vertical gradient magnetic (MAG) data because they are primarily affected by near surface targets, they provide better resolution of individual targets than TFM data, and they are immune to diurnal variations. We obtained the total field magnetic (TFM) data as a supplement to the MAG data, and to delineate deeply buried ferrous objects. Deep targets can be resolved with TFM data as long as their mass is large compared to their depth.

Significant variations in the physical parameters of subsurface materials can produce measurable variations in their electrical properties. These parameters

include, among others, mineralogy, texture, porosity, saturation, and groundwater quality. The vertical and lateral distribution of the electrical properties can be measured using a variety of electrical methods. For this investigation, we selected transient electromagnetics (TEM) because, of the currently available methods, it provides the best resolution, the greatest depth of investigation, and the most rapid data acquisition.

E. Scope of Work

The general scope of work, as defined in our proposal, includes the following items:

1) Obtain TFM and MAG data at stations distributed on 20 foot centers in a rectangular grid covering the designated areas, for a total of 5800 data points.

2) Obtain TEM sounding data at stations approximately 200 feet apart along two 5,000 foot long north-south profiles, one 1500 foot long east-west profile, and one 3000 foot long east-west profile.

3) Produce magnetic anomaly maps of the North Area and South Area showing the areas most likely to contain significant quantities of buried metal.

4) Reduce and interpret the TEM data to determine the vertical and horizontal distribution of subsurface electrical properties.

5) Present our findings in a written report.

The actual coverage we achieved, as described in Section IV below, differs from that listed in items 1 and 2 above, because of limited access in certain areas.

III METHODOLOGY

The methodology of the magnetic and transient electromagnetic techniques, as applied to this investigation, are described in Appendix A.

IV DATA ACQUISITION

Our magnetic and transient electromagnetic data acquisition procedures are described in Appendix B. The survey coverage is described in the following paragraphs.

A. Magnetometer Survey

We obtained TFM and MAG data at 4200 stations distributed on 20 foot centers in the North Area, and 444 stations, distributed on 20 foot centers in the South Area. A section near the center of the South Area was not surveyed because of large piles of surface debris. The magnetometer station locations are shown on Plate 2.

B. Transient Electromagnetic Survey

We obtained TEM data at a total of 70 stations. The stations were distributed at approximately 200 foot intervals along six north-south and east-west trending profiles, for a total coverage of 13,600 line feet. The six profiles are labeled A through F on Plate 1.

V DATA ANALYSIS

The procedures and software we used to reduce and interpret the magnetic and transient electromagnetic data are described in Appendix C. The salient features of our analysis are described in the following paragraphs.

A. Magnetic Anomaly Map

Our analysis of the TFM and MAG data resulted in the contour maps shown on Plates C1, C2, and C3. These maps indicate that both areas of investigation are densely covered by magnetic anomalies. However, many of these anomalies have a relatively small amplitude and are probably caused by small quantities of metal, such as debris or refuse. Therefore, it was necessary to construct a magnetic anomaly map that would show only those anomalies caused by significant quantities of buried metal.

We used the MAG data to construct the map because it has better lateral resolution than TFM data. To eliminate the effects of small quantities of metal, we contoured only those values in excess of 100 gammas per meter (g/m). In order to do this it was necessary to take the absolute value of the data, because MAG anomalies can be both positive and negative. We estimate that the 100 g/m lower limit is sufficient to detect significant targets, yet high enough to omit small debris type sources. Since the purpose of the survey is to determine the location and lateral extent of buried metal, we made no attempt to determine the depth of these objects.

B. Electrical Resistivity Cross-sections

To quantitatively determine the variation in electrical properties with depth, we used inverse modeling techniques (see Appendix C) to interpret the TEM data. The results are presented in the form of one dimensional models represented by the resistivity vs depth diagrams shown in Appendix D. The site conditions in many areas, particularly within the landfill, are conducive to interference. In spite of this, the data quality at almost all of the sounding locations was adequate for modelling. This is evidenced by the smoothness of the curves shown in Appendix D.

We used the one dimensional models to construct cross-sections representing the variation in resistivity with depth along each TEM profile. In order to correlate between soundings, it was necessary to group the resistivity values resolved by the models into four separate ranges which we refer to herein as resistivity units. The number of units, and their range of resistivity were determined so as to derive the simplest, most laterally continuous, and geologically reasonable cross-sections possible. Therefore, the range of values for each of these units varies slightly between profiles. However, all of the sections are comprised of four resistivity units.

VI RESULTS

The results of the magnetometer survey of the North Area and the South Area are presented by the MAG anomaly maps shown on Plates 3 and 4, respectively. The contours on these maps represent the absolute value of the vertical magnetic gradient at values equal to or above 100 gammas per meter (as described above). In general, the areas of investigation were free of surface cultural features which might interfere with the readings. Therefore, most of the anomalies are probably caused by buried ferrous objects.

The results of the transient electromagnetic survey are represented by the electrical resistivity versus depth cross-sections shown on Plates 5 through 7. These sections indicate the depth, thickness, and distribution of the various resistivity units, as well as the location of the TEM soundings and nearby borings along each profile. The length of the vertical lines representing the soundings indicates the approximate depth of investigation of the sounding. This depth can vary substantially depending on the number and thickness of resistivity layers, and the contrast between layers. Our interpretation of the TEM soundings are also represented by the resistivity vs. depth diagrams included in Appendix D.

A. Magnetometer Survey

The contour maps shown on Plate 3 and 4 indicate a random distribution of MAG anomalies throughout the North and the South areas. Some of the anoma-

lies are very small closures depicted by a single contour. Others are extensive, high magnitude anomalies represented by a large number of closely spaced contours. Theoretically, all of the anomalies represent significant quantities of buried metal. However, the largest accumulations of buried metal are represented by the large, high amplitude anomalies.

B. Transient Electromagnetic Survey

Our interpretation of the TEM data resolves the subsurface beneath Profiles A through F into four separate resistivity units, as described above. By correlating the TEM soundings with the geologic information from nearby boreholes, we have derived a lithologic correlation for these units. However, the number and depth of the boreholes is limited. Also, the resolution of the soundings decreases with depth, as explained below. Therefore, the correlation is approximate. The resistivity range and lithology of each unit are listed in the following table;

UNIT NUMBER	RESISTIVITY RANGE (Ohm-feet)	LITHOLOGY
1	0 - 30	Saturated (possibly saline) clays and silts.
2	15 - 175	Dry to saturated clays and silts with interbedded sands and gravels.
3	100 - 1000	Dry to saturated sands and gravels with interbedded clays and silts.
4	900 -	Predominantly dry sands and gravels and/or refuse.

The range in resistivity for the four units varies somewhat from one profile to the next. Therefore, the ranges listed above represent a composite of the units from all of the profiles. As a result there is some overlap between units. The reader should refer to the resistivity cross-sections shown on Plates 5 through 7 for the specific range of values of the units and their distribution beneath each profile.

The resistivity cross-sections shown on Plates 5 through 7 indicate a distribution of resistivity units that is, for the most part, laterally continuous. In the upper 100 feet of the subsurface, the units generally vary in thickness from less than 10 to as much as 50 feet. Below this, they are tens to hundreds of feet thick. This increase in thickness with depth may be an artifact of resolution. With TEM, as with many electrical methods, the deeper an object or layer is, the larger it has to be to be resolved. As a result, the deep, thick units may actually be an average of multiple, interbedded lithologic layers.

Typically, the sections indicate moderate to high resistivities at the surface and very low resistivities at depths of several hundred feet. Unit 1 forms the base of the sequence beneath each profile. The base is very irregular and varies in depth from less than 100 feet to over 400 feet. Where shallow it probably represents older bay mud (clays and silts). At depths of 200 to 400 feet, it could represent rock. Unit 1 also occurs in two thin stringers that are laterally continuous at depths of 20 to 70 feet. Boreholes indicate that they consist of clays and silts.

The stringers typically enclose an interbed of unit 3 or 4 material that correlates with sands and gravels. Given the depth and continuity of the upper stringer it may be associated with the base of the hydraulic fill and/or the top of the younger bay mud (clays and silts) described previously.

Unit 2 typically occurs in a relatively thick sequence overlying the basement layer (unit 1). At these depths it probably represents older bay mud. The unit is laterally discontinuous, and is locally replaced by unit 3. The variation from unit 2 to unit 3 probably corresponds with a lateral gradation from predominantly fine grained to predominantly coarse grained material. Unit 2 also occurs in small, near surface pockets. These may represent variations in the fill and/or old stream channels that have filled in with clays and silts.

Unit 3 is the most widespread. It makes up most of the surface layer and also occurs at depths in excess of 300 feet where it overlies the basement sequence (unit 1). Where shallow it probably represents hydraulic fill or the Merrit Sand. At depth, it probably represents a relatively coarse grained sequence of older bay mud.

Unit 4 probably represents refuse where it occurs in the landfill. In other areas, it may represent very coarse grained material (sand or gravel). Since the borehole data indicates that the groundwater in many areas has a high specific conductivity, the high resistivity of unit 4 is unexpected. However, there may be interstitial gas, particularly in the landfills, that contributes to the high resistivity.

C. Resistivity Correlation

A large number of borings have been drilled in the west portion of Alameda Naval Air Station. However, only a small number are close enough (< 200 feet) to the TEM profiles to be used for correlation purposes. Simplified geologic logs of these borings are included on the resistivity cross-sections (Plates 5 - 7). Only those on Profile A (Plate 5) extend below the surface resistivity layer.

All of the borings on Profile A indicate a sequence comprised primarily of coarse grained materials (sands, gravels, and fill) with interbeds of fine grained material (clays and silts). Typically, the coarse grained material corresponds with the moderate resistivities of Units 2 and 3, and the fine grained material corresponds with the low resistivities of Unit 1.

The four shallow borings on Profile A (M-024E, M-026E, M-028E, and M-029E) indicate a sequence of sand, gravel and fill, overlying clay. This fits with the sequence of Unit 3 overlying Unit 1, defined by the TEM data. However, in each case, the depth of Unit 1 is slightly greater than the depth of the clay.

Borings M-025C, M-027C, and M-001B all indicate a sequence of sands and gravels with clay interbeds. At each boring, the clay occurs at about the same depth as a Unit 1 layer.

The correlation described above shows that the TEM profiles have successfully differentiated between coarse and fine grained materials. The discrepancies in

depth and thickness are probably caused by the high contrast in resistivity between layers. When these conditions exist, several similar resistivity models can produce the same resistivity vs. depth curve (see Appendix D). For example, a thin layer of very low resistivity may provide the same contribution to a sounding curve as a thicker layer with somewhat higher resistivity.

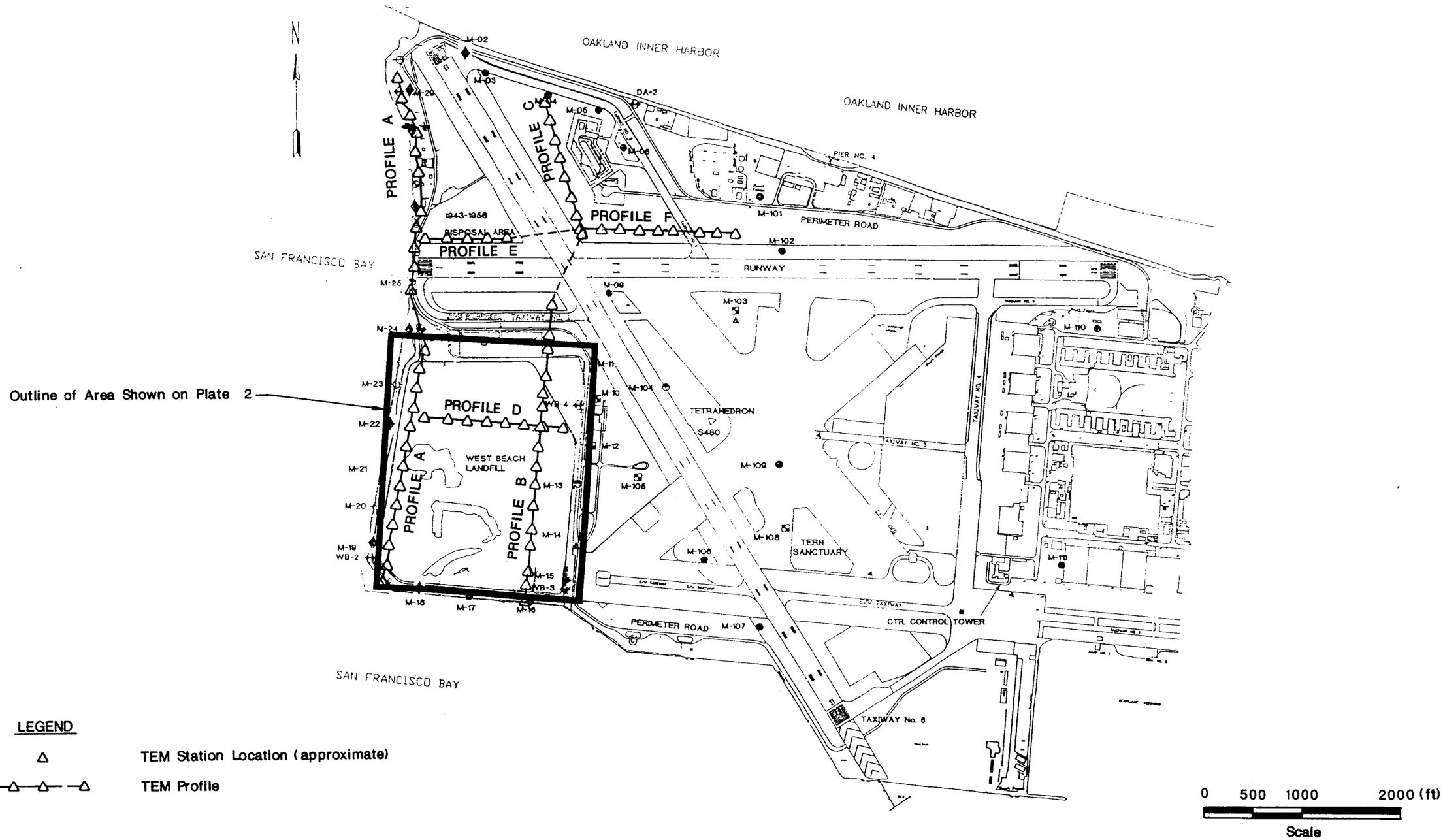
VII DISCUSSION

The TFM and MAG contours shown on Plates C1 - C3, indicate that the magnetic field is highly irregular, even where the values are relatively low. This and the random distribution of anomalies, indicate that varying amounts of ferrous material is buried in scattered locations throughout both the North Area and the South Area. There does not appear to be a consistent pattern that would indicate preferred burial locations such as pits or trenches. However, there is a general absence of anomalies along the berm. This could be due in part to a lower density of stations on the berm and/or the effect of the elevation of the berm.

The lower limit used to produce the magnetic anomaly maps shown on Plates 3 and 4, is designed to filter out anomalies associated with insignificant quantities of buried metal. However, the determination of what quantities are significant is purely subjective. Our experience and published studies, indicate that the value of 100 g/m we used, should filter out anomalies caused by debris or refuse, while preserving those caused by large targets like multiple buried drums. However, the amplitude of a magnetic anomaly is proportional, not only to the size of the source, but also to its distance from the sensors. Therefore, some of the anomalies that remain may be caused by large accumulations of debris or refuse buried at shallow depths. Conversely, there may be some objects of significant size that were buried so deep that their anomalies fall below the threshold.

The resistivity cross-sections presented on Plates 5 - 7 represent the geoelectric structure of the subsurface along Profiles A through F. They are based on our interpretation of the TEM data obtained along these profiles and, as such, represent one possible interpretation of the data. As discussed previously, the one dimensional models that we used to derive the cross-sections may not be unique. This is particularly true when there are large contrasts in resistivity between adjacent layers.

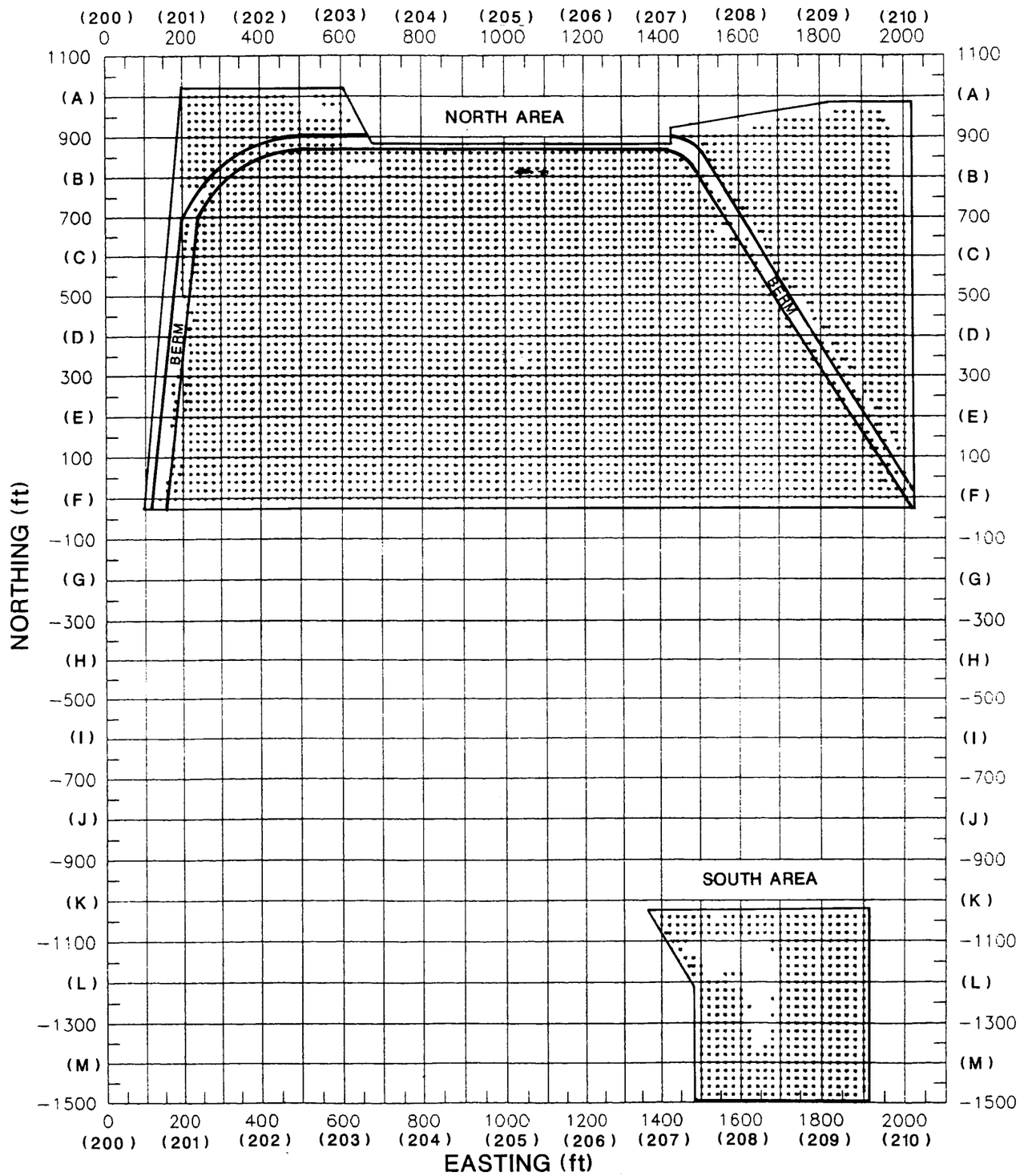
VIII ILLUSTRATIONS



Base map furnished by James M. Montgomery Consulting Engineers, Inc.

NORCAL GEOPHYSICAL CONSULTANTS			GEOPHYSICAL SURVEY LOCATION MAP
JOB: 91-157.10	APPR: WEB	DATE: 7/91	Naval Air Station Alameda, Ca.

PLATE 1



N

LEGEND

• Magnetometer Station

NOTES : 1. Letters and numbers in parentheses for NORTHING and EASTING are J.M.M. line designations.

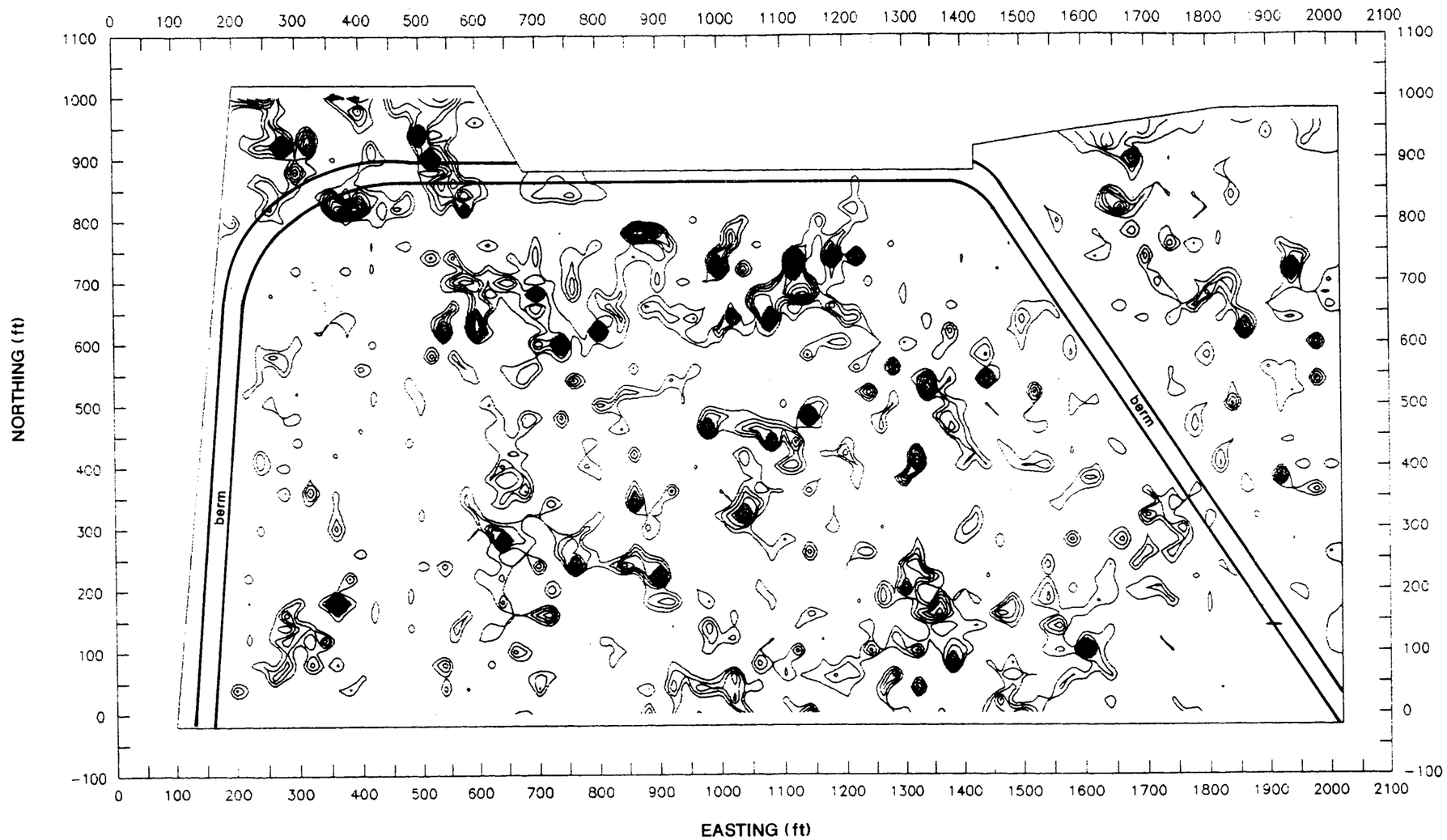
2. Gap in survey coverage in SOUTH AREA due to surface debris.

0 150 300 600 (ft)

Scale

NORCAL GEOPHYSICAL CONSULTANTS		MAGNETOMETER STATION LOCATION MAP	PLATE 2
JOB: 91-157.10	APPR:	DATE: 7/91	West Beach Landfill NAS Alameda, Ca

VERTICAL MAGNETIC GRADIENT CONTOURS

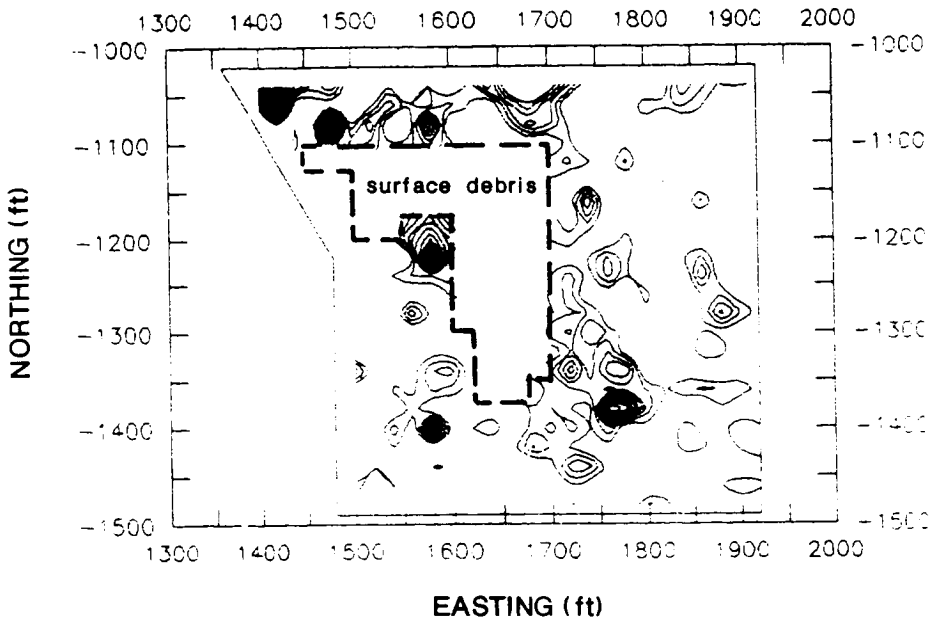


0 100 200 400 (ft)
Scale

NOTE: Contour interval = 50 gammas/meter
Minimum Contour = 100 gammas/meter

NORCAL GEOPHYSICAL CONSULTANTS			VERTICAL MAGNETIC GRADIENT ANOMALY MAP NORTH AREA	PLATE 3
JOB: 91-157.10	APPR:	DATE: 7/91	West Beach Landfill NAS Alameda, Ca.	

VERTICAL MAGNETIC GRADIENT CONTOURS



NOTES : 1. Contour interval = 50 gammas/meter
Minimum contour = 100 gammas/meter

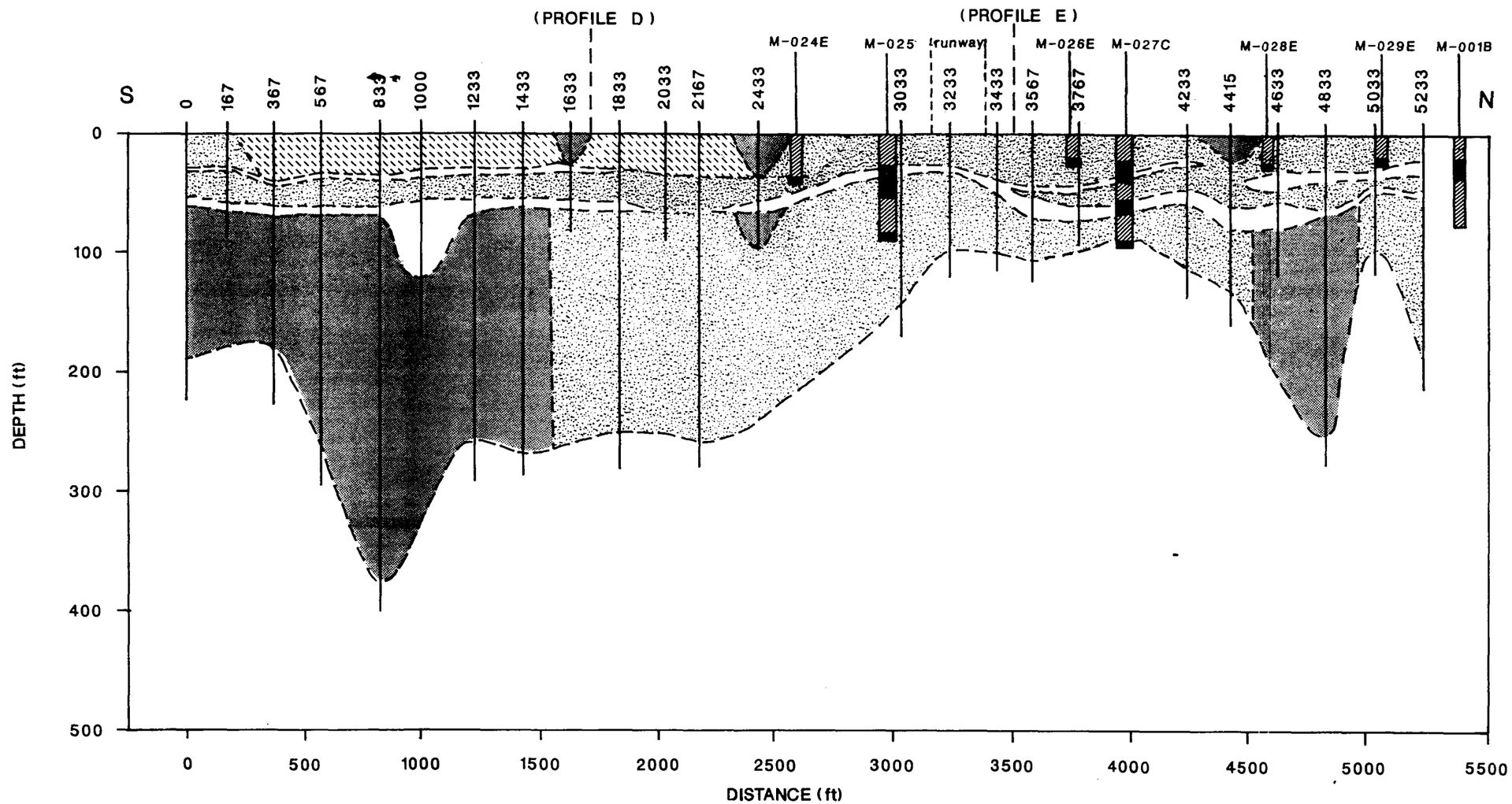
2. No survey coverage within dashed line due to surface debris.

0 100 200 400 (ft)

Scale

NORCAL GEOPHYSICAL CONSULTANTS			VERTICAL MAGNETIC GRADIENT ANOMALY MAP SOUTH AREA	PLATE 4
JOB: 91-157.10	APPR:	DATE: 7/91	West Beach Landfill NAS Alameda, Ca.	

PROFILE A



RESISTIVITY UNITS

1 ≤ 30 OHM - FT

2 31 - 175 OHM - FT

3 175 - 1000 OHM - FT

4 ≥ 1000 OHM - FT

LEGEND

833 — TEM Sounding Number and Location (Vertical line indicates total depth of computed model)

Interpreted Resistivity Boundary

SIMPLIFIED BORING LOG

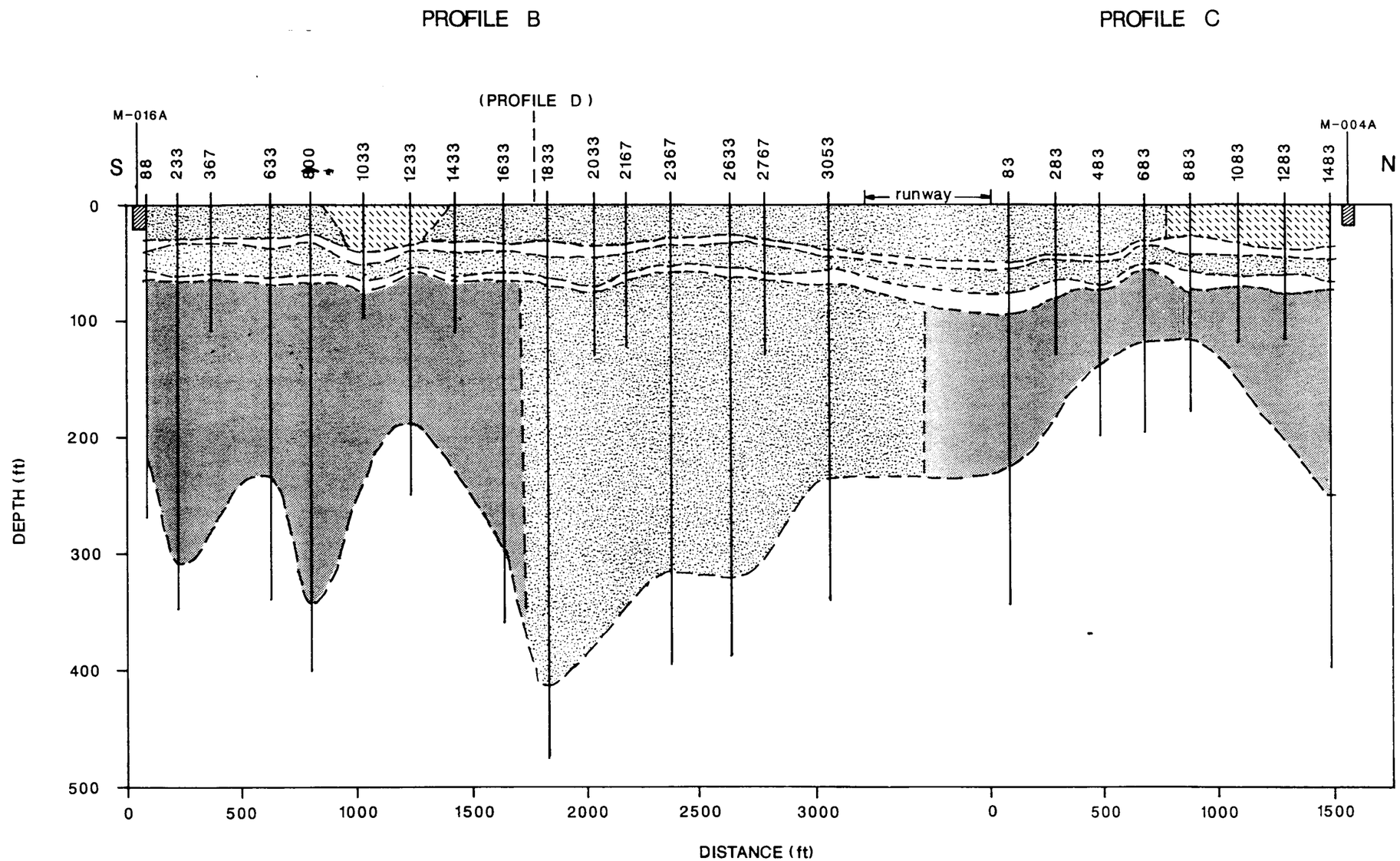
M-024E — boring location

clays and silts

sands, gravels and fill

NOTE : Vertical exaggeration = 5 :1

NORCAL GEOPHYSICAL CONSULTANTS		TRANSIENT ELECTROMAGNETIC PROFILE A	PLATE 5
JOB: 91-157.10	APPR: WEB	DATE: 7/91	West Beach Landfill Alameda NAS, Ca.



RESISTIVITY UNITS

1 ≤ 15 OHM - FT

2 15 - 100 OHM - FT

3 100 - 1000 OHM - FT

4 ≥ 1000 OHM - FT

NOTE : Vertical exaggeration = 5 :1

LEGEND

1833 TEM Sounding Number and Location
(Vertical line indicates total depth of computed model)

Interpreted Resistivity Boundary

SIMPLIFIED BORING LOG

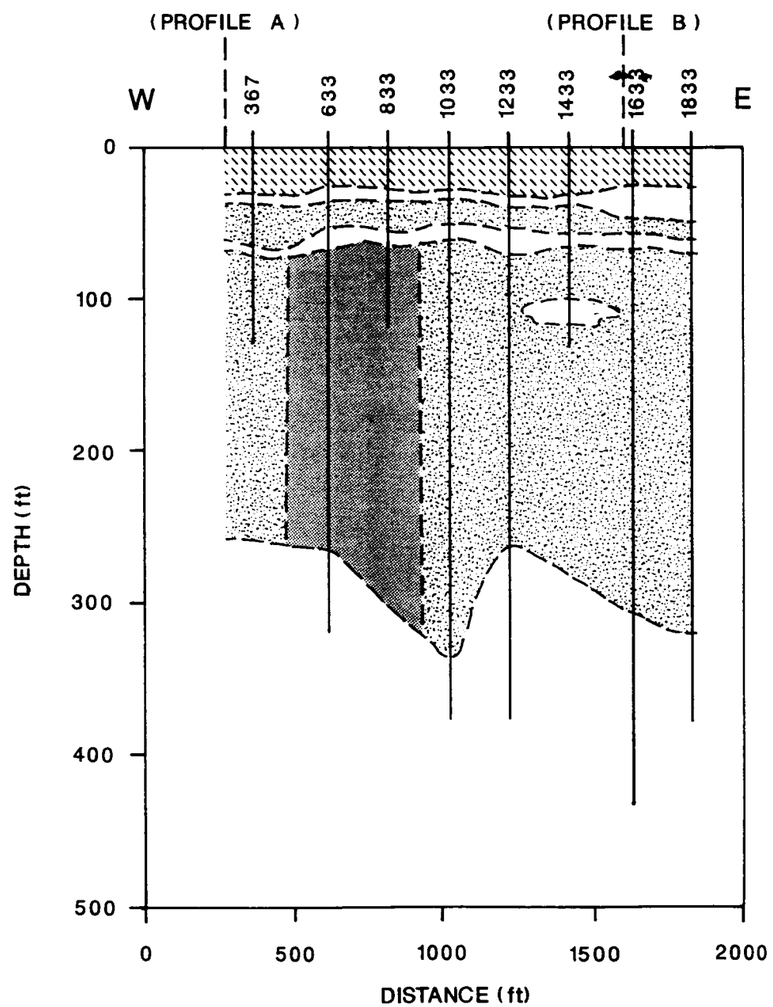
M-016A boring location

sands, gravels and fill

NORCAL GEOPHYSICAL CONSULTANTS			TRANSIENT ELECTROMAGNETIC PROFILES B and C
JOB: 91-157.10	APPR:	DATE: 7/91	West Beach Landfill Alameda NAS, Ca.

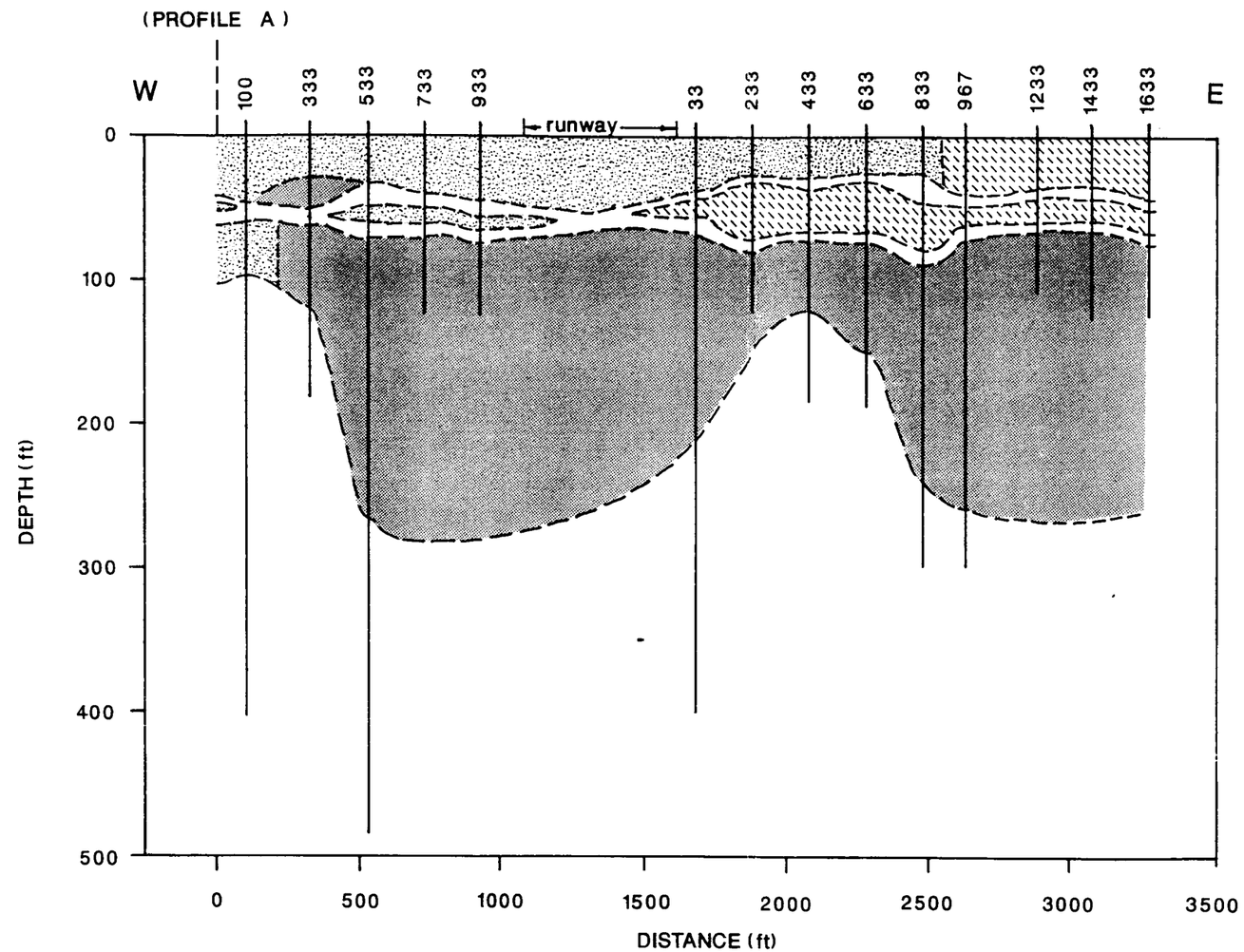
PLATE 6

PROFILE D



PROFILE E

PROFILE F



RESISTIVITY UNITS

1 ≤ 16 OHM - FT

2 16 - 80 OHM - FT

3 250 - 800 OHM - FT

4 ≥ 900 OHM - FT

NOTE : Vertical exaggeration = 5 :1

LEGEND

1833 — TEM Sounding Number and Location (Vertical line indicates total depth of computed model)

Interpreted Resistivity Boundary

NORCAL GEOPHYSICAL CONSULTANTS			TRANSIENT ELECTROMAGNETIC PROFILES D, E and F
JOB: 91-157.10	APPR: web	DATE: 7/91	West Beach Landfill Alameda NAS, Ca.

PLATE 7

NORCAL

APPENDIX A

METHODOLOGY

METHODOLOGY

A. Magnetometer Survey

A magnetometer is used to measure the earth's magnetic field at predetermined points distributed along a profile or in a grid pattern. Local variations in the measured values, when corrected for temporal fluctuations, can be attributed to geologic variations and/or the presence of buried ferrous material. Typical proton precession magnetometers have a single sensor mounted on a staff that is held vertical for each measurement. These instruments measure the total intensity of the earth's magnetic field and read out directly in gammas. Some magnetometers have two sensors and can record not only the total intensity of the earth's magnetic field (total field), but also its vertical gradient (gradiometer). A gradiometer provides higher sensitivity and better resolution of near surface sources than a total field magnetometer. Areas with significant amounts of buried metal typically produce anomalously steep magnetic gradients.

Magnetometer surveys are typically used to determine the presence of buried ferrous objects and to define the general limits of fill containing metallic debris. The depth of investigation for magnetic surveys depends on the size of the target but is generally in the upper 20 feet.

We used an EDA OMNI IV tie-line magnetometer to obtain the magnetic data. The instrument features a built-in memory that stores the vertical gradient and total field data, as well as survey grid information. The information can be

down-loaded to a computer for further processing.

B. Transient Electromagnetic Survey

Transient electromagnetics (TEM), also referred to as time-domain EM, is a geophysical method for measuring the electrical properties of the earth without direct ground contact. High frequency electrical current is transmitted into a single conductor wire laid on the ground surface in a rectangular loop. When the current in the wire is rapidly cut-off, electromagnetic induction causes electrical current to flow at the earth's surface. The amount of current induced in the earth is directly proportional to the amount of current flowing in the wire before cut-off, and the effective area of the transmitter loop (area enclosed by loop times number of turns). As the induced current diffuses downward into the earth, an associated secondary magnetic field is detected by a receiver coil. The measured signal is sampled at numerous, closely spaced time intervals (channels), as the field decays. The sampling is repeated several times in rapid succession as the current in the transmitter loop is turned on and off. The rate at which the on/off cycles are repeated is referred to as the repetition rate. The sampled signals are algebraically summed (stacked) to enhance the signal strength and minimize the influence of spurious noise (interference). The data in each channel can be displayed or printed out in units of voltage, apparent conductivity, or apparent resistivity versus time.

The data obtained at a single station can be interpreted as a vertical electric

sounding (VES). This involves using computer assisted inverse modeling techniques to derive a layered earth model indicating the variation in electrical resistivity with depth. Alternatively, the apparent resistivity or conductivity values measured at a series of stations can be plotted as profiles or contoured to indicate the vertical and lateral distribution of electrical properties. For the VES interpretation, it is often desirable, although not necessary, to obtain data using multiple repetition rates. This provides a longer and more detailed sampling of the decay curve, than that provided by a single repetition rate.

NORCAL

APPENDIX B

DATA ACQUISITION

DATA ACQUISITION

A. Magnetometer Survey

We measured the total intensity and vertical gradient of the earth's magnetic field at points distributed at 20 foot centers in a rectangular grid pattern in the North Area and the South Area. In the North Area this resulted in a total of 4200 data points. In the South Area we occupied 444 data points. In both areas we selected a central location as a base station. We reoccupied this location at 30 minute intervals throughout each survey day. This was done in order to provide information that could be used to correct the total field data for temporal fluctuations in the earth's magnetic field.

B. Transient Electromagnetics

We performed the TEM survey using a Geonics Protem EM-37. This system was configured with a multi-turn receiver coil with a diameter of 1 meter (31.4 square meter effective area), and a single turn transmitter loop that measured 20 by 20 meters (400 square meter effective area). At each sounding location the receiver coil was offset 10 meters from the edge of the transmitter loop, the center of which was considered the station location.

We obtained TEM data at approximately 200 foot intervals along a series of north-south and east-west trending profiles ranging in length from 900 to 5200 feet. This resulted in a total of 70 TEM stations. At each station, we obtained TEM data by transmitting 3 amps (the maximum level for this instrument) at repeti-

tion rates of 30, 75, and 315 Hertz (Hz). These frequencies sample the decay curve in overlapping time windows thus providing detailed information throughout the entire obtainable depth range. All of the TEM data were stored in memory and were later down-loaded to a computer for processing.

N00236.000848
ALAMEDA POINT
SSIC NO. 5090.3

APPENDIX C – DATA ANALYSIS

APPENDIX H – GEOPHYSICAL REPORT/DATA

FINAL
SOLID WASTE WATER QUALITY ASSESSMENT TEST AND DATA SUMMARY REPORT FOR REMEDIAL INVESTIGATION/FEASIBILITY STUDY FOR PHASES 5 AND 6

DATED 30 APRIL 1993

DATA ANALYSIS

A. Magnetics

We used program MAGDMP88, written by EDA Instruments, to download the total field, vertical gradient, and base station data to a computer. We then used a proprietary program to correct the total field data for temporal variations. Since gradient measurements are immune to the effect of distant sources, no drift corrections were required for the vertical gradient data.

We used the software package SURFER by Golden Software of Golden, Colorado to grid, plot, and contour the corrected total field and the vertical gradient data. We removed a value of 49,000 gammas from all of the readings in order to minimize the size of the contour labels. The magnetic total field contours of the north and south areas are shown on Plates C1 and C3, respectively. The vertical magnetic gradient contours of the north and south areas are shown on Plates C2 and C3, respectively.

B. Transient Electromagnetics

We used the software package GSPX7, written by Geonics Ltd. of Toronto, Canada to download the TEM data to a computer and reduce the instrument response to values of apparent resistivity. We then used the software package TEMIXGL written by INTERPEX LTD. of Golden, Colorado to invert the data obtained at the TEM stations to one dimensional layered earth models (see Appendix D). This software uses equations based on the ridge regression method

to invert the data. The program is interactive, allowing the user to control the interpretation process.

The typical procedure is for the interpreter to enter a preliminary model into the computer. The program computes the theoretical curve corresponding to this model. The user then compares the theoretical and model (observed data) curves, both of which are displayed on the screen. If the fit is not relatively close, the model can be adjusted, by adding or subtracting layers or altering thicknesses and resistivities as necessary. Once a model has been derived that provides a relatively good fit to the model curve, the software carries on the inversion process. The program repeatedly computes curves and adjusts the thickness and resistivity parameters, until the closest possible fit between the theoretical and model curves has been achieved.

N00236.000848
ALAMEDA POINT
SSIC NO. 5090.3

PLATES

APPENDIX C – DATA ANALYSIS

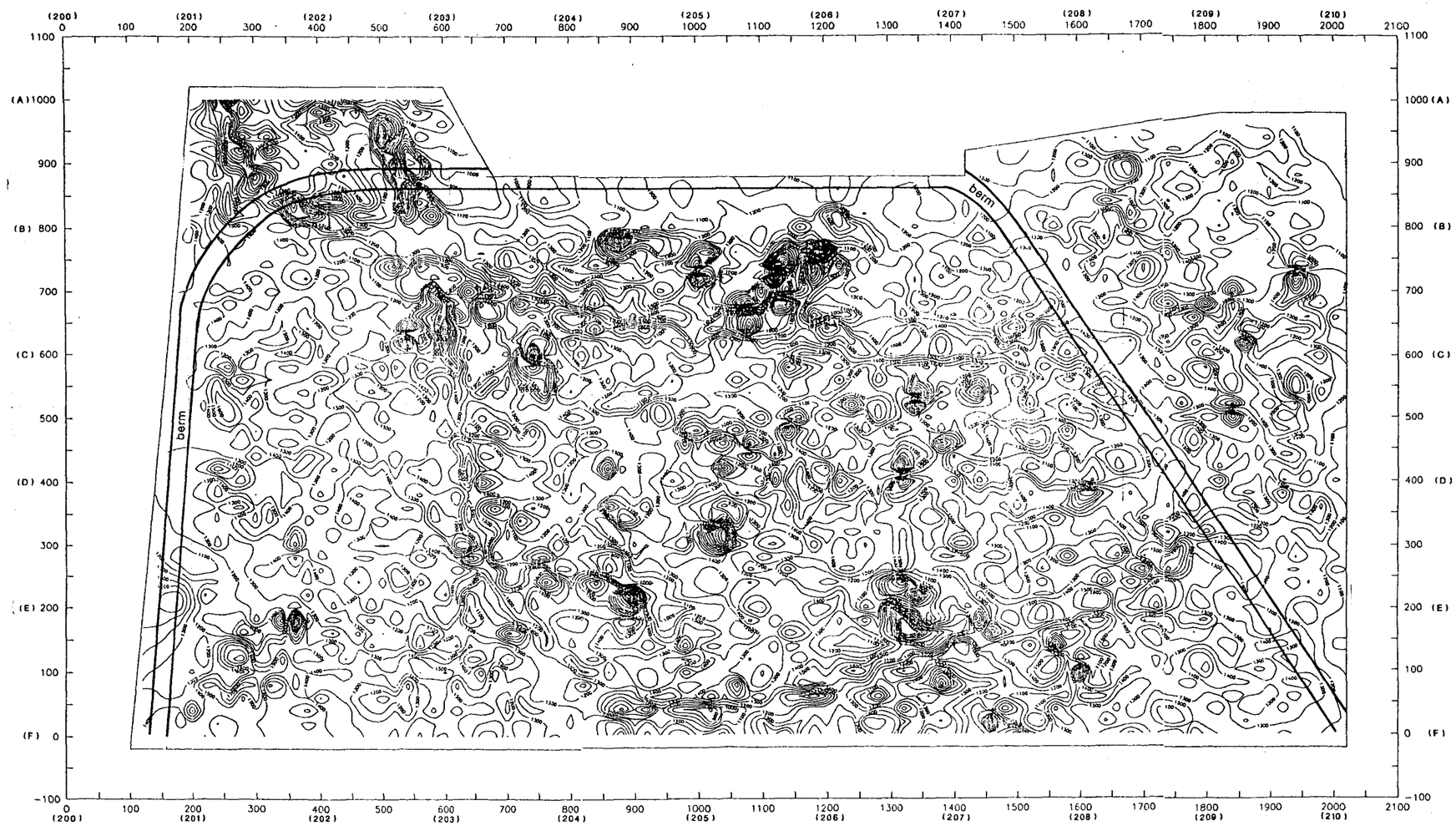
APPENDIX H – GEOPHYSICAL REPORT/DATA

FINAL
SOLID WASTE WATER QUALITY ASSESSMENT TEST AND DATA SUMMARY REPORT FOR REMEDIAL INVESTIGATION/FEASIBILITY STUDY FOR PHASES 5 AND 6

DATED 30 APRIL 1993

TOTAL FIELD MAGNETIC CONTOURS

Contour Interval = 100 gammas (−49,000)



MAGNETIC TOTAL FIELD ANOMALY MAP

NORTH AREA

West Beach Landfill
Naval Air Station Alameda
Alameda County, California

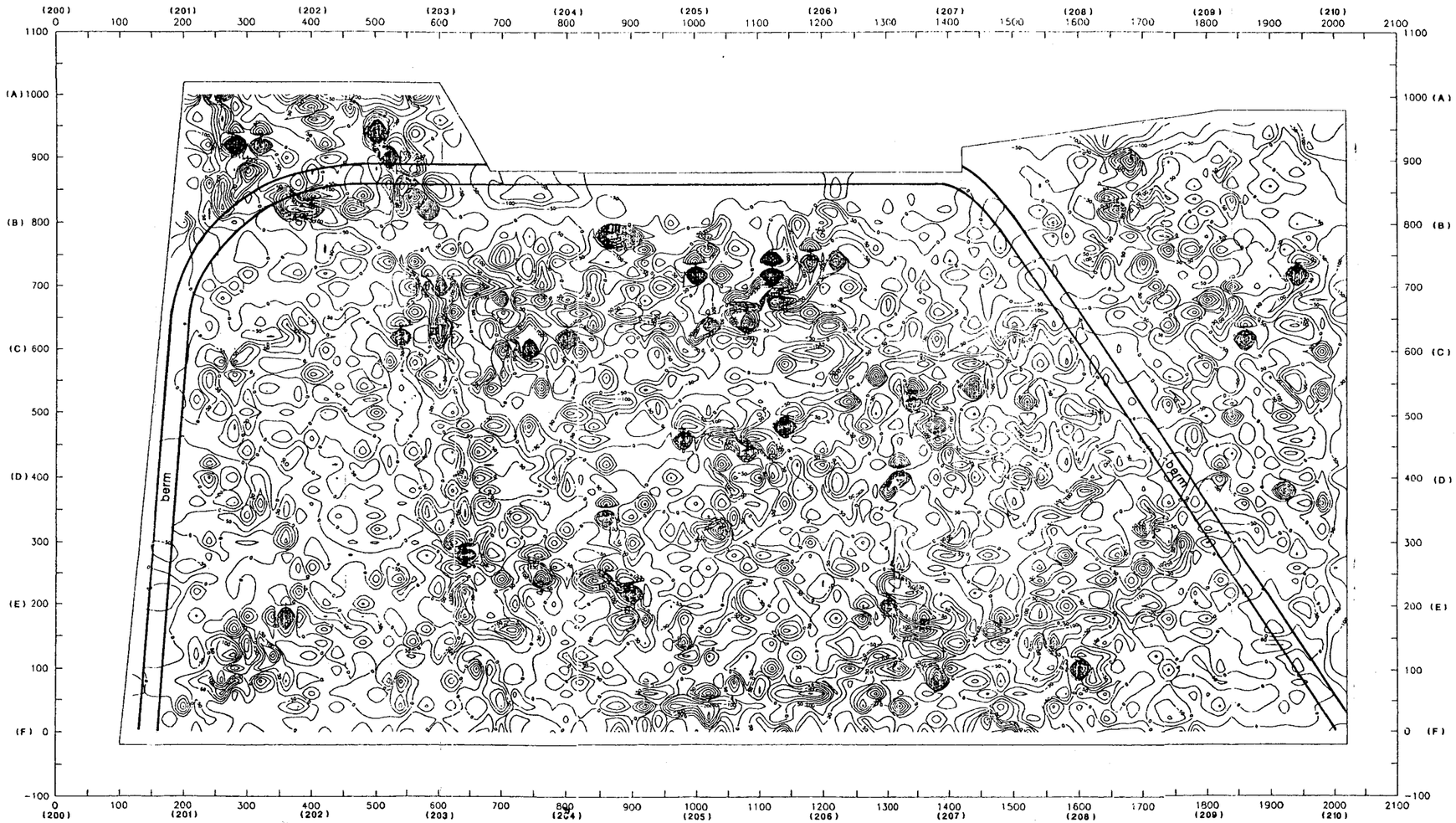
NORCAL
GEOPHYSICAL CONSULTANTS

Job No.:	Drawn By:	Approved:	Date:	Plate
91-157.10	JH	WEB	7/91	C1

NOTE : Letters and numbers in parentheses for NORTHING and EASTING are J.M.M. line designations.

VERTICAL MAGNETIC GRADIENT CONTOURS

Contour interval = 50 gammas/meter



N

0 50 100 200 (ft)
Scale

NOTE : Letters and numbers in parentheses for NORTHING and EASTING are J.M.M. line designations.

VERTICAL MAGNETIC GRADIENT ANOMALY MAP
NORTH AREA

West Beach Landfill
Naval Air Station Alameda
Alameda County, California

NORCAL
GEOPHYSICAL CONSULTANTS

Job No.:	Drawn By:	Approved:	Date:
91-157.10	JH	WEB	7/91

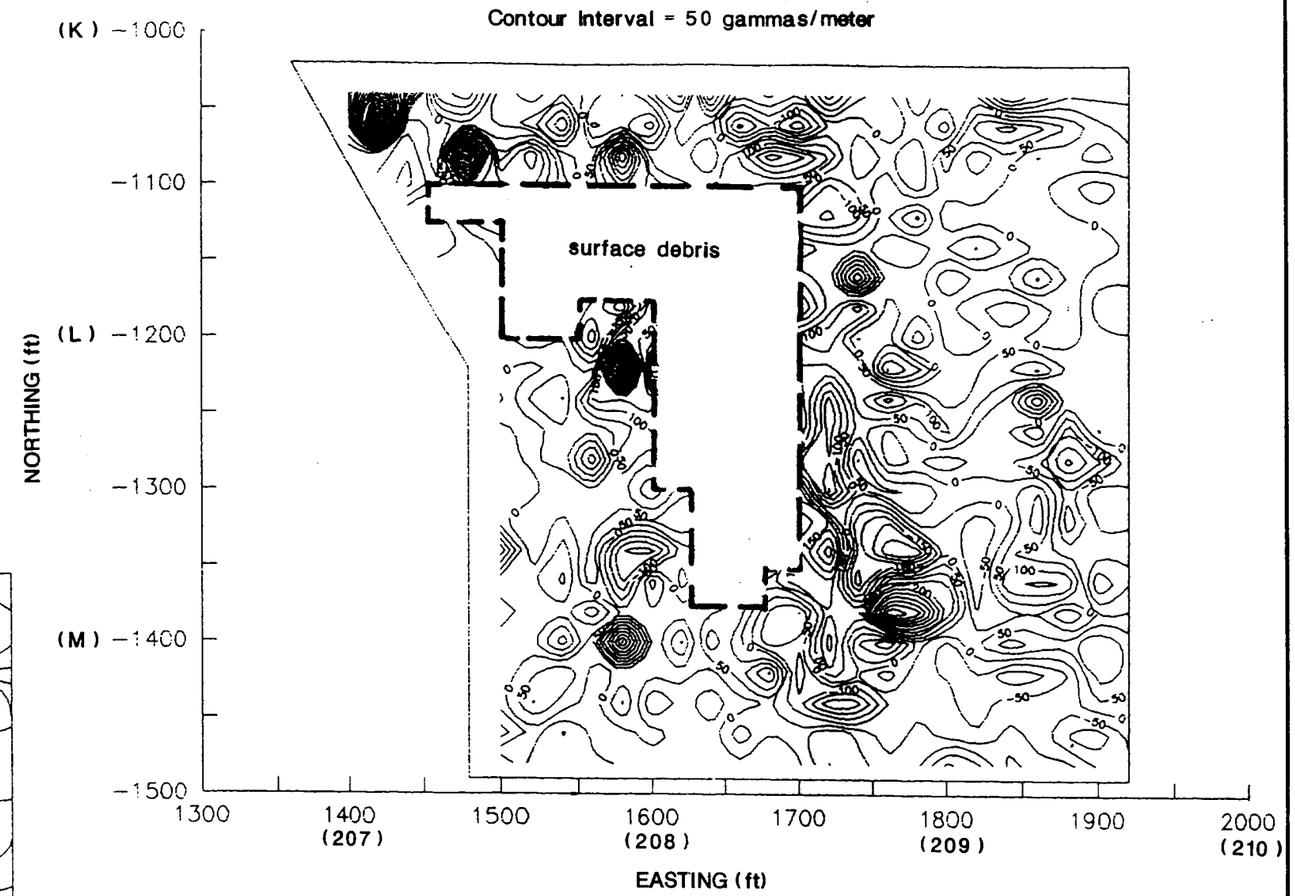
Plate
C2

NOTES : 1. Letters and numbers in parentheses for NORTHING and EASTING are J.M.M. line designations.

2. No survey coverage within dashed line due to surface debris.

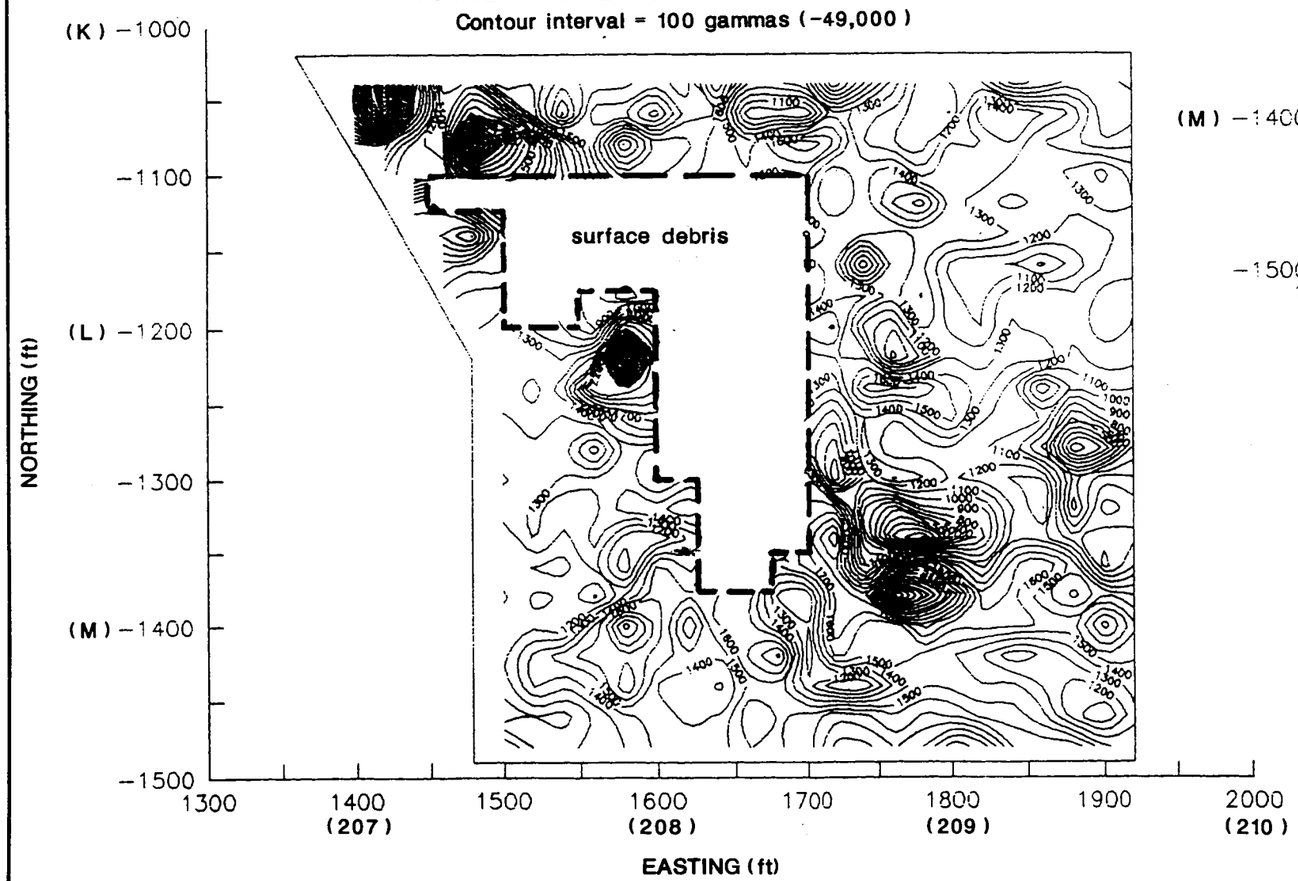
VERTICAL MAGNETIC GRADIENT CONTOURS

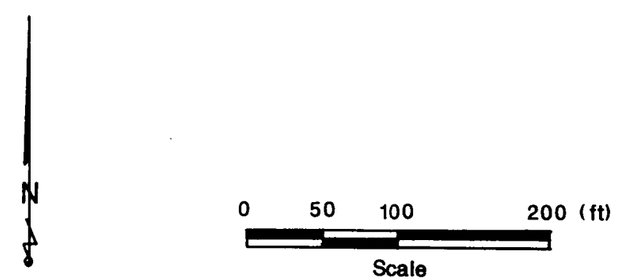
Contour Interval = 50 gammas/meter



TOTAL MAGNETIC FIELD CONTOURS

Contour interval = 100 gammas (-49,000)





NORCAL GEOPHYSICAL CONSULTANTS			MAGNETIC ANOMALY MAPS SOUTH AREA
JOB: 91-157.10	APPR: WEB	DATE: 7/91	West Beach Landfill NAS Alameda, Ca

PLATE C3

NORCAL

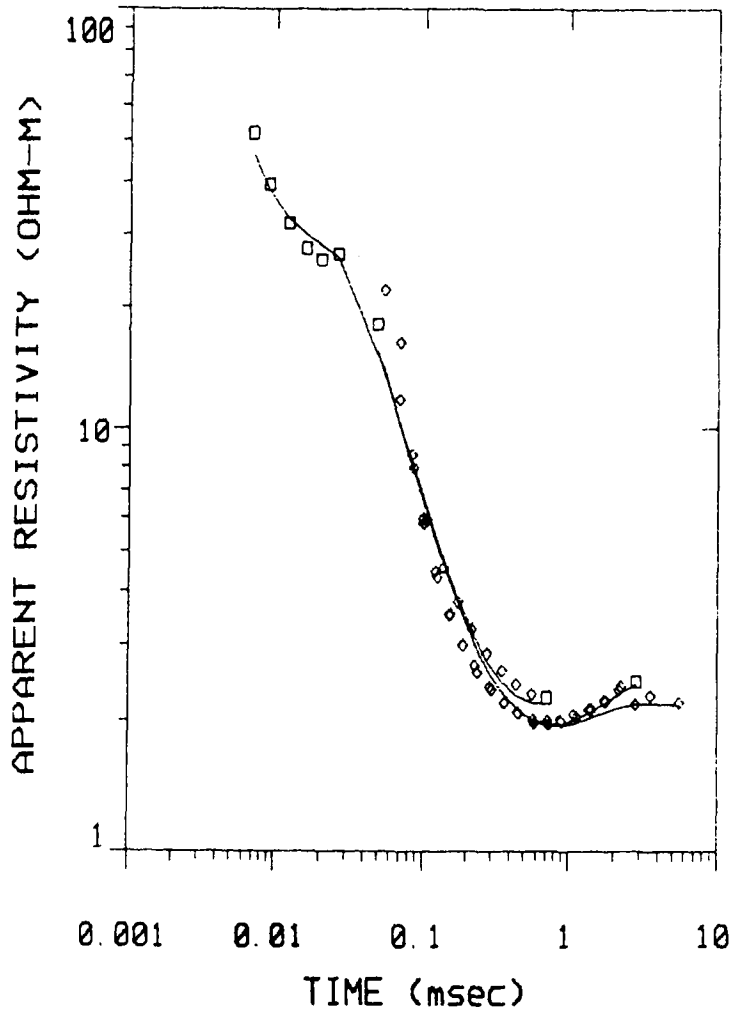
APPENDIX D

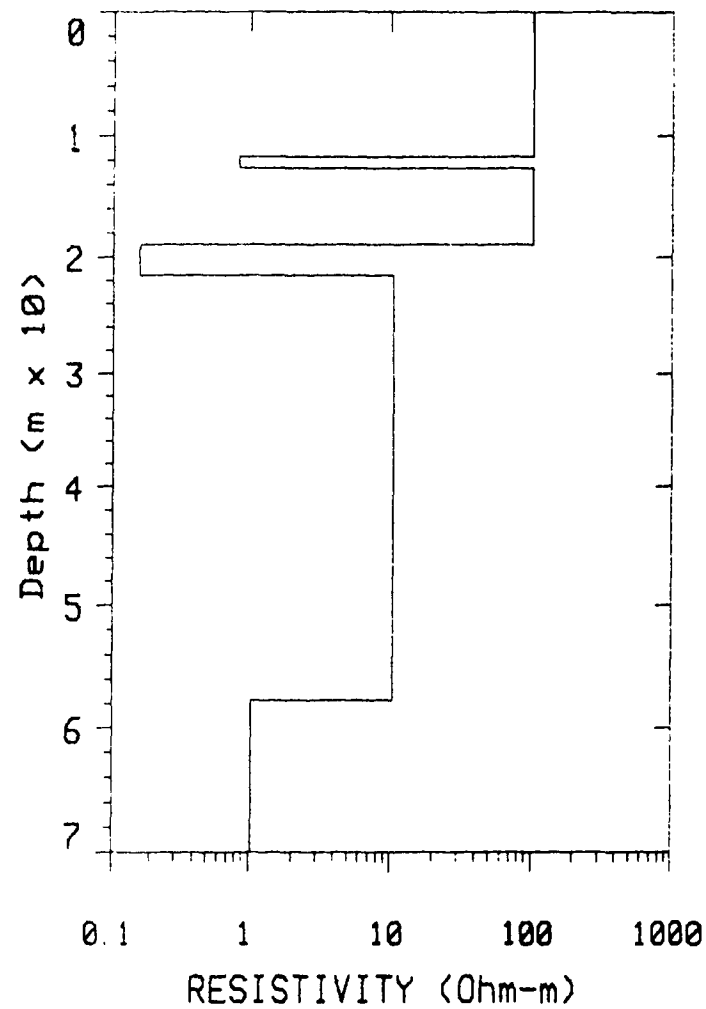
RESISTIVITY MODELS

RESISTIVITY MODELS

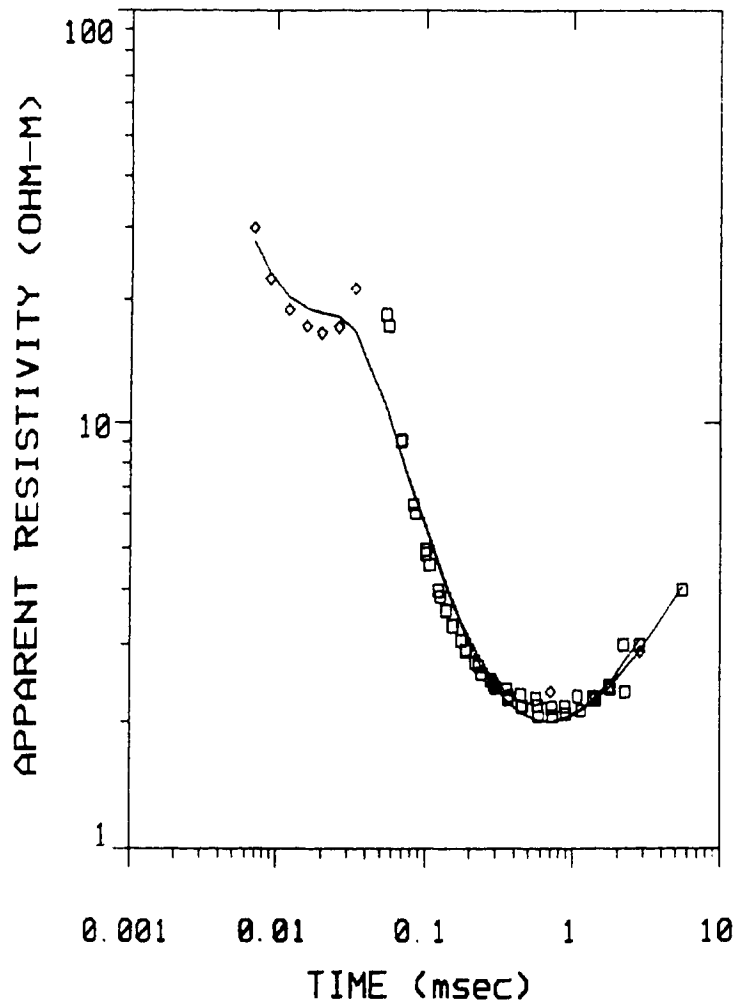
In the following diagrams, pertinent information regarding the location of each sounding is given in the title block. The right-hand portion of each diagram indicates the depth, thickness, and resistivity of each layer comprising the model. The scale varies according to the resistivity and depth range for each sounding. The left-hand portion of the diagram indicates how the model fits the observed data. The small symbols represent the observed apparent resistivities. Squares are used for resistivities computed from that portion of the signal having a positive sign. Diamonds are used for the portion of the signal having a negative sign (all of the computed resistivities are positive). The solid line represents the theoretical resistivities corresponding to the model. In most cases, the theoretical resistivities fit the observed resistivities closely. In spite of this, the resistivity models may not be unique. The Principal of Equivalence indicates that there may be other models that could fit the observed data. This is particularly true when there is a large contrast between layers.

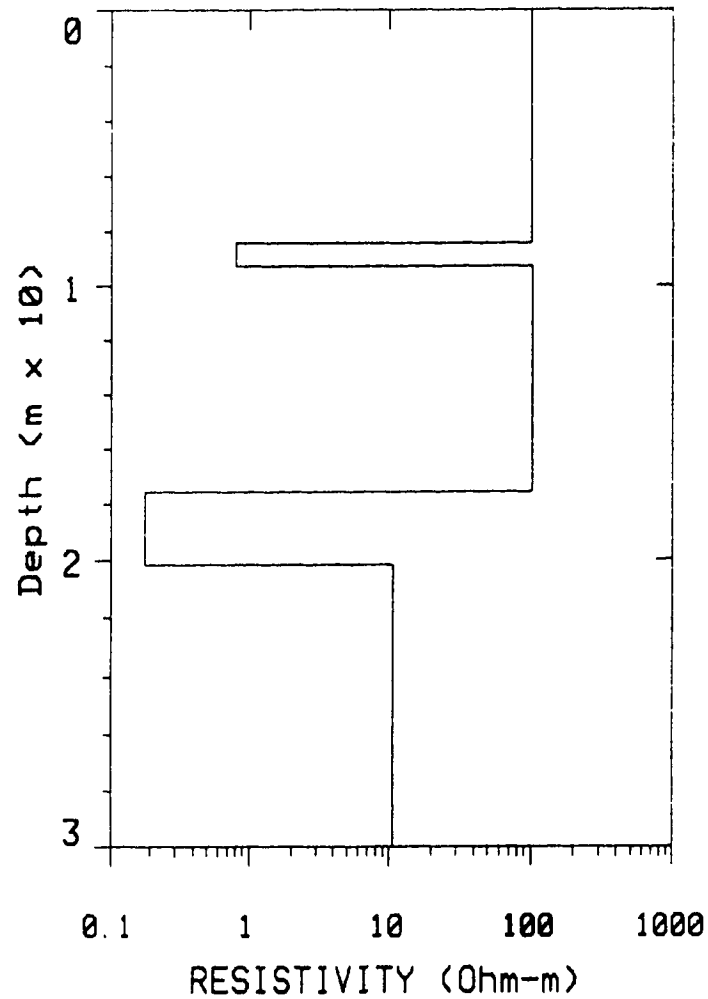
Most of the sounding curves indicate a steep, upward spike in the descending, left-hand portion of the curve. We modelled this spike as a high resistivity layer. However, it is so steep that no model could be derived to closely fit it. This opens the possibility that the spike is not related to subsurface conditions. Alternatively, it may be an artifact of the separation between the transmitter loop and receiver coil, or it could be caused by spurious noise.



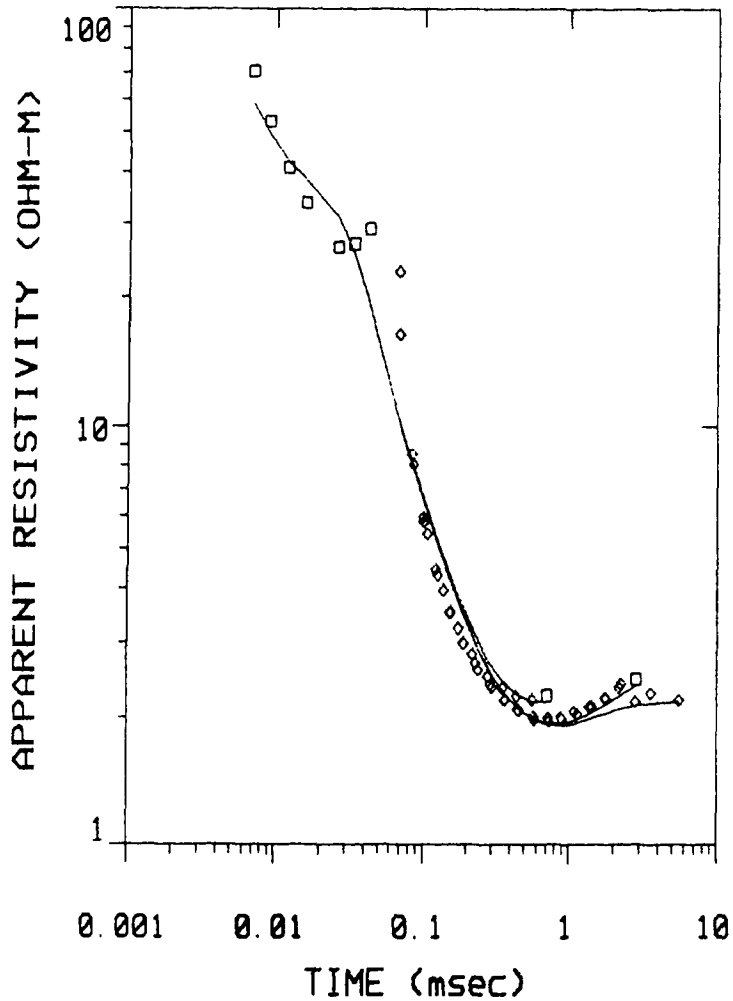


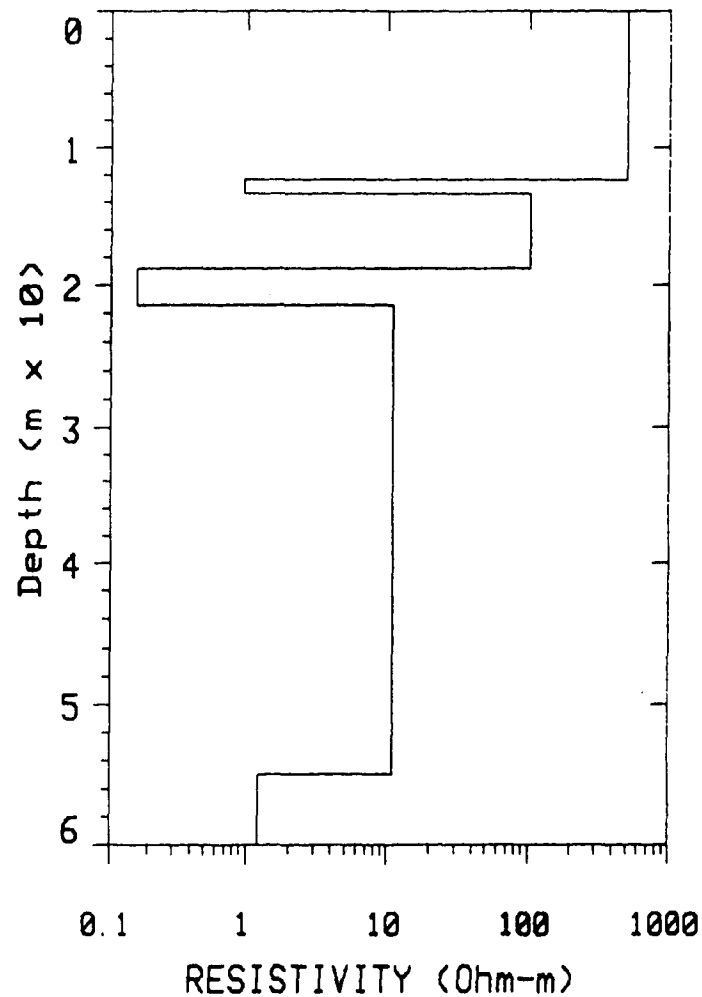
for: J. M. Montgomery	West Beach Landfill
by Norcal Geophysical Consultants, Inc	Alameda NAS Alameda County, CA
Data Set ANASA — Date: 5/30/91	
Equipment Geonics PROTEM — unding 0A	LOOP SIZE: 20. m



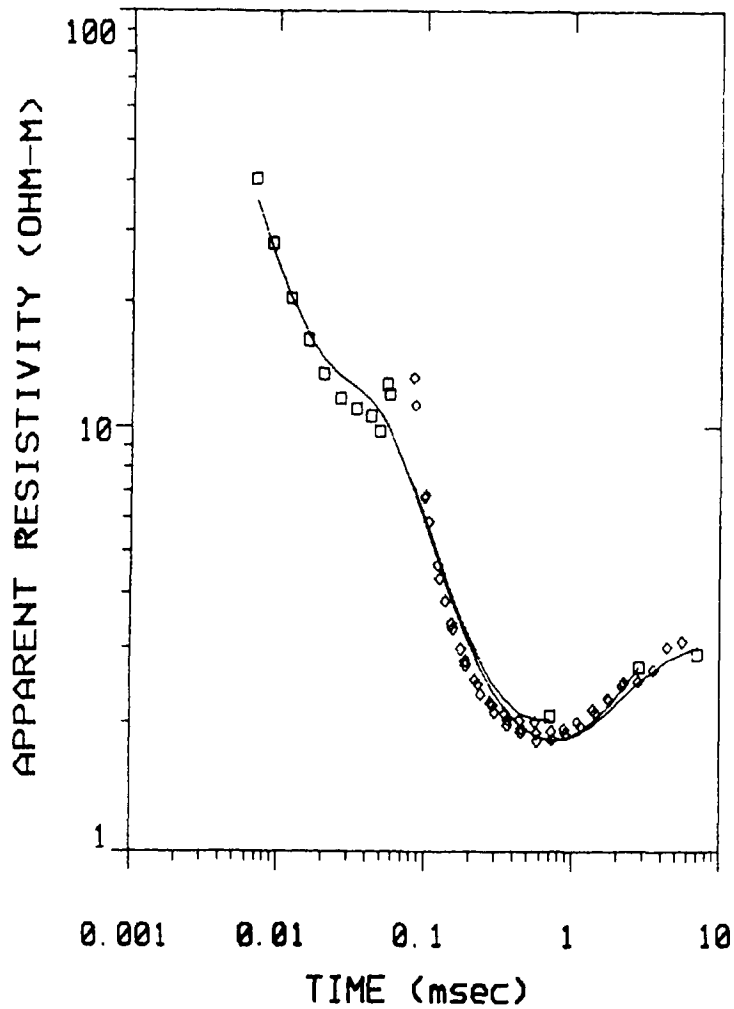


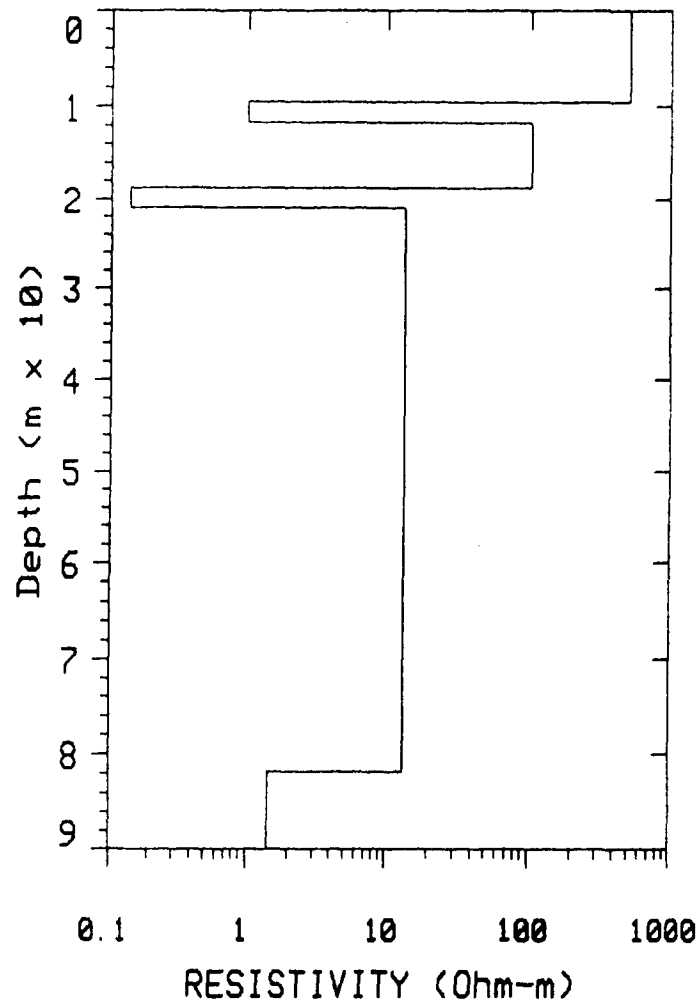
for: J. M. Montgomery	West Beach Landfill
by: Norcal Geophysical Consultants, Inc.	Alameda NAS Alameda County, CA
Data Set: ANASA — Date: 5/30/91	
Equipment: Geonics PROTEM — Sounding: 167A	LOOP SIZE: 20. m





for: J. M. Montgomery	West Beach Landfill
by: Norcal Geophysical Consultants, Inc	Alameda NAS Alameda County, CA
Data Set: ANASA — Date: 5/30/91	
Equipment: Geonics PROTEM — Funding: 367A	LOOP SIZE: 20. m





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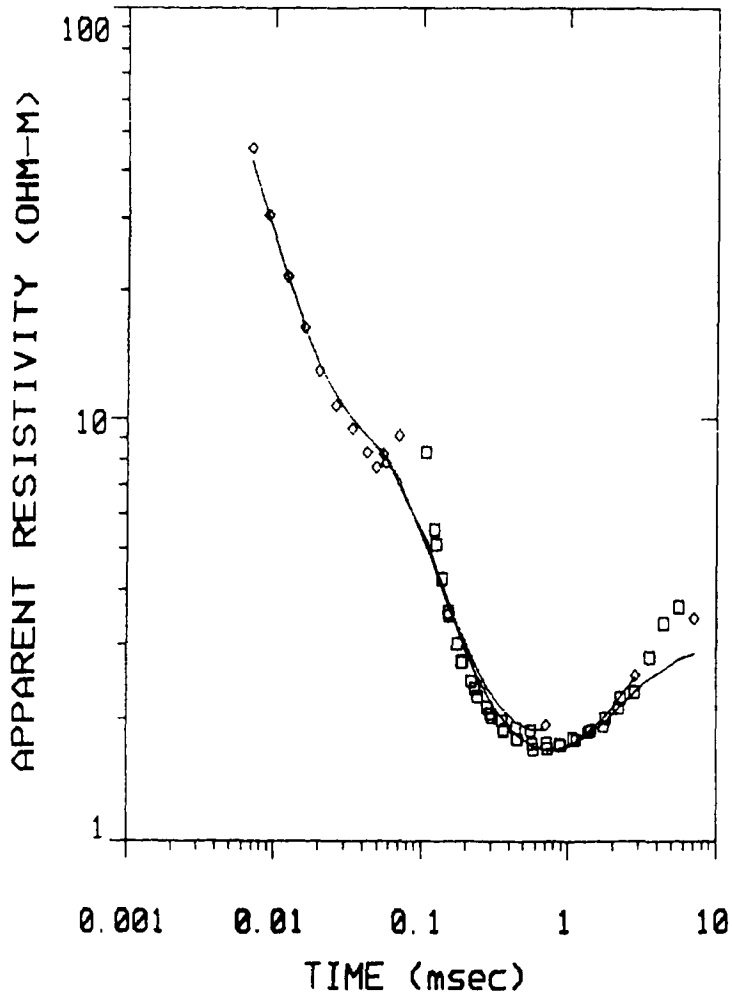
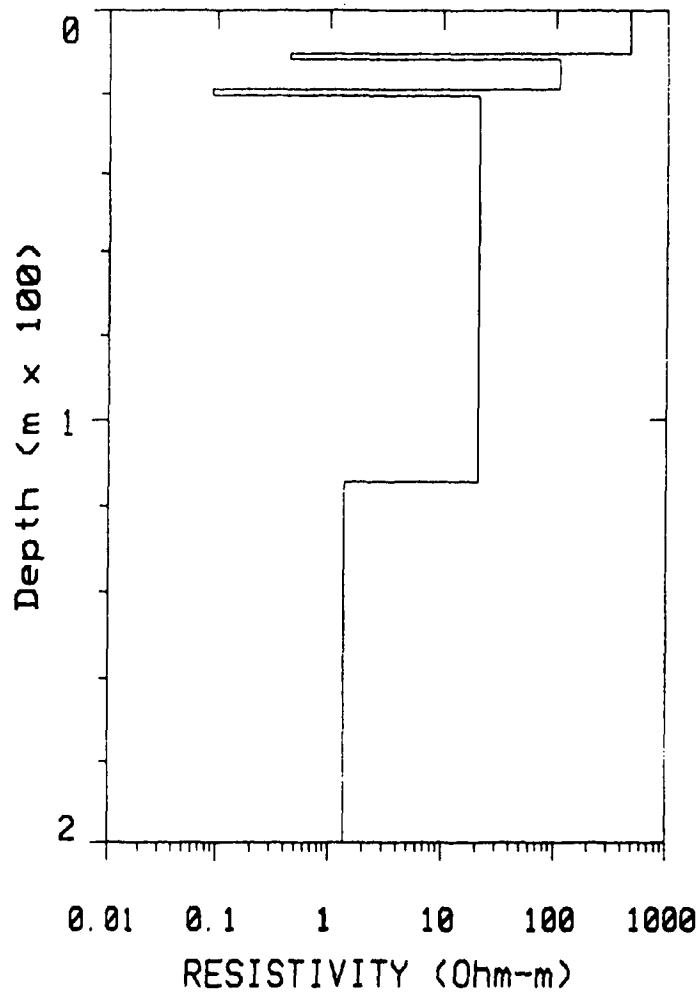
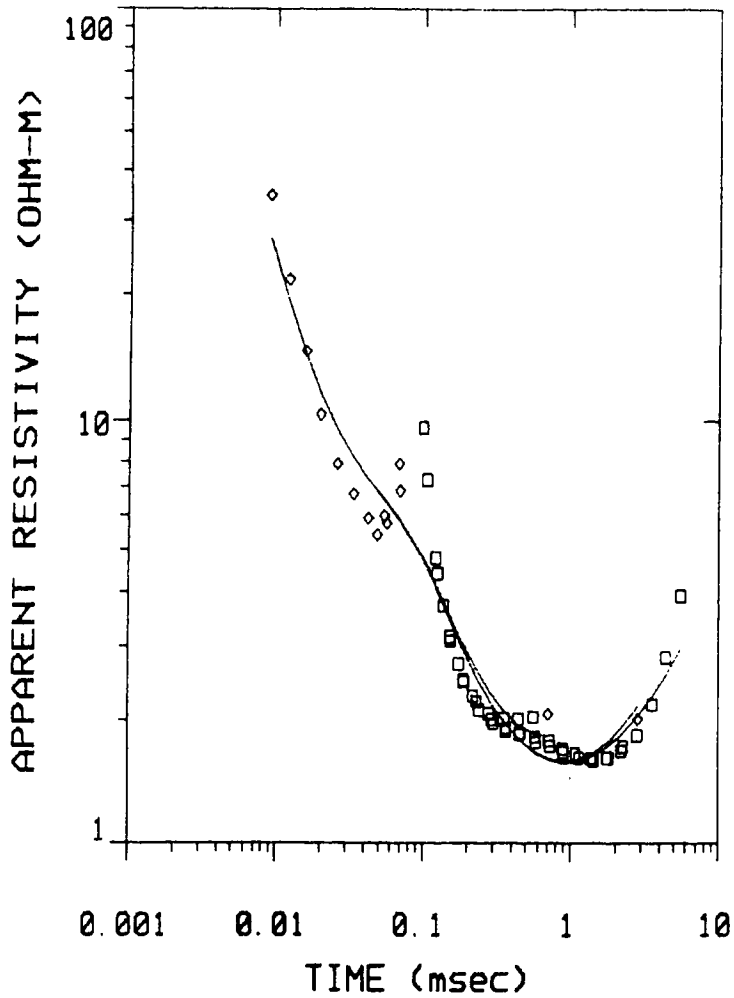
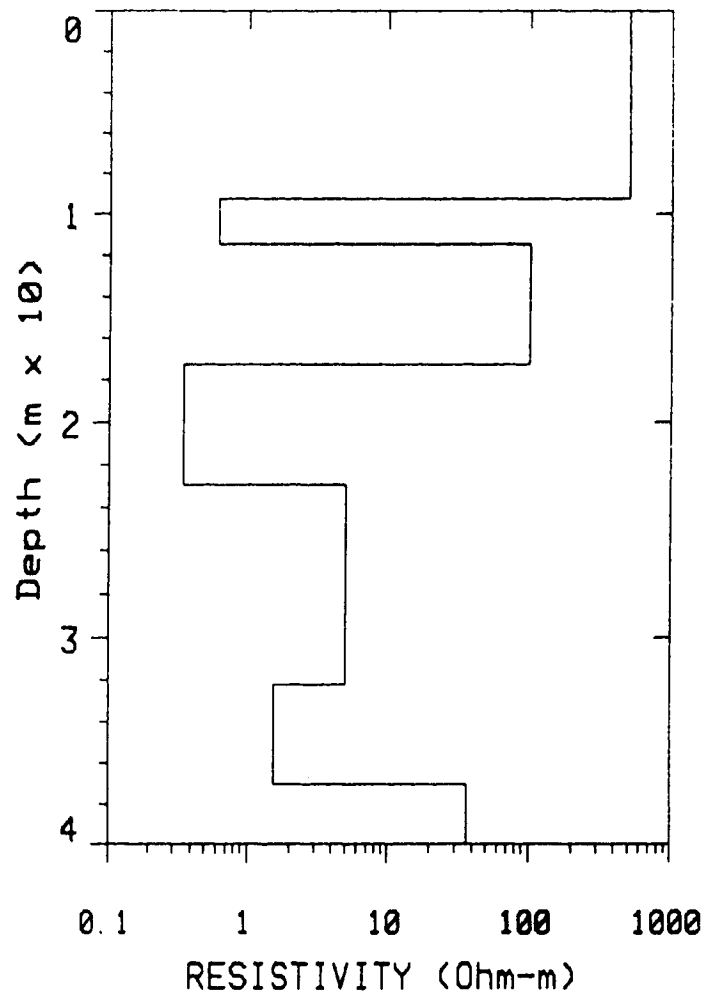
by: Norcal Geophysical Consultants, Inc.		Alameda NAS Alameda County, CA
Data Set: ANASA	Date: 530	
Equipment: Geonics PROTEM	Sounding: 567A	LOOP SIZE: 20. m





for: J. M. Montgomery	West Beach Landfill
by Norcal Geophysical Consultants, Inc.	Alameda NAS Alameda County, CA
Data Set: ANASA — Date: 5/30/91	
Equipment: Geonics PROTEM — Funding: 833A	LOOP SIZE: 20. m





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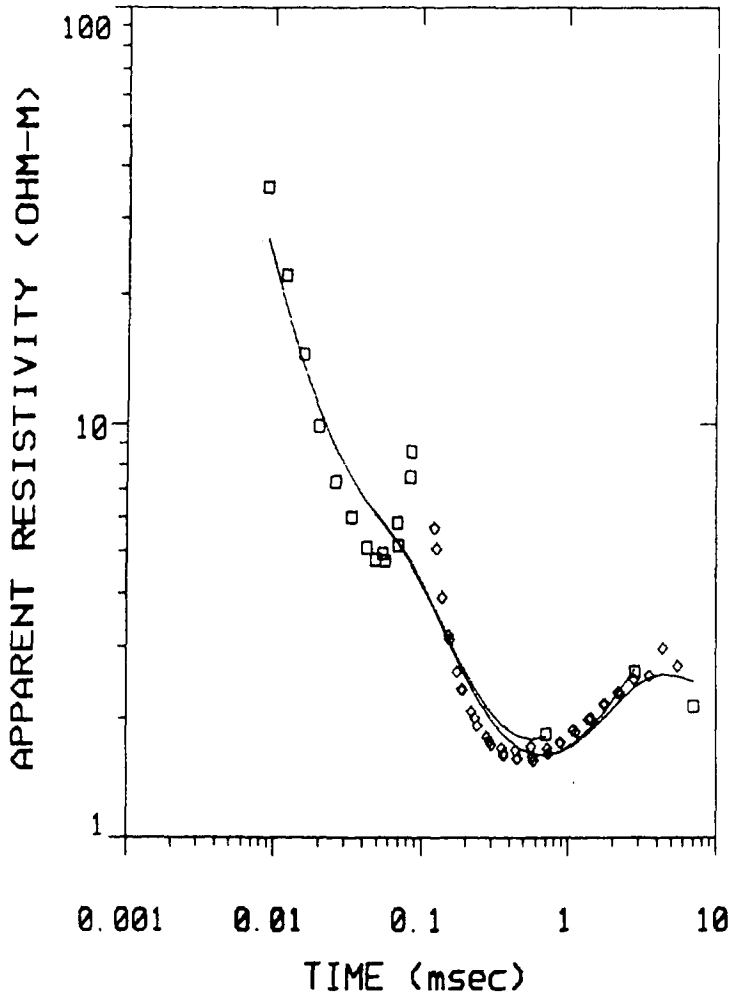
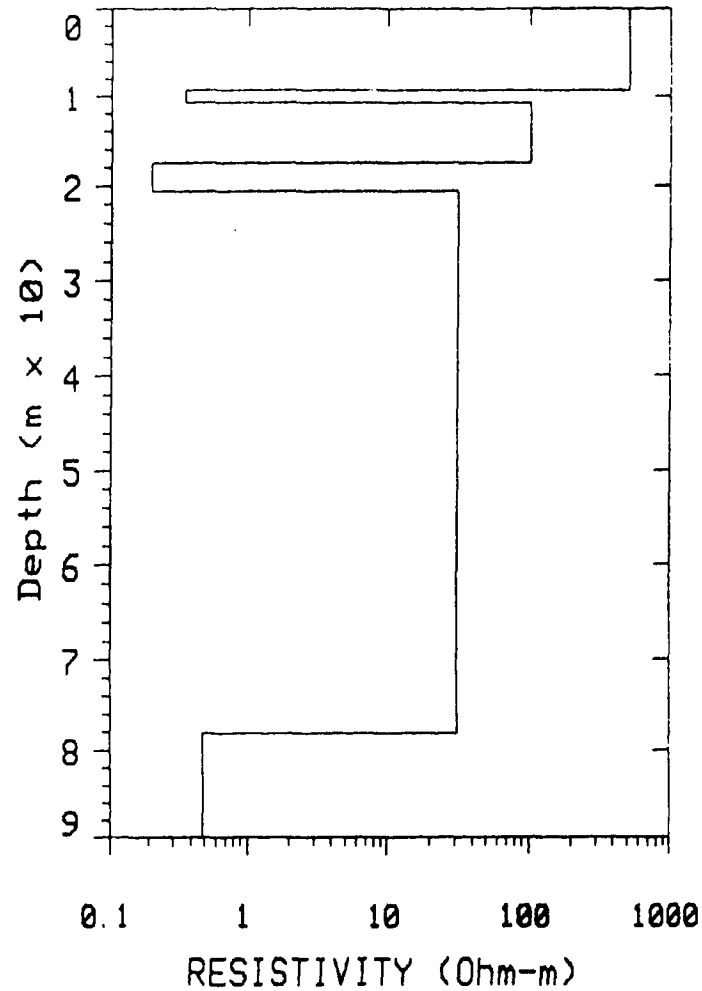
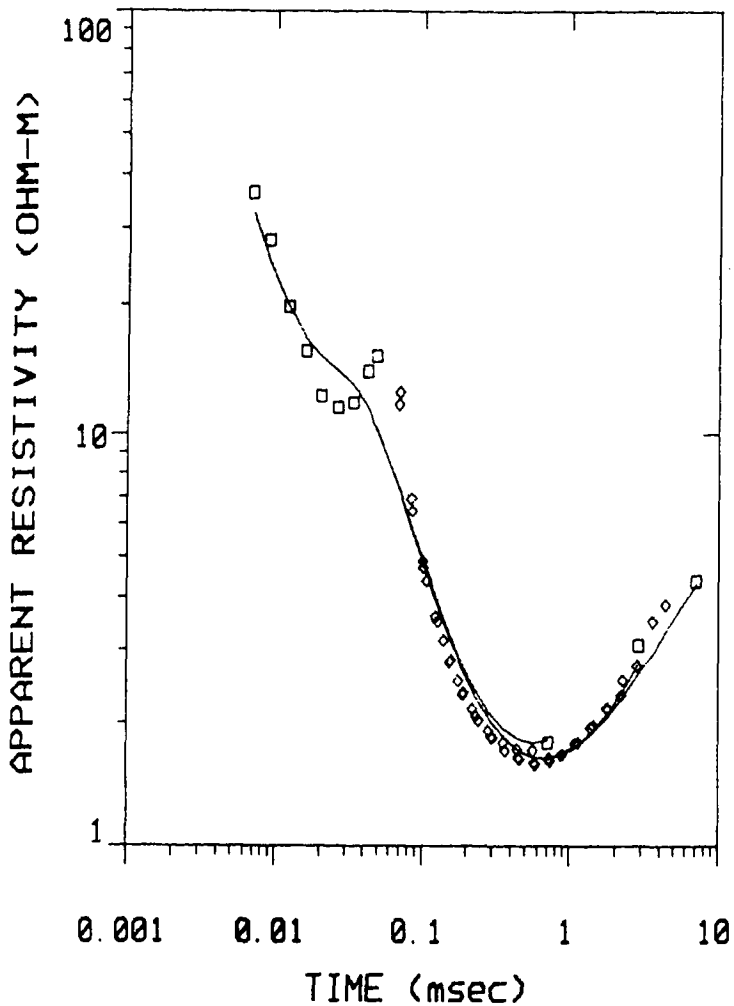
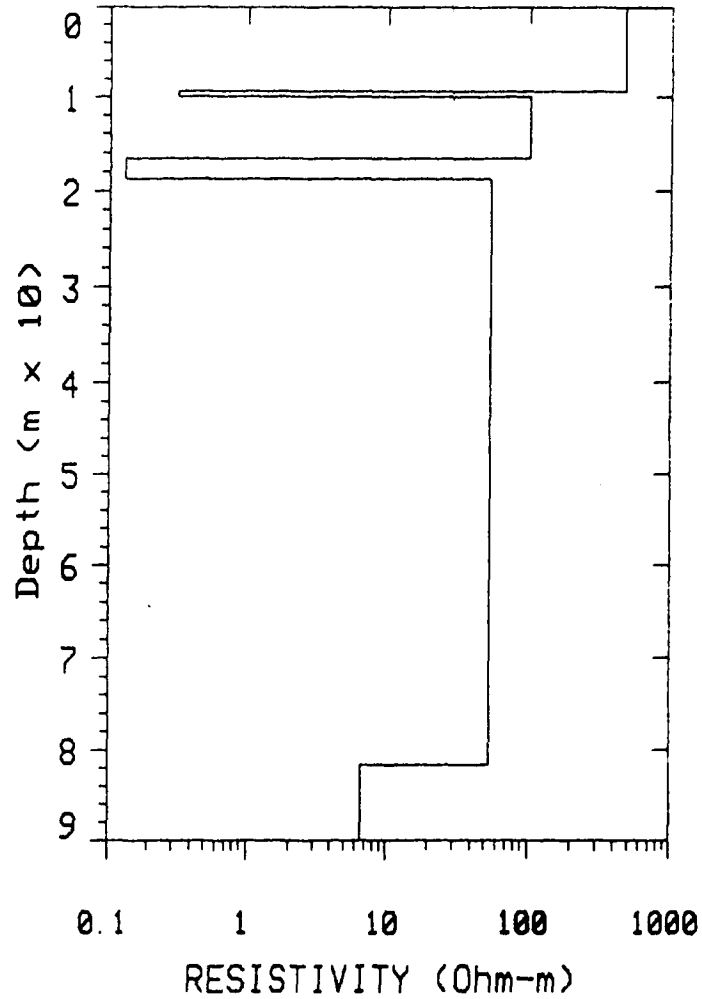
by: Norcal Geophysical Consultants, Inc.	Alameda NAS Alameda County, CA
Data Set: ANASA — Date: 5/30/91	
Equipment: Geonics PROTEM — Sounding: 1000A	LOOP SIZE: 20. m



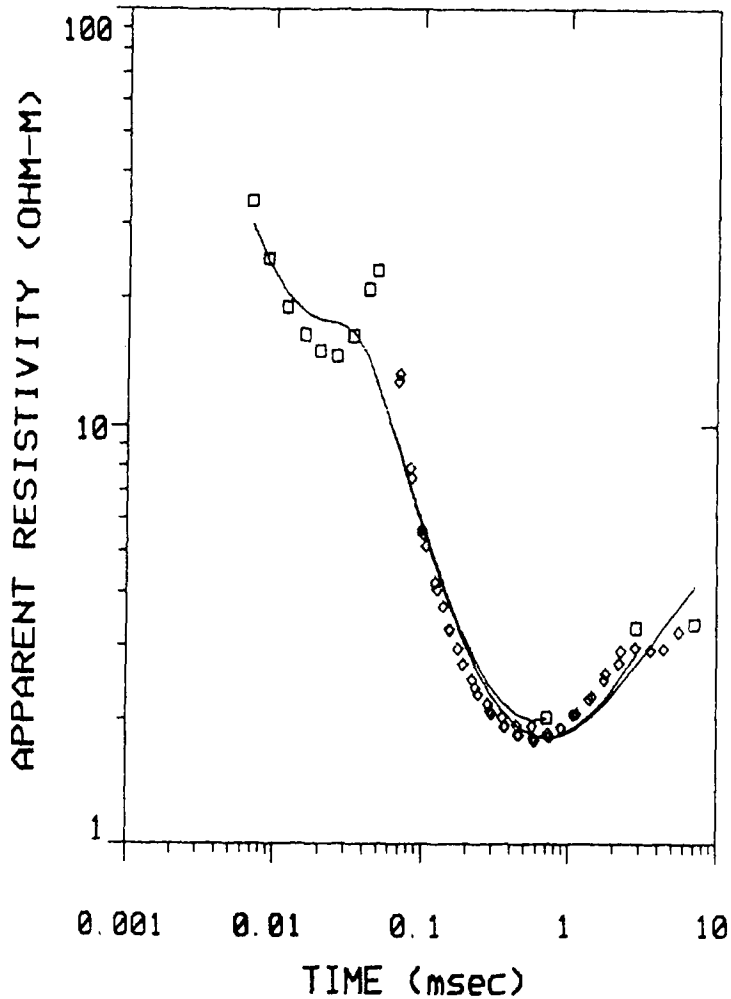


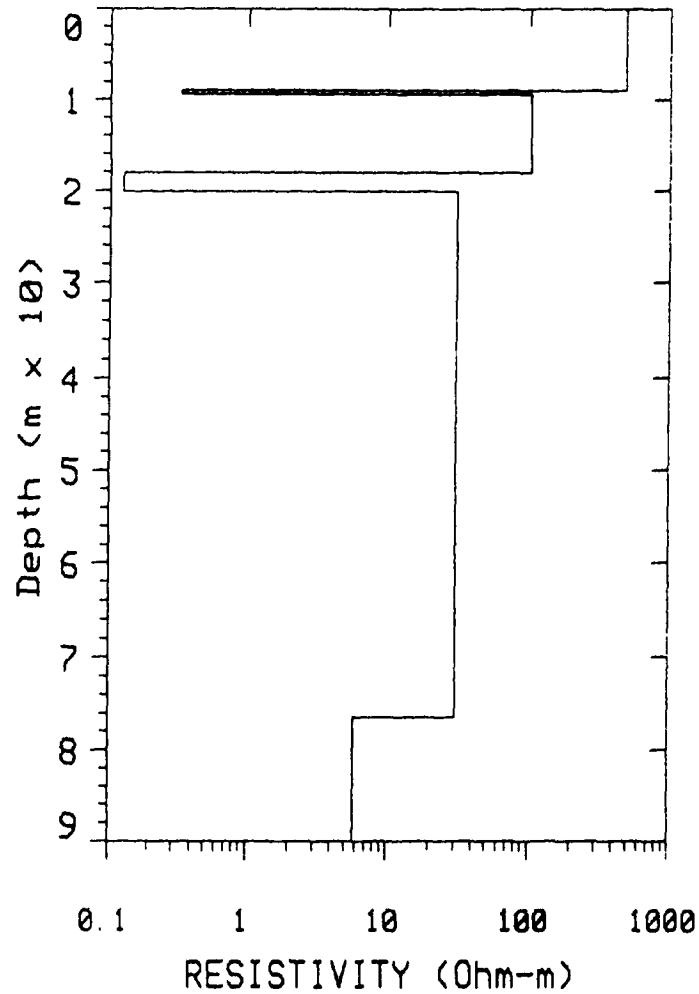
for: J. M. Montgomery	West Beach Landfill
Horcal Geophysical Consultants, Inc.	Alameda NAS Alameda County, CA
Data Set: ANASA — Date: 5/30/91	
Equipment: Geonics PROTEM — ...ding: 1233A	LOOP SIZE: 20. m



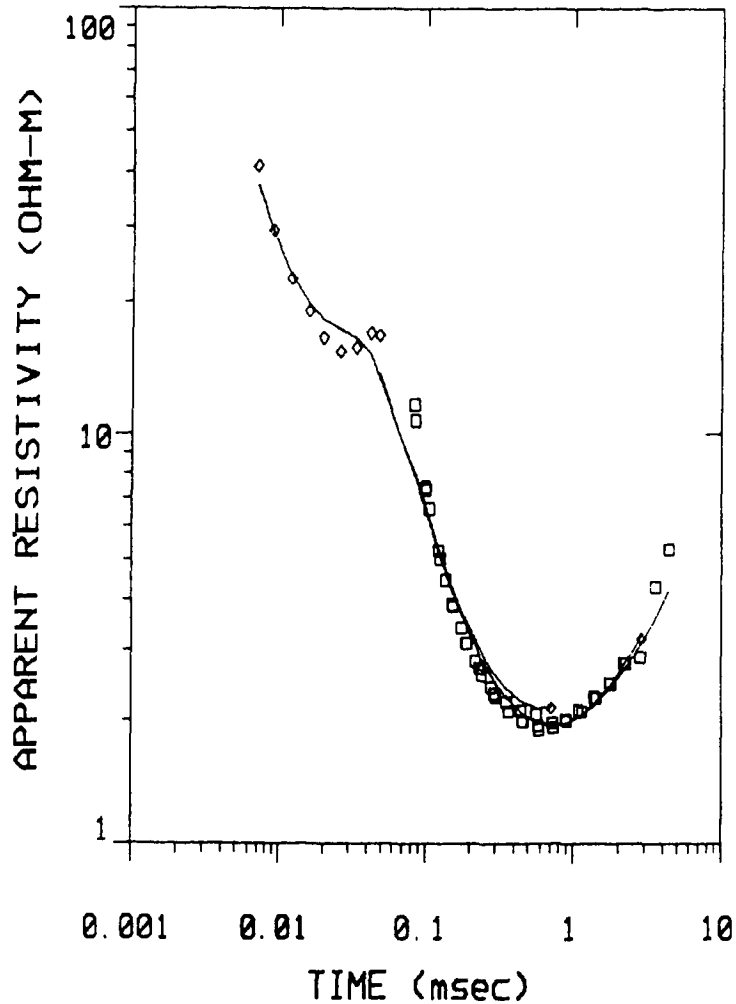


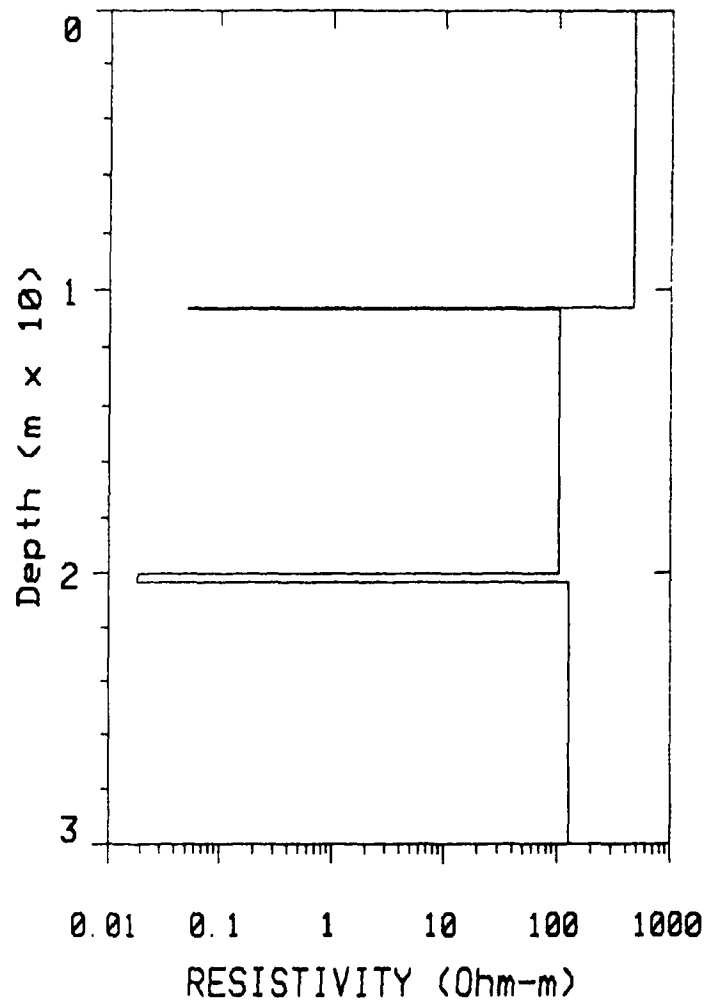
for: J. M. Montgomery	West Beach Landfill
Norcal Geophysical Consultants, Inc.	Alameda NAS Alameda County, CA
Data Set: ANASA — Date: 5/30/91	
Equipment: Geonics PROTEM — Sounding: 1433A	LOOP SIZE: 20. m



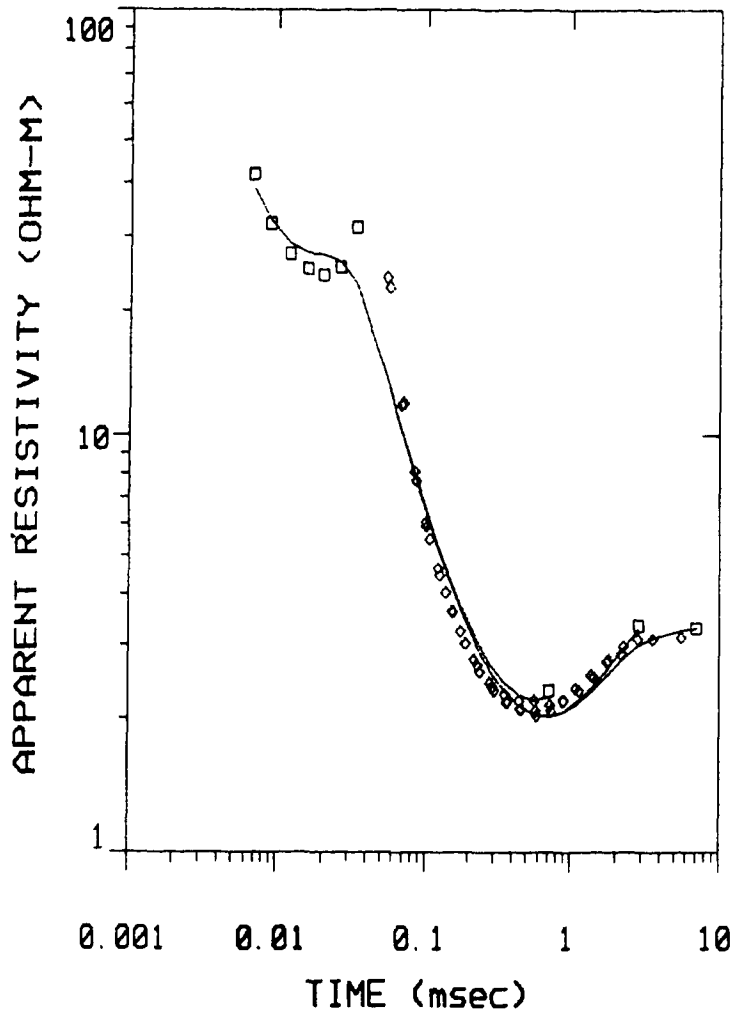


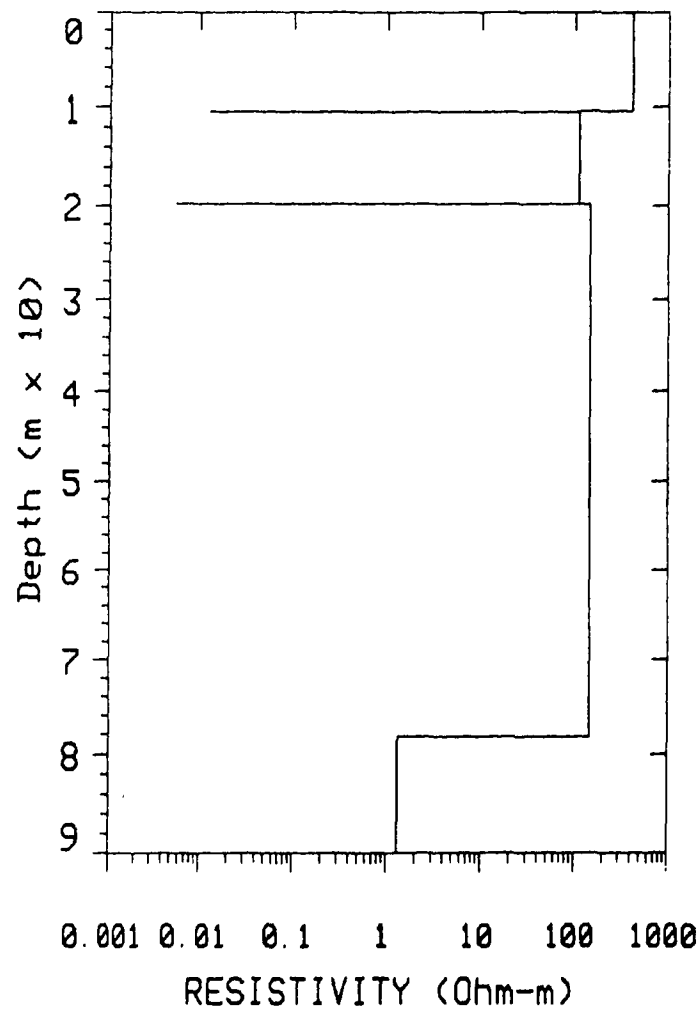
for: J. M. Montgomery	West Beach Landfill
Norcal Geophysical Consultants, Inc.	Alameda NAS Alameda County, CA
Data Set: ANASA — Date: 5/30/91	
Equipment: Geonics PROTEM — ding: 1833A	LOOP SIZE: 20. m



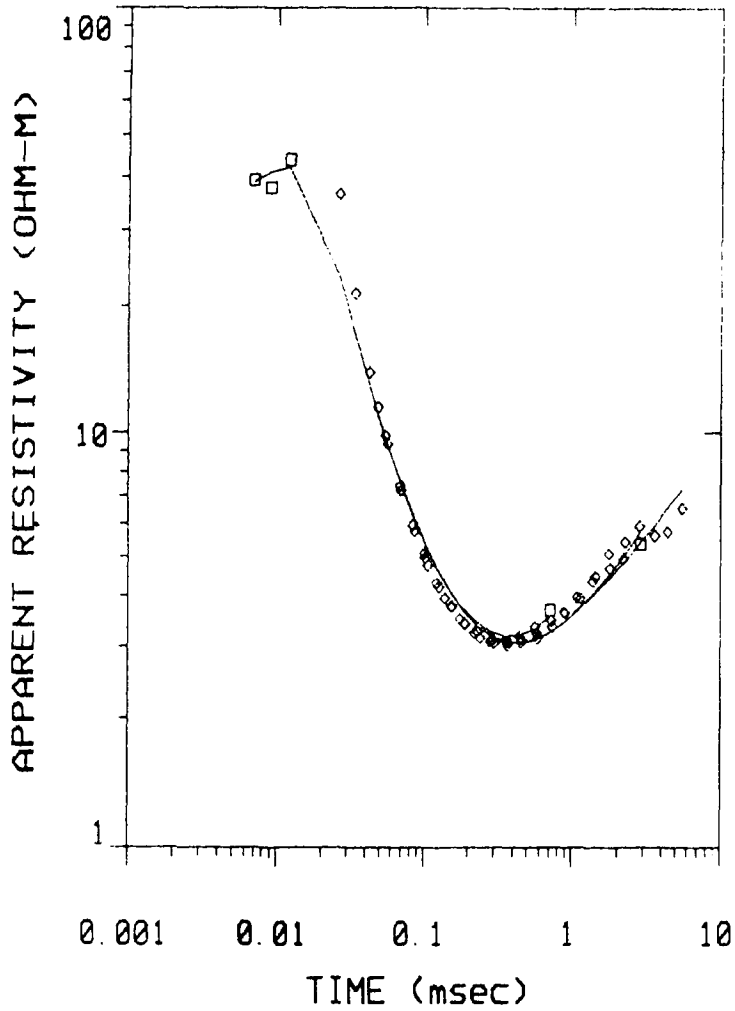


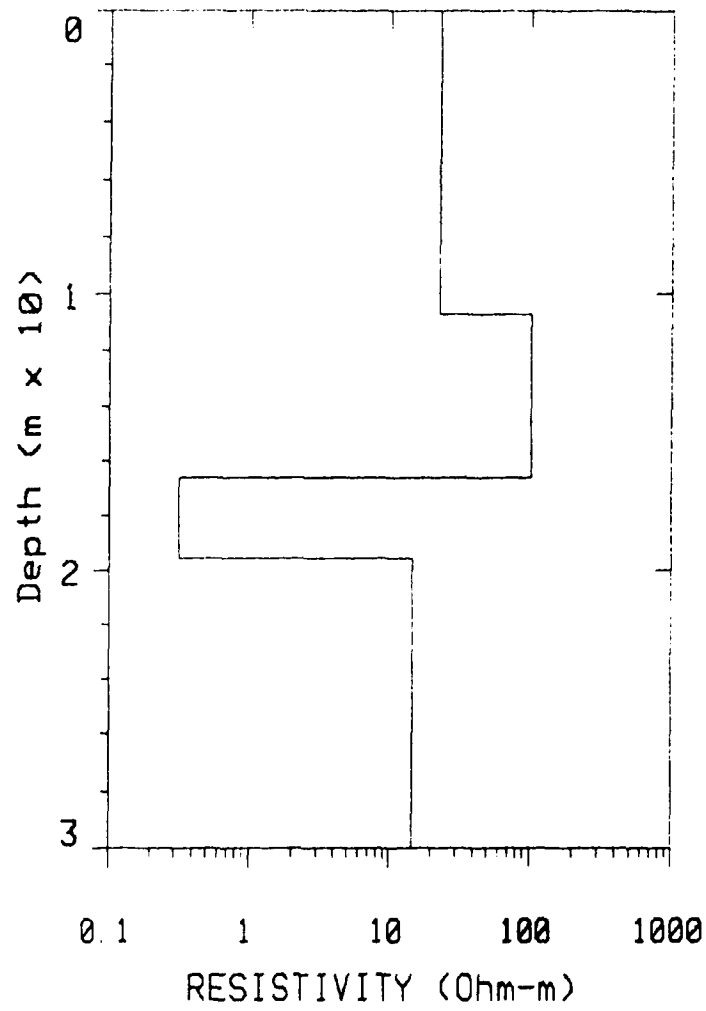
for: J. M. Montgomery	West Beach Landfill
Norcal Geophysical Consultants, Inc.	Alameda NAS Alameda County, CA
Data Set: ANASA — Date: 5/30/91	
Equipment: Geonics PROTEM — Sounding: 2033A	LOOP SIZE: 20. m





for: J. M. Montgomery	West Beach Landfill
Norcal Geophysical Consultants, Inc	Alameda NAS Alameda County, CA
Data Set: ANASA — Date: 5/30/91	
Equipment: Geonics PROTEM — Funding: 2167A	LOOP SIZE: 20. m





for: J. M. Montgomery	West Beach Landfill
by Norcal Geophysical Consultants, Inc	Alameda NAS Alameda County, CA
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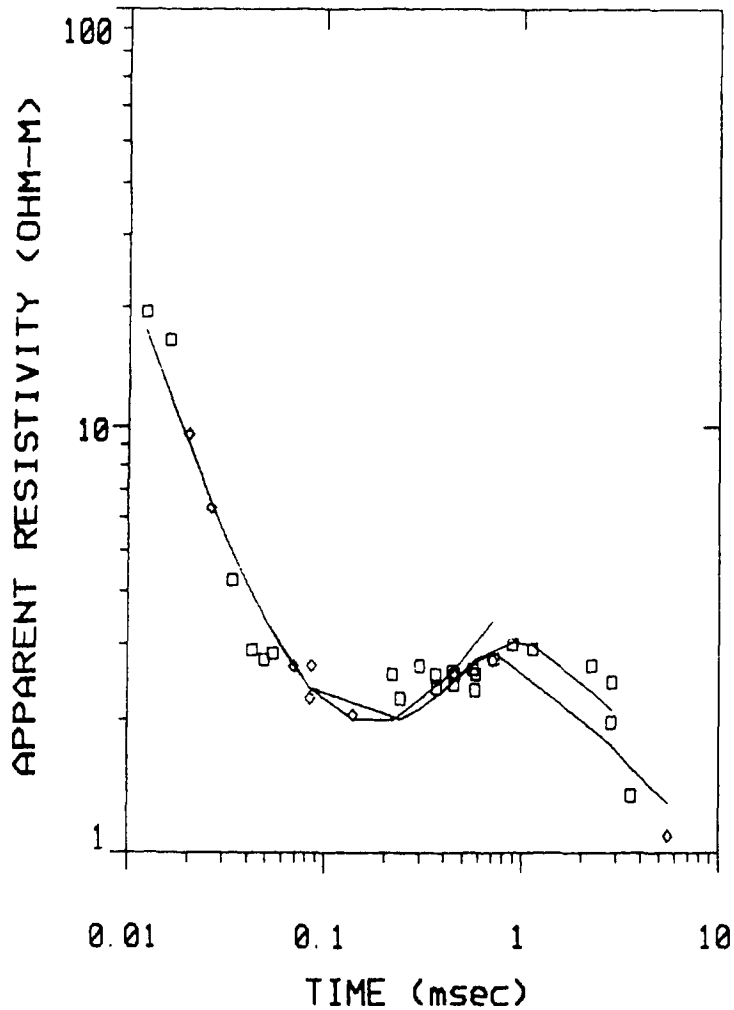
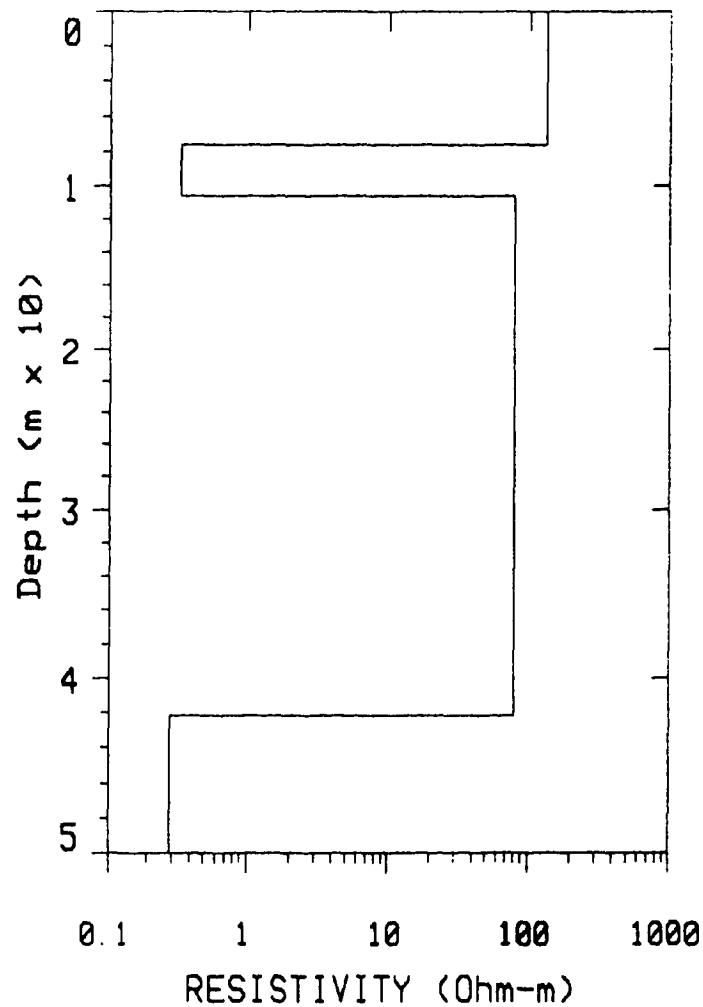
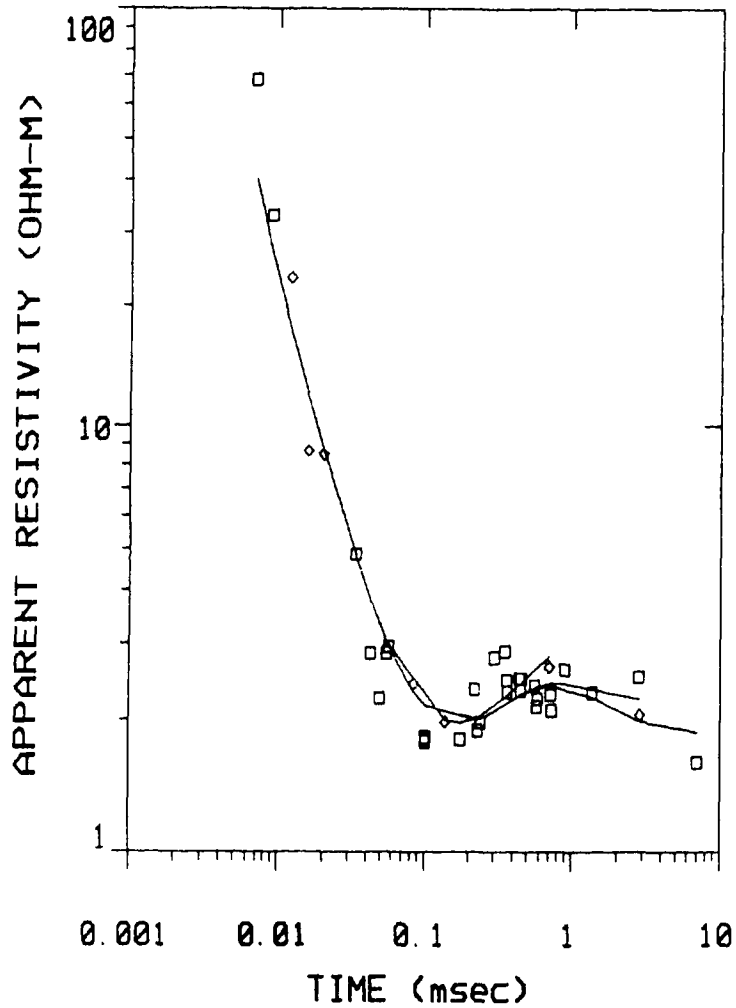
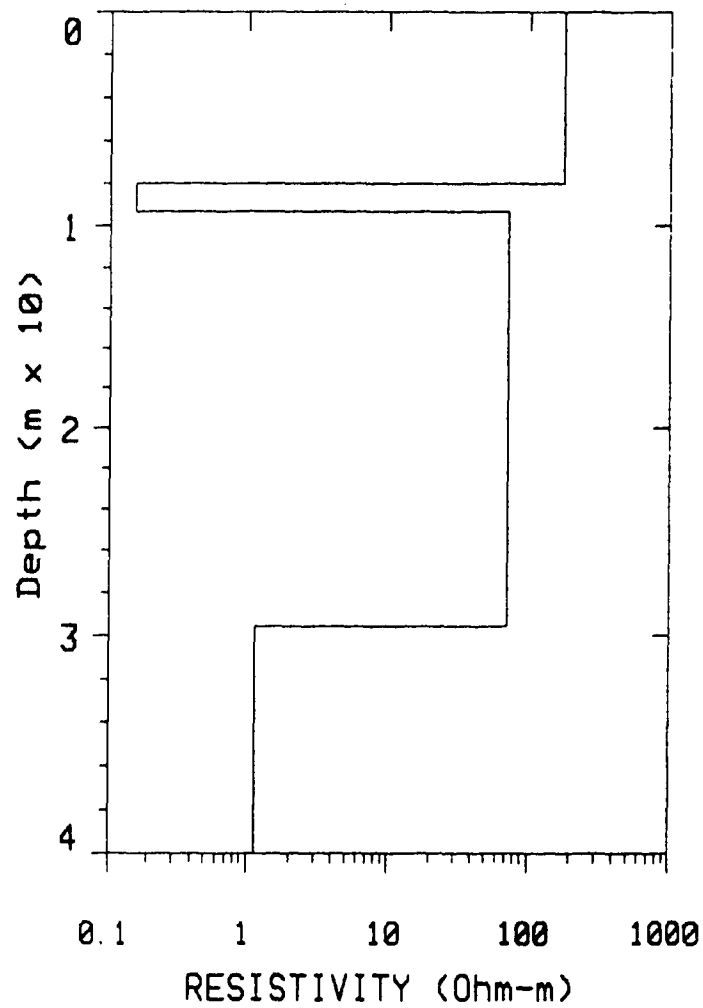


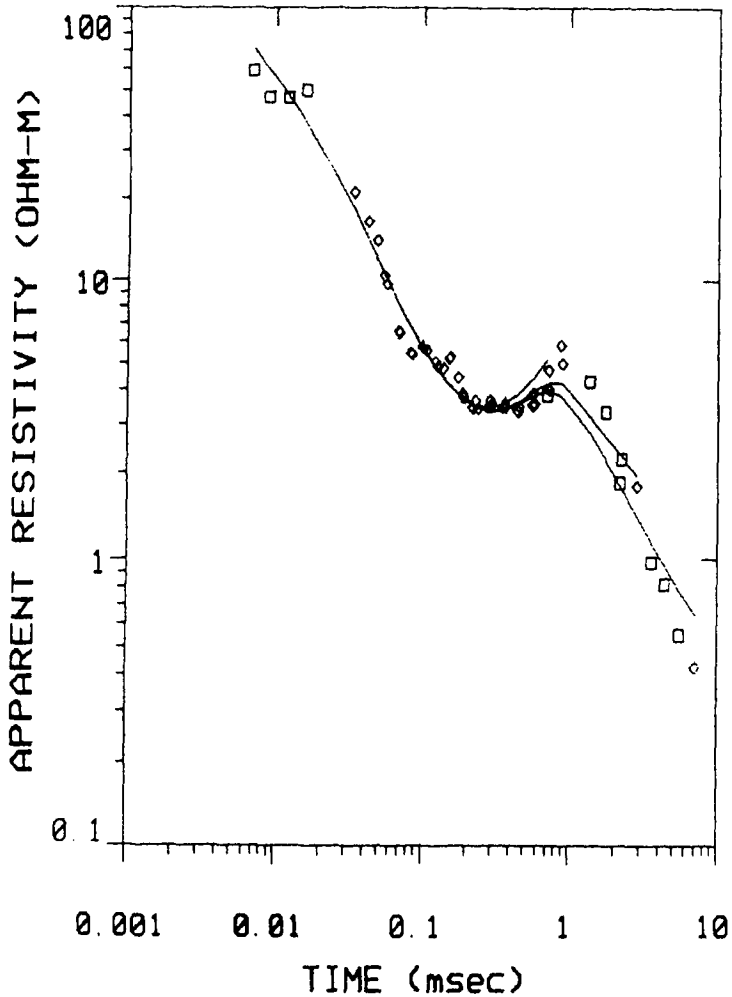


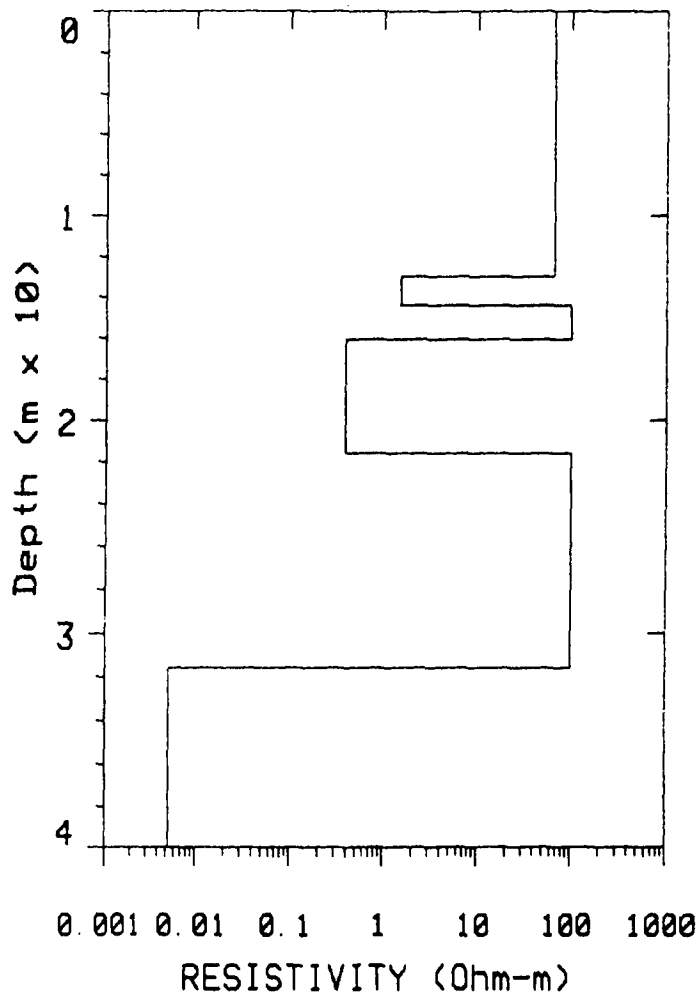
for: J. M. Montgomery	West Beach Landfill
by Norcal Geophysical Consultants, Inc.	Alameda NAS Alameda County, CA
Data Set: ANASA — Date: 5/30/91	
Equipment: Geonics PROTEM — Funding: 3033A	LOOP SIZE: 20. m



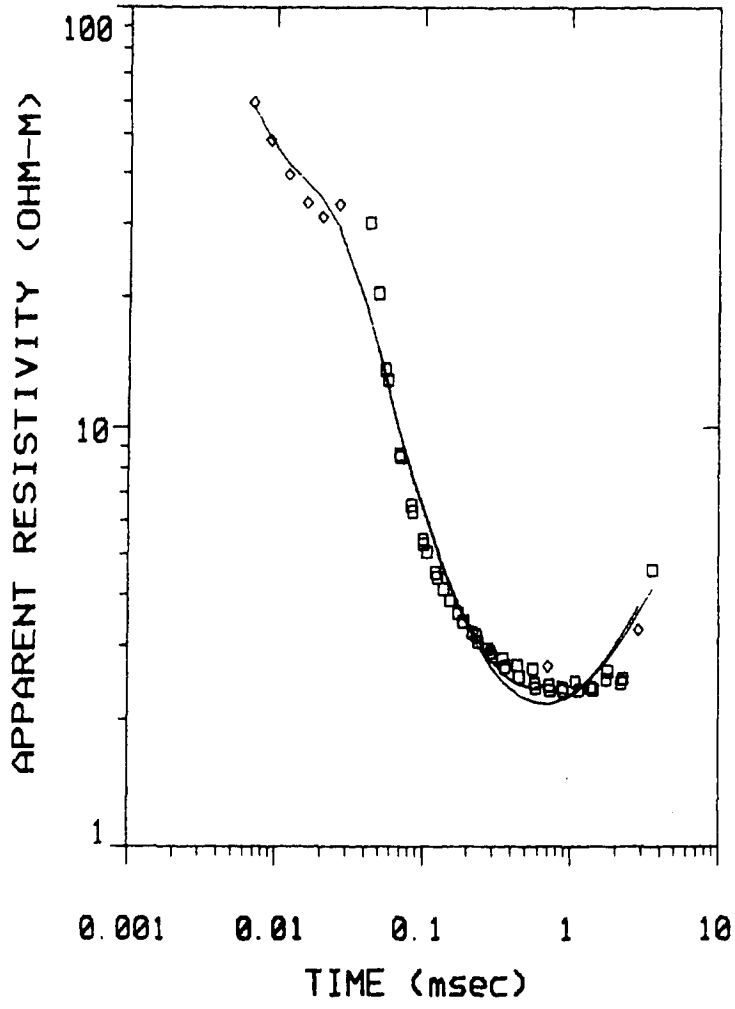


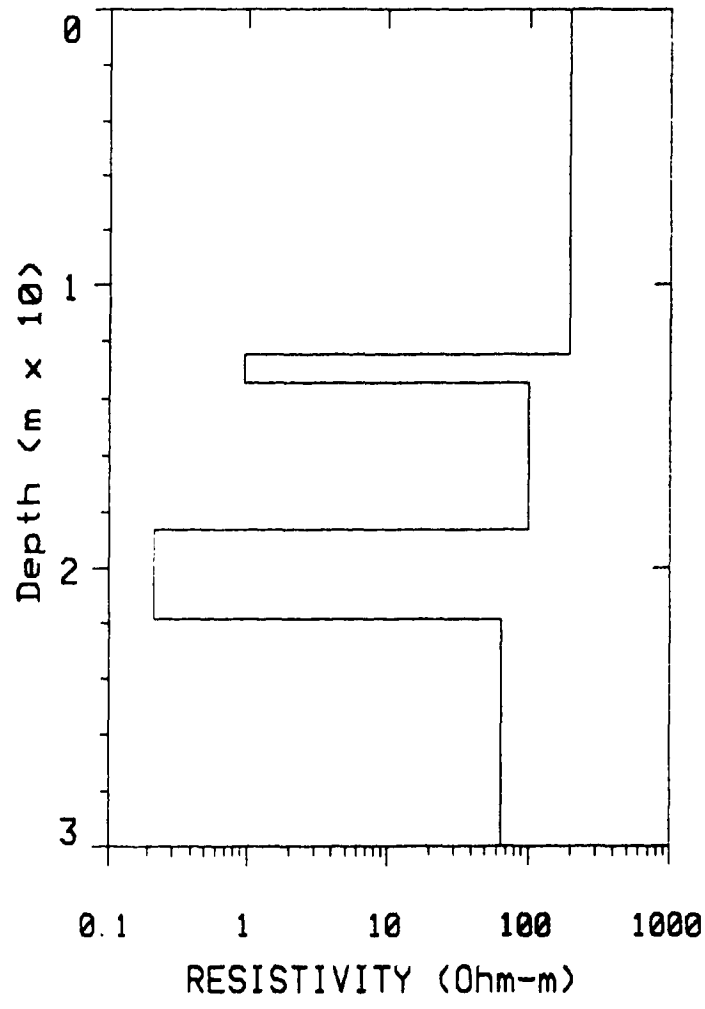
for: J. M. Montgomery	West Beach Landfill
by Norcal Geophysical Consultants, Inc.	Alameda NAS Alameda County, CA
Data Set: ANASA — Date: 5/30/91	
Equipment: Geonics PROTEM — Sounding: 3233A	LOOP SIZE: 20. m



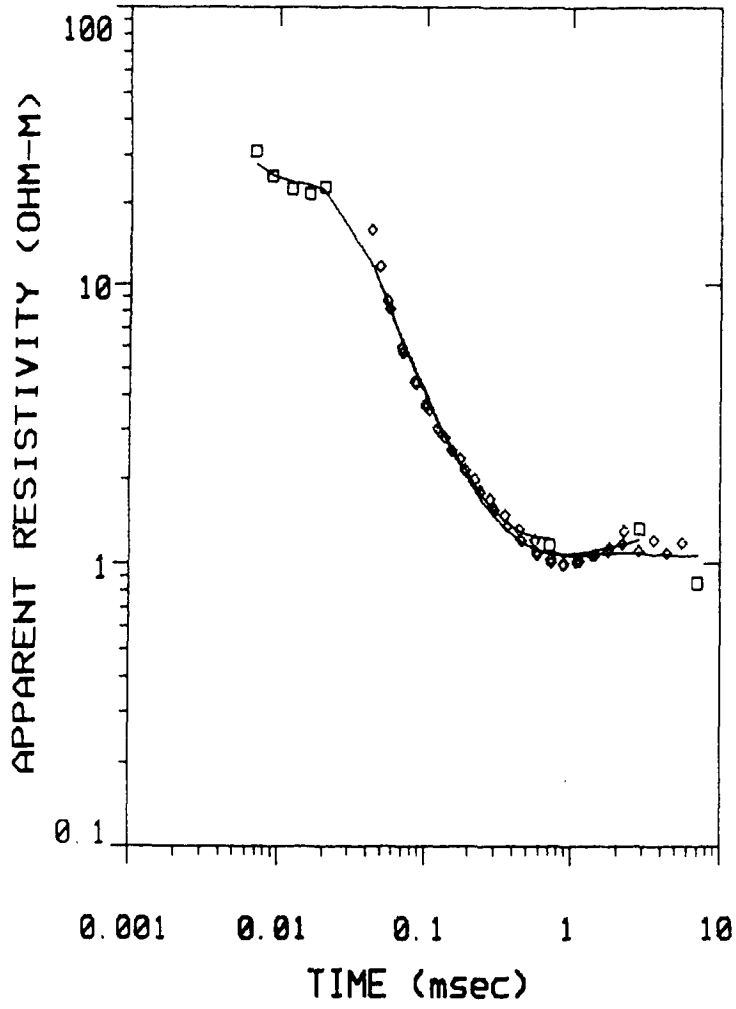


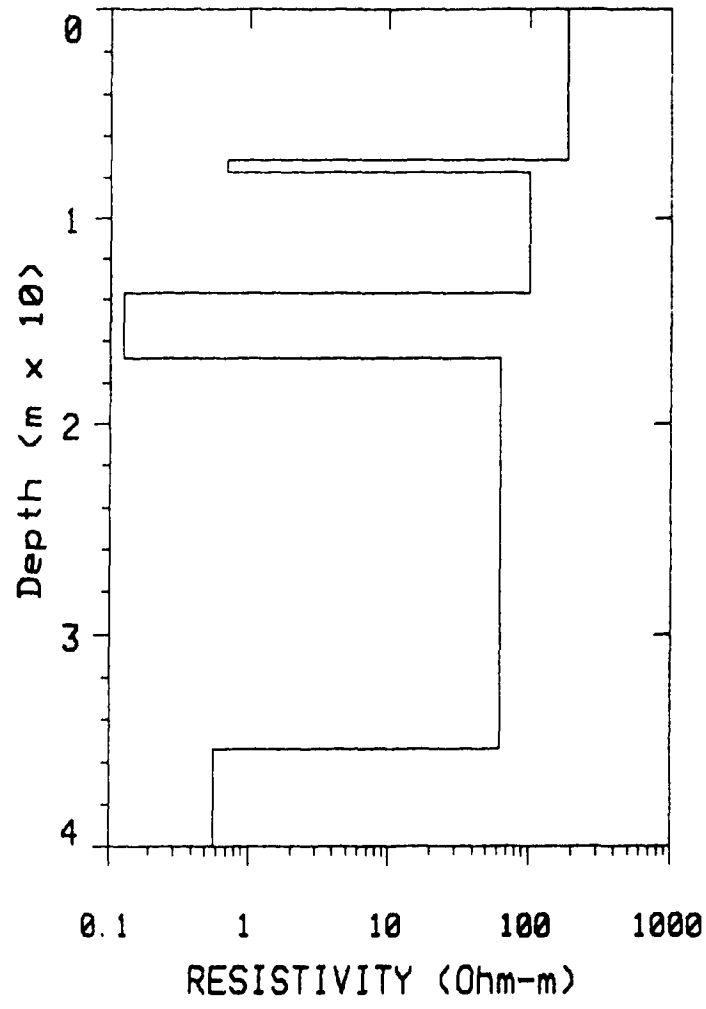
for: J.M. Montgomery	West Beach Landfill
by: Norcal Geophysical Consultants, Inc.	Alameda NAS Alameda County, CA
Data Set: 3567A — Date: 5/30/91	
Equipment: Geonics PROTEM — Sounding: 3567A	LOOP SIZE: 20. m



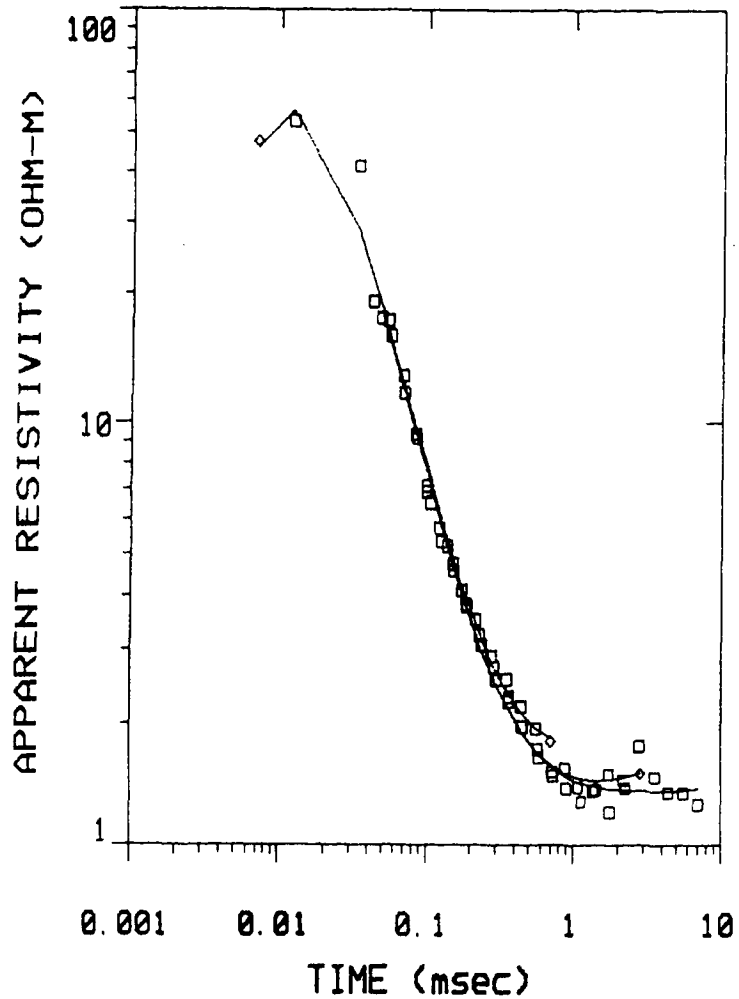


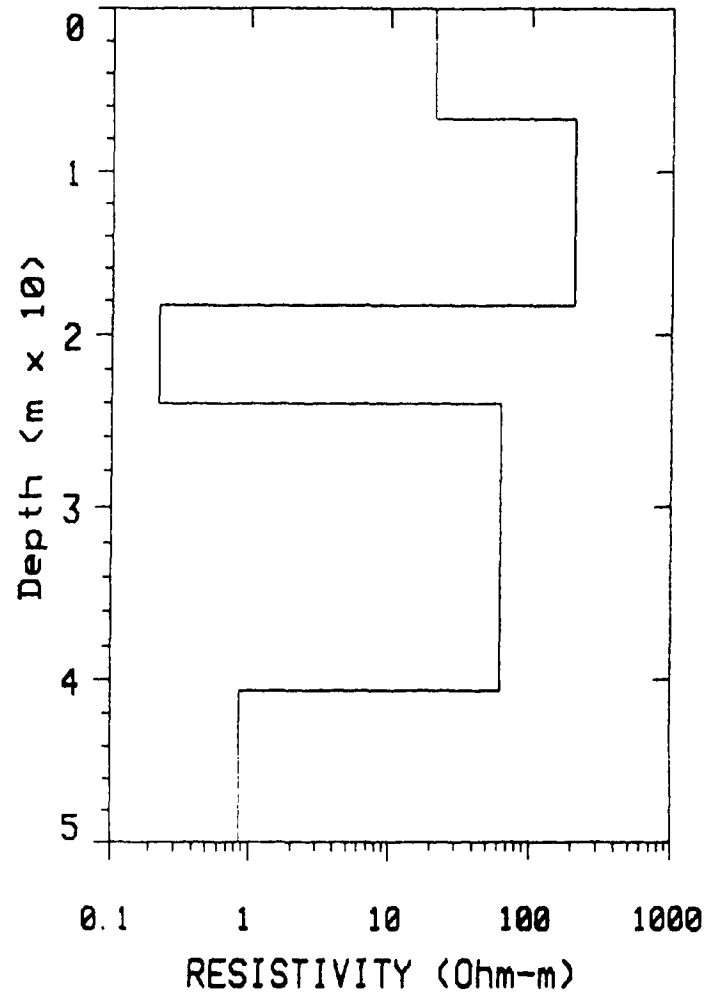
for: J.M. Montgomery	West Beach Landfill
by: Norcal Geophysical Consultants, Inc.	Alameda NAS Alameda County, CA
Data Set: 3767A — Date: 5/30/91	
Equipment: Geonics PROTEM — Sounding: 3767A	LOOP SIZE: 20. m



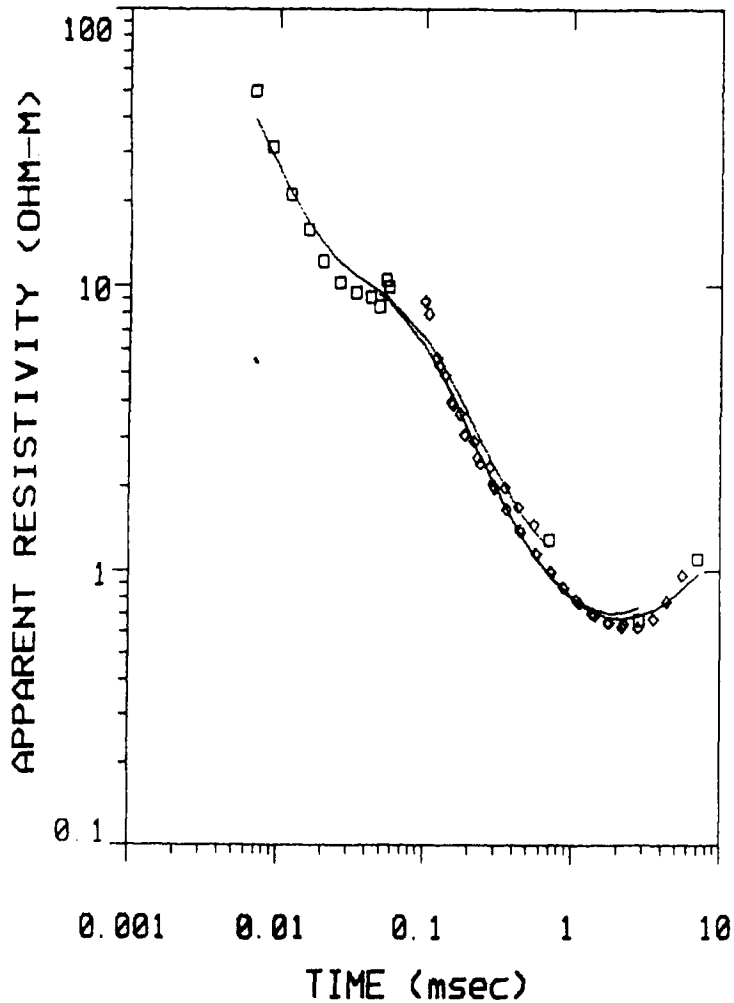


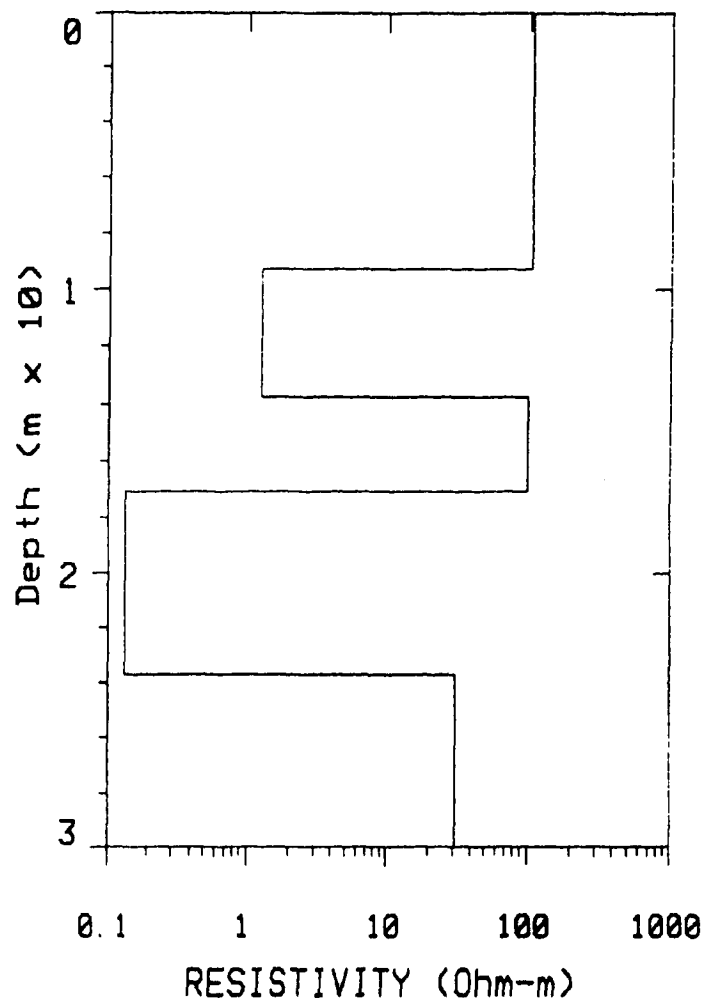
for: J.M. Montgomery	West Beach Landfill
Norcal Geophysical Consultants, Inc	Alameda NAS Alameda County, CA
Data Set: 4233A / Date: 5/30/91	
Equipment: Geonics PROTEM / Jnding: 4233A	LOOP SIZE: 20. m



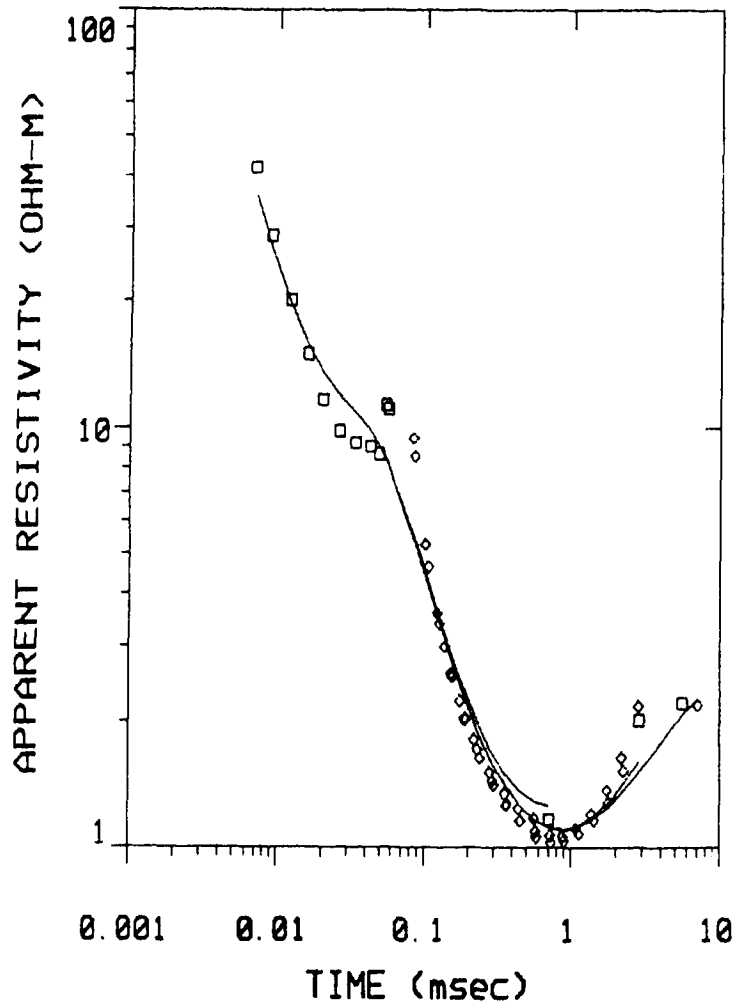


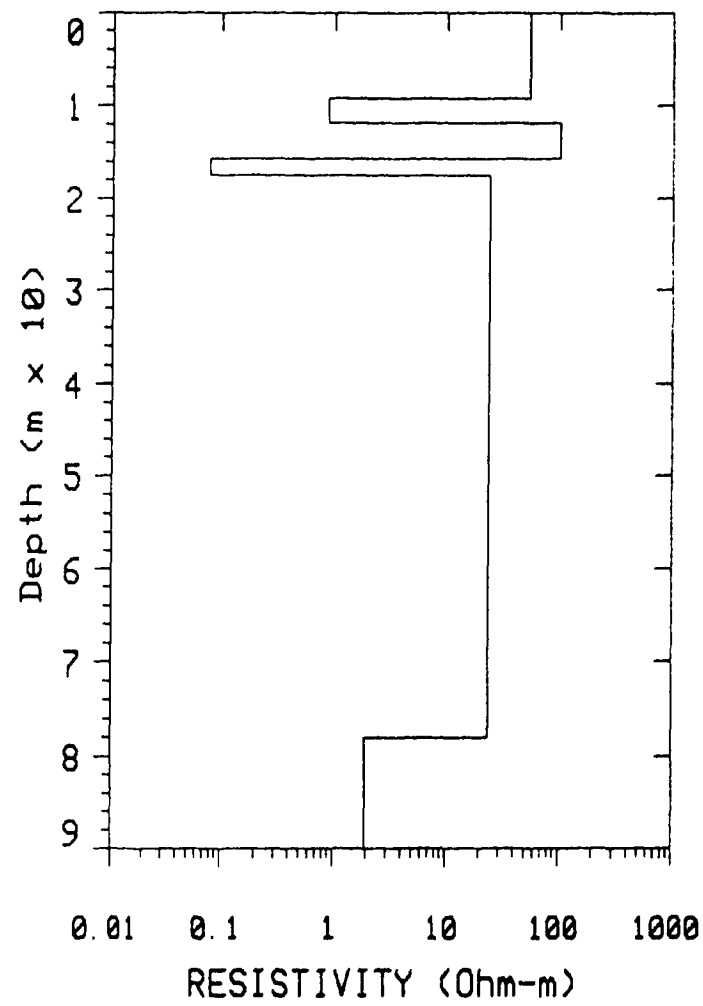
for: J.M. Montgomery	West Beach Landfill
by: Norcal Geophysical Consultants, Inc.	Alameda NAS Alameda County, CA
Data Set: 4415A — Date: 5/30/91	
Equipment: Geonics PROTEM — Sounding 4415A	LOOP SIZE: 20. m



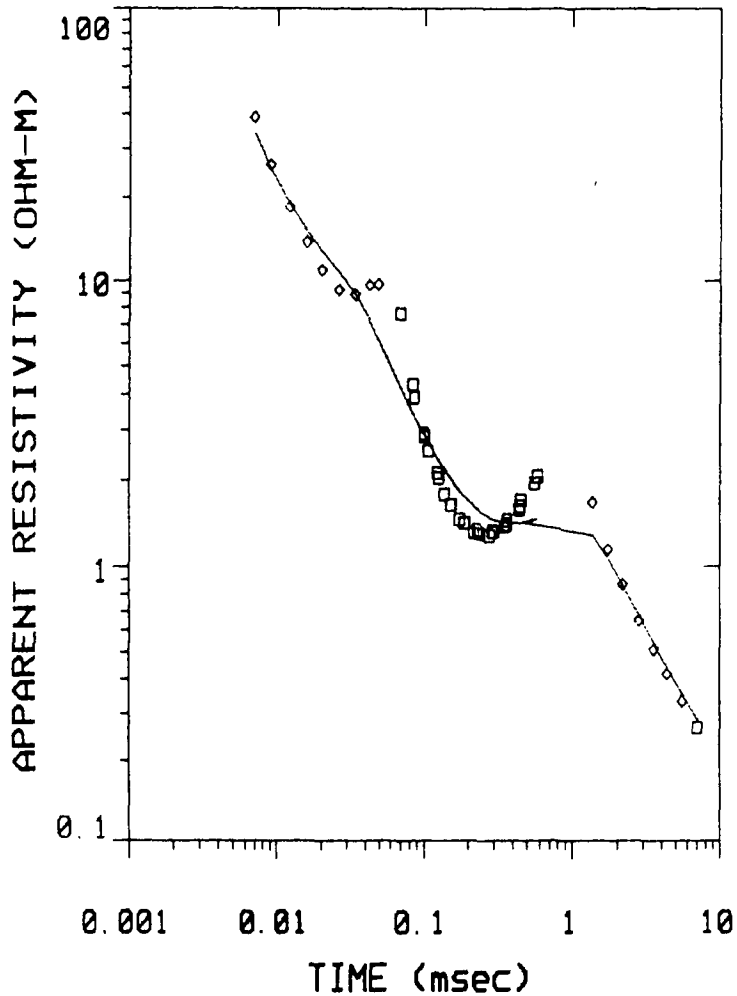


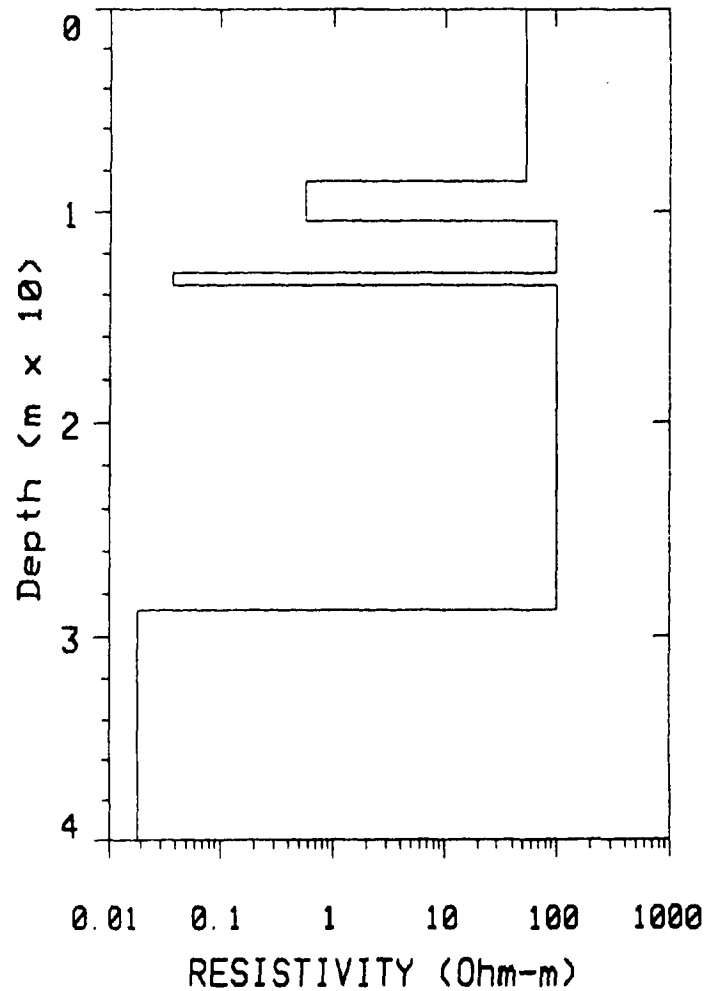
for: J.M. Montgomery	West Beach Landfill
Norcal Geophysical Consultants, Inc.	Alameda NAS Alameda County, CA
Data Set: 4633A — Date: 5/30/91	
Equipment: Geonics PROTEM — nding: 4633A	LOOP SIZE: 20. m



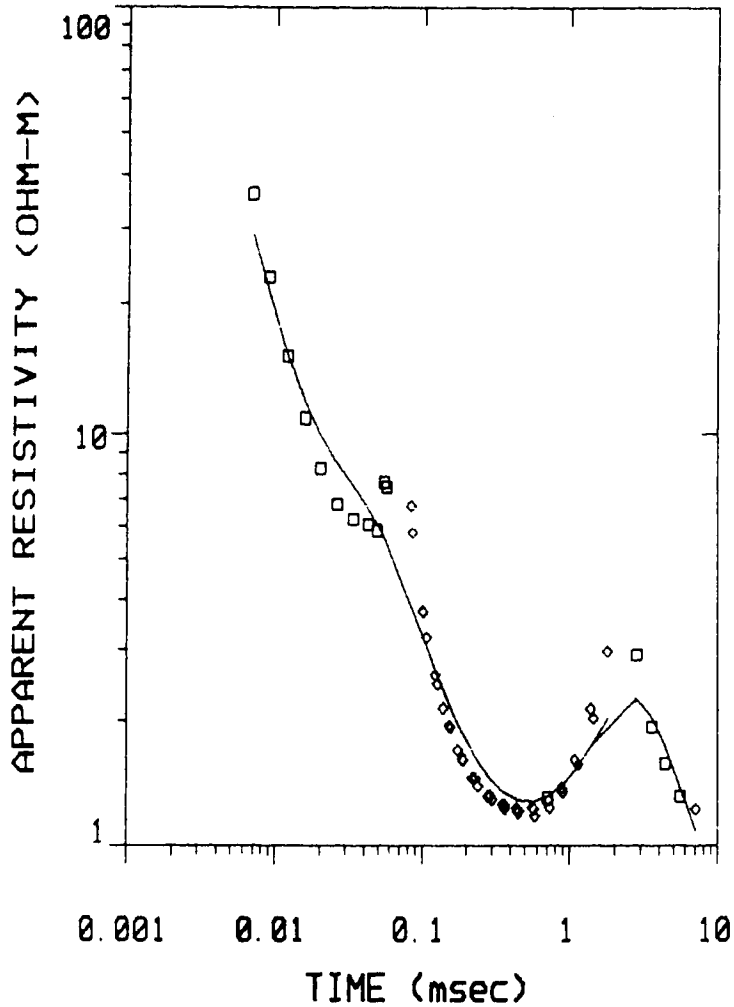


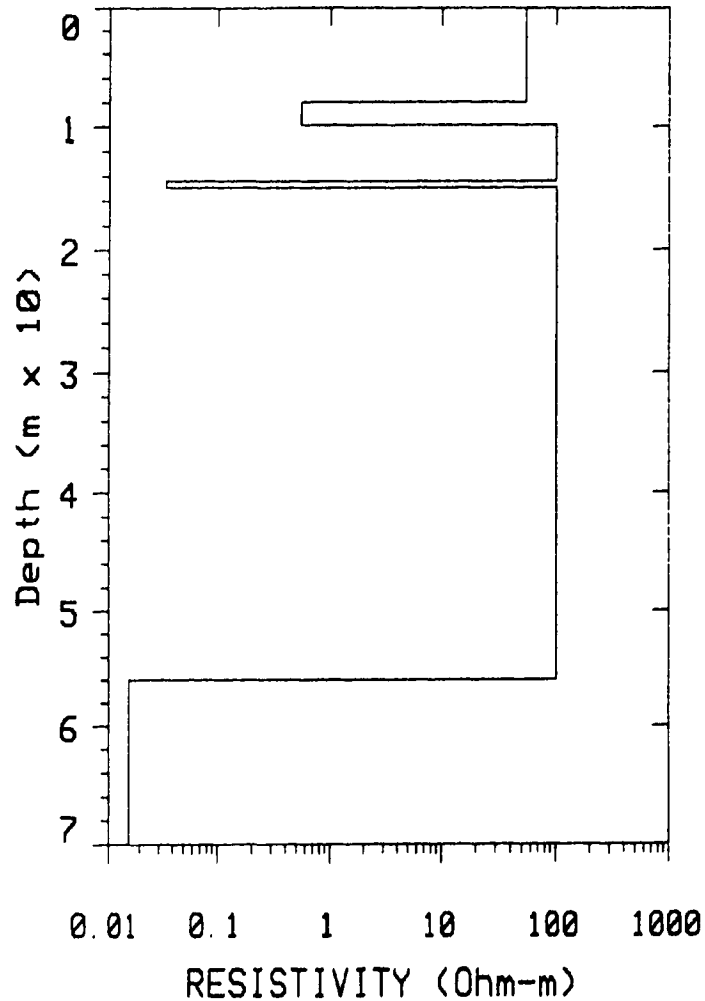
for: J. M. Montgomery	West Beach Landfill
by: Norcal Geophysical Consultants, Inc	Alameda NAS Alameda County, CA
Data Set: 4833A — Date: 5/30/91	
Equipment: Geonics PROTEM — Sounding: 4833A	LOOP SIZE: 20. m



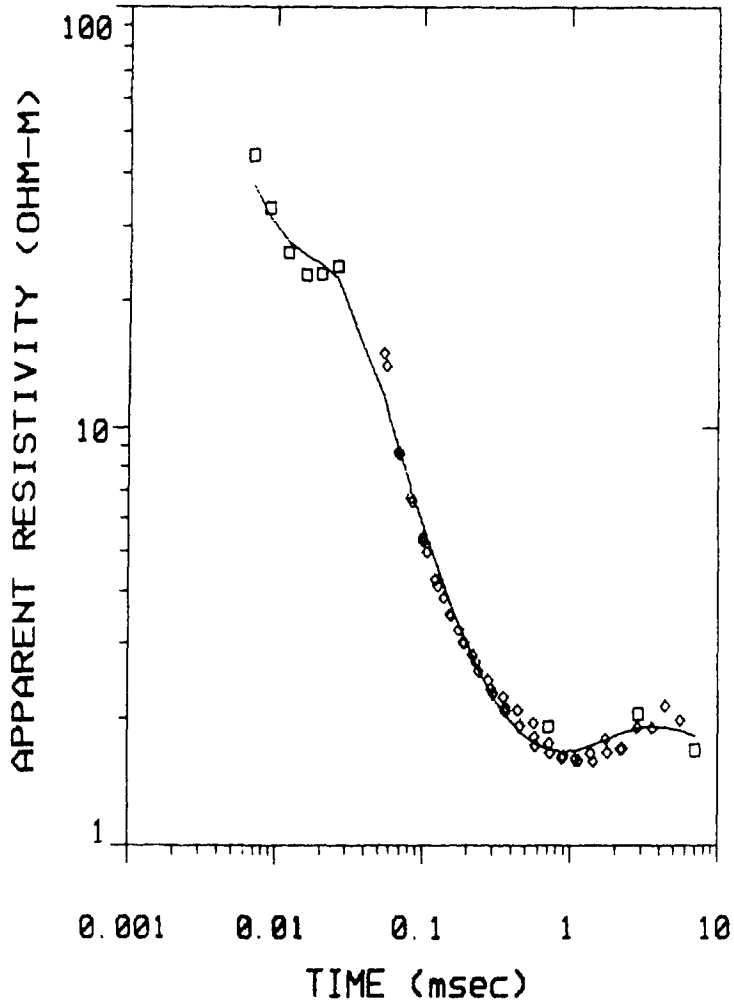


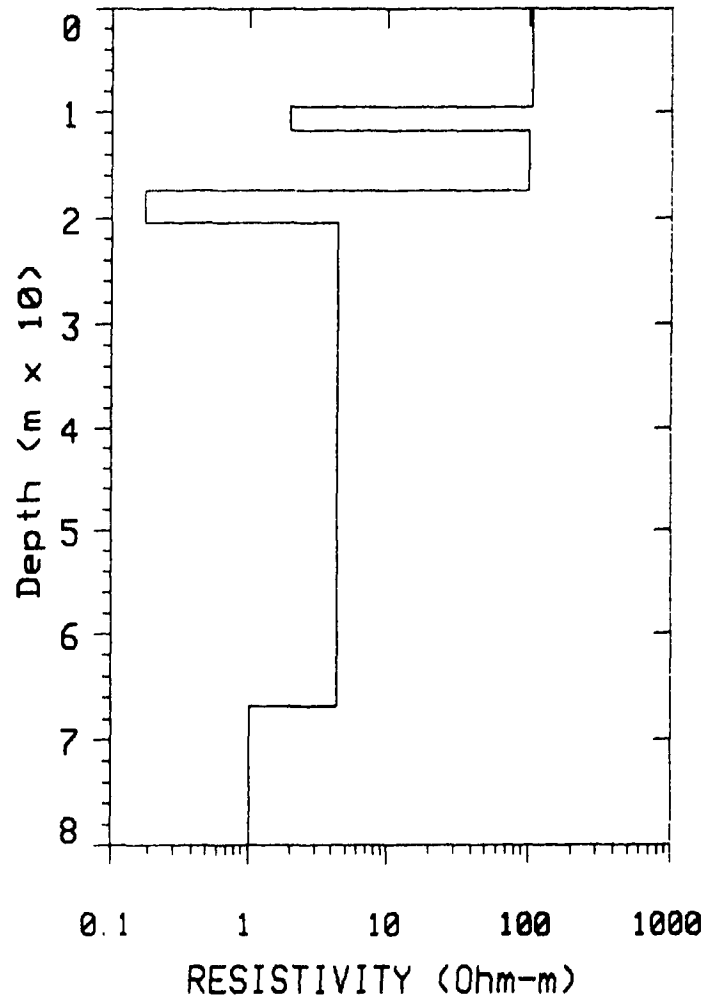
for: J. M. Montgomery	West Beach Landfill
by: Norcal Geophysical Consultants, Inc	Alameda NAS Alameda County, CA
Data Set: 5033A — Date: 5/30/91	
Equipment: Geonics PROTEM — unding: 5033A	LOOP SIZE: 20. m



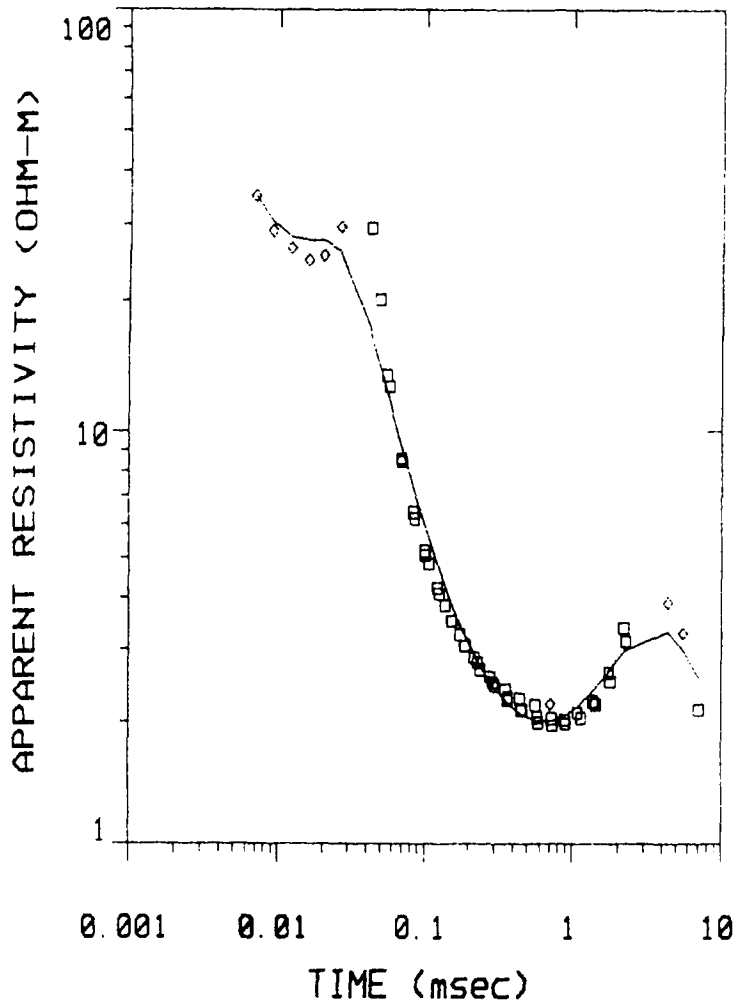


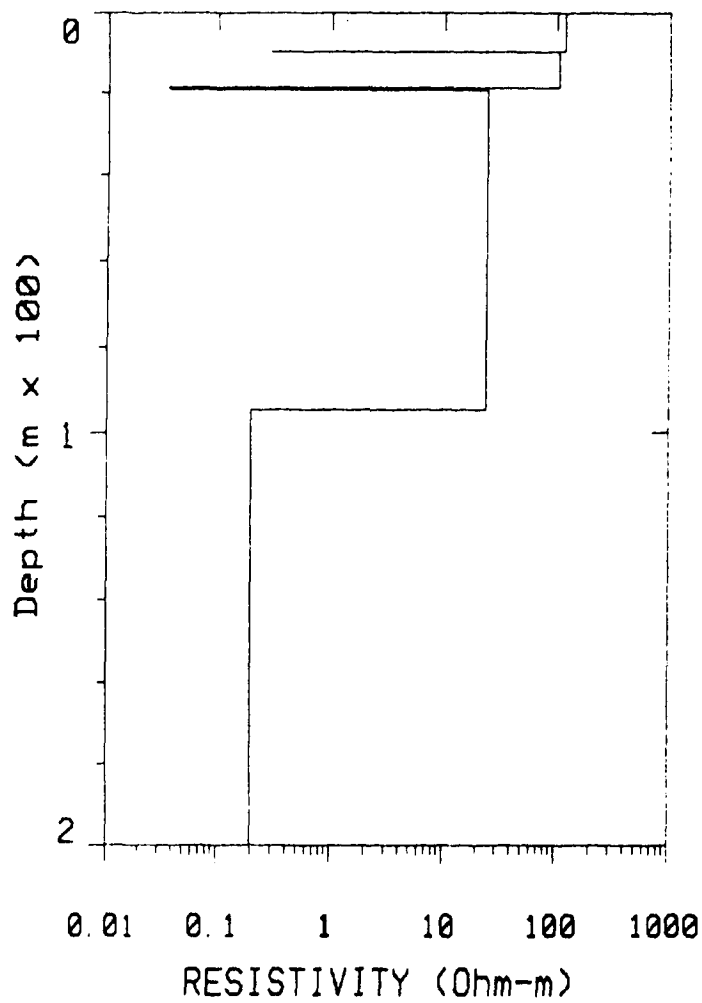
for: J. M. Montgomery	West Beach Landfill
by: Norcal Geophysical Consultants, Inc.	Alameda NAS Alameda County, CA
Data Set: 5233A — Date: 5/30/91	
Equipment: Geonics PROTEM — Sounding: 5233A	LOOP SIZE: 20. m



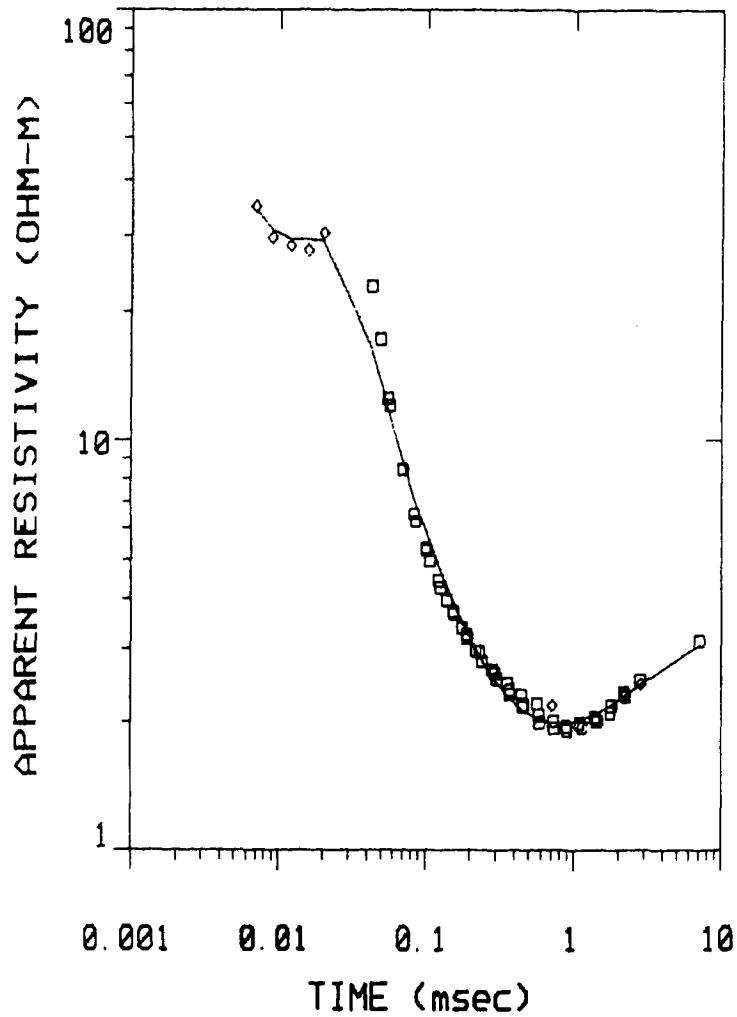


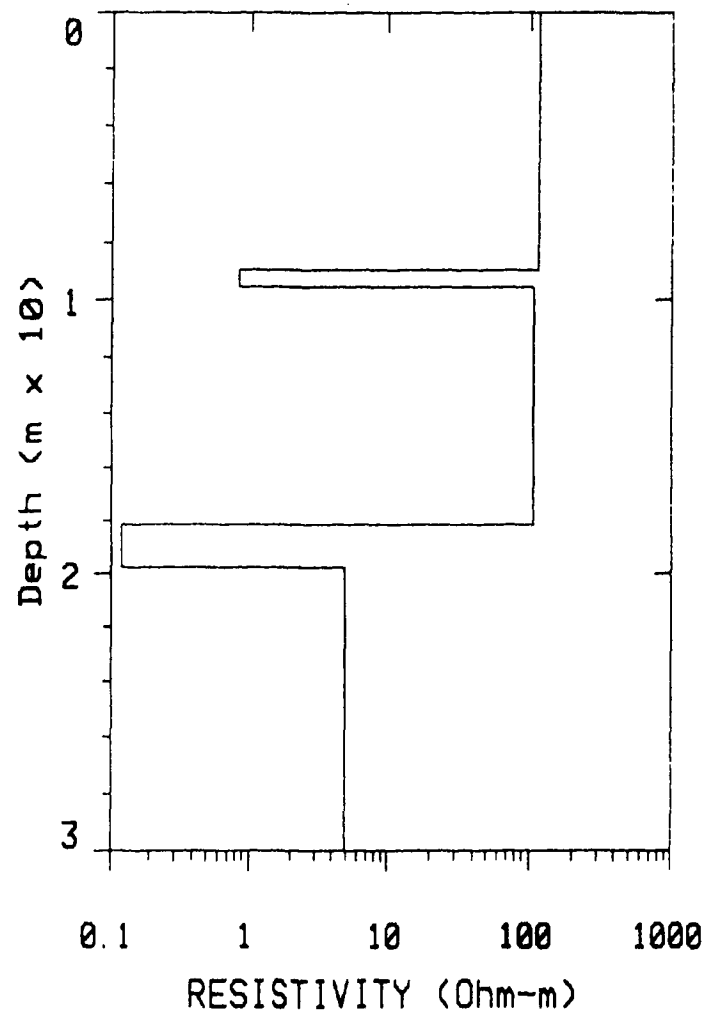
for: J. M. Montgomery	West Beach Landfill
by: Norcal Geophysical Consultants, Inc.	Alameda NAS Alameda County, CA
Data Set: 888 / Date: 5/31/91	
Equipment: Geonics PROTEM / Sounding: 888	LOOP SIZE: 20. m



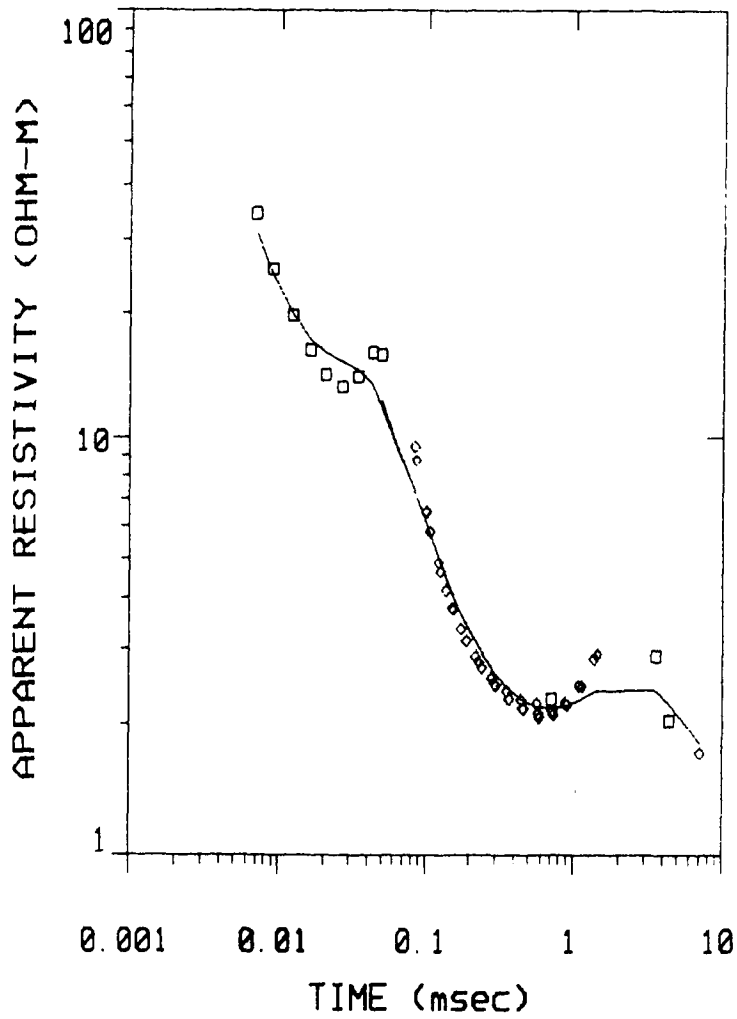


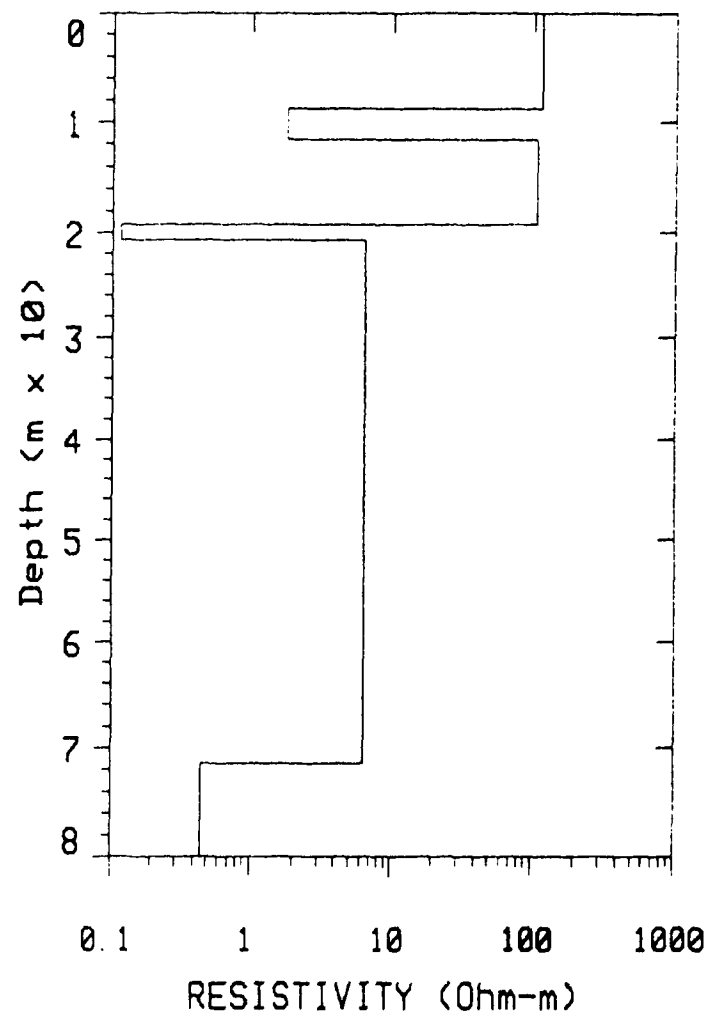
for: J. M. Montgomery	West Beach Landfill
by: Norcal Geophysical Consultants, Inc.	Alameda NAS Alameda County, CA
Data Set 233B — Date: 5/31/91	
Equipment: Geonics PROTEM — Sounding: 233B	LOOP SIZE: 20. m



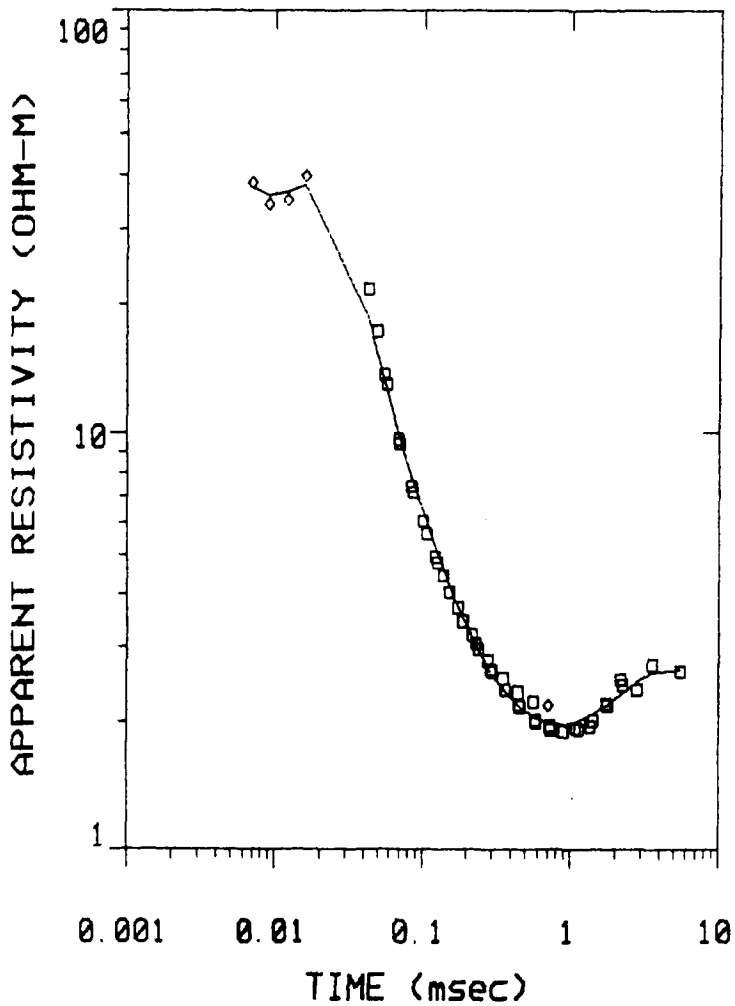


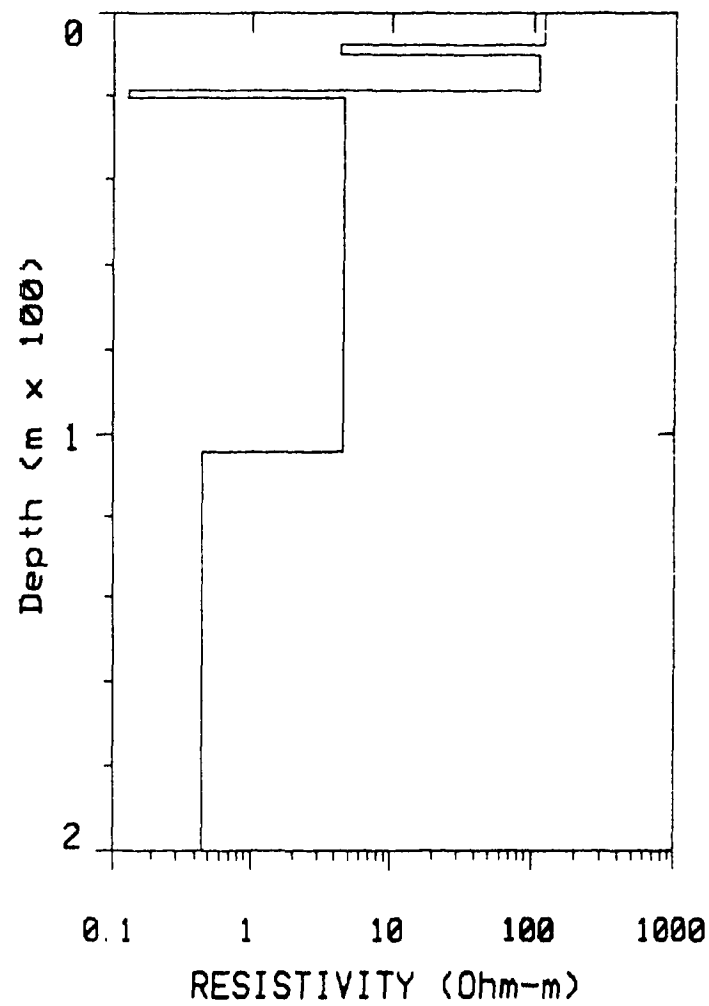
for: J. M. Montgomery	West Beach Landfill
by: Norcal Geophysical Consultants, Inc.	Alameda NAS Alameda County, CA
Data Set: 367B — Date: 5/31/91	
Equipment: Geonics PROTEM — Sounding: 367B	LOOP SIZE: 20. m



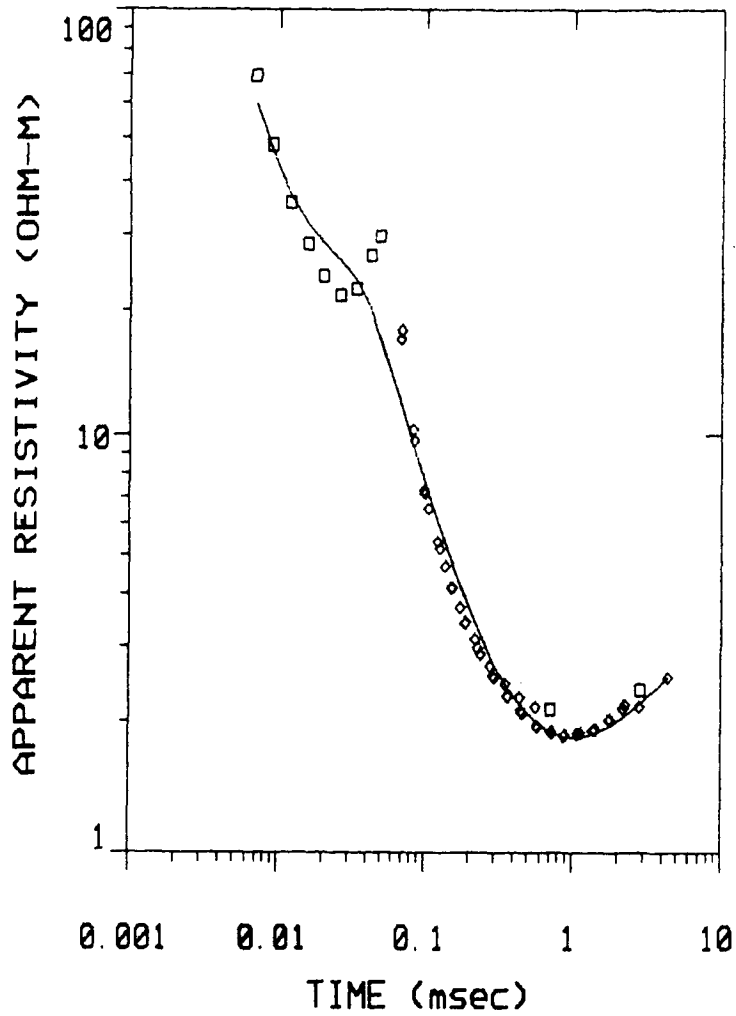


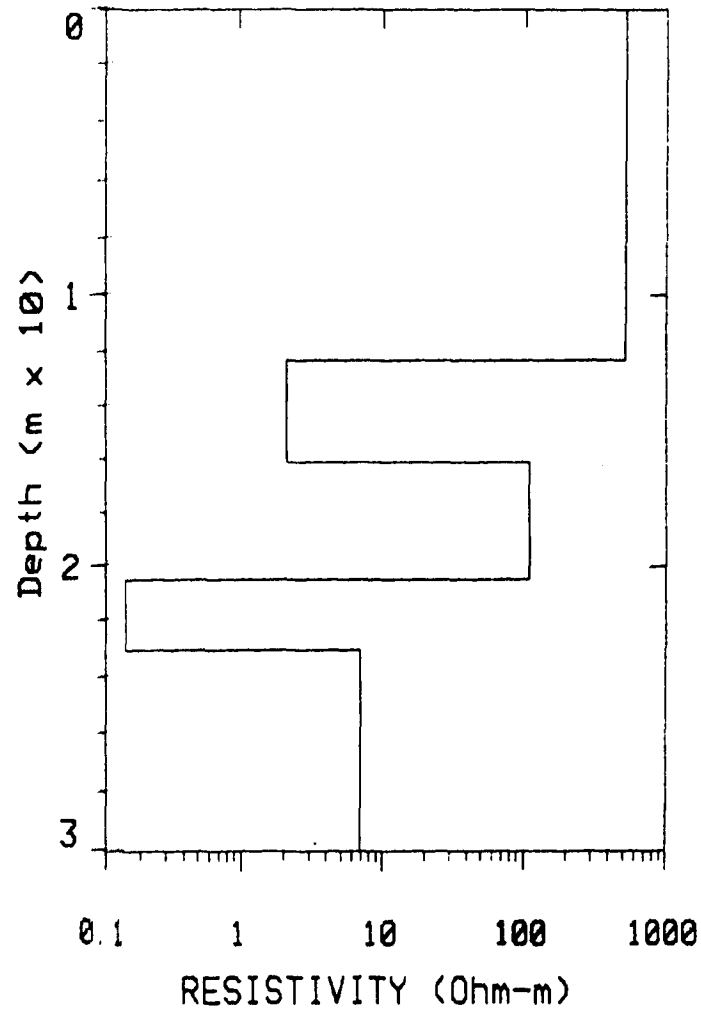
for: J. M. Montgomery	West Beach Landfill
Norcal Geophysical Consultants, Inc.	Alameda NAS Alameda County, CA
Data Set: 633B — Date: 5/31/91	
Equipment: Geonics PROTEM — Sounding: 633B	LOOP SIZE: 20. m



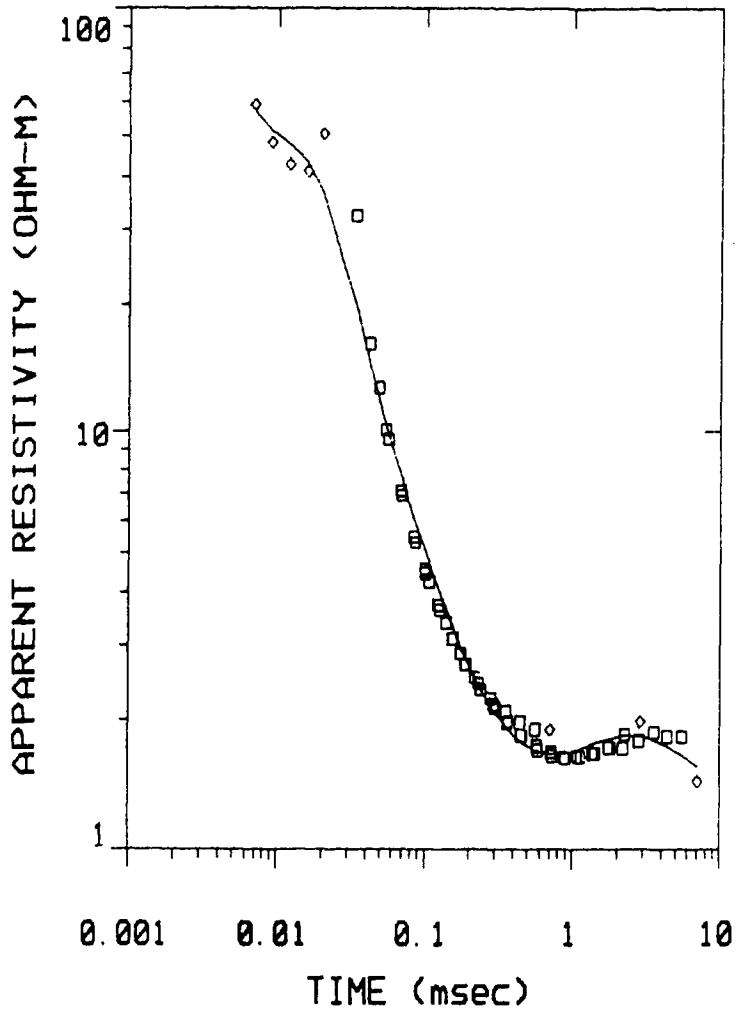


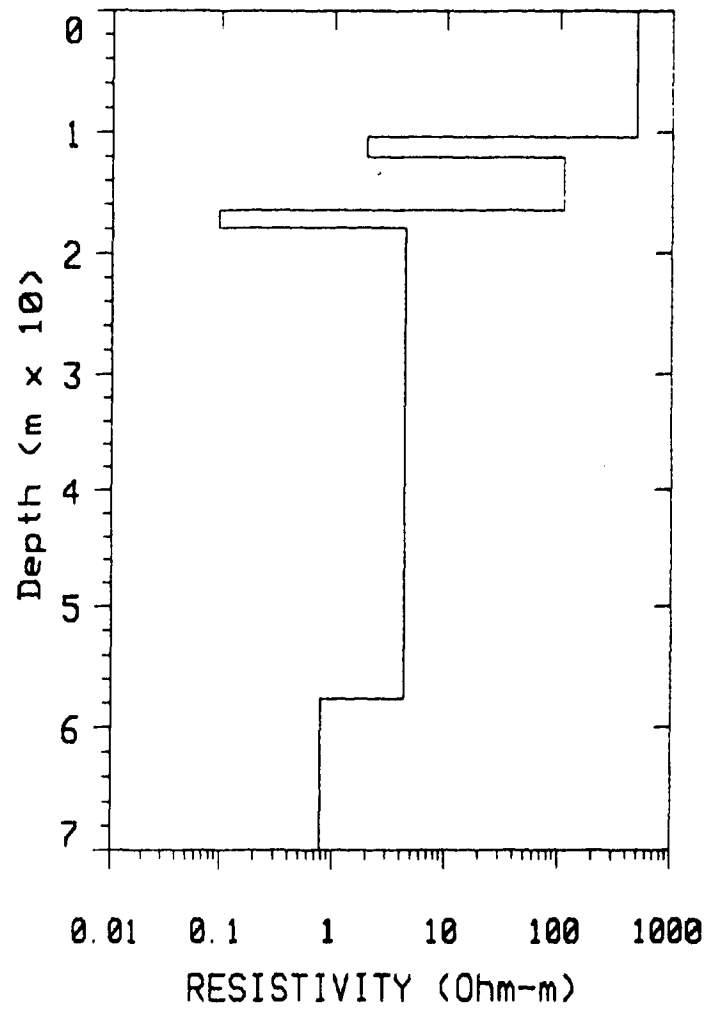
for: J. M. Montgomery	West Beach Landfill
by Norcal Geophysical Consultants, Inc.	Alameda NAS Alameda County, CA
Data Set: 8008 — Date: 5/31/91	
Equipment: Geonics PROTEM — nding: 8008	LOOP SIZE: 20. m



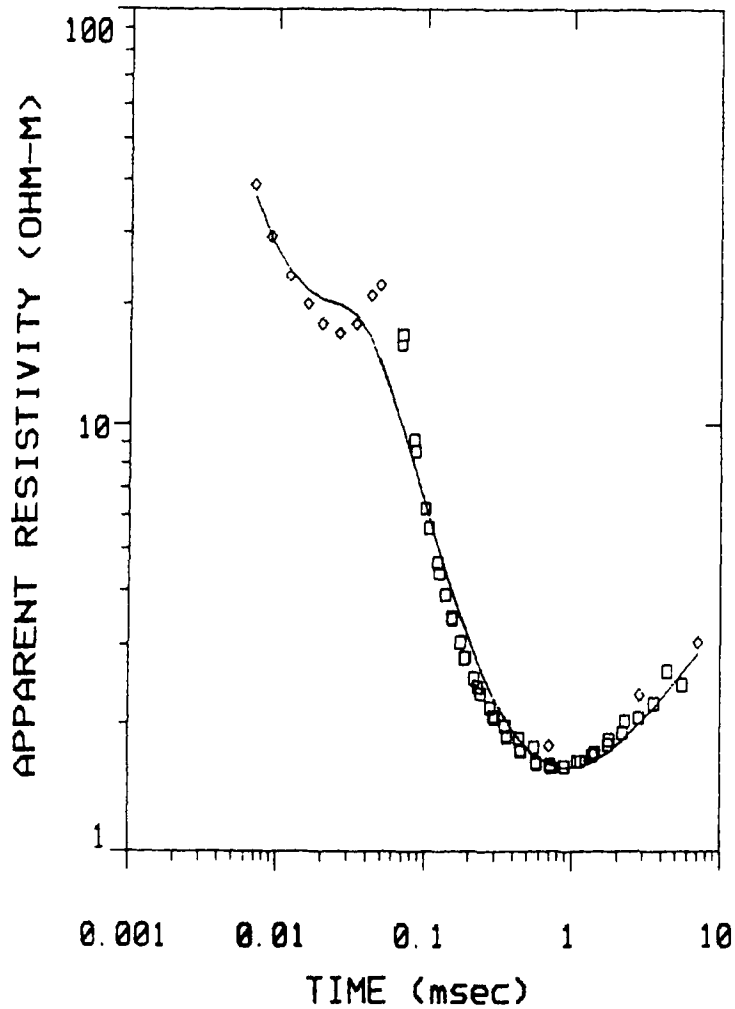


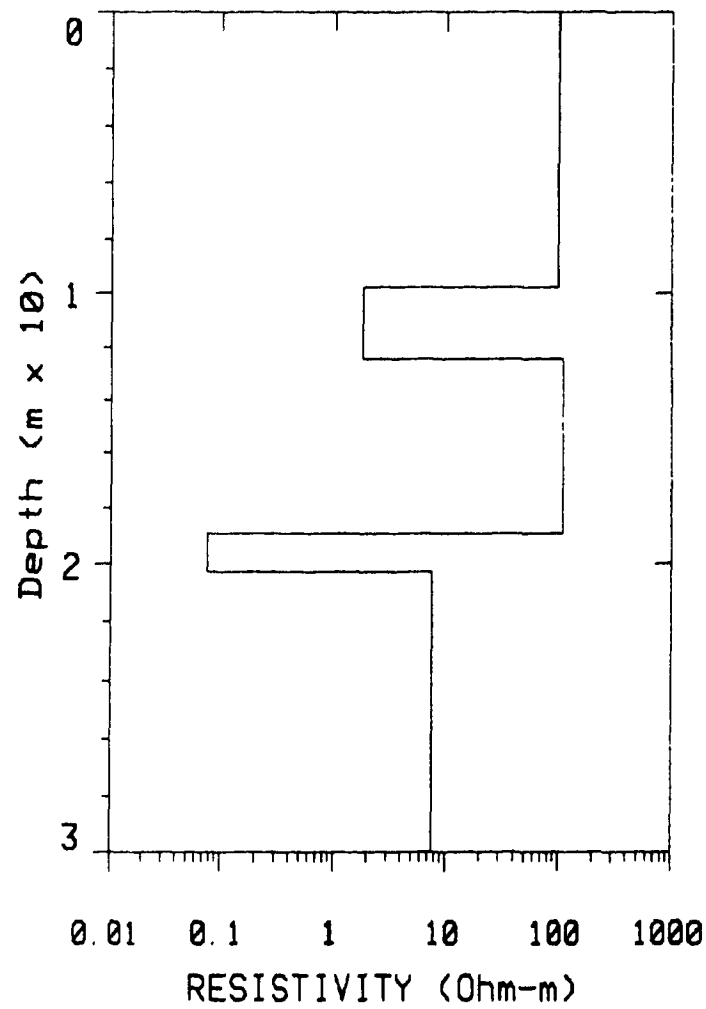
for: J. M. Montgomery	West Beach Landfill
by: Norcal Geophysical Consultants, Inc.	Alameda NAS Alameda County, CA
Data Set: 1033B — Date: 5/31/91	
Equipment: Geonics PROTEM — Sounding: 1033B	LOOP SIZE: 20. m



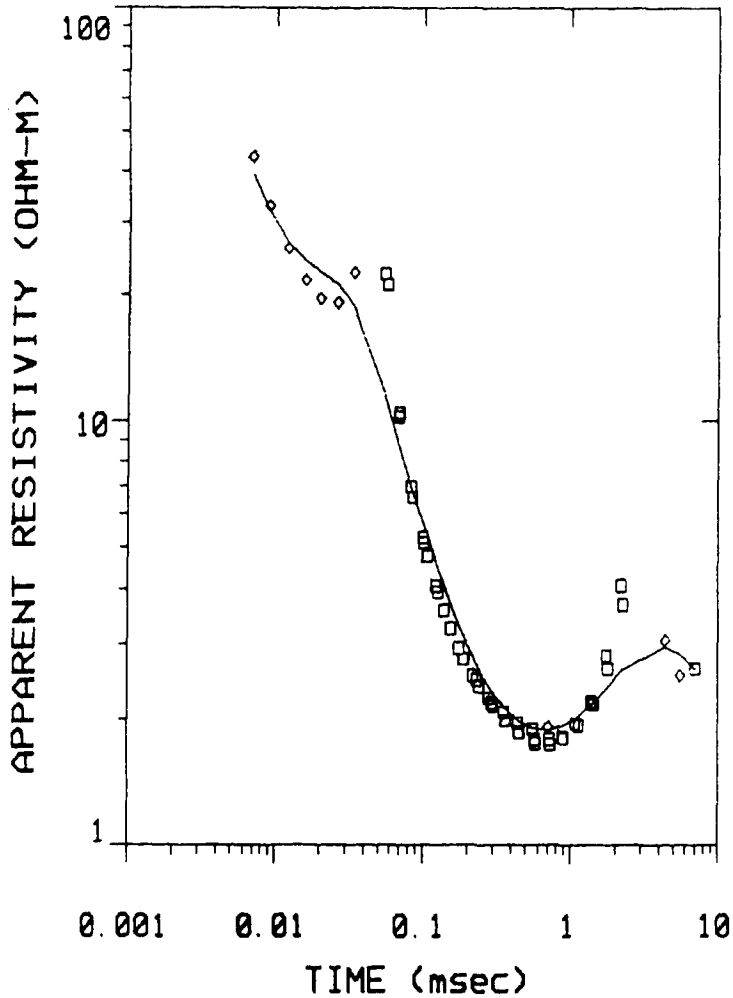


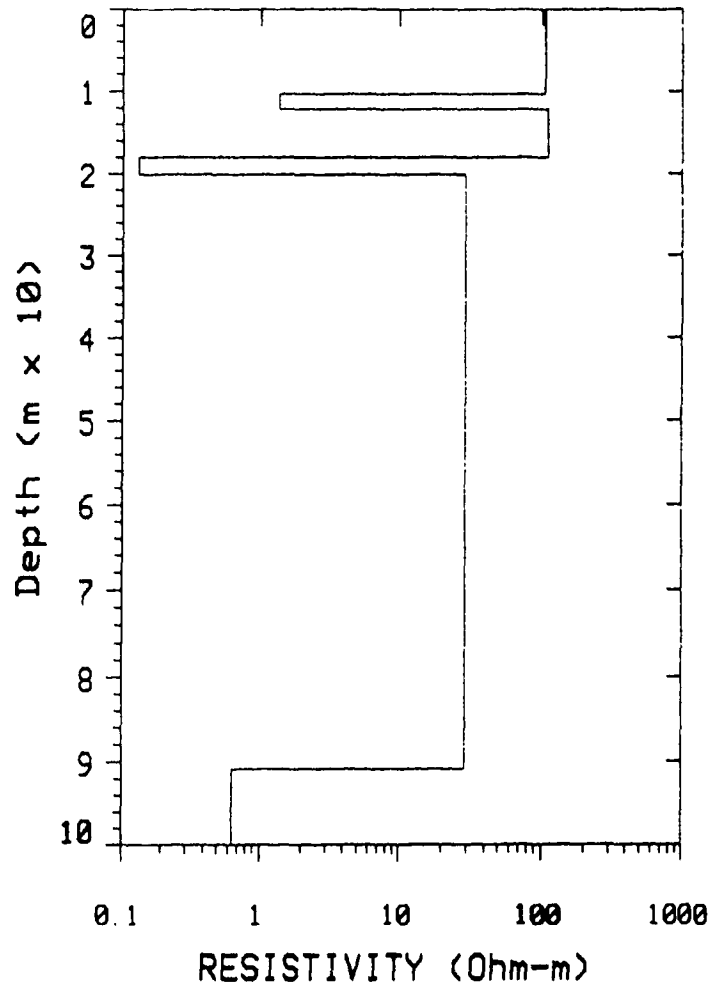
for: J. M. Montgomery	West Beach Landfill
by: Horcal Geophysical Consultants, Inc.	Alameda NAS Alameda County, CA
Data Set: 1233B — Date: 5/31/91	
Equipment: Geonics PROTEM — Sounding: 1233B	LOOP SIZE: 20. m



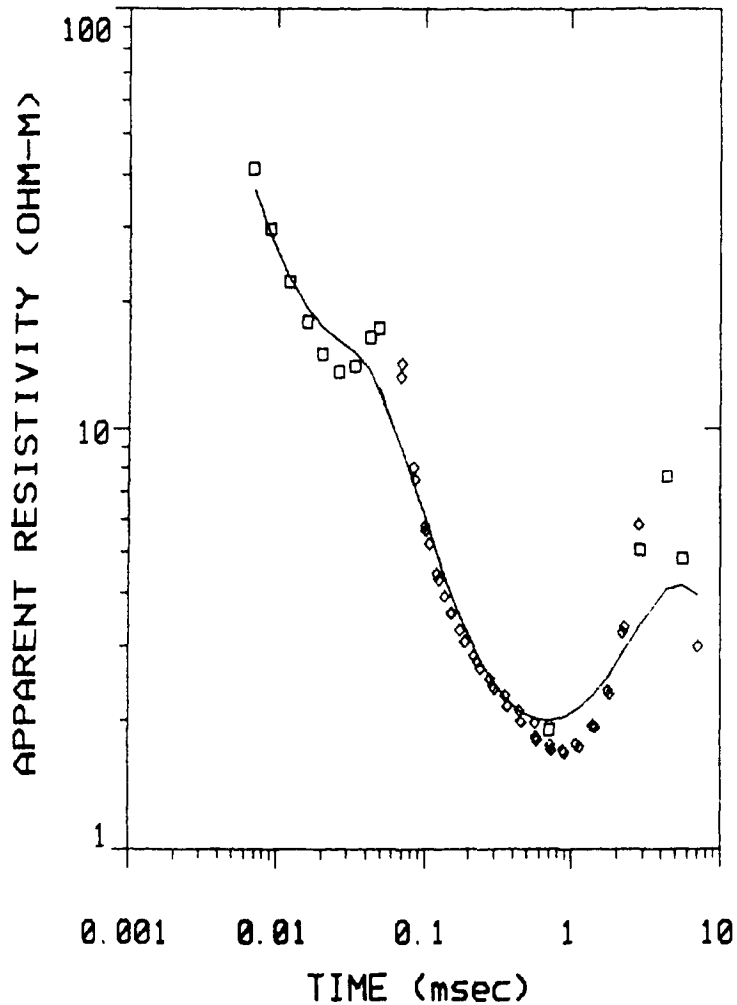


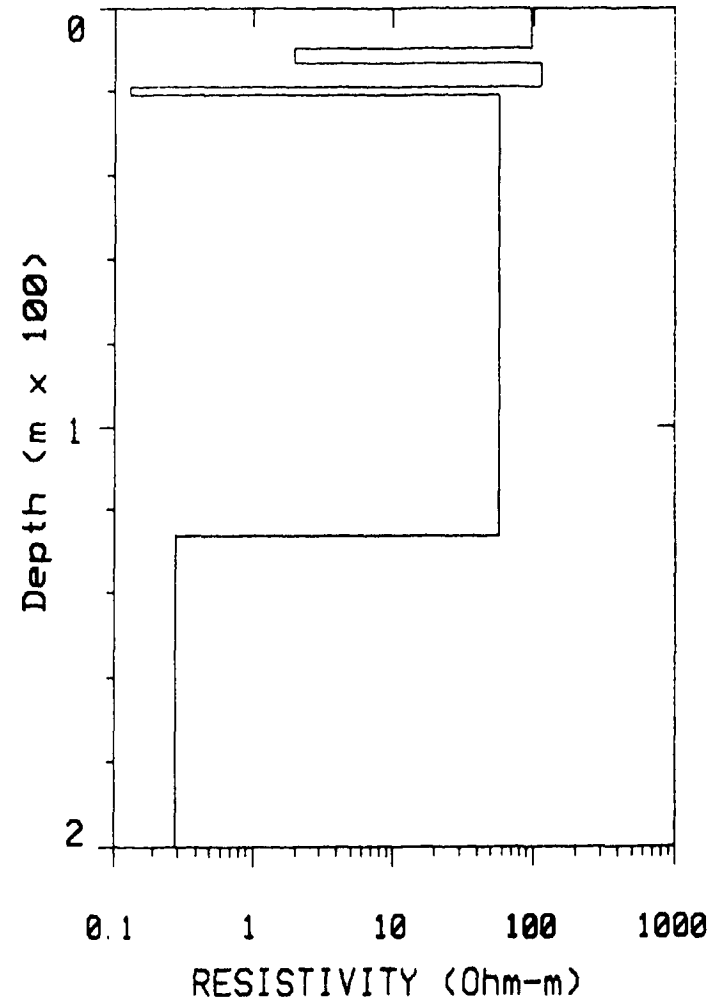
for: J. M. Montgomery	West Beach Landfill
by: Norcal Geophysical Consultants, Inc.	Alameda NAS Alameda County, CA
Data Set: 1433B — Date: 5/31/91	
Equipment: Geonics PROTEM — Sounding: 1433B	LOOP SIZE: 20. m



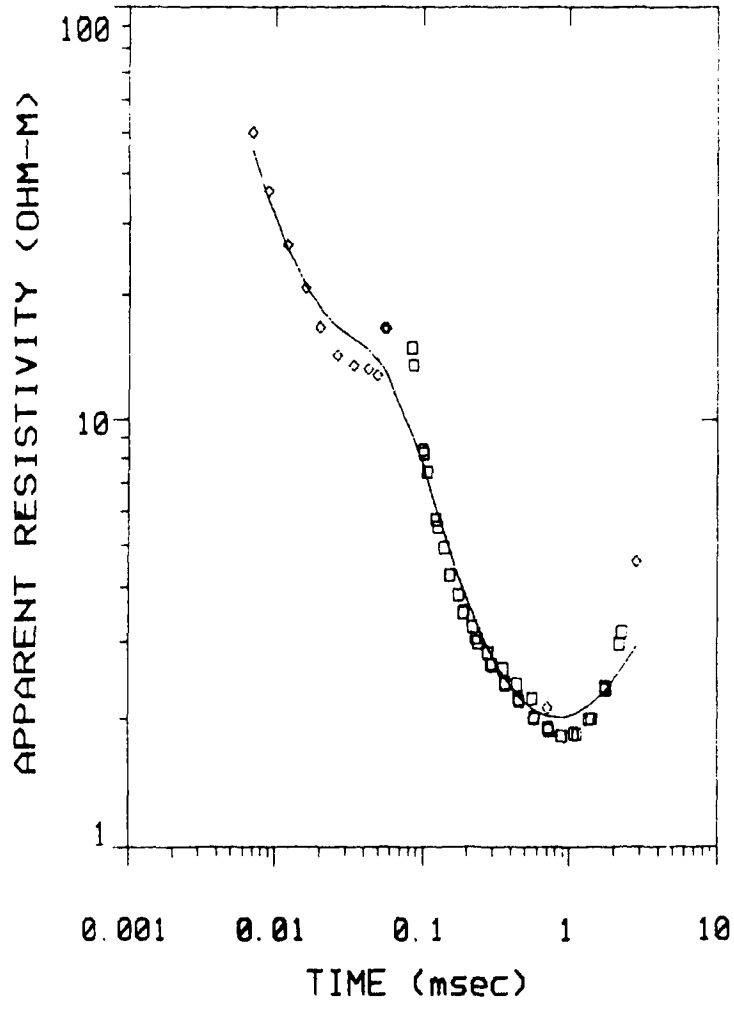


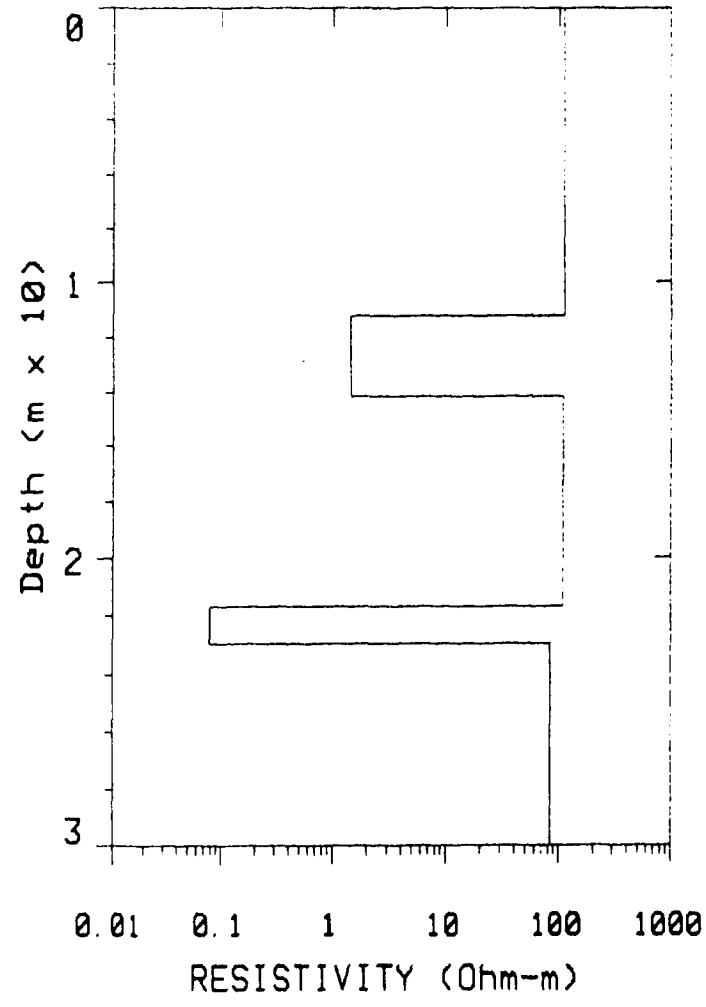
for: J. M. Montgomery	West Beach Landfill
by: Norcal Geophysical Consultants, Inc.	Alameda NAS Alameda County, CA
Data Set: 1633B — Date: 5/31/91	
Equipment: Geonics PROTEM — Funding: 1633B	LOOP SIZE: 20. m



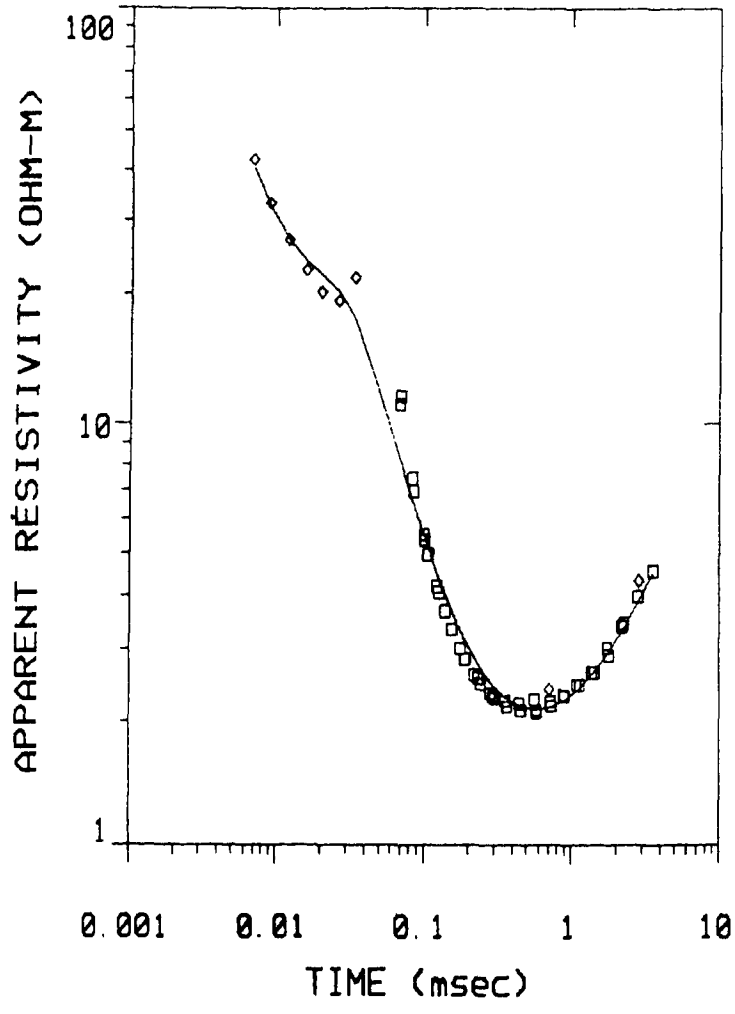


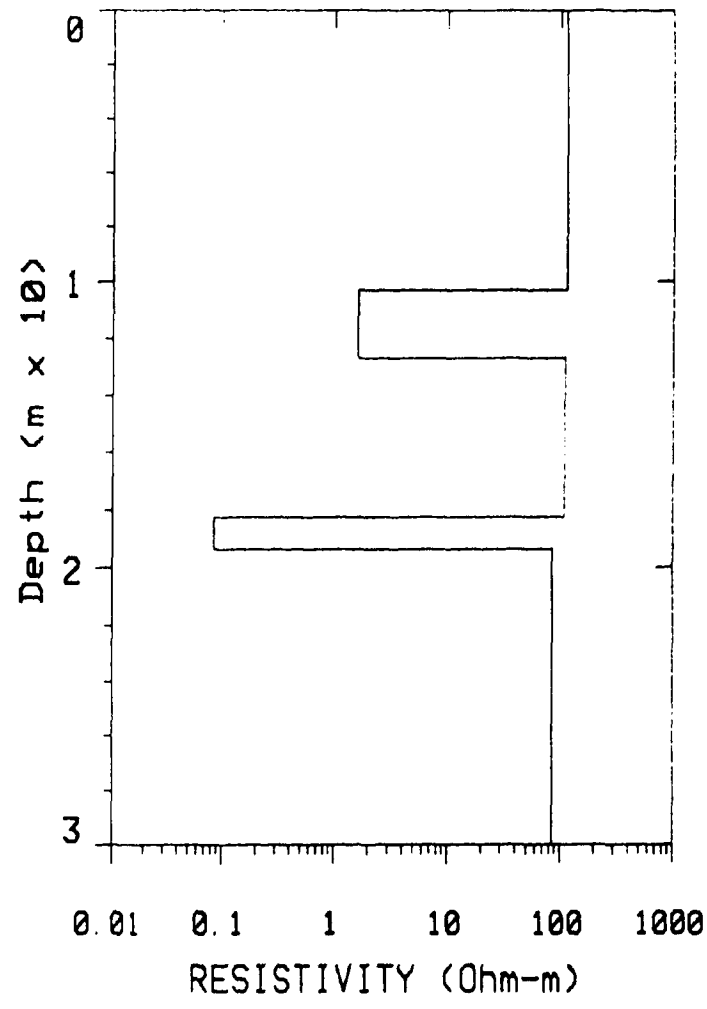
for: J. M. Montgomery	West Beach Landfill
by Norcal Geophysical Consultants, Inc	Alameda NAS Alameda County, CA
Data Set: 1833B — Date: 5/31/91	
Equipment: Geonics PROTEM — Sounding: 1833B	LOOP SIZE: 20. m



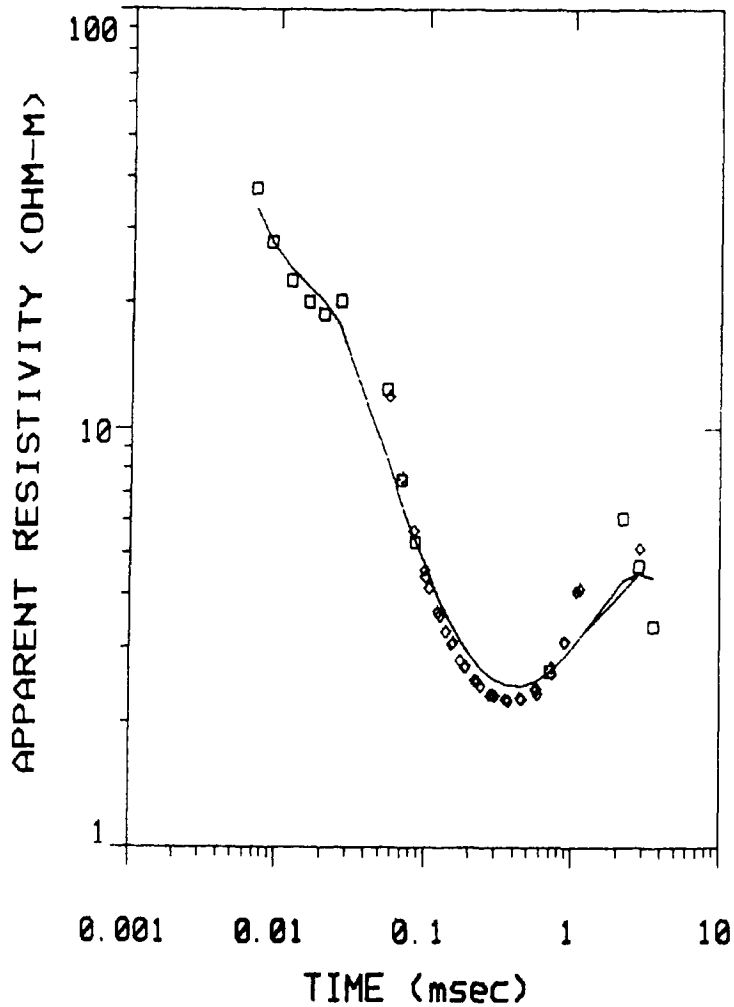


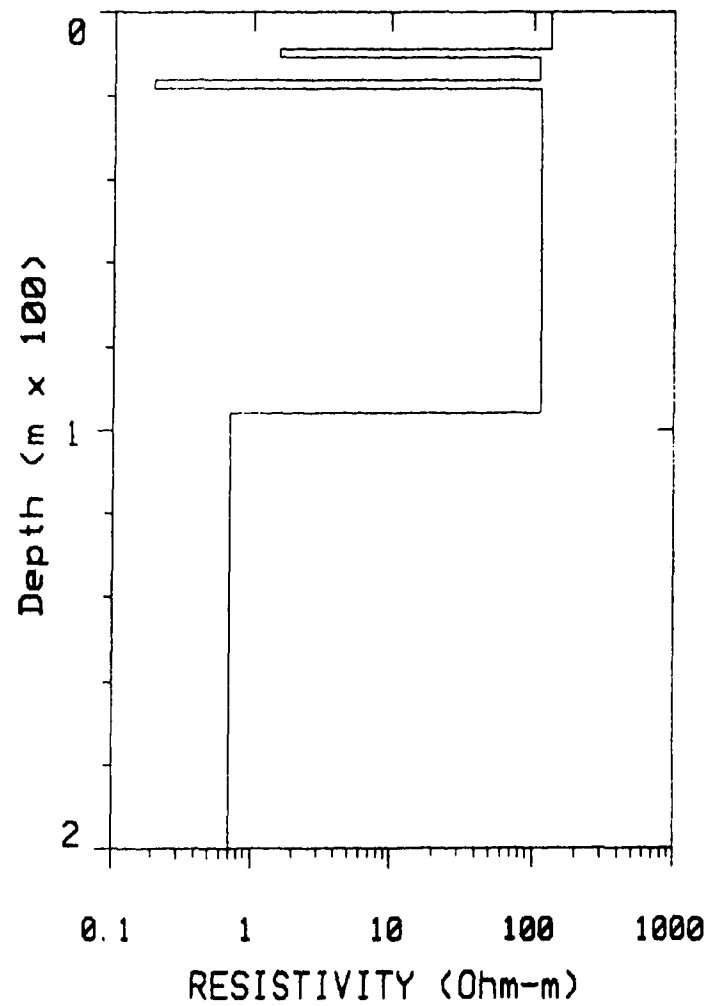
for: J. M. Montgomery	West Beach Landfill
Norcal Geophysical Consultants, Inc	Alameda NAS Alameda County, CA
Data Set: 20338 — Date: 5/31/91	
Equipment: Geonics PROTEM — Sounding 20338	LOOP SIZE: 20. m



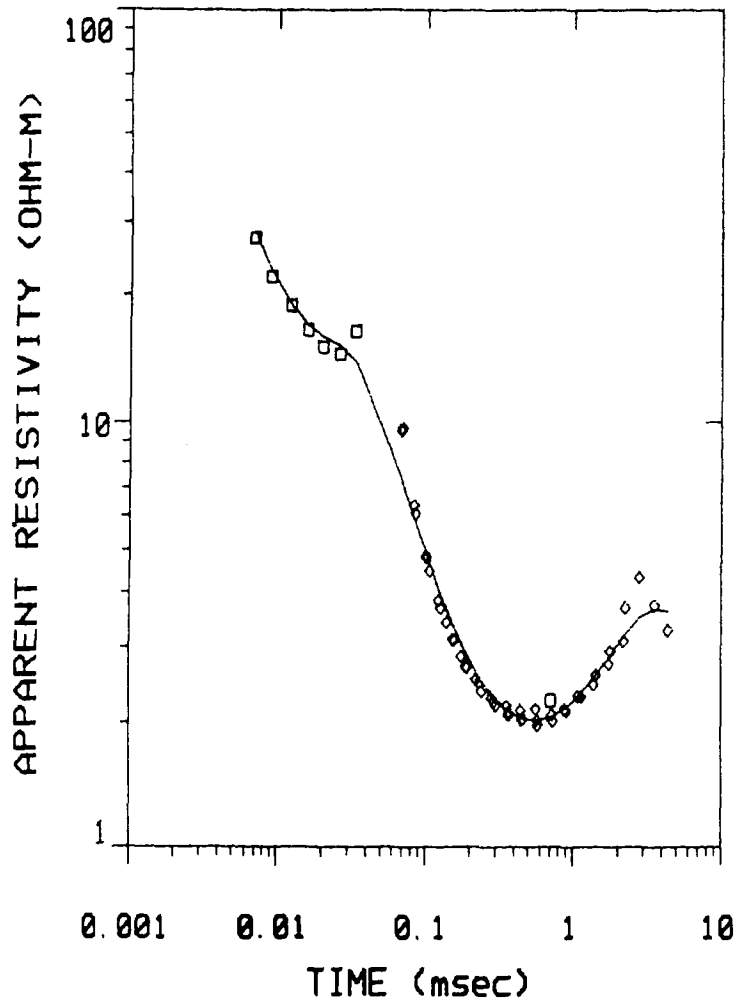


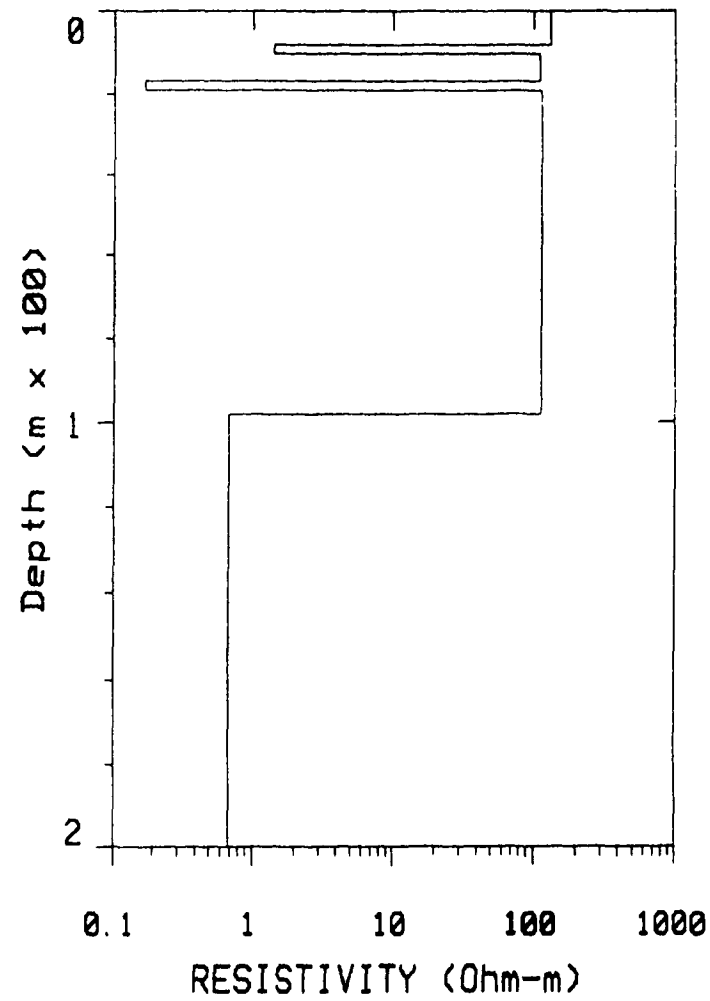
for: J. M. Montgomery	West Beach Landfill
by: Norcal Geophysical Consultants, Inc.	Alameda NAS Alameda County, CA
Data Set: 2167B — Date: 5/31/91	
Equipment: Geonics PROTEM — Sounding: 2167B	LOOP SIZE: 20. m



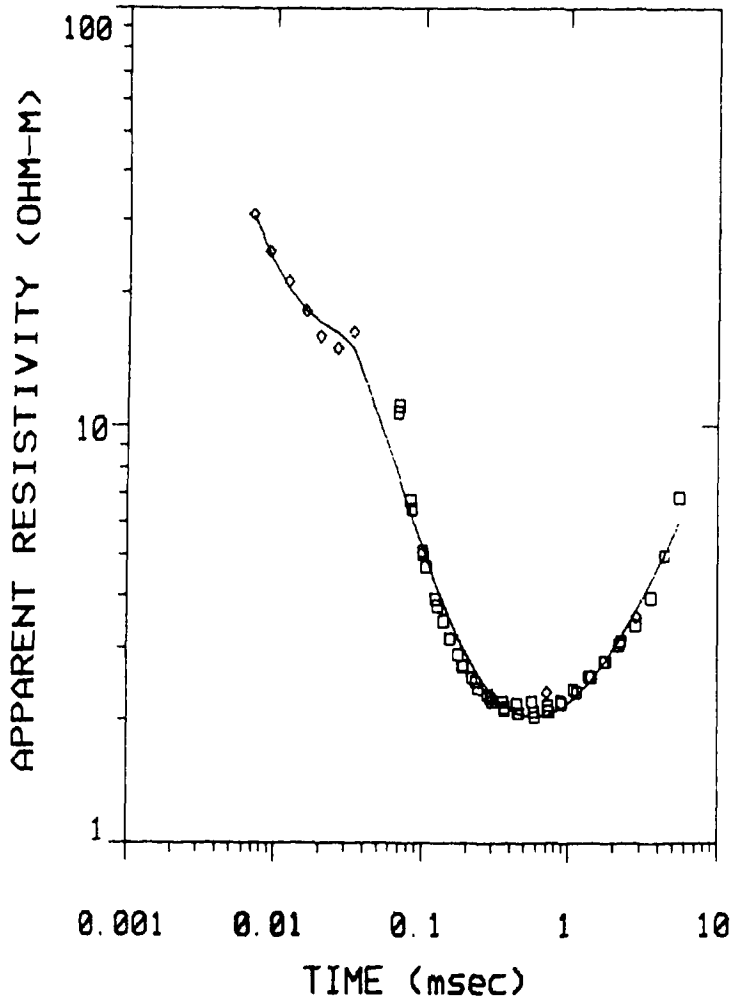


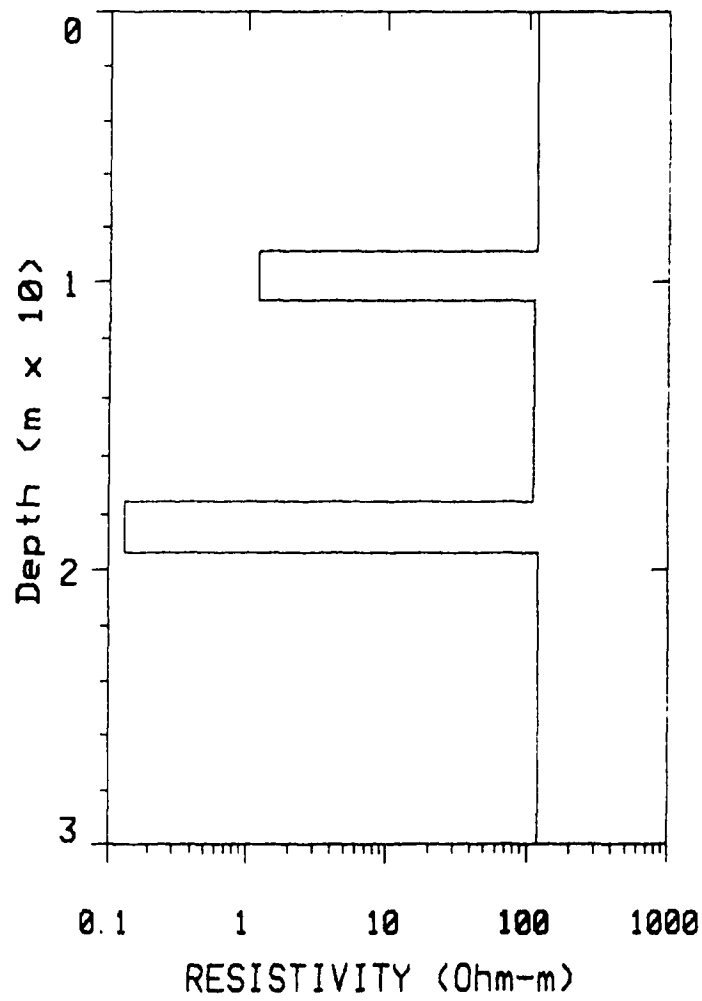
for: J. M. Montgomery	West Beach Landfill
by Norcal Geophysical Consultants, Inc.	Alameda NAS Alameda County, CA
Data Set: 2367B — Date: 5/31/91	
Equipment: Geonics PROTEM — Filing: 2367B	LOOP SIZE: 20. m



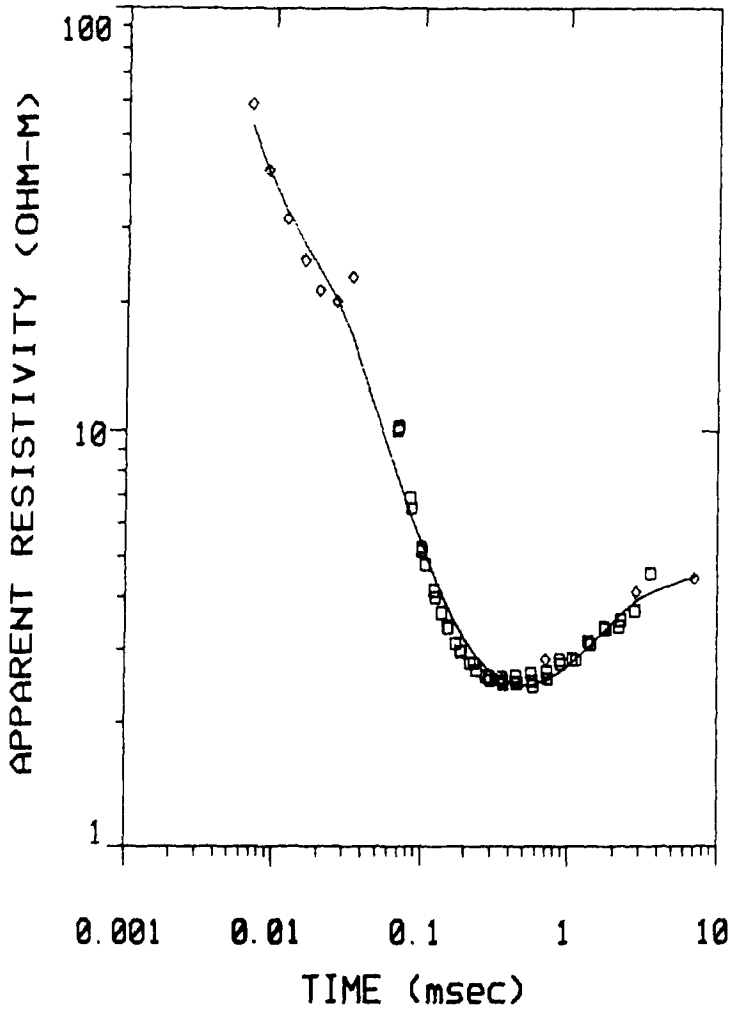


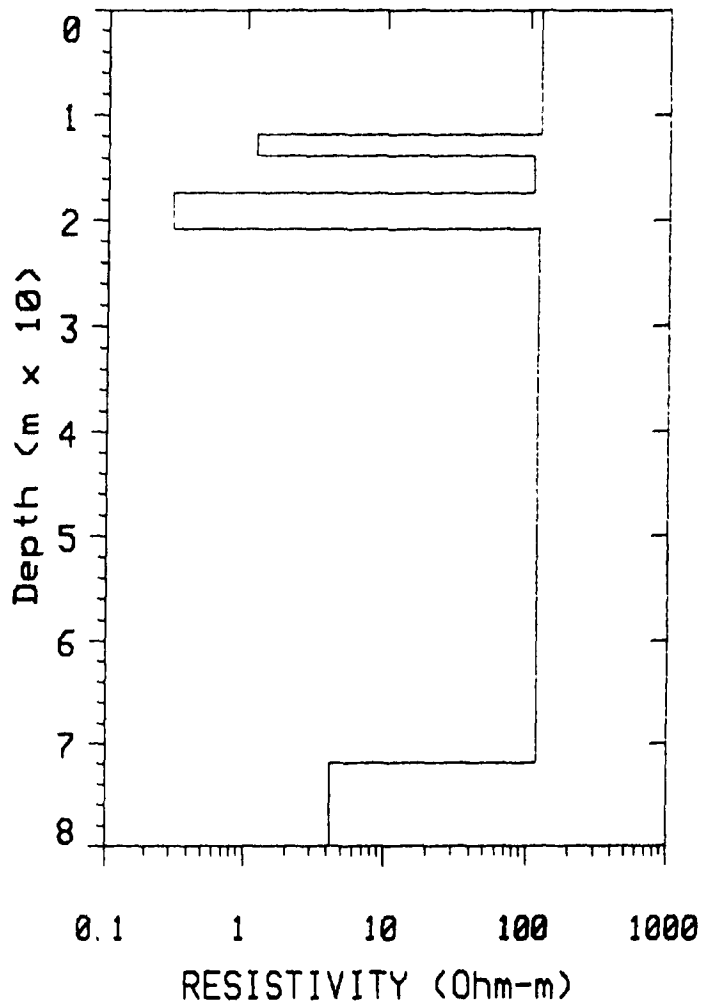
for: J. M. Montgomery	West Beach Landfill
by: Norcal Geophysical Consultants, Inc.	Alameda NAS Alameda County, CA
Data Set: 2633B — Date: 5/31/91	
Equipment: Geonics PROTEM — Sounding: 2633B	LOOP SIZE: 20. m



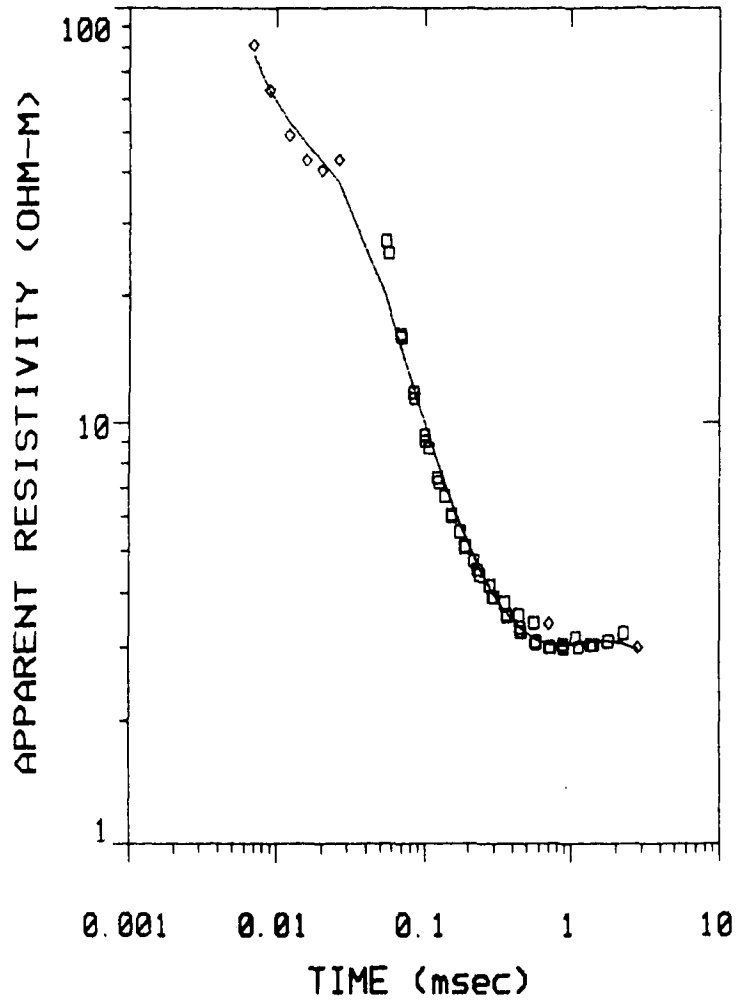


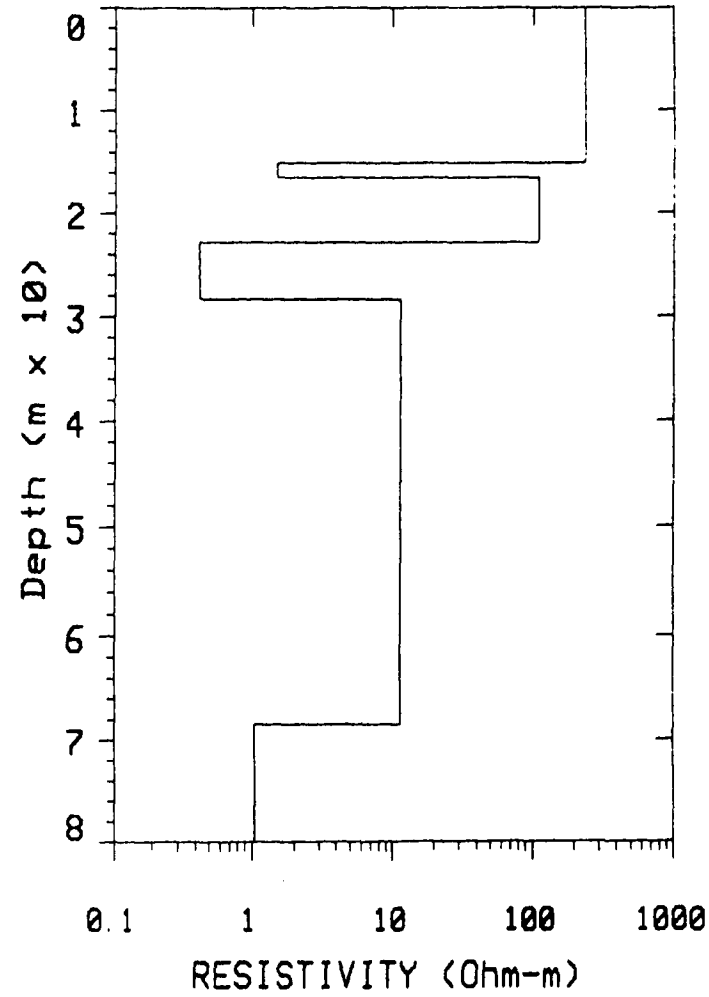
for: J. M. Montgomery	West Beach Landfill
by: Norcal Geophysical Consultants, Inc	Alameda NAS Alameda County, CA
Data Set: 2767B — Date: 5/31/91	
Equipment: Geonics PROTEM — Sounding: 2767B	LOOP SIZE: 20. m



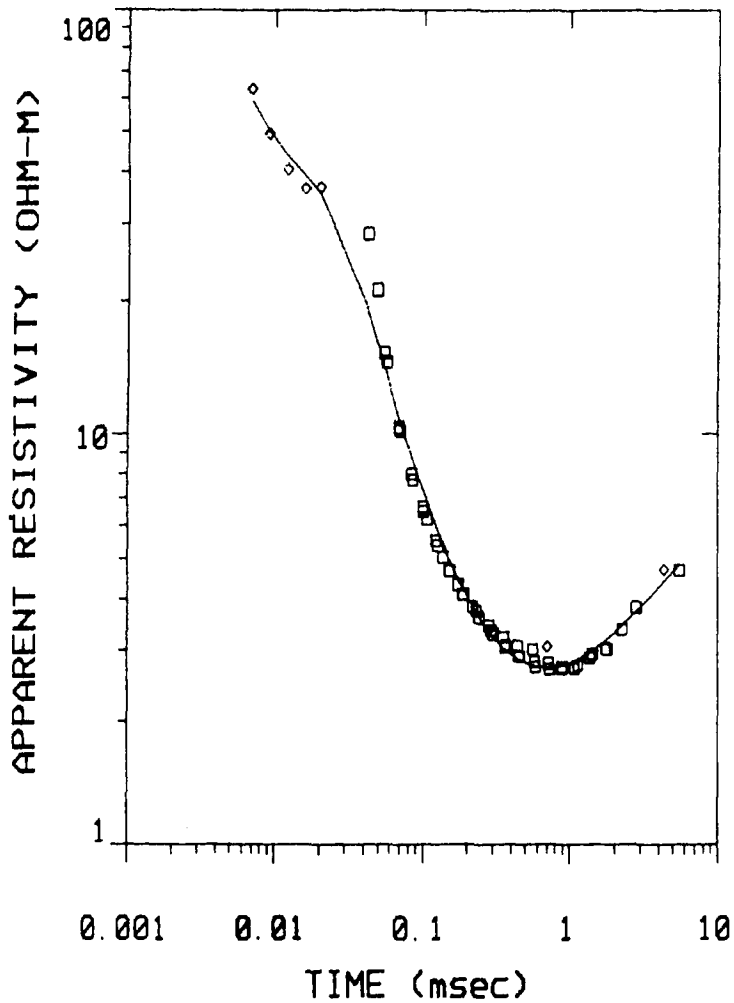


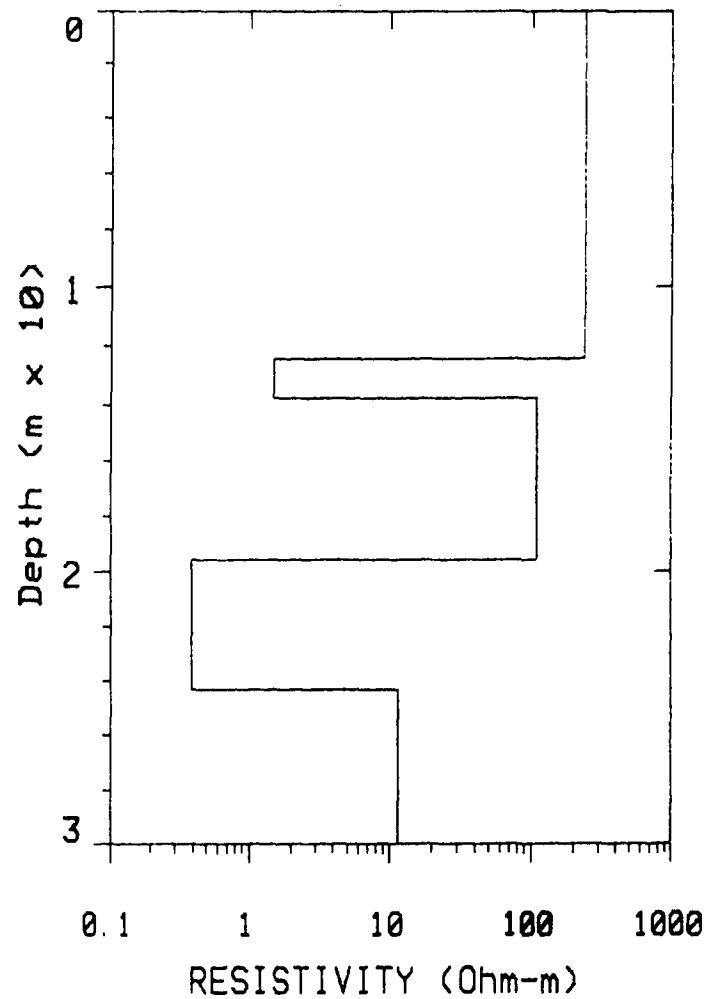
for: J. M. Montgomery	West Beach Landfill
by Norcal Geophysical Consultants, Inc.	Alameda NAS Alameda County, CA
Data Set: 2853B — Date: 5/31/91	
Equipment: Geonics PROTEM — Sounding: 2853B	LOOP SIZE: 20. m



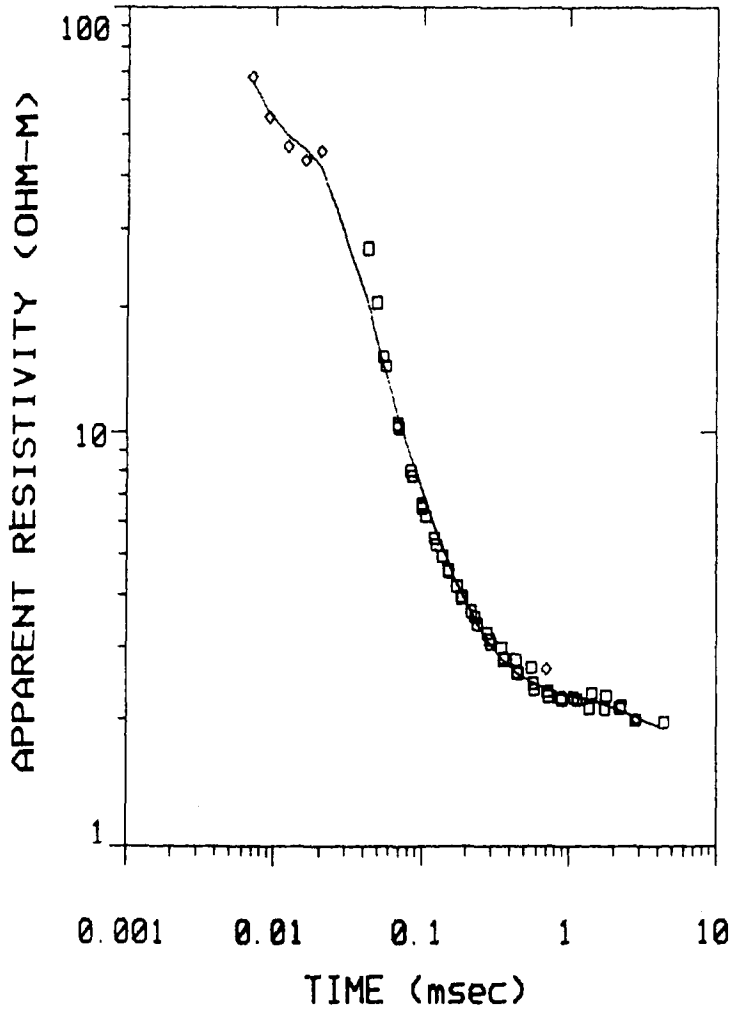


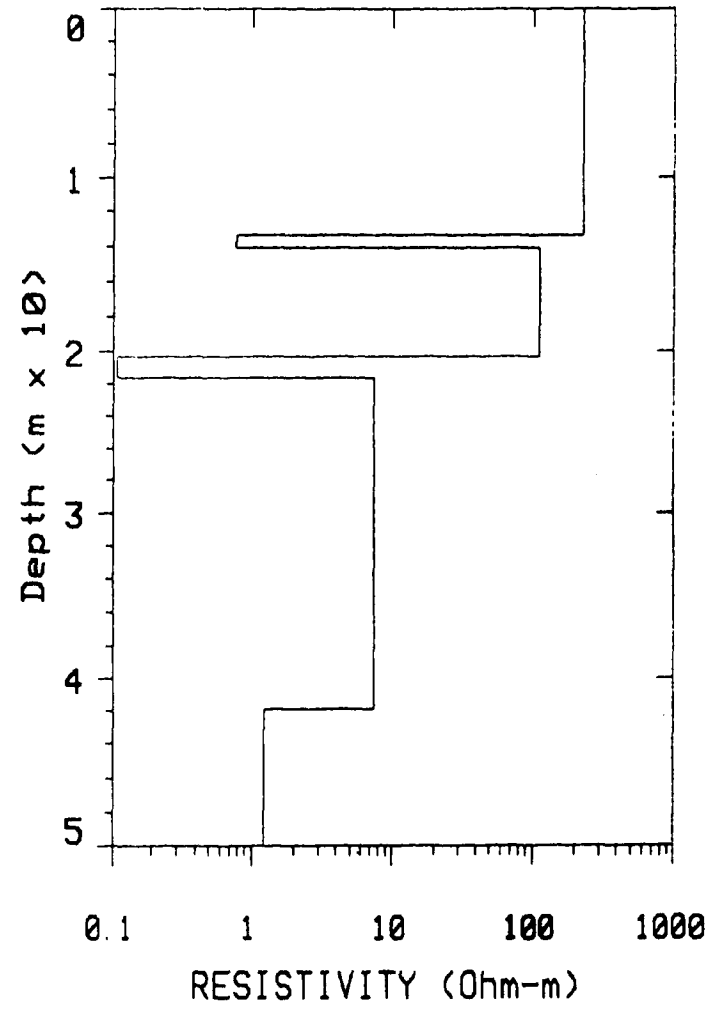
for: J. M. Montgomery	West Beach Landfill
Norcal Geophysical Consultants, Inc	Alameda NAS Alameda County, CA
Data Set: / Date: 5/31/91	
Equipment: Geonics PROTEM / Sounding: 83C	LOOP SIZE: 20. m



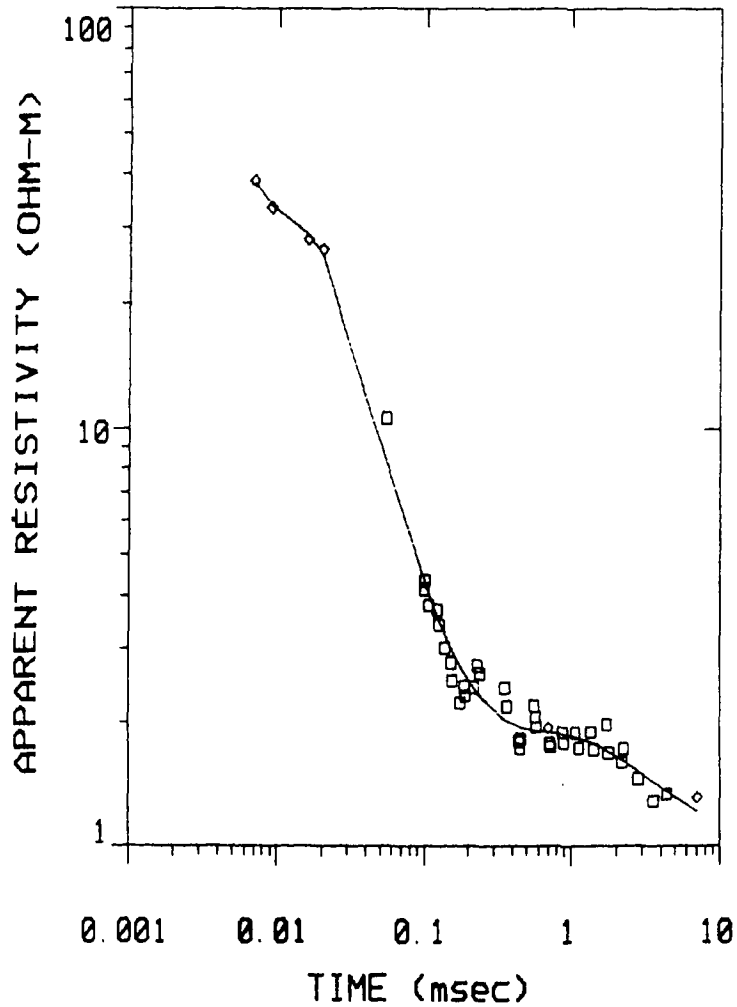


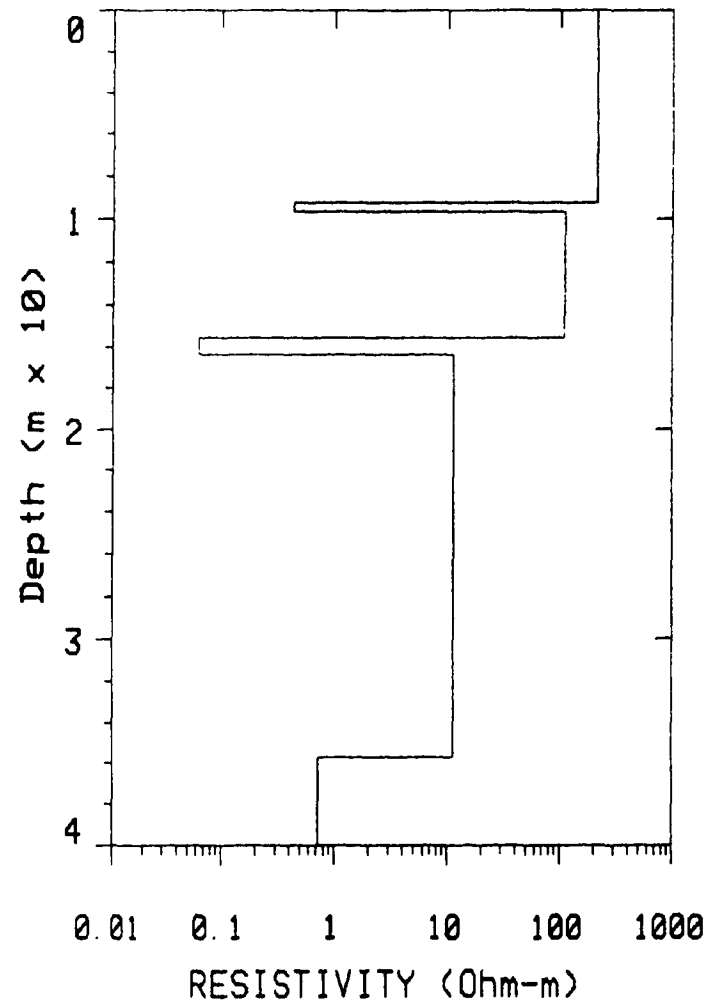
for: J. M. Montgomery	West Beach Landfill
by: Norcal Geophysical Consultants, Inc.	Alameda NAS Alameda County, CA
Data Set: 283 / Date: 5/31/91	
Equipment: Geonics PROTEM / Sounding: 283C	LOOP SIZE: 20. m



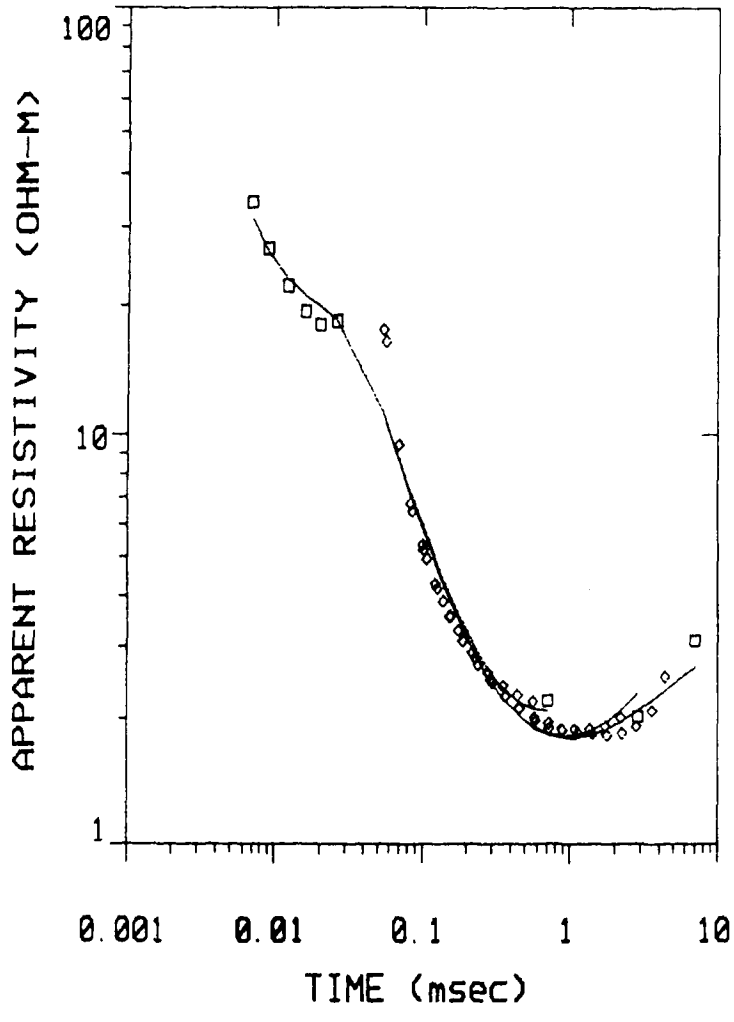


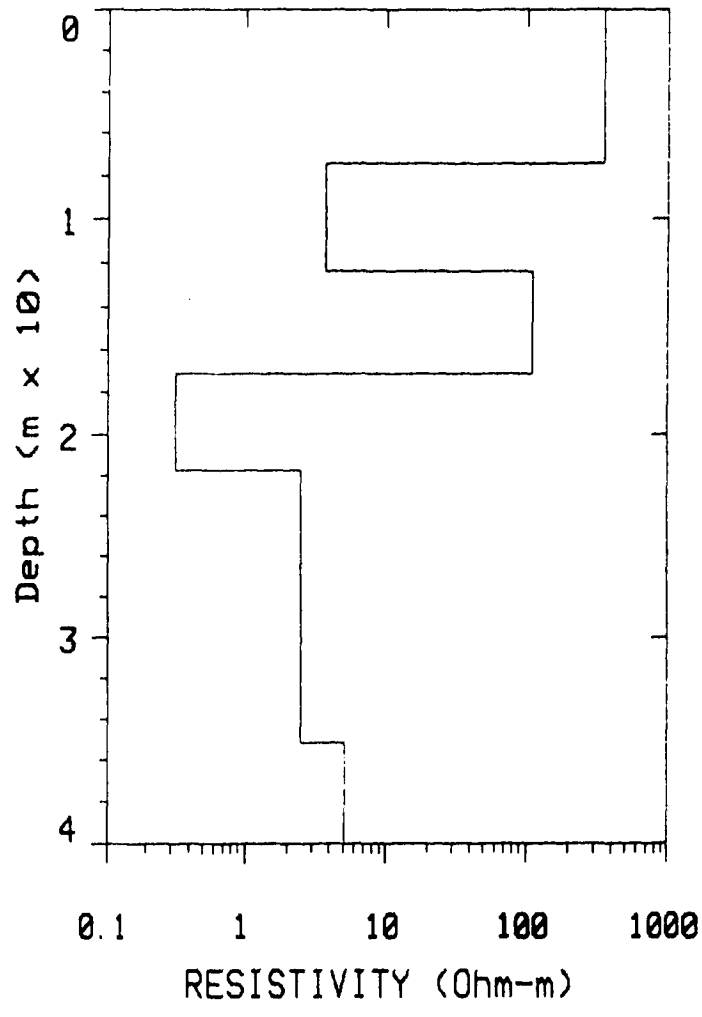
for: J. M. Montgomery	West Beach Landfill
Norcal Geophysical Consultants, Inc.	Alameda NAS Alameda County, CA
Data Set: 483C — Date: 5/31/91	
Equipment: Geonics PROTEM — unding 483C	LOOP SIZE: 20. m



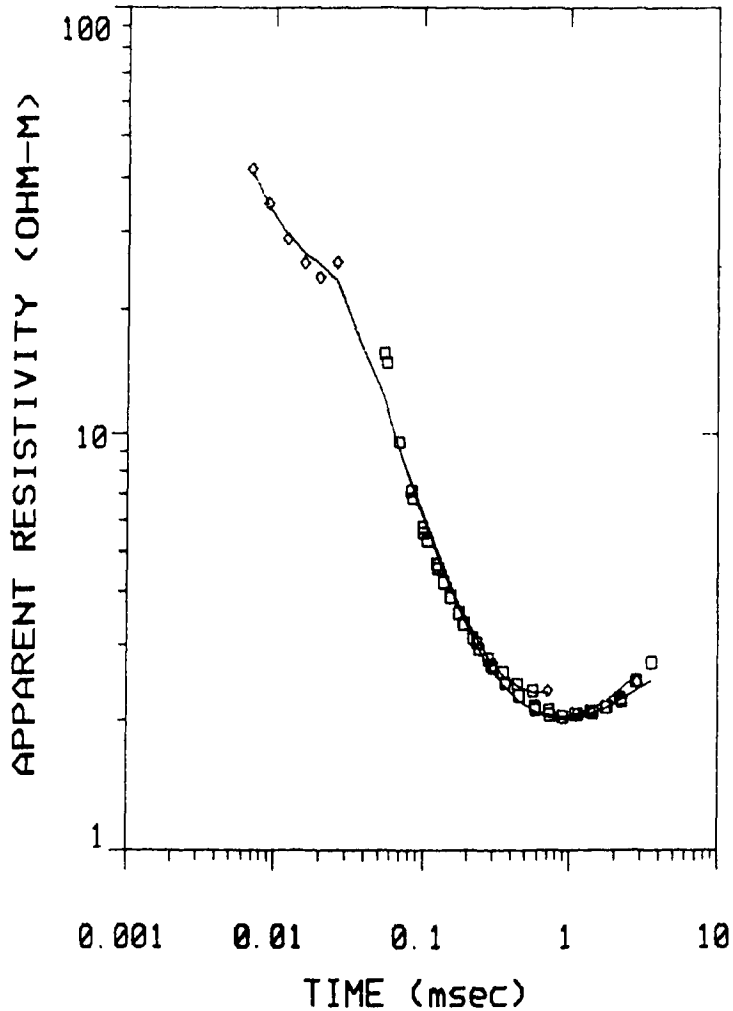


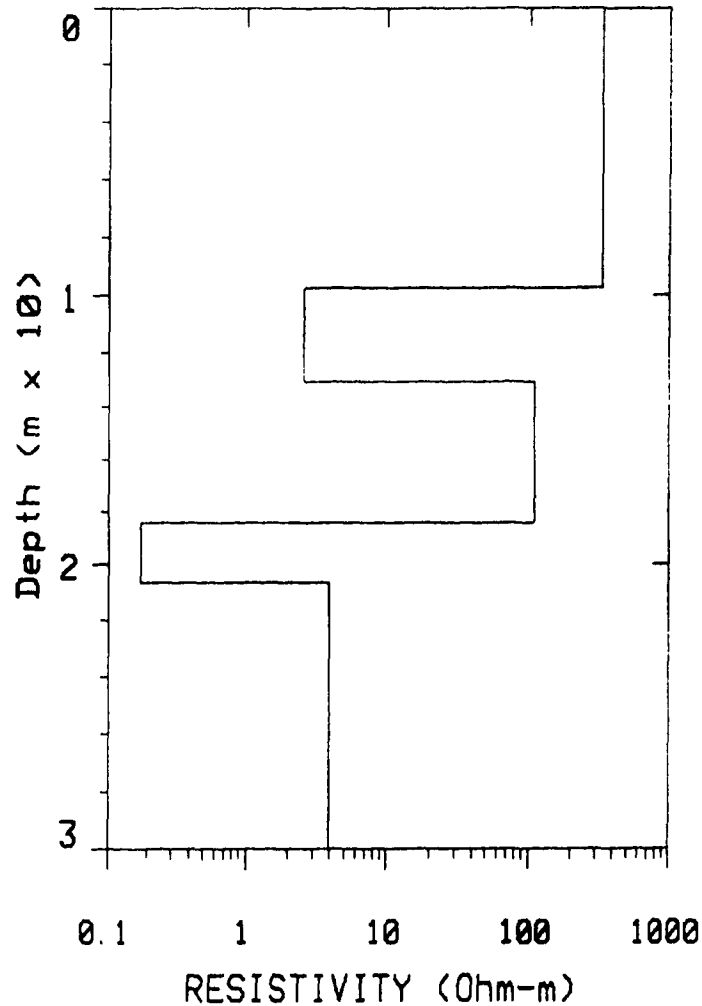
for: J. M. Montgomery	West Beach Landfill
by Norcal Geophysical Consultants, Inc.	Alameda NAS Alameda County, CA
Data Set: 683C — Date: 5/31/91	
Equipment: Geonics PROTEM — Sounding: 683C	LOOP SIZE: 20. m



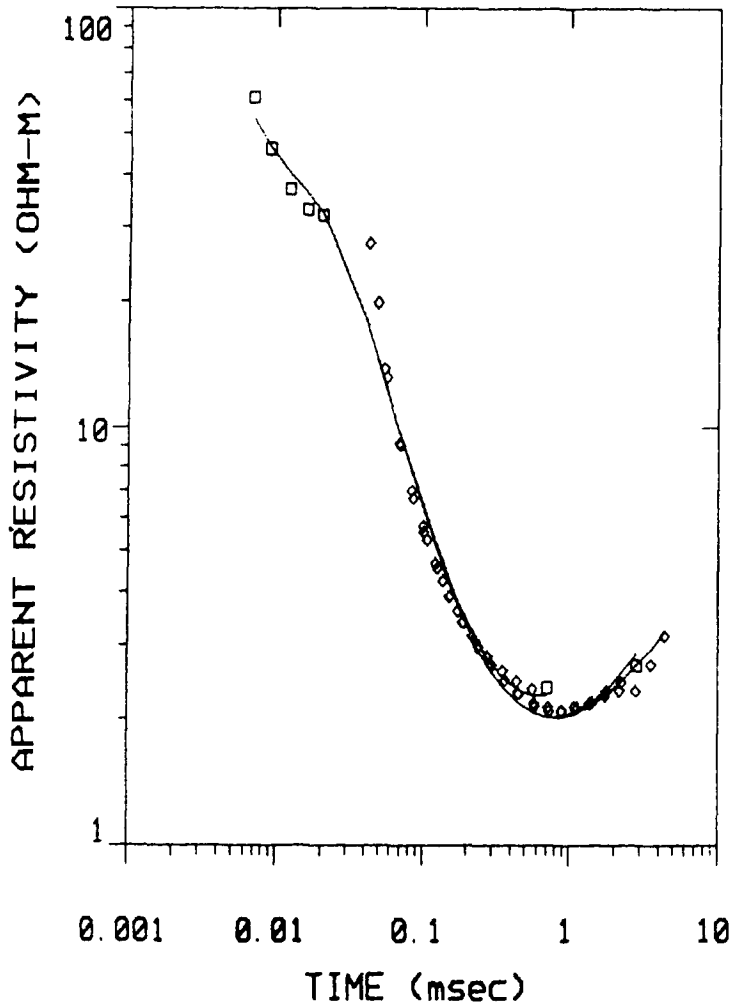


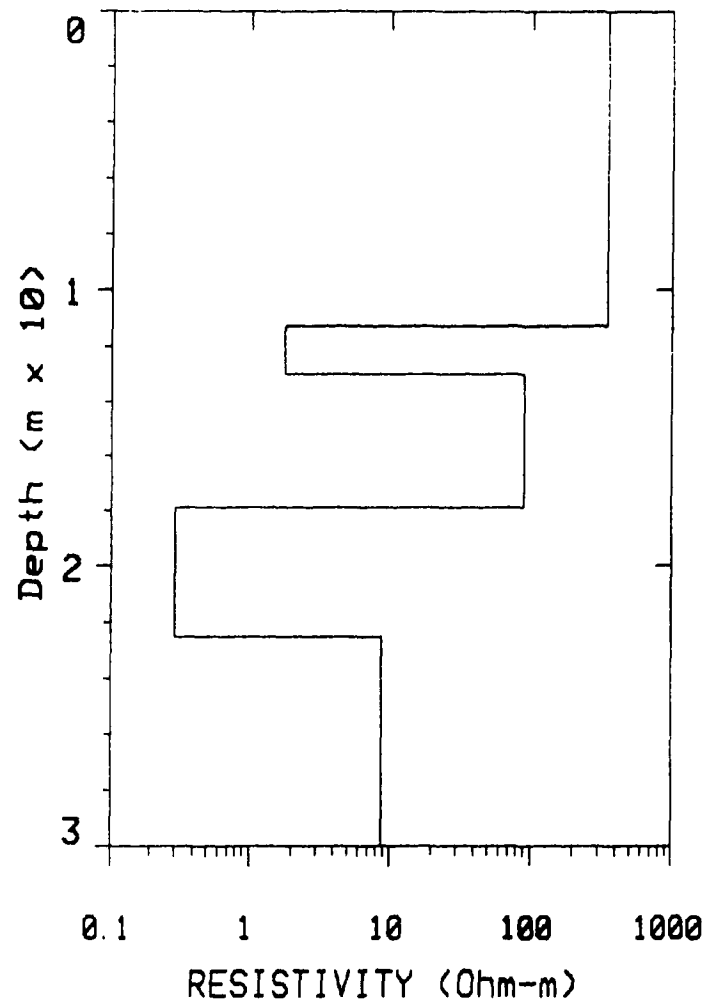
for: J. M. Montgomery	West Beach Landfill
by Norcal Geophysical Consultants, Inc.	Alameda NAS Alameda County, CA
Data Set: 883C — Date: 5/31/91	
Equipment: Geonics PROTEM — Sounding 883C	LOOP SIZE: 20. m



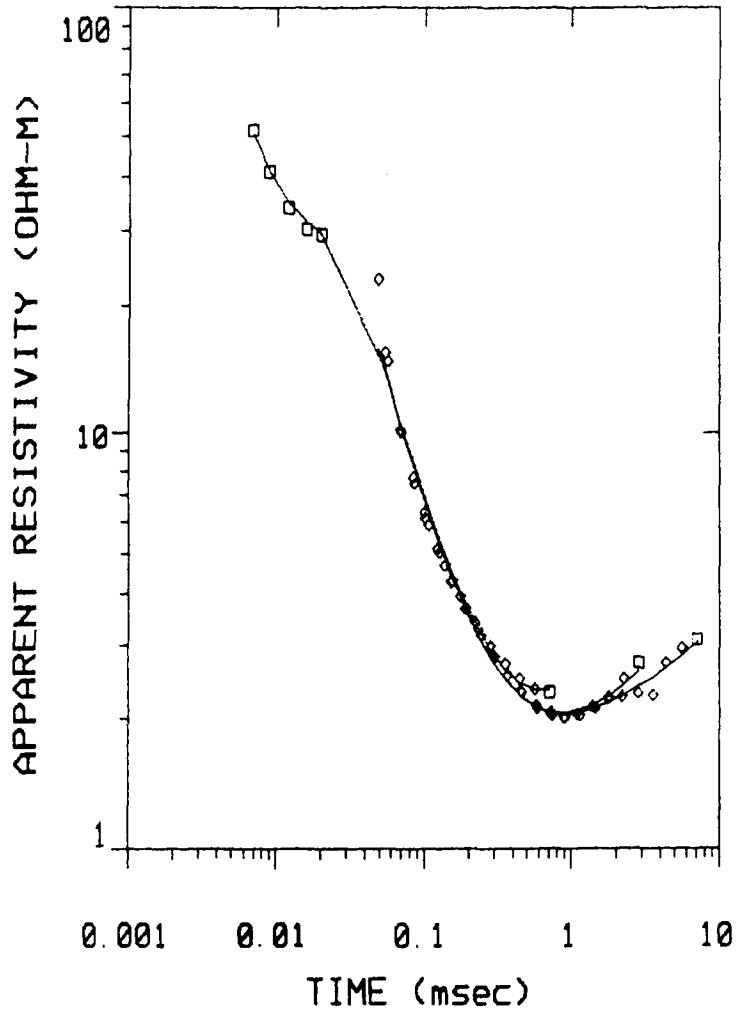


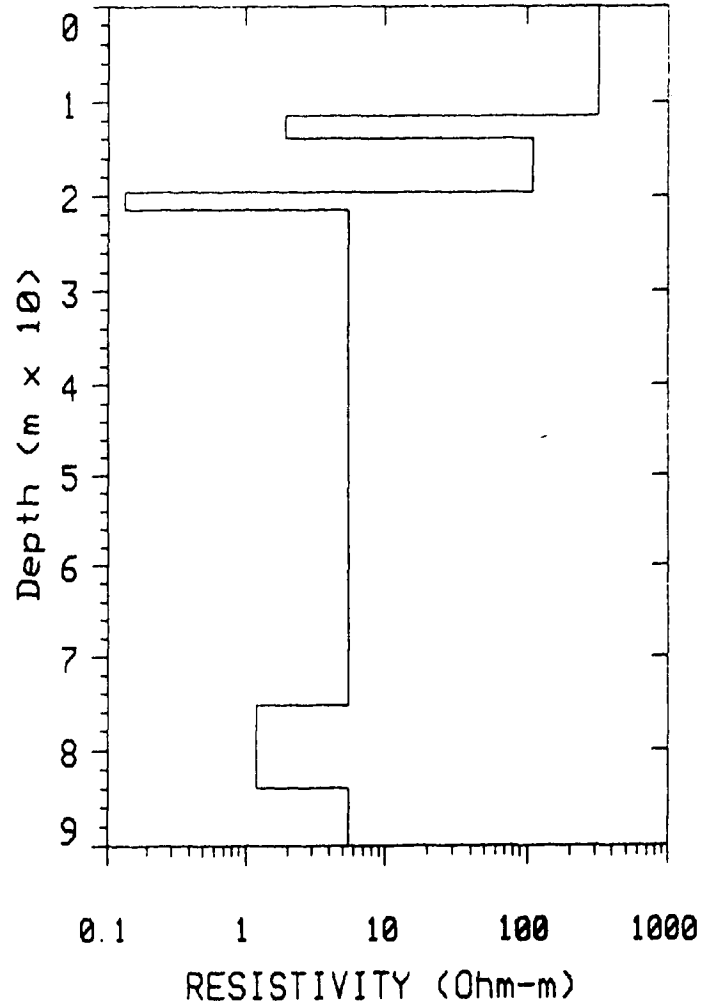
for: J. M. Montgomery		West Beach Landfill
by: Norcal Geophysical Consultants, Inc.		Alameda NAS Alameda County, CA
Data Set: 1083C	Date: 5/31/91	
Equipment: Geonics PROTEM	Sounding: 1083C	LOOP SIZE: 20. m



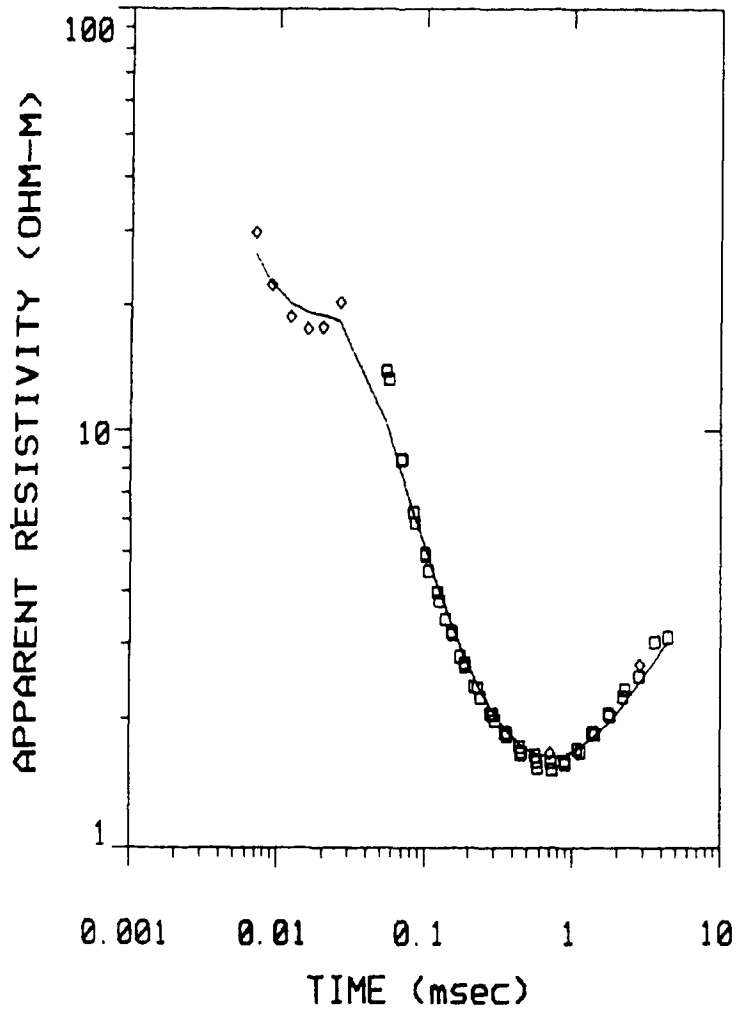


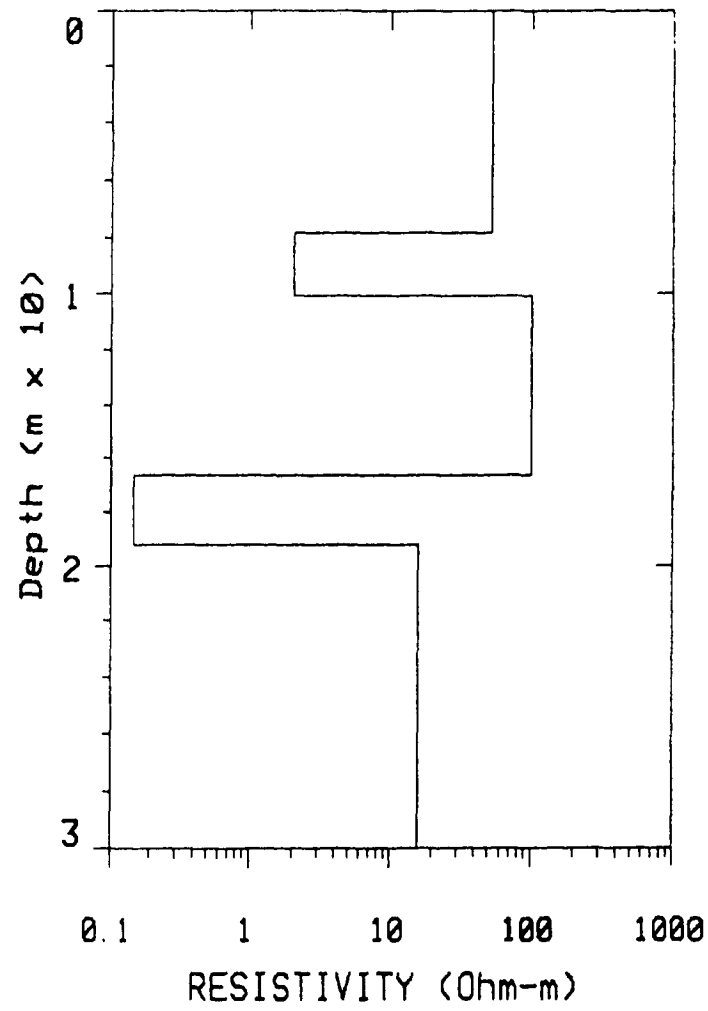
for: J. M. Montgomery	West Beach Landfill
Norcal Geophysical Consultants, Inc	Alameda NAS Alameda County, CA
Data Set: ANASC — Date: 5/31/91	
Equipment: Geonics PROTEM — Sounding: 1283C	LOOP SIZE: 20. m



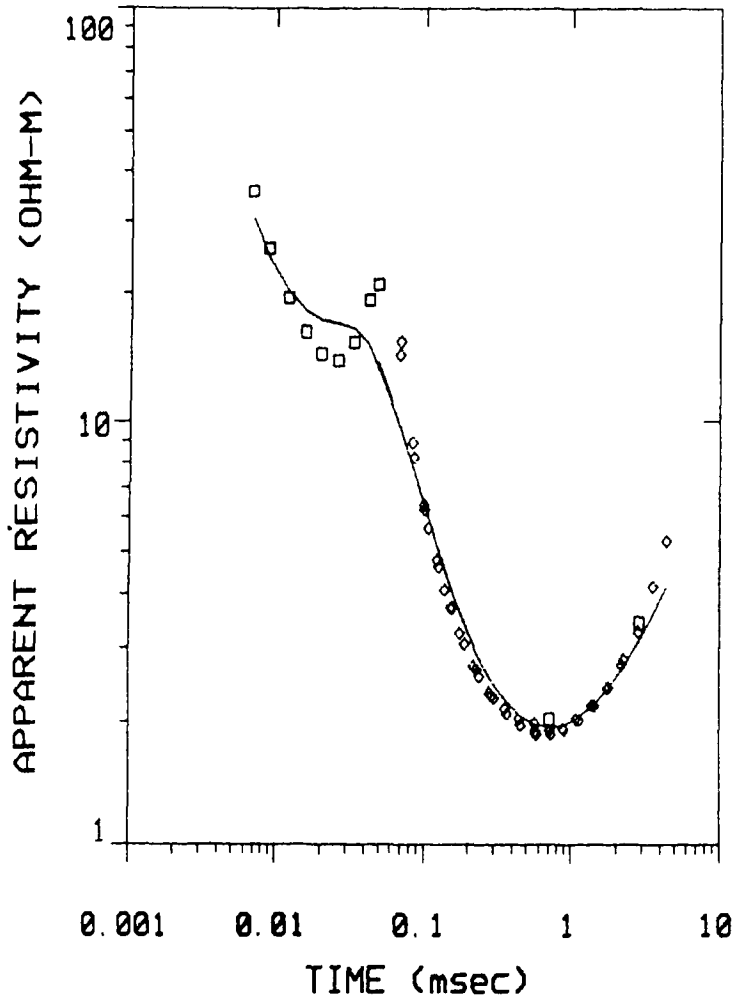


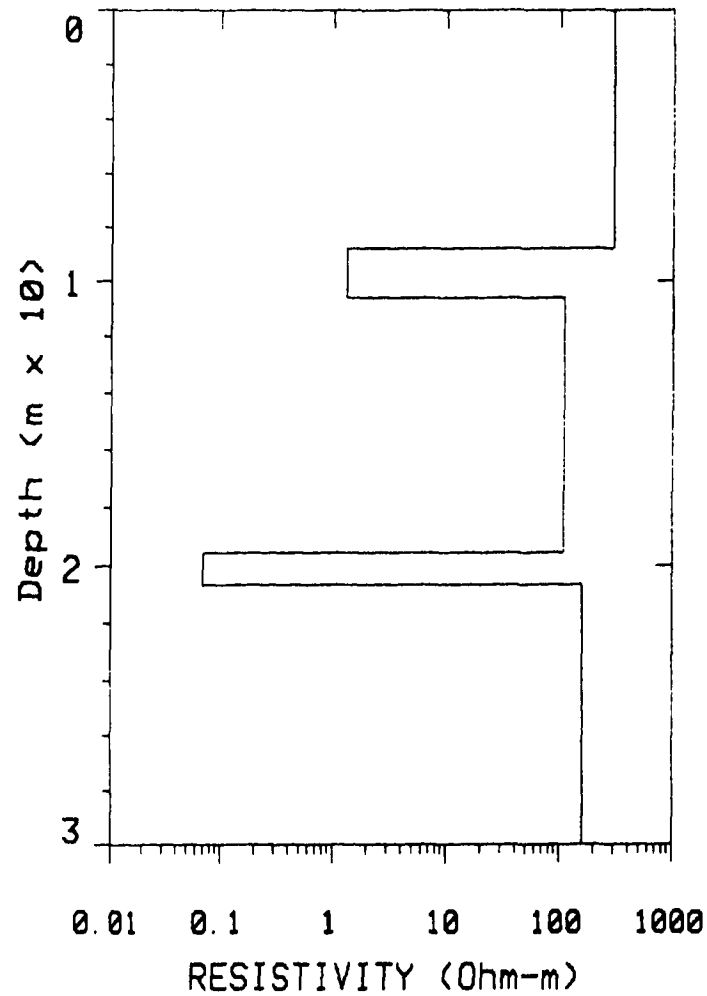
for: J. M. Montgomery	West Beach Landfill
Norcal Geophysical Consultants, Inc.	Alameda NAS Alameda County, CA
Data Set: 1483C — Date: 5/31/91	
Equipment: Geonics PROTEM — Sounding: 1483C	LOOP SIZE: 20. m



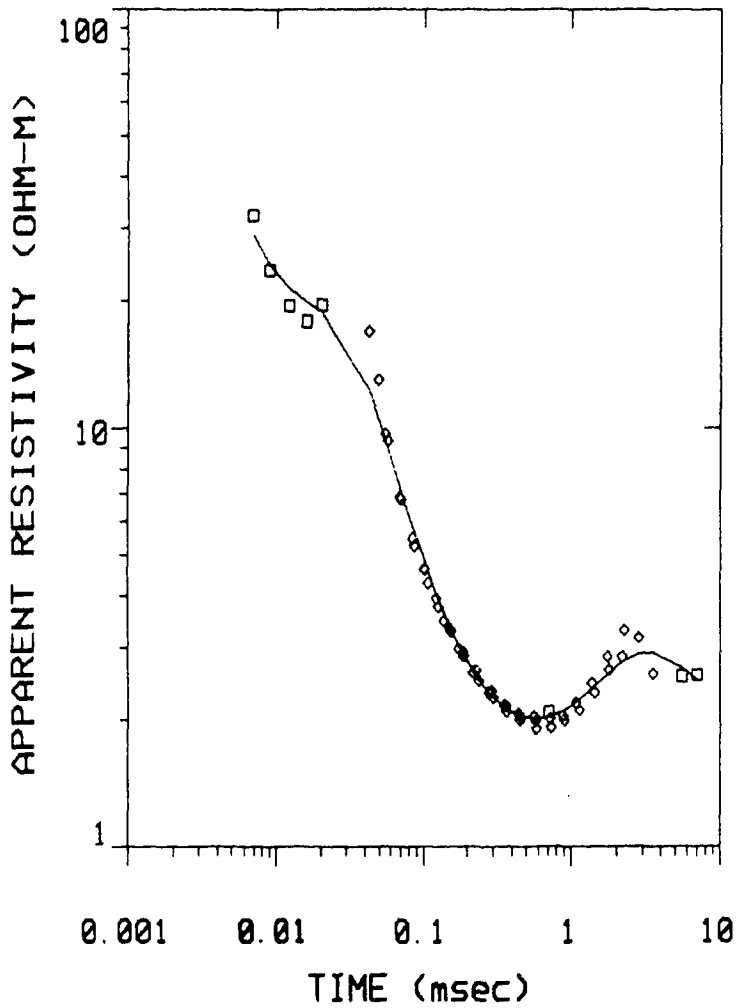


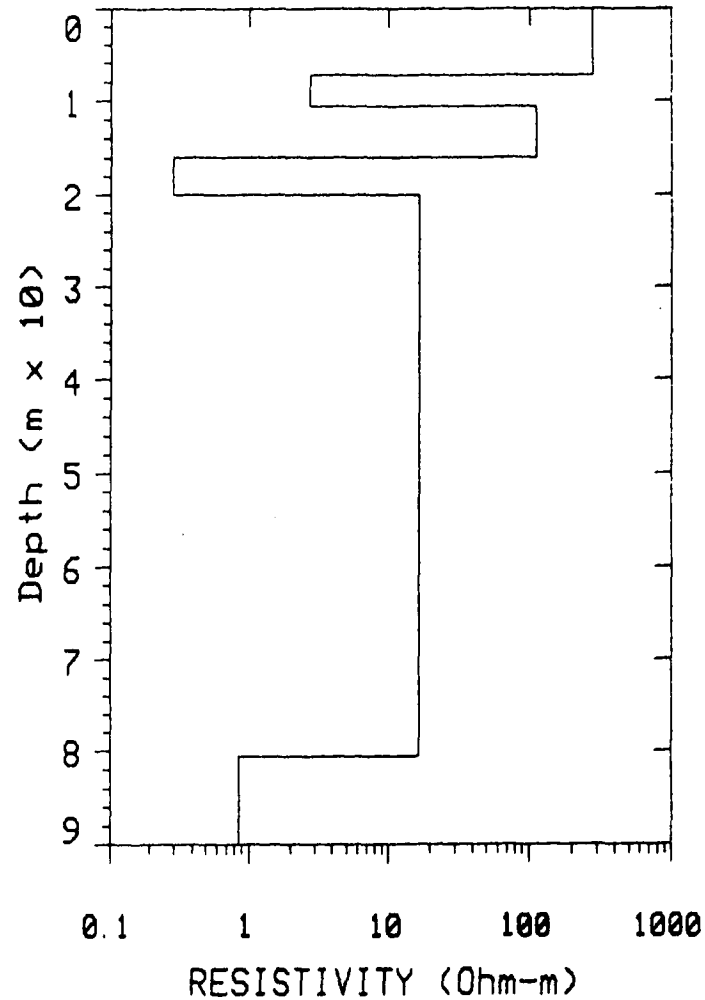
for: J. M. Montgomery	West Beach Landfill
by: Norcal Geophysical Consultants, Inc.	Alameda NAS Alameda County, CA
Data Set: 167D — Date: 6/7/91	
Equipment: Geonics PROTEM — unding: 167D	LOOP SIZE: 20. m



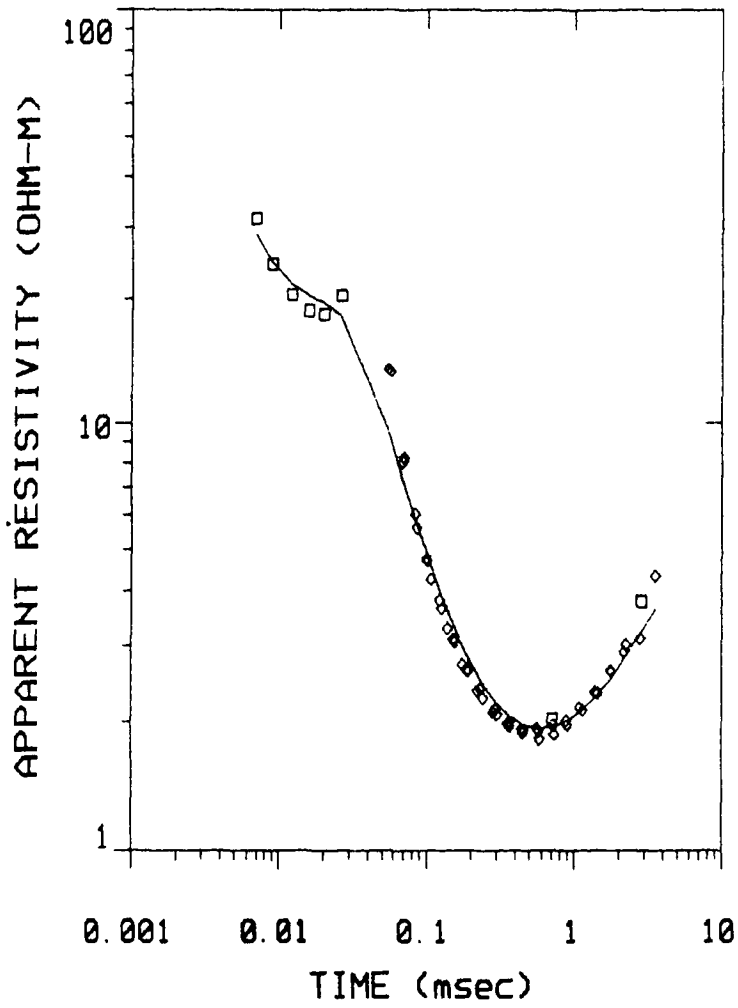


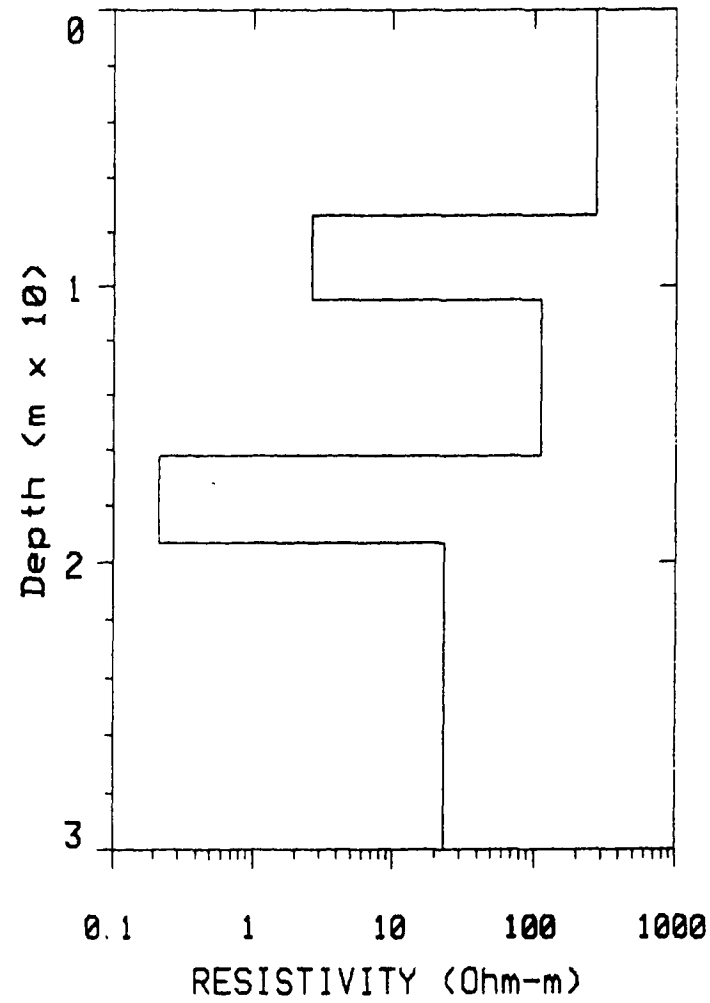
for: J. M. Montgomery		West Beach Landfill
by: Norcal Geophysical Consultants, Inc.		Alameda NAS Alameda County, CA
Data Set: 367D	Date: 6/7/91	
Equipment: Geonics PROTEM	Sounding: 367D	LOOP SIZE: 20. m



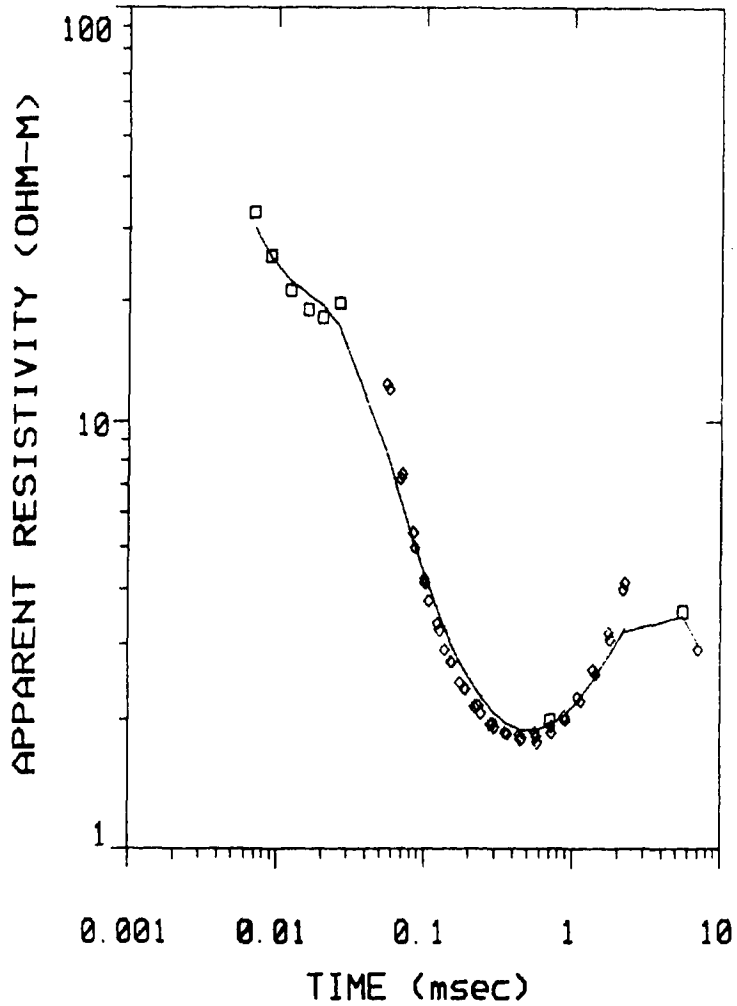


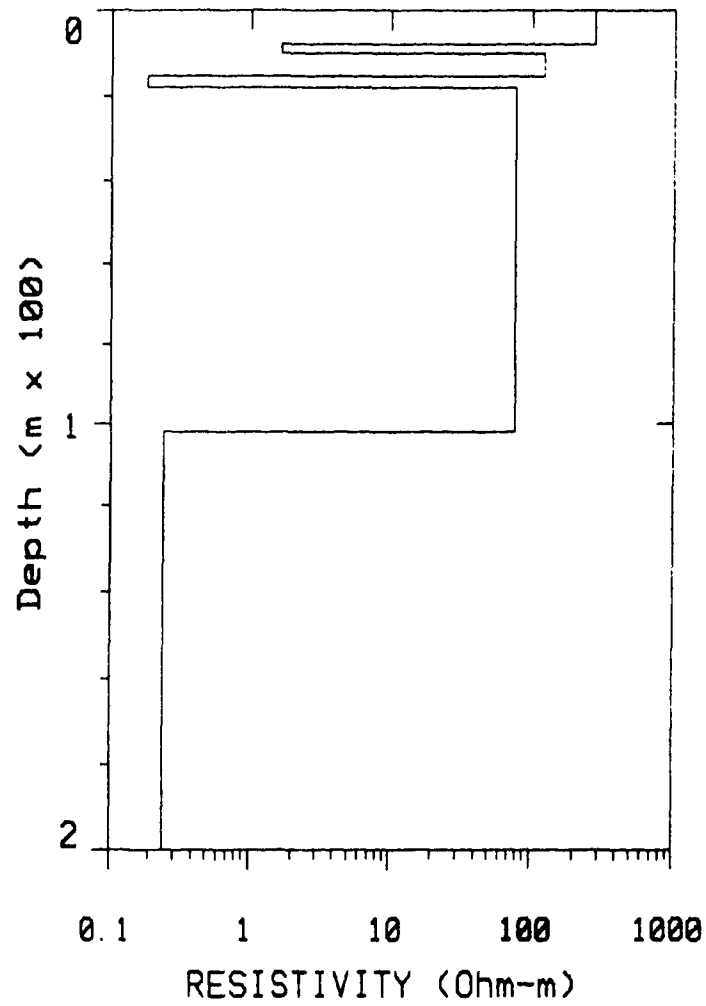
for: J. M. Montgomery	West Beach Landfill
Norcal Geophysical Consultants, Inc.	Alameda NAS Alameda County, CA
Data Set: 633D — Date: 6/7/91	
Equipment: Geonics PROTEM — Sounding: 633D	LOOP SIZE: 20. m



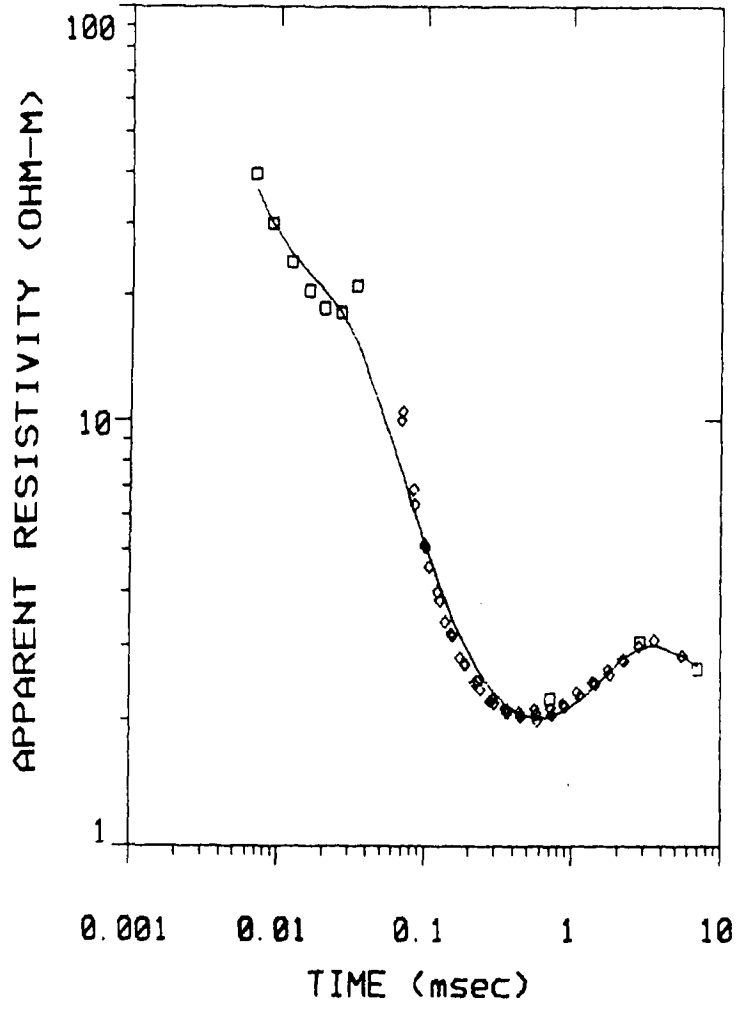


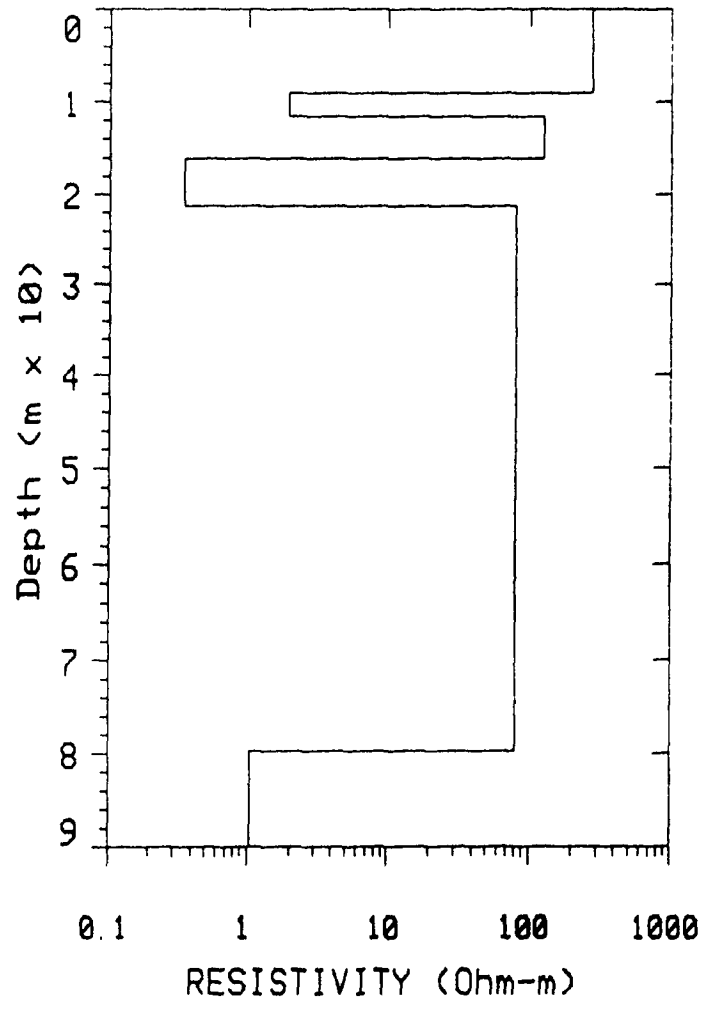
for: J. M. Montgomery	West Beach Landfill
Norcal Geophysical Consultants, Inc.	Alameda NAS Alameda County, CA
Data Set: 833D — Date: 6/7/91	
Equipment: Geonics PROTEM — Sounding 833D	LOOP SIZE: 20. m



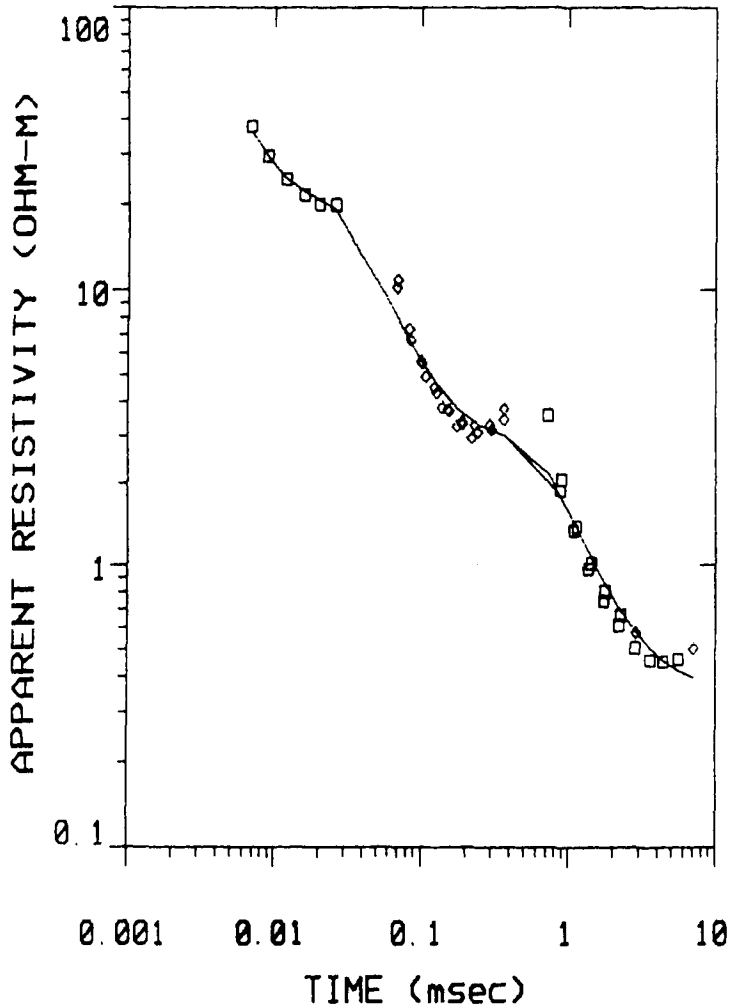


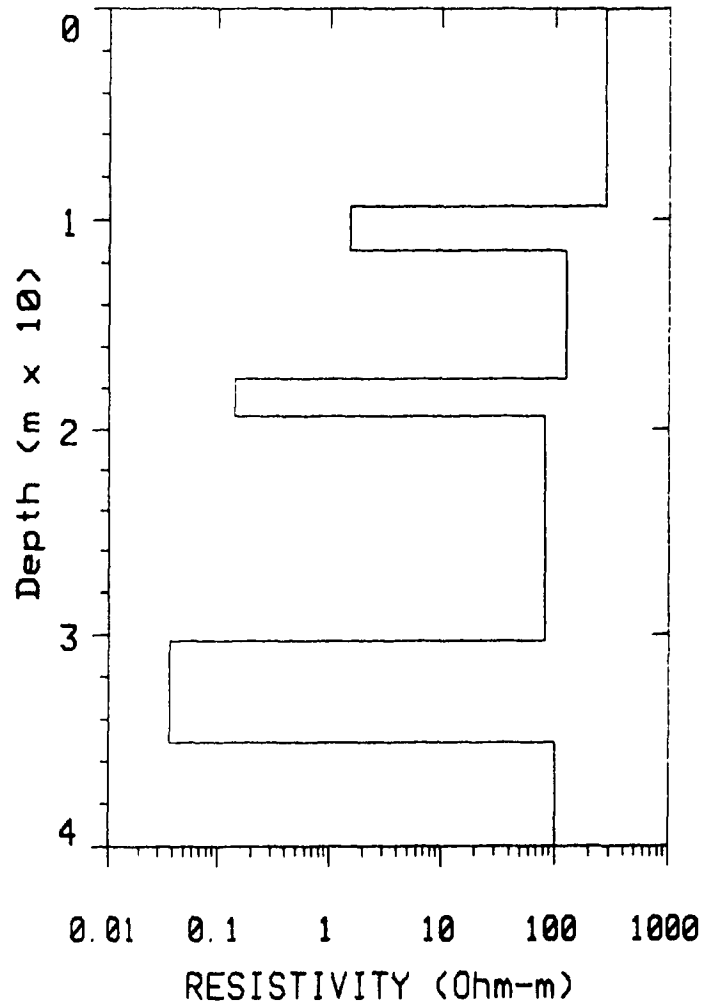
for: J. M. Montgomery	West Beach Landfill
by: Norcal Geophysical Consultants, Inc.	Alameda NAS Alameda County, CA
Data Set: 1033D — Date: 6/7/91	
Equipment: Geonics PROTEM — Reading: 1033D	LOOP SIZE: 20. m



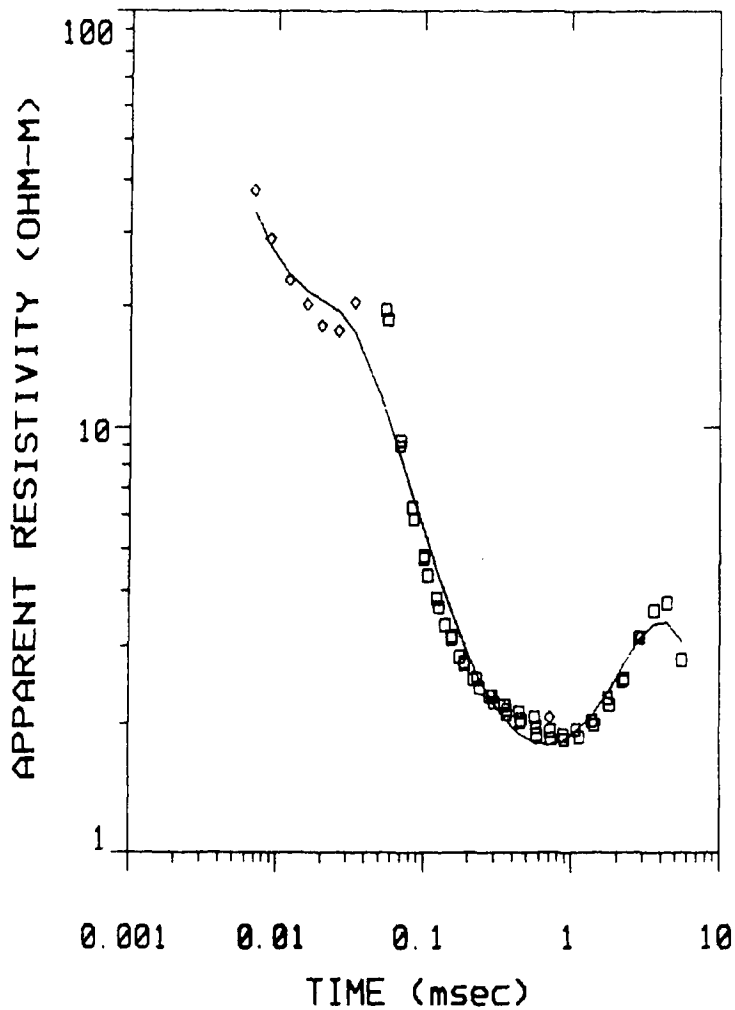


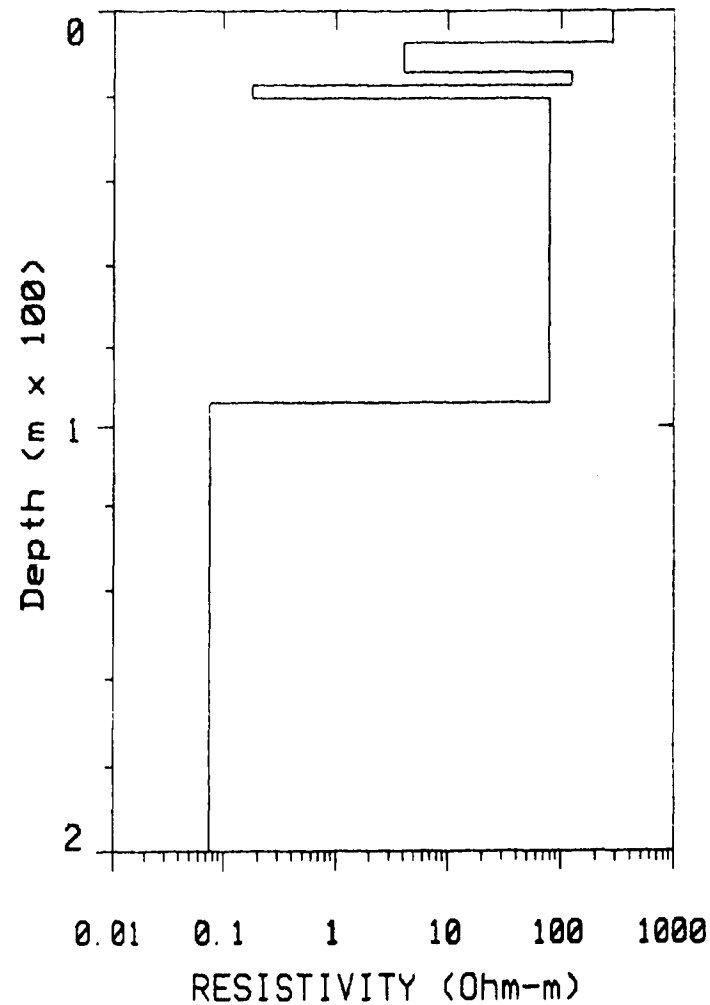
for: J. M. Montgomery	West Beach Landfill
by Norcal Geophysical Consultants, Inc.	Alameda NAS Alameda County, CA
Data Set: 1233D — Date: 6/7/91	
Equipment: Geonics PROTEM — Sounding: 1233D	LOOP SIZE: 20. m



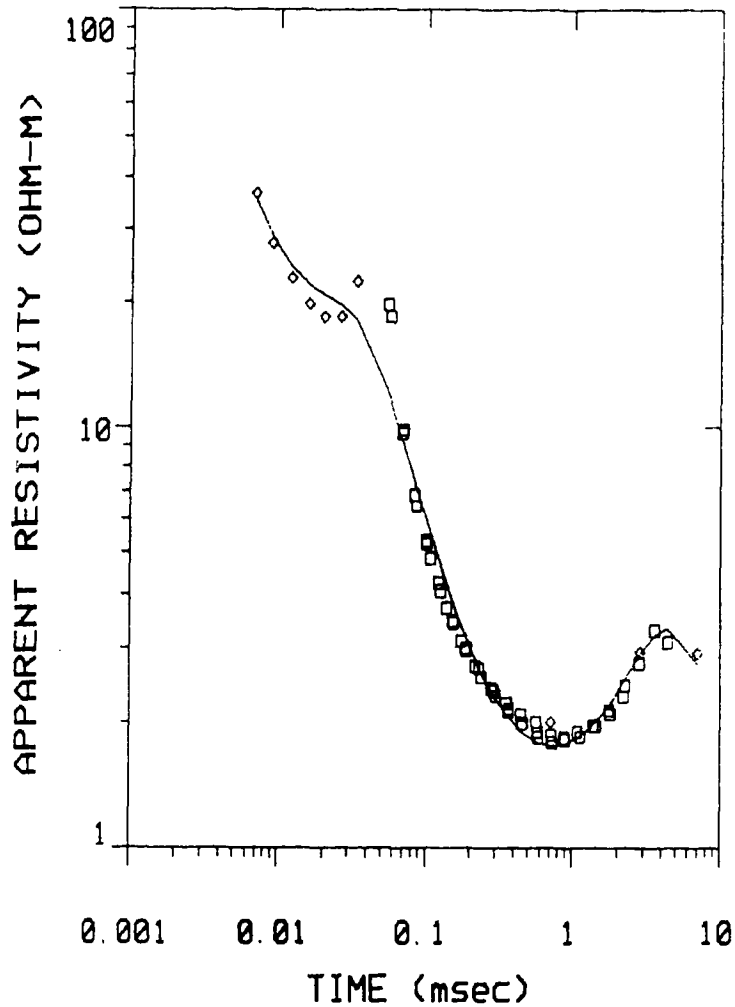


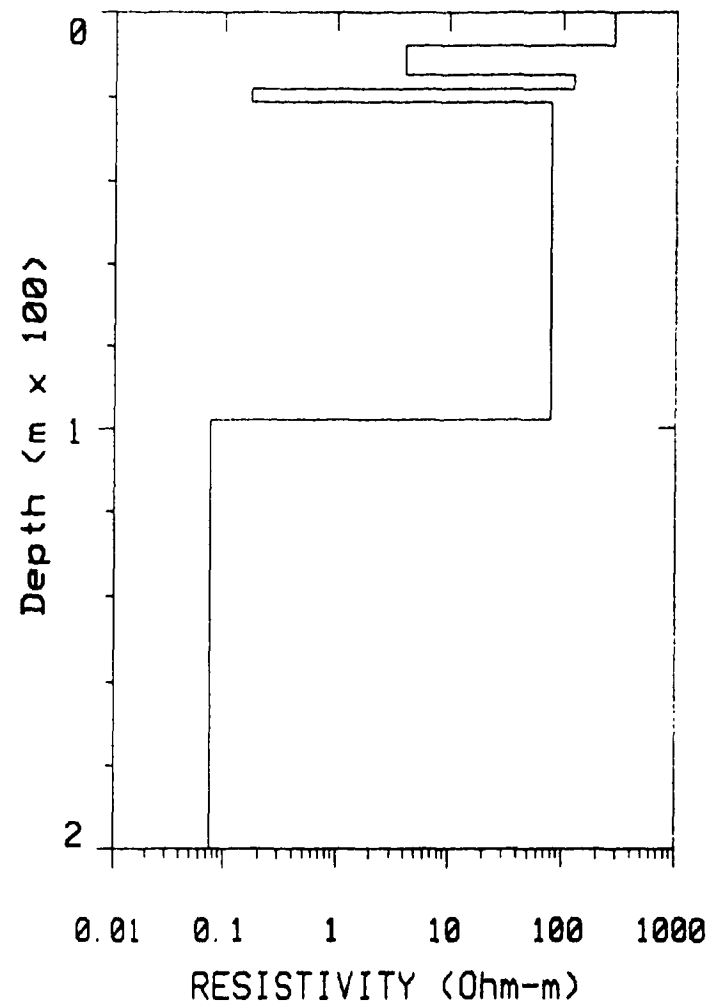
for: J. M. Montgomery	West Beach Landfill
by: Norcal Geophysical Consultants, Inc.	Alameda NAS Alameda County, CA
Data Set: 1433D — Date: 6/7/91	
Equipment: Geonics PROTEM — Finding 1433D	LOOP SIZE: 20. m



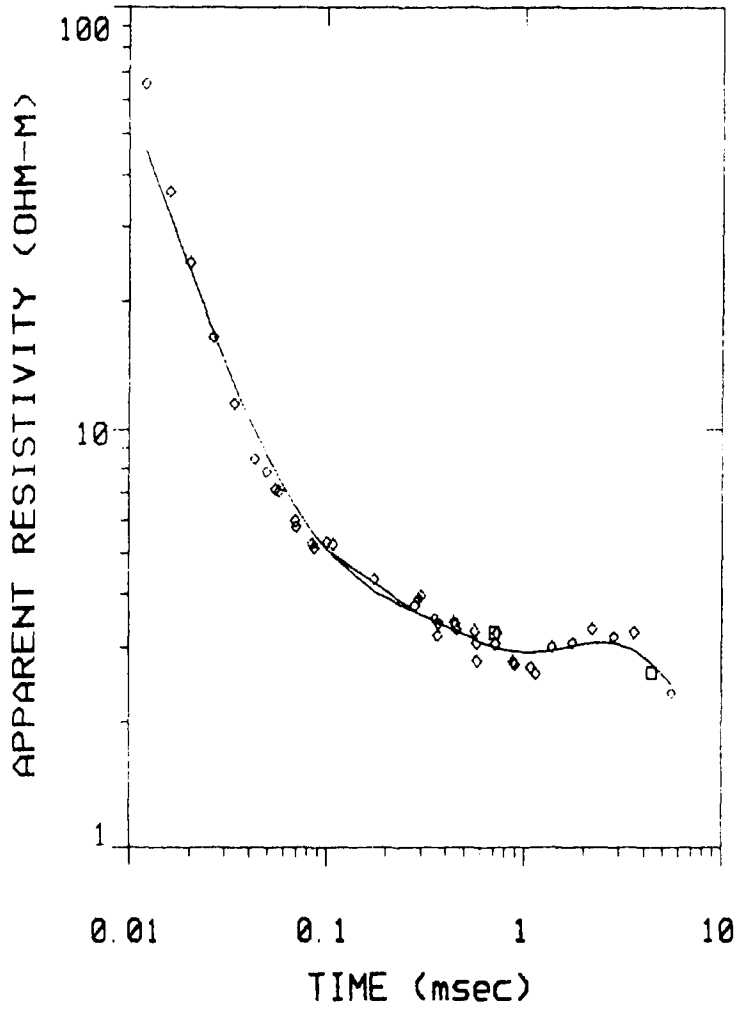


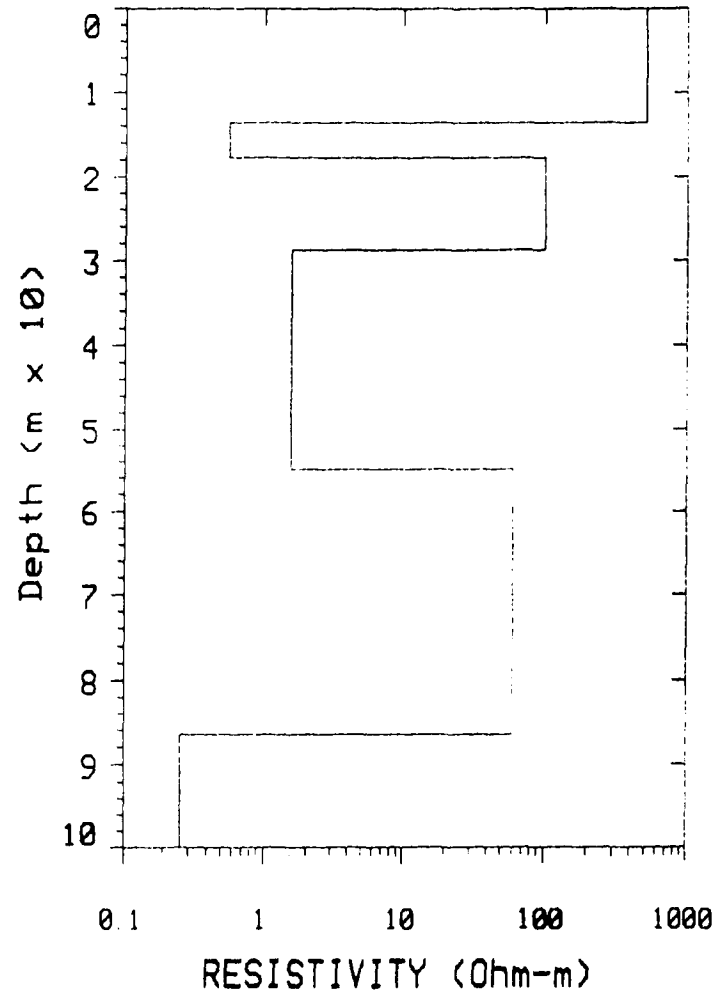
for: J. M. Montgomery	West Beach Landfill
by: Norcal Geophysical Consultants, Inc.	Alameda NAS Alameda County, CA
Data Set: 1633D — Date: 6/7/91	
Equipment: Geonics PROTEM — Sounding: 1633D	LOOP SIZE: 20. m



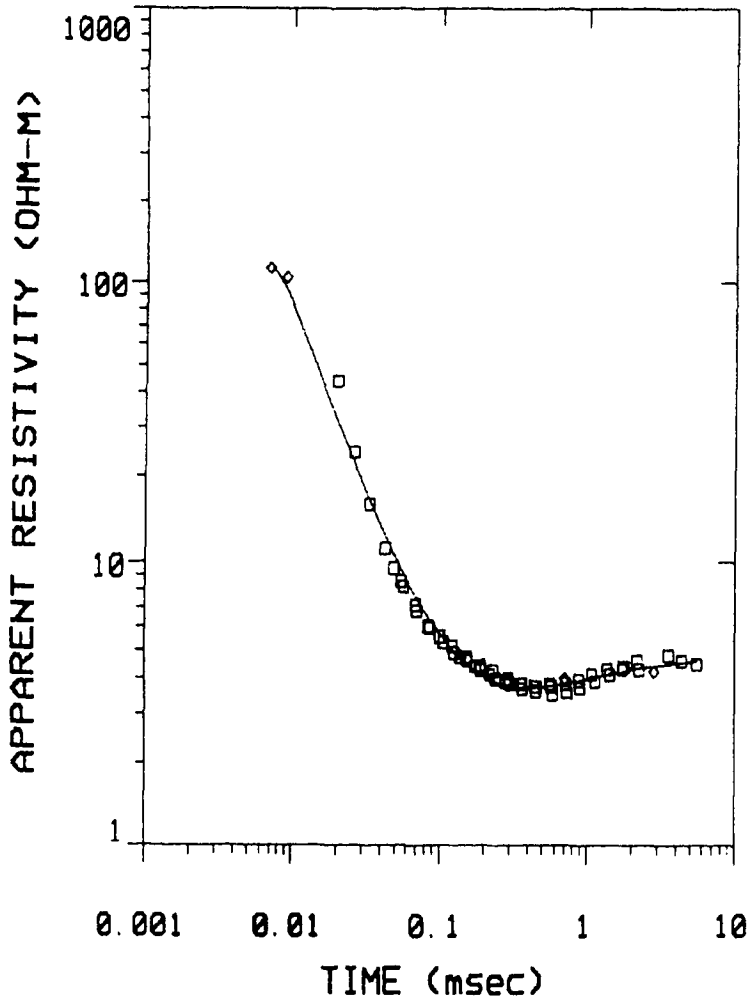


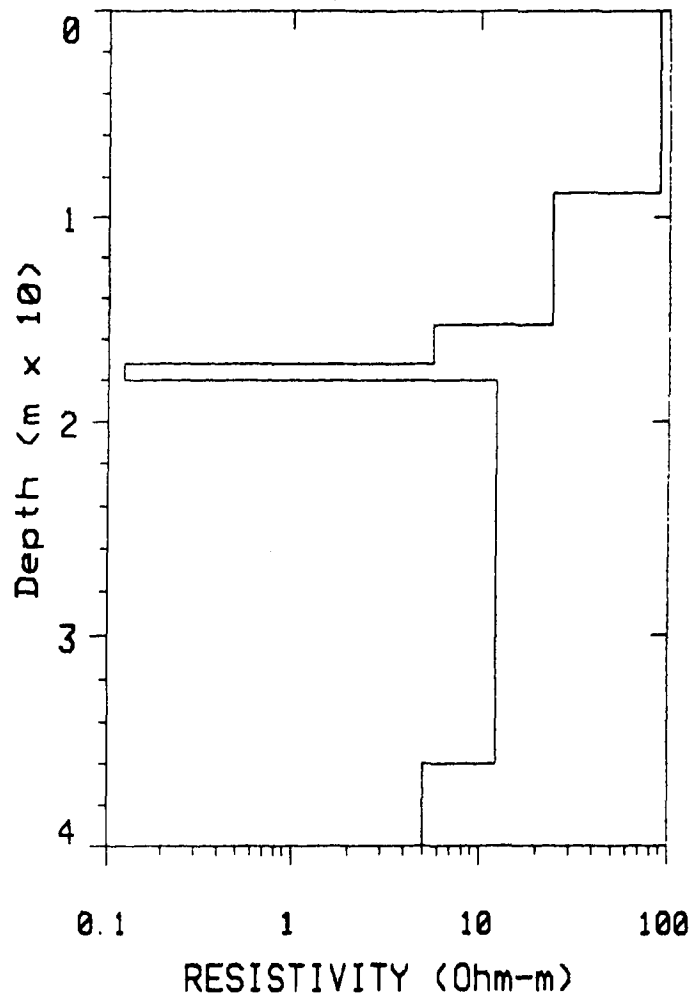
for: J. M. Montgomery	West Beach Landfill
by: Norcal Geophysical Consultants, Inc.	Alameda NAS Alameda County, CA
Data Set: 1833D — Date: 6/7/91	
Equipment: Geonics PROTEM — Grinding: 1833D	LOOP SIZE: 20. m



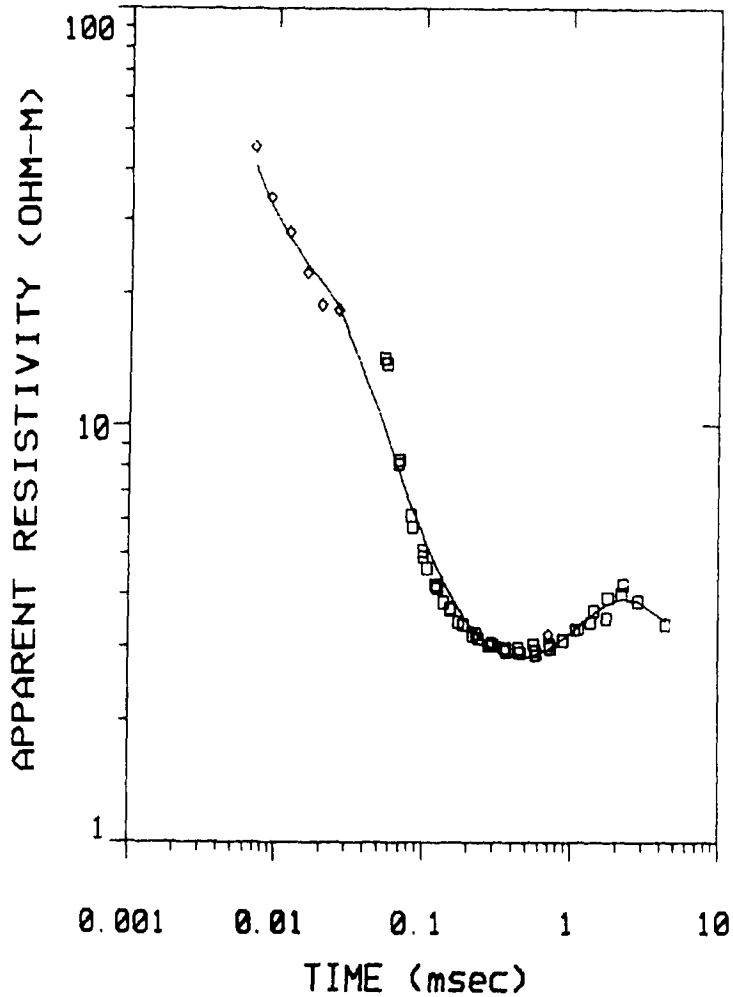


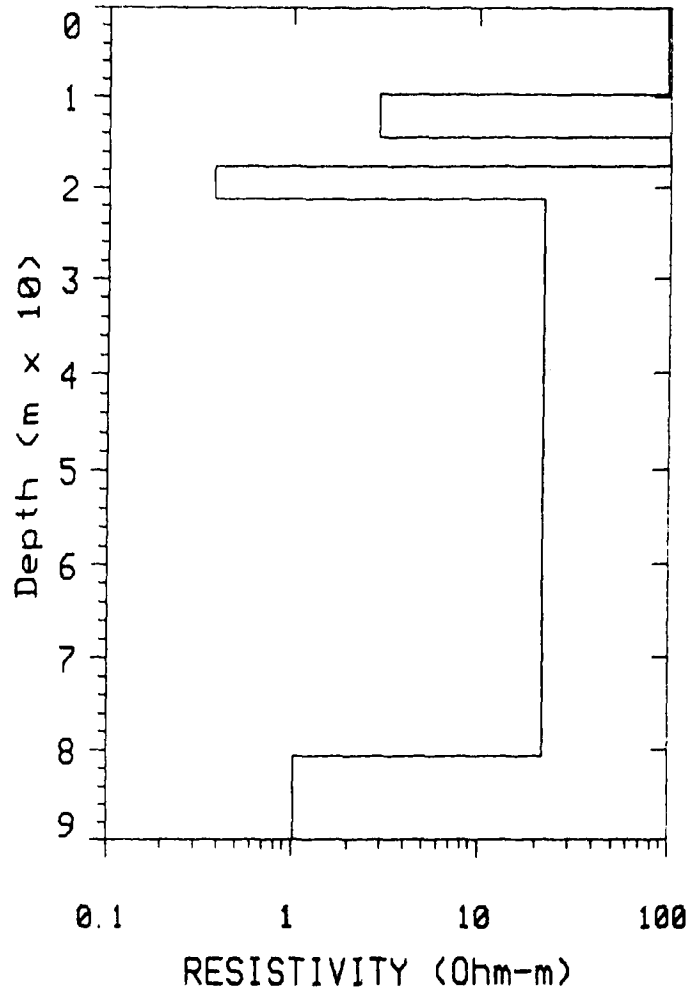
for: J. M. Montgomery	West Beach Landfill
by: Norcal Geophysical Consultants, Inc	Alameda NAS Alameda County, CA
Data Set 100E — Date: 6/7/91	
Equipment: Geonics PROTEM — Sounding 100E	LOOP SIZE: 20. m



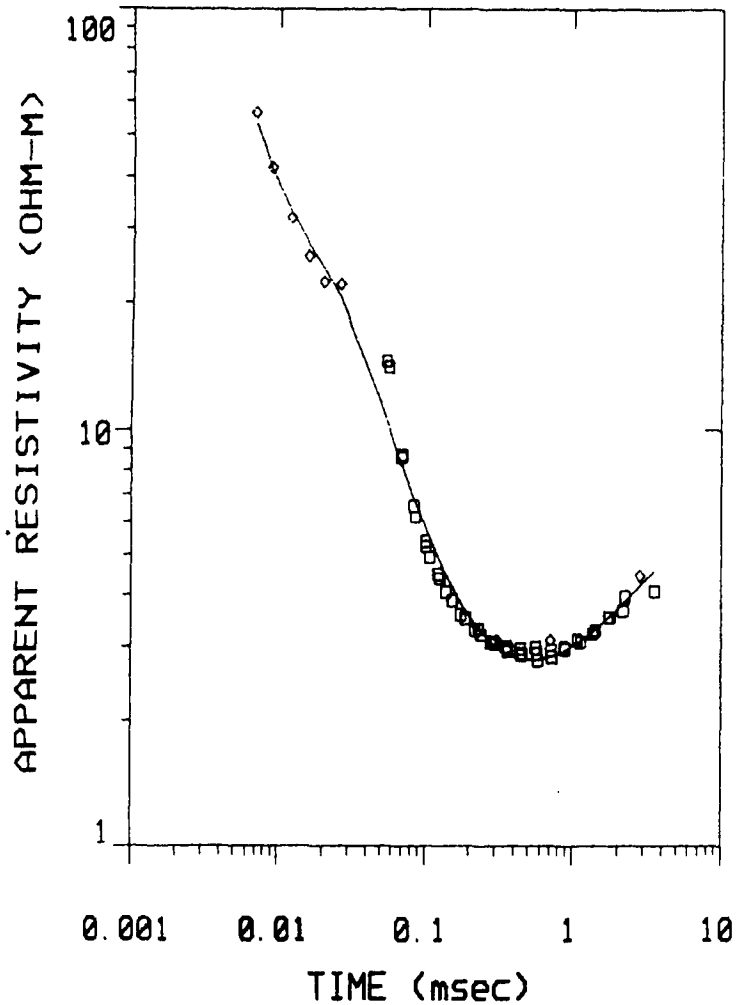


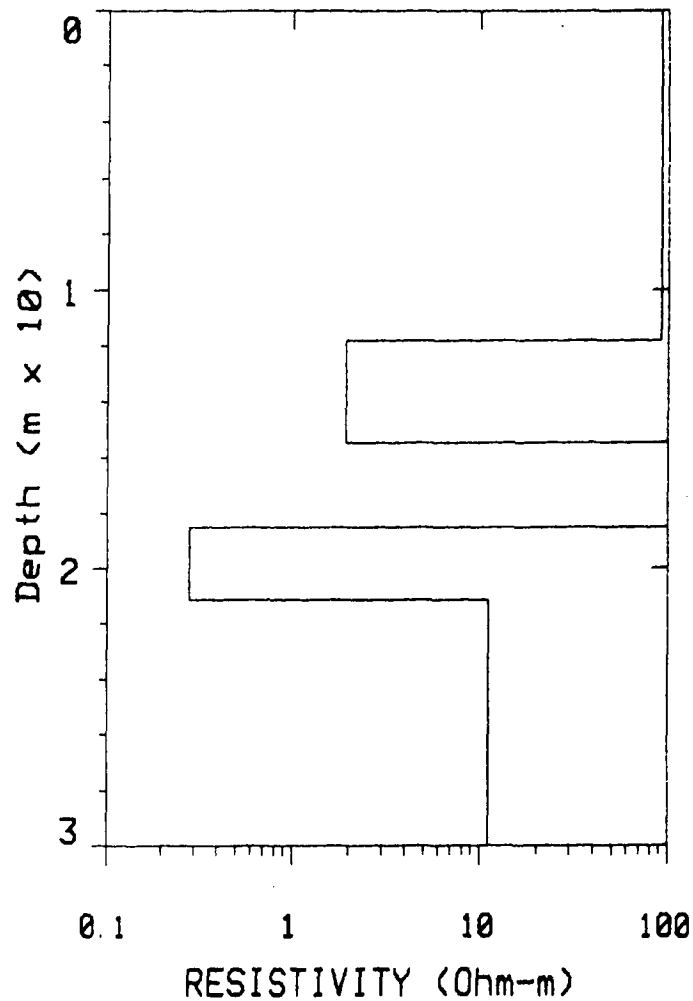
for: J. M. Montgomery	West Beach Landfill
by: Norcal Geophysical Consultants, Inc.	Alameda NAS Alameda County, CA
Data Set: 333E — Date: 6/7/91	
Equipment: Geonics PROTEM — Sounding: 333E	LOOP SIZE: 20. m



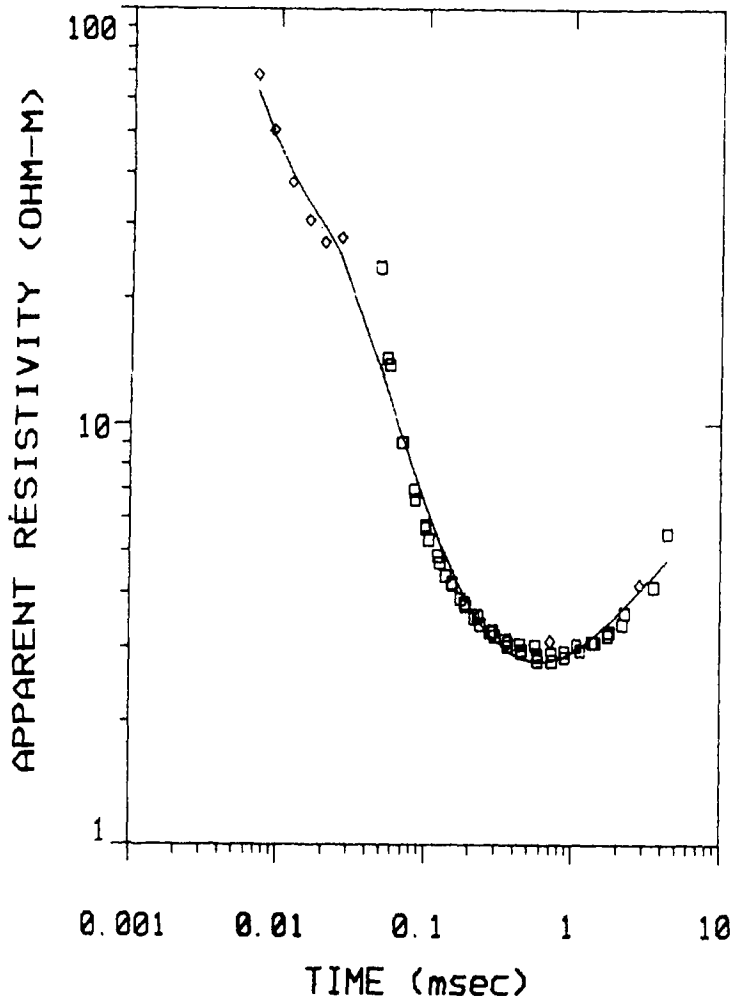


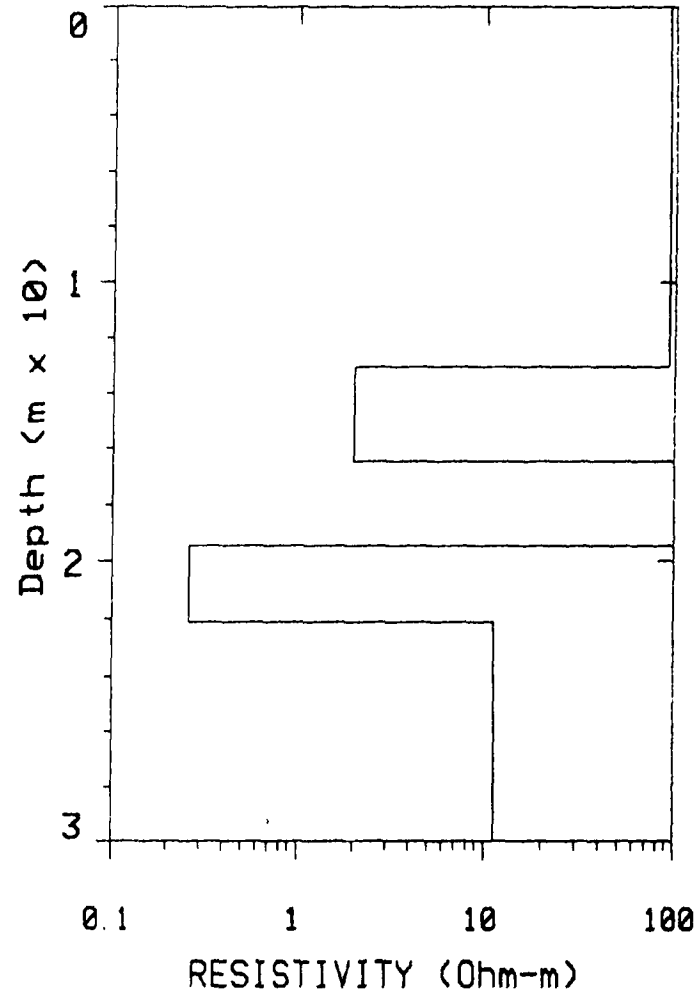
for: J. M. Montgomery	West Beach Landfill
by Norcal Geophysical Consultants, Inc.	Alameda NAS Alameda County, CA
Data Set: 533E — Date: 6/7/91	
Equipment: Geonics PROTEM — Sounding 533E	LOOP SIZE: 20. m



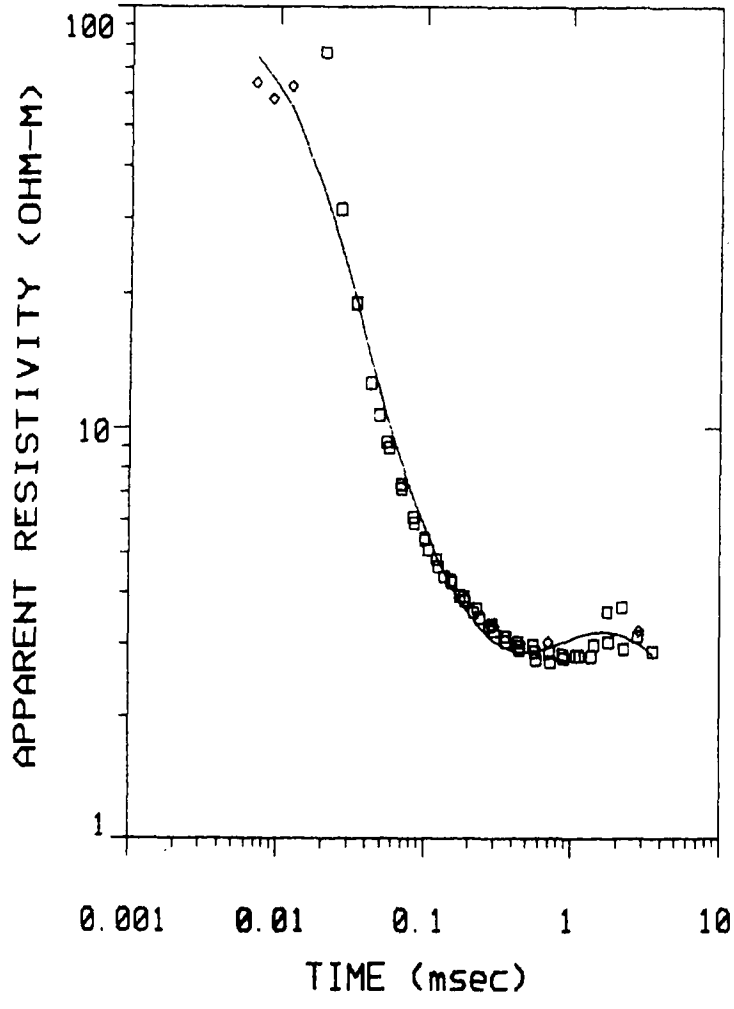


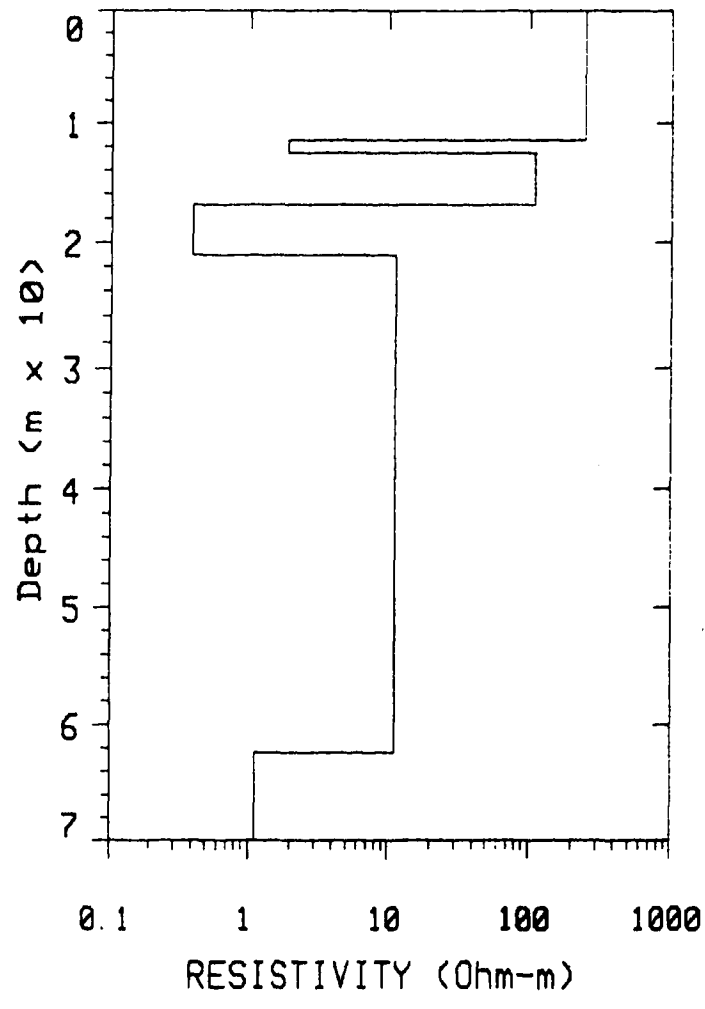
for: J. M. Montgomery	West Beach Landfill
by Norcal Geophysical Consultants, Inc.	Alameda NAS Alameda County, CA
Data Set 733E — Date 6/7/91	
Equipment: Geonics PROTEM — Sounding 733E	LOOP SIZE: 20. m



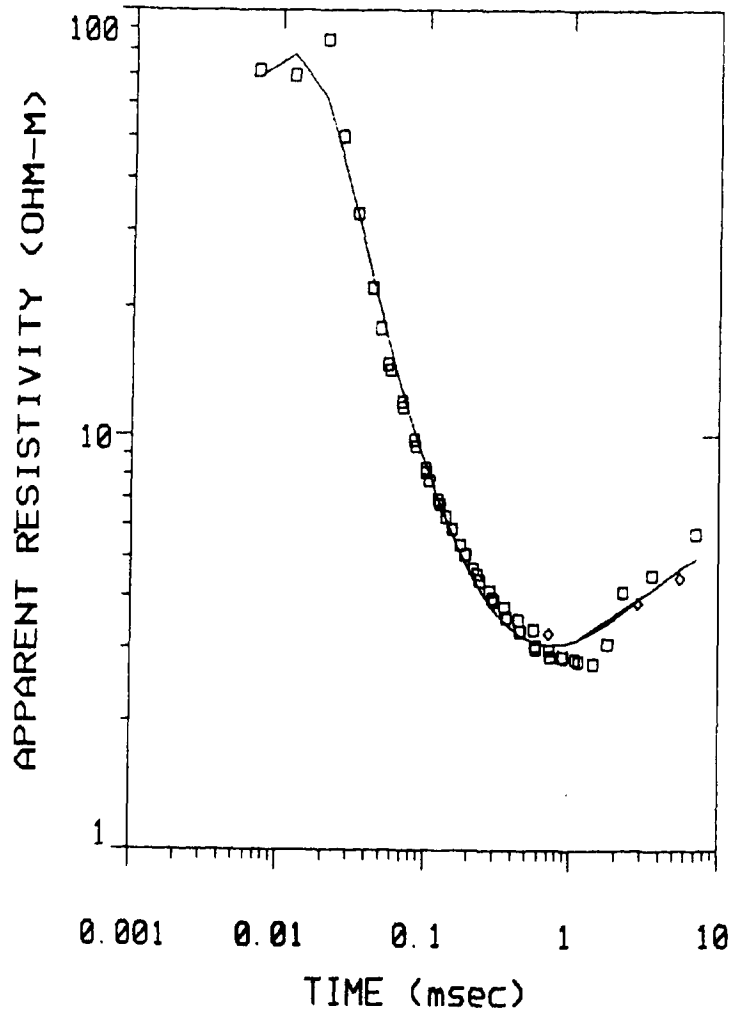


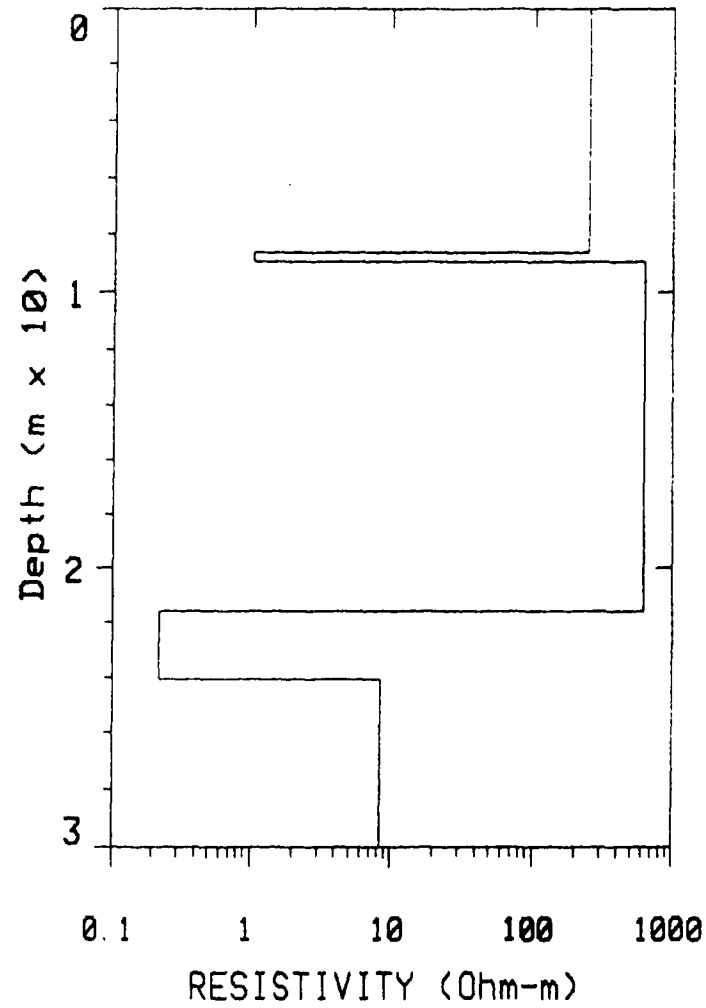
for: J. M. Montgomery	West Beach Landfill
by Norcal Geophysical Consultants, Inc.	Alameda NAS Alameda County, CA
Data Set: 933E — Date: 6/7/91	
Equipment: Geonics PROTEM — Sounding 933E	LOOP SIZE: 20. m



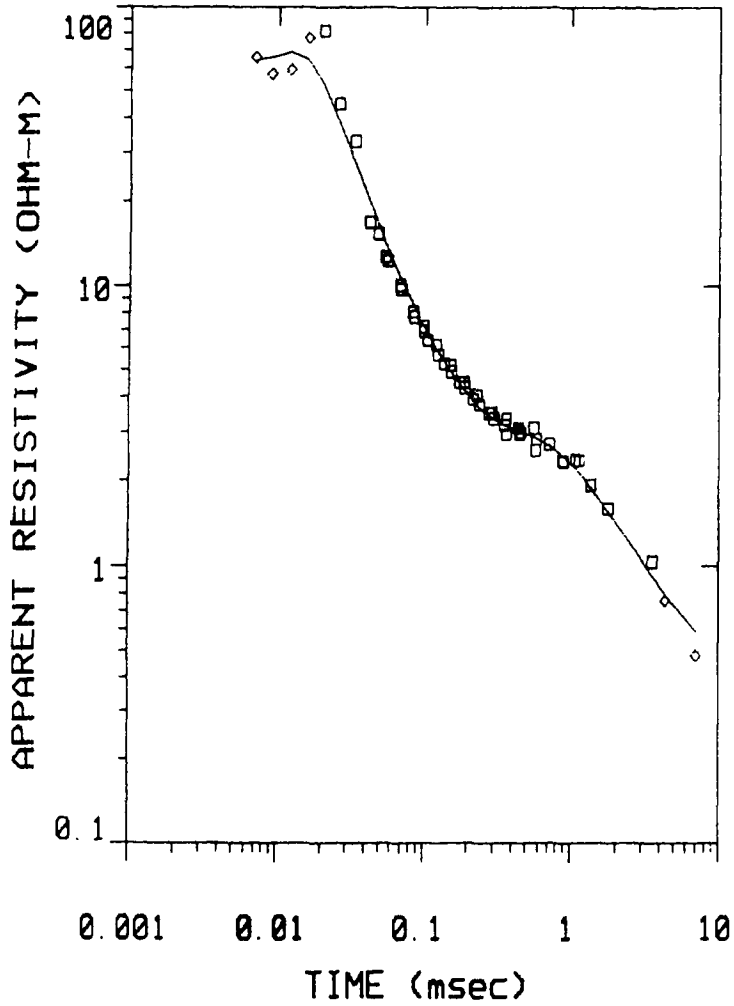


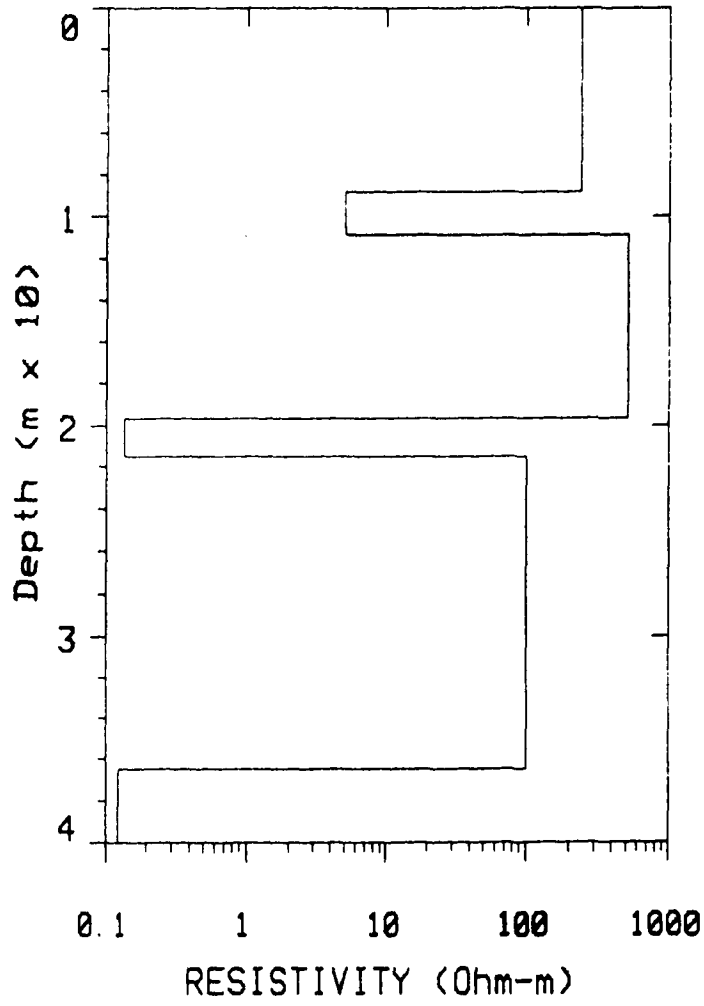
for: J. M. Montgomery	West Beach Landfill
by: Norcal Geophysical Consultants, Inc.	Alameda NAS Alameda County, CA
Data Set: 33F — Date: 6/7/91	
Equipment: Geonics PROTEM — Sounding: 33F	LOOP SIZE: 20. m



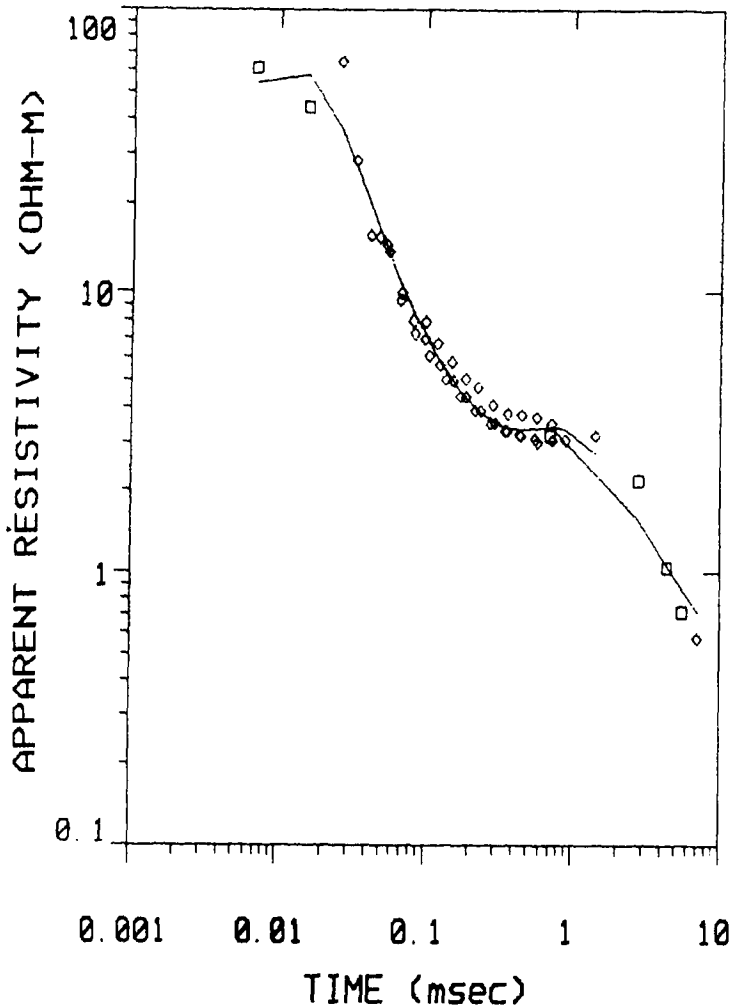


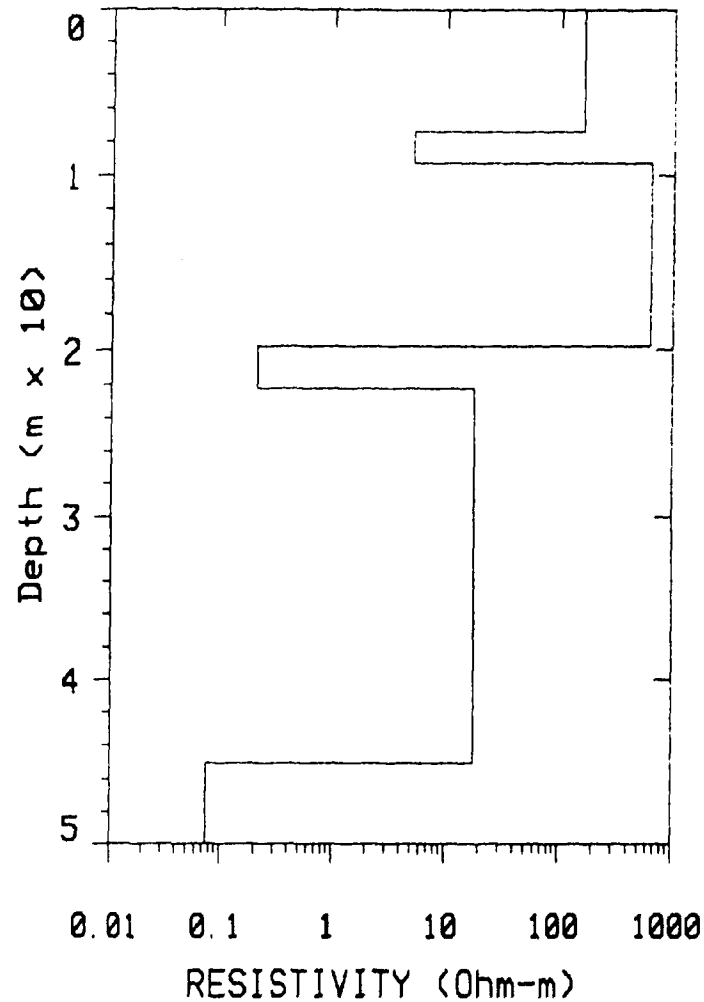
for: J. M. Montgomery		West Beach Landfill
Norcal Geophysical Consultants, Inc.		Alameda NAS Alameda County, CA
Data Set: 233F2	Date: 6/7/91	
Equipment: Geonics PROTEM	Sounding 233F	LOOP SIZE: 20. m



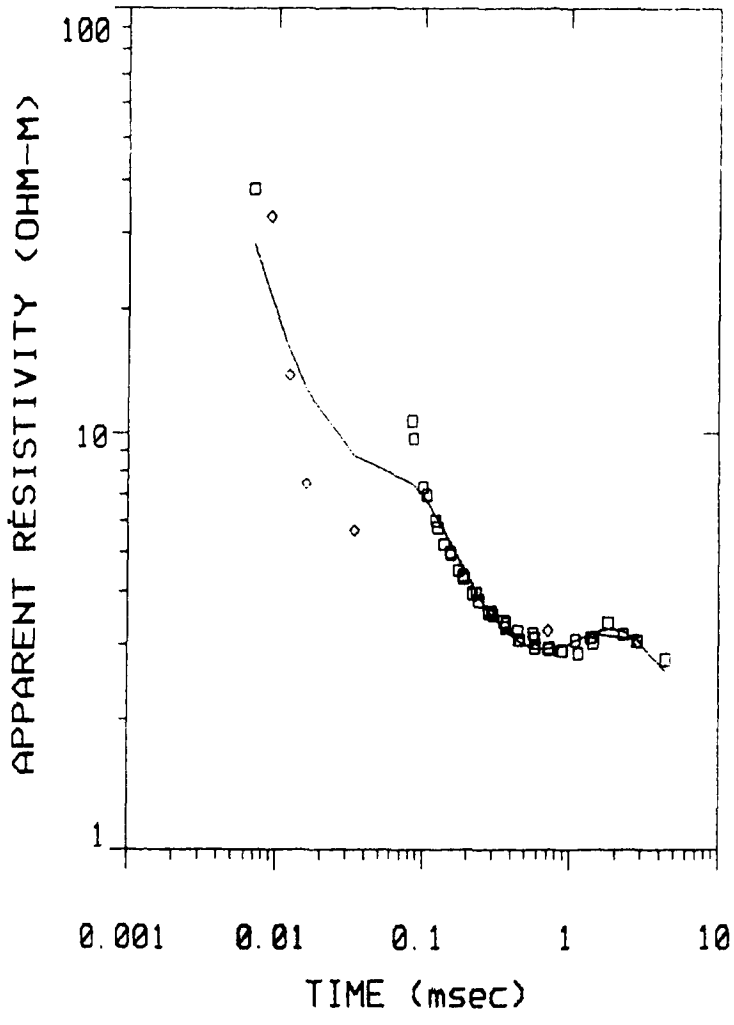


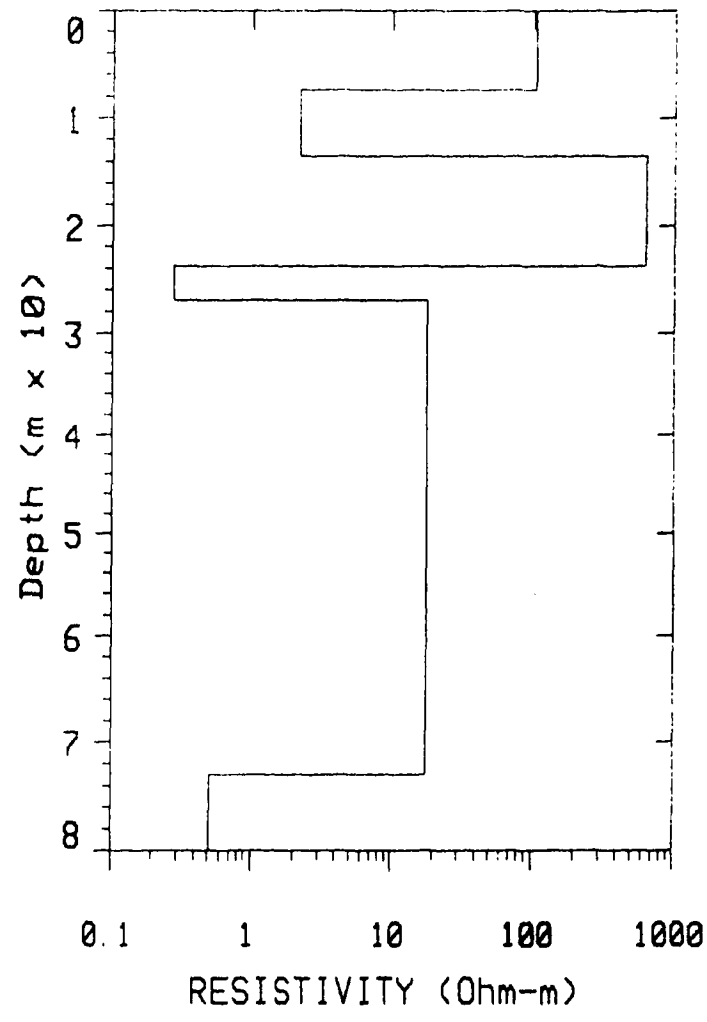
for: J. M. Montgomery	West Beach Landfill
by: Norcal Geophysical Consultants, Inc.	Alameda NAS Alameda County, CA
Data Set: 433F / Date: 6/7/91	
Equipment: Geonics PROTEM / unding 433F	LOOP SIZE: 20. m



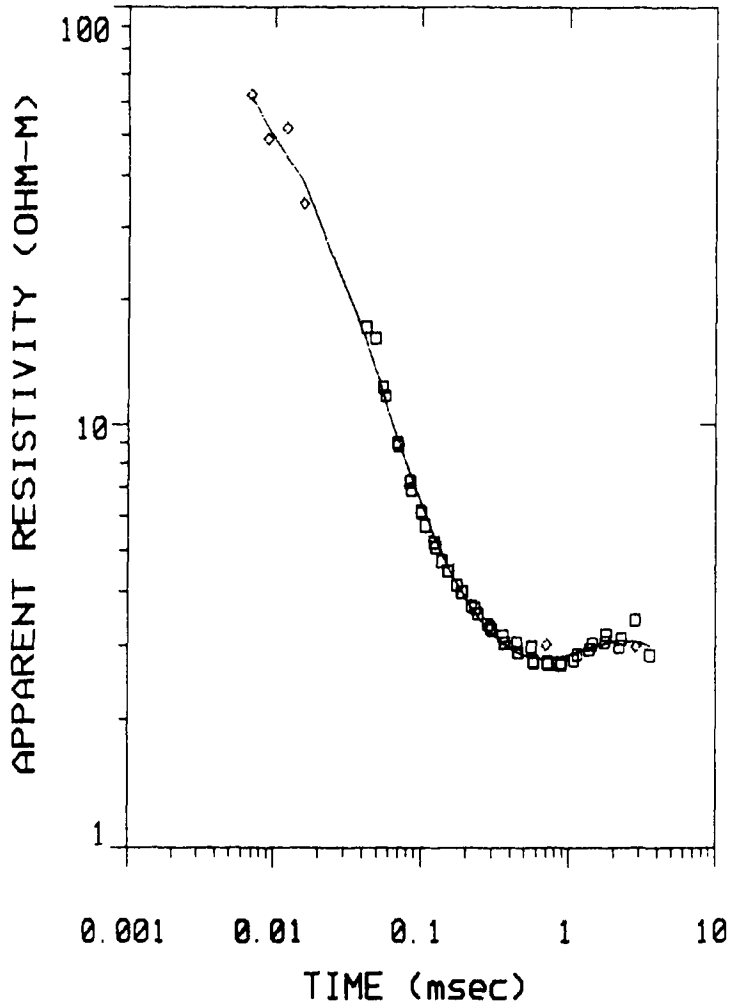


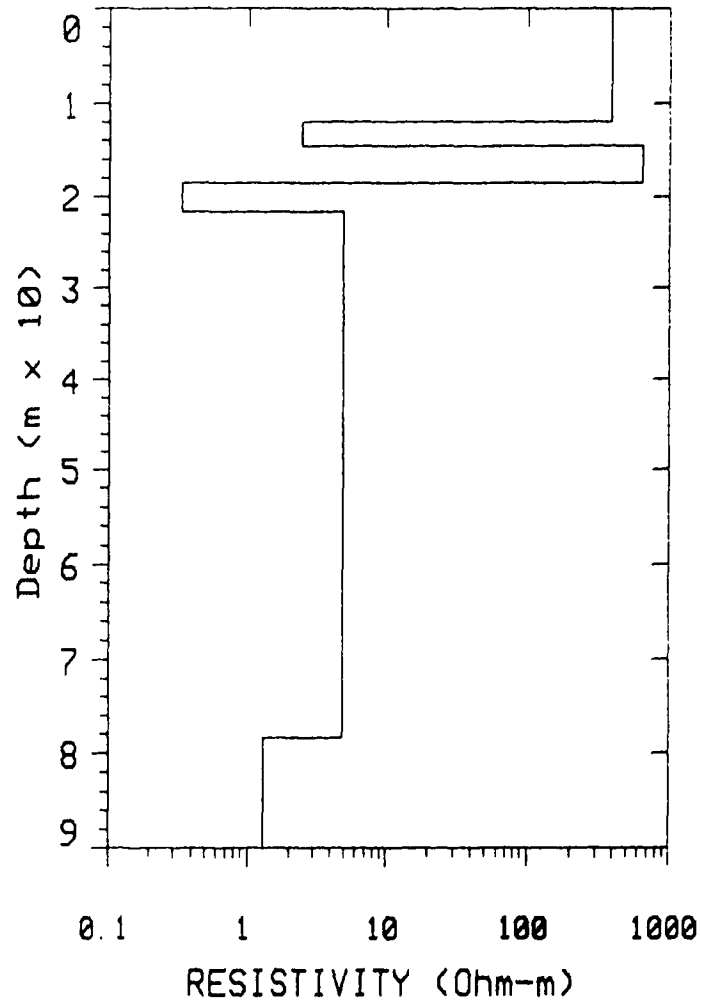
for: J. M. Montgomery	West Beach Landfill
by Norcal Geophysical Consultants, Inc.	Alameda NAS Alameda County, CA
Data Set: 633F — Date: 6/7/91	
Equipment: Geonics PROTEM — Sounding: 633F	LOOP SIZE: 20. m



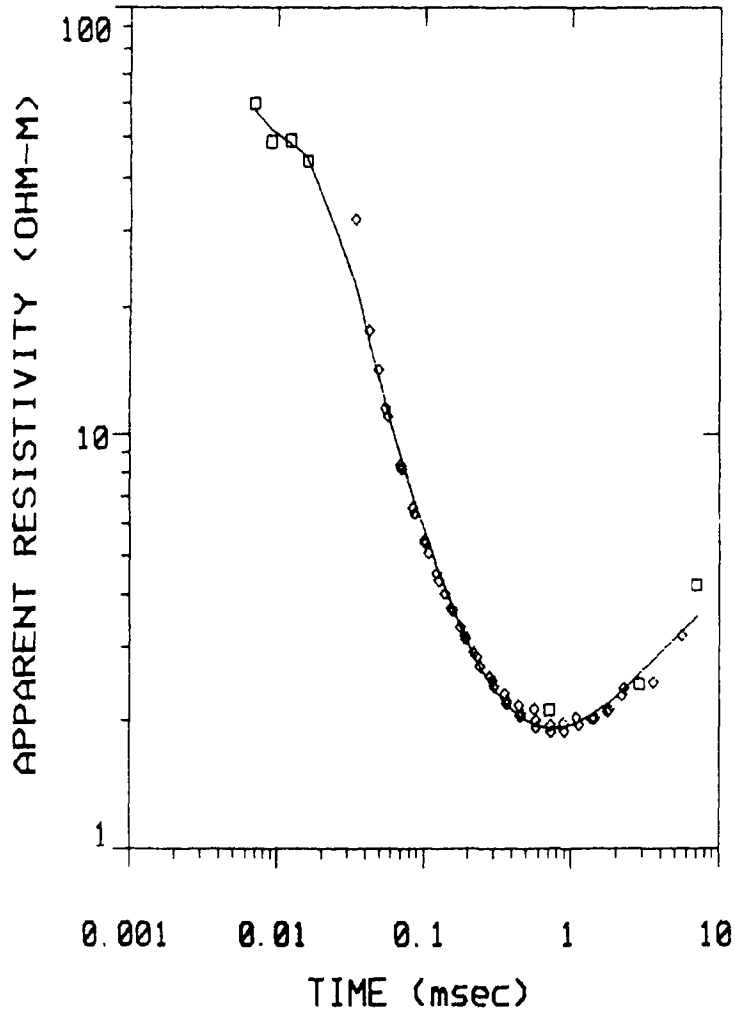


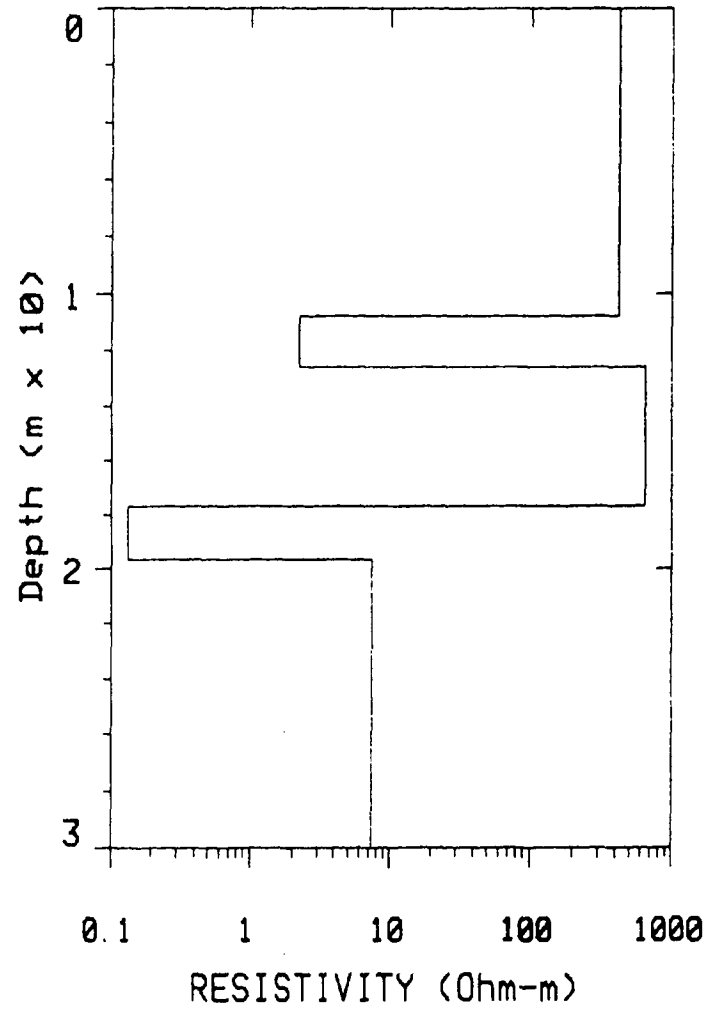
for: J. M. Montgomery	West Beach Landfill
by: Norcal Geophysical Consultants, Inc	Alameda NAS Alameda County, CA
Data Set: 833F — Date: 6/7/91	
Equipment: Geonics PROTEM — unding 833F	LOOP SIZE: 20. m



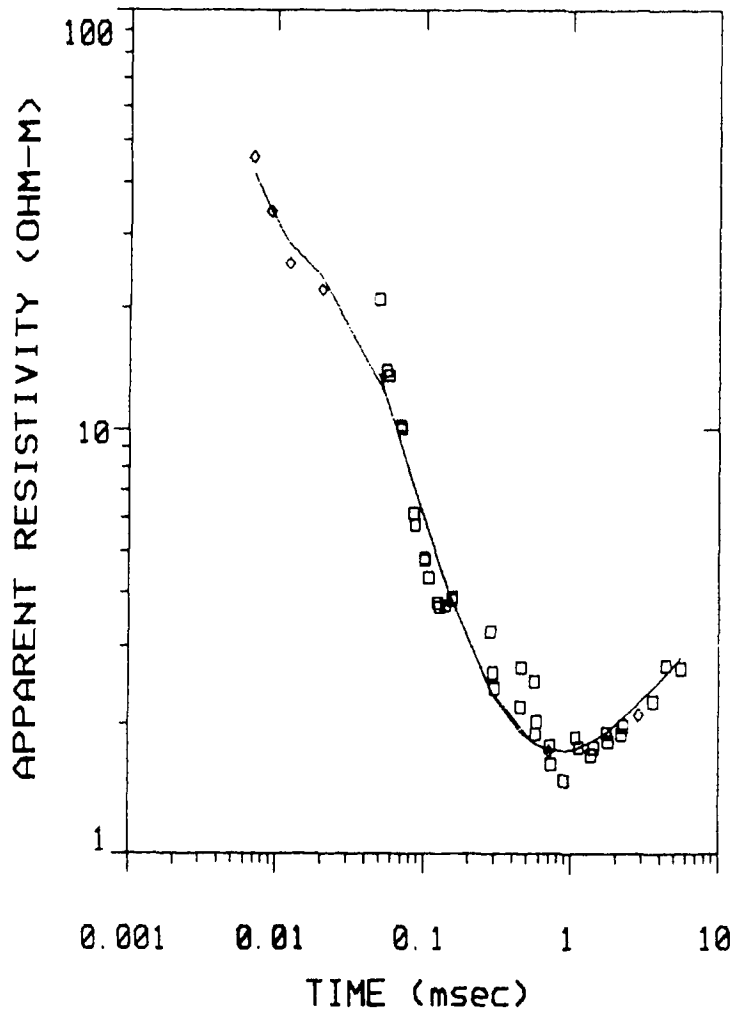


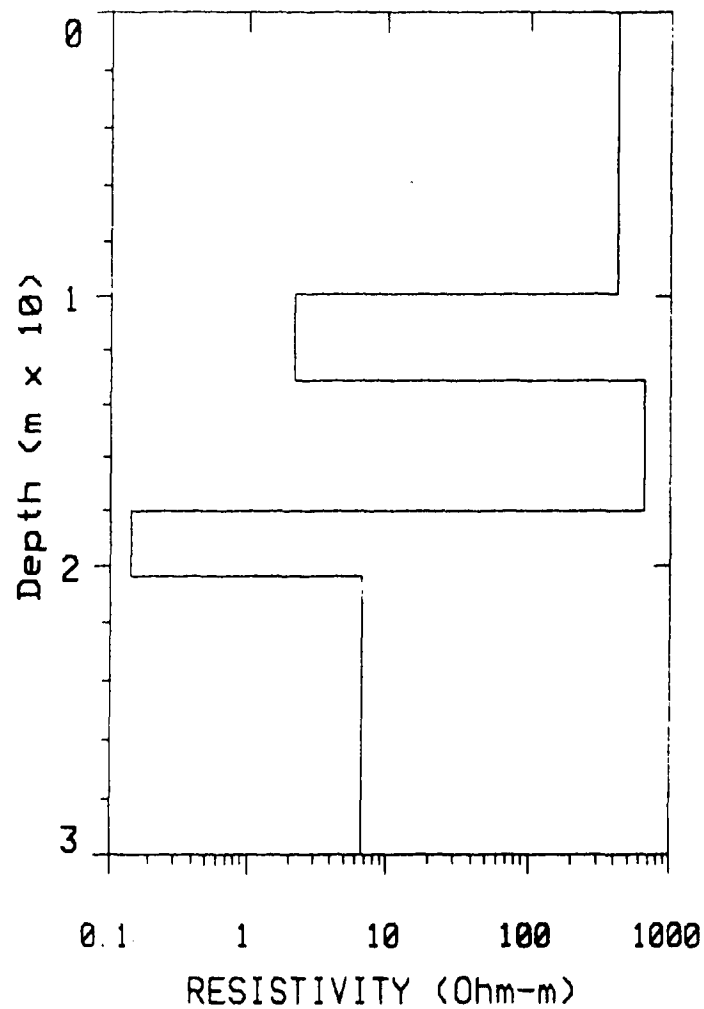
for: J. M. Montgomery	West Beach Landfill
Norcal Geophysical Consultants, Inc.	Alameda NAS Alameda County, CA
Data Set: 967F — Date: 6/7/91	
Equipment: Geonics PROTEM — Sounding: 967F	LOOP SIZE: 20. m



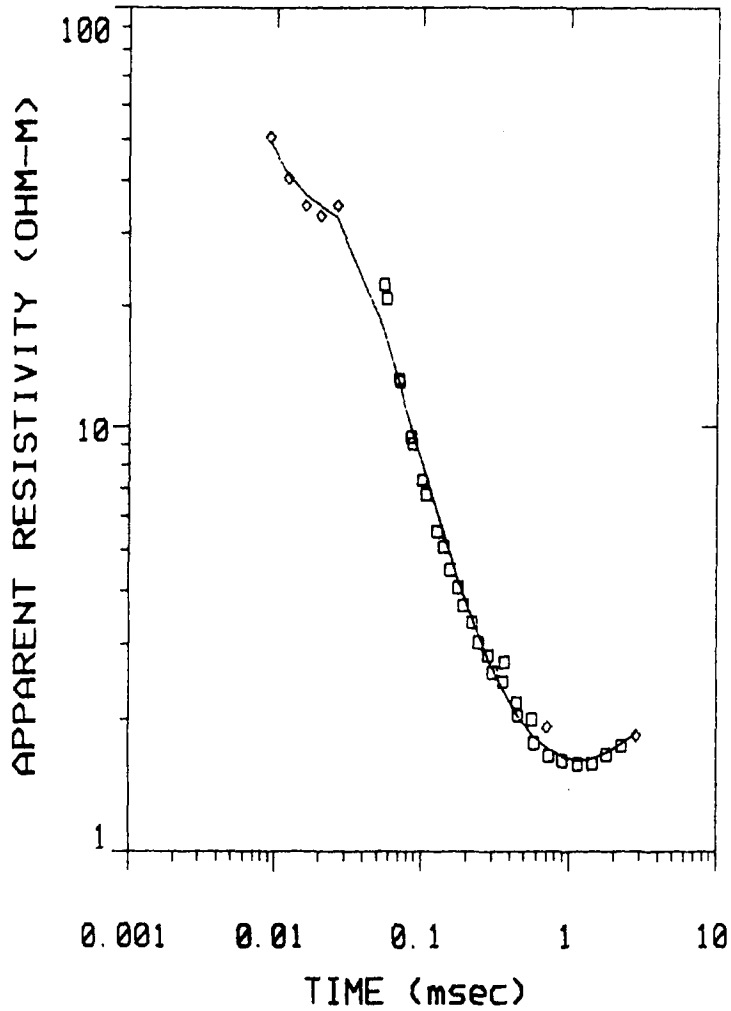


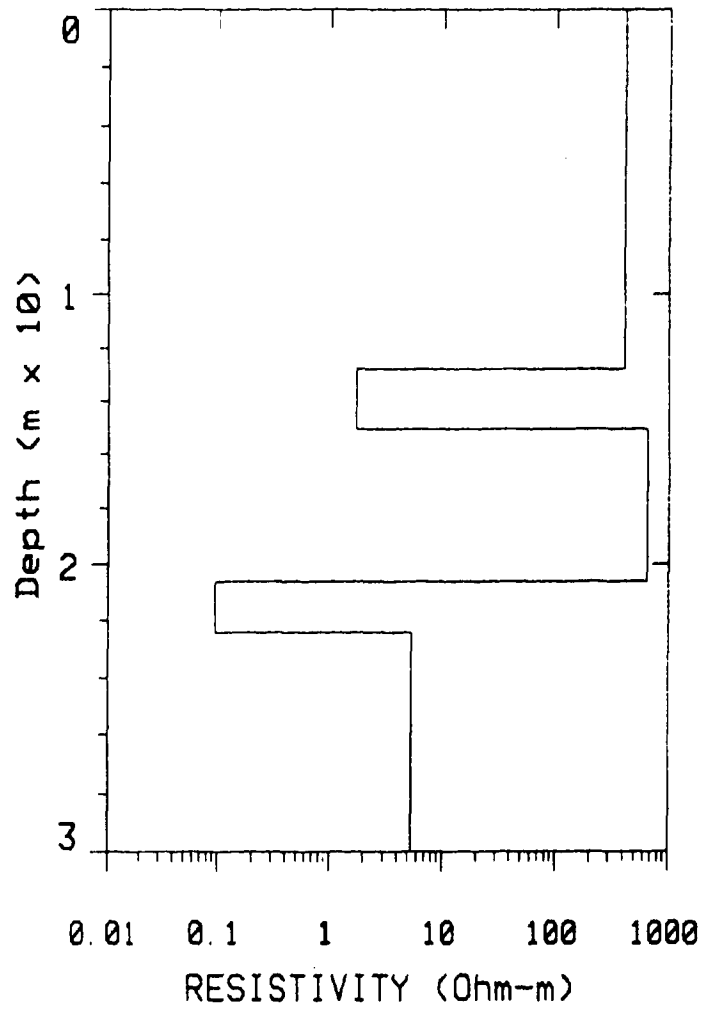
for: J. M. Montgomery	West Beach Landfill
Norcal Geophysical Consultants, Inc	Alameda NAS Alameda County, CA
Data Set: 1233F — Date: 6/7/91	
Equipment: Geonics PROTEM — Funding: 1233F	LOOP SIZE: 20. m





for: J. M. Montgomery		West Beach Landfill
by Norcal Geophysical Consultants, Inc.		Alameda NAS Alameda County, CA
Data Set: 1433F	Date: 6/7/91	
Equipment: Geonics PROTEM	Sounding 1433F	LOOP SIZE: 20. m





for: J. M. Montgomery	West Beach Landfill
Norcal Geophysical Consultants, Inc.	Alameda NAS Alameda County, CA
Data Set: 1633F — Date: 6/7/91	
Equipment: Geonics PROTEM — Reading: 1633F	LOOP SIZE: 20. m

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Walnut Creek, California 94598

Attention: Mr. Scott Weber

APPENDIX I

STATISTICAL ANALYSIS OF METALS CONCENTRATIONS

This appendix presents the results of a statistical analysis to estimate the site background metals concentrations at the 95 percent/95 percent statistical tolerance interval for the Sites 1 and 2 of NAS Alameda (Taylor, 1990). The 95 percent/95 percent statistical tolerance interval is the range within which 95 percent of background samples collected on the base are expected to fall 95 percent of the time. Samples with concentrations outside of this range may be below or above background concentrations. Results of this statistical analysis were used to evaluate whether any soil samples collected during the SWAT investigation contained metals concentrations exceeding the upgradient, background levels. Details of the statistical analysis are presented below.

Background Soil Samples

For this statistical analysis, metals results of soil samples collected from areas that have no history of chemical use or operations are assumed to represent background soil conditions. Based on this assumption, a total of 23 soil samples collected from 14 borings (M-101A, M-102A, M-103A, M-103B, M-104A, M-104C, M-105A, M-105B, M-106A, M-107A, M-108A, M-108B, M-109A, and M-110A) were considered as background soil samples for this analysis. Because of the nature of NAS Alameda's construction, all of the background borings are located in areas where fill has been placed over native sediments. Much of the fill is locally derived near shore sediment, but some may be imported. Locations of these borings are shown on Figure 7-1, within the main body of this report. The results of the metals analyses performed on these 23 background soil samples are presented in Table I-1.

Statistical Analysis of Soil Samples

In general, population distributions of naturally occurring inorganic soil constituents, including metals, are best described by a normal distribution curve (Gilbert, 1987). Therefore, this statistical analysis of metals was conducted assuming that the background populations for the NAS Alameda follow a normal distribution.

The procedures used to determine the 95 percent/95 percent statistical tolerance interval are as follows. Metal concentrations of the background samples were treated as constituents of a normal population. The detection limit divided by two was substituted for nondetected values (Hornung and Reed, 1990). Arithmetic means and standard deviations were calculated for each metal. Lower and upper limits of the 95 percent/95 percent statistical tolerance interval were calculated by adding and subtracting the standard deviation multiplied by a statistical tolerance factor (k) to the mean. The k variable is dependent of the proportion of the population one wishes to include in the tolerance interval, the probability of inclusion in the interval, and the number of samples on which the standard deviation is based (Taylor, 1990).

Statistical Analysis of Groundwater Samples

The same basic statistical procedure is used for both soil and groundwater samples. In order to account for seasonal fluctuations of naturally occurring metals in groundwater, tolerance intervals were computed separately for each round of groundwater samples collected from the background wells.

Table I-2 presents a summary of means and the 95 percent/95 percent statistical tolerance intervals of the data for the metals in the groundwater from "A" wells. Table I-3 presents the summary data for the metals in the groundwater from "B" and "C" wells.

N00236.000848
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TABLES

APPENDIX I – STATISTICAL ANALYSIS OF METALS CONCENTRATIONS

FINAL
SOLID WASTE WATER QUALITY ASSESSMENT TEST AND DATA SUMMARY REPORT FOR REMEDIAL INVESTIGATION/FEASIBILITY STUDY FOR PHASES 5 AND 6

DATED 30 APRIL 1993

TABLE I-1
STATISTICAL ANALYSIS OF BACKGROUND SOIL SAMPLES

Metals (mg/kg)	Average	Standard Deviation	Tolerance Interval at 95% Confidence	
			Lower Limit (mg/kg)	Upper Limit (mg/kg)
Aluminum	4396.11	1788.80	0.00	10442.26
Antimony	1.25	0.37	0.00	2.51
Arsenic	3.99	3.93	0.00	17.29
Barium	37.96	22.59	0.00	114.30
Beryllium	0.41	0.39	0.00	1.73
Cadmium	0.37	0.57	0.00	2.28
Chromium	2156.50	863.70	0.00	5075.80
Cobalt	30.37	12.40	0.00	72.27
Copper	7.31	10.65	0.00	43.31
Lead	8.17	4.09	0.00	21.99
Mercury	8526.67	3357.81	0.00	19876.08
Nickel	8.49	8.24	0.00	36.33
Selenium	2939.44	1875.68	0.00	9279.23
Silver	144.42	116.24	0.00	537.31
Thallium	0.04	0.02	0.00	0.10
Vanadium	28.29	13.13	0.00	72.69
Zinc	616.06	224.85	0.00	1376.05

TABLE I-2
STATISTICAL ANALYSIS OF BACKGROUND GROUNDWATER SAMPLES FROM "A" AND "E" WELLS
(Sheet of 1 of 2)

Metal (µg/L)	FIRST QUARTER Average	Standard Deviation	Tolerance Interval at 95% Confidence Lower Limit (µg/L)	Upper Limit (µg/L)	SECOND QUARTER Average	Standard Deviation	Tolerance Interval at 95% Confidence Lower Limit (µg/L)	Upper Limit (µg/L)
Aluminum	558.53	1389.82	0.00	6687.63	65.61	119.24	0.00	510.39
Antimony	12.55	0.00	12.55	12.55	12.55	0.00	12.55	12.55
Arsenic	8.06	3.51	0.00	23.54	9.18	4.53	0.00	26.09
Barium	31.20	29.90	0.00	163.08	32.84	25.20	0.00	126.83
Beryllium	0.65	0.00	0.65	0.65	0.65	0.00	0.65	0.65
Cadmium	1.50	0.00	1.50	1.50	1.50	0.00	1.50	1.50
Chromium	4.46	4.25	0.00	23.21	2.85	0.00	2.85	2.85
Cobalt	3.05	0.00	3.05	3.05	3.05	0.00	3.05	3.05
Copper	16.49	7.68	0.00	50.37	14.59	6.73	0.00	39.68
Lead	1.87	2.31	0.00	12.04	1.30	0.90	0.00	4.66
Mercury	0.10	0.00	0.10	0.10	0.12	0.07	0.00	0.37
Nickel	7.97	3.63	0.00	23.97	6.60	0.00	6.60	6.60
Selenium	1.05	0.00	1.05	1.05	1.05	0.00	1.05	1.05
Silver	2.45	0.00	2.45	2.45	2.45	0.00	2.45	2.45
Thallium	1.35	0.00	1.35	1.35	1.35	0.00	1.35	1.35
Vanadium	14.99	17.84	0.00	93.67	11.42	12.04	0.00	56.31
Zinc	4.10	3.52	0.00	19.64	9.70	3.69	0.00	23.45

TABLE I-2
STATISTICAL ANALYSIS OF BACKGROUND GROUNDWATER SAMPLES FROM "A" AND "E" WELLS
(Sheet 2 of 2)

Metal (µg/L)	THIRD QUARTER Average	Standard Deviation	Tolerance Interval at 95% Confidence Lower Limit (µg/L)	Upper Limit (µg/L)	FOURTH QUARTER Average	Standard Deviation	Tolerance Interval at 95% Confidence Lower Limit (µg/L)	Upper Limit (µg/L)
Aluminum	71.24	112.29	0.00	450.77	426.71	735.37	0.00	3169.62
Antimony	20.77	6.71	0.00	43.45	18.75	0.00	18.75	18.75
Arsenic	5.94	2.77	0.00	15.29	8.81	5.87	0.00	30.70
Barium	32.40	28.57	0.00	128.96	18.37	14.35	0.00	71.89
Beryllium	1.25	0.00	1.25	1.25	1.25	0.00	1.25	1.25
Cadmium	1.95	0.00	1.95	1.95	1.95	0.00	1.95	1.95
Chromium	3.44	0.95	0.23	6.65	4.85	3.39	0.00	17.50
Cobalt	8.60	0.00	8.60	8.60	8.60	0.00	8.60	8.60
Copper	6.03	3.84	0.00	19.00	4.63	6.51	0.00	28.91
Lead	1.85	2.20	0.00	9.27	0.92	0.15	0.35	1.50
Mercury	0.10	0.00	0.10	0.10	0.10	0.00	0.10	0.10
Nickel	6.60	0.00	6.60	6.60	10.52	11.77	0.00	54.41
Selenium	1.00	0.00	1.00	1.00	1.44	1.33	0.00	6.42
Silver	2.89	1.10	0.00	6.61	2.40	0.00	2.40	2.40
Thallium	0.85	0.00	0.85	0.85	0.85	0.00	0.85	0.85
Vanadium	10.05	9.10	0.00	40.81	13.46	10.00	0.00	50.77
Zinc	5.69	3.36	0.00	17.04	4.80	2.44	0.00	13.89

TABLE I-3
STATISTICAL ANALYSIS OF BACKGROUND GROUNDWATER SAMPLES FROM "B" AND "C" WELLS
(Sheet 1 of 2)

Metal (µg/L)	FIRST QUARTER Average	Standard Deviation	Tolerance Interval at 95% Confidence Lower Limit (µg/L)	Upper Limit (µg/L)	SECOND QUARTER Average	Standard Deviation	Tolerance Interval at 95% Confidence Lower Limit (µg/L)	Upper Limit (µg/L)
Aluminum	21.07	9.64	0.00	116.71	36.65	16.08	0.00	139.05
Antimony	50.20	65.21	0.00	697.10	97.26	56.48	0.00	457.01
Arsenic	6.13	6.48	0.00	70.44	3.08	3.55	0.00	25.69
Barium	81.37	35.60	0.00	434.47	74.10	40.76	0.00	333.76
Beryllium	0.65	0.00	0.65	0.65	0.65	0.00	0.65	0.65
Cadmium	1.50	0.00	1.50	1.50	1.50	0.00	1.50	1.50
Chromium	2.85	0.00	2.85	2.85	2.85	0.00	2.85	2.85
Cobalt	4.90	3.20	0.00	36.69	5.65	3.40	0.00	27.30
Copper	7.18	9.64	0.00	102.86	17.90	11.44	0.00	90.78
Lead	3.67	2.31	0.00	26.58	4.00	2.00	0.00	16.74
Mercury	0.10	0.00	0.10	0.10	0.10	0.00	0.10	0.10
Nickel	6.60	0.00	6.60	6.60	14.08	9.01	0.00	71.45
Selenium	7.00	3.03	0.00	37.07	5.25	0.00	5.25	5.25
Silver	5.28	2.49	0.00	29.95	4.90	2.86	0.00	23.15
Thallium	9.00	3.90	0.00	47.66	6.75	0.00	6.75	6.75
Vanadium	8.40	10.91	0.00	116.65	26.58	48.95	0.00	338.39
Zinc	38.67	35.47	0.00	390.57	29.95	50.93	0.00	354.40

TABLE I-3
STATISTICAL ANALYSIS OF BACKGROUND GROUNDWATER SAMPLES FROM "B" AND "C" WELLS
(Sheet 2 of 2)

	THIRD QUARTER				FOURTH QUARTER			
			Tolerance Interval at 95% Confidence				Tolerance Interval at 95% Confidence	
Metal (µg/L)	Average	Standard Deviation	Lower Limit (µg/L)	Upper Limit (µg/L)	Average	Standard Deviation	Lower Limit (µg/L)	Upper Limit (µg/L)
Aluminum	57.31	26.28	0.00	224.70	29.70	20.91	0.00	162.88
Antimony	18.75	0.00	18.75	18.75	60.05	73.10	0.00	525.68
Arsenic	4.76	4.05	0.00	30.59	5.59	2.83	0.00	23.59
Barium	77.18	24.77	0.00	234.95	75.88	35.47	0.00	301.84
Beryllium	1.25	0.00	1.25	1.25	1.25	0.00	1.25	1.25
Cadmium	1.95	0.00	1.95	1.95	1.95	0.00	1.95	1.95
Chromium	3.15	0.00	3.15	3.15	3.15	0.00	3.15	3.15
Cobalt	8.60	0.00	8.60	8.60	8.60	0.00	8.60	8.60
Copper	1.90	0.00	1.90	1.90	12.00	10.67	0.00	79.99
Lead	2.14	1.30	0.00	10.44	2.70	1.39	0.00	11.57
Mercury	0.10	0.00	0.10	0.10	0.10	0.00	0.10	0.10
Nickel	13.73	8.53	0.00	68.05	10.20	5.06	0.00	42.42
Selenium	5.00	0.00	5.00	5.00	5.20	3.19	0.00	25.54
Silver	3.35	1.90	0.00	15.45	3.18	1.74	0.00	14.29
Thallium	5.31	2.13	0.00	18.85	4.08	0.38	1.66	6.50
Vanadium	3.00	0.00	3.00	3.00	5.16	4.83	0.00	35.93
Zinc	56.23	64.34	0.00	466.08	22.24	44.59	0.00	306.26

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SSIC NO. 5090.3

APPENDIX J – TIDAL INFLUENCE STUDY DATA TABLES AND CHARTS

FINAL
SOLID WASTE WATER QUALITY ASSESSMENT TEST AND DATA SUMMARY REPORT FOR REMEDIAL INVESTIGATION/FEASIBILITY STUDY FOR PHASES 5 AND 6

DATED 30 APRIL 1993

Averaging Time	Averaging Elevation	Average 1	Average 2	Final Average
4/16/92 18:04	1.086814272	3.36375129	3.228156903	3.203659747
4/16/92 19:04	1.514269825	3.37914919	3.221251481	
4/16/92 20:04	2.836134797	3.37447156	3.214697113	
4/16/92 21:04	4.341224756	3.34535229	3.208263486	
4/16/92 22:04	5.801613774	3.30950555	3.202163654	
4/16/92 23:04	6.985737899	3.2697612	3.196482555	
4/17/92 0:04	7.664961467	3.23302248	3.191353091	
4/17/92 1:04	7.298408045	3.20673483	3.18706041	
4/17/92 2:04	6.010630752	3.20543375	3.183945921	
4/17/92 3:04	3.832402585	3.23126152	3.181985349	
4/17/92 4:04	1.852556242	3.27562084	3.18118851	
4/17/92 5:04	0.162227369	3.3115363	3.181122629	
4/17/92 6:04	-0.998448544	3.33961902	3.182051426	
4/17/92 7:04	-1.253410748	3.35774046	3.183474521	
4/17/92 8:04	-0.751297407	3.33890538	3.185725383	
4/17/92 9:04	0.650614497	3.29899601	3.189057244	
4/17/92 10:04	2.378025954	3.23183562	3.193381477	
4/17/92 11:04	3.877926549	3.15866012	3.198655172	
4/17/92 12:04	5.030173311	3.0934735	3.204975213	
4/17/92 13:04	5.721751689	3.05167364	3.211643372	
4/17/92 14:04	5.763755403	3.02213589	3.218604794	
4/17/92 15:04	4.967087148	3.01602177	3.225834328	
4/17/92 16:04	3.676081153	3.04646163	3.233080959	
4/17/92 17:04	2.28079018	3.09366106	3.240195909	
4/17/92 18:04	1.456363941	3.14913767	3.247142774	
4/17/92 19:04	1.40200663	3.19111576		
4/17/92 20:04	2.137272209	3.21528998		
4/17/92 21:04	3.480903205	3.21363088		
4/17/92 22:04	4.847749312	3.1928565		
4/17/92 23:04	6.104008637	3.16747807		
4/18/92 0:04	7.034057724	3.14152459		
4/18/92 1:04	7.267182311	3.12570546		
4/18/92 2:04	6.630497096	3.12887262		
4/18/92 3:04	4.897026405	3.15641943		
4/18/92 4:04	2.714527161	3.21134056		
4/18/92 5:04	0.836212544	3.27397382		
4/18/92 6:04	-0.563533952	3.33475622		
4/18/92 7:04	-1.7054525	3.37519639		
4/18/92 8:04	-1.709122465	3.41401201		
4/18/92 9:04	-0.961234676	3.4222019		
4/18/92 10:04	0.621813768	3.40710183		
4/18/92 11:04	2.313447762	3.36367799		
4/18/92 12:04	4.026976727	3.31666115		
4/18/92 13:04	5.012845524	3.26017746		

4/18/92 14:04	5.617016518	3.22570919		
4/18/92 15:04	5.697643914	3.20287424		
4/18/92 16:04	4.808867457	3.19718753		
4/18/92 17:04	3.612228855	3.2243354		
4/18/92 18:04	2.463838057	3.26733267		
4/18/92 19:04	1.982188009			
4/18/92 20:04	2.09745373			
4/18/92 21:04	2.982318115			
4/18/92 22:04	4.238666948			
4/18/92 23:04	5.481125194			
4/19/92 0:04	6.654398513			
4/19/92 1:04	7.343194163			
4/19/92 2:04	7.291620623			
4/19/92 3:04	6.215133531			
4/19/92 4:04	4.217725273			
4/19/92 5:04	2.294990256			
4/19/92 6:04	0.407030004			
4/19/92 7:04	-0.773877552			
4/19/92 8:04	-1.512565146			
4/19/92 9:04	-1.323636219			
4/19/92 10:04	-0.420358478			
4/19/92 11:04	1.185043691			
4/19/92 12:04	2.671368063			
4/19/92 13:04	4.185607127			
4/19/92 14:04	5.068977721			
4/19/92 15:04	5.561162788			
4/19/92 16:04	5.460416322			
4/19/92 17:04	4.644163369			

Seaplane Lagoon

Time	Elevation	Average 1	Average 2	Final Average
4/16/92 17:55	1.358	3.49	3.376241667	3.351853
4/16/92 18:55	1.707	3.51058333	3.370275	
4/16/92 19:55	2.659	3.50716667	3.364388333	
4/16/92 20:55	4.026	3.485625	3.358716667	
4/16/92 21:55	5.359	3.451375	3.353255	
4/16/92 22:55	6.56	3.41604167	3.348245	
4/16/92 23:55	7.405	3.38070833	3.343655	
4/17/92 0:55	7.25	3.34958333	3.33981	
4/17/92 1:55	6.201	3.345125	3.337085	
4/17/92 2:55	4.294	3.3685	3.335273333	
4/17/92 3:55	2.498	3.40841667	3.334318333	
4/17/92 4:55	0.962	3.44295833	3.33395	
4/17/92 5:55	-0.184	3.46770833	3.334243333	
4/17/92 6:55	-0.657	3.481875	3.335328333	
4/17/92 7:55	-0.389	3.47820833	3.33707	
4/17/92 8:55	0.726	3.44870833	3.339466667	
4/17/92 9:55	2.233	3.39541667	3.342481667	
4/17/92 10:55	3.651	3.33354167	3.346143333	
4/17/92 11:55	4.833	3.274875	3.350536667	
4/17/92 12:55	5.614	3.2285	3.355428333	
4/17/92 13:55	5.778	3.19516667	3.360793333	
4/17/92 14:55	5.217	3.18558333	3.366478333	
4/17/92 15:55	3.966	3.20595833	3.3722	
4/17/92 16:55	2.693	3.25179167	3.377805	
4/17/92 17:55	1.852	3.302625	3.383136667	
4/17/92 18:55	1.625	3.34083333		
4/17/92 19:55	2.142	3.36341667		
4/17/92 20:55	3.204	3.365375		
4/17/92 21:55	4.511	3.34908333		
4/17/92 22:55	5.712	3.326125		
4/17/92 23:55	6.658	3.30129167		
4/18/92 0:55	7.143	3.28458333		
4/18/92 1:55	6.762	3.28145833		
4/18/92 2:55	5.252	3.29983333		
4/18/92 3:55	3.327	3.344625		
4/18/92 4:55	1.556	3.39920833		
4/18/92 5:55	0.156	3.45029167		
4/18/92 6:55	-0.745	3.49483333		
4/18/92 7:55	-1.097	3.52541667		
4/18/92 8:55	-0.553	3.538125		
4/18/92 9:55	0.748	3.52408333		
4/18/92 10:55	2.243	3.48695833		
4/18/92 11:55	3.72	3.443375		
4/18/92 12:55	4.814	3.39716667		

4/18/92 13:55	5.548	3.362625		
4/18/92 14:55	5.706	3.33729167		
4/18/92 15:55	5.066	3.328625		
4/18/92 16:55	3.913	3.34608333		
4/18/92 17:55	2.769	3.38508333		
4/18/92 18:55	2.167			
4/18/92 19:55	2.189			
4/18/92 20:55	2.813			
4/18/92 21:55	3.96			
4/18/92 22:55	5.116			
4/18/92 23:55	6.257			
4/19/92 0:55	7.068			
4/19/92 1:55	7.203			
4/19/92 2:55	6.327			
4/19/92 3:55	4.637			
4/19/92 4:55	2.782			
4/19/92 5:55	1.225			
4/19/92 6:55	-0.011			
4/19/92 7:55	-0.792			
4/19/92 8:55	-0.89			
4/19/92 9:55	-0.143			
4/19/92 10:55	1.197			
4/19/92 11:55	2.611			
4/19/92 12:55	3.985			
4/19/92 13:55	4.94			
4/19/92 14:55	5.498			
4/19/92 15:55	5.485			
4/19/92 16:55	4.849			

Time	Elevation	Average 1	Average 2	Final Average
4/16/92 17:58	3.113	3.08195833	3.071158333	3.061811333
4/16/92 18:58	3.109	3.08025	3.070328333	
4/16/92 19:58	3.087	3.07883333	3.069566667	
4/16/92 20:58	3.081	3.07791667	3.06883	
4/16/92 21:58	3.078	3.07645833	3.068098333	
4/16/92 22:58	3.087	3.07554167	3.067388333	
4/16/92 23:58	3.068	3.074375	3.066673333	
4/17/92 0:58	3.065	3.073625	3.065961667	
4/17/92 1:58	3.05	3.073125	3.065226667	
4/17/92 2:58	3.068	3.07325	3.064458333	
4/17/92 3:58	3.065	3.07233333	3.063653333	
4/17/92 4:58	3.072	3.07170833	3.062846667	
4/17/92 5:58	3.059	3.07129167	3.061996667	
4/17/92 6:58	3.078	3.07116667	3.061121667	
4/17/92 7:58	3.091	3.0705	3.060236667	
4/17/92 8:58	3.081	3.06916667	3.059346667	
4/17/92 9:58	3.097	3.068375	3.058478333	
4/17/92 10:58	3.068	3.06716667	3.057621667	
4/17/92 11:58	3.081	3.06733333	3.056813333	
4/17/92 12:58	3.097	3.06679167	3.055998333	
4/17/92 13:58	3.094	3.06575	3.055241667	
4/17/92 14:58	3.091	3.06454167	3.054511667	
4/17/92 15:58	3.084	3.06333333	3.053846667	
4/17/92 16:58	3.103	3.06266667	3.05323	
4/17/92 17:58	3.072	3.0615	3.05265	
4/17/92 18:58	3.075	3.06120833		
4/17/92 19:58	3.065	3.06120833		
4/17/92 20:58	3.046	3.06041667		
4/17/92 21:58	3.056	3.059625		
4/17/92 22:58	3.059	3.05870833		
4/17/92 23:58	3.05	3.05766667		
4/18/92 0:58	3.053	3.05658333		
4/18/92 1:58	3.053	3.05525		
4/18/92 2:58	3.046	3.05391667		
4/18/92 3:58	3.05	3.053125		
4/18/92 4:58	3.062	3.05216667		
4/18/92 5:58	3.056	3.05045833		
4/18/92 6:58	3.062	3.04941667		
4/18/92 7:58	3.059	3.04904167		
4/18/92 8:58	3.062	3.04825		
4/18/92 9:58	3.068	3.04745833		
4/18/92 10:58	3.072	3.04695833		
4/18/92 11:58	3.068	3.04695833		
4/18/92 12:58	3.072	3.04695833		

4/18/92 13:58	3.065	3.047875		
4/18/92 14:58	3.062	3.0475		
4/18/92 15:58	3.068	3.04791667		
4/18/92 16:58	3.075	3.04791667		
4/18/92 17:58	3.065	3.04816667		
4/18/92 18:58	3.075			
4/18/92 19:58	3.046			
4/18/92 20:58	3.027			
4/18/92 21:58	3.034			
4/18/92 22:58	3.034			
4/18/92 23:58	3.024			
4/19/92 0:58	3.021			
4/19/92 1:58	3.021			
4/19/92 2:58	3.027			
4/19/92 3:58	3.027			
4/19/92 4:58	3.021			
4/19/92 5:58	3.031			
4/19/92 6:58	3.053			
4/19/92 7:58	3.04			
4/19/92 8:58	3.043			
4/19/92 9:58	3.056			
4/19/92 10:58	3.072			
4/19/92 11:58	3.068			
4/19/92 12:58	3.094			
4/19/92 13:58	3.056			
4/19/92 14:58	3.072			
4/19/92 15:58	3.068			
4/19/92 16:58	3.081			

Time	Elevation	Average 1	Average 2	Final Average
4/16/92 18:00	4.018	4.032875	4.023605	4.014833867
4/16/92 19:00	4.015	4.032625	4.02289	
4/16/92 20:00	4.022	4.032125	4.022175	
4/16/92 21:00	4.031	4.03120833	4.021455	
4/16/92 22:00	4.05	4.03016667	4.020731667	
4/16/92 23:00	4.072	4.02883333	4.019995	
4/17/92 0:00	4.085	4.02754167	4.019238333	
4/17/92 1:00	4.088	4.02620833	4.018496667	
4/17/92 2:00	4.094	4.02541667	4.017771667	
4/17/92 3:00	4.082	4.02475	4.017053333	
4/17/92 4:00	4.05	4.02408333	4.016356667	
4/17/92 5:00	4.025	4.02383333	4.015696667	
4/17/92 6:00	4.003	4.02354167	4.015031667	
4/17/92 7:00	3.991	4.02329167	4.014363333	
4/17/92 8:00	3.978	4.0225	4.013683333	
4/17/92 9:00	3.978	4.021875	4.012996667	
4/17/92 10:00	3.988	4.02108333	4.012283333	
4/17/92 11:00	4.003	4.019875	4.01154	
4/17/92 12:00	4.003	4.01925	4.010776667	
4/17/92 13:00	4.047	4.01875	4.009923333	
4/17/92 14:00	4.047	4.01716667	4.00897	
4/17/92 15:00	4.044	4.016375	4.008003333	
4/17/92 16:00	4.044	4.01595833	4.007001667	
4/17/92 17:00	4.031	4.01566667	4.005955	
4/17/92 18:00	4.012	4.015125	4.004853333	
4/17/92 19:00	4.003	4.015		
4/17/92 20:00	4	4.01475		
4/17/92 21:00	4.006	4.014125		
4/17/92 22:00	4.018	4.013125		
4/17/92 23:00	4.041	4.01175		
4/18/92 0:00	4.053	4.00991667		
4/18/92 1:00	4.069	4.009		
4/18/92 2:00	4.078	4.00808333		
4/18/92 3:00	4.066	4.00745833		
4/18/92 4:00	4.044	4.00733333		
4/18/92 5:00	4.018	4.00758333		
4/18/92 6:00	3.997	4.00720833		
4/18/92 7:00	3.972	4.00683333		
4/18/92 8:00	3.963	4.00629167		
4/18/92 9:00	3.959	4.00533333		
4/18/92 10:00	3.959	4.00404167		
4/18/92 11:00	3.988	4.0025		
4/18/92 12:00	3.991	4.00079167		
4/18/92 13:00	4.009	3.99791667		

4/18/92 14:00	4.028	3.99491667		
4/18/92 15:00	4.034	3.993		
4/18/92 16:00	4.037	3.99133333		
4/18/92 17:00	4.018	3.98979167		
4/18/92 18:00	4.009	3.988125		
4/18/92 19:00	3.997			
4/18/92 20:00	3.985			
4/18/92 21:00	3.982			
4/18/92 22:00	3.985			
4/18/92 23:00	3.997			
4/19/92 0:00	4.031			
4/19/92 1:00	4.047			
4/19/92 2:00	4.063			
4/19/92 3:00	4.063			
4/19/92 4:00	4.05			
4/19/92 5:00	4.009			
4/19/92 6:00	3.988			
4/19/92 7:00	3.959			
4/19/92 8:00	3.94			
4/19/92 9:00	3.928			
4/19/92 10:00	3.922			
4/19/92 11:00	3.947			
4/19/92 12:00	3.922			
4/19/92 13:00	3.937			
4/19/92 14:00	3.982			
4/19/92 15:00	3.994			
4/19/92 16:00	4			
4/19/92 17:00	3.978			

Time	Elevation	Average 1	Average 2	Final Average
4/16/92 18:00	3.956	3.94366667	3.927545	3.912232267
4/16/92 19:00	3.953	3.9425	3.926276667	
4/16/92 20:00	3.953	3.94108333	3.925011667	
4/16/92 21:00	3.953	3.93979167	3.923745	
4/16/92 22:00	3.956	3.938375	3.922466667	
4/16/92 23:00	3.962	3.93683333	3.921176667	
4/17/92 0:00	3.968	3.93529167	3.919875	
4/17/92 1:00	3.968	3.933375	3.918586667	
4/17/92 2:00	3.972	3.932	3.917316667	
4/17/92 3:00	3.968	3.93058333	3.91607	
4/17/92 4:00	3.965	3.92945833	3.914816667	
4/17/92 5:00	3.956	3.92820833	3.913565	
4/17/92 6:00	3.95	3.92716667	3.912295	
4/17/92 7:00	3.941	3.926	3.911025	
4/17/92 8:00	3.928	3.92454167	3.909755	
4/17/92 9:00	3.922	3.92308333	3.908491667	
4/17/92 10:00	3.906	3.9215	3.907228333	
4/17/92 11:00	3.919	3.92033333	3.90598	
4/17/92 12:00	3.912	3.91966667	3.904736667	
4/17/92 13:00	3.931	3.918875	3.903463333	
4/17/92 14:00	3.925	3.91704167	3.902121667	
4/17/92 15:00	3.925	3.91625	3.900748333	
4/17/92 16:00	3.931	3.91545833	3.899321667	
4/17/92 17:00	3.928	3.91429167	3.897858333	
4/17/92 18:00	3.928	3.91325	3.89633	
4/17/92 19:00	3.919	3.91195833		
4/17/92 20:00	3.922	3.910875		
4/17/92 21:00	3.919	3.90941667		
4/17/92 22:00	3.919	3.90783333		
4/17/92 23:00	3.925	3.906125		
4/18/92 0:00	3.922	3.90429167		
4/18/92 1:00	3.935	3.90308333		
4/18/92 2:00	3.938	3.901625		
4/18/92 3:00	3.941	3.90083333		
4/18/92 4:00	3.935	3.89925		
4/18/92 5:00	3.931	3.89816667		
4/18/92 6:00	3.922	3.89645833		
4/18/92 7:00	3.906	3.89541667		
4/18/92 8:00	3.893	3.89425		
4/18/92 9:00	3.884	3.89295833		
4/18/92 10:00	3.878	3.8915		
4/18/92 11:00	3.903	3.89029167		
4/18/92 12:00	3.893	3.88925		
4/18/92 13:00	3.887	3.88783333		

4/18/92 14:00	3.906	3.88533333		
4/18/92 15:00	3.906	3.88270833		
4/18/92 16:00	3.903	3.88058333		
4/18/92 17:00	3.903	3.878875		
4/18/92 18:00	3.897	3.87608333		
4/18/92 19:00	3.893			
4/18/92 20:00	3.887			
4/18/92 21:00	3.881			
4/18/92 22:00	3.878			
4/18/92 23:00	3.881			
4/19/92 0:00	3.893			
4/19/92 1:00	3.9			
4/19/92 2:00	3.919			
4/19/92 3:00	3.903			
4/19/92 4:00	3.909			
4/19/92 5:00	3.89			
4/19/92 6:00	3.897			
4/19/92 7:00	3.878			
4/19/92 8:00	3.862			
4/19/92 9:00	3.849			
4/19/92 10:00	3.849			
4/19/92 11:00	3.878			
4/19/92 12:00	3.859			
4/19/92 13:00	3.827			
4/19/92 14:00	3.843			
4/19/92 15:00	3.855			
4/19/92 16:00	3.862			
4/19/92 17:00	3.836			

Time	Elevation	Average 1	Average 2	Final Average
4/16/92 17:54	4.275	4.253625	4.239363333	4.229727333
4/16/92 18:54	4.272	4.25195833	4.238281667	
4/16/92 19:54	4.266	4.25054167	4.237235	
4/16/92 20:54	4.263	4.249375	4.236251667	
4/16/92 21:54	4.26	4.24820833	4.235295	
4/16/92 22:54	4.26	4.24691667	4.234368333	
4/16/92 23:54	4.263	4.245625	4.233493333	
4/17/92 0:54	4.269	4.24433333	4.232686667	
4/17/92 1:54	4.272	4.24291667	4.231911667	
4/17/92 2:54	4.275	4.24166667	4.231166667	
4/17/92 3:54	4.275	4.24054167	4.23045	
4/17/92 4:54	4.275	4.23979167	4.229753333	
4/17/92 5:54	4.272	4.23891667	4.229076667	
4/17/92 6:54	4.263	4.23804167	4.228455	
4/17/92 7:54	4.257	4.23729167	4.227851667	
4/17/92 8:54	4.248	4.236	4.227256667	
4/17/92 9:54	4.229	4.23479167	4.226676667	
4/17/92 10:54	4.226	4.233875	4.226123333	
4/17/92 11:54	4.213	4.23295833	4.22558	
4/17/92 12:54	4.226	4.23245833	4.225035	
4/17/92 13:54	4.232	4.231	4.224505	
4/17/92 14:54	4.235	4.22970833	4.223921667	
4/17/92 15:54	4.226	4.22854167	4.223363333	
4/17/92 16:54	4.235	4.22775	4.222815	
4/17/92 17:54	4.235	4.22725	4.222266667	
4/17/92 18:54	4.238	4.22658333		
4/17/92 19:54	4.238	4.22579167		
4/17/92 20:54	4.235	4.22595833		
4/17/92 21:54	4.229	4.22545833		
4/17/92 22:54	4.229	4.22504167		
4/17/92 23:54	4.232	4.22504167		
4/18/92 0:54	4.235	4.22545833		
4/18/92 1:54	4.242	4.22495833		
4/18/92 2:54	4.248	4.22429167		
4/18/92 3:54	4.257	4.22375		
4/18/92 4:54	4.254	4.223125		
4/18/92 5:54	4.251	4.222875		
4/18/92 6:54	4.245	4.223375		
4/18/92 7:54	4.226	4.22295833		
4/18/92 8:54	4.219	4.22241667		
4/18/92 9:54	4.207	4.2215		
4/18/92 10:54	4.204	4.22095833		
4/18/92 11:54	4.201	4.22029167		
4/18/92 12:54	4.191	4.21933333		

4/18/92 13:54	4.201	4.21920833		
4/18/92 14:54	4.207	4.21641667		
4/18/92 15:54	4.207	4.21575		
4/18/92 16:54	4.223	4.21483333		
4/18/92 17:54	4.219	4.21404167		
4/18/92 18:54	4.219			
4/18/92 19:54	4.242			
4/18/92 20:54	4.223			
4/18/92 21:54	4.219			
4/18/92 22:54	4.229			
4/18/92 23:54	4.242			
4/19/92 0:54	4.223			
4/19/92 1:54	4.226			
4/19/92 2:54	4.235			
4/19/92 3:54	4.242			
4/19/92 4:54	4.248			
4/19/92 5:54	4.263			
4/19/92 6:54	4.235			
4/19/92 7:54	4.213			
4/19/92 8:54	4.197			
4/19/92 9:54	4.194			
4/19/92 10:54	4.188			
4/19/92 11:54	4.178			
4/19/92 12:54	4.188			
4/19/92 13:54	4.134			
4/19/92 14:54	4.191			
4/19/92 15:54	4.185			
4/19/92 16:54	4.204			

M006A

Time	Elevation	Average 1	Average 2	Final Average
4/16/92 18:01	4.956	4.94666667	4.941565	4.938408933
4/16/92 19:01	4.956	4.94629167	4.941301667	
4/16/92 20:01	4.959	4.94579167	4.941048333	
4/16/92 21:01	4.953	4.94529167	4.940795	
4/16/92 22:01	4.953	4.944375	4.940561667	
4/16/92 23:01	4.953	4.94375	4.940343333	
4/17/92 0:01	4.947	4.943125	4.940123333	
4/17/92 1:01	4.947	4.942625	4.939901667	
4/17/92 2:01	4.95	4.94225	4.939673333	
4/17/92 3:01	4.953	4.941875	4.939438333	
4/17/92 4:01	4.953	4.94125	4.939213333	
4/17/92 5:01	4.947	4.940625	4.939001667	
4/17/92 6:01	4.944	4.940375	4.938778333	
4/17/92 7:01	4.941	4.94025	4.938528333	
4/17/92 8:01	4.935	4.93958333	4.938261667	
4/17/92 9:01	4.928	4.93904167	4.93799	
4/17/92 10:01	4.931	4.93891667	4.937708333	
4/17/92 11:01	4.935	4.93908333	4.937388333	
4/17/92 12:01	4.941	4.93933333	4.93702	
4/17/92 13:01	4.944	4.93933333	4.9366	
4/17/92 14:01	4.95	4.93945833	4.936138333	
4/17/92 15:01	4.941	4.93945833	4.935625	
4/17/92 16:01	4.95	4.94008333	4.93506	
4/17/92 17:01	4.953	4.94020833	4.934423333	
4/17/92 18:01	4.947	4.94008333	4.933735	
4/17/92 19:01	4.944	4.94008333		
4/17/92 20:01	4.947	4.93995833		
4/17/92 21:01	4.931	4.93945833		
4/17/92 22:01	4.938	4.93945833		
4/17/92 23:01	4.938	4.93891667		
4/18/92 0:01	4.935	4.93825		
4/18/92 1:01	4.938	4.93758333		
4/18/92 2:01	4.941	4.93691667		
4/18/92 3:01	4.938	4.936375		
4/18/92 4:01	4.938	4.93625		
4/18/92 5:01	4.941	4.93595833		
4/18/92 6:01	4.941	4.93504167		
4/18/92 7:01	4.925	4.934125		
4/18/92 8:01	4.922	4.93358333		
4/18/92 9:01	4.925	4.93279167		
4/18/92 10:01	4.935	4.932		
4/18/92 11:01	4.941	4.93091667		
4/18/92 12:01	4.941	4.929875		
4/18/92 13:01	4.947	4.92883333		

4/18/92 14:01	4.95	4.92779167		
4/18/92 15:01	4.956	4.926625		
4/18/92 16:01	4.953	4.92533333		
4/18/92 17:01	4.95	4.92416667		
4/18/92 18:01	4.947	4.923		
4/18/92 19:01	4.941			
4/18/92 20:01	4.935			
4/18/92 21:01	4.931			
4/18/92 22:01	4.925			
4/18/92 23:01	4.922			
4/19/92 0:01	4.919			
4/19/92 1:01	4.922			
4/19/92 2:01	4.928			
4/19/92 3:01	4.935			
4/19/92 4:01	4.931			
4/19/92 5:01	4.919			
4/19/92 6:01	4.919			
4/19/92 7:01	4.912			
4/19/92 8:01	4.903			
4/19/92 9:01	4.906			
4/19/92 10:01	4.909			
4/19/92 11:01	4.916			
4/19/92 12:01	4.916			
4/19/92 13:01	4.922			
4/19/92 14:01	4.922			
4/19/92 15:01	4.925			
4/19/92 16:01	4.925			
4/19/92 17:01	4.922			

Time	Elevation	Average 1	Average 2	Final Average
4/16/92 18:07	5.07	5.08529167	5.069106667	5.050783133
4/16/92 19:07	5.081	5.08433333	5.067611667	
4/16/92 20:07	5.087	5.08304167	5.066088333	
4/16/92 21:07	5.084	5.08170833	5.064546667	
4/16/92 22:07	5.092	5.08041667	5.063005	
4/16/92 23:07	5.095	5.078875	5.061458333	
4/17/92 0:07	5.092	5.07745833	5.059916667	
4/17/92 1:07	5.092	5.07641667	5.058365	
4/17/92 2:07	5.101	5.075375	5.056806667	
4/17/92 3:07	5.112	5.07441667	5.055233333	
4/17/92 4:07	5.112	5.073	5.053656667	
4/17/92 5:07	5.109	5.07170833	5.052093333	
4/17/92 6:07	5.112	5.07066667	5.050525	
4/17/92 7:07	5.106	5.069375	5.048936667	
4/17/92 8:07	5.104	5.067875	5.047361667	
4/17/92 9:07	5.095	5.06608333	5.045803333	
4/17/92 10:07	5.095	5.06420833	5.044296667	
4/17/92 11:07	5.075	5.06220833	5.042831667	
4/17/92 12:07	5.067	5.06054167	5.041418333	
4/17/92 13:07	5.061	5.05875	5.04003	
4/17/92 14:07	5.064	5.05695833	5.038671667	
4/17/92 15:07	5.044	5.05483333	5.037341667	
4/17/92 16:07	5.05	5.05316667	5.036063333	
4/17/92 17:07	5.047	5.051375	5.03481	
4/17/92 18:07	5.047	5.04958333	5.0336	
4/17/92 19:07	5.05	5.04791667		
4/17/92 20:07	5.055	5.04625		
4/17/92 21:07	5.053	5.0445		
4/17/92 22:07	5.055	5.04316667		
4/17/92 23:07	5.061	5.04175		
4/18/92 0:07	5.067	5.04033333		
4/18/92 1:07	5.067	5.03866667		
4/18/92 2:07	5.078	5.03745833		
4/18/92 3:07	5.078	5.03604167		
4/18/92 4:07	5.081	5.035		
4/18/92 5:07	5.084	5.03391667		
4/18/92 6:07	5.081	5.0325		
4/18/92 7:07	5.07	5.03095833		
4/18/92 8:07	5.061	5.03		
4/18/92 9:07	5.05	5.02891667		
4/18/92 10:07	5.047	5.02841667		
4/18/92 11:07	5.035	5.02758333		
4/18/92 12:07	5.024	5.026875		
4/18/92 13:07	5.018	5.02583333		

4/18/92 14:07	5.013	5.02479167		
4/18/92 15:07	5.004	5.02370833		
4/18/92 16:07	5.007	5.022875		
4/18/92 17:07	5.004	5.02183333		
4/18/92 18:07	5.007	5.021125		
4/18/92 19:07	5.01			
4/18/92 20:07	5.013			
4/18/92 21:07	5.021			
4/18/92 22:07	5.021			
4/18/92 23:07	5.027			
4/19/92 0:07	5.027			
4/19/92 1:07	5.038			
4/19/92 2:07	5.044			
4/19/92 3:07	5.053			
4/19/92 4:07	5.055			
4/19/92 5:07	5.05			
4/19/92 6:07	5.044			
4/19/92 7:07	5.047			
4/19/92 8:07	5.035			
4/19/92 9:07	5.038			
4/19/92 10:07	5.027			
4/19/92 11:07	5.018			
4/19/92 12:07	4.999			
4/19/92 13:07	4.993			
4/19/92 14:07	4.987			
4/19/92 15:07	4.984			
4/19/92 16:07	4.982			
4/19/92 17:07	4.987			

M009A

Time	Elevation	Average 1	Average 2	Final Average
4/16/92 17:59	4.973	4.93058333	4.91502	4.904228867
4/16/92 18:59	4.963	4.92875	4.913918333	
4/16/92 19:59	4.967	4.92758333	4.912863333	
4/16/92 20:59	4.96	4.926375	4.911828333	
4/16/92 21:59	4.954	4.92520833	4.91082	
4/16/92 22:59	4.951	4.92375	4.909843333	
4/16/92 23:59	4.948	4.92229167	4.908898333	
4/17/92 0:59	4.938	4.92054167	4.907991667	
4/17/92 1:59	4.938	4.919375	4.907123333	
4/17/92 2:59	4.938	4.91820833	4.906275	
4/17/92 3:59	4.951	4.91729167	4.905451667	
4/17/92 4:59	4.948	4.91583333	4.904648333	
4/17/92 5:59	4.944	4.914625	4.903861667	
4/17/92 6:59	4.935	4.91333333	4.903091667	
4/17/92 7:59	4.922	4.911875	4.902341667	
4/17/92 8:59	4.913	4.91016667	4.901608333	
4/17/92 9:59	4.9	4.90845833	4.900895	
4/17/92 10:59	4.887	4.907125	4.900203333	
4/17/92 11:59	4.878	4.90633333	4.899508333	
4/17/92 12:59	4.891	4.90608333	4.898775	
4/17/92 13:59	4.897	4.90541667	4.897983333	
4/17/92 14:59	4.906	4.90475	4.89714	
4/17/92 15:59	4.91	4.90425	4.896223333	
4/17/92 16:59	4.922	4.90383333	4.895236667	
4/17/92 17:59	4.929	4.90345833	4.894171667	
4/17/92 18:59	4.935	4.90304167		
4/17/92 19:59	4.938	4.902375		
4/17/92 20:59	4.932	4.90170833		
4/17/92 21:59	4.919	4.90116667		
4/17/92 22:59	4.916	4.90079167		
4/17/92 23:59	4.906	4.900125		
4/18/92 0:59	4.91	4.899625		
4/18/92 1:59	4.91	4.89883333		
4/18/92 2:59	4.916	4.89816667		
4/18/92 3:59	4.916	4.897625		
4/18/92 4:59	4.919	4.89720833		
4/18/92 5:59	4.913	4.89616667		
4/18/92 6:59	4.9	4.895375		
4/18/92 7:59	4.881	4.89458333		
4/18/92 8:59	4.872	4.89354167		
4/18/92 9:59	4.868	4.89233333		
4/18/92 10:59	4.868	4.89116667		
4/18/92 11:59	4.872	4.88975		
4/18/92 12:59	4.875	4.888		

4/18/92 13:59	4.881	4.88629167		
4/18/92 14:59	4.894	4.88433333		
4/18/92 15:59	4.9	4.88183333		
4/18/92 16:59	4.913	4.87958333		
4/18/92 17:59	4.919	4.87720833		
4/18/92 18:59	4.919			
4/18/92 19:59	4.922			
4/18/92 20:59	4.919			
4/18/92 21:59	4.91			
4/18/92 22:59	4.9			
4/18/92 23:59	4.894			
4/19/92 0:59	4.891			
4/19/92 1:59	4.894			
4/19/92 2:59	4.903			
4/19/92 3:59	4.906			
4/19/92 4:59	4.894			
4/19/92 5:59	4.894			
4/19/92 6:59	4.881			
4/19/92 7:59	4.856			
4/19/92 8:59	4.843			
4/19/92 9:59	4.84			
4/19/92 10:59	4.834			
4/19/92 11:59	4.83			
4/19/92 12:59	4.834			
4/19/92 13:59	4.834			
4/19/92 14:59	4.834			
4/19/92 15:59	4.846			
4/19/92 16:59	4.856			

M010A

Time	Elevation	Average 1	Average 2	Final Average
4/16/92 17:59	4.242	4.24895833	4.23503	4.2187266
4/16/92 18:59	4.235	4.24779167	4.233731667	
4/16/92 19:59	4.238	4.24691667	4.232423333	
4/16/92 20:59	4.235	4.24579167	4.231098333	
4/16/92 21:59	4.235	4.24479167	4.22976	
4/16/92 22:59	4.264	4.24391667	4.228388333	
4/16/92 23:59	4.304	4.24220833	4.22701	
4/17/92 0:59	4.32	4.24025	4.225648333	
4/17/92 1:59	4.326	4.23920833	4.224301667	
4/17/92 2:59	4.298	4.23845833	4.222938333	
4/17/92 3:59	4.267	4.23833333	4.221578333	
4/17/92 4:59	4.238	4.23779167	4.220186667	
4/17/92 5:59	4.235	4.23704167	4.218806667	
4/17/92 6:59	4.229	4.23629167	4.21741	
4/17/92 7:59	4.22	4.23516667	4.21599	
4/17/92 8:59	**4.211**	4.234	4.214558333	
4/17/92 9:59	4.242	4.23283333	4.213115	
4/17/92 10:59	4.214	4.22995833	4.211666667	
4/17/92 11:59	4.214	4.228125	4.210286667	
4/17/92 12:59	4.217	4.22629167	4.208923333	
4/17/92 13:59	4.245	4.22433333	4.207576667	
4/17/92 14:59	4.257	4.221625	4.206318333	
4/17/92 15:59	4.257	4.21983333	4.205063333	
4/17/92 16:59	4.232	4.21841667	4.203813333	
4/17/92 17:59	4.214	4.21741667	4.202541667	
4/17/92 18:59	4.214	4.2165		
4/17/92 19:59	4.211	4.21508333		
4/17/92 20:59	4.211	4.21379167		
4/17/92 21:59	4.214	4.21233333		
4/17/92 22:59	4.223	4.2105		
4/17/92 23:59	4.257	4.20945833		
4/18/92 0:59	4.295	4.20816667		
4/18/92 1:59	4.308	4.20658333		
4/18/92 2:59	4.295	4.205125		
4/18/92 3:59	4.254	4.20445833		
4/18/92 4:59	4.22	4.20354167		
4/18/92 5:59	4.217	4.20329167		
4/18/92 6:59	4.202	4.202125		
4/18/92 7:59	4.192	4.20079167		
4/18/92 8:59	4.183	4.199375		
4/18/92 9:59	4.173	4.19791667		
4/18/92 10:59	4.17	4.196625		
4/18/92 11:59	4.17	4.19545833		
4/18/92 12:59	4.17	4.19404167		

4/18/92 13:59	4.18	4.192625		
4/18/92 14:59	4.214	4.192875		
4/18/92 15:59	4.223	4.19025		
4/18/92 16:59	4.208	4.18858333		
4/18/92 17:59	4.192	4.186625		
4/18/92 18:59	4.18			
4/18/92 19:59	4.18			
4/18/92 20:59	4.176			
4/18/92 21:59	4.17			
4/18/92 22:59	4.198			
4/18/92 23:59	4.226			
4/19/92 0:59	4.257			
4/19/92 1:59	4.273			
4/19/92 2:59	4.279			
4/19/92 3:59	4.232			
4/19/92 4:59	4.214			
4/19/92 5:59	4.189			
4/19/92 6:59	4.17			
4/19/92 7:59	4.158			
4/19/92 8:59	4.148			
4/19/92 9:59	4.142			
4/19/92 10:59	4.142			
4/19/92 11:59	4.136			
4/19/92 12:59	4.136			
4/19/92 13:59	4.186			
4/19/92 14:59	4.151			
4/19/92 15:59	4.183			
4/19/92 16:59	4.161			

M012A

Time	Elevation	Average 1	Average 2	Final Average
4/16/92 17:59	5.606	5.5935	5.580931667	5.569539
4/16/92 18:59	5.603	5.59233333	5.57995	
4/16/92 19:59	5.606	5.59129167	5.578983333	
4/16/92 20:59	5.603	5.590125	5.578021667	
4/16/92 21:59	5.6	5.58870833	5.57708	
4/16/92 22:59	5.603	5.58766667	5.576153333	
4/16/92 23:59	* 5.6	5.5865	5.575231667	
4/17/92 0:59	5.6	5.58533333	5.574325	
4/17/92 1:59	5.603	5.58441667	5.573413333	
4/17/92 2:59	5.606	5.58354167	5.572495	
4/17/92 3:59	5.606	5.58266667	5.571575	
4/17/92 4:59	5.597	5.58166667	5.570641667	
4/17/92 5:59	5.594	5.58075	5.569706667	
4/17/92 6:59	* 5.591	5.58008333	5.568761667	
4/17/92 7:59	5.588	5.57916667	5.567795	
4/17/92 8:59	5.582	5.57795833	5.566823333	
4/17/92 9:59	5.597	5.576875	5.565848333	
4/17/92 10:59	5.578	5.57558333	5.564858333	
4/17/92 11:59	**5.572**	5.57454167	5.563878333	
4/17/92 12:59	5.582	5.57375	5.562898333	
4/17/92 13:59	5.578	5.57279167	5.561886667	
4/17/92 14:59	5.582	5.57229167	5.560886667	
4/17/92 15:59	5.585	5.571625	5.559848333	
4/17/92 16:59	5.582	5.57054167	5.558785	
4/17/92 17:59	5.578	5.56958333	5.557696667	
4/17/92 18:59	5.578	5.56895833		
4/17/92 19:59	5.578	5.56816667		
4/17/92 20:59	5.569	5.56725		
4/17/92 21:59	5.575	5.56658333		
4/17/92 22:59	5.575	5.56554167		
4/17/92 23:59	5.572	5.564625		
4/18/92 0:59	5.578	5.56383333		
4/18/92 1:59	5.582	5.56254167		
4/18/92 2:59	5.585	5.56145833		
4/18/92 3:59	5.582	5.56054167		
4/18/92 4:59	5.575	5.55933333		
4/18/92 5:59	5.578	5.55829167		
4/18/92 6:59	5.569	5.557125		
4/18/92 7:59	5.559	5.55591667		
4/18/92 8:59	5.556	5.554875		
4/18/92 9:59	5.566	5.55358333		
4/18/92 10:59	5.553	5.552125		
4/18/92 11:59	5.553	5.55108333		
4/18/92 12:59	5.559	5.55004167		

4/18/92 13:59	5.566	5.54845833		
4/18/92 14:59	5.566	5.54779167		
4/18/92 15:59	5.559	5.54633333		
4/18/92 16:59	5.559	5.54504167		
4/18/92 17:59	5.563	5.54333333		
4/18/92 18:59	5.559			
4/18/92 19:59	5.556			
4/18/92 20:59	5.553			
4/18/92 21:59	5.55			
4/18/92 22:59	5.553			
4/18/92 23:59	5.553			
4/19/92 0:59	5.547			
4/19/92 1:59	5.556			
4/19/92 2:59	5.563			
4/19/92 3:59	5.553			
4/19/92 4:59	5.55			
4/19/92 5:59	5.55			
4/19/92 6:59	5.54			
4/19/92 7:59	5.534			
4/19/92 8:59	5.525			
4/19/92 9:59	5.531			
4/19/92 10:59	5.528			
4/19/92 11:59	5.528			
4/19/92 12:59	5.521			
4/19/92 13:59	5.55			
4/19/92 14:59	5.531			
4/19/92 15:59	5.528			
4/19/92 16:59	5.518			

Time	Elevation	Average 1	Average 2	Final Average
4/16/92 18:00	5.721	5.72583333	5.722275	5.717873333
4/16/92 19:00	5.721	5.72570833	5.721948333	
4/16/92 20:00	5.728	5.72558333	5.721616667	
4/16/92 21:00	5.724	5.72529167	5.72127	
4/16/92 22:00	5.724	5.72479167	5.72093	
4/16/92 23:00	5.743	5.72454167	5.720595	
4/17/92 0:00	5.763	5.72391667	5.720258333	
4/17/92 1:00	5.766	5.72308333	5.719931667	
4/17/92 2:00	5.769	5.72295833	5.719605	
4/17/92 3:00	5.756	5.72295833	5.719261667	
4/17/92 4:00	5.74	5.72308333	5.718913333	
4/17/92 5:00	5.724	5.72308333	5.718565	
4/17/92 6:00	5.718	5.72295833	5.718206667	
4/17/92 7:00	5.712	5.72283333	5.717826667	
4/17/92 8:00	5.705	5.72241667	5.717431667	
4/17/92 9:00	5.699	5.72166667	5.717021667	
4/17/92 10:00	5.69	5.72116667	5.7166	
4/17/92 11:00	5.687	5.72091667	5.716166667	
4/17/92 12:00	5.699	5.72104167	5.715701667	
4/17/92 13:00	5.705	5.72066667	5.715195	
4/17/92 14:00	5.728	5.72016667	5.714656667	
4/17/92 15:00	5.74	5.71895833	5.714091667	
4/17/92 16:00	5.737	5.71791667	5.713508333	
4/17/92 17:00	5.721	5.71766667	5.712923333	
4/17/92 18:00	5.718	5.71766667	5.712333333	
4/17/92 19:00	5.718	5.71766667		
4/17/92 20:00	5.721	5.71741667		
4/17/92 21:00	5.712	5.71691667		
4/17/92 22:00	5.718	5.71679167		
4/17/92 23:00	5.728	5.71641667		
4/18/92 0:00	5.743	5.716125		
4/18/92 1:00	5.763	5.71575		
4/18/92 2:00	5.769	5.71491667		
4/18/92 3:00	5.759	5.714375		
4/18/92 4:00	5.74	5.71425		
4/18/92 5:00	5.721	5.714375		
4/18/92 6:00	5.715	5.714125		
4/18/92 7:00	5.702	5.71345833		
4/18/92 8:00	5.687	5.71295833		
4/18/92 9:00	5.687	5.71216667		
4/18/92 10:00	5.684	5.711125		
4/18/92 11:00	5.69	5.71033333		
4/18/92 12:00	5.69	5.70929167		
4/18/92 13:00	5.693	5.708375		

4/18/92 14:00	5.699	5.70720833		
4/18/92 15:00	5.715	5.70604167		
4/18/92 16:00	5.731	5.704375		
4/18/92 17:00	5.721	5.70329167		
4/18/92 18:00	5.718	5.70291667		
4/18/92 19:00	5.712			
4/18/92 20:00	5.709			
4/18/92 21:00	5.709			
4/18/92 22:00	5.709			
4/18/92 23:00	5.721			
4/19/92 0:00	5.734			
4/19/92 1:00	5.743			
4/19/92 2:00	5.756			
4/19/92 3:00	5.756			
4/19/92 4:00	5.743			
4/19/92 5:00	5.715			
4/19/92 6:00	5.699			
4/19/92 7:00	5.69			
4/19/92 8:00	5.668			
4/19/92 9:00	5.662			
4/19/92 10:00	5.665			
4/19/92 11:00	5.665			
4/19/92 12:00	5.668			
4/19/92 13:00	5.665			
4/19/92 14:00	5.671			
4/19/92 15:00	5.675			
4/19/92 16:00	5.705			
4/19/92 17:00	5.712			

Time	Elevation	Average 1	Average 2	Final Average
4/16/92 17:57	4.962	4.96220833	4.951968333	4.942137667
4/16/92 18:57	4.955	4.96141667	4.951123333	
4/16/92 19:57	4.958	4.96079167	4.950285	
4/16/92 20:57	4.955	4.95991667	4.94944	
4/16/92 21:57	4.962	4.95891667	4.948603333	
4/16/92 22:57	4.98	4.957875	4.94777	
4/16/92 23:57	* 4.993	4.95658333	4.946948333	
4/17/92 0:57	4.996	4.95541667	4.946141667	
4/17/92 1:57	5.003	4.954625	4.94534	
4/17/92 2:57	4.999	4.95383333	4.944533333	
4/17/92 3:57	4.98	4.95320833	4.943731667	
4/17/92 4:57	4.965	4.95283333	4.942945	
4/17/92 5:57	4.955	4.95216667	4.942158333	
4/17/92 6:57	* 4.949	4.95166667	4.941373333	
4/17/92 7:57	4.943	4.95091667	4.940581667	
4/17/92 8:57	4.937	4.95004167	4.939788333	
4/17/92 9:57	4.934	4.949125	4.938988333	
4/17/92 10:57	4.931	4.94833333	4.938178333	
4/17/92 11:57	4.94	4.94754167	4.937358333	
4/17/92 12:57	4.943	4.9465	4.936518333	
4/17/92 13:57	4.965	4.94545833	4.935673333	
4/17/92 14:57	4.971	4.94379167	4.934811667	
4/17/92 15:57	4.968	4.942625	4.933938333	
4/17/92 16:57	4.949	4.94183333	4.93306	
4/17/92 17:57	4.943	4.94158333	4.932183333	
4/17/92 18:57	4.94	4.94108333		
4/17/92 19:57	4.937	4.94045833		
4/17/92 20:57	4.931	4.93966667		
4/17/92 21:57	4.937	4.939		
4/17/92 22:57	4.949	4.93808333		
4/17/92 23:57	4.965	4.93733333		
4/18/92 0:57	4.977	4.93641667		
4/18/92 1:57	4.984	4.935375		
4/18/92 2:57	4.984	4.93445833		
4/18/92 3:57	4.971	4.93379167		
4/18/92 4:57	4.949	4.93354167		
4/18/92 5:57	4.943	4.93316667		
4/18/92 6:57	4.931	4.93254167		
4/18/92 7:57	4.922	4.931875		
4/18/92 8:57	4.915	4.93108333		
4/18/92 9:57	4.915	4.93004167		
4/18/92 10:57	4.912	4.928875		
4/18/92 11:57	4.915	4.92783333		
4/18/92 12:57	4.918	4.92654167		

4/18/92 13:57	4.925	4.925375		
4/18/92 14:57	4.943	4.92391667		
4/18/92 15:57	4.949	4.92195833		
4/18/92 16:57	4.943	4.92066667		
4/18/92 17:57	4.931	4.91991667		
4/18/92 18:57	4.925			
4/18/92 19:57	4.918			
4/18/92 20:57	4.915			
4/18/92 21:57	4.915			
4/18/92 22:57	4.931			
4/18/92 23:57	4.943			
4/19/92 0:57	4.952			
4/19/92 1:57	4.962			
4/19/92 2:57	4.968			
4/19/92 3:57	4.965			
4/19/92 4:57	4.94			
4/19/92 5:57	4.928			
4/19/92 6:57	4.915			
4/19/92 7:57	4.903			
4/19/92 8:57	4.89			
4/19/92 9:57	4.887			
4/19/92 10:57	4.887			
4/19/92 11:57	4.884			
4/19/92 12:57	4.89			
4/19/92 13:57	4.89			
4/19/92 14:57	4.896			
4/19/92 15:57	4.918			
4/19/92 16:57	4.925			

Time	Elevation	Average 1	Average 2	Final Average
4/16/92 18:05	3.016	3.20975	3.185201667	3.1716462
4/16/92 19:05	3	3.21091667	3.183461667	
4/16/92 20:05	3.041	3.21091667	3.181753333	
4/16/92 21:05	3.142	3.20933333	3.180066667	
4/16/92 22:05	3.295	3.20591667	3.1784	
4/16/92 23:05	3.485	3.20016667	3.176786667	
4/17/92 0:05	3.652	3.19358333	3.175246667	
4/17/92 1:05	3.69	3.187125	3.173811667	
4/17/92 2:05	3.585	3.18408333	3.172551667	
4/17/92 3:05	3.396	3.18475	3.171471667	
4/17/92 4:05	3.243	3.186875	3.170553333	
4/17/92 5:05	3.104	3.18829167	3.169728333	
4/17/92 6:05	2.99	3.18933333	3.16902	
4/17/92 7:05	2.915	3.189875	3.168406667	
4/17/92 8:05	2.877	3.18908333	3.167891667	
4/17/92 9:05	2.905	3.18708333	3.167483333	
4/17/92 10:05	2.984	3.18354167	3.16715	
4/17/92 11:05	3.088	3.17866667	3.166875	
4/17/92 12:05	3.211	3.17329167	3.166668333	
4/17/92 13:05	3.33	3.167375	3.166508333	
4/17/92 14:05	3.384	3.161125	3.16641	
4/17/92 15:05	3.336	3.15741667	3.16639	
4/17/92 16:05	3.239	3.15770833	3.166413333	
4/17/92 17:05	3.126	3.16033333	3.166445	
4/17/92 18:05	3.044	3.1635	3.16646	
4/17/92 19:05	3	3.16625		
4/17/92 20:05	3.003	3.16820833		
4/17/92 21:05	3.06	3.16875		
4/17/92 22:05	3.157	3.16766667		
4/17/92 23:05	3.327	3.16558333		
4/18/92 0:05	3.497	3.16166667		
4/18/92 1:05	3.617	3.15770833		
4/18/92 2:05	3.601	3.155625		
4/18/92 3:05	3.447	3.15708333		
4/18/92 4:05	3.277	3.16179167		
4/18/92 5:05	3.129	3.16625		
4/18/92 6:05	3.003	3.17058333		
4/18/92 7:05	2.896	3.174		
4/18/92 8:05	2.829	3.177		
4/18/92 9:05	2.82	3.178875		
4/18/92 10:05	2.867	3.17875		
4/18/92 11:05	2.959	3.17666667		
4/18/92 12:05	3.069	3.1735		
4/18/92 13:05	3.18	3.16929167		

4/18/92 14:05	3.295	3.16491667		
4/18/92 15:05	3.343	3.160625		
4/18/92 16:05	3.302	3.158		
4/18/92 17:05	3.202	3.1585		
4/18/92 18:05	3.11	3.16070833		
4/18/92 19:05	3.047			
4/18/92 20:05	3.016			
4/18/92 21:05	3.034			
4/18/92 22:05	3.107			
4/18/92 23:05	3.233			
4/19/92 0:05	3.402			
4/19/92 1:05	3.567			
4/19/92 2:05	3.636			
4/19/92 3:05	3.56			
4/19/92 4:05	3.384			
4/19/92 5:05	3.233			
4/19/92 6:05	3.085			
4/19/92 7:05	2.968			
4/19/92 8:05	2.874			
4/19/92 9:05	2.817			
4/19/92 10:05	2.817			
4/19/92 11:05	2.883			
4/19/92 12:05	2.968			
4/19/92 13:05	3.075			
4/19/92 14:05	3.192			
4/19/92 15:05	3.28			
4/19/92 16:05	3.314			
4/19/92 17:05	3.255			

Time	Elevation	Average 1	Average 2	Final Average
4/16/92 18:00	1.411	1.98891667	1.952253333	1.938827533
4/16/92 19:00	1.436	1.99458333	1.949968333	
4/16/92 20:00	1.636	1.99525	1.947705	
4/16/92 21:00	2.013	1.990625	1.945488333	
4/16/92 22:00	2.422	1.98083333	1.943315	
4/16/92 23:00	2.801	1.96908333	1.941258333	
4/17/92 0:00	3.057	1.95733333	1.939356667	
4/17/92 1:00	3.086	1.94795833	1.937693333	
4/17/92 2:00	2.836	1.94466667	1.936315	
4/17/92 3:00	2.33	1.948875	1.935241667	
4/17/92 4:00	1.835	1.95820833	1.93449	
4/17/92 5:00	1.439	1.96641667	1.933971667	
4/17/92 6:00	1.164	1.97225	1.933658333	
4/17/92 7:00	1.028	1.97516667	1.933533333	
4/17/92 8:00	1.018	1.974375	1.933591667	
4/17/92 9:00	1.18	1.969625	1.933813333	
4/17/92 10:00	1.509	1.95970833	1.934178333	
4/17/92 11:00	1.889	1.94454167	1.934696667	
4/17/92 12:00	2.235	1.92791667	1.935388333	
4/17/92 13:00	2.493	1.91270833	1.936243333	
4/17/92 14:00	2.573	1.90075	1.937273333	
4/17/92 15:00	2.437	1.89545833	1.938455	
4/17/92 16:00	2.124	1.899125	1.939696667	
4/17/92 17:00	1.782	1.90979167	1.940943333	
4/17/92 18:00	1.547	1.92216667	1.94216	
4/17/92 19:00	1.452	1.93179167		
4/17/92 20:00	1.525	1.938		
4/17/92 21:00	1.778	1.93983333		
4/17/92 22:00	2.14	1.93629167		
4/17/92 23:00	2.519	1.92941667		
4/18/92 0:00	2.832	1.92154167		
4/18/92 1:00	3.007	1.91575		
4/18/92 2:00	2.937	1.9135		
4/18/92 3:00	2.554	1.91783333		
4/18/92 4:00	2.032	1.93008333		
4/18/92 5:00	1.579	1.94525		
4/18/92 6:00	1.234	1.95858333		
4/18/92 7:00	1.009	1.969125		
4/18/92 8:00	0.904	1.976625		
4/18/92 9:00	0.942	1.97991667		
4/18/92 10:00	1.145	1.97875		
4/18/92 11:00	1.49	1.97266667		
4/18/92 12:00	1.87	1.96183333		
4/18/92 13:00	2.206	1.94929167		

4/18/92 14:00	2.446	1.93845833		
4/18/92 15:00	2.525	1.93029167		
4/18/92 16:00	2.38	1.9265		
4/18/92 17:00	2.079	1.93029167		
4/18/92 18:00	1.778	1.94020833		
4/18/92 19:00	1.601			
4/18/92 20:00	1.569			
4/18/92 21:00	1.693			
4/18/92 22:00	1.975			
4/18/92 23:00	2.33			
4/19/92 0:00	2.693			
4/19/92 1:00	2.953			
4/19/92 2:00	3.041			
4/19/92 3:00	2.848			
4/19/92 4:00	2.396			
4/19/92 5:00	1.899			
4/19/92 6:00	1.487			
4/19/92 7:00	1.189			
4/19/92 8:00	0.983			
4/19/92 9:00	0.914			
4/19/92 10:00	0.999			
4/19/92 11:00	1.23			
4/19/92 12:00	1.569			
4/19/92 13:00	1.946			
4/19/92 14:00	2.25			
4/19/92 15:00	2.434			
4/19/92 16:00	2.471			
4/19/92 17:00	2.317			

M018A

Time	Elevation	Average 1	Average 2	Final Average
4/16/92 18:03	0.848	1.49170833	1.441485	1.4149172
4/16/92 19:03	0.753	1.500125	1.437165	
4/16/92 20:03	0.933	1.50420833	1.432925	
4/16/92 21:03	1.418	1.500375	1.42877	
4/16/92 22:03	1.949	1.48875	1.424651667	
4/16/92 23:03	2.503	1.47491667	1.420771667	
4/17/92 0:03	* 2.969	1.45920833	1.417155	
4/17/92 1:03	3.165	1.444125	1.413888333	
4/17/92 2:03	3.013	1.43566667	1.411051667	
4/17/92 3:03	2.389	1.43620833	1.408685	
4/17/92 4:03	1.744	1.44808333	1.406883333	
4/17/92 5:03	1.136	1.45766667	1.405483333	
4/17/92 6:03	0.601	1.46675	1.404518333	
4/17/92 7:03	+ 0.227	1.473875	1.403955	
4/17/92 8:03	0.012	1.47679167	1.403755	
4/17/92 9:03	0.043	1.474125	1.40394	
4/17/92 10:03	0.423	1.46291667	1.404538333	
4/17/92 11:03	0.898	1.4405	1.4055	
4/17/92 12:03	1.367	1.4165	1.406888333	
4/17/92 13:03	1.845	1.39329167	1.408671667	
4/17/92 14:03	2.148	1.36929167	1.410833333	
4/17/92 15:03	2.164	1.35179167	1.413385	
4/17/92 16:03	1.864	1.346	1.416251667	
4/17/92 17:03	1.389	1.35375	1.419318333	
4/17/92 18:03	1.05	1.3705	1.42246	
4/17/92 19:03	0.851	1.38370833		
4/17/92 20:03	0.841	1.394125		
4/17/92 21:03	1.139	1.40033333		
4/17/92 22:03	1.617	1.39741667		
4/17/92 23:03	2.126	1.39175		
4/18/92 0:03	2.607	1.3845		
4/18/92 1:03	2.962	1.37754167		
4/18/92 2:03	3.026	1.37320833		
4/18/92 3:03	2.674	1.3765		
4/18/92 4:03	1.974	1.39116667		
4/18/92 5:03	1.354	1.41308333		
4/18/92 6:03	0.772	1.43354167		
4/18/92 7:03	0.297	1.45266667		
4/18/92 8:03	-0.052	1.468875		
4/18/92 9:03	-0.226	1.48141667		
4/18/92 10:03	-0.115	1.48908333		
4/18/92 11:03	0.322	1.48695833		
4/18/92 12:03	0.81	1.47520833		
4/18/92 13:03	1.269	1.46108333		

4/18/92 14:03	1.728	1.44733333		
4/18/92 15:03	2.025	1.43308333		
4/18/92 16:03	2.05	1.42345833		
4/18/92 17:03	1.791	1.42266667		
4/18/92 18:03	1.367	1.43229167		
4/18/92 19:03	1.101			
4/18/92 20:03	0.99			
4/18/92 21:03	1.069			
4/18/92 22:03	1.481			
4/18/92 23:03	1.952			
4/19/92 0:03	2.44			
4/19/92 1:03	2.858			
4/19/92 2:03	3.105			
4/19/92 3:03	3.026			
4/19/92 4:03	2.5			
4/19/92 5:03	1.845			
4/19/92 6:03	1.231			
4/19/92 7:03	0.686			
4/19/92 8:03	0.249			
4/19/92 9:03	-0.042			
4/19/92 10:03	-0.166			
4/19/92 11:03	0.04			
4/19/92 12:03	0.471			
4/19/92 13:03	0.939			
4/19/92 14:03	1.386			
4/19/92 15:03	1.794			
4/19/92 16:03	2.031			
4/19/92 17:03	2.022			

M020A

Time	Elevation	Average 1	Average 2	Final Average
4/16/92 17:54	1.999	2.294125	2.263216667	2.2650162
4/16/92 18:54	1.862	2.29775	2.261483333	
4/16/92 19:54	1.803	2.30033333	2.259961667	
4/16/92 20:54	1.884	2.3005	2.258693333	
4/16/92 21:54	2.235	2.29675	2.257656667	
4/16/92 22:54	2.817	2.28458333	2.256826667	
4/16/92 23:54	3.18	2.26795833	2.256151667	
4/17/92 0:54	3.313	2.25358333	2.25585	
4/17/92 1:54	3.161	2.24466667	2.255963333	
4/17/92 2:54	2.811	2.243625	2.25646	
4/17/92 3:54	2.52	2.24708333	2.25733	
4/17/92 4:54	2.275	2.25120833	2.258426667	
4/17/92 5:54	2.07	2.25558333	2.259715	
4/17/92 6:54	1.903	2.26	2.261185	
4/17/92 7:54	1.772	2.264125	2.262803333	
4/17/92 8:54	1.661	2.267875	2.264551667	
4/17/92 9:54	1.608	2.271375	2.266423333	
4/17/92 10:54	1.704	2.27279167	2.268418333	
4/17/92 11:54	1.962	2.26945833	2.270511667	
4/17/92 12:54	2.458	2.26	2.272703333	
4/17/92 13:54	2.672	2.24020833	2.275031667	
4/17/92 14:54	2.647	2.23025	2.277568333	
4/17/92 15:54	2.473	2.2295	2.280203333	
4/17/92 16:54	2.269	2.23466667	2.282843333	
4/17/92 17:54	2.086	2.24241667	2.285426667	
4/17/92 18:54	1.924	2.25079167		
4/17/92 19:54	1.807	2.25970833		
4/17/92 20:54	1.794	2.268625		
4/17/92 21:54	1.943	2.27458333		
4/17/92 22:54	2.418	2.276		
4/17/92 23:54	2.835	2.26770833		
4/18/92 0:54	3.099	2.26041667		
4/18/92 1:54	3.136	2.25641667		
4/18/92 2:54	2.894	2.25708333		
4/18/92 3:54	2.619	2.265375		
4/18/92 4:54	2.38	2.2745		
4/18/92 5:54	2.176	2.28341667		
4/18/92 6:54	2.002	2.29233333		
4/18/92 7:54	1.862	2.30045833		
4/18/92 8:54	1.745	2.30783333		
4/18/92 9:54	1.642	2.31466667		
4/18/92 10:54	1.624	2.32125		
4/18/92 11:54	1.735	2.325125		
4/18/92 12:54	1.983	2.32425		

4/18/92 13:54	2.433	2.31820833		
4/18/92 14:54	2.629	2.303625		
4/18/92 15:54	2.597	2.296125		
4/18/92 16:54	2.455	2.2955		
4/18/92 17:54	2.287	2.29925		
4/18/92 18:54	2.138			
4/18/92 19:54	2.021			
4/18/92 20:54	1.937			
4/18/92 21:54	1.977			
4/18/92 22:54	2.219			
4/18/92 23:54	2.66			
4/19/92 0:54	3.003			
4/19/92 1:54	3.152			
4/19/92 2:54	3.093			
4/19/92 3:54	2.838			
4/19/92 4:54	2.594			
4/19/92 5:54	2.39			
4/19/92 6:54	2.197			
4/19/92 7:54	2.039			
4/19/92 8:54	1.909			
4/19/92 9:54	1.8			
4/19/92 10:54	1.717			
4/19/92 11:54	1.714			
4/19/92 12:54	1.838			
4/19/92 13:54	2.083			
4/19/92 14:54	2.449			
4/19/92 15:54	2.582			
4/19/92 16:54	2.545			

M021A

Time	Elevation	Average 1	Average 2	Final Average
4/16/92 16:54	2.866485736	3.02420797	2.98943538	2.958674934
4/16/92 17:54	2.790558251	3.02604235	2.986247355	
4/16/92 18:54	2.705035825	3.02663581	2.983025506	
4/16/92 19:54	2.646600144	3.02677731	2.979830844	
4/16/92 20:54	2.629603403	3.02606911	2.97667018	
4/16/92 21:54	2.70843167	3.02504899	2.973509497	
4/16/92 22:54	3.336370418	3.02074436	2.97032725	
4/16/92 23:54	3.773501557	3.00528442	2.966757641	
4/17/92 0:54	3.888326819	2.98905999	2.96345519	
4/17/92 1:54	3.662487233	2.98160153	2.960581886	
4/17/92 2:54	3.374031179	2.98427755	2.958097153	
4/17/92 3:54	3.258289645	2.98441761	2.955974959	
4/17/92 4:54	3.136270275	2.98427729	2.95398291	
4/17/92 5:54	3.026866853	2.98413671	2.952153815	
4/17/92 6:54	2.920666383	2.98399589	2.950478945	
4/17/92 7:54	2.814973003	2.98357275	2.948952932	
4/17/92 8:54	2.728803101	2.98314893	2.947597455	
4/17/92 9:54	2.670388298	2.98201712	2.946390169	
4/17/92 10:54	2.646600144	2.98017609	2.945331239	
4/17/92 11:54	2.69145071	2.97745563	2.944415108	
4/17/92 12:54	3.006586984	2.97229929	2.943607796	
4/17/92 13:54	3.18685836	2.95542981	2.942967049	
4/17/92 14:54	3.10859896	2.94306885	2.942555429	
4/17/92 15:54	3.003206399	2.94250624	2.942341888	
4/17/92 16:54	2.910510893	2.9436329	2.942185766	
4/17/92 17:54	2.804801282	2.94450733		
4/17/92 18:54	2.70843167	2.94549615		
4/17/92 19:54	2.629603403	2.94676926		
4/17/92 20:54	2.605120479	2.94776069		
4/17/92 21:54	2.605120479	2.94705205		
4/17/92 22:54	2.965331997	2.94549281		
4/17/92 23:54	3.384115189	2.93150412		
4/18/92 0:54	3.709323809	2.92272315		
4/18/92 1:54	3.726711594	2.91722739		
4/18/92 2:54	3.377392689	2.91948321		
4/18/92 3:54	3.254921996	2.9312227		
4/18/92 4:54	3.132896349	2.93461638		
4/18/92 5:54	3.023487309	2.9385499		
4/18/92 6:54	2.910510893	2.94226498		
4/18/92 7:54	2.804801282	2.94584555		
4/18/92 8:54	2.701639806	2.94968582		
4/18/92 9:54	2.626203534	2.95296678		
4/18/92 10:54	2.581309019	2.95554388		
4/18/92 11:54	2.567698655	2.95727282		

4/18/92 12:54	2.601719362	2.95727282		
4/18/92 13:54	2.890195232	2.95628062		
4/18/92 14:54	3.095096527	2.9451393		
4/18/92 15:54	3.030246225	2.93773034		
4/18/92 16:54	2.931497185	2.93860318		
4/18/92 17:54	2.82853287			
4/18/92 18:54	2.738986475			
4/18/92 19:54	2.653397626			
4/18/92 20:54	2.58811316			
4/18/92 21:54	2.567698655			
4/18/92 22:54	2.629603403			
4/18/92 23:54	3.173372019			
4/19/92 0:54	3.577425533			
4/19/92 1:54	3.780851175			
4/19/92 2:54	3.659140463			
4/19/92 3:54	3.336370418			
4/19/92 4:54	3.227300735			
4/19/92 5:54	3.112649149			
4/19/92 6:54	2.996444708			
4/19/92 7:54	2.896967812			
4/19/92 8:54	2.780382784			
4/19/92 9:54	2.688053997			
4/19/92 10:54	2.622803492			
4/19/92 11:54	2.567698655			
4/19/92 12:54	2.577906688			
4/19/92 13:54	2.622803492			
4/19/92 14:54	2.917281393			
4/19/92 15:54	3.051194457			

Time	Elevation	Average 1	Average 2	Final Average
4/16/92 17:54	1.428	2.11270833	2.033305	1.949455733
4/16/92 18:54	1.22	2.1285	2.024205	
4/16/92 19:54	1.248	2.13758333	2.014878333	
4/16/92 20:54	1.57	2.1405	2.005471667	
4/16/92 21:54	2.066	2.13525	1.995995	
4/16/92 22:54	2.869	2.12445833	1.986508333	
4/16/92 23:54	3.298	2.10195833	1.977068333	
4/17/92 0:54	3.512	2.08929167	1.968135	
4/17/92 1:54	3.525	2.08154167	1.959445	
4/17/92 2:54	3.418	2.07825	1.951001667	
4/17/92 3:54	3.159	2.07429167	1.942911667	
4/17/92 4:54	2.518	2.07083333	1.93536	
4/17/92 5:54	1.763	2.063875	1.929066667	
4/17/92 6:54	1.248	2.06004167	1.924021667	
4/17/92 7:54	0.793	2.051375	1.920145	
4/17/92 8:54	0.471	2.04045833	1.9174	
4/17/92 9:54	0.724	2.02808333	1.91565	
4/17/92 10:54	1.286	2.00304167	1.914511667	
4/17/92 11:54	1.792	1.967625	1.91406	
4/17/92 12:54	2.3	1.93995833	1.914215	
4/17/92 13:54	2.793	1.91166667	1.914928333	
4/17/92 14:54	2.825	1.88154167	1.916208333	
4/17/92 15:54	2.645	1.8685	1.918113333	
4/17/92 16:54	2.234	1.866625	1.920525	
4/17/92 17:54	1.807	1.87466667	1.923263333	
4/17/92 18:54	1.438	1.88520833		
4/17/92 19:54	1.318	1.89533333		
4/17/92 20:54	1.444	1.90241667		
4/17/92 21:54	1.807	1.90358333		
4/17/92 22:54	2.329	1.89808333		
4/17/92 23:54	2.994	1.88845833		
4/18/92 0:54	3.326	1.878625		
4/18/92 1:54	3.446	1.87204167		
4/18/92 2:54	3.323	1.87045833		
4/18/92 3:54	3.076	1.876		
4/18/92 4:54	2.351	1.8855		
4/18/92 5:54	1.671	1.9135		
4/18/92 6:54	1.04	1.93775		
4/18/92 7:54	0.531	1.963125		
4/18/92 8:54	0.174	1.98275		
4/18/92 9:54	0.123	1.99670833		
4/18/92 10:54	0.436	1.999625		
4/18/92 11:54	1.128	1.99175		
4/18/92 12:54	1.621	1.9715		

4/18/92 13:54	2.07	1.95779167		
4/18/92 14:54	2.512	1.94366667		
4/18/92 15:54	2.6	1.92916667		
4/18/92 16:54	2.427	1.92879167		
4/18/92 17:54	2.06	1.93508333		
4/18/92 18:54	1.681			
4/18/92 19:54	1.488			
4/18/92 20:54	1.472			
4/18/92 21:54	1.675			
4/18/92 22:54	2.098			
4/18/92 23:54	2.758			
4/19/92 0:54	3.168			
4/19/92 1:54	3.408			
4/19/92 2:54	3.456			
4/19/92 3:54	3.304			
4/19/92 4:54	3.023			
4/19/92 5:54	2.253			
4/19/92 6:54	1.649			
4/19/92 7:54	1.002			
4/19/92 8:54	0.509			
4/19/92 9:54	0.193			
4/19/92 10:54	0.247			
4/19/92 11:54	0.642			
4/19/92 12:54	1.292			
4/19/92 13:54	1.731			
4/19/92 14:54	2.164			
4/19/92 15:54	2.591			
4/19/92 16:54	2.578			

Time	Elevation	Average 1	Average 2	Final Average
4/16/92 17:56	2.153	2.498375	2.469225	2.451408333
4/16/92 18:56	1.973	2.50629167	2.466481667	
4/16/92 19:56	1.913	2.512625	2.463753333	
4/16/92 20:56	1.992	2.515375	2.46103	
4/16/92 21:56	2.254	2.51404167	2.458313333	
4/16/92 22:56	2.813	2.50654167	2.455623333	
4/16/92 23:56	* 3.321	2.490375	2.452953333	
4/17/92 0:56	3.712	2.475	2.45054	
4/17/92 1:56	3.741	2.46041667	2.448456667	
4/17/92 2:56	3.412	2.45566667	2.446878333	
4/17/92 3:56	3.03	2.45883333	2.445831667	
4/17/92 4:56	2.658	2.46383333	2.445143333	
4/17/92 5:56	2.339	2.46870833	2.444743333	
4/17/92 6:56	* 2.055	2.47279167	2.444591667	
4/17/92 7:56	1.831	2.47595833	2.444681667	
4/17/92 8:56	1.689	2.47766667	2.444981667	
4/17/92 9:56	1.679	2.47741667	2.445475	
4/17/92 10:56	1.806	2.473625	2.446105	
4/17/92 11:56	2.039	2.46545833	2.44685	
4/17/92 12:56	2.428	2.45416667	2.44771	
4/17/92 13:56	2.785	2.43679167	2.448695	
4/17/92 14:56	2.917	2.42070833	2.449823333	
4/17/92 15:56	2.819	2.4135	2.451088333	
4/17/92 16:56	2.602	2.41520833	2.452426667	
4/17/92 17:56	2.343	2.42125	2.453806667	
4/17/92 18:56	2.125	2.42979167		
4/17/92 19:56	1.979	2.43808333		
4/17/92 20:56	1.96	2.44454167		
4/17/92 21:56	2.074	2.44745833		
4/17/92 22:56	2.425	2.44679167		
4/17/92 23:56	2.952	2.43979167		
4/18/92 0:56	3.362	2.43004167		
4/18/92 1:56	3.627	2.42291667		
4/18/92 2:56	3.488	2.42095833		
4/18/92 3:56	3.15	2.4295		
4/18/92 4:56	2.775	2.441625		
4/18/92 5:56	2.437	2.45383333		
4/18/92 6:56	2.131	2.46491667		
4/18/92 7:56	1.872	2.47504167		
4/18/92 8:56	1.683	2.48345833		
4/18/92 9:56	1.588	2.49		
4/18/92 10:56	1.61	2.49316667		
4/18/92 11:56	1.768	2.49225		
4/18/92 12:56	2.011	2.48695833		

4/18/92 13:56	2.399	2.47879167		
4/18/92 14:56	2.744	2.465		
4/18/92 15:56	2.86	2.45233333		
4/18/92 16:56	2.747	2.44695833		
4/18/92 17:56	2.548	2.44970833		
4/18/92 18:56	2.324			
4/18/92 19:56	2.134			
4/18/92 20:56	2.03			
4/18/92 21:56	2.058			
4/18/92 22:56	2.257			
4/18/92 23:56	2.718			
4/19/92 0:56	3.191			
4/19/92 1:56	3.58			
4/19/92 2:56	3.693			
4/19/92 3:56	3.441			
4/19/92 4:56	3.068			
4/19/92 5:56	2.703			
4/19/92 6:56	2.374			
4/19/92 7:56	2.074			
4/19/92 8:56	1.84			
4/19/92 9:56	1.664			
4/19/92 10:56	1.588			
4/19/92 11:56	1.641			
4/19/92 12:56	1.815			
4/19/92 13:56	2.068			
4/19/92 14:56	2.44			
4/19/92 15:56	2.731			
4/19/92 16:56	2.813			

Time	Elevation	Average 1	Average 2	Final Average
4/16/92 17:58	2.02	2.32029167	2.290636667	2.287461467
4/16/92 18:58	1.887	2.31379167	2.290073333	
4/16/92 19:58	1.401	2.31295833	2.289781667	
4/16/92 20:58	1.912	2.31325	2.28948	
4/16/92 21:58	2.889	2.29858333	2.289166667	
4/16/92 22:58	3.814	2.27004167	2.288726667	
4/16/92 23:58	4.315	2.24125	2.288583333	
4/17/92 0:58	4.16	2.220375	2.289051667	
4/17/92 1:58	3.43	2.21904167	2.290206667	
4/17/92 2:58	2.232	2.2365	2.291848333	
4/17/92 3:58	1.573	2.26533333	2.293773333	
4/17/92 4:58	1.113	2.280625	2.295396667	
4/17/92 5:58	0.894	2.29370833	2.296751667	
4/17/92 6:58	1.002	2.30441667	2.297556667	
4/17/92 7:58	0.837	2.32420833	2.297368333	
4/17/92 8:58	1.09	2.34441667	2.295711667	
4/17/92 9:58	1.579	2.35304167	2.292743333	
4/17/92 10:58	1.982	2.343125	2.289123333	
4/17/92 11:58	2.6	2.32779167	2.285413333	
4/17/92 12:58	3.322	2.30241667	2.281815	
4/17/92 13:58	3.487	2.27341667	2.27839	
4/17/92 14:58	3.186	2.260625	2.275411667	
4/17/92 15:58	2.673	2.26695833	2.272706667	
4/17/92 16:58	2.289	2.28491667	2.269895	
4/17/92 17:58	1.864	2.29483333	2.266925	
4/17/92 18:58	1.867	2.30620833		
4/17/92 19:58	1.408	2.3065		
4/17/92 20:58	1.56	2.30541667		
4/17/92 21:58	2.204	2.30541667		
4/17/92 22:58	3.123	2.28758333		
4/17/92 23:58	3.814	2.26645833		
4/18/92 0:58	4.128	2.25295833		
4/18/92 1:58	3.849	2.24925		
4/18/92 2:58	2.924	2.26008333		
4/18/92 3:58	1.94	2.284625		
4/18/92 4:58	1.427	2.30591667		
4/18/92 5:58	1.151	2.3145		
4/18/92 6:58	1.477	2.31383333		
4/18/92 7:58	1.322	2.29970833		
4/18/92 8:58	1.297	2.28279167		
4/18/92 9:58	1.341	2.27020833		
4/18/92 10:58	1.614	2.26254167		
4/18/92 11:58	1.991	2.250375		
4/18/92 12:58	2.626	2.23783333		

4/18/92 13:58	3.18	2.21679167		
4/18/92 14:58	3.338	2.19895833		
4/18/92 15:58	3.104	2.193		
4/18/92 16:58	2.527	2.19666667		
4/18/92 17:58	2.137	2.21066667		
4/18/92 18:58	1.874			
4/18/92 19:58	1.382			
4/18/92 20:58	1.56			
4/18/92 21:58	1.776			
4/18/92 22:58	2.616			
4/18/92 23:58	3.49			
4/19/92 0:58	4.039			
4/19/92 1:58	4.109			
4/19/92 2:58	3.513			
4/19/92 3:58	2.451			
4/19/92 4:58	1.633			
4/19/92 5:58	1.135			
4/19/92 6:58	1.138			
4/19/92 7:58	0.916			
4/19/92 8:58	0.995			
4/19/92 9:58	1.157			
4/19/92 10:58	1.322			
4/19/92 11:58	1.69			
4/19/92 12:58	2.121			
4/19/92 13:58	2.752			
4/19/92 14:58	3.195			
4/19/92 15:58	3.192			
4/19/92 16:58	2.863			

Time	Elevation	Average 1	Average 2	Final Average
4/16/92 17:58	2.914	2.984375	2.971671667	2.9569822
4/16/92 18:58	2.889	2.98545833	2.970413333	
4/16/92 19:58	2.873	2.985875	2.969121667	
4/16/92 20:58	2.867	2.9855	2.967813333	
4/16/92 21:58	2.914	2.98483333	2.966495	
4/16/92 22:58	3	2.98341667	2.96513	
4/16/92 23:58	3.088	2.98091667	2.963716667	
4/17/92 0:58	3.159	2.977625	2.962313333	
4/17/92 1:58	3.188	2.97504167	2.960926667	
4/17/92 2:58	3.169	2.97304167	2.959581667	
4/17/92 3:58	3.122	2.972375	2.958295	
4/17/92 4:58	3.066	2.97208333	2.957066667	
4/17/92 5:58	3.012	2.97208333	2.955891667	
4/17/92 6:58	2.974	2.97195833	2.954763333	
4/17/92 7:58	2.93	2.97116667	2.953683333	
4/17/92 8:58	2.892	2.97025	2.952666667	
4/17/92 9:58	2.864	2.96945833	2.951698333	
4/17/92 10:58	2.858	2.96829167	2.950786667	
4/17/92 11:58	2.88	2.96670833	2.949911667	
4/17/92 12:58	2.946	2.96408333	2.949063333	
4/17/92 13:58	2.996	2.960125	2.948236667	
4/17/92 14:58	3.022	2.95658333	2.947458333	
4/17/92 15:58	3.012	2.95445833	2.94669	
4/17/92 16:58	2.99	2.95329167	2.945943333	
4/17/92 17:58	2.94	2.95279167	2.945216667	
4/17/92 18:58	2.899	2.95291667		
4/17/92 19:58	2.864	2.95316667		
4/17/92 20:58	2.851	2.95316667		
4/17/92 21:58	2.88	2.95254167		
4/17/92 22:58	2.94	2.95070833		
4/17/92 23:58	3.009	2.94808333		
4/18/92 0:58	3.097	2.94583333		
4/18/92 1:58	3.14	2.94295833		
4/18/92 2:58	3.153	2.94141667		
4/18/92 3:58	3.115	2.940875		
4/18/92 4:58	3.066	2.94166667		
4/18/92 5:58	3.009	2.94270833		
4/18/92 6:58	2.955	2.943875		
4/18/92 7:58	2.908	2.94495833		
4/18/92 8:58	2.873	2.94575		
4/18/92 9:58	2.836	2.94604167		
4/18/92 10:58	2.82	2.94666667		
4/18/92 11:58	2.817	2.94641667		
4/18/92 12:58	2.851	2.9455		

4/18/92 13:58	2.911	2.94341667		
4/18/92 14:58	2.971	2.94066667		
4/18/92 15:58	2.984	2.937375		
4/18/92 16:58	2.978	2.93579167		
4/18/92 17:58	2.943	2.935125		
4/18/92 18:58	2.905			
4/18/92 19:58	2.864			
4/18/92 20:58	2.836			
4/18/92 21:58	2.836			
4/18/92 22:58	2.877			
4/18/92 23:58	2.955			
4/19/92 0:58	3.028			
4/19/92 1:58	3.103			
4/19/92 2:58	3.14			
4/19/92 3:58	3.134			
4/19/92 4:58	3.091			
4/19/92 5:58	3.037			
4/19/92 6:58	2.981			
4/19/92 7:58	2.927			
4/19/92 8:58	2.88			
4/19/92 9:58	2.851			
4/19/92 10:58	2.814			
4/19/92 11:58	2.795			
4/19/92 12:58	2.801			
4/19/92 13:58	2.845			
4/19/92 14:58	2.892			
4/19/92 15:58	2.946			
4/19/92 16:58	2.962			

M028A

Time	Elevation	Average 1	Average 2	Final Average
4/16/92 17:53	3.235	3.27745833	3.267485	3.256533067
4/16/92 18:53	3.229	3.27758333	3.266566667	
4/16/92 19:53	3.229	3.27745833	3.265626667	
4/16/92 20:53	3.238	3.27704167	3.264665	
4/16/92 21:53	3.26	3.276375	3.263678333	
4/16/92 22:53	3.317	3.27533333	3.262671667	
4/16/92 23:53	* 3.371	3.27333333	3.261645	
4/17/92 0:53	3.393	3.27120833	3.260623333	
4/17/92 1:53	3.38	3.26975	3.259633333	
4/17/92 2:53	3.339	3.26925	3.258685	
4/17/92 3:53	3.31	3.269125	3.257783333	
4/17/92 4:53	3.291	3.26875	3.256908333	
4/17/92 5:53	3.269	3.26808333	3.256048333	
4/17/92 6:53	* 3.254	3.26758333	3.25521	
4/17/92 7:53	3.238	3.26679167	3.254386667	
4/17/92 8:53	3.222	3.266	3.253585	
4/17/92 9:53	3.222	3.265375	3.252798333	
4/17/92 10:53	3.222	3.26433333	3.252015	
4/17/92 11:53	3.241	3.26304167	3.251246667	
4/17/92 12:53	3.272	3.26120833	3.250488333	
4/17/92 13:53	3.301	3.259125	3.249735	
4/17/92 14:53	3.294	3.25691667	3.248996667	
4/17/92 15:53	3.272	3.25575	3.24829	
4/17/92 16:53	3.26	3.255375	3.24761	
4/17/92 17:53	3.238	3.254875	3.246945	
4/17/92 18:53	3.226	3.2545		
4/17/92 19:53	3.219	3.25408333		
4/17/92 20:53	3.222	3.25341667		
4/17/92 21:53	3.235	3.252375		
4/17/92 22:53	3.269	3.25120833		
4/17/92 23:53	3.32	3.24966667		
4/18/92 0:53	3.358	3.24779167		
4/18/92 1:53	3.368	3.24645833		
4/18/92 2:53	3.336	3.24604167		
4/18/92 3:53	3.301	3.24670833		
4/18/92 4:53	3.275	3.24725		
4/18/92 5:53	3.257	3.24725		
4/18/92 6:53	3.235	3.247125		
4/18/92 7:53	3.219	3.247		
4/18/92 8:53	3.207	3.24675		
4/18/92 9:53	3.197	3.24633333		
4/18/92 10:53	3.191	3.24579167		
4/18/92 11:53	3.197	3.245125		
4/18/92 12:53	3.222	3.24408333		

4/18/92 13:53	3.248	3.242375		
4/18/92 14:53	3.266	3.24066667		
4/18/92 15:53	3.263	3.23925		
4/18/92 16:53	3.248	3.23875		
4/18/92 17:53	3.229	3.23875		
4/18/92 18:53	3.216			
4/18/92 19:53	3.203			
4/18/92 20:53	3.197			
4/18/92 21:53	3.207			
4/18/92 22:53	3.232			
4/18/92 23:53	3.275			
4/19/92 0:53	3.326			
4/19/92 1:53	3.358			
4/19/92 2:53	3.352			
4/19/92 3:53	3.314			
4/19/92 4:53	3.275			
4/19/92 5:53	3.254			
4/19/92 6:53	3.232			
4/19/92 7:53	3.213			
4/19/92 8:53	3.197			
4/19/92 9:53	3.184			
4/19/92 10:53	3.175			
4/19/92 11:53	3.172			
4/19/92 12:53	3.181			
4/19/92 13:53	3.207			
4/19/92 14:53	3.232			
4/19/92 15:53	3.251			
4/19/92 16:53	3.248			

Time	Elevation	Average 1	Average 2	Final Average
4/16/92 17:58	2.946	2.96875	2.960985	2.9499312
4/16/92 18:58	2.928	2.96916667	2.960106667	
4/16/92 19:58	2.921	2.96954167	2.959201667	
4/16/92 20:58	2.915	2.96966667	2.958261667	
4/16/92 21:58	2.928	2.96941667	2.9573	
4/16/92 22:58	2.953	2.969	2.956301667	
4/16/92 23:58	2.984	2.96820833	2.955273333	
4/17/92 0:58	3.018	2.96691667	2.954228333	
4/17/92 1:58	3.052	2.96575	2.953173333	
4/17/92 2:58	3.056	2.96420833	2.952118333	
4/17/92 3:58	3.052	2.963125	2.951105	
4/17/92 4:58	3.024	2.96208333	2.950135	
4/17/92 5:58	3.002	2.96158333	2.9492	
4/17/92 6:58	2.981	2.96095833	2.948295	
4/17/92 7:58	2.956	2.96004167	2.947436667	
4/17/92 8:58	2.934	2.959125	2.94663	
4/17/92 9:58	2.918	2.95820833	2.945875	
4/17/92 10:58	2.909	2.95754167	2.945151667	
4/17/92 11:58	2.924	2.956875	2.944445	
4/17/92 12:58	2.94	2.95533333	2.943753333	
4/17/92 13:58	2.972	2.9535	2.943081667	
4/17/92 14:58	2.978	2.951125	2.942436667	
4/17/92 15:58	2.984	2.94929167	2.941833333	
4/17/92 16:58	2.975	2.948	2.941255	
4/17/92 17:58	2.956	2.94720833	2.940696667	
4/17/92 18:58	2.937	2.94679167		
4/17/92 19:58	2.924	2.94654167		
4/17/92 20:58	2.909	2.94604167		
4/17/92 21:58	2.918	2.945625		
4/17/92 22:58	2.934	2.94445833		
4/17/92 23:58	2.953	2.94329167		
4/18/92 0:58	2.99	2.94208333		
4/18/92 1:58	3.015	2.94054167		
4/18/92 2:58	3.03	2.939375		
4/18/92 3:58	3.027	2.938875		
4/18/92 4:58	3.012	2.938875		
4/18/92 5:58	2.987	2.93870833		
4/18/92 6:58	2.959	2.93895833		
4/18/92 7:58	2.934	2.9395		
4/18/92 8:58	2.912	2.939875		
4/18/92 9:58	2.902	2.94025		
4/18/92 10:58	2.893	2.940125		
4/18/92 11:58	2.887	2.939875		
4/18/92 12:58	2.896	2.93958333		

4/18/92 13:58	2.915	2.93854167		
4/18/92 14:58	2.934	2.937375		
4/18/92 15:58	2.953	2.93604167		
4/18/92 16:58	2.956	2.93483333		
4/18/92 17:58	2.946	2.93404167		
4/18/92 18:58	2.931			
4/18/92 19:58	2.912			
4/18/92 20:58	2.899			
4/18/92 21:58	2.89			
4/18/92 22:58	2.906			
4/18/92 23:58	2.924			
4/19/92 0:58	2.953			
4/19/92 1:58	2.987			
4/19/92 2:58	3.018			
4/19/92 3:58	3.027			
4/19/92 4:58	3.008			
4/19/92 5:58	2.993			
4/19/92 6:58	2.972			
4/19/92 7:58	2.943			
4/19/92 8:58	2.921			
4/19/92 9:58	2.899			
4/19/92 10:58	2.887			
4/19/92 11:58	2.88			
4/19/92 12:58	2.871			
4/19/92 13:58	2.887			
4/19/92 14:58	2.902			
4/19/92 15:58	2.924			
4/19/92 16:58	2.937			

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Time	Elevation	Average 1	Average 2	Final Average
4/16/92 18:00	4.981	4.97545833	4.97677	4.9799002
4/16/92 19:00	4.981	4.97508333	4.977218333	
4/16/92 20:00	4.994	4.97495833	4.977686667	
4/16/92 21:00	4.997	4.97458333	4.978153333	
4/16/92 22:00	5.003	4.97420833	4.97863	
4/16/92 23:00	5.006	4.97358333	4.97911	
4/17/92 0:00	5.006	4.97320833	4.979578333	
4/17/92 1:00	4.991	4.97270833	4.98003	
4/17/92 2:00	4.978	4.97308333	4.98046	
4/17/92 3:00	4.966	4.97375	4.980848333	
4/17/92 4:00	4.972	4.97479167	4.981193333	
4/17/92 5:00	4.966	4.97516667	4.981481667	
4/17/92 6:00	4.963	4.97566667	4.981703333	
4/17/92 7:00	4.956	4.97616667	4.981853333	
4/17/92 8:00	4.953	4.97645833	4.98193	
4/17/92 9:00	4.959	4.97633333	4.981926667	
4/17/92 10:00	4.963	4.97620833	4.981855	
4/17/92 11:00	4.959	4.97645833	4.981693333	
4/17/92 12:00	4.963	4.977375	4.981421667	
4/17/92 13:00	4.969	4.97866667	4.981013333	
4/17/92 14:00	4.975	4.98008333	4.980438333	
4/17/92 15:00	4.972	4.9815	4.979686667	
4/17/92 16:00	4.969	4.98304167	4.978763333	
4/17/92 17:00	4.969	4.98470833	4.977663333	
4/17/92 18:00	4.972	4.986	4.976396667	
4/17/92 19:00	4.978	4.98666667		
4/17/92 20:00	4.985	4.98679167		
4/17/92 21:00	4.988	4.986625		
4/17/92 22:00	4.988	4.9865		
4/17/92 23:00	4.997	4.98620833		
4/18/92 0:00	4.994	4.98529167		
4/18/92 1:00	5	4.9845		
4/18/92 2:00	4.994	4.98345833		
4/18/92 3:00	4.991	4.98279167		
4/18/92 4:00	4.981	4.982375		
4/18/92 5:00	4.978	4.982		
4/18/92 6:00	4.975	4.98070833		
4/18/92 7:00	4.963	4.97941667		
4/18/92 8:00	4.95	4.97808333		
4/18/92 9:00	4.956	4.976375		
4/18/92 10:00	4.969	4.97454167		
4/18/92 11:00	4.981	4.97216667		
4/18/92 12:00	4.994	4.96966667		
4/18/92 13:00	5.003	4.96716667		

4/18/92 14:00	5.009	4.96429167		
4/18/92 15:00	5.009	4.96129167		
4/18/92 16:00	5.009	4.95841667		
4/18/92 17:00	5	4.95554167		
4/18/92 18:00	4.988	4.95304167		
4/18/92 19:00	4.981			
4/18/92 20:00	4.981			
4/18/92 21:00	4.985			
4/18/92 22:00	4.981			
4/18/92 23:00	4.975			
4/19/92 0:00	4.975			
4/19/92 1:00	4.975			
4/19/92 2:00	4.978			
4/19/92 3:00	4.981			
4/19/92 4:00	4.972			
4/19/92 5:00	4.947			
4/19/92 6:00	4.944			
4/19/92 7:00	4.931			
4/19/92 8:00	4.909			
4/19/92 9:00	4.912			
4/19/92 10:00	4.912			
4/19/92 11:00	4.921			
4/19/92 12:00	4.934			
4/19/92 13:00	4.934			
4/19/92 14:00	4.937			
4/19/92 15:00	4.94			
4/19/92 16:00	4.94			
4/19/92 17:00	4.94			

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Time	Elevation	Average 1	Average 2	Final Average
4/16/92 18:06	5.685	5.67016667	5.660010965	5.648508929
4/16/92 19:06	5.688	5.669375	5.65946875	
4/16/92 20:06	5.688	5.66833333	5.658928571	
4/16/92 21:06	5.682	5.66729167	5.658382576	
4/16/92 22:06	5.685	5.66595833	5.657831522	
4/16/92 23:06	5.685	5.6645	5.657270833	
4/17/92 0:06	5.675	5.66304167	5.656701667	
4/17/92 1:06	5.669	5.662125	5.655553333	
4/17/92 2:06	5.675	5.66108333	5.654378333	
4/17/92 3:06	5.682	5.66016667	5.653176667	
4/17/92 4:06	5.678	5.65883333	5.651965	
4/17/92 5:06	5.675	5.65766667	5.650738333	
4/17/92 6:06	5.672	5.656625	5.649496667	
4/17/92 7:06	5.666	5.65545833	5.64823	
4/17/92 8:06	5.656	5.654	5.646936667	
4/17/92 9:06	5.65	5.65270833	5.645616667	
4/17/92 10:06	5.65	5.65166667	5.644281667	
4/17/92 11:06	5.647	5.650875	5.642941667	
4/17/92 12:06	5.656	5.65033333	5.641575	
4/17/92 13:06	5.656	5.64916667	5.64017	
4/17/92 14:06	5.666	5.648125	5.638748333	
4/17/92 15:06	5.663	5.64691667	5.637311667	
4/17/92 16:06	5.669	5.64570833	5.635853333	
4/17/92 17:06	5.666	5.644375	5.634353333	
4/17/92 18:06	5.666	5.64304167	5.632801667	
4/17/92 19:06	5.663	5.64145833		
4/17/92 20:06	5.663	5.64		
4/17/92 21:06	5.65	5.63829167		
4/17/92 22:06	5.65	5.637		
4/17/92 23:06	5.65	5.63529167		
4/18/92 0:06	5.653	5.63345833		
4/18/92 1:06	5.644	5.631375		
4/18/92 2:06	5.653	5.62979167		
4/18/92 3:06	5.65	5.62808333		
4/18/92 4:06	5.65	5.62679167		
4/18/92 5:06	5.65	5.62533333		
4/18/92 6:06	5.644	5.6235		
4/18/92 7:06	5.631	5.6215		
4/18/92 8:06	5.625	5.61991667		
4/18/92 9:06	5.625	5.61808333		
4/18/92 10:06	5.631	5.61625		
4/18/92 11:06	5.634	5.61416667		
4/18/92 12:06	5.628	5.61208333		
4/18/92 13:06	5.631	5.610125		

4/18/92 14:06	5.637	5.60791667		
4/18/92 15:06	5.634	5.60570833		
4/18/92 16:06	5.637	5.60375		
4/18/92 17:06	5.634	5.60191667		
4/18/92 18:06	5.628	5.60020833		
4/18/92 19:06	5.628			
4/18/92 20:06	5.622			
4/18/92 21:06	5.619			
4/18/92 22:06	5.609			
4/18/92 23:06	5.606			
4/19/92 0:06	5.603			
4/19/92 1:06	5.606			
4/19/92 2:06	5.612			
4/19/92 3:06	5.619			
4/19/92 4:06	5.615			
4/19/92 5:06	5.606			
32251.25417	5.596			
32251.29583	5.593			
32251.3375	5.581			
32251.37917	5.581			
32251.42083	5.581			
32251.4625	5.584			
32251.50417	5.581			
32251.54583	5.578			
32251.5875	5.584			
32251.62917	5.587			
32251.67083	5.593			
32251.7125	5.593			

Time	Elevation	Average 1	Average 2	Final Average
4/16/92 18:06	6.463	6.44525	6.429758333	6.411177733
4/16/92 19:06	6.463	6.44395833	6.428381667	
4/16/92 20:06	6.457	6.44291667	6.426983333	
4/16/92 21:06	6.457	6.442	6.425553333	
4/16/92 22:06	6.454	6.44083333	6.424091667	
4/16/92 23:06	6.454	6.43954167	6.422608333	
4/17/92 0:06	6.451	6.43825	6.421108333	
4/17/92 1:06	6.451	6.43708333	6.419586667	
4/17/92 2:06	6.451	6.43579167	6.418048333	
4/17/92 3:06	6.454	6.434625	6.416488333	
4/17/92 4:06	6.448	6.43320833	6.4149	
4/17/92 5:06	6.451	6.43204167	6.413293333	
4/17/92 6:06	6.448	6.43058333	6.411665	
4/17/92 7:06	6.448	6.429125	6.410026667	
4/17/92 8:06	6.442	6.42741667	6.408373333	
4/17/92 9:06	6.438	6.42558333	6.406703333	
4/17/92 10:06	6.435	6.42404167	6.405033333	
4/17/92 11:06	6.429	6.422625	6.40334	
4/17/92 12:06	6.432	6.42158333	6.401618333	
4/17/92 13:06	6.435	6.42	6.39985	
4/17/92 14:06	6.435	6.41858333	6.39806	
4/17/92 15:06	6.429	6.41704167	6.396246667	
4/17/92 16:06	6.429	6.41545833	6.394421667	
4/17/92 17:06	6.432	6.414	6.392581667	
4/17/92 18:06	6.432	6.41241667	6.390721667	
4/17/92 19:06	6.438	6.41083333		
4/17/92 20:06	6.435	6.409		
4/17/92 21:06	6.429	6.40716667		
4/17/92 22:06	6.423	6.40545833		
4/17/92 23:06	6.423	6.40375		
4/18/92 0:06	6.423	6.40204167		
4/18/92 1:06	6.42	6.40020833		
4/18/92 2:06	6.423	6.398625		
4/18/92 3:06	6.42	6.39679167		
4/18/92 4:06	6.42	6.39491667		
4/18/92 5:06	6.416	6.39304167		
4/18/92 6:06	6.413	6.39133333		
4/18/92 7:06	6.407	6.389625		
4/18/92 8:06	6.398	6.38779167		
4/18/92 9:06	6.401	6.38566667		
4/18/92 10:06	6.401	6.38383333		
4/18/92 11:06	6.404	6.38170833		
4/18/92 12:06	6.394	6.37958333		
4/18/92 13:06	6.401	6.377375		

4/18/92 14:06	6.398	6.37525		
4/18/92 15:06	6.391	6.37325		
4/18/92 16:06	6.394	6.37141667		
4/18/92 17:06	6.394	6.36945833		
4/18/92 18:06	6.394	6.3675		
4/18/92 19:06	6.394			
4/18/92 20:06	6.391			
4/18/92 21:06	6.388			
4/18/92 22:06	6.382			
4/18/92 23:06	6.382			
4/19/92 0:06	6.379			
4/19/92 1:06	6.382			
4/19/92 2:06	6.379			
4/19/92 3:06	6.375			
4/19/92 4:06	6.375			
4/19/92 5:06	6.375			
4/19/92 6:06	6.372			
4/19/92 7:06	6.363			
4/19/92 8:06	6.347			
4/19/92 9:06	6.357			
4/19/92 10:06	6.35			
4/19/92 11:06	6.353			
4/19/92 12:06	6.341			
4/19/92 13:06	6.35			
4/19/92 14:06	6.35			
4/19/92 15:06	6.347			
4/19/92 16:06	6.347			
4/19/92 17:06	6.347			

Time	Elevation	Average 1	Average 2	Final Average
4/16/92 18:02	6.384	6.35816667	6.341293333	6.324166733
4/16/92 19:02	6.381	6.357	6.339858333	
4/16/92 20:02	6.375	6.35608333	6.338411667	
4/16/92 21:02	6.368	6.355125	6.33695	
4/16/92 22:02	6.365	6.35383333	6.335478333	
4/16/92 23:02	6.365	6.352375	6.334006667	
4/17/92 0:02	* 6.362	6.35079167	6.33254	
4/17/92 1:02	6.356	6.34920833	6.331083333	
4/17/92 2:02	6.362	6.34775	6.329636667	
4/17/92 3:02	6.362	6.34616667	6.328195	
4/17/92 4:02	6.362	6.34458333	6.326768333	
4/17/92 5:02	6.362	6.343	6.325351667	
4/17/92 6:02	6.359	6.34141667	6.323945	
4/17/92 7:02	* 6.356	6.33983333	6.322543333	
4/17/92 8:02	6.349	6.33795833	6.321153333	
4/17/92 9:02	6.343	6.336	6.31978	
4/17/92 10:02	6.343	6.33416667	6.318426667	
4/17/92 11:02	6.337	6.33270833	6.317088333	
4/17/92 12:02	6.33	6.33191667	6.315755	
4/17/92 13:02	6.356	6.33125	6.314396667	
4/17/92 14:02	6.359	6.3295	6.313018333	
4/17/92 15:02	6.352	6.32791667	6.311661667	
4/17/92 16:02	6.352	6.3265	6.31031	
4/17/92 17:02	6.356	6.32533333	6.308951667	
4/17/92 18:02	6.356	6.32375	6.307565	
4/17/92 19:02	6.359	6.32229167		
4/17/92 20:02	6.352	6.32083333		
4/17/92 21:02	6.337	6.31954167		
4/17/92 22:02	6.33	6.31833333		
4/17/92 23:02	6.327	6.31704167		
4/18/92 0:02	6.324	6.31570833		
4/18/92 1:02	6.321	6.314375		
4/18/92 2:02	6.324	6.31304167		
4/18/92 3:02	6.324	6.31170833		
4/18/92 4:02	6.324	6.3105		
4/18/92 5:02	6.324	6.30916667		
4/18/92 6:02	6.321	6.30783333		
4/18/92 7:02	6.311	6.306375		
4/18/92 8:02	6.302	6.30508333		
4/18/92 9:02	6.299	6.303625		
4/18/92 10:02	6.308	6.30216667		
4/18/92 11:02	6.318	6.30070833		
4/18/92 12:02	6.314	6.299375		
4/18/92 13:02	6.314	6.29795833		

4/18/92 14:02	6.321	6.29679167		
4/18/92 15:02	6.318	6.29558333		
4/18/92 16:02	6.324	6.294125		
4/18/92 17:02	6.318	6.29254167		
4/18/92 18:02	6.321	6.29066667		
4/18/92 19:02	6.324			
4/18/92 20:02	6.321			
4/18/92 21:02	6.308			
4/18/92 22:02	6.299			
4/18/92 23:02	6.295			
4/19/92 0:02	6.292			
4/19/92 1:02	6.289			
4/19/92 2:02	6.292			
4/19/92 3:02	6.295			
4/19/92 4:02	6.292			
4/19/92 5:02	6.292			
4/19/92 6:02	6.286			
4/19/92 7:02	6.28			
4/19/92 8:02	6.267			
4/19/92 9:02	6.264			
4/19/92 10:02	6.273			
4/19/92 11:02	6.286			
4/19/92 12:02	6.28			
4/19/92 13:02	6.286			
4/19/92 14:02	6.292			
4/19/92 15:02	6.283			
4/19/92 16:02	6.286			
4/19/92 17:02	6.273			

Time	Elevation	Average 1	Average 2	Final Average
4/16/92 17:54	6.77	6.75875	6.746873333	6.7322078
4/16/92 18:54	6.767	6.75783333	6.745833333	
4/16/92 19:54	6.77	6.75704167	6.744778333	
4/16/92 20:54	6.767	6.756	6.743696667	
4/16/92 21:54	6.764	6.75495833	6.742598333	
4/16/92 22:54	6.764	6.75404167	6.741478333	
4/16/92 23:54	6.764	6.753	6.740331667	
4/17/92 0:54	6.761	6.75195833	6.739158333	
4/17/92 1:54	6.761	6.75104167	6.737963333	
4/17/92 2:54	6.761	6.750125	6.736741667	
4/17/92 3:54	6.764	6.74920833	6.735493333	
4/17/92 4:54	6.761	6.74816667	6.734213333	
4/17/92 5:54	6.761	6.74725	6.7329	
4/17/92 6:54	6.758	6.74620833	6.73156	
4/17/92 7:54	6.758	6.745125	6.730198333	
4/17/92 8:54	6.755	6.74391667	6.728811667	
4/17/92 9:54	6.748	6.74283333	6.7274	
4/17/92 10:54	6.751	6.74204167	6.725963333	
4/17/92 11:54	6.758	6.741	6.72449	
4/17/92 12:54	6.748	6.73966667	6.72299	
4/17/92 13:54	6.755	6.73875	6.721475	
4/17/92 14:54	6.751	6.73754167	6.719928333	
4/17/92 15:54	6.751	6.736375	6.718356667	
4/17/92 16:54	6.742	6.73495833	6.716773333	
4/17/92 17:54	6.748	6.73404167	6.715188333	
4/17/92 18:54	6.748	6.73275		
4/17/92 19:54	6.745	6.73145833		
4/17/92 20:54	6.742	6.73		
4/17/92 21:54	6.742	6.72854167		
4/17/92 22:54	6.739	6.72695833		
4/17/92 23:54	6.739	6.725375		
4/18/92 0:54	6.739	6.72366667		
4/18/92 1:54	6.739	6.72208333		
4/18/92 2:54	6.739	6.7205		
4/18/92 3:54	6.739	6.71891667		
4/18/92 4:54	6.739	6.71720833		
4/18/92 5:54	6.736	6.71533333		
4/18/92 6:54	6.732	6.71375		
4/18/92 7:54	6.729	6.71216667		
4/18/92 8:54	6.729	6.71045833		
4/18/92 9:54	6.729	6.708625		
4/18/92 10:54	6.726	6.70691667		
4/18/92 11:54	6.726	6.70520833		
4/18/92 12:54	6.726	6.7035		

4/18/92 13:54	6.726	6.70179167		
4/18/92 14:54	6.723	6.70008333		
4/18/92 15:54	6.717	6.69825		
4/18/92 16:54	6.72	6.69679167		
4/18/92 17:54	6.717	6.69533333		
4/18/92 18:54	6.717			
4/18/92 19:54	6.71			
4/18/92 20:54	6.707			
4/18/92 21:54	6.704			
4/18/92 22:54	6.701			
4/18/92 23:54	6.698			
4/19/92 0:54	6.701			
4/19/92 1:54	6.701			
4/19/92 2:54	6.701			
4/19/92 3:54	6.698			
4/19/92 4:54	6.694			
4/19/92 5:54	6.698			
4/19/92 6:54	6.694			
4/19/92 7:54	6.688			
4/19/92 8:54	6.685			
4/19/92 9:54	6.688			
4/19/92 10:54	6.685			
4/19/92 11:54	6.685			
4/19/92 12:54	6.685			
4/19/92 13:54	6.685			
4/19/92 14:54	6.679			
4/19/92 15:54	6.682			
4/19/92 16:54	6.685			

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Time	Elevation	Average 1	Average 2	Final Average
4/16/92 18:05	7.066	7.05391667	7.050256667	7.047779333
4/16/92 19:05	7.066	7.05341667	7.050025	
4/16/92 20:05	7.063	7.05304167	7.049808333	
4/16/92 21:05	7.063	7.05279167	7.049591667	
4/16/92 22:05	7.063	7.05229167	7.04938	
4/16/92 23:05	7.06	7.05166667	7.049183333	
4/17/92 0:05	* 7.057	7.05116667	7.049006667	
4/17/92 1:05	7.057	7.05104167	7.04883	
4/17/92 2:05	7.06	7.05066667	7.048653333	
4/17/92 3:05	7.06	7.05029167	7.048481667	
4/17/92 4:05	7.057	7.05004167	7.048315	
4/17/92 5:05	7.057	7.04991667	7.048148333	
4/17/92 6:05	7.057	7.04979167	7.047976667	
4/17/92 7:05	* 7.054	7.04966667	7.04779	
4/17/92 8:05	7.048	7.04929167	7.047596667	
4/17/92 9:05	7.045	7.048875	7.047398333	
4/17/92 10:05	7.035	7.04845833	7.04718	
4/17/92 11:05	7.035	7.04858333	7.046953333	
4/17/92 12:05	7.042	7.049	7.046695	
4/17/92 13:05	7.042	7.049	7.046403333	
4/17/92 14:05	7.051	7.049125	7.046085	
4/17/92 15:05	7.051	7.048875	7.04574	
4/17/92 16:05	7.051	7.04875	7.045373333	
4/17/92 17:05	7.054	7.0485	7.044995	
4/17/92 18:05	7.054	7.04825	7.044616667	
4/17/92 19:05	7.057	7.048125		
4/17/92 20:05	7.057	7.048		
4/17/92 21:05	7.051	7.047625		
4/17/92 22:05	7.048	7.0475		
4/17/92 23:05	7.048	7.047375		
4/18/92 0:05	7.054	7.04725		
4/18/92 1:05	7.048	7.04675		
4/18/92 2:05	7.051	7.046625		
4/18/92 3:05	7.054	7.046375		
4/18/92 4:05	7.054	7.046125		
4/18/92 5:05	7.054	7.045875		
4/18/92 6:05	7.054	7.045625		
4/18/92 7:05	7.045	7.045125		
4/18/92 8:05	7.038	7.04483333		
4/18/92 9:05	7.035	7.04433333		
4/18/92 10:05	7.038	7.04341667		
4/18/92 11:05	7.045	7.04279167		
4/18/92 12:05	7.042	7.042125		
4/18/92 13:05	7.045	7.04170833		

4/18/92 14:05	7.045	7.04104167		
4/18/92 15:05	7.048	7.0405		
4/18/92 16:05	7.045	7.03970833		
4/18/92 17:05	7.048	7.03929167		
4/18/92 18:05	7.051	7.03904167		
4/18/92 19:05	7.054			
4/18/92 20:05	7.048			
4/18/92 21:05	7.048			
4/18/92 22:05	7.045			
4/18/92 23:05	7.045			
4/19/92 0:05	7.042			
4/19/92 1:05	7.045			
4/19/92 2:05	7.045			
4/19/92 3:05	7.048			
4/19/92 4:05	7.048			
4/19/92 5:05	7.048			
4/19/92 6:05	7.042			
4/19/92 7:05	7.038			
4/19/92 8:05	7.026			
4/19/92 9:05	7.013			
4/19/92 10:05	7.023			
4/19/92 11:05	7.029			
4/19/92 12:05	7.032			
4/19/92 13:05	7.029			
4/19/92 14:05	7.032			
4/19/92 15:05	7.029			
4/19/92 16:05	7.035			
4/19/92 17:05	7.042			

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Time	Elevation	Average 1	Average 2	Final Average
4/16/92 17:58	7.425	7.418625	7.418831667	7.4231294
4/16/92 18:58	7.422	7.41825	7.41901	
4/16/92 19:58	7.425	7.418	7.41923	
4/16/92 20:58	7.422	7.41775	7.419486667	
4/16/92 21:58	7.422	7.4175	7.41978	
4/16/92 22:58	7.419	7.41725	7.42011	
4/16/92 23:58	7.419	7.41725	7.420471667	
4/17/92 0:58	7.422	7.417375	7.42085	
4/17/92 1:58	7.422	7.417375	7.42124	
4/17/92 2:58	7.422	7.4175	7.421646667	
4/17/92 3:58	7.425	7.417625	7.422065	
4/17/92 4:58	7.422	7.417625	7.422495	
4/17/92 5:58	7.422	7.417875	7.422936667	
4/17/92 6:58	7.419	7.418125	7.42338	
4/17/92 7:58	7.413	7.41825	7.42383	
4/17/92 8:58	7.413	7.418625	7.424285	
4/17/92 9:58	7.407	7.418875	7.424735	
4/17/92 10:58	7.407	7.419375	7.42519	
4/17/92 11:58	7.419	7.420125	7.42563	
4/17/92 12:58	7.413	7.420375	7.426061667	
4/17/92 13:58	7.419	7.420625	7.426505	
4/17/92 14:58	7.416	7.420875	7.42695	
4/17/92 15:58	7.416	7.421375	7.427396667	
4/17/92 16:58	7.416	7.42175	7.42784	
4/17/92 17:58	7.416	7.42241667	7.428278333	
4/17/92 18:58	7.416	7.42308333		
4/17/92 19:58	7.419	7.42375		
4/17/92 20:58	7.416	7.42441667		
4/17/92 21:58	7.416	7.42508333		
4/17/92 22:58	7.419	7.42575		
4/17/92 23:58	7.422	7.42629167		
4/18/92 0:58	7.422	7.42670833		
4/18/92 1:58	7.425	7.427125		
4/18/92 2:58	7.425	7.42754167		
4/18/92 3:58	7.425	7.42795833		
4/18/92 4:58	7.428	7.428375		
4/18/92 5:58	7.428	7.42866667		
4/18/92 6:58	7.422	7.42895833		
4/18/92 7:58	7.422	7.429375		
4/18/92 8:58	7.419	7.429625		
4/18/92 9:58	7.419	7.429875		
4/18/92 10:58	7.425	7.43025		
4/18/92 11:58	7.425	7.430375		
4/18/92 12:58	7.419	7.43091667		

4/18/92 13:58	7.425	7.43145833		
4/18/92 14:58	7.428	7.43175		
4/18/92 15:58	7.425	7.43204167		
4/18/92 16:58	7.432	7.43245833		
4/18/92 17:58	7.432	7.43270833		
4/18/92 18:58	7.432			
4/18/92 19:58	7.435			
4/18/92 20:58	7.432			
4/18/92 21:58	7.432			
4/18/92 22:58	7.432			
4/18/92 23:58	7.432			
4/19/92 0:58	7.432			
4/19/92 1:58	7.435			
4/19/92 2:58	7.435			
4/19/92 3:58	7.435			
4/19/92 4:58	7.435			
4/19/92 5:58	7.435			
4/19/92 6:58	7.432			
4/19/92 7:58	7.428			
4/19/92 8:58	7.425			
4/19/92 9:58	7.428			
4/19/92 10:58	7.428			
4/19/92 11:58	7.438			
4/19/92 12:58	7.432			
4/19/92 13:58	7.432			
4/19/92 14:58	7.435			
4/19/92 15:58	7.435			
4/19/92 16:58	7.438			

Time	Elevation	Average 1	Average 2	Final Average
4/16/92 17:58	2.741	2.69133333	2.692385	2.689524067
4/16/92 18:58	2.751	2.69029167	2.692541667	
4/16/92 19:58	2.71	2.68975	2.692698333	
4/16/92 20:58	2.679	2.68804167	2.692866667	
4/16/92 21:58	2.679	2.68725	2.693066667	
4/16/92 22:58	2.672	2.68645833	2.693245	
4/16/92 23:58	→ 2.663	2.68595833	2.693396667	
4/17/92 0:58	2.641	2.68541667	2.693531667	
4/17/92 1:58	2.647	2.68620833	2.69362	
4/17/92 2:58	2.657	2.687125	2.693603333	
4/17/92 3:58	2.672	2.687625	2.693508333	
4/17/92 4:58	2.666	2.68841667	2.69332	
4/17/92 5:58	2.666	2.68983333	2.69297	
4/17/92 6:58	→ 2.685	2.69154167	2.692458333	
4/17/92 7:58	2.675	2.69308333	2.69177	
4/17/92 8:58	2.675	2.69491667	2.69088	
4/17/92 9:58	2.697	2.69704167	2.68979	
4/17/92 10:58	2.682	2.69825	2.688493333	
4/17/92 11:58	2.707	2.70033333	2.68706	
4/17/92 12:58	2.719	2.70033333	2.685465	
4/17/92 13:58	2.713	2.69954167	2.683818333	
4/17/92 14:58	2.719	2.69941667	2.682098333	
4/17/92 15:58	2.722	2.698625	2.680305	
4/17/92 16:58	2.754	2.69745833	2.678496667	
4/17/92 17:58	2.716	2.695375	2.676713333	
4/17/92 18:58	2.738	2.69525		
4/17/92 19:58	2.669	2.69420833		
4/17/92 20:58	2.66	2.69395833		
4/17/92 21:58	2.66	2.69304167		
4/17/92 22:58	2.66	2.69170833		
4/17/92 23:58	2.65	2.69025		
4/18/92 0:58	→ 2.66	2.68933333		
4/18/92 1:58	2.669	2.687625		
4/18/92 2:58	2.669	2.68579167		
4/18/92 3:58	2.691	2.68475		
4/18/92 4:58	2.7	2.68291667		
4/18/92 5:58	2.707	2.67966667		
4/18/92 6:58	→ 2.722	2.67704167		
4/18/92 7:58	2.719	2.67433333		
4/18/92 8:58	2.726	2.67083333		
4/18/92 9:58	2.726	2.66766667		
4/18/92 10:58	2.732	2.664625		
4/18/92 11:58	2.707	2.66241667		
4/18/92 12:58	2.7	2.66045833		

4/18/92 13:58	2.71	2.65916667		
4/18/92 14:58	2.7	2.65654167		
4/18/92 15:58	2.694	2.65458333		
4/18/92 16:58	2.704	2.65341667		
4/18/92 17:58	2.713	2.652875		
4/18/92 18:58	2.713			
4/18/92 19:58	2.663			
4/18/92 20:58	2.638			
4/18/92 21:58	2.628			
4/18/92 22:58	2.625			
4/18/92 23:58	2.628			
4/19/92 0:58	2.619			
4/19/92 1:58	2.625			
4/19/92 2:58	2.644			
4/19/92 3:58	2.647			
4/19/92 4:58	2.622			
4/19/92 5:58	2.644			
4/19/92 6:58	2.657			
4/19/92 7:58	2.635			
4/19/92 8:58	2.65			
4/19/92 9:58	2.653			
4/19/92 10:58	2.679			
4/19/92 11:58	2.66			
4/19/92 12:58	2.669			
4/19/92 13:58	2.647			
4/19/92 14:58	2.653			
4/19/92 15:58	2.666			
4/19/92 16:58	2.691			

Time	Elevation	Average 1	Average 2	Final Average
4/16/92 18:03	0.064	1.32833333	1.253813333	1.233708133
4/16/92 19:03	0.137	1.341125	1.249268333	
4/16/92 20:03	0.691	1.34320833	1.244835	
4/16/92 21:03	1.575	1.33108333	1.240501667	
4/16/92 22:03	2.469	1.30916667	1.236288333	
4/16/92 23:03	3.285	1.284875	1.232406667	
4/17/92 0:03	-> 3.865	1.26070833	1.228891667	
4/17/92 1:03	3.865	1.24066667	1.225883333	
4/17/92 2:03	3.241	1.23566667	1.22355	
4/17/92 3:03	2.066	1.24741667	1.221918333	
4/17/92 4:03	0.929	1.270625	1.221015	
4/17/92 5:03	-0.031	1.29066667	1.220636667	
4/17/92 6:03	-0.76	1.3065	1.220781667	
4/17/92 7:03	-> -1.14	1.316125	1.221391667	
4/17/92 8:03	-1.153	1.316375	1.222451667	
4/17/92 9:03	-0.668	1.304	1.223971667	
4/17/92 10:03	0.238	1.2755	1.225965	
4/17/92 11:03	1.15	1.235125	1.22837	
4/17/92 12:03	1.936	1.19595833	1.231316667	
4/17/92 13:03	2.503	1.16270833	1.234705	
4/17/92 14:03	2.68	1.137	1.238503333	
4/17/92 15:03	2.38	1.12633333	1.242623333	
4/17/92 16:03	1.667	1.135	1.246918333	
4/17/92 17:03	0.891	1.16020833	1.251241667	
4/17/92 18:03	0.371	1.19095833	1.255455	
4/17/92 19:03	0.187	1.21470833		
4/17/92 20:03	0.4	1.23029167		
4/17/92 21:03	1.049	1.234875		
4/17/92 22:03	1.886	1.22575		
4/17/92 23:03	2.705	1.212125		
4/18/92 0:03	3.384	1.197		
4/18/92 1:03	-> 3.745	1.1855		
4/18/92 2:03	3.523	1.18233333		
4/18/92 3:03	2.623	1.194875		
4/18/92 4:03	1.41	1.22483333		
4/18/92 5:03	0.349	1.26116667		
4/18/92 6:03	-0.529	1.29429167		
4/18/92 7:03	-> -1.134	1.32175		
4/18/92 8:03	-1.45	1.342625		
4/18/92 9:03	-1.352	1.354375		
4/18/92 10:03	-0.731	1.35383333		
4/18/92 11:03	0.21	1.335625		
4/18/92 12:03	1.138	1.30879167		
4/18/92 13:03	1.886	1.28066667		

4/18/92 14:03	2.424	1.25766667		
4/18/92 15:03	2.588	1.24		
4/18/92 16:03	2.272	1.23370833		
4/18/92 17:03	1.629	1.24308333		
4/18/92 18:03	0.941	1.26554167		
4/18/92 19:03	0.561			
4/18/92 20:03	0.51			
4/18/92 21:03	0.83			
4/18/92 22:03	1.559			
4/18/92 23:03	2.342			
4/19/92 0:03	3.108			
4/19/92 1:03	3.669			
4/19/92 2:03	3.824			
4/19/92 3:03	3.342			
4/19/92 4:03	2.282			
4/19/92 5:03	1.144			
4/19/92 6:03	0.13			
4/19/92 7:03	-0.633			
4/19/92 8:03	-1.168			
4/19/92 9:03	-1.365			
4/19/92 10:03	-1.168			
4/19/92 11:03	-0.434			
4/19/92 12:03	0.463			
4/19/92 13:03	1.334			
4/19/92 14:03	2			
4/19/92 15:03	2.437			
4/19/92 16:03	2.497			
4/19/92 17:03	2.168			

4/16/92	17:54	0.047960032	1.82988547	1.739977203	1.720657061
4/16/92	18:54	0.197754638	1.84971026	1.734973778	
4/16/92	19:54	0.861554429	1.85269724	1.73001082	
4/16/92	20:54	2.075093469	1.83939999	1.725180846	
4/16/92	21:54	3.343397709	1.81034465	1.720408842	
4/16/92	22:54	4.593105023	1.77586347	1.715977659	
4/16/92	23:54	-> 5.409653724	1.73928102	1.711989885	
4/17/92	0:54	5.316330894	1.71053476	1.708754112	
4/17/92	1:54	4.292965687	1.70519905	1.706529221	
4/17/92	2:54	2.654331205	1.72713823	1.705241876	
4/17/92	3:54	1.150773829	1.76000712	1.704782938	
4/17/92	4:54	-0.141167364	1.78852075	1.704902613	
4/17/92	5:54	-1.105621664	1.81086838	1.705636742	
4/17/92	6:54	-> -1.572503416	1.82376793	1.706971879	
4/17/92	7:54	-1.518585179	1.82475507	1.708797717	
4/17/92	8:54	-0.841864118	1.80921412	1.711050742	
4/17/92	9:54	0.369752509	1.77303219	1.713751555	
4/17/92	10:54	1.644744899	1.72079112	1.716912254	
4/17/92	11:54	2.7958182	1.66831228	1.720662967	
4/17/92	12:54	3.627415263	1.62260996	1.724890821	
4/17/92	13:54	3.842975711	1.58714406	1.729599347	
4/17/92	14:54	3.313698129	1.57537028	1.734661409	
4/17/92	15:54	2.306601549	1.59320516	1.739859061	
4/17/92	16:54	1.253066194	1.62989581	1.74497089	
4/17/92	17:54	0.523754984	1.67188168	1.749931336	
4/17/92	18:54	0.269442066	1.70479986		
4/17/92	19:54	0.542420471	1.72563631		
4/17/92	20:54	1.377765364	1.73194789		
4/17/92	21:54	2.515849331	1.72009988		
4/17/92	22:54	3.715126314	1.69956506		
4/17/92	23:54	4.719743348	1.67616912		
4/18/92	0:54	-> 5.188273856	1.65838672		
4/18/92	1:54	4.819506115	1.65491248		
4/18/92	2:54	3.443184606	1.67301541		
4/18/92	3:54	1.835100824	1.7156648		
4/18/92	4:54	0.395175802	1.76299899		
4/18/92	5:54	-0.796032538	1.80687398		
4/18/92	6:54	-> -1.548811936	1.8442468		
4/18/92	7:54	-1.891568028	1.86941388		
4/18/92	8:54	-1.710230529	1.88108071		
4/18/92	9:54	-0.88403311	1.87673443		
4/18/92	10:54	0.385252783	1.85204968		
4/18/92	11:54	1.698962562	1.81455893		
4/18/92	12:54	2.776233465	1.77400863		
4/18/92	13:54	3.560405041	1.74032311		
4/18/92	14:54	3.741735247	1.71369562		

4/18/92 15:54	3.187177192	1.70531157		
4/18/92 16:54	2.260727182	1.72100087		
4/18/92 17:54	1.313791267	1.75390697		
4/18/92 18:54	0.769516799			
4/18/92 19:54	0.693898518			
4/18/92 20:54	1.093413113			
4/18/92 21:54	2.023013564			
4/18/92 22:54	3.153623794			
4/18/92 23:54	4.292965687			
4/19/92 0:54	5.104892054			
4/19/92 1:54	5.253976495			
4/19/92 2:54	4.466769896			
4/19/92 3:54	2.971121395			
4/19/92 4:54	1.448175546			
4/19/92 5:54	0.100915226			
4/19/92 6:54	-0.944802066			
4/19/92 7:54	-1.61156403			
4/19/92 8:54	-1.814541236			
4/19/92 9:54	-1.476467239			
4/19/92 10:54	-0.514525033			
4/19/92 11:54	0.725755209			
4/19/92 12:54	1.967781113			
4/19/92 13:54	2.921345289			
4/19/92 14:54	3.540518052			
4/19/92 15:54	3.563720298			
4/19/92 16:54	3.050473536			

Time	Elevation	Average 1	Average 2	Final Average
4/16/92 17:54	0.41689625	1.96089902	1.887372747	1.871922403
4/16/92 18:54	0.47692025	1.9806465	1.883035596	
4/16/92 19:54	0.99837875	1.98551824	1.878745339	
4/16/92 20:54	2.0781855	1.97551424	1.874602016	
4/16/92 21:54	3.224894	1.95053029	1.870505586	
4/16/92 22:54	4.3265845	1.91999725	1.866708235	
4/16/92 23:54	-> 5.06563	1.8881616	1.863348558	
4/17/92 0:54	5.08501275	1.86302134	1.860630805	
4/17/92 1:54	4.285318	1.85616965	1.858760265	
4/17/92 2:54	2.8810065	1.8731556	1.857700466	
4/17/92 3:54	1.5354685	1.9018129	1.857403473	
4/17/92 4:54	0.35687225	1.92773472	1.857628563	
4/17/92 5:54	-0.5778765	1.94894111	1.858390325	
4/17/92 6:54	-> -1.0830785	1.96261846	1.859720024	
4/17/92 7:54	-1.1305975	1.96603128	1.861487397	
4/17/92 8:54	-0.59976025	1.95524572	1.86364972	
4/17/92 9:54	0.473794	1.92523372	1.866190319	
4/17/92 10:54	1.6680215	1.87813155	1.869131078	
4/17/92 11:54	2.76408475	1.82863259	1.872639773	
4/17/92 12:54	3.5212625	1.78507351	1.876612195	
4/17/92 13:54	3.792621	1.75284708	1.881048343	
4/17/92 14:54	3.38308225	1.73958657	1.885826295	
4/17/92 15:54	2.5333675	1.75297734	1.890777233	
4/17/92 16:54	1.5854885	1.78429195	1.895670857	
4/17/92 17:54	0.89083575	1.82154643	1.900474861	
4/17/92 18:54	0.593842	1.85247025		
4/17/92 19:54	0.75828275	1.87339007		
4/17/92 20:54	1.47857075	1.88193516		
4/17/92 21:54	2.492101	1.8731035		
4/17/92 22:54	3.562529	1.8555965		
4/17/92 23:54	4.46226375	1.83600533		
4/18/92 0:54	-> 4.920572	1.82021777		
4/18/92 1:54	4.692981	1.81625785		
4/18/92 2:54	3.5687815	1.82967468		
4/18/92 3:54	2.15759225	1.86573076		
4/18/92 4:54	0.86582575	1.90744015		
4/18/92 5:54	-0.24962025	1.94677879		
4/18/92 6:54	-> -1.00117075	1.98218357		
4/18/92 7:54	-1.389451	2.00680279		
4/18/92 8:54	-1.32004825	2.02008935		
4/18/92 9:54	-0.656658	2.0187607		
4/18/92 10:54	0.4800465	1.9987527		
4/18/92 11:54	1.71866675	1.96584892		
4/18/92 12:54	2.74782825	1.92794314		

4/18/92 13:54	3.47436875	1.89597723		
4/18/92 14:54	3.70446075	1.87229589		
4/18/92 15:54	3.284918	1.86336002		
4/18/92 16:54	2.479596	1.87531793		
4/18/92 17:54	1.6330075	1.90439205		
4/18/92 18:54	1.09591775			
4/18/92 19:54	0.96336475			
4/18/92 20:54	1.266611			
4/18/92 21:54	2.071933			
4/18/92 22:54	3.092341			
4/18/92 23:54	4.08336225			
4/19/92 0:54	4.825534			
4/19/92 1:54	5.01498475			
4/19/92 2:54	4.4341275			
4/19/92 3:54	3.1586175			
4/19/92 4:54	1.80995325			
4/19/92 5:54	0.6000945			
4/19/92 6:54	-0.4103095			
4/19/92 7:54	-1.0705735			
4/19/92 8:54	-1.351936			
4/19/92 9:54	-1.13685			
4/19/92 10:54	-0.30964425			
4/19/92 11:54	0.808928			
4/19/92 12:54	1.9806465			
4/19/92 13:54	2.9060165			
4/19/92 14:54	3.49			
4/19/92 15:54	3.57190775			
4/19/92 16:54	3.177375			

Time	Elevation	Average 1	Average 2	Final Average
4/16/92 17:54	0.297	1.777375	1.721291667	1.7039702
4/16/92 18:54	0.313	1.79491667	1.718331667	
4/16/92 19:54	0.816	1.80004167	1.715515	
4/16/92 20:54	1.823	1.79333333	1.712708333	
4/16/92 21:54	2.963	1.77129167	1.709706667	
4/16/92 22:54	4.042	1.74316667	1.706743333	
4/16/92 23:54	—> 4.789	1.71375	1.703966667	
4/17/92 0:54	4.85	1.69029167	1.701521667	
4/17/92 1:54	4.131	1.68366667	1.69962	
4/17/92 2:54	2.76	1.699875	1.698268333	
4/17/92 3:54	1.424	1.729	1.697471667	
4/17/92 4:54	0.306	1.755125	1.696976667	
4/17/92 5:54	-0.53	1.77545833	1.696818333	
4/17/92 6:54	—> -0.941	1.78829167	1.696975	
4/17/92 7:54	-1.039	1.79275	1.697283333	
4/17/92 8:54	-0.72	1.78758333	1.697683333	
4/17/92 9:54	0.138	1.76925	1.698175	
4/17/92 10:54	1.285	1.73129167	1.698776667	
4/17/92 11:54	2.412	1.68379167	1.699676667	
4/17/92 12:54	3.177	1.63904167	1.700946667	
4/17/92 13:54	3.481	1.60729167	1.702555	
4/17/92 14:54	3.139	1.59345833	1.704368333	
4/17/92 15:54	2.336	1.60470833	1.706243333	
4/17/92 16:54	1.405	1.63516667	1.708021667	
4/17/92 17:54	0.718	1.672375	1.70961	
4/17/92 18:54	0.436	1.703375		
4/17/92 19:54	0.655	1.7245		
4/17/92 20:54	1.294	1.729875		
4/17/92 21:54	2.288	1.71829167		
4/17/92 22:54	3.336	1.69720833		
4/17/92 23:54	4.226	1.67375		
4/18/92 0:54	—> 4.691	1.652625		
4/18/92 1:54	4.52	1.64275		
4/18/92 2:54	3.459	1.649875		
4/18/92 3:54	2.051	1.67995833		
4/18/92 4:54	0.794	1.716625		
4/18/92 5:54	-0.222	1.75116667		
4/18/92 6:54	—> -0.834	1.779375		
4/18/92 7:54	-1.163	1.796		
4/18/92 8:54	-1.16	1.80275		
4/18/92 9:54	-0.773	1.799875		
4/18/92 10:54	0.145	1.78429167		
4/18/92 11:54	1.338	1.75379167		
4/18/92 12:54	2.415	1.71554167		

4/18/92 13:54	3.149	1.67925		
4/18/92 14:54	3.409	1.652625		
4/18/92 15:54	3.067	1.64033333		
4/18/92 16:54	2.298	1.64916667		
4/18/92 17:54	1.462	1.674875		
4/18/92 18:54	0.943			
4/18/92 19:54	0.784			
4/18/92 20:54	1.016			
4/18/92 21:54	1.782			
4/18/92 22:54	2.773			
4/18/92 23:54	3.719			
4/19/92 0:54	4.454			
4/19/92 1:54	4.691			
4/19/92 2:54	4.181			
4/19/92 3:54	2.931			
4/19/92 4:54	1.623			
4/19/92 5:54	0.455			
4/19/92 6:54	-0.435			
4/19/92 7:54	-1.001			
4/19/92 8:54	-1.229			
4/19/92 9:54	-1.147			
4/19/92 10:54	-0.587			
4/19/92 11:54	0.42			
4/19/92 12:54	1.544			
4/19/92 13:54	2.51			
4/19/92 14:54	3.114			
4/19/92 15:54	3.279			
4/19/92 16:54	2.915			

Time	Elevation	Average 1	Average 2	Final Average
4/16/92 17:56	1.351	2.32420833	2.274168333	2.2607744
4/16/92 18:56	1.202	2.337875	2.270888333	
4/16/92 19:56	1.411	2.3455	2.267673333	
4/16/92 20:56	1.992	2.34179167	2.264538333	
4/16/92 21:56	2.861	2.328625	2.261446667	
4/16/92 22:56	3.9	2.303875	2.258513333	
4/16/92 23:56	-> 4.554	2.27516667	2.255833333	
4/17/92 0:56	4.636	2.25279167	2.253763333	
4/17/92 1:56	4.114	2.24516667	2.252393333	
4/17/92 2:56	3.106	2.25479167	2.251713333	
4/17/92 3:56	2.261	2.27404167	2.251706667	
4/17/92 4:56	1.613	2.28954167	2.252025	
4/17/92 5:56	1.164	2.30070833	2.252598333	
4/17/92 6:56	-> 0.75	2.30754167	2.253368333	
4/17/92 7:56	0.558	2.31308333	2.254423333	
4/17/92 8:56	0.586	2.31254167	2.255651667	
4/17/92 9:56	0.962	2.30479167	2.257075	
4/17/92 10:56	1.629	2.28558333	2.258645	
4/17/92 11:56	2.368	2.25554167	2.26042	
4/17/92 12:56	3.138	2.224875	2.262453333	
4/17/92 13:56	3.451	2.19266667	2.26475	
4/17/92 14:56	3.28	2.17816667	2.2673	
4/17/92 15:56	2.735	2.182375	2.269993333	
4/17/92 16:56	2.159	2.20075	2.272696667	
4/17/92 17:56	1.679	2.22220833	2.275321667	
4/17/92 18:56	1.385	2.24220833		
4/17/92 19:56	1.322	2.2575		
4/17/92 20:56	1.676	2.267125		
4/17/92 21:56	2.267	2.2645		
4/17/92 22:56	3.211	2.25529167		
4/17/92 23:56	4.017	2.236875		
4/18/92 0:56	-> 4.453	2.22341667		
4/18/92 1:56	4.345	2.21854167		
4/18/92 2:56	3.568	2.22816667		
4/18/92 3:56	2.633	2.254625		
4/18/92 4:56	1.881	2.282		
4/18/92 5:56	1.328	2.303875		
4/18/92 6:56	-> 0.883	2.31995833		
4/18/92 7:56	0.545	2.33391667		
4/18/92 8:56	0.4	2.34379167		
4/18/92 9:56	0.501	2.348125		
4/18/92 10:56	0.908	2.34404167		
4/18/92 11:56	1.632	2.32995833		
4/18/92 12:56	2.365	2.306375		

4/18/92 13:56	3.103	2.28229167		
4/18/92 14:56	3.381	2.25641667		
4/18/92 15:56	3.176	2.2455		
4/18/92 16:56	2.674	2.24995833		
4/18/92 17:56	2.159	2.266375		
4/18/92 18:56	1.752			
4/18/92 19:56	1.553			
4/18/92 20:56	1.613			
4/18/92 21:56	2.046			
4/18/92 22:56	2.769			
4/18/92 23:56	3.694			
4/19/92 0:56	4.336			
4/19/92 1:56	4.576			
4/19/92 2:56	4.203			
4/19/92 3:56	3.29			
4/19/92 4:56	2.406			
4/19/92 5:56	1.714			
4/19/92 6:56	1.218			
4/19/92 7:56	0.782			
4/19/92 8:56	0.504			
4/19/92 9:56	0.403			
4/19/92 10:56	0.57			
4/19/92 11:56	1.066			
4/19/92 12:56	1.787			
4/19/92 13:56	2.482			
4/19/92 14:56	3.119			
4/19/92 15:56	3.283			
4/19/92 16:56	3.068			

Time	Elevation	Average 1	Average 2	Final Average
4/16/92 17:58	0.611	1.50829167	1.534438333	1.5865968
4/16/92 18:58	0.589	1.52375	1.538353333	
4/16/92 19:58	0.767	1.53379167	1.542285	
4/16/92 20:58	1.249	1.53591667	1.546025	
4/16/92 21:58	2.037	1.52891667	1.549558333	
4/16/92 22:58	2.769	1.51045833	1.553038333	
4/16/92 23:58	3.28	1.49275	1.556776667	
4/17/92 0:58	3.257	1.47954167	1.560841667	
4/17/92 1:58	2.715	1.47904167	1.565386667	
4/17/92 2:58	1.79	1.494	1.570353333	
4/17/92 3:58	1.122	1.51525	1.57571	
4/17/92 4:58	0.71	1.5315	1.581208333	
4/17/92 5:58	0.494	1.54379167	1.586626667	
4/17/92 6:58	0.409	1.55425	1.59177	
4/17/92 7:58	0.317	1.56333333	1.596765	
4/17/92 8:58	0.386	1.573625	1.601513333	
4/17/92 9:58	0.719	1.57854167	1.605976667	
4/17/92 10:58	1.122	1.57195833	1.610375	
4/17/92 11:58	1.705	1.55845833	1.614836667	
4/17/92 12:58	2.284	1.54220833	1.61941	
4/17/92 13:58	2.503	1.5285	1.62389	
4/17/92 14:58	2.259	1.52679167	1.628346667	
4/17/92 15:58	1.815	1.53908333	1.632791667	
4/17/92 16:58	1.29	1.56154167	1.63721	
4/17/92 17:58	0.982	1.58566667	1.641433333	
4/17/92 18:58	0.83	1.60616667		
4/17/92 19:58	0.818	1.62204167		
4/17/92 20:58	1.081	1.62729167		
4/17/92 21:58	1.594	1.62425		
4/17/92 22:58	2.344	1.61591667		
4/17/92 23:58	2.963	1.60391667		
4/18/92 0:58	3.245	1.594375		
4/18/92 1:58	3.074	1.59316667		
4/18/92 2:58	2.3	1.60320833		
4/18/92 3:58	1.512	1.62791667		
4/18/92 4:58	1.005	1.65270833		
4/18/92 5:58	0.745	1.66695833		
4/18/92 6:58	0.627	1.672375		
4/18/92 7:58	0.564	1.679125		
4/18/92 8:58	0.504	1.68204167		
4/18/92 9:58	0.561	1.68520833		
4/18/92 10:58	0.798	1.6885		
4/18/92 11:58	1.315	1.6835		
4/18/92 12:58	1.955	1.67279167		

4/18/92 13:58	2.462	1.65420833		
4/18/92 14:58	2.554	1.63991667		
4/18/92 15:58	2.354	1.63791667		
4/18/92 16:58	1.869	1.64954167		
4/18/92 17:58	1.474	1.667125		
4/18/92 18:58	1.211			
4/18/92 19:58	0.944			
4/18/92 20:58	1.008			
4/18/92 21:58	1.394			
4/18/92 22:58	2.056			
4/18/92 23:58	2.734			
4/19/92 0:58	3.216			
4/19/92 1:58	3.315			
4/19/92 2:58	2.893			
4/19/92 3:58	2.107			
4/19/92 4:58	1.347			
4/19/92 5:58	0.875			
4/19/92 6:58	0.789			
4/19/92 7:58	0.634			
4/19/92 8:58	0.58			
4/19/92 9:58	0.64			
4/19/92 10:58	0.678			
4/19/92 11:58	1.058			
4/19/92 12:58	1.509			
4/19/92 13:58	2.119			
4/19/92 14:58	2.506			
4/19/92 15:58	2.633			
4/19/92 16:58	2.291			

Time	Elevation	Average 1	Average 2	Final Average
4/16/92 17:58	2.92	3.03791667	3.018423333	3.003309867
4/16/92 18:58	2.885	3.03858333	3.016771667	
4/16/92 19:58	2.875	3.039125	3.015135	
4/16/92 20:58	2.907	3.038625	3.013503333	
4/16/92 21:58	3.009	3.03704167	3.011876667	
4/16/92 22:58	3.151	3.03370833	3.01024	
4/16/92 23:58	-> 3.278	3.029125	3.008615	
4/17/92 0:58	3.354	3.02420833	3.007058333	
4/17/92 1:58	3.338	3.020625	3.005598333	
4/17/92 2:58	3.249	3.01916667	3.004266667	
4/17/92 3:58	3.151	3.01916667	3.003078333	
4/17/92 4:58	3.069	3.01941667	3.002011667	
4/17/92 5:58	3.006	3.01929167	3.00104	
4/17/92 6:58	-> 2.952	3.01875	3.000146667	
4/17/92 7:58	2.904	3.01795833	2.999343333	
4/17/92 8:58	2.869	3.01691667	2.99863	
4/17/92 9:58	2.853	3.01575	2.998	
4/17/92 10:58	2.869	3.01404167	2.997448333	
4/17/92 11:58	2.942	3.01125	2.99696	
4/17/92 12:58	3.037	3.00675	2.99652	
4/17/92 13:58	3.107	3.001625	2.996126667	
4/17/92 14:58	3.113	2.997125	2.995796667	
4/17/92 15:58	3.063	2.994625	2.995546667	
4/17/92 16:58	3.009	2.9945	2.995375	
4/17/92 17:58	2.936	2.99529167	2.995235	
4/17/92 18:58	2.898	2.996625		
4/17/92 19:58	2.863	2.99766667		
4/17/92 20:58	2.869	2.99833333		
4/17/92 21:58	2.929	2.99795833		
4/17/92 22:58	3.041	2.996125		
4/17/92 23:58	3.16	2.99308333		
4/18/92 0:58	-> 3.268	2.99020833		
4/18/92 1:58	3.303	2.98770833		
4/18/92 2:58	3.249	2.98733333		
4/18/92 3:58	3.157	2.98945833		
4/18/92 4:58	3.066	2.9925		
4/18/92 5:58	2.993	2.995125		
4/18/92 6:58	-> 2.933	2.99695833		
4/18/92 7:58	2.879	2.99866667		
4/18/92 8:58	2.841	3.000125		
4/18/92 9:58	2.812	3.00116667		
4/18/92 10:58	2.802	3.00195833		
4/18/92 11:58	2.834	3.00183333		
4/18/92 12:58	2.914	3.00025		

4/18/92 13:58	2.999	2.99691667		
4/18/92 14:58	3.053	2.993375		
4/18/92 15:58	3.06	2.990875		
4/18/92 16:58	3.028	2.99033333		
4/18/92 17:58	2.968	2.991		
4/18/92 18:58	2.923			
4/18/92 19:58	2.879			
4/18/92 20:58	2.86			
4/18/92 21:58	2.885			
4/18/92 22:58	2.968			
4/18/92 23:58	3.091			
4/19/92 0:58	3.208			
4/19/92 1:58	3.294			
4/19/92 2:58	3.3			
4/19/92 3:58	3.23			
4/19/92 4:58	3.129			
4/19/92 5:58	3.037			
4/19/92 6:58	2.974			
4/19/92 7:58	2.914			
4/19/92 8:58	2.866			
4/19/92 9:58	2.831			
4/19/92 10:58	2.799			
4/19/92 11:58	2.796			
4/19/92 12:58	2.834			
4/19/92 13:58	2.914			
4/19/92 14:58	2.993			
4/19/92 15:58	3.047			
4/19/92 16:58	3.044			

Time	Elevation	Average 1	Average 2	Final Average
4/16/92 17:53	2.882	2.95983333	2.949296667	2.939736667
4/16/92 18:53	2.869	2.96020833	2.948411667	
4/16/92 19:53	2.869	2.96045833	2.947511667	
4/16/92 20:53	2.904	2.96033333	2.946596667	
4/16/92 21:53	2.969	2.95925	2.94565	
4/16/92 22:53	3.07	2.95704167	2.94469	
4/16/92 23:53	-> 3.149	2.95375	2.94373	
4/17/92 0:53	3.168	2.95070833	2.942806667	
4/17/92 1:53	3.13	2.949125	2.941951667	
4/17/92 2:53	3.038	2.949125	2.941165	
4/17/92 3:53	2.975	2.95004167	2.940453333	
4/17/92 4:53	2.938	2.95058333	2.939773333	
4/17/92 5:53	2.91	2.95058333	2.939098333	
4/17/92 6:53	-> 2.888	2.95033333	2.938438333	
4/17/92 7:53	2.866	2.94991667	2.937795	
4/17/92 8:53	2.847	2.9495	2.937168333	
4/17/92 9:53	2.85	2.94908333	2.936558333	
4/17/92 10:53	2.872	2.94791667	2.935953333	
4/17/92 11:53	2.926	2.94583333	2.935368333	
4/17/92 12:53	2.988	2.94279167	2.934798333	
4/17/92 13:53	3.029	2.93941667	2.934245	
4/17/92 14:53	3.01	2.93666667	2.933716667	
4/17/92 15:53	2.963	2.936	2.933221667	
4/17/92 16:53	2.926	2.936625	2.932743333	
4/17/92 17:53	2.891	2.93729167	2.932275	
4/17/92 18:53	2.875	2.93770833		
4/17/92 19:53	2.866	2.93770833		
4/17/92 20:53	2.878	2.93758333		
4/17/92 21:53	2.916	2.93666667		
4/17/92 22:53	2.991	2.93525		
4/17/92 23:53	3.076	2.93304167		
4/18/92 0:53	-> 3.13	2.93066667		
4/18/92 1:53	3.13	2.92933333		
4/18/92 2:53	3.06	2.92945833		
4/18/92 3:53	2.988	2.93133333		
4/18/92 4:53	2.938	2.93304167		
4/18/92 5:53	2.904	2.93370833		
4/18/92 6:53	-> 2.878	2.93408333		
4/18/92 7:53	2.856	2.93425		
4/18/92 8:53	2.837	2.93425		
4/18/92 9:53	2.822	2.93425		
4/18/92 10:53	2.822	2.93395833		
4/18/92 11:53	2.853	2.93329167		
4/18/92 12:53	2.907	2.93158333		

4/18/92 13:53	2.963	2.92895833		
4/18/92 14:53	2.994	2.92620833		
4/18/92 15:53	2.978	2.92429167		
4/18/92 16:53	2.942	2.92404167		
4/18/92 17:53	2.901	2.92491667		
4/18/92 18:53	2.875			
4/18/92 19:53	2.863			
4/18/92 20:53	2.856			
4/18/92 21:53	2.882			
4/18/92 22:53	2.938			
4/18/92 23:53	3.019			
4/19/92 0:53	3.098			
4/19/92 1:53	3.133			
4/19/92 2:53	3.105			
4/19/92 3:53	3.029			
4/19/92 4:53	2.954			
4/19/92 5:53	2.913			
4/19/92 6:53	2.882			
4/19/92 7:53	2.856			
4/19/92 8:53	2.837			
4/19/92 9:53	2.815			
4/19/92 10:53	2.806			
4/19/92 11:53	2.812			
4/19/92 12:53	2.844			
4/19/92 13:53	2.897			
4/19/92 14:53	2.948			
4/19/92 15:53	2.972			
4/19/92 16:53	2.963			

Time	Elevation	Average 1	Average 2	Final Average
4/16/92 17:58	2.939	3.01958333	3.00343	2.985864133
4/16/92 18:58	2.882	3.02129167	3.00172	
4/16/92 19:58	2.863	3.022875	2.999983333	
4/16/92 20:58	2.857	3.02354167	2.998198333	
4/16/92 21:58	2.904	3.023	2.996391667	
4/16/92 22:58	2.999	3.02154167	2.994555	
4/16/92 23:58	→ 3.105	3.01891667	2.992691667	
4/17/92 0:58	3.232	3.01541667	2.990838333	
4/17/92 1:58	3.314	3.01104167	2.989011667	
4/17/92 2:58	3.308	3.00708333	2.98727	
4/17/92 3:58	3.244	3.00470833	2.985701667	
4/17/92 4:58	3.156	3.00354167	2.984311667	
4/17/92 5:58	3.078	3.002875	2.983063333	
4/17/92 6:58	→ 3.005	3.00208333	2.98195	
4/17/92 7:58	2.936	3.00104167	2.980973333	
4/17/92 8:58	2.888	2.99995833	2.980118333	
4/17/92 9:58	2.853	2.99879167	2.979375	
4/17/92 10:58	2.841	2.99775	2.978715	
4/17/92 11:58	2.885	2.99616667	2.978118333	
4/17/92 12:58	2.948	2.992625	2.97758	
4/17/92 13:58	3.034	2.98804167	2.977115	
4/17/92 14:58	3.075	2.982625	2.976728333	
4/17/92 15:58	3.081	2.97866667	2.976436667	
4/17/92 16:58	3.043	2.97641667	2.97623	
4/17/92 17:58	2.98	2.97616667	2.976096667	
4/17/92 18:58	2.92	2.97683333		
4/17/92 19:58	2.879	2.977875		
4/17/92 20:58	2.844	2.97825		
4/17/92 21:58	2.869	2.978375		
4/17/92 22:58	2.936	2.97708333		
4/17/92 23:58	3.021	2.97495833		
4/18/92 0:58	→ 3.127	2.97258333		
4/18/92 1:58	3.219	2.96975		
4/18/92 2:58	3.251	2.9675		
4/18/92 3:58	3.216	2.967875		
4/18/92 4:58	3.14	2.96995833		
4/18/92 5:58	3.059	2.97233333		
4/18/92 6:58	→ 2.98	2.97504167		
4/18/92 7:58	2.91	2.97766667		
4/18/92 8:58	2.86	2.97966667		
4/18/92 9:58	2.828	2.981375		
4/18/92 10:58	2.803	2.98229167		
4/18/92 11:58	2.8	2.98283333		
4/18/92 12:58	2.838	2.98270833		

4/18/92 13:58	2.904	2.981		
4/18/92 14:58	2.98	2.978375		
4/18/92 15:58	3.027	2.97533333		
4/18/92 16:58	3.037	2.9735		
4/18/92 17:58	2.996	2.97308333		
4/18/92 18:58	2.945			
4/18/92 19:58	2.888			
4/18/92 20:58	2.847			
4/18/92 21:58	2.838			
4/18/92 22:58	2.885			
4/18/92 23:58	2.964			
4/19/92 0:58	3.059			
4/19/92 1:58	3.165			
4/19/92 2:58	3.26			
4/19/92 3:58	3.266			
4/19/92 4:58	3.197			
4/19/92 5:58	3.124			
4/19/92 6:58	3.043			
4/19/92 7:58	2.958			
4/19/92 8:58	2.901			
4/19/92 9:58	2.85			
4/19/92 10:58	2.816			
4/19/92 11:58	2.797			
4/19/92 12:58	2.797			
4/19/92 13:58	2.841			
4/19/92 14:58	2.907			
4/19/92 15:58	2.983			
4/19/92 16:58	3.027			

M001B

Time	Elevation	Average 1	Average 2	Final Average
4/16/92 17:58	0.733	1.73425	1.66455	1.644705333
4/16/92 18:58	0.79	1.74604167	1.659945	
4/16/92 19:58	1.226	1.74666667	1.655496667	
4/16/92 20:58	1.9	1.734375	1.651275	
4/16/92 21:58	2.641	1.7165	1.647288333	
4/16/92 22:58	3.354	1.69533333	1.64364	
4/16/92 23:58	→ 3.903	1.67320833	1.640378333	
4/17/92 0:58	3.947	1.654	1.637588333	
4/17/92 1:58	3.517	1.64720833	1.635456667	
4/17/92 2:58	2.585	1.65545833	1.633926667	
4/17/92 3:58	1.584	1.673625	1.63303	
4/17/92 4:58	0.661	1.69333333	1.632636667	
4/17/92 5:58	-0.096	1.70966667	1.632731667	
4/17/92 6:58	→ -0.514	1.72079167	1.633266667	
4/17/92 7:58	-0.557	1.72291667	1.634225	
4/17/92 8:58	-0.108	1.71241667	1.635553333	
4/17/92 9:58	0.658	1.68675	1.637255	
4/17/92 10:58	1.415	1.65154167	1.639381667	
4/17/92 11:58	2.092	1.61645833	1.642073333	
4/17/92 12:58	2.641	1.58691667	1.6452	
4/17/92 13:58	2.877	1.56258333	1.64873	
4/17/92 14:58	2.691	1.550125	1.652511667	
4/17/92 15:58	2.142	1.55379167	1.656483333	
4/17/92 16:58	1.54	1.572625	1.660518333	
4/17/92 17:58	1.016	1.59716667	1.664491667	
4/17/92 18:58	0.805	1.619125		
4/17/92 19:58	0.931	1.63483333		
4/17/92 20:58	1.471	1.641125		
4/17/92 21:58	2.133	1.63470833		
4/17/92 22:58	2.823	1.62529167		
4/17/92 23:58	3.442	1.61379167		
4/18/92 0:58	→ 3.784	1.60345833		
4/18/92 1:58	3.715	1.60070833		
4/18/92 2:58	3.021	1.60895833		
4/18/92 3:58	2.057	1.63304167		
4/18/92 4:58	1.053	1.66379167		
4/18/92 5:58	0.171	1.69570833		
4/18/92 6:58	→ -0.463	1.72304167		
4/18/92 7:58	-0.809	1.74475		
4/18/92 8:58	-0.724	1.756125		
4/18/92 9:58	-0.187	1.75495833		
4/18/92 10:58	0.573	1.73991667		
4/18/92 11:58	1.383	1.71883333		
4/18/92 12:58	2.057	1.694625		

4/18/92 13:58	2.578	1.67516667		
4/18/92 14:58	2.779	1.657125		
4/18/92 15:58	2.594	1.64941667		
4/18/92 16:58	2.129	1.65466667		
4/18/92 17:58	1.543	1.67195833		
4/18/92 18:58	1.182			
4/18/92 19:58	1.082			
4/18/92 20:58	1.317			
4/18/92 21:58	1.907			
4/18/92 22:58	2.547			
4/18/92 23:58	3.194			
4/19/92 0:58	3.718			
4/19/92 1:58	3.913			
4/19/92 2:58	3.599			
4/19/92 3:58	2.795			
4/19/92 4:58	1.819			
4/19/92 5:58	0.827			
4/19/92 6:58	0.058			
4/19/92 7:58	-0.536			
4/19/92 8:58	-0.752			
4/19/92 9:58	-0.548			
4/19/92 10:58	0.067			
4/19/92 11:58	0.802			
4/19/92 12:58	1.59			
4/19/92 13:58	2.145			
4/19/92 14:58	2.594			
4/19/92 15:58	2.72			
4/19/92 16:58	2.544			

Time	Elevation	Average 1	Average 2	Final Average
4/16/92 18:07	2.734	2.809875	2.778756667	2.7577478
4/16/92 19:07	2.718	2.80804167	2.77612	
4/16/92 20:07	2.75	2.80645833	2.773568333	
4/16/92 21:07	2.803	2.80383333	2.771063333	
4/16/92 22:07	2.888	2.80058333	2.768636667	
4/16/92 23:07	2.992	2.79666667	2.766303333	
4/17/92 0:07	→ 3.09	2.79208333	2.764068333	
4/17/92 1:07	3.147	2.787625	2.761948333	
4/17/92 2:07	3.15	2.78420833	2.759963333	
4/17/92 3:07	3.09	2.78220833	2.758126667	
4/17/92 4:07	3.005	2.78154167	2.75646	
4/17/92 5:07	2.891	2.781125	2.754946667	
4/17/92 6:07	2.772	2.78141667	2.753611667	
4/17/92 7:07	→ 2.665	2.78179167	2.752433333	
4/17/92 8:07	2.584	2.781375	2.75143	
4/17/92 9:07	2.549	2.77966667	2.7506	
4/17/92 10:07	2.559	2.77625	2.749948333	
4/17/92 11:07	2.593	2.7715	2.749481667	
4/17/92 12:07	2.655	2.766	2.749205	
4/17/92 13:07	2.721	2.76016667	2.74908	
4/17/92 14:07	2.781	2.75458333	2.749088333	
4/17/92 15:07	2.794	2.74895833	2.749226667	
4/17/92 16:07	2.775	2.74554167	2.74949	
4/17/92 17:07	2.731	2.74383333	2.749848333	
4/17/92 18:07	2.69	2.74358333	2.75029	
4/17/92 19:07	2.68	2.74395833		
4/17/92 20:07	2.687	2.74425		
4/17/92 21:07	2.725	2.74383333		
4/17/92 22:07	2.794	2.74316667		
4/17/92 23:07	2.882	2.74225		
4/18/92 0:07	2.983	2.74079167		
4/18/92 1:07	→ 3.065	2.73908333		
4/18/92 2:07	3.102	2.738		
4/18/92 3:07	3.074	2.73829167		
4/18/92 4:07	2.995	2.74054167		
4/18/92 5:07	2.898	2.74370833		
4/18/92 6:07	2.781	2.74775		
4/18/92 7:07	→ 2.655	2.75195833		
4/18/92 8:07	2.543	2.75670833		
4/18/92 9:07	2.467	2.760625		
4/18/92 10:07	2.445	2.763375		
4/18/92 11:07	2.461	2.76458333		
4/18/92 12:07	2.515	2.76458333		
4/18/92 13:07	2.587	2.762875		

4/18/92 14:07	2.646	2.760375		
4/18/92 15:07	2.712	2.75804167		
4/18/92 16:07	2.734	2.75554167		
4/18/92 17:07	2.725	2.7545		
4/18/92 18:07	2.699	2.754875		
4/18/92 19:07	2.687			
4/18/92 20:07	2.677			
4/18/92 21:07	2.709			
4/18/92 22:07	2.772			
4/18/92 23:07	2.847			
4/19/92 0:07	2.942			
4/19/92 1:07	3.039			
4/19/92 2:07	3.109			
4/19/92 3:07	3.128			
4/19/92 4:07	3.071			
4/19/92 5:07	2.995			
4/19/92 6:07	2.882			
4/19/92 7:07	2.769			
4/19/92 8:07	2.637			
4/19/92 9:07	2.533			
4/19/92 10:07	2.474			
4/19/92 11:07	2.461			
4/19/92 12:07	2.474			
4/19/92 13:07	2.527			
4/19/92 14:07	2.59			
4/19/92 15:07	2.652			
4/19/92 16:07	2.709			
4/19/92 17:07	2.734			

Time	Elevation	Average 1	Average 2	Final Average
4/16/92 17:59	4.594	4.578	4.567155	4.5690458
4/16/92 18:59	4.588	4.57666667	4.566815	
4/16/92 19:59	4.591	4.57545833	4.566596667	
4/16/92 20:59	4.597	4.573875	4.566478333	
4/16/92 21:59	4.603	4.57254167	4.566455	
4/16/92 22:59	4.603	4.57095833	4.566491667	
4/16/92 23:59	4.597	4.569375	4.566618333	
4/17/92 0:59	4.588	4.56779167	4.566835	
4/17/92 1:59	4.581	4.56658333	4.567136667	
4/17/92 2:59	4.578	4.56554167	4.567513333	
4/17/92 3:59	4.578	4.564875	4.567943333	
4/17/92 4:59	4.562	4.56433333	4.568358333	
4/17/92 5:59	4.556	4.56420833	4.568811667	
4/17/92 6:59	4.556	4.56408333	4.56927	
4/17/92 7:59	4.556	4.56408333	4.569696667	
4/17/92 8:59	4.553	4.56383333	4.57008	
4/17/92 9:59	4.588	4.56354167	4.570421667	
4/17/92 10:59	4.569	4.56233333	4.570743333	
4/17/92 11:59	4.578	4.56204167	4.571081667	
4/17/92 12:59	4.578	4.56204167	4.571395	
4/17/92 13:59	4.572	4.56258333	4.571665	
4/17/92 14:59	4.565	4.563875	4.571955	
4/17/92 15:59	4.572	4.56558333	4.572156667	
4/17/92 16:59	4.569	4.56675	4.572258333	
4/17/92 17:59	4.562	4.56791667	4.572213333	
4/17/92 18:59	4.559	4.5695		
4/17/92 19:59	4.553	4.57120833		
4/17/92 20:59	4.565	4.5725		
4/17/92 21:59	4.565	4.57329167		
4/17/92 22:59	4.565	4.57345833		
4/17/92 23:59	4.559	4.574125		
4/18/92 0:59	4.559	4.57479167		
4/18/92 1:59	4.556	4.57533333		
4/18/92 2:59	4.562	4.576		
4/18/92 3:59	4.565	4.57629167		
4/18/92 4:59	4.559	4.57525		
4/18/92 5:59	4.553	4.57566667		
4/18/92 6:59	4.556	4.57566667		
4/18/92 7:59	4.55	4.57475		
4/18/92 8:59	4.546	4.57366667		
4/18/92 9:59	4.559	4.572375		
4/18/92 10:59	4.562	4.57158333		
4/18/92 11:59	4.578	4.57079167		
4/18/92 12:59	4.591	4.569875		

4/18/92 13:59	4.603	4.56879167		
4/18/92 14:59	4.606	4.56983333		
4/18/92 15:59	4.6	4.56891667		
4/18/92 16:59	4.597	4.568125		
4/18/92 17:59	4.6	4.565625		
4/18/92 18:59	4.6			
4/18/92 19:59	4.584			
4/18/92 20:59	4.584			
4/18/92 21:59	4.569			
4/18/92 22:59	4.581			
4/18/92 23:59	4.575			
4/19/92 0:59	4.572			
4/19/92 1:59	4.572			
4/19/92 2:59	4.569			
4/19/92 3:59	4.54			
4/19/92 4:59	4.569			
4/19/92 5:59	4.553			
4/19/92 6:59	4.534			
4/19/92 7:59	4.524			
4/19/92 8:59	4.515			
4/19/92 9:59	4.54			
4/19/92 10:59	4.543			
4/19/92 11:59	4.556			
4/19/92 12:59	4.565			
4/19/92 13:59	4.628			
4/19/92 14:59	4.584			
4/19/92 15:59	4.581			
4/19/92 16:59	4.537			

Time	Elevation	Average 1	Average 2	Final Average
4/16/92 17:59	4.705	4.69916667	4.686196667	4.678353
4/16/92 18:59	4.705	4.698	4.685316667	
4/16/92 19:59	4.718	4.69695833	4.684466667	
4/16/92 20:59	4.727	4.695625	4.683643333	
4/16/92 21:59	4.724	4.69416667	4.682858333	
4/16/92 22:59	4.721	4.69283333	4.682106667	
4/16/92 23:59	4.718	4.69179167	4.681396667	
4/17/92 0:59	4.705	4.69058333	4.680713333	
4/17/92 1:59	4.696	4.68966667	4.680073333	
4/17/92 2:59	4.689	4.689	4.67947	
4/17/92 3:59	4.686	4.68833333	4.678888333	
4/17/92 4:59	4.683	4.68716667	4.678316667	
4/17/92 5:59	4.689	4.686125	4.677791667	
4/17/92 6:59	4.689	4.68508333	4.677281667	
4/17/92 7:59	4.699	4.68404167	4.676771667	
4/17/92 8:59	4.689	4.68245833	4.676276667	
4/17/92 9:59	4.721	4.68129167	4.675808333	
4/17/92 10:59	4.708	4.67958333	4.67535	
4/17/92 11:59	4.689	4.67829167	4.674933333	
4/17/92 12:59	4.696	4.67779167	4.674551667	
4/17/92 13:59	4.686	4.67725	4.674153333	
4/17/92 14:59	4.683	4.677375	4.673776667	
4/17/92 15:59	4.677	4.6775	4.673358333	
4/17/92 16:59	4.677	4.6775	4.672913333	
4/17/92 17:59	4.677	4.67733333	4.672411667	
4/17/92 18:59	4.68	4.67716667		
4/17/92 19:59	4.686	4.67675		
4/17/92 20:59	4.692	4.676375		
4/17/92 21:59	4.692	4.676		
4/17/92 22:59	4.696	4.675375		
4/17/92 23:59	4.689	4.67508333		
4/18/92 0:59	4.683	4.67470833		
4/18/92 1:59	4.68	4.67458333		
4/18/92 2:59	4.673	4.67458333		
4/18/92 3:59	4.658	4.67445833		
4/18/92 4:59	4.658	4.67404167		
4/18/92 5:59	4.664	4.67404167		
4/18/92 6:59	4.664	4.673375		
4/18/92 7:59	4.661	4.67233333		
4/18/92 8:59	4.661	4.67166667		
4/18/92 9:59	4.68	4.67075		
4/18/92 10:59	4.677	4.66983333		
4/18/92 11:59	4.677	4.66916667		
4/18/92 12:59	4.683	4.66875		

4/18/92 13:59	4.689	4.66783333		
4/18/92 14:59	4.686	4.66783333		
4/18/92 15:59	4.677	4.66691667		
4/18/92 16:59	4.673	4.666375		
4/18/92 17:59	4.673	4.66495833		
4/18/92 18:59	4.67			
4/18/92 19:59	4.677			
4/18/92 20:59	4.683			
4/18/92 21:59	4.677			
4/18/92 22:59	4.689			
4/18/92 23:59	4.68			
4/19/92 0:59	4.68			
4/19/92 1:59	4.68			
4/19/92 2:59	4.67			
4/19/92 3:59	4.648			
4/19/92 4:59	4.658			
4/19/92 5:59	4.648			
4/19/92 6:59	4.639			
4/19/92 7:59	4.645			
4/19/92 8:59	4.639			
4/19/92 9:59	4.658			
4/19/92 10:59	4.661			
4/19/92 11:59	4.667			
4/19/92 12:59	4.661			
4/19/92 13:59	4.689			
4/19/92 14:59	4.664			
4/19/92 15:59	4.664			
4/19/92 16:59	4.639			

Time	Elevation	Average 1	Average 2	Final Average
4/16/92 18:00	4.473	4.49566667	4.480481667	4.470464533
4/16/92 19:00	4.486	4.494375	4.479415	
4/16/92 20:00	4.505	4.49279167	4.478368333	
4/16/92 21:00	4.524	4.49108333	4.477348333	
4/16/92 22:00	4.536	4.48925	4.47636	
4/16/92 23:00	4.549	4.48770833	4.475408333	
4/17/92 0:00	→ 4.555	4.486125	4.474481667	
4/17/92 1:00	4.542	4.48470833	4.473591667	
4/17/92 2:00	4.527	4.48395833	4.472736667	
4/17/92 3:00	4.502	4.48329167	4.471911667	
4/17/92 4:00	4.486	4.482875	4.471125	
4/17/92 5:00	4.473	4.48220833	4.470366667	
4/17/92 6:00	4.467	4.48141667	4.469641667	
4/17/92 7:00	→ 4.47	4.480375	4.468941667	
4/17/92 8:00	4.47	4.47891667	4.468278333	
4/17/92 9:00	4.477	4.47720833	4.467656667	
4/17/92 10:00	4.489	4.47533333	4.467071667	
4/17/92 11:00	4.489	4.4735	4.466525	
4/17/92 12:00	4.489	4.47220833	4.466018333	
4/17/92 13:00	4.502	4.47129167	4.465521667	
4/17/92 14:00	4.499	4.47008333	4.465025	
4/17/92 15:00	4.483	4.46941667	4.464555	
4/17/92 16:00	4.458	4.46929167	4.464085	
4/17/92 17:00	4.445	4.46954167	4.463603333	
4/17/92 18:00	4.442	4.46941667	4.463095	
4/17/92 19:00	4.448	4.469		
4/17/92 20:00	4.464	4.46820833		
4/17/92 21:00	4.48	4.46729167		
4/17/92 22:00	4.499	4.466375		
4/17/92 23:00	4.511	4.46545833		
4/18/92 0:00	4.521	4.46454167		
4/18/92 1:00	→ 4.524	4.463875		
4/18/92 2:00	4.511	4.46333333		
4/18/92 3:00	4.492	4.46333333		
4/18/92 4:00	4.47	4.463625		
4/18/92 5:00	4.454	4.46391667		
4/18/92 6:00	4.442	4.46408333		
4/18/92 7:00	→ 4.435	4.46391667		
4/18/92 8:00	4.429	4.46379167		
4/18/92 9:00	4.432	4.463375		
4/18/92 10:00	4.445	4.46258333		
4/18/92 11:00	4.458	4.46166667		
4/18/92 12:00	4.467	4.46083333		
4/18/92 13:00	4.473	4.45979167		

4/18/92 14:00	4.483	4.458875		
4/18/92 15:00	4.48	4.45833333		
4/18/92 16:00	4.464	4.45766667		
4/18/92 17:00	4.442	4.45725		
4/18/92 18:00	4.432	4.45683333		
4/18/92 19:00	4.429			
4/18/92 20:00	4.442			
4/18/92 21:00	4.458			
4/18/92 22:00	4.477			
4/18/92 23:00	4.489			
4/19/92 0:00	4.505			
4/19/92 1:00	4.511			
4/19/92 2:00	4.511			
4/19/92 3:00	4.499			
4/19/92 4:00	4.477			
4/19/92 5:00	4.458			
4/19/92 6:00	4.438			
4/19/92 7:00	4.432			
4/19/92 8:00	4.419			
4/19/92 9:00	4.413			
4/19/92 10:00	4.423			
4/19/92 11:00	4.438			
4/19/92 12:00	4.442			
4/19/92 13:00	4.451			
4/19/92 14:00	4.47			
4/19/92 15:00	4.464			
4/19/92 16:00	4.454			
4/19/92 17:00	4.432			

Time	Elevation	Average 1	Average 2	Final Average
4/16/92 17:57	3.968	4.04858333	4.025091667	4.0103862
4/16/92 18:57	3.974	4.04754167	4.02327	
4/16/92 19:57	4.012	4.045875	4.021495	
4/16/92 20:57	4.077	4.04341667	4.019765	
4/16/92 21:57	4.148	4.04029167	4.018093333	
4/16/92 22:57	4.22	4.03695833	4.01649	
4/16/92 23:57	→ 4.286	4.03358333	4.014956667	
4/17/92 0:57	4.301	4.03016667	4.013511667	
4/17/92 1:57	4.267	4.02833333	4.012178333	
4/17/92 2:57	4.183	4.02791667	4.01095	
4/17/92 3:57	4.101	4.02841667	4.009836667	
4/17/92 4:57	4.015	4.02870833	4.008816667	
4/17/92 5:57	3.931	4.02883333	4.007903333	
4/17/92 6:57	→ 3.878	4.02895833	4.007093333	
4/17/92 7:57	3.846	4.02791667	4.006376667	
4/17/92 8:57	3.862	4.02570833	4.005765	
4/17/92 9:57	3.906	4.02220833	4.005236667	
4/17/92 10:57	3.956	4.01779167	4.0048	
4/17/92 11:57	4.012	4.013375	4.004466667	
4/17/92 12:57	4.062	4.00920833	4.004211667	
4/17/92 13:57	4.086	4.00541667	4.00403	
4/17/92 14:57	4.074	4.00258333	4.003906667	
4/17/92 15:57	4.027	4.00141667	4.00383	
4/17/92 16:57	3.974	4.00158333	4.003793333	
4/17/92 17:57	3.943	4.0025	4.003786667	
4/17/92 18:57	3.934	4.00304167		
4/17/92 19:57	3.953	4.00316667		
4/17/92 20:57	4.002	4.002625		
4/17/92 21:57	4.068	4.001625		
4/17/92 22:57	4.139	4.00020833		
4/17/92 23:57	4.204	3.998625		
4/18/92 0:57	→ 4.257	3.99745833		
4/18/92 1:57	4.257	3.99683333		
4/18/92 2:57	4.195	3.997625		
4/18/92 3:57	4.108	4.00008333		
4/18/92 4:57	4.018	4.00291667		
4/18/92 5:57	3.934	4.005875		
4/18/92 6:57	→ 3.853	4.00858333		
4/18/92 7:57	3.793	4.01104167		
4/18/92 8:57	3.778	4.012625		
4/18/92 9:57	3.8	4.0125		
4/18/92 10:57	3.85	4.01129167		
4/18/92 11:57	3.912	4.00945833		
4/18/92 12:57	3.971	4.007		

4/18/92 13:57	4.018	4.00466667		
4/18/92 14:57	4.046	4.00233333		
4/18/92 15:57	4.031	4.00066667		
4/18/92 16:57	3.996	4.0005		
4/18/92 17:57	3.956	4.00141667		
4/18/92 18:57	3.937			
4/18/92 19:57	3.94			
4/18/92 20:57	3.978			
4/18/92 21:57	4.034			
4/18/92 22:57	4.101			
4/18/92 23:57	4.176			
4/19/92 0:57	4.242			
4/19/92 1:57	4.276			
4/19/92 2:57	4.254			
4/19/92 3:57	4.176			
4/19/92 4:57	4.089			
4/19/92 5:57	3.999			
4/19/92 6:57	3.912			
4/19/92 7:57	3.831			
4/19/92 8:57	3.775			
4/19/92 9:57	3.771			
4/19/92 10:57	3.806			
4/19/92 11:57	3.853			
4/19/92 12:57	3.915			
4/19/92 13:57	3.962			
4/19/92 14:57	4.006			
4/19/92 15:57	4.027			
4/19/92 16:57	4.018			

Time	Elevation	Average 1	Average 2	Final Average
4/16/92 17:54	2.190863436	2.42801779	2.404065303	2.409939155
4/16/92 18:54	2.209168488	2.4287805	2.403128248	
4/16/92 19:54	2.326209946	2.42750921	2.402355838	
4/16/92 20:54	2.505058015	2.42354748	2.40174198	
4/16/92 21:54	2.688304511	2.41789682	2.401281519	
4/16/92 22:54	2.862614149	2.41127398	2.401001523	
4/16/92 23:54	—> 3.000303259	2.40464226	2.400930891	
4/17/92 0:54	2.990649689	2.39852738	2.401090256	
4/17/92 1:54	2.865636548	2.39664117	2.401529431	
4/17/92 2:54	2.639808589	2.39893221	2.402207018	
4/17/92 3:54	2.418731757	2.40337584	2.403119475	
4/17/92 4:54	2.206117971	2.40722591	2.404221159	
4/17/92 5:54	2.027130572	2.41070662	2.405516705	
4/17/92 6:54	—> 1.924914042	2.41315219	2.407007663	
4/17/92 7:54	1.903473026	2.41327979	2.408674063	
4/17/92 8:54	1.992870539	2.41016366	2.410495739	
4/17/92 9:54	2.153628726	2.403987	2.412467607	
4/17/92 10:54	2.314027075	2.39626868	2.414568136	
4/17/92 11:54	2.486221092	2.38996699	2.416766595	
4/17/92 12:54	2.593706624	2.38421336	2.418980428	
4/17/92 13:54	2.636776489	2.38051967	2.421234897	
4/17/92 14:54	2.581569534	2.38001426	2.423452988	
4/17/92 15:54	2.446708088	2.38383025	2.425579109	
4/17/92 16:54	2.307934859	2.39073887	2.427587973	
4/17/92 17:54	2.209168488	2.39842067	2.429474336	
4/17/92 18:54	2.178657468	2.40459143		
4/17/92 19:54	2.231128369	2.40947024		
4/17/92 20:54	2.36944233	2.41216276		
4/17/92 21:54	2.529356334	2.41203594		
4/17/92 22:54	2.703452659	2.41089693		
4/17/92 23:54	2.853546174	2.40950818		
4/18/92 0:54	—> 2.945380824	2.40862638		
4/18/92 1:54	2.920621473	2.40950676		
4/18/92 2:54	2.746455668	2.41358087		
4/18/92 3:54	2.511133375	2.42174362		
4/18/92 4:54	2.289655091	2.43091793		
4/18/92 5:54	2.0858241	2.43961457		
4/18/92 6:54	—> 1.927976524	2.44798057		
4/18/92 7:54	1.828685948	2.45481218		
4/18/92 8:54	1.84463067	2.45882169		
4/18/92 9:54	1.968389099	2.45946036		
4/18/92 10:54	2.162786597	2.45650023		
4/18/92 11:54	2.348133869	2.45123014		
4/18/92 12:54	2.505058015	2.44531281		

4/18/92 13:54	2.624646786	2.4405751		
4/18/92 14:54	2.673153112	2.43597194		
4/18/92 15:54	2.612515002	2.43316729		
4/18/92 16:54	2.492298065	2.43405185		
4/18/92 17:54	2.357266847	2.43789793		
4/18/92 18:54	2.295748867			
4/18/92 19:54	2.295748867			
4/18/92 20:54	2.366398654			
4/18/92 21:54	2.50202014			
4/18/92 22:54	2.670122442			
4/18/92 23:54	2.832383013			
4/19/92 0:54	2.966509936			
4/19/92 1:54	3.018400114			
4/19/92 2:54	2.942361859			
4/19/92 3:54	2.731316755			
4/19/92 4:54	2.498374518			
4/19/92 5:54	2.286608008			
4/19/92 6:54	2.091935252			
4/19/92 7:54	1.924914042			
4/19/92 8:54	1.859958817			
4/19/92 9:54	1.897345851			
4/19/92 10:54	2.036304596			
4/19/92 11:54	2.206117971			
4/19/92 12:54	2.391352956			
4/19/92 13:54	2.51417086			
4/19/92 14:54	2.605841634			
4/19/92 15:54	2.633744258			
4/19/92 16:54	2.584604002			

Time	Elevation	Average 1	Average 2	Final Average
4/16/92 17:55	4.057597521	4.1651992	4.223518815	4.178264941
4/16/92 18:55	4.279773506	4.14731361	4.221158049	
4/16/92 19:55	4.409524759	4.14133332	4.218815061	
4/16/92 20:55	4.549162185	4.14984618	4.217022886	
4/16/92 21:55	4.658262243	4.1635756	4.215104722	
4/16/92 22:55	4.750401562	4.17432441	4.212213037	
4/16/92 23:55	→ 4.824971048	4.18405504	4.208728253	
4/17/92 0:55	4.878668452	4.19477976	4.204673446	
4/17/92 1:55	4.810869043	4.20594244	4.200812042	
4/17/92 2:55	4.689212235	4.21934506	4.19752515	
4/17/92 3:55	4.539052271	4.23600519	4.194683963	
4/17/92 4:55	4.423702728	4.25172108	4.1916104	
4/17/92 5:55	4.337918919	4.26799292	4.187897008	
4/17/92 6:55	→ 4.283155282	4.28487162	4.184092761	
4/17/92 7:55	4.235796606	4.29909875	4.180099411	
4/17/92 8:55	4.146410758	4.31047032	4.175377287	
4/17/92 9:55	3.80346596	4.31746406	4.169486162	
4/17/92 10:55	3.417256568	4.32018542	4.162580992	
4/17/92 11:55	3.878978624	4.31890254	4.154422494	
4/17/92 12:55	3.237822865	4.28177184	4.144785075	
4/17/92 13:55	3.327591794	4.2645849	4.135126209	
4/17/92 14:55	3.628343324	4.22574437	4.125810144	
4/17/92 15:55	3.455554768	4.18414765	4.117148623	
4/17/92 16:55	3.34128781	4.14975045	4.10981309	
4/17/92 17:55	3.628343324	4.12954465	4.10411845	
4/17/92 18:55	4.136246583	4.10618007		
4/17/92 19:55	4.613833299	4.08873889		
4/17/92 20:55	4.878668452	4.09652894		
4/17/92 21:55	4.916233523	4.10189208		
4/17/92 22:55	4.983936691	4.09128348		
4/17/92 23:55	5.082364332	4.08720481		
4/18/92 0:55	→ 5.146572815	4.08268487		
4/18/92 1:55	5.132531989	4.09824465		
4/18/92 2:55	5.089055325	4.12377015		
4/18/92 3:55	4.916233523	4.14831538		
4/18/92 4:55	4.814226906	4.15916612		
4/18/92 5:55	4.74300772	4.15888629		
4/18/92 6:55	→ 4.62460638	4.17288674		
4/18/92 7:55	4.508714335	4.18503787		
4/18/92 8:55	4.314260505	4.18104564		
4/18/92 9:55	3.86877858	4.1631922		
4/18/92 10:55	3.386467436	4.14483479		
4/18/92 11:55	2.987841799	4.11622297		
4/18/92 12:55	2.825336452	4.07796706		

4/18/92 13:55	2.395418927	4.04030019		
4/18/92 14:55	2.630022028	4.0316833		
4/18/92 15:55	2.630022028	4.00920633		
4/18/92 16:55	2.856348724	4.00075933		
4/18/92 17:55	3.067593396	4.00738445		
4/18/92 18:55	3.71765826			
4/18/92 19:55	4.800794544			
4/18/92 20:55	5.007383739			
4/18/92 21:55	4.661626994			
4/18/92 22:55	4.886048808			
4/18/92 23:55	4.97388568			
4/19/92 0:55	5.52000748			
4/19/92 1:55	5.74514397			
4/19/92 2:55	5.678140854			
4/19/92 3:55	5.176651286			
4/19/92 4:55	4.807511028			
4/19/92 5:55	5.079018608			
4/19/92 6:55	4.916233523			
4/19/92 7:55	4.412900709			
4/19/92 8:55	3.885777895			
4/19/92 9:55	3.428200853			
4/19/92 10:55	2.699783666			
4/19/92 11:55	2.069700039			
4/19/92 12:55	1.921331435			
4/19/92 13:55	2.188613592			
4/19/92 14:55	2.090574903			
4/19/92 15:55	2.427293878			
4/19/92 16:55	3.015351575			

Time	Elevation	Average 1	Average 2	Final Average
4/16/92 17:54	2.467	2.77141667	2.759378333	2.788564067
4/16/92 18:54	2.518	2.77354167	2.760038333	
4/16/92 19:54	2.682	2.773	2.760918333	
4/16/92 20:54	2.894	2.76891667	2.762015	
4/16/92 21:54	3.107	2.763125	2.763326667	
4/16/92 22:54	3.297	2.75658333	2.764886667	
4/16/92 23:54	→ 3.414	2.75025	2.766715	
4/17/92 0:54	3.37	2.74525	2.768843333	
4/17/92 1:54	3.193	2.74495833	2.771303333	
4/17/92 2:54	2.897	2.74941667	2.77405	
4/17/92 3:54	2.622	2.75633333	2.777086667	
4/17/92 4:54	2.385	2.762375	2.780345	
4/17/92 5:54	2.198	2.7675	2.783805	
4/17/92 6:54	→ 2.126	2.77108333	2.787465	
4/17/92 7:54	2.154	2.77158333	2.791298333	
4/17/92 8:54	2.312	2.76829167	2.795291667	
4/17/92 9:54	2.54	2.76170833	2.799433333	
4/17/92 10:54	2.758	2.75379167	2.803691667	
4/17/92 11:54	2.944	2.74770833	2.808035	
4/17/92 12:54	3.063	2.74391667	2.812383333	
4/17/92 13:54	3.101	2.74275	2.816695	
4/17/92 14:54	3.001	2.74525	2.820906667	
4/17/92 15:54	2.827	2.75325	2.82496	
4/17/92 16:54	2.644	2.76491667	2.828805	
4/17/92 17:54	2.518	2.77754167	2.832425	
4/17/92 18:54	2.505	2.78791667		
4/17/92 19:54	2.584	2.79554167		
4/17/92 20:54	2.755	2.80041667		
4/17/92 21:54	2.95	2.80170833		
4/17/92 22:54	3.145	2.802125		
4/17/92 23:54	3.294	2.80229167		
4/18/92 0:54	→ 3.363	2.80345833		
4/18/92 1:54	3.3	2.80675		
4/18/92 2:54	3.063	2.813625		
4/18/92 3:54	2.767	2.82533333		
4/18/92 4:54	2.508	2.83779167		
4/18/92 5:54	2.284	2.848875		
4/18/92 6:54	→ 2.138	2.859		
4/18/92 7:54	2.075	2.86691667		
4/18/92 8:54	2.154	2.87141667		
4/18/92 9:54	2.35	2.87183333		
4/18/92 10:54	2.612	2.86816667		
4/18/92 11:54	2.853	2.862375		
4/18/92 12:54	3.035	2.85641667		

4/18/92 13:54	3.161	2.85170833		
4/18/92 14:54	3.193	2.84804167		
4/18/92 15:54	3.107	2.84658333		
4/18/92 16:54	2.947	2.849375		
4/18/92 17:54	2.767	2.85541667		
4/18/92 18:54	2.688			
4/18/92 19:54	2.701			
4/18/92 20:54	2.786			
4/18/92 21:54	2.96			
4/18/92 22:54	3.149			
4/18/92 23:54	3.322			
4/19/92 0:54	3.442			
4/19/92 1:54	3.465			
4/19/92 2:54	3.344			
4/19/92 3:54	3.066			
4/19/92 4:54	2.774			
4/19/92 5:54	2.527			
4/19/92 6:54	2.328			
4/19/92 7:54	2.183			
4/19/92 8:54	2.164			
4/19/92 9:54	2.262			
4/19/92 10:54	2.473			
4/19/92 11:54	2.71			
4/19/92 12:54	2.922			
4/19/92 13:54	3.073			
4/19/92 14:54	3.158			
4/19/92 15:54	3.174			
4/19/92 16:54	3.092			

Time	Elevation	Average 1	Average 2	Final Average
4/16/92 17:56	2.801	3.01379167	3.003473333	3.032312333
4/16/92 18:56	2.836	3.01483333	3.00422	
4/16/92 19:56	2.977	3.01379167	3.005195	
4/16/92 20:56	3.135	3.00958333	3.006405	
4/16/92 21:56	3.282	3.00479167	3.007856667	
4/16/92 22:56	3.423	2.99983333	3.009563333	
4/16/92 23:56	—> 3.507	2.995	3.011505	
4/17/92 0:56	3.464	2.99095833	3.013718333	
4/17/92 1:56	3.329	2.99108333	3.016213333	
4/17/92 2:56	3.092	2.99420833	3.018965	
4/17/92 3:56	2.898	2.99966667	3.021993333	
4/17/92 4:56	2.726	3.004125	3.025198333	
4/17/92 5:56	2.617	3.00816667	3.028548333	
4/17/92 6:56	—> 2.554	3.010125	3.032028333	
4/17/92 7:56	2.57	3.01066667	3.035653333	
4/17/92 8:56	2.676	3.00804167	3.039408333	
4/17/92 9:56	2.848	3.00308333	3.04331	
4/17/92 10:56	2.989	2.99775	3.04729	
4/17/92 11:56	3.123	2.994125	3.051305	
4/17/92 12:56	3.207	2.99191667	3.055288333	
4/17/92 13:56	3.223	2.99245833	3.059193333	
4/17/92 14:56	3.151	2.99620833	3.06291	
4/17/92 15:56	3.008	3.00375	3.066398333	
4/17/92 16:56	2.895	3.014375	3.069616667	
4/17/92 17:56	2.826	3.0245	3.072551667	
4/17/92 18:56	2.811	3.03245833		
4/17/92 19:56	2.876	3.03920833		
4/17/92 20:56	3.02	3.04404167		
4/17/92 21:56	3.163	3.045875		
4/17/92 22:56	3.307	3.04745833		
4/17/92 23:56	3.41	3.048375		
4/18/92 0:56	—> 3.467	3.05033333		
4/18/92 1:56	3.404	3.05333333		
4/18/92 2:56	3.223	3.059875		
4/18/92 3:56	3.005	3.06991667		
4/18/92 4:56	2.823	3.07979167		
4/18/92 5:56	2.664	3.087875		
4/18/92 6:56	—> 2.567	3.09516667		
4/18/92 7:56	2.507	3.10075		
4/18/92 8:56	2.557	3.10454167		
4/18/92 9:56	2.72	3.10558333		
4/18/92 10:56	2.902	3.10258333		
4/18/92 11:56	3.07	3.098125		
4/18/92 12:56	3.22	3.09370833		

4/18/92 13:56	3.313	3.08954167		
4/18/92 14:56	3.332	3.085375		
4/18/92 15:56	3.263	3.08341667		
4/18/92 16:56	3.138	3.08420833		
4/18/92 17:56	3.017	3.08775		
4/18/92 18:56	2.973			
4/18/92 19:56	2.992			
4/18/92 20:56	3.064			
4/18/92 21:56	3.201			
4/18/92 22:56	3.329			
4/18/92 23:56	3.457			
4/19/92 0:56	3.539			
4/19/92 1:56	3.561			
4/19/92 2:56	3.464			
4/19/92 3:56	3.242			
4/19/92 4:56	3.017			
4/19/92 5:56	2.839			
4/19/92 6:56	2.701			
4/19/92 7:56	2.598			
4/19/92 8:56	2.582			
4/19/92 9:56	2.648			
4/19/92 10:56	2.795			
4/19/92 11:56	2.964			
4/19/92 12:56	3.12			
4/19/92 13:56	3.213			
4/19/92 14:56	3.285			
4/19/92 15:56	3.282			
4/19/92 16:56	3.223			

Time	Elevation	Average 1	Average 2	Final Average
4/16/92 17:58	2.084	2.54341667	2.49949	2.493826867
4/16/92 18:58	2.175	2.54420833	2.497378333	
4/16/92 19:58	2.444	2.54108333	2.495418333	
4/16/92 20:58	2.774	2.5325	2.4936	
4/16/92 21:58	3.093	2.52241667	2.491946667	
4/16/92 22:58	3.349	2.5115	2.490491667	
4/16/92 23:58	→ 3.497	2.501625	2.489258333	
4/17/92 0:58	3.421	2.494125	2.488305	
4/17/92 1:58	3.131	2.49295833	2.487673333	
4/17/92 2:58	2.661	2.49795833	2.487371667	
4/17/92 3:58	2.28	2.50675	2.487401667	
4/17/92 4:58	1.948	2.51304167	2.487661667	
4/17/92 5:58	1.718	2.51804167	2.488153333	
4/17/92 6:58	→ 1.629	2.52	2.48884	
4/17/92 7:58	1.692	2.517625	2.489753333	
4/17/92 8:58	1.945	2.509625	2.490876667	
4/17/92 9:58	2.276	2.49633333	2.49221	
4/17/92 10:58	2.582	2.4815	2.493726667	
4/17/92 11:58	2.815	2.46825	2.495415	
4/17/92 12:58	2.967	2.45879167	2.49722	
4/17/92 13:58	2.973	2.452875	2.499081667	
4/17/92 14:58	2.812	2.45220833	2.500943333	
4/17/92 15:58	2.519	2.45825	2.50278	
4/17/92 16:58	2.257	2.47008333	2.504543333	
4/17/92 17:58	2.103	2.48208333	2.506131667	
4/17/92 18:58	2.1	2.490625		
4/17/92 19:58	2.238	2.49520833		
4/17/92 20:58	2.532	2.495625		
4/17/92 21:58	2.831	2.49116667		
4/17/92 22:58	3.112	2.48604167		
4/17/92 23:58	3.317	2.48066667		
4/18/92 0:58	→ 3.393	2.47779167		
4/18/92 1:58	3.251	2.47833333		
4/18/92 2:58	2.872	2.48541667		
4/18/92 3:58	2.431	2.49870833		
4/18/92 4:58	2.068	2.51325		
4/18/92 5:58	1.765	2.52533333		
4/18/92 6:58	→ 1.572	2.53520833		
4/18/92 7:58	1.5	2.54283333		
4/18/92 8:58	1.626	2.54570833		
4/18/92 9:58	1.92	2.54295833		
4/18/92 10:58	2.264	2.53425		
4/18/92 11:58	2.588	2.52370833		
4/18/92 12:58	2.825	2.513375		

4/18/92 13:58	2.957	2.50533333		
4/18/92 14:58	2.957	2.49941667		
4/18/92 15:58	2.803	2.498125		
4/18/92 16:58	2.545	2.50233333		
4/18/92 17:58	2.308	2.50979167		
4/18/92 18:58	2.21			
4/18/92 19:58	2.248			
4/18/92 20:58	2.425			
4/18/92 21:58	2.708			
4/18/92 22:58	2.983			
4/18/92 23:58	3.248			
4/19/92 0:58	3.406			
4/19/92 1:58	3.421			
4/19/92 2:58	3.191			
4/19/92 3:58	2.78			
4/19/92 4:58	2.358			
4/19/92 5:58	2.002			
4/19/92 6:58	1.755			
4/19/92 7:58	1.569			
4/19/92 8:58	1.56			
4/19/92 9:58	1.711			
4/19/92 10:58	2.011			
4/19/92 11:58	2.34			
4/19/92 12:58	2.632			
4/19/92 13:58	2.815			
4/19/92 14:58	2.926			
4/19/92 15:58	2.904			
4/19/92 16:58	2.724			

Time	Elevation	Average 1	Average 2	Final Average
4/16/92 17:58	1.852	2.29475	2.253488333	2.250864867
4/16/92 18:58	1.934	2.29541667	2.25161	
4/16/92 19:58	2.201	2.29291667	2.249895	
4/16/92 20:58	2.526	2.28495833	2.248306667	
4/16/92 21:58	2.837	2.27520833	2.246878333	
4/16/92 22:58	3.081	2.264625	2.24566	
4/16/92 23:58	—> 3.224	2.255125	2.244675	
4/17/92 0:58	3.144	2.24783333	2.24398	
4/17/92 1:58	2.856	2.24679167	2.243618333	
4/17/92 2:58	2.396	2.25191667	2.24359	
4/17/92 3:58	2.026	2.260625	2.243891667	
4/17/92 4:58	1.706	2.26670833	2.244425	
4/17/92 5:58	1.487	2.27158333	2.245196667	
4/17/92 6:58	—> 1.405	2.27345833	2.246163333	
4/17/92 7:58	1.471	2.27091667	2.247361667	
4/17/92 8:58	1.722	2.262875	2.248771667	
4/17/92 9:58	2.039	2.24966667	2.250376667	
4/17/92 10:58	2.33	2.23525	2.252166667	
4/17/92 11:58	2.564	2.223125	2.254115	
4/17/92 12:58	2.716	2.21441667	2.256148333	
4/17/92 13:58	2.719	2.209125	2.258213333	
4/17/92 14:58	2.551	2.20875	2.260278333	
4/17/92 15:58	2.264	2.215125	2.262331667	
4/17/92 16:58	2.023	2.22708333	2.264331667	
4/17/92 17:58	1.868	2.23895833	2.266148333	
4/17/92 18:58	1.874	2.24779167		
4/17/92 19:58	2.01	2.25254167		
4/17/92 20:58	2.292	2.25320833		
4/17/92 21:58	2.583	2.24925		
4/17/92 22:58	2.853	2.24475		
4/17/92 23:58	3.049	2.24		
4/18/92 0:58	—> 3.119	2.23775		
4/18/92 1:58	2.979	2.23879167		
4/18/92 2:58	2.605	2.24608333		
4/18/92 3:58	2.172	2.25945833		
4/18/92 4:58	1.823	2.27395833		
4/18/92 5:58	1.532	2.286		
4/18/92 6:58	—> 1.344	2.29575		
4/18/92 7:58	1.278	2.30341667		
4/18/92 8:58	1.405	2.30616667		
4/18/92 9:58	1.693	2.303		
4/18/92 10:58	2.039	2.29441667		
4/18/92 11:58	2.355	2.28395833		
4/18/92 12:58	2.589	2.27395833		

4/18/92 13:58	2.71	2.26604167		
4/18/92 14:58	2.704	2.26075		
4/18/92 15:58	2.551	2.26008333		
4/18/92 16:58	2.308	2.265125		
4/18/92 17:58	2.08	2.2725		
4/18/92 18:58	1.988			
4/18/92 19:58	2.026			
4/18/92 20:58	2.197			
4/18/92 21:58	2.475			
4/18/92 22:58	2.739			
4/18/92 23:58	2.995			
4/19/92 0:58	3.144			
4/19/92 1:58	3.154			
4/19/92 2:58	2.926			
4/19/92 3:58	2.52			
4/19/92 4:58	2.112			
4/19/92 5:58	1.766			
4/19/92 6:58	1.528			
4/19/92 7:58	1.344			
4/19/92 8:58	1.329			
4/19/92 9:58	1.487			
4/19/92 10:58	1.788			
4/19/92 11:58	2.115			
4/19/92 12:58	2.399			
4/19/92 13:58	2.583			
4/19/92 14:58	2.688			
4/19/92 15:58	2.672			
4/19/92 16:58	2.485			

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Time	Elevation	Average 1	Average 2	Final Average
4/16/92 18:06	5.694	5.66070833	5.638635	5.6266096
4/16/92 19:06	5.691	5.658375	5.637263333	
4/16/92 20:06	5.688	5.65604167	5.635968333	
4/16/92 21:06	5.685	5.65383333	5.63474	
4/16/92 22:06	5.685	5.65145833	5.63358	
4/16/92 23:06	5.685	5.64895833	5.63249	
4/17/92 0:06	→ 5.682	5.64658333	5.63147	
4/17/92 1:06	5.672	5.6445	5.630498333	
4/17/92 2:06	5.669	5.64254167	5.62958	
4/17/92 3:06	5.669	5.641	5.628698333	
4/17/92 4:06	5.666	5.63929167	5.627853333	
4/17/92 5:06	5.66	5.63758333	5.627046667	
4/17/92 6:06	5.657	5.636	5.626268333	
4/17/92 7:06	→ 5.65	5.63454167	5.625503333	
4/17/92 8:06	5.644	5.633	5.62475	
4/17/92 9:06	5.638	5.63133333	5.624001667	
4/17/92 10:06	5.638	5.63004167	5.623263333	
4/17/92 11:06	**5.635**	5.629	5.622505	
4/17/92 12:06	5.638	5.62845833	5.621706667	
4/17/92 13:06	5.641	5.62779167	5.620848333	
4/17/92 14:06	5.647	5.62741667	5.619923333	
4/17/92 15:06	5.641	5.62704167	5.61891	
4/17/92 16:06	5.641	5.62691667	5.617808333	
4/17/92 17:06	5.641	5.62679167	5.616608333	
4/17/92 18:06	5.638	5.62666667	5.61532	
4/17/92 19:06	5.635	5.62641667		
4/17/92 20:06	5.635	5.626		
4/17/92 21:06	5.628	5.62533333		
4/17/92 22:06	5.625	5.62483333		
4/17/92 23:06	5.628	5.62420833		
4/18/92 0:06	5.632	5.62345833		
4/18/92 1:06	→ 5.625	5.62229167		
4/18/92 2:06	5.632	5.62154167		
4/18/92 3:06	5.628	5.6205		
4/18/92 4:06	5.625	5.619875		
4/18/92 5:06	5.622	5.619125		
4/18/92 6:06	5.622	5.618125		
4/18/92 7:06	→ 5.613	5.616875		
4/18/92 8:06	5.604	5.61570833		
4/18/92 9:06	5.607	5.61429167		
4/18/92 10:06	5.613	5.612875		
4/18/92 11:06	5.622	5.61108333		
4/18/92 12:06	5.622	5.60904167		
4/18/92 13:06	5.632	5.607		

4/18/92 14:06	5.638	5.60466667		
4/18/92 15:06	5.638	5.60208333		
4/18/92 16:06	5.638	5.5995		
4/18/92 17:06	5.638	5.59691667		
4/18/92 18:06	5.632	5.59458333		
4/18/92 19:06	5.625			
4/18/92 20:06	5.619			
4/18/92 21:06	5.616			
4/18/92 22:06	5.61			
4/18/92 23:06	5.61			
4/19/92 0:06	5.604			
4/19/92 1:06	5.607			
4/19/92 2:06	5.607			
4/19/92 3:06	5.613			
4/19/92 4:06	5.607			
4/19/92 5:06	5.598			
4/19/92 6:06	5.592			
4/19/92 7:06	5.585			
4/19/92 8:06	5.57			
4/19/92 9:06	5.573			
4/19/92 10:06	5.57			
4/19/92 11:06	5.573			
4/19/92 12:06	5.573			
4/19/92 13:06	5.576			
4/19/92 14:06	5.576			
4/19/92 15:06	5.576			
4/19/92 16:06	5.576			
4/19/92 17:06	5.582			

Time	Elevation	Average 1	Average 2	Final Average
4/16/92 18:02	6.181	6.14441667	6.148595	6.167595333
4/16/92 19:02	6.171	6.144	6.149595	
4/16/92 20:02	6.168	6.144	6.150718333	
4/16/92 21:02	6.162	6.14466667	6.15192	
4/16/92 22:02	6.156	6.14504167	6.153175	
4/16/92 23:02	6.162	6.144625	6.15452	
4/17/92 0:02	→ 6.156	6.14370833	6.155976667	
4/17/92 1:02	6.149	6.14304167	6.157558333	
4/17/92 2:02	6.149	6.14316667	6.159241667	
4/17/92 3:02	6.149	6.14358333	6.160988333	
4/17/92 4:02	6.159	6.143875	6.162813333	
4/17/92 5:02	6.156	6.144	6.164711667	
4/17/92 6:02	6.149	6.1445	6.166668333	
4/17/92 7:02	→ 6.146	6.14558333	6.168661667	
4/17/92 8:02	6.13	6.14558333	6.17069	
4/17/92 9:02	6.115	6.146125	6.172765	
4/17/92 10:02	6.118	6.146625	6.17486	
4/17/92 11:02	6.105	6.14766667	6.176956667	
4/17/92 12:02	6.096	6.14991667	6.179021667	
4/17/92 13:02	6.127	6.15279167	6.180991667	
4/17/92 14:02	6.092	6.15504167	6.182825	
4/17/92 15:02	6.143	6.15954167	6.184536667	
4/17/92 16:02	6.159	6.16179167	6.186041667	
4/17/92 17:02	6.168	6.16466667	6.18741	
4/17/92 18:02	6.171	6.16691667	6.188641667	
4/17/92 19:02	6.171	6.16941667		
4/17/92 20:02	6.184	6.17208333		
4/17/92 21:02	6.171	6.17404167		
4/17/92 22:02	6.146	6.17604167		
4/17/92 23:02	6.14	6.17866667		
4/18/92 0:02	6.14	6.18104167		
4/18/92 1:02	→ 6.152	6.18325		
4/18/92 2:02	6.159	6.185125		
4/18/92 3:02	6.156	6.18683333		
4/18/92 4:02	6.162	6.18920833		
4/18/92 5:02	6.168	6.19133333		
4/18/92 6:02	6.175	6.19291667		
4/18/92 7:02	→ 6.146	6.19433333		
4/18/92 8:02	6.143	6.19629167		
4/18/92 9:02	6.127	6.19745833		
4/18/92 10:02	6.143	6.1985		
4/18/92 11:02	6.159	6.19904167		
4/18/92 12:02	6.165	6.19929167		
4/18/92 13:02	6.181	6.19916667		

4/18/92 14:02	6.2	6.198625		
4/18/92 15:02	6.197	6.19783333		
4/18/92 16:02	6.228	6.19716667		
4/18/92 17:02	6.222	6.196		
4/18/92 18:02	6.231	6.19545833		
4/18/92 19:02	6.235			
4/18/92 20:02	6.231			
4/18/92 21:02	6.219			
4/18/92 22:02	6.209			
4/18/92 23:02	6.197			
4/19/92 0:02	6.193			
4/19/92 1:02	6.197			
4/19/92 2:02	6.2			
4/19/92 3:02	6.213			
4/19/92 4:02	6.213			
4/19/92 5:02	6.206			
4/19/92 6:02	6.209			
4/19/92 7:02	6.193			
4/19/92 8:02	6.171			
4/19/92 9:02	6.152			
4/19/92 10:02	6.156			
4/19/92 11:02	6.165			
4/19/92 12:02	6.162			
4/19/92 13:02	6.168			
4/19/92 14:02	6.181			
4/19/92 15:02	6.181			
4/19/92 16:02	6.2			
4/19/92 17:02	6.209			

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Time	Elevation	Average 1	Average 2	Final Average
4/16/92 17:54	5.095	5.091625	5.076006667	5.0657826
4/16/92 18:54	5.095	5.09016667	5.074958333	
4/16/92 19:54	5.107	5.08883333	5.073941667	
4/16/92 20:54	5.117	5.087125	5.072951667	
4/16/92 21:54	5.123	5.08529167	5.071998333	
4/16/92 22:54	5.129	5.08358333	5.071081667	
4/16/92 23:54	—> 5.126	5.081875	5.070196667	
4/17/92 0:54	5.12	5.08041667	5.069343333	
4/17/92 1:54	5.104	5.07920833	5.068523333	
4/17/92 2:54	5.091	5.07829167	5.067736667	
4/17/92 3:54	5.079	5.077375	5.066976667	
4/17/92 4:54	5.069	5.07645833	5.066231667	
4/17/92 5:54	5.066	5.07541667	5.065501667	
4/17/92 6:54	—> 5.066	5.074375	5.064781667	
4/17/92 7:54	5.069	5.07308333	5.064071667	
4/17/92 8:54	5.079	5.07179167	5.063365	
4/17/92 9:54	5.082	5.07033333	5.062651667	
4/17/92 10:54	5.091	5.06916667	5.061938333	
4/17/92 11:54	5.098	5.068	5.061218333	
4/17/92 12:54	5.091	5.06708333	5.060491667	
4/17/92 13:54	5.091	5.06658333	5.059748333	
4/17/92 14:54	5.085	5.06620833	5.058971667	
4/17/92 15:54	5.069	5.06595833	5.058156667	
4/17/92 16:54	5.057	5.06595833	5.057305	
4/17/92 17:54	5.06	5.06595833	5.056416667	
4/17/92 18:54	5.063	5.06541667		
4/17/92 19:54	5.066	5.06475		
4/17/92 20:54	5.073	5.06408333		
4/17/92 21:54	5.082	5.06329167		
4/17/92 22:54	5.088	5.062375		
4/17/92 23:54	5.091	5.06145833		
4/18/92 0:54	—> 5.091	5.06054167		
4/18/92 1:54	5.082	5.05991667		
4/18/92 2:54	5.069	5.05954167		
4/18/92 3:54	5.057	5.05929167		
4/18/92 4:54	5.044	5.05875		
4/18/92 5:54	5.041	5.05820833		
4/18/92 6:54	—> 5.035	5.05741667		
4/18/92 7:54	5.038	5.056625		
4/18/92 8:54	5.044	5.05541667		
4/18/92 9:54	5.054	5.05395833		
4/18/92 10:54	5.063	5.0525		
4/18/92 11:54	5.076	5.05116667		
4/18/92 12:54	5.079	5.04983333		

4/18/92 13:54	5.082	5.0485		
4/18/92 14:54	5.079	5.04716667		
4/18/92 15:54	5.069	5.04583333		
4/18/92 16:54	5.057	5.04466667		
4/18/92 17:54	5.047	5.04375		
4/18/92 18:54	5.047			
4/18/92 19:54	5.05			
4/18/92 20:54	5.054			
4/18/92 21:54	5.06			
4/18/92 22:54	5.066			
4/18/92 23:54	5.069			
4/19/92 0:54	5.076			
4/19/92 1:54	5.073			
4/19/92 2:54	5.063			
4/19/92 3:54	5.044			
4/19/92 4:54	5.031			
4/19/92 5:54	5.022			
4/19/92 6:54	5.016			
4/19/92 7:54	5.009			
4/19/92 8:54	5.009			
4/19/92 9:54	5.019			
4/19/92 10:54	5.031			
4/19/92 11:54	5.044			
4/19/92 12:54	5.047			
4/19/92 13:54	5.05			
4/19/92 14:54	5.047			
4/19/92 15:54	5.041			
4/19/92 16:54	5.035			

Time	Elevation	Average 1	Average 2	Final Average
4/16/92 18:05	4.928	4.948375	4.933701667	4.927356133
4/16/92 19:05	4.928	4.94733333	4.932746667	
4/16/92 20:05	4.95	4.94616667	4.931838333	
4/16/92 21:05	4.972	4.94445833	4.930971667	
4/16/92 22:05	4.997	4.942625	4.930156667	
4/16/92 23:05	5.023	4.94054167	4.929398333	
4/17/92 0:05	→ 5.038	4.93854167	4.928696667	
4/17/92 1:05	5.038	4.93683333	4.928055	
4/17/92 2:05	5.019	4.93566667	4.927476667	
4/17/92 3:05	4.985	4.93516667	4.926965	
4/17/92 4:05	4.953	4.93475	4.926526667	
4/17/92 5:05	4.925	4.934375	4.926156667	
4/17/92 6:05	4.897	4.93395833	4.92585	
4/17/92 7:05	→ 4.881	4.93358333	4.9256	
4/17/92 8:05	4.875	4.93283333	4.925406667	
4/17/92 9:05	4.885	4.93154167	4.925263333	
4/17/92 10:05	4.897	4.92966667	4.925178333	
4/17/92 11:05	4.912	4.92795833	4.925153333	
4/17/92 12:05	4.934	4.92641667	4.925181667	
4/17/92 13:05	4.95	4.925	4.925246667	
4/17/92 14:05	4.966	4.92383333	4.925351667	
4/17/92 15:05	4.956	4.92279167	4.925491667	
4/17/92 16:05	4.937	4.92279167	4.925658333	
4/17/92 17:05	4.915	4.92333333	4.92583	
4/17/92 18:05	4.903	4.924	4.926001667	
4/17/92 19:05	4.9	4.9245		
4/17/92 20:05	4.909	4.924625		
4/17/92 21:05	4.928	4.9245		
4/17/92 22:05	4.947	4.92408333		
4/17/92 23:05	4.975	4.92366667		
4/18/92 0:05	4.997	4.923		
4/18/92 1:05	→ 5.01	4.9225		
4/18/92 2:05	5.007	4.922375		
4/18/92 3:05	4.975	4.922875		
4/18/92 4:05	4.944	4.92420833		
4/18/92 5:05	4.915	4.9255		
4/18/92 6:05	4.888	4.92670833		
4/18/92 7:05	→ 4.863	4.92770833		
4/18/92 8:05	4.844	4.92875		
4/18/92 9:05	4.84	4.92925		
4/18/92 10:05	4.856	4.92941667		
4/18/92 11:05	4.875	4.92904167		
4/18/92 12:05	4.9	4.92866667		
4/18/92 13:05	4.922	4.92804167		

4/18/92 14:05	4.941	4.927625		
4/18/92 15:05	4.956	4.92733333		
4/18/92 16:05	4.95	4.92695833		
4/18/92 17:05	4.931	·4.92708333		
4/18/92 18:05	4.915	4.927625		
4/18/92 19:05	4.903			
4/18/92 20:05	4.906			
4/18/92 21:05	4.918			
4/18/92 22:05	4.937			
4/18/92 23:05	4.959			
4/19/92 0:05	4.985			
4/19/92 1:05	5.007			
4/19/92 2:05	5.019			
4/19/92 3:05	5.007			
4/19/92 4:05	4.975			
4/19/92 5:05	4.944			
4/19/92 6:05	4.912			
4/19/92 7:05	4.888			
4/19/92 8:05	4.856			
4/19/92 9:05	4.844			
4/19/92 10:05	4.847			
4/19/92 11:05	4.866			
4/19/92 12:05	4.885			
4/19/92 13:05	4.912			
4/19/92 14:05	4.934			
4/19/92 15:05	4.947			
4/19/92 16:05	4.953			
4/19/92 17:05	4.944			

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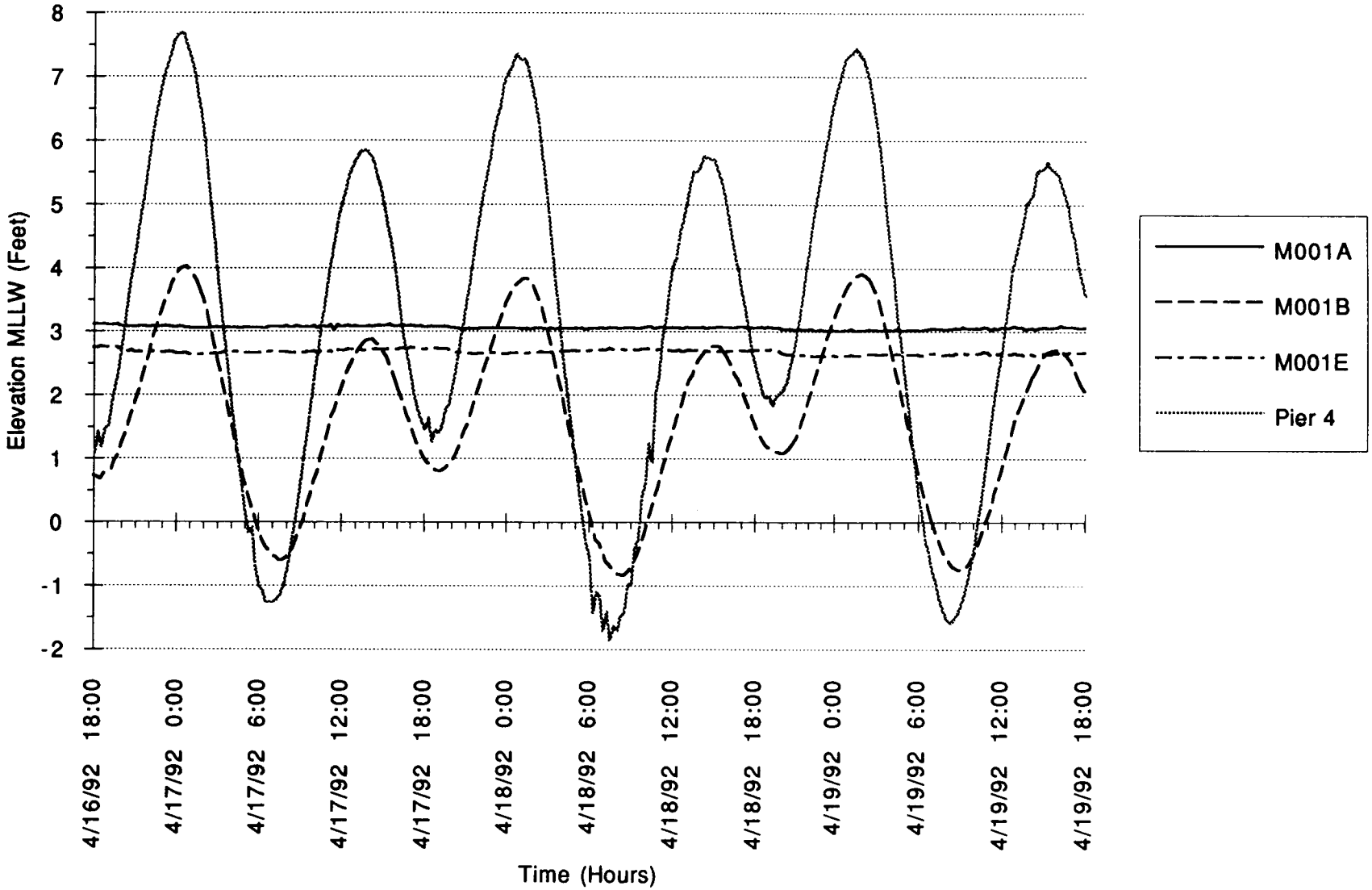

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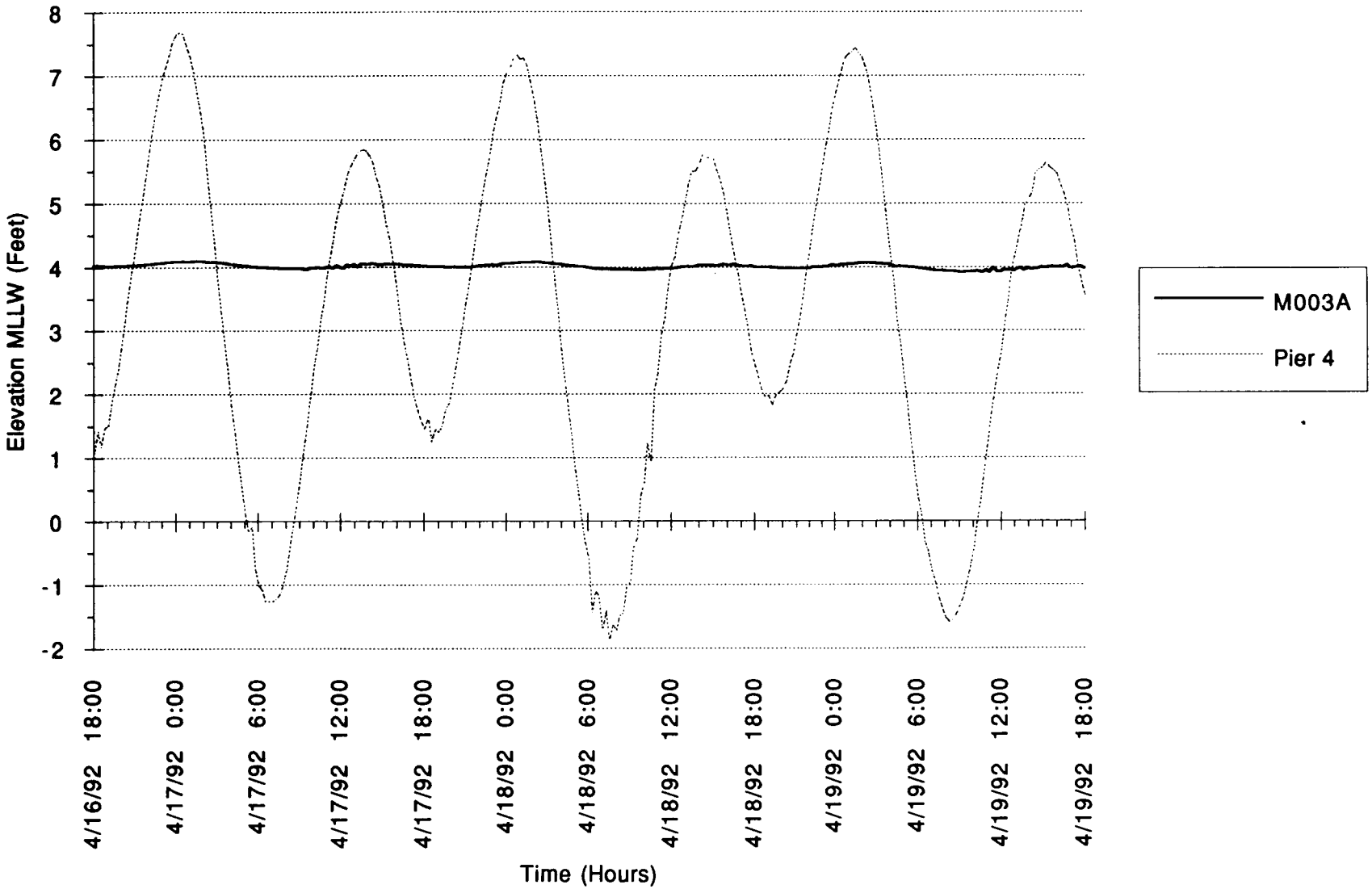

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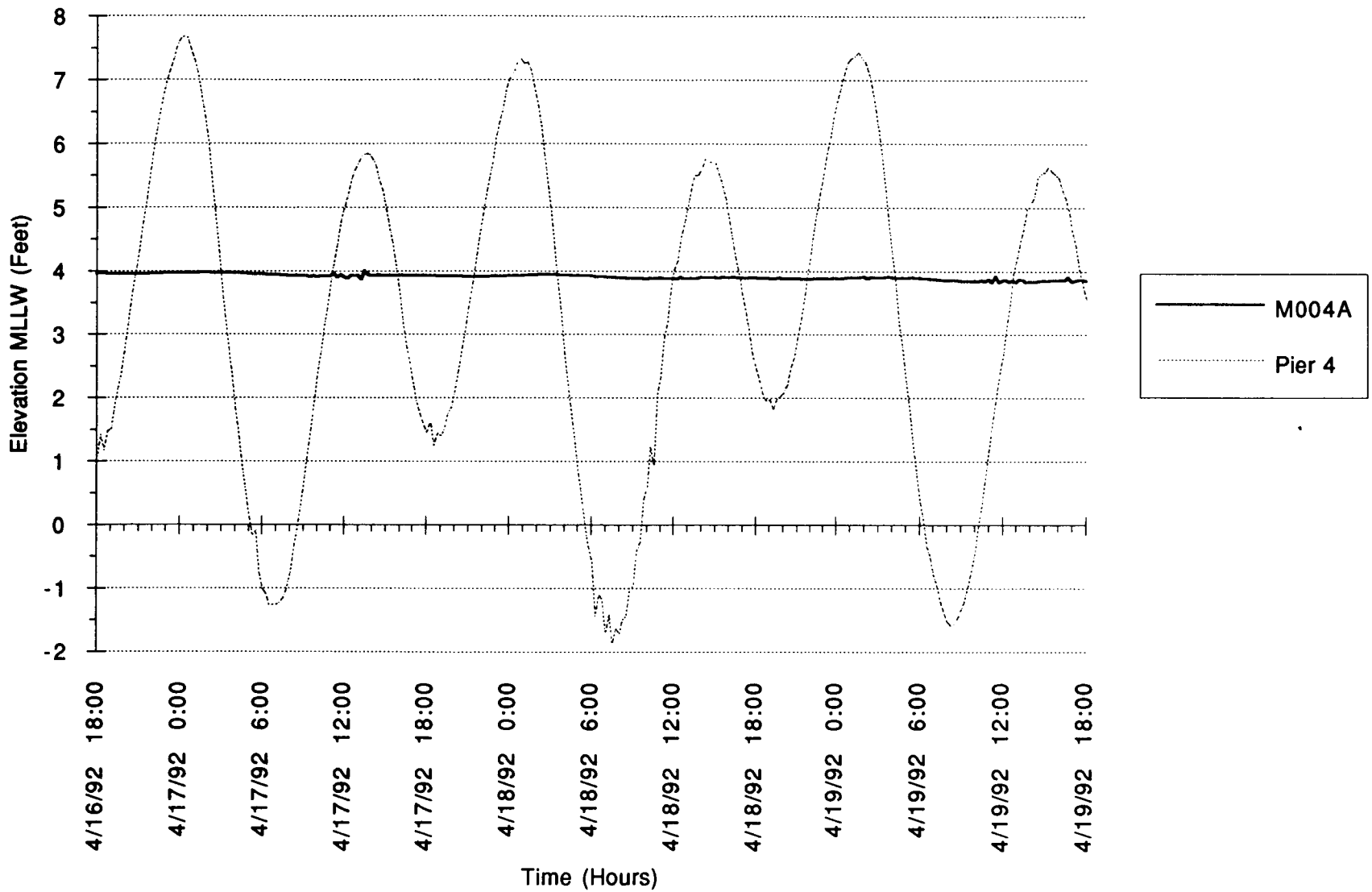

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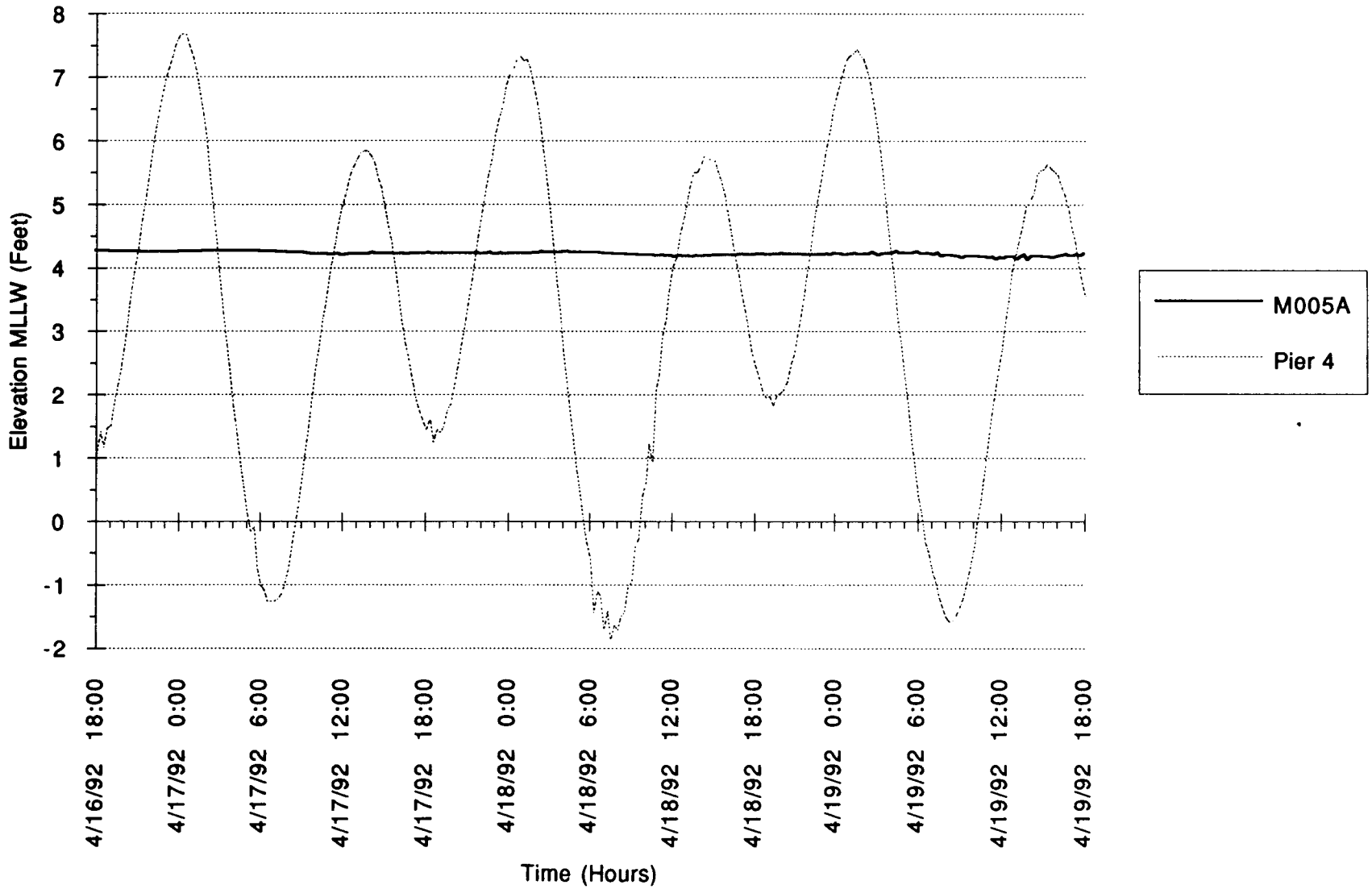

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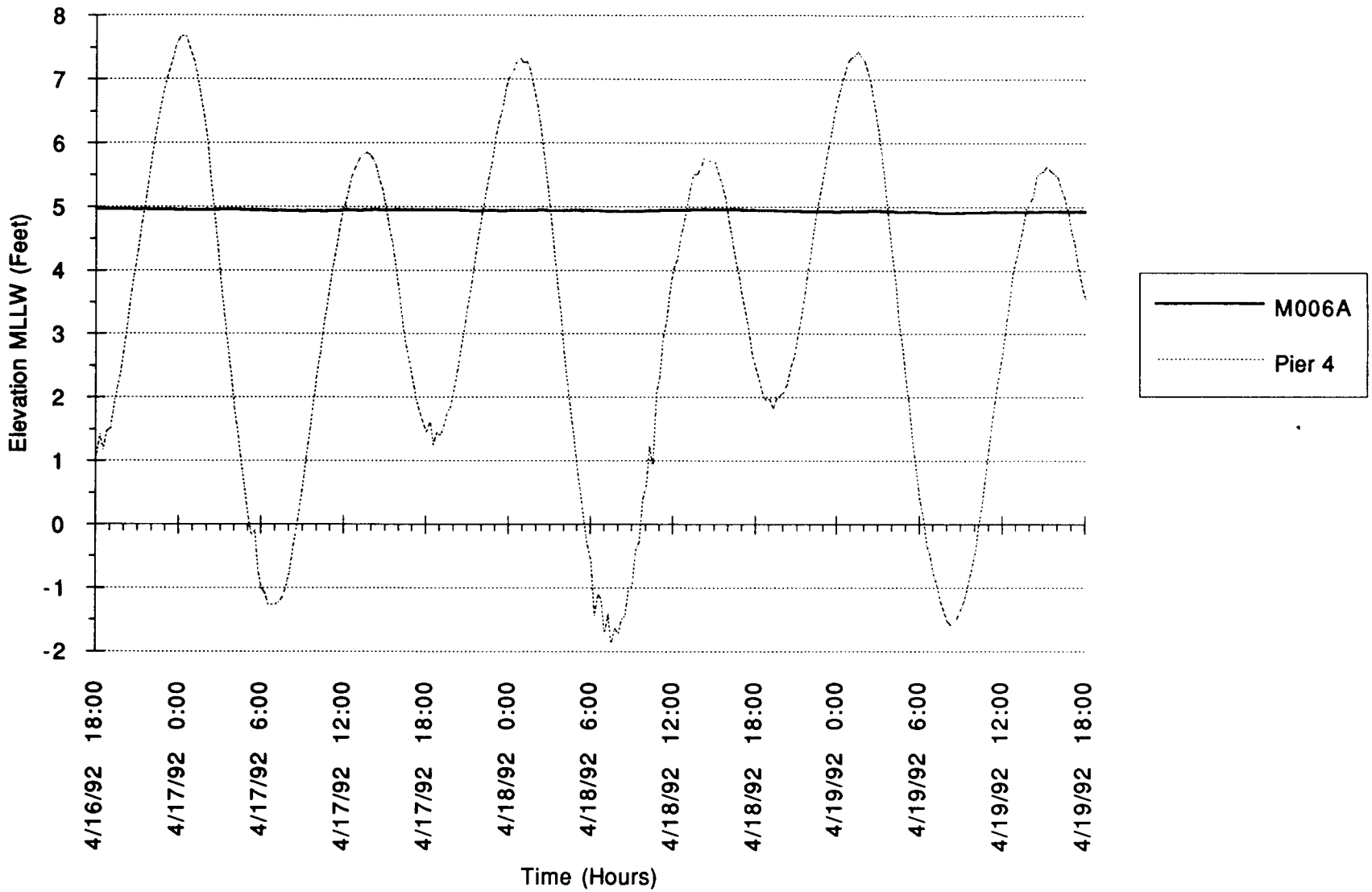

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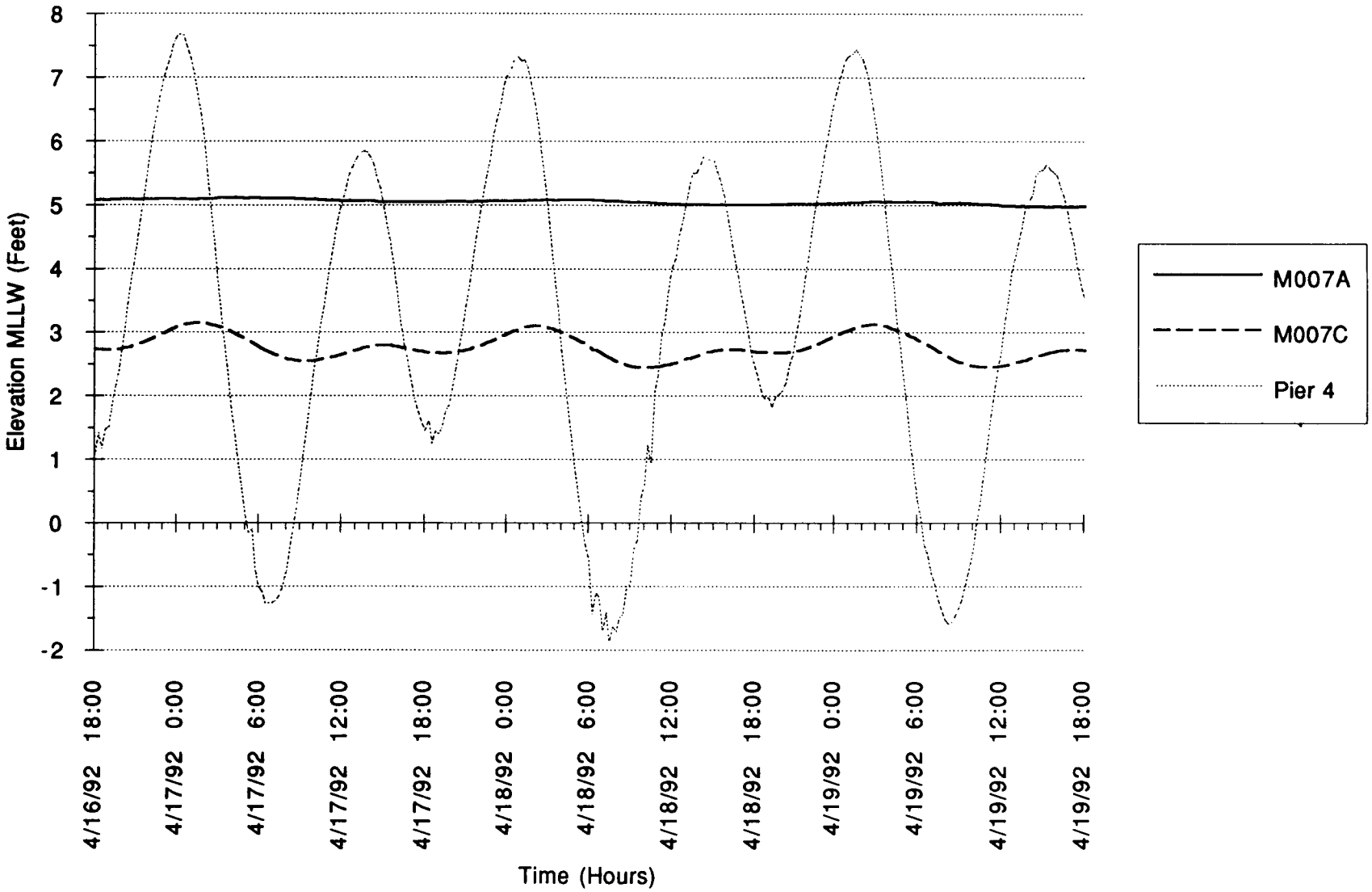

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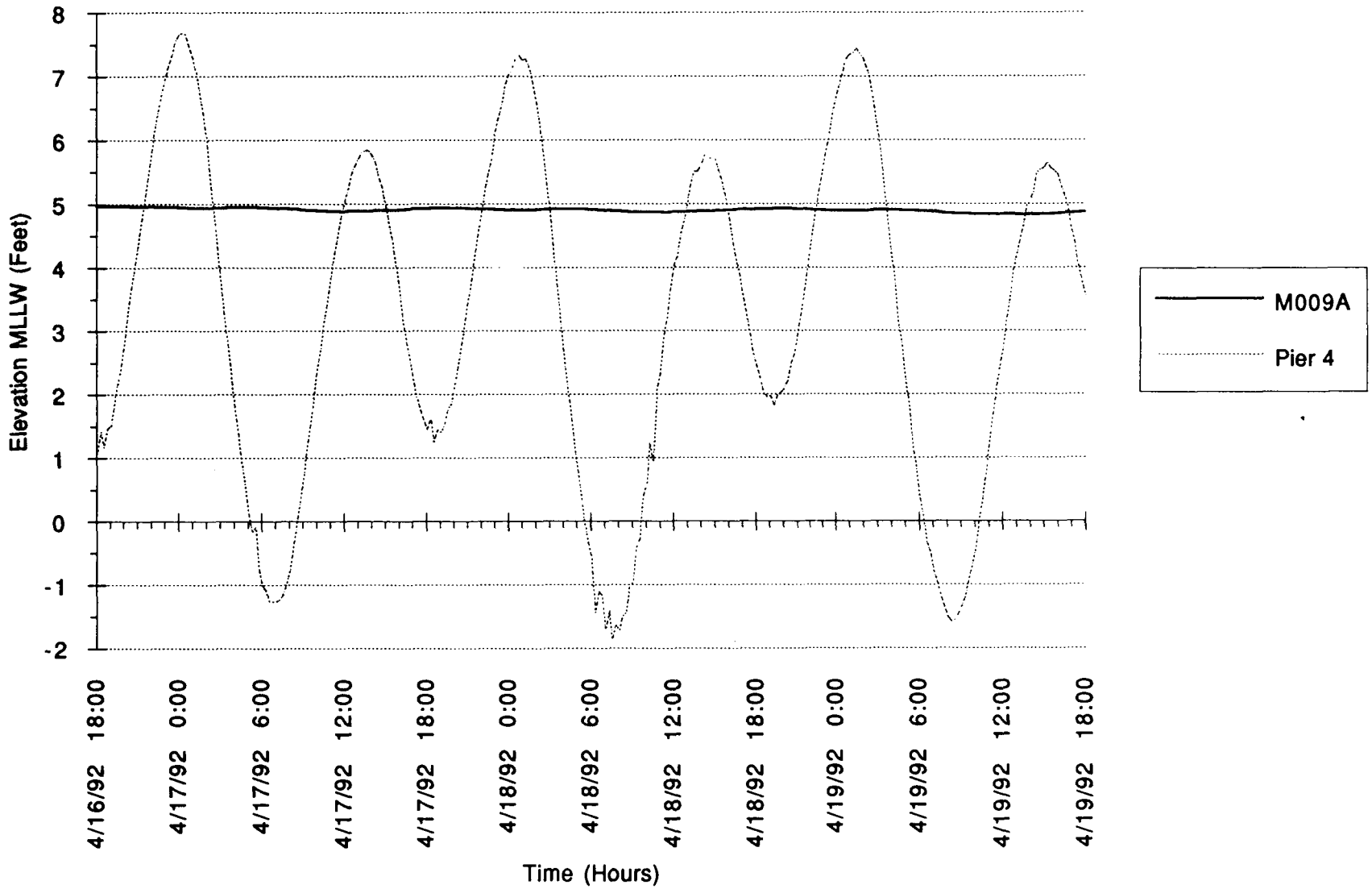
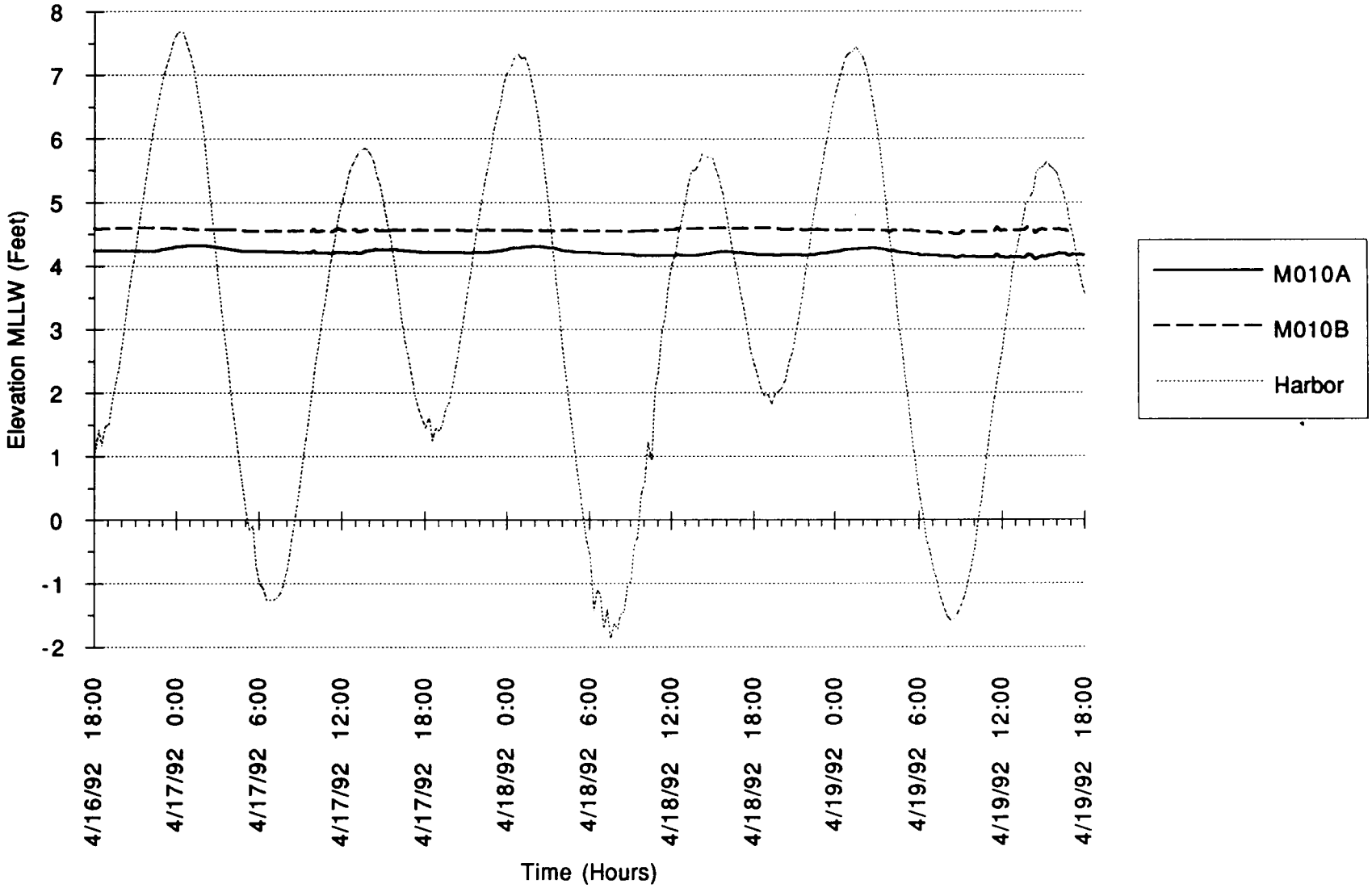


M010A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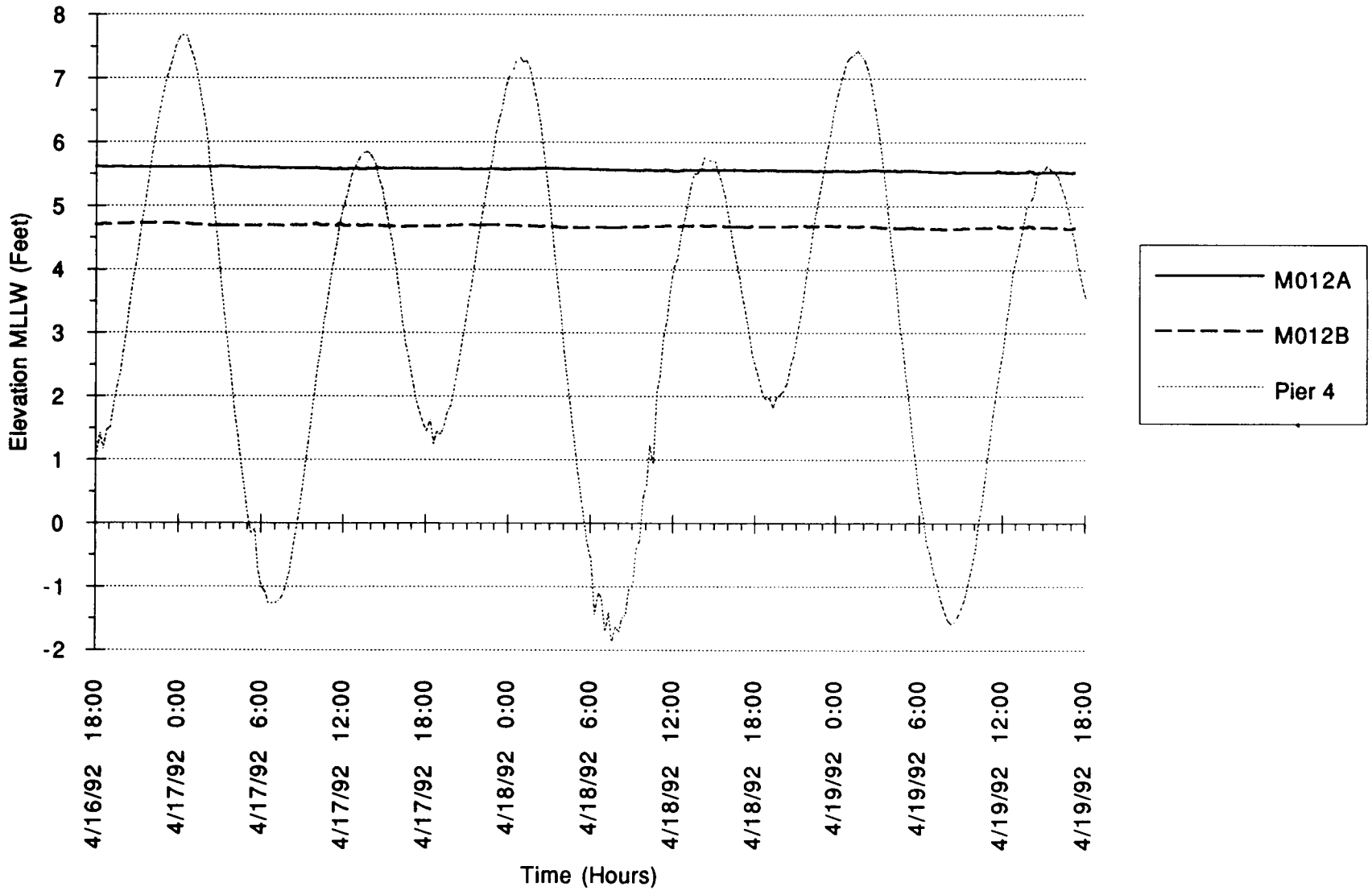
Time (Hours)
M010A
M010B
Harbor

M012 Cluster



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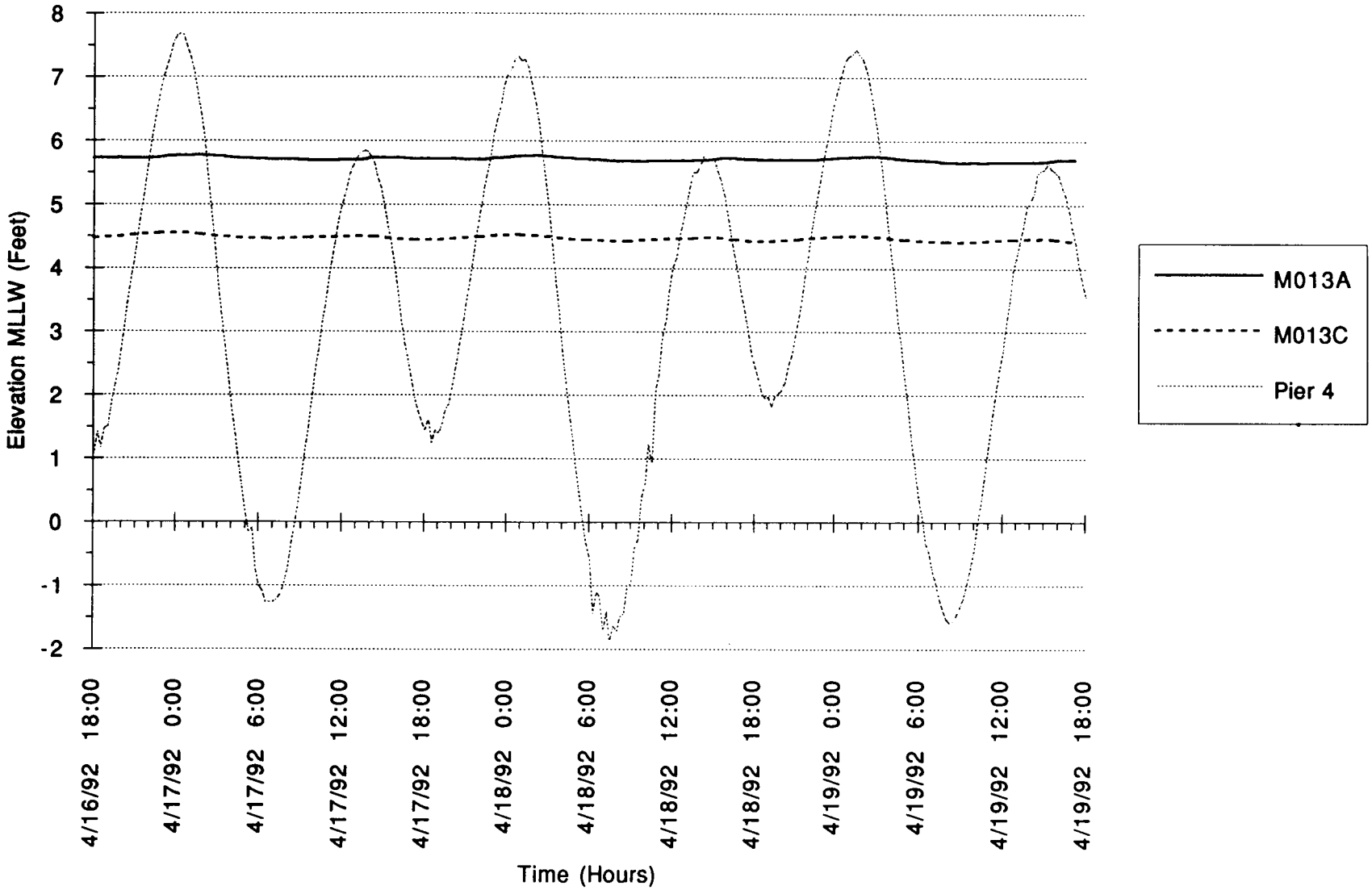

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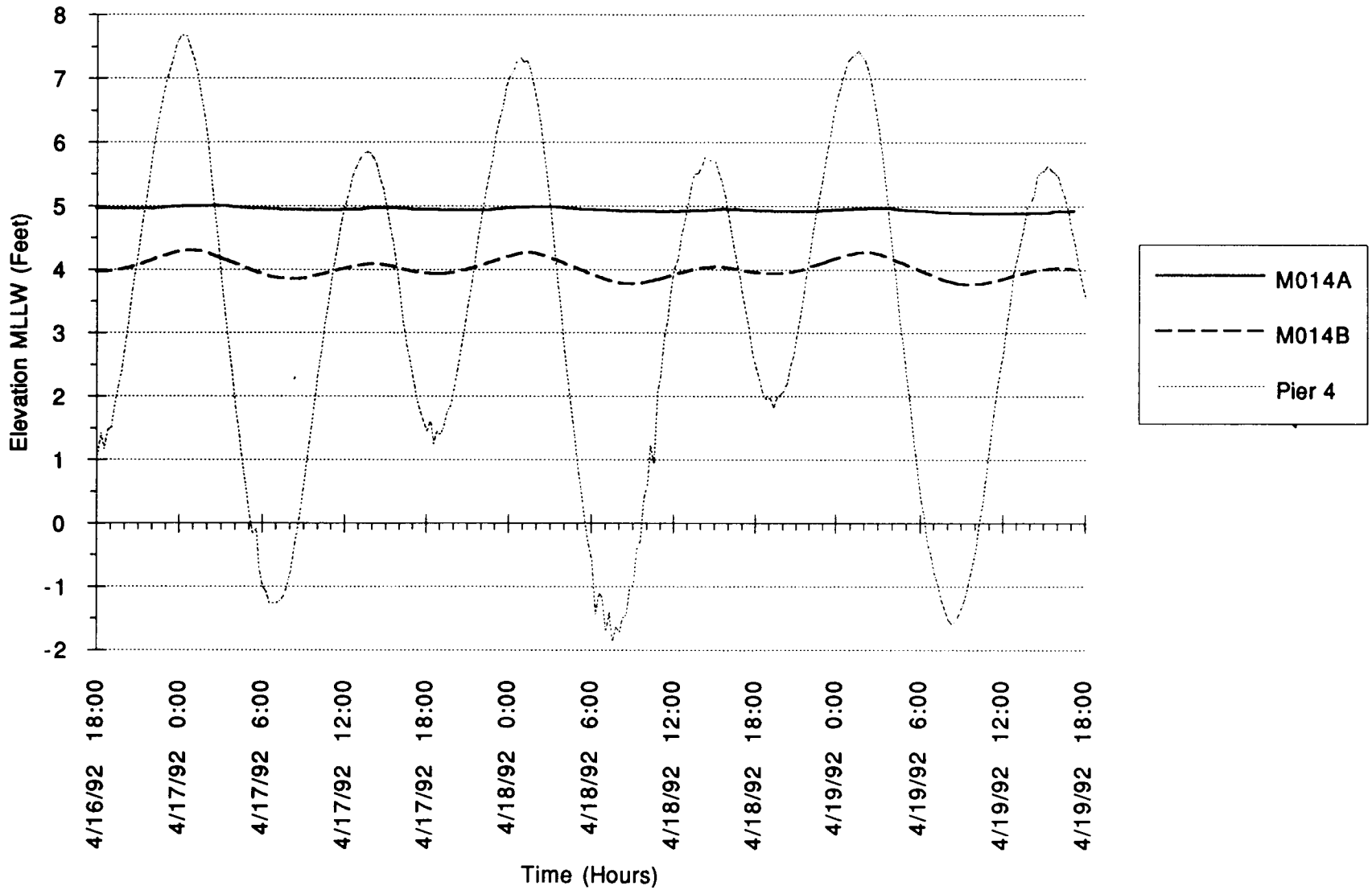

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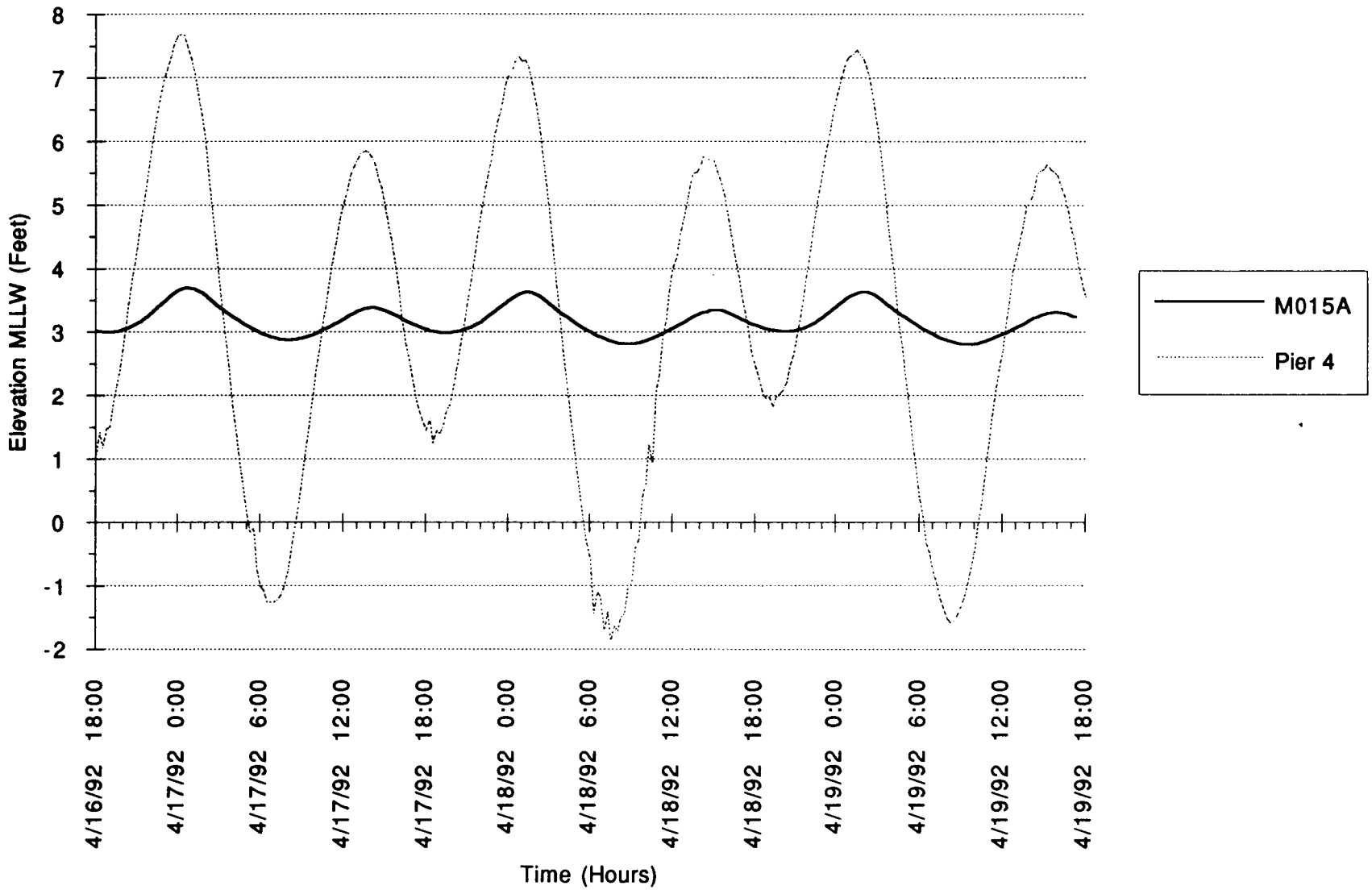

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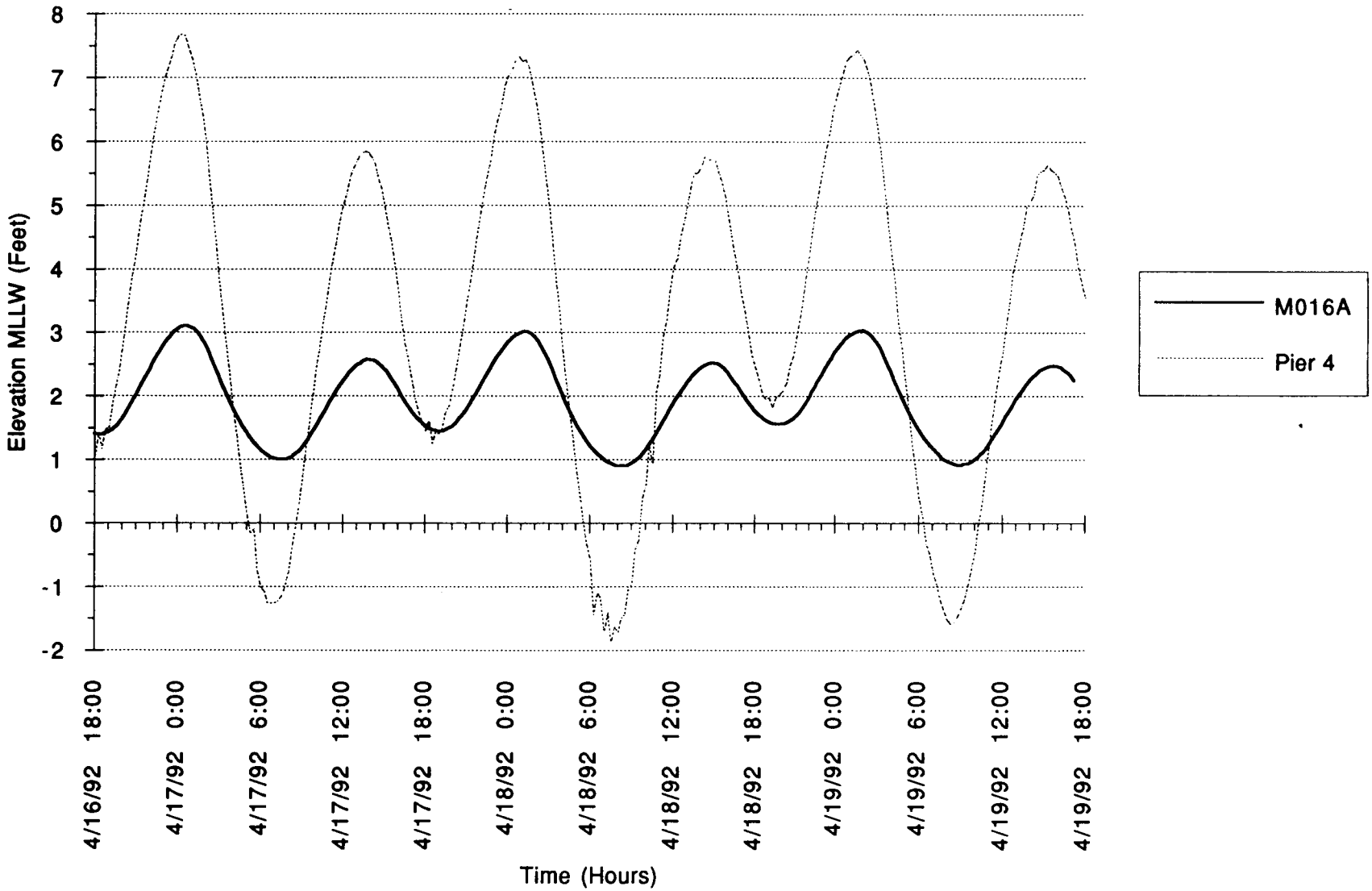

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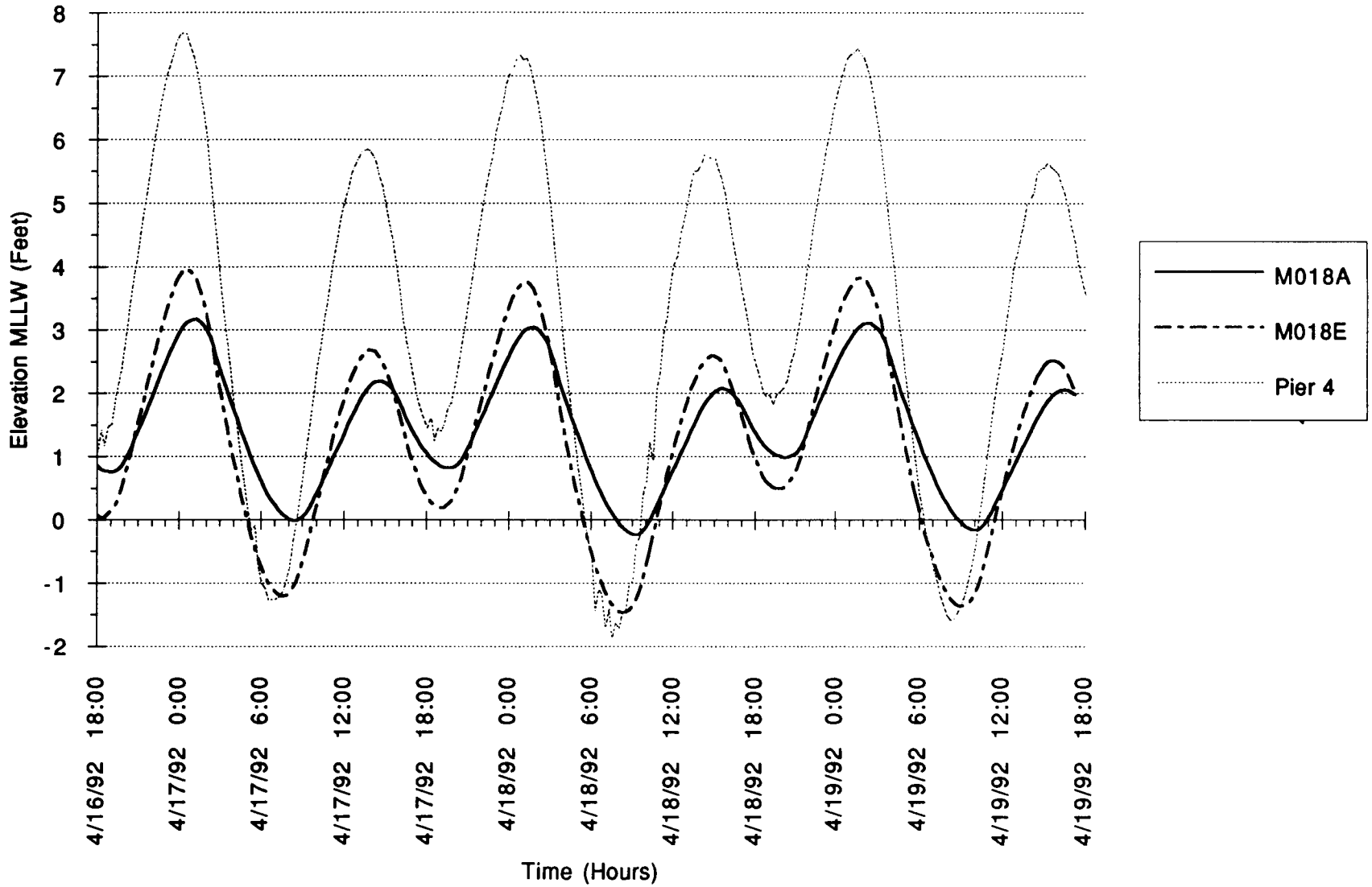

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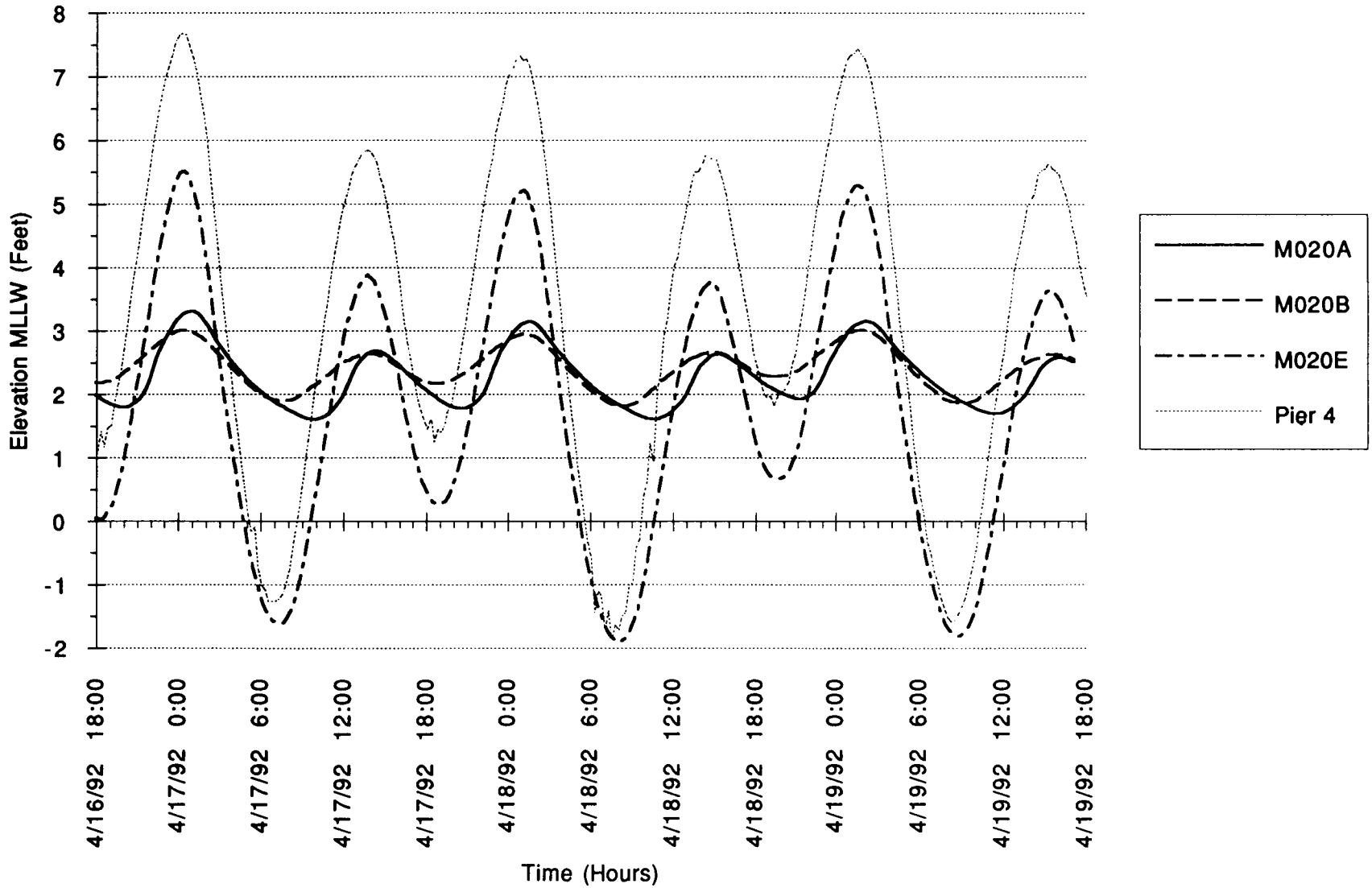

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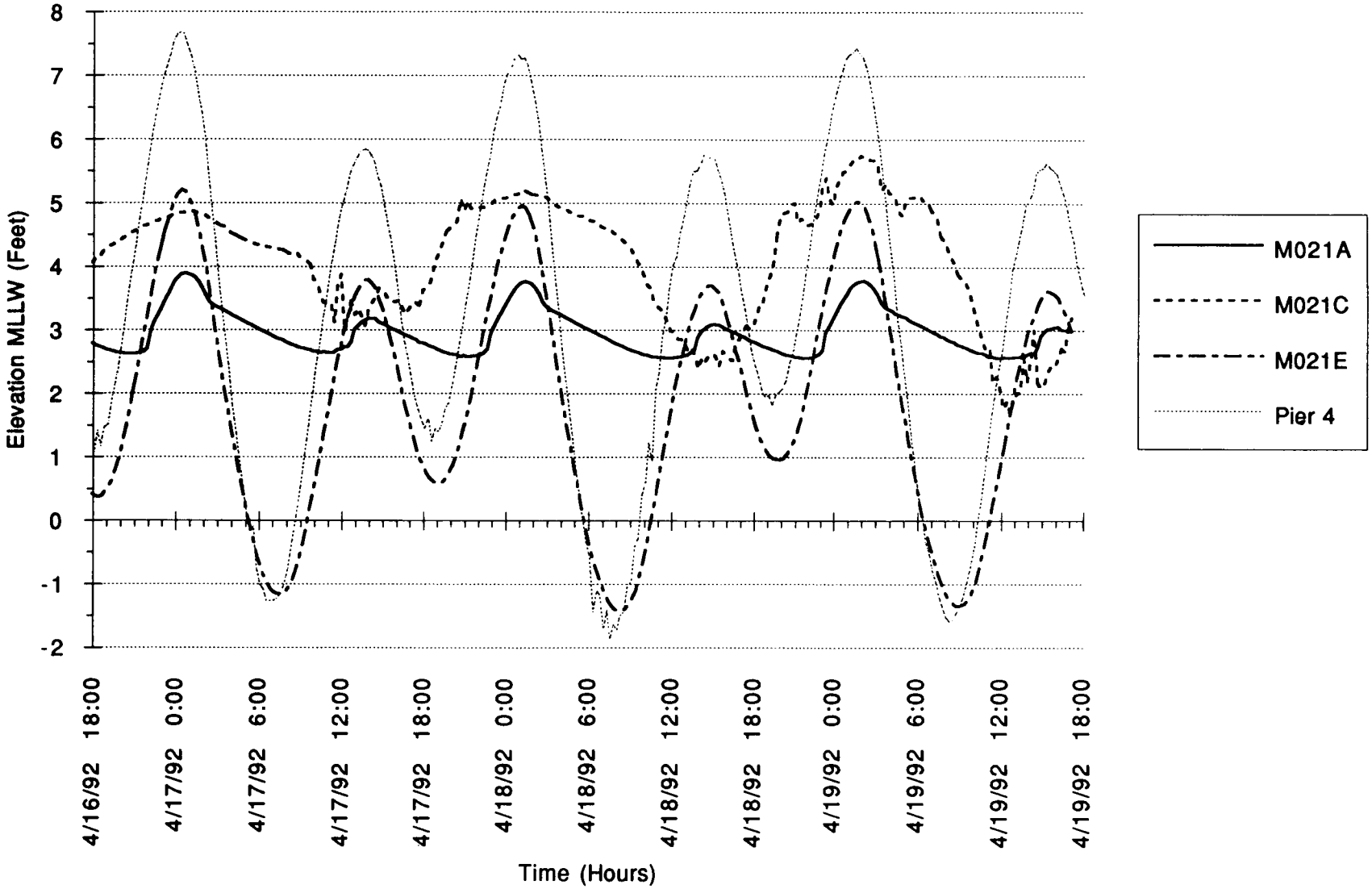

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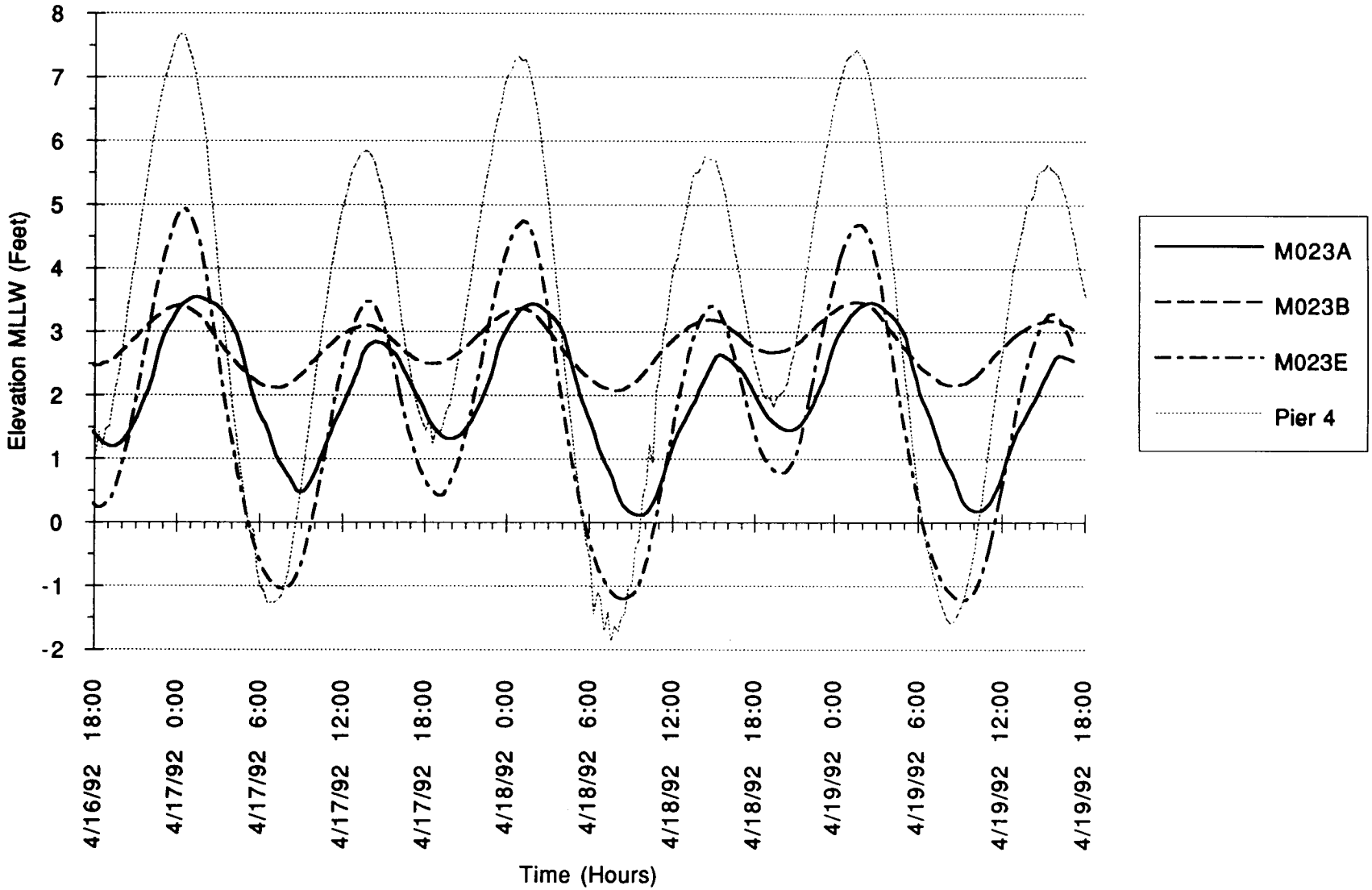

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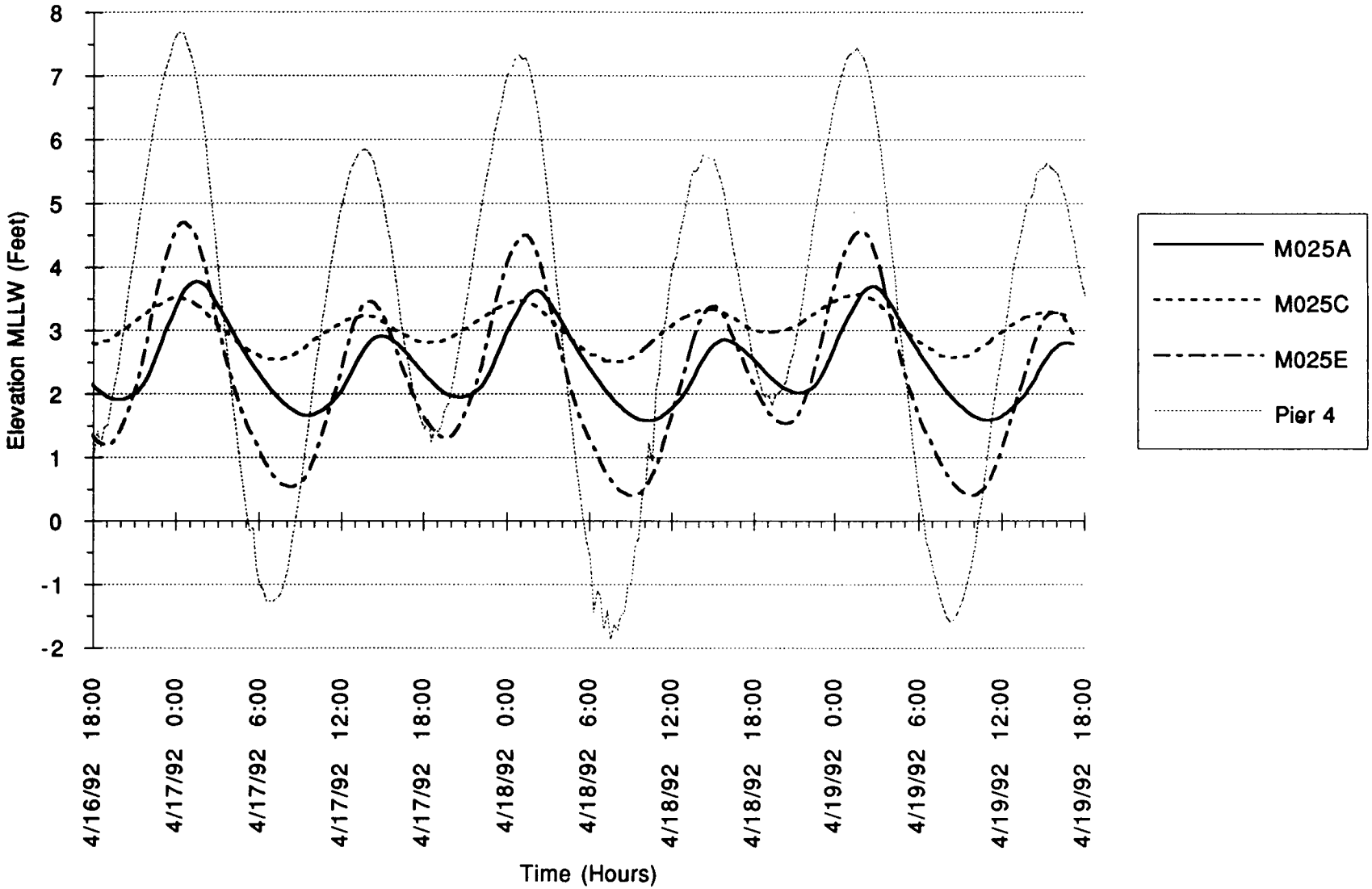

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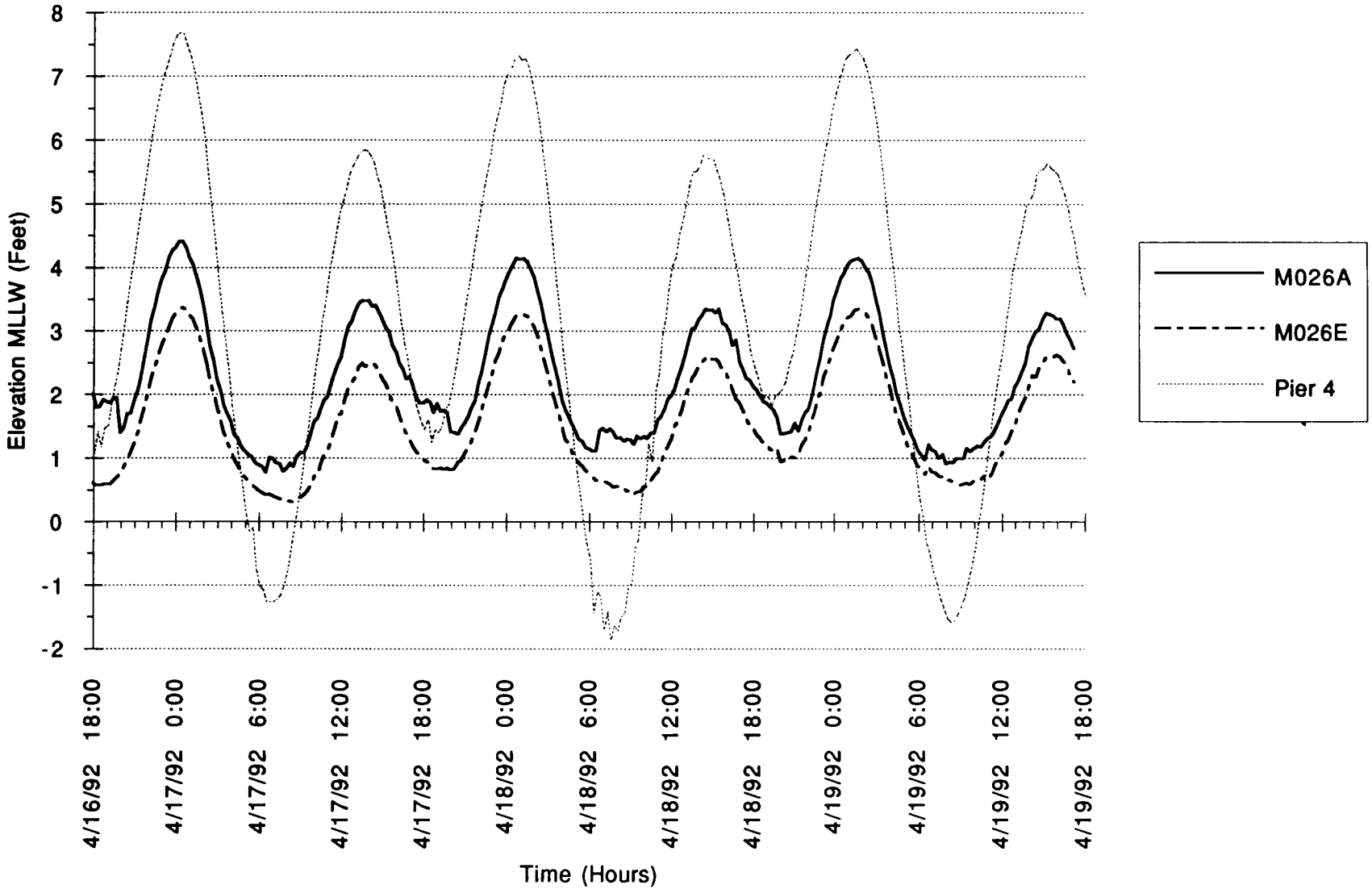

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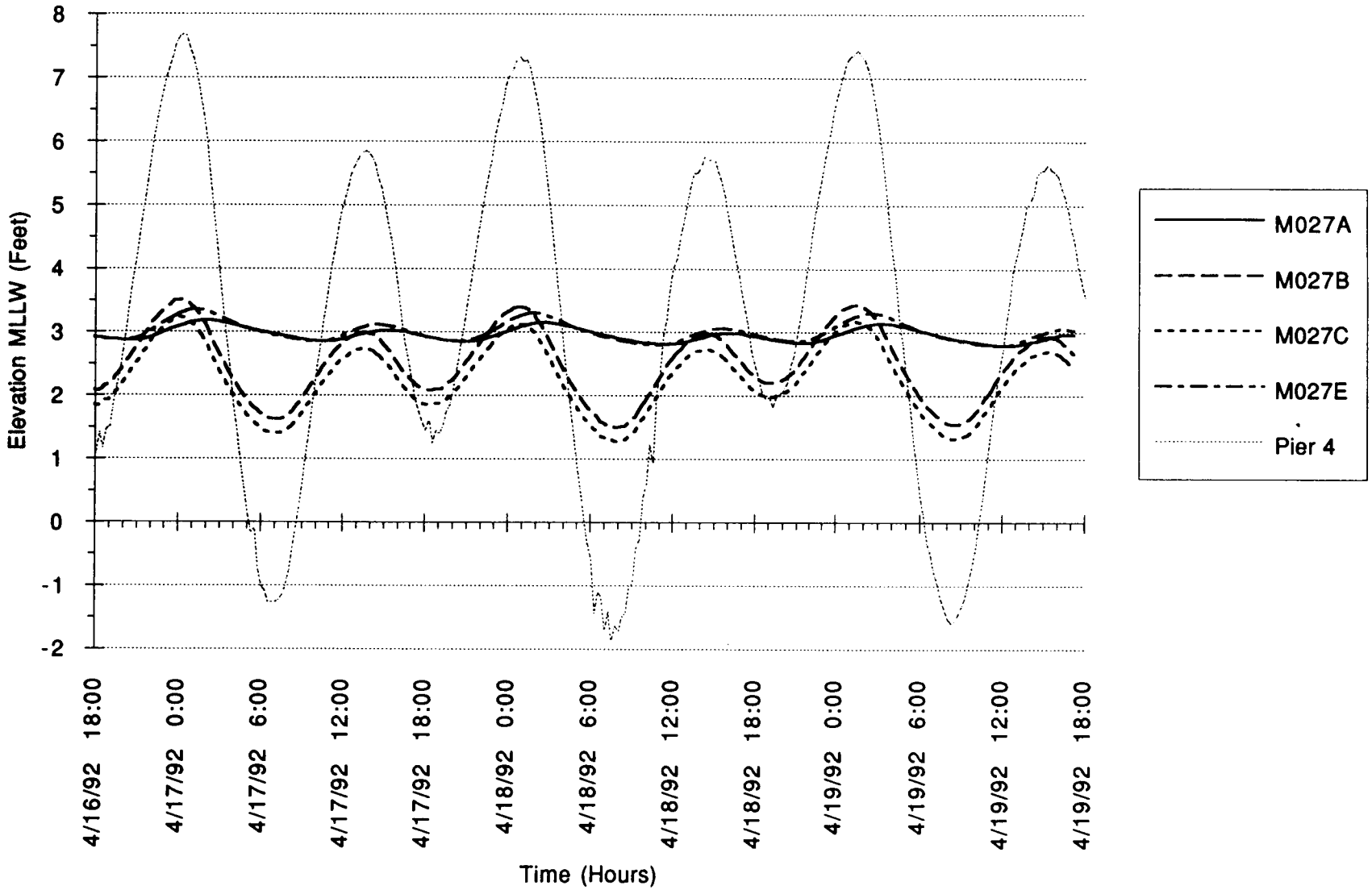

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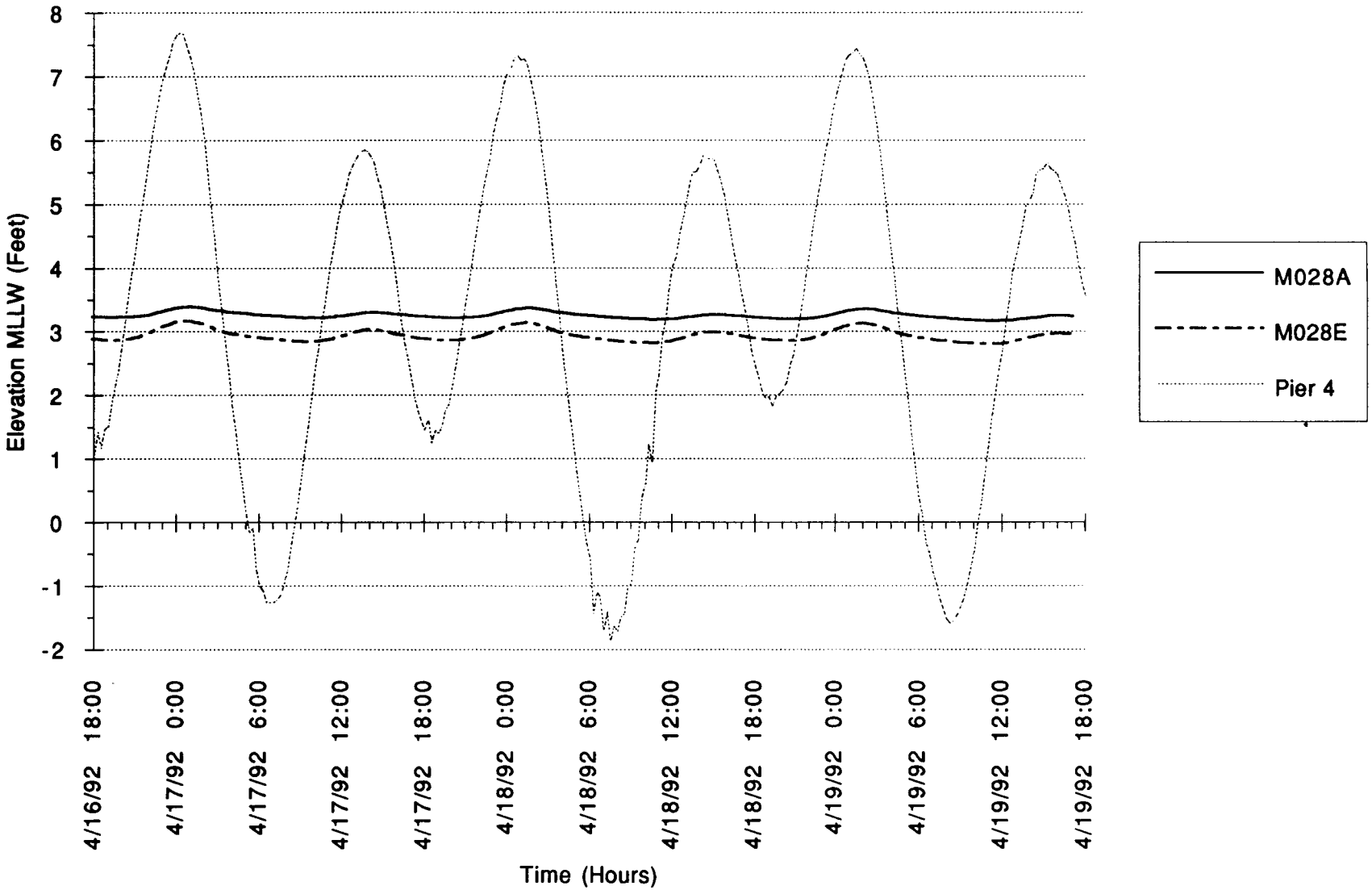

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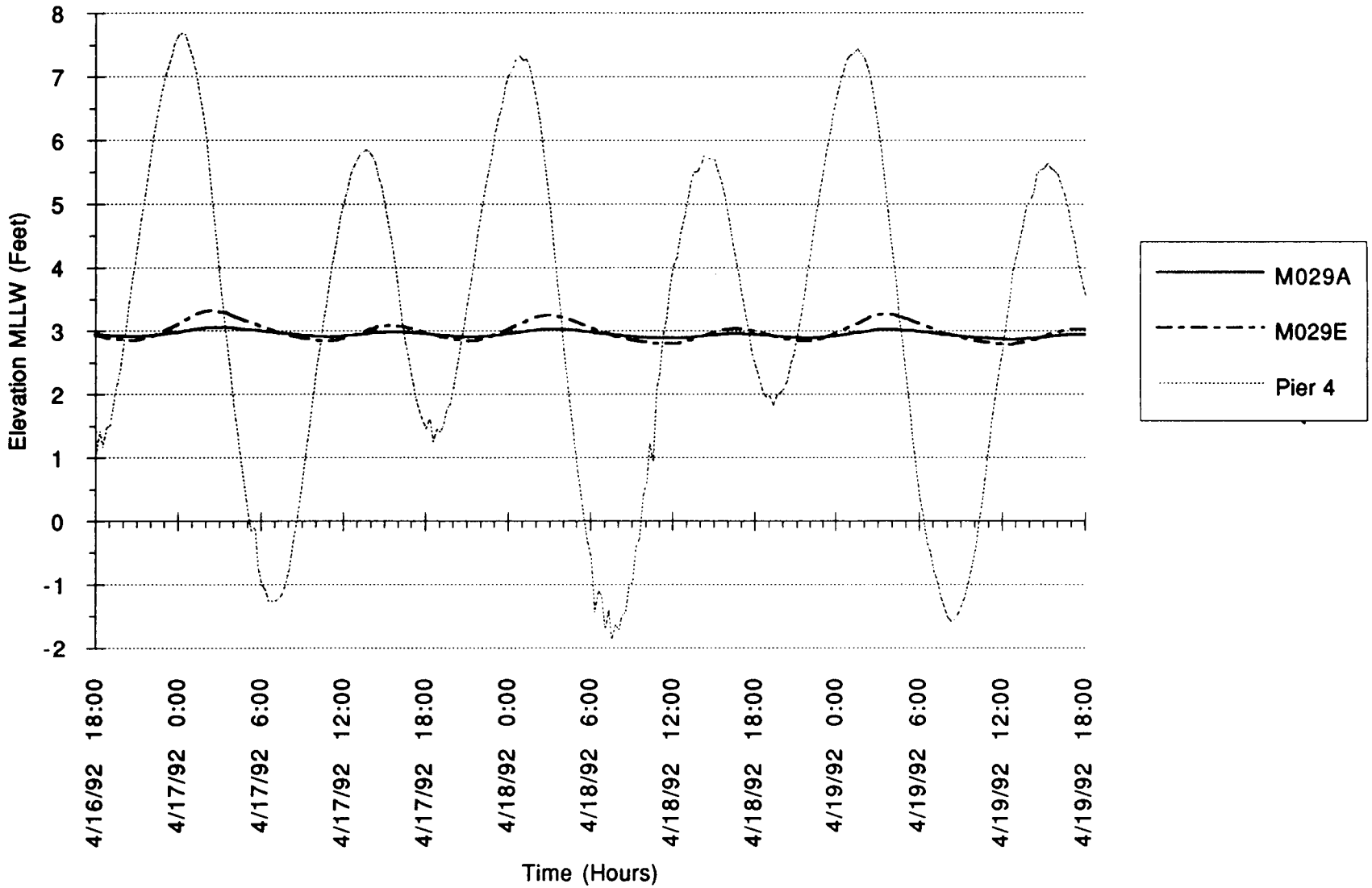

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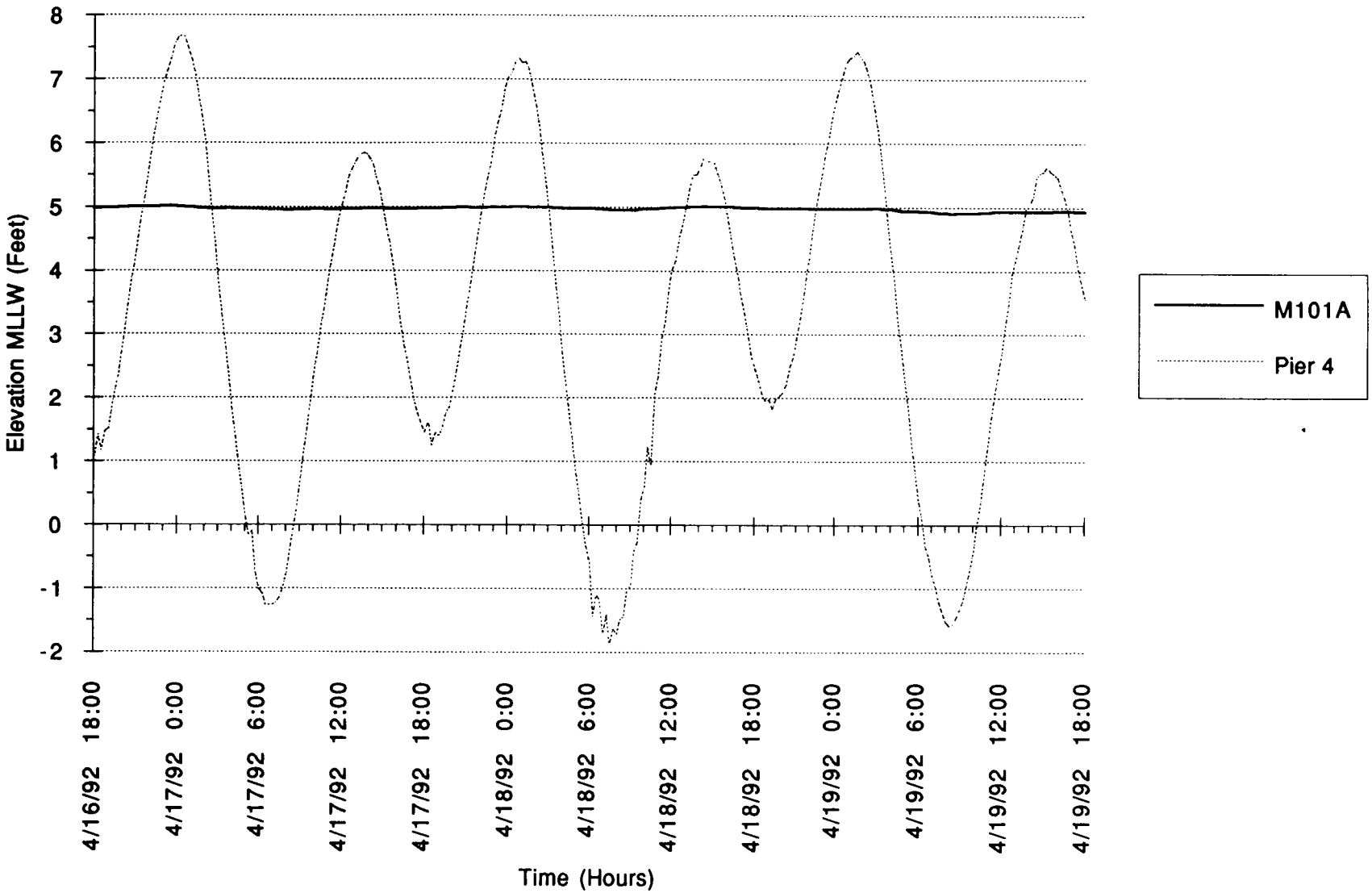

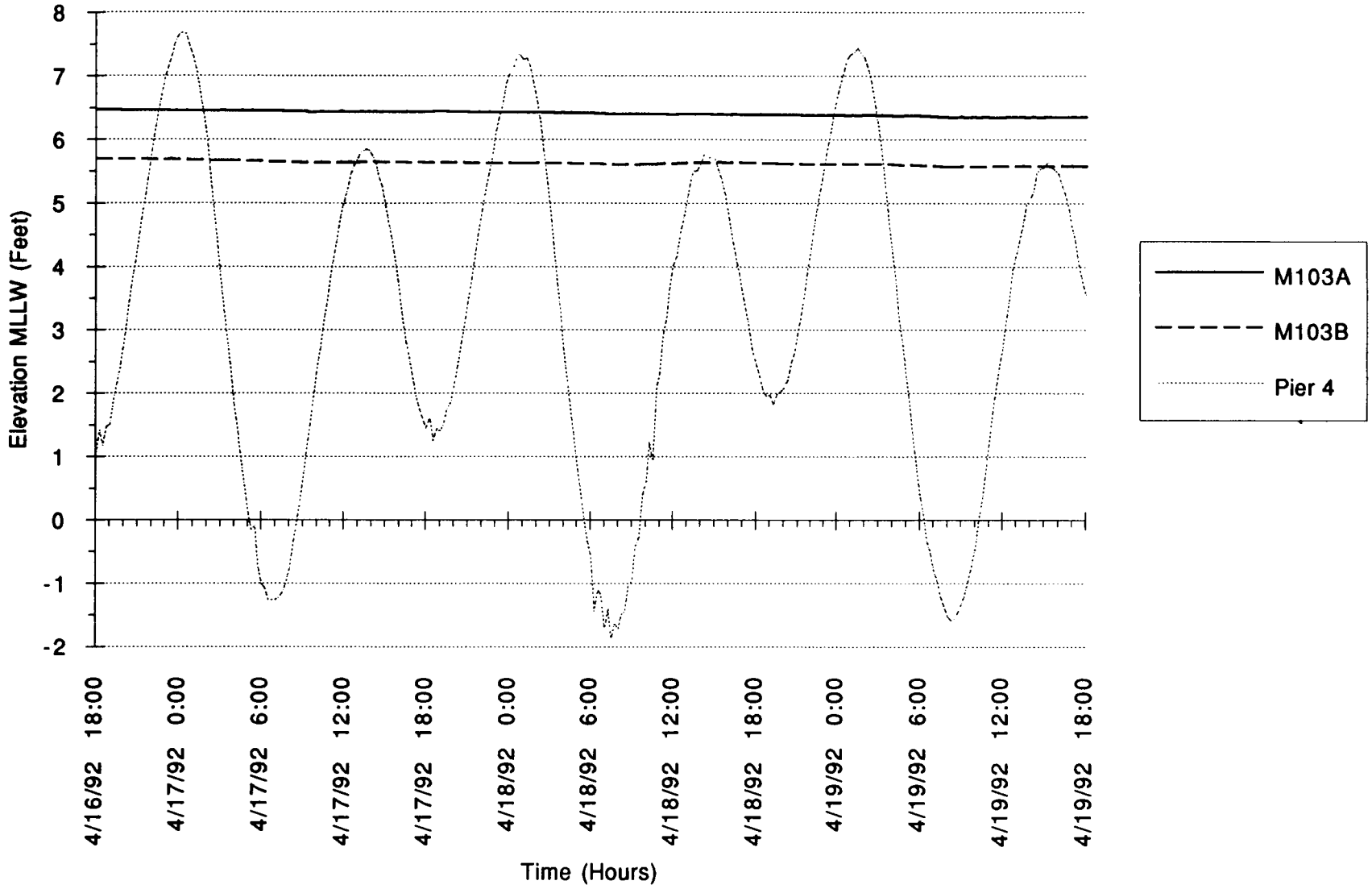
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Elevation MLLW (Feet)
4/16/92 18:00
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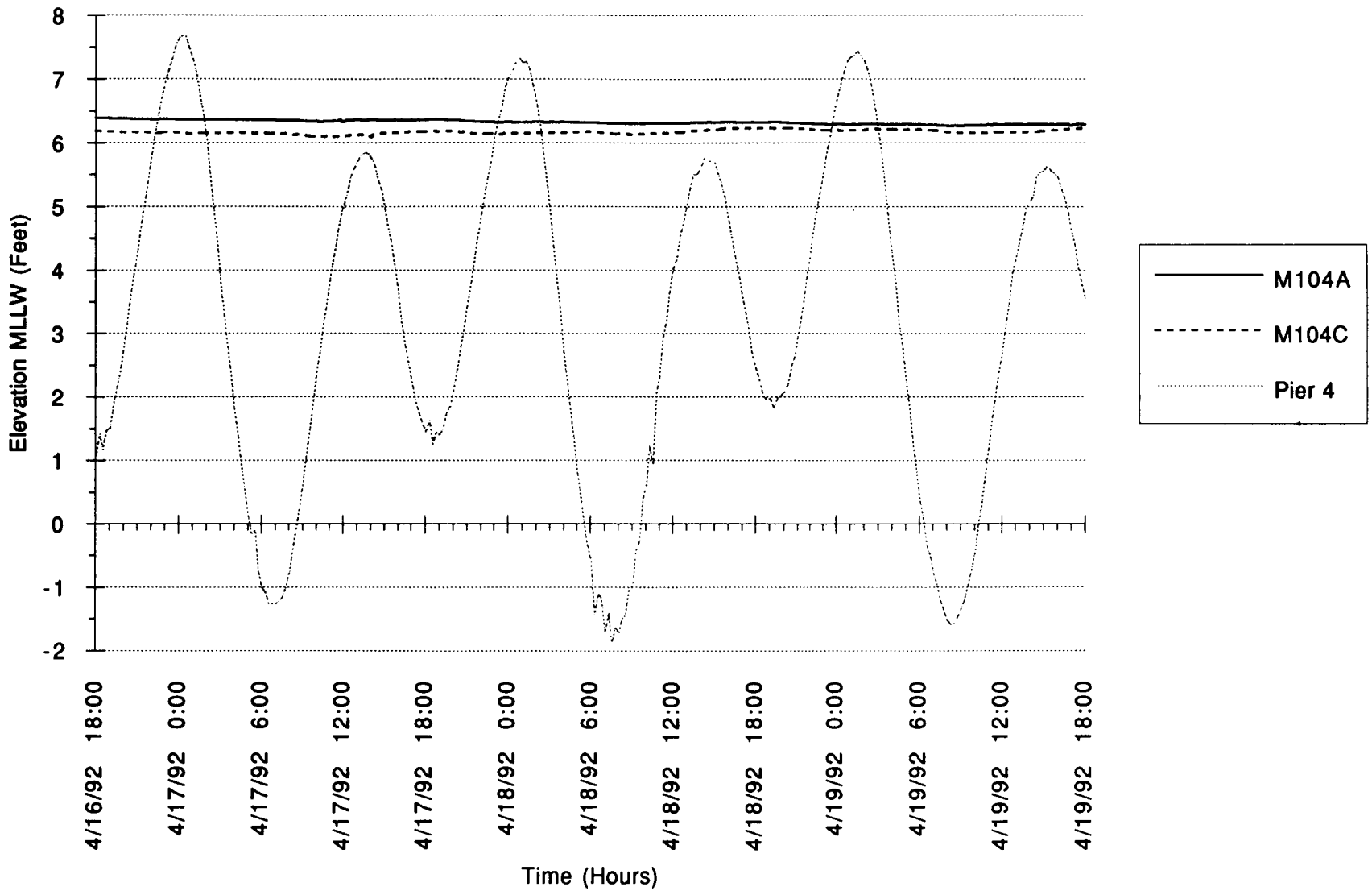
Time (Hours)
M103A
M103B
Pier 4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Elevation MLLW (Feet)
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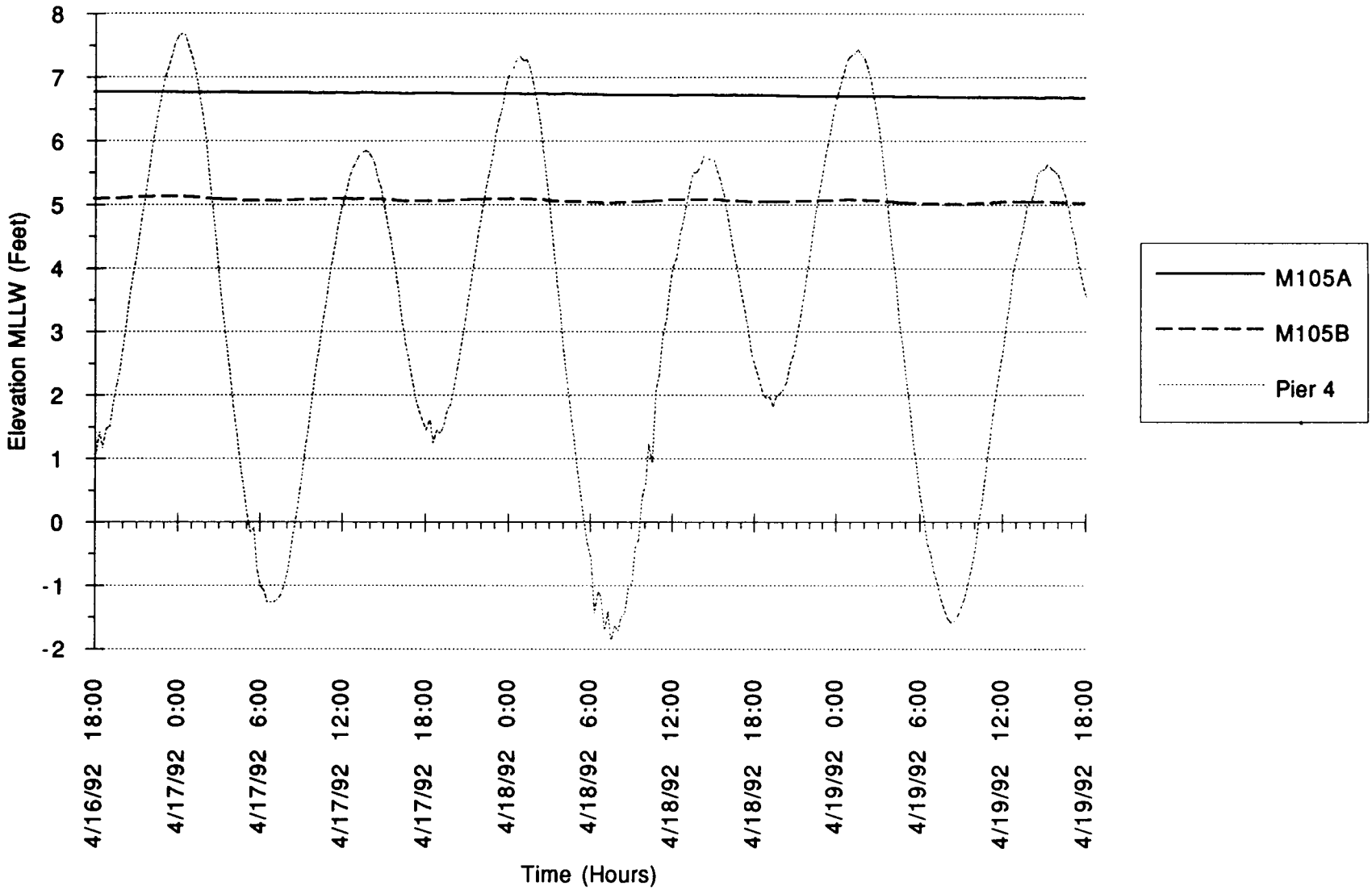
Time (Hours)
M104A
M104C
Pier 4

M105 Cluster



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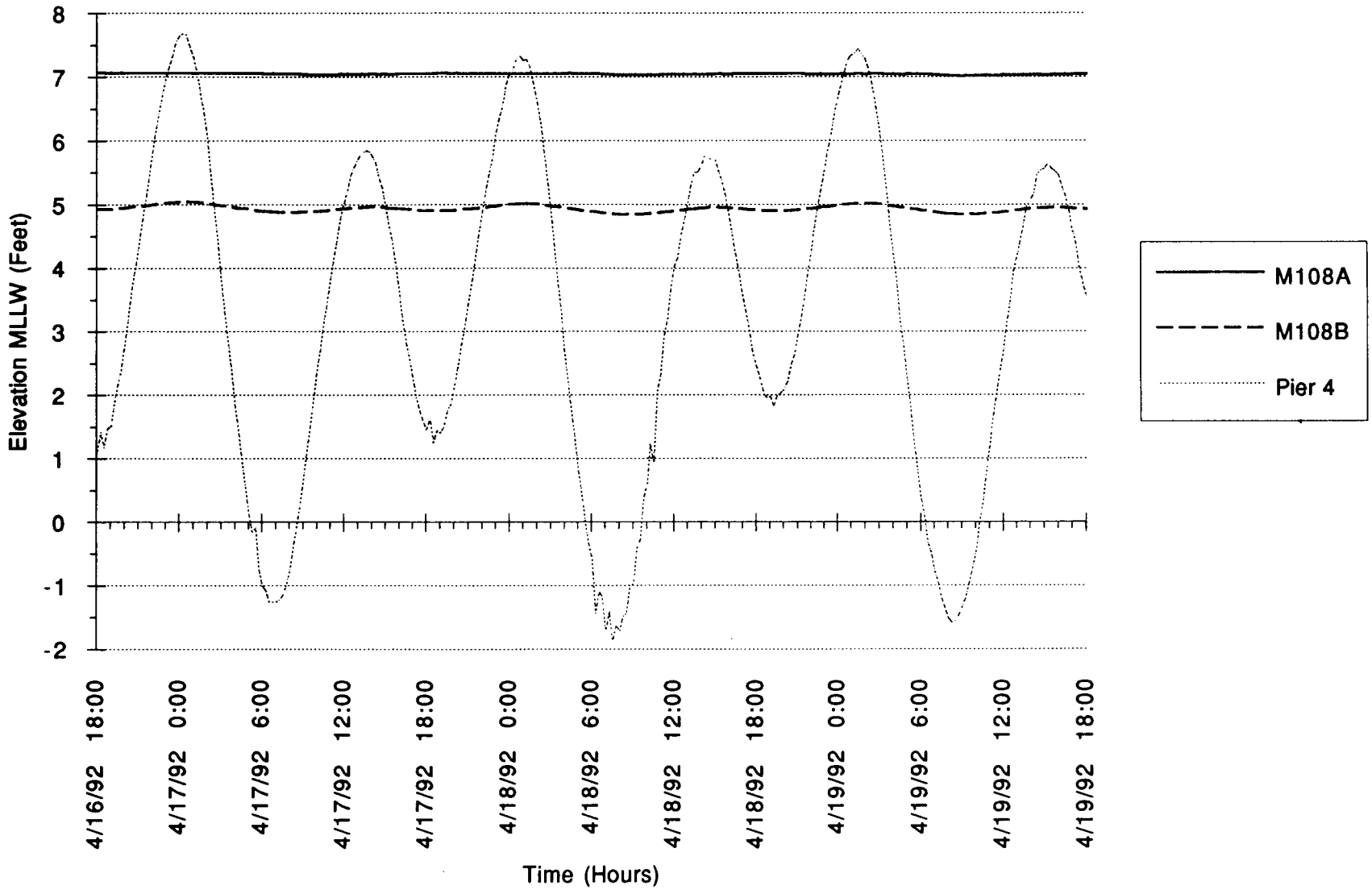

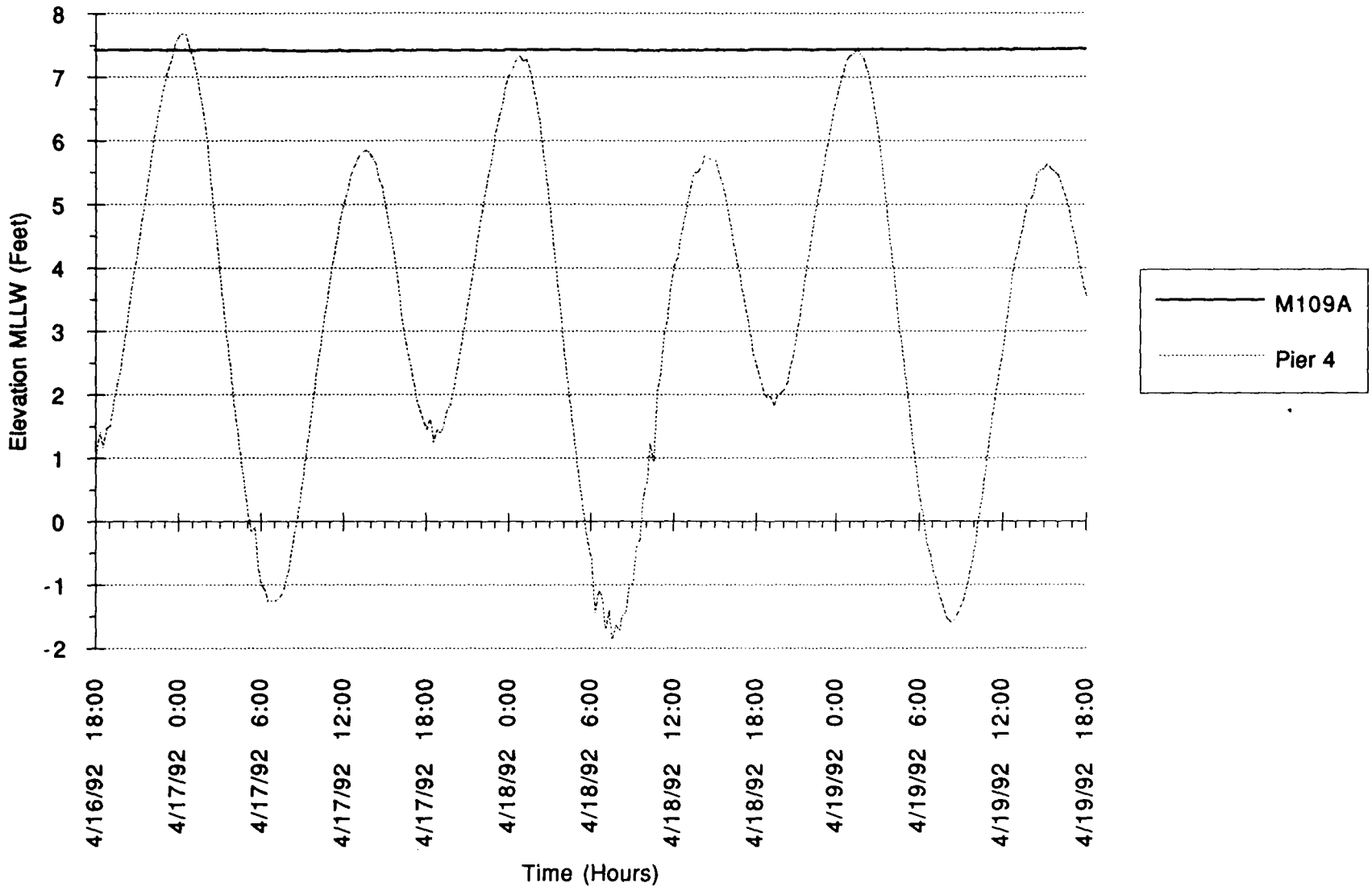
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Elevation MLLW (Feet)
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4/19/92 12:00
4/19/92 18:00
Time (Hours)
M109A
Pier 4

APPENDIX K

NAS ALAMEDA - RADIONUCLIDE DATA

1.0 INTRODUCTION

As part of the RI/FS work at NAS Alameda that was initially performed by Canonie and is presently being undertaken by the PRC team, surface soil samples, subsurface soil samples, and groundwater samples were analyzed for radionuclide concentrations. The intent was to determine whether or not there are potentially hazardous concentrations of radionuclides that are attributable to disposal activities at the base.

2.0 DATA COLLECTED AND ANALYSIS

For the assessment of radionuclides at NAS Alameda, in 1990, Canonie Environmental collected surface soil samples from 69 locations in Site 1, and a total of 28 subsurface soil samples from six boreholes around the perimeters of Sites 1 and 2. The surface sample locations and borehole locations are shown in Figures K-1 and K-2, respectively.

During CTO No. 0085 and CTO No. 0107, the PRC team collected 165 surface soil samples on a closely-spaced, 200-foot grid in Site 2 (at locations shown in Figure K-3), and collected 42 surface soil samples, 55 subsurface soil samples, and 309 groundwater samples from 40 well clusters throughout the western half of the base. Six of the well clusters were drilled under CTO No. 0085 and 34 of the clusters were drilled under CTO No. 107. At many of the borehole locations, shown on Figure K-2, two or three wells were installed to obtain water samples from different zones. The wells are designated as "A", "E", "B", or "C". "A" wells penetrate to the top of the first water-bearing zone, "E" wells are screened at the bottom of the first water-bearing zone, "B" wells are screened at the top of the second water-bearing zone, and "C" wells are screened at the bottom of the second water-bearing zone. Of the 40 well clusters, 11 clusters (11 "A" wells, three "B" wells, and one "C" well) are located in the Runway Area, 14 clusters (14 "A" wells, seven "E" wells, two "B" wells, and three "C" wells) are located around the perimeter of Site 1, and 15 clusters (15 "A" wells, seven "E" wells, five "B" wells, and two "C" wells) are located along the east, south and west margins of Site 2. The groundwater was monitored for one year on a quarterly basis in June/July 1991, September/October 1991, January/February 1992 and March/April 1992.

Radioactivity measurements of gross alpha, gross beta, and radium-226 and radium-228 have been performed on soil and groundwater samples. Different groups of samples were measured by three different laboratories. The surface and subsurface soil samples collected by Canonie were analyzed by Hazen

Research, Inc. in Golden, Colorado. Analytical Technologies Inc. in San Diego, California, analyzed the soil samples collected under CTO No. 0085, and Environmental Science and Engineering in Gainesville, Florida, analyzed the soil and groundwater samples collected under CTO No. 0107. The analytical procedures used for the radionuclide measurements are described in USEPA (1986b), and the data for soil are presented in Appendix D. Soil sample data are reported in pico (10^{-12}) curies per gram (pCi/g), and groundwater data in picocuries per liter (pCi/l). Values preceded by the symbol "<" are below the limit of detection of the method.

For the results of each of the four radionuclide analyses, there is an associated count error, which indicates the 95% confidence interval (±1.96 standard deviations). In many cases, the lower limit of the 95% confidence interval would be a negative number, but as zero is the lowest possible count, the actual range in these cases is from zero to the sum of the value plus the count error.

3.0 REGULATORY LIMITS FOR RADIONUCLIDES

There are three sets of regulations that can be used as a frame of reference for evaluating the radionuclide data, but it appears that none of these regulations actually apply to NAS Alameda.

3.1 Drinking Water Standards

The groundwater in the first and second water-bearing zones is not used for drinking water and is not flowing in the direction of drinking water wells. The second water-bearing zone contains brackish water, and the first water-bearing zone, if pumped, would before long produce brackish or saline water as a result of invasion from San Francisco Bay. Nonetheless, in the absence of regulatory constraints on radioactivity levels in groundwater, and solely as a frame of reference for evaluating these waters, they can be compared with drinking water standards. USEPA and California MCL standards for drinking water are:

Gross alpha	15 pCi/l
Gross beta	50 pCi/l
Ra-226 + Ra-228	5 pCi/l.

3.2 Radionuclide Releases to Unrestricted Areas

Our investigations indicate that NAS Alameda does not have a license to handle radioactive materials. However, for facilities that have such a license, CCR §17-30355, Appendix A lists, for numerous radioisotopes, concentrations above background that can be released into the air and water in

unrestricted areas. The levels given for both radium-226, radium-228, and for a concentration of unknown radionuclides, are:

3×10^{-8} µCi/ml	=	30 pCi/l	above background for soluble materials
3×10^{-5} µCi/ml	=	3×10^{4} pCi/l	above background for insoluble materials.

According to Hickman (1992) of the Radiologic Health Branch of the California Department of Toxic Substances Control in Sacramento, California, the limit for insoluble materials can be applied to soil by making the conservative assumption that one milliliter of soil weighs one gram, which yields the limit:

3×10^{-5} µCi/ml	=	30 pCi/g	above background for soil.

Hickman also indicated that these limits should be applied independently for gross alpha and gross beta emissions.

3.3 Pending Limits for Radium in Soil

According to Wong (1992), there is pending legislation in California to set a limit on concentrations of Ra-226 + Ra-228 in soils. The proposed limit, which is presently in effect in Louisiana (State of Louisiana Department of Environmental Quality, 1989) but not in California, is:

5 pCi/g	in the top 15 centimeters
15 pCi/g	below the top 15 centimeters.

4.0 NATURAL RADIOACTIVITY

Many radioisotopes are naturally-occurring in the environment and account for background levels of radioactivity that vary from one location to another. Extensive information on this topic is presented by Eisenbud (1987), the source for the following table and other technical data and information presented in this section.

Radium, uranium, thorium, and potassium are found in varying amounts in all rocks and soils. Average concentrations of their predominant radioisotopes in several rock types are shown in the table below. Local concentrations can depart significantly from the listed values. Ra-226, U-238, and Th-232 decay by alpha emission, and K-40 is a beta emitter.

Average Radium, Uranium, Thorium, and Potassium Contents in Various Rocks

Type of rock	Ra-226	U-238	Th-232	K-40
	(Concentrations in pCi/g)			
Igneous	1.3	1.3	1.3	22.
Sedimentary				
Sandstones	0.71	0.4	0.65	8.8
Shales	1.08	0.4	1.1	22.
Limestones	0.42	0.4	0.14	2.2

Of the three naturally occurring potassium isotopes, only K-40 is unstable. It comprises 0.01% of natural potassium and is responsible for an activity level of approximately 800 pCi/g of potassium. The potassium content of rocks varies from approximately 0.1% in limestone, to 1% in sandstone, to 3.5% in granite.

The radioactivity of surface soils can become elevated above natural levels through the application of fertilizers. High levels of naturally-occurring radioactivity are found in virtually all fertilizers as a consequence of two primary constituent ingredients, potassium, discussed above, and phosphates. Agricultural phosphorus is obtained as phosphate rock, found in sedimentary formations, usually interbedded with marine shales or limestones. The phosphates are high in radium and uranium.

Groundwater can contain significant levels of naturally-occurring radionuclides. For various aquifer types in the Atlantic Coastal Plain and Piedmont Provinces, Eisenbud (1987) reports Ra-226 concentrations averaging between 0.12 to 2.19 pCi/l with a maximum range of 0.0 to 25.9 pCi/l, and Ra-228 concentrations averaging between 0.06 and 2.16 pCi/l with a maximum range of 0.0 to 22.6 pCi/l.

Rainwater can contain a concentration of 1-10 pCi/l of lead-210, a radioisotope that decays by beta emission. Precipitation is the primary source of recharge for the first water-bearing zone at NAS Alameda.

Seawater contains approximately 0.39 gram per liter of potassium, which results in natural concentrations of 300 pCi/l from K-40, alone. Rubidium-87 contributes approximately 2.8 pCi/l of additional beta activity. Based upon the specific conductances of most of the groundwater samples from the second water-bearing zone at NAS Alameda, they appear to contain significant proportions of saline water from San Francisco Bay. (For comparison with the groundwater values, seawater has a specific conductance of approximately 46,000 µmhos/cm.) The presence of seawater, or for that matter, any other natural source of increased levels of dissolved solids in groundwater, will increase the level of radioactivity from natural sources.

The naturally-occurring radioisotope concentrations in rocks, soils, rain water, groundwater and seawater discussed above from Eisenbud (1987) do not identify all sources of natural radioactivity in these earth materials. However, this information is useful for assessing the radionuclide data that have been acquired at NAS Alameda.

5.0 DATA EVALUATION

5.1 Individual Sample Data

Results for many of the groundwater samples, particularly those with very low reported radionuclide concentrations (less than 1 pCi/l), yielded count errors considerably larger than the count itself. The upper end of some of these ranges appear to represent moderate levels of radioactivity. However, because of the analytical technique, this is not an appropriate interpretation of the data. These data simply indicate that the sample was very small. For gross alpha and gross beta analyses, the EPA analytical technique requires that a water sample be heated to evaporate all the water. The remaining dry residue is used for the measurement. If the water sample was small in the first place, and/or if there was very little residue, the count error will necessarily be very high. This should be interpreted to indicate that little or no radioactivity was detected, or that the sample was so small that it may not be accurate or representative. In general, the soil samples yielded considerably smaller error counts than the groundwater samples because significant quantities of dry material were available for the measurements.

Because of the measurement technique, as described above, the radionuclide data for nearly all of the water samples yield large error counts (broad 95% confidence intervals), particularly for the samples suggesting moderate values. For this reason, the data for any one of these samples do not have statistical significance.

However, for the soil samples, larger solid sample sizes resulted in somewhat smaller error counts (95% confidence intervals) than for the water samples. While the broad confidence interval may still cast statistical doubt on the significance of any one sample, clusters of samples may provide indications of trends.

One such cluster may be the gross beta values for the surface soil samples at Site 1. Out of 69 samples, only three are below 5 pCi/g, and these are at scattered locations. A majority of the values were reported between 10 and 15 pCi/g, and the highest value is 20 ± 5 pCi/g. Virtually all the data from this survey suggest elevated values compared with most other surface samples. There are two reasonable

interpretations, the first being that there were differences in the procedures or calibrations used by the Canonie and the PRC team laboratories that performed the analyses, and the second being that the survey area actually displays elevated beta activity. Slightly increased beta counts could be explained by the fact that this entire surface soil survey was conducted in a grassy area that has presumable been fertilized, probably on a regular basis. As discussed above in Section 4.0 on naturally-occurring radioactivity, fertilizers are high in potassium, which contains the radioisotope K-40, a beta emitter.

By way of comparison, the surface soil samples for Site 2 (Appendix D) suggest an area of slightly elevated radionuclides within a consistent set of data, but not for the entire data set. There is a cluster of sites in the west-central to south-central portion of Site 2 that display values above 5 pCi/g for at least two of the three parameters, gross alpha, gross beta, and Ra-226 + Ra-228. These sites are surface soil sample locations G-202, G-203, H-201, H-202, H-203, H-204, H-205, I-202, I-203, I-204, I-205, J-101, J-205, and K-205, whose locations are shown in Figure K-3. They are in the wetland area of Site 2. The highest of the values are:

14.1 ± 4.0 pCi/g for gross alpha
12.5 ± 1.9 pCi/g for gross beta
12.2 ± 1.8 pCi/g for Ra-226 + Ra-228.

5.2 Estimation of Average Values for Specific Areas

Attempts have been made to determine whether or not there are trends and patterns in the soil and groundwater radionuclide data. As presented in Appendix D for the soil data, and Sections 7, 8 and 9 for the groundwater data, the data are grouped by area - Runway Area, Site 1, and Site 2, respectively. The groundwater data have also been grouped by the first or second water-bearing zone and by the quarter in which the samples were collected. For Site 1 and Site 2, there are sufficient "A" and "E" wells to analyze for significant differences between the groundwater at the top and bottom of the first water-bearing zone.

Average (mean) levels of radioactivity in the soil and in the groundwater from the three areas and two water-bearing zones have been calculated. The reported count was used for each sample, without regard for the reported count error. Data determined to be "qualified, estimated not detected" and "qualified, not usable," designated "UJ" and "R," respectively, were not included in these averages. Radionuclides reported below the detection limit (indicated by "<") were assumed present at the level of the detection limit divided by $\sqrt{2}$ (Hornung and Reed, 1990; Miesch, 1967). The values of the measured parameters - gross alpha, gross beta, radium-226, radium-228, and also the sum of radium-226 plus radium-228 (Ra-226 + Ra-228) - were averaged, the standard deviation calculated, and the 95% confidence limits

(±1.96 standard deviations) calculated for the group of reported counts. For many of the groundwater samples, these confidence limits are larger than the average value, a consequence of the distribution of values within a particular group not being a normal distribution. Many data sets include several values below the levels of detectability, several scattered moderate values, and perhaps one or two slightly elevated values.

5.2.1 Groundwater Data. The results of calculating averages and 95% confidence limits for these groupings are shown in Table K-1 for the groundwater from the first water-bearing zone. Considering the large 95% confidence intervals and the fact that the average alpha and beta counts vary markedly and inconsistently from one quarter to the next, the data do not demonstrate any significant trends based upon the quarter in which the samples were collected, or between the top and bottom of the first water-bearing zone.

The two right-hand columns in Table K-1 show average values, 95% confidence intervals, and 95% confidence limits for the sample means for all groundwater samples from the first water-bearing zone for the Runway Area, Site 1, and Site 2. The upper bound 95% confidence limits are higher at Site 1 and Site 2 than in the Runway Area, but the extensive overlap in these statistically-derived ranges, not to mention the broad count error range associated with each measurement, may make the differences insignificant.

For the second water-bearing zone, there are insufficient groundwater samples to attempt a statistical comparison between the top and bottom of the aquifer, but the data from the "B" and "C" wells are very similar. Table K-2 shows the average data for each area on a quarterly basis, but there may not be enough samples to make a statistically significant comparison from one quarter to the next. The two right-hand columns present the average values, 95% confidence intervals, and 95% confidence limits of the sample means for all samples from each of the three areas. The 95% confidence ranges for each parameter are very similar for all three areas, with most of the maximum limits in the Runway Area being slightly higher than at Sites 1 and 2.

5.2.2 Soil Sample Data. The results of calculating averages and 95% confidence limits for the radionuclide data for surface and subsurface soil samples collected from the three areas are shown in Table K-3. Both Canonie and PRC team data are included.

As noted in Section 5.1 above, there is a general difference between gross beta count levels measured for most soil samples by Canonie versus the PRC team, and to a lesser extent, there may also be a difference between the levels of gross alpha measured. As the Canonie and the PRC team measurements

were performed at different laboratories, it is not known whether these differences represent minor variations of radionuclide levels, or differences in laboratory technique, instrument calibration, etc.

The average values are low and, with three exceptions, demonstrate considerable overlap in their 95% confidence level ranges when compared among the areas for a particular parameter. One of these exceptions is seen in the Canonie surface soil measurements of gross beta at Site 1. While low in absolute terms, the Canonie data suggest a higher range of values than indicated by other surface soil data. The other two slightly higher values appear in the second water-bearing zone at Site 1 for gross alpha, and at Site 2 for gross beta. For the most part, these appear to be the result of higher values being reported by Canonie measurements. There is very little basis for comparison with values the Runway Area because only one soil sample was measured from the second water-bearing zone in the Runway Area.

6.0 CONCLUSIONS

In absolute terms, the measured radionuclide concentrations in the soil and groundwater throughout NAS Alameda are very low. Activity levels approximate background concentrations.

Moderate variations among the three areas or two water-bearing zones, if real in light of generally large count errors for many samples, may be the result of a combination of factors.

- The fill material in the Runway Area, Site 1, and Site 2 were emplaced at different times with material from different areas, so it should not be expected that they would be identical in physical characteristics,

- The application of fertilizer to surface soils, and

- The mixing of seawater with fresh groundwater can also result in moderately elevated radionuclide concentrations.

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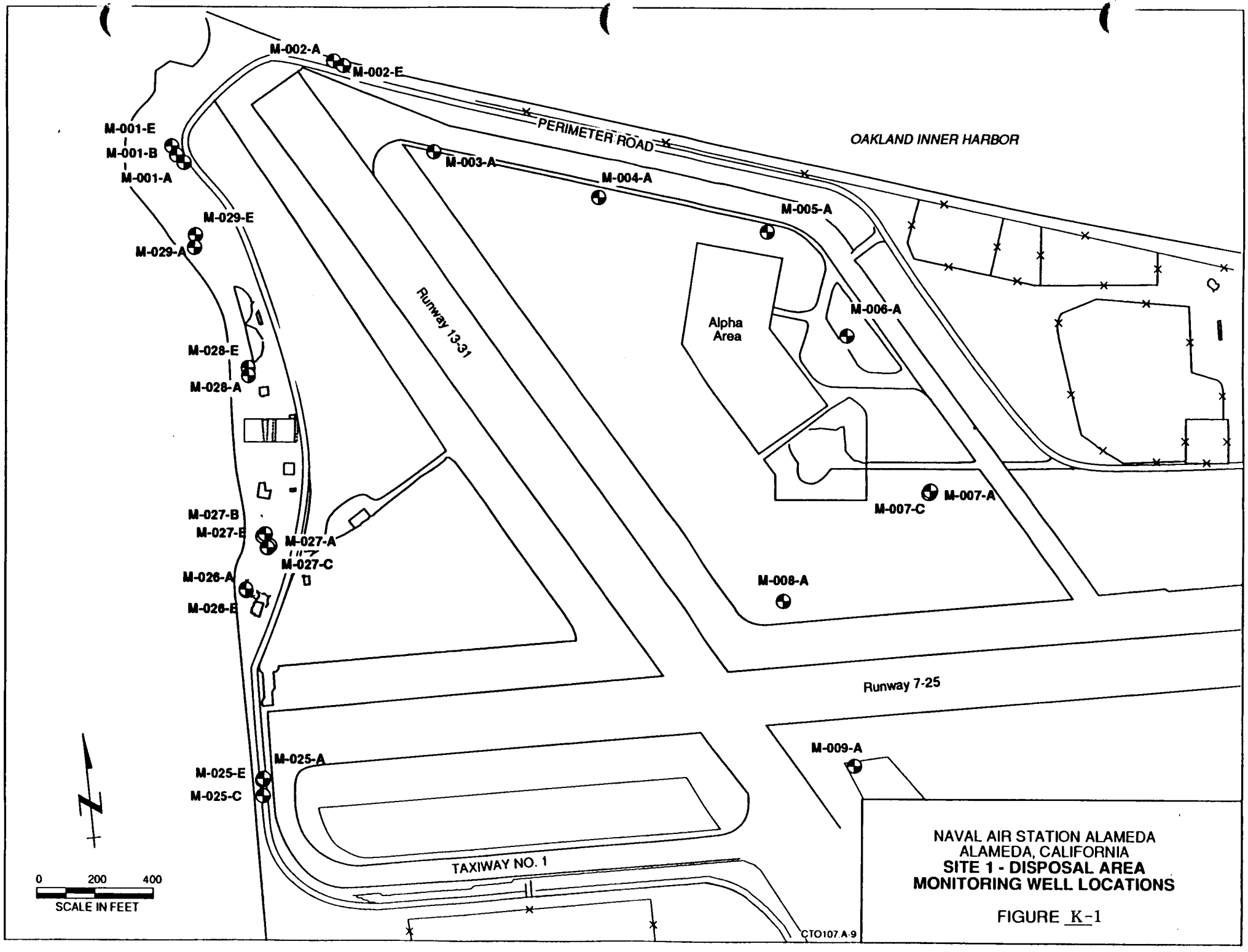
ALAMEDA POINT
SSIC NO. 5090.3

FIGURES

APPENDIX K – RADIONUCLIDES DISCUSSION AND SUMMARY

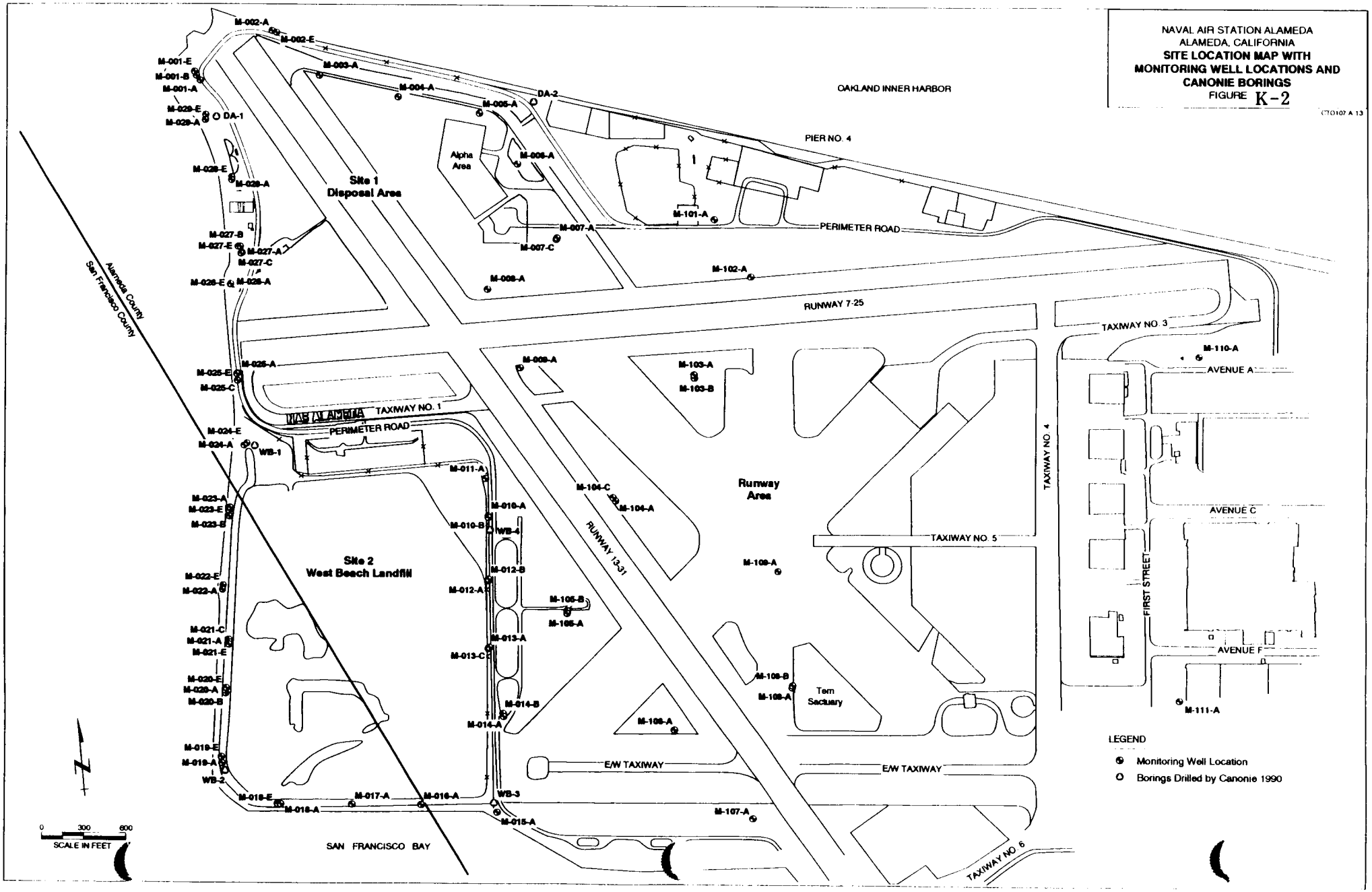
FINAL
SOLID WASTE WATER QUALITY ASSESSMENT TEST AND DATA SUMMARY REPORT FOR REMEDIAL INVESTIGATION/FEASIBILITY STUDY FOR PHASES 5 AND 6

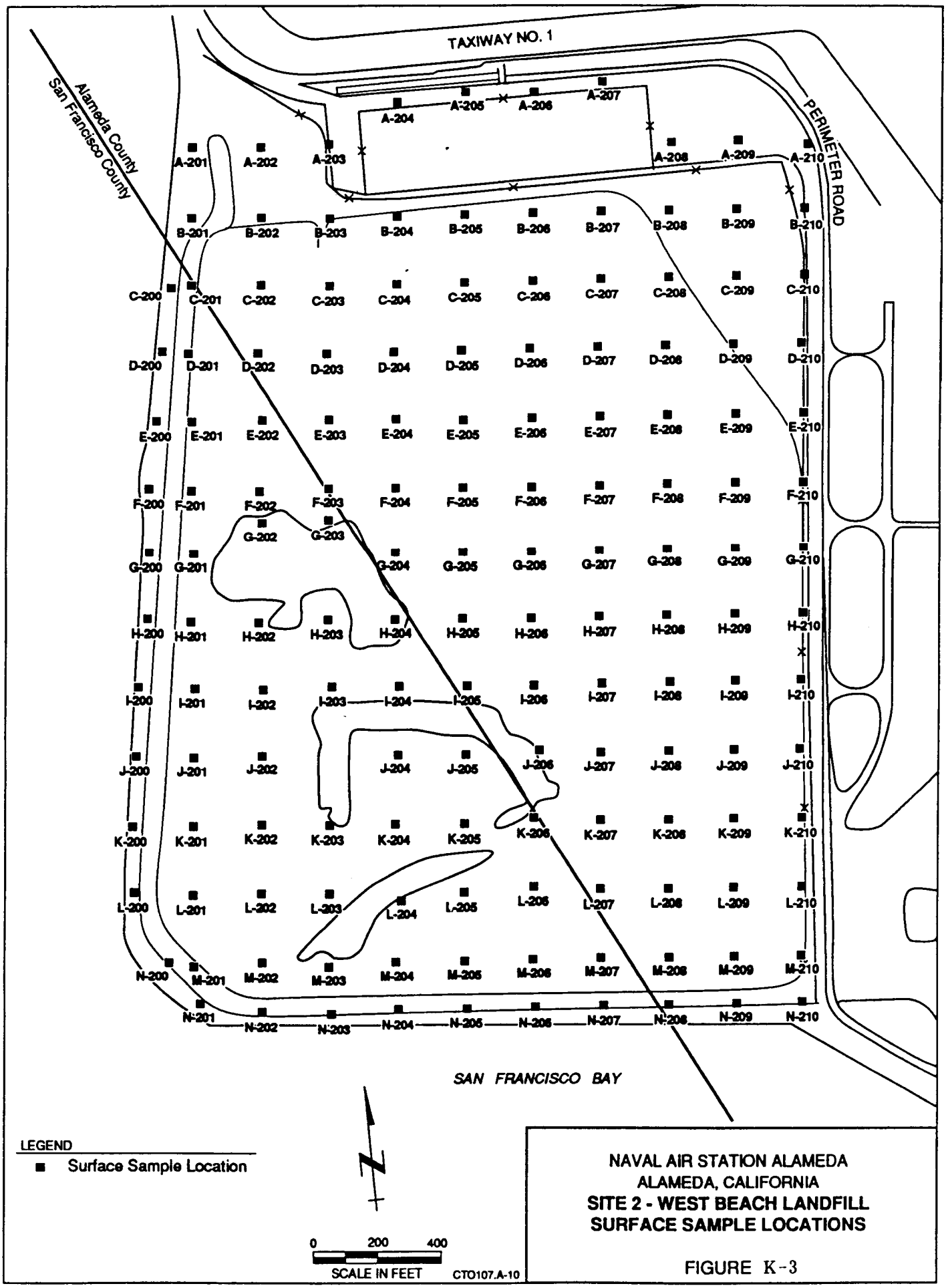
DATED 30 APRIL 1993



NAVAL AIR STATION ALAMEDA
ALAMEDA, CALIFORNIA
SITE 1 - DISPOSAL AREA
MONITORING WELL LOCATIONS

FIGURE K-1


NAVAL AIR STATION ALAMEDA
ALAMEDA, CALIFORNIA
SITE LOCATION MAP WITH
MONITORING WELL LOCATIONS AND
CANONIE BORINGS
FIGURE K-2
OAKLAND INNER HARBOR
PIER NO. 4
Alpha Area
Site 1
Disposal Area
PERIMETER ROAD
RUNWAY 7-25
TAXIWAY NO. 3
AVENUE A
NAS ALAMEDA
TAXIWAY NO. 1
PERIMETER ROAD
Runway Area
TAXIWAY NO. 4
AVENUE C
TAXIWAY NO. 5
RUNWAY 13-31
Site 2
West Beach Landfill
FIRST STREET
AVENUE F
Tern Sactuary
E/W TAXIWAY
E/W TAXIWAY
TAXIWAY NO. 6
SAN FRANCISCO BAY
Alameda County
San Francisco County
SCALE IN FEET
0
300
600
LEGEND
Monitoring Well Location
Borings Drilled by Canonie 1990



NAVAL AIR STATION ALAMEDA
ALAMEDA, CALIFORNIA
SITE 2 - WEST BEACH LANDFILL
SURFACE SAMPLE LOCATIONS

FIGURE K-3

N00236.000848
ALAMEDA POINT
SSIC NO. 5090.3

TABLES

APPENDIX K – RADIONUCLIDES DISCUSSION AND SUMMARY

FINAL
SOLID WASTE WATER QUALITY ASSESSMENT TEST AND DATA SUMMARY REPORT FOR REMEDIAL INVESTIGATION/FEASIBILITY STUDY FOR PHASES 5 AND 6

DATED 30 APRIL 1993

TABLE K-1 - GROUNDWATER [illegible]ST WATER BEARING ZONE

Averages and Errors for Radionuclide Values

Errors are for 95% confidence limits.
"#" indicates number of samples.

RUNWAY AREA - "A" Wells

	1st Quarter				2nd Quarter				3rd Quarter				4th Quarter				All Samples				Conf. Limits	
(pCi/l)	#	Avg		Error	#	Avg		Error	#	Avg		Error	#	Avg		Error	#	Avg		Error	Min.	Max.
Alpha, gross	10	7.7	±	19.4	12	21.3	±	46.6	14	9.9	±	26.0	12	10.0	±	12.9	48	12.3	±	30.2	0.0	42.6
Beta, gross	10	9.3	±	26.2	12	14.8	±	25.9	14	25.5	±	64.5	11	23.3	±	33.5	47	18.8	±	43.3	0.0	62.1
Radium 226	6	6.6	±	13.4	12	4.2	±	4.4	12	1.4	±	1.9	12	1.0	±	2.7	42	2.8	±	6.8	0.0	9.6
Radium 228	10	0.5	±	1.4	8	2.2	±	3.5	8	0.8	±	2.0	7	2.2	±	4.3	33	1.3	±	3.2	0.0	4.5
Ra 226 + Ra 228	6	6.9	±	13.3	8	5.8	±	4.6	8	1.9	±	2.6	7	3.0	±	6.1	29	4.3	±	7.9	0.0	12.2

SITE 1 - "A" and "E" Wells

	1st Quarter				2nd Quarter				3rd Quarter				4th Quarter				"A" Wells				"E" Wells				All Samples				Conf. Limits	
(pCi/l)	#	Avg		Error	#	Avg		Error	#	Avg		Error	#	Avg		Error	#	Avg		Error	#	Avg		Error	#	Avg		Error	Min.	Max.
Alpha, gross	23	21.9	±	81.7	23	21.0	±	68.3	21	17.0	±	38.2	22	15.1	±	36.5	60	18.0	±	64.6	29	20.6	±	47.3	89	18.8	±	59.3	0.0	78.1
Beta, gross	23	38.1	±	83.6	23	47.0	±	128.9	23	50.6	±	117.5	24	51.7	±	74.8	63	40.8	±	93.3	30	59.8	±	116.6	93	46.9	±	102.2	0.0	149.2
Radium 226	19	4.1	±	7.9	23	3.9	±	4.9	19	1.7	±	2.8	15	1.3	±	1.9	49	2.9	±	5.8	27	2.9	±	5.1	76	2.9	±	5.5	0.0	8.4
Radium 228	23	0.5	±	0.7	18	1.6	±	2.3	23	1.6	±	3.6	18	0.9	±	2.1	56	1.1	±	2.3	26	1.2	±	3.1	82	1.1	±	2.6	0.0	3.7
Ra 226 + Ra 228	19	4.6	±	8.2	19	5.2	±	3.3	19	3.1	±	6.1	13	2.2	±	2.5	45	4.0	±	6.3	25	3.7	±	5.5	70	3.9	±	6.0	0.0	9.9

SITE 2 - "A" and "E" Wells

	1st Quarter				2nd Quarter				3rd Quarter				4th Quarter				"A" Wells				"E" Wells				All Samples				Conf. Limits	
(pCi/l)	#	Avg		Error	#	Avg		Error	#	Avg		Error	#	Avg		Error	#	Avg		Error	#	Avg		Error	#	Avg		Error	Min.	Max.
Alpha, gross	26	105.1	±	309.5	25	22.6	±	84.8	23	206.3	±	332.0	24	188.0	±	326.2	67	99.3	±	273.1	31	190.3	±	357.6	98	128.1	±	311.9	0.0	440.0
Beta, gross	26	145.1	±	304.4	25	90.3	±	240.1	23	50.3	±	99.7	24	370.3	±	593.7	67	152.3	±	411.1	31	189.4	±	461.2	98	164.0	±	426.6	0.0	590.6
Radium 226	9	8.1	±	10.8	25	3.2	±	5.5	23	2.0	±	2.0	8	3.4	±	3.6	45	3.3	±	5.5	20	3.9	±	8.8	65	3.5	±	6.6	0.0	10.1
Radium 228	26	0.3	±	0.4	23	4.0	±	4.8	19	2.2	±	3.1	20	2.0	±	3.1	60	1.8	±	3.7	28	2.8	±	4.9	88	2.1	±	4.2	0.0	6.3
Ra 226 + Ra 228	9	8.4	±	10.9	23	7.1	±	8.6	20	4.1	±	4.5	6	4.4	±	3.3	40	5.5	±	5.9	18	7.1	±	11.3	58	6.0	±	8.0	0.0	14.0

TABLE K-2 - GROUNDWATER - SECOND WATER BEARING ZONE

Averages and Errors for Radionuclide Values

Errors are for 95% confidence limits.
"#" indicates number of samples.

RUNWAY AREA - "B" and "C" Wells

	1st Quarter				2nd Quarter				3rd Quarter				4th Quarter				All Samples				Conf. Limits	
(pCi/l)	#	Avg		Error	#	Avg		Error	#	Avg		Error	#	Avg		Error	#	Avg		Error	Min.	Max.
Alpha, gross	3	< 0.3			5	70.4	±	137.5	3	14.5	±	49.0	5	60.7	±	89.6	16	43.7	±	104.4	0.0	148.1
Beta, gross	3	83.5	±	282.7	5	62.7	±	66.0	3	132.3	±	113.4	5	357.6	±	200.8	16	171.8	±	301.5	0.0	473.3
Radium 226	3	4.3	±	4.9	5	3.7	±	2.3	3	2.8	±	2.9	5	2.6	±	2.6	16	3.3	±	3.1	0.2	6.4
Radium 228	3	1.5	±	3.2	3	4.1	±	3.9	3	1.5	±	1.3	2	1.0	±	0.8	11	2.1	±	3.4	0.0	5.6
Ra 226 + Ra 228	3	5.8	±	5.8	3	7.3	±	6.6	3	4.3	±	4.1	2	2.7	±	0.4	11	5.2	±	5.5	0.0	10.7

SITE 1 - "B" and "C" Wells

	1st Quarter				2nd Quarter				3rd Quarter				4th Quarter				All Samples				Conf. Limits	
(pCi/l)	#	Avg		Error	#	Avg		Error	#	Avg		Error	#	Avg		Error	#	Avg		Error	Min.	Max.
Alpha, gross	5	56.3	±	83.6	7	7.8	±	33.0	6	21.7	±	72.5	6	136.2	±	226.9	24	53.5	±	155.4	0.0	208.9
Beta, gross	5	22.2	±	96.2	7	38.8	±	81.6	6	48.2	±	107.6	6	217.8	±	140.7	24	82.5	±	187.0	0.0	269.5
Radium 226	4	1.4	±	1.0	7	2.5	±	1.9	6	1.4	±	2.1	3	1.7	±	2.0	20	1.8	±	2.0	0.0	3.8
Radium 228	5	0.7	±	0.9	7	2.7	±	2.5	5	2.0	±	2.7	6	1.7	±	2.5	23	1.9	±	2.6	0.0	4.5
Ra 226 + Ra 228	4	2.1	±	1.0	7	5.2	±	3.8	5	3.4	±	4.9	3	3.6	±	2.9	19	3.8	±	4.1	0.0	7.9

SITE 2 - "B" and "C" Wells

	1st Quarter				2nd Quarter				3rd Quarter				4th Quarter				All Samples				Conf. Limits	
(pCi/l)	#	Avg		Error	#	Avg		Error	#	Avg		Error	#	Avg		Error	#	Avg		Error	Min.	Max.
Alpha, gross	8	48.4	±	178.5	7	3.1	±	14.7	8	121.3	±	137.6	7	52.8	±	106.4	30	58.3	±	147.7	0.0	206.0
Beta, gross	8	33.4	±	80.2	7	55.8	±	107.7	8	45.4	±	149.3	7	159.3	±	164.9	30	71.2	±	156.8	0.0	228.0
Radium 226	4	5.4	±	6.9	7	3.1	±	3.2	8	1.4	±	1.2	7	2.5	±	2.9	26	2.8	±	4.1	0.0	6.9
Radium 228	8	0.3	±	0.3	7	3.3	±	3.3	8	1.3	±	1.4	5	2.4	±	1.9	28	1.7	±	2.9	0.0	4.6
Ra 226 + Ra 228	4	5.7	±	6.8	7	6.4	±	5.3	8	2.8	±	2.3	5	5.3	±	5.0	24	4.8	±	5.4	0.0	10.2

TABLE K-3 - SURFACE AND SUBSURFACE SOIL SAMPLES

Averages and Errors for Radionuclide Values
Errors are for 95% confidence limits.

RUNWAY AREA

	Surface At well locations				1st Water Bearing Zone		2nd Water Bearing Zone
Depth (feet)	0.0-0.5				1.5-5.5		62.0
No. of samples	11				6		1
(pCi/g)	Avg		Error		Avg	Error	
Alpha, gross	1.9	±	1.6		1.7	± 3.2	1.2
Beta, gross	1.2	±	2.3		0.8	± 2.6	0.4
Radium 226	3.0	±	3.4		1.8	± 0.8	3.0
Radium 228	0.3	±	0.2		0.2	± 0.0	0.2
Ra 226 + Ra 228	3.3	±	3.4		2.0	± 0.8	3.2

SITE 1

	Surface At well locations			Surface Phase 1 survey			1st Water Bearing Zone		2nd Water Bearing Zone		
Depth (feet)	0.0-0.5			0.0-0.5			0.5-26.5		40.0-88.0		
No. of samples	19			69			28		7		
(pCi/g)	Avg		Error	Avg		Error	Avg	Error	Avg		Error
Alpha, gross	2.4	±	2.8	3.5	±	4.3	4.5	± 6.9	9.7	±	18.7
Beta, gross	2.0	±	2.7	11.4	±	7.0	4.7	± 5.5	2.6	±	3.1
Radium 226	1.9	±	2.8	0.4	±	0.7	2.1	± 2.7	2.8	±	2.3
Radium 228	0.2	±	0.0	0.8	±	1.7	0.3	± 0.3	1.1	±	1.9
Ra 226 + Ra 228	2.1	±	2.8	1.1	±	1.9	2.3	± 2.7	3.9	±	2.0

SITE 2

	Surface At well locations			Surface Phase 2 survey			1st Water Bearing Zone		2nd Water Bearing Zone		
Depth (feet)	0.0			0.0			0.5-45.0		46.0-92.0		
No. of samples	12			165			34		7		
(pCi/g)	Avg	±	Error	Avg		Error	Avg	Error	Avg		Error
Alpha, gross	2.2	±	2.3	3.2	±	4.7	2.8	± 2.4	3.8	±	3.2
Beta, gross	2.0	±	2.4	2.5	±	4.4	4.0	± 4.6	12.4	±	13.7
Radium 226	1.5	±	3.3	3.6	±	4.0	2.1	± 1.6	1.7	±	2.1
Radium 228	0.2	±	0.2	0.2	±	0.2	0.4	± 0.4	0.3	±	0.2
Ra 226 + Ra 228	1.8	±	3.4	3.8	±	4.0	2.5	± 1.5	1.9	±	2.1