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B-5 SLUG TEST AND STREAMBED HYDRAULIC CONDUCTIVITY CALCULATIONS

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

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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 (length^3/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

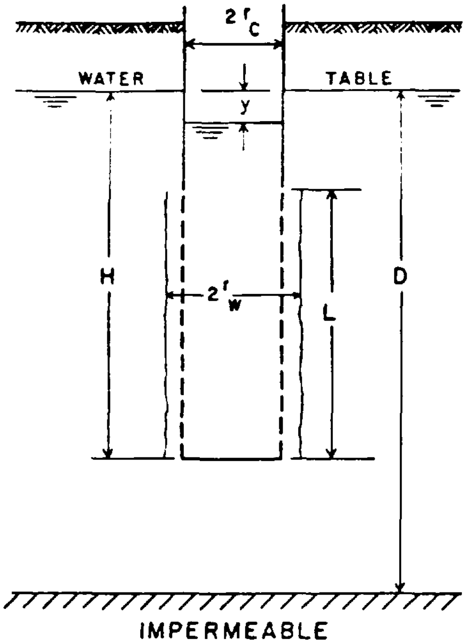

Fig. 1. Geometry and symbols of a partially penetrating, partially perforated well in unconfined aquifer with gravel pack or developed zone around perforated section.

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_w 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

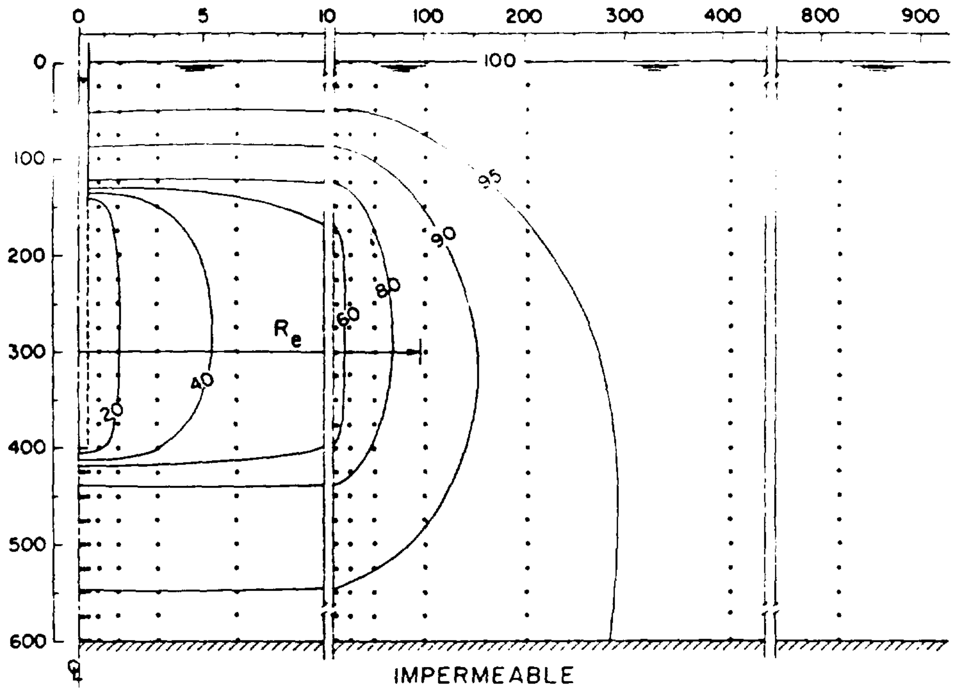

Fig. 2. Node arrangement (dots) for resistance network analog and potential distribution (indicated as percentages on equipotentials) for system with $L/r_w = 625$, $H/r_w = 1000$, and $D/r_w = 1500$. The numbers on the left and at the top of the figure are arbitrary length units (note breaks in horizontal 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_t into the simulated well varied essentially linearly with L and could be described by the equation

$$Q_t = mL + n \qquad (7)$$

Because of the linearity between Q_t 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:

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

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

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

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

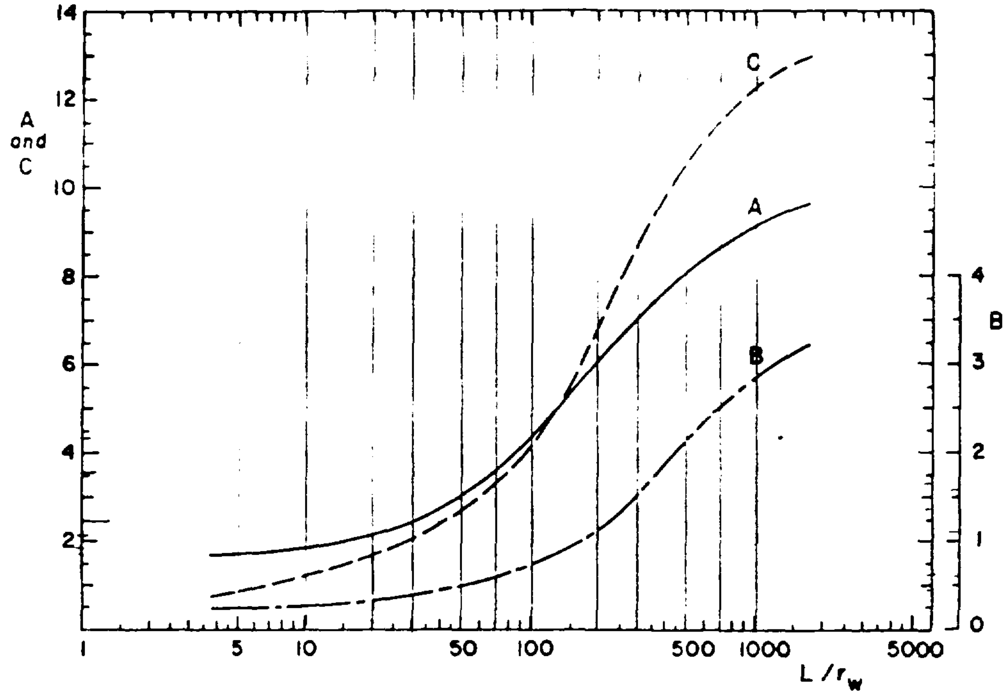

Fig. 3. Curves relating coefficients A, B, and C to L/r_w.

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

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

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

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

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

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

where A_Y is a geometry factor with dimension of length. Values of A_Y were evaluated with an electrolytic tank analog by *Youngs* [1968], whose results were expressed in tabular form as A_Y/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

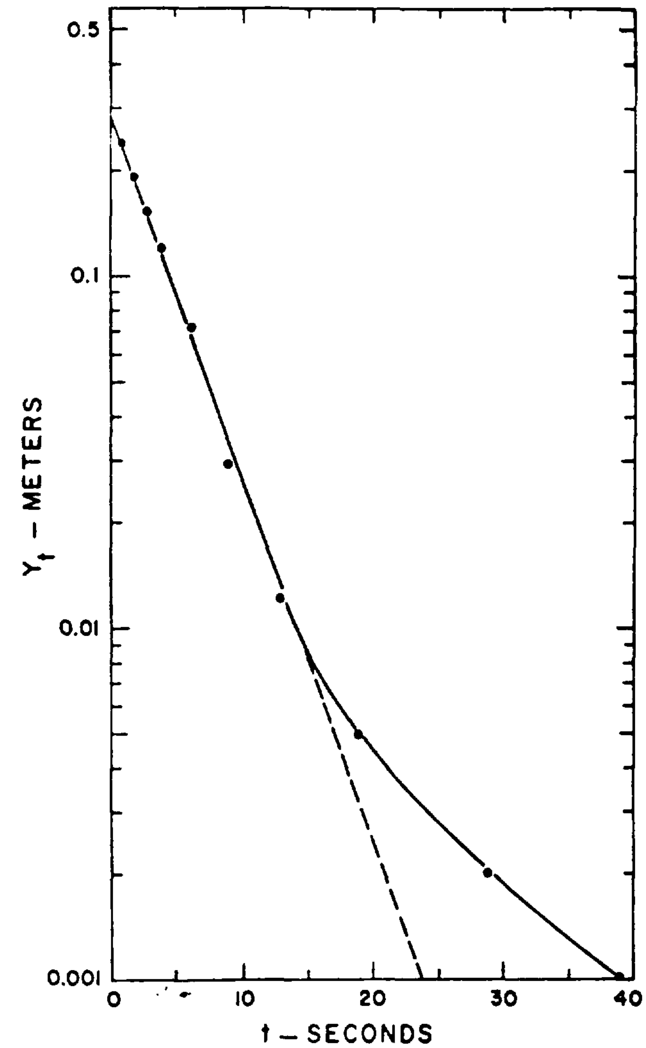

Fig. 4. Plot of y versus t for slug test on east well.

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, this yields $T = 62.8$ 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.

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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, in 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) if r is set equal to the effective radius r_e [... 1947, p. 1049] of the screen or open hole. Then, since r_e is small, the exponential approaches unity quickly, so that the equation becomes $H = V/4\pi Tt$, 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 $\pi r_c^2 H_0$, where r_c 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

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

and equation 2 can be written

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

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

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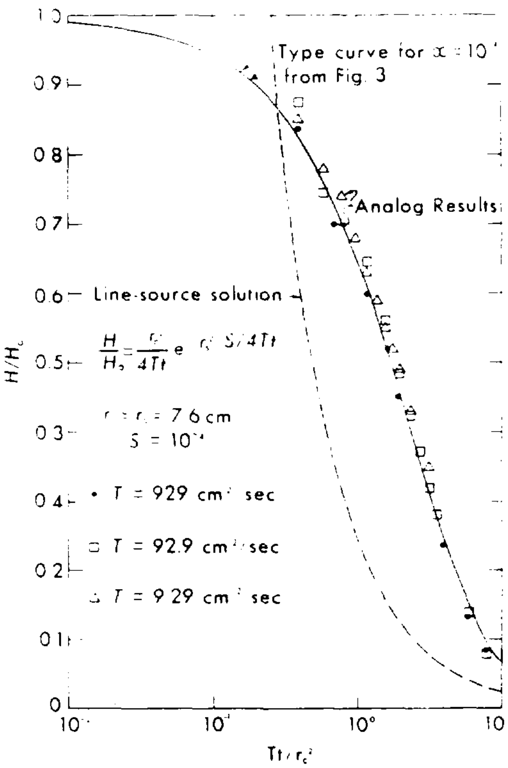

Fig. 1. Comparison of analog results with curve representing line-source solution.

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

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

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

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

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

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

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

Equation 5 is the differential equation governing nonsteady radial flow of confined ground water. (See, for example, *Jacob*, 1950, p. 3...) 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

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

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

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

for which the solution is

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

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

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

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

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

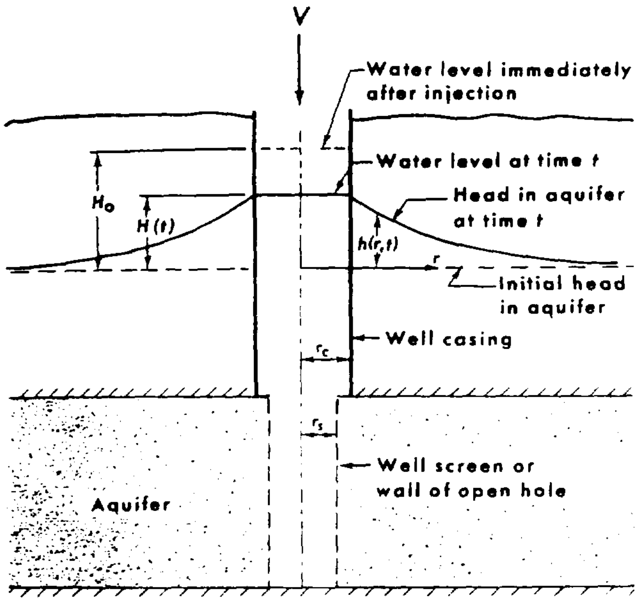

Fig. 2. Idealized representation of a well into which a volume V of water is suddenly injected.

The head $H(t)$ inside the well, obtained by substituting $r = r_c$ 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 good approximation of the finite-source solution 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 Grandview 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 m^3 of water when floating in the well. Its withdrawal was therefore equivalent to a negative charge of $V = 0.01016$ m^3. 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 da[illegible] plot is translated horizontally to a positi[illegible] where the data best fit the type curves, [illegible]

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 fro[illegible] 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		0.5[illegible]
1.00×10^{0}	0.2438	0.2494	0.2499	0.2500		0.2[illegible]
2.15×10^{0}	0.1150	0.1162	0.1163			0.11[illegible]
4.64×10^{0}	0.05359	0.05385	0.05388			0.[illegible]
7.00×10^{0}	0.03558	0.03570	0.03571			0.[illegible]
1.00×10^{1}	0.02494	0.02499	0.02500			0.[illegible]
1.40×10^{1}	0.01783	0.01786				0.01[illegible]
2.15×10^{1}	0.01162	0.01163				0.01[illegible]
3.00×10^{1}	0.008326	0.008333				0.[illegible]
4.64×10^{1}	0.005385	0.005388				0.[illegible]
7.00×10^{1}	0.003570	0.003571				0.00[illegible]
1.00×10^{2}	0.002499	0.002500				0.0[illegible]
2.15×10^{2}	0.001163					0.001[illegible]

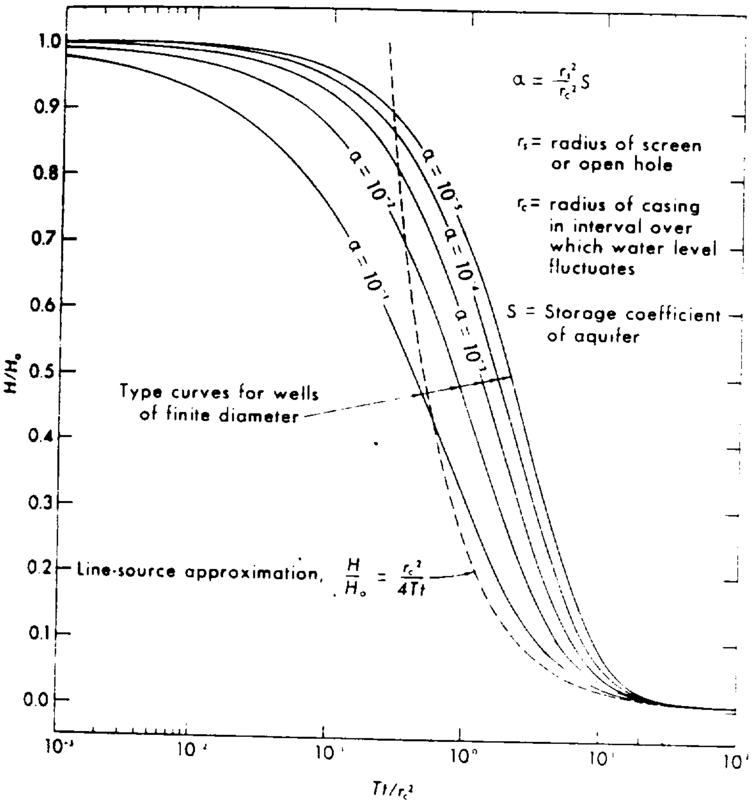

Fig. 3. Type curves for instantaneous charge in well of finite diameter.

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 $r_c = r_s$, 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

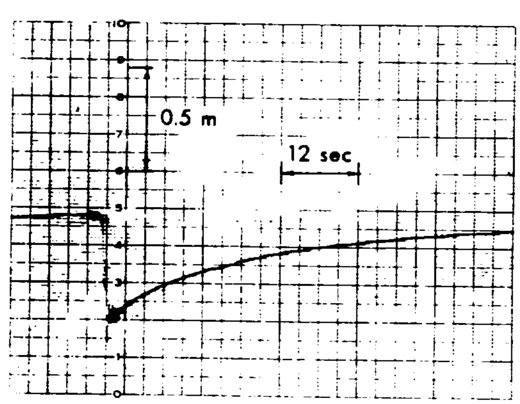

Fig. 4. Hydrograph of well at Dawsonville, Georgia, showing response of water level to the sudden withdrawal of a weighted float.

TABLE 2. 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

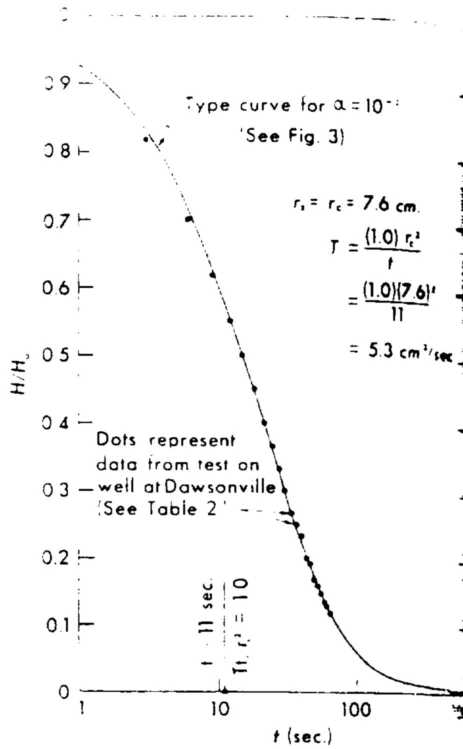

Fig. 5. Plot of data from test at Dawson[ville], Georgia, superposed on type curve.

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] prop[erly] 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 p[art]

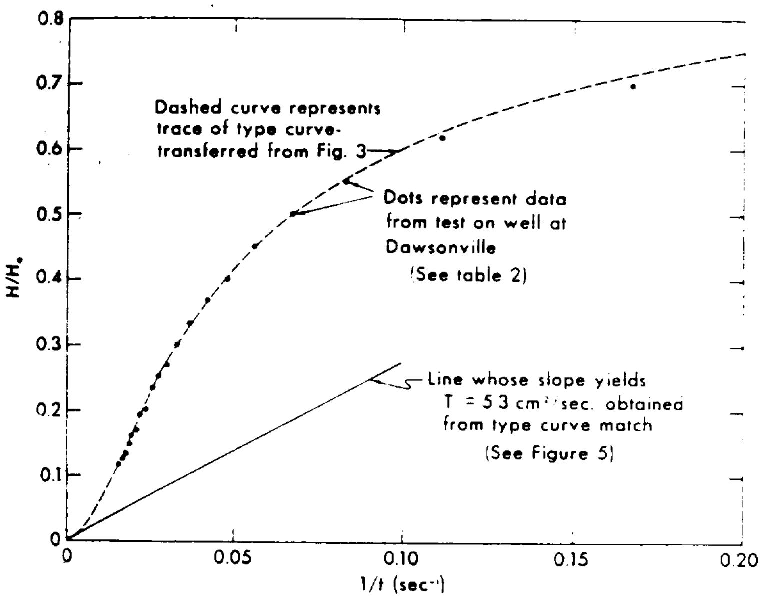

Fig. 6. Data from test on well of Dawsonville, Georgia, plotted according to the Ferris-Knowles method.

of the aquifer in which the well is screened or zone, 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.

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On the Analysis of 'Slug Test' Data

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Methods of analyzing 'slug test' data are reviewed, and additional type curves for the analysis of test data from formations with very low storage coefficients are presented.

The 'slug test' as a method of estimating the transmissivity of an aquifer was introduced by *Ferris and Knowles* [1954] (see also *Ferris et al.* [1962]). As is well known, the test consists of causing an instantaneous change in the water level of a well either by suddenly introducing or removing a known volume of water or by any other possible means and observing the recovery of the water level in the well with time. The method proposed by *Ferris and Knowles* [1954] for analyzing the test data is based on a solution that assumes a well of infinitesimal diameter (mathematical line source) and that can be expressed as

$$H/H_0 = r_c^2/4Tt \qquad (1)$$

where

- H_0, instantaneous head change in the well;
- H, head in the well at time $t > 0$;
- r_c, radius of the well casing in the interval over which the head change takes place;
- T, transmissivity of the aquifer;
- t, time since the instantaneous head change.

The transmissivity is determined from the slope of an arithmetic plot of H or of H/H_0 against $1/t$. Later we [*Cooper et al.*, 1967] presented a solution for a well of finite diameter and showed that the line source approximation of Ferris and Knowles is valid only for the relatively large times $t > 100\ r_c^2/T$, or, equivalently, when $H/H_0 < 0.0025$ (see the dashed line in Figure 1).

Our solution, which is applicable for all times t, has the form

$$H/H_0 = F(\beta, \alpha) \qquad (2)$$

where

- $\beta = Tt/r_c^2$;
- $\alpha = r_s^2 S/r_c^2$;
- r_s, effective radius of the well;
- S, storage coefficient of the aquifer;
- $F(\beta, \alpha)$, a function whose tables and graphs were presented for five orders of α, 10^{-1}–10^{-5}, and for $10^{-3} < \beta < 2.15 \times 10^2$ (for larger values of β the function is closely approximated by equation 1).

On the basis of this solution a type curve method for analyzing test data was proposed.

As both *Ferris et al.* [1962] and *Cooper et al.* [1967] recognize, transmissivities determined from the analysis of slug test data are 'representative only of the water-bearing material close to the well.' The test provides, however, an economical means of determining 'point' transmissivities. In some types of groundwater investigations a large number of such point transmissivities are often of greater use than a single value of the transmissivity obtained from a long-term pumping test at the same cost. The test has also been used as an indicator of the effectiveness of well development (W. A. Meneley, oral communication, 1972). In a properly developed well the slug test transmissivity should be higher than the long-term pumping test transmissivity. In the oil industry the type curve method has been adapted to

TABLE 1. Values of H/H_0 for a Well of Finite Diameter

Tt/r_c^2	$\alpha = 10^{-6}$	$\alpha = 10^{-7}$	$\alpha = 10^{-8}$	$\alpha = 10^{-9}$	$\alpha = 10^{-10}$
0.001	0.9994	0.9996	0.9996	0.9997	0.9997
0.002	0.9989	0.9992	0.9993	0.9994	0.9995
0.004	0.9980	0.9985	0.9987	0.9989	0.9991
0.006	0.9972	0.9978	0.9982	0.9984	0.9986
0.008	0.9964	0.9971	0.9976	0.9980	0.9982
0.01	0.9956	0.9965	0.9971	0.9975	0.9978
0.02	0.9919	0.9934	0.9944	0.9952	0.9958
0.04	0.9848	0.9875	0.9894	0.9908	0.9919
0.06	0.9782	0.9819	0.9846	0.9866	0.9881
0.08	0.9718	0.9765	0.9799	0.9824	0.9844
0.1	0.9655	0.9712	0.9753	0.9784	0.9807
0.2	0.9361	0.9459	0.9532	0.9587	0.9631
0.4	0.8828	0.8995	0.9122	0.9220	0.9298
0.6	0.8345	0.8569	0.8741	0.8875	0.8984
0.8	0.7901	0.8173	0.8383	0.8550	0.8686
1.0	0.7489	0.7801	0.8045	0.8240	0.8401
2.0	0.5800	0.6235	0.6591	0.6889	0.7139
3.0	0.4554	0.5033	0.5442	0.5792	0.6096
4.0	0.3613	0.4093	0.4517	0.4891	0.5222
5.0	0.2893	0.3351	0.3768	0.4146	0.4487
6.0	0.2337	0.2759	0.3157	0.3525	0.3865
7.0	0.1903	0.2285	0.2655	0.3007	0.3337
8.0	0.1562	0.1903	0.2243	0.2573	0.2888
9.0	0.1292	0.1594	0.1902	0.2208	0.2505
10.0	0.1078	0.1343	0.1620	0.1900	0.2178
20.0	0.02720	0.03343	0.04129	0.05071	0.06149
30.0	0.01286	0.01448	0.01667	0.01956	0.02320
40.0	0.008337	0.008898	0.009637	0.01062	0.01190
50.0	0.006209	0.006470	0.006789	0.007192	0.007709
60.0	0.004961	0.005111	0.005283	0.005487	0.005735
80.0	0.003547	0.003617	0.003691	0.003773	0.003863
100.0	0.002763	0.002803	0.002845	0.002890	0.002938
200.0	0.001313	0.001322	0.001330	0.001339	0.001348

analyze drill-stem tests [*Kohlhaas*, 1972], most of which 'do not have production to the surface, either because of low formation productivity or because of the limited duration of the flow period.'

In recent years the increased interest in determining the hydrologic properties of low transmissivity formations, mostly in relation with deep-well waste disposal studies, has also increased the popularity of the slug test. The yield of test wells in tight formations is often too low to permit a pumping test of even relatively short duration, and the slug test becomes one of the few available field test methods. Some of these tight formations because of their low compressibility and low porosity, sometimes as low as 0.1%, have also a very small storage coefficient. Under these conditions the value of the parameter α appearing in (2) is smaller than 10^{-5}, and the test data cannot be matched to the available type curves. These conditions were observed in data from tests conducted on oil shales at the Piceance Basin, Colorado, by J. D. Bredehoeft and R. G. Wolff of the U.S. Geological Survey and were also reported to us by several investigators conducting tests on similar formations elsewhere.

Therefore we are presenting here an extension to the previously available values of $F(\beta, \alpha)$, i.e., of H/H_0, for another five orders of α, 10^{-6}–10^{-10} (Table 1). These values are plotted together with the previously available type curves in Figure 1. As can be noted in the figure, for these small values of α the curves have a very similar shape, run close to each other, and are almost parallel for most of their length. This fact indicates that, when the storage coefficient is so small, the recovery of the water level in the test well becomes very insensitive, even to order of magnitude changes in the storage coefficient. In *Cooper et al.* [1967] we stated that 'a deter-

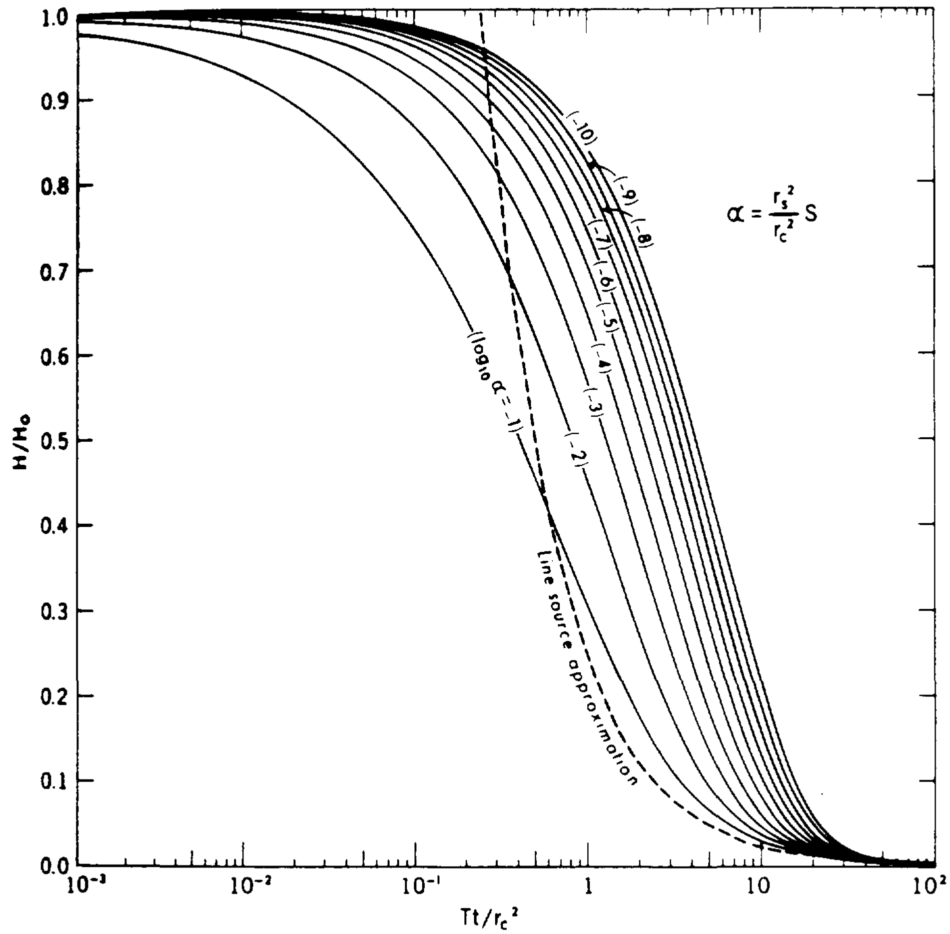

Fig. 1. Type curves for instantaneous change in a well of finite diameter.

mination of S by this method has questionable reliability; reliability becomes even more questionable when α is smaller than 10^{-5}. Of course, the similarity of the type curves in this range of α also affects the determinations of transmissivity. Even the most carefully and accurately collected test data could easily be matched with more than one of the type curves. The best one could expect is to be within one or two orders of magnitude of the actual α. An analysis in the range $\alpha < 10^{-6}$ indicates that, if the value of α for the chosen type curve is within two orders of magnitude of its actual value, the error in the determined T would be less than about 30%. This possible error should be kept in mind when one is making use of transmissivities determined by this method.

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Ferris, J. G., and D. B. Knowles, The slug test for estimating transmissibility, *U.S. Geol. Surv. Ground Water Note 26*, 1–7, 1954.

Ferris, J. G., D. B. Knowles, R. H. Brown, and R. W. Stallman, Theory of aquifer tests, *U.S. Geol. Surv. Water Supply Pap. 1536-E*, 104–105, 1962.

Kohlhaas, C. A., A method for analyzing pressures measured during drillstem-test flow periods, *J. Petrol. Technol. 24*, 1278–1282, 1972.

(Received February 23, 1973.)

(Rising head test 1)
Slug Test Analysis - Bouwer & Rice/Hvorslev's Methods (V2.4.5)

Client	EPA			Revised	11/05/91
Site:	Rosehill			Well ID:	MW-01-01
Test by:	K. Arena			Date:	10/28/91
Analysis:	K. Arena			Date:	11/25/91

USER INPUT DATA		WORKSHEET	A=	2.7	ERR
Aquifer Thickness=	20.24	FIGURES	B =	0.42	ERR
Exposed Len.(Le) =	15		C =	2.4	ERR
Well Length (Lw) =	13.22	R(eq) =	0.1873	0.0675	ERR
Casing Radius(Rc)=	0.083	Est. Rw			ERR
Well Radius (Rw) =	0.333	Est. n		-0.023	
Sandpack Porosity=	0.270	log(Le/Rw)		1.5984	ERR
Slug Volume =	0.025	ln(Re/Rw)		2.5053	ERR
Static Level =	6.50	Max. Y(t)		1.77	
Offset time =	0	Regr. Y(0)		1.74	
Shape Factor =	24.8	Casing Y(0)		1.15	DRAINED
(F from est. Rw)	ERR				

	ft/min	cm/sec	ft/day
Bouwer & Rice - user porosity & Rw	2.7E-02	5.3E-02	39.11
Bouwer & Rice - estimated porosity	3.5E-03	7.0E-03	5.09
Bouwer & Rice - estimated Rw	ERR	ERR	ERR
Hvorslev - user porosity and Rw	3.6E-02	7.2E-02	52.37
Hvorslev - estimated porosity	4.7E-03	9.3E-03	6.81
Hvorslev - estimated Rw	ERR	ERR	ERR

Regression Output:

Constant	0.556636
Std Err of Y Est	0.018701
R Squared	0.936918
No. of Observations	8
Degrees of Freedom	6

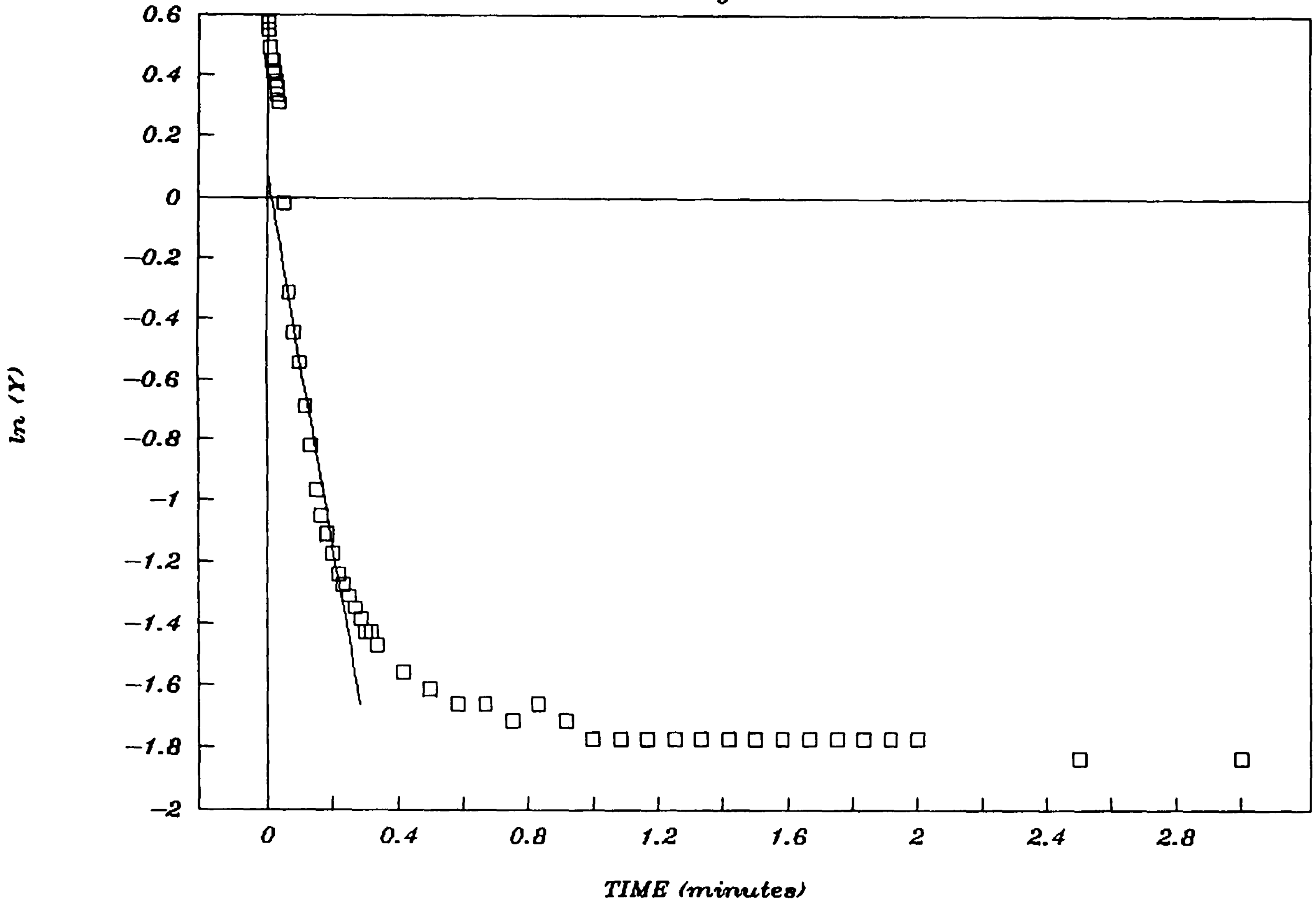
X Coefficient(s)	-8.17235
Std Err of Coef.	0.865707

Time (min)	level (ft)	Drawdown Y(t) ft	ln(Y)	Indicate Regress. Range	EST lnY
0	-1.77	1.77	0.5710	B	0.5566
0.0033	-1.73	1.73	0.5481		0.5297
0.0066	-1.63	1.63	0.4886		0.5027
0.0099	-1.56	1.56	0.4447		0.4757
0.0133	-1.56	1.56	0.4447		0.4479
0.0166	-1.51	1.51	0.4121		0.4210
0.02	-1.5	1.50	0.4055		0.3932
0.0233	-1.46	1.46	0.3784	E	0.3662
0.0266	-1.43	1.43	0.3577		0.3393
0.03	-1.4	1.40	0.3365		0.3115
0.0333	-1.36	1.36	0.3075		0.2845
0.05	-0.98	0.98	-0.0202	b2	0.1480
0.0666	-0.73	0.73	-0.3147		0.0124
0.0833	-0.64	0.64	-0.4463		-0.1241
0.1	-0.58	0.58	-0.5447		-0.2606
0.1166	-0.5	0.50	-0.6931		-0.3963
0.1333	-0.44	0.44	-0.8210		-0.5327
0.15	-0.38	0.38	-0.9676		-0.6692
0.1666	-0.35	0.35	-1.0498		-0.8049
0.1833	-0.33	0.33	-1.1087		-0.9414

0.2	-0.31	0.31	-1.1712		-1.0778
0.2166	-0.29	0.29	-1.2379		-1.2135
0.2333	-0.28	0.28	-1.2730		-1.3500
0.25	-0.27	0.27	-1.3093	e2	-1.4865
0.2666	-0.26	0.26	-1.3471		-1.6221
0.2833	-0.25	0.25	-1.3863		-1.7586
0.3	-0.24	0.24	-1.4271		-1.8951
0.3166	-0.24	0.24	-1.4271		-2.0307
0.3333	-0.23	0.23	-1.4697		-2.1672
0.4167	-0.21	0.21	-1.5606		-2.8488
0.5	-0.2	0.20	-1.6094		-3.5295
0.5833	-0.19	0.19	-1.6607		-4.2103
0.6667	-0.19	0.19	-1.6607		-4.8919
0.75	-0.18	0.18	-1.7148		-5.5726
0.8333	-0.19	0.19	-1.6607		-6.2534
0.9167	-0.18	0.18	-1.7148		-6.9350
1	-0.17	0.17	-1.7720		-7.6157
1.0833	-0.17	0.17	-1.7720		-8.2965
1.1667	-0.17	0.17	-1.7720		-8.9781
1.25	-0.17	0.17	-1.7720		-9.6588
1.3333	-0.17	0.17	-1.7720		-10.3396
1.4166	-0.17	0.17	-1.7720		-11.0203
1.5	-0.17	0.17	-1.7720		-11.7019
1.5833	-0.17	0.17	-1.7720		-12.3827
1.6667	-0.17	0.17	-1.7720		-13.0642
1.75	-0.17	0.17	-1.7720		-13.7450
1.8333	-0.17	0.17	-1.7720		-14.4257
1.9167	-0.17	0.17	-1.7720		-15.1073
2	-0.17	0.17	-1.7720		-15.7881
2.5	-0.16	0.16	-1.8326		-19.8743
3	-0.16	0.16	-1.8326		-23.9604
3.5	-0.16	0.16	-1.8326		-28.0466
4	-0.16	0.16	-1.8326		-32.1328
4.5	-0.17	0.17	-1.7720		-36.2190
5	-0.17	0.17	-1.7720		-40.3052
5.5	-0.16	0.16	-1.8326		-44.3913
6	-0.16	0.16	-1.8326		-48.4775
6.5	-0.16	0.16	-1.8326		-52.5637
7	-0.16	0.16	-1.8326		-56.6499
7.5	-0.17	0.17	-1.7720		-60.7361
8	-0.17	0.17	-1.7720		-64.8222
8.5	-0.16	0.16	-1.8326		-68.9084
9	-0.16	0.16	-1.8326		-72.9946
9.5	-0.16	0.16	-1.8326		-77.0808
10	-0.17	0.17	-1.7720		-81.1670
12	-0.16	0.16	-1.8326		-97.5117

ROSEHILL SLUG TEST

MW-01-01 Rising Head Test 1



(First rising head test)
Slug Test Analysis - Bouwer & Rice/Hvorslev's Methods (V2.4.5)

Client:	EPA	Revised	11/05/91
Site:	Rosehill	Well ID:	MW-01-02
Test by:	K.Arena	Date:	10/28/91
Analysis:	K.Arena	Date:	12/03/91

USER INPUT DATA		WORKSHEET	A=	5.7	5.7
Aquifer Thickness=	300	FIGURES	B =	1.08	1.08
Exposed Len.(Le) =	46.69		C =	6.4	6.4
Well Length (Lw) =	77.7	R(eq) =	0.2500	0.2500	0.2500
Casing Radius(Rc)=	0.250	Est. Rw			0.250
Well Radius (Rw) =	0.250	Est. n		NA	
Sandpack Porosity=	0.270	log(Le/Rw)		2.2713	2.2713
Slug Volume =	0.153	ln(Re/Rw)		3.8928	3.8928
Static Level =	6.31	Max. Y(t)		0.75	
Offset time =	0	Regr. Y(0)		0.73	
Shape Factor =	56.1	Casing Y(0)		0.78	UNDRAINED
(F from est. Rw)	56.1				

	ft/min	cm/sec	ft/day
Bouwer & Rice - user porosity & Rw	4.4E-05	8.7E-05	0.06
Bouwer & Rice - estimated porosity	4.4E-05	8.7E-05	0.06
Bouwer & Rice - estimated Rw	4.4E-05	8.7E-05	0.06
Hvorslev - user porosity and Rw	6.0E-05	1.2E-04	0.09
Hvorslev - estimated porosity	6.0E-05	1.2E-04	0.09
Hvorslev - estimated Rw	6.0E-05	1.2E-04	0.09

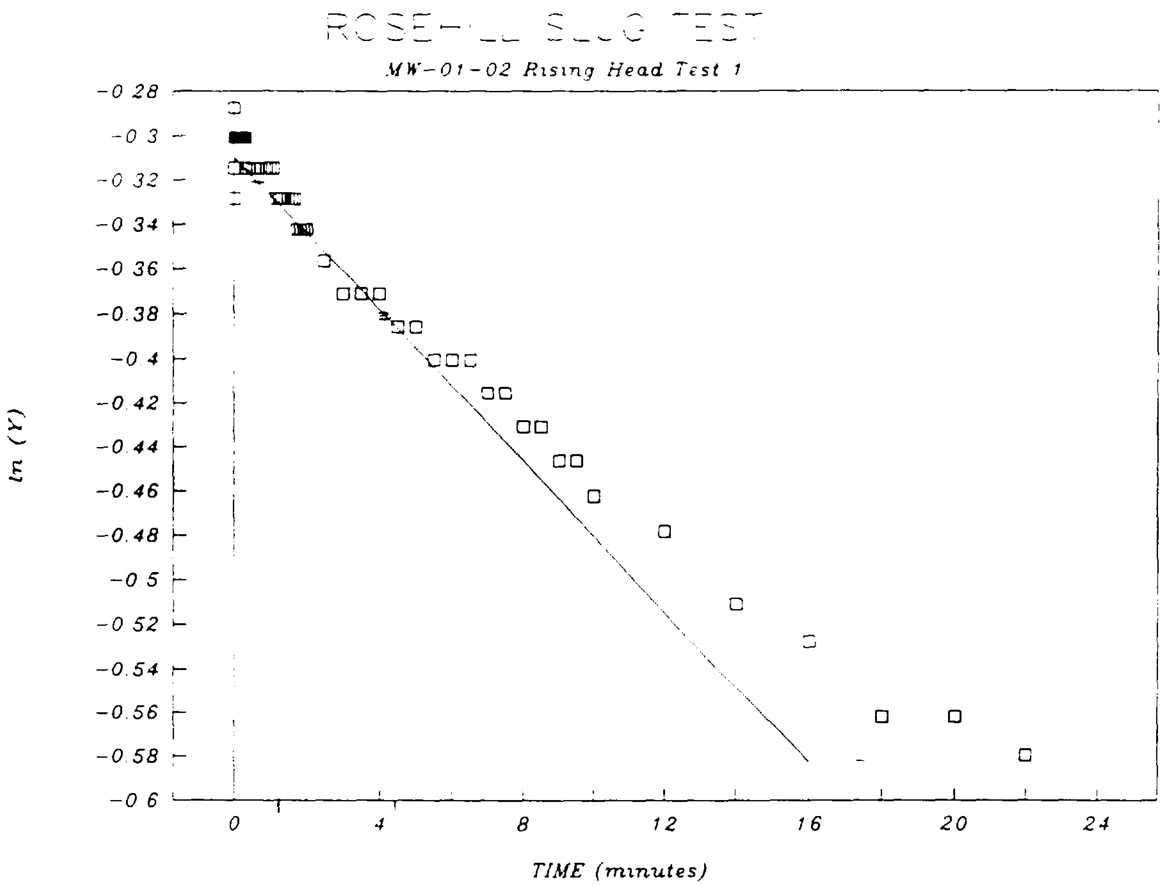
Regression Output:

Constant	-0.30993
Std Err of Y Est	0.005895
R Squared	0.908633
No. of Observations	10
Degrees of Freedom	8

X Coefficient(s)	-0.01704
Std Err of Coef.	0.001911

Time (min)	level (ft)	Drawdown Y(t) ft	ln(Y)	Indicate Regress. Range	EST lnY
0	-0.75	0.73	-0.3147		-0.3099
0.0033	-0.73	0.75	-0.2877		-0.3100
0.0066	-0.75	0.73	-0.3147		-0.3100
0.0099	-0.73	0.75	-0.2877		-0.3101
0.0133	-0.75	0.72	-0.3285		-0.3102
0.0166	-0.72	0.74	-0.3011		-0.3102
0.02	-0.74	0.73	-0.3147		-0.3103
0.0233	-0.73	0.73	-0.3147		-0.3103
0.0266	-0.73	0.74	-0.3011		-0.3104
0.03	-0.74	0.74	-0.3011		-0.3104
0.0333	-0.74	0.74	-0.3011		-0.3105
0.05	-0.74	0.74	-0.3011		-0.3108
0.0666	-0.74	0.74	-0.3011		-0.3111
0.0833	-0.74	0.74	-0.3011		-0.3114
0.1	-0.74	0.74	-0.3011		-0.3116
0.1166	-0.74	0.74	-0.3011		-0.3119
0.1333	-0.74	0.74	-0.3011		-0.3122
0.15	-0.74	0.74	-0.3011		-0.3125
0.1666	-0.74	0.74	-0.3011		-0.3128
0.1833	-0.74	0.74	-0.3011		-0.3131

0.2	-0.74	0.74	-0.3011		-0.3133
0.2166	-0.74	0.74	-0.3011		-0.3136
0.2333	-0.74	0.74	-0.3011		-0.3139
0.25	-0.74	0.74	-0.3011		-0.3142
0.2666	-0.74	0.74	-0.3011		-0.3145
0.2833	-0.74	0.74	-0.3011		-0.3148
0.3	-0.74	0.74	-0.3011		-0.3150
0.3166	-0.74	0.74	-0.3011		-0.3153
0.3333	-0.74	0.73	-0.3147		-0.3156
0.4167	-0.73	0.73	-0.3147		-0.3170
0.5	-0.73	0.73	-0.3147		-0.3185
0.5833	-0.73	0.73	-0.3147		-0.3199
0.6667	-0.73	0.73	-0.3147		-0.3213
0.75	-0.73	0.73	-0.3147		-0.3227
0.8333	-0.73	0.73	-0.3147		-0.3241
0.9167	-0.73	0.73	-0.3147		-0.3256
1	-0.73	0.73	-0.3147		-0.3270
1.0833	-0.73	0.73	-0.3147		-0.3284
1.1667	-0.73	0.72	-0.3285		-0.3298
1.25	-0.72	0.72	-0.3285		-0.3312
1.3333	-0.72	0.72	-0.3285		-0.3327
1.4166	-0.72	0.72	-0.3285		-0.3341
1.5	-0.72	0.72	-0.3285		-0.3355
1.5833	-0.72	0.72	-0.3285		-0.3369
1.6667	-0.72	0.72	-0.3285	B	-0.3384
1.75	-0.72	0.71	-0.3425		-0.3398
1.8333	-0.71	0.71	-0.3425		-0.3412
1.9167	-0.71	0.71	-0.3425		-0.3426
2	-0.71	0.71	-0.3425		-0.3440
2.5	-0.71	0.70	-0.3567		-0.3526
3	-0.7	0.69	-0.3711		-0.3611
3.5	-0.69	0.69	-0.3711		-0.3696
4	-0.69	0.69	-0.3711		-0.3781
4.5	-0.69	0.68	-0.3857	E	-0.3867
5	-0.68	0.68	-0.3857		-0.3952
5.5	-0.68	0.67	-0.4005		-0.4037
6	-0.67	0.67	-0.4005		-0.4122
6.5	-0.67	0.67	-0.4005		-0.4208
7	-0.67	0.66	-0.4155		-0.4293
7.5	-0.66	0.66	-0.4155		-0.4378
8	-0.66	0.65	-0.4308		-0.4463
8.5	-0.65	0.65	-0.4308		-0.4549
9	-0.65	0.64	-0.4463		-0.4634
9.5	-0.64	0.64	-0.4463		-0.4719
10	-0.64	0.63	-0.4620		-0.4804
12	-0.63	0.62	-0.4780		-0.5145
14	-0.62	0.60	-0.5108		-0.5486
16	-0.6	0.59	-0.5276		-0.5827
18	-0.59	0.57	-0.5621		-0.6168
20	-0.57	0.57	-0.5621		-0.6509
22	-0.57	0.56	-0.5798		-0.6850
24	-0.56	0.00	ERR		-0.7191


ROSEHILL SLUG TEST
MW-01-02 Rising Head Test 1
ln (Y)
-0.28
-0.3
-0.32
-0.34
-0.36
-0.38
-0.4
-0.42
-0.44
-0.46
-0.48
-0.5
-0.52
-0.54
-0.56
-0.58
-0.6
0
4
8
12
16
20
24
TIME (minutes)

(Rising Head test 1 MW-02-01)

Slug Test Analysis - Bouwer & Rice/Hvorslev's Methods (V2.4.5)

Client:	EPA	Revised	11/05/91
Site:	Rosehill	Well ID:	MW-02-01
Test by:	K.Arena	Date:	10/30/91
Analysis:	K.Arena	Date:	11/26/91

USER INPUT DATA		WORKSHEET			
Aquifer Thickness=	46.26	FIGURES	A=	5.6	5.6
			B =	1.05	1.05
Exposed Len.(Le) =	15		C =	6.3	6.3
Well Length (Lw) =	23.89	R(eq) =	0.0833	0.0833	0.0833
Casing Radius(Rc)=	0.083	Est. Rw			0.083
Well Radius (Rw) =	0.083	Est. n		NA	
Sandpack Porosity=	0.270	log(Le/Rw)		2.2553	2.2553
Slug Volume =	0.025	ln(Re/Rw)		3.8715	3.8715
Static Level =	24.05	Max. Y(t)		0.41	
Offset time =	0.0066	Regr. Y(0)		0.40	
Shape Factor =	18.1	Casing Y(0)		1.15	UNDRAINED
(F from est. Rw)	18.1				

	ft/min	cm/sec	ft/day
Bouwer & Rice - user porosity & Rw	2.6E-02	5.0E-02	36.77
Bouwer & Rice - estimated porosity	2.6E-02	5.0E-02	36.77
Bouwer & Rice - estimated Rw	2.6E-02	5.0E-02	36.77
Hvorslev - user porosity and Rw	3.4E-02	6.7E-02	49.32
Hvorslev - estimated porosity	3.4E-02	6.7E-02	49.32
Hvorslev - estimated Rw	3.4E-02	6.7E-02	49.32

Regression Output:

Constant	-0.73587
Std Err of Y Est	0.135850
R Squared	0.983609
No. of Observations	10
Degrees of Freedom	8

X Coefficient(s)	-28.4950
Std Err of Coef.	1.300478

Time (min)	level (ft)	Drawdown Y(t) ft	ln(Y)	Indicate Regress. Range	EST lnY
0	-0.54	0.54	-0.6162		-0.7359
0.0033	-0.71	0.71	-0.3425		-0.8299
0.0066	-0.8	0.80	-0.2231		-0.9239
0.0099	-0.68	0.68	-0.3857		-1.0180
0.0133	-0.53	0.53	-0.6349		-1.1149
0.0166	-0.41	0.41	-0.8916		-1.2089
0.02	-0.33	0.33	-1.1087	B3	-1.3058
0.0233	-0.27	0.27	-1.3093		-1.3998
0.0266	-0.23	0.23	-1.4697		-1.4938
0.03	-0.2	0.20	-1.6094		-1.5907
0.0333	-0.17	0.17	-1.7720		-1.6848
0.05	-0.1	0.10	-2.3026		-2.1606
0.0666	-0.06	0.06	-2.8134		-2.6336
0.0833	-0.04	0.04	-3.2189		-3.1095
0.1	-0.03	0.03	-3.5066		-3.5854
0.1166	-0.02	0.02	-3.9120	E3	-4.0584
0.1333	-0.02	0.02	-3.9120		-4.5343
0.15	-0.01	0.01	-4.6052		-5.0101
0.1666	-0.01	0.01	-4.6052		-5.4832
0.1833	-0.01	0.01	-4.6052		-5.9590

0.2	-0.01	0.01	-4.6052	-6.4349
0.2166	-0.01	0.01	-4.6052	-6.9079
0.2333	0	0.00	ERR	-7.3838
0.25	0	0.00	ERR	-7.8596
0.2666	0	0.00	ERR	-8.3327
0.2833	0	0.00	ERR	-8.8085
0.3	0	0.00	ERR	-9.2844
0.3166	0	0.00	ERR	-9.7574
0.3333	0	0.00	ERR	-10.2333
0.4167	0	0.00	ERR	-12.6098
0.5	0	0.00	ERR	-14.9834
0.5833	0	0.00	ERR	-17.3571
0.6667	0	0.00	ERR	-19.7335
0.75	0	0.00	ERR	-22.1072
0.8333	0	0.00	ERR	-24.4808
0.9167	0	0.00	ERR	-26.8573
1	0	0.00	ERR	-29.2310
1.0833	0	0.00	ERR	-31.6046
1.1667	0	0.00	ERR	-33.9811
1.25	0	0.00	ERR	-36.3547
1.3333	0	0.00	ERR	-38.7284
1.4166	0	0.00	ERR	-41.1020
1.5	0	0.00	ERR	-43.4785
1.5833	0	0.00	ERR	-45.8521
1.6667	0	0.00	ERR	-48.2286
1.75	0	0.00	ERR	-50.6023
1.8333	0	0.00	ERR	-52.9759
1.9167	0	0.00	ERR	-55.3524
2	0	0.00	ERR	-57.7260
2.5	0	0.00	ERR	-71.9736
3	0	0.00	ERR	-86.2211
3.5	0	0.00	ERR	*********
4	0	0.00	ERR	*********
4.5	0	0.00	ERR	*********
5	0	0.00	ERR	*********
5.5	0	0.00	ERR	*********
6	0	0.00	ERR	*********
6.5	0	0.00	ERR	*********
7	0	0.00	ERR	*********
7.5	0	0.00	ERR	*********

(Rising Head test 1 MW-02-01)
Slug Test Analysis - Bouwer & Rice/Hvorslev's Methods (V2.4.5)
Client: EPA Revised 11/05/91
Site: Rosehill Well ID: MW-02-01
Test by: K.Arena Date: 10/30/91
Analysis:K.Arena Date: 11/26/91

USER INPUT DATA		WORKSHEET			
Aquifer Thickness=	46.26	FIGURES	A=	2.5	4.1
Exposed Len.(Le) =	15		B =	0.39	0.65
Well Length (Lw) =	11.75		C =	2.2	4.1
Casing Radius(Rc)=	0.083	R(eq) =	0.1973	0.0985	0.0985
Well Radius (Rw) =	0.354	Est. Rw			0.131
Sandpack Porosity=	0.270	Est. n		0.023	
Slug Volume =	0.025	log(Le/Rw)		1.5208	1.9526
Static Level =	24.05	ln(Re/Rw)		2.2563	2.5936
Offset time =	0.0066	Max. Y(t)		0.8	
Shape Factor =	25.2	Regr. Y(0)		0.82	
(F from est. Rw)	19.9	Casing Y(0)		1.15	DRAINED

	ft/min	cm/sec	ft/day
Bouwer & Rice - user porosity & Rw	2.5E-01	4.9E-01	361.22
Bouwer & Rice - estimated porosity	6.3E-02	1.2E-01	90.04
Bouwer & Rice - estimated Rw	7.2E-02	1.4E-01	103.51
Hvorslev - user porosity and Rw	3.3E-01	6.4E-01	469.78
Hvorslev - estimated porosity	8.1E-02	1.6E-01	117.10
Hvorslev - estimated Rw	1.0E-01	2.0E-01	148.18

Regression Output:

Constant	0.244255
Std Err of Y Est	0.025788
R Squared	0.996992
No. of Observations	6
Degrees of Freedom	4

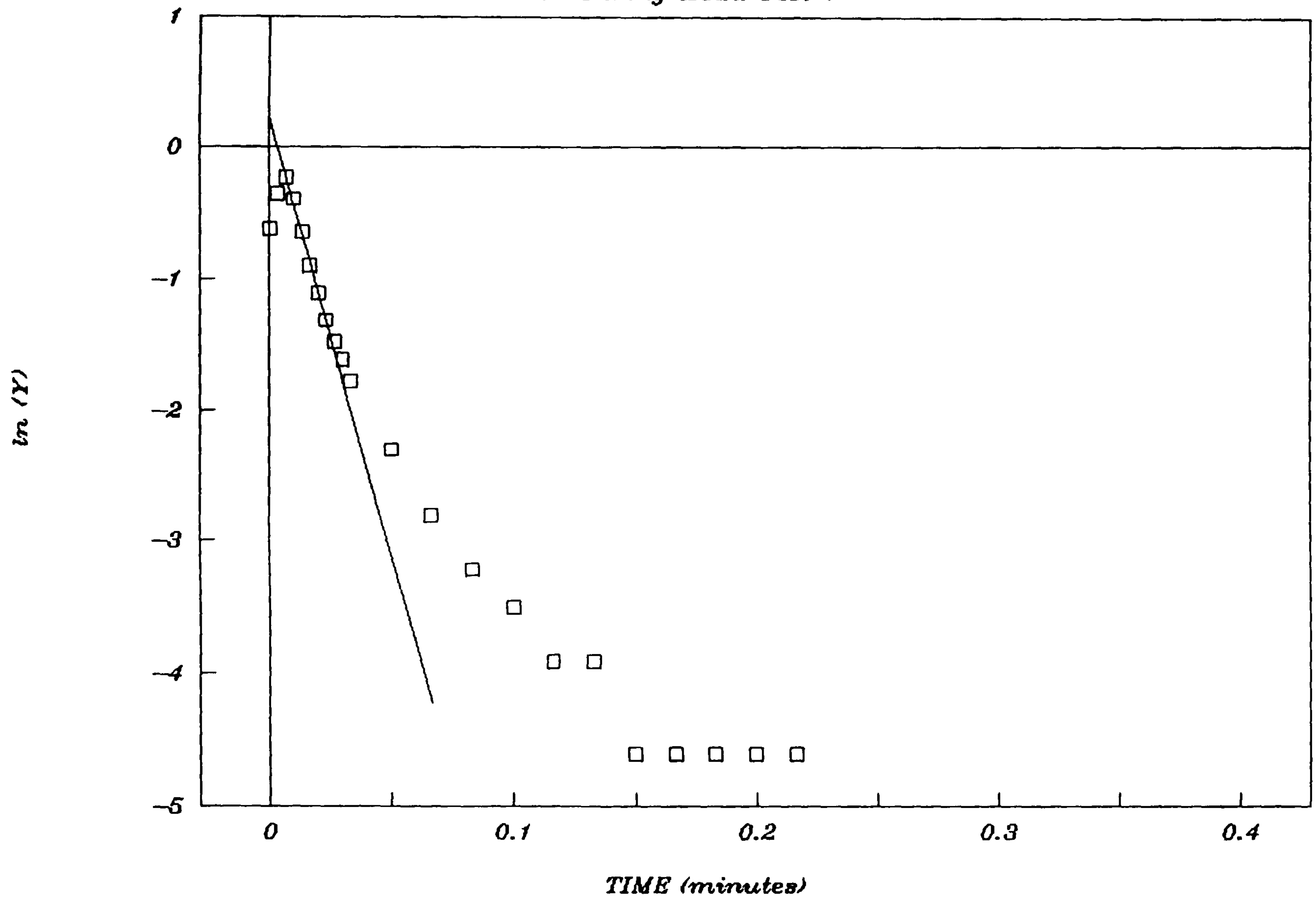
X Coefficient(s)	-67.0993
Std Err of Coef.	1.842521

Time (min)	level (ft)	Drawdown Y(t) ft	ln(Y)	Indicate Regress. Range	EST lnY
0	-0.54	0.54	-0.6162		0.2443
0.0033	-0.71	0.71	-0.3425		0.0228
0.0066	-0.8	0.80	-0.2231	b	-0.1986
0.0099	-0.68	0.68	-0.3857		-0.4200
0.0133	-0.53	0.53	-0.6349		-0.6482
0.0166	-0.41	0.41	-0.8916		-0.8696
0.02	-0.33	0.33	-1.1087		-1.0977
0.0233	-0.27	0.27	-1.3093	e	-1.3192
0.0266	-0.23	0.23	-1.4697		-1.5406
0.03	-0.2	0.20	-1.6094		-1.7687
0.0333	-0.17	0.17	-1.7720		-1.9902
0.05	-0.1	0.10	-2.3026		-3.1107
0.0666	-0.06	0.06	-2.8134		-4.2246
0.0833	-0.04	0.04	-3.2189		-5.3451
0.1	-0.03	0.03	-3.5066		-6.4657
0.1166	-0.02	0.02	-3.9120		-7.5795
0.1333	-0.02	0.02	-3.9120		-8.7001
0.15	-0.01	0.01	-4.6052		-9.8206
0.1666	-0.01	0.01	-4.6052		-10.9345
0.1833	-0.01	0.01	-4.6052		-12.0551

0.2	-0.01	0.01	-4.6052	-13.1756
0.2166	-0.01	0.01	-4.6052	-14.2895
0.2333	0	0.00	ERR	-15.4100
0.25	0	0.00	ERR	-16.5306
0.2666	0	0.00	ERR	-17.6444
0.2833	0	0.00	ERR	-18.7650
0.3	0	0.00	ERR	-19.8855
0.3166	0	0.00	ERR	-20.9994
0.3333	0	0.00	ERR	-22.1200
0.4167	0	0.00	ERR	-27.7160
0.5	0	0.00	ERR	-33.3054
0.5833	0	0.00	ERR	-38.8948
0.6667	0	0.00	ERR	-44.4909
0.75	0	0.00	ERR	-50.0802
0.8333	0	0.00	ERR	-55.6696
0.9167	0	0.00	ERR	-61.2657
1	0	0.00	ERR	-66.8551
1.0833	0	0.00	ERR	-72.4444
1.1667	0	0.00	ERR	-78.0405
1.25	0	0.00	ERR	-83.6299
1.3333	0	0.00	ERR	-89.2193
1.4166	0	0.00	ERR	-94.8087
1.5	0	0.00	ERR	-100.4047
1.5833	0	0.00	ERR	-105.9941
1.6667	0	0.00	ERR	-111.5902
1.75	0	0.00	ERR	-117.1796
1.8333	0	0.00	ERR	-122.7689
1.9167	0	0.00	ERR	-128.3650
2	0	0.00	ERR	-133.9544
2.5	0	0.00	ERR	-167.5041
3	0	0.00	ERR	-201.0537
3.5	0	0.00	ERR	-234.6034
4	0	0.00	ERR	-268.1531
4.5	0	0.00	ERR	-301.7027
5	0	0.00	ERR	-335.2524
5.5	0	0.00	ERR	-368.8021
6	0	0.00	ERR	-402.3517
6.5	0	0.00	ERR	-435.9014
7	0	0.00	ERR	-469.4510
7.5	0	0.00	ERR	-503.0007

ROSEHILL SLUG TEST

MW–02–01 Rising Head Test 1



(Rising head test 1 in MW-02-02)
Slug Test Analysis - Bouwer & Rice/Hvorslev's Methods (V2.4.5)

Client: EPA		Revised	11/05/91
Site: Rosehill		Well ID:	MW-02-02
Test by: K.Arena		Date:	10/30/91
Analysis:K.Arena		Date:	11/26/91

USER INPUT DATA		WORKSHEET			
Aquifer Thickness=	46.87	FIGURES	B =	0.46	0.46
			A=	3.0	3.0
Exposed Len.(Le) =	10		C =	2.7	2.7
Well Length (Lw) =	46.87	R(eq) =	0.0833	0.0833	0.0833
Casing Radius(Rc)=	0.083	Est. Rw			0.208
Well Radius (Rw) =	0.208	Est. n		NA	
Sandpack Porosity=	0.270	log(Le/Rw)		1.6812	1.6812
Slug Volume =	0.025	ln(Re/Rw)		3.8573	3.8573
Static Level =	23.70	Max. Y(t)		0.76	
Offset time =	0.0233	Regr. Y(0)		0.76	
Shape Factor =	16.2	Casing Y(0)		1.15	UNDRAINED
(F from est. Rw)	16.2				

	ft/min	cm/sec	ft/day
Bouwer & Rice - user porosity & Rw	1.1E-02	2.1E-02	15.23
Bouwer & Rice - estimated porosity	1.1E-02	2.1E-02	15.23
Bouwer & Rice - estimated Rw	1.1E-02	2.1E-02	15.23
Hvorslev - user porosity and Rw	1.1E-02	2.1E-02	15.28
Hvorslev - estimated porosity	1.1E-02	2.1E-02	15.28
Hvorslev - estimated Rw	1.1E-02	2.1E-02	15.28

Regression Output:

Constant	-0.08512
Std Err of Y Est	0.022942
R Squared	0.998492
No. of Observations	16
Degrees of Freedom	14

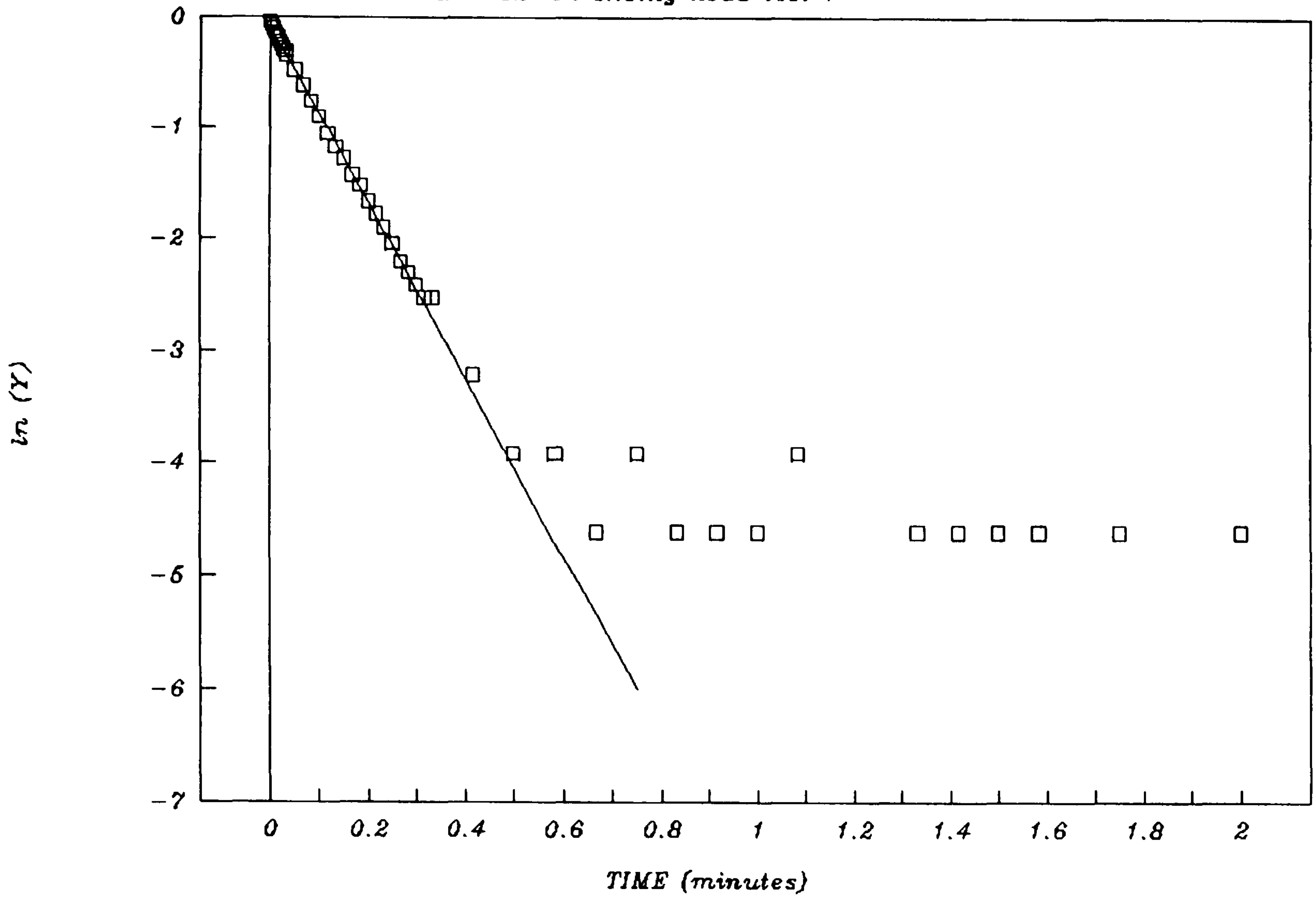
X Coefficient(s) -7.89409
Std Err of Coef. 0.081986

Time (min)	level (ft)	Drawdown Y(t) ft	ln(Y)	Indicate Regress. Range	EST lnY
0	-0.96	0.96	-0.0408		-0.0851
0.0033	-0.93	0.93	-0.0726		-0.1112
0.0066	-0.9	0.90	-0.1054		-0.1372
0.0099	-0.87	0.87	-0.1393		-0.1633
0.0133	-0.85	0.85	-0.1625		-0.1901
0.0166	-0.83	0.83	-0.1863		-0.2162
0.02	-0.8	0.80	-0.2231		-0.2430
0.0233	-0.78	0.78	-0.2485	B	-0.2691
0.0266	-0.76	0.76	-0.2744		-0.2951
0.03	-0.74	0.74	-0.3011		-0.3219
0.0333	-0.71	0.71	-0.3425		-0.3480
0.05	-0.62	0.62	-0.4780		-0.4798
0.0666	-0.54	0.54	-0.6162		-0.6109
0.0833	-0.47	0.47	-0.7550		-0.7427
0.1	-0.41	0.41	-0.8916		-0.8745
0.1166	-0.35	0.35	-1.0498		-1.0056
0.1333	-0.31	0.31	-1.1712		-1.1374
0.15	-0.28	0.28	-1.2730		-1.2692
0.1666	-0.24	0.24	-1.4271		-1.4003
0.1833	-0.22	0.22	-1.5141		-1.5321

0.2	-0.19	0.19	-1.6607		-1.6639
0.2166	-0.17	0.17	-1.7720		-1.7950
0.2333	-0.15	0.15	-1.8971	E	-1.9268
0.25	-0.13	0.13	-2.0402		-2.0586
0.2666	-0.11	0.11	-2.2073		-2.1897
0.2833	-0.1	0.10	-2.3026		-2.3215
0.3	-0.09	0.09	-2.4079		-2.4534
0.3166	-0.08	0.08	-2.5257		-2.5844
0.3333	-0.08	0.08	-2.5257		-2.7162
0.4167	-0.04	0.04	-3.2189		-3.3746
0.5	-0.02	0.02	-3.9120		-4.0322
0.5833	-0.02	0.02	-3.9120		-4.6897
0.6667	-0.01	0.01	-4.6052		-5.3481
0.75	-0.02	0.02	-3.9120		-6.0057
0.8333	-0.01	0.01	-4.6052		-6.6633
0.9167	-0.01	0.01	-4.6052		-7.3216
1	-0.01	0.01	-4.6052		-7.9792
1.0833	-0.02	0.02	-3.9120		-8.6368
1.1667	0	0.00	ERR		-9.2952
1.25	0	0.00	ERR		-9.9527
1.3333	-0.01	0.01	-4.6052		-10.6103
1.4166	-0.01	0.01	-4.6052		-11.2679
1.5	-0.01	0.01	-4.6052		-11.9263
1.5833	-0.01	0.01	-4.6052		-12.5838
1.6667	0	0.00	ERR		-13.2422
1.75	-0.01	0.01	-4.6052		-13.8998
1.8333	0	0.00	ERR		-14.5574
1.9167	0	0.00	ERR		-15.2157
2	-0.01	0.01	-4.6052		-15.8733
2.5	-0.01	0.01	-4.6052		-19.8204
3	-0.01	0.01	-4.6052		-23.7674
3.5	0	0.00	ERR		-27.7145
4	-0.01	0.01	-4.6052		-31.6615
4.5	0	0.00	ERR		-35.6085
5	-0.01	0.01	-4.6052		-39.5556
5.5	0	0.00	ERR		-43.5026

ROSEHILL SLUG TEST

MW-02-02 Rising head test 1



(Rising Head Test 1)
Slug Test Analysis - Bouwer & Rice/Hvorslev's Methods (V2.4.5)

Client:	EPA	Revised	11/05/91
Site:	Rosehill	Well ID:	MW-03-01
Test by:	D.Berler	Date:	11/01/91
Analysis:	K.Arena	Date:	12/03/91

USER INPUT DATA		WORKSHEET			
Aquifer Thickness=	44.42	FIGURES	A=	2.4	2.4
Exposed Len.(Le) =	10		B =	0.38	0.38
Well Length (Lw) =	11.46		C =	2.1	2.1
Casing Radius(Rc)=	0.083	R(eq) =	0.0833	0.0833	0.0833
Well Radius (Rw) =	0.333	Est. Rw			0.333
Sandpack Porosity=	0.270	Est. n		NA	
Slug Volume =	0.025	log(Le/Rw)		1.4771	1.4771
Static Level =	0.00	ln(Re/Rw)		2.2308	2.2308
Offset time =	0.0033	Max. Y(t)		1.26	
Shape Factor =	18.5	Regr. Y(0)		1.26	
(F from est. Rw)	18.5	Casing Y(0)		1.15	UNDRAINED

	ft/min	cm/sec	ft/day
Bouwer & Rice - user porosity & Rw	3.5E-03	7.0E-03	5.10
Bouwer & Rice - estimated porosity	3.5E-03	7.0E-03	5.10
Bouwer & Rice - estimated Rw	3.5E-03	7.0E-03	5.10
Hvorslev - user porosity and Rw	5.4E-03	1.1E-02	7.77
Hvorslev - estimated porosity	5.4E-03	1.1E-02	7.77
Hvorslev - estimated Rw	5.4E-03	1.1E-02	7.77

Regression Output:

Constant	0.249496
Std Err of Y Est	0.009088
R Squared	0.999755
No. of Observations	6
Degrees of Freedom	4

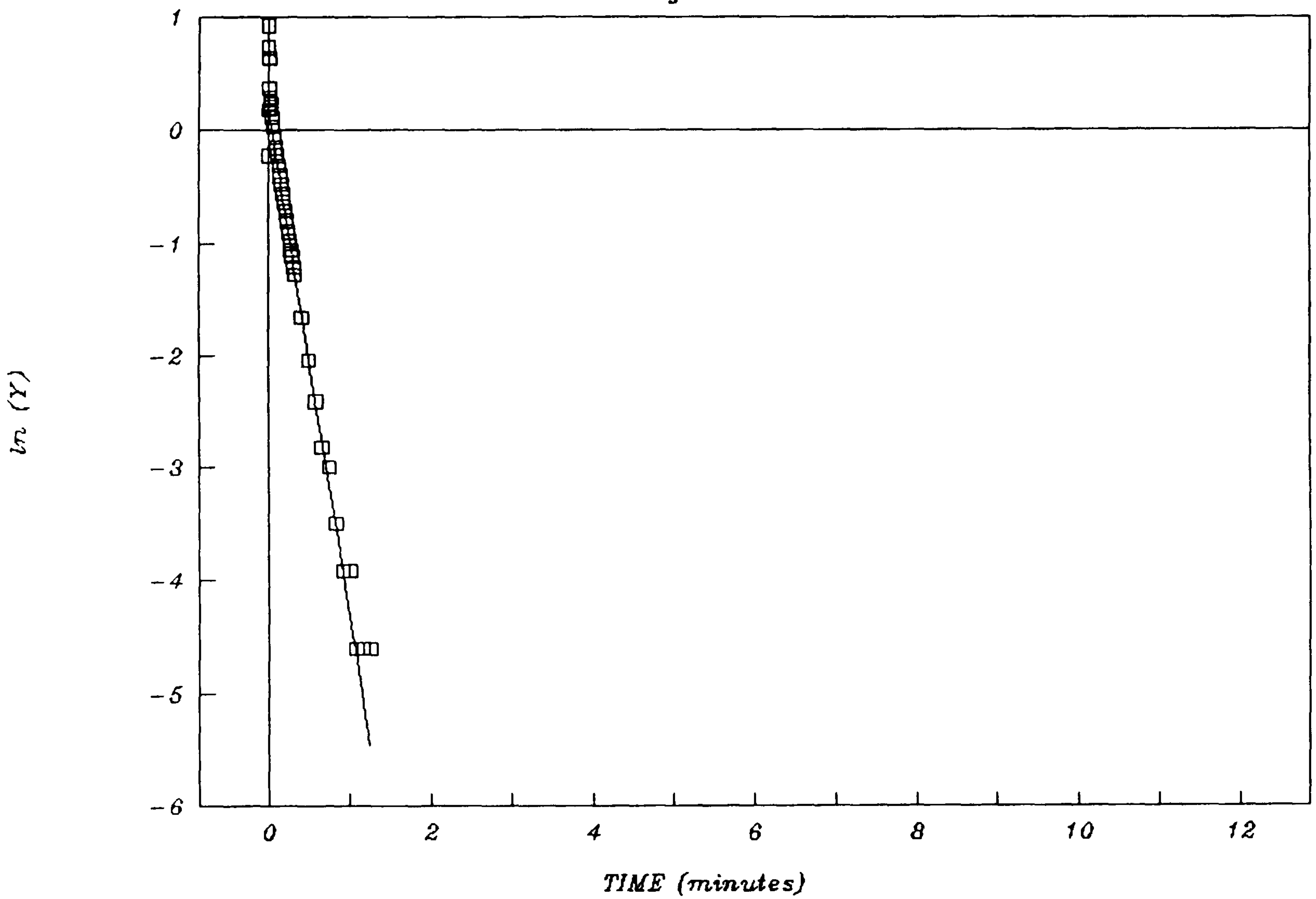
X Coefficient(s)	-4.56813
Std Err of Coef.	0.035684

Time (min)	level (ft)	Drawdown Y(t) ft	ln(Y)	Indicate Regress. Range	EST lnY
0	-2.07	2.07	0.7275		0.2495
0.0033	-2.51	2.51	0.9203		0.2344
0.0066	-0.8	0.80	-0.2231		0.2193
0.0099	-1.9	1.90	0.6419		0.2043
0.0133	-1.2	1.20	0.1823		0.1887
0.0166	-1.46	1.46	0.3784		0.1737
0.02	-1.3	1.30	0.2624		0.1581
0.0233	-1.33	1.33	0.2852		0.1431
0.0266	-1.28	1.28	0.2469		0.1280
0.03	-1.26	1.26	0.2311		0.1125
0.0333	-1.23	1.23	0.2070		0.0974
0.05	-1.12	1.12	0.1133		0.0211
0.0666	-1.03	1.03	0.0296		-0.0547
0.0833	-0.94	0.94	-0.0619		-0.1310
0.1	-0.86	0.86	-0.1508		-0.2073
0.1166	-0.8	0.80	-0.2231		-0.2831
0.1333	-0.73	0.73	-0.3147		-0.3594
0.15	-0.67	0.67	-0.4005		-0.4357
0.1666	-0.62	0.62	-0.4780		-0.5116
0.1833	-0.57	0.57	-0.5621		-0.5878

0.2	-0.53	0.53	-0.6349		-0.6641
0.2166	-0.49	0.49	-0.7133		-0.7400
0.2333	-0.45	0.45	-0.7985		-0.8162
0.25	-0.41	0.41	-0.8916		-0.8925
0.2666	-0.38	0.38	-0.9676		-0.9684
0.2833	-0.35	0.35	-1.0498		-1.0447
0.3	-0.33	0.33	-1.1087	B	-1.1209
0.3166	-0.3	0.30	-1.2040		-1.1968
0.3333	-0.28	0.28	-1.2730		-1.2731
0.4167	-0.19	0.19	-1.6607		-1.6540
0.5	-0.13	0.13	-2.0402		-2.0346
0.5833	-0.09	0.09	-2.4079	E	-2.4151
0.6667	-0.06	0.06	-2.8134		-2.7961
0.75	-0.05	0.05	-2.9957		-3.1766
0.8333	-0.03	0.03	-3.5066		-3.5571
0.9167	-0.02	0.02	-3.9120		-3.9381
1	-0.02	0.02	-3.9120		-4.3186
1.0833	-0.01	0.01	-4.6052		-4.6992
1.1667	-0.01	0.01	-4.6052		-5.0801
1.25	-0.01	0.01	-4.6052		-5.4607
1.3333	0	0.00	ERR		-5.8412
1.4166	0	0.00	ERR		-6.2217
1.5	0	0.00	ERR		-6.6027
1.5833	0	0.00	ERR		-6.9832
1.6667	0	0.00	ERR		-7.3642
1.75	0	0.00	ERR		-7.7447
1.8333	0	0.00	ERR		-8.1253
1.9167	0	0.00	ERR		-8.5063
2	0	0.00	ERR		-8.8868
2.5	0	0.00	ERR		-11.1708
3	0	0.00	ERR		-13.4549
3.5	0	0.00	ERR		-15.7390
4	0	0.00	ERR		-18.0231
4.5	0	0.00	ERR		-20.3071
5	0	0.00	ERR		-22.5912
5.5	0	0.00	ERR		-24.8753
6	0	0.00	ERR		-27.1593
6.5	0	0.00	ERR		-29.4434
7	0	0.00	ERR		-31.7275
7.5	0	0.00	ERR		-34.0115
8	0	0.00	ERR		-36.2956
8.5	0	0.00	ERR		-38.5797
9	0	0.00	ERR		-40.8637
9.5	0	0.00	ERR		-43.1478
10	0	0.00	ERR		-45.4319
12	0	0.00	ERR		-54.5682

ROSEHILL SLUG TEST

MW-03-01 Rising Head Test 1



(First rising head test)
Slug Test Analysis - Bouwer & Rice/Hvorslev's Methods (V2.4.5)

Client: EPA — Revised 11/05/91
Site: Rosehill — Well ID: MW-03-02
Test by: D.Berler — Date: 11/01/91
Analysis: K.Arena — Date: 12/03/91

	1.3					
USER INPUT DATA		WORKSHEET	A=		3.0	3.0
Aquifer Thickness=	44.68	FIGURES	B =		0.46	0.46
Exposed Len.(Le) =	10		C =		2.7	2.7
Well Length (Lw) =	43.03	R(eq) =		0.0833	0.0833	0.0833
Casing Radius(Rc)=	0.083	Est. Rw				0.208
Well Radius (Rw) =	0.208	Est. n			NA	
Sandpack Porosity=	0.270	log(Le/Rw)			1.6812	1.6812
Slug Volume =	0.025	ln(Re/Rw)			3.4758	3.4758
Static Level =	1.72	Max. Y(t)			2.95	
Offset time =	0.0033	Regr. Y(0)			1.52	
Shape Factor =	16.2	Casing Y(0)			1.15	UNDRAINED
(F from est. Rw)	16.2					

	ft/min	cm/sec	ft/day
Bouwer & Rice - user porosity & Rw	3.7E-03	7.3E-03	5.35
Bouwer & Rice - estimated porosity	3.7E-03	7.3E-03	5.35
Bouwer & Rice - estimated Rw	3.7E-03	7.3E-03	5.35
Hvorslev - user porosity and Rw	4.1E-03	8.2E-03	5.96
Hvorslev - estimated porosity	4.1E-03	8.2E-03	5.96
Hvorslev - estimated Rw	4.1E-03	8.2E-03	5.96

Regression Output:

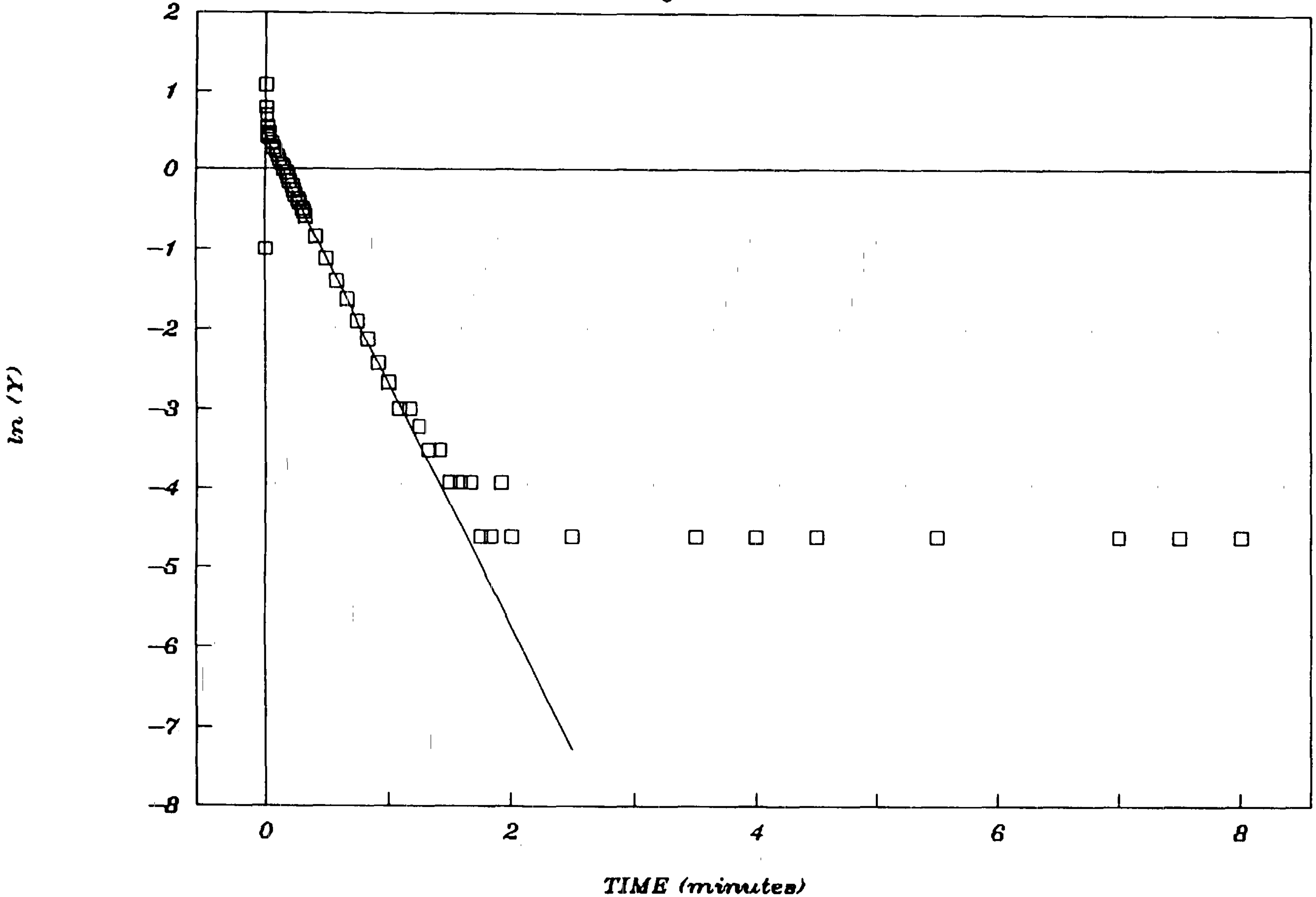
Constant	0.427261
Std Err of Y Est	0.017968
R Squared	0.998881
No. of Observations	6
Degrees of Freedom	4
X Coefficient(s)	-3.08077
Std Err of Coef.	0.051540

Time (min)	level (ft)	Drawdown Y(t) ft	ln(Y)	Indicate Regress. Range	EST lnY
0	-0.37	0.37	-0.9943		0.4273
0.0033	-2.95	2.95	1.0818		0.4171
0.0066	-2.2	2.20	0.7885		0.4069
0.0099	-1.97	1.97	0.6780		0.3968
0.0133	-1.7	1.70	0.5306		0.3863
0.0166	-1.52	1.52	0.4187		0.3761
0.02	-1.57	1.57	0.4511		0.3656
0.0233	-1.59	1.59	0.4637		0.3555
0.0266	-1.55	1.55	0.4383		0.3453
0.03	-1.51	1.51	0.4121		0.3348
0.0333	-1.5	1.50	0.4055		0.3247
0.05	-1.41	1.41	0.3436		0.2732
0.0666	-1.33	1.33	0.2852		0.2221
0.0833	-1.26	1.26	0.2311		0.1706
0.1	-1.19	1.19	0.1740		0.1192
0.1166	-1.13	1.13	0.1222		0.0680
0.1333	-1.07	1.07	0.0677		0.0166
0.15	-1.02	1.02	0.0198		-0.0349
0.1666	-0.96	0.96	-0.0408		-0.0860
0.1833	-0.91	0.91	-0.0943		-0.1374

0.2	-0.86	0.86	-0.1508		-0.1889
0.2166	-0.81	0.81	-0.2107		-0.2400
0.2333	-0.77	0.77	-0.2614		-0.2915
0.25	-0.73	0.73	-0.3147		-0.3429
0.2666	-0.69	0.69	-0.3711		-0.3941
0.2833	-0.66	0.66	-0.4155		-0.4455
0.3	-0.62	0.62	-0.4780		-0.4970
0.3166	-0.59	0.59	-0.5276		-0.5481
0.3333	-0.56	0.56	-0.5798		-0.5996
0.4167	-0.43	0.43	-0.8440		-0.8565
0.5	-0.33	0.33	-1.1087	B	-1.1131
0.5833	-0.25	0.25	-1.3863		-1.3698
0.6667	-0.2	0.20	-1.6094		-1.6267
0.75	-0.15	0.15	-1.8971		-1.8833
0.8333	-0.12	0.12	-2.1203		-2.1399
0.9167	-0.09	0.09	-2.4079	E	-2.3969
1	-0.07	0.07	-2.6593		-2.6535
1.0833	-0.05	0.05	-2.9957		-2.9101
1.1667	-0.05	0.05	-2.9957		-3.1671
1.25	-0.04	0.04	-3.2189		-3.4237
1.3333	-0.03	0.03	-3.5066		-3.6803
1.4166	-0.03	0.03	-3.5066		-3.9370
1.5	-0.02	0.02	-3.9120		-4.1939
1.5833	-0.02	0.02	-3.9120		-4.4505
1.6667	-0.02	0.02	-3.9120		-4.7075
1.75	-0.01	0.01	-4.6052		-4.9641
1.8333	-0.01	0.01	-4.6052		-5.2207
1.9167	-0.02	0.02	-3.9120		-5.4777
2	-0.01	0.01	-4.6052		-5.7343
2.5	-0.01	0.01	-4.6052		-7.2747
3	0	0.00	ERR		-8.8151
3.5	-0.01	0.01	-4.6052		-10.3554
4	-0.01	0.01	-4.6052		-11.8958
4.5	-0.01	0.01	-4.6052		-13.4362
5	0	0.00	ERR		-14.9766
5.5	-0.01	0.01	-4.6052		-16.5170
6	0	0.00	ERR		-18.0574
6.5	0	0.00	ERR		-19.5978
7	-0.01	0.01	-4.6052		-21.1382
7.5	-0.01	0.01	-4.6052		-22.6785
8	-0.01	0.01	-4.6052		-24.2189

ROSEHILL SLUG TEST

MW-03-02 Rising Head Test 1



(First Rising Head Test)
Slug Test Analysis - Bouwer & Rice/Hvorslev's Methods (V2.4.5)

Client: EPA	Revised 11/05/91
Site: Rosehill	Well ID: MW-03-03
Test by: D.Berler	Date: 11/01/91
Analysis:K.Arena	Date: 12/03/91

USER INPUT DATA		WORKSHEET			
			A=	7.3	7.3
Aquifer Thickness=	142.57	FIGURES	B =	1.68	1.68
Exposed Len.(Le) =	90.5		C =	8.9	8.9
Well Length (Lw) =	142.57	R(eq) =	0.2500	0.2500	0.2500
Casing Radius(Rc)=	0.250	Est. Rw			0.250
Well Radius (Rw) =	0.250	Est. n		NA	
Sandpack Porosity=	0.270	log(Le/Rw)		2.5587	2.5587
Slug Volume =	0.153	ln(Re/Rw)		5.0518	5.0518
Static Level =	1.94	Max. Y(t)		1.2	
Offset time =	0.0066	Regr. Y(0)		0.73	
Shape Factor =	96.5	Casing Y(0)		0.78	UNDRAINED
(F from est. Rw)	96.5				

	ft/min	cm/sec	ft/day
Bouwer & Rice - user porosity & Rw	1.4E-03	2.7E-03	2.00
Bouwer & Rice - estimated porosity	1.4E-03	2.7E-03	2.00
Bouwer & Rice - estimated Rw	1.4E-03	2.7E-03	2.00
Hvorslev - user porosity and Rw	1.6E-03	3.2E-03	2.33
Hvorslev - estimated porosity	1.6E-03	3.2E-03	2.33
Hvorslev - estimated Rw	1.6E-03	3.2E-03	2.33

Regression Output:

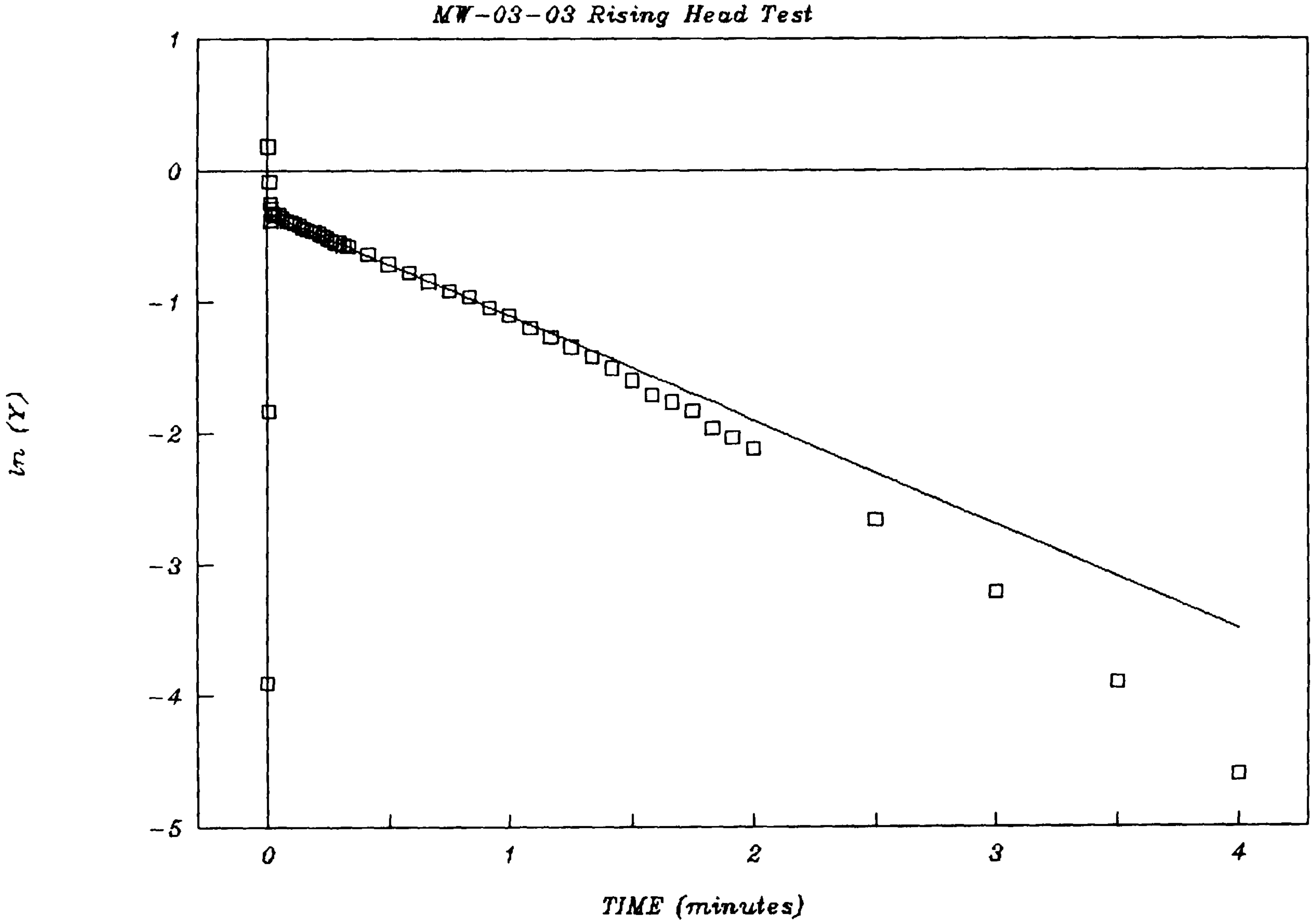
Constant	-0.31428
Std Err of Y Est	0.005783
R Squared	0.998642
No. of Observations	7
Degrees of Freedom	5

X Coefficient(s)	-0.79546
Std Err of Coef.	0.013115

Time (min)	level (ft)	Drawdown Y(t) ft	ln(Y)	Indicate Regress. Range	EST lnY
0	-0.02	0.02	-3.9120		-0.3143
0.0033	-1.2	1.20	0.1823		-0.3169
0.0066	0.16	0.16	-1.8326		-0.3195
0.0099	-0.92	0.92	-0.0834		-0.3222
0.0133	-0.78	0.78	-0.2485		-0.3249
0.0166	-0.69	0.69	-0.3711		-0.3275
0.02	-0.75	0.75	-0.2877		-0.3302
0.0233	-0.73	0.73	-0.3147		-0.3328
0.0266	-0.72	0.72	-0.3285		-0.3354
0.03	-0.71	0.71	-0.3425		-0.3381
0.0333	-0.72	0.72	-0.3285		-0.3408
0.05	-0.72	0.72	-0.3285		-0.3541
0.0666	-0.7	0.70	-0.3567		-0.3673
0.0833	-0.69	0.69	-0.3711		-0.3805
0.1	-0.68	0.68	-0.3857		-0.3938
0.1166	-0.67	0.67	-0.4005		-0.4070
0.1333	-0.66	0.66	-0.4155		-0.4203
0.15	-0.65	0.65	-0.4308		-0.4336
0.1666	-0.64	0.64	-0.4463		-0.4468
0.1833	-0.63	0.63	-0.4620		-0.4601

0.2	-0.63	0.63	-0.4620		-0.4734
0.2166	-0.62	0.62	-0.4780		-0.4866
0.2333	-0.61	0.61	-0.4943		-0.4999
0.25	-0.6	0.60	-0.5108		-0.5132
0.2666	-0.59	0.59	-0.5276		-0.5264
0.2833	-0.58	0.58	-0.5447		-0.5396
0.3	-0.58	0.58	-0.5447		-0.5529
0.3166	-0.57	0.57	-0.5621		-0.5661
0.3333	-0.56	0.56	-0.5798		-0.5794
0.4167	-0.53	0.53	-0.6349		-0.6458
0.5	-0.49	0.49	-0.7133	B	-0.7120
0.5833	-0.46	0.46	-0.7765		-0.7783
0.6667	-0.43	0.43	-0.8440		-0.8446
0.75	-0.4	0.40	-0.9163		-0.9109
0.8333	-0.38	0.38	-0.9676		-0.9771
0.9167	-0.35	0.35	-1.0498		-1.0435
1	-0.33	0.33	-1.1087	E	-1.1098
1.0833	-0.3	0.30	-1.2040		-1.1760
1.1667	-0.28	0.28	-1.2730		-1.2424
1.25	-0.26	0.26	-1.3471		-1.3086
1.3333	-0.24	0.24	-1.4271		-1.3749
1.4166	-0.22	0.22	-1.5141		-1.4411
1.5	-0.2	0.20	-1.6094		-1.5075
1.5833	-0.18	0.18	-1.7148		-1.5738
1.6667	-0.17	0.17	-1.7720		-1.6401
1.75	-0.16	0.16	-1.8326		-1.7064
1.8333	-0.14	0.14	-1.9661		-1.7726
1.9167	-0.13	0.13	-2.0402		-1.8390
2	-0.12	0.12	-2.1203		-1.9052
2.5	-0.07	0.07	-2.6593		-2.3030
3	-0.04	0.04	-3.2189		-2.7007
3.5	-0.02	0.02	-3.9120		-3.0984
4	-0.01	0.01	-4.6052		-3.4962
4.5	-0.01	0.01	-4.6052		-3.8939
5	0	0.00	ERR		-4.2916
5.5	0	0.00	ERR		-4.6894
6	0	0.00	ERR		-5.0871
6.5	0	0.00	ERR		-5.4848
7	0	0.00	ERR		-5.8826
7.5	0	0.00	ERR		-6.2803
8	0	0.00	ERR		-6.6780
8.5	0	0.00	ERR		-7.0758
9	0	0.00	ERR		-7.4735
9.5	0	0.00	ERR		-7.8712
10	0	0.00	ERR		-8.2690
12	0	0.00	ERR		-9.8599

ROSEHILL SLUG TEST



(Rising Head test 1 for MW-04-01)
Slug Test Analysis - Bouwer & Rice/Hvorslev's Methods (V2.4.5)

Client:	EPA	Revised	11/05/91
Site:	Rosehill	Well ID:	MW-04-01
Test by:	K.Arena	Date:	10/30/91
Analysis:	K.Arena	Date:	11/26/91

USER INPUT DATA		WORKSHEET			
			A=	2.4	2.4
Aquifer Thickness=	13.37	FIGURES	B =	0.38	0.38
Exposed Len.(Le) =	10		C =	2.1	2.1
Well Length (Lw) =	10.05	R(eq) =	0.0833	0.0833	0.0833
Casing Radius(Rc)=	0.083	Est. Rw			0.333
Well Radius (Rw) =	0.333	Est. n		NA	
Sandpack Porosity=	0.270	log(Le/Rw)		1.4771	1.4771
Slug Volume =	0.025	ln(Re/Rw)		2.3194	2.3194
Static Level =	4.80	Max. Y(t)		1.21	
Offset time =	0.0833	Regr. Y(0)		1.19	
Shape Factor =	18.5	Casing Y(0)		1.15	UNDRAINED
(F from est. Rw)	18.5				

	ft/min	cm/sec	ft/day
Bouwer & Rice - user porosity & Rw	1.2E-03	2.4E-03	1.76
Bouwer & Rice - estimated porosity	1.2E-03	2.4E-03	1.76
Bouwer & Rice - estimated Rw	1.2E-03	2.4E-03	1.76
Hvorslev - user porosity and Rw	1.8E-03	3.5E-03	2.57
Hvorslev - estimated porosity	1.8E-03	3.5E-03	2.57
Hvorslev - estimated Rw	1.8E-03	3.5E-03	2.57

Regression Output:

Constant	0.296275
Std Err of Y Est	0.004530
R Squared	0.997178
No. of Observations	11
Degrees of Freedom	9

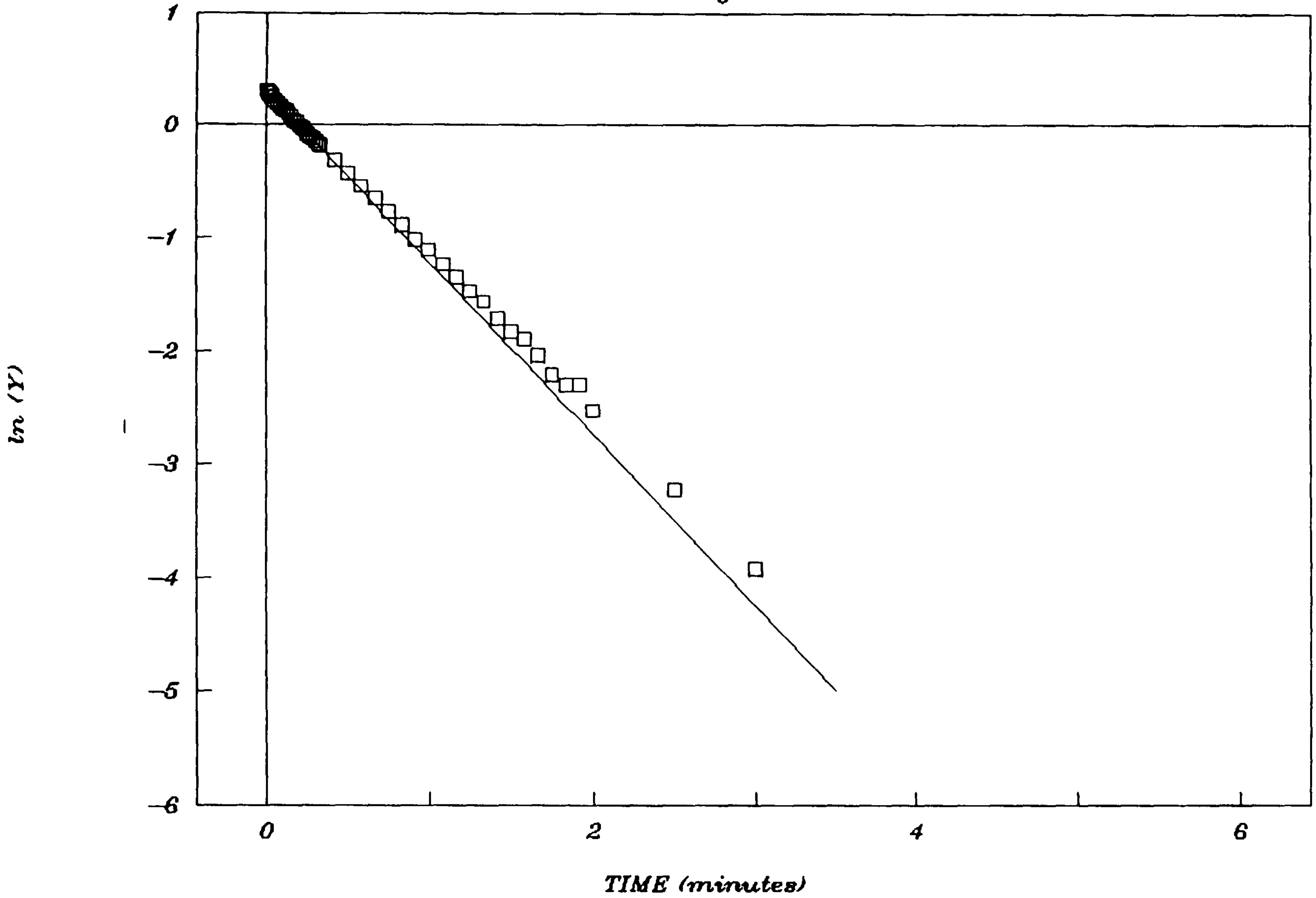
X Coefficient(s)	-1.51390
Std Err of Coef.	0.026842

Time (min)	level (ft)	Drawdown Y(t) ft	ln(Y)	Indicate Regress. Range	EST lnY
0	-1.36	1.36	0.3075		0.2963
0.0033	-1.36	1.36	0.3075		0.2913
0.0066	-1.35	1.35	0.3001		0.2863
0.0099	-1.34	1.34	0.2927		0.2813
0.0133	-1.33	1.33	0.2852		0.2761
0.0166	-1.32	1.32	0.2776		0.2711
0.02	-1.32	1.32	0.2776		0.2660
0.0233	-1.3	1.30	0.2624		0.2610
0.0266	-1.3	1.30	0.2624		0.2560
0.03	-1.29	1.29	0.2546	B	0.2509
0.0333	-1.28	1.28	0.2469		0.2459
0.05	-1.25	1.25	0.2231		0.2206
0.0666	-1.21	1.21	0.1906		0.1954
0.0833	-1.18	1.18	0.1655		0.1702
0.1	-1.15	1.15	0.1398		0.1449
0.1166	-1.13	1.13	0.1222		0.1198
0.1333	-1.1	1.10	0.0953		0.0945
0.15	-1.08	1.08	0.0770		0.0692
0.1666	-1.04	1.04	0.0392		0.0441
0.1833	-1.02	1.02	0.0198	E	0.0188

0.2	-0.99	0.99	-0.0101	-0.0065
0.2166	-0.97	0.97	-0.0305	-0.0316
0.2333	-0.95	0.95	-0.0513	-0.0569
0.25	-0.92	0.92	-0.0834	-0.0822
0.2666	-0.9	0.90	-0.1054	-0.1073
0.2833	-0.88	0.88	-0.1278	-0.1326
0.3	-0.86	0.86	-0.1508	-0.1579
0.3166	-0.84	0.84	-0.1744	-0.1830
0.3333	-0.83	0.83	-0.1863	-0.2083
0.4167	-0.73	0.73	-0.3147	-0.3346
0.5	-0.65	0.65	-0.4308	-0.4607
0.5833	-0.58	0.58	-0.5447	-0.5868
0.6667	-0.52	0.52	-0.6539	-0.7130
0.75	-0.46	0.46	-0.7765	-0.8392
0.8333	-0.41	0.41	-0.8916	-0.9653
0.9167	-0.36	0.36	-1.0217	-1.0915
1	-0.33	0.33	-1.1087	-1.2176
1.0833	-0.29	0.29	-1.2379	-1.3437
1.1667	-0.26	0.26	-1.3471	-1.4700
1.25	-0.23	0.23	-1.4697	-1.5961
1.3333	-0.21	0.21	-1.5606	-1.7222
1.4166	-0.18	0.18	-1.7148	-1.8483
1.5	-0.16	0.16	-1.8326	-1.9746
1.5833	-0.15	0.15	-1.8971	-2.1007
1.6667	-0.13	0.13	-2.0402	-2.2269
1.75	-0.11	0.11	-2.2073	-2.3531
1.8333	-0.1	0.10	-2.3026	-2.4792
1.9167	-0.1	0.10	-2.3026	-2.6054
2	-0.08	0.08	-2.5257	-2.7315
2.5	-0.04	0.04	-3.2189	-3.4885
3	-0.02	0.02	-3.9120	-4.2454
3.5	0	0.00	ERR	-5.0024
4	0	0.00	ERR	-5.7593
4.5	0	0.00	ERR	-6.5163
5	0	0.00	ERR	-7.2732
5.5	0	0.00	ERR	-8.0302

ROSEHILL SLUG TEST

MW-04-01 Rising Head Test 1



(Rising head test 2 on MW-04-02)
Slug Test Analysis - Bouwer & Rice/Hvorslev's Methods (V2.4.5)

Client: EPA — Revised 11/05/91
Site: Rosehill — Well ID: MW-04-02
Test by: K.Arena — Date: 10/30/91
Analysis:K.Arena — Date: 11/26/91

USER INPUT DATA		WORKSHEET			
Aquifer Thickness=	33.37	FIGURES	A=	2.4	2.4
Exposed Len.(Le) =	10		B =	0.38	0.38
Well Length (Lw) =	29.68		C =	2.1	2.1
Casing Radius(Rc)=	0.083	R(eq) =	0.0833	0.0833	0.0833
Well Radius (Rw) =	0.333	Est. Rw			0.333
Sandpack Porosity=	0.270	Est. n		NA	
Slug Volume =	0.025	log(Le/Rw)		1.4771	1.4771
Static Level =	4.69	ln(Re/Rw)		2.8202	2.8202
Offset time =	0	Max. Y(t)		0.81	
Shape Factor =	18.5	Regr. Y(0)		0.81	
(F from est. Rw)	18.5	Casing Y(0)		1.15	UNDRAINED

	ft/min	cm/sec	ft/day
Bouwer & Rice - user porosity & Rw	2.6E-02	5.1E-02	37.48
Bouwer & Rice - estimated porosity	2.6E-02	5.1E-02	37.48
Bouwer & Rice - estimated Rw	2.6E-02	5.1E-02	37.48
Hvorslev - user porosity and Rw	3.1E-02	6.2E-02	45.20
Hvorslev - estimated porosity	3.1E-02	6.2E-02	45.20
Hvorslev - estimated Rw	3.1E-02	6.2E-02	45.20

Regression Output:

Constant	-0.21175
Std Err of Y Est	0.002584
R Squared	0.999804
No. of Observations	6
Degrees of Freedom	4

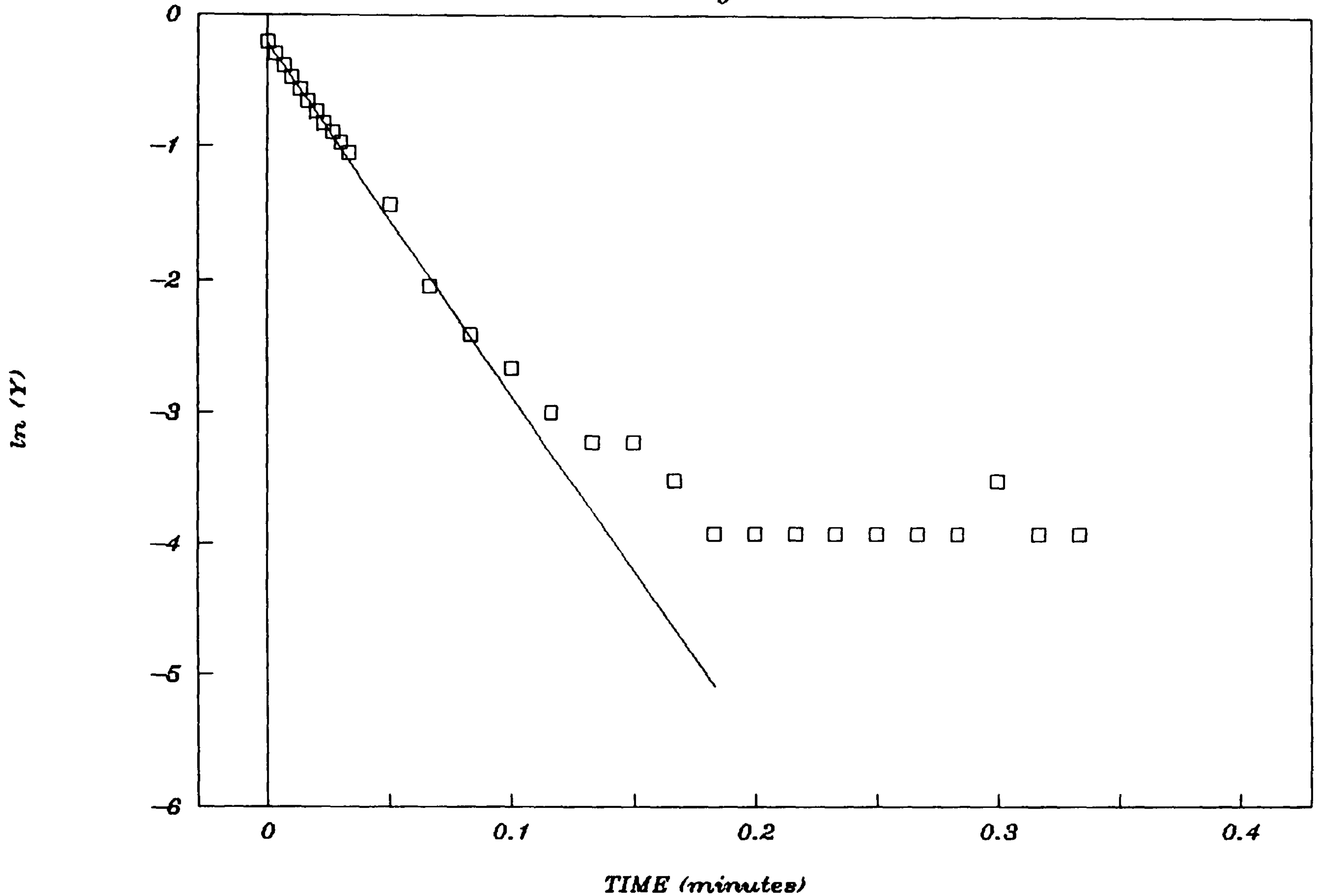
X Coefficient(s)	-26.5804
Std Err of Coef.	0.185941

Time (min)	level (ft)	Drawdown Y(t) ft	ln(Y)	Indicate Regress. Range	EST lnY
0	-0.81	0.81	-0.2107	b	-0.2118
0.0033	-0.74	0.74	-0.3011		-0.2995
0.0066	-0.68	0.68	-0.3857		-0.3872
0.0099	-0.62	0.62	-0.4780		-0.4749
0.0133	-0.57	0.57	-0.5621		-0.5653
0.0166	-0.52	0.52	-0.6539	e	-0.6530
0.02	-0.48	0.48	-0.7340		-0.7434
0.0233	-0.44	0.44	-0.8210		-0.8311
0.0266	-0.41	0.41	-0.8916		-0.9188
0.03	-0.38	0.38	-0.9676		-1.0092
0.0333	-0.35	0.35	-1.0498		-1.0969
0.05	-0.24	0.24	-1.4271		-1.5408
0.0666	-0.13	0.13	-2.0402		-1.9820
0.0833	-0.09	0.09	-2.4079		-2.4259
0.1	-0.07	0.07	-2.6593		-2.8698
0.1166	-0.05	0.05	-2.9957		-3.3110
0.1333	-0.04	0.04	-3.2189		-3.7549
0.15	-0.04	0.04	-3.2189		-4.1988
0.1666	-0.03	0.03	-3.5066		-4.6401
0.1833	-0.02	0.02	-3.9120		-5.0840

0.2	-0.02	0.02	-3.9120	-5.5278
0.2166	-0.02	0.02	-3.9120	-5.9691
0.2333	-0.02	0.02	-3.9120	-6.4130
0.25	-0.02	0.02	-3.9120	-6.8569
0.2666	-0.02	0.02	-3.9120	-7.2981
0.2833	-0.02	0.02	-3.9120	-7.7420
0.3	-0.03	0.03	-3.5066	-8.1859
0.3166	-0.02	0.02	-3.9120	-8.6271
0.3333	-0.02	0.02	-3.9120	-9.0710
0.4167	-0.02	0.02	-3.9120	-11.2878
0.5	-0.02	0.02	-3.9120	-13.5020
0.5833	-0.02	0.02	-3.9120	-15.7161
0.6667	-0.01	0.01	-4.6052	-17.9329
0.75	-0.01	0.01	-4.6052	-20.1471
0.8333	-0.02	0.02	-3.9120	-22.3613
0.9167	-0.02	0.02	-3.9120	-24.5781
1	-0.02	0.02	-3.9120	-26.7922
1.0833	-0.02	0.02	-3.9120	-29.0064
1.1667	-0.02	0.02	-3.9120	-31.2232
1.25	-0.02	0.02	-3.9120	-33.4373
1.3333	-0.02	0.02	-3.9120	-35.6515
1.4166	-0.02	0.02	-3.9120	-37.8656
1.5	-0.02	0.02	-3.9120	-40.0824
1.5833	-0.02	0.02	-3.9120	-42.2966
1.6667	-0.02	0.02	-3.9120	-44.5134
1.75	-0.02	0.02	-3.9120	-46.7276
1.8333	-0.02	0.02	-3.9120	-48.9417
1.9167	-0.02	0.02	-3.9120	-51.1585
2	-0.02	0.02	-3.9120	-53.3727
2.5	-0.02	0.02	-3.9120	-66.6629
3	-0.02	0.02	-3.9120	-79.9531
3.5	-0.02	0.02	-3.9120	-93.2434
4	-0.03	0.03	-3.5066	-106.5336
4.5	-0.01	0.01	-4.6052	-119.8238
5	-0.01	0.01	-4.6052	-133.1141

ROSEHILL SLUG TEST

MW-04-02 Rising Head Test 2



Rising Head Test 1
Slug Test Analysis - Bouwer & Rice/Hvorslev's Methods (V2.4.5)

Client: EPA				Revised	11/05/91
Site: Rosehill				Well ID:	MW-04-03
Test by: K.Arena				Date:	11/01/91
Analysis:K.Arena				Date:	12/19/91

USER INPUT DATA		WORKSHEET	A=	7.4	7.4
Aquifer Thickness=	300	FIGURES	B =	1.73	1.73
Exposed Len.(Le) =	94.7		C =	9.1	9.1
Well Length (Lw) =	129.67	R(eq) =	0.2500	0.2500	0.2500
Casing Radius(Rc)=	0.250	Est. Rw			0.250
Well Radius (Rw) =	0.250	Est. n		NA	
Sandpack Porosity=	0.270	log(Le/Rw)		2.5784	2.5784
Slug Volume =	0.153	ln(Re/Rw)		4.4901	4.4901
Static Level =	10.33	Max. Y(t)		0.75	
Offset time =	3	Regr. Y(0)		0.75	
Shape Factor =	100.2	Casing Y(0)		0.78	UNDRAINED
(F from est. Rw)	100.2				

	ft/min	cm/sec	ft/day
Bouwer & Rice - user porosity & Rw	4.0E-05	7.9E-05	0.06
Bouwer & Rice - estimated porosity	4.0E-05	7.9E-05	0.06
Bouwer & Rice - estimated Rw	4.0E-05	7.9E-05	0.06
Hvorslev - user porosity and Rw	5.3E-05	1.0E-04	0.08
Hvorslev - estimated porosity	5.3E-05	1.0E-04	0.08
Hvorslev - estimated Rw	5.3E-05	1.0E-04	0.08

Regression Output:

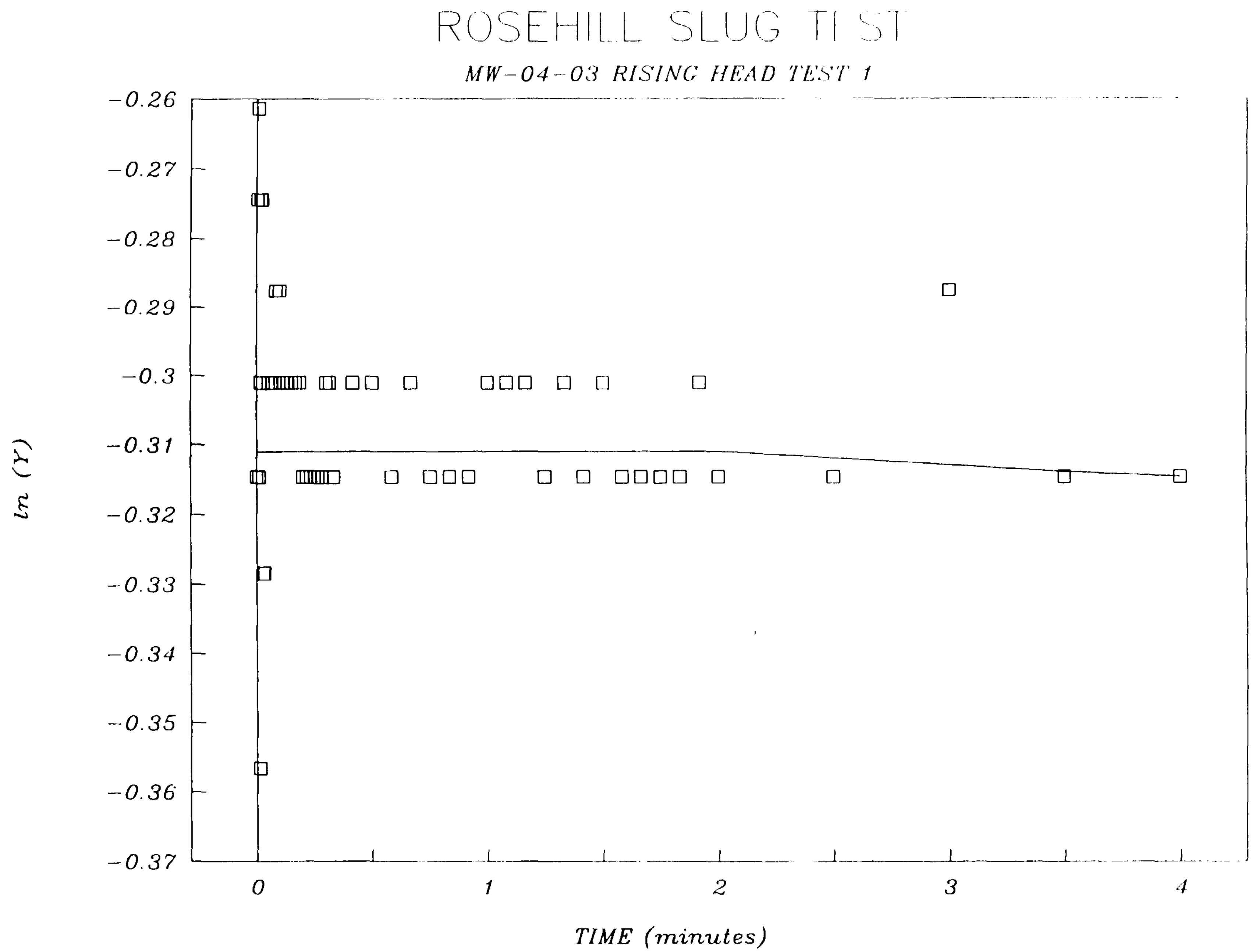
Constant	-0.21110
Std Err of Y Est	0.011034
R Squared	0.75
No. of Observations	3
Degrees of Freedom	1

X Coefficient(s)	-0.02702
Std Err of Coef.	0.015605

Time (min)	level (ft)	Drawdown Y(t) ft	ln(Y)	Indicate Regress. Range	EST lnY	
0	-0.73	0.73	-0.3147		-0.2111	-0.311
0.0033	-0.76	0.76	-0.2744		-0.2112	-0.311
0.0066	-0.77	0.77	-0.2614		-0.2113	-0.311
0.0099	-0.73	0.73	-0.3147		-0.2114	-0.311
0.0133	-0.7	0.70	-0.3567		-0.2115	-0.311
0.0166	-0.74	0.74	-0.3011		-0.2115	-0.311
0.02	-0.76	0.76	-0.2744		-0.2116	-0.311
0.0233	-0.76	0.76	-0.2744		-0.2117	-0.311
0.0266	-0.74	0.74	-0.3011		-0.2118	-0.311
0.03	-0.72	0.72	-0.3285		-0.2119	-0.311
0.0333	-0.72	0.72	-0.3285		-0.2120	-0.311
0.05	-0.74	0.74	-0.3011		-0.2125	-0.311
0.0666	-0.74	0.74	-0.3011		-0.2129	-0.311
0.0833	-0.75	0.75	-0.2877		-0.2134	-0.311
0.1	-0.75	0.75	-0.2877		-0.2138	-0.311
0.1166	-0.74	0.74	-0.3011		-0.2143	-0.311
0.1333	-0.74	0.74	-0.3011		-0.2147	-0.311
0.15	-0.74	0.74	-0.3011		-0.2152	-0.311
0.1666	-0.74	0.74	-0.3011		-0.2156	-0.311
0.1833	-0.74	0.74	-0.3011		-0.2161	-0.311

0.2	-0.73	0.73	-0.3147		-0.2165	-0.311
0.2166	-0.73	0.73	-0.3147		-0.2170	-0.311
0.2333	-0.73	0.73	-0.3147		-0.2174	-0.311
0.25	-0.73	0.73	-0.3147		-0.2179	-0.311
0.2666	-0.73	0.73	-0.3147		-0.2183	-0.311
0.2833	-0.73	0.73	-0.3147		-0.2188	-0.311
0.3	-0.74	0.74	-0.3011		-0.2192	-0.311
0.3166	-0.74	0.74	-0.3011		-0.2197	-0.311
0.3333	-0.73	0.73	-0.3147		-0.2201	-0.311
0.4167	-0.74	0.74	-0.3011		-0.2224	-0.311
0.5	-0.74	0.74	-0.3011		-0.2246	-0.311
0.5833	-0.73	0.73	-0.3147		-0.2269	-0.311
0.6667	-0.74	0.74	-0.3011		-0.2291	-0.311
0.75	-0.73	0.73	-0.3147		-0.2314	-0.311
0.8333	-0.73	0.73	-0.3147		-0.2336	-0.311
0.9167	-0.73	0.73	-0.3147		-0.2359	-0.311
1	-0.74	0.74	-0.3011		-0.2381	-0.311
1.0833	-0.74	0.74	-0.3011		-0.2404	-0.311
1.1667	-0.74	0.74	-0.3011		-0.2426	-0.311
1.25	-0.73	0.73	-0.3147		-0.2449	-0.311
1.3333	-0.74	0.74	-0.3011		-0.2471	-0.311
1.4166	-0.73	0.73	-0.3147		-0.2494	-0.311
1.5	-0.74	0.74	-0.3011		-0.2516	-0.311
1.5833	-0.73	0.73	-0.3147		-0.2539	-0.311
1.6667	-0.73	0.73	-0.3147		-0.2561	-0.311
1.75	-0.73	0.73	-0.3147		-0.2584	-0.311
1.8333	-0.73	0.73	-0.3147		-0.2607	-0.311
1.9167	-0.74	0.74	-0.3011		-0.2629	-0.311
2	-0.73	0.73	-0.3147		-0.2652	-0.311
2.5	-0.73	0.73	-0.3147		-0.2787	-0.312
3	-0.75	0.75	-0.2877	B2	-0.2922	-0.313
3.5	-0.73	0.73	-0.3147		-0.3057	-0.314
4	-0.73	0.73	-0.3147	E2	-0.3192	-0.3147
4.5	-0.73	0.73	-0.3147		-0.3327	
5	-0.73	0.73	-0.3147		-0.3462	
5.5	-0.73	0.73	-0.3147		-0.3598	
6	-0.73	0.73	-0.3147		-0.3733	
6.5	-0.73	0.73	-0.3147		-0.3868	
7	-0.73	0.73	-0.3147		-0.4003	
7.5	-0.73	0.73	-0.3147		-0.4138	
8	-0.73	0.73	-0.3147		-0.4273	
8.5	-0.73	0.73	-0.3147		-0.4408	
9	-0.73	0.73	-0.3147		-0.4544	
9.5	-0.73	0.73	-0.3147		-0.4679	
10	-0.73	0.73	-0.3147		-0.4814	
12	-0.73	0.73	-0.3147		-0.5354	
14	-0.72	0.72	-0.3285		-0.5895	
16	-0.72	0.72	-0.3285		-0.6436	
18	-0.72	0.72	-0.3285		-0.6976	
20	-0.73	0.73	-0.3147		-0.7517	
22	-0.73	0.73	-0.3147		-0.8057	
24	-0.72	0.72	-0.3285		-0.8598	
26	-0.73	0.73	-0.3147		-0.9138	
28	-0.72	0.72	-0.3285		-0.9679	
30	-0.72	0.72	-0.3285		-1.0220	
32	-0.72	0.72	-0.3285		-1.0760	
34	-0.73	0.73	-0.3147		-1.1301	
36	-0.72	0.72	-0.3285		-1.1841	
38	0.75	0.75	-0.2877		-1.2382	
40	0.74	0.74	-0.3011		-1.2922	

42	0.75	0.75	-0.2877	-1.3463
44	0.75	0.75	-0.2877	-1.4004
46	0.75	0.75	-0.2877	-1.4544
48	0.75	0.75	-0.2877	-1.5085
50	0.75	0.75	-0.2877	-1.5625
52	0.75	0.75	-0.2877	-1.6166
54	0.76	0.76	-0.2744	-1.6706



ROSEHILL SLUG TEST
MW-04-03 RISING HEAD TEST 1
ln (Y)
-0.26
-0.27
-0.28
-0.29
-0.3
-0.31
-0.32
-0.33
-0.34
-0.35
-0.36
-0.37
0
1
2
3
4
TIME (minutes)

Slug Test Analysis - Bouwer & Rice/Hvorslev's Methods (V2.4.5)

RISING OR FALLING TEST: RISING TEST 1 (B1-E1)

Client: EPA	Revised 11/05/91
Site: ROSE HILL	Well ID: MW-05-01
Test by: DANIEL H. BERLER	Date: 10/30/91
Analysis: DANIEL H. BERLER	Date: 11/19/91

USER INPUT DATA		WORKSHEET			
Aquifer Thickness=	23.33	FIGURES	A=	2.4	2.4
Exposed Len.(Le) =	10		B =		0.38
Well Length (Lw) =	11.53		C =	2.1	2.1
Casing Radius(Rc)=	0.083	R(eq) =	0.0830	0.0830	0.0830
Well Radius (Rw) =	0.333	Est. Rw			0.333
Sandpack Porosity=	0.270	Est. n		NA	
Slug Volume =	0.025	log(Le/Rw)		1.4776	1.4776
Static Level =	6.42	ln(Re/Rw)		2.5684	2.5684
Offset time =	0.0666	Max. Y(t)		1.01	
Shape Factor =	18.5	Regr. Y(0)		1.01	
(F from est. Rw)	18.5	Casing Y(0)		1.16	UNDRAINED

	ft/min	cm/sec	ft/day
Bouwer & Rice - user porosity & Rw	3.5E-03	6.9E-03	5.03
Bouwer & Rice - estimated porosity	3.5E-03	6.9E-03	5.03
Bouwer & Rice - estimated Rw	3.5E-03	6.9E-03	5.03
Hvorslev - user porosity and Rw	4.6E-03	9.1E-03	6.67
Hvorslev - estimated porosity	4.6E-03	9.1E-03	6.67
Hvorslev - estimated Rw	4.6E-03	9.1E-03	6.67

Regression Output:

Constant	0.269926
Std Err of Y Est	0.006637
R Squared	0.998550
No. of Observations	8
Degrees of Freedom	6

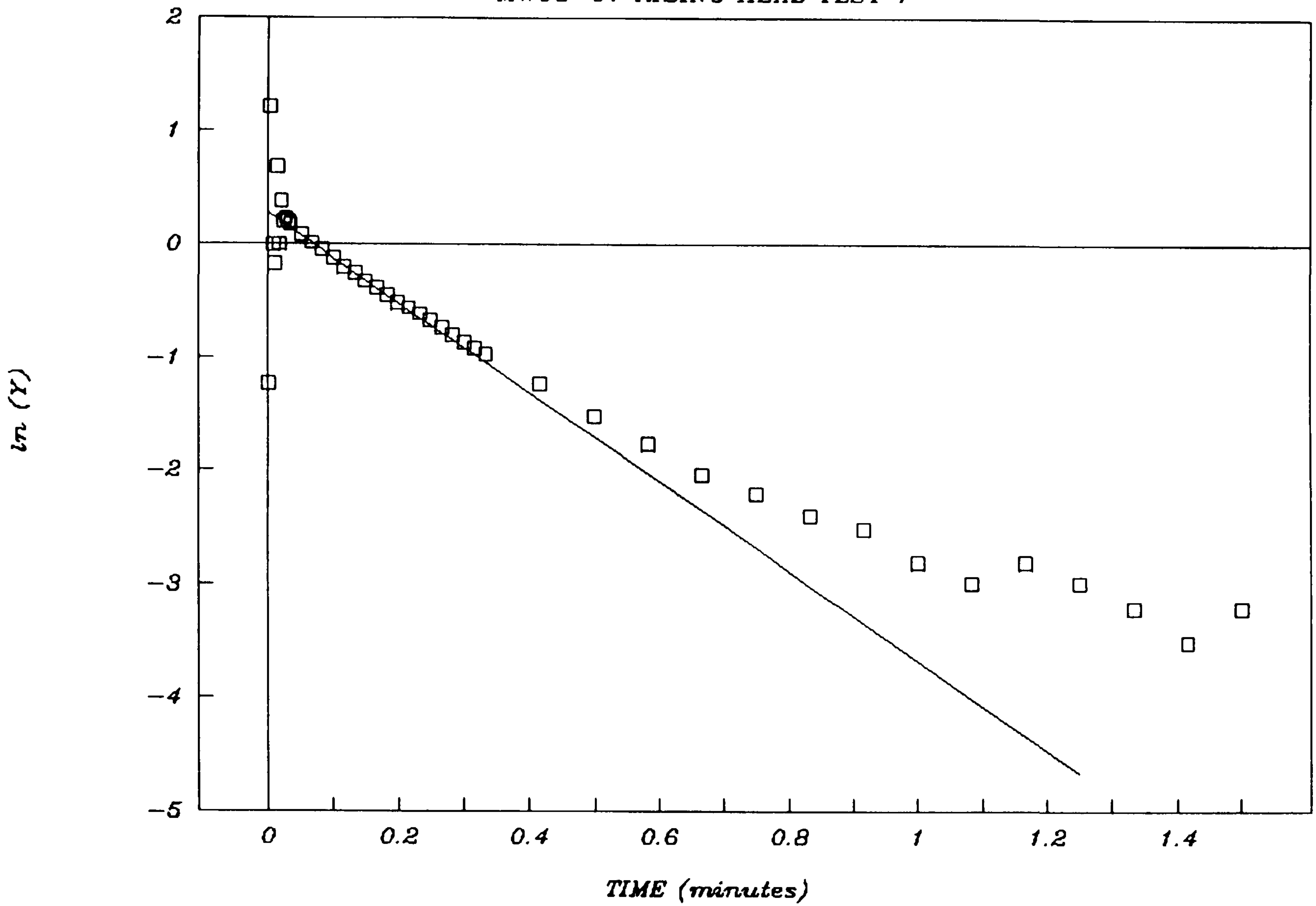
X Coefficient(s)	-3.95004
Std Err of Coef.	0.061447

Time (min)	level (ft)	Drawdown Y(t) ft	ln(Y)	Indicate Regress. Range	EST lnY
0	-0.29	0.29	-1.23787		0.2699
0.0033	-3.39	3.39	1.220829		0.2569
0.0066	-0.99	0.99	-0.01005		0.2439
0.0099	-0.84	0.84	-0.17435		0.2308
0.0133	-1.99	1.99	0.688134		0.2174
0.0166	-1	1	0		0.2044
0.02	-1.46	1.46	0.378436		0.1909
0.0233	-1.22	1.22	0.198850		0.1779
0.0266	-1.26	1.26	0.231111		0.1649
0.03	-1.22	1.22	0.198850		0.1514
0.0333	-1.19	1.19	0.173953		0.1384
0.05	-1.09	1.09	0.086177		0.0724
0.0666	-1.01	1.01	0.009950	B1	0.0069
0.0833	-0.95	0.95	-0.05129		-0.0591
0.1	-0.88	0.88	-0.12783		-0.1251
0.1166	-0.82	0.82	-0.19845		-0.1906
0.1333	-0.77	0.77	-0.26136		-0.2566
0.15	-0.72	0.72	-0.32850		-0.3226
0.1666	-0.68	0.68	-0.38566		-0.3882
0.1833	-0.64	0.64	-0.44628	E1	-0.4541

0.2	-0.6	0.6	-0.51082	B	-0.5201
0.2166	-0.57	0.57	-0.56211		-0.5857
0.2333	-0.54	0.54	-0.61618		-0.6516
0.25	-0.51	0.51	-0.67334		-0.7176
0.2666	-0.48	0.48	-0.73396		-0.7832
0.2833	-0.45	0.45	-0.79850		-0.8491
0.3	-0.42	0.42	-0.86750		-0.9151
0.3166	-0.4	0.4	-0.91629		-0.9807
0.3333	-0.38	0.38	-0.96758		-1.0466
0.4167	-0.29	0.29	-1.23787		-1.3761
0.5	-0.22	0.22	-1.51412		-1.7051
0.5833	-0.17	0.17	-1.77195	E	-2.0341
0.6667	-0.13	0.13	-2.04022		-2.3636
0.75	-0.11	0.11	-2.20727		-2.6926
0.8333	-0.09	0.09	-2.40794		-3.0216
0.9167	-0.08	0.08	-2.52572		-3.3511
1	-0.06	0.06	-2.81341		-3.6801
1.0833	-0.05	0.05	-2.99573		-4.0092
1.1667	-0.06	0.06	-2.81341		-4.3386
1.25	-0.05	0.05	-2.99573		-4.6676
1.3333	-0.04	0.04	-3.21887		-4.9967
1.4166	-0.03	0.03	-3.50655		-5.3257
1.5	-0.04	0.04	-3.21887		-5.6551
1.5833	-0.04	0.04	-3.21887		-5.9842
1.6667	-0.04	0.04	-3.21887		-6.3136
1.75	-0.04	0.04	-3.21887		-6.6427
1.8333	-0.03	0.03	-3.50655		-6.9717
1.9167	-0.03	0.03	-3.50655		-7.3011
2	-0.03	0.03	-3.50655		-7.6302
2.5	-0.03	0.03	-3.50655		-9.6052
3	-0.03	0.03	-3.50655		-11.5802
3.5	-0.03	0.03	-3.50655		-13.5552
4	-0.03	0.03	-3.50655		-15.5303
4.5	-0.02	0.02	-3.91202		-17.5053
5	-0.03	0.03	-3.50655		-19.4803
5.5	-0.02	0.02	-3.91202		-21.4553
6	-0.03	0.03	-3.50655		-23.4304
6.5	-0.02	0.02	-3.91202		-25.4054
7	-0.02	0.02	-3.91202		-27.3804
7.5	-0.02	0.02	-3.91202		-29.3554
8	-0.02	0.02	-3.91202		-31.3304
8.5	-0.02	0.02	-3.91202		-33.3055
9	-0.02	0.02	-3.91202		-35.2805
9.5	-0.02	0.02	-3.91202		-37.2555
10	-0.03	0.03	-3.50655		-39.2305

ROSE HILL SLUG TEST

MW05-01 RISING HEAD TEST 1



Slug Test Analysis - Bouwer & Rice/Hvorslev's Methods (V2.4.5)
RISING OR FALLING TEST: RISING TEST 1

Client:	EPA	Revised	11/05/91
Site:	ROSE HILL	Well ID:	MW05-02
Test by:	DANIEL H. BERLER	Date:	10/30/91
Analysis:	DANIEL H. BERLER	Date:	11/19/91

USER INPUT DATA		WORKSHEET	A=		3.0	3.0
Aquifer Thickness=	23.58	FIGURES	B =			0.46
Exposed Len.(Le) =	10		C =		2.7	2.7
Well Length (Lw) =	22.14	R(eq) =		0.0830	0.0830	0.0830
Casing Radius(Rc)=	0.083	Est. Rw				0.209
Well Radius (Rw) =	0.209	Est. n			NA	
Sandpack Porosity=	0.270	log(Le/Rw)			1.6809	1.6809
Slug Volume =	0.025	ln(Re/Rw)			3.3632	3.3632
Static Level =	6.71	Max. Y(t)			ERR	
Offset time =	0.0033	Regr. Y(0)			1.42	
Shape Factor =	16.2	Casing Y(0)			1.16	UNDRAINED
(F from est. Rw)	16.2					

	ft/min	cm/sec	ft/day
Bouwer & Rice - user porosity & Rw	4.7E-03	9.2E-03	6.75
Bouwer & Rice - estimated porosity	4.7E-03	9.2E-03	6.75
Bouwer & Rice - estimated Rw	4.7E-03	9.2E-03	6.75
Hvorslev - user porosity and Rw	5.4E-03	1.1E-02	7.77
Hvorslev - estimated porosity	5.4E-03	1.1E-02	7.77
Hvorslev - estimated Rw	5.4E-03	1.1E-02	7.77

Regression Output:

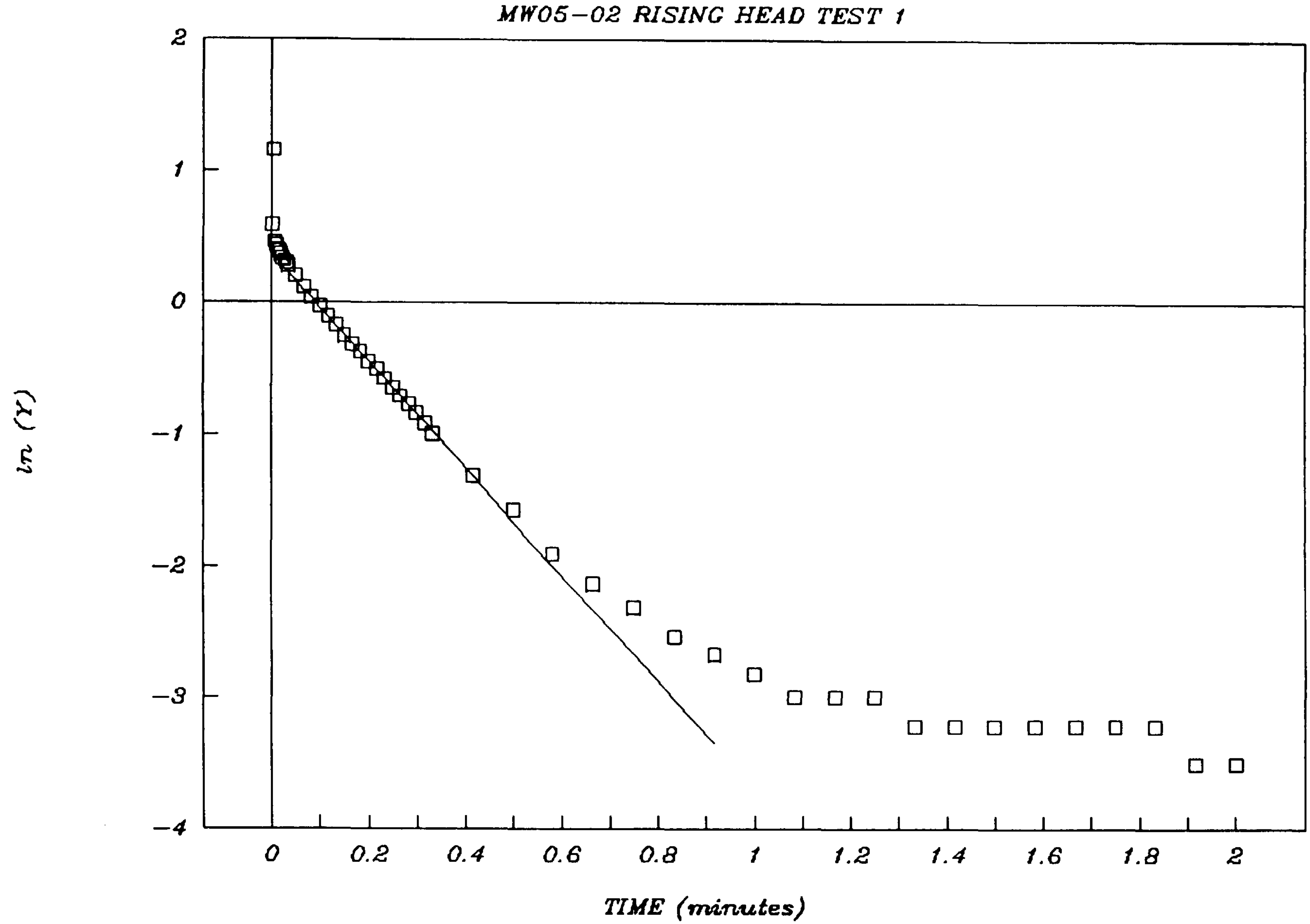
Constant	0.365701
Std Err of Y Est	0.005189
R Squared	0.999642
No. of Observations	13
Degrees of Freedom	11

X Coefficient(s)	-4.04801
Std Err of Coef.	0.023079

Time (min)	level (ft)	Drawdown Y(t) ft	ln(Y)	Indicate Regress. Range	EST lnY
0	-1.82	1.82	0.598836		0.3657
0.0033	-3.19	3.19	1.160020		0.3523
0.0066	-1.6	1.6	0.470003		0.3390
0.0099	-1.55	1.55	0.438254		0.3256
0.0133	-1.5	1.5	0.405465		0.3119
0.0166	-1.49	1.49	0.398776		0.2985
0.02	-1.45	1.45	0.371563		0.2847
0.0233	-1.41	1.41	0.343589		0.2714
0.0266	-1.38	1.38	0.322083		0.2580
0.03	-1.36	1.36	0.307484		0.2443
0.0333	-1.33	1.33	0.285178		0.2309
0.05	-1.23	1.23	0.207014		0.1633
0.0666	-1.13	1.13	0.122217		0.0961
0.0833	-1.04	1.04	0.039220		0.0285
0.1	-0.97	0.97	-0.03045	B	-0.0391
0.1166	-0.9	0.9	-0.10536		-0.1063
0.1333	-0.84	0.84	-0.17435		-0.1739
0.15	-0.78	0.78	-0.24846		-0.2415
0.1666	-0.73	0.73	-0.31471		-0.3087
0.1833	-0.69	0.69	-0.37106		-0.3763

0.2	-0.64	0.64	-0.44628		-0.4439
0.2166	-0.6	0.6	-0.51082		-0.5111
0.2333	-0.56	0.56	-0.57981		-0.5787
0.25	-0.52	0.52	-0.65392		-0.6463
0.2666	-0.49	0.49	-0.71334		-0.7135
0.2833	-0.46	0.46	-0.77652		-0.7811
0.3	-0.43	0.43	-0.84397	E	-0.8487
0.3166	-0.4	0.4	-0.91629		-0.9159
0.3333	-0.37	0.37	-0.99425		-0.9835
0.4167	-0.27	0.27	-1.30933		-1.3211
0.5	-0.21	0.21	-1.56064		-1.6583
0.5833	-0.15	0.15	-1.89711		-1.9955
0.6667	-0.12	0.12	-2.12026		-2.3331
0.75	-0.1	0.1	-2.30258		-2.6703
0.8333	-0.08	0.08	-2.52572		-3.0075
0.9167	-0.07	0.07	-2.65926		-3.3451
1	-0.06	0.06	-2.81341		-3.6823
1.0833	-0.05	0.05	-2.99573		-4.0195
1.1667	-0.05	0.05	-2.99573		-4.3571
1.25	-0.05	0.05	-2.99573		-4.6943
1.3333	-0.04	0.04	-3.21887		-5.0315
1.4166	-0.04	0.04	-3.21887		-5.3687
1.5	-0.04	0.04	-3.21887		-5.7063
1.5833	-0.04	0.04	-3.21887		-6.0435
1.6667	-0.04	0.04	-3.21887		-6.3811
1.75	-0.04	0.04	-3.21887		-6.7183
1.8333	-0.04	0.04	-3.21887		-7.0555
1.9167	-0.03	0.03	-3.50655		-7.3931
2	-0.03	0.03	-3.50655		-7.7303
2.5	-0.03	0.03	-3.50655		-9.7543
3	-0.03	0.03	-3.50655		-11.7784
3.5	-0.04	0.04	-3.21887		-13.8024
4	-0.03	0.03	-3.50655		-15.8264
4.5	-0.03	0.03	-3.50655		-17.8504
5	-0.03	0.03	-3.50655		-19.8744
5.5	-0.03	0.03	-3.50655		-21.8984
6	-0.03	0.03	-3.50655		-23.9224
6.5	-0.03	0.03	-3.50655		-25.9464
7	-0.03	0.03	-3.50655		-27.9704
7.5	-0.03	0.03	-3.50655		-29.9944
8	-0.04	0.04	-3.21887		-32.0185
8.5	-0.03	0.03	-3.50655		-34.0425
9	-0.03	0.03	-3.50655		-36.0665
9.5	-0.03	0.03	-3.50655		-38.0905
10	-0.03	0.03	-3.50655		-40.1145

ROSE HILL SLUG TEST



Slug Test Analysis - Bouwer & Rice/Hvorslev's Methods (V2.4.5)
Client: EPA Revised 11/05/91
(First Rising Head Test)
Site: Rosehill Well ID: MW-06-01
Test by: D.Berler Date: 10/31/91
Analysis:K.Arena Date: 12/03/91

USER INPUT DATA		WORKSHEET	A=	2.5	4.3
Aquifer Thickness=	16.62	FIGURES	B =	0.40	0.69
Exposed Len.(Le) =	15		C =	2.2	4.4
Well Length (Lw) =	14.32	R(eq) =	0.2279	0.1037	0.1037
Casing Radius(Rc)=	0.083	Est. Rw			0.145
Well Radius (Rw) =	0.417	Est. n		0.023	
Sandpack Porosity=	0.270	log(Le/Rw)		1.5362	1.9941
Slug Volume =	0.025	ln(Re/Rw)		2.4751	2.8996
Static Level =	5.30	Max. Y(t)		0.79	
Offset time =	0.02	Regr. Y(0)		0.74	
Shape Factor =	26.3	Casing Y(0)		1.15	DRAINED
(F from est. Rw)	20.3				

	ft/min	cm/sec	ft/day
Bouwer & Rice - user porosity & Rw	1.5E-01	3.0E-01	216.26
Bouwer & Rice - estimated porosity	3.1E-02	6.1E-02	44.79
Bouwer & Rice - estimated Rw	3.6E-02	7.2E-02	52.47
Hvorslev - user porosity and Rw	2.1E-01	4.1E-01	298.91
Hvorslev - estimated porosity	4.3E-02	8.5E-02	61.91
Hvorslev - estimated Rw	5.6E-02	1.1E-01	80.13

Regression Output:

Constant	0.367474
Std Err of Y Est	0.028848
R Squared	0.997870
No. of Observations	6
Degrees of Freedom	4

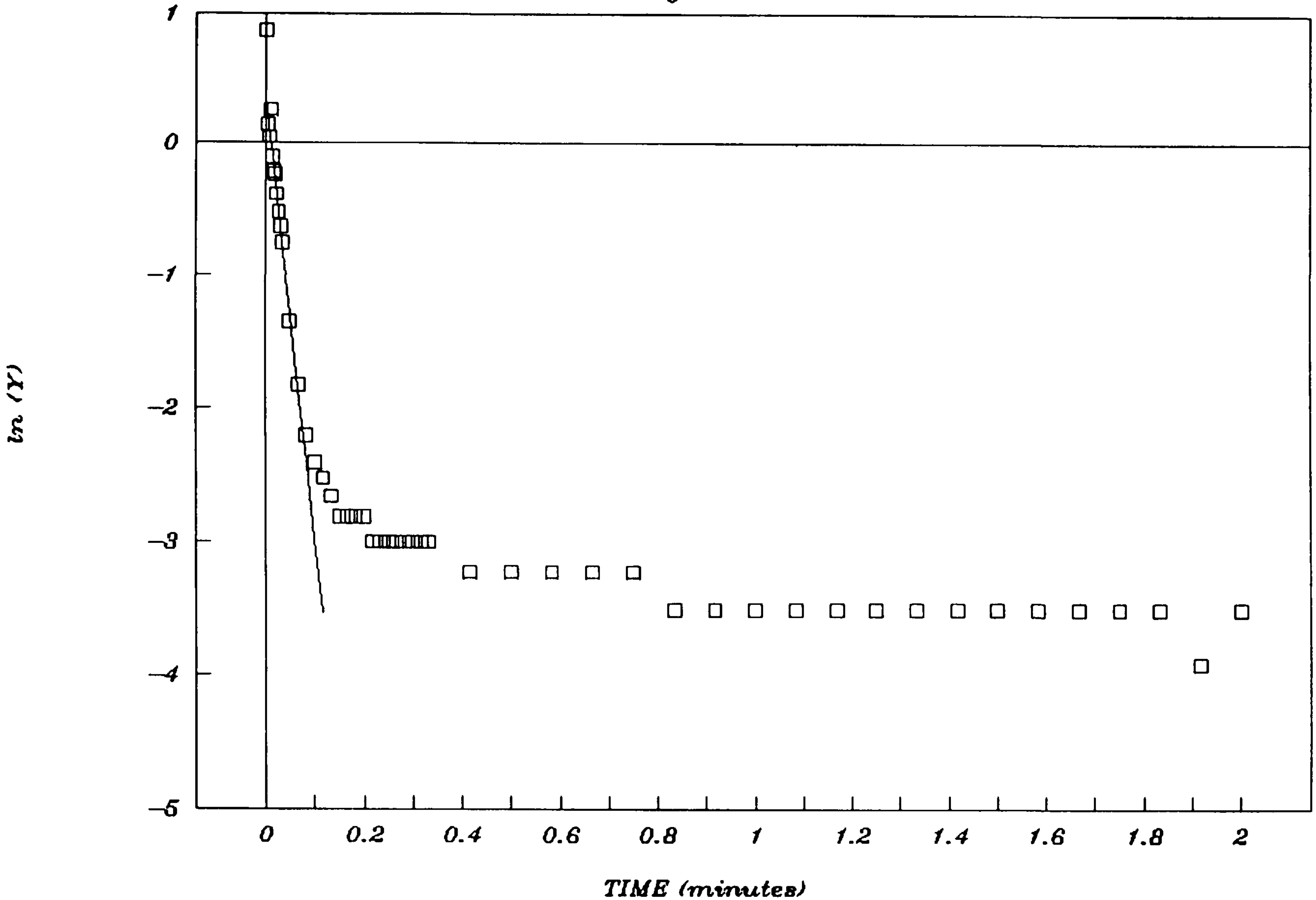
X Coefficient(s)	-33.4538
Std Err of Coef.	0.772781

Time (min)	level (ft)	Drawdown Y(t) ft	ln(Y)	Indicate Regress. Range	EST lnY
0	-2.38	2.38	0.8671		0.3675
0.0033	-1.15	1.15	0.1398		0.2571
0.0066	-1.05	1.05	0.0488		0.1467
0.0099	-1.3	1.30	0.2624		0.0363
0.0133	-0.9	0.90	-0.1054		-0.0775
0.0166	-0.81	0.81	-0.2107		-0.1879
0.02	-0.79	0.79	-0.2357		-0.3016
0.0233	-0.68	0.68	-0.3857	B1	-0.4120
0.0266	-0.59	0.59	-0.5276		-0.5224
0.03	-0.53	0.53	-0.6349		-0.6361
0.0333	-0.47	0.47	-0.7550		-0.7465
0.05	-0.26	0.26	-1.3471		-1.3052
0.0666	-0.16	0.16	-1.8326	E1	-1.8606
0.0833	-0.11	0.11	-2.2073		-2.4192
0.1	-0.09	0.09	-2.4079		-2.9779
0.1166	-0.08	0.08	-2.5257		-3.5332
0.1333	-0.07	0.07	-2.6593		-4.0919
0.15	-0.06	0.06	-2.8134		-4.6506
0.1666	-0.06	0.06	-2.8134		-5.2059
0.1833	-0.06	0.06	-2.8134		-5.7646

0.2	-0.06	0.06	-2.8134	-6.3233
0.2166	-0.05	0.05	-2.9957	-6.8786
0.2333	-0.05	0.05	-2.9957	-7.4373
0.25	-0.05	0.05	-2.9957	-7.9960
0.2666	-0.05	0.05	-2.9957	-8.5513
0.2833	-0.05	0.05	-2.9957	-9.1100
0.3	-0.05	0.05	-2.9957	-9.6687
0.3166	-0.05	0.05	-2.9957	-10.2240
0.3333	-0.05	0.05	-2.9957	-10.7827
0.4167	-0.04	0.04	-3.2189	-13.5728
0.5	-0.04	0.04	-3.2189	-16.3595
0.5833	-0.04	0.04	-3.2189	-19.1462
0.6667	-0.04	0.04	-3.2189	-21.9362
0.75	-0.04	0.04	-3.2189	-24.7229
0.8333	-0.03	0.03	-3.5066	-27.5096
0.9167	-0.03	0.03	-3.5066	-30.2997
1	-0.03	0.03	-3.5066	-33.0864
1.0833	-0.03	0.03	-3.5066	-35.8731
1.1667	-0.03	0.03	-3.5066	-38.6632
1.25	-0.03	0.03	-3.5066	-41.4499
1.3333	-0.03	0.03	-3.5066	-44.2366
1.4166	-0.03	0.03	-3.5066	-47.0233
1.5	-0.03	0.03	-3.5066	-49.8133
1.5833	-0.03	0.03	-3.5066	-52.6000
1.6667	-0.03	0.03	-3.5066	-55.3901
1.75	-0.03	0.03	-3.5066	-58.1768
1.8333	-0.03	0.03	-3.5066	-60.9635
1.9167	-0.02	0.02	-3.9120	-63.7536
2	-0.03	0.03	-3.5066	-66.5403
2.5	-0.02	0.02	-3.9120	-83.2672
3	-0.02	0.02	-3.9120	-99.9941
3.5	-0.02	0.02	-3.9120	-116.7211
4	-0.02	0.02	-3.9120	-133.4480
4.5	-0.02	0.02	-3.9120	-150.1749
5	-0.02	0.02	-3.9120	-166.9019
5.5	-0.02	0.02	-3.9120	-183.6288
6	-0.02	0.02	-3.9120	-200.3557
6.5	-0.02	0.02	-3.9120	-217.0827
7	-0.02	0.02	-3.9120	-233.8096
7.5	-0.02	0.02	-3.9120	-250.5365

ROSEHILL SLUG TEST

MW-06-01 Rising Head Test 1



(First Rising Head Test)
Slug Test Analysis - Bouwer & Rice/Hvorslev's Methods (V2.4.5)
Client: EPA — Revised 11/05/91
Site: Rosehill — Well ID: MW-06-02
Test by: D.Berler — Date: 10/31/91
Analysis:K.Arena — Date: 12/03/91

USER INPUT DATA		WORKSHEET FIGURES			
Aquifer Thickness=	30.29	A=		3.0	3.0
Exposed Len.(Le) =	10	B =		0.46	0.46
Well Length (Lw) =	28.19	C =		2.7	2.7
Casing Radius(Rc)=	0.083	R(eq) =	0.0833	0.0833	0.0833
Well Radius (Rw) =	0.208	Est. Rw			0.208
Sandpack Porosity=	0.270	Est. n		NA	
Slug Volume =	0.025	log(Le/Rw)		1.6812	1.6812
Static Level =	5.50	ln(Re/Rw)		3.2489	3.2489
Offset time =	0.0266	Max. Y(t)		1.14	
Shape Factor =	16.2	Regr. Y(0)		1.13	
(F from est. Rw)	16.2	Casing Y(0)		1.15	UNDRAINED

	ft/min	cm/sec	ft/day
Bouwer & Rice - user porosity & Rw	1.4E-02	2.8E-02	20.13
Bouwer & Rice - estimated porosity	1.4E-02	2.8E-02	20.13
Bouwer & Rice - estimated Rw	1.4E-02	2.8E-02	20.13
Hvorslev - user porosity and Rw	1.7E-02	3.3E-02	23.99
Hvorslev - estimated porosity	1.7E-02	3.3E-02	23.99
Hvorslev - estimated Rw	1.7E-02	3.3E-02	23.99

Regression Output:

Constant	0.453071
Std Err of Y Est	0.009126
R Squared	0.999445
No. of Observations	7
Degrees of Freedom	5

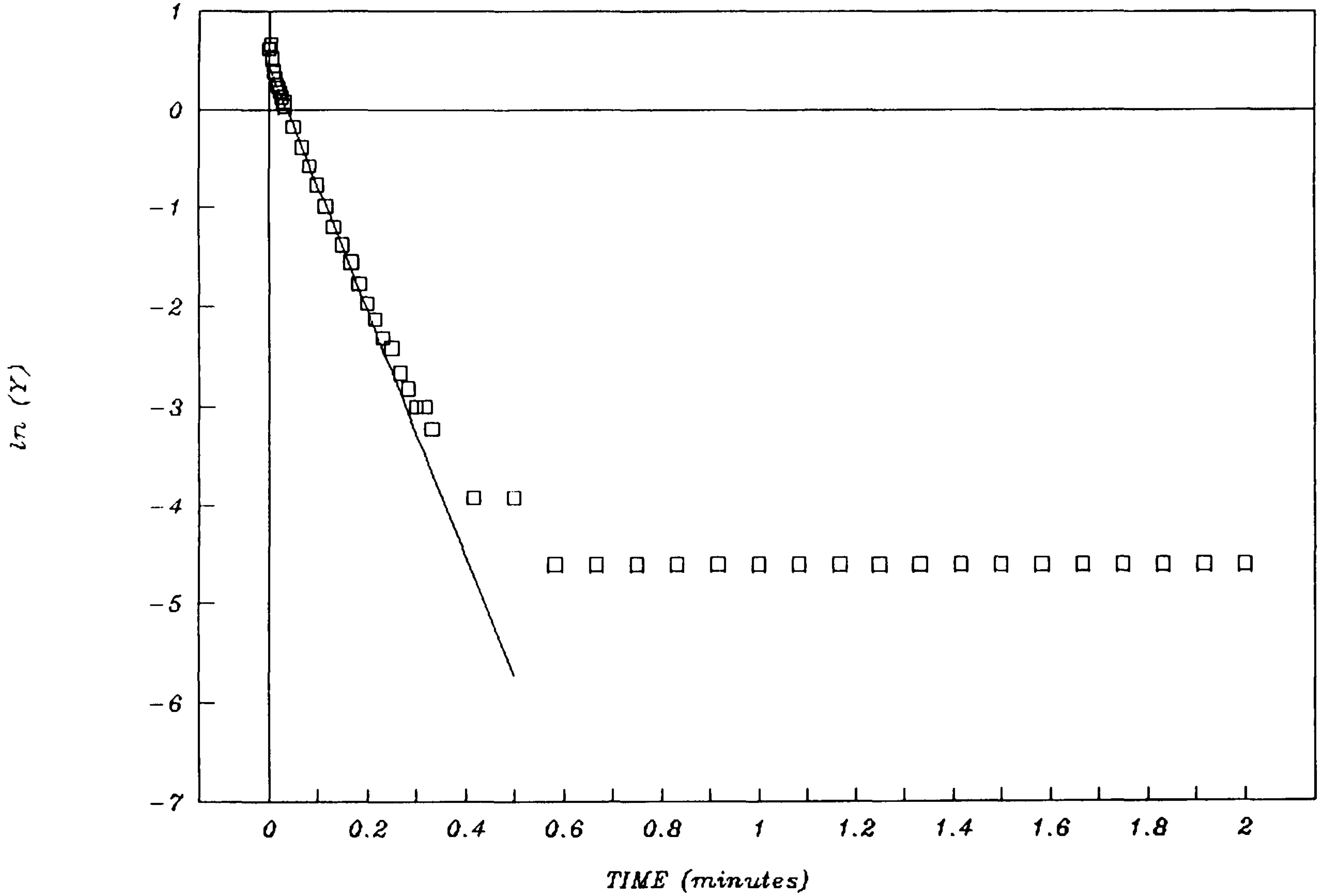
X Coefficient(s)	-12.3946
Std Err of Coef.	0.130590

Time (min)	level (ft)	Drawdown Y(t) ft	ln(Y)	Indicate Regress. Range	EST lnY
0	-1.86	1.86	0.6206		0.4531
0.0033	-1.96	1.96	0.6729		0.4122
0.0066	-1.69	1.69	0.5247		0.3713
0.0099	-1.49	1.49	0.3988		0.3304
0.0133	-1.38	1.38	0.3221		0.2882
0.0166	-1.31	1.31	0.2700		0.2473
0.02	-1.26	1.26	0.2311		0.2052
0.0233	-1.2	1.20	0.1823		0.1643
0.0266	-1.14	1.14	0.1310	B	0.1234
0.03	-1.09	1.09	0.0862		0.0812
0.0333	-1.04	1.04	0.0392		0.0403
0.05	-0.84	0.84	-0.1744		-0.1667
0.0666	-0.68	0.68	-0.3857		-0.3724
0.0833	-0.56	0.56	-0.5798		-0.5794
0.1	-0.46	0.46	-0.7765	E	-0.7864
0.1166	-0.37	0.37	-0.9943		-0.9921
0.1333	-0.3	0.30	-1.2040		-1.1991
0.15	-0.25	0.25	-1.3863		-1.4061
0.1666	-0.21	0.21	-1.5606		-1.6119
0.1833	-0.17	0.17	-1.7720		-1.8189

0.2	-0.14	0.14	-1.9661	-2.0259
0.2166	-0.12	0.12	-2.1203	-2.2316
0.2333	-0.1	0.10	-2.3026	-2.4386
0.25	-0.09	0.09	-2.4079	-2.6456
0.2666	-0.07	0.07	-2.6593	-2.8513
0.2833	-0.06	0.06	-2.8134	-3.0583
0.3	-0.05	0.05	-2.9957	-3.2653
0.3166	-0.05	0.05	-2.9957	-3.4711
0.3333	-0.04	0.04	-3.2189	-3.6781
0.4167	-0.02	0.02	-3.9120	-4.7118
0.5	-0.02	0.02	-3.9120	-5.7443
0.5833	-0.01	0.01	-4.6052	-6.7767
0.6667	-0.01	0.01	-4.6052	-7.8104
0.75	-0.01	0.01	-4.6052	-8.8429
0.8333	-0.01	0.01	-4.6052	-9.8754
0.9167	-0.01	0.01	-4.6052	-10.9091
1	-0.01	0.01	-4.6052	-11.9416
1.0833	-0.01	0.01	-4.6052	-12.9741
1.1667	-0.01	0.01	-4.6052	-14.0078
1.25	-0.01	0.01	-4.6052	-15.0403
1.3333	-0.01	0.01	-4.6052	-16.0727
1.4166	-0.01	0.01	-4.6052	-17.1052
1.5	-0.01	0.01	-4.6052	-18.1389
1.5833	-0.01	0.01	-4.6052	-19.1714
1.6667	-0.01	0.01	-4.6052	-20.2051
1.75	-0.01	0.01	-4.6052	-21.2376
1.8333	-0.01	0.01	-4.6052	-22.2701
1.9167	-0.01	0.01	-4.6052	-23.3038
2	-0.01	0.01	-4.6052	-24.3363
2.5	-0.01	0.01	-4.6052	-30.5336
3	-0.01	0.01	-4.6052	-36.7309
3.5	-0.01	0.01	-4.6052	-42.9282
4	-0.01	0.01	-4.6052	-49.1256
4.5	0	0.00	ERR	-55.3229
5	0	0.00	ERR	-61.5202
5.5	-0.01	0.01	-4.6052	-67.7176
6	-0.01	0.01	-4.6052	-73.9149
6.5	-0.01	0.01	-4.6052	-80.1122
7	0	0.00	ERR	-86.3096
7.5	-0.01	0.01	-4.6052	-92.5069
8	0	0.00	ERR	-98.7042
8.5	0	0.00	ERR	-104.9015
9	0	0.00	ERR	-111.0989
9.5	0	0.00	ERR	-117.2962
10	0	0.00	ERR	-123.4935

ROSEHILL SLUG TEST

MW-06-02 Rising Head Test 1



(Rising Head Test 1 MW-07-01)
Slug Test Analysis - Bouwer & Rice/Hvorslev's Methods (V2.4.5)

Client:	EPA	Revised	11/05/91
Site:	Rosehill	Well ID:	MW-07-01
Test by:	K.Arena	Date:	10/31/91
Analysis:	K.Arena	Date:	11/26/91

USER INPUT DATA		WORKSHEET			
Aquifer Thickness=	25.53	FIGURES	A=	2.5	5.4
Exposed Len.(Le) =	15		B =	0.40	0.98
Well Length (Lw) =	14.13		C =	2.2	6.0
Casing Radius(Rc)=	0.083	R(eq) =	0.2279	0.0841	0.0841
Well Radius (Rw) =	0.417	Est. Rw			0.086
Sandpack Porosity=	0.270	Est. n		0.001	
Slug Volume =	0.025	log(Le/Rw)		1.5304	2.2141
Static Level =	20.15	ln(Re/Rw)		2.3547	2.8838
Offset time =	0.0166	Max. Y(t)		1.12	
Shape Factor =	26.3	Regr. Y(0)		1.12	
(F from est. Rw)	18.3	Casing Y(0)		1.15	DRAINED

	ft/min	cm/sec	ft/day
Bouwer & Rice - user porosity & Rw	2.5E-02	5.0E-02	36.62
Bouwer & Rice - estimated porosity	3.5E-03	6.8E-03	4.99
Bouwer & Rice - estimated Rw	4.2E-03	8.4E-03	6.11
Hvorslev - user porosity and Rw	3.6E-02	7.2E-02	52.50
Hvorslev - estimated porosity	5.0E-03	9.8E-03	7.16
Hvorslev - estimated Rw	7.2E-03	1.4E-02	10.30

Regression Output:

Constant	0.214298
Std Err of Y Est	0.004371
R Squared	0.994244
No. of Observations	9
Degrees of Freedom	7

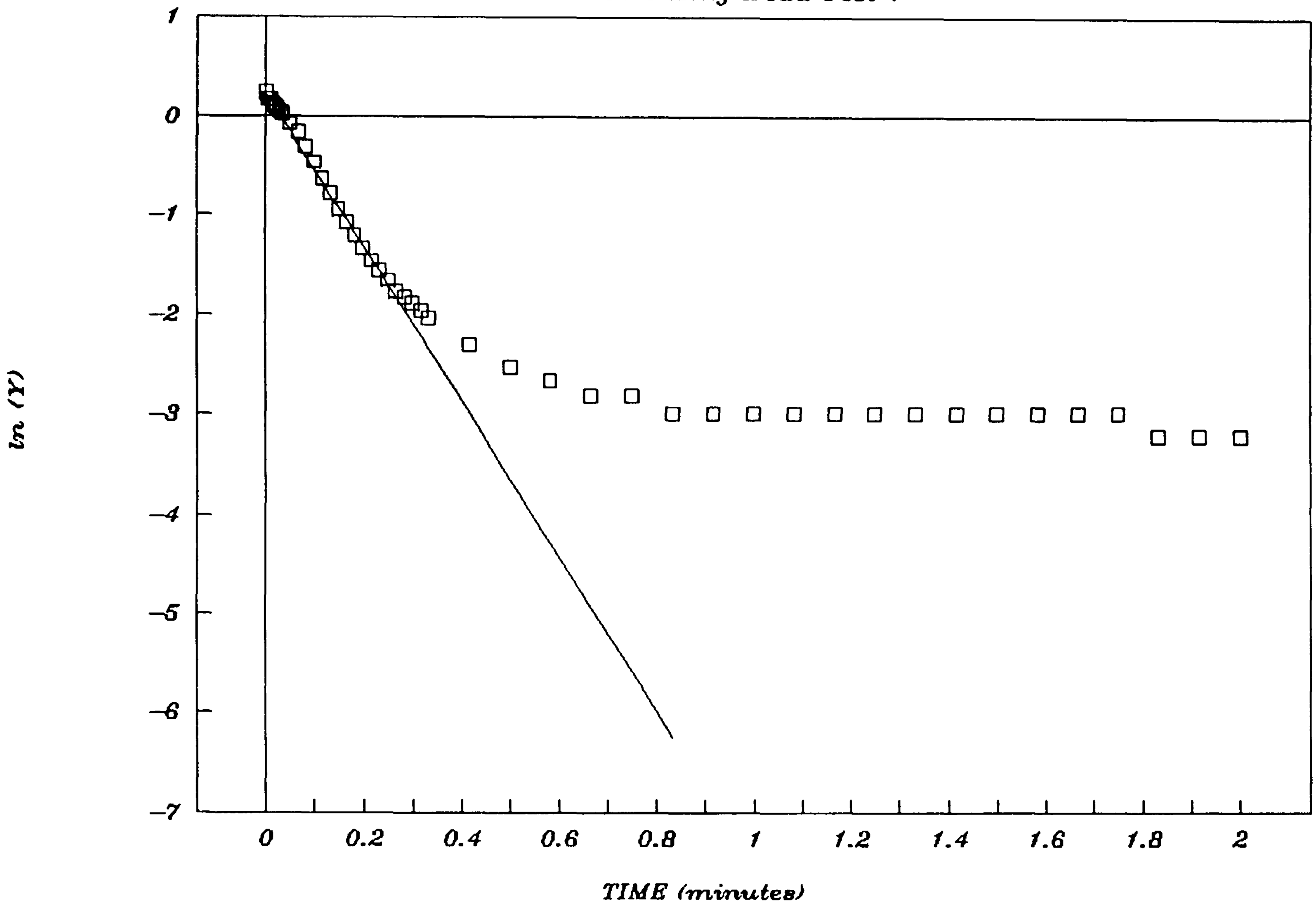
X Coefficient(s)	-5.87581
Std Err of Coef.	0.168977

Time (min)	level (ft)	Drawdown Y(t) ft	ln(Y)	Indicate Regress. Range	EST lnY
0	-1.28	1.28	0.2469		0.2143
0.0033	-1.19	1.19	0.1740		0.1949
0.0066	-1.19	1.19	0.1740	B	0.1755
0.0099	-1.18	1.18	0.1655		0.1561
0.0133	-1.14	1.14	0.1310		0.1361
0.0166	-1.12	1.12	0.1133		0.1168
0.02	-1.1	1.10	0.0953		0.0968
0.0233	-1.08	1.08	0.0770		0.0774
0.0266	-1.06	1.06	0.0583		0.0580
0.03	-1.04	1.04	0.0392		0.0380
0.0333	-1.02	1.02	0.0198	E	0.0186
0.05	-0.93	0.93	-0.0726		-0.0795
0.0666	-0.85	0.85	-0.1625		-0.1770
0.0833	-0.74	0.74	-0.3011		-0.2752
0.1	-0.63	0.63	-0.4620		-0.3733
0.1166	-0.53	0.53	-0.6349		-0.4708
0.1333	-0.46	0.46	-0.7765		-0.5689
0.15	-0.39	0.39	-0.9416		-0.6671
0.1666	-0.34	0.34	-1.0788		-0.7646
0.1833	-0.3	0.30	-1.2040		-0.8627

0.2	-0.26	0.26	-1.3471	-0.9609
0.2166	-0.23	0.23	-1.4697	-1.0584
0.2333	-0.21	0.21	-1.5606	-1.1565
0.25	-0.19	0.19	-1.6607	-1.2547
0.2666	-0.17	0.17	-1.7720	-1.3522
0.2833	-0.16	0.16	-1.8326	-1.4503
0.3	-0.15	0.15	-1.8971	-1.5484
0.3166	-0.14	0.14	-1.9661	-1.6460
0.3333	-0.13	0.13	-2.0402	-1.7441
0.4167	-0.1	0.10	-2.3026	-2.2342
0.5	-0.08	0.08	-2.5257	-2.7236
0.5833	-0.07	0.07	-2.6593	-3.2131
0.6667	-0.06	0.06	-2.8134	-3.7031
0.75	-0.06	0.06	-2.8134	-4.1926
0.8333	-0.05	0.05	-2.9957	-4.6820
0.9167	-0.05	0.05	-2.9957	-5.1721
1	-0.05	0.05	-2.9957	-5.6615
1.0833	-0.05	0.05	-2.9957	-6.1510
1.1667	-0.05	0.05	-2.9957	-6.6410
1.25	-0.05	0.05	-2.9957	-7.1305
1.3333	-0.05	0.05	-2.9957	-7.6199
1.4166	-0.05	0.05	-2.9957	-8.1094
1.5	-0.05	0.05	-2.9957	-8.5994
1.5833	-0.05	0.05	-2.9957	-9.0889
1.6667	-0.05	0.05	-2.9957	-9.5789
1.75	-0.05	0.05	-2.9957	-10.0684
1.8333	-0.04	0.04	-3.2189	-10.5578
1.9167	-0.04	0.04	-3.2189	-11.0479
2	-0.04	0.04	-3.2189	-11.5373
2.5	-0.04	0.04	-3.2189	-14.4752
3	-0.05	0.05	-2.9957	-17.4131
3.5	-0.05	0.05	-2.9957	-20.3511
4	-0.05	0.05	-2.9957	-23.2890
4.5	-0.05	0.05	-2.9957	-26.2269
5	-0.05	0.05	-2.9957	-29.1648
5.5	-0.05	0.05	-2.9957	-32.1027
6	-0.05	0.05	-2.9957	-35.0406
6.5	-0.05	0.05	-2.9957	-37.9785
7	-0.05	0.05	-2.9957	-40.9164
7.5	-0.05	0.05	-2.9957	-43.8543
8	-0.05	0.05	-2.9957	-46.7922
8.5	-0.05	0.05	-2.9957	-49.7301
9	-0.05	0.05	-2.9957	-52.6680
9.5	-0.05	0.05	-2.9957	-55.6059
10	-0.05	0.05	-2.9957	-58.5439

ROSEHILL SLUG TEST

MW-07-01 Rising Head Test 1



Rising Head test 1
Slug Test Analysis - Bouwer & Rice/Hvorslev's Methods (V2.4.5)

Client:	EPA	Revised	11/05/91
Site:	Rosehill	Well ID:	MW-07-02
Test by:	K.Arena	Date:	10/31/91
Analysis:	K.Arena	Date:	12/05/91

USER INPUT DATA		WORKSHEET			
			A=	4.3	5.3
Aquifer Thickness=	300	FIGURES	B =	0.70	0.94
Exposed Len.(Le) =	25		C =	4.4	5.8
Well Length (Lw) =	52.78	R(eq) =	0.1928	0.1658	0.1658
Casing Radius(Rc)=	0.167	Est. Rw			0.163
Well Radius (Rw) =	0.250	Est. n		-0.009	
Sandpack Porosity=	0.270	log(Le/Rw)		2.0000	2.1851
Slug Volume =	0.153	ln(Rc/Rw)		3.4433	3.6329
Static Level =	19.84	Max. Y(t)		1.79	
Offset time =	0.1	Regr. Y(0)		1.77	
Shape Factor =	265.9	Casing Y(0)		1.75	DRAINED
(F from est. Rw)	250.8				

	ft/min	cm/sec	ft/day
Bouwer & Rice - user porosity & Rw	2.6E-03	5.1E-03	3.75
Bouwer & Rice - estimated porosity	1.9E-03	3.8E-03	2.77
Bouwer & Rice - estimated Rw	2.0E-03	4.0E-03	2.92
Hvorslev - user porosity and Rw	4.5E-04	8.8E-04	0.64
Hvorslev - estimated porosity	3.3E-04	6.5E-04	0.48
Hvorslev - estimated Rw	3.5E-04	6.9E-04	0.50

Regression Output:

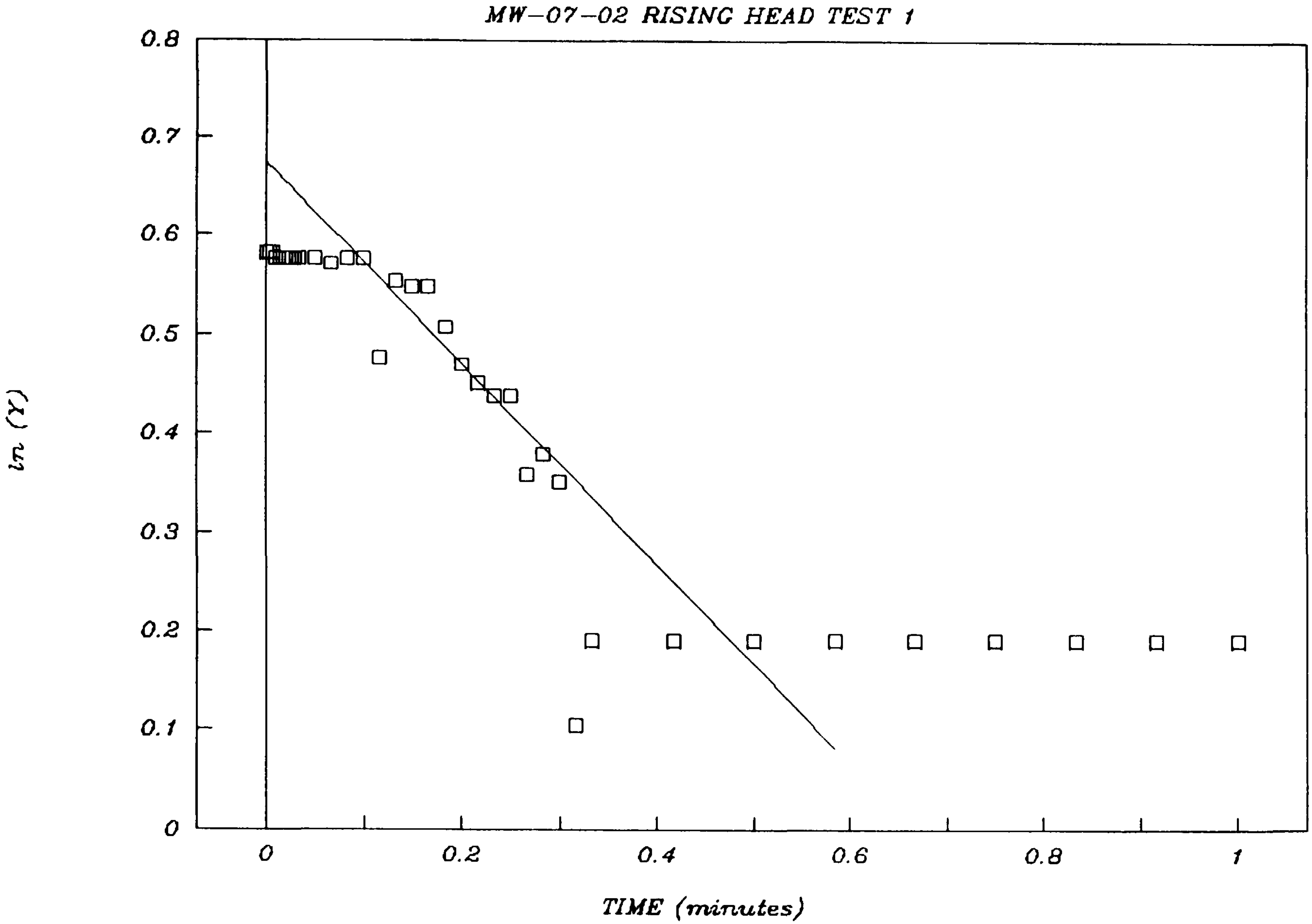
Constant	0.674256
Std Err of Y Est	0.036362
R Squared	0.726661
No. of Observations	11
Degrees of Freedom	9

X Coefficient(s) -1.01759
Std Err of Coef. 0.208034

Time (min)	level (ft)	Drawdown Y(t) ft	ln(Y)	Indicate Regress. Range	EST lnY
0	-1.79	1.79	0.5822		0.6743
0.0033	-1.79	1.79	0.5822		0.6709
0.0066	-1.79	1.79	0.5822		0.6675
0.0099	-1.78	1.78	0.5766		0.6642
0.0133	-1.78	1.78	0.5766		0.6607
0.0166	-1.78	1.78	0.5766		0.6574
0.02	-1.78	1.78	0.5766		0.6539
0.0233	-1.78	1.78	0.5766		0.6505
0.0266	-1.78	1.78	0.5766		0.6472
0.03	-1.78	1.78	0.5766		0.6437
0.0333	-1.78	1.78	0.5766		0.6404
0.05	-1.78	1.78	0.5766		0.6234
0.0666	-1.77	1.77	0.5710		0.6065
0.0833	-1.78	1.78	0.5766		0.5895
0.1	-1.78	1.78	0.5766	B1	0.5725
0.1166	-1.61	1.61	0.4762		0.5556
0.1333	-1.74	1.74	0.5539		0.5386
0.15	-1.73	1.73	0.5481		0.5216
0.1666	-1.73	1.73	0.5481		0.5047
0.1833	-1.66	1.66	0.5068		0.4877

0.2	-1.6	1.60	0.4700		0.4707
0.2166	-1.57	1.57	0.4511		0.4538
0.2333	-1.55	1.55	0.4383		0.4369
0.25	-1.55	1.55	0.4383		0.4199
0.2666	-1.43	1.43	0.3577	e1	0.4030
0.2833	-1.46	1.46	0.3784		0.3860
0.3	-1.42	1.42	0.3507		0.3690
0.3166	-1.11	1.11	0.1044		0.3521
0.3333	-1.21	1.21	0.1906		0.3351
0.4167	-1.21	1.21	0.1906		0.2502
0.5	-1.21	1.21	0.1906		0.1655
0.5833	-1.21	1.21	0.1906		0.0807
0.6667	-1.21	1.21	0.1906		-0.0042
0.75	-1.21	1.21	0.1906		-0.0889
0.8333	-1.21	1.21	0.1906		-0.1737
0.9167	-1.21	1.21	0.1906		-0.2586
1	-1.21	1.21	0.1906		-0.3433
1.0833	-1.21	1.21	0.1906		-0.4281
1.1667	-1.21	1.21	0.1906		-0.5130
1.25	-1.21	1.21	0.1906		-0.5977
1.3333	-1.21	1.21	0.1906		-0.6825
1.4166	-1.21	1.21	0.1906		-0.7673
1.5	-1.21	1.21	0.1906		-0.8521
1.5833	-1.21	1.21	0.1906		-0.9369
1.6667	-1.21	1.21	0.1906		-1.0218
1.75	-1.21	1.21	0.1906		-1.1065
1.8333	-1.21	1.21	0.1906		-1.1913
1.9167	-1.21	1.21	0.1906		-1.2762
2	-1.21	1.21	0.1906		-1.3609
2.5	-1.21	1.21	0.1906		-1.8697
3	-1.21	1.21	0.1906		-2.3785
3.5	-1.21	1.21	0.1906		-2.8873
4	-1.21	1.21	0.1906		-3.3961
4.5	-1.21	1.21	0.1906		-3.9049
5	-1.22	1.22	0.1989		-4.4137
5.5	-1.22	1.22	0.1989		-4.9225
6	-1.22	1.22	0.1989		-5.4313
6.5	-1.22	1.22	0.1989		-5.9401
7	-1.22	1.22	0.1989		-6.4489
7.5	-1.22	1.22	0.1989		-6.9577
8	-1.22	1.22	0.1989		-7.4665
8.5	-1.22	1.22	0.1989		-7.9753
9	-1.22	1.22	0.1989		-8.4841
9.5	-1.22	1.22	0.1989		-8.9929
10	-1.22	1.22	0.1989		-9.5016
12	-1.23	1.23	0.2070		-11.5368
14	-1.23	1.23	0.2070		-13.5720
16	-1.24	1.24	0.2151		-15.6072
18	-1.24	1.24	0.2151		-17.6424
20	-1.25	1.25	0.2231		-19.6776
22	-1.25	1.25	0.2231		-21.7127
24	-1.25	1.25	0.2231		-23.7479
26	-1.25	1.25	0.2231		-25.7831

ROSEHILL SLUG TEST



Slug Test Analysis - Bouwer & Rice/Hvorslev's Methods (V2.4.5)
RISING OR FALLING TEST: RISING TEST 1

Client:	EPA	Revised	11/05/91
Site:	ROSE HILL	Well ID:	MW08-01
Test by:	DANIEL H. BERLER	Date:	10/29/91
Analysis:	DANIEL H. BERLER	Date:	11/18/91

USER INPUT DATA		WORKSHEET			
Aquifer Thickness=	10.89	FIGURES	A=	2.2	4.4
			B =		0.71
Exposed Len.(Le) =	10		C =	1.9	4.5
Well Length (Lw) =	8.4	R(eq) =	0.1871	0.0827	0.0827
Casing Radius(Rc)=	0.083	Est. Rw			0.081
Well Radius (Rw) =	0.333	Est. n		-0.001	
Sandpack Porosity=	0.270	log(Le/Rw)		1.4018	2.0151
Slug Volume =	0.025	ln(Re/Rw)		2.3321	3.0762
Static Level =	6.86	Max. Y(t)		1.16	
Offset time =	0.05	Regr. Y(0)		1.16	
Shape Factor =	18.5	Casing Y(0)		1.15	DRAINED
(F from est. Rw)	13.1				

	ft/min	cm/sec	ft/day
Bouwer & Rice - user porosity & Rw	3.0E-02	5.8E-02	42.77
Bouwer & Rice - estimated porosity	5.8E-03	1.1E-02	8.36
Bouwer & Rice - estimated Rw	7.7E-03	1.5E-02	11.03
Hvorslev - user porosity and Rw	3.6E-02	7.2E-02	52.41
Hvorslev - estimated porosity	7.1E-03	1.4E-02	10.25
Hvorslev - estimated Rw	1.0E-02	2.0E-02	14.50

Regression Output:

Constant	0.455963
Std Err of Y Est	0.003010
R Squared	0.999875
No. of Observations	8
Degrees of Freedom	6

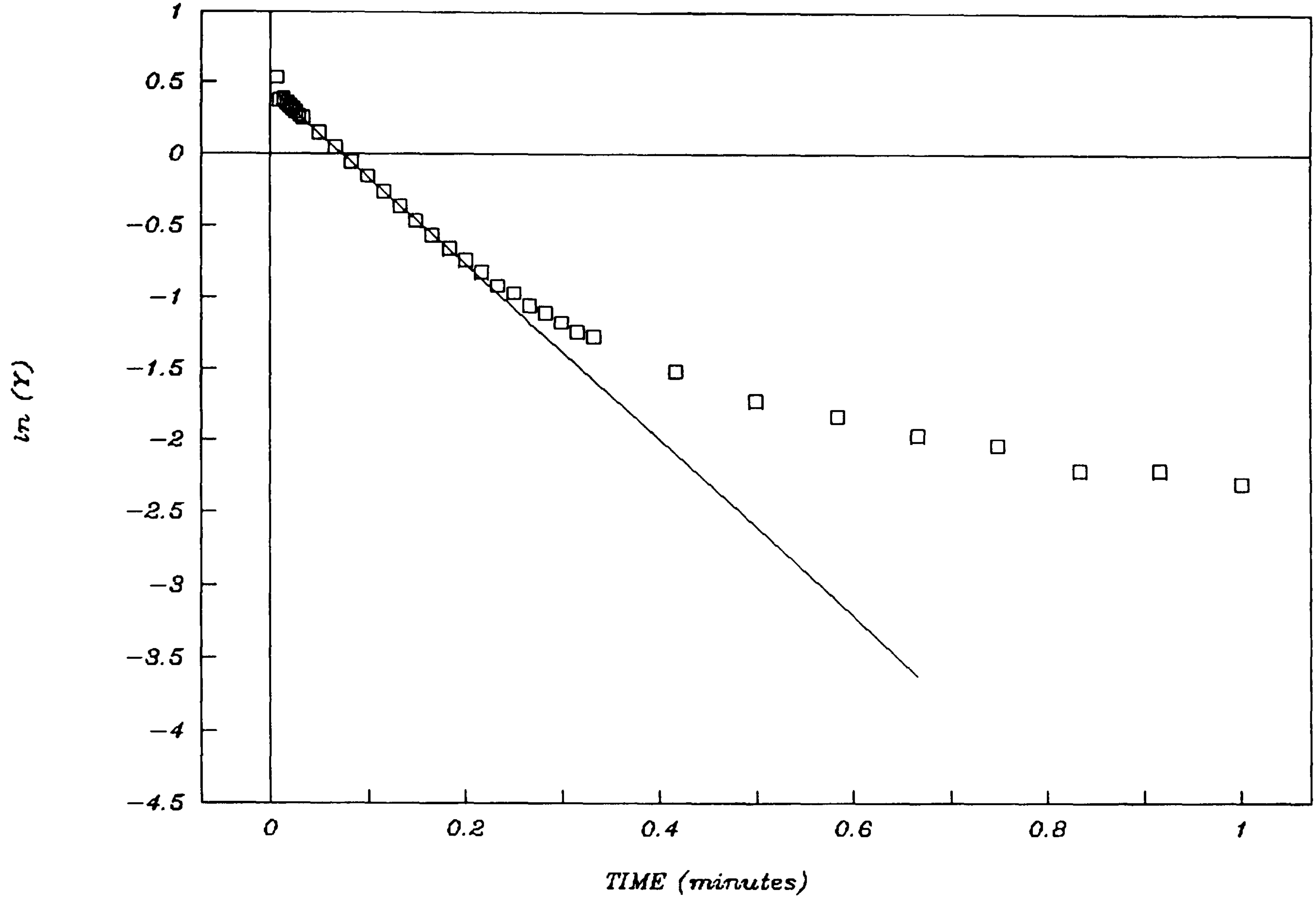
X Coefficient(s)	-6.11127
Std Err of Coef.	0.027871

Time (min)	level (ft)	Drawdown Y(t) ft	ln(Y)	Indicate Regress. Range	EST lnY
0	-4.93	4.93	1.595338		0.4560
0.0033	-0.55	0.55	-0.59783		0.4358
0.0066	-1.71	1.71	0.536493		0.4156
0.0099	-1.46	1.46	0.378436		0.3955
0.0133	-1.47	1.47	0.385262		0.3747
0.0166	-1.43	1.43	0.357674		0.3545
0.02	-1.4	1.4	0.336472		0.3337
0.0233	-1.37	1.37	0.314810		0.3136
0.0266	-1.34	1.34	0.292669		0.2934
0.03	-1.31	1.31	0.270027		0.2726
0.0333	-1.29	1.29	0.254642		0.2525
0.05	-1.16	1.16	0.148420	B	0.1504
0.0666	-1.05	1.05	0.048790		0.0490
0.0833	-0.95	0.95	-0.05129		-0.0531
0.1	-0.86	0.86	-0.15082		-0.1552
0.1166	-0.77	0.77	-0.26136		-0.2566
0.1333	-0.7	0.7	-0.35667		-0.3587
0.15	-0.63	0.63	-0.46203		-0.4607
0.1666	-0.57	0.57	-0.56211	E	-0.5622
0.1833	-0.52	0.52	-0.65392		-0.6642

0.2	-0.48	0.48	-0.73396	-0.7663
0.2166	-0.44	0.44	-0.82098	-0.8677
0.2333	-0.4	0.4	-0.91629	-0.9698
0.25	-0.38	0.38	-0.96758	-1.0719
0.2666	-0.35	0.35	-1.04982	-1.1733
0.2833	-0.33	0.33	-1.10866	-1.2754
0.3	-0.31	0.31	-1.17118	-1.3774
0.3166	-0.29	0.29	-1.23787	-1.4789
0.3333	-0.28	0.28	-1.27296	-1.5809
0.4167	-0.22	0.22	-1.51412	-2.0906
0.5	-0.18	0.18	-1.71479	-2.5997
0.5833	-0.16	0.16	-1.83258	-3.1087
0.6667	-0.14	0.14	-1.96611	-3.6184
0.75	-0.13	0.13	-2.04022	-4.1275
0.8333	-0.11	0.11	-2.20727	-4.6366
0.9167	-0.11	0.11	-2.20727	-5.1462
1	-0.1	0.1	-2.30258	-5.6553
1.0833	-0.09	0.09	-2.40794	-6.1644
1.1667	-0.09	0.09	-2.40794	-6.6741
1.25	-0.09	0.09	-2.40794	-7.1831
1.3333	-0.07	0.07	-2.65926	-7.6922
1.4166	-0.08	0.08	-2.52572	-8.2013
1.5	-0.07	0.07	-2.65926	-8.7109
1.5833	-0.07	0.07	-2.65926	-9.2200
1.6667	-0.07	0.07	-2.65926	-9.7297
1.75	-0.06	0.06	-2.81341	-10.2388
1.8333	-0.06	0.06	-2.81341	-10.7478
1.9167	-0.06	0.06	-2.81341	-11.2575
2	-0.06	0.06	-2.81341	-11.7666
2.5	-0.05	0.05	-2.99573	-14.8222
3	-0.05	0.05	-2.99573	-17.8779
3.5	-0.04	0.04	-3.21887	-20.9335
4	-0.04	0.04	-3.21887	-23.9891
4.5	-0.03	0.03	-3.50655	-27.0448
5	-0.03	0.03	-3.50655	-30.1004
5.5	-0.03	0.03	-3.50655	-33.1561
6	-0.03	0.03	-3.50655	-36.2117
6.5	-0.02	0.02	-3.91202	-39.2673
7	-0.02	0.02	-3.91202	-42.3230
7.5	-0.02	0.02	-3.91202	-45.3786
8	-0.02	0.02	-3.91202	-48.4342
8.5	-0.02	0.02	-3.91202	-51.4899
9	-0.02	0.02	-3.91202	-54.5455
9.5	-0.02	0.02	-3.91202	-57.6012
10	-0.02	0.02	-3.91202	-60.6568

ROSE HILL SLUG TEST

MW08-01 RISING HEAD TEST 1



Slug Test Analysis - Bouwer & Rice/Hvorslev's Methods (V2.4.5)
RISING OR FALLING TEST: RISING TEST 1
Client: EPA Revised 11/05/91
Site: ROSE HILL Well ID: MW-08-02
Test by: DANIEL H. BERLER Date: 10/29/91
Analysis: DANIEL H. BERLER Date: 11/19/91

USER INPUT DATA		WORKSHEET	A=	2.2	2.2
Aquifer Thickness=	300	FIGURES	B =		0.35
Exposed Len.(Le) =	5		C =	1.9	1.9
Well Length (Lw) =	19.75	R(eq) =	0.0833	0.0833	0.0833
Casing Radius(Rc)=	0.083	Est. Rw			0.208
Well Radius (Rw) =	0.208	Est. n		NA	
Sandpack Porosity=	0.270	log(Le/Rw)		1.3809	1.3809
Slug Volume =	0.025	ln(Re/Rw)		3.0082	3.0082
Static Level =	8.05	Max. Y(t)		1.4	
Offset time =	0.0666	Regr. Y(0)		1.40	
Shape Factor =	9.9	Casing Y(0)		1.15	UNDRAINED
(F from est. Rw)	9.9				

	ft/min	cm/sec	ft/day
Bouwer & Rice - user porosity & Rw	6.6E-03	1.3E-02	9.49
Bouwer & Rice - estimated porosity	6.6E-03	1.3E-02	9.49
Bouwer & Rice - estimated Rw	6.6E-03	1.3E-02	9.49
Hvorslev - user porosity and Rw	7.0E-03	1.4E-02	10.03
Hvorslev - estimated porosity	7.0E-03	1.4E-02	10.03
Hvorslev - estimated Rw	7.0E-03	1.4E-02	10.03

Regression Output:

Constant	0.545237
Std Err of Y Est	0.002933
R Squared	0.999637
No. of Observations	9
Degrees of Freedom	7

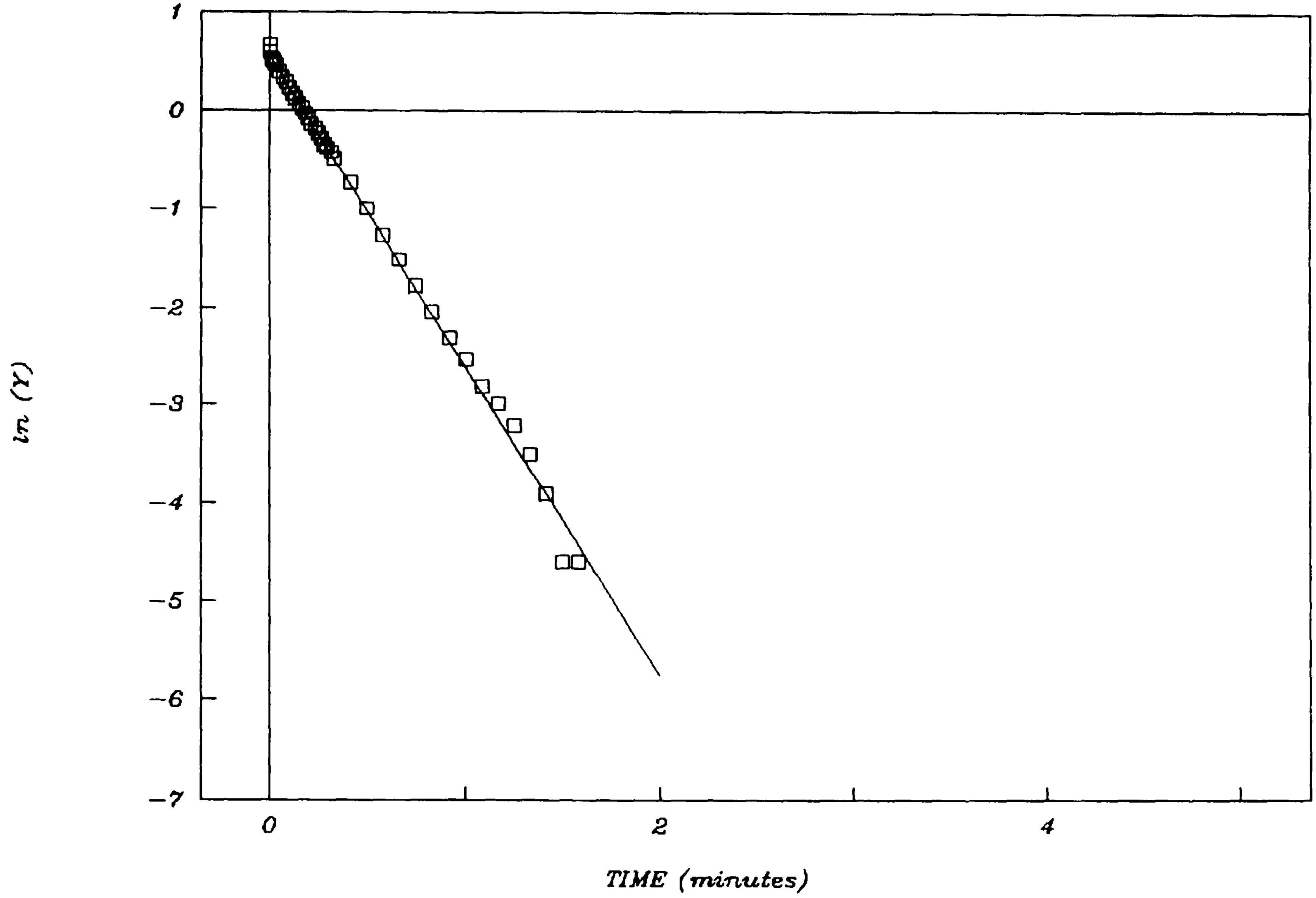
X Coefficient(s) -3.15460
Std Err of Coef. 0.022719

Time (min)	level (ft)	Drawdown Y(t) ft	ln(Y)	Indicate Regress. Range	EST lnY
0	-1.79	1.79	0.582215		0.5452
0.0033	-1.93	1.93	0.657520		0.5348
0.0066	-1.71	1.71	0.536493		0.5244
0.0099	-1.67	1.67	0.512823		0.5140
0.0133	-1.7	1.7	0.530628		0.5033
0.0166	-1.68	1.68	0.518793		0.4929
0.02	-1.65	1.65	0.500775		0.4821
0.0233	-1.63	1.63	0.488580		0.4717
0.0266	-1.61	1.61	0.476234		0.4613
0.03	-1.59	1.59	0.463734		0.4506
0.0333	-1.57	1.57	0.451075		0.4402
0.05	-1.48	1.48	0.392042		0.3875
0.0666	-1.4	1.4	0.336472	B	0.3351
0.0833	-1.33	1.33	0.285178		0.2825
0.1	-1.26	1.26	0.231111		0.2298
0.1166	-1.19	1.19	0.173953		0.1774
0.1333	-1.13	1.13	0.122217		0.1247
0.15	-1.07	1.07	0.067658		0.0720
0.1666	-1.02	1.02	0.019802		0.0197
0.1833	-0.97	0.97	-0.03045		-0.0330

0.2	-0.92	0.92	-0.08338	E	-0.0857
0.2166	-0.87	0.87	-0.13926		-0.1381
0.2333	-0.83	0.83	-0.18632		-0.1907
0.25	-0.79	0.79	-0.23572		-0.2434
0.2666	-0.75	0.75	-0.28768		-0.2958
0.2833	-0.71	0.71	-0.34249		-0.3485
0.3	-0.68	0.68	-0.38566		-0.4011
0.3166	-0.65	0.65	-0.43078		-0.4535
0.3333	-0.61	0.61	-0.49429		-0.5062
0.4167	-0.48	0.48	-0.73396		-0.7693
0.5	-0.37	0.37	-0.99425		-1.0321
0.5833	-0.28	0.28	-1.27296		-1.2948
0.6667	-0.22	0.22	-1.51412		-1.5579
0.75	-0.17	0.17	-1.77195		-1.8207
0.8333	-0.13	0.13	-2.04022		-2.0835
0.9167	-0.1	0.1	-2.30258		-2.3466
1	-0.08	0.08	-2.52572		-2.6094
1.0833	-0.06	0.06	-2.81341		-2.8722
1.1667	-0.05	0.05	-2.99573		-3.1352
1.25	-0.04	0.04	-3.21887		-3.3980
1.3333	-0.03	0.03	-3.50655		-3.6608
1.4166	-0.02	0.02	-3.91202		-3.9236
1.5	-0.01	0.01	-4.60517		-4.1867
1.5833	-0.01	0.01	-4.60517		-4.4495
1.6667	0	0	ERR		-4.7125
1.75	0	0	ERR		-4.9753
1.8333	0	0	ERR		-5.2381
1.9167	0	0	ERR		-5.5012
2	0	0	ERR		-5.7640
2.5	0	0	ERR		-7.3413
3	0	0	ERR		-8.9186
3.5	0	0	ERR		-10.4959
4	0	0	ERR		-12.0732
4.5	0	0	ERR		-13.6505
5	0	0	ERR		-15.2278
5.5	0	0	ERR		-16.8051
6	0	0	ERR		-18.3824
6.5	0	0	ERR		-19.9597
7	0	0	ERR		-21.5370
7.5	0	0	ERR		-23.1143
8	0	0	ERR		-24.6916
8.5	0	0	ERR		-26.2689
9	0	0	ERR		-27.8462
9.5	0	0	ERR		-29.4236
10	0	0	ERR		-31.0009

ROSE HILL SLUG TEST

MW08-02 RISING HEAD TEST 1



(Rising head test 1 for MW-09-01)

Slug Test Analysis - Bouwer & Rice/Hvorslev's Methods (V2.4.5)

Client:	EPA	Revised	11/05/91
Site:	Rosehill	Well ID:	MW-09-01
Test by:	K.Arena	Date:	10/31/91
Analysis:	K.Arena	Date:	11/26/91

USER INPUT DATA		WORKSHEET			
Aquifer Thickness=	20.14	FIGURES	A=	3.0	3.0
Exposed Len.(Le) =	10		B =	0.46	0.46
			C =	2.7	2.7
Well Length (Lw) =	17.91	R(eq) =	0.0833	0.0833	0.0833
Casing Radius(Rc)=	0.083	Est. Rw			0.208
Well Radius (Rw) =	0.208	Est. n		NA	
Sandpack Porosity=	0.270	log(Le/Rw)		1.6812	1.6812
Slug Volume =	0.025	ln(Re/Rw)		3.0193	3.0193
Static Level =	17.59	Max. Y(t)		1.46	
Offset time =	0	Regr. Y(0)		1.35	
Shape Factor =	16.2	Casing Y(0)		1.15	UNDRAINED
(F from est. Rw)	16.2				

	ft/min	cm/sec	ft/day
Bouwer & Rice - user porosity & Rw	3.8E-03	7.5E-03	5.52
Bouwer & Rice - estimated porosity	3.8E-03	7.5E-03	5.52
Bouwer & Rice - estimated Rw	3.8E-03	7.5E-03	5.52
Hvorslev - user porosity and Rw	4.9E-03	9.7E-03	7.07
Hvorslev - estimated porosity	4.9E-03	9.7E-03	7.07
Hvorslev - estimated Rw	4.9E-03	9.7E-03	7.07

Regression Output:

Constant	0.297528
Std Err of Y Est	0.004276
R Squared	0.999655
No. of Observations	12
Degrees of Freedom	10

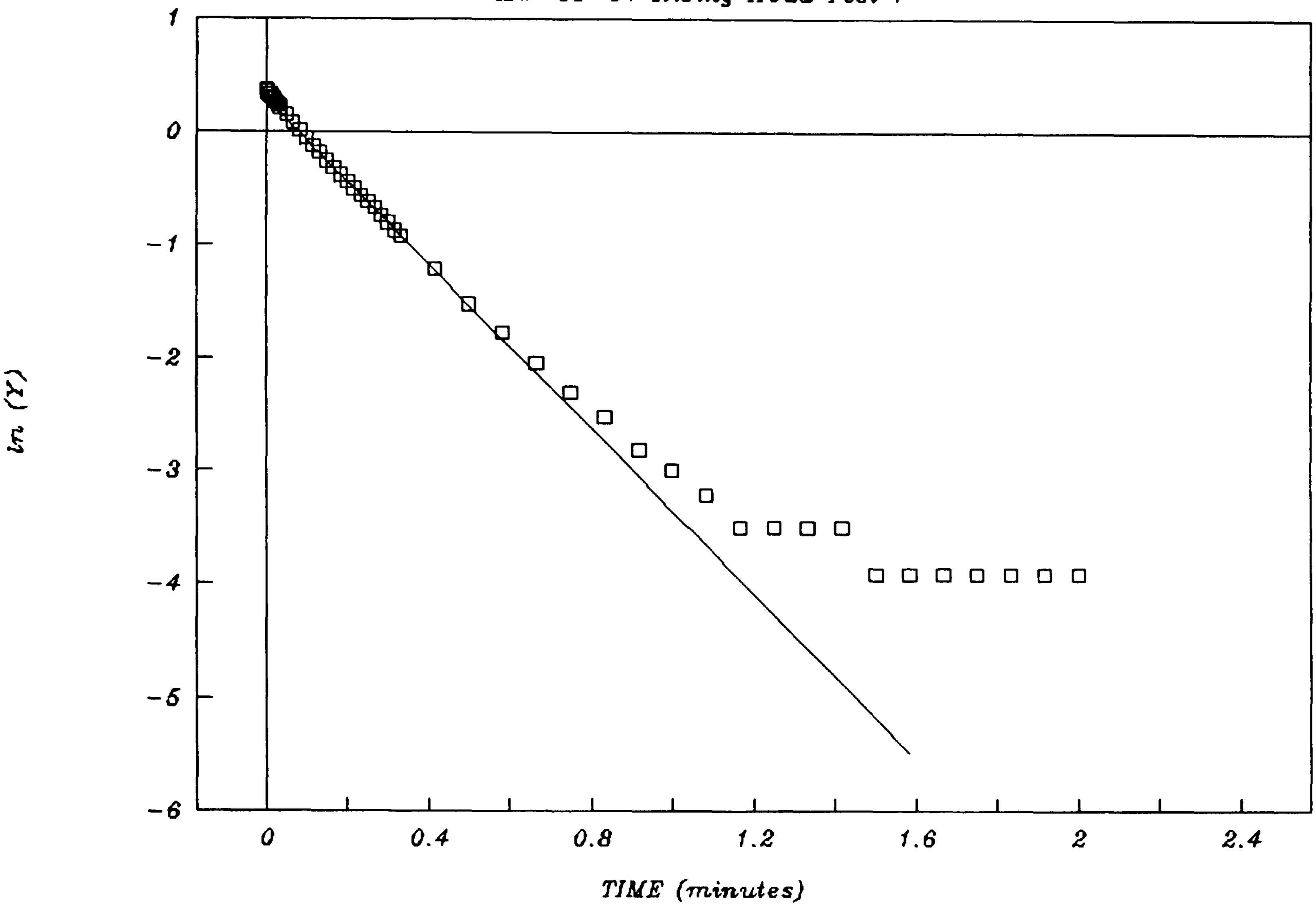
X Coefficient(s)	-3.65484
Std Err of Coef.	0.021456

Time (min)	level (ft)	Drawdown Y(t) ft	ln(Y)	Indicate Regress. Range	EST lnY
0	-1.46	1.46	0.3784		0.2975
0.0033	-1.43	1.43	0.3577		0.2855
0.0066	-1.4	1.40	0.3365		0.2734
0.0099	-1.39	1.39	0.3293		0.2613
0.0133	-1.37	1.37	0.3148		0.2489
0.0166	-1.35	1.35	0.3001		0.2369
0.02	-1.33	1.33	0.2852		0.2244
0.0233	-1.31	1.31	0.2700		0.2124
0.0266	-1.29	1.29	0.2546		0.2003
0.03	-1.27	1.27	0.2390		0.1879
0.0333	-1.25	1.25	0.2231		0.1758
0.05	-1.17	1.17	0.1570		0.1148
0.0666	-1.09	1.09	0.0862		0.0541
0.0833	-1.02	1.02	0.0198		-0.0069
0.1	-0.95	0.95	-0.0513		-0.0680
0.1166	-0.89	0.89	-0.1165		-0.1286
0.1333	-0.84	0.84	-0.1744		-0.1897
0.15	-0.78	0.78	-0.2485	B	-0.2507
0.1666	-0.73	0.73	-0.3147		-0.3114
0.1833	-0.69	0.69	-0.3711		-0.3724

0.2	-0.65	0.65	-0.4308		-0.4334
0.2166	-0.61	0.61	-0.4943		-0.4941
0.2333	-0.57	0.57	-0.5621		-0.5551
0.25	-0.54	0.54	-0.6162		-0.6162
0.2666	-0.51	0.51	-0.6733		-0.6769
0.2833	-0.48	0.48	-0.7340		-0.7379
0.3	-0.45	0.45	-0.7985		-0.7989
0.3166	-0.42	0.42	-0.8675		-0.8596
0.3333	-0.4	0.40	-0.9163	E	-0.9206
0.4167	-0.3	0.30	-1.2040		-1.2254
0.5	-0.22	0.22	-1.5141		-1.5299
0.5833	-0.17	0.17	-1.7720		-1.8343
0.6667	-0.13	0.13	-2.0402		-2.1392
0.75	-0.1	0.10	-2.3026		-2.4436
0.8333	-0.08	0.08	-2.5257		-2.7480
0.9167	-0.06	0.06	-2.8134		-3.0529
1	-0.05	0.05	-2.9957		-3.3573
1.0833	-0.04	0.04	-3.2189		-3.6618
1.1667	-0.03	0.03	-3.5066		-3.9666
1.25	-0.03	0.03	-3.5066		-4.2710
1.3333	-0.03	0.03	-3.5066		-4.5755
1.4166	-0.03	0.03	-3.5066		-4.8799
1.5	-0.02	0.02	-3.9120		-5.1847
1.5833	-0.02	0.02	-3.9120		-5.4892
1.6667	-0.02	0.02	-3.9120		-5.7940
1.75	-0.02	0.02	-3.9120		-6.0984
1.8333	-0.02	0.02	-3.9120		-6.4029
1.9167	-0.02	0.02	-3.9120		-6.7077
2	-0.02	0.02	-3.9120		-7.0122
2.5	-0.01	0.01	-4.6052		-8.8396
3	-0.02	0.02	-3.9120		-10.6670
3.5	-0.01	0.01	-4.6052		-12.4944
4	-0.01	0.01	-4.6052		-14.3218
4.5	-0.01	0.01	-4.6052		-16.1493
5	-0.01	0.01	-4.6052		-17.9767
5.5	-0.01	0.01	-4.6052		-19.8041
6	-0.01	0.01	-4.6052		-21.6315
6.5	-0.01	0.01	-4.6052		-23.4589
7	-0.01	0.01	-4.6052		-25.2864
7.5	-0.01	0.01	-4.6052		-27.1138
8	-0.01	0.01	-4.6052		-28.9412
8.5	-0.01	0.01	-4.6052		-30.7686
9	-0.01	0.01	-4.6052		-32.5960
9.5	-0.01	0.01	-4.6052		-34.4235
10	-0.01	0.01	-4.6052		-36.2509
12	-0.01	0.01	-4.6052		-43.5606

ROSEHILL SLUG TEST

MW-09-01 Rising Head Test 1



Slug Test Analysis - Bouwer & Rice/Hvorslev's Methods (V2.4.5)
RISING OR FALLING TEST: RISING TEST 1

Client: EPA	Revised 11/05/91
Site: ROSE HILL	Well ID: MW10-01
Test by: DANIEL H. BERLER	Date: 10/30/91
Analysis: DANIEL H. BERLER	Date: 11/19/91

USER INPUT DATA		WORKSHEET			
			A=	3.0	3.0
Aquifer Thickness=	30.56	FIGURES	B =		0.46
Exposed Len.(Le) =	10		C =	2.7	2.7
Well Length (Lw) =	28.99	R(eq) =	0.0833	0.0833	0.0833
Casing Radius(Rc)=	0.083	Est. Rw			0.208
Well Radius (Rw) =	0.208	Est. n		NA	
Sandpack Porosity=	0.270	log(Le/Rw)		1.6819	1.6819
Slug Volume =	0.025	ln(Re/Rw)		3.5178	3.5178
Static Level =	8.51	Max. Y(t)		ERR	
Offset time =	0.0033	Regr. Y(0)		1.43	
Shape Factor =	16.2	Casing Y(0)		1.15	UNDRAINED
(F from est. Rw)	16.2				

	ft/min	cm/sec	ft/day
Bouwer & Rice - user porosity & Rw	1.2E-02	2.3E-02	16.68
Bouwer & Rice - estimated porosity	1.2E-02	2.3E-02	16.68
Bouwer & Rice - estimated Rw	1.2E-02	2.3E-02	16.68
Hvorslev - user porosity and Rw	1.3E-02	2.5E-02	18.37
Hvorslev - estimated porosity	1.3E-02	2.5E-02	18.37
Hvorslev - estimated Rw	1.3E-02	2.5E-02	18.37

Regression Output:

Constant	0.389842
Std Err of Y Est	0.019517
R Squared	0.998524
No. of Observations	10
Degrees of Freedom	8

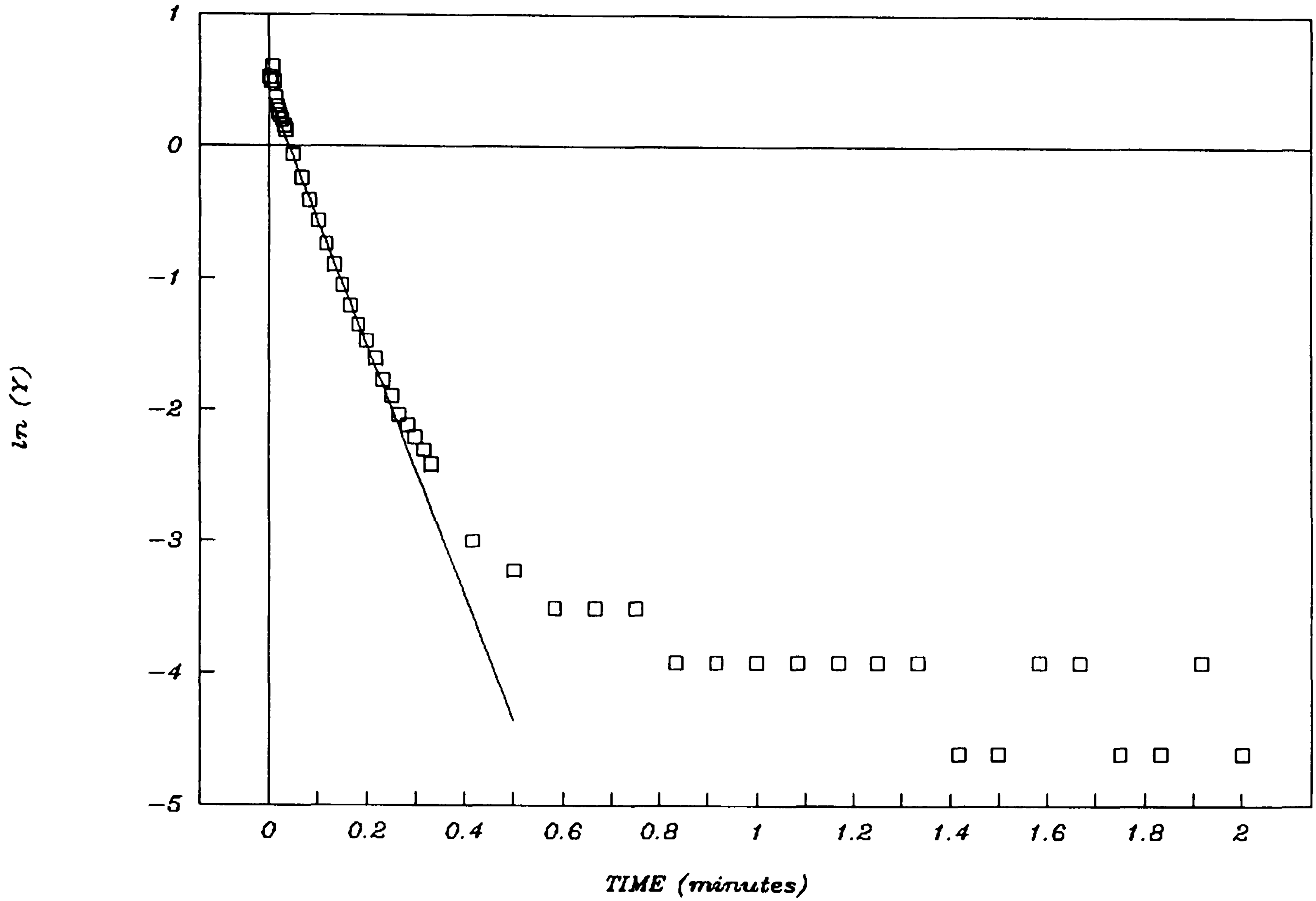
X Coefficient(s)	-9.48606
Std Err of Coef.	0.128922

Time (min)	level (ft)	Drawdown Y(t) ft	ln(Y)	Indicate Regress. Range	EST lnY
0	-1.68	1.68	0.518793		0.3898
0.0033	-1.63	1.63	0.488580		0.3585
0.0066	-1.83	1.83	0.604315		0.3272
0.0099	-1.64	1.64	0.494696		0.2959
0.0133	-1.44	1.44	0.364643		0.2637
0.0166	-1.36	1.36	0.307484		0.2324
0.02	-1.31	1.31	0.270027		0.2001
0.0233	-1.26	1.26	0.231111		0.1688
0.0266	-1.22	1.22	0.198850		0.1375
0.03	-1.17	1.17	0.157003		0.1053
0.0333	-1.13	1.13	0.122217		0.0740
0.05	-0.94	0.94	-0.06187	B	-0.0845
0.0666	-0.79	0.79	-0.23572		-0.2419
0.0833	-0.67	0.67	-0.40047		-0.4003
0.1	-0.57	0.57	-0.56211		-0.5588
0.1166	-0.48	0.48	-0.73396		-0.7162
0.1333	-0.41	0.41	-0.89159		-0.8746
0.15	-0.35	0.35	-1.04982		-1.0331
0.1666	-0.3	0.3	-1.20397		-1.1905
0.1833	-0.26	0.26	-1.34707		-1.3490

0.2	-0.23	0.23	-1.46967 E	-1.5074
0.2166	-0.2	0.2	-1.60943	-1.6648
0.2333	-0.17	0.17	-1.77195	-1.8233
0.25	-0.15	0.15	-1.89711	-1.9817
0.2666	-0.13	0.13	-2.04022	-2.1391
0.2833	-0.12	0.12	-2.12026	-2.2976
0.3	-0.11	0.11	-2.20727	-2.4560
0.3166	-0.1	0.1	-2.30258	-2.6134
0.3333	-0.09	0.09	-2.40794	-2.7719
0.4167	-0.05	0.05	-2.99573	-3.5630
0.5	-0.04	0.04	-3.21887	-4.3532
0.5833	-0.03	0.03	-3.50655	-5.1434
0.6667	-0.03	0.03	-3.50655	-5.9345
0.75	-0.03	0.03	-3.50655	-6.7247
0.8333	-0.02	0.02	-3.91202	-7.5149
0.9167	-0.02	0.02	-3.91202	-8.3060
1	-0.02	0.02	-3.91202	-9.0962
1.0833	-0.02	0.02	-3.91202	-9.8864
1.1667	-0.02	0.02	-3.91202	-10.6775
1.25	-0.02	0.02	-3.91202	-11.4677
1.3333	-0.02	0.02	-3.91202	-12.2579
1.4166	-0.01	0.01	-4.60517	-13.0481
1.5	-0.01	0.01	-4.60517	-13.8393
1.5833	-0.02	0.02	-3.91202	-14.6294
1.6667	-0.02	0.02	-3.91202	-15.4206
1.75	-0.01	0.01	-4.60517	-16.2108
1.8333	-0.01	0.01	-4.60517	-17.0010
1.9167	-0.02	0.02	-3.91202	-17.7921
2	-0.01	0.01	-4.60517	-18.5823
2.5	-0.01	0.01	-4.60517	-23.3253
3	-0.01	0.01	-4.60517	-28.0683
3.5	-0.01	0.01	-4.60517	-32.8114
4	-0.01	0.01	-4.60517	-37.5544
4.5	-0.01	0.01	-4.60517	-42.2974
5	-0.01	0.01	-4.60517	-47.0405
5.5	-0.01	0.01	-4.60517	-51.7835
6	-0.01	0.01	-4.60517	-56.5265
6.5	-0.01	0.01	-4.60517	-61.2696
7	-0.01	0.01	-4.60517	-66.0126
7.5	-0.01	0.01	-4.60517	-70.7556
8	-0.01	0.01	-4.60517	-75.4987
8.5	-0.01	0.01	-4.60517	-80.2417
9	-0.01	0.01	-4.60517	-84.9847
9.5	-0.01	0.01	-4.60517	-89.7277

ROSE HILL SLUG TEST

MW10-01 RISING HEAD TEST 1



Slug Test Analysis - Bouwer & Rice/Hvorslev's Methods (V2.4.5)

RISING OR FALLING TEST: RISING TEST 2

Client:	EPA	Revised	11/05/91
Site:	ROSE HILL	Well ID:	MW11-01
Test by:	DANIEL H. BERLER	Date:	10/31/91
Analysis:	DANIEL H. BERLER	Date:	11/21/91

USER INPUT DATA		WORKSHEET			
			A=	2.9	2.9
Aquifer Thickness=	40.7	FIGURES	B =		0.45
Exposed Len.(Le) =	15		C =	2.6	2.6
Well Length (Lw) =	16.05	R(eq) =	0.0833	0.0833	0.0833
Casing Radius(Rc)=	0.083	Est. Rw			0.333
Well Radius (Rw) =	0.333	Est. n		NA	
Sandpack Porosity=	0.270	log(Le/Rw)		1.6532	1.6532
Slug Volume =	0.025	ln(Re/Rw)		2.8781	2.8781
Static Level =	8.20	Max. Y(t)		1.09	
Offset time =	0	Regr. Y(0)		0.95	
Shape Factor =	24.8	Casing Y(0)		1.15	UNDRAINED
(F from est. Rw)	24.8				

	ft/min	cm/sec	ft/day
Bouwer & Rice - user porosity & Rw	1.3E-03	2.5E-03	1.85
Bouwer & Rice - estimated porosity	1.3E-03	2.5E-03	1.85
Bouwer & Rice - estimated Rw	1.3E-03	2.5E-03	1.85
Hvorslev - user porosity and Rw	1.7E-03	3.3E-03	2.44
Hvorslev - estimated porosity	1.7E-03	3.3E-03	2.44
Hvorslev - estimated Rw	1.7E-03	3.3E-03	2.44

Rw: If radius is thought to be variable

ESTIMATED POROSITY: If radius is thought to remain the same ove screened length

Regression Output:

Constant	-0.04849
Std Err of Y Est	0.021893
R Squared	0.972628
No. of Observations	13
Degrees of Freedom	11

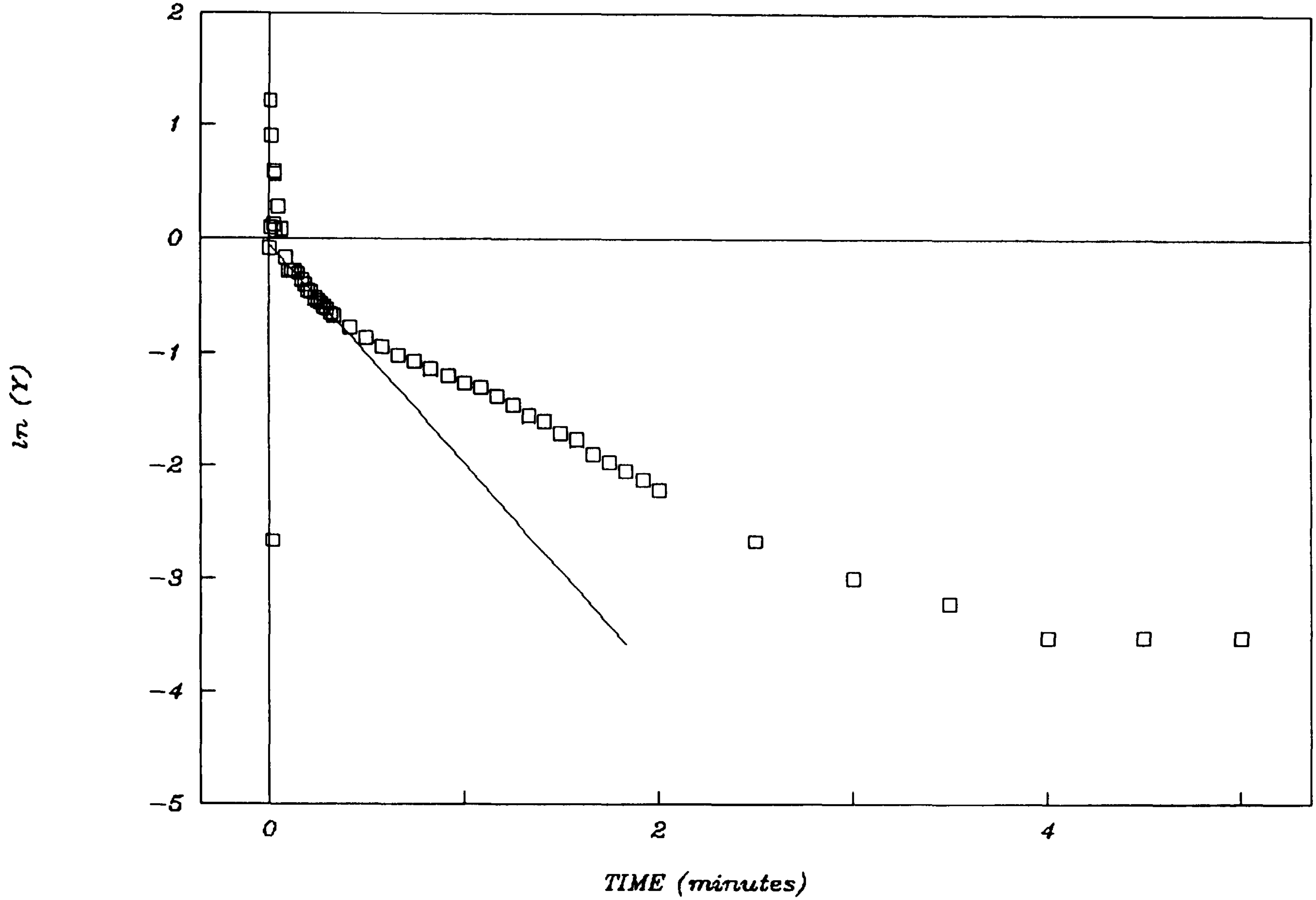
X Coefficient(s)	-1.92508
Std Err of Coef.	0.097370

Time (min)	level (ft)	Drawdown Y(t) ft	ln(Y)	Indicate Regress. Range	EST lnY
0.0033	-0.92	0.92	-0.08338		-0.0548
0.0066	-3.36	3.36	1.211940		-0.0612
0.0099	-2.48	2.48	0.908258		-0.0675
0.0133	-1.1	1.1	0.095310		-0.0741
0.0166	0	0	ERR		-0.0804
0.02	0.07	0.07	-2.65926		-0.0870
0.0233	-1.13	1.13	0.122217		-0.0933
0.0266	-1.8	1.8	0.587786		-0.0997
0.03	-1.75	1.75	0.559615		-0.1062
0.0333	-1.07	1.07	0.067658		-0.1126
0.05	-1.32	1.32	0.277631		-0.1447
0.0666	-1.09	1.09	0.086177		-0.1767
0.0833	-0.85	0.85	-0.16251		-0.2088
0.1	-0.75	0.75	-0.28768	B	-0.2410
0.1166	-0.76	0.76	-0.27443		-0.2730
0.1333	-0.76	0.76	-0.27443		-0.3051
0.15	-0.74	0.74	-0.30110		-0.3373

0.1666	-0.7	0.7	-0.35667		-0.3692
0.1833	-0.67	0.67	-0.40047		-0.4014
0.2	-0.64	0.64	-0.44628		-0.4335
0.2166	-0.63	0.63	-0.46203		-0.4655
0.2333	-0.6	0.6	-0.51082		-0.4976
0.25	-0.58	0.58	-0.54472		-0.5298
0.2666	-0.57	0.57	-0.56211		-0.5617
0.2833	-0.55	0.55	-0.59783		-0.5939
0.3	-0.54	0.54	-0.61618	E	-0.6260
0.3166	-0.52	0.52	-0.65392		-0.6580
0.3333	-0.51	0.51	-0.67334		-0.6901
0.4167	-0.46	0.46	-0.77652		-0.8507
0.5	-0.42	0.42	-0.86750		-1.0110
0.5833	-0.39	0.39	-0.94160		-1.1714
0.6667	-0.36	0.36	-1.02165		-1.3319
0.75	-0.34	0.34	-1.07880		-1.4923
0.8333	-0.32	0.32	-1.13943		-1.6527
0.9167	-0.3	0.3	-1.20397		-1.8132
1	-0.28	0.28	-1.27296		-1.9736
1.0833	-0.27	0.27	-1.30933		-2.1339
1.1667	-0.25	0.25	-1.38629		-2.2945
1.25	-0.23	0.23	-1.46967		-2.4549
1.3333	-0.21	0.21	-1.56064		-2.6152
1.4166	-0.2	0.2	-1.60943		-2.7756
1.5	-0.18	0.18	-1.71479		-2.9361
1.5833	-0.17	0.17	-1.77195		-3.0965
1.6667	-0.15	0.15	-1.89711		-3.2570
1.75	-0.14	0.14	-1.96611		-3.4174
1.8333	-0.13	0.13	-2.04022		-3.5778
1.9167	-0.12	0.12	-2.12026		-3.7383
2	-0.11	0.11	-2.20727		-3.8987
2.5	-0.07	0.07	-2.65926		-4.8612
3	-0.05	0.05	-2.99573		-5.8238
3.5	-0.04	0.04	-3.21887		-6.7863
4	-0.03	0.03	-3.50655		-7.7488
4.5	-0.03	0.03	-3.50655		-8.7114
5	-0.03	0.03	-3.50655		-9.6739
5.5	-0.03	0.03	-3.50655		-10.6365
6	-0.02	0.02	-3.91202		-11.5990
6.5	-0.02	0.02	-3.91202		-12.5616
7	-0.02	0.02	-3.91202		-13.5241
7.5	-0.02	0.02	-3.91202		-14.4867
8	-0.02	0.02	-3.91202		-15.4492
8.5	-0.02	0.02	-3.91202		-16.4117
9	-0.02	0.02	-3.91202		-17.3743
9.5	-0.02	0.02	-3.91202		-18.3368
10	-0.02	0.02	-3.91202		-19.2994

ROSE HILL SLUG TEST

MW11-01 RISING HEAD TEST 2



(Slug Test for 1st rising head test in MW-11-02)
Slug Test Analysis - Bouwer & Rice/Hvorslev's Methods (V2.4.5)

Client: EPA — Revised 11/05/91
Site: ROSEHILL — Well ID: MW-11-02
Test by: K.ARENA — Date: 10/29/91
Analysis: K.ARENA — Date: 11/21/91

USER INPUT DATA		WORKSHEET	A=	3.0	3.0
Aquifer Thickness=	41.94	FIGURES	B =	0.46	0.46
Exposed Len.(Le) =	10		C =	2.7	2.7
Well Length (Lw) =	39.64	R(eq) =	0.0833	0.0833	0.0833
Casing Radius(Rc)=	0.083	Est. Rw			0.208
Well Radius (Rw) =	0.208	Est. n		NA	
Sandpack Porosity=	0.270	log(Le/Rw)		1.6812	1.6812
Slug Volume =	0.025	ln(Re/Rw)		3.4001	3.4001
Static Level =	7.35	Max. Y(t)		0.43	
Offset time =	0.0133	Regr. Y(0)		0.43	
Shape Factor =	16.2	Casing Y(0)		1.15	UNDRAINED
(F from est. Rw)	16.2				

	ft/min	cm/sec	ft/day
Bouwer & Rice - user porosity & Rw	3.7E-02	7.4E-02	53.88
Bouwer & Rice - estimated porosity	3.7E-02	7.4E-02	53.88
Bouwer & Rice - estimated Rw	3.7E-02	7.4E-02	53.88
Hvorslev - user porosity and Rw	4.3E-02	8.4E-02	61.34
Hvorslev - estimated porosity	4.3E-02	8.4E-02	61.34
Hvorslev - estimated Rw	4.3E-02	8.4E-02	61.34

Regression Output:

Constant	-0.41134
Std Err of Y Est	0.019563
R Squared	0.989796
No. of Observations	5
Degrees of Freedom	3

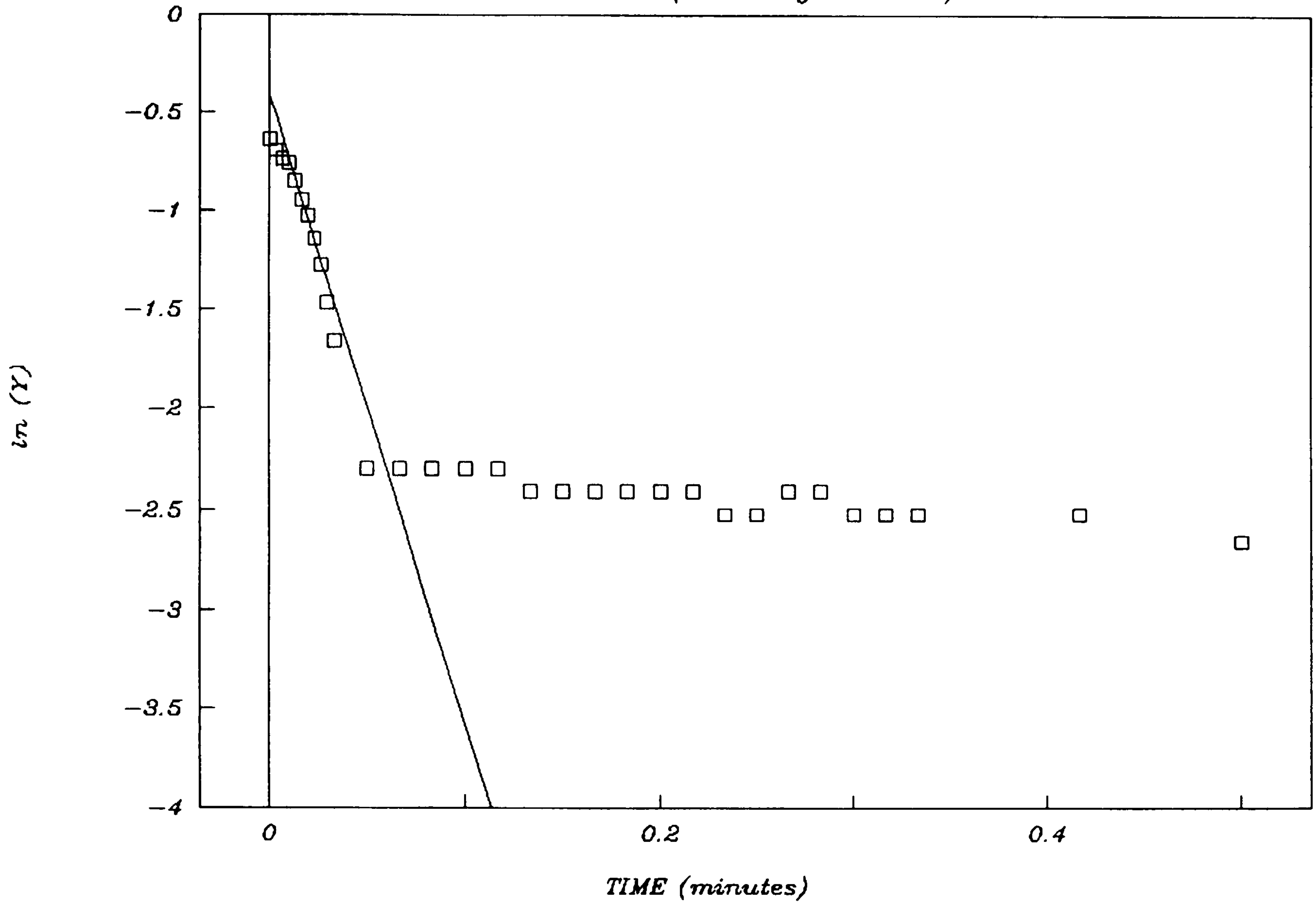
X Coefficient(s) -31.6923
Std Err of Coef. 1.857816

Time (min)	level (ft)	Drawdown Y(t) ft	ln(Y)	Indicate Regress. Range	EST lnY
0	-0.53	0.53	-0.6349		-0.4113
0.0033	-0.5	0.50	-0.6931		-0.5159
0.0066	-0.48	0.48	-0.7340		-0.6205
0.0099	-0.47	0.47	-0.7550		-0.7251
0.0133	-0.43	0.43	-0.8440	B	-0.8329
0.0166	-0.39	0.39	-0.9416		-0.9374
0.02	-0.36	0.36	-1.0217		-1.0452
0.0233	-0.32	0.32	-1.1394		-1.1498
0.0266	-0.28	0.28	-1.2730	E	-1.2544
0.03	-0.23	0.23	-1.4697		-1.3621
0.0333	-0.19	0.19	-1.6607		-1.4667
0.05	-0.1	0.10	-2.3026		-1.9960
0.0666	-0.1	0.10	-2.3026		-2.5221
0.0833	-0.1	0.10	-2.3026		-3.0513
0.1	-0.1	0.10	-2.3026		-3.5806
0.1166	-0.1	0.10	-2.3026		-4.1067
0.1333	-0.09	0.09	-2.4079		-4.6359
0.15	-0.09	0.09	-2.4079		-5.1652
0.1666	-0.09	0.09	-2.4079		-5.6913
0.1833	-0.09	0.09	-2.4079		-6.2205

0.2	-0.09	0.09	-2.4079	-6.7498
0.2166	-0.09	0.09	-2.4079	-7.2759
0.2333	-0.08	0.08	-2.5257	-7.8052
0.25	-0.08	0.08	-2.5257	-8.3344
0.2666	-0.09	0.09	-2.4079	-8.8605
0.2833	-0.09	0.09	-2.4079	-9.3898
0.3	-0.08	0.08	-2.5257	-9.9190
0.3166	-0.08	0.08	-2.5257	-10.4451
0.3333	-0.08	0.08	-2.5257	-10.9744
0.4167	-0.08	0.08	-2.5257	-13.6175
0.5	-0.07	0.07	-2.6593	-16.2575
0.5833	-0.07	0.07	-2.6593	-18.8975
0.6667	-0.07	0.07	-2.6593	-21.5406
0.75	-0.07	0.07	-2.6593	-24.1806
0.8333	-0.07	0.07	-2.6593	-26.8205
0.9167	-0.06	0.06	-2.8134	-29.4637
1	-0.07	0.07	-2.6593	-32.1037
1.0833	-0.07	0.07	-2.6593	-34.7436
1.1667	-0.07	0.07	-2.6593	-37.3868
1.25	-0.06	0.06	-2.8134	-40.0267
1.3333	-0.07	0.07	-2.6593	-42.6667
1.4166	-0.06	0.06	-2.8134	-45.3067
1.5	-0.06	0.06	-2.8134	-47.9498
1.5833	-0.06	0.06	-2.8134	-50.5898
1.6667	-0.06	0.06	-2.8134	-53.2329
1.75	-0.06	0.06	-2.8134	-55.8729
1.8333	-0.06	0.06	-2.8134	-58.5129
1.9167	-0.07	0.07	-2.6593	-61.1560
2	-0.06	0.06	-2.8134	-63.7960
2.5	-0.06	0.06	-2.8134	-79.6421
3	-0.06	0.06	-2.8134	-95.4883
3.5	-0.06	0.06	-2.8134	-111.3344
4	-0.06	0.06	-2.8134	-127.1806
4.5	-0.07	0.07	-2.6593	-143.0267
5	-0.06	0.06	-2.8134	-158.8729
5.5	-0.06	0.06	-2.8134	-174.7190
6	-0.06	0.06	-2.8134	-190.5652
6.5	-0.06	0.06	-2.8134	-206.4113
7	-0.06	0.06	-2.8134	-222.2575
7.5	-0.06	0.06	-2.8134	-238.1036
8	-0.06	0.06	-2.8134	-253.9498
8.5	-0.06	0.06	-2.8134	-269.7960
9	-0.06	0.06	-2.8134	-285.6421
9.5	-0.06	0.06	-2.8134	-301.4883
10	-0.06	0.06	-2.8134	-317.3344
12	-0.07	0.07	-2.6593	-380.7190

ROSEHILL

Well MW-11-02 (1st rising head test)



(Rising head test 1)

Slug Test Analysis - Bouwer & Rice/Hvorslev's Methods (V2.4.5)

Client:	EPA	Revised	11/05/91
Site:	Rosehill	Well ID:	MW-11-03
Test by:	K.Arena	Date:	10/29/91
Analysis:	K.Arena	Date:	12/04/91

USER INPUT DATA		WORKSHEET			
Aquifer Thickness=	78.15	FIGURES			
		A=		4.7	4.7
		B =		0.79	0.79
Exposed Len.(Le) =	30	C =		5.0	5.0
Well Length (Lw) =	74.54	R(eq) =	0.1667	0.1667	0.1667
Casing Radius(Rc)=	0.167	Est. Rw			0.250
Well Radius (Rw) =	0.250	Est. n		NA	
Sandpack Porosity=	0.270	log(Le/Rw)		2.0792	2.0792
Slug Volume =	0.153	ln(Re/Rw)		4.0031	4.0031
Static Level =	5.32	Max. Y(t)		1.83	
Offset time =	0.03	Regr. Y(0)		1.76	
Shape Factor =	39.4	Casing Y(0)		1.75	UNDRAINED
(F from est. Rw)	39.4				

	ft/min	cm/sec	ft/day
Bouwer & Rice - user porosity & Rw	7.6E-05	1.5E-04	0.11
Bouwer & Rice - estimated porosity	7.6E-05	1.5E-04	0.11
Bouwer & Rice - estimated Rw	7.6E-05	1.5E-04	0.11
Hvorslev - user porosity and Rw	9.1E-05	1.8E-04	0.13
Hvorslev - estimated porosity	9.1E-05	1.8E-04	0.13
Hvorslev - estimated Rw	9.1E-05	1.8E-04	0.13

Regression Output:

Constant	0.564232
Std Err of Y Est	0.004017
R Squared	0.997963
No. of Observations	14
Degrees of Freedom	12

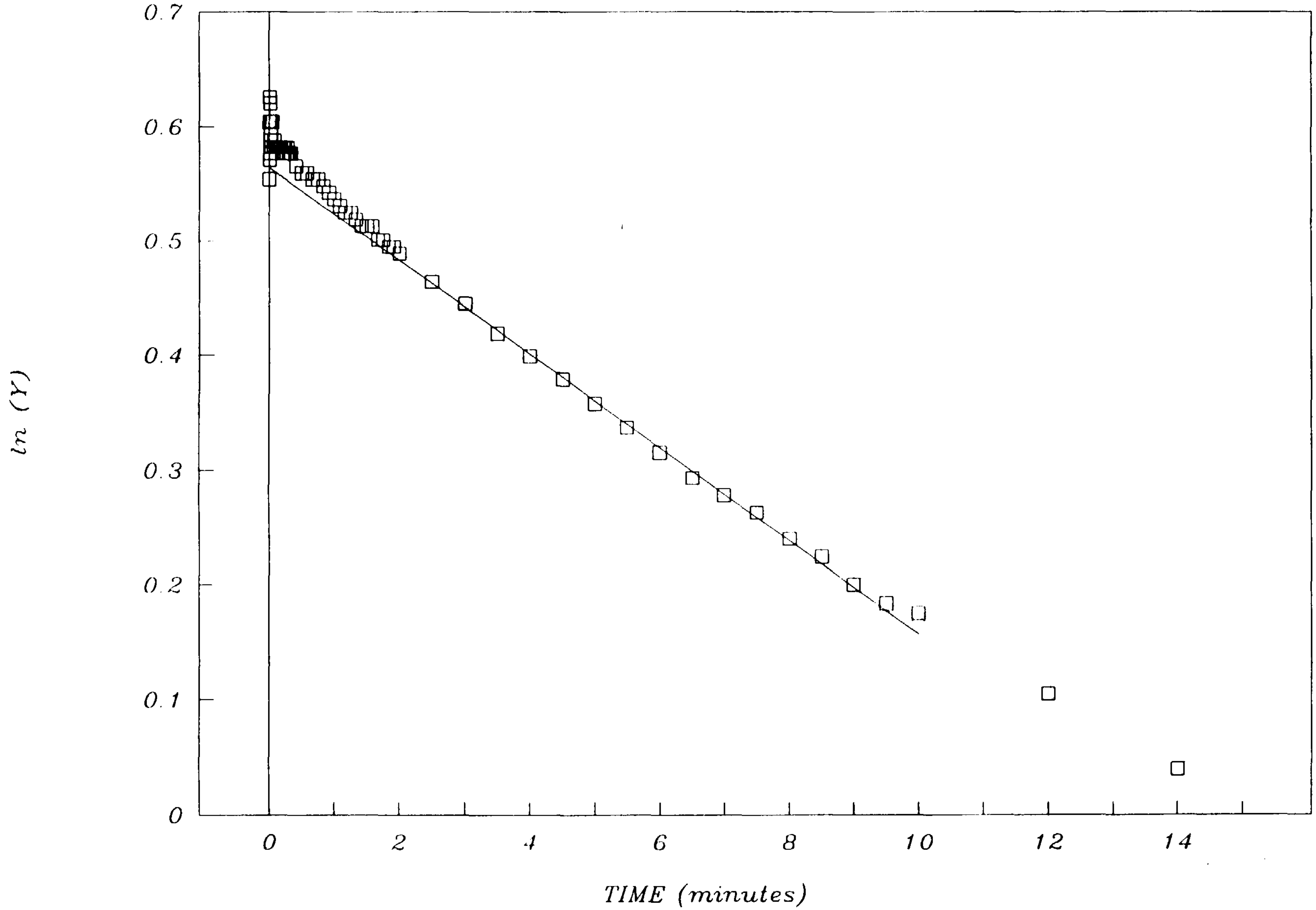
X Coefficient(s)	-0.04085
Std Err of Coef.	0.000532

Time (min)	level (ft)	Drawdown Y(t) ft	ln(Y)	Indicate Regress. Range	EST lnY
0	-1.74	1.74	0.5539		0.5642
0.0033	-1.83	1.83	0.6043		0.5641
0.0066	-1.87	1.87	0.6259		0.5640
0.0099	-1.77	1.77	0.5710		0.5638
0.0133	-1.79	1.79	0.5822		0.5637
0.0166	-1.86	1.86	0.6206		0.5636
0.02	-1.8	1.80	0.5878		0.5634
0.0233	-1.78	1.78	0.5766		0.5633
0.0266	-1.83	1.83	0.6043		0.5631
0.03	-1.81	1.81	0.5933		0.5630
0.0333	-1.79	1.79	0.5822		0.5629
0.05	-1.83	1.83	0.6043		0.5622
0.0666	-1.79	1.79	0.5822		0.5615
0.0833	-1.8	1.80	0.5878		0.5608
0.1	-1.79	1.79	0.5822		0.5601
0.1166	-1.79	1.79	0.5822		0.5595
0.1333	-1.79	1.79	0.5822		0.5588
0.15	-1.79	1.79	0.5822		0.5581
0.1666	-1.79	1.79	0.5822		0.5574
0.1833	-1.79	1.79	0.5822		0.5567

0.2	-1.78	1.78	0.5766		0.5561
0.2166	-1.79	1.79	0.5822		0.5554
0.2333	-1.78	1.78	0.5766		0.5547
0.25	-1.79	1.79	0.5822		0.5540
0.2666	-1.78	1.78	0.5766		0.5533
0.2833	-1.79	1.79	0.5822	B1	0.5527
0.3	-1.78	1.78	0.5766		0.5520
0.3166	-1.78	1.78	0.5766		0.5513
0.3333	-1.78	1.78	0.5766		0.5506
0.4167	-1.76	1.76	0.5653		0.5472
0.5	-1.75	1.75	0.5596		0.5438
0.5833	-1.75	1.75	0.5596		0.5404
0.6667	-1.74	1.74	0.5539		0.5370
0.75	-1.74	1.74	0.5539		0.5336
0.8333	-1.73	1.73	0.5481	E1	0.5302
0.9167	-1.72	1.72	0.5423		0.5268
1	-1.71	1.71	0.5365		0.5234
1.0833	-1.7	1.70	0.5306		0.5200
1.1667	-1.69	1.69	0.5247		0.5166
1.25	-1.69	1.69	0.5247		0.5132
1.3333	-1.68	1.68	0.5188		0.5098
1.4166	-1.67	1.67	0.5128		0.5064
1.5	-1.67	1.67	0.5128		0.5030
1.5833	-1.67	1.67	0.5128		0.4996
1.6667	-1.65	1.65	0.5008		0.4961
1.75	-1.65	1.65	0.5008		0.4927
1.8333	-1.64	1.64	0.4947		0.4893
1.9167	-1.64	1.64	0.4947		0.4859
2	-1.63	1.63	0.4886	B2	0.4825
2.5	-1.59	1.59	0.4637		0.4621
3	-1.56	1.56	0.4447		0.4417
3.5	-1.52	1.52	0.4187		0.4213
4	-1.49	1.49	0.3988		0.4008
4.5	-1.46	1.46	0.3784		0.3804
5	-1.43	1.43	0.3577		0.3600
5.5	-1.4	1.40	0.3365		0.3396
6	-1.37	1.37	0.3148		0.3191
6.5	-1.34	1.34	0.2927		0.2987
7	-1.32	1.32	0.2776		0.2783
7.5	-1.3	1.30	0.2624		0.2578
8	-1.27	1.27	0.2390		0.2374
8.5	-1.25	1.25	0.2231	E2	0.2170
9	-1.22	1.22	0.1989		0.1966
9.5	-1.2	1.20	0.1823		0.1761
10	-1.19	1.19	0.1740		0.1557
12	-1.11	1.11	0.1044		0.0740
14	-1.04	1.04	0.0392		-0.0077
16	-0.98	0.98	-0.0202		-0.0894
18	-0.93	0.93	-0.0726		-0.1711

ROSEHILL SLUG TEST

MW-11-03 Rising Head Test 1



(Rising Head Test 1 MW-12-01)
Slug Test Analysis - Bouwer & Rice/Hvorslev's Methods (V2.4.5)

Client:	EPA			Revised	11/05/91
Site:	Rosehill			Well ID:	MW-12-01
Test by:	K.Arena			Date:	11/01/91
Analysis:	K.Arena			Date:	11/26/91

USER INPUT DATA		WORKSHEET	A=	2.9	2.9
Aquifer Thickness=	44.94	FIGURES	B =	0.45	0.45
Exposed Len.(Le) =	15		C =	2.6	2.6
Well Length (Lw) =	20.44	R(eq) =	0.0833	0.0833	0.0833
Casing Radius(Rc)=	0.083	Est. Rw			0.333
Well Radius (Rw) =	0.333	Est. n		NA	
Sandpack Porosity=	0.270	log(Le/Rw)		1.6532	1.6532
Slug Volume =	0.025	ln(Re/Rw)		2.6780	2.6780
Static Level =	2.05	Max. Y(t)		ERR	
Offset time =	0	Regr. Y(0)		1.38	
Shape Factor =	24.8	Casing Y(0)		1.15	UNDRAINED
(F from est. Rw)	24.8				

	ft/min	cm/sec	ft/day
Bouwer & Rice - user porosity & Rw	1.4E-03	2.8E-03	2.02
Bouwer & Rice - estimated porosity	1.4E-03	2.8E-03	2.02
Bouwer & Rice - estimated Rw	1.4E-03	2.8E-03	2.02
Hvorslev - user porosity and Rw	2.0E-03	3.9E-03	2.88
Hvorslev - estimated porosity	2.0E-03	3.9E-03	2.88
Hvorslev - estimated Rw	2.0E-03	3.9E-03	2.88

Regression Output:

Constant	0.324627
Std Err of Y Est	0.016322
R Squared	0.999446
No. of Observations	20
Degrees of Freedom	18

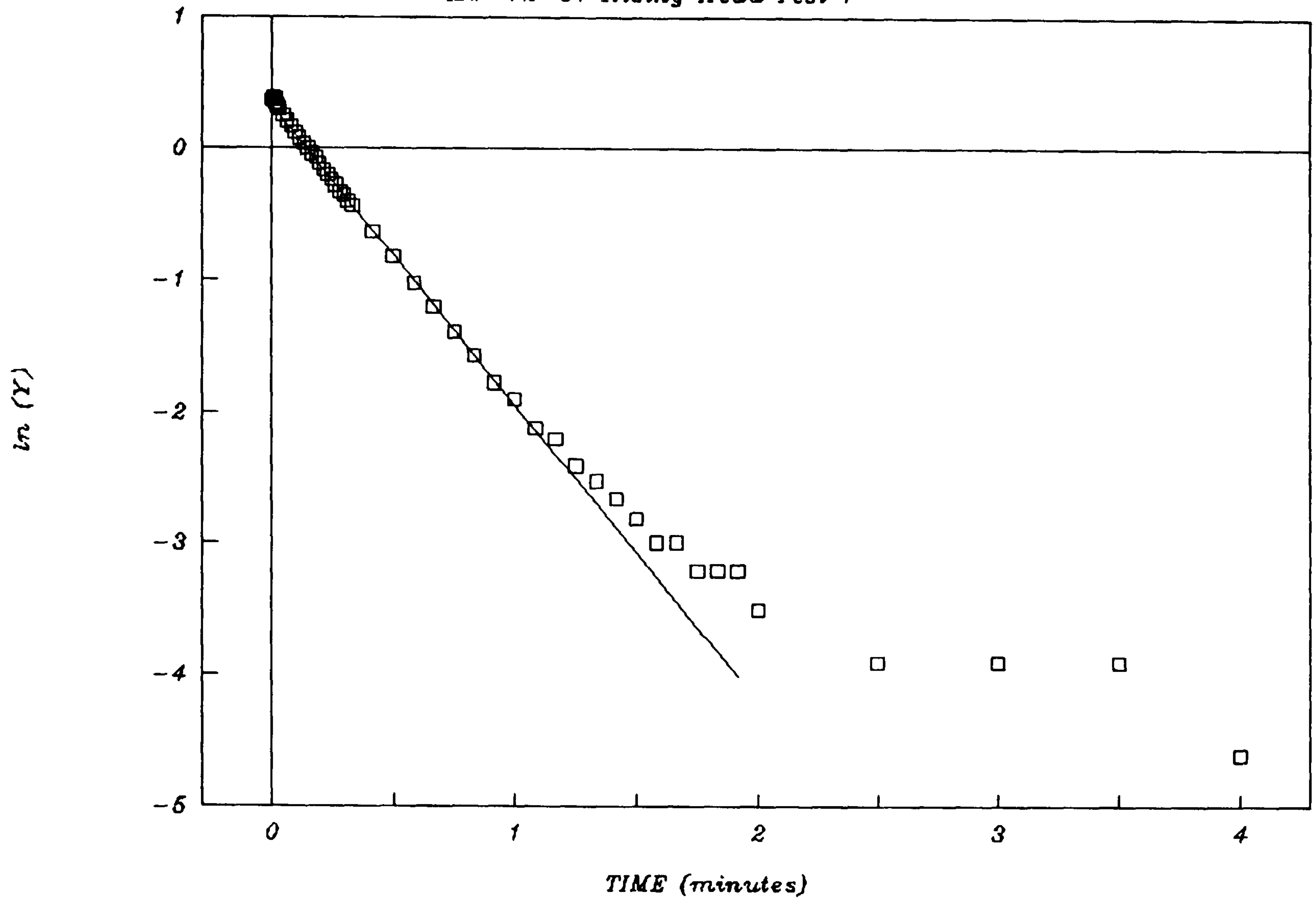
X Coefficient(s)	-2.26617
Std Err of Coef.	0.012574

Time (min)	level (ft)	Drawdown Y(t) ft	ln(Y)	Indicate Regress. Range	EST lnY
0	-1.44	1.44	0.3646		0.3246
0.0033	-1.44	1.44	0.3646		0.3171
0.0066	-1.47	1.47	0.3853		0.3097
0.0099	-1.44	1.44	0.3646		0.3022
0.0133	-1.42	1.42	0.3507		0.2945
0.0166	-1.45	1.45	0.3716		0.2870
0.02	-1.4	1.40	0.3365		0.2793
0.0233	-1.38	1.38	0.3221		0.2718
0.0266	-1.37	1.37	0.3148		0.2643
0.03	-1.36	1.36	0.3075		0.2566
0.0333	-1.34	1.34	0.2927		0.2492
0.05	-1.28	1.28	0.2469		0.2113
0.0666	-1.23	1.23	0.2070		0.1737
0.0833	-1.18	1.18	0.1655		0.1359
0.1	-1.13	1.13	0.1222		0.0980
0.1166	-1.08	1.08	0.0770		0.0604
0.1333	-1.04	1.04	0.0392		0.0225
0.15	-1	1.00	0.0000		-0.0153
0.1666	-0.96	0.96	-0.0408	B	-0.0529
0.1833	-0.93	0.93	-0.0726		-0.0908

0.2	-0.89	0.89	-0.1165		-0.1286
0.2166	-0.85	0.85	-0.1625		-0.1662
0.2333	-0.82	0.82	-0.1985		-0.2041
0.25	-0.79	0.79	-0.2357		-0.2419
0.2666	-0.76	0.76	-0.2744		-0.2795
0.2833	-0.72	0.72	-0.3285		-0.3174
0.3	-0.7	0.70	-0.3567		-0.3552
0.3166	-0.67	0.67	-0.4005		-0.3928
0.3333	-0.65	0.65	-0.4308		-0.4307
0.4167	-0.53	0.53	-0.6349		-0.6197
0.5	-0.44	0.44	-0.8210		-0.8085
0.5833	-0.36	0.36	-1.0217		-0.9972
0.6667	-0.3	0.30	-1.2040		-1.1862
0.75	-0.25	0.25	-1.3863		-1.3750
0.8333	-0.21	0.21	-1.5606		-1.5638
0.9167	-0.17	0.17	-1.7720		-1.7528
1	-0.15	0.15	-1.8971		-1.9416
1.0833	-0.12	0.12	-2.1203	E	-2.1303
1.1667	-0.11	0.11	-2.2073		-2.3193
1.25	-0.09	0.09	-2.4079		-2.5081
1.3333	-0.08	0.08	-2.5257		-2.6969
1.4166	-0.07	0.07	-2.6593		-2.8856
1.5	-0.06	0.06	-2.8134		-3.0746
1.5833	-0.05	0.05	-2.9957		-3.2634
1.6667	-0.05	0.05	-2.9957		-3.4524
1.75	-0.04	0.04	-3.2189		-3.6412
1.8333	-0.04	0.04	-3.2189		-3.8300
1.9167	-0.04	0.04	-3.2189		-4.0190
2	-0.03	0.03	-3.5066		-4.2077
2.5	-0.02	0.02	-3.9120		-5.3408
3	-0.02	0.02	-3.9120		-6.4739
3.5	-0.02	0.02	-3.9120		-7.6070
4	-0.01	0.01	-4.6052		-8.7401
4.5	-0.02	0.02	-3.9120		-9.8732
5	-0.02	0.02	-3.9120		-11.0063
5.5	-0.02	0.02	-3.9120		-12.1394
6	-0.01	0.01	-4.6052		-13.2725
6.5	-0.01	0.01	-4.6052		-14.4055
7	-0.01	0.01	-4.6052		-15.5386
7.5	-0.01	0.01	-4.6052		-16.6717
8	-0.01	0.01	-4.6052		-17.8048
8.5	-0.01	0.01	-4.6052		-18.9379

ROSEHILL SLUG TEST

MW-12-01 Rising Head Test 1



(MW-12-02 rising head test 1)
Slug Test Analysis - Bouwer & Rice/Hvorslev's Methods (V2.4.5)

Client:	EPA	Revised	11/05/91
Site:	Rosehill	Well ID:	MW-12-02
Test by:	K.Arena	Date:	11/01/91
Analysis:	K.Arena	Date:	11/26/91

USER INPUT DATA		WORKSHEET			
Aquifer Thickness=	44.67	FIGURES			
		A=		2.2	2.2
		B =		0.35	0.35
Exposed Len.(Le) =	10	C =		1.9	1.9
Well Length (Lw) =	44.67	R(eq) =	0.0833	0.0833	0.0833
Casing Radius(Rc)=	0.083	Est. Rw			0.417
Well Radius (Rw) =	0.417	Est. n		NA	
Sandpack Porosity=	0.270	log(Le/Rw)		1.3802	1.3802
Slug Volume =	0.025	ln(Re/Rw)		3.1970	3.1970
Static Level =	2.64	Max. Y(t)		0.69	
Offset time =	0	Regr. Y(0)		0.69	
Shape Factor =	19.8	Casing Y(0)		1.15	UNDRAINED
(F from est. Rw)	19.8				

	ft/min	cm/sec	ft/day
Bouwer & Rice - user porosity & Rw	2.3E-02	4.4E-02	32.44
Bouwer & Rice - estimated porosity	2.3E-02	4.4E-02	32.44
Bouwer & Rice - estimated Rw	2.3E-02	4.4E-02	32.44
Hvorslev - user porosity and Rw	2.2E-02	4.4E-02	32.25
Hvorslev - estimated porosity	2.2E-02	4.4E-02	32.25
Hvorslev - estimated Rw	2.2E-02	4.4E-02	32.25

Regression Output:

Constant	-0.37675
Std Err of Y Est	0.005171
R Squared	0.998956
No. of Observations	7
Degrees of Freedom	5

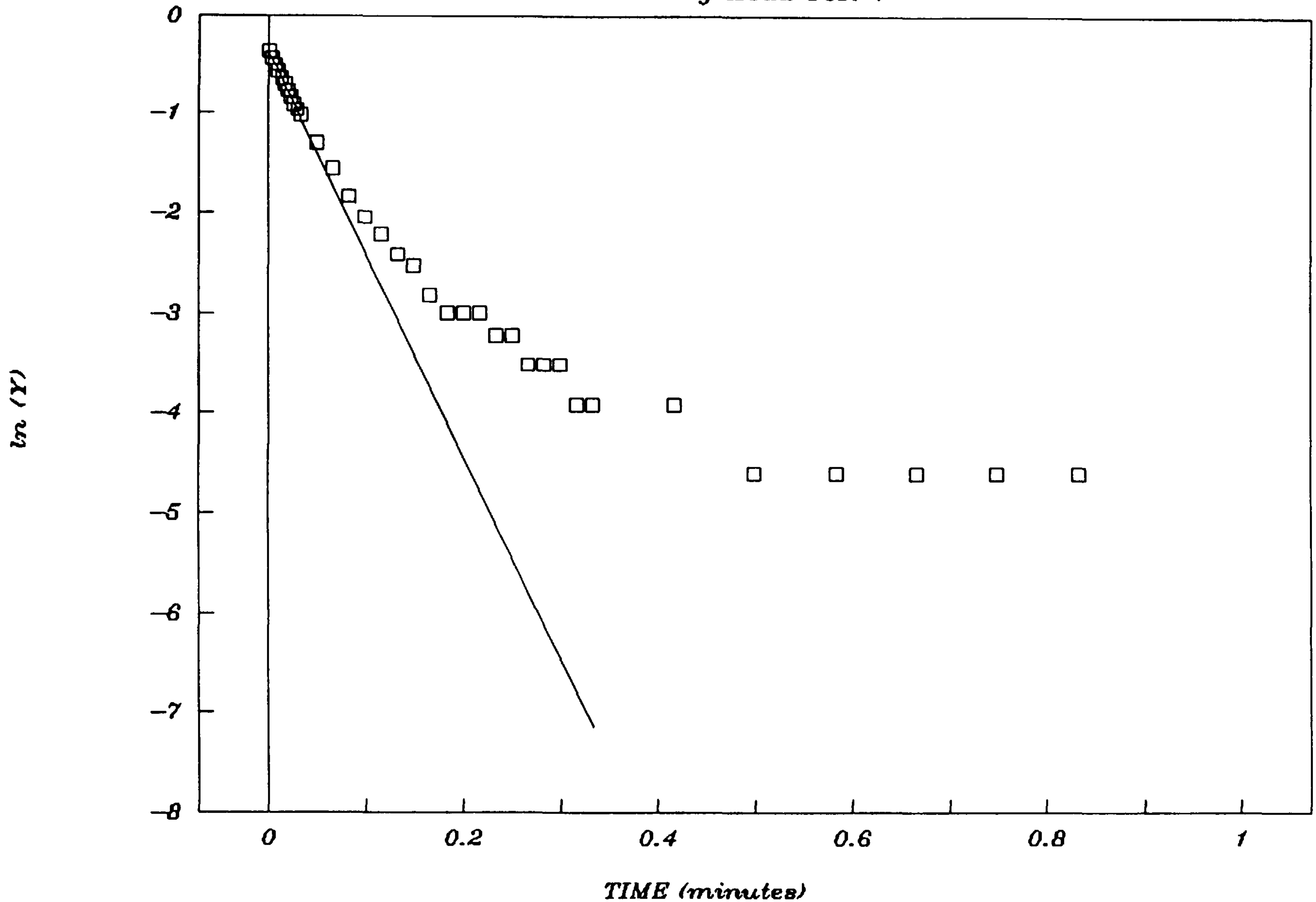
X Coefficient(s)	-20.2943
Std Err of Coef.	0.293272

Time (min)	level (ft)	Drawdown Y(t) ft	ln(Y)	Indicate Regress. Range	EST lnY
0	-0.69	0.69	-0.3711	B	-0.3768
0.0033	-0.64	0.64	-0.4463		-0.4437
0.0066	-0.6	0.60	-0.5108		-0.5107
0.0099	-0.56	0.56	-0.5798		-0.5777
0.0133	-0.52	0.52	-0.6539		-0.6467
0.0166	-0.49	0.49	-0.7133		-0.7136
0.02	-0.46	0.46	-0.7765	E	-0.7826
0.0233	-0.43	0.43	-0.8440		-0.8496
0.0266	-0.4	0.40	-0.9163		-0.9166
0.03	-0.38	0.38	-0.9676		-0.9856
0.0333	-0.36	0.36	-1.0217		-1.0526
0.05	-0.27	0.27	-1.3093		-1.3915
0.0666	-0.21	0.21	-1.5606		-1.7284
0.0833	-0.16	0.16	-1.8326		-2.0673
0.1	-0.13	0.13	-2.0402		-2.4062
0.1166	-0.11	0.11	-2.2073		-2.7431
0.1333	-0.09	0.09	-2.4079		-3.0820
0.15	-0.08	0.08	-2.5257		-3.4209
0.1666	-0.06	0.06	-2.8134		-3.7578
0.1833	-0.05	0.05	-2.9957		-4.0967

0.2	-0.05	0.05	-2.9957	-4.4356
0.2166	-0.05	0.05	-2.9957	-4.7725
0.2333	-0.04	0.04	-3.2189	-5.1114
0.25	-0.04	0.04	-3.2189	-5.4503
0.2666	-0.03	0.03	-3.5066	-5.7872
0.2833	-0.03	0.03	-3.5066	-6.1261
0.3	-0.03	0.03	-3.5066	-6.4651
0.3166	-0.02	0.02	-3.9120	-6.8019
0.3333	-0.02	0.02	-3.9120	-7.1409
0.4167	-0.02	0.02	-3.9120	-8.8334
0.5	-0.01	0.01	-4.6052	-10.5239
0.5833	-0.01	0.01	-4.6052	-12.2144
0.6667	-0.01	0.01	-4.6052	-13.9070
0.75	-0.01	0.01	-4.6052	-15.5975
0.8333	-0.01	0.01	-4.6052	-17.2880
0.9167	0	0.00	ERR	-18.9806
1	0	0.00	ERR	-20.6711
1.0833	0	0.00	ERR	-22.3616
1.1667	0	0.00	ERR	-24.0542
1.25	0	0.00	ERR	-25.7447
1.3333	0	0.00	ERR	-27.4352
1.4166	0	0.00	ERR	-29.1257
1.5	0	0.00	ERR	-30.8183
1.5833	0	0.00	ERR	-32.5088
1.6667	0	0.00	ERR	-34.2013
1.75	0	0.00	ERR	-35.8919
1.8333	0	0.00	ERR	-37.5824
1.9167	0	0.00	ERR	-39.2749
2	0	0.00	ERR	-40.9654
2.5	0	0.00	ERR	-51.1126
3	0	0.00	ERR	-61.2598
3.5	0	0.00	ERR	-71.4070
4	0	0.00	ERR	-81.5541
4.5	0	0.00	ERR	-91.7013
5	0	0.00	ERR	-101.8485
5.5	0	0.00	ERR	-111.9956
6	0	0.00	ERR	-122.1428
6.5	0	0.00	ERR	-132.2900
7	0	0.00	ERR	-142.4372
7.5	0	0.00	ERR	-152.5843
8	0	0.00	ERR	-162.7315
8.5	0	0.00	ERR	-172.8787
9	0	0.00	ERR	-183.0259
9.5	0	0.00	ERR	-193.1730
10	0	0.00	ERR	-203.3202

ROSEHILL SLUG TEST

MW-12-02 Rising Head Test 1



Slug Test Analysis - Bouwer & Rice/Hvorslev's Methods (V2.4.5)
RISING OR FALLING TEST: RISING TEST 1

Client:	EPA	Revised	11/05/91
Site:	ROSE HILL	Well ID:	MW-13-01
Test by:	DANIEL H. BERLER	Date:	10/28/91
Analysis:	DANIEL H. BERLER	Date:	11/11/91

USER INPUT DATA		WORKSHEET	A=	2.2	4.1
Aquifer Thickness=	22.96	FIGURES	B =	0.36	0.65
Exposed Len.(Le) =	10.02		C =	1.9	4.1
Well Length (Lw) =	8.39	R(eq) =	0.1871	0.0865	0.0865
Casing Radius(Rc)=	0.083	Est. Rw			0.094
Well Radius (Rw) =	0.333	Est. n		0.005	
Sandpack Porosity=	0.270	log(Le/Rw)		1.4013	1.9488
Slug Volume =	0.025	ln(Re/Rw)		2.0717	2.4701
Static Level =	9.05	Max. Y(t)		1.1	
Offset time =	0.05	Regr. Y(0)		1.06	
Shape Factor =	18.5	Casing Y(0)		1.15	DRAINED
(F from est. Rw)	13.5				

	ft/min	cm/sec	ft/day
Bouwer & Rice - user porosity & Rw	7.0E-02	1.4E-01	100.69
Bouwer & Rice - estimated porosity	1.5E-02	2.9E-02	21.50
Bouwer & Rice - estimated Rw	1.8E-02	3.5E-02	25.63
Hvorslev - user porosity and Rw	9.6E-02	1.9E-01	138.54
Hvorslev - estimated porosity	2.1E-02	4.0E-02	29.58
Hvorslev - estimated Rw	2.8E-02	5.5E-02	40.53

Regression Output:

Constant	0.871417
Std Err of Y Est	0.038965
R Squared	0.997024
No. of Observations	8
Degrees of Freedom	6

X Coefficient(s)	-16.1772
Std Err of Coef.	0.360799

Time (min)	level (ft)	Drawdown Y(t) ft	ln(Y)	Indicate Regress. Range	EST lnY
0		0.34	-1.0788		0.8714
0.0033		1.1	0.0953		0.8180
0.0066		0.35	-1.0498		0.7646
0.0099		2.01	0.6981		0.7113
0.0133		0.47	-0.7550		0.6563
0.0166		1.34	0.2927		0.6029
0.02		1.47	0.3853		0.5479
0.0233		1.37	0.3148		0.4945
0.0266		1.31	0.2700		0.4411
0.03		1.23	0.2070		0.3861
0.0333		1.18	0.1655		0.3327
0.05		1.1	0.0953	B	0.0626
0.0666		0.8	-0.2231		-0.2060
0.0833		0.63	-0.4620		-0.4761
0.1		0.48	-0.7340		-0.7463
0.1166		0.34	-1.0788		-1.0148
0.1333		0.27	-1.3093		-1.2850
0.15		0.21	-1.5606		-1.5552
0.1666		0.17	-1.7720	E	-1.8237

0.1833	0.15	-1.8971	-2.0939
0.2	0.13	-2.0402	-2.3640
0.2166	0.11	-2.2073	-2.6326
0.2333	0.1	-2.3026	-2.9027
0.25	0.09	-2.4079	-3.1729
0.2666	0.08	-2.5257	-3.4414
0.2833	0.08	-2.5257	-3.7116
0.3	0.07	-2.6593	-3.9817
0.3166	0.07	-2.6593	-4.2503
0.3333	0.06	-2.8134	-4.5204
0.4167	0.05	-2.9957	-5.8696
0.5	0.04	-3.2189	-7.2172
0.5833	0.04	-3.2189	-8.5647
0.6667	0.03	-3.5066	-9.9139
0.75	0.03	-3.5066	-11.2615
0.8333	0.03	-3.5066	-12.6090
0.9167	0.03	-3.5066	-13.9582
1	0.02	-3.9120	-15.3058
1.0833	0.02	-3.9120	-16.6533
1.1667	0.02	-3.9120	-18.0025
1.25	0.02	-3.9120	-19.3501
1.3333	0.02	-3.9120	-20.6976
1.4166	0.02	-3.9120	-22.0452
1.5	0.02	-3.9120	-23.3944
1.5833	0.01	-4.6052	-24.7419
1.6667	0.01	-4.6052	-26.0911
1.75	0.02	-3.9120	-27.4387
1.8333	0.01	-4.6052	-28.7862
1.9167	0.01	-4.6052	-30.1354
2	0.01	-4.6052	-31.4830
2.5	0.01	-4.6052	-39.5716
3	0.01	-4.6052	-47.6602
3.5	0.01	-4.6052	-55.7488
4	0.01	-4.6052	-63.8374
4.5	0.01	-4.6052	-71.9260
5	0.01	-4.6052	-80.0146
5.5	0.01	-4.6052	-88.1032
6	0.01	-4.6052	-96.1918
6.5	0.01	-4.6052	-104.2804
7	0.01	-4.6052	-112.3690
7.5	0.01	-4.6052	-120.4576
8	0.01	-4.6052	-128.5462
8.5	0.01	-4.6052	-136.6348
9	0.01	-4.6052	-144.7234
9.5	0	ERR	-152.8120
10	0	ERR	-160.9006
	0	ERR	0.8714
	0	ERR	0.8714
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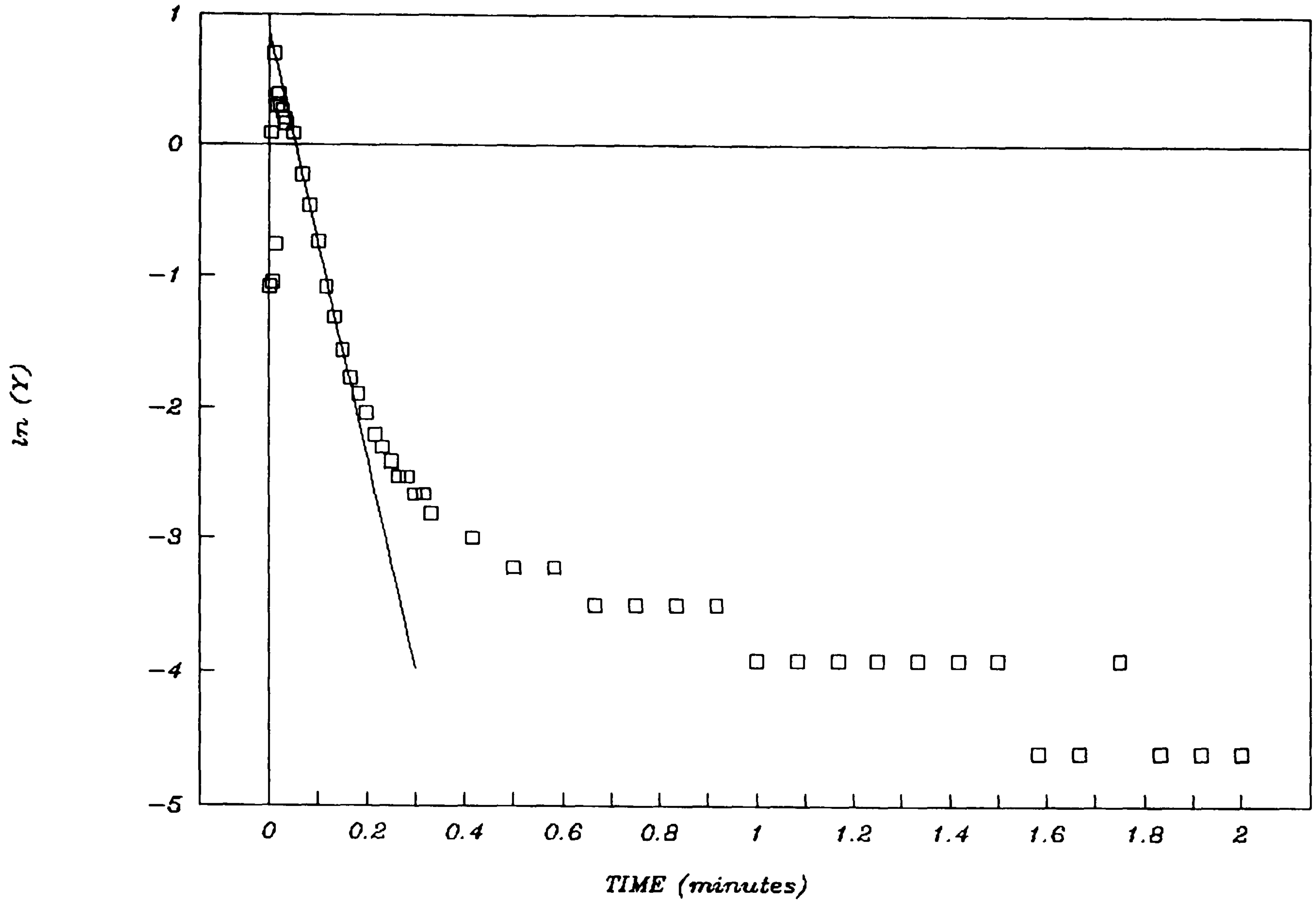
	0	ERR	0.8714

ROSE HILL SLUG TEST

MW13-01 RISING HEAD TEST 1



Slug Test Analysis - Bouwer & Rice/Hvorslev's Methods (V2.4.5)
RISING OR FALLING TEST: RISING TEST 1

Client:	EPA	Revised	11/05/91
Site:	ROSE HILL	Well ID:	MW13-02
Test by:	DANIEL H. BERLER	Date:	10/29/91
Analysis:	DANIEL H. BERLER	Date:	11/13/91

USER INPUT DATA		WORKSHEET			
Aquifer Thickness=	22.86	FIGURES	A=	2.3	2.3
			B =		0.37
Exposed Len.(Le) =	9.5		C =	2.0	2.0
Well Length (Lw) =	20.11	R(eq) =	0.0833	0.0833	0.0833
Casing Radius(Rc)=	0.083	Est. Rw			0.333
Well Radius (Rw) =	0.333	Est. n		NA	
Sandpack Porosity=	0.270	log(Le/Rw)		1.4553	1.4553
Slug Volume =	0.025	ln(Re/Rw)		2.8595	2.8595
Static Level =	9.29	Max. Y(t)		2.09	
Offset time =	0.0066	Regr. Y(0)		1.34	
Shape Factor =	17.8	Casing Y(0)		1.15	UNDRAINED
(F from est. Rw)	17.8				

	ft/min	cm/sec	ft/day
Bouwer & Rice - user porosity & Rw	1.2E-02	2.3E-02	17.06
Bouwer & Rice - estimated porosity	1.2E-02	2.3E-02	17.06
Bouwer & Rice - estimated Rw	1.2E-02	2.3E-02	17.06
Hvorslev - user porosity and Rw	1.4E-02	2.7E-02	19.99
Hvorslev - estimated porosity	1.4E-02	2.7E-02	19.99
Hvorslev - estimated Rw	1.4E-02	2.7E-02	19.99

Regression Output:

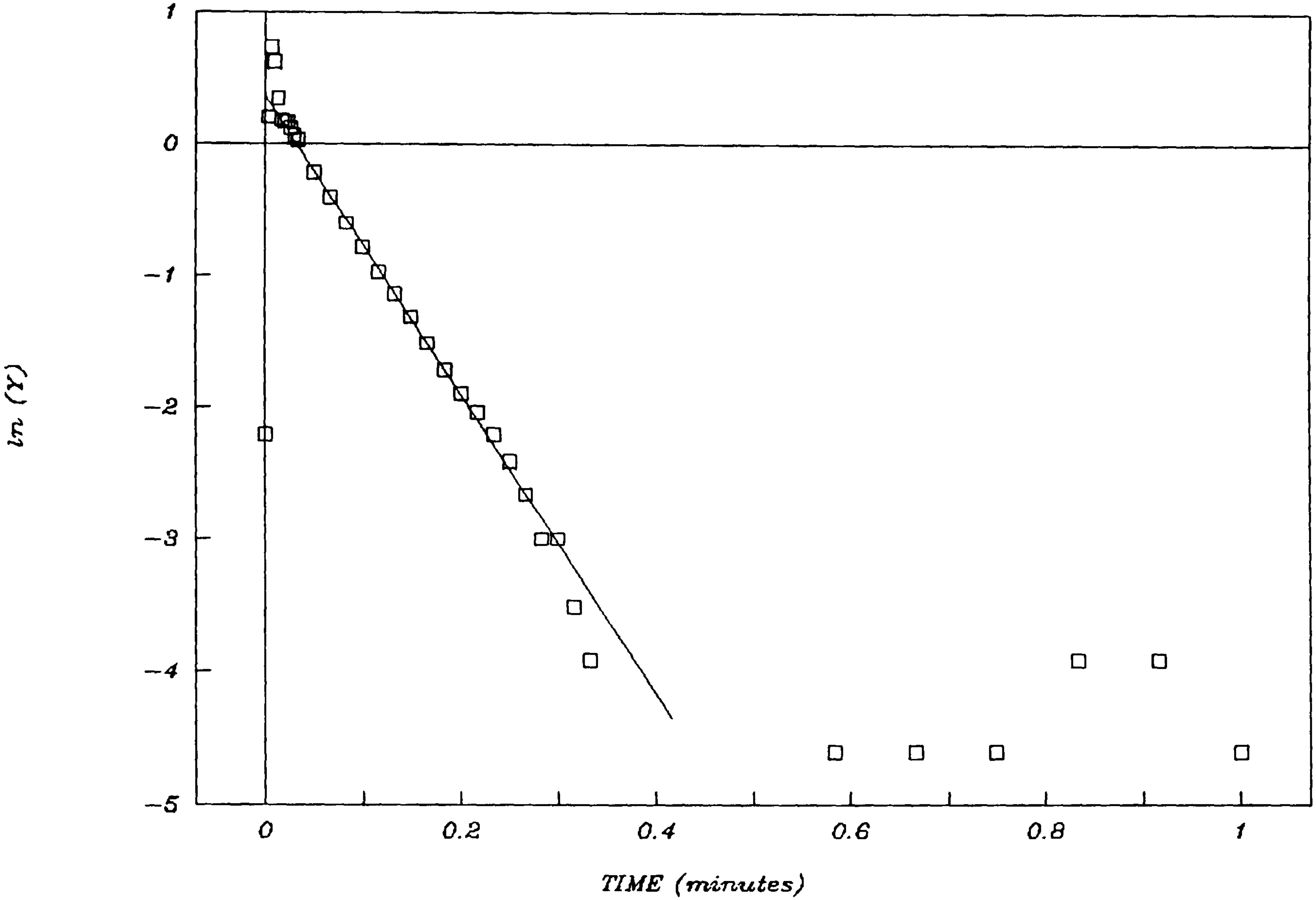
Constant	0.367349
Std Err of Y Est	0.018967
R Squared	0.999175
No. of Observations	11
Degrees of Freedom	9
X Coefficient(s)	-11.3322
Std Err of Coef.	0.108506

Time (min)	level (ft)	Drawdown Y(t) ft	ln(Y)	Indicate Regress. Range	EST lnY
0	-0.11	0.11	-2.2073		0.3673
0.0033	-1.23	1.23	0.2070		0.3300
0.0066	-2.09	2.09	0.7372		0.2926
0.0099	-1.87	1.87	0.6259		0.2552
0.0133	-1.41	1.41	0.3436		0.2166
0.0166	-1.2	1.2	0.1823		0.1792
0.02	-1.19	1.19	0.1740		0.1407
0.0233	-1.19	1.19	0.1740		0.1033
0.0266	-1.13	1.13	0.1222		0.0659
0.03	-1.07	1.07	0.0677		0.0274
0.0333	-1.03	1.03	0.0296	B	-0.0100
0.05	-0.81	0.81	-0.2107		-0.1993
0.0666	-0.67	0.67	-0.4005		-0.3874
0.0833	-0.55	0.55	-0.5978		-0.5766
0.1	-0.46	0.46	-0.7765		-0.7659
0.1166	-0.38	0.38	-0.9676		-0.9540
0.1333	-0.32	0.32	-1.1394		-1.1432
0.15	-0.27	0.27	-1.3093		-1.3325
0.1666	-0.22	0.22	-1.5141		-1.5206

0.1833	-0.18	0.18	-1.7148		-1.7098
0.2	-0.15	0.15	-1.8971	E	-1.8991
0.2166	-0.13	0.13	-2.0402		-2.0872
0.2333	-0.11	0.11	-2.2073		-2.2765
0.25	-0.09	0.09	-2.4079		-2.4657
0.2666	-0.07	0.07	-2.6593		-2.6538
0.2833	-0.05	0.05	-2.9957		-2.8431
0.3	-0.05	0.05	-2.9957		-3.0323
0.3166	-0.03	0.03	-3.5066		-3.2204
0.3333	-0.02	0.02	-3.9120		-3.4097
0.4167	0	0	ERR		-4.3548
0.5	0	0	ERR		-5.2988
0.5833	0.01	0.01	-4.6052		-6.2427
0.6667	0.01	0.01	-4.6052		-7.1878
0.75	0.01	0.01	-4.6052		-8.1318
0.8333	0.02	0.02	-3.9120		-9.0758
0.9167	0.02	0.02	-3.9120		-10.0209
1	0.01	0.01	-4.6052		-10.9649
1.0833	0.02	0.02	-3.9120		-11.9089
1.1667	0.02	0.02	-3.9120		-12.8540
1.25	0.02	0.02	-3.9120		-13.7979
1.3333	0.02	0.02	-3.9120		-14.7419
1.4166	0.02	0.02	-3.9120		-15.6859
1.5	0.02	0.02	-3.9120		-16.6310
1.5833	0.02	0.02	-3.9120		-17.5750
1.6667	0.02	0.02	-3.9120		-18.5201
1.75	0.02	0.02	-3.9120		-19.4640
1.8333	0.02	0.02	-3.9120		-20.4080
1.9167	0.02	0.02	-3.9120		-21.3531
2	0.02	0.02	-3.9120		-22.2971
2.5	0.02	0.02	-3.9120		-27.9632
3	0.02	0.02	-3.9120		-33.6293
3.5	0.02	0.02	-3.9120		-39.2954
4	0.02	0.02	-3.9120		-44.9616
4.5	0.02	0.02	-3.9120		-50.6277
5	0.02	0.02	-3.9120		-56.2938

ROSE HILL SLUG TEST

MW13-02 RISING HEAD TEST 1



(First Rising Head Test)
Slug Test Analysis - Bouwer & Rice/Hvorslev's Methods (V2.4.5)

Client:	EPA	Revised	11/05/91
Site:	Rosehill	Well ID:	MW-14-01
Test by:	K.Arena	Date:	10/29/91
Analysis:	K.Arena	Date:	12/03/91

USER INPUT DATA		WORKSHEET		A=	2.1	2.9
Aquifer Thickness=	11.1	FIGURES		B =	0.34	0.46
Exposed Len.(Le) =	10			C =	1.8	2.7
Well Length (Lw) =	7.1	R(eq) =	0.1873		0.1056	0.1056
Casing Radius(Rc)=	0.083	Est. Rw				0.150
Well Radius (Rw) =	0.333	Est. n			0.040	
Sandpack Porosity=	0.270	log(Le/Rw)			1.3284	1.6746
Slug Volume =	0.025	ln(Re/Rw)			2.0085	2.2926
Static Level =	28.10	Max. Y(t)			0.72	
Offset time =	0.1666	Regr. Y(0)			0.71	
Shape Factor =	18.5	Casing Y(0)			1.15	DRAINED
(F from est. Rw)	15.0					

	ft/min	cm/sec	ft/day
Bouwer & Rice - user porosity & Rw	1.3E-02	2.6E-02	19.25
Bouwer & Rice - estimated porosity	4.3E-03	8.4E-03	6.13
Bouwer & Rice - estimated Rw	4.9E-03	9.6E-03	6.99
Hvorslev - user porosity and Rw	1.6E-02	3.2E-02	23.15
Hvorslev - estimated porosity	5.1E-03	1.0E-02	7.36
Hvorslev - estimated Rw	6.3E-03	1.2E-02	9.09

Regression Output:

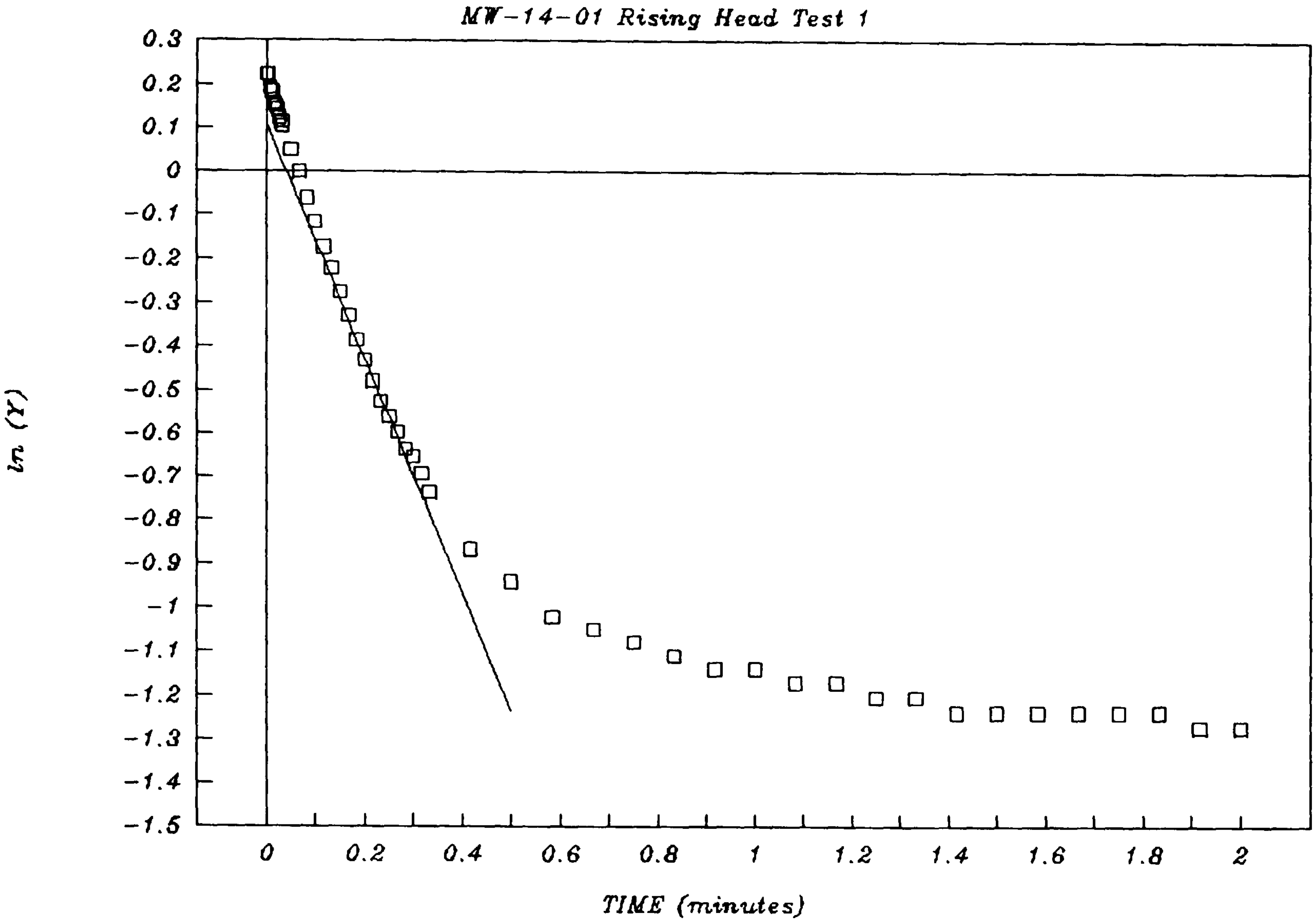
Constant	0.110892
Std Err of Y Est	0.008050
R Squared	0.994296
No. of Observations	7
Degrees of Freedom	5

X Coefficient(s)	-2.69507
Std Err of Coef.	0.091281

Time (min)	level (ft)	Drawdown Y(t) ft	ln(Y)	Indicate Regress. Range	EST lnY
0	-1.25	1.25	0.2231		0.1109
0.0033	-1.25	1.25	0.2231		0.1020
0.0066	-1.21	1.21	0.1906		0.0931
0.0099	-1.2	1.20	0.1823		0.0842
0.0133	-1.2	1.20	0.1823		0.0750
0.0166	-1.17	1.17	0.1570		0.0662
0.02	-1.16	1.16	0.1484		0.0570
0.0233	-1.15	1.15	0.1398		0.0481
0.0266	-1.13	1.13	0.1222		0.0392
0.03	-1.12	1.12	0.1133		0.0300
0.0333	-1.11	1.11	0.1044		0.0211
0.05	-1.05	1.05	0.0488		-0.0239
0.0666	-1	1.00	0.0000		-0.0686
0.0833	-0.94	0.94	-0.0619		-0.1136
0.1	-0.89	0.89	-0.1165		-0.1586
0.1166	-0.84	0.84	-0.1744		-0.2034
0.1333	-0.8	0.80	-0.2231		-0.2484
0.15	-0.76	0.76	-0.2744		-0.2934
0.1666	-0.72	0.72	-0.3285	b	-0.3381
0.1833	-0.68	0.68	-0.3857		-0.3831

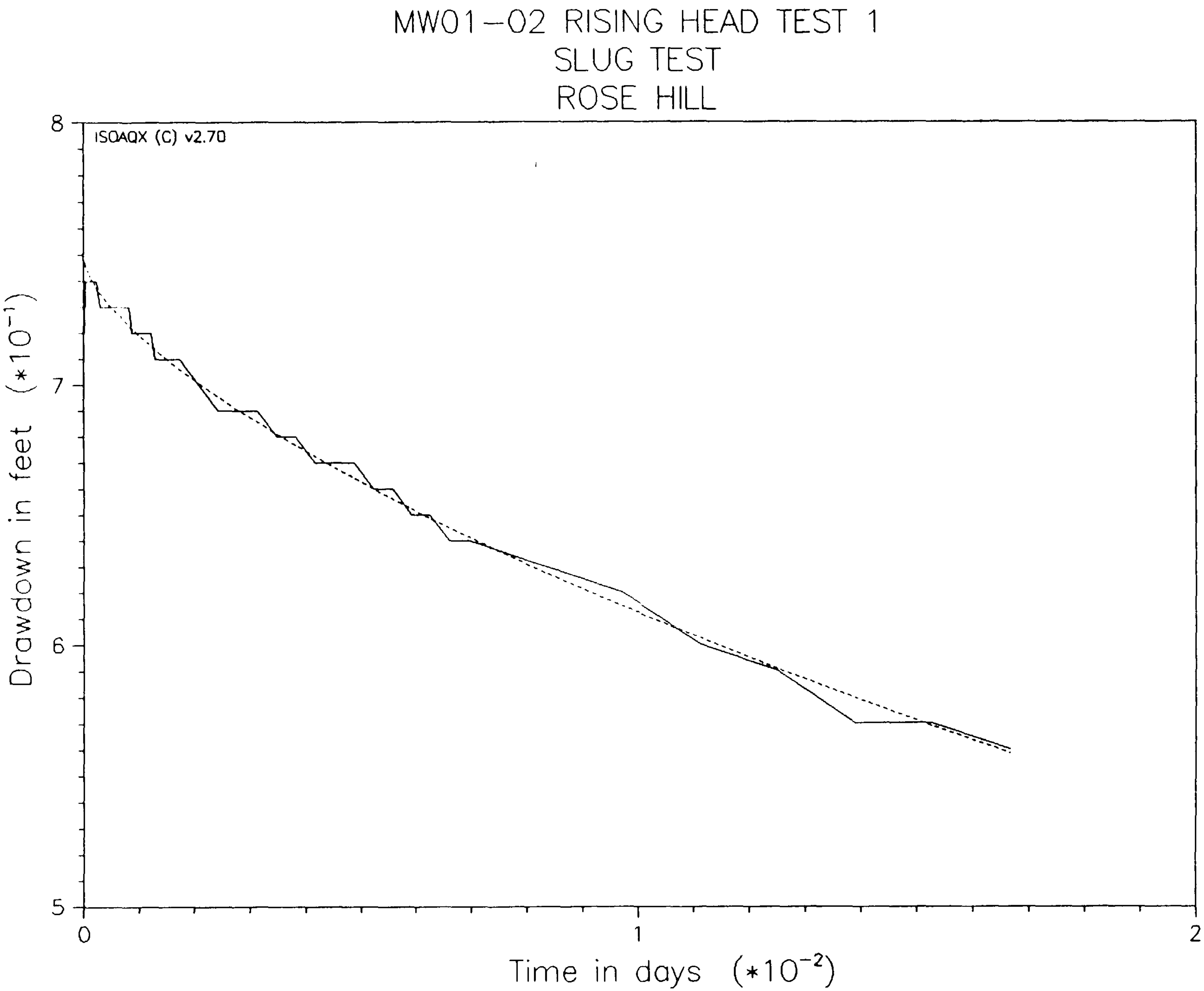
0.2	-0.65	0.65	-0.4308		-0.4281
0.2166	-0.62	0.62	-0.4780		-0.4729
0.2333	-0.59	0.59	-0.5276		-0.5179
0.25	-0.57	0.57	-0.5621		-0.5629
0.2666	-0.55	0.55	-0.5978	E	-0.6076
0.2833	-0.53	0.53	-0.6349		-0.6526
0.3	-0.52	0.52	-0.6539		-0.6976
0.3166	-0.5	0.50	-0.6931		-0.7424
0.3333	-0.48	0.48	-0.7340		-0.7874
0.4167	-0.42	0.42	-0.8675		-1.0121
0.5	-0.39	0.39	-0.9416		-1.2366
0.5833	-0.36	0.36	-1.0217		-1.4611
0.6667	-0.35	0.35	-1.0498		-1.6859
0.75	-0.34	0.34	-1.0788		-1.9104
0.8333	-0.33	0.33	-1.1087		-2.1349
0.9167	-0.32	0.32	-1.1394		-2.3597
1	-0.32	0.32	-1.1394		-2.5842
1.0833	-0.31	0.31	-1.1712		-2.8087
1.1667	-0.31	0.31	-1.1712		-3.0335
1.25	-0.3	0.30	-1.2040		-3.2580
1.3333	-0.3	0.30	-1.2040		-3.4825
1.4166	-0.29	0.29	-1.2379		-3.7070
1.5	-0.29	0.29	-1.2379		-3.9317
1.5833	-0.29	0.29	-1.2379		-4.1562
1.6667	-0.29	0.29	-1.2379		-4.3810
1.75	-0.29	0.29	-1.2379		-4.6055
1.8333	-0.29	0.29	-1.2379		-4.8300
1.9167	-0.28	0.28	-1.2730		-5.0548
2	-0.28	0.28	-1.2730		-5.2793
2.5	-0.27	0.27	-1.3093		-6.6268
3	-0.26	0.26	-1.3471		-7.9743
3.5	-0.25	0.25	-1.3863		-9.3219
4	-0.25	0.25	-1.3863		-10.6694
4.5	-0.24	0.24	-1.4271		-12.0170
5	-0.24	0.24	-1.4271		-13.3645
5.5	-0.24	0.24	-1.4271		-14.7120
6	-0.23	0.23	-1.4697		-16.0596
6.5	-0.23	0.23	-1.4697		-17.4071
7	-0.23	0.23	-1.4697		-18.7547
7.5	-0.22	0.22	-1.5141		-20.1022
8	-0.22	0.22	-1.5141		-21.4497
8.5	-0.22	0.22	-1.5141		-22.7973
9	-0.21	0.21	-1.5606		-24.1448
9.5	-0.21	0.21	-1.5606		-25.4924
10	-0.21	0.21	-1.5606		-26.8399
12	-0.2	0.20	-1.6094		-32.2301
14	-0.19	0.19	-1.6607		-37.6202

ROSEHILL SLUG TEST



Cooper, Bredehoeft and Papdopulous Method

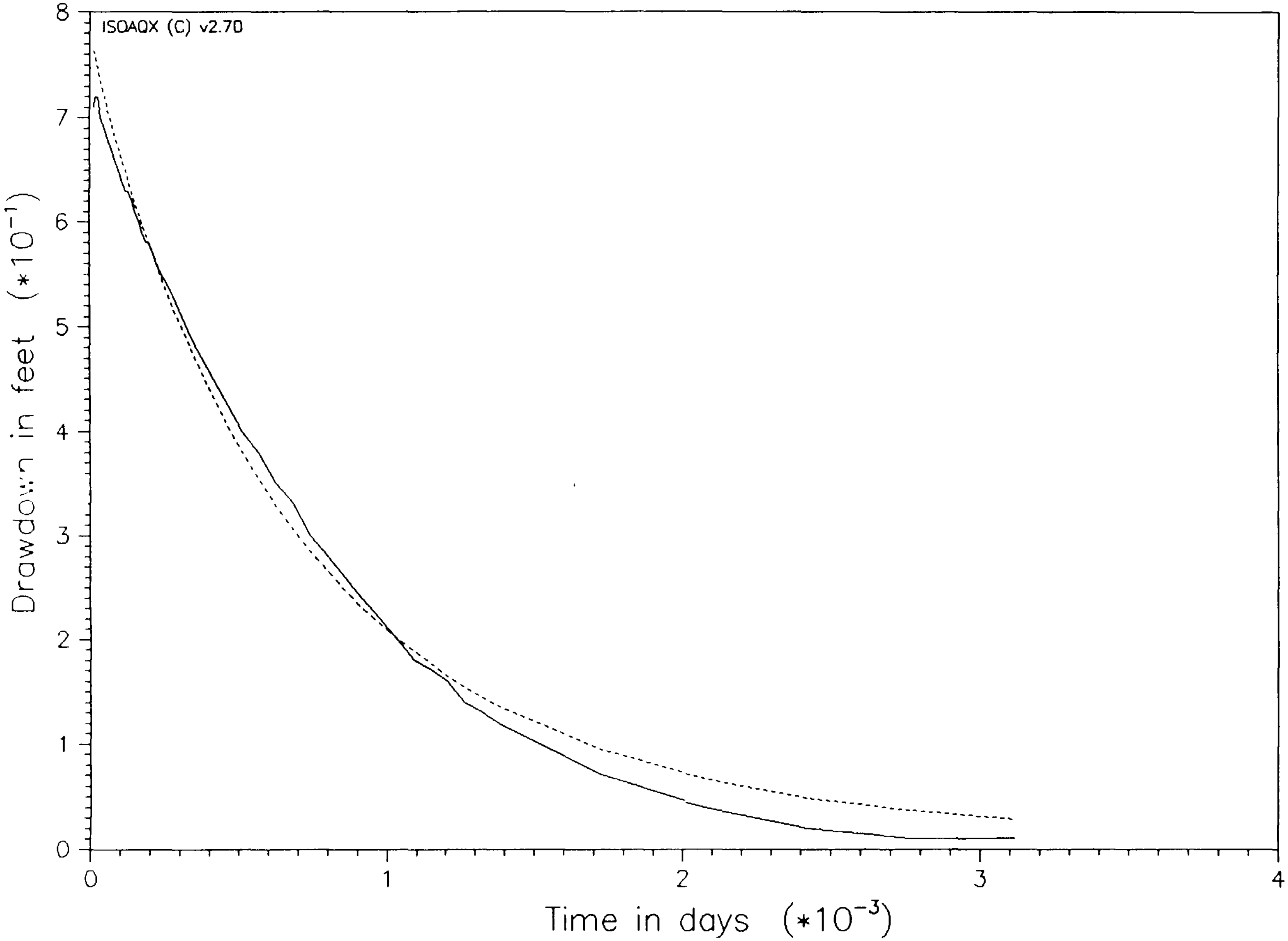
```
---------------------------------------------------------------
             ISOAQX (C) v2.70 --- FILE C:MW01-02.01
test # comb:  2
---------------------------------------------------------------
    unbiased C-B-P SLUG TEST MODEL:
    full analysis:                all active data points used
    using closure tolerance setting           =       3.00E-03
    root mean squared error (ft)              =      -5.68E-03
    transmissivity (ft**2/day)                =       1.01
    storativity (dimensionless)               =       9.82E-03
    initial head (ft)                         =       0.750
    casing radius (ft)                        =       0.250
    screen radius (ft)                        =       0.250
---------------------------------------------------------------
```


MW01-02 RISING HEAD TEST 1
SLUG TEST
ROSE HILL
ISOAQX (C) v2.70
8
7
6
5
0
1
2
Drawdown in feet (*10^-1)
Time in days (*10^-2)

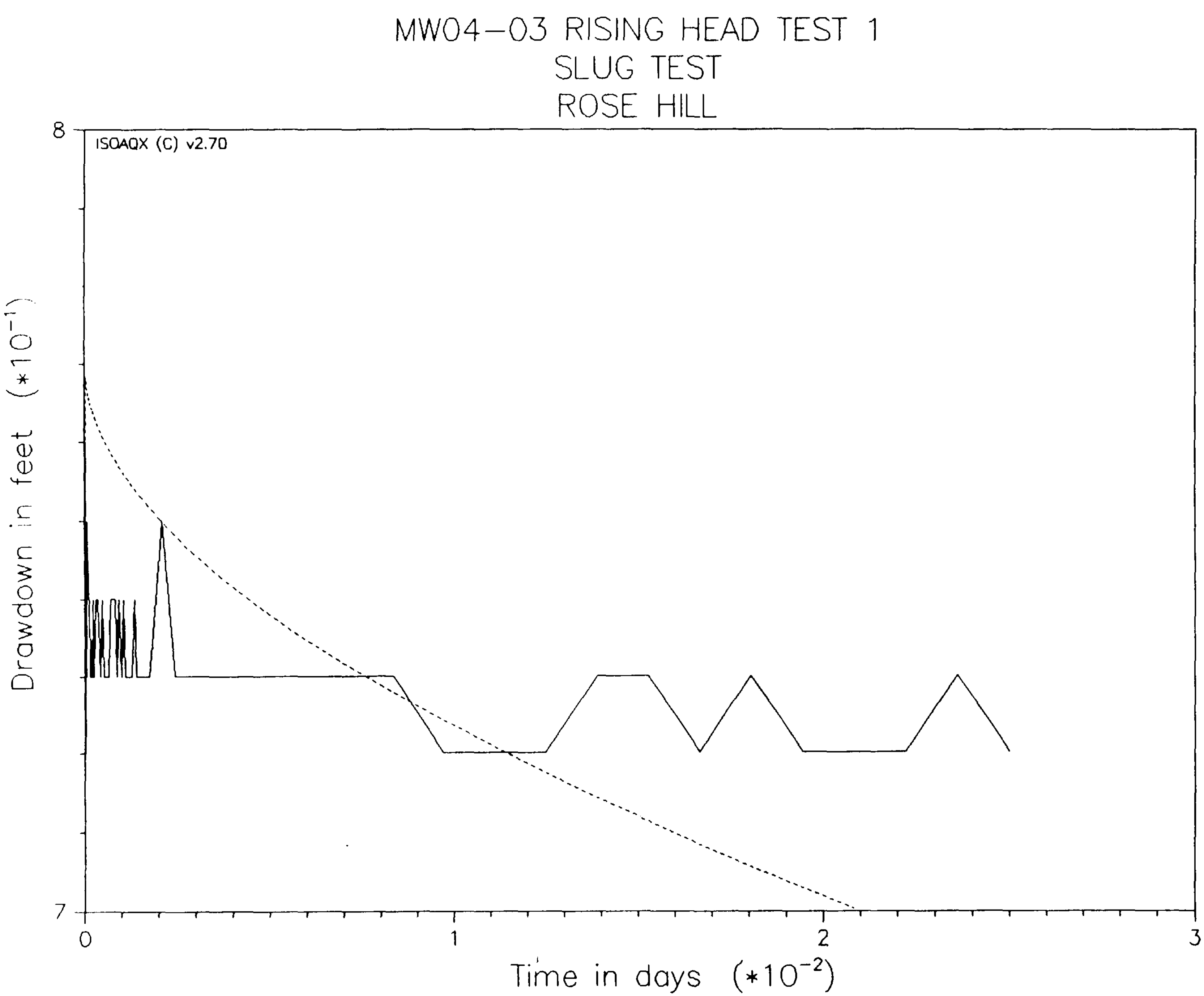
```
-----------------------------------------------------------------
              ISOAQX (C) v2.70 --- FILE c:mw03a.01
test # comb:  1
-----------------------------------------------------------------
    unbiased C-B-P SLUG TEST MODEL:
    full analysis:                all active data points used
    using closure tolerance setting            =       1.00E-03
    root mean squared error (ft)               =      -2.02E-02
    transmissivity (ft**2/day)                 =     396.98
    storativity (dimensionless)                =       5.64E-08
    initial head (ft)                          =       0.780
    casing radius (ft)                         =       0.250
    screen radius (ft)                         =       0.250
-----------------------------------------------------------------
```

Test run with corrected data

mw03–03 RISING HEAD TEST
SLUG TEST USING CORRECTED TIMES FOR START OF TEST AND A BEG.
ROSE HILL

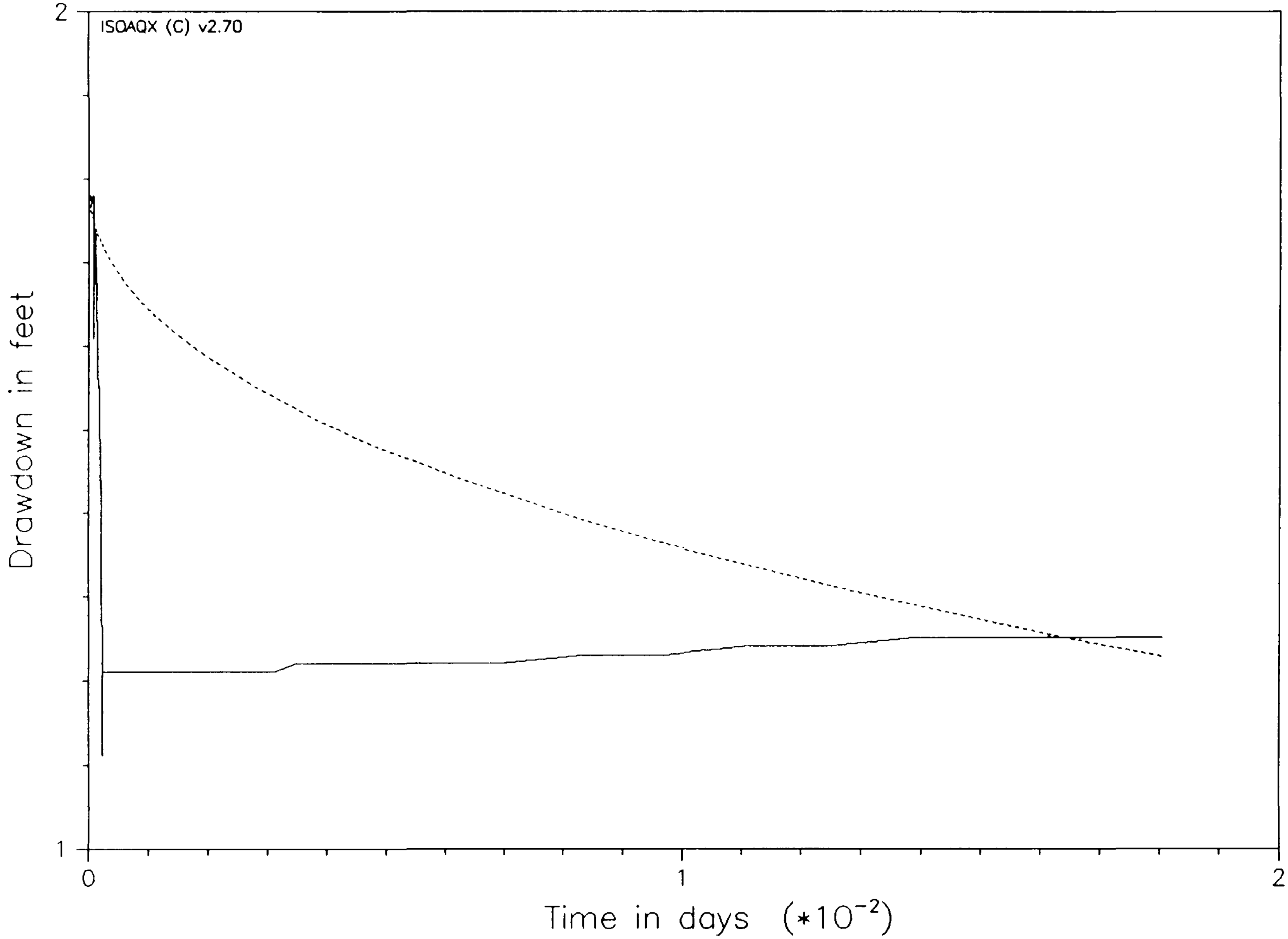


```
----------------------------------------------------------------
             ISOAQX (C) v2.70 --- FILE A:MW04-03.01
test # comb:  6
----------------------------------------------------------------
    unbiased C-B-P SLUG TEST MODEL:
    full analysis:                all active data points used
    using closure tolerance setting          =      3.00E-03
    root mean squared error (ft)             =     -2.29E-02
    transmissivity (ft**2/day)               =      6.31E-02
    storativity (dimensionless)              =      5.67E-02
    initial head (ft)                        =      0.770
    casing radius (ft)                       =      0.250
    screen radius (ft)                       =      0.250
----------------------------------------------------------------
```

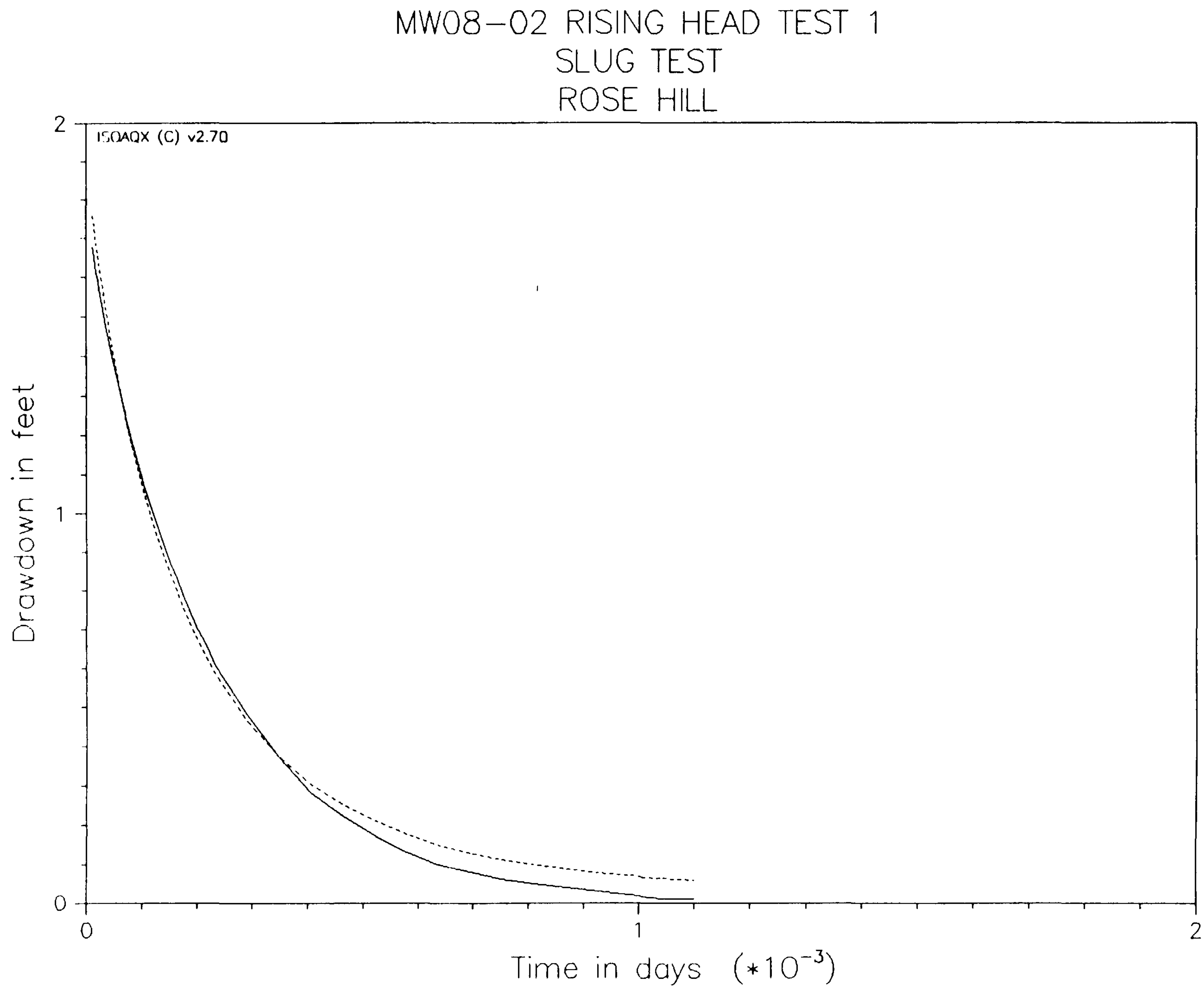

MW04–03 RISING HEAD TEST 1
SLUG TEST
ROSE HILL
ISOAQX (C) v2.70
8
7
0
1
2
3
Drawdown in feet (*10⁻¹)
Time in days (*10⁻²)

```
-----------------------------------------------------------------
             ISOAQX (C) v2.70 --- FILE A:MW07-02.01
test # comb:  7
-----------------------------------------------------------------
    unbiased C-B-P SLUG TEST MODEL:
    full analysis:               all active data points used
    using closure tolerance setting          =       3.00E-03
    root mean squared error (ft)             =      -4.24E-01
    transmissivity (ft**2/day)               =       2.38E-01
    storativity (dimensionless)              =       3.56E-01
    initial head (ft)                        =       1.790
    casing radius (ft)                       =       0.250
    screen radius (ft)                       =       0.250
-----------------------------------------------------------------
```

MW07—02 RISING HEAD TEST 1
SLUG TEST
ROSE HILL



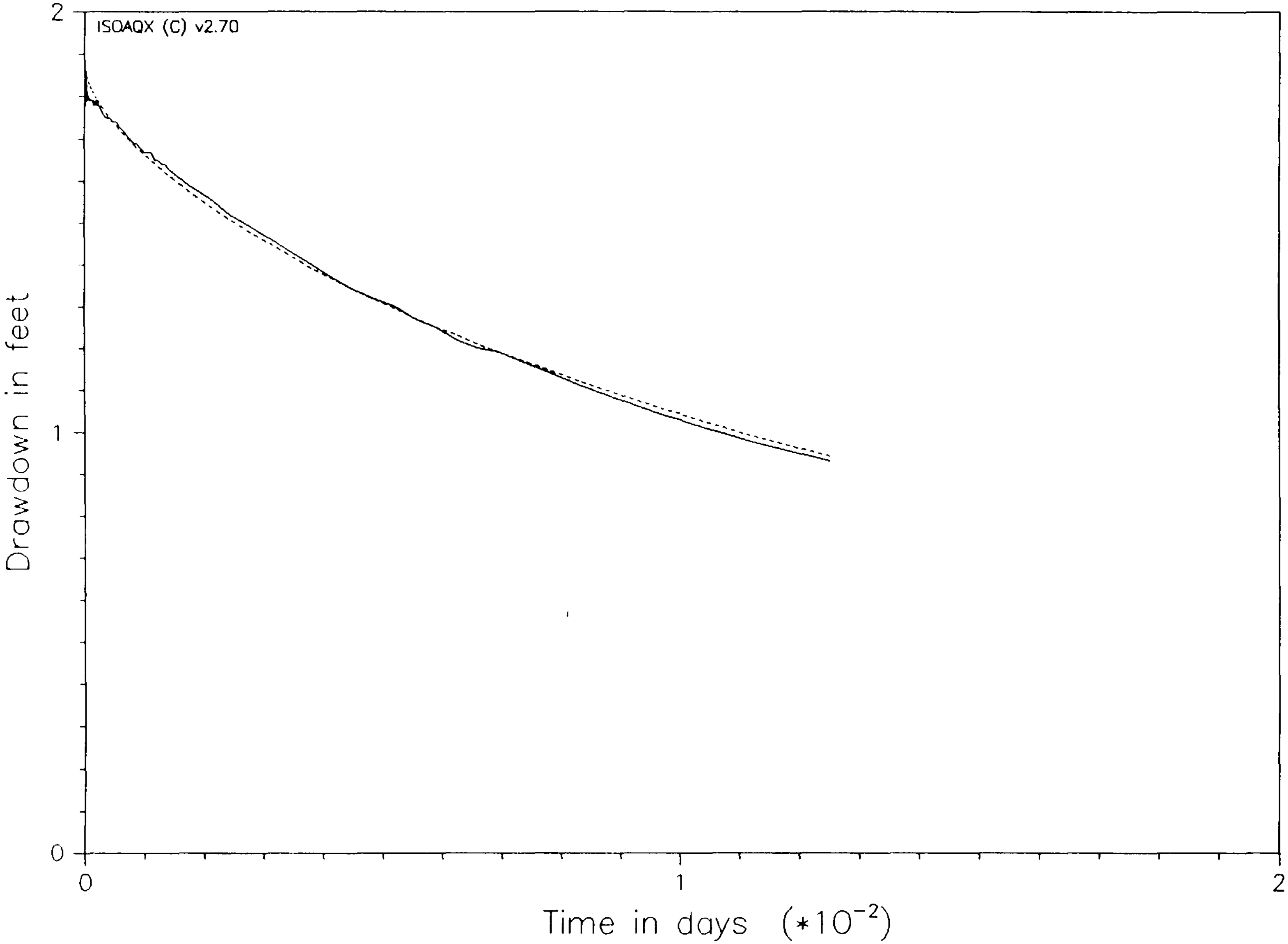
```
----------------------------------------------------------------
             ISOAQX (C) v2.70 --- FILE A:MW08-02.01
test # comb:  1
----------------------------------------------------------------
    unbiased C-B-P SLUG TEST MODEL:
    full analysis:                all active data points used
    using closure tolerance setting          =       3.00E-03
    root mean squared error (ft)             =      -4.33E-02
    transmissivity (ft**2/day)               =      92.22
    storativity (dimensionless)              =       1.89E-04
    initial head (ft)                        =       1.930
    casing radius (ft)                       =       0.083
    screen radius (ft)                       =       0.083
----------------------------------------------------------------
```



MW08-02 RISING HEAD TEST 1
SLUG TEST
ROSE HILL
ISOAQX (C) v2.70
Drawdown in feet
2
1
0
0
1
2
Time in days (*10^-3)

```
--------------------------------------------------------------
             ISOAQX (C) v2.70 --- FILE A:MW11-03.01
test # comb:  4
--------------------------------------------------------------
    unbiased C-B-P SLUG TEST MODEL:
    full analysis:                all active data points used
    using closure tolerance setting           =       3.00E-02
    root mean squared error (ft)              =      -2.10E-02
    transmissivity (ft**2/day)                =       3.72
    storativity (dimensionless)               =       1.69E-02
    initial head (ft)                         =       1.870
    casing radius (ft)                        =       0.250
    screen radius (ft)                        =       0.250
--------------------------------------------------------------
```

MW11-03 RISING HEAD TEST 1
SLUG TEST
ROSE HILL



STREAM BED HYDRAULIC CONDUCTIVITY MEASUREMENTS

ROUND: II D 10/02/91

MINI-PIEZOMETERS	Q FLOW INTO (-Q) FLOW OUT (+Q) OF MINI-PIEZOMETERS OR SEEPAGE METERS (CM^3/MINUTE)	Q FLOW INTO (-Q) FLOW OUT (+Q) OF MINI-PIEZOMETERS OR SEEPAGE METERS (CM^3/SEC)	L LENGTH OF SCREENED INTERVAL (CMS.)	D DIAMETER OF SCREEN (CMS.)	H HEAD DIFFERENCE BETWEEN MINI-PIEZOMETER AND SURFACE WATER (FT.)	H HEAD DIFFERENCE BETWEEN MINI-PIEZOMETER AND SURFACE WATER (CMS.)	K HYDRAULIC CONDUCTIVITY (CMS./SEC)	K HYDRAULIC CONDUCTIVITY (FT./DAY)
MP-01			4.267	0.48				
MP-03			4.267	0.48				
MP-07			4.267	0.48				
MP-08			4.267	0.48				
MP-09			4.267	0.48				
MP-10			4.267	0.48				
MP-11			4.267	0.48				
MP-12	-65.333	-1.089	4.267	0.48	-0.729	-22.220	5.27E-03	1.49E+01

SEEPAGE METERS	Q FLOW INTO (-Q) FLOW OUT (+Q) OF MINI-PIEZOMETERS OR SEEPAGE METERS (CM^3/MINUTE)	Q FLOW INTO (-Q) FLOW OUT (+Q) OF MINI-PIEZOMETERS OR SEEPAGE METERS (CM^3/SEC)	H 1* HEAD DIFFERENCE (FT.)	H 1* HEAD DIFFERENCE FT. * 30.48CMS/FT. (CMS.)	I HYDRAULIC GRADIENT = H/15.24CMS. (CMS./CMS.)	A CROSS-SECTIONAL AREA OF SEEPAGE METER 55 GALLON DRUM (CMS.^2)	K HYDRAULIC CONDUCTIVITY K=Q/IA (CMS./SEC)	K HYDRAULIC CONDUCTIVITY (FT./DAY)
SM-01								
SM-05	4.167	0.069	0.1875	5.715	0.375	336.50	5.50E-04	1.56E+00
SM-07								

NOTES: *1 DIFFERENCE IN HEAD WAS FOUND BY MEASURING THE HEIGHT OF WATER IN THE CLEAR TYGON TUBING, ATTACHED TO THE SEEPAGE METER, ABOVE (+) OR BELOW (-) THE SURFACE WATER-AIR INTERFACE IN FEET. THE HEAD DIFFERENCE IN FEET WAS THEN CONVERTED TO CENTIMETERS BY MULTIPLYING TIMES THE CONVERSION FACTOR 30.48.

STREAM BED HYDRAULIC CONDUCTIVITY MEASUREMENTS

ROUND: II DATE: 10/01/91

MINI-PIEZOMETERS	Q FLOW INTO (-Q) FLOW OUT (-Q) OF MINI-PIEZOMETERS OR SEEPAGE METERS (CM^3/MINUTE)	Q FLOW INTO (-Q) FLOW OUT (-Q) OF MINI-PIEZOMETERS OR SEEPAGE METERS (CM^3/SEC)	L LENGTH OF SCREENED INTERVAL (CMS.)	D DIAMETER OF SCREEN (CMS.)	H HEAD DIFFERENCE BETWEEN MINI-PIEZOMETER AND SURFACE WATER (FT.)	H HEAD DIFFERENCE BETWEEN MINI-PIEZOMETER AND SURFACE WATER (CMS.)	K HYDRAULIC CONDUCTIVITY (CMS./SEC)
MP-01			4.267	0.48			
MP-03			4.267	0.48			
MP-07			4.267	0.48			
MP-08			4.267	0.48			
MP-09			4.267	0.48			
MP-10			4.267	0.48			
MP-11			4.267	0.48			
MP-12	-7.305	-0.122	4.267	0.48	-0.703	-21.427	6.11E-04

SEEPAGE METERS	Q FLOW INTO (-Q) FLOW OUT (-Q) OF MINI-PIEZOMETERS OR SEEPAGE METERS (CM^3/MINUTE)	Q FLOW INTO (-Q) FLOW OUT (-Q) OF MINI-PIEZOMETERS OR SEEPAGE METERS (CM^3/SEC)	H 1* HEAD DIFFERENCE (FT.)	H 1* HEAD DIFFERENCE FT. * 30.48CMS/FT. (CMS.)	I HYDRAULIC GRADIENT = H/15.24CMS. (CMS./CMS.)	A CROSS-SECTIONAL AREA OF SEEPAGE METER 55 GALLON DRUM (CMS.^2)	K HYDRAULIC CONDUCTIVITY K=Q/IA (CMS./SEC)
SM-01							
SM-05	10.102	0.168	0.323 *2	9.84504	0.646	336.50	7.75E-04
SM-07							

NOTES: *1 DIFFERENCE IN HEAD WAS FOUND BY MEASURING THE HEIGHT OF WATER IN THE CLEAR TYGON TUBING, ATTACHED TO THE SEEPAGE METER, ABOVE (+) OR BELOW (-) THE SURFACE WATER-AIR INTERFACE IN FEET. THE HEAD DIFFERENCE IN FEET WAS THEN CONVERTED TO CENTIMETERS BY MULTIPLYING TIMES THE CONVERSION FACTOR 30.48.

*2 THE AVERAGE OF HEAD DIFFERENCES MEASURED BFORE AND IMMEDIATELY AFTER THE TEST

STREAM BED HYDRAULIC CONDUCTIVITY MEASUREMENTS

ROUND: II 10/01/91

MINI-PIEZOMETERS	Q FLOW INTO (-Q) FLOW OUT (+Q) OF MINI-PIEZOMETERS OR SEEPAGE METERS (CM^3/MINUTE)	Q FLOW INTO (-Q) FLOW OUT (+Q) OF MINI-PIEZOMETERS OR SEEPAGE METERS (CM^3/SEC)	L LENGTH OF SCREENED INTERVA (CMS.)	D DIAMETER OF SCREEN (CMS.)	H HEAD DIFFERENCE BETWEEN MINI-PIEZOMETER AND SURFACE WATER (FT.)	H HEAD DIFFERENCE BETWEEN MINI-PIEZOMETER AND SURFACE WATER (CMS.)	K HYDRAULIC CONDUCTIVITY (CMS./SEC)	K HYDRAULIC CONDUCTIVITY (FT./DAY)
MP-01			4.267	0.48				
MP-03			4.267	0.48				
MP-07			4.267	0.48				
MP-08			4.267	0.48				
MP-09			4.267	0.48				
MP-10			4.267	0.48				
MP-11			4.267	0.48				
MP-12	-7.305	-0.122	4.267	0.48	-0.703	-21.427	6.11E-04	1.73E+00

SEEPAGE METERS	Q FLOW INTO (-Q) FLOW OUT (+Q) OF MINI-PIEZOMETERS OR SEEPAGE METERS (CM^3/MINUTE)	Q FLOW INTO (-Q) FLOW OUT (+Q) OF MINI-PIEZOMETERS OR SEEPAGE METERS (CM^3/SEC)	H 1* HEAD DIFFERENCE (FT.)	H 1* HEAD DIFFERENCE FT. * 30.48CMS/FT. (CMS.)	I HYDRAULIC GRADIENT = H/15.24CMS. (CMS./CMS.)	A CROSS-SECTIONAL AREA OF SEEPAGE METER 55 GALLON DRUM (CMS.^2)	K HYDRAULIC CONDUCTIVITY K=Q/IA (CMS./SEC)	K HYDRAULIC CONDUCTIVITY (FT./DAY)
SM-01								
SM-05	10.102	0.168	0.323	9.84504	0.646	336.50	7.75E-04	2.20E+00
SM-07								

NOTES: *1 DIFFERENCE IN HEAD WAS FOUND BY MEASURING THE HEIGHT OF WATER IN THE CLEAR TYGON TUBING, ATTACHED TO THE SEEPAGE METER, ABOVE (+) OR BELOW (-) THE SURFACE WATER-AIR INTERFACE IN FEET. THE HEAD DIFFERENCE IN FEET WAS THEN CONVERTED TO CENTIMETERS BY MULTIPLYING TIMES THE CONVERSION FACTOR 30.48.

*2 THE AVERAGE OF HEAD DIFFERENCES MEASURED BFORE AND IMMEDIATELY AFTER THE TEST

B-6 FINAL GEOPHYSICAL SURVEY RESULTS

Geophysical Survey Results
Rose Hill Regional Landfill
Superfund Site
South Kingstown, Rhode Island

Gartner Lee

Subcontract No. 90-004609-023

Prepared by:

Gartner Lee, Inc.
105 Main Street
Niagara Falls, NY, 14303

Prepared for:

Metcalf & Eddy, Inc.
30 Harvard Mill Square
Wakefield, MA 01880

Project No. 91-804

January 22,1992

Distribution: Metcalf & Eddy, Inc. 8
File - 2

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Professional Services in Environmental Management

January 22, 1992

Ms. Deborah Simone
Project Manager
Metcalf & Eddy
P.O. Box 4043
Woburn, MA 01888-4043

Dear Ms. Simone:

Re: Geophysical Survey Results, Rose Hill Regional Landfill Superfund Site, South Kingstown, Rhode Island

We are pleased to forward you this report for the above noted investigation. The report contains the methodologies, results and conclusions of the geophysical surveys performed May 21st through June 13th. The geophysical survey data, presented in profile format, are located at the end of the report and are referenced to your base map.

At the request of Metcalf & Eddy, the original seismic refraction data results were re-processed and re-calibrated based upon additional borehole information gathered during a recent Metcalf & Eddy drilling program. The results of the re-calibrated seismic data are discussed in detail in Sections 1.0, 2.3, 3.4 and 4.4. The seismic refraction data indicates that bedrock topography is variable throughout the study area and appears to deepen towards the Saugatucket River.

On November 4th through 6th, 1991 Lines 4 through 25 were voluntarily re-surveyed at a 20 meter intercoil spacing with a Geonics EM34-3. The site was revisited as a result of a mechanical problem with the equipment that occurred during the initial survey. A discussion of the methodologies, results and conclusions of the EM34-3 survey are in Sections 1.0, 2.1.1, 3.1 and 4.1.

The EM 34-3 survey identified 20 anomalies that may be due to the presence of contaminated fill, soils or ground water. The anomalies are discussed in detail in Sections 3.1 and 4.1. The background values of apparent conductivity for the site were very low, between 0 and 2 milliSiemens per meter (mS/m). When the values of apparent conductivity are very low, error due to coil misalignment with the EM34-3 equipment can equal or exceed real changes in conductivities that may result from subsurface contaminants or stratigraphic/lithologic changes.

The VLF and near surface EM31-DL survey data are generally of good quality. VLF data were collected along three survey lines at the site and identified three anomalies that may be representative of north trending fracture zones or igneous intrusions (Section 4.3). The near surface EM31-DL survey was performed along two profile lines. The EM31-DL survey identified two anomalies that may represent contaminated soils, fill or ground water contamination (Section 4.2).

We trust this information is sufficient for your needs. We would like to take this opportunity to thank Metcalf & Eddy for involving us in this most interesting project. If there are any questions, please feel free to contact us.

Respectfully submitted,

GARTNER LEE, INC.

Thomas E. Jordan FOR

David D. Slaine, M.S., C.G.W.P.
Principal
Hydrogeologist/Geophysicist

TABLE OF CONTENTS

1.0 Introduction

On May 21st through June 13th, 1991, a geophysical investigation was performed at the Rose Hill Regional Landfill Superfund Site in South Kingstown, Rhode Island. The geophysical surveys included electromagnetic profiling (EM34-3, EM31 and VLF) and a seismic refraction survey.

All geophysical methods utilize interpretative techniques which can be significantly impacted by varying site conditions. EM and VLF anomalies can only be identified if they show recognizable patterns against data representative of background or natural conditions. Seismic data relies upon borehole or testpit control to interpret bedrock topography and overburden stratigraphy.

Upon completion of the geophysical surveys, limited borehole information was available for use to calibrate the seismic refraction data and interpret the EM data. The drilling data that did exist was generally of poor quality and somewhat suspect as depth to bedrock was not confirmed by obtaining core samples.

Upon completion of the geophysical investigation, Metcalf & Eddy installed monitoring wells and completed test borings at the site. Metcalf and Eddy then compared the additional borehole information to the results of the seismic refraction survey. It was determined that the additional borehole information could be used to re-calibrate the seismic refraction data. Metcalf & Eddy requested that Gartner Lee re-interpret the seismic data with the additional borehole information to attempt to achieve a more accurate profile of subsurface conditions. Gartner Lee re-interpreted the seismic refraction data and the revised data are presented herein.

The additional borehole information raised suspicions as to the validity of the 20 meter intercoil EM34-3 data collected on the eastern portion of the site. The initial interpretation of the EM data appeared to show a lithologic or stratigraphic change occurring at or near the Mitchel Brook stream valley. The results of the Metcalf and Eddy drilling program did not reveal a significant lithologic or stratigraphic change at the site. As a result, Gartner Lee voluntarily remobilized the site with an EM34-3 on November 4th through 6th, 1991. The site was revisited by Gartner Lee to test a hypothesis of possible mechanical problems with the EM equipment during the initial survey. The second EM survey revealed that a mechanical problem had occurred during the initial survey with the 20 meter cable. The anomalous areas were resurveyed at a 20 meter intercoil spacing and tied into the initial survey data. The results of the revised survey data are presented herein.

The following report discusses the methodologies, results and the conclusions of these three geophysical surveys.

1.1 Background Information

According to on-site Metcalf and Eddy personnel, the Rose Hill Regional Landfill Site is 70 acres in area. The site was previously utilized as a gravel quarry prior to initiation of landfill operations. Three closed landfills currently exist on the 70 acre site. These landfills are a solid waste landfill, a bulky waste landfill and a sewage sludge landfill.

The solid waste landfill is approximately 28 acres in area and accepted wastes from 1967 though 1983. The solid waste landfill is located along the western site boundary.

The bulky waste disposal area is approximately 11 acres in size and operated from 1978 to 1983. The bulky waste landfill is located in the southern portion of the site.

The limits of the sewage sludge landfill are currently unknown. The sewage sludge landfill accepted sludges from 1977 to 1983. The sewage sludge landfill was located in the northeast portion of the site.

The southern portion of the site is currently owned by the Town of South Kingstown which constructed and operates a waste transfer station on-site. The remaining area of the site is owned by a private citizen which operates a trap and skeet shooting facility and a hunting dog training facility.

1.2 Purpose and Scope

The purpose of the geophysical surveys were to:

- map conductive zones around the periphery of the waste sites that may be attributed to ground water contamination;
- delineate areas of fill;
- map major bedrock features; and
- map bedrock topography and where possible, overburden stratigraphy.

2.0 Methodologies

To meet the objectives of the investigation, Metcalf & Eddy requested an EM34-3 survey, an EM31-DL survey, a VLF survey and a seismic refraction survey to be completed at the site. Data for each geophysical technique were collected and presented as two-dimensional profiles. Geophysical survey line locations were determined by Metcalf & Eddy personnel prior to Gartner Lee mobilizing to the site. Gartner Lee adopted Metcalf & Eddy's nomenclature for referencing the site survey lines for the purpose of this report.

2.1 Electromagnetic (EM) Surveys

2.1.1 EM34-3 Survey

The EM-34-3 survey was performed along 27 profile lines (Lines 1 through 26, and S3) from May 22nd to June 13th, 1991. The site was re-visited on November 4th through 6th, 1991 to re-survey Lines 4 through 26 and S3 at a 20 meter intercoil spacing. Survey lines were cleared, staked and labelled by Metcalf & Eddy personnel at 100 foot increments.

Data were collected at 25 foot increments along profile lines 1 through 26, and S3 with a Geonics EM34-3 Terrain Conductivity Meter and solid state data logger. The EM34-3 device is equipped with a transmitter coil and a receiver coil that can be separated by 10, 20 or 40 meters intercoil spacings. Data were collected at the site with the coil's dipole oriented horizontally and vertically and at 10 and 20 meter intercoil separations.

The EM34-3 was used to measure the quadrature component of the electromagnetic field at each station. The quadrature component data are a measurement of the apparent ground conductivity collected in units of millisiemens per meter (mS/m). The quadrature component data are representative of changes in the electrical conductivity of pore fluids, the presence of buried metals and fills, changes in saturated soil types, changes in bedrock lithology, and the presence of saturated bedrock fractures.

The depth of investigation of the EM34-3 is dependant upon the coil's dipole orientation and the intercoil spacing. The effective depth of investigation with the dipoles oriented horizontally is equal to approximately 0.75 the intercoil separation. The effective depth of exploration with the dipoles oriented vertically is equal to approximately 1.50 times the intercoil spacing. The effective depths of exploration for the site survey is as follows:

- 10 meter intercoil spacing, horizontal dipole mode: surface to 7.5 meters.
- 10 meter intercoil spacing, vertical dipole mode: near surface to 15 meters.
- 20 meter intercoil spacing, horizontal dipole mode: surface to 15 meters.
- 20 meter intercoil spacing, vertical dipole mode: near surface to 30 meters.

Apparent conductivity data collected in the horizontal dipole configuration are more representative of near surface conditions than apparent conductivity collected in the vertical dipole configuration. Data collected in the horizontal dipole configuration are less sensitive to the presence of buried metals, vertical fractures and data collection error due to coil misalignment relative to data collected in the vertical dipole orientation.

The data were digitally recorded with a solid state data logger. The data logger was interfaced daily to a portable laptop computer and the data were transferred to a floppy disk for subsequent processing an interpretation.

The EM34-3 was mechanically and electronically nulled daily following procedures specified in the operations manual, however, data collected in May and June on the east side Mitchel Brook were not tied into data collected on the west side of Mitchel Brook. This resulted in a failure to identify an electrical problem after it had occurred in the 20 meter cable. The damaged cable resulted in the 20 meter data collected on the east side of Mitchel Brook to appear 20 to 30 mS/m above the values recorded west of Mitchel Brook. The 20 to 30 mS/m offset was initially attributed to a lithologic or stratigraphic change suspected to occur at or near the Mitchel Brook stream valley. The data became suspect after results of the Metcalf & Eddy drilling program became available and after speaking with Geonics, the equipment manufacturer. To examine the validity of the 20 meter intercoil data collected at the site, Gartner Lee voluntarily remobilized to Rose Hill in November and collected data along Lines 4 through 26 and Line S3. The data recorded in November demonstrated that the 20 meter cable was damaged and that the 20 meter data are similar on both sides of Mitchel Brook.

2.1.2 EM31-DL Survey

Data were also collected along survey lines S7 and Mitchel Brook (revised line 3) with a Geonics EM31-DL and solid state data logger. The Geonics EM31-DL has a fixed intercoil spacing of 3.67 meters. Quadrature and in-phase data were simultaneously collected at approximately 2.5 foot intervals with the dipoles oriented vertically along the two survey lines. The quadrature component data, as mentioned above, are a measurement of the apparent ground conductivity. Quadrature component data were collected in units of mS/m. The EM31-DL also records the in-phase component of the electromagnetic field measured in units of parts per thousand (ppt). The in-phase component data are susceptible to the presence of highly electrically conductive materials such as metals. All readings with the EM31-DL were taken with the instrument oriented parallel to the direction of travel, in the vertical dipole mode and with the instrument at waist height.

The EM31-DL was nulled prior to data collection following procedures specified in the operations manual. Readings were automatically stored in a solid state data logger during the survey. The data logger was interfaced to a portable computer and the data were transferred to a floppy disk for subsequent processing and interpretation.

Both EM34-3 and EM31-DL data were edited and analyzed utilizing the Geonics software package DAT34-3/DAT31Q and LOTUS 123. Data were then plotted and presented utilizing the Golden Software package GRAPHER. The EM34-3 data are presented as Figures 1 through 31. The EM31-DL data are presented as Figures 32 and 33.

2.2 Very Low Frequency (VLF) Survey

A VLF survey was performed along three survey lines designated VLF 1, 2 and 3 (EM survey Line 5, seismic Line 4 and EM Line 11). Data were collected at 12.5 foot station intervals with an ABEM Wadi VLF instrument. VLF surveying utilizes the magnetic components of the electromagnetic field generated by the VLF band (15 to 30 kHz) military navigation radio transmitters. Buried electrically conductive material locally affects the direction and strength of the VLF transmitter signal (primary field). A secondary field is generated around the buried conductor through electromagnetic induction.

The Wadi VLF meter measures and records the ratio (in percent) of the horizontal and vertical in-phase components of the total VLF field. This measurement is commonly referred to as the in-phase or real part data. The in-phase or real data is equivalent to tilt angle data which was measured by analog VLF meters. The device also measures and records the ratio (in percent) of the out-of-phase components of the total VLF field. This measurement is commonly referred to as the ellipticity, out-of-phase or imaginary data.

The depth of penetration with the Wadi VLF instrument is dependant upon the resistivity of the subsurface material and to a lesser extent the frequency of the VLF transmitter. As the resistivity of the subsurface increases (terrain conductivity decrease) the depth of penetration increases. For the terrain conductivities observed at the Rose Hill Landfill Site (approximately 3 to 20 mS/m or 330 to 50 ohm-meters) the estimated depth of penetration was approximately 30 to 70 meters. Below this depth at this specific site, the transmitted VLF signal becomes too weak to induce a secondary field around a conductive body.

The Wadi VLF device also applies a Hjelt filter to the tilt angle and ellipticity data and stores the data separately in the solid state memory. A Hjelt filter is similar to the more familiar Fraser filter in that it was designed to be used with data that exhibits cross over type responses. The Hjelt filter differs in that the filter attempts to determine current flow and distribution responsible for producing the measured magnetic field. The error introduced by this filter is believed to be less than 8%. The filtered in-phase or tilt angle data is equivalent to the current density. Filtered tilt angle data always exhibits a positive anomaly over a buried conductor. Filtered tilt angle anomalies tend to deviate from zero dependant upon conductivity and depth of burial. The filtered imaginary or ellipticity data can exhibit both positive and negative anomalies over a conductor. Filtered and unfiltered imaginary data are less dependant upon conductivity, shape and depth of burial. As a result, all interpretations were made based upon the filtered and unfiltered tilt angle data.

For identifying buried bedrock fractures, the fractures should approximately trend towards the transmitting station. A bedrock outcrop was visited north of the site along Highway 138. This outcrop exhibited northerly tending fractures. As a result, the VLF transmitter used for the Rose Hill Landfill survey was located in Cutler, Maine which transmits at a frequency of 24.0 kHz. An attempt was made to use a transmitting station located in Seattle, Washington to examine the presence of east-west trending steeply dipping fractures This attempt was unsuccessful due to low signal strength from the Seattle, Washington transmitter.

2.3 <u>Seismic Refraction Survey</u>

A 24 channel EG&G 2401 Digital Instantaneous Floating Point (DIFP) seismograph was utilized to collect seismic refraction data at the Rose Hill landfill Site.

Available site information, concerning depth to bedrock and overburden materials, suggested that a refraction survey would be the most suitable seismic technique to employ at the Rose Hill Landfill Site. Seismic data are collected by generating a shock wave and recording the travel time and amplitude of the wave at nearby locations. The shock wave travels downward into the earth and reflects/refracts back to surface off geologic strata. The amplitude of the returning signal is measured as a function of time with ultra-sensitive motion detectors (geophones), and transmitted through a cable to a digital recording device; a seismograph. After field acquisition of the data is completed, Gartner Lee utilized the General Reciprocal Method (GRM) of seismic refraction data analysis.

Seismic line locations were selected by Metcalf & Eddy to provide information on overburden stratigraphy and bedrock topography at the Rose Hill Landfill Site. A total of seven seismic lines were surveyed during the May/June work. These data were collected using a geophone spacing of 16 ft (5 meters). All data were collected using a single 14 Hz geophone per channel. A 10 pound sledge hammer and steel plate was used as the seismic source. For each shot, data were stacked from 1-5 times. "Stacking" of shots is used to improve the signal-to-noise ratio of the data. All shots were stacked until good "first breaks" were observed on the QA/QC printout of the seismograph. First breaks are the time of onset of the refracted wave arrival. The accurate measurement of these first break times is crucial for quality refraction analysis.

The data for the Rose Hill landfill were collected using 24 channels per seismic spread. Each spread was overlapped 4 geophones as the line progressed. For each spread, 9 shots were made at varying shot to geophone offsets. The far offset (typically 60 to 120 ft.) was chosen so that all first breaks measured for that shot were refractions off the bedrock interface. This was necessary to provide complete GRM coverage of the bedrock refractor. Data were collected and stored on a 24 channel engineering seismograph. Each evening, data were transferred to a lap top computer and backed up on floppy disks.

Due to the seismic noise caused by the transfer station located at the southern end of the site, long delays in seismic data collection were encountered waiting for noise levels to reduce such that data collection could commence. Twenty-four channel seismic data collection in the immediate vicinity of the transfer station was only possible during early morning hours and evening hours when the facility was closed.

At the completion of the survey, data were collected from shots along a "weathering spread". The weathering spreads were used to delineate the near surface velocity variations. The geophone spacing for the weathering spreads was approximately 3 feet (1 meter).

The first step in data interpretation involved selecting the "first break" arrival times from the seismic traces. These measurements represent the arrival times of the p-wave seismic energy refracted along layers exhibiting significant velocity contrast. From these data, the number and velocities of the subsurface layers are determined.

The GRM of analysis was used to convert the data from measurements of time to measurements of layer thickness. The GRM allows for the interpretation of data from a number of undulating refractors and was used to interpret the arrival times from each layer. The technique accepts variation in both the surface topography and the velocities of the upper layers.

Seismic data provides an estimation of layer thickness. The process of converting refraction arrivals in units of time (milliseconds) to depth (feet) has an approximate accuracy of $^{+}/-$ 15%. The lithologic interpretation is based upon seismic velocities correlated to geologic information obtained from borehole logs. Seismic profile data should be used as relative estimates to evaluate changes in overburden stratigraphy and bedrock topography between borehole locations.

Upon completion of the geophysical surveys, Metcalf and Eddy installed monitors and test borings at the site. The additional information obtained from the recent Metcalf and Eddy drilling program at the site was then used to re-calibrate the seismic data.

3.0 Results

3.1 EM34 Results

The EM34 survey was performed along 27 survey lines. The purpose of the EM34-3 survey was to identify areas of contaminated soils and fill materials and to identify the presence of groundwater contamination.

The EM results indicate that the soils and bedrock of the site are very resistive (low conductivities). Values of background apparent conductivity observed at the site were approximately between 0 and 2 mS/m. These values are indicative of coarse textured soils and/or granitic bedrock.

It should be noted that the vertical data for some of the profiles presented are erratic or "noisy" as a result of the presence of fill material or buried metals. Vertical dipole data can also appear noisy or erratic as this dipole orientation is more sensitive to coil misalignment.

The following is a discussion of pertinent physical features noted along each survey line and the annotated anomalies observed during the EM34 survey. It should be noted that anomalies annotated with a capital letter were observed when the dipoles were oriented horizontally and anomalies annotated with small case letters correspond to anomalies observed with the dipoles oriented vertically. An attempt was made to keep the vertical and horizontal scales equal for comparison purposes. Exceptions were made for lines that contained erratic or noisy data such as Lines 3, 4 and 14 as well as along extremely long survey lines such as the cumulative presentation of Lines 15 through 26.

Line 1 Horizontal Dipole Data (Figure 1)

Line 1 was located on the west side of Rose Hill Road on the west side of the site. Data were collected in a south to north direction. Dead trees were noted at station locations 175 to 200, 425, and 875 North. Overhead power lines were noted at locations 650 and 800. The presence of the overhead power lines may have resulted in some signal interference at these locations.

A water table measurement taken at the completion of test boring X-2 was approximately 26 feet. If the water table was approximately the same depth during the survey, the 10 m horizontal dipole readings would have been performed in mostly unsaturated overburden. Anomalies observed during data collection in the 10 meter horizontal dipole mode are probably indicative of stratigraphic changes and possibly the presence of fill materials at this survey line location.

Background apparent conductivities were approximately 2 mS/m and were observed along the southern and northern extents of the line. The following anomalies were observed:

(A) An anomaly of approximately 3 mS/m above background was noted in the 20 meter horizontal dipole data. A slight increase in elevation was noted at this location. A dead tree was also noted at this location. This anomaly may be due to the presence of ground water contaminants or a stratigraphic change.

(B) An above background anomaly of approximately 2 to 3 mS/m above background was noted in the 10 and 20 meter horizontal dipole data. Overhead power lines were noted in the vicinity and may have contributed to the observed response. This anomaly may be due to the presence of overhead power lines, a stratigraphic change or the presence of subsurface contaminants.

(C) An anomaly of approximately 2 mS/m above background was noted in the 10 meter horizontal dipole data. An anomaly of approximately 2 mS/m below background was noted in the 20 meter horizontal dipole data. Dead oak trees were noted in the vicinity of this anomaly. This anomaly may represent an area of near surface fill or a stratigraphic change.

(D) A broad anomaly of approximately 3 mS/m above background was noted in the 10 and 20 meter horizontal dipole data. This anomaly may represent the presence of contaminated soils, contaminated ground water or a stratigraphic change.

Line 1 Vertical Dipole Data (Figure 2)

(a,b) Anomalies "a" and "b" were observed in the vicinity of overhead power lines. The presence of the power lines are probably responsible for the erratic response observed at these locations.

(c) A relatively high apparent conductivity anomaly, approximately 6 mS/m above background, was noted at this location in the 20 meter vertical dipole mode. This anomaly may be due to the presence of a buried conductor.

(d) Anomaly "d" was a low apparent conductivity anomaly approximately 2 to 5 mS/m above background that corresponds to the anomaly D of Figure 1.

(e) Anomaly "e" was observed as a apparent conductivity low. A house was noted in the vicinity of this anomaly as well as a mail box. This anomaly may represent a stratigraphic change or noise due to surface anthropogenic features.

Line 2 Horizontal Dipole Data (Figure 3)

Line 2 was located on the southwest side of the site, south of the transfer station access road. Data were collected in a hummocky and wooded area. During data collection, surface debris were noted along the survey line. During the planting of geophones for the seismic refraction survey, plastic and paper debris were unearthed. Data were collected west to east.

(A) Anomaly "A" was approximately 3 to 5 mS/m above background and was noted in the 10 and 20 meter horizontal dipole data. This anomaly corresponded with a decrease in surface elevation. This anomaly may represent a change in topography, stratigraphy or the presence of fill.

Line 2 Vertical Dipole Data (Figure 4)

(a,b) These apparent conductivity lows were observed in the vicinity of surface debris. The erratic responses observed at these locations are probably due to the presence of fill and metallic debris.

Line 3 Horizontal Dipole Data (Figure 5)

Data were collected at Line 3 along the northern toe of the solid waste landfill. An anomaly of approximately 20 to 50 mS/m above background was observed at this location that probably represents the presence of contaminated fill and buried metals. Prior to performing the EM survey, it was thought that survey Line 3 was not located on fill material.

As a result of Line 3 being located on conductive fill material, 20 meter dipole data were not collected. A topographic expression marking the apparent eastern extent of the landfill was noted at 475 east. Dead trees were noted north of Line 3 between 125 and 325 east. A crushed 55-gallon drum was noted at location 425 east. Near background values were noted at the end of the line.

(A) Anomaly "A" was located between location 0 east and 525 east and likely represents the presence of contaminated fill. The erratic response observed in the vertical dipole data suggests that the fill may contain buried metals.

Line 3 Vertical Dipole Data (Figure 6)

(a,c) Anomalies "a" and "c" are approximately 10 to 20 mS/m below background. These apparent conductivity lows probably represents contaminated fill materials with associated buried metals.

(b) Anomaly b, (approximately 50 mS/m below background) is an apparent conductivity low which represents buried metals or other highly conductive materials.

Line 4 Horizontal Dipole Data (Figure 7)

Line 4 was located near the north eastern corner of the solid waste landfill. Above background data was observed along Line 4 suggesting that it was located on or near the toe of the landfill.

(A) Anomaly "A", was a relatively high apparent conductivity anomaly in the 10 meter intercoil spacing and a conductivity low and 20 meter intercoil spacing, probably represents the presence of contaminated fill material buried within the toe of the solid waste landfill. The erratic noisy response observed in the vertical dipole mode (Figure 8) at this location supports the hypothesis of the presence of contaminated fill with associated buried metals.

(B) Anomaly "B", a broad 10 and 20 meter intercoil spacing apparent conductivity high, may represent an area of contaminated fill or ground water contamination. The erratic noisy response observed in the vertical dipole mode (Figure 8) at this location supports the hypothesis of the presence of contaminated fill with associated buried metals. The response may have also been affected by the presence of the landfill located to the west of the survey line.

Line 4 Vertical Dipole Data (Figure 8)

(a,b) Erratic, noisy responses were observed in both the 10 and 20 meter intercoil spacings. This response is often indicative of the presence of fill material with associated buried metals.

Line 5 Horizontal Dipole Data (Figure 9)

Line 5 data were collected in-between the solid waste landfill and the bulky waste landfill in what appears to be an eroded stream valley that now contains Mitchel Brook. A regional trend of decreasing apparent conductivity values was observed from south to north. This decreasing trend may represent increasing elevation. A swampy area was noted along the south of the survey line and Mitchel Brook was crossed twice during the Line 5 survey.

(A,B) Anomalies "A" and "B" were observed south and north of Mitchel Brook, respectively. Both anomalies were observed at a 10 meter intercoil spacing. Anomaly A was observed near a swampy area in the vicinity of Mitchel Brook and may represent the presence of porous near surface organic sediments. Anomaly B was observed along the north bank of Mitchel Brook and may represent the presence of near surface fill material.

(C) Anomaly "C" was a narrow high 20 meter intercoil spacing response. This anomaly was measured while the receiver was in a small ravine (approximately 8 feet deep). As this anomaly is defined by only one data point and only in the 20 meter intercoil spacing, it probably represents an error in coil alignment due to steep topography in the ravine.

(D) Anomaly "D" was observed in the 10 and 20 meter intercoil spacings. This nomaly was observed north of a paved access road in the vicinity of Mitchel Brook. This anomaly may represent the presence of fill or a change in topography.

(E) Anomaly "E" was observed as a narrow high response in the 10 meter intercoil spacing data. This anomaly was observed near the banks of Mitchel Brook. As this anomaly is defined by only one data point and only in the 10 meter intercoil spacing, it probably represents an error in coil alignment due to steep topography.

Line 5 Vertical Dipole Data (Figure 10)

(a,b) Anomalies "a" and "b" were observed as conductivity lows in the 20 meter intercoil data. These anomalies were observed in the vicinity of the banks of Mitchel Brook and may represent topographic changes or coil misalignment due to steep topography.

Line 6 Horizontal and Vertical Dipole Data (Figures 11 and 12)

Line 6 was located on the west side of the bulky waste landfill. The survey line was located in a wooded area. A soil mound was observed at the southern extent of the survey line.

(A,a) Anomalies "A" and "a" were conductivity lows which were observed in the 10 meter horizontal and vertical intercoil data. These anomalies may represent buried metallic debris. A soil mound was noted in the vicinity of these anomalies.

Line 7 Horizontal and Vertical Dipole Data (Figures 13 and 14)

Line 7 was located on the northwest side of the bulky waste landfill. Line 7 was located in an area vegetated with grasses and brush. The following anomaly was observed.

(A,a) Anomalies "A" and "a" were narrow apparent conductivity lows observed in the 10 meter horizontal and vertical data. These anomalies may represent an area of fill that contains metallic debris.

Line 8 Horizontal and Vertical Dipole Data (Figures 15 and 16)

Line 8 was located on the west side of the sewage sludge landfill. The following anomalies were observed.

(A,a) Anomalies "A" and "a" were narrow apparent conductivity highs that may be representative of a pocket of fill material or coil misalignment.

Line 9 Horizontal and Vertical Data (Figures 17 and 18)

Line 9 was located on the north side of the sewage sludge landfill. A regional trend of increasing apparent condictivities was noted in the vertical data as the survey trended east. This regional trend may be representative of a decrease in elevation.

Line 10 Horizontal and Vertical Data (Figures 19 and 20)

Line 10 was located on the northeast corner of the sewage sludge landfill. A regional trend of increasing apparent conductivities was observed that may represent a decrease in elevation. The following anomaly was observed.

(A) A noisy response was observed in the 10 meter horizontal data. This response may represent the presence of near surface fill material.

Line 11 Horizontal Dipole Data (Figure 21)

Line 11 was located on the east side of the sewage sludge landfill in a wooded area. The following anomalies were observed.

(A) Anomaly "A" was a broad, low frequency anomaly that may represent a stratigraphic change or the possible presence of fill, or the presence of contaminated ground water. This anomaly is observed in both the 20 meter horizontal and 10 meter vertical intercoil spacing data.

(B) Anomaly "B" was a high frequency apparent conductivity low observed in the 10 meter data. This anomaly may represent the presence of near surface fill containing metals or represents coil misalignment.

Line 11 Vertical Dipole Data (Figure 22)

(a) Anomaly "a" was observed in the 10 meter data as a narrow apparent conductivity high. This anomaly may be the result of poor alignment of the transmitter and receiver coils due to topography or the presence of fill material.

(b) Anomaly "B" was associated with anomaly "A" (Figure 21). This anomaly may represent a stratigraphic change, the presence of fill or the presence of contaminated ground water.

Line 12 Horizontal and Vertical Data (Figures 23 and 24)

Line 12 was located along the eastern side of the bulky waste landfill. Due to the close proximity of the eastern toe of the landfill to the survey line, some signal interference may have occurred especially as the intercoil spacings were increased to 20 meters. The following anomalies were observed.

(A,B,a) Anomalies "A", "B" and "a" were observed along Line 12. These anomalies may represent the survey lines close proximity to the bulky waste landfill or the presence of contaminated soils or ground water. A gradual decrease in apparent conductivity was also observed as the line proceeded north and may represent an increase in elevation.

Line 13 Horizontal and Vertical Data (Figures 25 and 26)

Line 13 was located on or near the southern toe of the bulky waste landfill. The presence of the landfill may have caused signal interference. The following anomalies were observed.

(A,B,a) Anomalies "A", "B" and "a" may represent an area of fill, contaminated soils and/or contaminated ground water. The erratic, noisy response noted in the vertical dipole mode suggests the presence of fill at or near the survey line with associated buried metals.

Line 14 Horizontal Data (Figure 27)

Line 14 was located on and near the southern toe of the bulky waste landfill. The toe of the landfill appeared to topographically end at, or near station 250 east. The following anomalies were observed.

(A) Anomaly "A" is a broad conductivity high that may represent an area of contaminated soils and fill. The erratic response observed in the vertical data suggests the presence of fill with buried metals.

Line 14 Vertical Data (Figure 28)

(a, b) Anomalies "a" and "b" are believed to be representative of fill with associated buried metals.

Lines 15 though 26 Horizontal Data (Figure 29)

Lines 15 through 26 were located in fields and wooded areas on the east side of the Saugatucket River.

(A) Anomaly "A" was observed in the vicinity of a wire fence. This anomaly may have been caused by a the presence of metal in a wire fence.

Lines 15 through 26 Vertical Data (Figure 30)

(a) Anomaly "a" was a conductivity low probably due to the presence of a power line observed south of this location.

Line S3 Horizontal Data (Figure 31)

Line S3 trended east from the eastern toe of the solid waste landfill to the western toe of the bulky waste landfill. The following anomalies were observed.

(A, B) Anomalies "A" and "B" represent the approximate extent of contaminated fill at the solid waste and bulky waste landfills respectively.

Line S3 Vertical Data (Figure 32)

(a,b) Anomalies "a" and "b" represent the approximate extent of fill at the solid waste and bulky waste landfills, respectively.

3.2 EM31-DL Results

Stream Survey, Mitchel Brook (Figure 33)

Due to the presence of fill materials along EM Line 3, a secondary line was chosen north of the solid waste landfill that followed the stream bottom of Mitchel Brook. Iron stained soils were observed in the vicinity of Mitchel Brook that were thought to represent leachate seeps or the presence of near surface contamination. In order to map these possible near surface contaminants, an EM31-DL survey was requested. Background values of apparent conductivity were approximately 1 to 2 mS/m at this location. The following anomalies were observed.

(A) Anomaly "A", a broad apparent conductivity high that was 1 to 3 mS/m above background readings, may represent an area of soil or ground water contamination. This anomaly may also represent a near surface stratigraphic change.

(B) Anomaly "B", a negative apparent conductivity, probably represents the presence of metallic debris. An above background in-phase response was also observed at this location.

(C) Anomaly "C", a negative apparent conductivity and in-phase response is probably due to the presence of metals in a bridge located at the end of the survey line.

Line S7 (Figure 34)

It was noted during the seismic survey that iron stained soils, possibly due to leachate seeps, were present along the swampy, northern extent of the survey line. While the EM31-DL equipment was available on-site, Gartner Lee volunteered to perform a survey along seismic survey line S7. The EM31-DL survey was performed to further define the presence of possible near surface contaminants. The following anomalies were observed.

(A) Anomaly "A" was located along the northern area of the survey line in a swampy topographic low area. This anomaly may correspond to a decrease in elevation and the presence of near surface ground water contamination.

3.3 VLF Results

The VLF survey was performed along three survey lines designated VLF 1, VLF 2 and VLF 3. The purpose of the VLF survey was to identify the presence of steeply dipping bedrock fractures that may act as preferential pathways for contaminant migration. Two plots were constructed for each profile line. These plots consist of (1) unfiltered tilt angle and unfiltered ellipticity data; and (2) filtered tilt angle and filtered ellipticity data. All data are presented in units of percent. The following are the results of the survey.

Line VLF 1 (Figures 35 and 36)

Survey Line VLF 1 was located in the Mitchel Brook stream valley that separates the sanitary landfill and the bulky landfill. The following anomalies were observed:

(A, B, C) Anomalies "A", "B" and "C" may represent steeply dipping fractures or dipping conductive intrusions that trend northwards. Anomaly B appears to correlate to the EM34-3 anomaly "D" of Figure 9.

Line VLF 2 (Figure 37 and 38)

Survey line VLF 2 was a west-east trending survey line that was located along seismic Line S4. This survey line was located north of the bulky waste area. The following anomaly was observed.

(A) Anomaly "A", represented as a strong positive peak in the filtered data, may represent a steeply dipping bedrock fracture or conductive igneous intrusion.

Line VLF 3 (Figures 39 and 40)

There were not any VLF anomalies observed at this line location.

3.4 Seismic Refraction Results

Results are presented in the form of depth profiles denoting velocity contrasts in the subsurface. These have been corrected for near surface variations in velocity and variations in surface elevations. Surface elevations are referenced to a surveyed elevation of 64.27 feet above sea level at the 0+00 stake of Seismic Line 2. A total of seven seismic lines were surveyed at the Rose Hill Landfill Site. The locations of these lines are shown on Plate 1. The seismic depth sections are presented in Figures 41 through 48. Our interpretations indicate that bedrock topography, depicted with arcs on Figures 41 through 48, is variable across the study area. In general, bedrock appears to deepen to the east of the site towards the Saugatucket River.

Initial interpretation of the seismic data indicated three refracting layers, interpretted as unsaturated overburden, saturated overburden, and bedrock. The unsaturated overburden layer was initially interpretted as being a uniformly thin (5 to 10 ft.) low velocity layer. Subsequent borehole data provided by Metcalf & Eddy,Inc. indicated discrepancies in the depth to bedrock determined through analysis of the seismic data. This difference was most notable in the northeast portion of the study area. As a result of this discrepency, the seismic data were re-interpretted utilizing the borehole data. The re-interpretation indicated that in the northeast portion of the site, four refracting layers could be distinguished: (1) a near surface, loose, unsaturated, low velocity layer: (2) an unsaturated overburden layer: (3) a saturated overburden layer; and (4) bedrock. The initial interpretation grouped layers (1) and (2) together, which resulted in an underestimation of the depth to the water table and bedrock. Since the water table in the northeast portion of the site is relatively deep (> 20 ft.) a careful review identified refractions from the unsaturated sands and silts of layer (2) on several geophone channels. Where the water table was shallow it was not possible to identify and separate layers (1) and (2). The geophone spacing was not short enough to record arrivals from these shallow, thin layers. Data from the "short spreads" (1 meter geophone spacing) were utilized to determine an average velocity for these near surface layers and this velocity was used for depth calculations along Seismic Lines S1, S2, S3, and S7.

Figures 41 through 48 present the results of the seismic survey. Three layers were interpretted on Lines S1, S2, S3, and S7. On Lines S4, S5, and S6 it was possible to distinguish four layers. Boreholes, in the vicinity of the seismic lines, as well as seismic tie locations, are plotted on the figures where appropriate. For the four layer case, the following approximate velocities observed were:

Layer 1	150 - 300 m/s	loose, slow, unsaturated overburden;
Layer 2	450 - 750 m/s	unsaturated overburden;
Layer 3	1300 - 1700 m/s	saturated overburden;
Layer 4	3800 - 4500 m/s	bedrock.

For the three layer case, the following approximate velocities observed were:

Layer 1	250 - 500 m/s	unsaturated overburden;
Layer 2	1300 - 1700 m/s	saturated overburden;
Layer 3	3800 - 4500 m/s	bedrock.

It is likely that if a weathered bedrock zone exists above competent bedrock, the depths interpreted from a seismic refraction survey would represent the competent bedrock.

It should be noted that irregular surface topography at the Rose Hill Landfill Site adversely affected the definition of the bedrock refractor. Surface layers have low velocities relative to the bedrock velocity. Variations in the thicknesses or velocities in these shallow layers produce time anomalies which are much greater than anomalies produced by similar variations in bedrock topography. For unsaturated overburden and bedrock velocities of 300 m/s and 4200 m/sec respectively, a change in thickness/elevation of the overburden of 1 meter corresponds to a 6.6 millisecond time anomaly. This same time anomaly, if interpreted as a change in bedrock topography, would correspond to a 13.9 meter apparent change in bedrock topography. However, for this survey, this possible source of error was minimized as follows:

- by collecting data from weathering spreads along lines to identify near surface velocity variations;

- by surveying the elevations of seismic lines; and

- and thorough interpretation and comparison of multiple forward and reverse shots using the Generalized Reciprocal Method (GRM) of seismic refraction interpretation.

4.0 Conclusions

4.1 EM34-3 Data

Values of apparent conductivity at the Rose Hill Site were very low (very resistive). When the values of apparent conductivity are low, error due to coil misalignment can equal or exceed small changes in apparent conductivity values, which could possibly be representative of the presence of low levels of contaminants or stratigraphic/lithologic change. Geophysical equipment other than that requested in the work plan may have been better suited for mapping the resistive subsurface conditions observed at the Rose Hill Site. This equipment includes, VLF resistivity and/or Ground Penetrating Radar (GPR) profiling. The extremely resistive soils and bedrock at the site would have been conducive for a GPR survey. A GPR survey may have helped identify the presence of boulders, the water table, fill and possibly provided supplimental data of the bedrock topography.

A general regional trend of decreasing apparent conductivities was observed as survey lines trended north. This trend is believed to be due to the northward increase in elevation at the site. No attempt was made to remove this regional trend from the data by applying a low cut filter as the trend was felt to be of minor importance.

Several areas of broad, above background anomalies were identified at the site that can be representative of stratigraphic change, topographic change or the presence of contaminated ground water or soils were observed at the site. The following anomalous areas were identified in the 10 and 20 meter horizontal dipole data that may represent areas of contaminated fill, soils and/or ground water.

Line 1, Anomalies A & D (Figure 1)
Line 2, Anomaly A (Figure 3)
Line 3, Anomaly A (Figure 3)
Line 4, Anomalies A & B, (Figure 7)
Line 5, Anomaly D (Figure 9)
Line 6, Anomaly A (Figure 11)
Line 7, Anomaly A (Figure 13)
Line 8, Anomalies A & B (Figure 15)
Line 10, Anomaly A (Figure 19)
Line 11, Anomaly A (Figure 21)
Line 12, Anomalies A & B (Figure 23)
Line 13, Anomalies A & B (Figure 25)
Line 14, Anomaly A (Figure 27)
Line S3, Anomalies A & B (Figure 31)

4.2 EM31-DL Data

The EM31-DL survey identified two areas of broad, above background quadrature component anomalies. These anomalies are inferred to represent areas of near surface soil and/or ground water contamination. These areas were located north of the solid waste landfill and south of the bulky waste landfill. The following anomalies were observed.

Stream Survey, Mitchel Brook, Anomaly A (Figure 33)

Line S7, Anomaly A (Figure 34)

4.3 VLF Data

The VLF data identified several conductive anomalies that may represent large fracture zones or conductive intrusions in the bedrock. The following anomalies were observed:

Line VLF 1, Anomalies A and B (Figures 35 and 36)

Line VLF 2, Anomaly A (Figures 37 and 38)

4.4 Seismic Refraction Data

The seismic refraction surveys at the Rose Hill Landfill Site appear to have been successful at delineated relative changes in bedrock topography along the profile lines.

Our interpretations indicate that bedrock topography is variable beneath the seismic lines. Bedrock appears to deepen to the east of the site towards the Saugatucket River.

Relative changes in bedrock topography interpreted along profile lines is believed to be representative of true, competent bedrock topography.

We would like to thank Metcalf & Eddy, Inc. for involving our firm in this most interesting study. If you have any questions, please do not hesitate to contact our office at (716) 285-5448.

Respectfully submitted,

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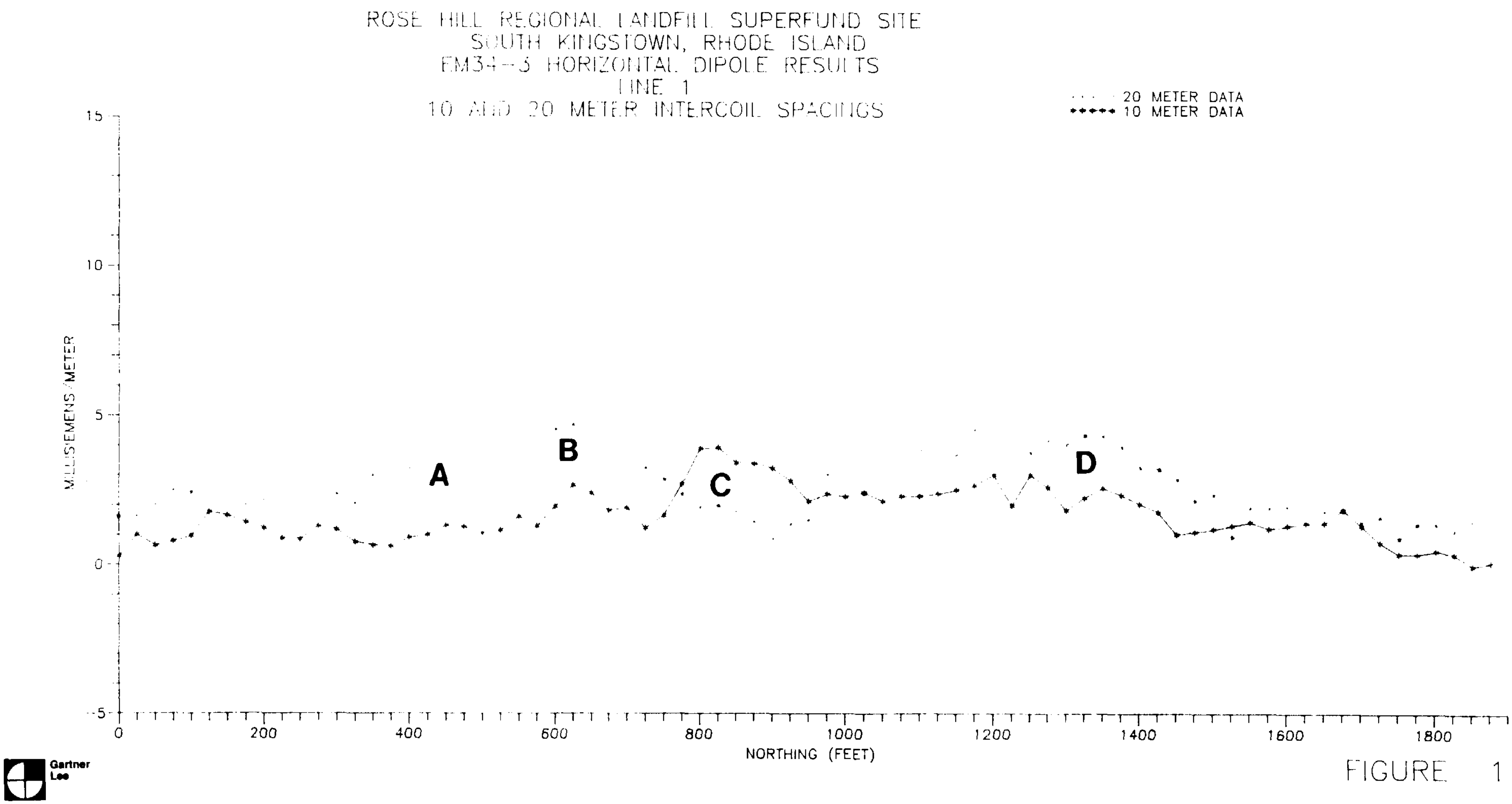
TEJ/DDS:pmk

FIGURES


ROSE HILL REGIONAL LANDFILL SUPERFUND SITE
SOUTH KINGSTOWN, RHODE ISLAND
EM34-3 HORIZONTAL DIPOLE RESULTS
LINE 1
10 AND 20 METER INTERCOIL SPACINGS
20 METER DATA
10 METER DATA
A
B
C
D
MILLISIEMENS/METER
15
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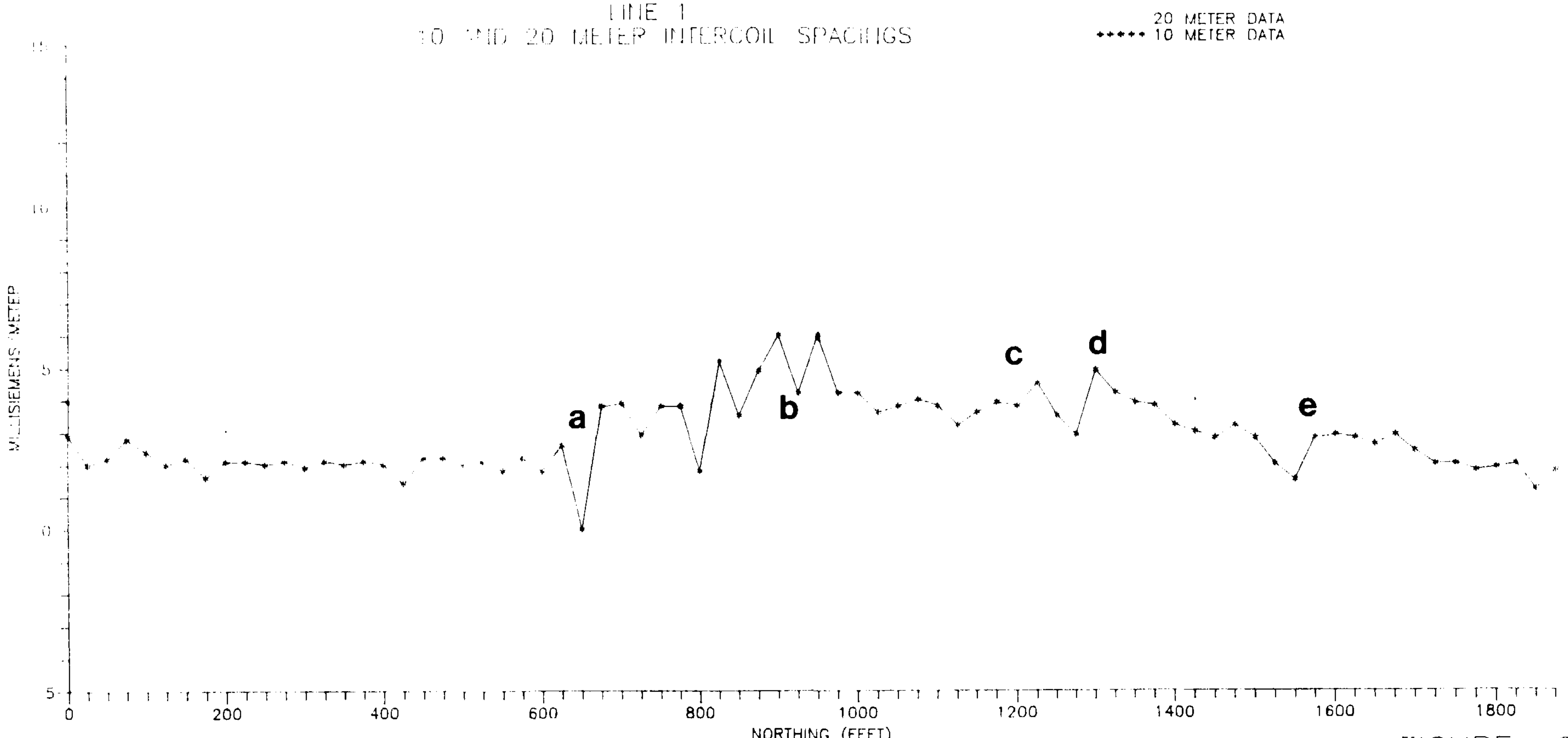
NORTHING (FEET)
Gartner Lee
FIGURE 1

ROSE HILL REGIONAL LANDFILL SUPERFUND SITE
SOUTH KINGSTOWN, RHODE ISLAND
EM34-3 VERTICAL DIPOLE RESULTS
LINE 1
10 AND 20 METER INTERCOIL SPACINGS



Gartner Lee

FIGURE 2

ROSE HILL REGIONAL LANDFILL SUPERFUND SITE
SOUTH KINGSTOWN, RHODE ISLAND
EM34-3 HORIZONTAL DIPOLE RESULTS
LINE 2
10 AND 20 METER INTERCOIL SPACINGS

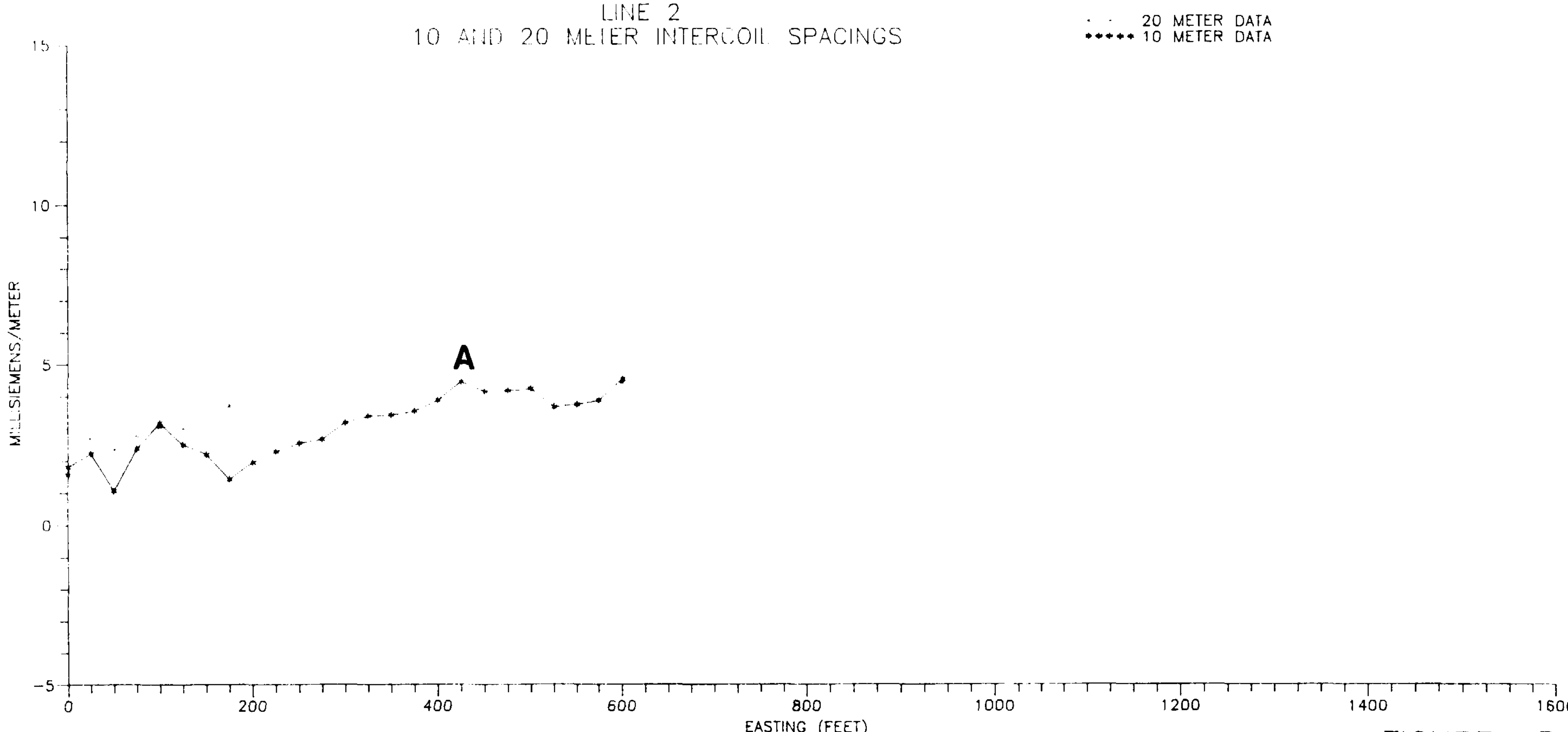


FIGURE 3

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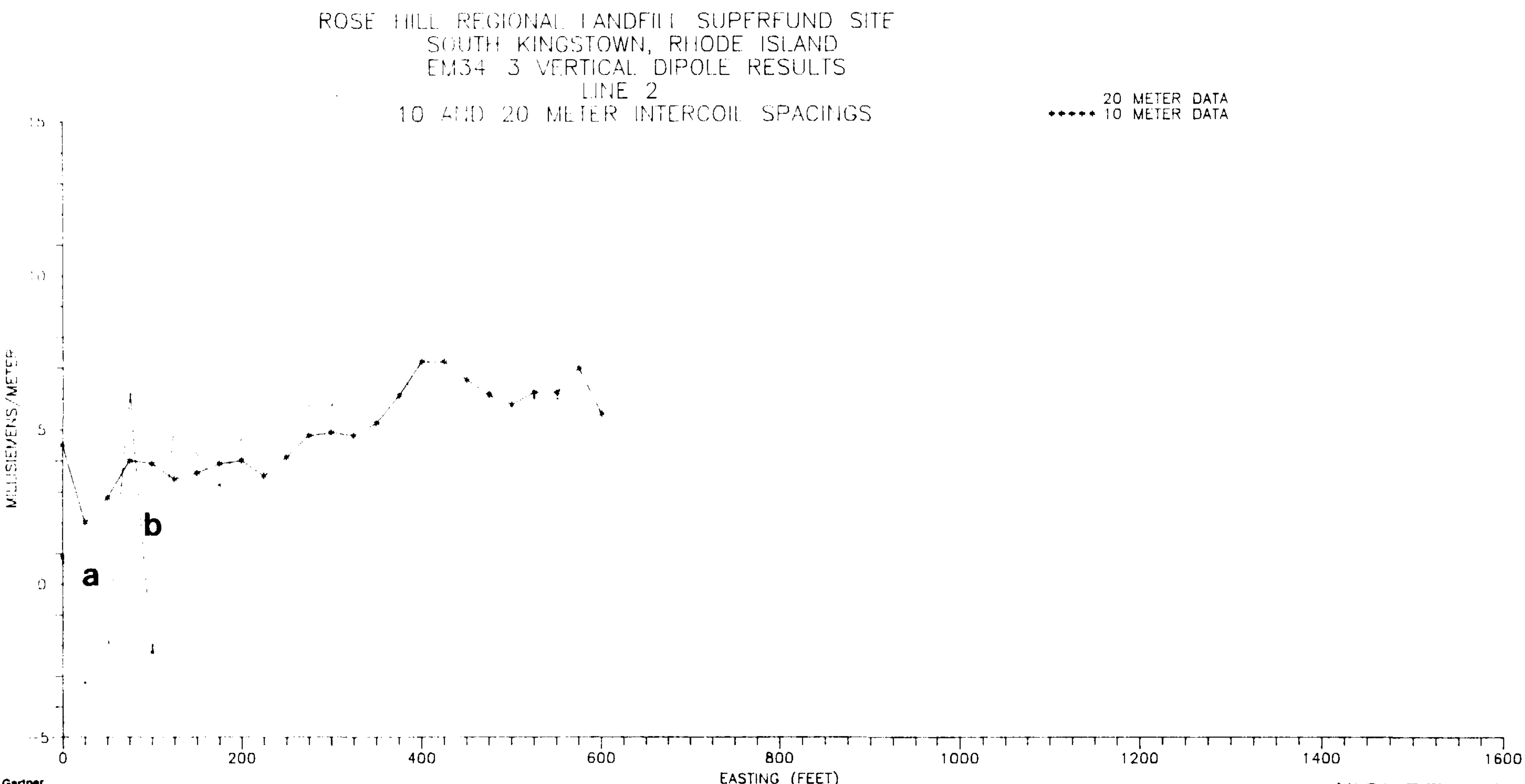
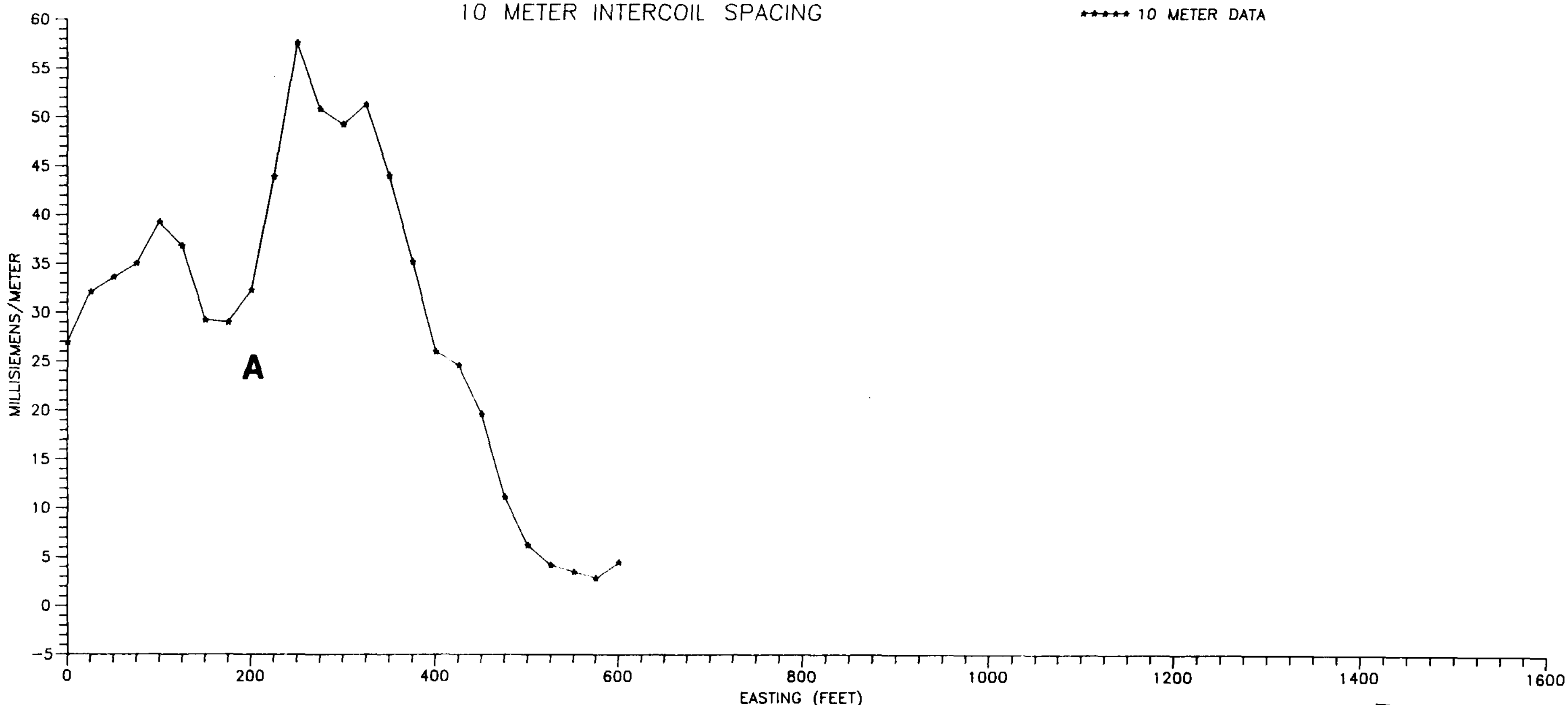

ROSE HILL REGIONAL LANDFILL SUPERFUND SITE
SOUTH KINGSTOWN, RHODE ISLAND
EM34 3 VERTICAL DIPOLE RESULTS
LINE 2
10 AND 20 METER INTERCOIL SPACINGS
20 METER DATA
10 METER DATA
MILLISIEMENS/METER
5
0
-5
a
b
0
200
400
600
800
1000
1200
1400
1600
EASTING (FEET)

FIGURE 4

ROSE HILL REGIONAL LANDFILL SUPERFUND SITE
SOUTH KINGSTOWN, RHODE ISLAND
EM34-3 HORIZONTAL DIPOLE RESULTS
LINE 3
10 METER INTERCOIL SPACING



Gartner Lee

FIGURE 5

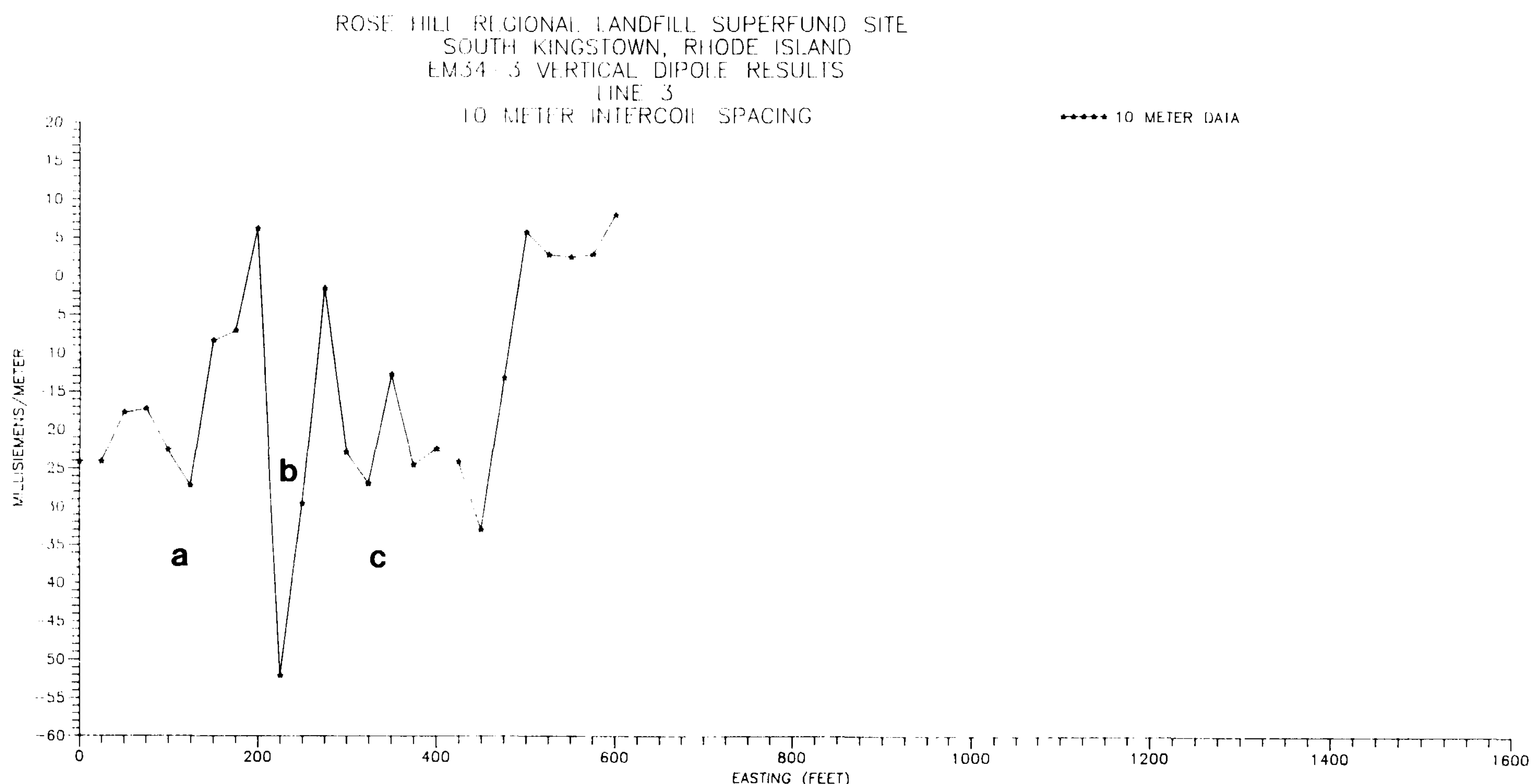

ROSE HILL REGIONAL LANDFILL SUPERFUND SITE
SOUTH KINGSTOWN, RHODE ISLAND
EM34-3 VERTICAL DIPOLE RESULTS
LINE 3
10 METER INTERCOIL SPACING
10 METER DATA
MILLISIEMENS/METER
20
15
10
5
0
-5
-10
-15
-20
-25
-30
-35
-40
-45
-50
-55
-60
a
b
c
0
200
400
600
800
1000
1200
1400
1600
EASTING (FEET)

FIGURE 6

ROSE HILL REGIONAL LANDFILL SUPERFUND SITE
SOUTH KINGSTOWN, RHODE ISLAND
EM34-3 HORIZONTAL DIPOLE RESULTS
LINE 4
10 AND 20 METER INTERCOIL SPACINGS

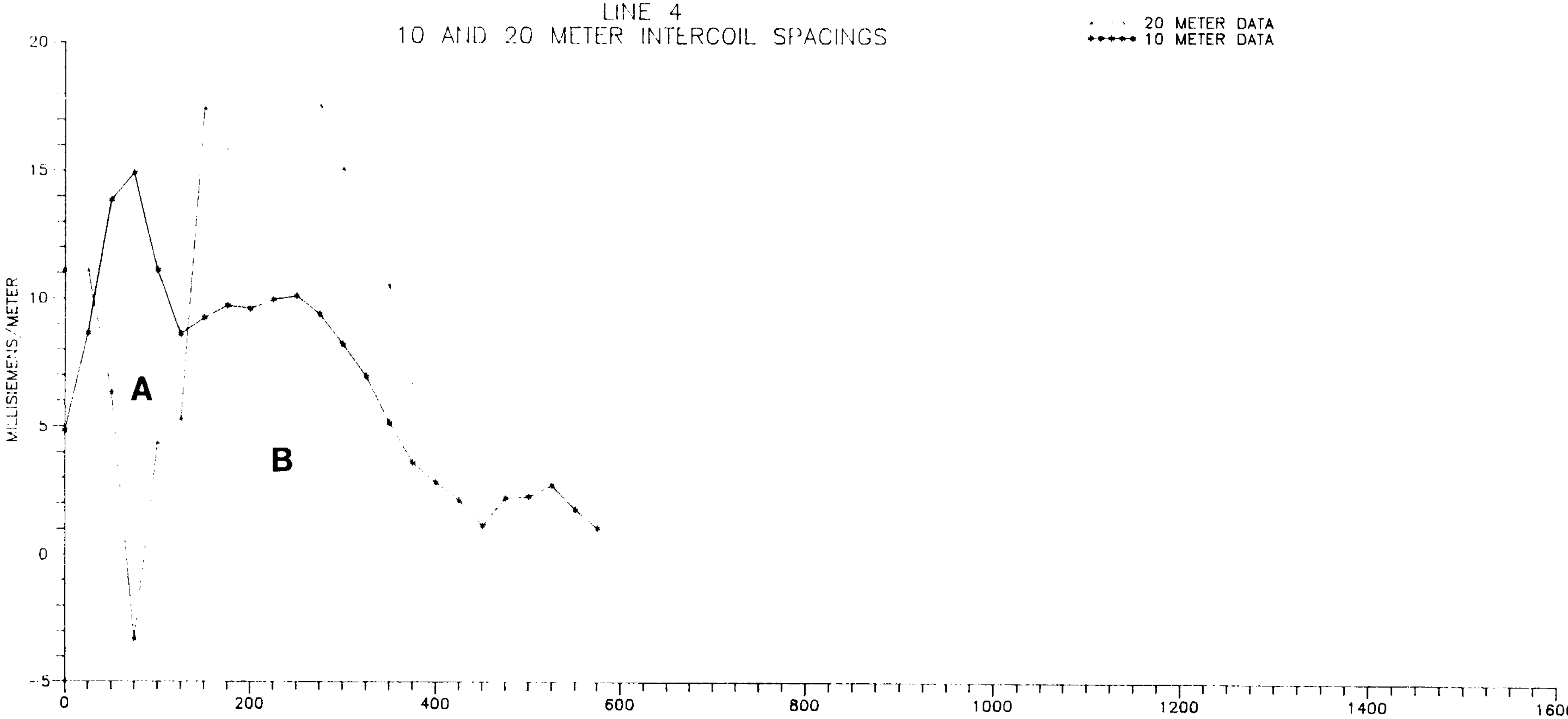


FIGURE 7

Gartner Lee

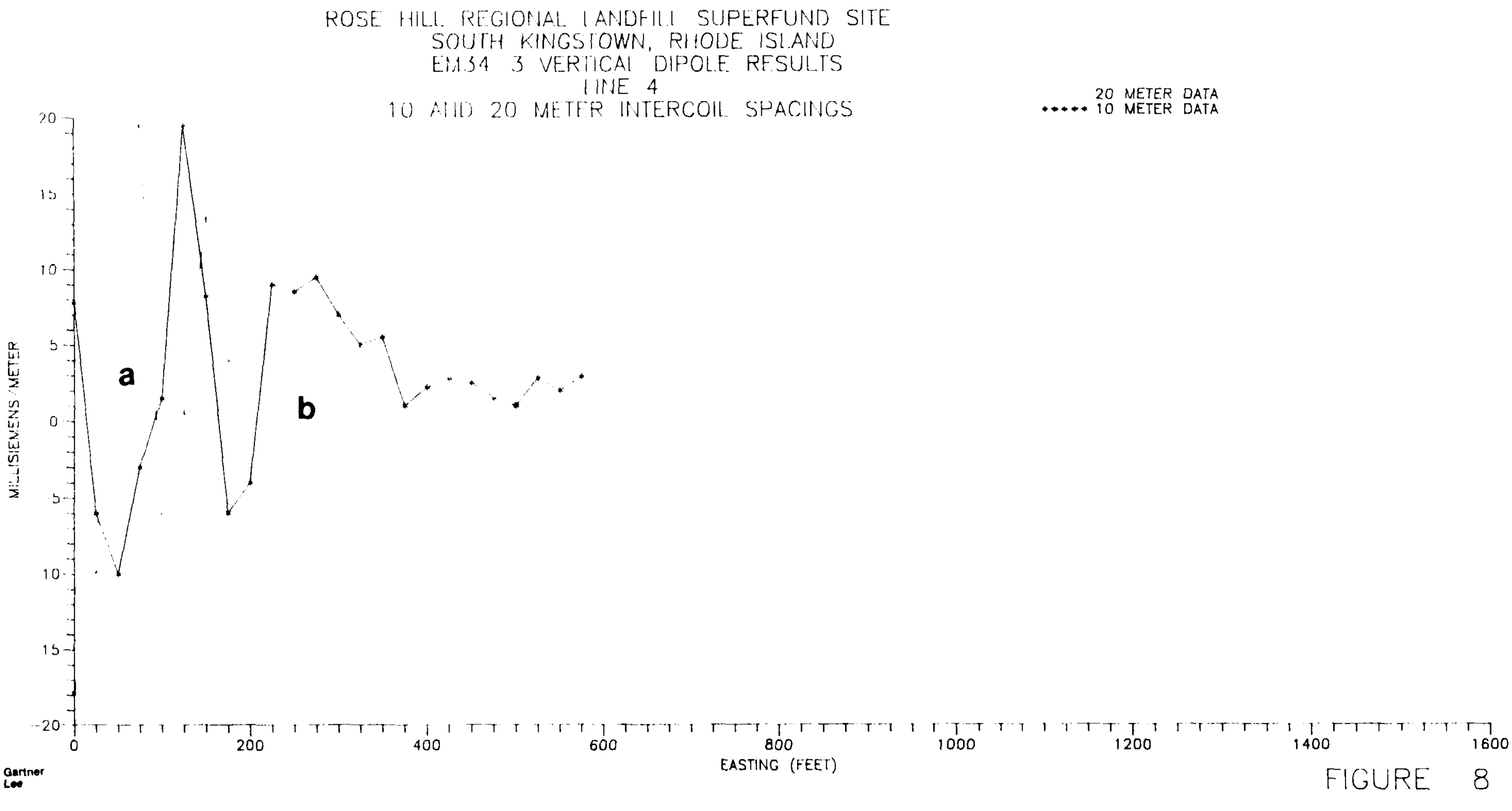
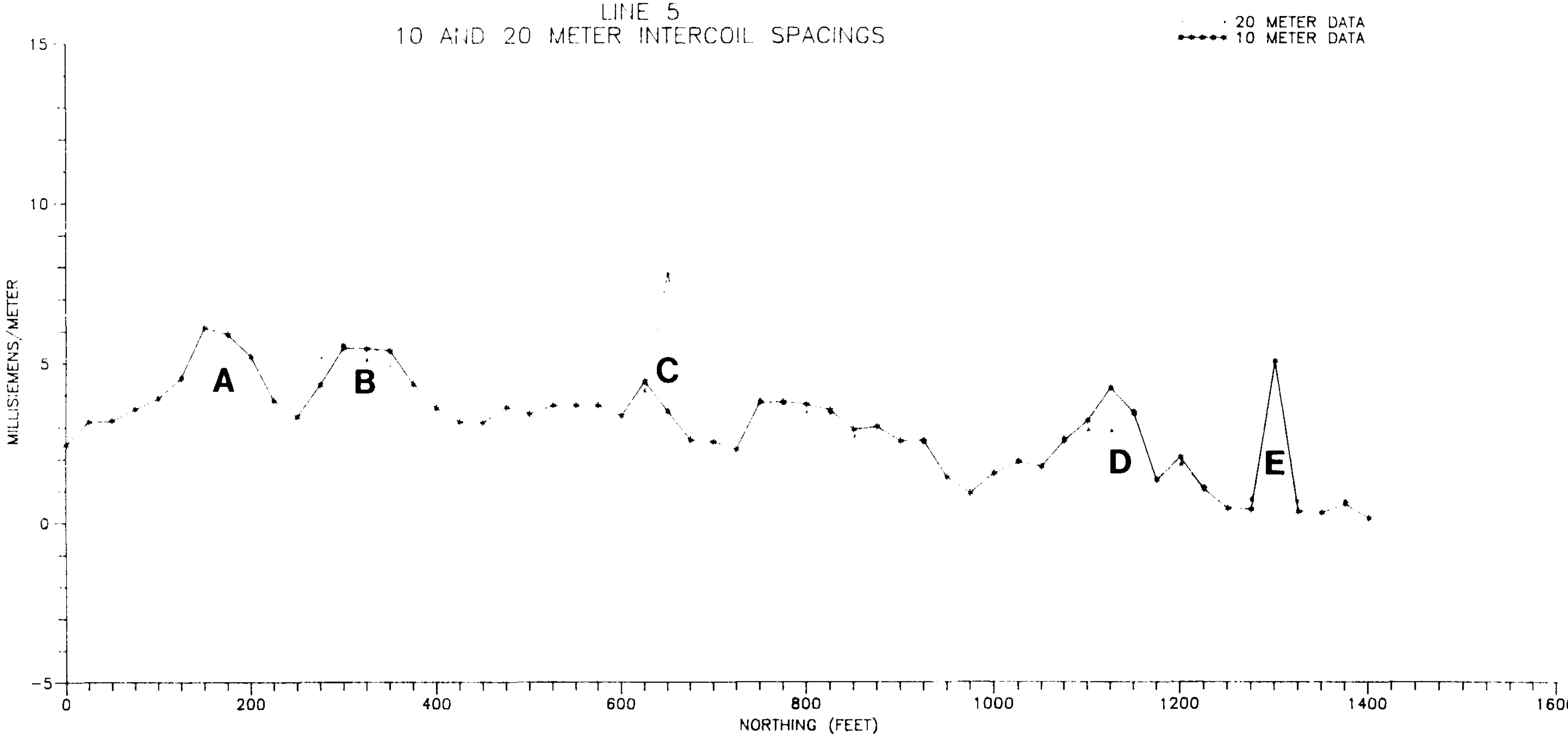

ROSE HILL REGIONAL LANDFILL SUPERFUND SITE
SOUTH KINGSTOWN, RHODE ISLAND
EM34 3 VERTICAL DIPOLE RESULTS
LINE 4
10 AND 20 METER INTERCOIL SPACINGS
20 METER DATA
10 METER DATA
MILLISIEMENS/METER
EASTING (FEET)
a
b
Gartner Lee

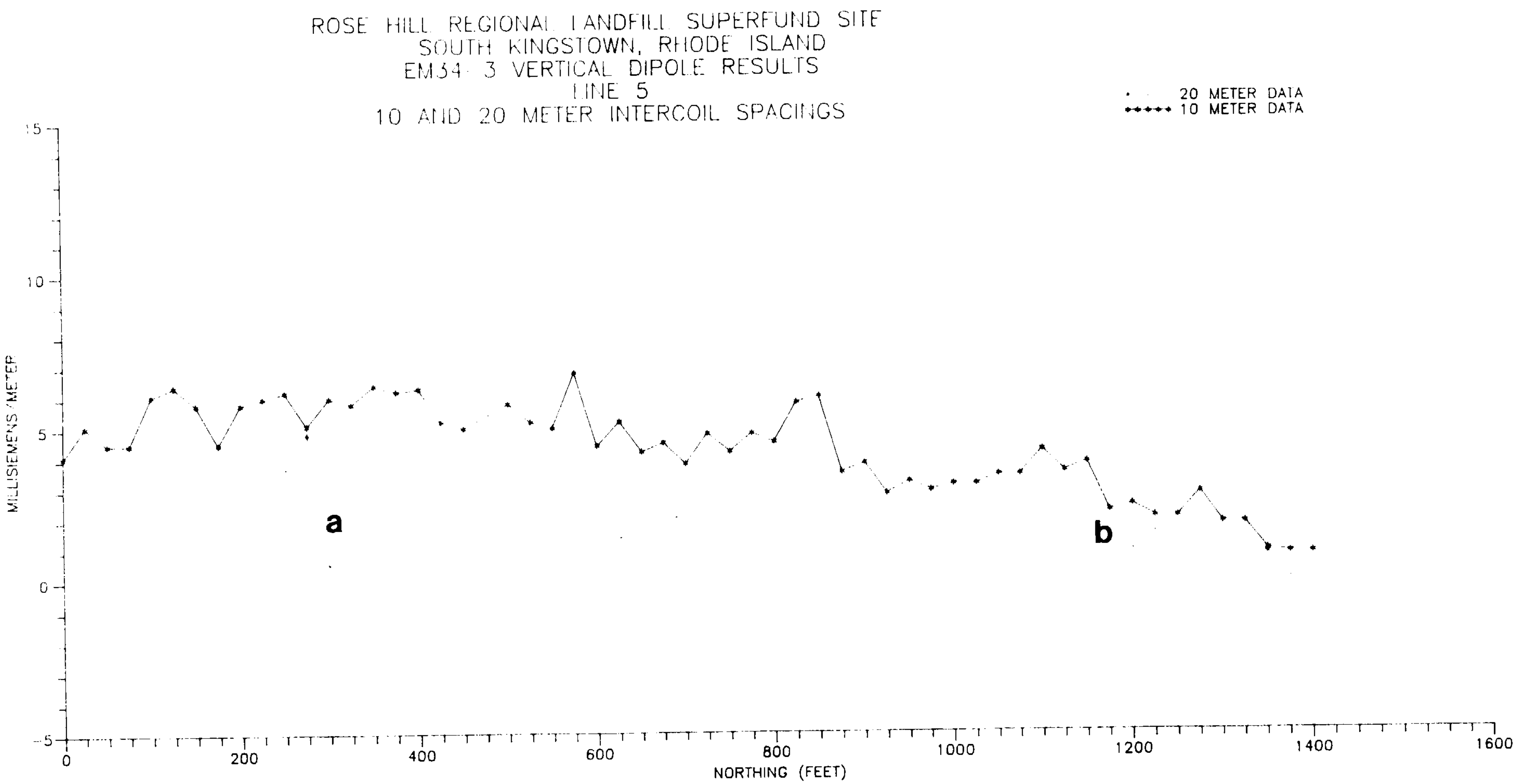
FIGURE 8

ROSE HILL REGIONAL LANDFILL SUPERFUND SITE
SOUTH KINGSTOWN, RHODE ISLAND
EM34-3 HORIZONTAL DIPOLE RESULTS
LINE 5
10 AND 20 METER INTERCOIL SPACINGS



Gartner Lee

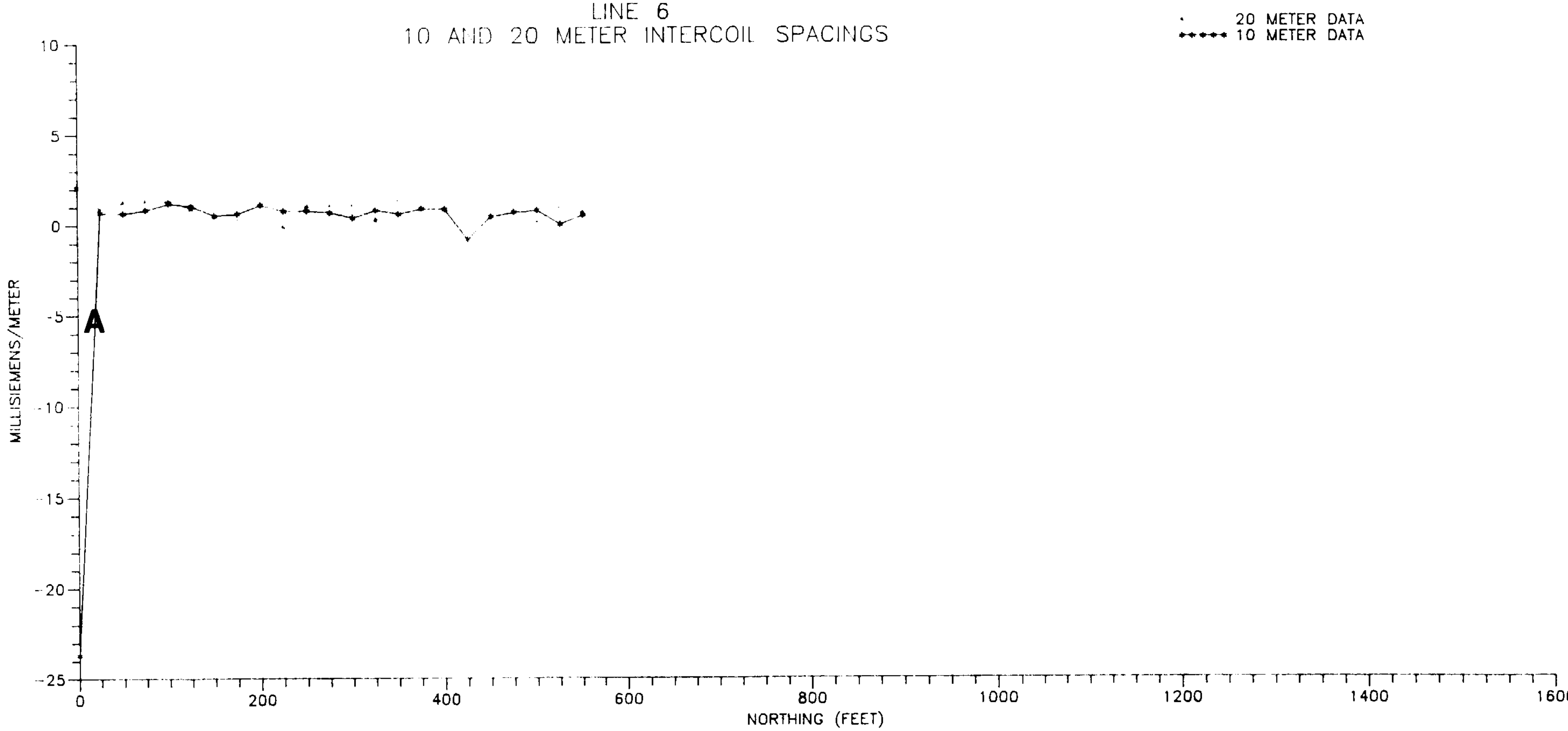
FIGURE 9



Gartner Lee

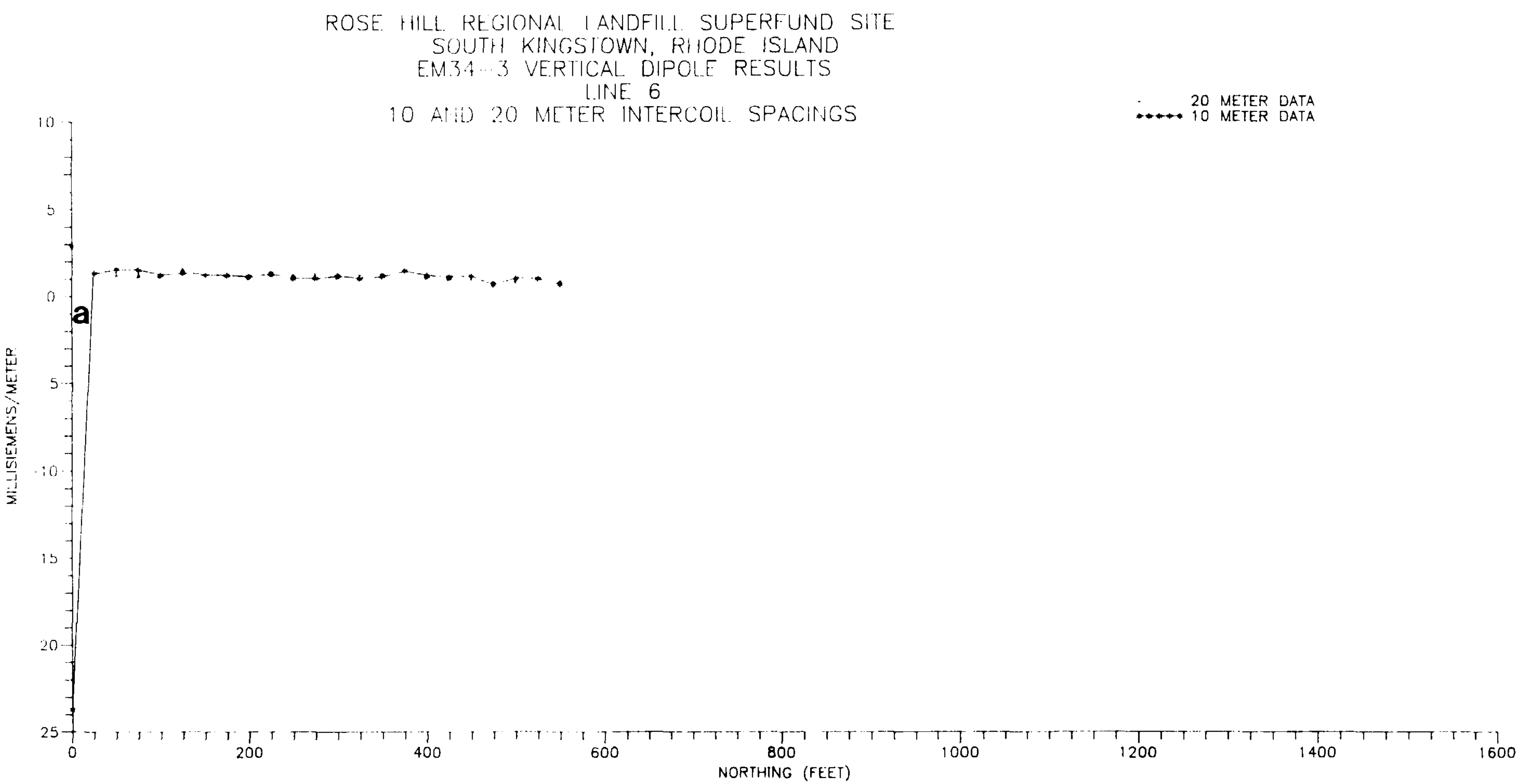
FIGURE 10

ROSE HILL REGIONAL LANDFILL SUPERFUND SITE
SOUTH KINGSTOWN, RHODE ISLAND
EM34-3 HORIZONTAL DIPOLE RESULTS
LINE 6
10 AND 20 METER INTERCOIL SPACINGS



Gartner Lee

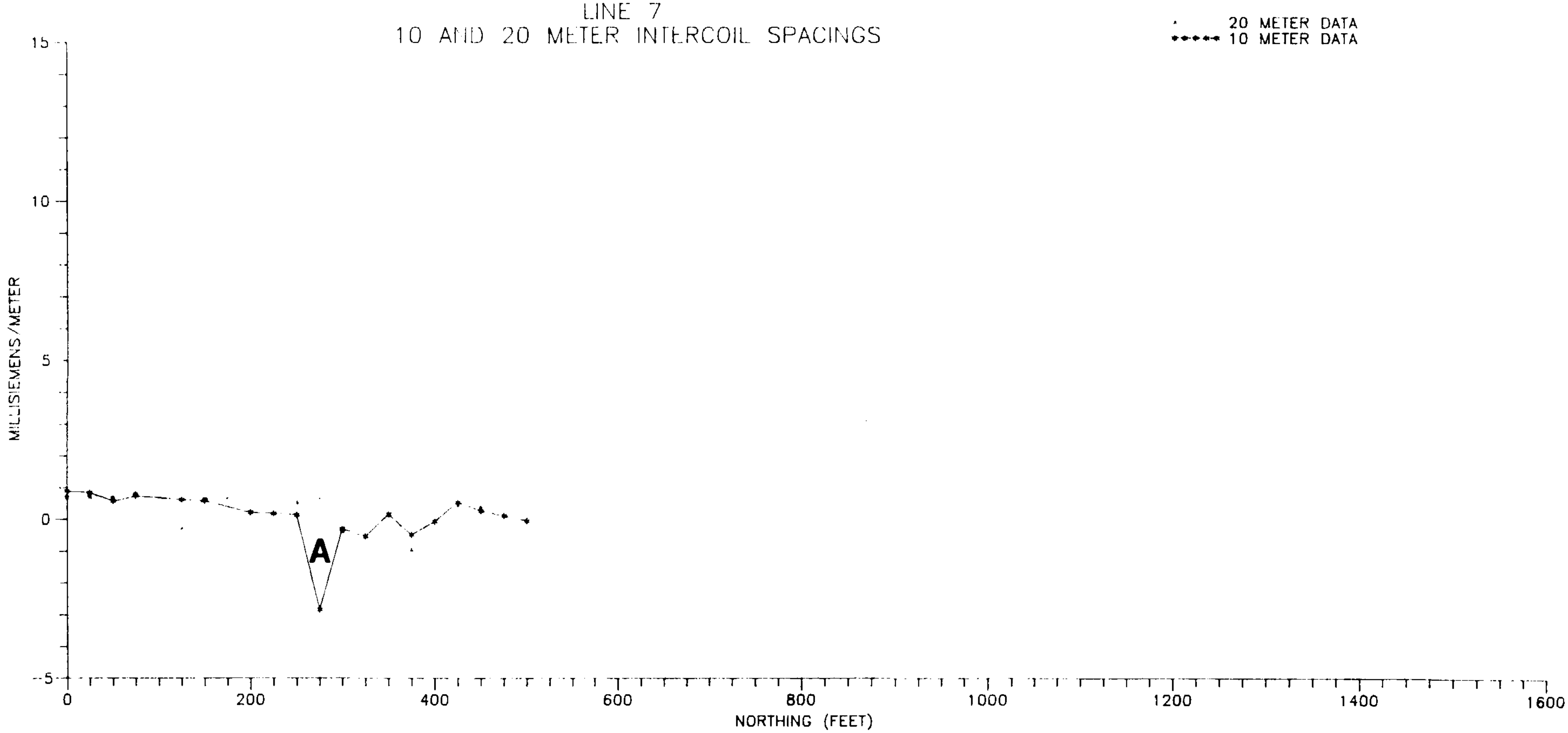
FIGURE 11



Gartner Lee

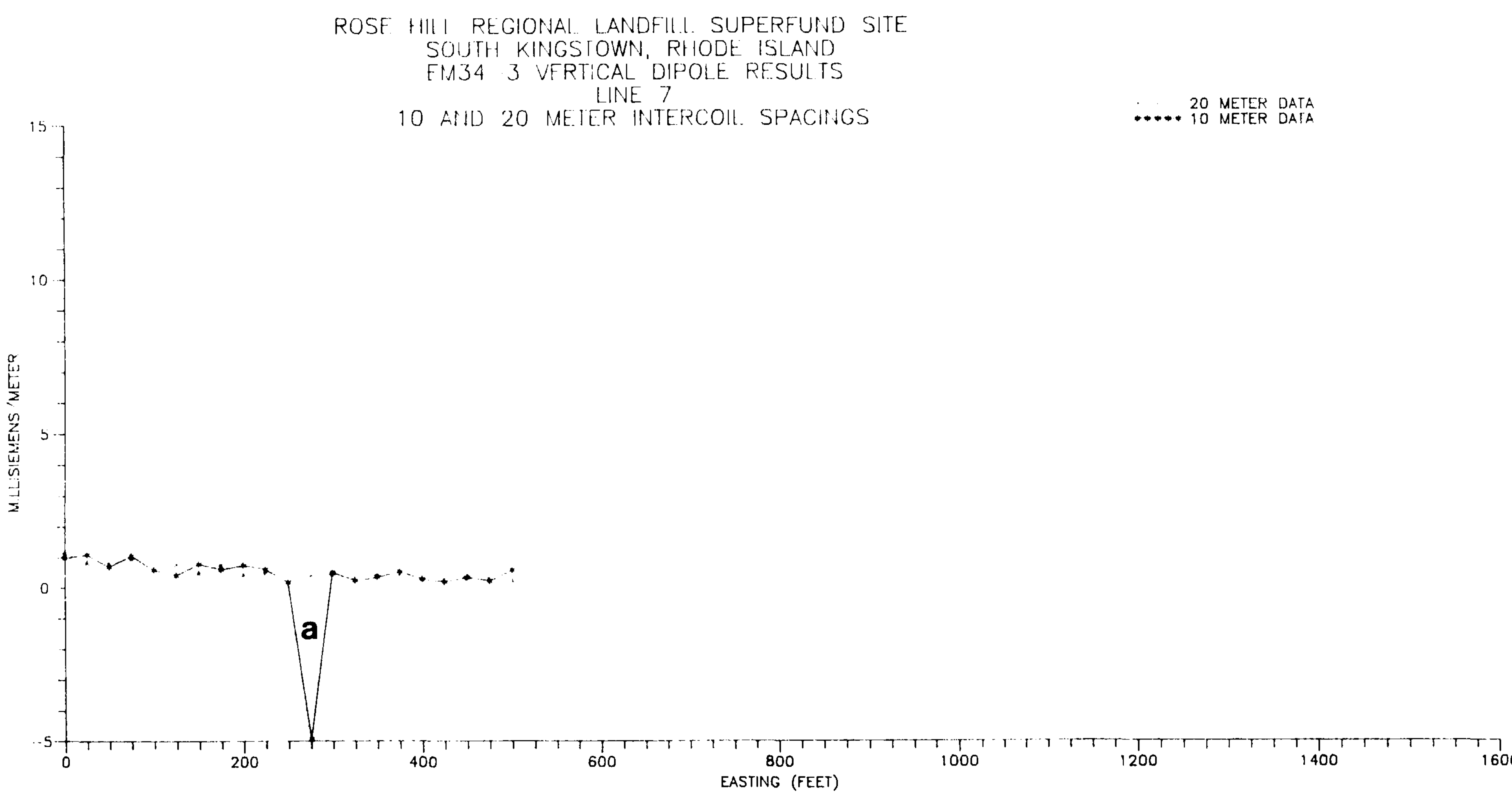
FIGURE 12

ROSE HILL REGIONAL LANDFILL SUPERFUND SITE
SOUTH KINGSTOWN, RHODE ISLAND
FM34-3 HORIZONTAL DIPOLE RESULTS
LINE 7
10 AND 20 METER INTERCOIL SPACINGS



Gartner Lee

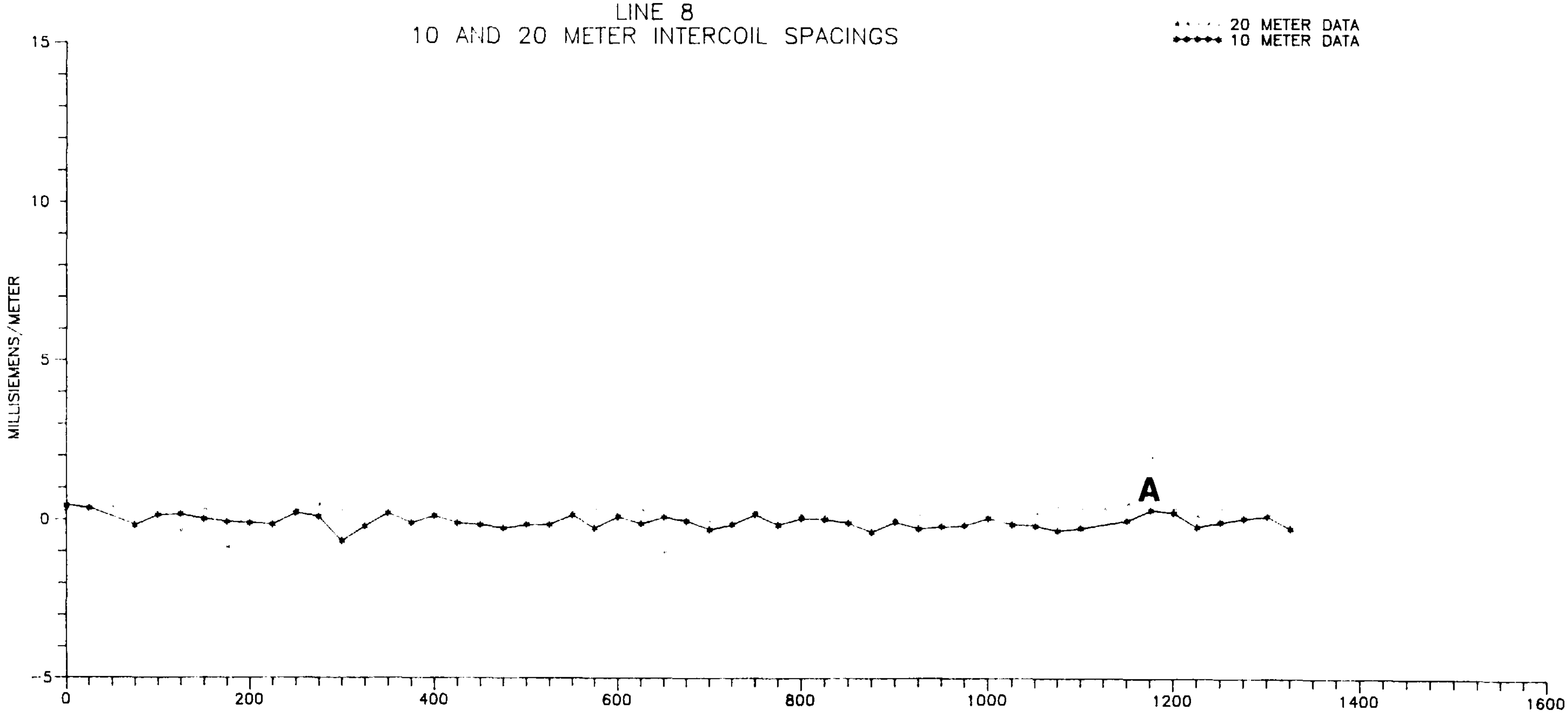
FIGURE 13



Gartner Lee

FIGURE 14

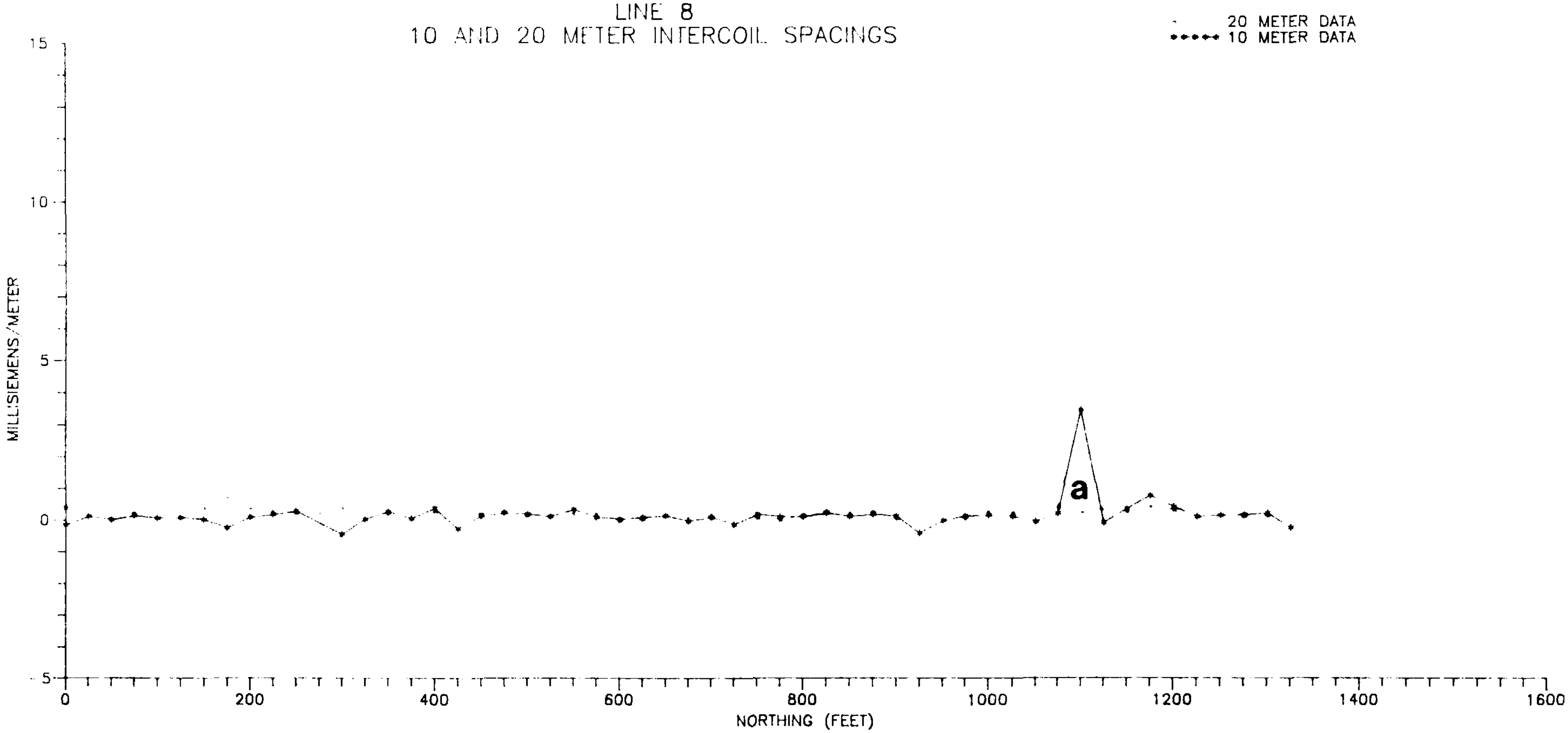
ROSE HILL REGIONAL LANDFILL SUPERFUND SITE
SOUTH KINGSTOWN, RHODE ISLAND
EM34-3 HORIZONTAL DIPOLE RESULTS
LINE 8
10 AND 20 METER INTERCOIL SPACINGS



Gartner Lee

FIGURE 15

ROSE HILL REGIONAL LANDFILL SUPERFUND SITE
SOUTH KINGSTOWN, RHODE ISLAND
EM34-3 VERTICAL DIPOLE RESULTS
LINE 8
10 AND 20 METER INTERCOIL SPACINGS



Gartner Lee

FIGURE 16

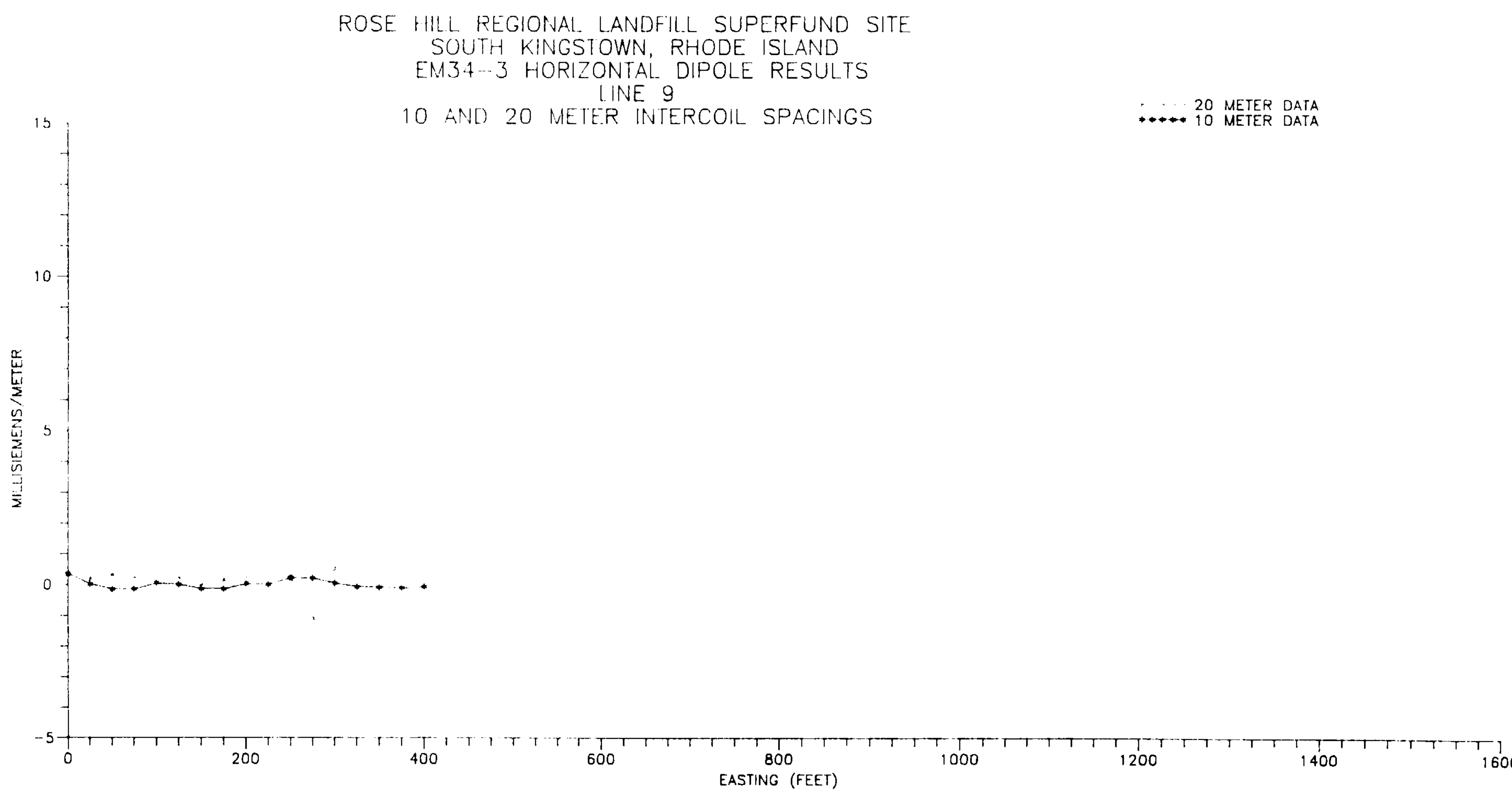
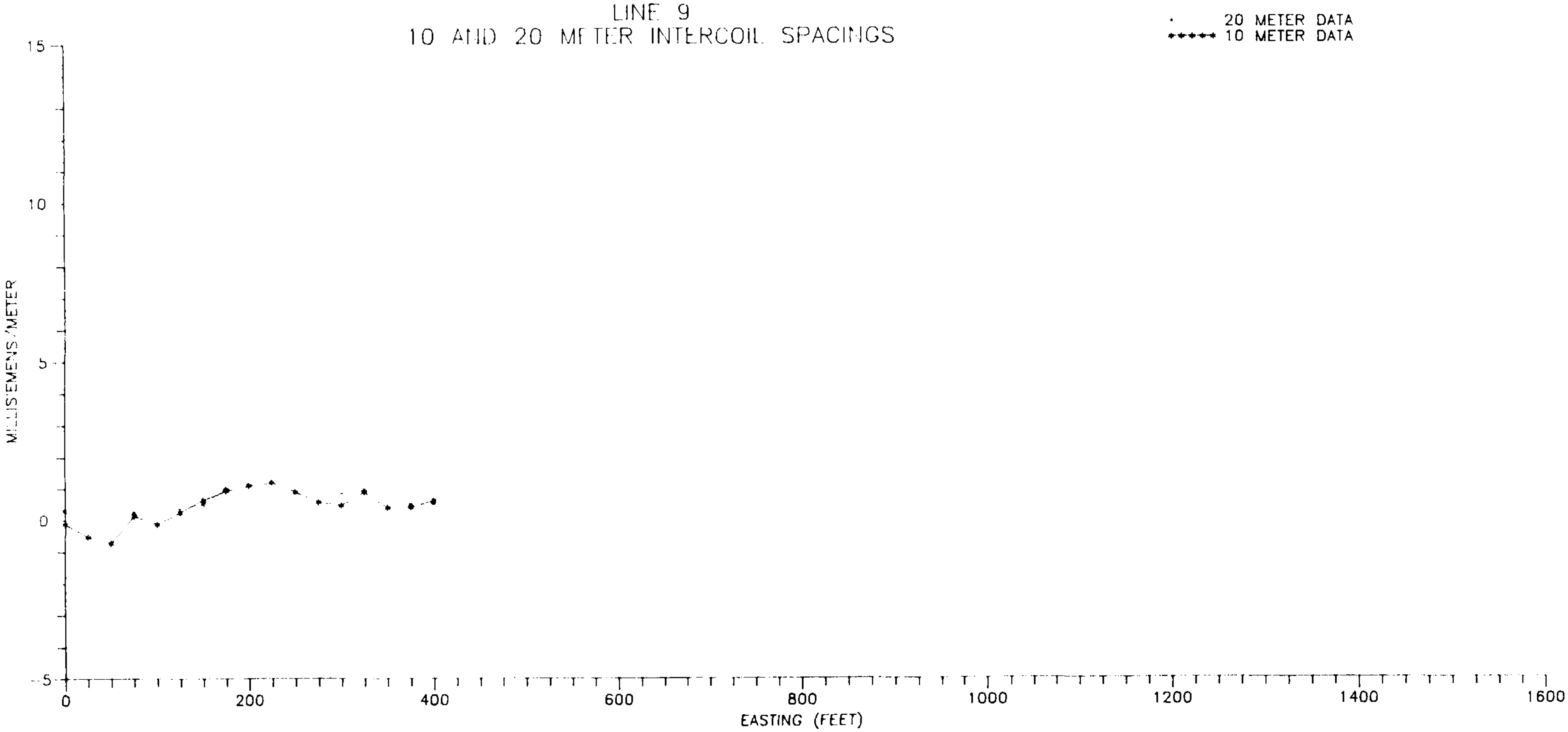


FIGURE 17

Gartner Lee

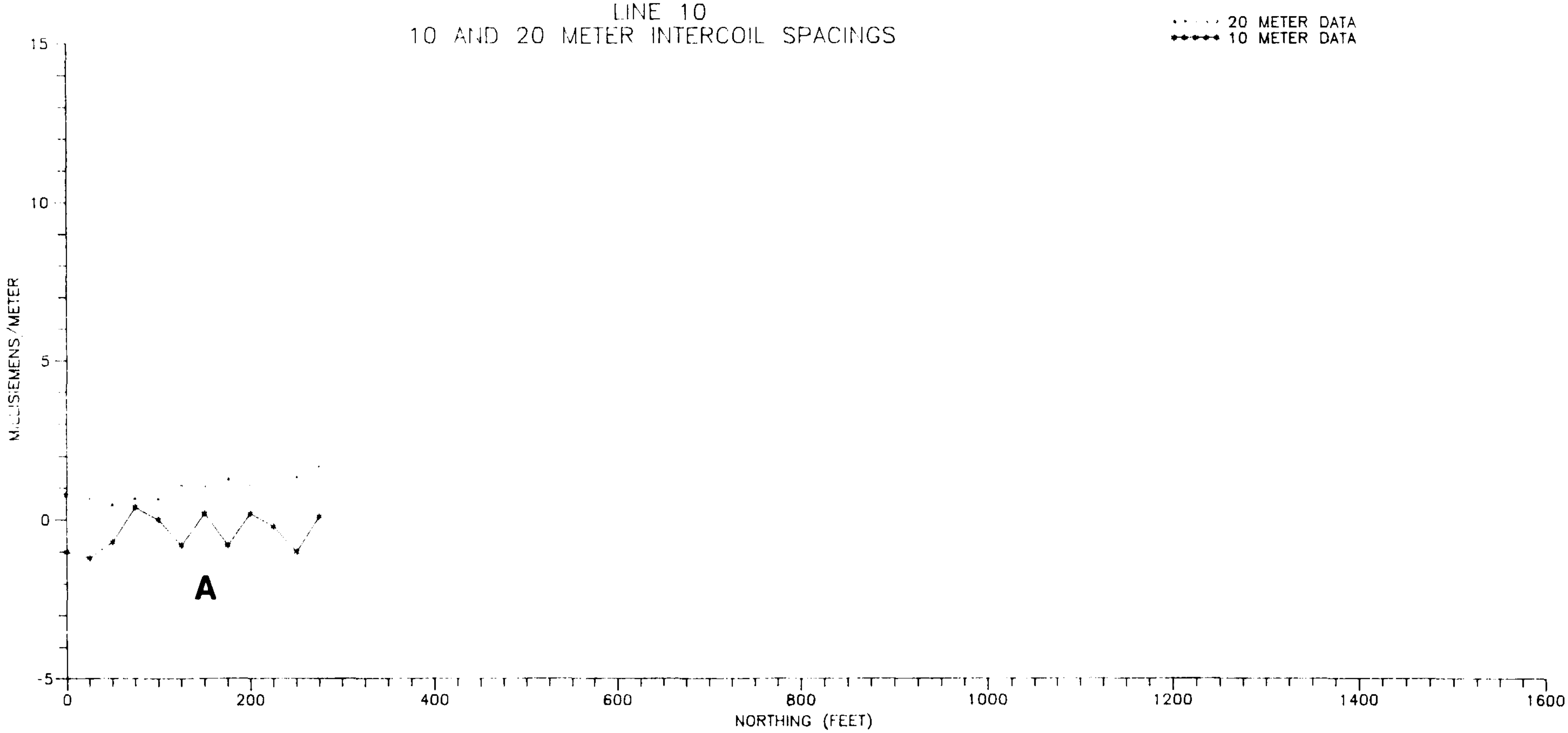
ROSE HILL REGIONAL LANDFILL SUPERFUND SITE
SOUTH KINGSTOWN, RHODE ISLAND
EM34-3 VERTICAL DIPOLE RESULTS
LINE 9
10 AND 20 METER INTERCOIL SPACINGS



Gartner Lee

FIGURE 18

ROSE HILL REGIONAL LANDFILL SUPERFUND SITE
SOUTH KINGSTOWN, RHODE ISLAND
EM34-3 HORIZONTAL DIPOLE RESULTS
LINE 10
10 AND 20 METER INTERCOIL SPACINGS



Gartner Lee

FIGURE 19

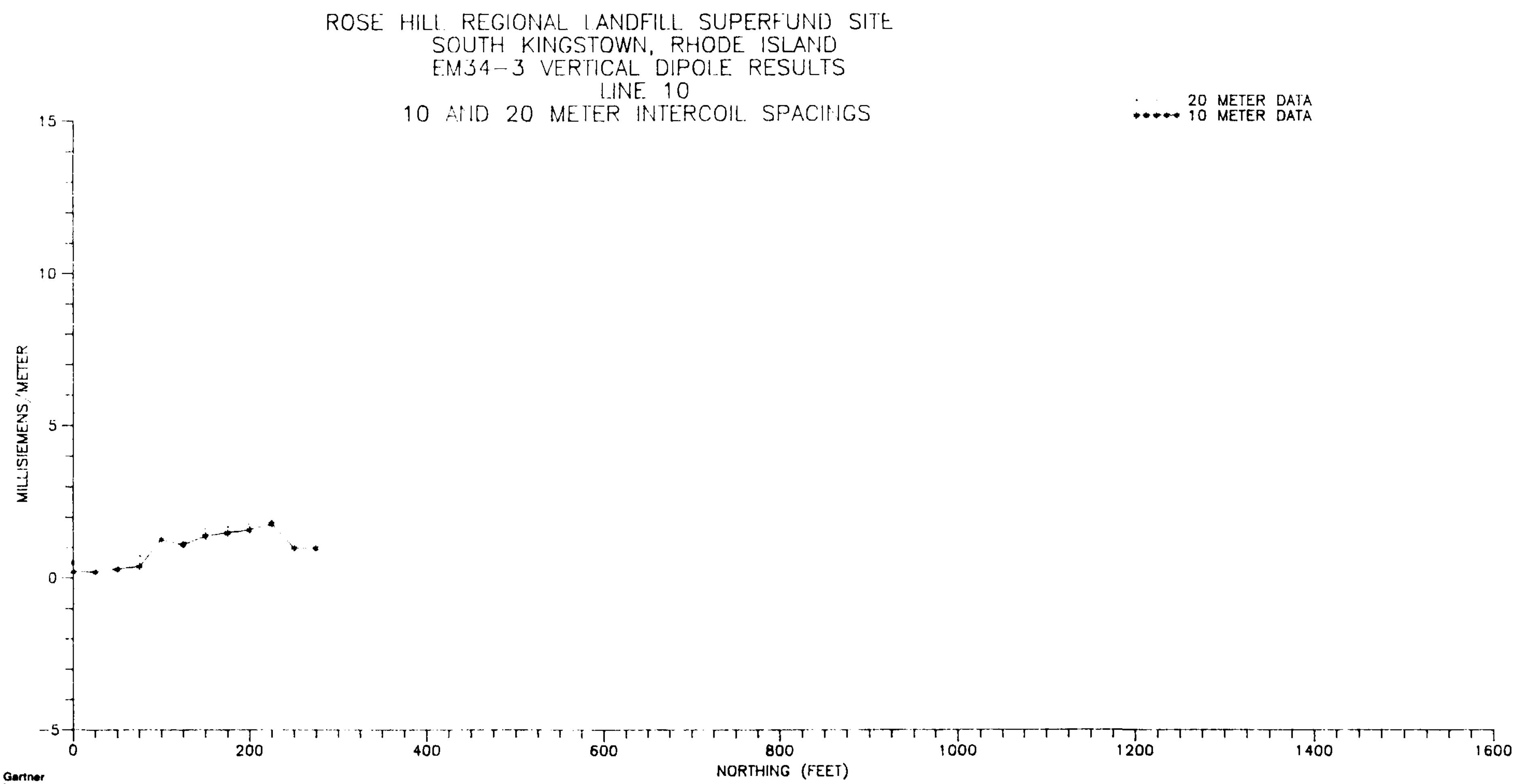

ROSE HILL REGIONAL LANDFILL SUPERFUND SITE
SOUTH KINGSTOWN, RHODE ISLAND
EM34-3 VERTICAL DIPOLE RESULTS
LINE 10
10 AND 20 METER INTERCOIL SPACINGS
20 METER DATA
10 METER DATA
MILLISIEMENS/METER
15
10
5
0
-5
0
200
400
600
800
1000
1200
1400
1600
NORTHING (FEET)
Gartner Lee

FIGURE 20

ROSE HILL REGIONAL LANDFILL SUPERFUND SITE
SOUTH KINGSTOWN, RHODE ISLAND
EM34-3 HORIZONTAL DIPOLE RESULTS
LINE 11
10 AND 20 METER INTERCOIL SPACINGS

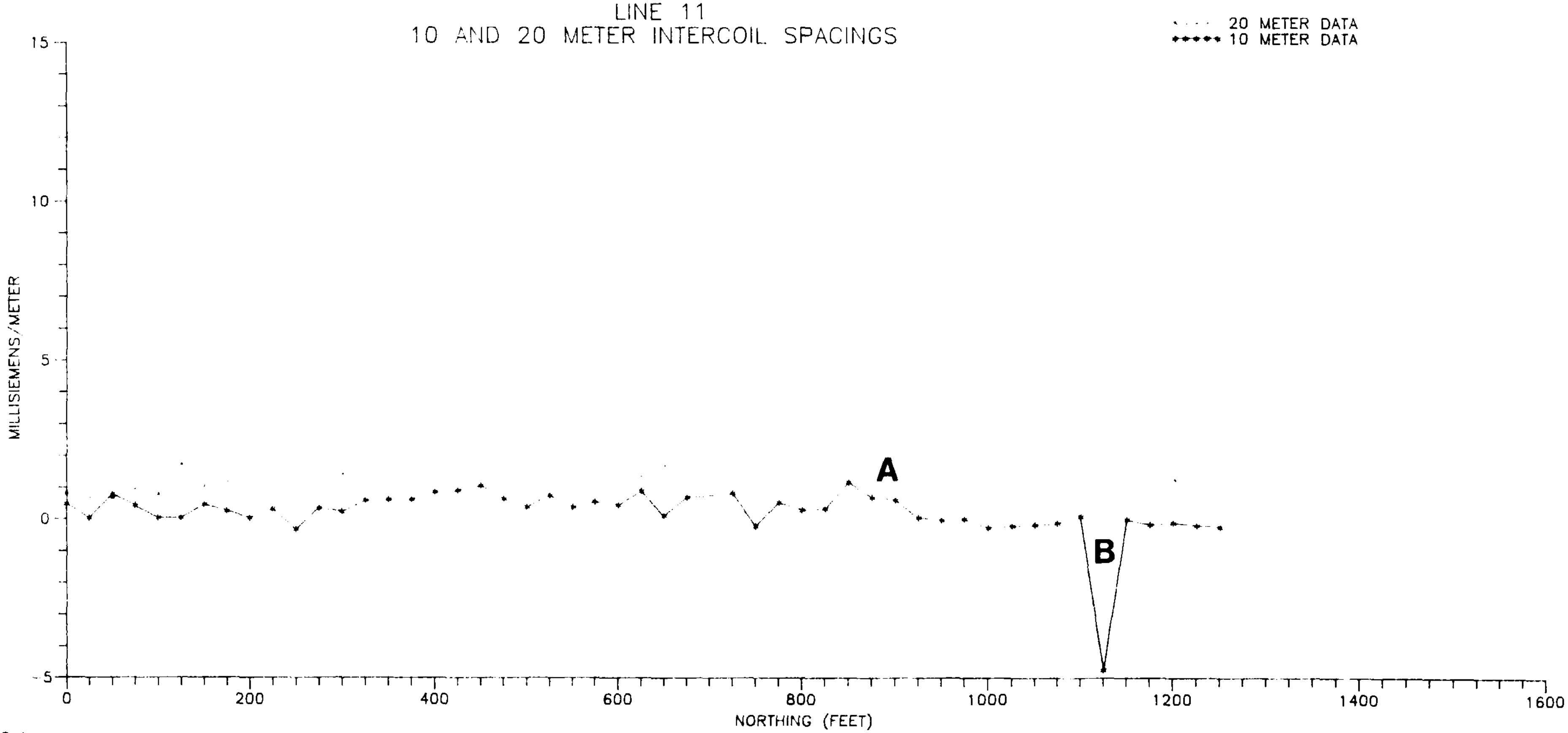
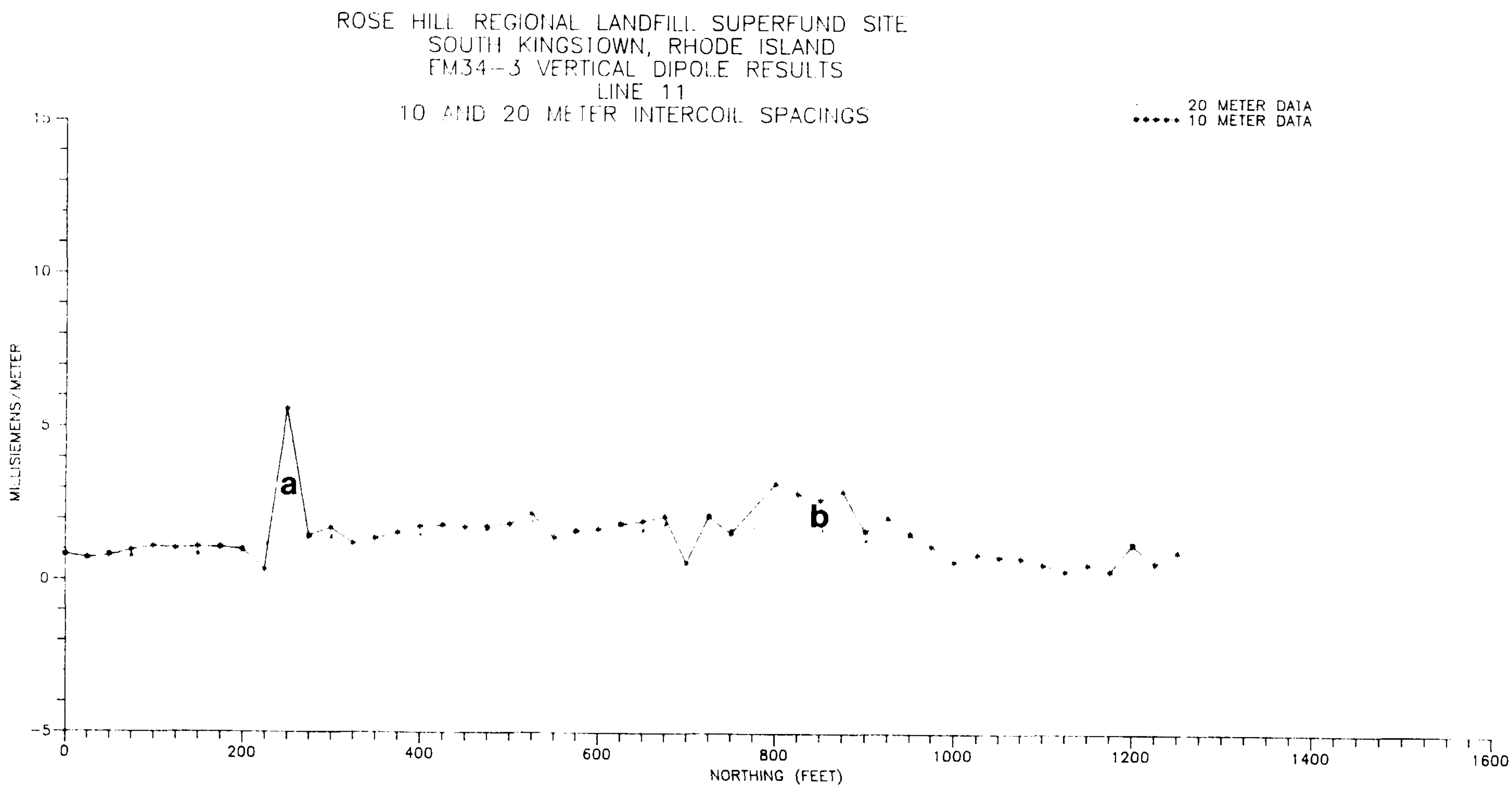


FIGURE 21



Gartner Lee

FIGURE 22

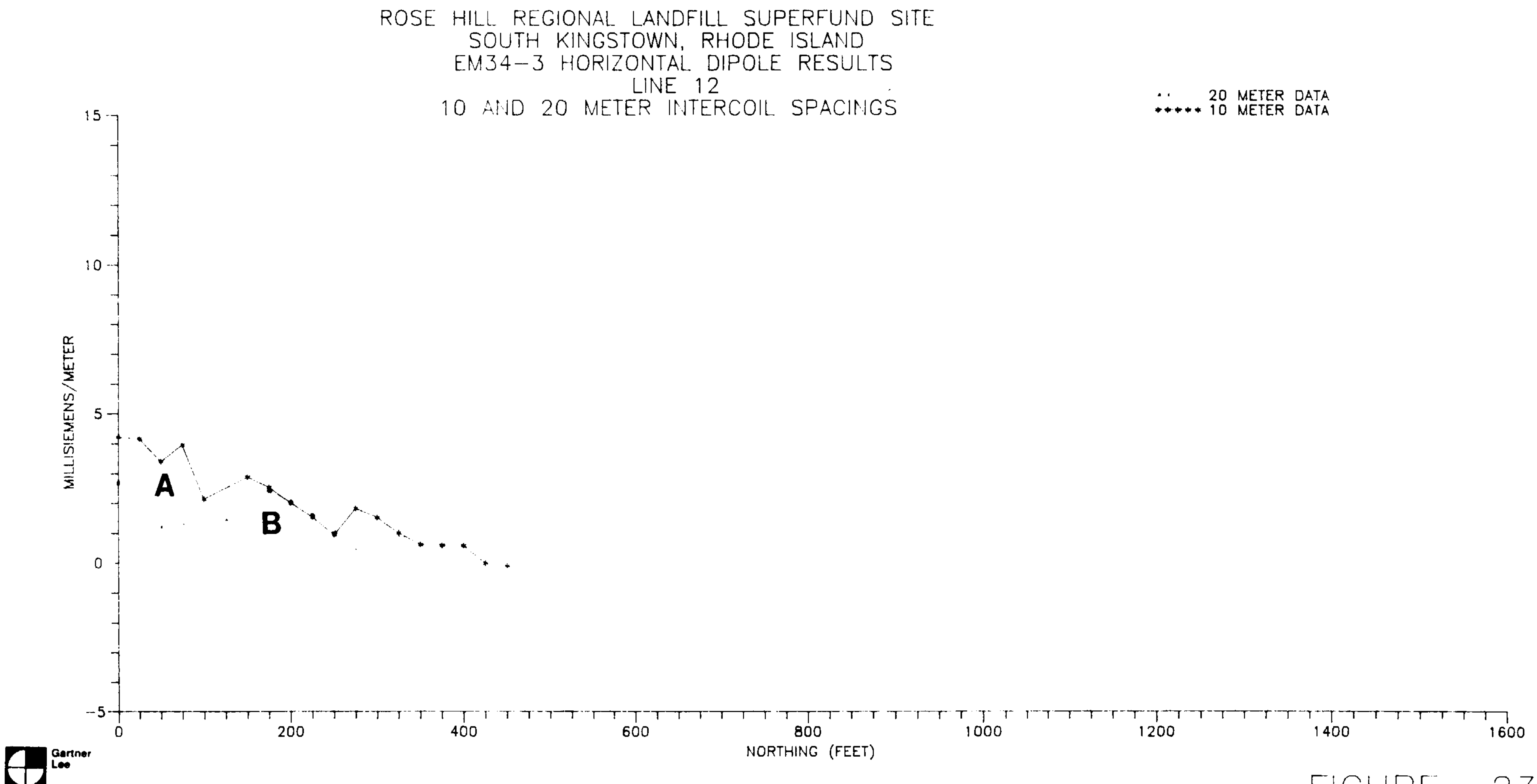
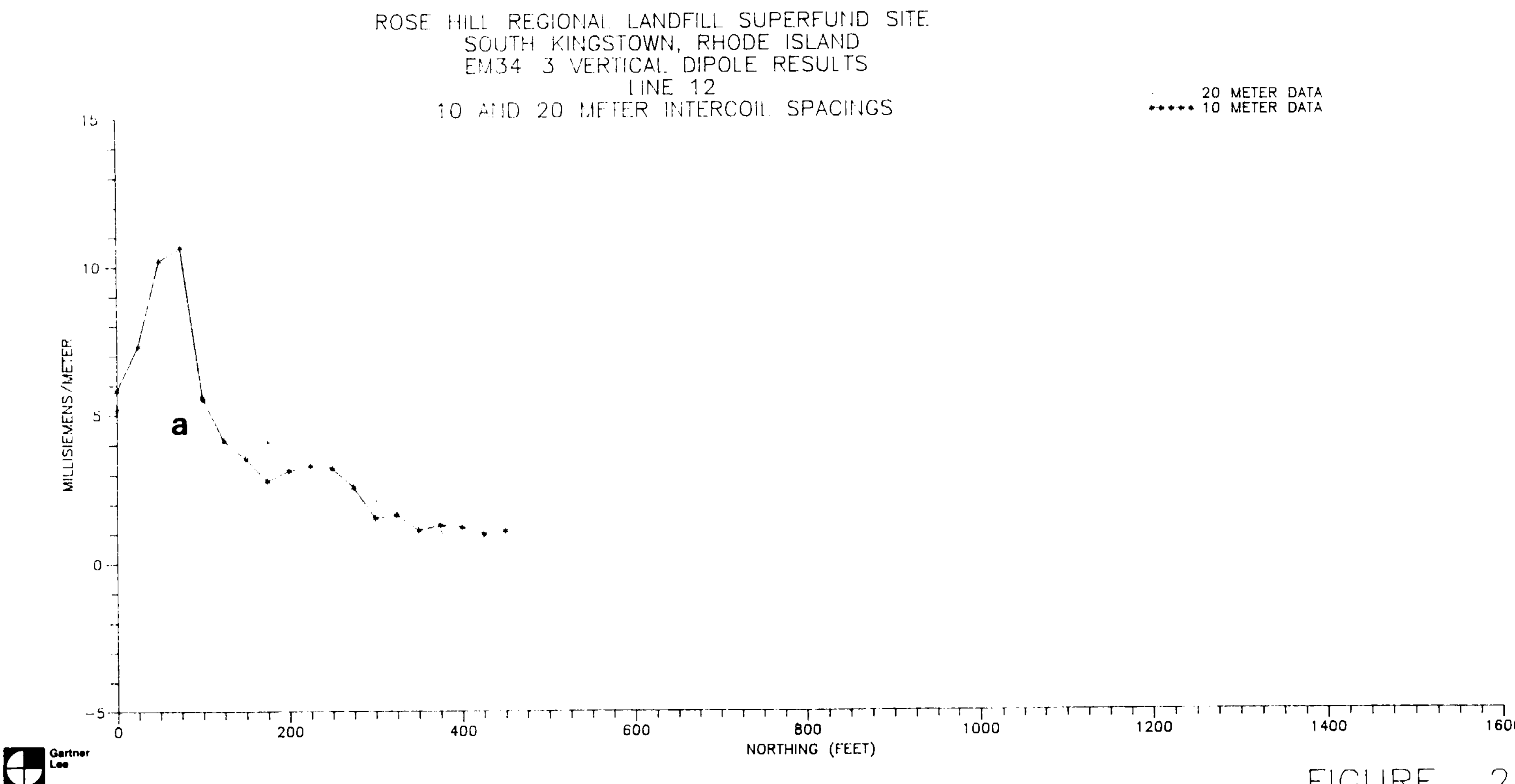

ROSE HILL REGIONAL LANDFILL SUPERFUND SITE
SOUTH KINGSTOWN, RHODE ISLAND
EM34-3 HORIZONTAL DIPOLE RESULTS
LINE 12
10 AND 20 METER INTERCOIL SPACINGS
20 METER DATA
10 METER DATA
MILLISIEMENS/METER
15
10
5
0
-5
0
200
400
600
800
1000
1200
1400
1600
NORTHING (FEET)
A
B
Gartner Lee

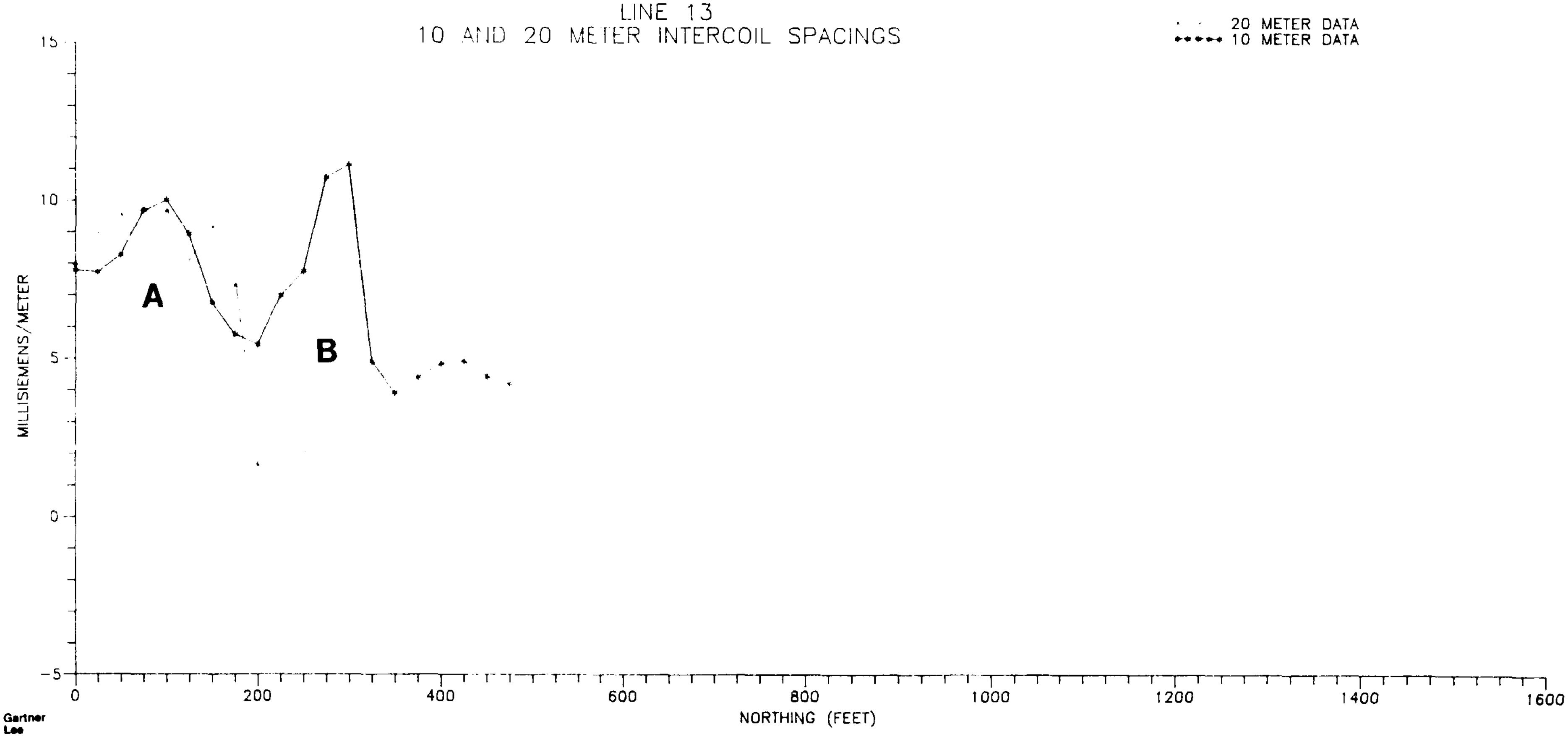
FIGURE 23



ROSE HILL REGIONAL LANDFILL SUPERFUND SITE
SOUTH KINGSTOWN, RHODE ISLAND
EM34 3 VERTICAL DIPOLE RESULTS
LINE 12
10 AND 20 METER INTERCOIL SPACINGS
20 METER DATA
10 METER DATA
MILLISIEMENS/METER
15
10
5
0
-5
a
0
200
400
600
800
1000
1200
1400
1600
NORTHING (FEET)
Gartner Lee

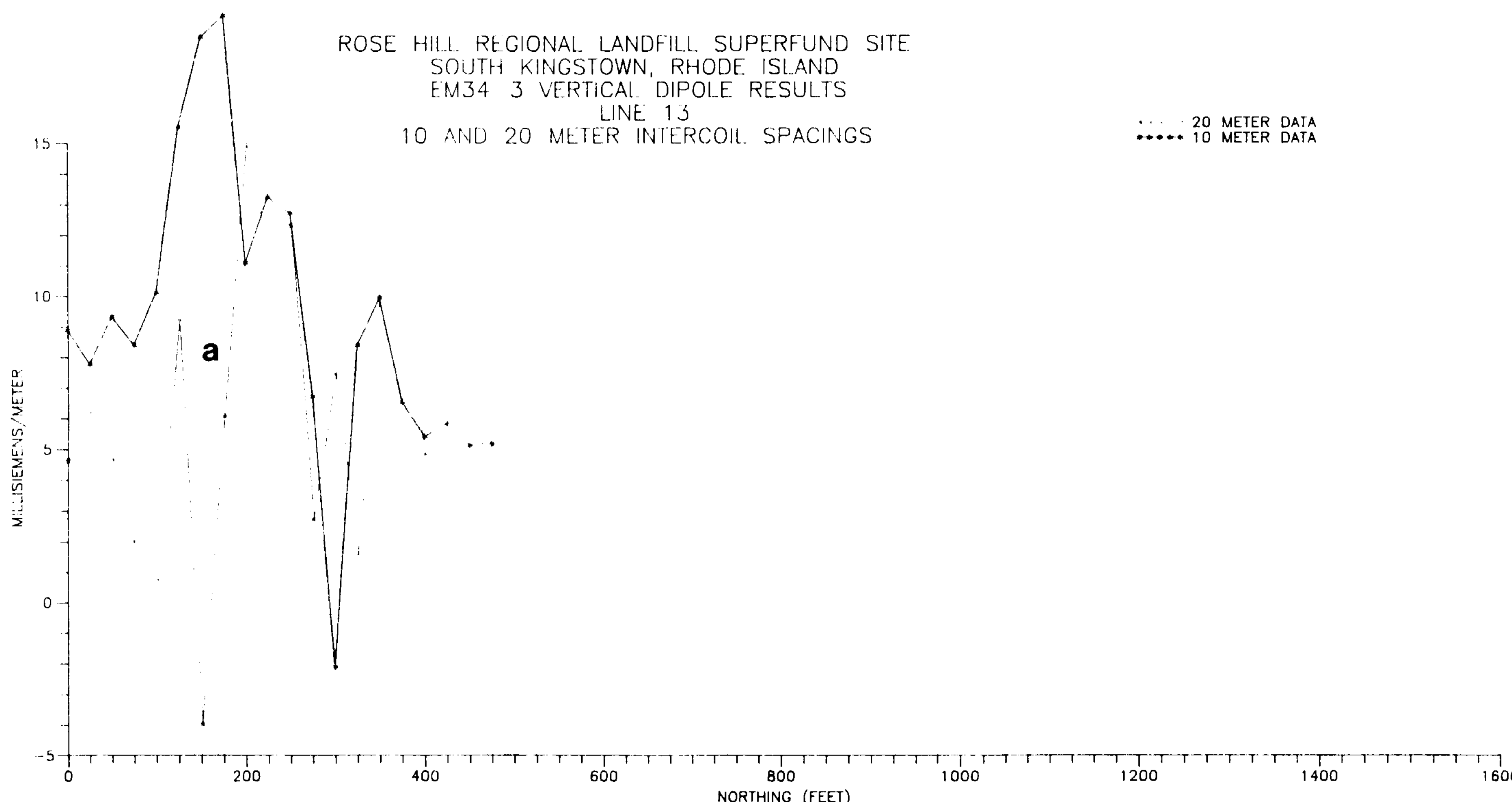
FIGURE 24

ROSE HILL REGIONAL LANDFILL SUPERFUND SITE
SOUTH KINGSTOWN, RHODE ISLAND
EM34-3 HORIZONTAL DIPOLE RESULTS
LINE 13
10 AND 20 METER INTERCOIL SPACINGS



Gartner Lee

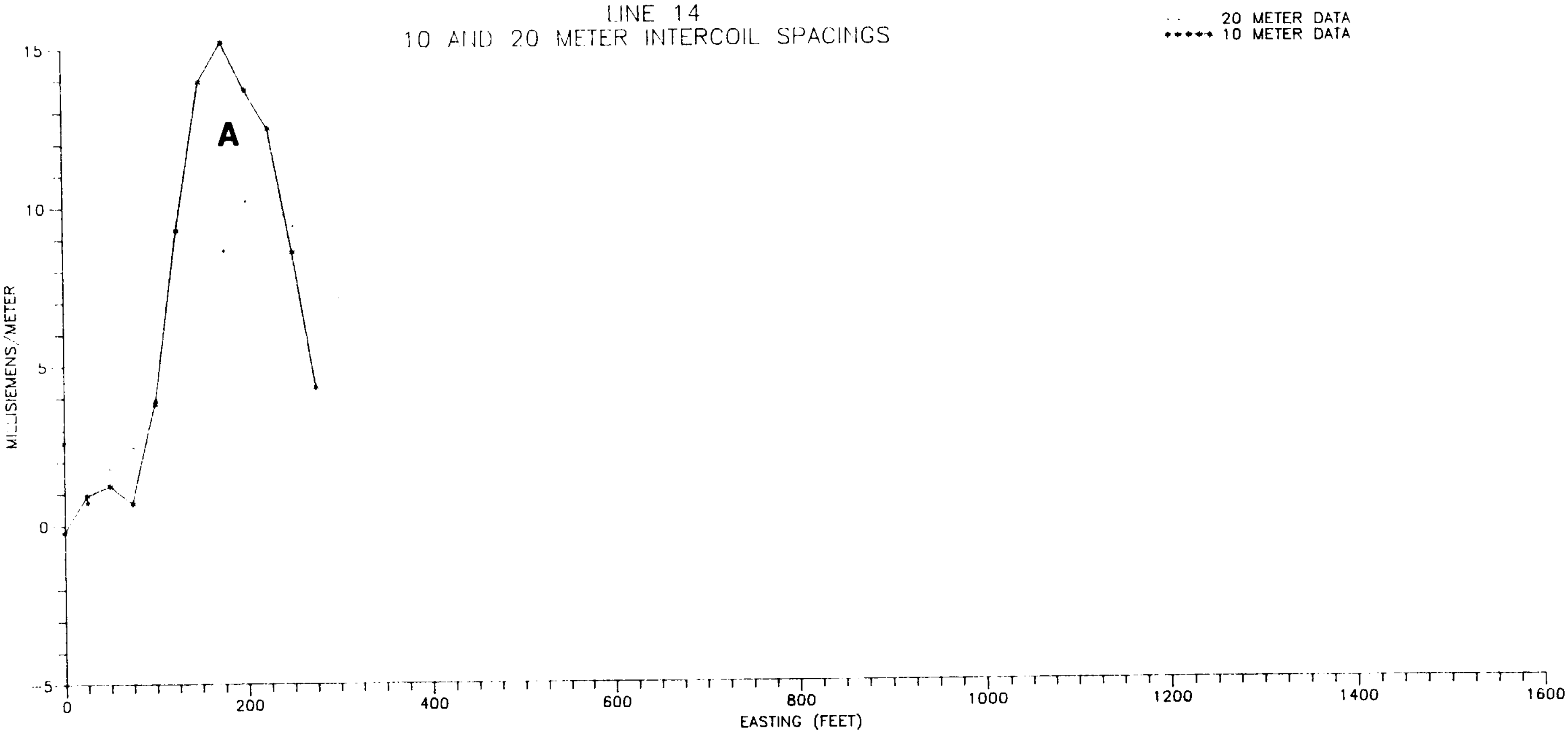
FIGURE 25



Gartner Lee

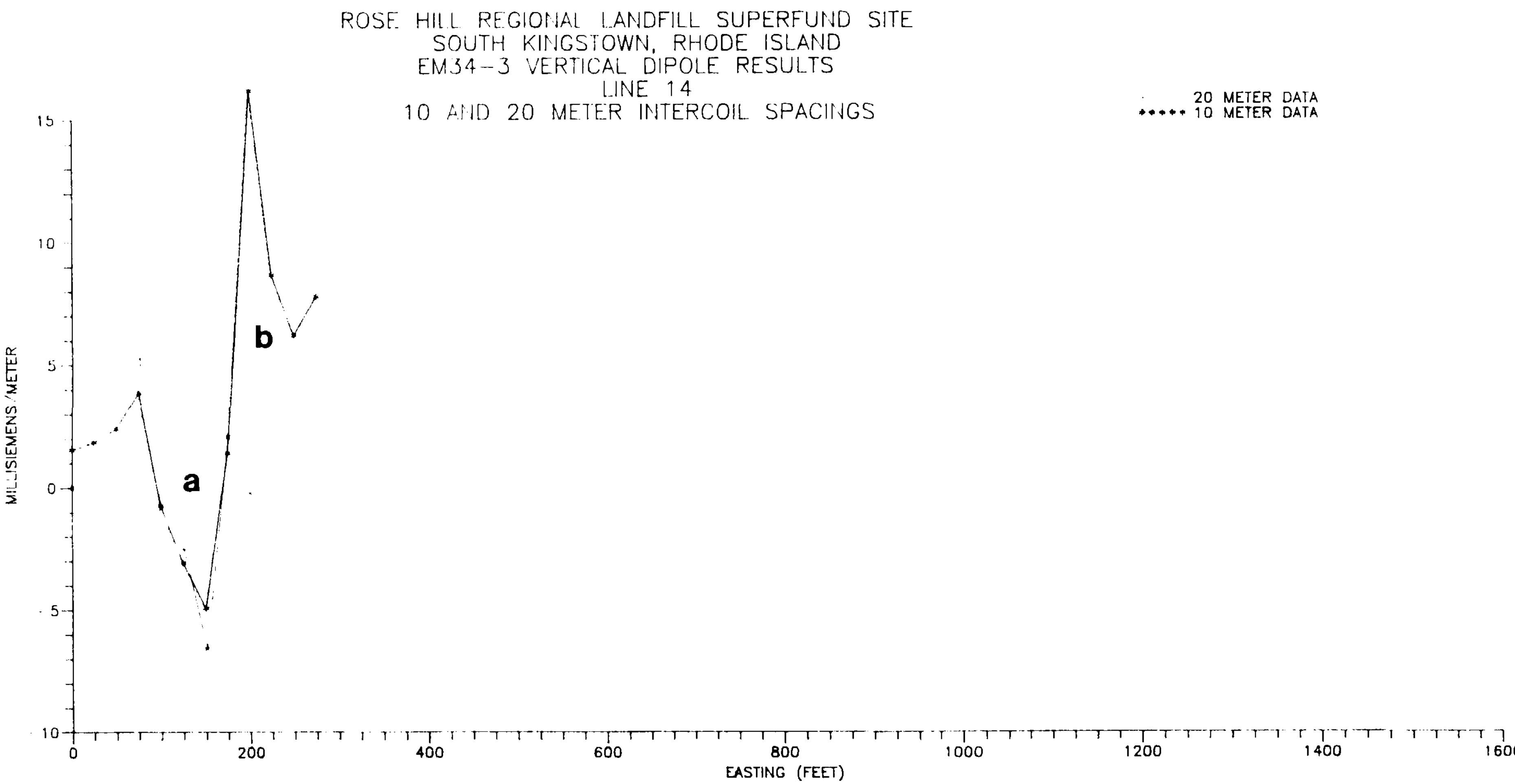
FIGURE 26

ROSE HILL REGIONAL LANDFILL SUPERFUND SITE
SOUTH KINGSTOWN, RHODE ISLAND
EM34-3 HORIZONTAL DIPOLE RESULTS
LINE 14
10 AND 20 METER INTERCOIL SPACINGS



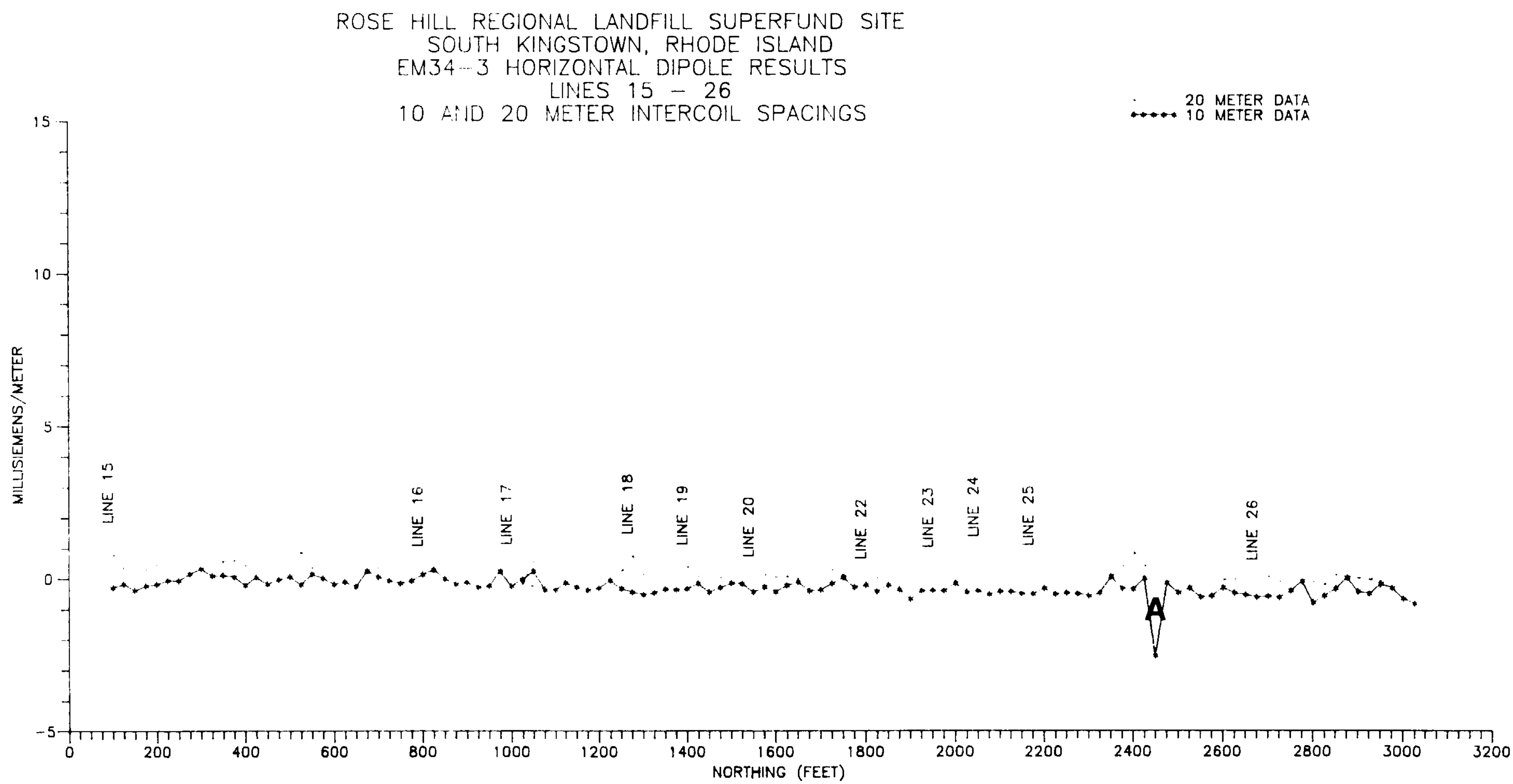
Gartner Lee

FIGURE 27



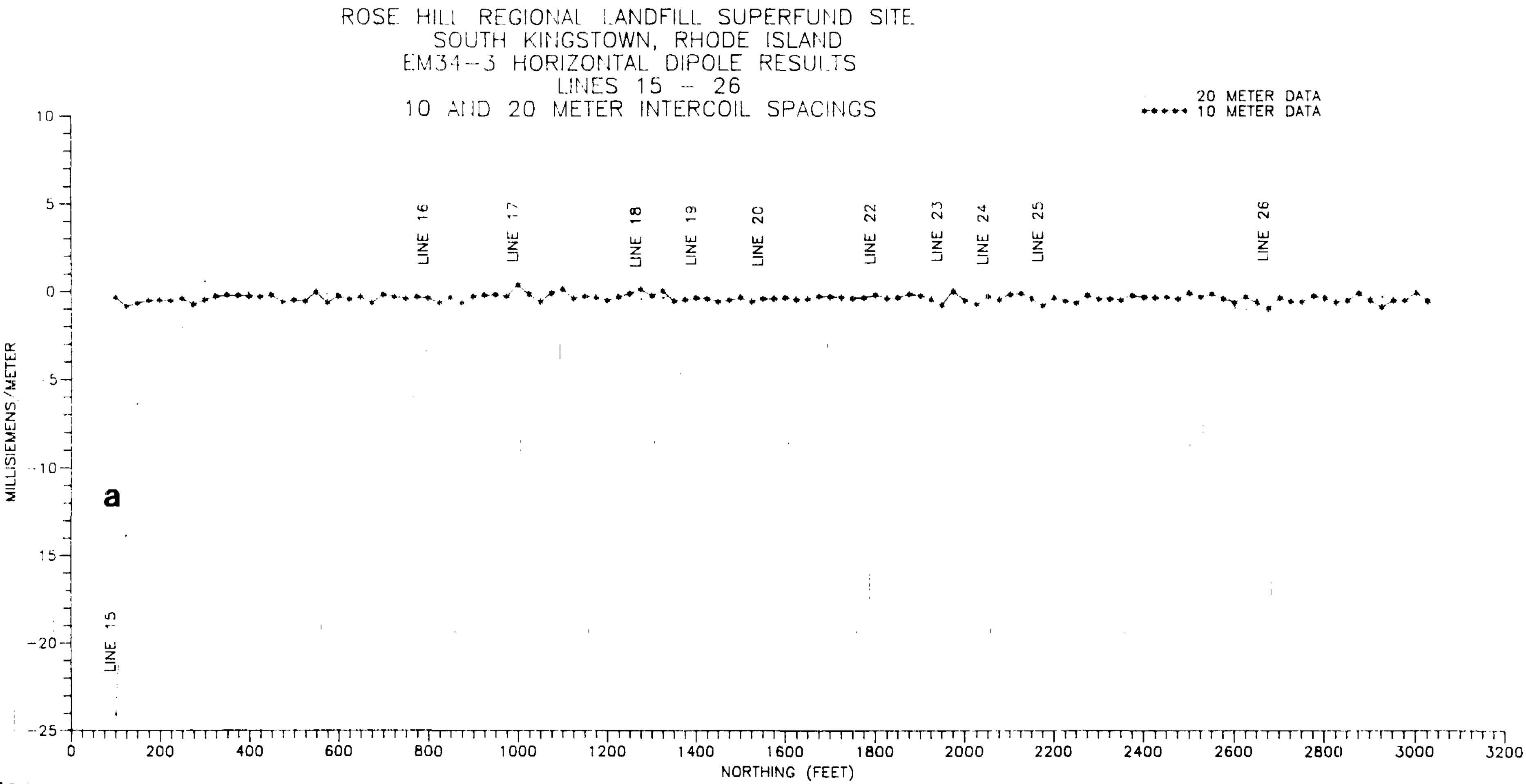
Gartner Lee

FIGURE 28



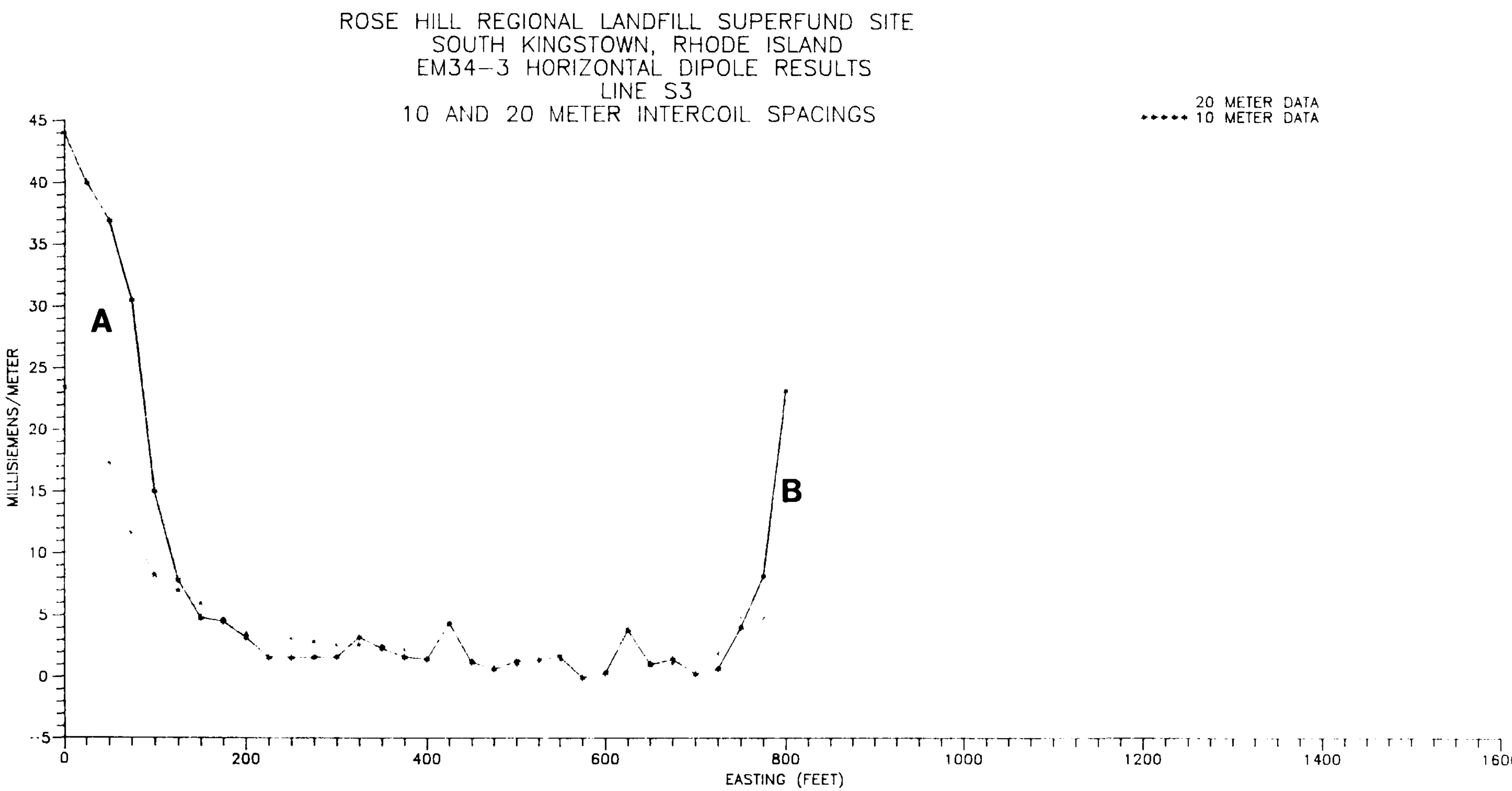
Gartner Lee

FIGURE 29



Gartner Lee

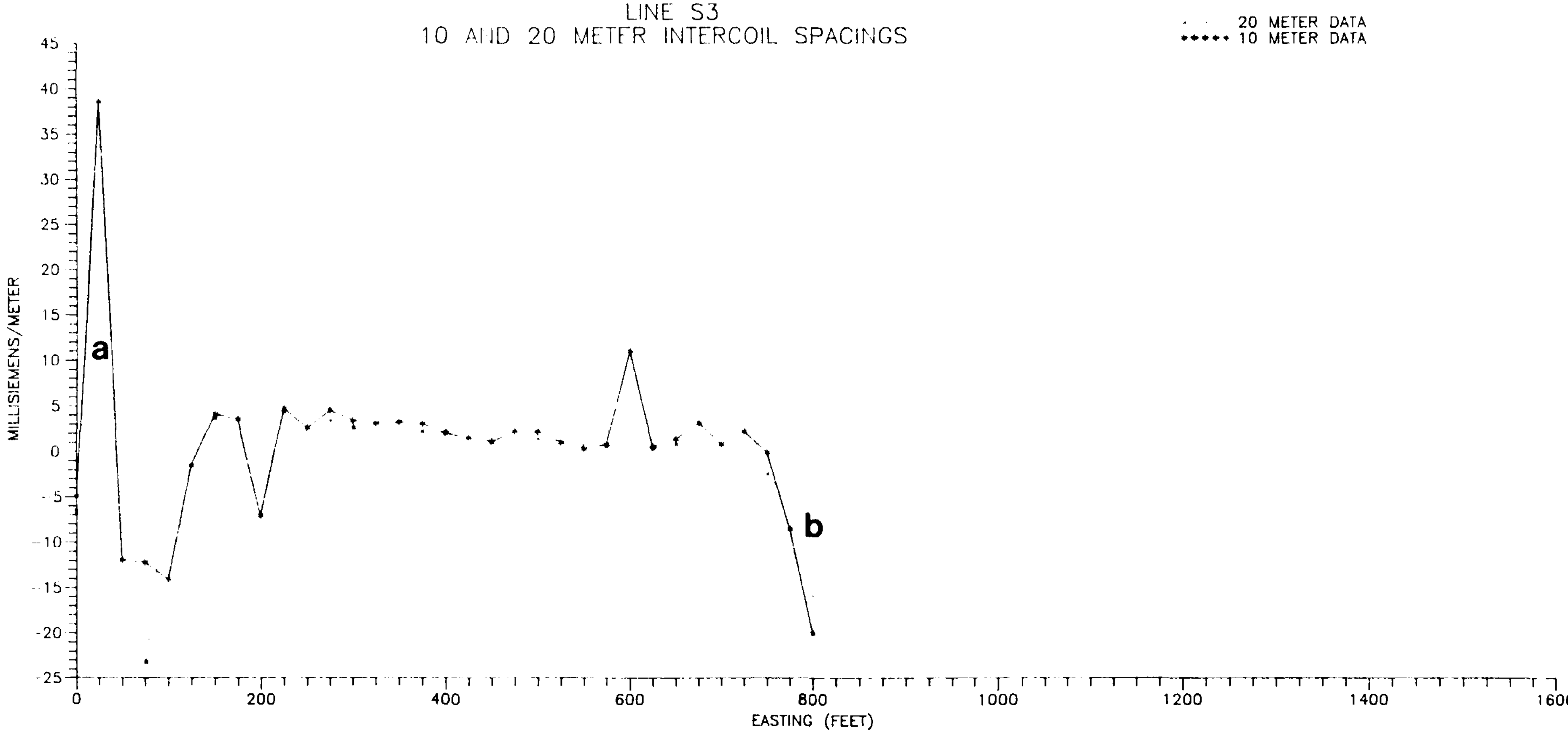
FIGURE 30



Gartner Lee

FIGURE 31

ROSE HILL REGIONAL LANDFILL SUPERFUND SITE
SOUTH KINGSTOWN, RHODE ISLAND
EM34-3 VERTICAL DIPOLE RESULTS
LINE S3
10 AND 20 METER INTERCOIL SPACINGS



Gartner Lee

FIGURE 32

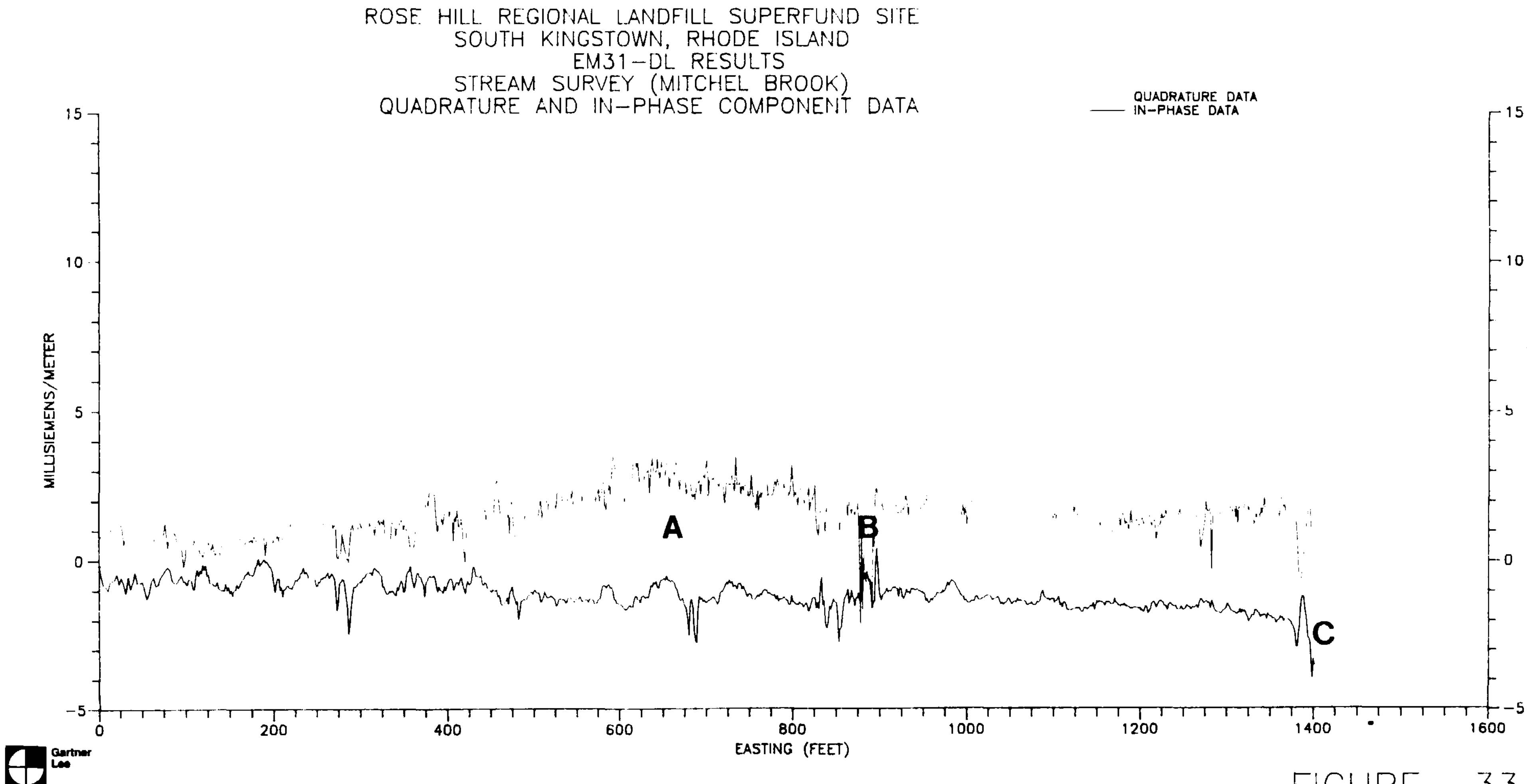

ROSE HILL REGIONAL LANDFILL SUPERFUND SITE
SOUTH KINGSTOWN, RHODE ISLAND
EM31-DL RESULTS
STREAM SURVEY (MITCHEL BROOK)
QUADRATURE AND IN-PHASE COMPONENT DATA
QUADRATURE DATA
IN-PHASE DATA
MILLISIEMENS/METER
PARTS PER THOUSAND (PPT)
EASTING (FEET)
A
B
C
15
10
5
0
-5
0
200
400
600
800
1000
1200
1400
1600
Gartner Lee

FIGURE 33

ROSE HILL REGIONAL LANDFILL SUPERFUND SITE
SOUTH KINGSTOWN, RHODE ISLAND
EM31-DL RESULTS
LINE S7
QUADRATURE AND IN-PHASE COMPONENT DATA

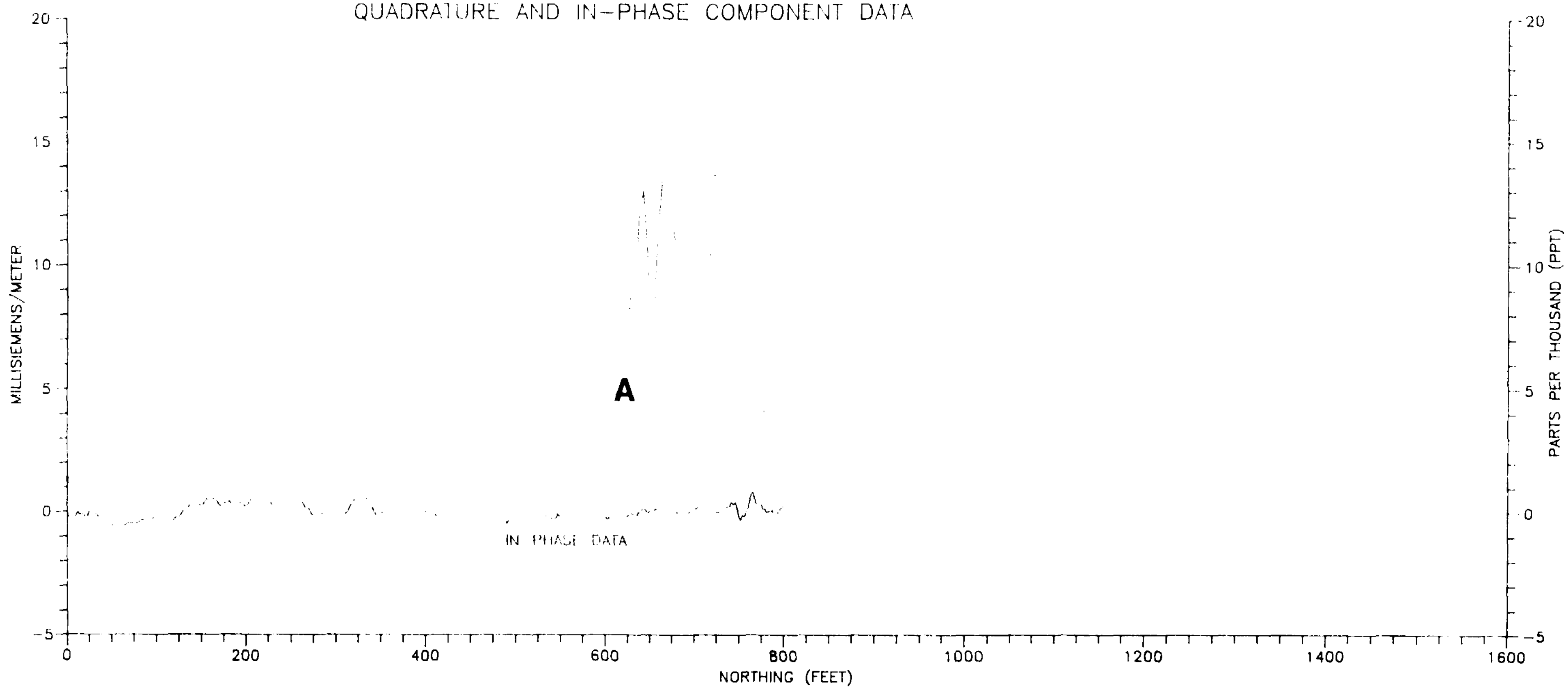


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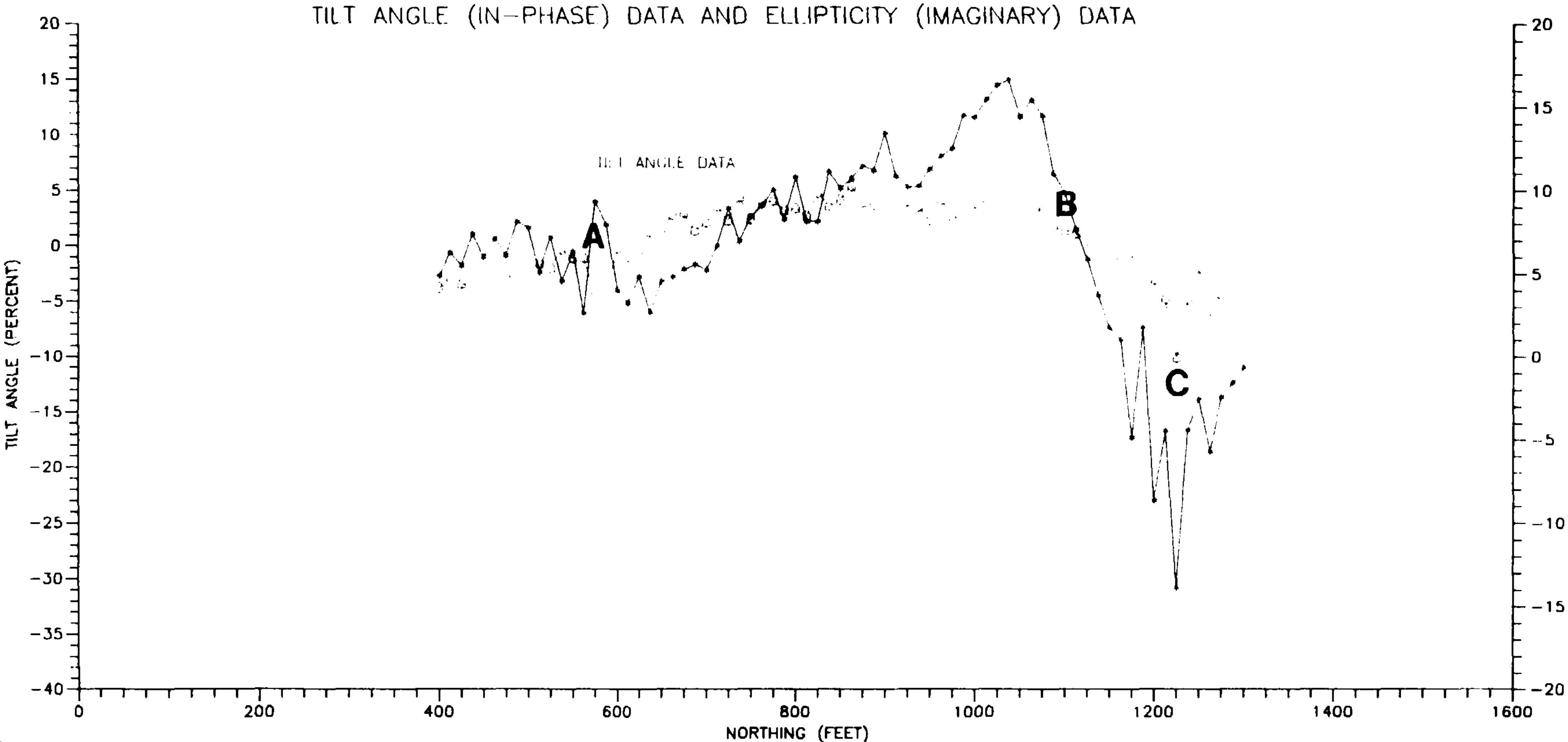
FIGURE 34

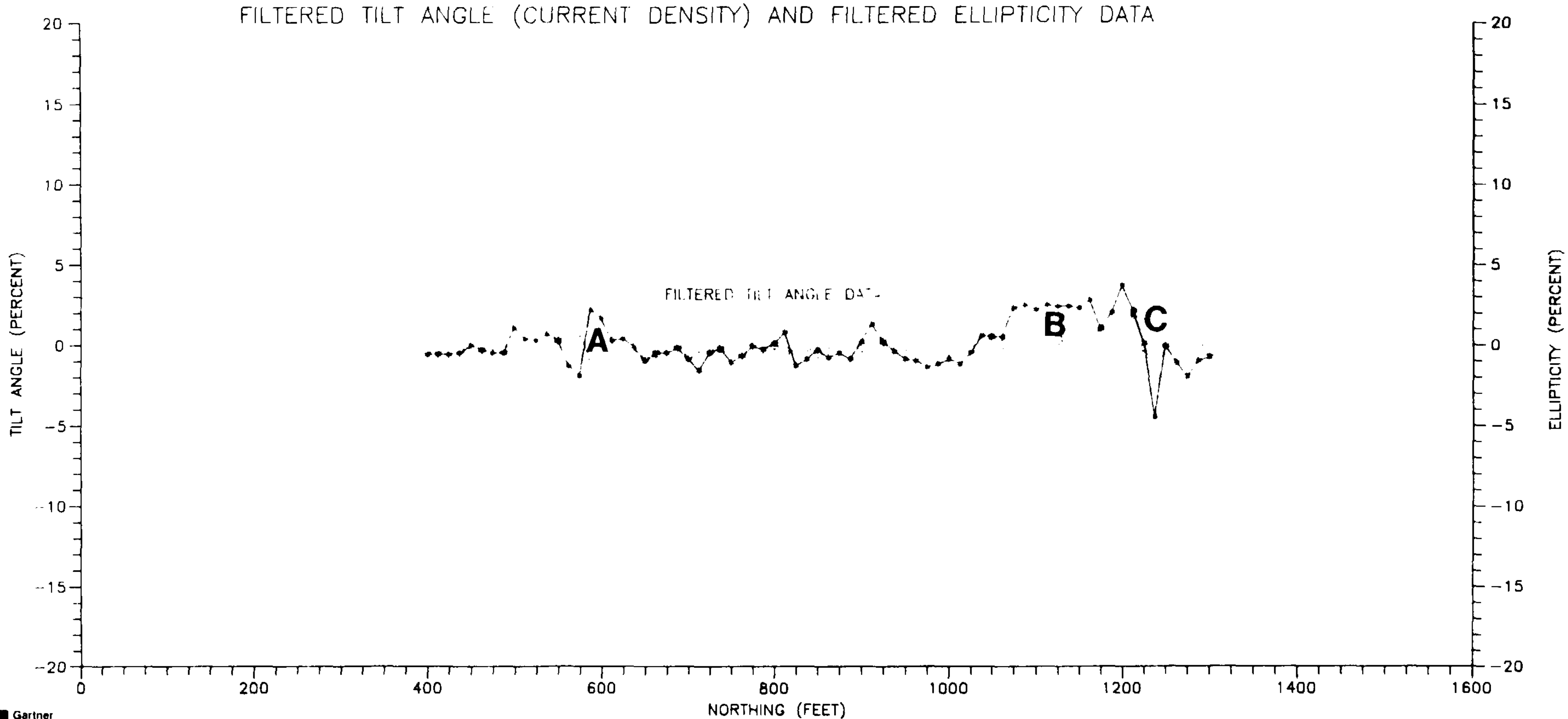
ROSE HILL REGIONAL LANDFILL SUPERFUND SITE
SOUTH KINGSTOWN, RHODE ISLAND
ABEM WADI VLF RESULTS
LINE VLF 1
TILT ANGLE (IN-PHASE) DATA AND ELLIPTICITY (IMAGINARY) DATA



Gartner Lee

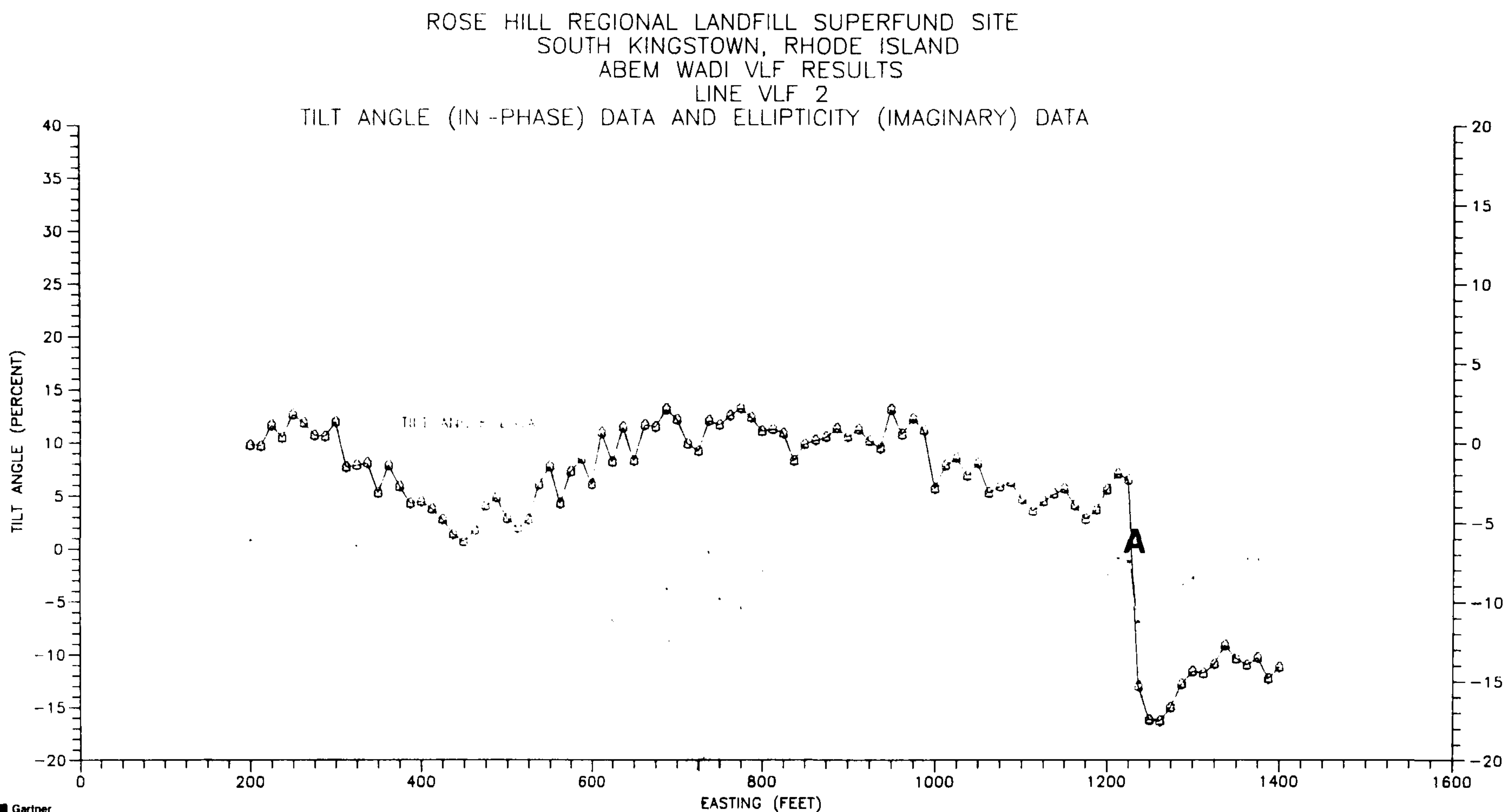
FIGURE 35

ROSE HILL REGIONAL LANDFILL SUPERFUND SITE
SOUTH KINGSTOWN, RHODE ISLAND
ABEM WADI VLF RESULTS
LINE VLF 1
FILTERED TILT ANGLE (CURRENT DENSITY) AND FILTERED ELLIPTICITY DATA



Gartner Lee

FIGURE 36



Gartner Lee

FIGURE 37

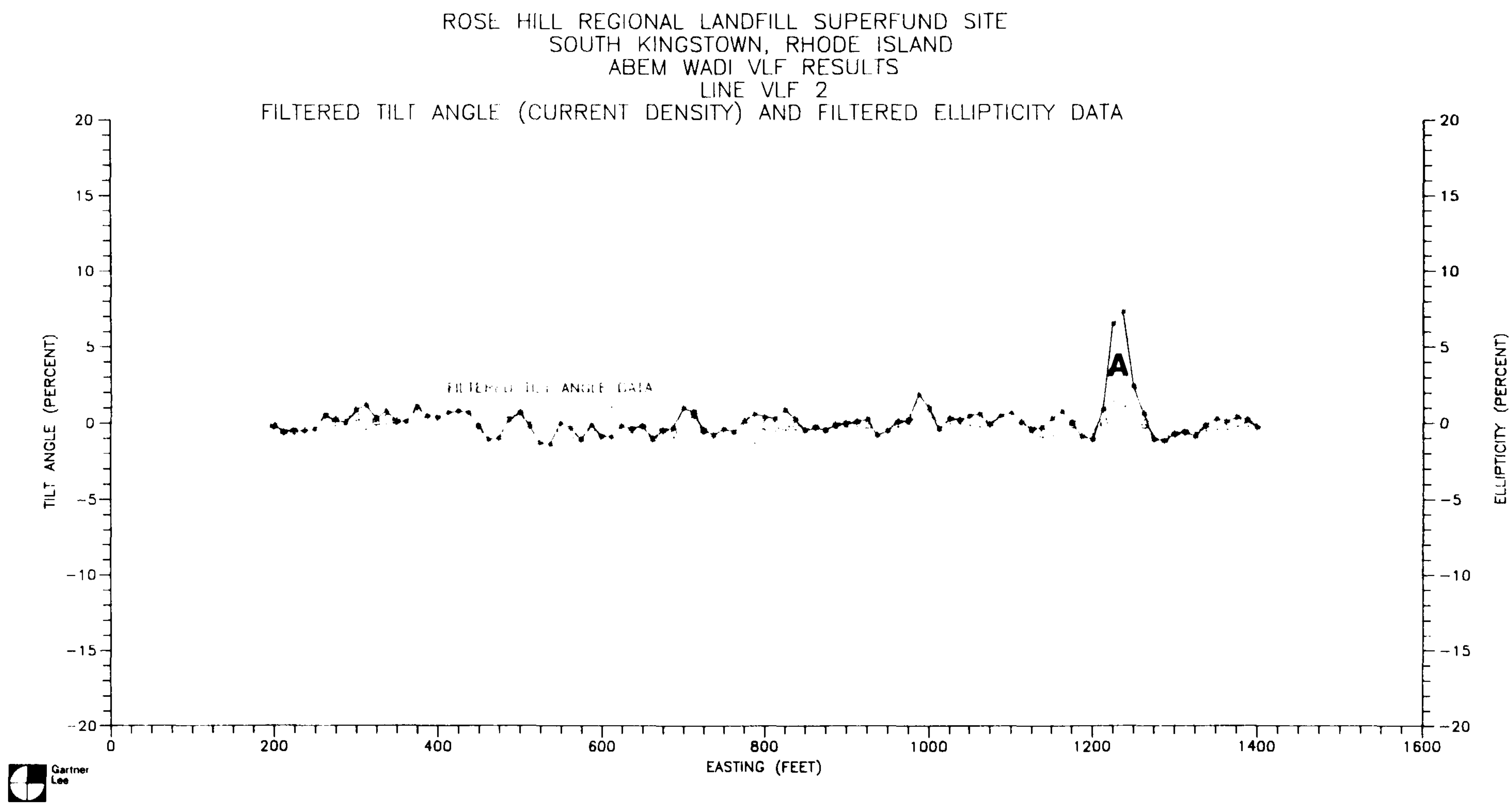

ROSE HILL REGIONAL LANDFILL SUPERFUND SITE
SOUTH KINGSTOWN, RHODE ISLAND
ABEM WADI VLF RESULTS
LINE VLF 2
FILTERED TILT ANGLE (CURRENT DENSITY) AND FILTERED ELLIPTICITY DATA
TILT ANGLE (PERCENT)
ELLIPTICITY (PERCENT)
EASTING (FEET)
A
20
15
10
5
0
-5
-10
-15
-20
0
200
400
600
800
1000
1200
1400
1600
Gartner Lee

FIGURE 38

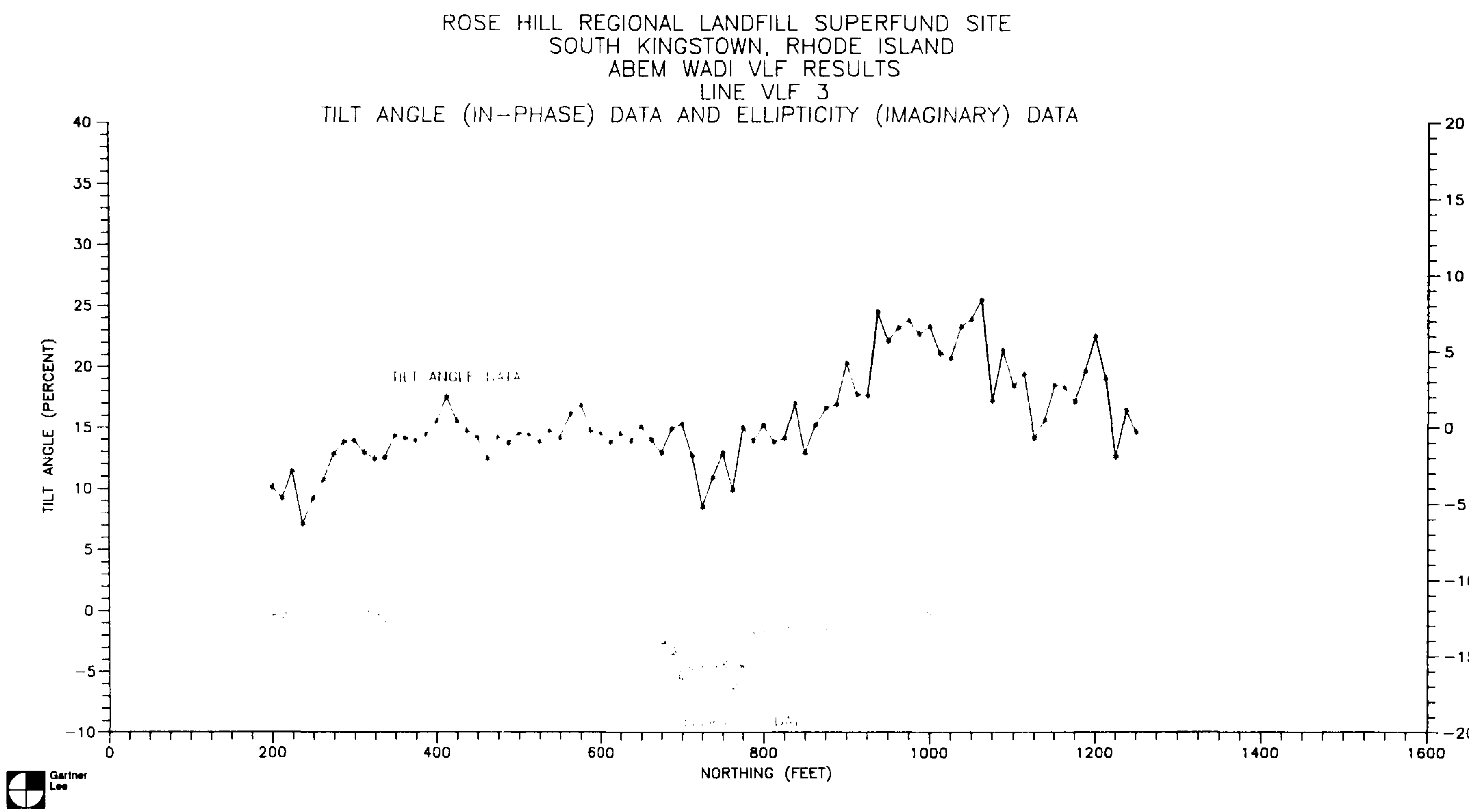
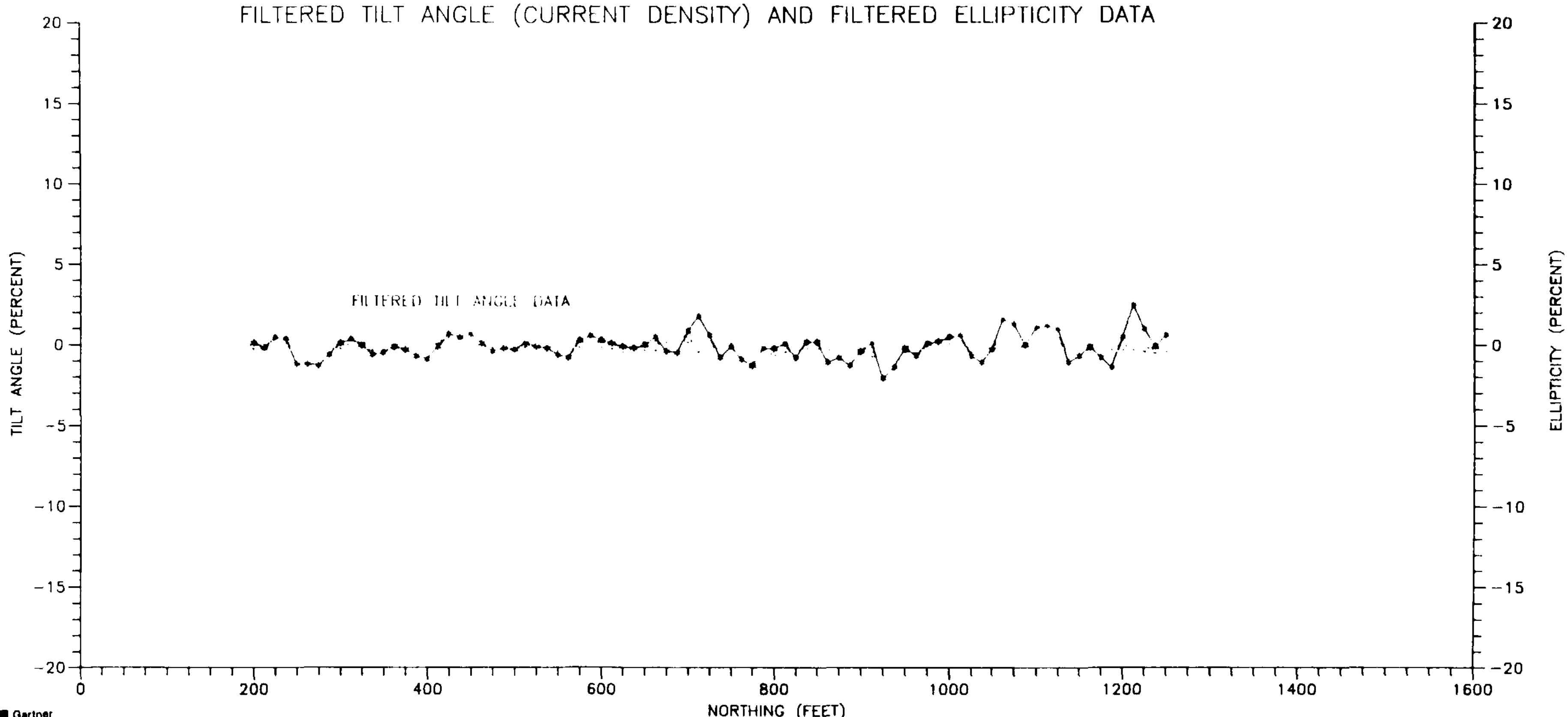

ROSE HILL REGIONAL LANDFILL SUPERFUND SITE
SOUTH KINGSTOWN, RHODE ISLAND
ABEM WADI VLF RESULTS
LINE VLF 3
TILT ANGLE (IN-PHASE) DATA AND ELLIPTICITY (IMAGINARY) DATA
TILT ANGLE (PERCENT)
ELLIPTICITY (PERCENT)
NORTHING (FEET)
40
35
30
25
20
15
10
5
0
-5
-10
20
15
10
5
0
-5
-10
-15
-20
0
200
400
600
800
1000
1200
1400
1600
Gartner Lee

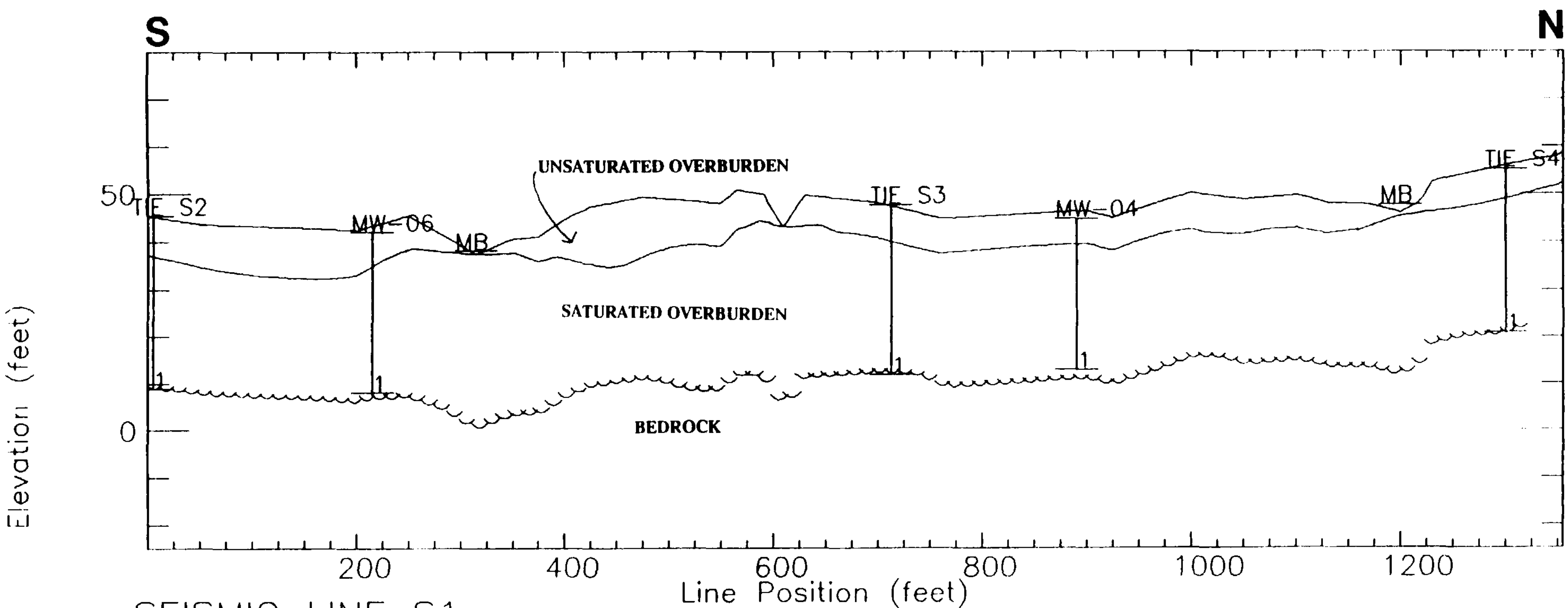
FIGURE 39

ROSE HILL REGIONAL LANDFILL SUPERFUND SITE
SOUTH KINGSTOWN, RHODE ISLAND
ABEM WADI VLF RESULTS
LINE VLF 3
FILTERED TILT ANGLE (CURRENT DENSITY) AND FILTERED ELLIPTICITY DATA



Gartner Lee

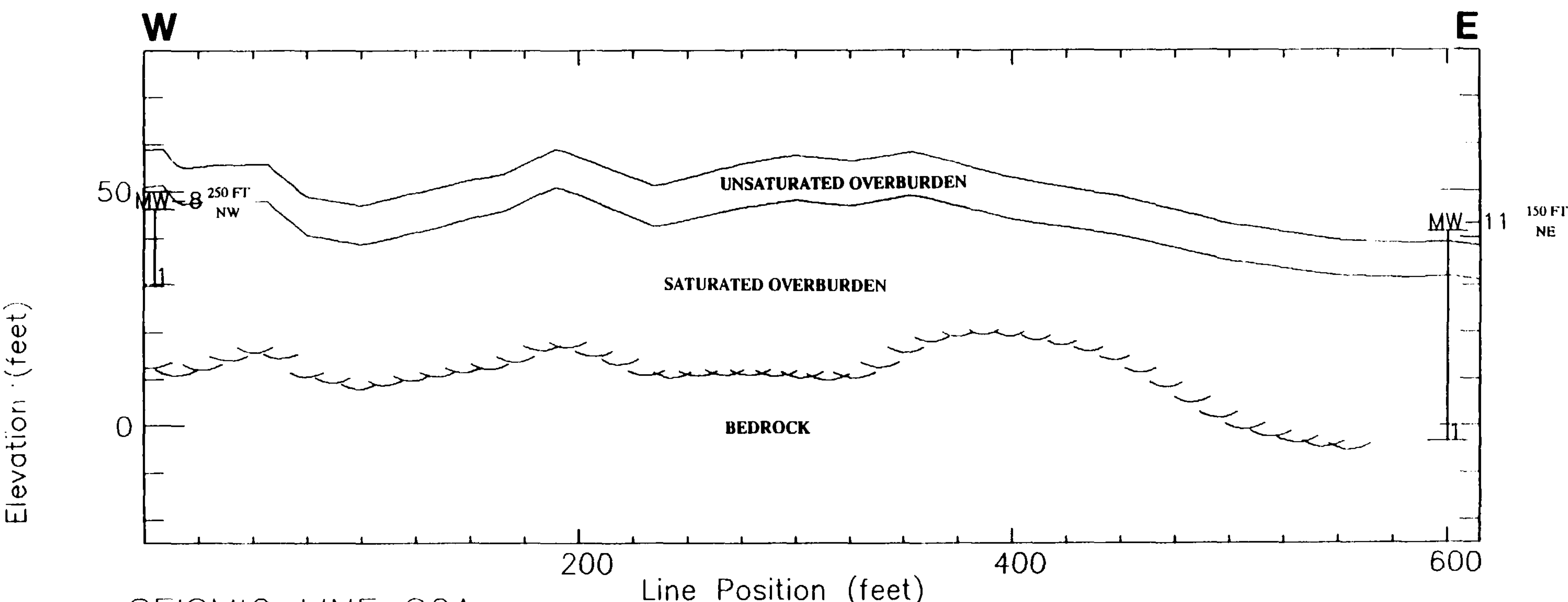
FIGURE 40



SEISMIC LINE S1
ROSE HILL LANDFILL
GARTNER LEE, INC., JUNE 1991

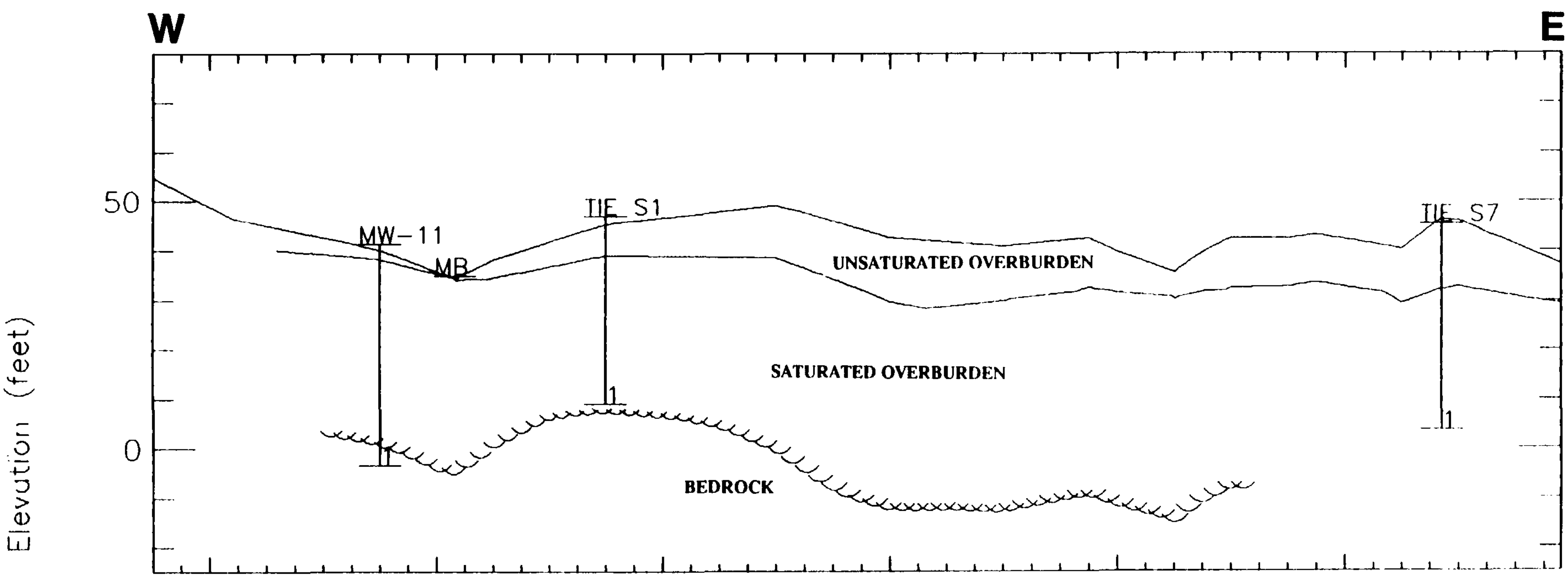
FIGURE 41

Gartner Lee



SEISMIC LINE S2A
ROSE HILL LANDFILL
GARTNER LEE, INC., JUNE 1981

FIGURE 42



SEISMIC LINES 2B AND 2C
ROSE HILL LANDFILL
GARTNER LEE, INC., JUNE 1991

FIGURE 43

Gartner Lee

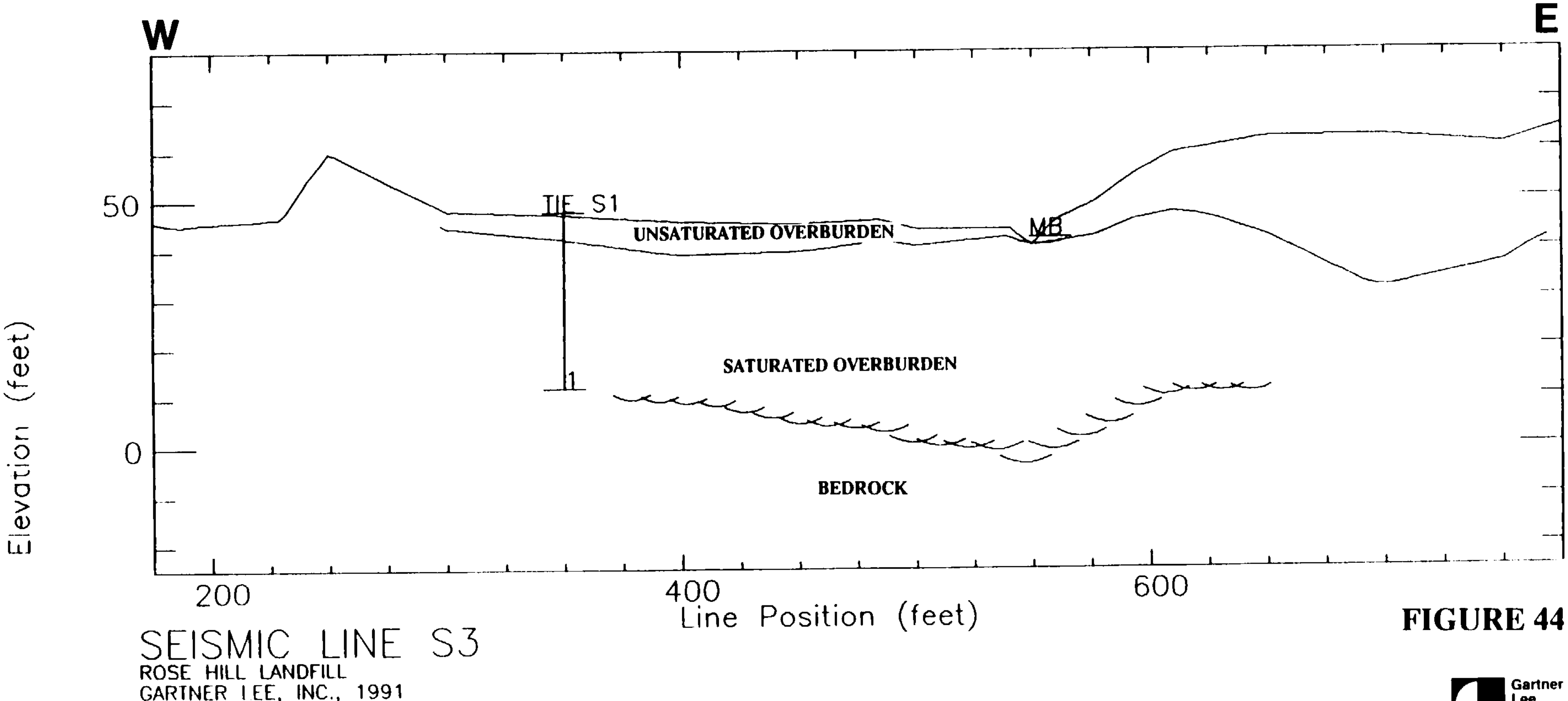
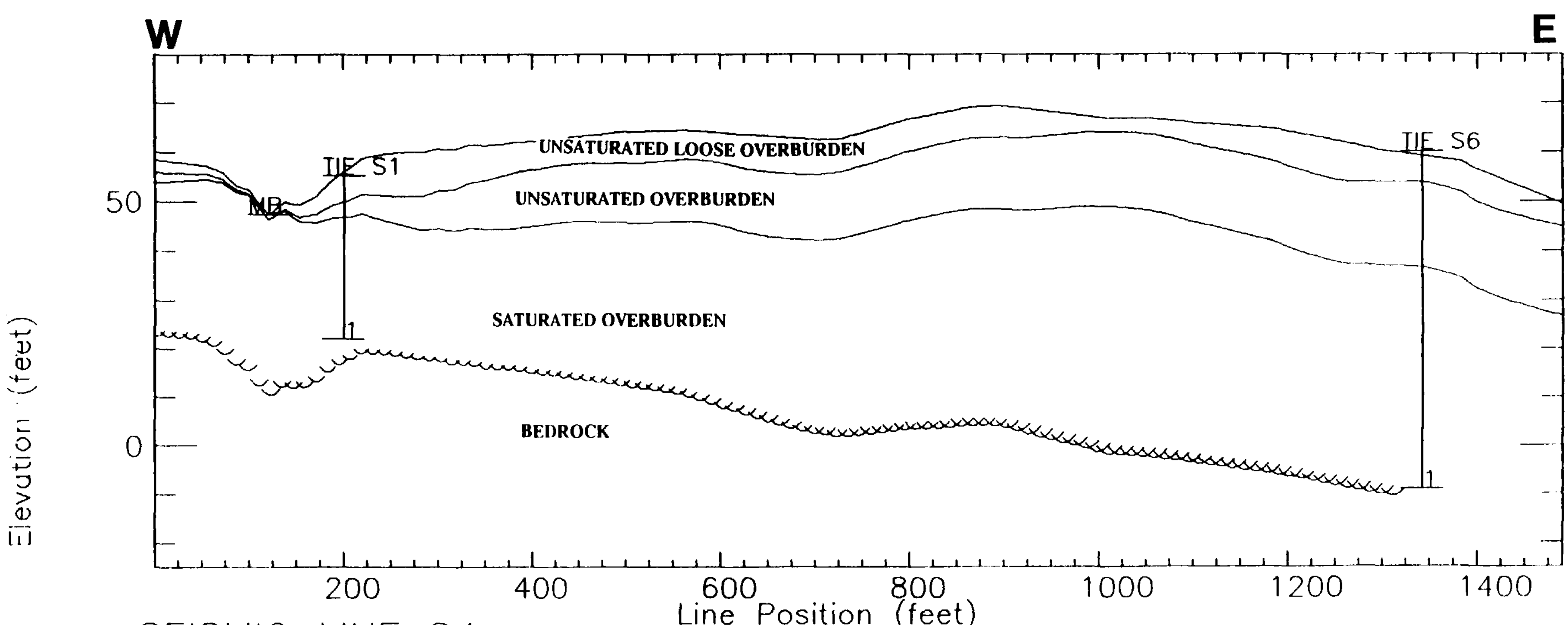


FIGURE 44

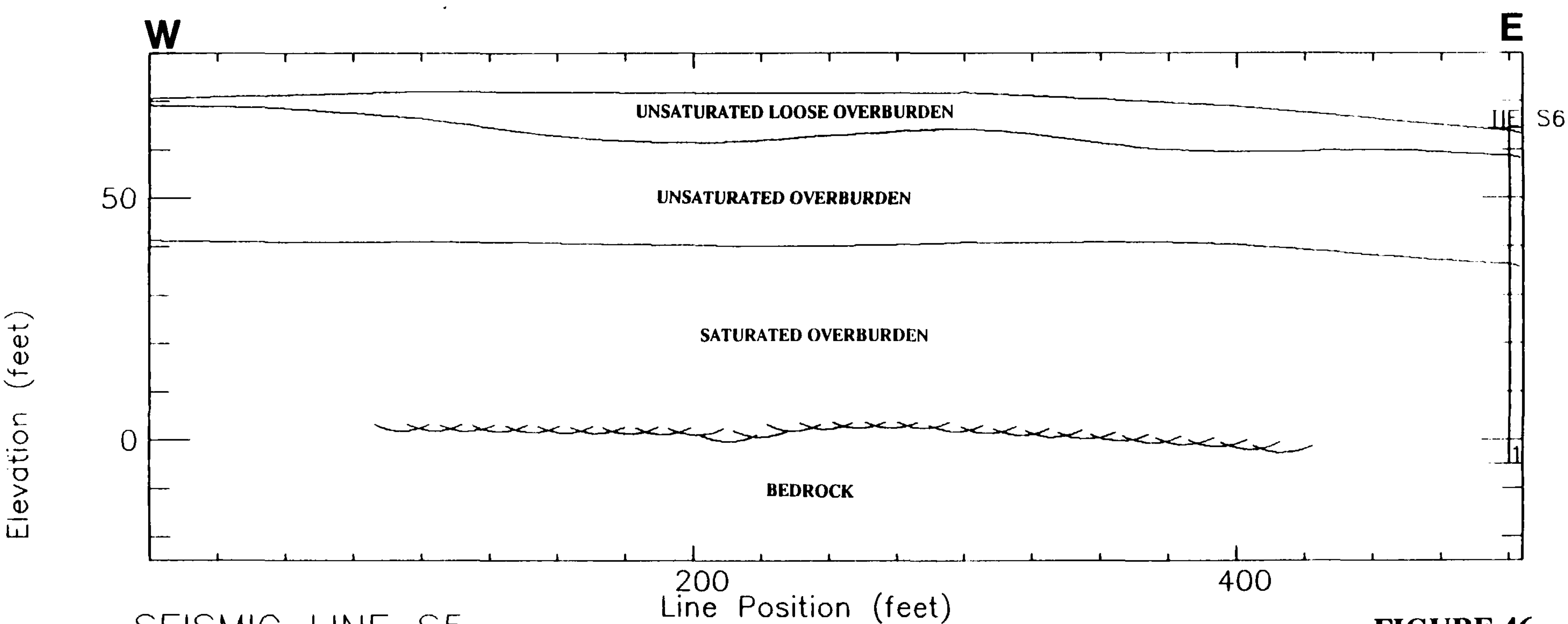
Gartner Lee



SEISMIC LINE S4
ROSE HILL LANDFILL
GARTNER LEE, INC., JUNE 1991

FIGURE 45

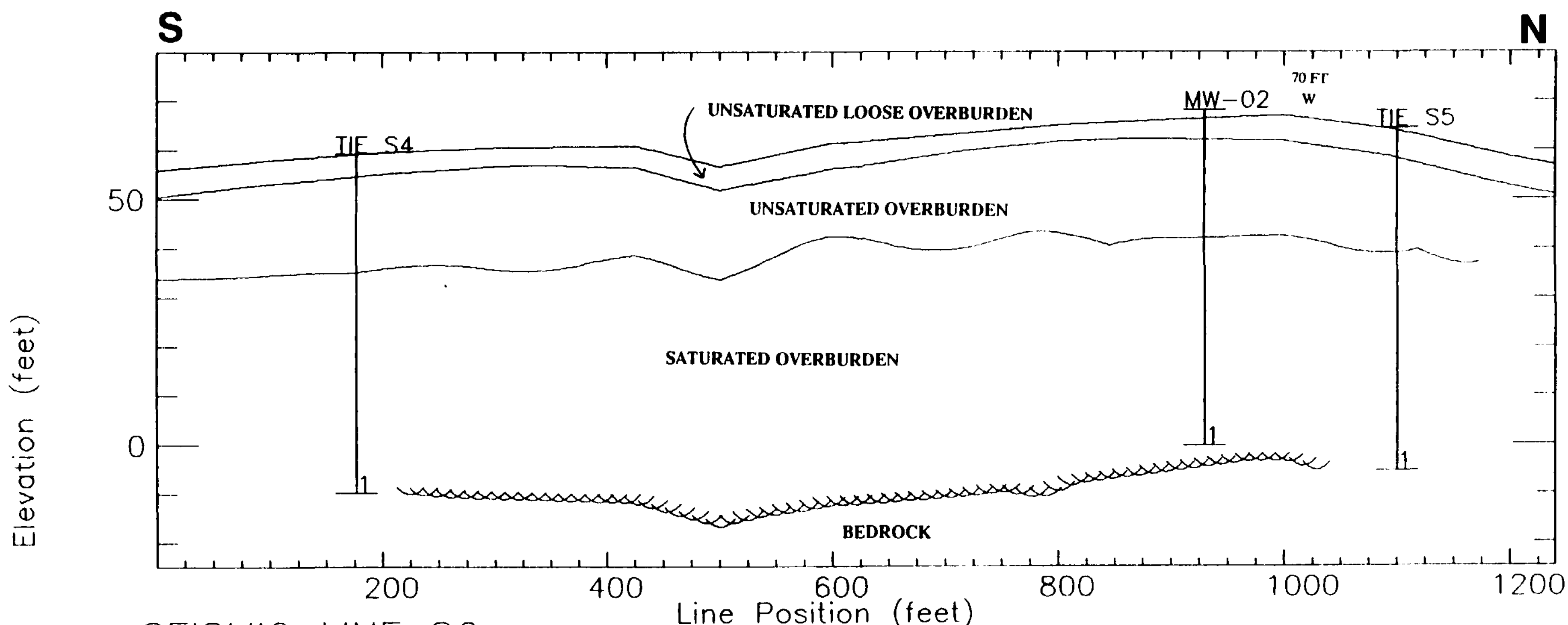
Gartner Lee



SEISMIC LINE S5
ROSE HILL LANDFILL SITE
GARTNER LEE, INC., JUNE 1991

FIGURE 46

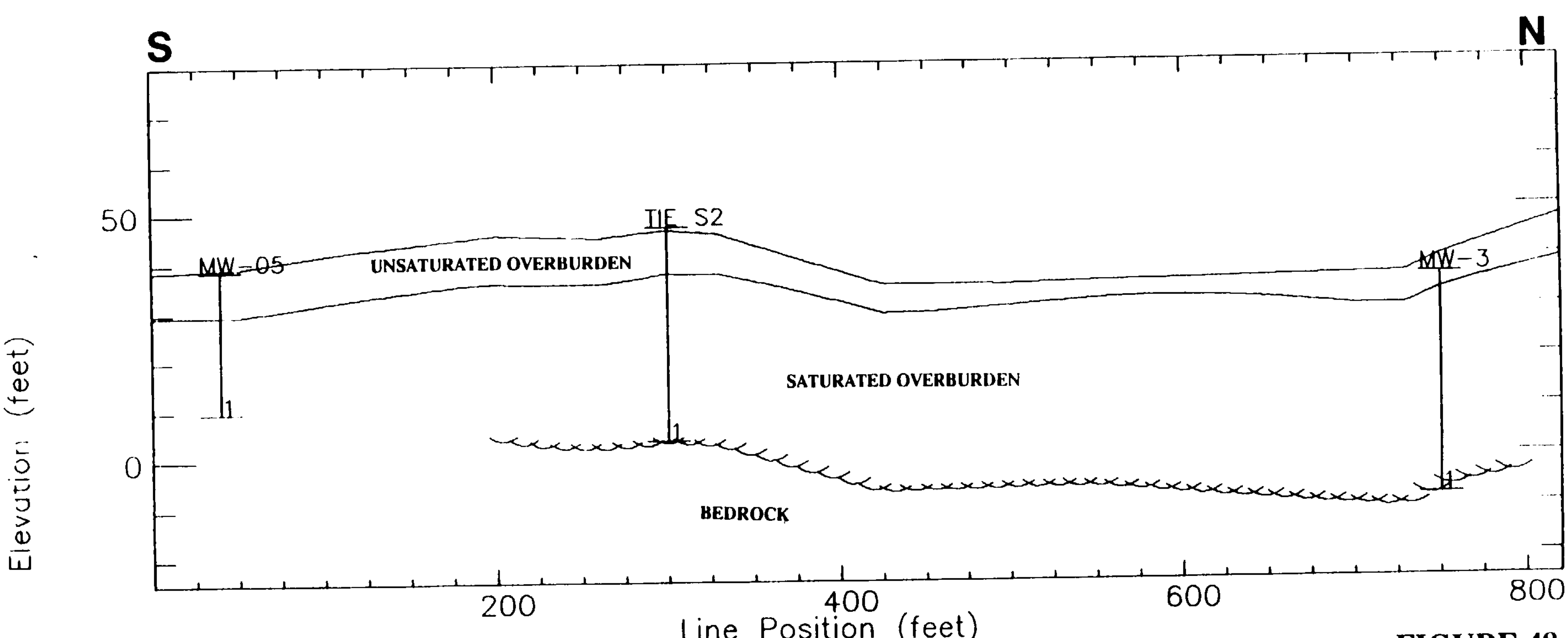
Gartner Lee



SEISMIC LINE S6
ROSE HILL LANDFILL
GARTNER LEE, INC., JUNE 1991

FIGURE 47

Gartner Lee



SEISMIC LINE S7
ROSE HILL LANDFILL
GARTNER LEE, INC. JUNE 1991

FIGURE 48

Gartner Lee

B-7 TEST BORING AND PERMEABILITY TEST POINTS - 07/22/91 - 09/04/91

TEST BORING AND PERMEABILITY TEST POINTS - 07/22/91-09/04/91
ROSE HILL GEOTECHNICAL DATA

LOCATION NAME:		MW-02-01	MW-03-01	MW-03-01	MW-03-01	MW-07-01
SAMPLE DEPTH (FT):		18 - 22	16 - 21	25 - 40	25 - 40	26 - 32
M&E SAMPLE ID:		MW-02-1-18.0-22.0-NX-B-103	MW-03-1-16.2-20.5-NX-B-104-2	MW-03-1-25.0-39.5-FD-B-124-2	MW-03-1-25.0-39.5-NX-B-104-2	MW-07-1-26-32-NX-B-113-2
DATE SAMPLED:		07/26/91	07/31/91	08/01/91	08/01/91	08/06/91
REMARKS:				Field Duplicate		
TOTAL COMBUSTIBLE ORGANICS						
Moisture Content	(%)	4.6	20.2	5.7	5.7	9.0
Organic Content	(%)	0.5	0.6	0.2	0.2	0.5
Solids Content	(%)	95.4	79.7	94.3	94.4	91.0
GRAIN SIZE						
Clay	(%)	.1	3	0	0	1.3
Gravel	(%)	3.5	0	2.6	3.1	20.3
Sand	(%)	81.9	6.9	90.4	90.6	69.2
Silt	(%)	14.5	90	7	6.3	9.2
ATTERBERG LIMITS						
Liquid Limit	--	NA	NA	NA	NA	NA
Plastic Limit	--	NA	NA	NA	NA	NA

TEST BORING AND PERMEABILITY TEST POINTS - 07/22/91-09/04/91
ROSE HILL GEOTECHNICAL DATA

LOCATION NAME:		MW-09-01	MW-10-01	MW-11-01	MW-12-01	MW-13-01
SAMPLE DEPTH (FT):		16 - 26	6.0 - 14	8.0 - 13	27 - 32	9.0 - 17
M&E SAMPLE ID:		MW-09-1-16'-26'-NX-B-116-2	MW-10-1-6'-14'-NX-B-118-2	MW-11-01-8'-13'-NX-B-119-2	MW-12-1-26.9-32-NX-B-121-2	NMW-13-1-9.0-17.0-NX-B-122-2
DATE SAMPLED:		09/04/91	08/26/91	08/15/91	08/09/91	07/22/91
REMARKS:						
TOTAL COMBUSTIBLE ORGANICS						
Moisture Content	(%)	*	20.9	9.7	21.9	14.2
Organic Content	(%)	0.3	2.6	0.9	0.9	0.4
Solids Content	(%)	*	79.1	90.4	78.1	85.8
GRAIN SIZE						
Clay	(%)	1.8	0	1.7	10.3	0
Gravel	(%)	21.3	.8	23.7	0	7.7
Sand	(%)	57.5	28.9	68.8	6.7	87.4
Silt	(%)	19.4	70.3	5.8	82.9	4.9
ATTERBERG LIMITS						
Liquid Limit	--	NA	NA	NA	NA	NA
Plastic Limit	--	NA	NA	NA	NA	NA

TEST BORING AND PERMEABILITY TEST POINTS - 07/22/91-09/04/91
ROSE HILL GEOTECHNICAL DATA

LOCATION NAME:		MW-13-01	PT-01	PT-01	PT-02	PT-02
SAMPLE DEPTH (FT):		21 - 30	0.0 -2.0	0.0 -4.0	0.0 -2.0	0.0 -4.0
M&E SAMPLE ID:		NMW-13-1-21-29.5-NX-B-122	BH-08-0-02-NX-B-139-2	BH-08-0-04-NX-B-139-2	BH-09-0-02-NX-B-141-2	BH-09-0-04-NX-B-141-2
DATE SAMPLED:		07/25/91	08/27/91	08/27/91	08/27/91	08/27/91
REMARKS:						
TOTAL COMBUSTIBLE ORGANICS						
Moisture Content	(%)	10.2	NA	16.9	NA	14.6
Organic Content	(%)	0.2	NA	2.3	NA	3.6
Solids Content	(%)	89.8	NA	83.1	NA	85.4
GRAIN SIZE						
Clay	(%)	0.8	NA	6	NA	4.6
Gravel	(%)	26.8	NA	7.7	NA	13.7
Sand	(%)	57.1	NA	44.5	NA	54.3
Silt	(%)	15.3	NA	41.8	NA	27.4
ATTERBERG LIMITS						
Liquid Limit	--	NA	NA	--	NA	--
Plastic Limit	--	NA	NA	NP	NA	NP

TEST BORING AND PERMEABILITY TEST POINTS - 07/22/91-09/04/91
ROSE HILL GEOTECHNICAL DATA

LOCATION NAME:		PT-03	PT-03	PT-04	PT-04	PT-05
SAMPLE DEPTH (FT):		0.0 -2.0	0.0 -4.0	0.0 -2.0	0.0 -4.0	0.0 -2.0
M&E SAMPLE ID:		BH-10-0-02-NX-B-143-2	BH-10-0-04-NX-B-143-2	BH-11-0-02-NX-B-155-2	BH-11-0-04-NX-B-155-2	BH-12-0-02-FD-B-144-2
DATE SAMPLED:		08/27/91	08/27/91	08/27/91	08/27/91	08/27/91
REMARKS:						Field Duplicate
TOTAL COMBUSTIBLE ORGANICS						
Moisture Content	(%)	NA	11.9	NA	10.1	NA
Organic Content	(%)	NA	2.6	NA	2.2	NA
Solids Content	(%)	NA	88.1	NA	89.9	NA
GRAIN SIZE						
Clay	(%)	NA	5	NA	5.1	NA
Gravel	(%)	NA	15	NA	11.5	NA
Sand	(%)	NA	55	NA	57.8	NA
Silt	(%)	NA	24.9	NA	25.5	NA
ATTERBERG LIMITS						
Liquid Limit	--	NA	--	NA	--	NA
Plastic Limit	--	NA	NP	NA	NP	NA

TEST BORING AND PERMEABILITY TEST POINTS - 07/22/91-09/04/91
ROSE HILL GEOTECHNICAL DATA

LOCATION NAME:		PT-05	PT-05	PT-05
SAMPLE DEPTH (FT):		0.0 -2.0	0.0 -4.0	0.0 -4.0
M&E SAMPLE ID:		BH-12-0-02-NX-B-156-2	BH-12-0-04-FD-B-144-2	BH-12-0-04-NX-B-156-2
DATE SAMPLED:		08/27/91	08/27/91	08/27/91
REMARKS:			Field Duplicate	
TOTAL COMBUSTIBLE ORGANICS				
Moisture Content	(%)	NA	11.0	10.8
Organic Content	(%)	NA	1.9	2.1
Solids Content	(%)	NA	95.1	89.2
GRAIN SIZE				
Clay	(%)	NA	3.3	3.3
Gravel	(%)	NA	8.2	10.5
Sand	(%)	NA	59.8	59.9
Silt	(%)	NA	28.6	27.2
ATTERBERG LIMITS				
Liquid Limit	--	NA	--	--
Plastic Limit	--	NA	NP	NP

B-7 TEST BORING AND PERMEABILITY TEST POINTS -
07/22/91 - 09/04/91

TEST BORING AND PERMEABILITY TEST POINTS - 07/22/91-09/04/91
ROSE HILL GEOTECHNICAL DATA

LOCATION NAME:		MW-02-01	MW-03-01	MW-03-01	MW-03-01	MW-07-01
SAMPLE DEPTH (FT):		18 - 22	16 - 21	25 - 40	25 - 40	26 - 32
M&E SAMPLE ID:		MW-02-1-18.0-22.0-NX-B-103	MW-03-1-16.2-20.5-NX-B-104-2	MW-03-1-25.0-39.5-FD-B-124-2	MW-03-1-25.0-39.5-NX-B-104-2	MW-07-1-26-32-NX-B-113-2
DATE SAMPLED:		07/26/91	07/31/91	08/01/91	08/01/91	08/06/91
REMARKS:				Field Duplicate		
TOTAL COMBUSTIBLE ORGANICS						
Moisture Content	(%)	4.6	20.2	5.7	5.7	9.0
Organic Content	(%)	0.5	0.6	0.2	0.2	0.5
Solids Content	(%)	95.4	79.7	94.3	94.4	91.0
GRAIN SIZE						
Clay	(%)	.1	3	0	0	1.3
Gravel	(%)	3.5	0	2.6	3.1	20.3
Sand	(%)	81.9	6.9	90.4	90.6	69.2
Silt	(%)	14.5	90	7	6.3	9.2
ATTERBERG LIMITS						
Liquid Limit	--	NA	NA	NA	NA	NA
Plastic Limit	--	NA	NA	NA	NA	NA

TEST BORING AND PERMEABILITY TEST POINTS - 07/22/91-09/04/91
ROSE HILL GEOTECHNICAL DATA

LOCATION NAME:		MW-09-01	MW-10-01	MW-11-01	MW-12-01	MW-13-01
SAMPLE DEPTH (FT):		16 - 26	6.0 - 14	8.0 - 13	27 - 32	9.0 - 17
M&E SAMPLE ID:		MW-09-1-16'-26'-NX-B-116-2	MW-10-1-6'-14'-NX-B-118-2	MW-11-01-8'-13'-NX-B-119-2	MW-12-1-26.9-32-NX-B-121-2	NMW-13-1-9.0-17.0-NX-B-122-2
DATE SAMPLED:		09/04/91	08/26/91	08/15/91	08/09/91	07/22/91
REMARKS:						
TOTAL COMBUSTIBLE ORGANICS						
Moisture Content	(%)	*	20.9	9.7	21.9	14.2
Organic Content	(%)	0.3	2.6	0.9	0.9	0.4
Solids Content	(%)	*	79.1	90.4	78.1	85.8
GRAIN SIZE						
Clay	(%)	1.8	0	1.7	10.3	0
Gravel	(%)	21.3	.8	23.7	0	7.7
Sand	(%)	57.5	28.9	68.8	6.7	87.4
Silt	(%)	19.4	70.3	5.8	82.9	4.9
ATTERBERG LIMITS						
Liquid Limit	--	NA	NA	NA	NA	NA
Plastic Limit	--	NA	NA	NA	NA	NA

TEST BORING AND PERMEABILITY TEST POINTS - 07/22/91-09/04/91
ROSE HILL GEOTECHNICAL DATA

LOCATION NAME:		MW-13-01	PT-01	PT-01	PT-02	PT-02
SAMPLE DEPTH (FT):		21 - 30	0.0 -2.0	0.0 -4.0	0.0 -2.0	0.0 -4.0
M&E SAMPLE ID:		NMW-13-1-21-29.5-NX-B-122	BH-08-0-02-NX-B-139-2	BH-08-0-04-NX-B-139-2	BH-09-0-02-NX-B-141-2	BH-09-0-04-NX-B-141-2
DATE SAMPLED:		07/25/91	08/27/91	08/27/91	08/27/91	08/27/91
REMARKS:						
TOTAL COMBUSTIBLE ORGANICS						
Moisture Content	(%)	10.2	NA	16.9	NA	14.6
Organic Content	(%)	0.2	NA	2.3	NA	3.6
Solids Content	(%)	89.8	NA	83.1	NA	85.4
GRAIN SIZE						
Clay	(%)	0.8	NA	6	NA	4.6
Gravel	(%)	26.8	NA	7.7	NA	13.7
Sand	(%)	57.1	NA	44.5	NA	54.3
Silt	(%)	15.3	NA	41.8	NA	27.4
ATTERBERG LIMITS						
Liquid Limit	--	NA	NA	--	NA	--
Plastic Limit	--	NA	NA	NP	NA	NP

TEST BORING AND PERMEABILITY TEST POINTS - 07/22/91-09/04/91
ROSE HILL GEOTECHNICAL DATA

LOCATION NAME:		PT-03	PT-03	PT-04	PT-04	PT-05
SAMPLE DEPTH (FT):		0.0 -2.0	0.0 -4.0	0.0 -2.0	0.0 -4.0	0.0 -2.0
M&E SAMPLE ID:		BH-10-0-02-NX-B-143-2	BH-10-0-04-NX-B-143-2	BH-11-0-02-NX-B-155-2	BH-11-0-04-NX-B-155-2	BH-12-0-02-FD-B-144-2
DATE SAMPLED:		08/27/91	08/27/91	08/27/91	08/27/91	08/27/91
REMARKS:						Field Duplicate
TOTAL COMBUSTIBLE ORGANICS						
Moisture Content	(%)	NA	11.9	NA	10.1	NA
Organic Content	(%)	NA	2.6	NA	2.2	NA
Solids Content	(%)	NA	88.1	NA	89.9	NA
GRAIN SIZE						
Clay	(%)	NA	5	NA	5.1	NA
Gravel	(%)	NA	15	NA	11.5	NA
Sand	(%)	NA	55	NA	57.8	NA
Silt	(%)	NA	24.9	NA	25.5	NA
ATTERBERG LIMITS						
Liquid Limit	--	NA	--	NA	--	NA
Plastic Limit	--	NA	NP	NA	NP	NA

TEST BORING AND PERMEABILITY TEST POINTS - 07/22/91-09/04/91
ROSE HILL GEOTECHNICAL DATA

LOCATION NAME:		PT-05	PT-05	PT-05
SAMPLE DEPTH (FT):		0.0 -2.0	0.0 -4.0	0.0 -4.0
M&E SAMPLE ID:		BH-12-0-02-NX-B-156-2	BH-12-0-04-FD-B-144-2	BH-12-0-04-NX-B-156-2
DATE SAMPLED:		08/27/91	08/27/91	08/27/91
REMARKS:			Field Duplicate	
TOTAL COMBUSTIBLE ORGANICS				
Moisture Content	(%)	NA	11.0	10.8
Organic Content	(%)	NA	1.9	2.1
Solids Content	(%)	NA	95.1	89.2
GRAIN SIZE				
Clay	(%)	NA	3.3	3.3
Gravel	(%)	NA	8.2	10.5
Sand	(%)	NA	59.8	59.9
Silt	(%)	NA	28.6	27.2
ATTERBERG LIMITS				
Liquid Limit	--	NA	--	--
Plastic Limit	--	NA	NP	NP

APPENDIX C
SOIL GAS SURVEY DATA

C-1 HANDHELD INSTRUMENT SAMPLING DATA

ROSE HILL LANDFILL GAS DATA
ROUND 1 HAND HELD INSTRUMENT DATA – JUNE/JULY, 1991 SAMPLING

Location	Type of Point	Waste Area	Carbon Dioxide (percent)	Oxygen (percent)	OVA (ppm)	Methane (percent)	PID(10.6) (ppm)	LEL (percent)
BW(00_000)	TP	bulky	3.36	17.40	35.00	0.00	NA	NA
BW(00_100)	TP	bulky	35.70	2.90	NA	45.10	NA	NA
BW(00_200)	TP	bulky	12.90	NA	NA	21.90	NA	NA
BW(01_000)	TP	bulky	32.90	1.30	NA	49.60	NA	NA
BW(01_300)	TP	bulky	30.70	1.00	NA	49.60	NA	NA
BW(01_–25)	TP	bulky	18.00	2.50	NA	1.15	NA	NA
BW(02_100)	TP	bulky	45.00	2.00	NA	55.60	NA	NA
BW(02_300)	TP	bulky	49.00	4.80	NA	52.00	NA	NA
BW(02_400)	TP	bulky	4.02	19.00	NA	4.90	NA	NA
BW(03_000)	TP	bulky	0.00	20.60	25.00	0.00	NA	NA
BW(03_200)	TP	bulky	43.00	2.00	NA	57.20	NA	NA
BW(03_400)	TP	bulky	25.00	7.30	NA	32.00	NA	NA
BW(03_500)	TP	bulky	18.40	7.30	NA	36.30	NA	NA
BW(04_100)	TP	bulky	30.00	6.40	NA	38.70	NA	NA
BW(04_300)	TP	bulky	47.00	0.90	NA	53.00	NA	NA
BW(04_500)	TP	bulky	41.00	1.10	NA	50.00	NA	NA
BW(04_600)	TP	bulky	4.20	16.70	NA	0.50	NA	NA
BW(05_000)	TP	bulky	3.08	17.40	NA	3.23	NA	NA
BW(05_200)	TP	bulky	35.60	2.20	NA	22.70	NA	NA
BW(05_400)	TP	bulky	43.00	2.70	NA	56.00	NA	NA
BW(05_500)	TP	bulky	42.00	1.10	NA	55.00	NA	NA
BW(05_600)	TP	bulky	7.32	19.50	9.00	0.00	NA	NA
BW(06_200)	TP	bulky	0.00	20.60	NA	0.00	NA	NA
BW(06_300)	TP	bulky	0.00	20.60	20.00	0.00	NA	NA
BW(06_500)	TP	bulky	33.90	3.20	NA	29.50	NA	NA
BW(07_400)	TP	bulky	11.30	15.20	NA	10.30	NA	NA
LFGF–01	PP	north perimeter	1.13	19.60	12.00	0.00	NA	NA
LFGF–02	PP	north perimeter	1.18	19.75	13.00	0.00	NA	NA
LFGF–03	PP	north perimeter	31.50	2.70	NA	58.00	NA	NA
LFGF–04	PP	north perimeter	1.44	19.60	18.00	0.07	NA	NA
LFGF–05	PP	north perimeter	2.28	19.40	5.00	0.08	NA	NA
LFGF–06	PP	north perimeter	0.60	20.30	0.00	0.00	NA	NA

ROSE HILL LANDFILL GAS DATA
ROUND 1 HAND HELD INSTRUMENT DATA - JUNE/JULY, 1991 SAMPLING

Location	Type of Point	Waste Area	Carbon Dioxide (percent)	Oxygen (percent)	OVA (ppm)	Methane (percent)	PID(10.6) (ppm)	LEL (percent)
LFGF-07	PP	north perimeter	0.50	20.30	0.00	0.00	NA	NA
LFGF-08	PP	north perimeter	0.30	20.40	4.00	0.00	NA	NA
LFGF-09	PP	north perimeter	0.60	20.30	0.00	0.00	NA	NA
LFGR-02	PP	west perimeter	2.70	18.60	5.00	0.10	NA	NA
LFGR-03	PP	west perimeter	1.80	19.20	2.00	0.10	NA	NA
LFGR-04	PP	west perimeter	3.35	17.60	5.00	0.10	NA	NA
LFGR-05	PP	west perimeter	2.95	17.90	NA	0.10	NA	NA
LFGR-06	PP	west perimeter	3.43	17.60	2.00	0.11	NA	NA
LFGR-07	PP	west perimeter	24.00	0.90	NA	15.90	NA	NA
LFGR-08	PP	west perimeter	44.20	0.90	NA	60.90	NA	NA
LFGR-09	PP	west perimeter	19.40	20.60	NA	13.80	NA	NA
LFGR-10	PP	west perimeter	47.00	1.10	NA	56.40	NA	NA
LFGR-11	PP	west perimeter	42.20	2.45	NA	46.55	NA	NA
LFGR-12	PP	west perimeter	NA	NA	NA	NA	NA	NA
LFGR-13	PP	west perimeter	43.00	5.60	NA	47.10	NA	NA
LFGR-14	PP	west perimeter	2.30	NA	NA	1.50	NA	NA
LFGR-15	PP	west perimeter	1.50	18.80	10.00	0.80	NA	NA
LFGR-16	PP	west perimeter	21.60	1.30	NA	6.00	NA	NA
LFGR-17	PP	west perimeter	29.20	1.10	NA	17.90	NA	NA
LFGR-18	PP	west perimeter	2.64	18.60	110.00	0.60	NA	NA
LFGR-19	PP	west perimeter	1.40	19.30	30.00	0.15	NA	NA
LFGT-01	PP	south perimeter	22.40	1.60	NA	8.30	NA	NA
LFGT-02	PP	south perimeter	55.00	1.60	NA	54.00	NA	NA
LFGT-03	PP	south perimeter	51.10	0.90	NA	53.60	NA	NA
LFGT-04	PP	south perimeter	31.10	1.10	NA	15.90	NA	NA
LFGT-05	PP	south perimeter	31.50	1.00	NA	18.30	NA	NA
SS(00_000)	TP	sewage sludge	0.74	20.40	1.00	0.00	NA	NA
SS(00_100)	TP	sewage sludge	2.90	17.60	0.60	0.00	NA	NA
SS(01_100)	TP	sewage sludge	11.30	8.20	80.00	0.00	NA	NA
SS(01_200)	TP	sewage sludge	0.30	20.00	0.00	0.00	NA	NA
SS(02_000)	TP	sewage sludge	0.10	20.80	0.25	0.00	NA	NA
SS(02_300)	TP	sewage sludge	2.72	18.50	0.00	0.00	NA	NA

ROSE HILL LANDFILL GAS DATA
ROUND 1 HAND HELD INSTRUMENT DATA – JUNE/JULY, 1991 SAMPLING

Location	Type of Point	Waste Area	Carbon Dioxide (percent)	Oxygen (percent)	OVA (ppm)	Methane (percent)	PID(10.6) (ppm)	LEL (percent)
SS(03_100)	TP	sewage sludge	6.30	14.80	NA	0.00	NA	NA
SS(04_000)	TP	sewage sludge	13.70	11.80	NA	0.00	NA	NA
SS(05_100)	TP	sewage sludge	2.60	18.50	1.60	0.00	NA	NA
SS(05_300)	TP	sewage sludge	0.60	20.20	0.00	0.00	NA	NA
SS(06_200)	TP	sewage sludge	0.62	19.80	1.00	0.00	NA	NA
SS(07_000)	TP	sewage sludge	9.46	12.00	100.00	0.00	NA	NA
SS(07_100)	TP	sewage sludge	0.62	19.80	0.60	0.00	NA	NA
SS(08_000)	TP	sewage sludge	12.10	9.00	NA	8.76	NA	NA
SS(09_100)	TP	sewage sludge	2.80	16.30	NA	0.00	NA	NA
SS(09_300)	TP	sewage sludge	0.00	20.60	0.00	0.00	NA	NA
SS(10_200)	TP	sewage sludge	1.41	18.50	0.00	0.03	NA	NA
SS(11_100)	TP	sewage sludge	0.35	20.50	1.00	0.03	NA	NA
SS(11_300)	TP	sewage sludge	0.30	20.40	0.00	0.00	NA	NA
SS(12_000)	TP	sewage sludge	0.00	20.70	0.00	0.03	NA	NA
SS(13_100)	TP	sewage sludge	1.65	18.00	1.00	0.03	NA	NA
SS(13_300)	TP	sewage sludge	0.00	20.70	0.00	0.00	NA	NA
SW(01_100)	TP	solid	26.40	20.10	NA	31.10	NA	NA
SW(01_300)	TP	solid	35.50	1.40	NA	25.30	NA	NA
SW(01_500)	TP	solid	22.00	7.50	NA	4.60	NA	NA
SW(02_100)	TP	solid	54.10	0.60	NA	55.60	NA	NA
SW(02_200)	TP	solid	NA	4.00	NA	NA	NA	NA
SW(02_300)	TP	solid	NA	1.50	NA	NA	NA	NA
SW(02_500)	TP	solid	43.30	1.10	NA	50.70	NA	NA
SW(03_000)	TP	solid	0.00	20.70	20.00	0.00	NA	NA
SW(03_100)	TP	solid	58.00	1.80	NA	56.00	NA	NA
SW(03_300)	TP	solid	45.00	2.30	NA	36.00	NA	NA
SW(03_500)	TP	solid	13.70	7.30	NA	0.20	NA	NA
SW(04_000)	TP	solid	15.30	16.90	NA	17.90	NA	NA
SW(04_200)	TP	solid	NA	0.70	NA	NA	NA	NA
SW(04_300)	TP	solid	16.40	8.50	NA	13.10	NA	NA
SW(04_400)	TP	solid	NA	1.30	NA	NA	NA	NA
SW(04_500)	TP	solid	44.00	4.30	NA	39.00	NA	NA

ROSE HILL LANDFILL GAS DATA
ROUND 1 HAND HELD INSTRUMENT DATA – JUNE/JULY, 1991 SAMPLING

Location	Type of Point	Waste Area	Carbon Dioxide (percent)	Oxygen (percent)	OVA (ppm)	Methane (percent)	PID(10.6) (ppm)	LEL (percent)
SW(05_000)	TP	solid	53.15	3.20	NA	49.60	NA	NA
SW(05_100)	TP	solid	10.00	10.60	NA	5.00	NA	NA
SW(05_300)	TP	solid	39.00	1.10	NA	40.00	NA	NA
SW(05_500)	TP	solid	40.00	1.40	NA	47.00	NA	NA
SW(05_600)	TP	solid	0.00	NA	7.00	0.00	NA	NA
SW(05_-40)	TP	solid	19.50	6.50	NA	7.70	NA	NA
SW(06_000)	TP	solid	50.20	1.50	NA	55.30	NA	NA
SW(06_100)	TP	solid	44.00	1.40	NA	52.00	NA	NA
SW(06_200)	TP	solid	27.00	2.00	NA	24.00	NA	NA
SW(06_400)	TP	solid	25.00	2.80	NA	27.00	NA	NA
SW(06_600)	TP	solid	18.00	4.60	NA	15.00	NA	NA
SW(07_000)	TP	solid	50.20	0.70	NA	56.00	NA	NA
SW(07_100)	TP	solid	40.00	2.90	NA	50.00	NA	NA
SW(07_300)	TP	solid	41.00	1.00	NA	39.00	NA	NA
SW(07_500)	TP	solid	44.00	1.10	NA	48.00	NA	NA
SW(07_600)	TP	solid	42.00	0.80	NA	48.00	NA	NA
SW(08_000)	TP	solid	50.20	0.60	NA	57.60	NA	NA
SW(08_100)	TP	solid	24.00	0.80	NA	9.00	NA	NA
SW(08_200)	TP	solid	41.00	3.00	NA	45.00	NA	NA
SW(08_400)	TP	solid	45.00	0.70	NA	46.00	NA	NA
SW(08_600)	TP	solid	46.00	1.00	NA	51.00	NA	NA
SW(09_000)	TP	solid	29.10	6.90	NA	33.10	NA	NA
SW(09_100)	TP	solid	34.00	0.50	NA	21.00	NA	NA
SW(09_200)	TP	solid	44.00	1.20	NA	41.00	NA	NA
SW(09_300)	TP	solid	39.00	0.60	NA	41.00	NA	NA
SW(09_400)	TP	solid	28.00	7.00	NA	28.00	0.00	NA
SW(09_500)	TP	solid	37.00	1.00	NA	32.00	0.00	NA
SW(09_600)	TP	solid	43.00	1.20	NA	45.00	0.00	NA
SW(10_000)	TP	solid	41.00	7.00	NA	50.00	NA	NA
SW(10_100)	TP	solid	31.00	4.00	NA	36.00	NA	NA
SW(10_200)	TP	solid	32.00	2.80	NA	25.00	NA	NA
SW(10_300)	TP	solid	38.00	0.60	NA	47.00	0.00	NA

ROSE HILL LANDFILL GAS DATA
ROUND 1 HAND HELD INSTRUMENT DATA – JUNE/JULY, 1991 SAMPLING

Location	Type of Point	Waste Area	Carbon Dioxide (percent)	Oxygen (percent)	OVA (ppm)	Methane (percent)	PID(10.6) (ppm)	LEL (percent)
SW(10_400)	TP	solid	36.00	2.80	NA	42.00	0.00	NA
SW(10_500)	TP	solid	43.00	0.50	0.00	44.00	NA	NA
SW(10_600)	TP	solid	45.00	0.50	NA	48.00	0.00	NA
SW(10_700)	TP	solid	56.10	1.40	NA	54.70	NA	NA
SW(11_000)	TP	solid	4.30	17.00	550.00	0.04	NA	NA
SW(11_100)	TP	solid	43.00	7.50	NA	54.00	NA	NA
SW(11_200)	TP	solid	47.00	8.00	NA	58.00	NA	NA
SW(11_300)	TP	solid	38.00	3.00	NA	41.50	NA	NA
SW(11_400)	TP	solid	41.00	2.50	50.00	50.00	NA	NA
SW(11_500)	TP	solid	47.00	1.00	NA	49.00	NA	NA
SW(11_600)	TP	solid	47.00	1.00	NA	54.00	NA	NA
SW(11_700)	TP	solid	62.40	1.00	NA	56.40	NA	NA
SW(12_000)	TP	solid	0.00	NA	NA	0.00	NA	NA
SW(12_100)	TP	solid	45.00	3.00	NA	51.00	NA	NA
SW(12_200)	TP	solid	42.00	2.00	NA	58.00	NA	NA
SW(12_300)	TP	solid	34.00	4.00	1.00	41.50	0.00	NA
SW(12_400)	TP	solid	44.00	NA	NA	48.00	5.00	NA
SW(12_500)	TP	solid	50.00	0.70	NA	45.00	2.20	NA
SW(12_600)	TP	solid	43.00	0.80	NA	51.00	75.00	NA
SW(12_700)	TP	solid	45.00	0.80	NA	60.00	NA	NA
SW(13_100)	TP	solid	12.00	8.70	700.00	0.03	NA	NA
SW(13_200)	TP	solid	37.00	0.60	NA	59.00	60.00	NA
SW(13_300)	TP	solid	10.00	11.00	0.00	13.50	0.00	NA
SW(13_400)	TP	solid	47.00	0.70	NA	54.00	17.00	NA
SW(13_500)	TP	solid	23.00	18.60	NA	29.00	190.00	NA
SW(13_600)	TP	solid	43.00	0.80	NA	47.00	5.00	NA
SW(13_700)	TP	solid	13.00	0.60	NA	23.00	NA	NA
SW(14_200)	TP	solid	25.00	1.00	NA	27.00	20.00	NA
SW(14_300)	TP	solid	41.00	NA	NA	45.00	9.20	NA
SW(14_400)	TP	solid	0.11	NA	0.00	0.15	0.00	NA
SW(14_500)	TP	solid	37.00	1.00	5.50	51.00	760.00	NA
SW(14_600)	TP	solid	0.05	NA	42.00	0.10	216.00	NA

ROSE HILL LANDFILL GAS DATA
ROUND 1 HAND HELD INSTRUMENT DATA – JUNE/JULY, 1991 SAMPLING

Location	Type of Point	Waste Area	Carbon Dioxide (percent)	Oxygen (percent)	OVA (ppm)	Methane (percent)	PID(10.6) (ppm)	LEL (percent)
SW(14_700)	TP	solid	26.00	9.90	NA	28.00	NA	NA
SW(15_400)	TP	solid	19.60	14.60	NA	22.30	NA	NA
SW(15_500)	TP	solid	32.00	5.60	NA	41.00	NA	NA
SW(15_600)	TP	solid	56.00	0.80	NA	55.00	NA	NA
SW(15_700)	TP	solid	17.30	14.20	NA	17.50	NA	NA

Notes:
T – temporary point, sampled using KV apparatus.
PP – Permenant point installed in the summer of 1991.
NA – Not measured.

ROSE HILL LANDFILL GAS DATA
ROUND 2 HAND HELD INSTRUMENT DATA – SEPTEMBER, 1991 SAMPLING

Location	Area Type	Carbon Dioxide (percent)	Oxygen (percent)	OVA (ppm)	Methane (percent)	PID(10.6) (ppm)	LEL (percent)
LFGF–01	north	3.60	18.00	1.00	0.00	NA	1.00
LFGF–02	north	5.55	17.05	4.50	0.00	39.35	4.00
LFGF–03	north	39.00	0.60	NA	78.00	75.00	12.00
LFGF–04	north	0.00	NA	0.00	0.00	0.00	0.00
LFGF–05	north	5.20	7.00	1.50	0.00	0.00	13.40
LFGF–07	north	0.00	19.20	1.50	0.00	0.00	7.00
LFGF–08	north	1.87	19.50	0.30	0.00	20.00	0.00
LFGF–09	north	1.90	9.80	0.50	0.00	0.00	0.00
LFGR–02	west	17.00	3.60	NA	15.00	2.00	95.00
LFGR–03	west	3.40	18.60	9.00	0.00	25.10	0.00
LFGR–04	west	5.70	16.70	3.00	0.00	0.50	0.00
LFGR–05	west	4.30	17.60	1.00	0.00	0.00	0.00
LFGR–06	west	8.50	13.30	1.00	0.00	0.00	0.00
LFGR–07	west	21.80	1.00	NA	24.50	36.10	1.00
LFGR–08	west	44.40	0.70	NA	66.60	47.00	NA
LFGR–09	west	32.00	10.00	NA	39.00	0.00	98.00
LFGR–10	west	46.00	0.70	NA	68.00	0.00	NA
LFGR–11	west	42.20	2.00	NA	67.00	5.10	1.00
LFGR–12	west	NA	NA	NA	NA	NA	NA
LFGR–13	west	15.00	0.70	NA	13.00	0.00	NA
LFGR–14	west	1.00	20.20	0.00	0.00	0.00	0.00
LFGR–15	west	2.50	15.50	4.00	0.00	0.00	0.00
LFGR–16	west	33.00	1.20	NA	35.00	0.00	NA
LFGR–17	west	34.00	0.90	NA	42.00	0.00	NA
LFGR–18	west	6.00	15.70	15.00	0.00	0.00	0.00
LFGR–19	west	4.20	16.40	7.00	0.00	0.00	0.00
LFGT–01	south	28.20	1.50	NA	50.40	0.00	9.00
LFGT–02	south	NA	2.40	NA	NA	5.60	9.00

ROSE HILL LANDFILL GAS DATA
ROUND 2 HAND HELD INSTRUMENT DATA - SEPTEMBER, 1991 SAMPLING

Location	Area Type	Carbon Dioxide (percent)	Oxygen (percent)	OVA (ppm)	Methane (percent)	PID(10.6) (ppm)	LEL (percent)
LFGT-03	south	51.00	0.90	NA	62.00	38.00	NA
LFGT-04	south	NA	NA	NA	NA	NA	NA
LFGT-05	south	43.00	NA	NA	56.00	15.00	NA

Notes: NA - Not measured.

ROSE HILL LANDFILL GAS DATA
ROUND 3 HAND HELD INSTRUMENT DATA - DECEMBER 1991 SAMPLING

Location	Type of Point	Final Depth (feet)	Area Type	GC Analysis (Y/N)	Carbon Dioxide (percent)	Oxygen (percent)	OVA (ppm)	Methan (percent	PID(10.6) (ppm)	LEL (percent)
LFG-AD	NP	5.7	residential	Y	8.6	18.2	0	0	2	0
LFG-ETR	NP	8.7	residential	Y	3.6	19.8	0	0	1.2	0
LFG-GT	NP	4.2	residential	Y	0	20.8	0	0	1	0
LFG-JB	NP	5.6	residential	Y	0	20.9	0	0	0	0
LFG-JF	NP	6.4	residential	Y	0.7	20.7	0	0	0	0
LFG-LHR	NP	5.4	residential	Y	5.6	18.8	0	0	1	0
LFG-NG	NP	4.8	residential	Y	1.7	20.7	0	0	2	0
LFG-RK	NP	5.6	residential	Y	1.5	20.9	0	0	8	0
LFGF-3	PP	3	north	Y	34.9	1.3	>1000	52.5	NA	NA
LFGF-4	PP	3	north	N	NA	21.1	0	NA	5.5	0
LFGF-8	PP	3	north	Y	0.5	20.9	0	0	9	0
TP-F1	T	3	north	Y	NA	21.2	0	NA	0	0
TP-F2	T	3	north	Y	9	4.3	>1000	NA	26	75
TP-F3	T	3	north	Y	2.3	18.3	>1000	0.3	5	NA
TP-F4	T	2.5	north	N	NA	20.9	75	NA	1	0
TP-F5	T	4	north	Y	0.6	20.7	10	0	46	0
TP-F6	T	3	north	Y	0.3	20.9	0	0	3	0
LFGT-6	TP	5.3	south	N	5.6	NA	7.5	0	NA	NA
LFGT-7	TP	3.2	south	Y	0	NA	0	0	0	NA
LFGT-8	TP	5.3	south	Y	0	20.6	200	0.1	0	0
TP-T1	T	3	south	N	0.06	NA	0	0	NA	NA
TP-T2	T	6	south	Y	0	NA	7	0	NA	NA
TP-T2	T	3	south	N	0.46	NA	0	0	NA	NA
TP-T3	T	3	south	Y	2.4	NA	10	0	NA	NA
TP-T4	T	3	south	Y	12.8	NA	>1000	21.6	NA	NA
TP-T5	T	3	south	Y	0	NA	5	0	0	NA

ROSE HILL LANDFILL GAS DATA
ROUND 3 HAND HELD INSTRUMENT DATA - DECEMBER 1991 SAMPLING

Location	Type of Point	Final Depth (feet)	Area Type	GC Analysis (Y/N)	Carbon Dioxide (percent)	Oxygen (percent)	OVA (ppm)	Methan (percent	PID(10.6) (ppm)	LEL (percent)
TP-T5	T	6	south	N	0.65	17	>1000	1.3	0	247
LFGR-10	PP	3	west	Y	34.2	20.1	NA	50.4	550	200
LFGR-20	TP	8.8	west	Y	0.06	20.5	200	0	0	1
LFGR-21	TP	5.0	west	N	0	20.8	0	0	1	0
LFGR-22	TP	2.7	west	Y	0.8	18	7	0	3	0
LFGR-23	TP	6	west	Y	0	20.2	0	0	2.5	0
LFGR-5-9	NP	8.7	west	Y	0	20.9	3	0	0	0
LFGR-8	PP	3	west	Y	33	1.7	NA	51	43	168
TP-R1	T	6	west	Y	0.1	20.5	0	0	1	0
TP-R1	T	3	west	N	0.02	20.6	0	0	0	0
TP-R10	T	3	west	N	0	20.9	7	0	NA	0
TP-R10	T	6	west	Y	20	7.2	>1000	29.9	NA	NA
TP-R11	T	3	west	N	0	20.4	25	0	NA	0
TP-R11	T	6	west	N	5.6	17	10	0	26	2
TP-R12	T	3	west	Y	18	6.2	>1000	20	NA	NA
TP-R13	T	3	west	N	0	21	70	0	NA	0
TP-R13	T	3	west	Y	27	5	>1000	33	NA	NA
TP-R14	T	4	west	Y	4.5	18	0	0	NA	0
TP-R2	T	3	west	Y	0.14	20.6	>1000	0	5.1	1
TP-R2	T	6	west	Y	0.1	20.4	800	0	0.3	4
TP-R3	T	6	west	Y	12	10.5	>1000	7	1	31
TP-R4	T	3	west	N	NA	NA	70	NA	NA	NA
TP-R5	T	3	west	N	0	20.9	5	0	0	0
TP-R6	T	3	west	N	1.76	NA	>1000	1.79	0	24
TP-R7	T	6	west	N	15	3.2	>1000	1	2	15
TP-R7	T	3	west	Y	6.6	17.8	0	0	7.5	NA

ROSE HILL LANDFILL GAS DATA

ROUND 3 HAND HELD INSTRUMENT DATA - DECEMBER 1991 SAMPLING

Location	Type of Point	Final Depth (feet)	Area Type	GC Analysis (Y/N)	Carbon Dioxide (percent)	Oxygen (percent)	OVA (ppm)	Methan (percent	PID(10.6) (ppm)	LEL (percent)
TP-R8	T	3	west	N	4.5	14.1	>1000	8	0	68
TP-R9	T	3	west	Y	10.1	17	>1000	13	46	170

Notes:
T - temporary point, sampled using KV apparatus.
TP - Tempoary point that was subsequently installed as a permenant point. It will be resampled in the future.
PP - Previously existing permenant point. These points were installed in the summer of 1991.
They were sampled for confirmation of previous results and comparison with results obtained this round.
NP - Newly installed permanent points. These points were installed in locations determined prior to field work.

ROSE HILL LANDFILL GAS DATA
ROUND 4 HAND HELD INSTRUMENT DATA - JANUARY, 1992 SAMPLING

Location	Type of Point	Final Depth (feet)	Area Type	GC Analysis (Y/N)	Carbon Dioxide (percent)	Methane (percent)	OVA (ppm)	PID(10.6) (ppm)	PID(11.7) (ppm)	LEL (percent)	Oxygen (percent)
LFGF-2A	PP	3	north	Y	2.35	0	8	NA	NA	11	18.6
LFGF-2B	PP	3.0	north	Y	NA	NA	25	NA	NA	NA	NA
LFGF-3	PP	3	north	Y	30	43	NA	16	NA	NA	0.5
LFGF-8	PP	3	north	Y	4	0	NA	NA	NA	0	21.7
LFGR-11	PP	3.0	west	Y	35	59	NA	NA	NA	NA	0.6
LFGR-15	PP	3.0	west	Y	0.8	0	0	NA	NA	0	17.7
LFGR-17	PP	3.0	west	Y	20.4	16.7	NA	NA	NA	NA	0.5
LFGR-20	TP	8.8	west	N	0	0	>1000	0.4	NA	NA	NA
LFGR-21	TP	5.0	west	Y	2.7	7	>1000	0	NA	105	18.8
LFGR-22	TP	2.7	west	Y	4	0	3	NA	NA	2	16
LFGR-23	TP	6	west	Y	11.3	0	9	NA	NA	2	3.9
LFGR-4	PP	3.0	west	Y	1.9	0	0	NA	NA	2	22
LFGR-5-9	NP	8.7	west	Y	0	0	>1000	NA	NA	NA	NA
LFGR-8	PP	3	west	Y	35	56	NA	24.8	NA	NA	0.5
LFGT-5	PP	3	south	Y	28	41	NA	0.33	NA	NA	0.5
LFGT-6	TP	5.3	south	Y	4.4	0	0	0.2	0	0	22
LFGT-7	TP	3.2	south	N	15	0	>1000	0	0	4	2
LFGT-8	TP	5.3	south	N	NA	NA	NA	NA	NA	NA	NA
LFG-AD	NP	5.7	residential	Y	4.2	0	0	0	NA	0	14.8
LFG-ETR	NP	8.7	residential	Y	2	0	0	0	0	0	22
LFG-GT	NP	4.2	residential	Y	0.8	0	0.4	NA	NA	0	21.5
LFG-JB	NP	5.6	residential	Y	1.1	0	0	0	0	0	22
LFG-JF	NP	6.4	residential	N	0.33	0	0	0.3	0	0	21.9
LFG-LHR	NP	5.4	residential	Y	1.3	1.05	10	NA	NA	37	2.2
LFG-NG	NP	4.8	residential	Y	0.77	0	0	0.5	0	0	21.2
LFG-RK	NP	5.6	residential	Y	0.9	0	0	NA	NA	2	21.2

Notes:
T - temporary point, sampled using KV apparatus.
TP - Tempoary point that was subsequently installed as a permenant point. It will be resampled in the future.
PP - Previously existing permenant point. These points were installed in the summer of 1991.
They were sampled for confirmation of previous results and comparison with results obtained this round.
NP - Newly installed permanent points. These points were installed in December 1991.

ROSE HILL LANDFILL GAS DATA
ROUND 5 HAND HELD INSTRUMENT DATA - FEBRUARY, 1992 SAMPLING

Location	Type of Point	Final Depth (feet)	Area Type	GC Analysis (Y/N)	Carbon Dioxide (percent)	Methane (percent)	OVA (ppm)	PID(10.6) (ppm)	PID(11.7) (ppm)	LEL (percent)	Oxygen (percent)
LFGF-3	PP	3	north	Y	NA	29.6	>1000	18.3	NA	NA	2.5
LFGF-8	PP	3	north	Y	0.42	0	0	0	NA	0	20.8
LFGF-9	PP	3	north	Y	0.53	0	0	0	NA	0	20.9
LFGR-11	PP	3	west	Y	NA	41.2	>1000	4.3	NA	NA	NA
LFGR-14	PP	3	west	N	NA	NA	>1000	1	NA	0	20.9
LFGR-17	PP	3	west	N	NA	NA	>1000	0	NA	0	20.9
LFGR-20	TP	8.8	west	Y	NA	NA	>1000	8.1	NA	0	20.8
LFGR-21	TP	5.0	west	N	NA	NA	NA	NA	NA	NA	NA
LFGR-22	TP	2.7	west	Y	NA	NA	>10	3	NA	0	18.4
LFGR-23	TP	6	west	Y	12	2.4	>1000	0	NA	44	14.9
LFGR-3	PP	3	west	N	NA	NA	150	2.8	NA	0	20
LFGR-5	PP	3	west	Y	NA	NA	>1000	9.7	NA	0	21
LFGR-5-9	NP	8.7	west	N	NA	NA	>1000	1.6	NA	0	20.9
LFGR-8	PP	3	west	Y	NA	NA	>1000	22	NA	NA	0.6
LFGT-2	PP	3	south	N	NA	15.6	NA	NA	NA	NA	NA
LFGT-4	PP	3	south	Y	NA	45.6	>1000	0	NA	NA	NA
LFGT-6	TP	5.3	south	Y	4	0	7	0	NA	2	19.6
LFGT-7	TP	3.2	south	Y	16	0.23	>1000	11.5	NA	5	15.4
LFGT-8	TP	5.3	south	N	NA	NA	NA	NA	NA	NA	NA
LFG-AD	NP	5.7	residential	Y	9.3	0	0	0	NA	4	16.5
LFG-ETR	NP	8.7	residential	N	2.63	0	0	3.1	NA	0	19.6
LFG-GT	NP	4.2	residential	Y	1.36	0	0	0	NA	0	20.6
LFG-JB	NP	5.6	residential	N	0.15	0	1.3	0	NA	0	21
LFG-JF	NP	6.4	residential	N	NA	NA	NA	NA	NA	NA	NA
LFG-LHR	NP	5.4	residential	Y	12.5	0.55	>1000	1.4	NA	9	16.5
LFG-NG	NP	4.8	residential	Y	0.58	0	0	0	NA	0	20.4
LFG-RK	NP	5.6	residential	N	0.97	0	0	0	NA	0	20.5

Notes: T - temporary point, sampled using KV apparatus.
TP - Tempoary point that was subsequently installed as a permenant point. It will be resampled in the future.
PP - Previously existing permenant point. These points were installed in the summer of 1991.
They were sampled for confirmation of previous results and comparison with results obtained this round.
NP - Newly installed permanent points. These points were installed in December 1991.

ROSE HILL LANDFILL GAS DATA
ROUND 6 HAND HELD INSTRUMENT DATA - MARCH, 1992 SAMPLING

Location	Type of Point	Final Depth (feet)	Area Type	GC Analysis (Y/N)	Carbon Dioxide (percent)	Methane (percent)	OVA (ppm)	PID(10.6) (ppm)	PID(11.7) (ppm)	LEL (percent)	Oxygen (percent)
LFGF-1	PP	3.0	north	Y	0	0	0	1	NA	0	19.7
LFGF-3	PP	3	north	Y	27.8	35.3	>1000	34	NA	0	5.2
LFGF-5	PP	3.0	north	Y	0	0	0	0	NA	0	20.9
LFGF-9	PP	3	north	Y	0.58	0	0	0	NA	0	20.5
LFGR-11	PP	3	west	Y	40.2	67	>1000	0	NA	52	6
LFGR-14	PP	3.0	west	Y	0	0	400	2.4	NA	25	20.4
LFGR-18	PP	3	west	N	1.75	0	7	2.4	NA	6	19.6
LFGR-2	PP	3.0	west	Y	13.5	5.7	>1000	0	NA	142	7
LFGR-20	TP	8.8	west	Y	NA	NA	>1000	1.8	NA	199	15
LFGR-22	TP	2.7	west	N	NA	NA	NA	NA	NA	NA	NA
LFGR-23	TP	6	west	Y	12	0	>1000	3.9	NA	5	11.3
LFGR-4	PP	3.0	west	Y	1.11	0	0	0	NA	0	20.3
LFGR-6	PP	3.0	west	Y	2.8	0	0	0	NA	0	18
LFGR-8	PP	3	west	Y	39.8	69.5	NA	32	3500	66	4.9
LFGT-1	PP	3.0	south	N	12	40	NA	0	NA	NA	3
LFGT-3	PP	3.0	south	Y	37	67	NA	0	NA	0	1.6
LFGT-5	PP	3.0	south	N	21.8	10	>1000	0	NA	55	3.9
LFGT-6	TP	5.3	south	Y	3.78	0	0	0	0	1	18.3
LFGT-7	TP	3.2	south	Y	16.7	0.1	>1000	0	0		6.2
LFG-AD	NP	5.7	residential	Y	9.5	0	NA	0	NA	0	12.5
LFG-ETR	NP	8.7	residential	N	2.7	0	0	0	NA	0	19.1
LFG-GT	NP	4.2	residential	Y	1.3	0	0	0	NA	0	20.2
LFG-JB	NP	5.6	residential	N	0	0	0	0	NA	0	20.8
LFG-LHR	NP	5.4	residential	Y	9.3	0	>1000	2.8	NA	5	11.4

ROSE HILL LANDFILL GAS DATA
ROUND 6 HAND HELD INSTRUMENT DATA – MARCH, 1992 SAMPLING

Location	Type of Point	Final Depth (feet)	Area Type	GC Analysis (Y/N)	Carbon Dioxide (percent)	Methane (percent)	OVA (ppm)	PID(10.6) (ppm)	PID(11.7) (ppm)	LEL (percent)	Oxygen (percent)
LFG-NG	NP	4.8	residential	N	0.91	0	0	0	NA	0	20.9
LFG-RK	NP	5.6	residential	N	1.5	0	0	0	NA	0	20.3
FBW	FB	--	solid	Y	0.3	0.3	>1000	3.5	NA	0.6	20.8
FBE	FB	--	solid	Y	22	38	NA	50	NA	145	9.3

Notes: T – temporary point, sampled using KV apparatus.
TP – Tempoary point that was subsequently installed as a permenant point in December 1991. It will be resampled in the futu
PP – Previously existing permenant point. These points were installed in the summer of 1991.
They were sampled for confirmation of previous results and comparison with results obtained this round.
NP – Newly installed permanent points. These points were installed in December 1991.

ROSE HILL LANDFILL GAS DATA
ROUND 7 HAND HELD INSTRUMENT DATA – APRIL, 1992 SAMPLING

Location	Area Type	GC Analysis (Y/N)	Carbon Dioxide (percent)	Methane (percent)	OVA (ppm)	PID(10.6) (ppm)	PID(11.7) (ppm)	LEL (percent)	Oxygen (percent)
LFGF–1	north	Y	0.5	0	0	3.3	NA	0	19.6
LFGF–2A	north	Y	1.55	0	0	6.5	NA	0	17.1
LFGF–2B	north	N	NA	NA	NA	NA	NA	NA	NA
LFGF–3	north	Y	28.3	31.4	NA	18.3	716	NA	0.1
LFGF–4	north	N	NA	NA	NA	NA	NA	NA	NA
LFGF–5	north	Y	0.75	0	0	59.2	193	0	18.5
LFGF–7	north	Y	1.16	0	0	6.7	133	0	20.2
LFGF–8	north	Y	0.57	0	0	16.5	100	0	20.6
LFGF–9	north	Y	0	0	0	42.3	252	0	20.7
LFGR–10	west	Y	42.1	56.3	NA	5.1	346.9	NA	0.6
LFGR–11	west	Y	42.3	55.2	>1000	181	3049	NA	0.8
LFGR–12	west	Y	15.9	29	>1000	28.7	101	NA	10
LFGR–13	west	Y	37.5	50	NA	43.1	1562	NA	4
LFGR–14	west	Y	21.5	19.9	>1000	0	683	0	5.2
LFGR–15	west	Y	2.95	0.13	NA	1.1	255	0	15.6
LFGR–16	west	Y	16.2	8.53	NA	22.3	443	NA	0.6
LFGR–18	west	Y	1.46	0	0	6.4	NA	0	19.2
LFGR–19	west	Y	1.03	0	0	4.7	NA	0	18.9
LFGR–2	west	N	NA	NA	NA	NA	NA	NA	NA
LFGR–20	west	Y	15.1	17.9	>1000	NA	NA	NA	6.2
LFGR–21	west	Y	8.5	19.5	>1000	0	NA	NA	NA
LFGR–22	west	N	NA	NA	NA	NA	NA	NA	NA
LFGR–3	west	Y	0.71	0	110	2.6	NA	0	19.9
LFGR–4	west	Y	0	0	110	19.7	NA	0	21.1
LFGR–5	west	Y	2.47	0	1	0	NA	0	19.1
LFGR–5–9	west	N	NA	NA	NA	NA	NA	NA	NA
LFGR–6	west	Y	4.07	0	0	21.1	NA	0	15.5
LFGR–7	west	Y	24.2	30.6	>1000	23.1	307	NA	0.6
LFGR–8	west	Y	41	57.4	NA	22.2	NA	NA	0.1
LFGR–9	west	Y	26.6	28.2	NA	103.9	867	NA	11.9
LFGT–1	south	Y	10.7	36.9	NA	0	NA	NA	2
LFGT–2	south	Y	33.9	58.8	NA	0	NA	NA	3

ROSE HILL LANDFILL GAS DATA
ROUND 7 HAND HELD INSTRUMENT DATA - APRIL, 1992 SAMPLING

Location	Area Type	GC Analysis (Y/N)	Carbon Dioxide (percent)	Methane (percent)	OVA (ppm)	PID(10.6) (ppm)	PID(11.7) (ppm)	LEL (percent)	Oxygen (percent)
LFGT-3	south	Y	40.2	54.3	NA	0	115	NA	1
LFGT-4	south	N	NA	NA	NA	NA	NA	NA	NA
LFGT-5	south	Y	30	37.5	NA	0	50	NA	1
LFGT-6	south	Y	3.2	0	0	14.8	59	0	21
LFGT-7	south	Y	21.9	0	1	4.7	35	0	17.3
LFGT-8	south	N	NA	NA	NA	NA	NA	NA	NA
LFG-AD	residential	Y	9.3	0	120	0	31.9	7	11.1
LFG-GT	residential	Y	1.83	0	110	0	0	7	19.7
LFG-JB	residential	N	NA	NA	NA	NA	NA	NA	NA
LFG-JF	residential	N	NA	NA	NA	NA	NA	NA	NA
LFG-LHR	residential	Y	17.9	1.6	>1000	0	180.5	NA	0.7
LFG-NG	residential	Y	1.32	0	100	0	NA	0	20.7
LFG-RK	residential	Y	1.07	0	180	0	0	0	20.6
LGR-ETR	residential	Y	2.26	0	0	24.3	NA	0	19.1
FBW	solid waste	Y	1.67	0	4	4	660	3	19.3
FBE	solid waste	Y	36.3	58.3	NA	23.5	1800	NA	NA

Notes: TP - Tempoary point that was subsequently installed as a permenant point in December 1991.
PP - Previously existing permenant point. These points were installed in the summer of 1991.
They were sampled for confirmation of previous results and comparison with results obtained this round.
NP - Newly installed permanent points. These points were installed in December 1991.

ROSE HILL LANDFILL GAS DATA
ROUND 8 HAND HELD INSTRUMENT DATA – MAY, 1992 SAMPLING – SUMMA canister sampling round.

Location	Sample (feet)	Waste Area	Carbon Dioxide (percent)	Methane (percent)	OVA (ppm)	PID(10.6) (ppm)	PID(11.7) (ppm)	LEL (percent)	Oxygen (percent)
BW(04+100)–03	3.0	bulky	23	57	NA	0	NA	NA	7.4
BW(04+100)–06	6.0	bulky	28	45	NA	0	NA	NA	2.0
BW(05+500)–03	3.0	bulky	32	51	NA	0	0	NA	4.0
BW(05+500)–06	6.0	bulky	32	49	NA	0	0	NA	4.4
BW(05+500)–9.5	9.5	bulky	NA	NA	NA	NA	NA	NA	NA
BW(05+500)–12	2.0	bulky	NA	NA	NA	NA	NA	NA	NA
SS(08+000)–03	3.0	sewage sludge	0	0	120	0	NA	0	20.8
SS(08+000)–06	6.0	sewage sludge	0	0	100	0	0	0	20.7
SS(08+000)–09	9.0	sewage sludge	0	0	NA	0	0	1	20.7
SS(08+000)–12	12.0	sewage sludge	0	0	NA	0	0	8	20.8
SW(03+300)–03	3.0	solid	NA	NA	NA	NA	NA	NA	NA
SW(03+300)–06	6.0	solid	30	44	NA	0	NA	NA	0.6
SW(11+500)–03	3.0	solid	34	50	NA	27	NA	NA	3.9
SW(11+500)–05	5.0	solid	23	22	NA	48	NA	NA	6.8
SW(11+500)–06	6.0	solid	35	54	NA	28	NA	NA	3.0
SW(13+300)–09	9.0	solid	31	61	NA	26	NA	NA	0.5
SW(13+300)–12	12.0	solid	38	59	NA	35	NA	NA	0.7

Notes: NA – Not measured.

C-2 FIELD GC SAMPLING DATA

ROSEHILL REGIONAL LANDFILL

ROUND 1 LANDFILL GAS - FIELD GC ANALYSIS

POINT	Methylene Chloride	t-1,2 DCE	1,1-DCA	c-1,2 DCE	Chloroform	1,1,1-TCA	Benzene	TCE	Toluene	PCE	Ethylbenzen	m-Xylene	o-Xylene	Total VOC
BULKY WASTE AREA SAMPLING POINTS														
BW(00_000)	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	NA	NA	NA	ND
BW(00_100)	ND	ND	ND	2	ND	NA	NA	3	3	ND	NA	NA	NA	65
BW(00_200)	ND	ND	ND	3	ND	3	ND	3	2	ND	NA	NA	NA	43
BW(01_000)	ND	26	ND	125	ND	ND	20	22	12	NA	NA	NA	NA	481
BW(01_300)	ND	12	ND	180	ND	137	NA	63	26	ND	ND	ND	ND	1850
BW(01_-25)	ND	ND	ND	2	ND	2	ND	3	3	NA	NA	NA	NA	32
BW(02_100)-3'	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	NA	NA	NA	ND
BW(02_100)-4.5	ND	ND	ND	46	ND	NA	24	31	82	NA	12	10	9	750
BW(02_100)-6'	ND	NA	NA	36	ND	ND	NA	20	183	NA	NA	NA	NA	591
BW(02_300)	NA	NA	NA	91	ND	ND	NA	NA	127	NA	NA	NA	NA	832
BW(02_400)	ND	NA	NA	3	ND	ND	ND	ND	2	ND	NA	NA	NA	27
BW(03_000)	ND	ND	ND	ND	ND	1	ND	1	5	NA	NA	NA	NA	15
BW(03_200)	ND	ND	NA	110	ND	ND	43	43	77	NA	15	16	11	952
BW(03_400)	ND	NA	NA	28	ND	ND	NA	33	107	NA	NA	NA	NA	481
BW(03_500)	ND	ND	ND	24	ND	ND	NA	ND	5	NA	NA	NA	NA	293
BW(04_100)	ND	ND	ND	30	ND	ND	13	8	829	NA	15	12	ND	1653
BW(04_100)-3'	ND	ND	ND	NA	ND	ND	ND	3	TRACE	ND	NA	NA	NA	28
BW(04_300)	NA	ND	ND	245	ND	NA	NA	94	83	NA	14	16	5	1401
BW(04_500)	ND	36	ND	126	ND	NA	26	56	53	NA	26	18	ND	1923
BW(04_600)	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	NA	NA	NA	ND
BW(05_000)	ND	1	ND	10	ND	NA	ND	6	4	NA	NA	NA	NA	79
BW(05_200)	ND	ND	ND	TRACE	ND	ND	ND	2	119	NA	20	54	27	232
BW(05_400)	ND	34	ND	79	ND	NA	60	24	4791	NA	19	16	ND	19590
BW(05_500)	ND	119	ND	3485	ND	NA	121	188	171	NA	19	21	ND	10061
BW(05_600)	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	14	NA	NA	ND
BW(06_200)	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	NA	NA	NA	ND
BW(06_300)	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	NA	NA	NA	ND
BW(06_500)	ND	NA	NA	34	ND	NA	ND	26	43	NA	NA	12	ND	641
BW(07_400)	ND	ND	ND	47	ND	NA	ND	NA	35	ND	NA	NA	NA	299
PERMANENT LANDFILL GAS SAMPLING POINTS														
LFGF-01	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	NA	ND
LFGF-03	NA	ND	NA	1269	NA	ND	ND	22	31	ND	5	5	ND	3119
LFGF-04	ND	ND	ND	5	ND	5	ND	ND	ND	ND	ND	ND	ND	19

ROSEHILL REGIONAL LANDFILL
ROUND 1 LANDFILL GAS - FIELD GC ANALYSIS

POINT	Methylene Chloride	t-1,2 DCE	1,1-DCA	c-1,2 DCE	Chloroform	1,1,1-TCA	Benzene	TCE	Toluene	PCE	Ethylbenzen	m-Xylene	o-Xylene	Total VOC
LFGF-05	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
LFGF-06	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
LFGF-07	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
LFGF-08	ND	ND	ND	ND	ND	TRACE	ND	4	ND	ND	ND	ND	ND	7
LFGF-09	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
LFGF-2A	ND	NA	ND	6	ND	6	ND	13	ND	ND	ND	ND	ND	128
LFGF-2B	ND	ND	ND	8	ND	5	ND	16	ND	ND	ND	ND	ND	57
LFGR-02	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
LFGR-03	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
LFGR-04	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	NA	NA	NA	ND
LFGR-05	ND	ND	ND	ND	ND	ND	ND	ND	1	ND	NA	NA	NA	1
LFGR-06	ND	ND	ND	ND	ND	ND	ND	ND	TRACE	ND	NA	NA	NA	TRACE
LFGR-07	ND	ND	ND	15	ND	11	5	6	16	NA	7	6	9	223
LFGR-08	NA	161	ND	5619	ND	ND	ND	25	103	ND	22	21	18	11690
LFGR-09	ND	ND	ND	126	ND	NA	NA	4	8	NA	5	5	TRACE	502
LFGR-10	ND	ND	ND	9	ND	NA	6	8	9	NA	3	4	TRACE	181
LFGR-11	ND	ND	ND	16	ND	16	13	7	22	NA	NA	NA	NA	210
LFGR-12	ND	ND	ND	ND	ND	ND	TRACE	3	3	NA	3	2	ND	82
LFGR-13	ND	ND	ND	ND	ND	3	4	5	6	NA	4	3	ND	175
LFGR-14	ND	ND	ND	ND	ND	ND	1	ND	3	NA	5	4	NA	65
LFGR-15	ND	ND	ND	ND	ND	ND	ND	ND	TRACE	ND	ND	ND	ND	TRACE
LFGR-16	ND	ND	ND	ND	ND	ND	ND	2	2	ND	2	TRACE	ND	42
LFGR-17	ND	ND	ND	ND	ND	ND	ND	3	4	ND	4	1	ND	57
LFGR-18	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
LFGR-19	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	NA	NA	NA	ND
LFGT-01	ND	ND	ND	ND	ND	ND	ND	2	3	NA	6	2	ND	64
LFGT-02	ND	ND	ND	ND	ND	ND	2	5	8	NA	13	8	NA	217
LFGT-03	ND	ND	ND	ND	ND	ND	ND	4	18	NA	16	8	TRACE	182
LFGT-04	ND	ND	ND	ND	ND	1	ND	7	6	NA	7	4	NA	194
LFGT-05	ND	ND	ND	ND	ND	ND	ND	3	3	ND	5	3	ND	89
SOLID WASTE AREA SAMPLING POINTS														
SW(01_100)	ND	ND	ND	ND	ND	NA	2	3	7	NA	42	29	TRACE	294
SW(01_300)	ND	ND	ND	ND	ND	NA	ND	TRACE	12	ND	10	8	10	60
SW(01_500)	ND	ND	ND	1	ND	5	ND	8	29	ND	44	6	TRACE	229

ROSEHILL REGIONAL LANDFILL
ROUND 1 LANDFILL GAS - FIELD GC ANALYSIS

POINT	Methylene Chloride	t-1,2 DCE	1,1-DCA	c-1,2 DCE	Chloroform	1,1,1-TCA	Benzene	TCE	Toluene	PCE	Ethylbenzen	m-Xylene	o-Xylene	Total VOC
SW(02_100)	ND	ND	ND	ND	ND	2	4	5	8	ND	37	18	NA	380
SW(02_200)	ND	ND	ND	ND	ND	ND	ND	ND	ND	NA	NA	NA	NA	ND
SW(02_500)	ND	ND	ND	6	ND	11	6	8	10	NA	15	8	TRACE	353
SW(03_000)	ND	ND	ND	51	ND	NA	8	36	89	NA	90	98	59	970
SW(03_100)	ND	ND	ND	ND	ND	NA	6	8	9	NA	30	12	TRACE	537
SW(03_300)	ND	ND	ND	16	ND	NA	5	4	32	NA	NA	NA	NA	158
SW(03_500)	ND	ND	ND	ND	ND	ND	ND	ND	5	ND	2	1	ND	12
SW(04_000)	ND	ND	ND	ND	ND	NA	TRACE	ND	2	ND	NA	NA	NA	32
SW(04_200)	ND	ND	ND	11	ND	NA	NA	15	134	NA	NA	NA	NA	238
SW(04_300)	ND	ND	ND	ND	ND	6	ND	4	11	NA	3	TRACE	ND	203
SW(04_400)	ND	ND	ND	47	ND	NA	NA	24	108	NA	NA	NA	NA	371
SW(04_500)	ND	ND	ND	18	ND	19	5	13	102	NA	NA	NA	NA	435
SW(05_000)	56	NA	NA	496	ND	53	28	11	165	NA	42	32	TRACE	1908
SW(05_100)	ND	ND	ND	TRACE	ND	ND	ND	1	4	NA	NA	NA	NA	6
SW(05_300)	ND	13	ND	160	ND	ND	ND	25	41	NA	NA	NA	NA	429
SW(05_500)	ND	ND	ND	60	ND	ND	NA	46	106	NA	NA	NA	NA	302
SW(05_600)	ND	ND	ND	ND	ND	ND	ND	ND	ND	NA	NA	NA	NA	ND
SW(05_-40)	ND	ND	ND	ND	ND	ND	TRACE	TRACE	TRACE	ND	TRACE	TRACE	ND	30
SW(06_000)	ND	ND	ND	ND	ND	NA	4	6	79	NA	NA	NA	NA	252
SW(06_100)	ND	ND	ND	9	ND	14	NA	20	141	NA	47	123	68	275
SW(06_200)	ND	ND	ND	18	ND	ND	ND	11	18	NA	NA	NA	NA	102
SW(06_400)	ND	ND	ND	70	ND	ND	NA	25	71	NA	NA	NA	NA	221
SW(06_600)	ND	ND	ND	4	ND	ND	NA	5	5	NA	NA	NA	NA	34
SW(07_000)	ND	ND	ND	ND	ND	4	3	4	16	NA	NA	NA	NA	125
SW(07_100)	ND	ND	ND	13	ND	NA	NA	8	ND	NA	NA	NA	NA	72
SW(07_300)	ND	ND	ND	15	ND	ND	NA	14	20	NA	NA	NA	NA	92
SW(07_500)	ND	ND	ND	10	ND	ND	NA	10	12	NA	NA	NA	NA	74
SW(07_600)	ND	ND	ND	8	ND	ND	NA	11	50	NA	NA	NA	NA	81
SW(08_000)	ND	ND	ND	ND	ND	NA	3	3	4	NA	NA	NA	NA	85
SW(08_100)	ND	ND	ND	11	ND	ND	ND	31	88	NA	27	31	NA	267
SW(08_200)	ND	ND	ND	118	ND	ND	ND	34	114	NA	NA	NA	NA	296
SW(08_400)	ND	ND	ND	18	ND	ND	NA	12	16	NA	NA	NA	NA	74
SW(08_600)	ND	ND	ND	10	ND	ND	NA	13	16	NA	NA	NA	NA	79
SW(09_000)	ND	ND	ND	ND	ND	ND	3	4	2	NA	11	9	6	178
SW(09_100)	ND	ND	ND	27	ND	ND	NA	32	318	NA	NA	NA	NA	276

ROSEHILL REGIONAL LANDFILL
ROUND 1 LANDFILL GAS - FIELD GC ANALYSIS

POINT	Methylene Chloride	t-1,2 DCE	1,1-DCA	c-1,2 DCE	Chloroform	1,1,1-TCA	Benzene	TCE	Toluene	PCE	Ethylbenzen	m-Xylene	o-Xylene	Total VOC
SW(09_200)	ND	ND	ND	11	ND	ND	NA	16	14	NA	NA	NA	NA	101
SW(09_300)	ND	ND	ND	9	ND	ND	ND	10	4	NA	NA	NA	NA	75
SW(09_400)	ND	ND	ND	17	ND	ND	NA	8	9	NA	NA	NA	NA	78
SW(09_500)	ND	ND	NA	21	ND	ND	NA	16	NA	NA	37	22	NA	217
SW(09_600)	ND	ND	ND	16	ND	ND	NA	16	NA	NA	NA	NA	NA	109
SW(10_000)	ND	ND	ND	5	ND	7	ND	7	TRACE	NA	NA	NA	NA	66
SW(10_100)	ND	ND	ND	TRACE	ND	ND	ND	TRACE	ND	NA	NA	NA	NA	5
SW(10_200)	ND	ND	ND	8	ND	ND	8	8	34	NA	NA	NA	NA	87
SW(10_300)	ND	ND	ND	16	ND	ND	NA	18	5	NA	NA	NA	NA	130
SW(10_400)	ND	ND	ND	26	ND	ND	NA	22	263	NA	NA	NA	NA	200
SW(10_500)	ND	ND	ND	19	ND	ND	NA	16	NA	NA	NA	NA	NA	132
SW(10_600)	ND	ND	ND	35	ND	ND	NA	16	NA	NA	NA	NA	NA	165
SW(10_700)	ND	ND	ND	9	ND	12	7	10	17	NA	48	29	28	480
SW(11_100)	ND	ND	ND	13	ND	11	ND	10	15	NA	NA	NA	NA	113
SW(11_200)	ND	ND	ND	14	ND	12	10	11	4	NA	NA	NA	NA	130
SW(11_300)	ND	ND	ND	14	ND	29	ND	44	15	NA	NA	NA	NA	275
SW(11_400)	ND	ND	ND	7	ND	8	8	11	17	NA	NA	NA	NA	108
SW(11_500)	ND	164	ND	45912	ND	NA	TRACE	461	39	NA	NA	NA	NA	89292
SW(11_600)	NA	58	ND	1754	ND	NA	TRACE	74	21	NA	NA	NA	NA	3699
SW(11_700)	ND	ND	ND	10	ND	12	7	10	18	NA	50	30	30	515
SW(12_100)	ND	ND	ND	31	ND	12	ND	17	67	ND	TRACE	TRACE	TRACE	99
SW(12_200)	ND	ND	ND	16	ND	16	ND	22	23	NA	NA	NA	NA	195
SW(12_300)	ND	ND	ND	2	ND	4	ND	9	4	NA	NA	NA	NA	54
SW(12_400)	ND	ND	ND	7	ND	ND	7	10	10	NA	NA	NA	NA	168
SW(12_500)	2	32	26	58	308	ND	44	69	60	ND	69	14	ND	1647
SW(12_600)	ND	ND	ND	62	ND	ND	ND	62	45	NA	NA	NA	NA	1373
SW(12_700)	ND	ND	ND	16	ND	NA	10	24	9	NA	33	22	NA	880
SW(13_100)	ND	ND	ND	ND	ND	ND	ND	TRACE	ND	ND	TRACE	TRACE	TRACE	15
SW(13_200)	ND	113	93	9472	ND	ND	51	52	170	NA	NA	NA	NA	30306
SW(13_300)	ND	ND	ND	14	ND	ND	ND	28	ND	NA	NA	NA	NA	170
SW(13_400)	ND	ND	ND	3	15	15	ND	18	ND	NA	47	54	ND	469
SW(13_500)	ND	ND	ND	20	ND	ND	ND	19	ND	NA	NA	NA	NA	370
SW(13_600)	ND	ND	ND	24	ND	ND	ND	18	ND	NA	NA	NA	NA	423
SW(13_700)	ND	ND	ND	ND	ND	2	2	4	14	NA	13	7	NA	114
SW(14_200)	ND	ND	ND	4	ND	ND	8	6	ND	NA	NA	NA	NA	142

ROSEHILL REGIONAL LANDFILL

ROUND 2 LANDFILL GAS - FIELD GC ANALYSIS - September 1991

POINT	Methylene Chloride	t-1,2 DCE	1,1-DCA	c-1,2 DCE	Chloroform	1,1,1-TCA	Benzene	TCE	Toluene	PCE	Ethylbenzen	m-Xylene	o-Xylene	Total VOC
LFGF-01	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
LFGF-02A	ND	ND	ND	63	ND	28	ND	86	ND	ND	ND	ND	ND	410
LFGF-02B	ND	ND	ND	60	ND	173	ND	ND	ND	NA	NA	NA	NA	324
LFGF-03	ND	61	ND	1667	ND	ND	NA	ND	54	NA	10	14	ND	5501
LFGF-04	ND	ND	ND	166	ND	ND	ND	7	ND	ND	NA	NA	NA	496
LFGF-05	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	2
LFGF-07	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	TRACE
LFGF-08	ND	ND	ND	ND	ND	11	ND	45	ND	ND	ND	ND	ND	114
LFGF-09	ND	ND	ND	ND	ND	ND	ND	TRACE	ND	ND	ND	ND	ND	TRACE
LFGR-02	ND	ND	ND	ND	ND	ND	ND	2	ND	ND	ND	ND	ND	10
LFGR-03	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
LFGR-04	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
LFGR-05	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
LFGR-06	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
LFGR-07	ND	12	ND	10	ND	ND	5	5	71	ND	3	3	ND	360
LFGR-08	ND	72	ND	1267	ND	NA	ND	ND	59	NA	ND	ND	ND	5338
LFGR-09	ND	ND	ND	11	ND	ND	5	5	4	ND	2	2	ND	156
LFGR-10	ND	ND	ND	9	ND	ND	7	7	30	NA	3	3	ND	320
LFGR-11	ND	ND	ND	3	ND	ND	8	7	12	NA	5	6	ND	281
LFGR-13	ND	ND	ND	ND	ND	3	2	4	4	NA	NA	ND	ND	191
LFGR-14	ND	ND	ND	ND	ND	ND	ND	2	ND	ND	ND	ND	ND	5
LFGR-15	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	2
LFGR-16	ND	ND	ND	ND	ND	TRACE	ND	4	4	ND	ND	ND	ND	113
LFGR-17	ND	ND	ND	ND	ND	TRACE	ND	4	5	ND	ND	ND	ND	93
LFGR-18	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
LFGR-19	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
LFGT-01	ND	ND	ND	1	ND	ND	ND	1	3	ND	7	4	ND	90
LFGT-02	ND	ND	ND	ND	ND	ND	2	3	5	NA	13	11	TRACE	212
LFGT-03	ND	ND	ND	ND	ND	ND	1	3	13	NA	NA	NA	NA	81
LFGT-04	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
LFGT-05	ND	ND	ND	TRACE	ND	ND	3	5	4	NA	6	ND	ND	216

Notes: ND - Not detected above the minimum detection limit for that compound.
NA - Not analized for, or unable to make a determination due to matrix interferances.
TRACE - Detected below the minumum quantitation limit.

ROSEHILL REGIONAL LANDFILL

ROUND 3 LANDFILL GAS - FIELD GC ANALYSIS - December 1991

POINT	Methylene Chloride	t-1,2 DCE	1,1-DCA	c-1,2 DCE	Chloroform	1,1,1-TCA	Benzene	TCE	Toluene	PCE	Ethylbenzen	m-Xylene	o-Xylene	Total VOC
LFGF-03	NA	NA	ND	1362	NA	NA	NA	ND	49	NA	4	6	ND	4285
LFGF-08	ND	ND	ND	ND	ND	ND	ND	5	ND	ND	ND	ND	ND	16
LFGF-10	ND	ND	ND	4	ND	ND	4	ND	7	ND	2	1	ND	225
LFGR-05-9	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
LFGR-08	ND	NA	ND	1439	ND	ND	ND	ND	34	ND	ND	ND	ND	7232
LFGR-20	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
LFGR-22	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
LFGR-23	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
LFGT-07	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
LFGT-08	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
LFG-AD	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
LFG-ETR	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
LFG-GT	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
LFG-JB	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
LFG-JF	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
LFG-LHR	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
LFG-NG	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
LFG-RK	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
TP-F1	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
TP-F2	NA	NA	ND	ND	ND	16	ND	5	TRACE	ND	ND	ND	ND	149
TP-F3	NA	NA	ND	ND	ND	ND	ND	ND	TRACE	ND	ND	ND	ND	2
TP-F5	ND	ND	ND	ND	ND	ND	ND	12	ND	ND	ND	ND	ND	37
TP-F6	ND	ND	ND	ND	ND	ND	ND	TRACE	ND	ND	ND	ND	ND	1
TP-R01	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
TP-R02-3'	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
TP-R02-6'	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
TP-R03	ND	ND	ND	16	ND	ND	ND	ND	ND	ND	ND	ND	ND	126
TP-R07-3'	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
TP-R07-6'	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
TP-R09	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
TP-R10	ND	ND	ND	ND	ND	7	ND	TRACE	TRACE	ND	ND	ND	ND	58
TP-R12	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
TP-R13	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	6
TP-R14	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
TP-T2	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND

ROSEHILL REGIONAL LANDFILL

ROUND 3 LANDFILL GAS - FIELD GC ANALYSIS - December 1991

POINT	Methylene Chloride	t-1,2 DCE	1,1-DCA	c-1,2 DCE	Chloroform	1,1,1-TCA	Benzene	TCE	Toluene	PCE	Ethylbenzen	m-Xylene	o-Xylene	Total VOC
TP-T3	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
TP-T4	ND	ND	ND	ND	ND	ND	ND	2	1	ND	4	3	ND	153
TP-T5	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND

Notes:

ND - Not detected above the minimum detection limit for that compound.

NA - Not analized for, or unable to make a determination due to matrix interferances.

TRACE - Detected below the minumum quantitation limit.

ROSEHILL REGIONAL LANDFILL

ROUND 4 LANDFILL GAS - FIELD GC ANALYSIS - Jaunuary 1992

POINT	Methylene Chloride	t-1,2 DCE	1,1-DCA	c-1,2 DCE	Chloroform	1,1,1-TCA	Benzene	TCE	Toluene	PCE	Ethylbenzen	m-Xylene	o-Xylene	Total VOC
LFGF-02A	ND	ND	ND	ND	ND	ND	ND	TRACE	ND	ND	ND	ND	ND	4
LFGF-02B	ND	ND	ND	ND	ND	ND	ND	3	ND	ND	ND	ND	ND	5
LFGF-03	ND	ND	ND	3733	ND	ND	ND	ND	17	ND	ND	ND	ND	1289
LFGF-08	ND	ND	ND	ND	ND	ND	ND	3	ND	ND	ND	ND	ND	5
LFGR-04	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
LFGR-05-9	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
LFGR-08	ND	421	ND	10623	ND	ND	ND	ND	53	NA	TRACE	TRACE	ND	20468
LFGR-11	ND	ND	ND	ND	ND	11	ND	TRACE	ND	ND	ND	ND	ND	65
LFGR-15	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
LFGR-17	ND	ND	ND	ND	ND	ND	ND	2	ND	ND	ND	ND	ND	4
LFGR-21	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
LFGR-22	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
LFGT-05	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	14
LFGT-06	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
LFGT-08	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
LFG-AD	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
LFG-ETR	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
LFG-GT	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
LFG-JB	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
LFG-LHR	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
LFG-ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
LFG-RK	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND

Notes:
ND - Not detected above the minimum detection limit for that compound.
NA - Not analized for, or unable to make a determination due to matrix interferances.
TRACE - Detected below the minumum quantitation limit.

ROSEHILL REGIONAL LANDFILL

ROUND 5 LANDFILL GAS - FIELD GC ANALYSIS - February 1992

POINT	1,1-DCE	t-1,2 DCE	c-1,2 DCE	Benzene	TCE	Toluene	PCE	Ethylbenzene	m-Xylene	o-Xylene	Total VOC
LFGF-03	ND	ND	1190	ND	5	69	ND	ND	ND	ND	30727
LFGF-08	ND	ND	ND	ND	3	ND	ND	ND	ND	ND	27
LFGF-09-3	ND	ND	ND	ND	TRACE	ND	ND	ND	ND	ND	TRACE
LFGR-05-3	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
LFGR-08	ND	ND	6044	198	55	102	ND	16	23	ND	70042
LFGR-11	ND	ND	16	3	2	7	NA	TRACE	TRACE	ND	835
LFGR-22	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	14
LFGR-23	ND	ND	ND	ND	ND	TRACE	ND	ND	ND	ND	7
LFGT-02	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	13
LFGT-04	ND	ND	ND	3	5	6	NA	4	2	ND	393
LFGT-06	ND	ND	ND	ND	ND	TRACE	ND	ND	ND	ND	2
LFGT-07	ND	ND	ND	ND	ND	TRACE	ND	ND	ND	ND	52
LFG-AD	ND	ND	TRACE	ND	ND	ND	ND	ND	ND	ND	27
LFG-GT	ND	ND	TRACE	ND	ND	TRACE	ND	ND	ND	ND	2
LFG-LHR	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	19
LFG-NG	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND

Notes:

ND - Not detected above the minimum detection limit for that compound.

NA - Not analized for, or unable to make a determination due to matrix interferances.

TRACE - Detected below the minumum quantitation limit.

ROSEHILL REGIONAL LANDFILL

ROUND 6 LANDFILL GAS - FIELD GC ANALYSIS - April 1992

POINT	Methylene Chloride	t-1,2 DCE	1,1-DCA	c-1,2 DCE	Chloroform	1,1,1-TCA	Benzene	TCE	Toluene	PCE	Ethylbenzen	m-Xylene	o-Xylene	Total VOC
FLUXEAST	ND	301	ND	2750	ND	ND	ND	TRACE	114	ND	ND	TRACE	TRACE	11167
FLUXWEST	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
LFGF-01	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
LFGF-03	ND	ND	ND	880	ND	ND	ND	20	32	ND	7	ND	ND	9175
LFGF-05	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
LFGF-09	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
LFGR-11	ND	ND	ND	17	ND	ND	TRACE	6	9	ND	ND	ND	ND	137
LFGR-14	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	NA	ND
LFGR-02	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
LFGR-20	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
LFGR-23	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	NA	27
LFGR-04	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
LFGR-06	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
LFGR-08	ND	ND	ND	4535	ND	ND	ND	34	78	ND	23	30	ND	4534
LFGT-03	ND	ND	ND	ND	ND	ND	TRACE	ND	7	ND	11	7	ND	44
LFGT-06	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
LFGT-07	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
LFG-AD	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
LFG-GT	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
LFG-LHR	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	15

Notes:

ND - Not detected above the minimum detection limit for that compound.

NA - Not analized for, or unable to make a determination due to matrix interferances.

TRACE - Detected below the minumum quantitation limit.

ROSEHILL REGIONAL LANDFILL

ROUND 7 LANDFILL GAS - FIELD GC ANALYSIS - April 1992 - 11.7 eV lamp

POINT	Vinyl Chloride	Methylene Chloride	t-1,2 DCE	1,1-DCA	c-1,2 DCE	Chlorofor	1,1,1-TCA	Benzen	TCE	Toluene	PCE	Ethylbenz	m-Xylene	o-Xylene	Total VOC
FLUXEAST	484	ND	409	ND	6306	ND	ND	ND	ND	59	ND	ND	ND	ND	20611
LFGF-03	5331	ND	ND	ND	768	ND	ND	ND	TRACE	64	ND	ND	ND	ND	4994
LFGF-08	NA	ND	ND	ND	ND	ND	ND	ND	3	ND	NA	NA	NA	NA	6
LFGR-08	5582	ND	ND	ND	4046	ND	ND	ND	ND	232	ND	TRACE	78	ND	13106
LFGR-11	NA	ND	ND	ND	16	ND	ND	TRACE	13	12	NA	ND	ND	ND	445
LFGR-14	ND	ND	ND	ND	ND	ND	7	ND	ND	ND	ND	ND	ND	ND	73
LFGT-03	ND	ND	ND	ND	ND	ND	ND	ND	5	113	ND	10	5	TRACE	125
LFGT-07	NA	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
LFG-AD	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	2
LFG-ETR	NA	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
LFG-GT	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	1
LFG-LHR	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	1
LFG-NG	NA	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
LFG-RK	NA	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	NA	NA	NA	ND

Notes: ND - Not detected above the minimum detection limit for that compound.
NA - Not analized for, or unable to make a determination due to matrix interferances.
TRACE - Detected below the minumum quantitation limit.

ROSEHILL REGIONAL LANDFILL

ROUND 7 LANDFILL GAS - FIELD GC ANALYSIS - April 1992 - 10.2 eV lamp

POINT	Vinyl Chloride	t-1,2 DCE	c-1,2 DCE	Benzene	TCE	Toluene	PCE	Ethylbenzene	m-Xylene	o-Xylene	Total VOC
FLUXEAST	1728	ND	21926	ND	ND	207	ND	ND	ND	ND	323066
FLUXWEST	ND	ND	ND	ND	ND	ND	ND	NA	NA	NA	ND
LFGF-01	NA	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
LFGF-02A	NA	ND	ND	ND	TRACE	ND	NA	NA	NA	NA	7
LFGF-03	3533	ND	1004	ND	30	89	NA	TRACE	ND	ND	30546
LFGF-05	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
LFGF-07	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
LFGF-08	ND	ND	ND	ND	4	ND	ND	ND	ND	ND	7
LFGF-09	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
LFGR-02	ND	ND	ND	ND	1	7	ND	17	12	ND	292
LFGR-03	NA	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
LFGR-04	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
LFGR-05	ND	NA	NA	NA	NA	ND	ND	ND	ND	ND	ND
LFGR-06	NA	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
LFGR-07	495	ND	36	9	11	34	ND	24	ND	ND	3410
LFGR-08	3749	ND	5034	ND	ND	241	ND	ND	ND	ND	66945
LFGR-09	158	ND	137	ND	7	11	NA	ND	ND	ND	2373
LFGR-10	243	ND	ND	11	11	23	ND	ND	ND	ND	1787
LFGR-11	ND	ND	ND	9	15	49	NA	TRACE	TRACE	ND	2148
LFGR-12	ND	ND	ND	ND	2	9	NA	17	ND	ND	402
LFGR-13	ND	ND	ND	3	4	11	NA	48	71	ND	1049
LFGR-14	ND	ND	TRACE	ND	ND	5	ND	ND	ND	ND	229
LFGR-15	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
LFGR-16	ND	ND	ND	ND	TRACE	TRACE	ND	ND	ND	ND	16
LFGR-18	NA	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
LFGR-19	NA	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
LFGR-20	ND	ND	3	ND	2	1	ND	ND	ND	ND	127
LFGR-21	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
LFGT-01	NA	NA	ND	ND	1	4	NA	10	ND	11	208
LFGT-02	ND	ND	NA	NA	NA	NA	NA	NA	NA	NA	NA
LFGT-03	ND	ND	ND	TRACE	1	21	NA	23	15	ND	322
LFGT-05	ND	ND	ND	TRACE	TRACE	3	ND	ND	ND	ND	150
LFGT-06	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
LFGT-07	6	ND	ND	ND	ND	ND	ND	ND	ND	ND	7
LFG-AD	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	34

ROSEHILL REGIONAL LANDFILL
ROUND 7 LANDFILL GAS - FIELD GC ANALYSIS - April 1992 - 10.2 eV lamp

POINT	Vinyl Chloride	t-1,2 DCE	c-1,2 DCE	Benzene	TCE	Toluene	PCE	Ethylbenzene	m-Xylene	o-Xylene	Total VOC
LFG-ETR	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
LFG-GT	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	4
LFG-LHR	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	18
LFG-NG	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
LFG-RK	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND

Notes:
ND - Not detected above the minimum detection limit for that compound.
NA - Not analized for, or unable to make a determination due to matrix interferances.
TRACE - Detected below the minumum quantitation limit.

ROSEHILL REGIONAL LANDFILL

ROUND 8 LANDFILL GAS - FIELD GC ANALYSIS - May 1992 - SUMMA Canister Sampling round

POINT	Vinyl Chloride	Methylene Chloride	t-1,2 DCE	1,1-DCA	c-1,2 DCE	Chloroform	1,1,1-TCA	Benzene	TCE	Toluene	PCE	Ethylbenzen	m-Xylene	o-Xylene	Total VOC
BW(04+100)-03	ND	ND	ND	ND	ND	ND	ND	6	ND	16	NA	ND	ND	ND	87
BW(04+100)-06	ND	ND	ND	ND	4	ND	ND	6	ND	37	NA	ND	ND	ND	159
BW(05+500)-03	ND	ND	ND	ND	86	ND	ND	ND	60	53	NA	8	5	ND	684
BW(05+500)-06	ND	ND	ND	ND	91	ND	ND	ND	51	59	ND	6	6	ND	850
BW(05+500)-12	ND	ND	ND	ND	101	ND	ND	ND	20	31	ND	13	7	ND	346
BW(05+500)-9.5	ND	ND	ND	ND	75	ND	ND	ND	36	40	NA	ND	ND	ND	498
SS(08+000)-03	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
SS(08+000)-06	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
SS(08+000)-09	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
SS(08+000)-12	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
SW(03+300)-03	ND	ND	ND	ND	14	ND	ND	ND	ND	ND	ND	ND	ND	ND	36
SW(03+300)-06	ND	ND	ND	ND	7	ND	ND	TRACE	12	38	NA	42	64	ND	576
SW(11+500)-03	ND	ND	ND	ND	41227	ND	ND	ND	93	755	ND	ND	ND	ND	97424
SW(11+500)-05	83	162	142	ND	3824	ND	ND	ND	196	141	ND	18	29	ND	10844
SW(11+500)-06	ND	ND	ND	ND	6833	ND	ND	ND	65	59	ND	ND	ND	ND	16951
SW(13+300)-09	46	ND	396	ND	11041	ND	ND	ND	ND	121	ND	ND	ND	ND	39695
SW(13+300)-12	85	ND	TRACE	ND	12204	ND	ND	ND	ND	109	ND	ND	ND	ND	29883

Notes:

ND - Not detected above the minimum detection limit for that compound.

NA - Not analized for, or unable to make a determination due to matrix interferances.

TRACE - Detected below the minumum quantitation limit.

C-3 REDUCED SULFUR SAMPLING DATA

ROSE HILL REGIONAL LANDFILL
REDUCED SULFUR SAMPLING

PARAMETER	SAMPLE DATA						
Sample ID	BW(04+100)-6	SS(08+000)-12	BW(05+500)-1	SW(13+300)-12	SW(11+500)-5	SW(03+300)-6	SW(03+300)-6-DUP
Sampling Information							
Sampling Date	5/8/92	5/11/92	5/11/92	5/12/92	5/12/92	5/13/92	5/13/92
Start Time	14:40	10:34	17:15	10:43	15:37	09:59	12:12
End Time	15:34	13:20	18:01	12:56	18:08	11:59	14:18
Total Flow Time (min)	56	160	36	133	150	120	123
Average Flow Rate (l/min)	2.80	2.55	3.60	2.77	3.00	3.36	3.36
Average Temperature (degrees C)	10.00	16.51	18.33	11.74	17.28	17.78	23.22
Average Pressure (atmospheres)	0.545	0.520	0.465	0.630	0.551	0.548	0.549
Total Volume Sampled (L)	88.1	210.3	58.9	237.5	245.6	217.9	217.5
Vapor Pr. of Water at t (mm of Hg)	9.209	14.077	15.772	10.177	14.809	15.284	20.07
Analytical Information							
Date of Analysis	5/8/92	5/11/92	5/12/92	5/12/92	5/12/92	05/13/92	5/13/92
First Impinger							
Iodine Solution, added I1 (ml)	20	25		15	10	15	15
Normality of I solution, N1	0.049	0.00976		0.0105	0.0105	0.01	0.01
Sodium Thio. used for titration (ml)	19.3	25.1		6.7	8.7	8.3	7.4
Normality of Sodium Thiosulfate	0.05	0.01		0.01	0.01	0.01	0.01
Hydrogen Sulfide Detected (mg)	0.65604	0.06816	0	1.42284	0.18744	1.1076	1.26096
Second Impinger							
Iodine Solution, added I1 (ml)	20	5	25	10	10	10	10
Normality of I solution, N1	0.049	0.00976	0.0105	0.0105	0.0105	0.01	0.01
Sodium Thio. used for titration (ml)	20.05	5	24.6	9.4	9.4	8.9	9.2
Normality of Sodium Thiosulfate	0.05	0.01	0.01	0.01	0.01	0.01	0.01
Hydrogen Sulfide Detected (mg)	0.01704	0.166992	0.16188	0.06816	0.06816	0.15336	0.10224
Third Impinger							
Iodine Solution, added I1 (ml)	20	25	20	10	10	10	10
Normality of I solution, N1	0.049	0.00976	0.0105	0.0105	0.0105	0.01	0.01
Sodium Thio. used for titration (ml)	20.4	25.2	20.9	9.4	9.4	9.3	9.2
Normality of Sodium Thiosulfate	0.05	0.01	0.01	0.01	0.01	0.01	0.01
Methyl Mercaptan Detected (mg)	-0.9622	-0.024055	-0.38488	-0.14433	-0.14433	-0.19244	-0.072165

ROSE HILL REGIONAL LANDFILL
REDUCED SULFUR SAMPLING

PARAMETER	SAMPLE DATA						
Sample ID	BW(04+100)-6	SS(08+000)-12	BW(05+500)-1	SW(13+300)-12	SW(11+500)-5	SW(03+300)-6	SW(03+300)-6-DUP
Hydrogen Sulfide Blank							
Sodium Thio blank adjust. (subt. ml	0.47	1.1	-0.7	-0.7	-0.7	-0.2	-0.2
Methyl Mercaptan Blank							
Sodium Thio blank adjust. (subt. ml	0	0.7	-1.7	-1.7	-1.7	-1.1	-1.1
Results							
Hydrogen Sulfide (mg/Cubic M)	7.64	1.12	2.75	6.28	1.04	5.79	6.27
Hydrogen Sulfide (ppm)	5.38	0.79	1.93	4.42	0.73	4.07	4.41
Mercaptan as Methyl Mercaptan (mg/cubic M) *	-10.93	-0.11	-6.53	-0.61	-0.59	-0.88	-0.33
Mercaptan as Methyl Mercaptan (ppm)						-0.44	

Note: * - Negative sample results should be interpreted as non-detected (ND).

ROSE HILL REGIONAL LANDFILL
REDUCED SULFUR SAMPLING
Raw Sampling Data

	Time	flow rate (sec/140ml)	Temperature (degrees F)	Vacuum (in Hg)
BW(04+100)-6	14:40	3		
	14:50	3		
	15:00	3	50	13.6
	15:20	3	50	
	15:34	3	50	
Averages		3	50	13.6

	Time	flow rate (sec/140ml)	Temperature (degrees F)	Vacuum (in Hg)
SS(08-000)-12	10:34/10:48		60	14
	10:55	3.3		
	11:10	3.3	61	14.5
	11:30	3.3	61	14.5
	11:50	3.3	61	14
	12:05	3.3	62	14
	12:25	3.3	63	14.5
	12:43	3.3	64	15
	13:05	3.3	70	15
Averages		3.3	61.7	14.4

	Time	flow rate (sec/140ml)	Temperature (degrees F)	Vacuum (in Hg)
BW(05+500)-12	17:15			16
	17:40	3	65	
	17:50	2		
	17:58	2		
Averages		2.3	65	16

	Time	flow rate (sec/140ml)	Temperature (degrees F)	Vacuum (in Hg)
BW(13+300)-12	10:43	3	52	11
	10:59	3.1	52	11
	11:14	3.2	54	11
	11:30	3	54	11
	11:45	3	53	11
	12:02	3	52	11
	12:15	3	52	11
	12:35	3	56	11.5
Averages		3.0	53.1	11.1

ROSE HILL REGIONAL LANDFILL
REDUCED SULFUR SAMPLING
Raw Sampling Data

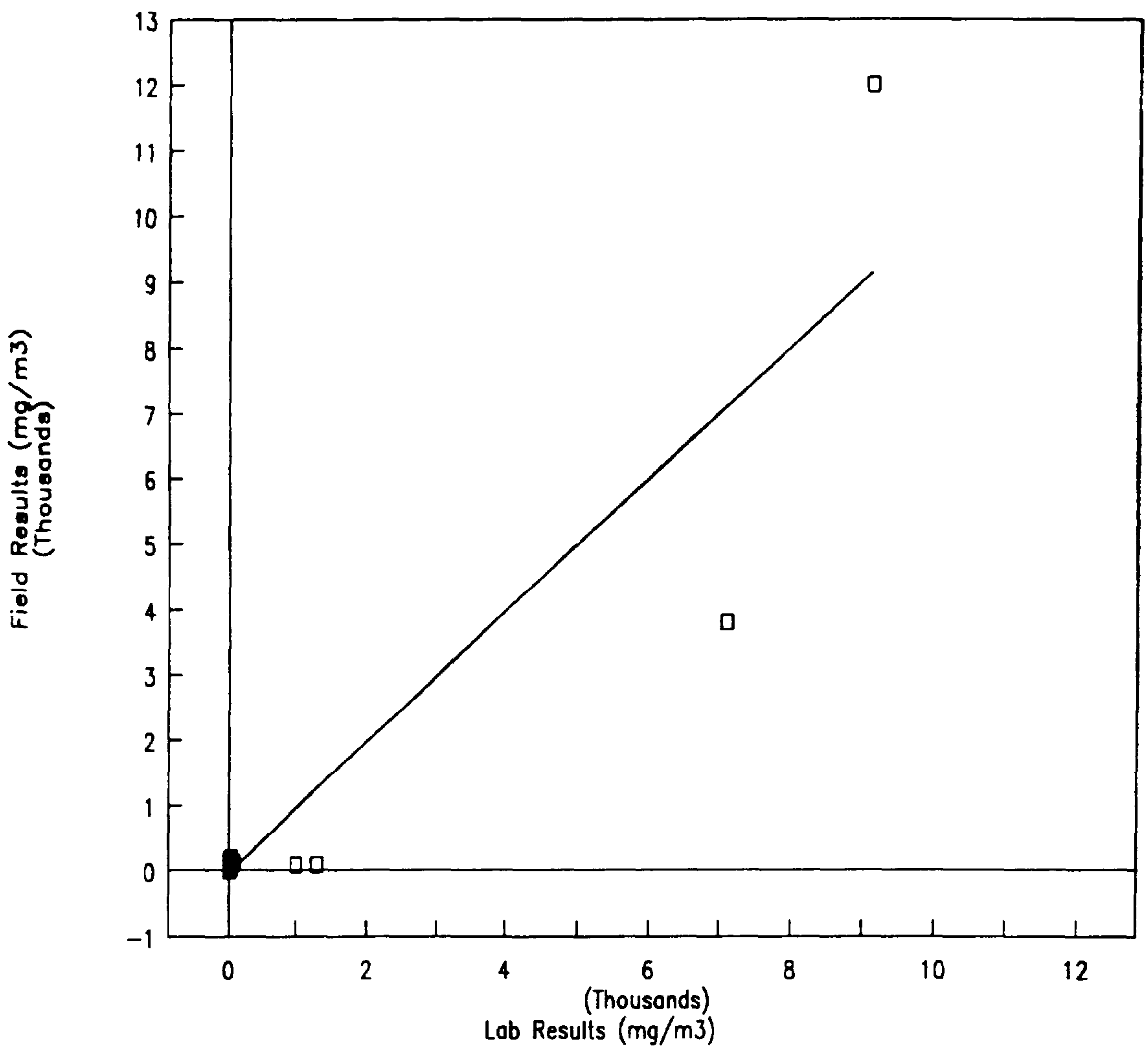
	Time	flow rate (sec/140ml)	Temperature (degrees F)	Vacuum (in Hg)
BW(11+500)-5	15:37	3.1	64	13.5
	15:51	3	62	13.3
	16:13	2.8	63	13.2
	16:34	2.8	64	13.3
	16:56	2.8	64	13.4
	17:10	2.9	64	13.5
	17:30	2.8	66	13.5
	18:00	2.5	61	13.6
	18:07	2.5	60	13.6
Averages		2.8	63.1	13.4

	Time	flow rate (sec/140ml)	Temperature (degrees F)	Vacuum (in Hg)
SW(03+300)-6	09:59	2.5	62	14
	10:12	2.5	60	13.4
	10:30	2.5	60	13.4
	10:45	2.5	60	13.5
	11:05	2.5	60	13.5
	11:30	2.5	70	13.5
	11:45	2.5	70	13.5
	11:59	2.5	70	13.5
Averages		2.5	64	13.5

	Time	flow rate (sec/140ml)	Temperature (degrees F)	Vacuum (in Hg)
BW(03+300)-6-DUP	12:12	2.5	70	13.5
	12:32	2.4	74	13.4
	13:03	2.5	76	13.5
	13:30	2.6	73	13.5
	13:48	2.5	76	13.5
Averages		2.5	73.8	13.48

C-4 DATA AND REGRESSION ANALYSIS

Field GC Results vs. Fixed Lab Results for VOCs in Soil Gas

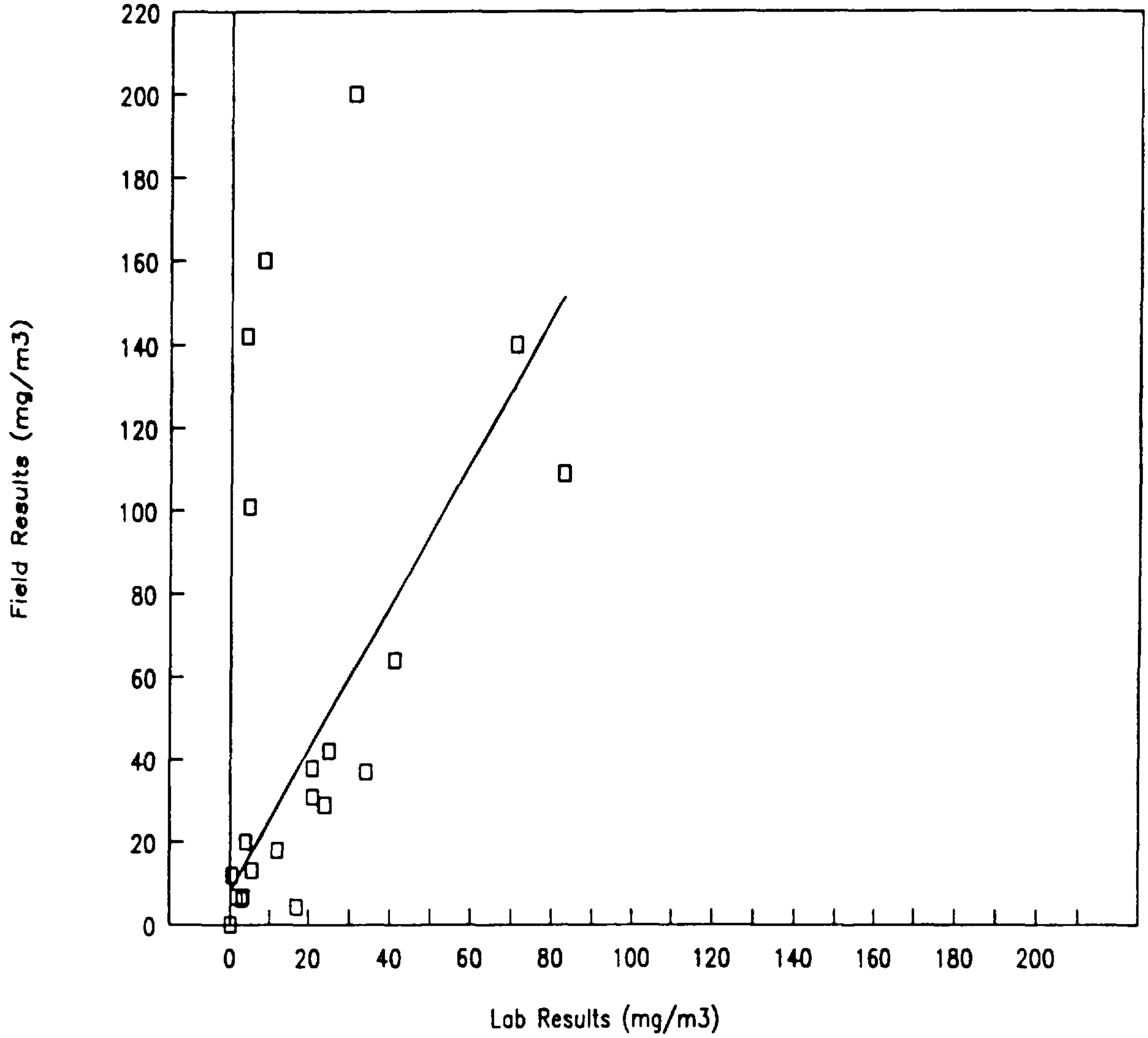


COMPOUND	lab result	Field Result mg/m3
Benzene	2.9	6.1
cis-1,2-Dichloroethene	1.5	6.7
cis-1,2-Dichloroethene	7100	3800
cis-1,2-Dichloroethene	17	4.3
cis-1,2-Dichloroethene	9100	12000
cis-1,2-Dichloroethene	4.8	101
Ethylbenzene	25	42
Ethylbenzene	12	18
Ethylbenzene	5.6	13
m,p-Xylene	24	29
m,p-Xylene	3.3	6.7
m,p-Xylene	41	64
Methylene Chloride	8.3	160
Toluene	83	109
Toluene	21	31
Toluene	71	140
Toluene	21	38
Toluene	34	37
trans-1,2-Dichloroethene	4	142
Trichloroethene	0.45	12
Trichloroethene	3.8	20
Trichloroethene	31	200
Vinyl Chloride	1300	85
Vinyl Chloride	1000	83

38 (0,0) points

Regression Output:		
Constant	−30.8865	
Std Err of Y Est	600.6389	R
R Squared	0.859304	0.926986
No. of Observations	62	
Degrees of Freedom	60	
X Coefficient(s)	1.007830	
Std Err of Coef.	0.052647	

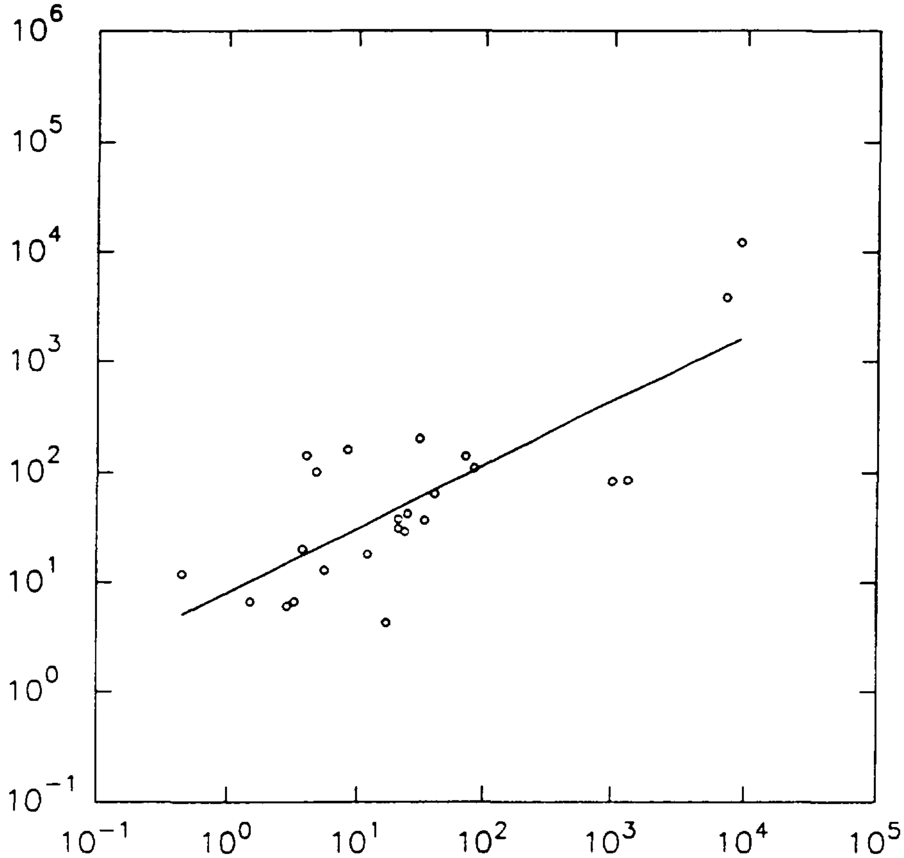
Field GC Results vs. Fixed Lab Results for VOCs in Soil Gas
(Omitting the highest four data points)



COMPOUND	lab result	Field Result mg/m3
Benzene	2.9	6.1
cis-1,2-Dichloroethene	1.5	6.7
cis-1,2-Dichloroethene	17	4.3
cis-1,2-Dichloroethene	4.8	101
Ethylbenzene	25	42
Ethylbenzene	12	18
Ethylbenzene	5.6	13
m,p-Xylene	24	29
m,p-Xylene	3.3	6.7
m,p-Xylene	41	64
Methylene Chloride	8.3	160
Toluene	83	109
Toluene	21	31
Toluene	71	140
Toluene	21	38
Toluene	34	37
trans-1,2-Dichloroethene	4	142
Trichloroethene	0.45	12
Trichloroethene	3.8	20
Trichloroethene	31	200

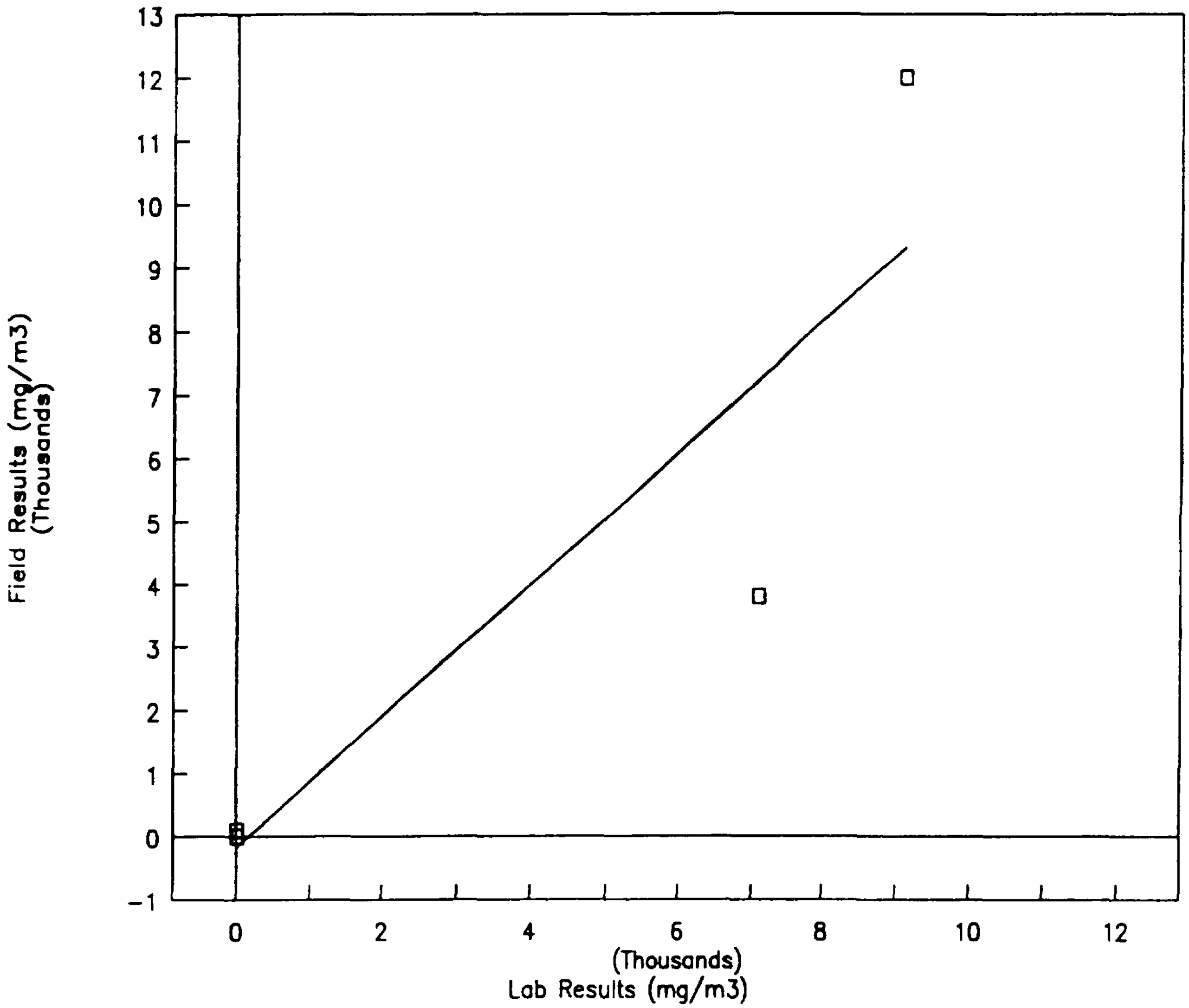
38 (0,0) points

Regression Output:		
Constant	7.989057	
Std Err of Y Est	35.09335	R
R Squared	0.400837	0.633117
No. of Observations	58	
Degrees of Freedom	56	
X Coefficient(s)	1.727805	
Std Err of Coef.	0.282285	



10^6
10^5
10^4
10^3
10^2
10^1
10^0
10^-1
10^-1
10^0
10^1
10^2
10^3
10^4
10^5

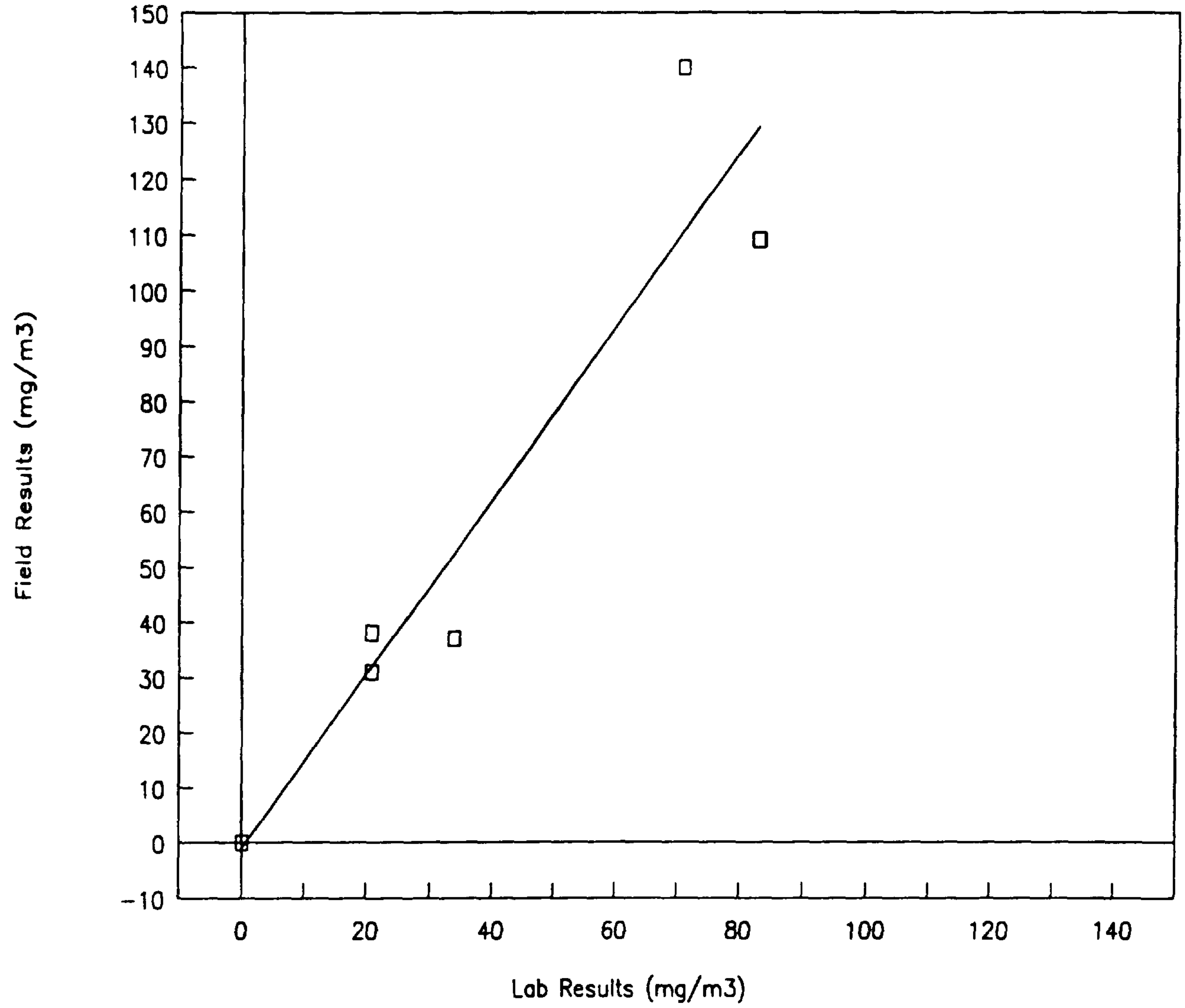
Field GC Results vs. Fixed Lab Results for cis-1,2-Dichloroethene in Soil Gas



COMPOUND	Lab result	Field Result mg/m3
cis-1,2-Dichloroethene	1.5	8.7
cis-1,2-Dichloroethene	4.8	101
cis-1,2-Dichloroethene	17	4.3
cis-1,2-Dichloroethene	7100	3800
cis-1,2-Dichloroethene	9100	12000
one (0,0) point		

Regression Output:		
Constant	-166.931	
Std Err of Y Est	2186.979	R
R Squared	0.835430	0.914018
No. of Observations	6	
Degrees of Freedom	4	
X Coefficient(s)	1.042549	
Std Err of Coef.	0.231359	

Field GC Results vs. Fixed Lab Results
Toluene in Soil Gas

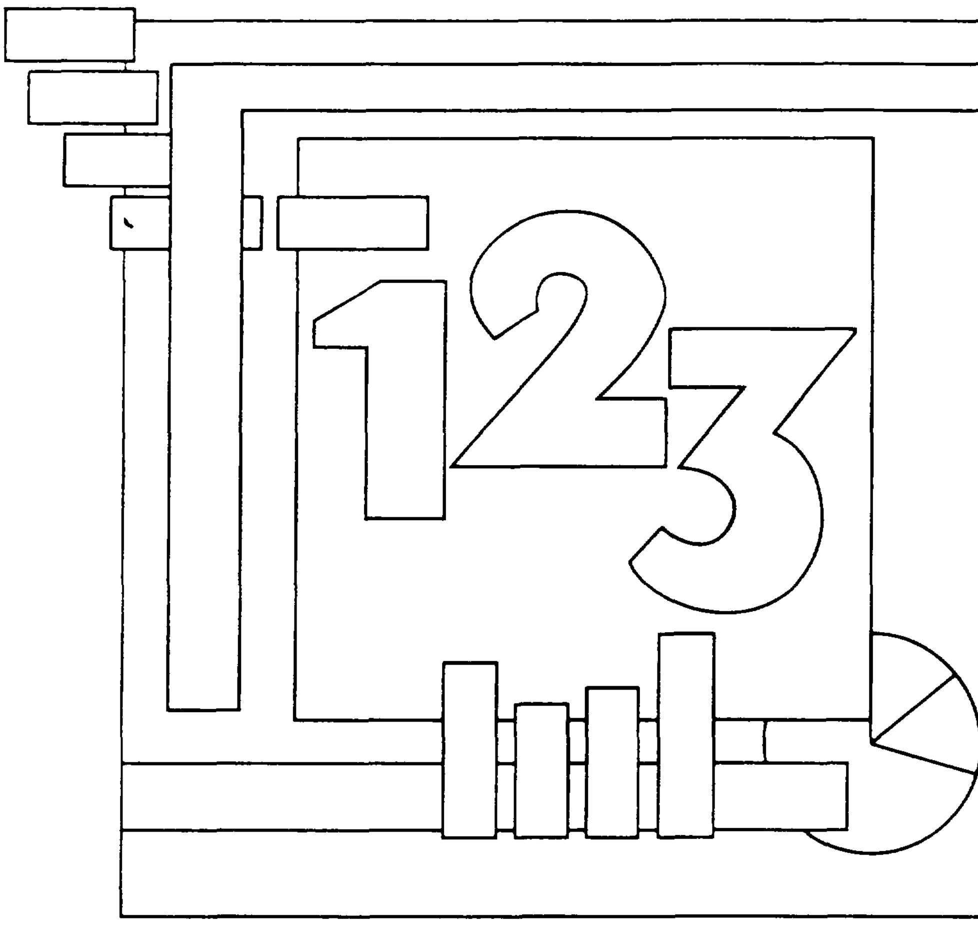


COMPOUND	Lab result	Field Result mg/m3
Toluene	21	38
Toluene	21	31
Toluene	34	37
Toluene	71	140
Toluene	83	109
one (0,0) point		

Regression Output:		
Constant	-1.00232	
Std Err of Y Est	19.74437	R
R Squared	0.890577	0.943704
No. of Observations	6	
Degrees of Freedom	4	
X Coefficient(s)	1.569625	
Std Err of Coef.	0.275095	

Lotus 1-2-3 Release 2.2

Reference



Input range

```
A1: 'LAST NAME                                                READY

      A            B            C            D        E        F
1   LAST NAME    LOCATION     DATE HIRED   SALARY    AGE
2   Percival     Boston       14-Feb-87    $32,200   44
3   Stolper      Boston       18-Dec-87    $19,200   36
4   Percival     Boston       14-Feb-87    $32,200   44
5   Stolper      Boston       18-Dec-87    $19,200   36
6
7   LAST NAME    LOCATION     DATE HIRED   SALARY    AGE
8                Boston
9
10  LAST NAME    LOCATION     DATE HIRED   SALARY    AGE
11  Percival     Boston       14-Feb-87    $32,200   44
12  Stolper      Boston       18-Dec-87    $19,200   36
13
14
15
16
```

Criteria range

Output range

Figure 4-26 /Data Query Unique eliminates duplicate records matching the criteria

Procedure

1. Before you use /Data Query Unique, you must specify an input range, a criteria range, and an output range.

   For more information, see "Required /Data Query Ranges" earlier in this section.

2. Select /Data Query Unique.

   1-2-3 copies to the output range the records in the input range that match your criteria, eliminating any duplicate records in the output range. Like /Data Query Extract, 1-2-3 keeps the records in the same order they were in in the database.

   1-2-3 displays an error message if you specified a multiple row output range and there are more matching records than can fit in the range. Press **ESC** to return 1-2-3 to READY mode. Use /Data Query Output to specify an output range with more rows, or if you have a lot of empty space below the output range, specify just the row that contains the field names as the output range.

   CAUTION If you specify a single row output range, 1-2-3 erases all data in the columns below the field names to the bottom row of the worksheet. Then 1-2-3 creates an output range that contains as many rows as needed to contain the data. To avoid possible data loss, save the worksheet before using /Data Query Unique. If you make a mistake when extracting records and the undo feature is on, press **UNDO (ALT-F4)** immediately to restore the worksheet to its original state.

/Data Regression

/Data Regression lets you perform a regression analysis on existing data. A **regression analysis** is a statistical application used for predicting likely future data based on current data.

Use the following commands to perform a data regression:

Command	Task
Go	Calculates a data regression for the selected X range, Y range, and output range.
Intercept	Determines whether 1-2-3 calculates the y-axis intercept automatically (default) or uses zero as the intercept. The y-axis intercept appears in the results as the constant.
Output-Range	Specifies the range in which 1-2-3 places the results of the regression analysis.
Quit	Returns 1-2-3 to READY mode.
Reset	Clears the X range, Y range, and output range; resets the intercept to Compute.
X-Range	Specifies the independent variables.
Y-Range	Specifies the dependent variable.

Use /Data Regression to predict a value for a dependent variable based on the values for one or more independent variables. /Data Regression also indicates the statistical accuracy of these values. Figure 4-27 shows an example of /Data Regression.

You can also use /Data Regression when you have several sets of values and you want to see how and whether one set is dependent on the others, and also to determine the slope and the y-axis intercept of the best-fitting line for a set of data points.

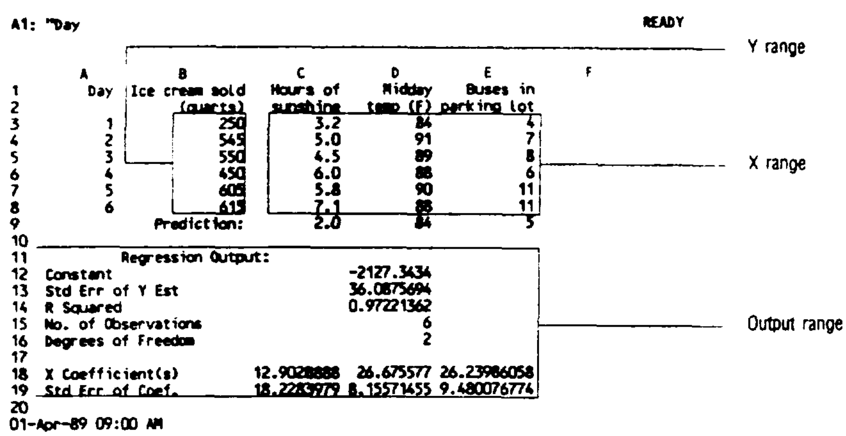


Figure 4-27 /Data Regression

How to Use This Section

- "Terms You Need to Know" defines important terms that are used frequently in this section.

- "Before You Use /Data Regression" explains procedures you must follow before using the Data Regression commands.
- "The /Data Regression Settings Sheet" describes the status screen that appears when you select /Data Regression.
- "Performing Regression Analysis: An Example" provides an illustrated example of performing regression analysis and using regression results. If you are not familiar with data regression, follow these examples before you try using /Data Regression.
- "How to Use /Data Regression" lists the steps you need to follow to complete the command.
- The remaining subsections describe each of the Data Regression commands in alphabetical order.

Terms You Need to Know

- An **independent variable** is a value used to determine a prediction.
- A **dependent variable** is the data for which you have current information, but which you want to predict.
- The **intercept** is the point at which the Y-axis is crossed by the predicted line.

Before You Use /Data Regression

Before you can use /Data Regression to perform a regression analysis, you need to create three data regression ranges: an X range, a Y range, and an output range. The X range contains the independent variables in the database. The Y range contains the dependent variable in the database. The output range is where 1-2-3 will place the results of the regression analysis.

The /Data Regression Settings Sheet

When you select /Data Regression, 1-2-3 displays a settings sheet like the one illustrated in Figure 4-28. The settings sheet lists by cell address the location of the X range, Y range, output range, and y-axis intercept. These are the settings 1-2-3 will use when you are ready to perform the regression with /Data Regression Go.

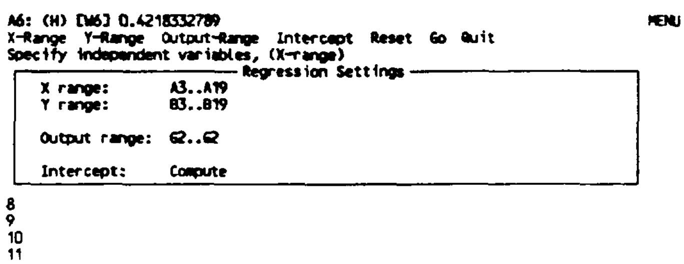


Figure 4-28 The /Data Regression settings sheet

Performing Regression Analysis: An Example

You are the proprietor of an ice cream stand at a tourist location, and you want to be able to predict in advance roughly how many quarts of ice cream you will sell the next day. You believe that your sales are influenced by three key factors: the number of hours of sunshine, the midday temperature, and the number of buses in a nearby parking lot.

You created a database that contains the available information for a six day period. (In practice, you would probably collect data for a much longer period to get greater accuracy.) Figure 4-29 shows the sample database.

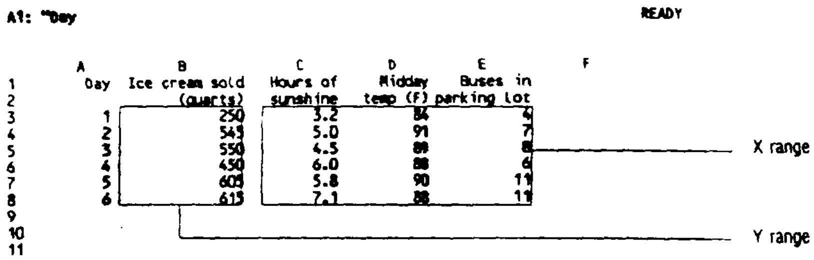


Figure 4-29 Sample database

Before you can predict sales, you need to perform a regression analysis on the existing data, as described in the steps below.

1. Select /Data Regression X-Range. The X range contains the independent variables in the database (the variables you can estimate with some degree of accuracy already). For the ice cream stand, the independent variables are the number of hours of sunshine, the midday temperature, and the number of buses in the parking lot (the range C3..E8).
2. Select /Data Regression Y-Range. The Y range contains the dependent variable in the database (the variable you want to predict). For the ice cream stand, the dependent variable is the amount of ice cream sold (the range B3..B8).
3. Select /Data Regression Output-Range to indicate the area of the worksheet in which you want 1-2-3 to place the results of the regression analysis. You need to specify only the first cell of the range (the cell A11).

4. Select /Data Regression Go. 1-2-3 automatically enters the following calculated results (including labels) in the output range, as illustrated in the figure below:

A1: "Day   READY

	A	B	C	D	E	F
1	Day	Ice cream sold	Hours of	Midday	Buses in	
2		(quarts)	sunshine	temp (F)	parking lot	
3	1	250	3.2	84	4	
4	2	565	5.0	91	7	
5	3	590	4.5	89	8	
6	4	450	6.0	88	6	
7	5	605	5.8	90	11	
8	6	615	7.1	88	11	
9						
10						
11	Regression Output:					
12	Constant			-2127.3434		
13	Std Err of Y Est			36.0875694		
14	R Squared			0.97221362		
15	No. of Observations			6		
16	Degrees of Freedom			2		
17						
18	X Coefficient(s)		12.9028888	26.675577	26.23986058	
19	Std Err of Coef.		18.2283979	8.15571455	9.480076774	
20						

01-Apr-89 09:00 AM

Output range

Figure 4-30 Results of data regression

Using the Regression Results

Now you can use the regression data you have generated for the prediction. Suppose the weather forecast tells you that tomorrow will be cloudy, with only two hours of sunshine and a midday temperature of 84° F. You guess that no more than five buses will visit. These are the predicted X values (independent variables).

To predict the ice cream sales (Y value) for tomorrow, complete the following steps.

1. Enter the predicted values (2, 84, 5) in cells C9..E9 of the database.
2. Enter the following formula in the cell where you want to see the prediction. (Enter the formula in cell F9 so that the prediction is in sequence with actual sales, but in a different column so that it is not confused with actual sales.)

   +(C9*$C$18)+(D9*$D$18)+(E9*$E$18)+$D$12

   This formula may look complicated, but it is really only the sum of the following:

   - the first predicted x value multiplied by the first x coefficient, plus
   - the second predicted x value multiplied by the second x coefficient, plus
   - the third predicted x value multiplied by the third x coefficient, plus
   - the constant

   Use absolute references for the x coefficients and the constant because you may want to copy the formula to other cells, and you do not want any adjustment made in references to the coefficients or the constant.

With labels added to cells B9, F1, and F2, the worksheet looks like this:

```
F9: (F0) [W11] (C9*$C$18)+(D9*$D$18)+(E9*$E$18)+$D$12                READY

         A          B           C          D          E          F
1      Day  Ice cream sold  Hours of     Midday   Buses in  Estimated
2                 (quarts)  sunshine   temp (F) parking lot       sale
3        1             250       3.2         84          4
4        2             545       5.0         91          7
5        3             550       4.5         89          8
6        4             450       6.0         88          6
7        5             605       5.8         90         11
8        6             615       7.1         88         11
9              Prediction:       2.0         84          5        270
10
11          Regression Output:
12  Constant                          -2127.3434
13  Std Err of Y Est                  36.0875694
14  R Squared                         0.97221362
15  No. of Observations                        6
16  Degrees of Freedom                         2
17
18  X Coefficient(s)       12.9028888  26.675577 26.23986058
19  Std Err of Coef.       18.2283979 8.15571455 9.480076774
20
01-Apr-89 09:00 AM
```

Figure 4-31 Using the regression analysis

The prediction indicates that you should expect to sell approximately 270 quarts of ice cream tomorrow.

Tip

- You can enter any number of values in each column of variables, assuming that the number does not exceed the number of rows in the worksheet.

How to Use /Data Regression

NOTE You can select Reset at any time to clear the regression settings.

1. Select /Data Regression.
2. Select X-Range to specify the independent variables.

   Independent variables are the values needed to determine a prediction. You can specify up to 16 independent variables.
3. Specify the X range and press ENTER.
4. Select Y-Range to specify the dependent variable.

   The **dependent variable** is the variable for which you have current information, but which you want to predict in the future.
5. Specify the Y range and press ENTER.

   NOTE The X range and Y range must have the same number of rows.

6. If you select Intercept, select one of the following options:

Compute	Calculates the y-axis intercept automatically.
Zero	Uses zero as the y-axis intercept. Do not select Zero unless your data is such that when all of the independent variables equal zero the dependent variable must equal zero.

7. Select Output-Range.
8. Specify the output range in a blank area of the worksheet and press ENTER.

   Use the cell address of the first cell in the range, a range name, or a range address. If you select a range that is too small to contain the regression calculations, 1-2-3 cannot perform the regression and displays an error message when you select Go.
9. Select Go to calculate the regression or select Quit to return 1-2-3 to READY mode without calculating the regression.

   When you select Go, 1-2-3 enters the following information in the output range:

Item	**Description**
Constant	The y-axis intercept.
Degrees of freedom	The number of observations minus the number of independent variables minus 1. If you use a zero intercept, the degrees of freedom equal the number of observations minus the number of independent variables.
No. of observations	The number of rows of data in the X and Y ranges.
R squared	The reliability of the regression (a value from 0 to 1, inclusive). **NOTE** If 1-2-3 displays a value less than zero, you specified a zero intercept when it was not appropriate to do so. Use /Data Regression Intercept Compute and then /Data Regression Go to recalculate the regression and adjust the R^2 value accordingly.
Std Err of Coef.	The standard error of each of the x coefficients.
Std Err of Y Est	The standard error of the estimated y values.
X coefficient(s)	The slope for each independent variable.

/Data Regression Go

/Data Regression Go lets you calculate a data regression for the selected X range, Y range, and output range.

Procedure

1. Before you use /Data Regression Go, you must specify the X range, Y range, and output range.

   For more information, see "How to Use /Data Regression" earlier in this section.
2. Select /Data Regression Go.

/Data Regression Intercept

/Data Regression Intercept lets you determine whether 1-2-3 calculates the y-axis intercept automatically or uses zero as the intercept. The y-axis intercept appears as the constant in the results.

Procedure

1. Select /Data Regression Intercept.
2. Select one of the following options:

Compute	Calculates the y-axis intercept automatically.
Zero	Uses zero as the y-axis intercept. Do not select this unless your data is such that when all of the independent variables equal zero the dependent variable must equal zero.

/Data Regression Output-Range

/Data Regression Output-Range lets you specify the range in which 1-2-3 places the results of the regression analysis. For more information, see "How to Use /Data Regression" earlier in this section.

Procedure

1. Select /Data Regression Output-Range.
2. Specify an output range in a blank area of the worksheet and press ENTER.
   - If you specify just one cell 1-2-3 will use that cell as the upper left cell of the output range, and determine how big a range it needs.
   - If you specify a larger range but one which is not big enough to contain the regression calculations, 1-2-3 will display an error message when you select Go.

/Data Regression Reset

/Data Regression Reset lets you clear range address settings for the X range, the Y range, and the output range, and resets the intercept to Compute.

Procedure

1. Select /Data Regression Reset.

/Data Regression X-Range

/Data Regression X-Range lets you specify the independent variables. For more information, see "Performing Regression Analysis" earlier in this section.

Procedure

1. Select /Data Regression X-Range.
2. Specify the independent variables and press ENTER.

   You can specify up to 16 independent variables (the values needed to make a prediction).

/Data Regression Y-Range

/Data Regression Y-Range lets you specify the dependent variable. For more information, see "Performing Regression Analysis" earlier in this section.

Procedure

1. Select /Data Regression Y-Range.
2. Specify the dependent variable (the variable for which you have current information, but want to predict in the future) and press ENTER.

   The X range and the Y range must have the same number of rows.

/Data Sort

/Data Sort lets you arrange the data in a range in the order you specify. The range can be records in a database or rows in the worksheet.

Use the following commands to perform a data sort:

Command	Task
Data-Range	Selects the range you want to sort.
Go	Sorts the data according to the current selections and returns 1-2-3 to READY mode.
Primary-Key	Determines the primary field for sorting records or rows. The data can be in either ascending or descending order.
Quit	Returns 1-2-3 to READY mode and does not sort the records or rows.
Reset	Clears range address settings and sort keys.
Secondary-Key	Determines the order for records or rows that have the same primary sort key entries. The data can be in either ascending or descending order.

How to Use This Section

- "Before You Use /Data Sort" explains procedures you must follow before using the Data Sort commands.
- "The /Data Sort Settings Sheet" describes the status screen that appears when you select /Data Sort.
- "Sort Order" includes information about the order in which 1-2-3 will sort both numeric and text data.
- "How to Use /Data Sort" lists the steps you need to follow to complete the command.
- The remaining subsections describe each of the Data Sort commands in alphabetical order.

C-5 SUMMARY OF LANDFILL GAS DATA CALCULATIONS

Project Rose Hill RI Acct. No. ______ Page ____ of ____
Subject Landfill Gas Comptd. By ______ Date ______
Detail Summary of field GC Calculations Ck'd. By ______ Date ______

Calibration:

- Identification of Compounds was based on the retention time (RT) of that compound in a standard mixture on a given day under a given set of conditions.
- A response factor (RF) was calculated for each compound for each calibration run.

$$RF = \frac{\text{concentration}}{\text{peak hieght}}$$

Typically several RF's calculated from different calibration runs were averaged together for one RF used for all analysis on that day.

- Total VOC - Because many of the compounds detected by field GC did not correspond to calibration compounds an RF was calculated for total VOC concentrations.

$RF_{\text{total VOC}}$ = Average of All other RF's for that day.

Project ______ Acct. No. ______ Page ______ of ______
Subject ______ Comptd. By ______ Date ______
Detail ______ Ck'd. By ______ Date ______

- Quantitation:

sample concentration = RF x peak hieght

peak hieght is generally in GC units

fequently several analysis were performed on the same sample using the same or different analytical parameters. Different sample concentrations may have been averaged ~~[illegible]~~ or the most appropriate analysis reported.