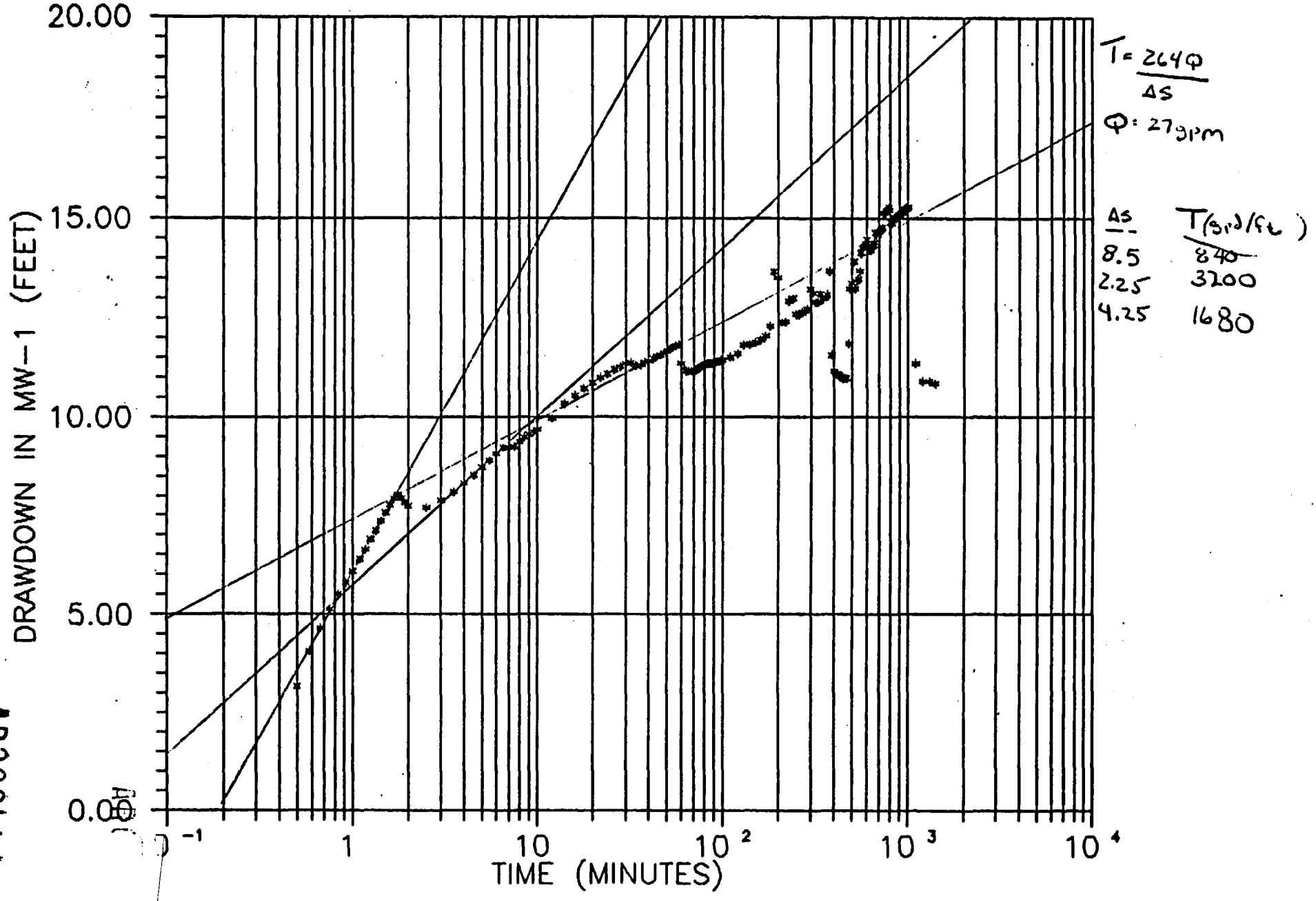
102661

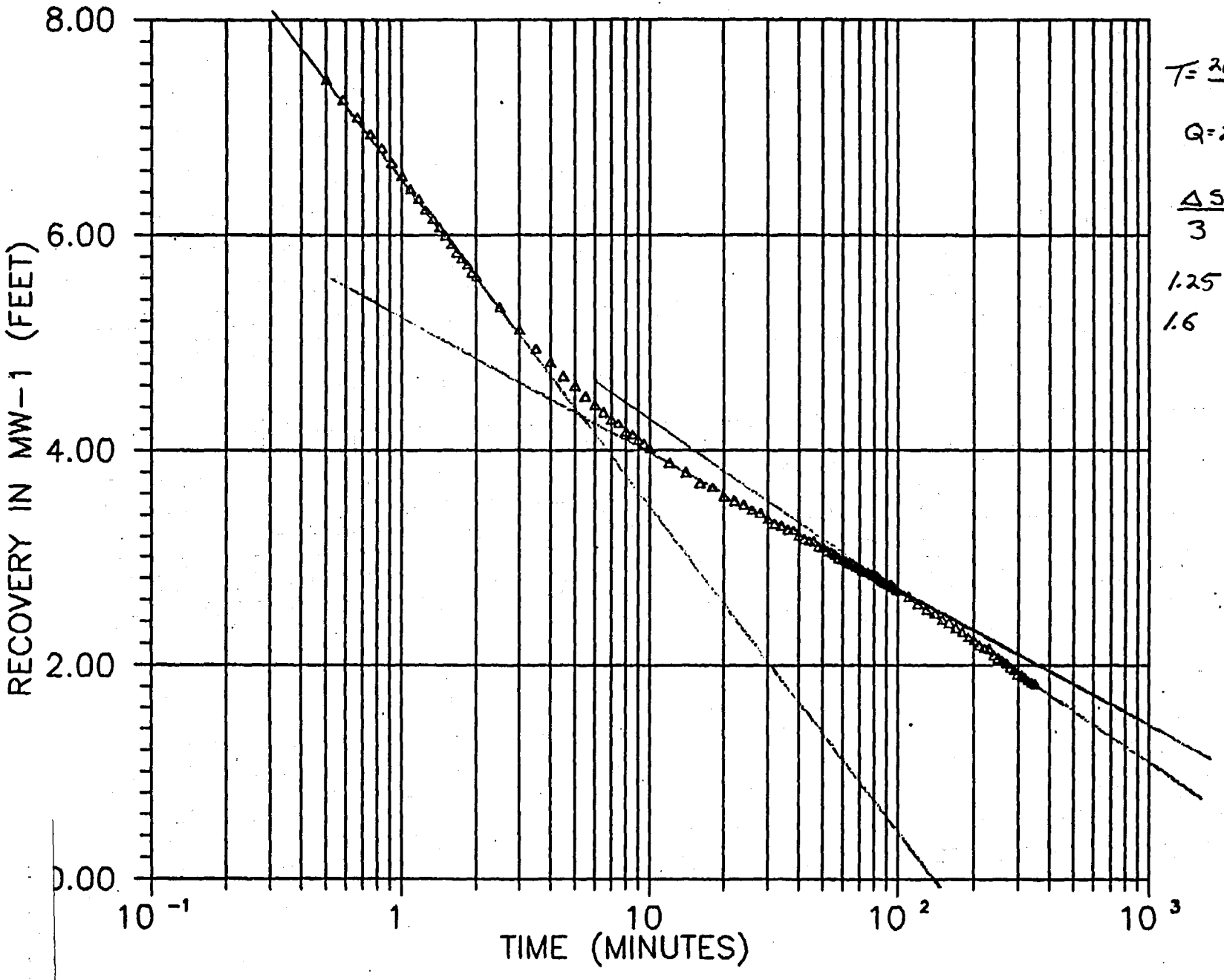
PUMP TEST NO. 1

PUMP TE NO. 1



AR300440

PUMP TE NO. 1



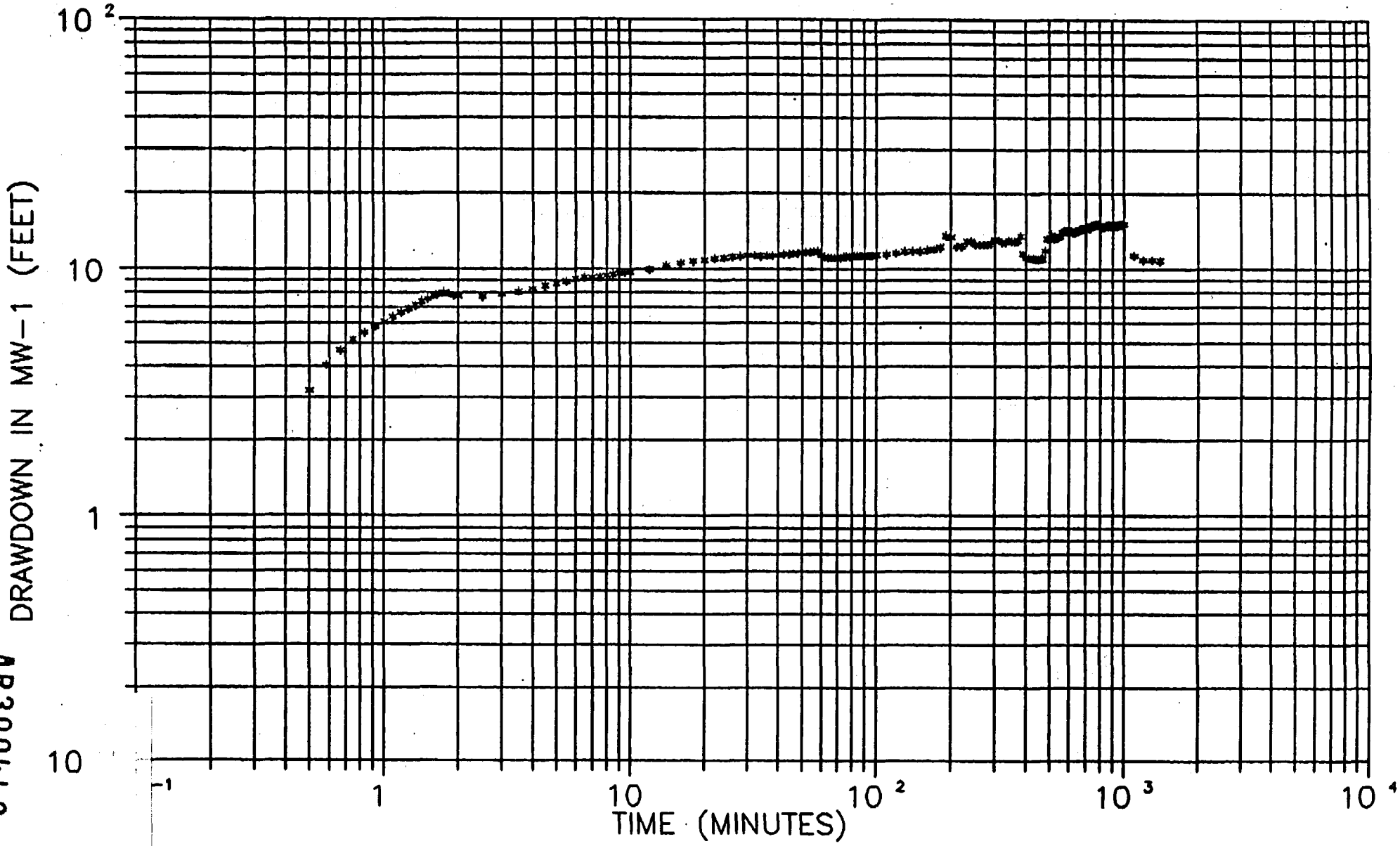
$T = \frac{264Q}{\Delta s}$

Q=27gpm

Δs	T(gpd)
3	2380
1.25	5700.
1.6	4460.

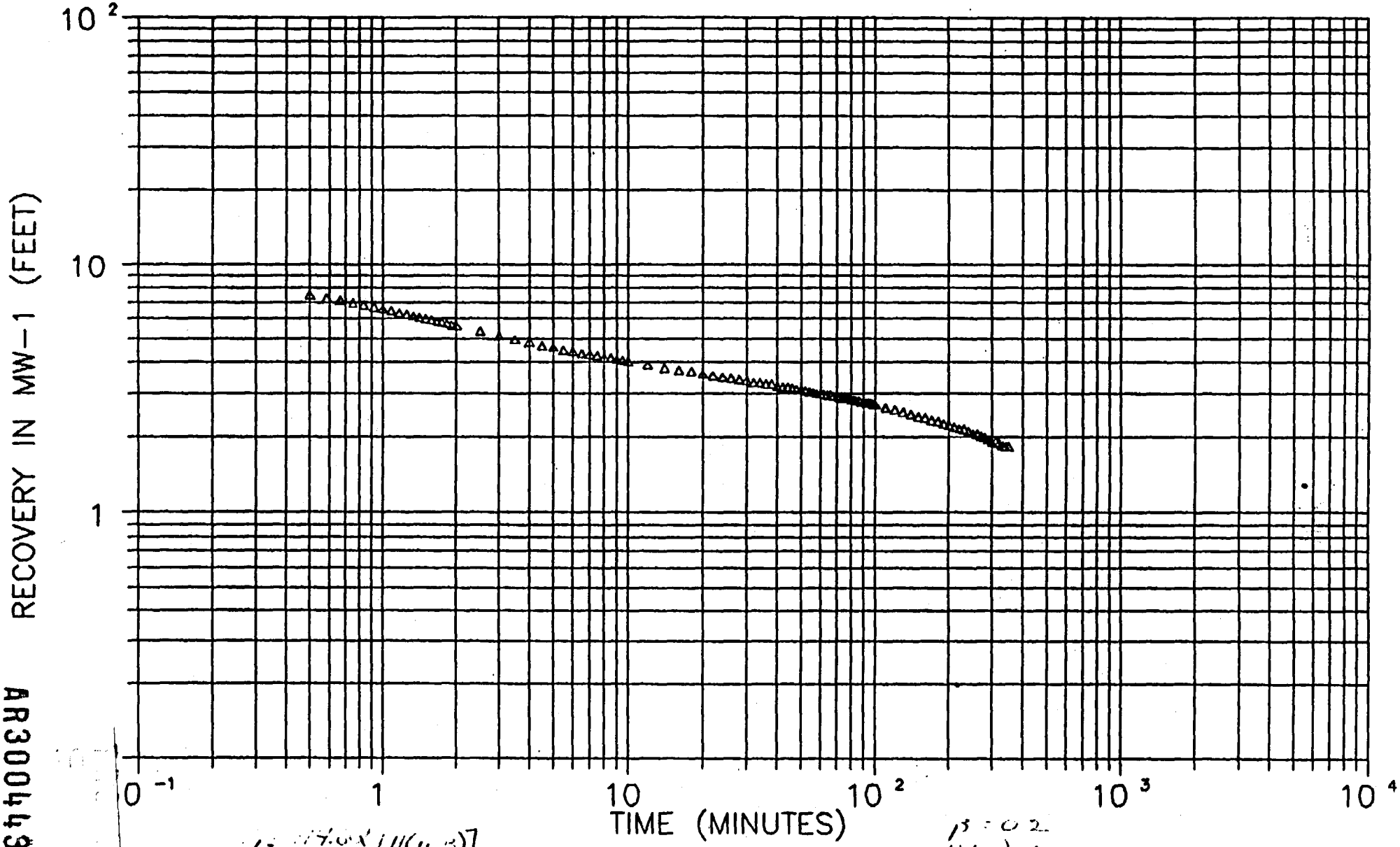
AR300441

PUMP TEST NO. 1



AR300442

PUMP TEST NO. 1



$T = \frac{264Q}{s}[W(u,\beta)]$

$Q = 27$ gpm

$T = 25$ SEC 11/51

$\beta = 0.2$

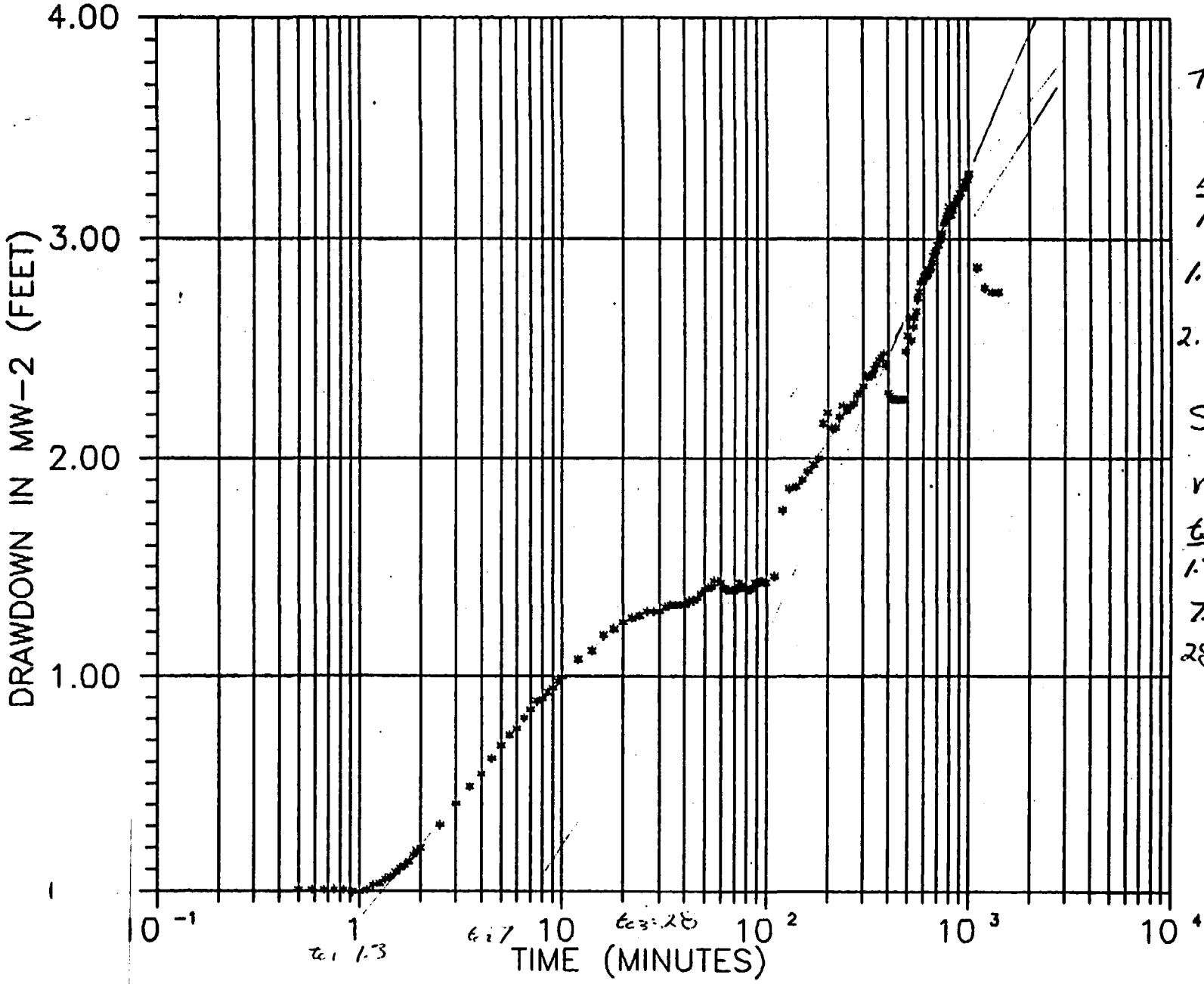
$W(u,\beta) = 1$

$u = 1$

$= 1.3$

AR300443

PUMP TE NO. 1



$T = \frac{264Q}{\Delta s}$

Q = 27 gpm

Δs	T (gpd/ft)
1.15	6200.
1.45	4900.
2.12	3360.

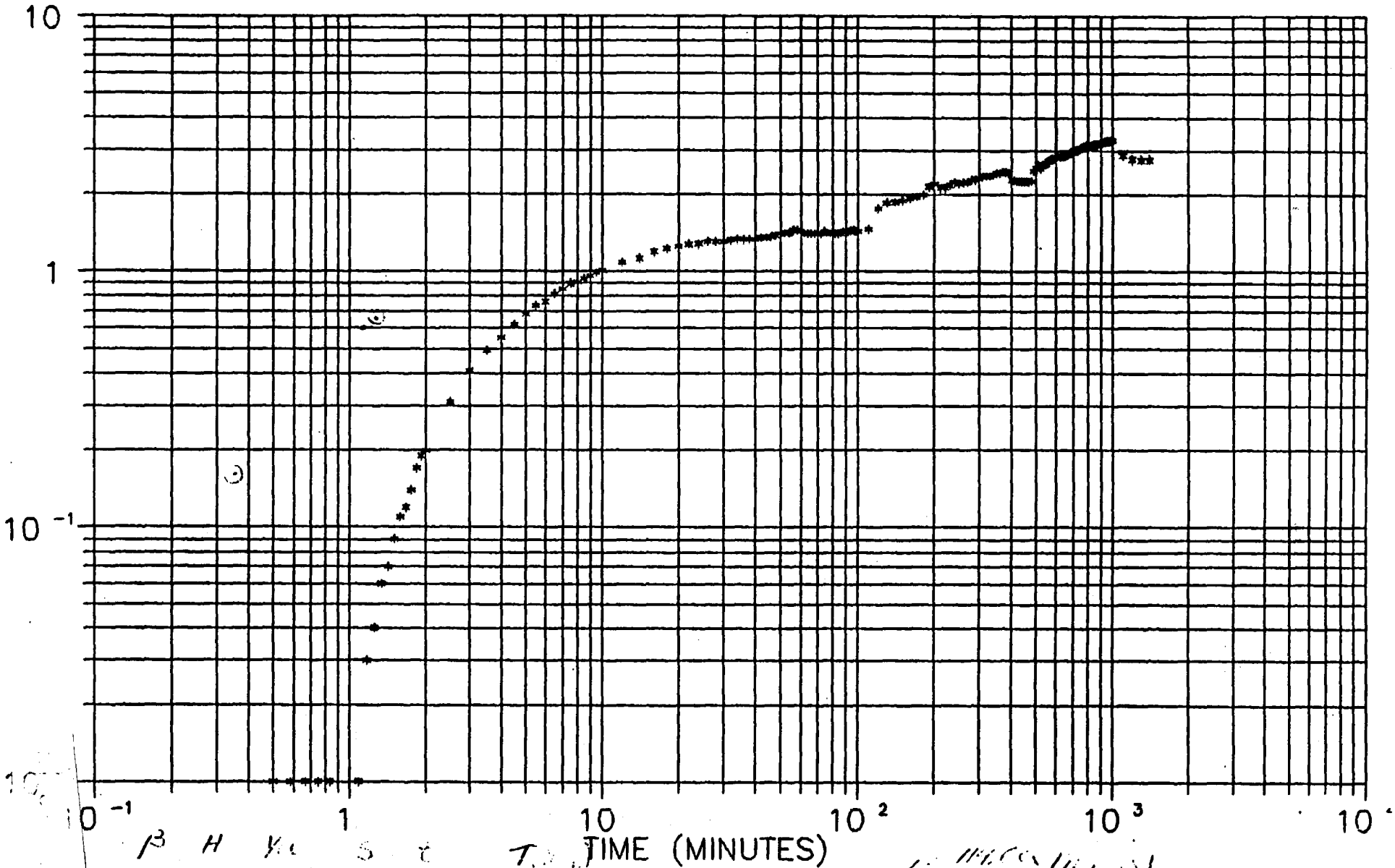
$S = \frac{2.08 \times 10^{-4} T t_0}{r^2}$

r = 75 ft

t_0	S
1.3	0.0003
7.	0.0013
28.	0.0035

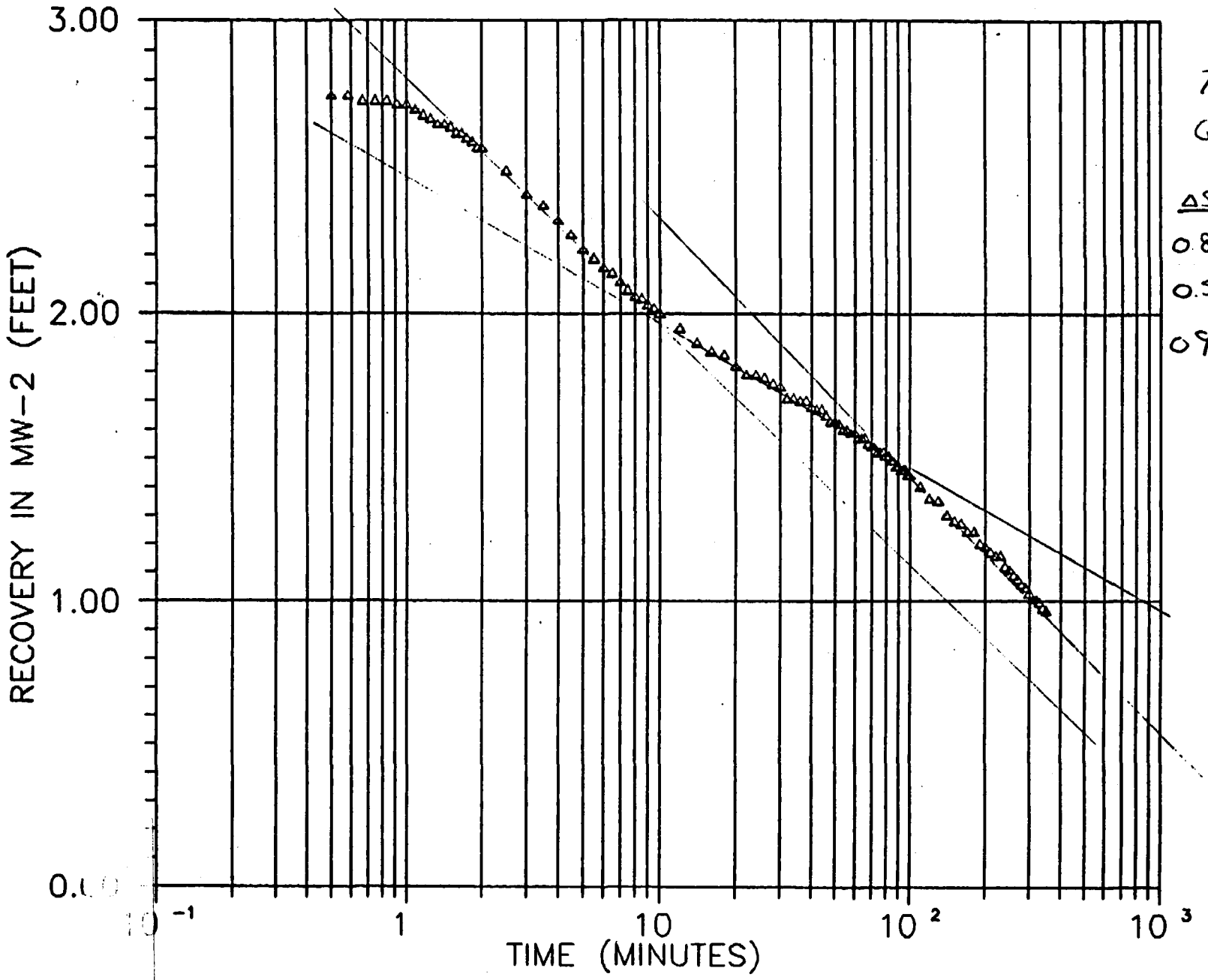
AR300444

PU( ) TEST NO. 1



AR300445

PUMP TE. NO. 1



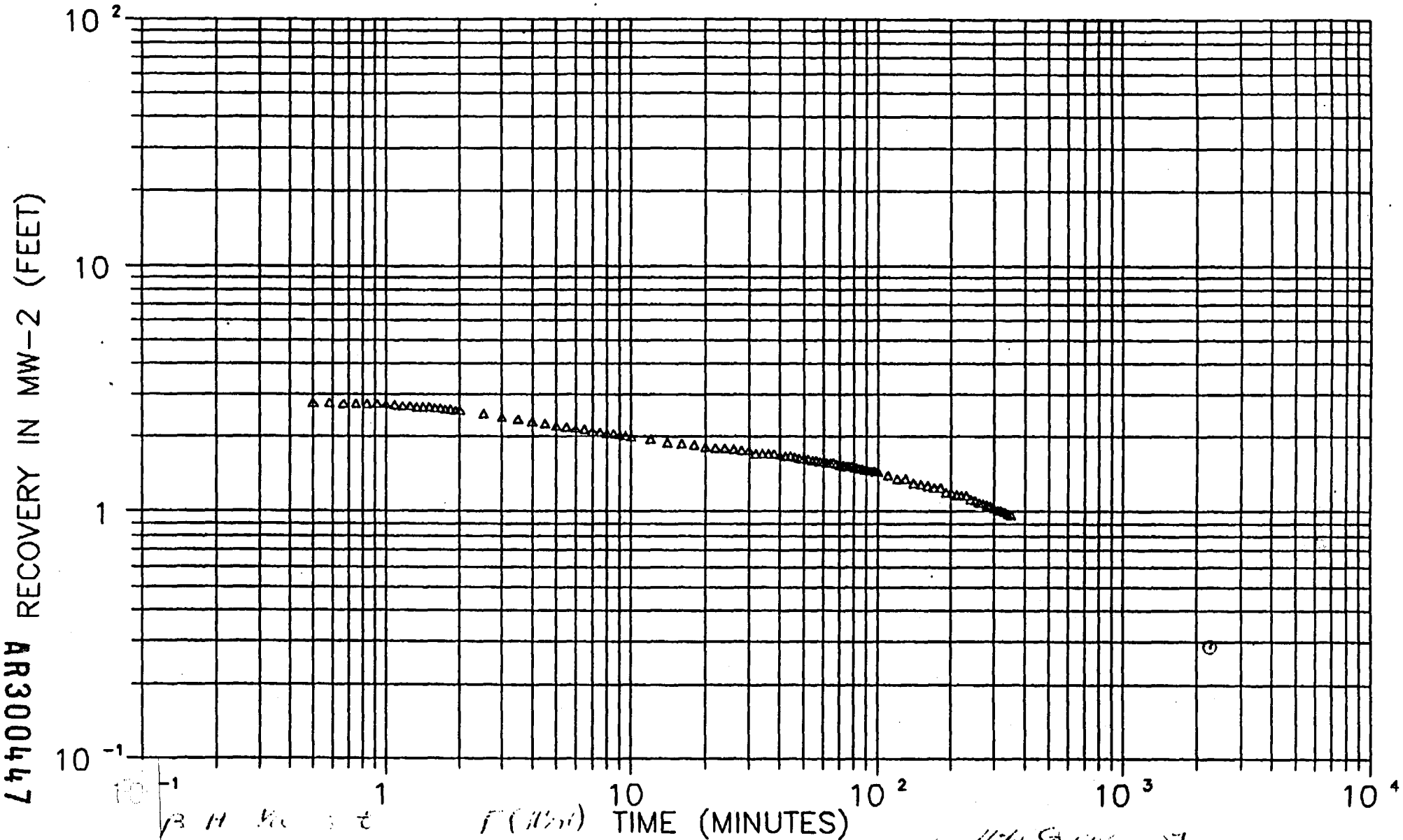
$T = \frac{264Q}{\Delta s}$

Q = 27 gpm

Δs	T (gpd/ft)
0.85	8390.
0.5	14,260.
09	7920.

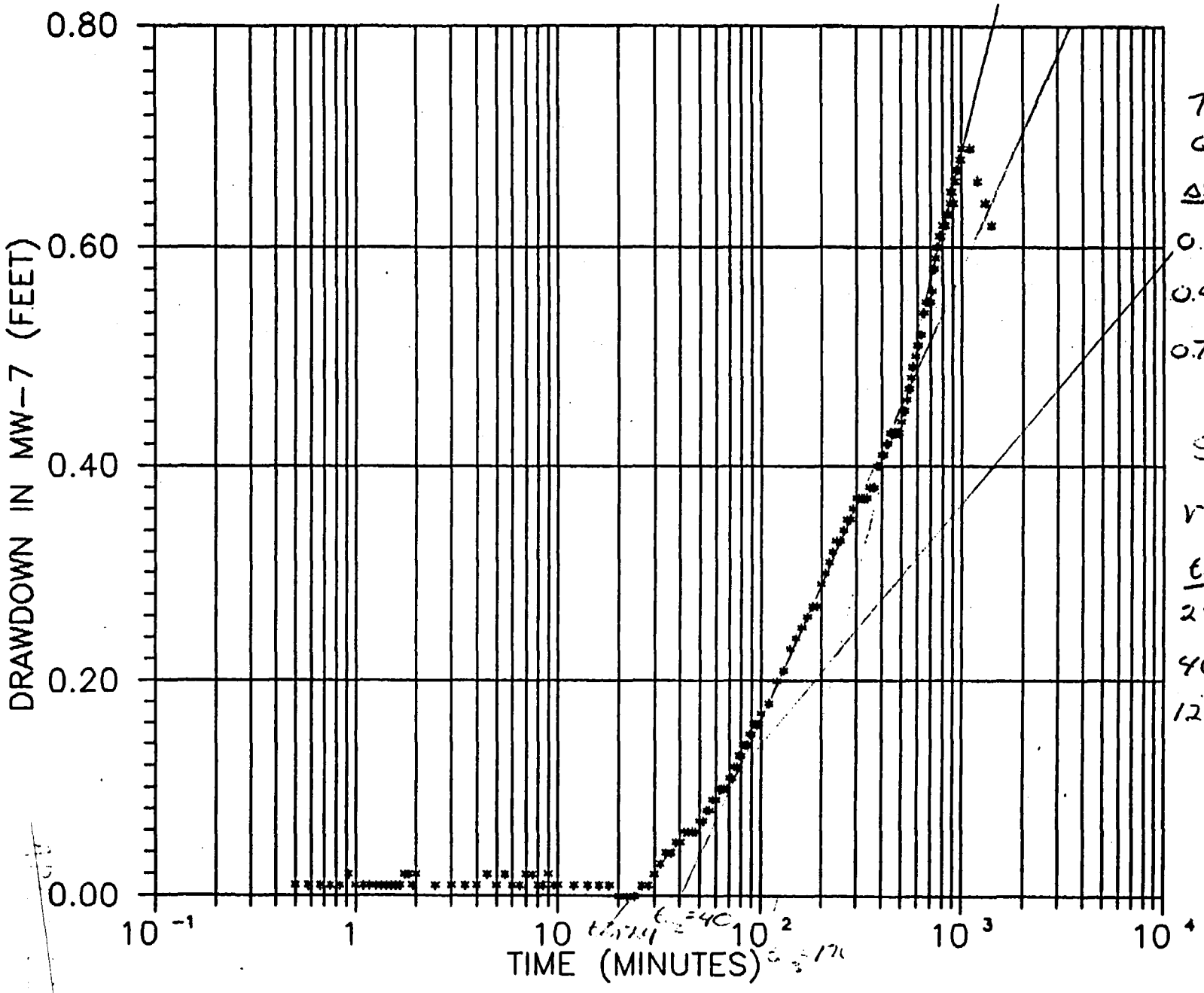
AR300446

PUMP TEST NO. 1



AR300447

PUMP TE. NO. 1



$T = \frac{264Q}{\Delta S}$

$Q = 27$ gpm

ΔS	T (gpd/ft)
0.22	32,400.
0.42	17,000.
0.74	9,630.

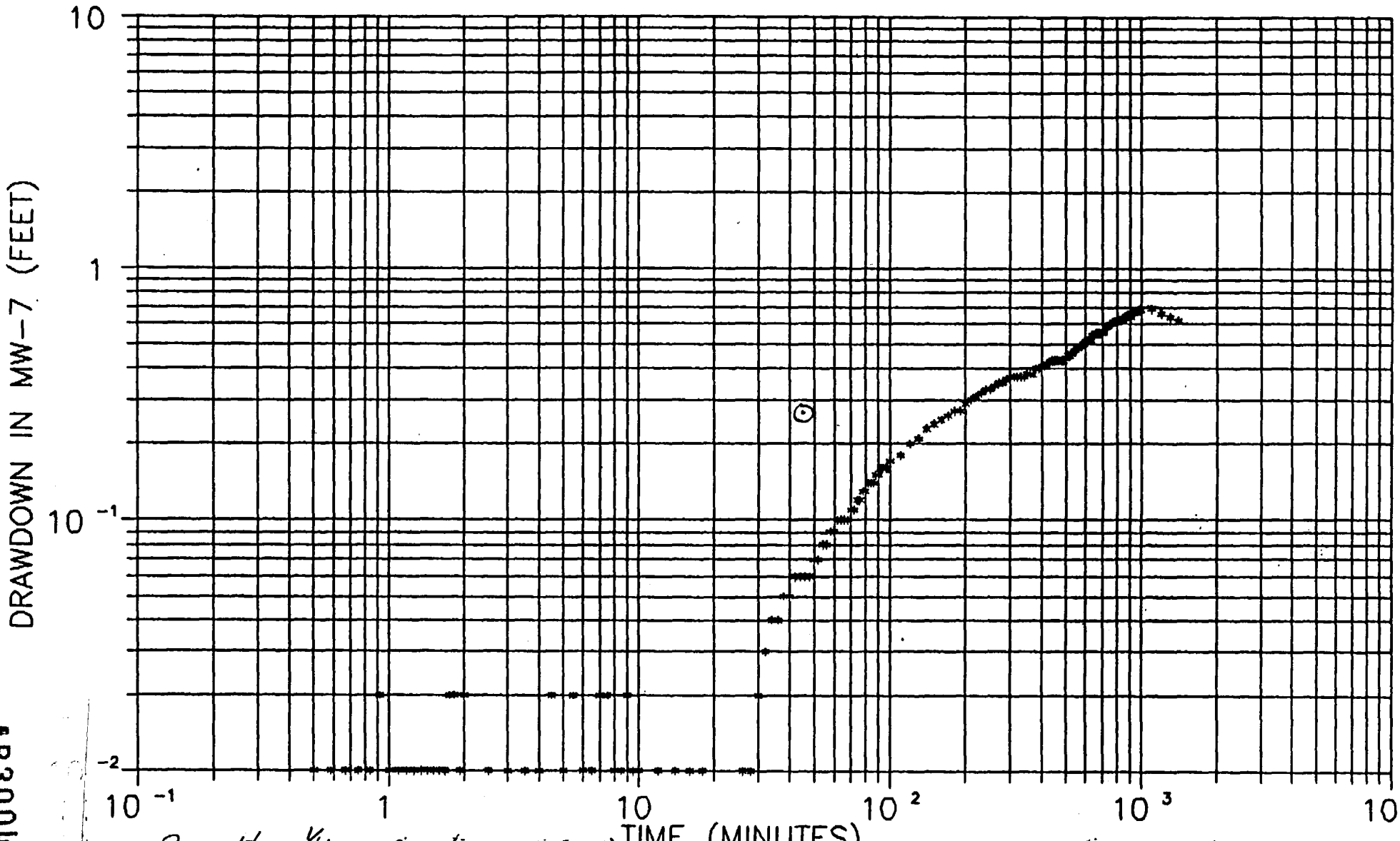
$S = \frac{2.08 \times 10^{-4} T t_0}{r^2}$

$r = 330$ ft.

t_0	S
24	[illegible]
40	0.0013
120	0.0022

AR300448

PU(? TEST NO. 1



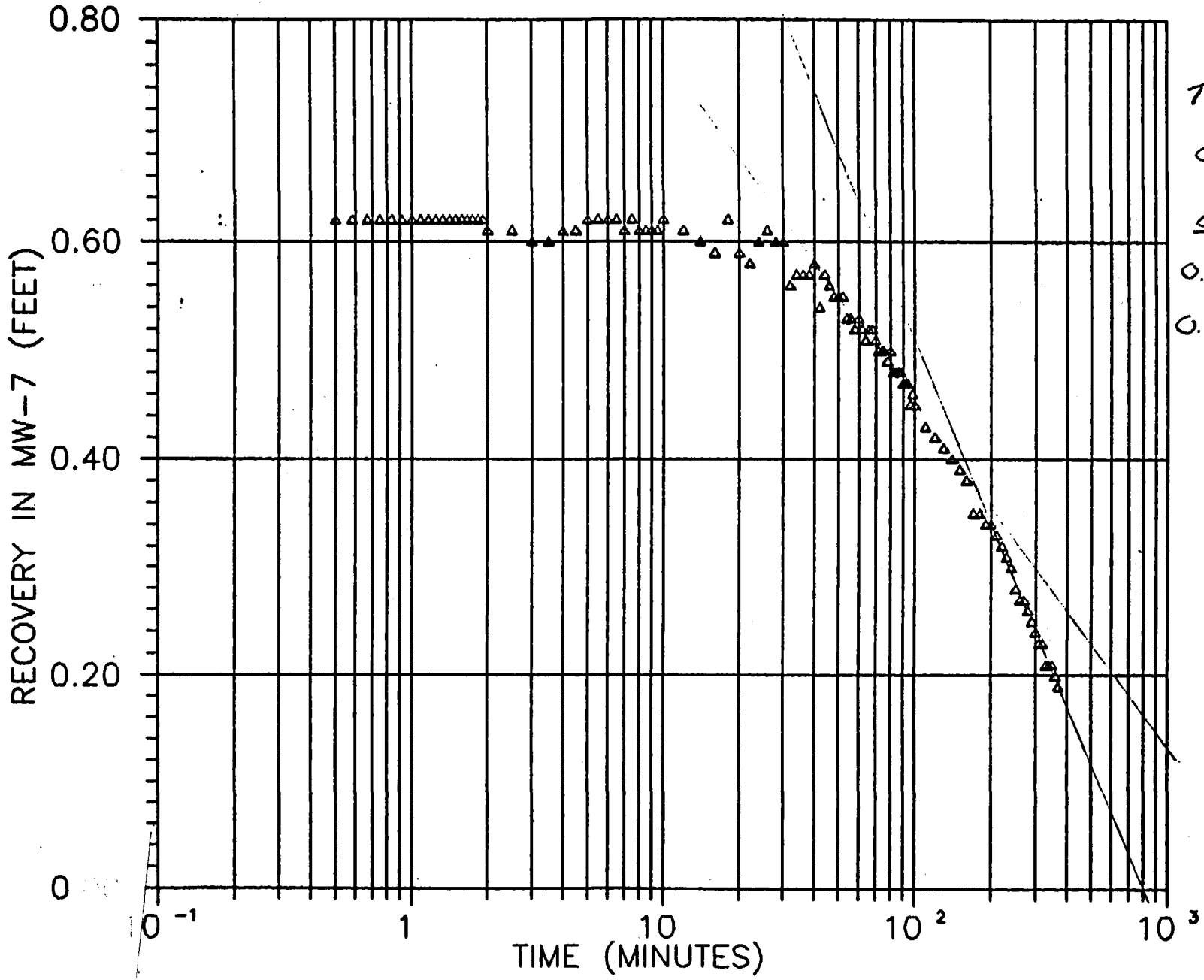
β	H	Yu	s	t	T (gpd/ft)
0	1	1	[illegible]	46	11,400

$T = \frac{114.6Q}{s}[\log(\beta)]$

$Q = 27$ gpm

AR300449

PUMP TE NO. 1



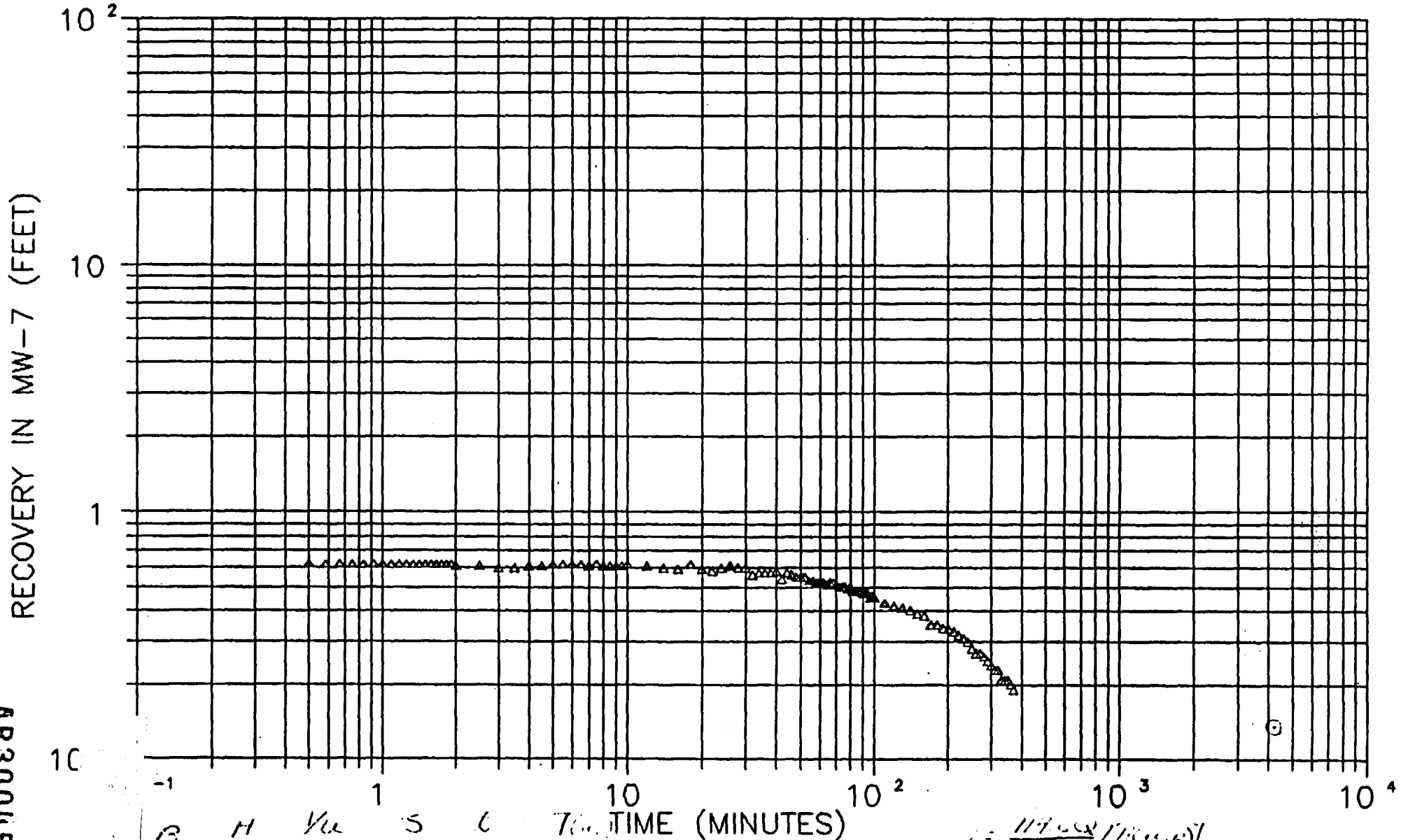
$T = \frac{264Q}{\Delta s}$

Q = 27 gpm

Δs	T (gpd/ft)
0.32	22,300.
0.56	12,700.

AR300450

PUMP TEST NO. 1

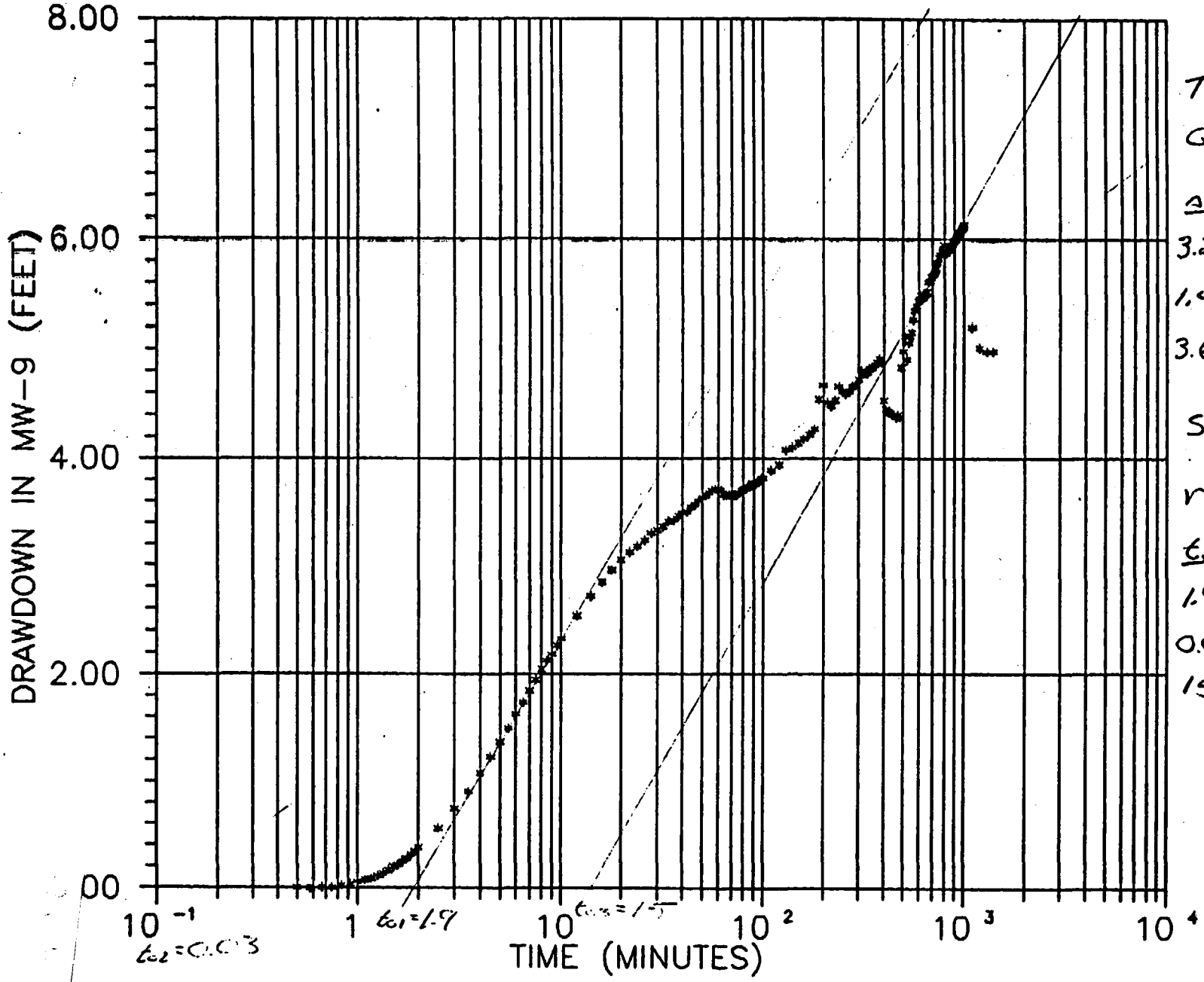


β	H	Vu	S	C	T
0	1	1	.15	4300	20,630

$T = \frac{114.6Q}{s}[\log(\beta)]$

AR300451

PUMP TE_ NO. 1



$T=\frac{264Q}{\Delta s}$

Q = 27 gpm

Δs	T (gpd/ft)
3.25	2200.
1.4	5100.
3.6	1980.

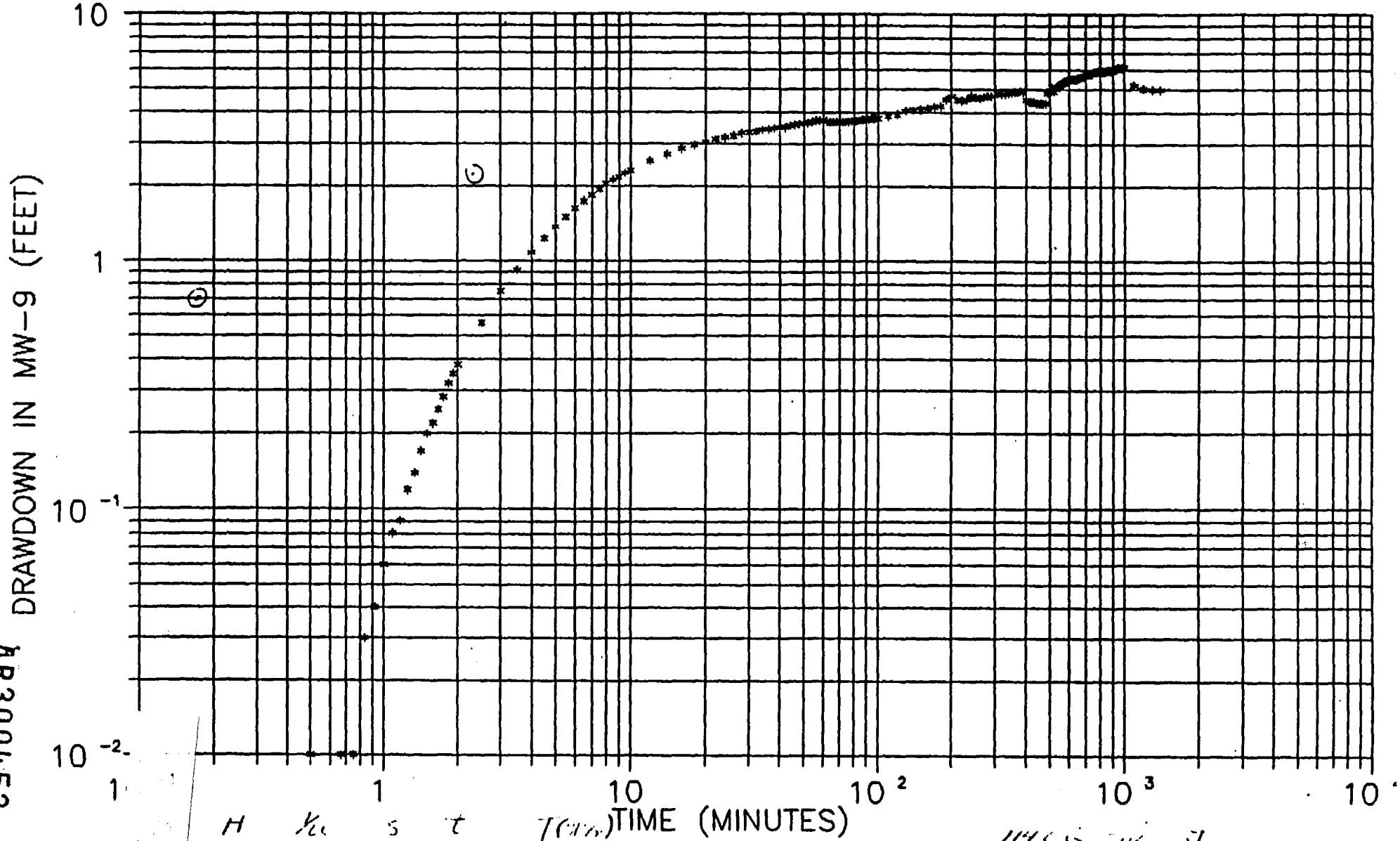
$S=\frac{2.08\times10^{-4}Tt_o}{r^2}$

r = 75 ft.

t_o	S
1.9	0.0002
0.03	6×10^{-6}
15	0.0011

AR300452

PU( ) TEST NO. 1



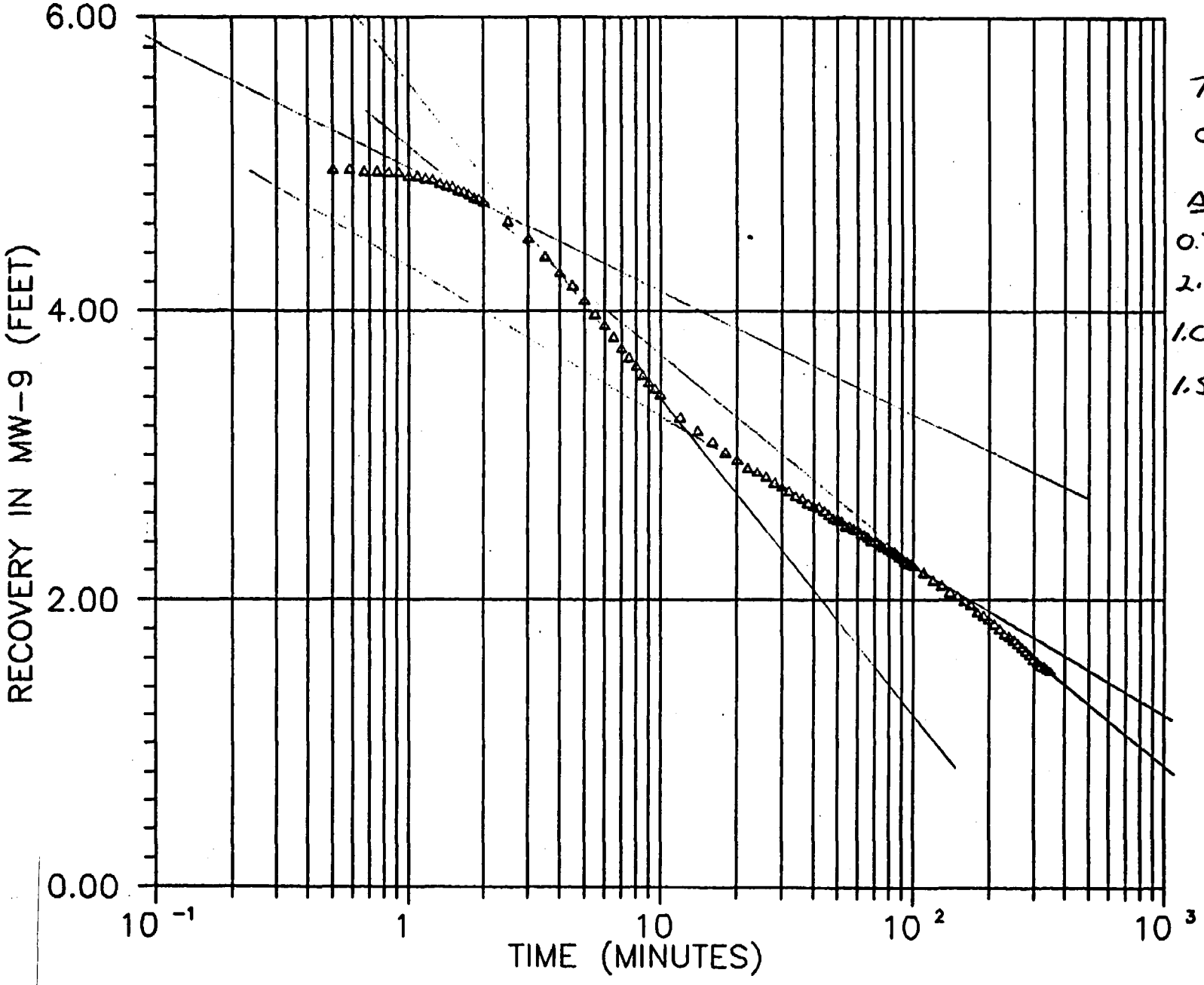
H	Xc	s	t	T(gpd)
1	1	.23	23	1350
1	1	.06	0.17	5160

$T = \frac{114.6\,Q}{s}\,[W(u,\beta)]$

Q = 2 gpm

AR300453

PUMP TE. . NO. 1



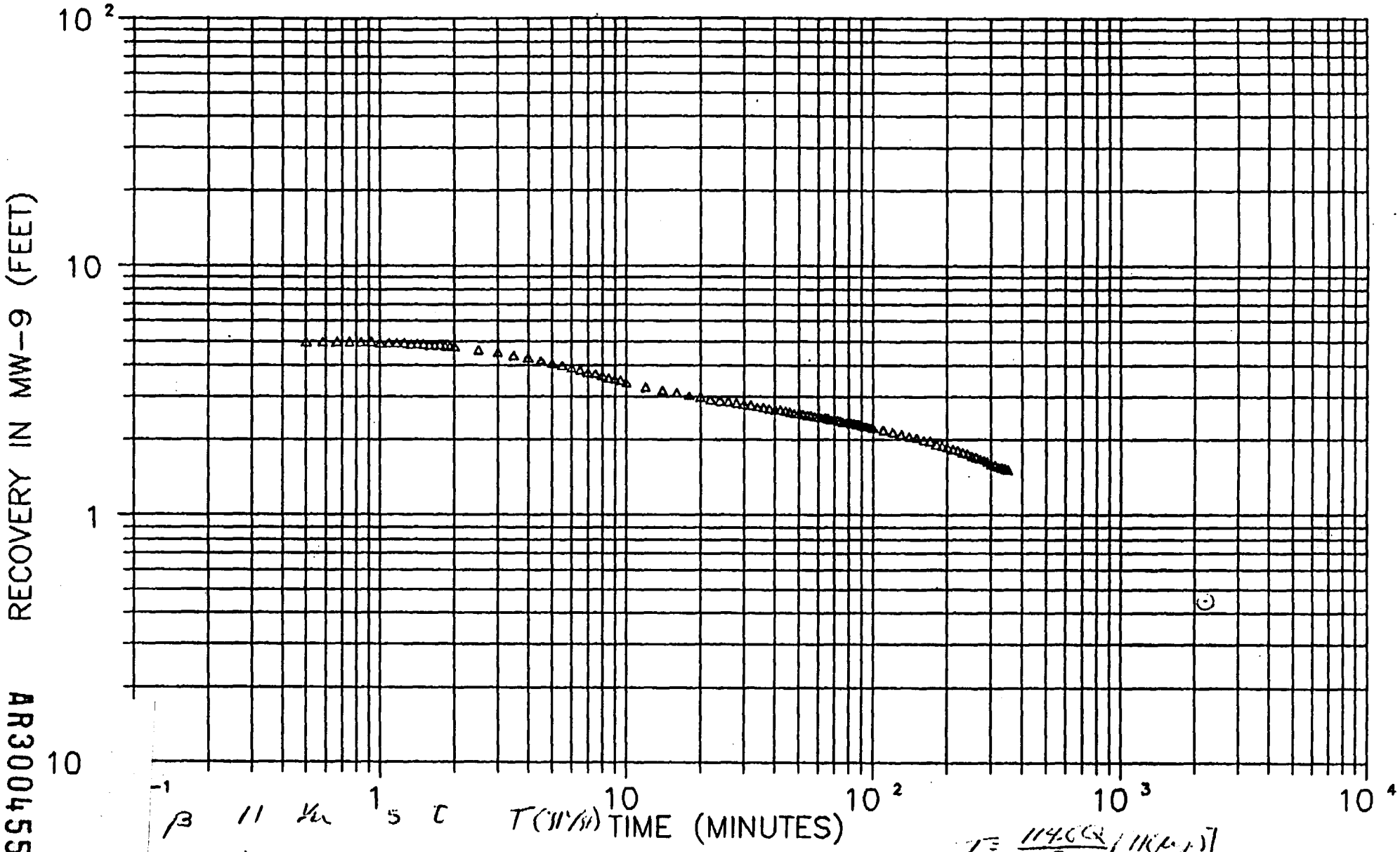
$T = \frac{264Q}{\Delta s}$

Q = 27 gpm

Δs	T (gpd/ft)
0.85	8390.
2.15	3320.
1.05	6790
1.5	4750.

AR300454

PUMP TEST NO. 1



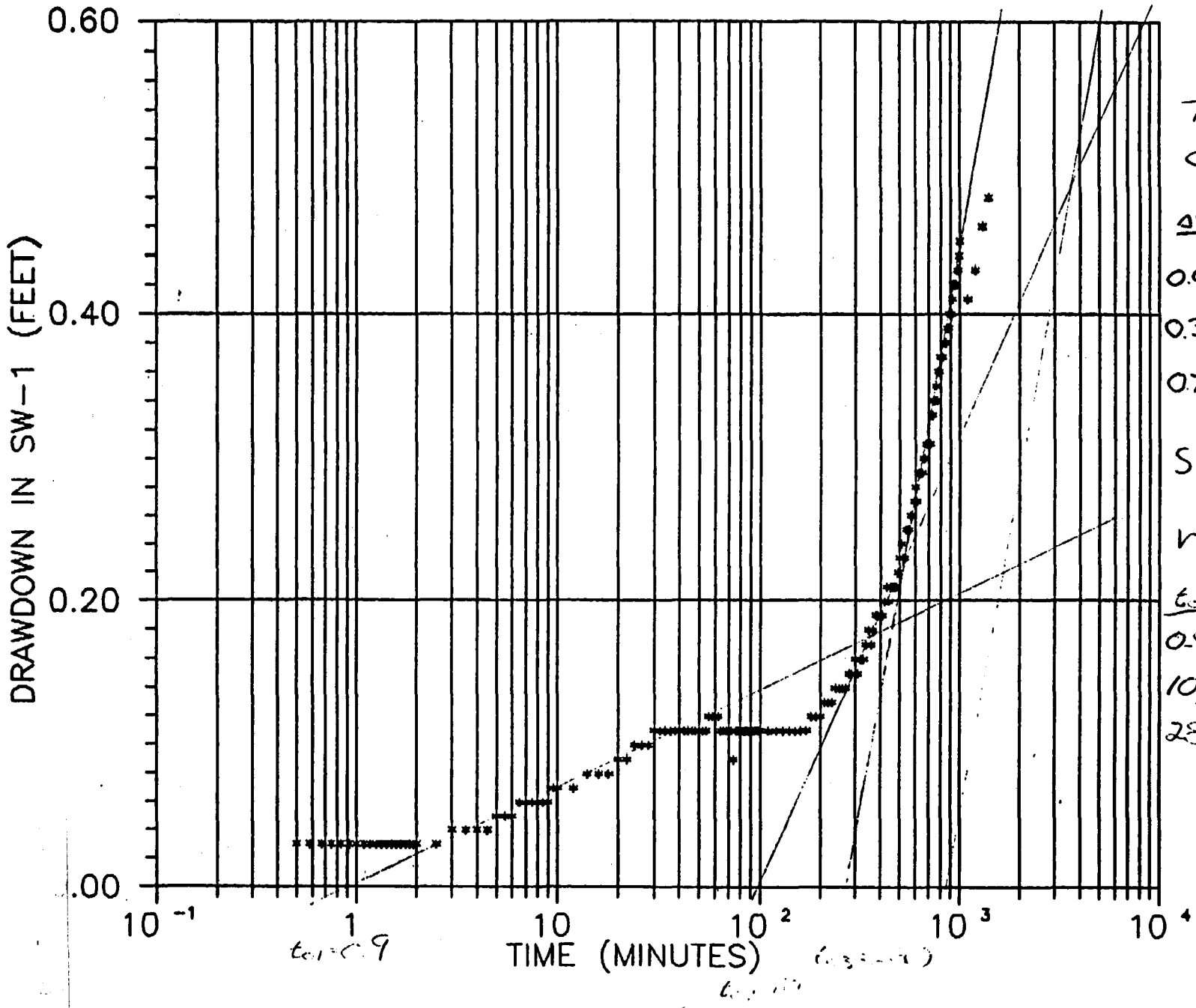
β	u	u	s	t	T(u/s)
0	1	10	046	2200	6730

$T = \frac{114.6Q}{s}[u(\mu)]$

$Q = 7$ gpm

AR300455

PUMP TE NO. 1



$T = \frac{264Q}{\Delta s}$

$Q = 27$ gpm

Δs	T (gpd/ft)
0.06	118,800.
0.31	23,000.
0.78	9140.

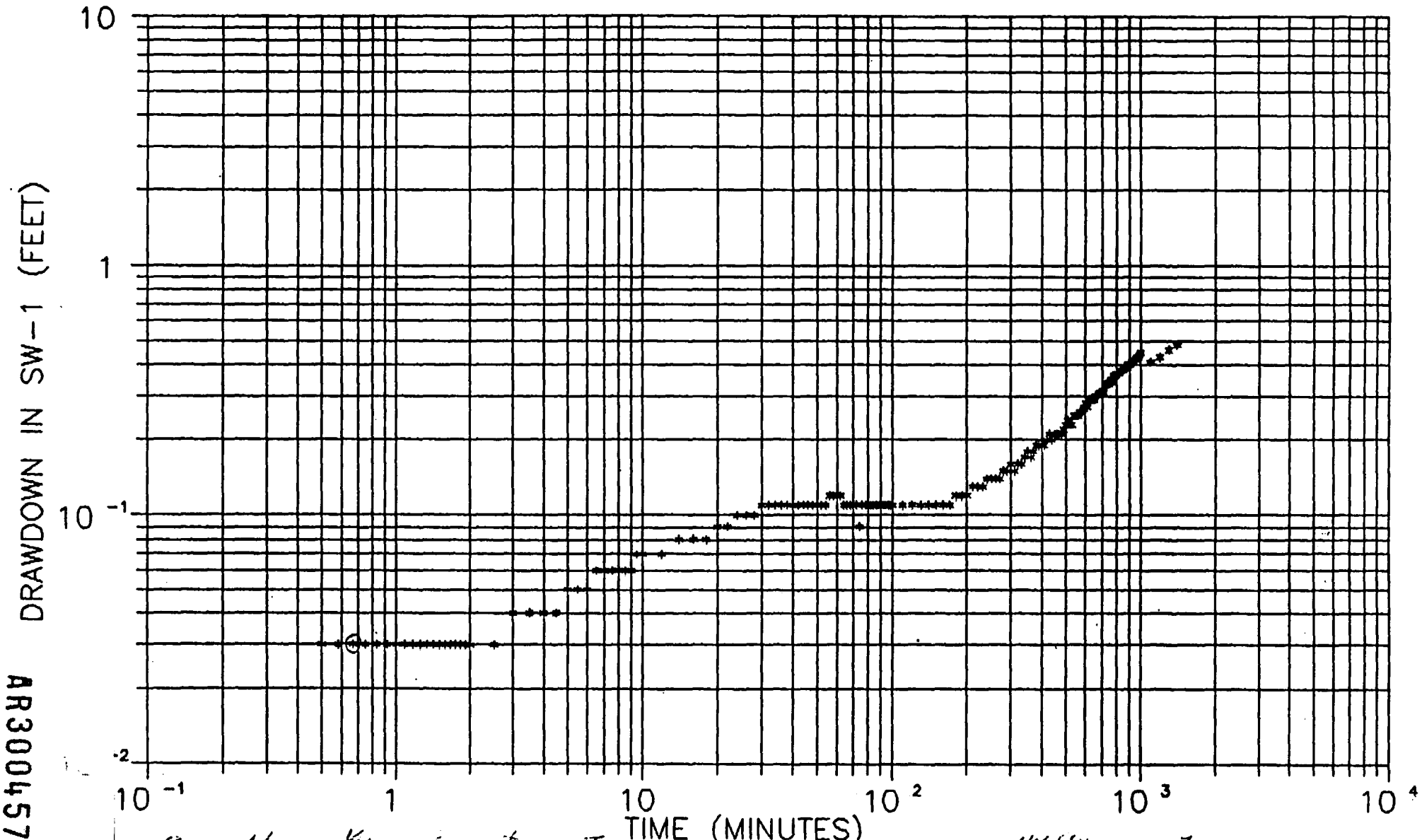
$S = \frac{2.08 \times 10^{-4} T t_0}{r^2}$

$r = 120$ ft.

t_0	S
0.9	0.0015
100	0.0332
280	0.0370

AR300456

PUMP TEST NO. 1



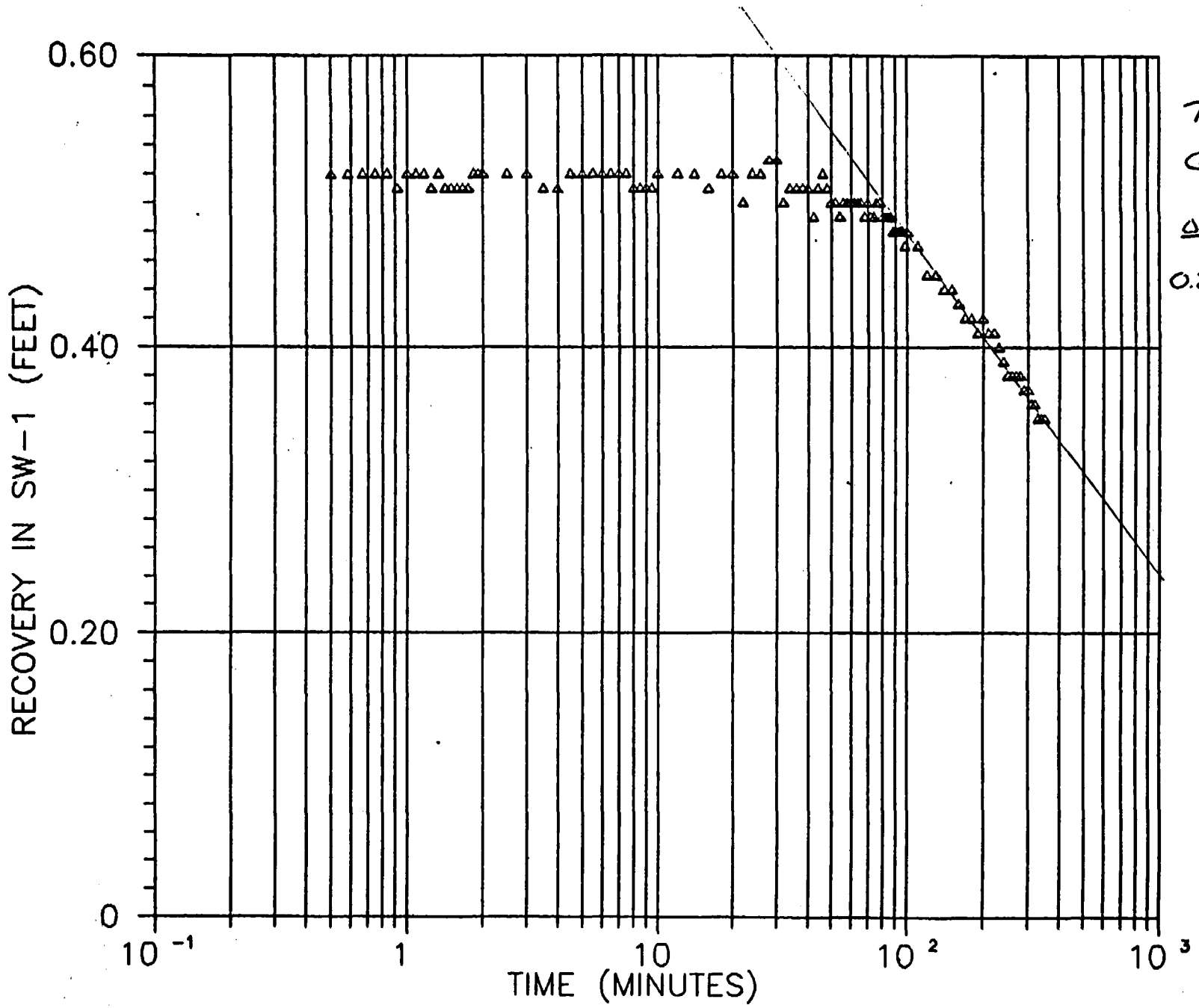
β	H	Xu	s	t	T
0	1	1	0.03	.68	103,140.

$T = \frac{114.6Q}{s}[H(u,\beta)]$

$Q = 21$ gpm

AR300457

PUMP TE NO. 1



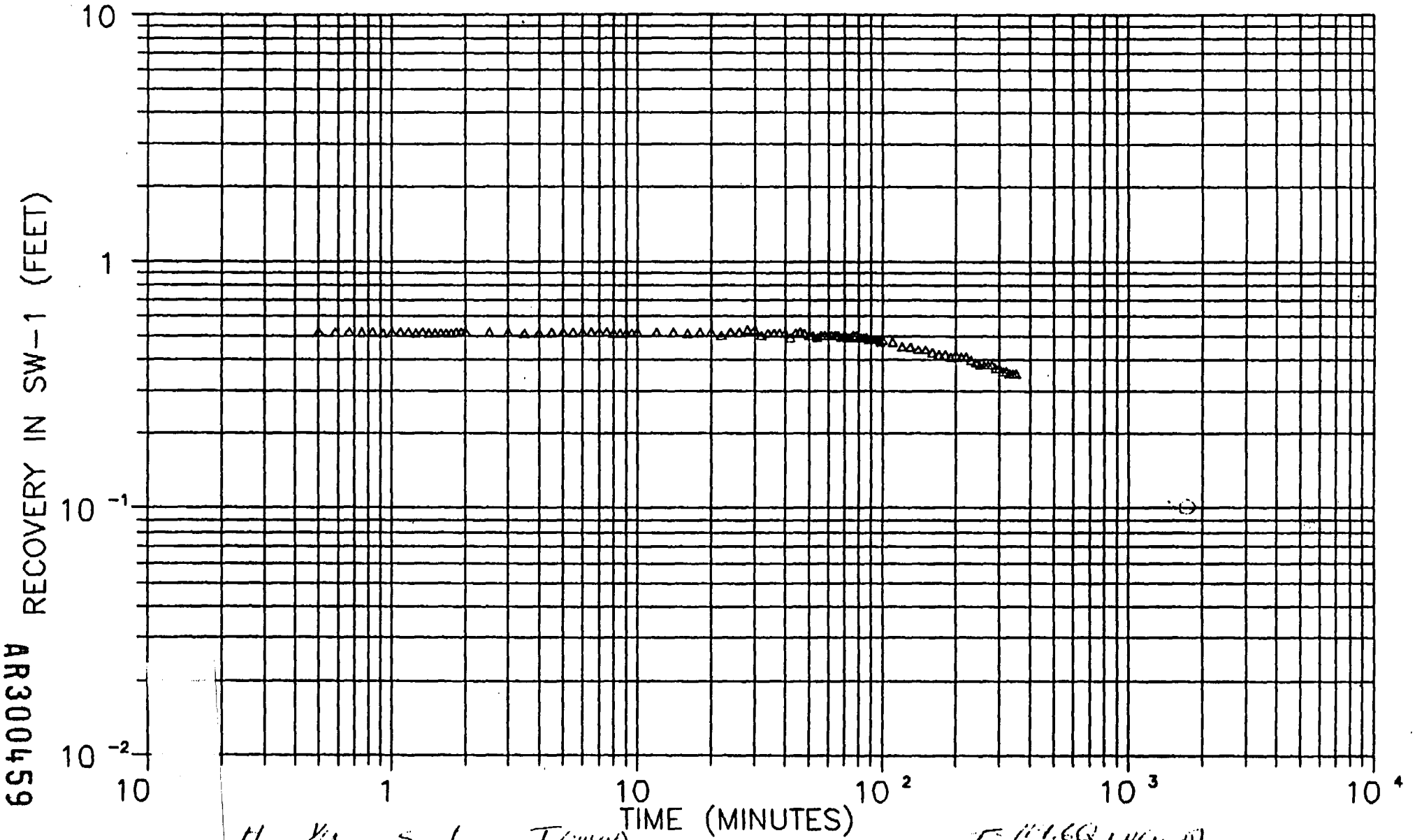
$T = \frac{264Q}{\Delta s}$

Q = 27 gpm

Δs	T (gpd/ft)
0.24	29,700.

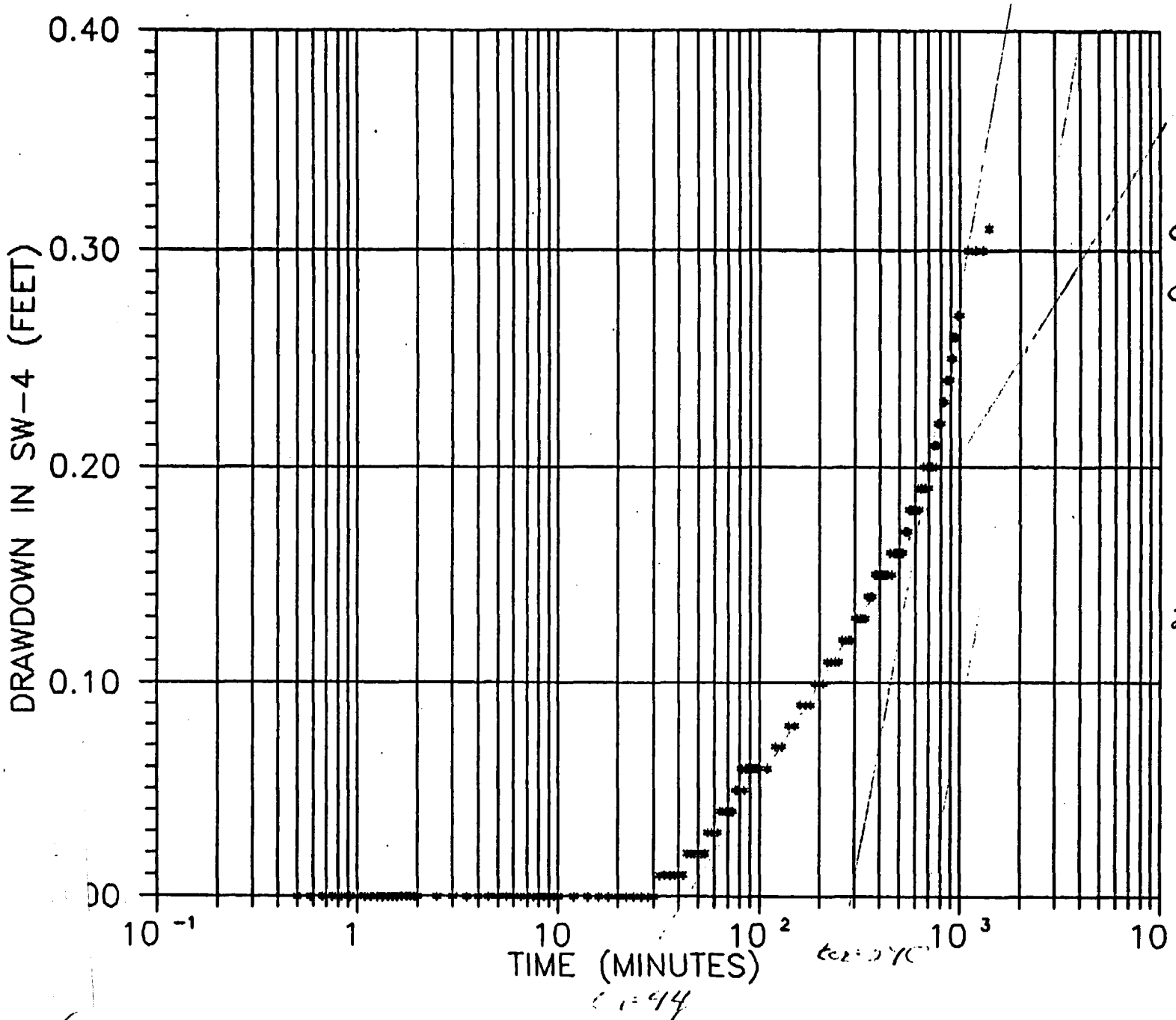
AR300458

PUMP TEST NO. 1



AR300459

PUMP TE_. NO. 1



$T = \frac{264Q}{\Delta s}$

Q = 27 gpm

Δs	T (gpd/ft)
0.15	47,500
0.52	13,700

$S = \frac{2.08 \times 10^{-4} T t_0}{r^2}$

r = 137 ft.

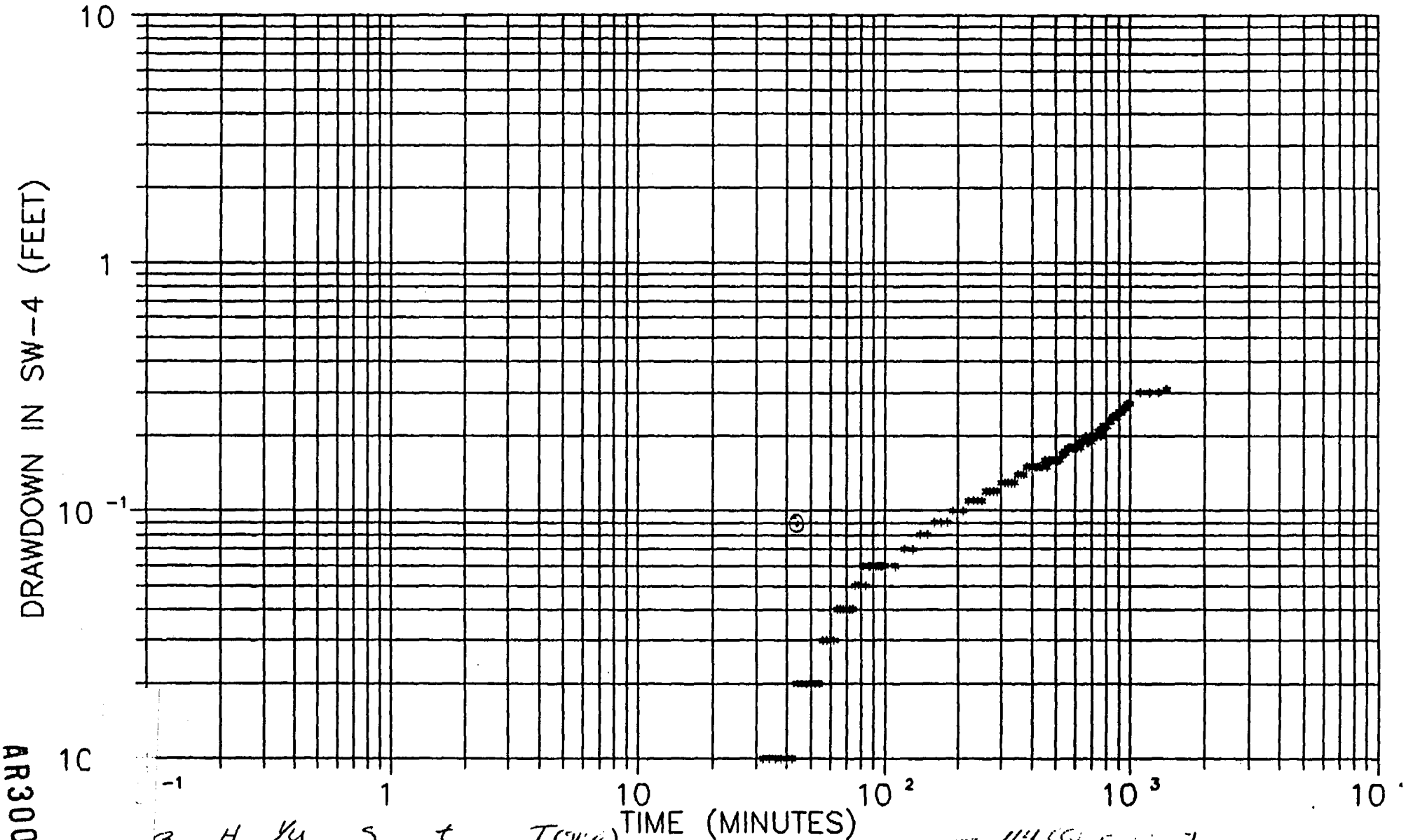
t_0	S
44	0.0232
240	[illegible]

$t_0 = 240$

$t_1 = 44$

AR300460

PU(? TEST NO. 1



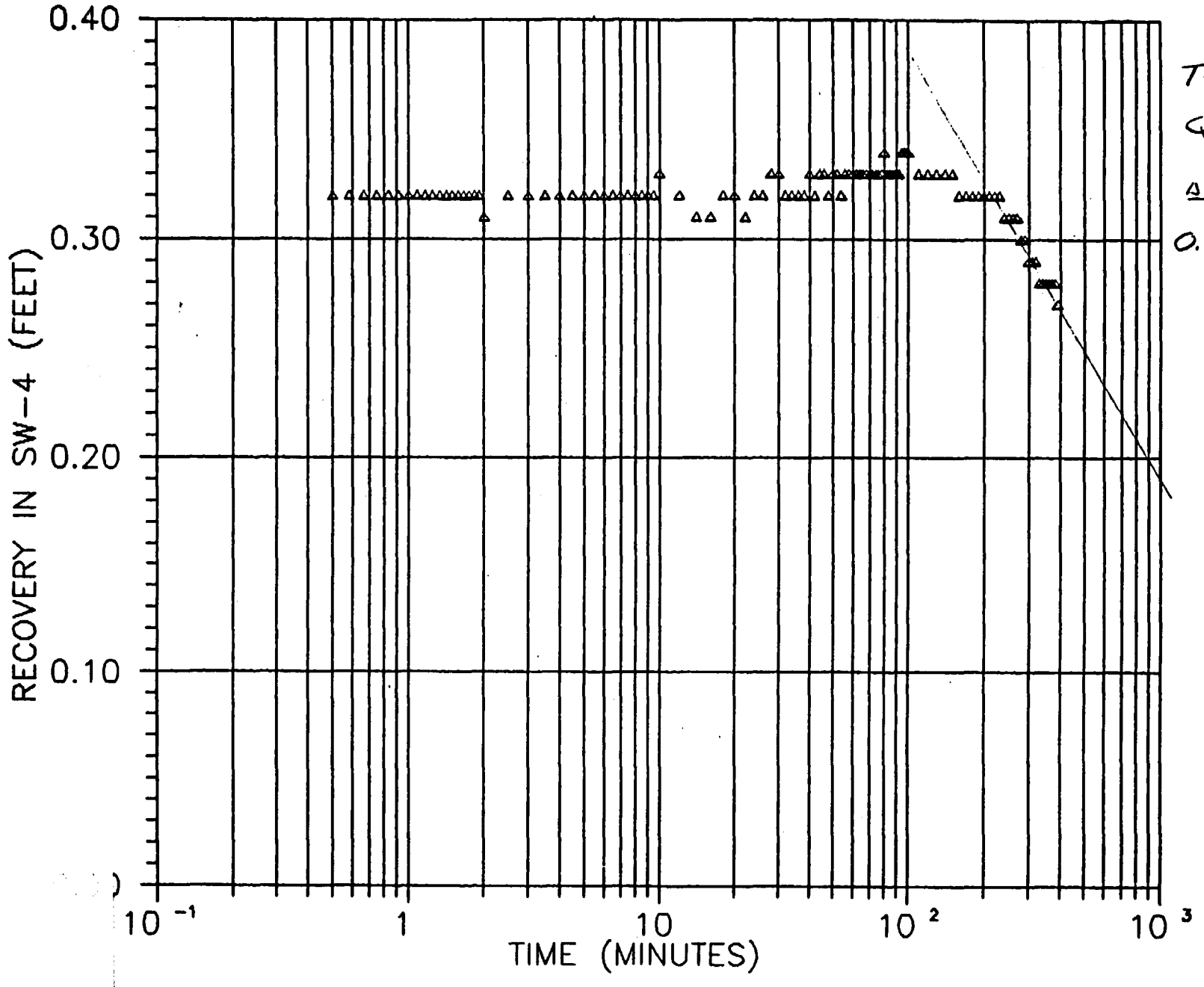
B	H	Yu	S	t	T(gpd)
0	1	1	0.09	44	34,500.

$T = \frac{114.6Q}{s}[W(u,\beta)]$

$Q = 50$ gpm

AR300461

PUMP TE' NO. 1



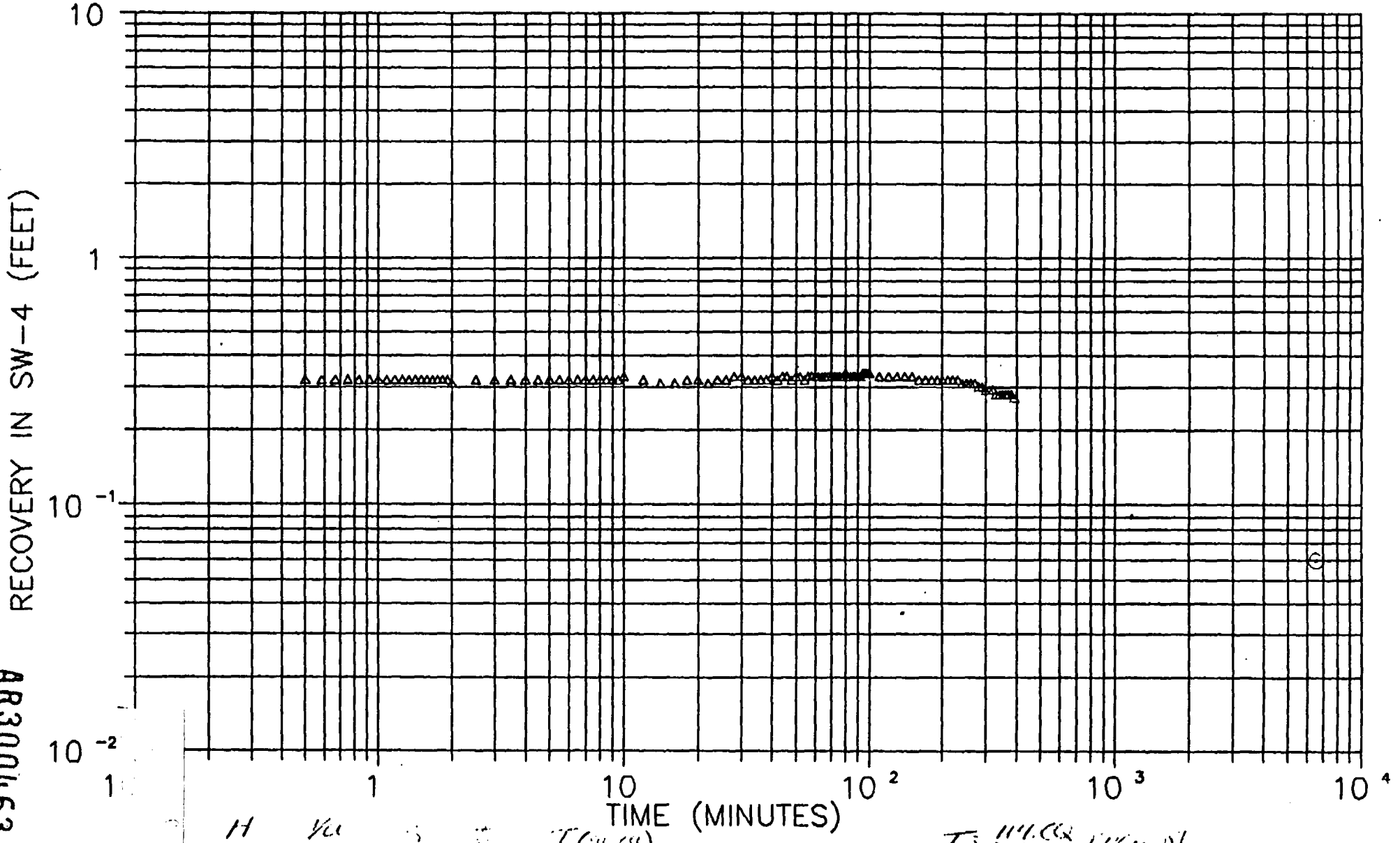
$T = \frac{264Q}{\Delta s}$

Q = 27 gpm

Δs	T (gpd/ft)
0.19	37,500.

AR300462

PUMP TEST NO. 1



AR300463

Baker Engineers

S.O. No. 15438-40-SR1

Subject: Banks Sand Pit - Distance Drawdown Calculations for Pump Test No 1 Time = 1000 minutes

Sheet No. ____ of ____

Drawing No. ____

Computed by RPA Checked By ____ Date 2/15/88

MW-1 is pumping well with a rate of 27gpm = 38880 gpd

MW-2 $T = \frac{Q}{2\pi(s_1 - s_2)} \ln\left(\frac{r_2}{r_1}\right)$

$Q = 38880$ gpd

s_1 = drawdown in pumping well (at t=1000 minutes) = 15.28 ft

s_2 = drawdown in observation well (at t=1000 minutes) = 3.30 ft

r_1 = pumping well radius = 0.25 ft

r_2 = radial distance to observation well = 77 feet

$T = \frac{38880}{2\pi(15.28 - 3.30)} \ln\left(\frac{77}{0.25}\right) = 2960$ gpd/ft.

MW-7 $Q = 38880$ gpd

$s_1 = 15.25$ ft

$s_2 = 0.69$ ft

$r_1 = 0.25$ ft

$r_2 = 335$ ft

$T = \frac{38880}{2\pi(15.25 - 0.69)} \ln\left(\frac{335}{0.25}\right) = 3050$ gpd/ft

AR300464

Baker Engineers

S.O. No. [illegible]

Subject: [illegible]

Sheet No. ____ of ____

Drawing No. ____

Computed by [illegible] Checked By ____ Date [illegible]

MW-9 $Q = 38850$ gpd

$S_1 = 15.28$ ft $r_1 = 0.25$ ft

$S_2 = 6.13$ ft $r_2 = 77$ ft.

$$T = \frac{38880}{2\pi(15.28 - 6.13)} \ln\left(\frac{77}{0.25}\right) = 3880 \text{ gpd/ft.}$$

SW-1 $Q = [illegible]$ gpd

$S_1 = [illegible]$ $r_1 = [illegible]$

$S_2 = [illegible]$ $r_2 = [illegible]$

$$T = \frac{[illegible]}{2\pi([illegible])} \ln\left([illegible]\right) = [illegible] \text{ gpd/ft}$$

SW-4 $Q = 38880$ gpd

$S_1 = 15.28$ ft $r_1 = [illegible]$

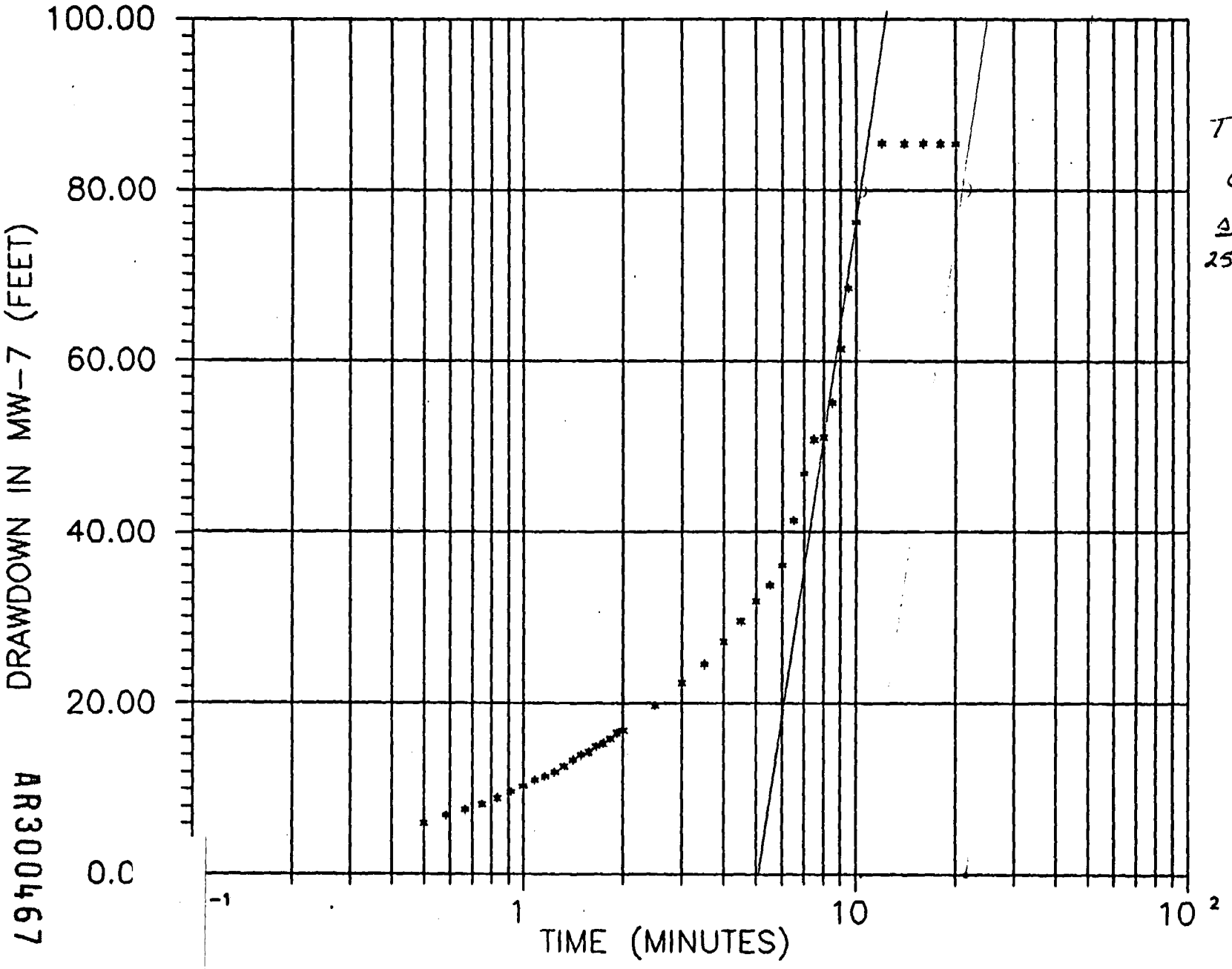
$S_2 = 0.27$ ft $r_2 = [illegible]$

$$T = \frac{38880}{2\pi(15.28 - 0.27)} \ln\left(\frac{[illegible]}{[illegible]}\right) = 2610 \text{ gpd/ft.}$$

AR300465

PUMP TEST NO. 2

PUMP TE(NO. 2



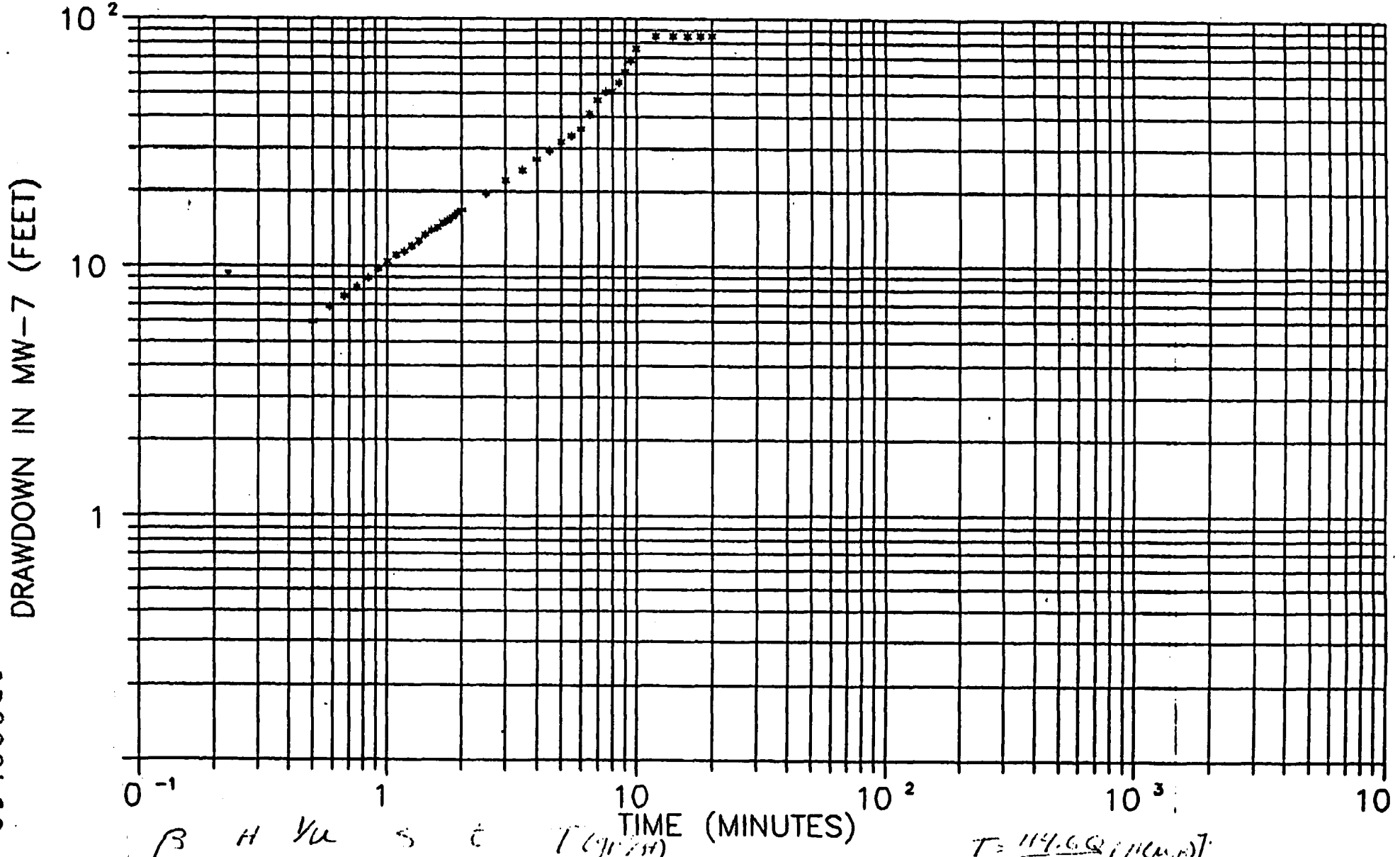
$T = \frac{264Q}{\Delta s}$

Q=40gpm

$\frac{\Delta s}{256}$ $\frac{T(gpd/ft)}{40}$

AR300467

PUMP TES. NO. 2

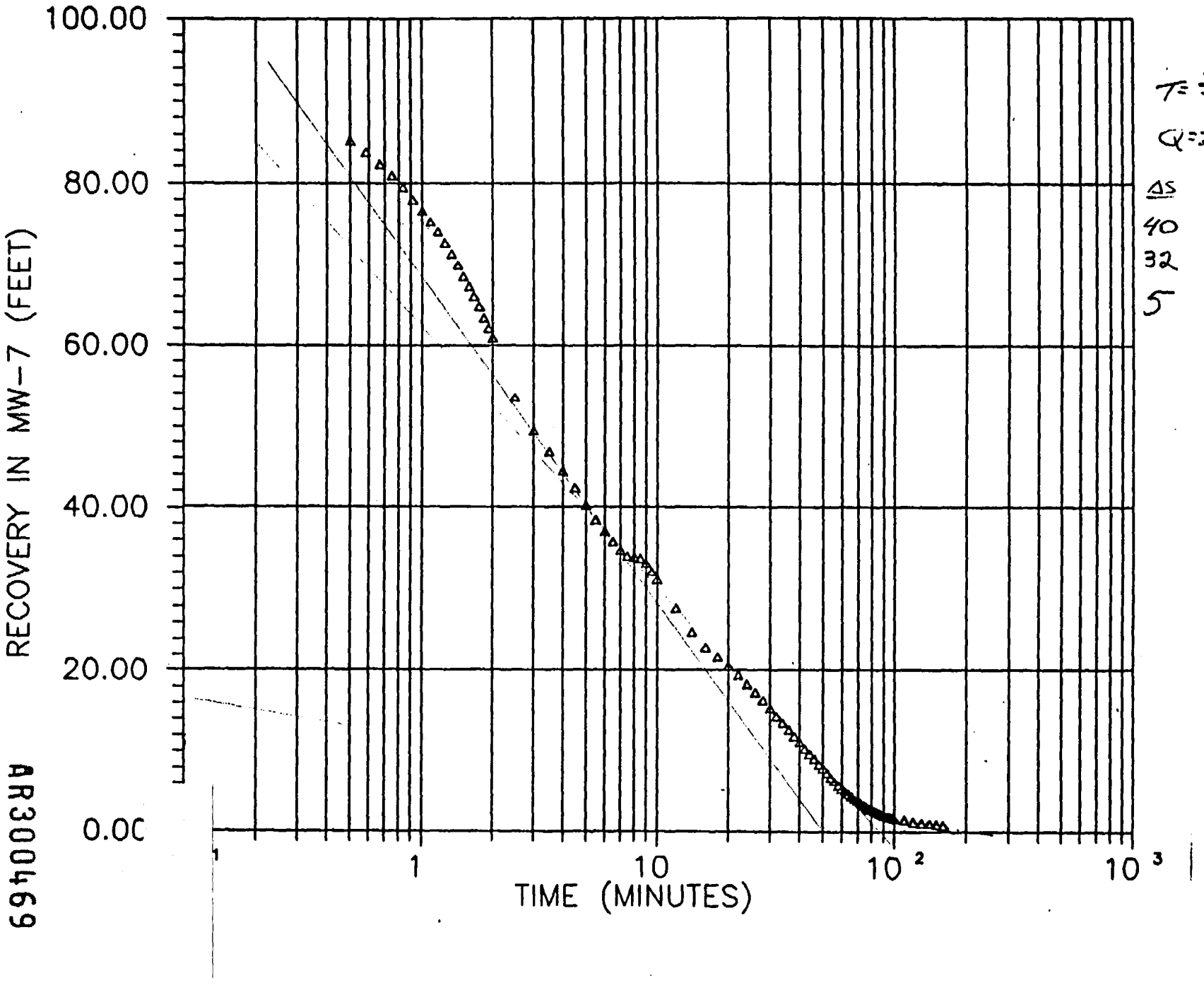


β H Yu S t T (gpd/ft)
0 1 1 .75 .23 480.

T = 114.6Q/[H(μ-β)]
Q ≈ 40 gpm

AR300468

PUMP TE(NO. 2



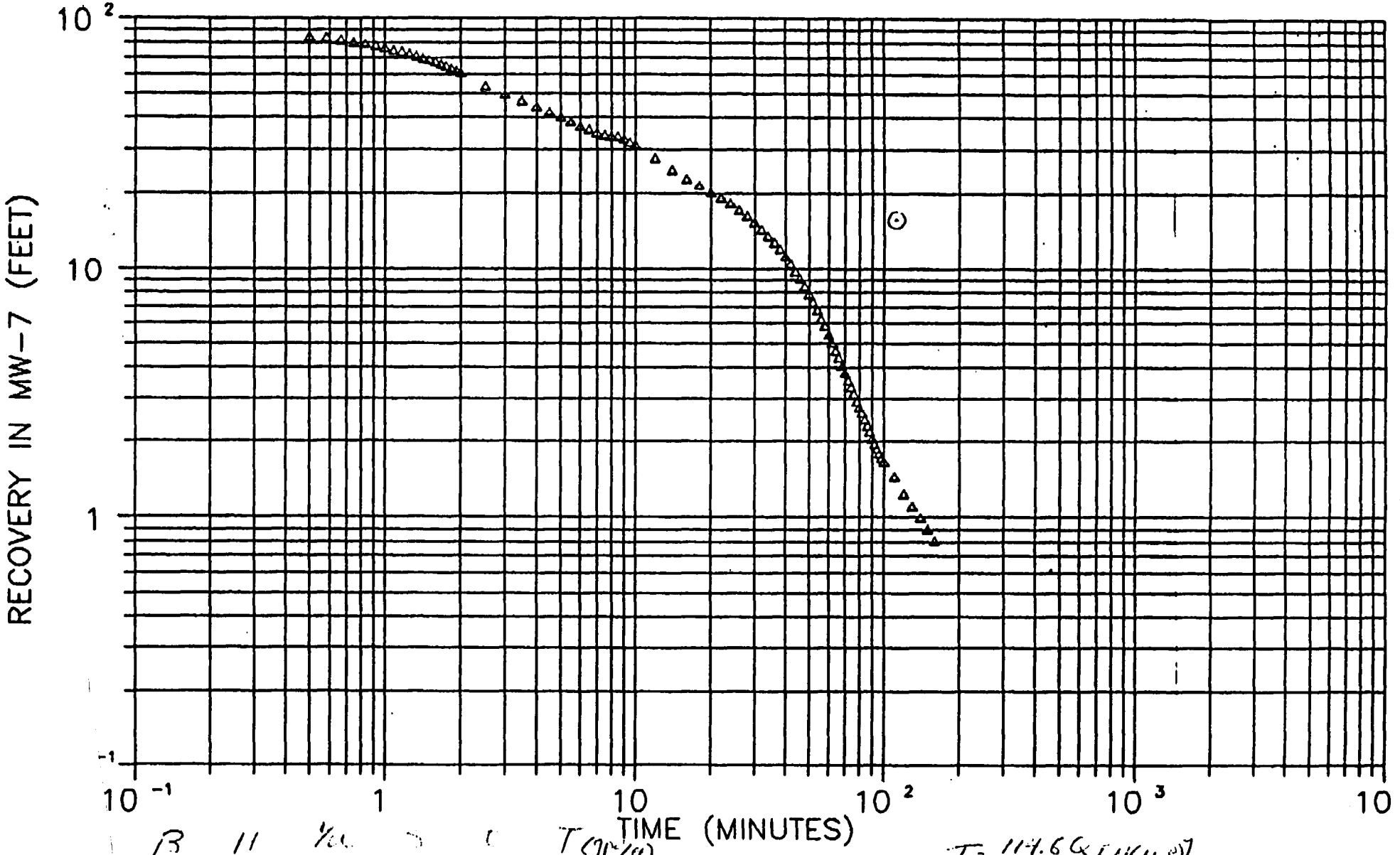
$T = \frac{264Q}{\Delta s}$

Q = 28 gpm

Δs	T (gpd/ft)
40	180
32	230
5	1500

AR300469

PL...P TEST NO. 2



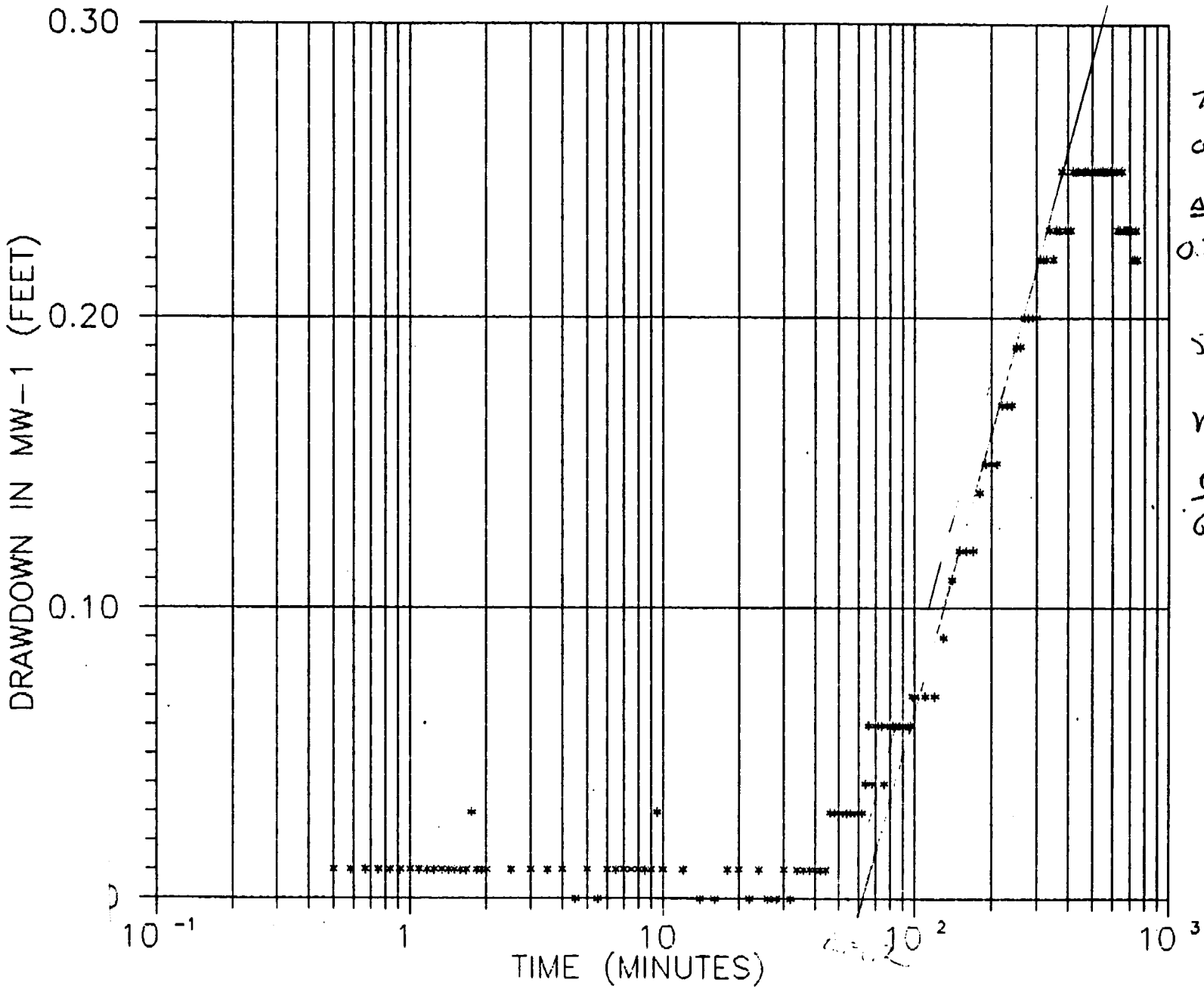
β 11 ½ T (gpm)
0 1 1 17 110 190

T = 114.6Q [114.6(28)]
Q = 28 gpm

AR300470

PUMP TEST NO. 3

PUMP TE. NO. 3



$T = \frac{264Q}{\Delta s}$

$Q = 8$ gpm

Δs	T (gpd/ft)
0.32	6600

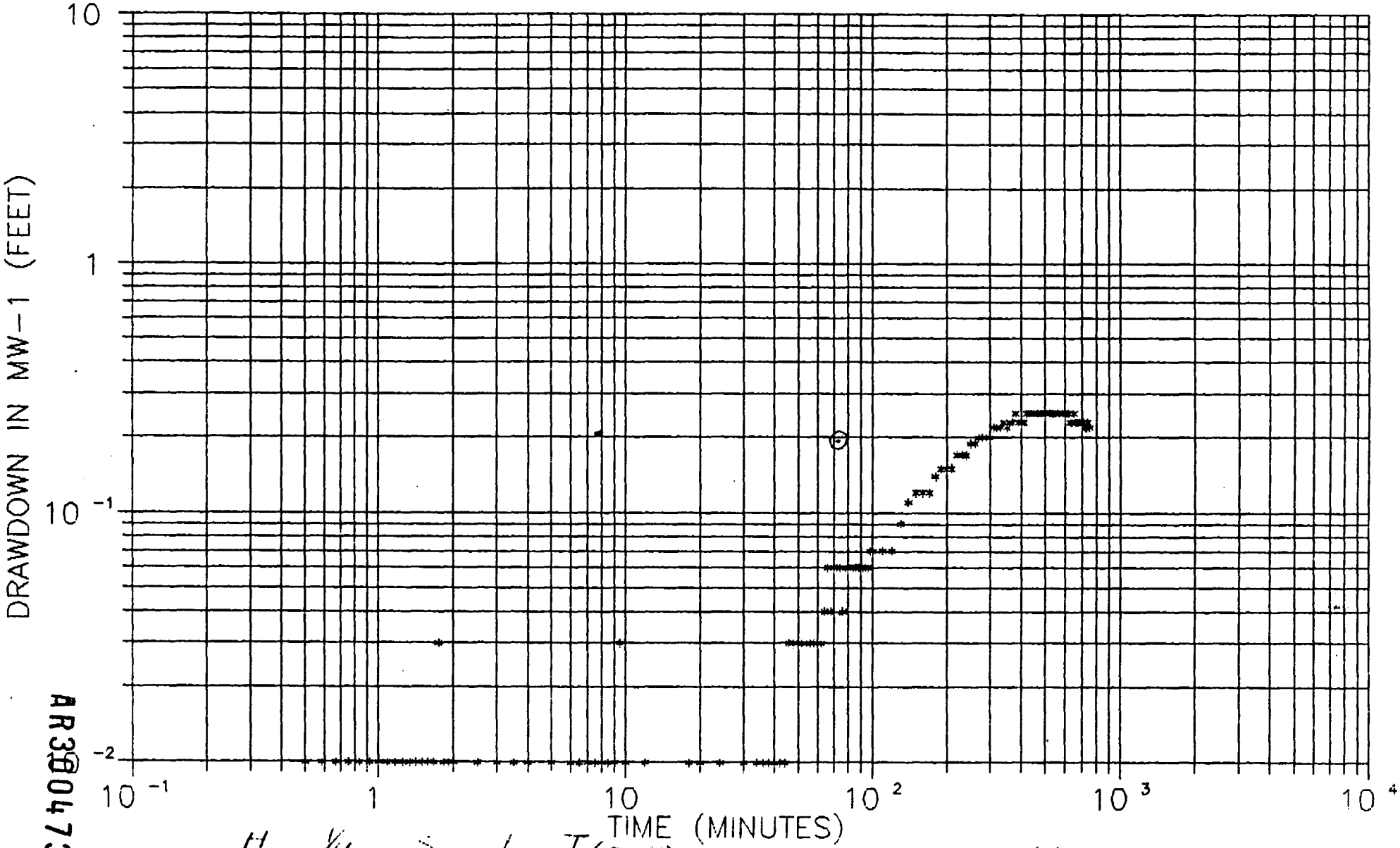
$S = \frac{2.08 \times 10^{-4}\, T t_0}{r^2}$

$r = 330$ ft

t_0	S
62	0.0008

AR300472

PU(' TEST NO. 3

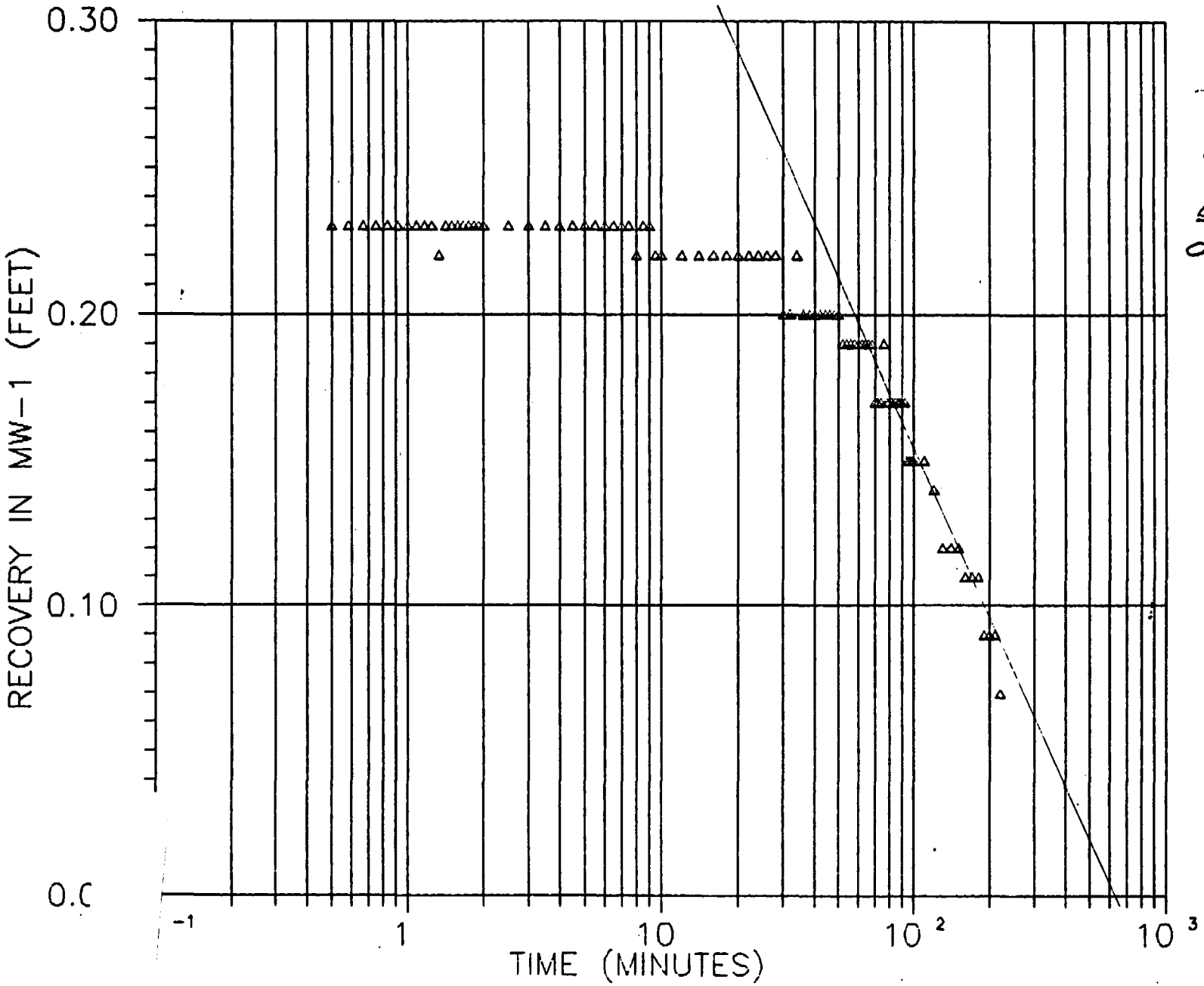


H	Yw	s	Q	T (gpd/ft)
1	1	.19	73	4830

$T = \frac{114.6Q}{s}[W(u,\beta)]$

AR300473

PUMP TE: NO. 3



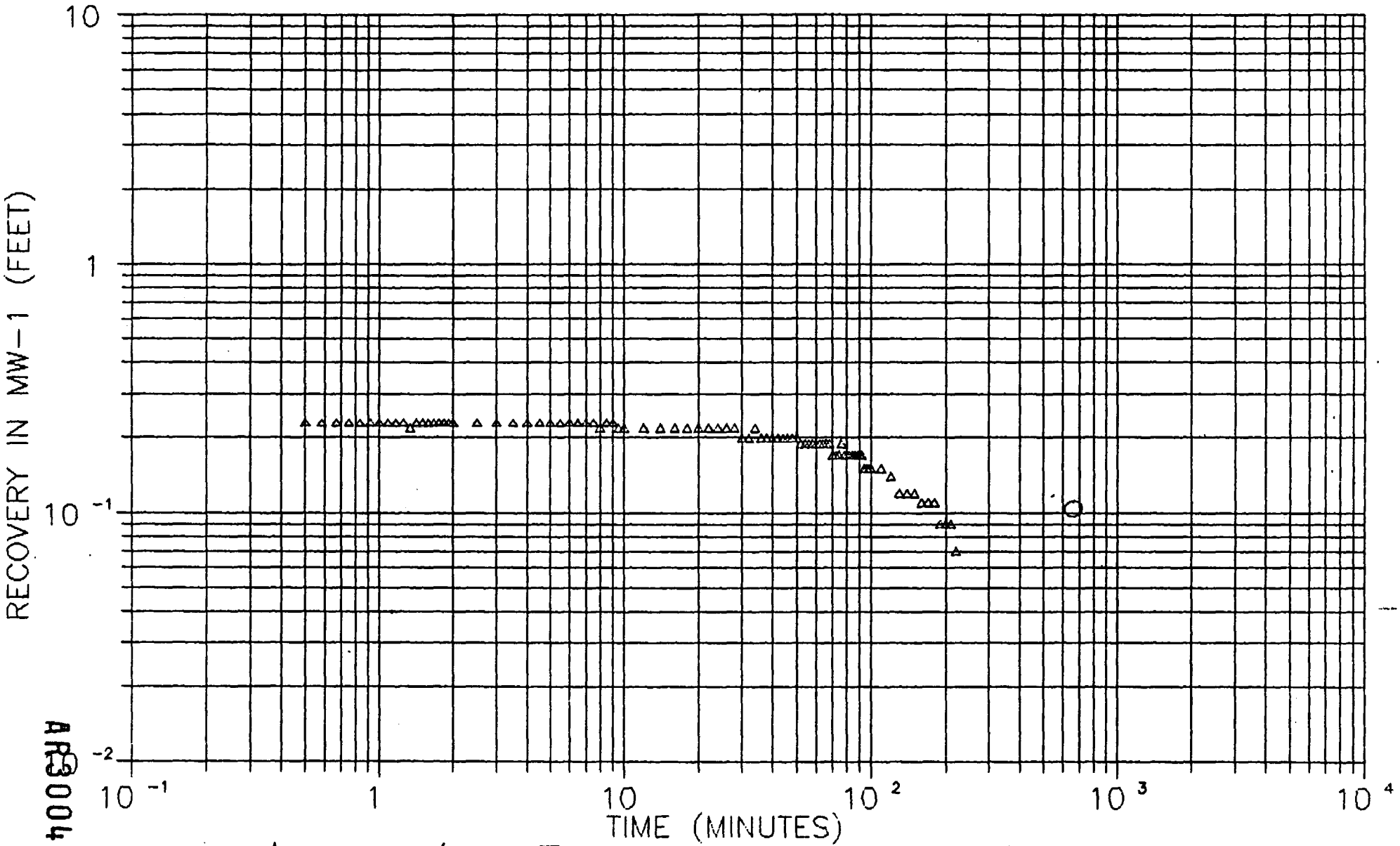
$T = \frac{264Q}{\Delta s}$

$Q = 8$ gpm

Δs	T (gpd/ft)
0.19	15,100

AR300474

PU(' TEST NO. 3

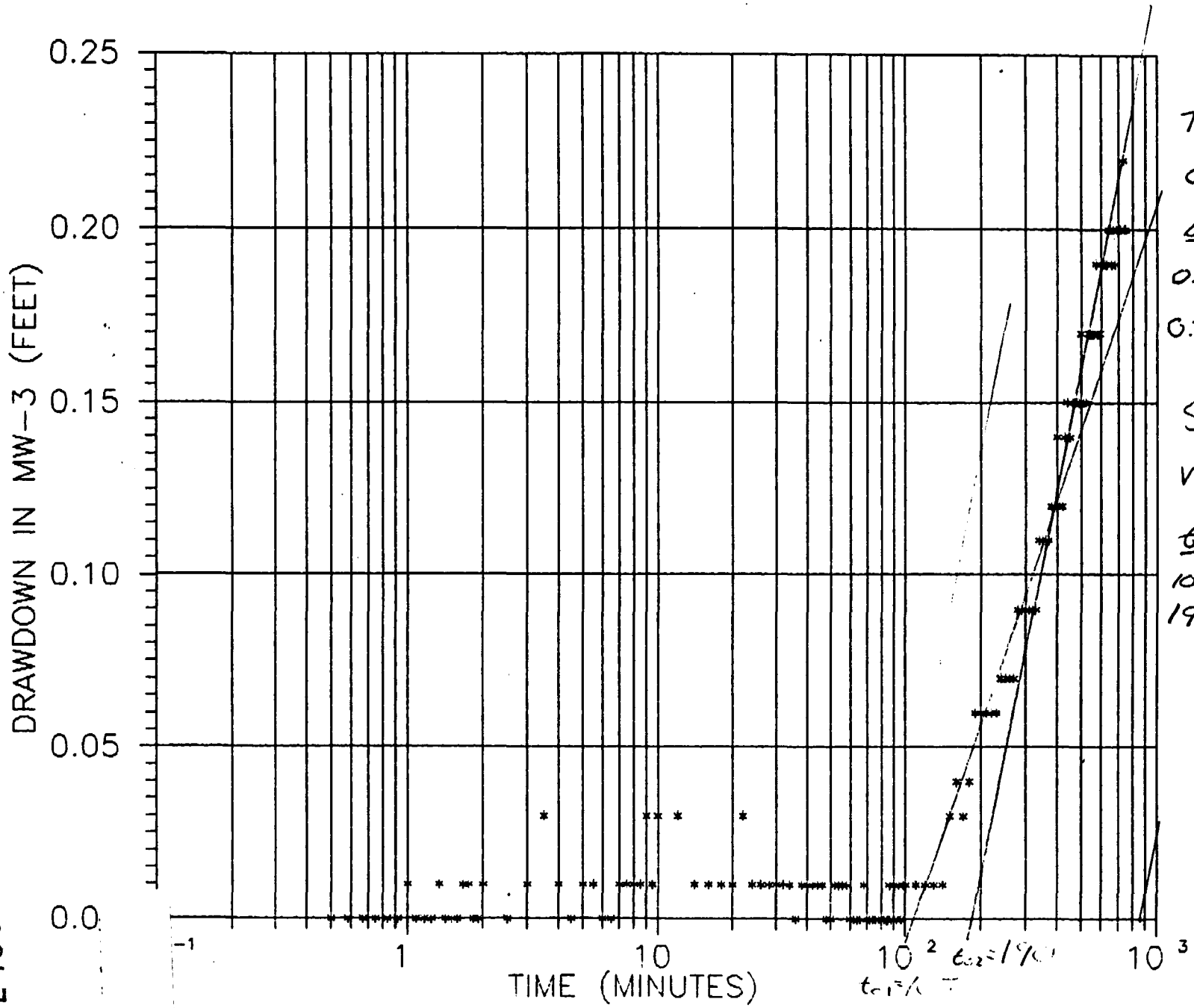


H	Yu	S	t	T (gpm/ft)
1	1	.11	680	[illegible]

$T = \frac{[illegible]}{s}$ [illegible]

AR300475

PUMP TES NO. 3



$T = \frac{264Q}{\Delta s}$

Q = 8gpm

Δs	T (gpd/ft)
0.21	10,060.
0.37	5700.

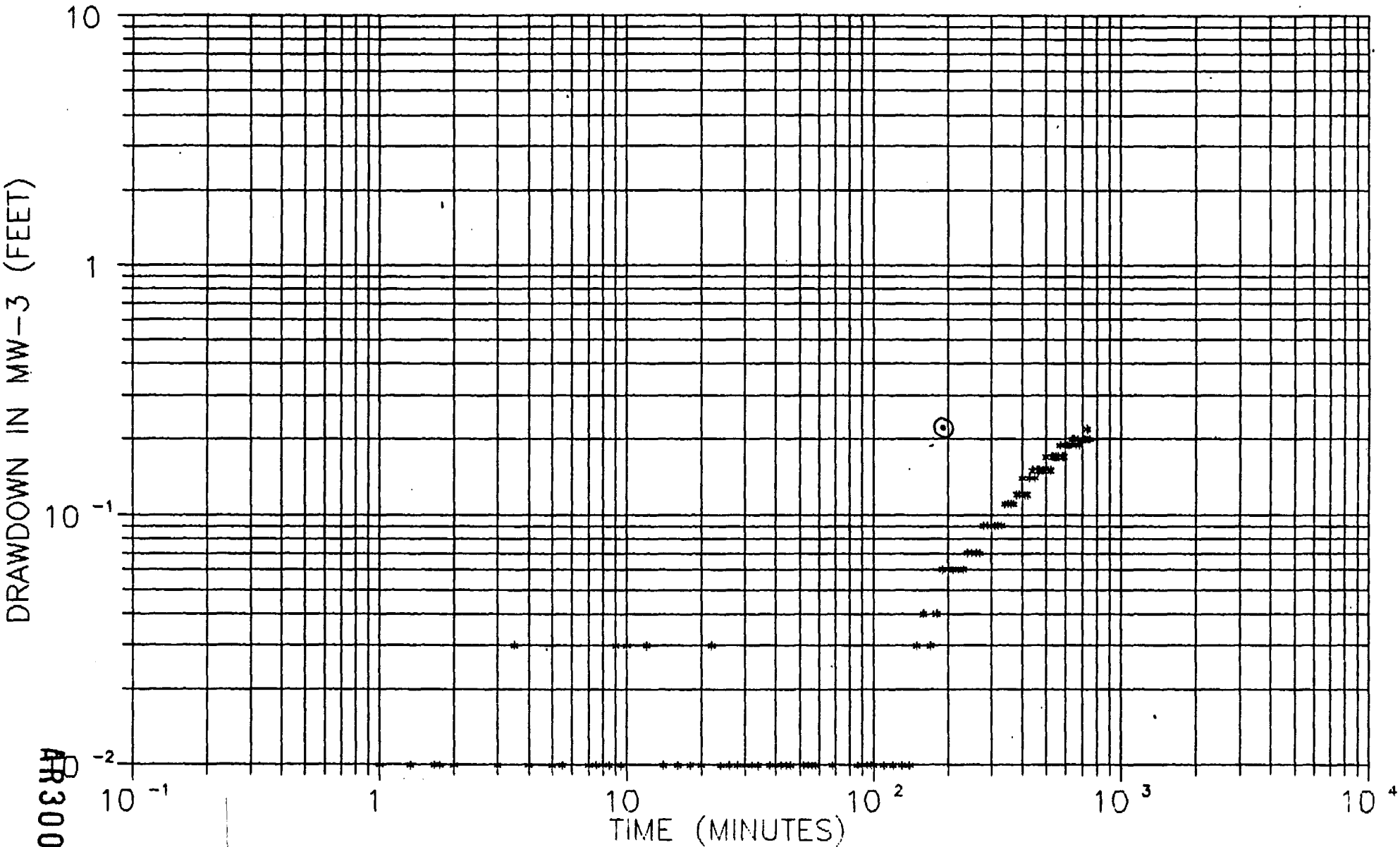
$S = \frac{2.08 \times 10^{-4} T t_0}{r^2}$

r = 275 ft

t_0	S
105	[illegible]
190	[illegible]

AR300476

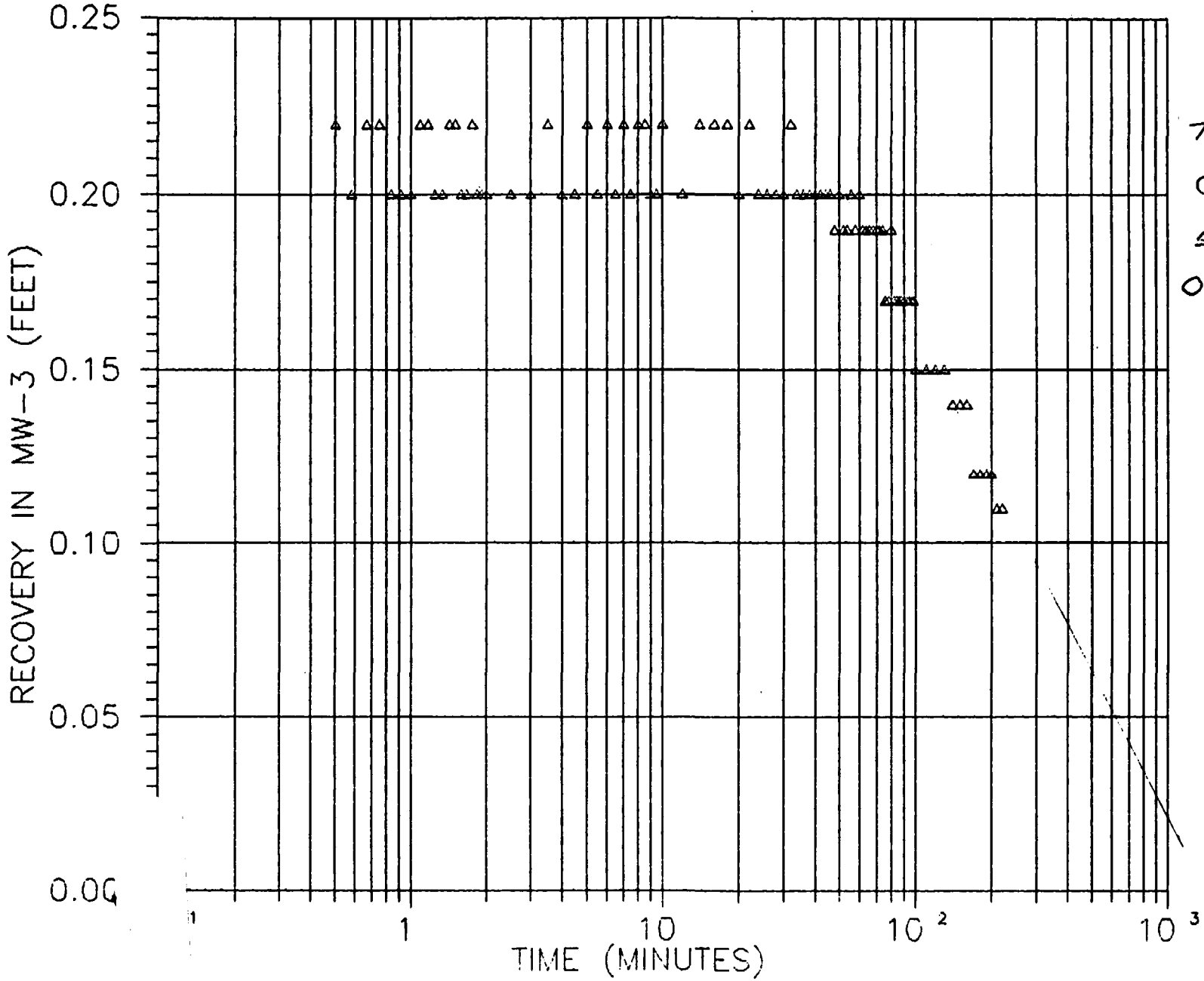
PU( ) TEST NO. 3



	H	Q	S	t	T (gpd/ft)
C	1	1	.23	140	3440.

AR300477

PUMP TE_ NO. 3



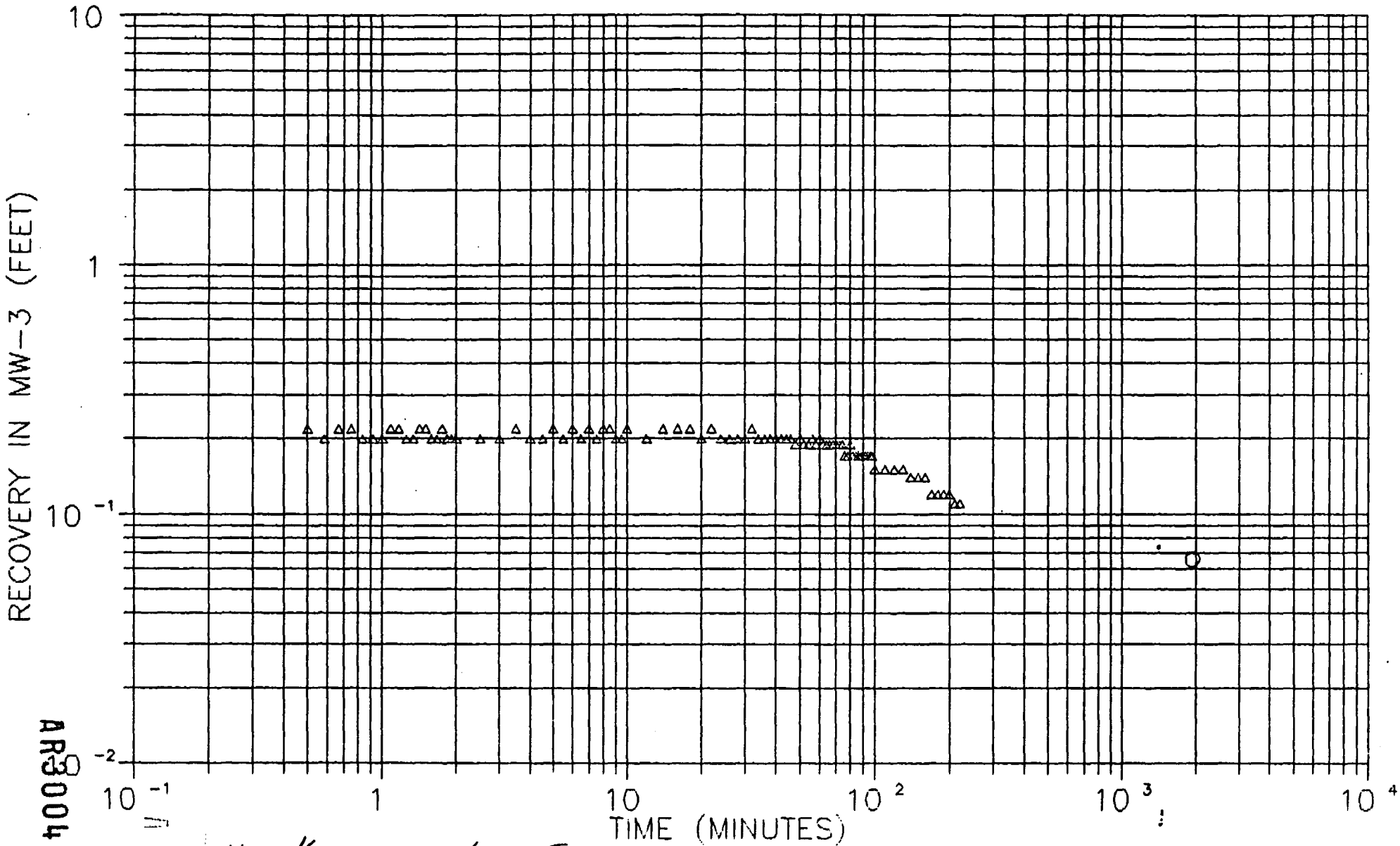
$T = \frac{264Q}{\Delta s}$

Q = 8gpm

Δs	T (gpd/ft)
0.14	15,100

AR300478

PU( ) TEST NO. 3



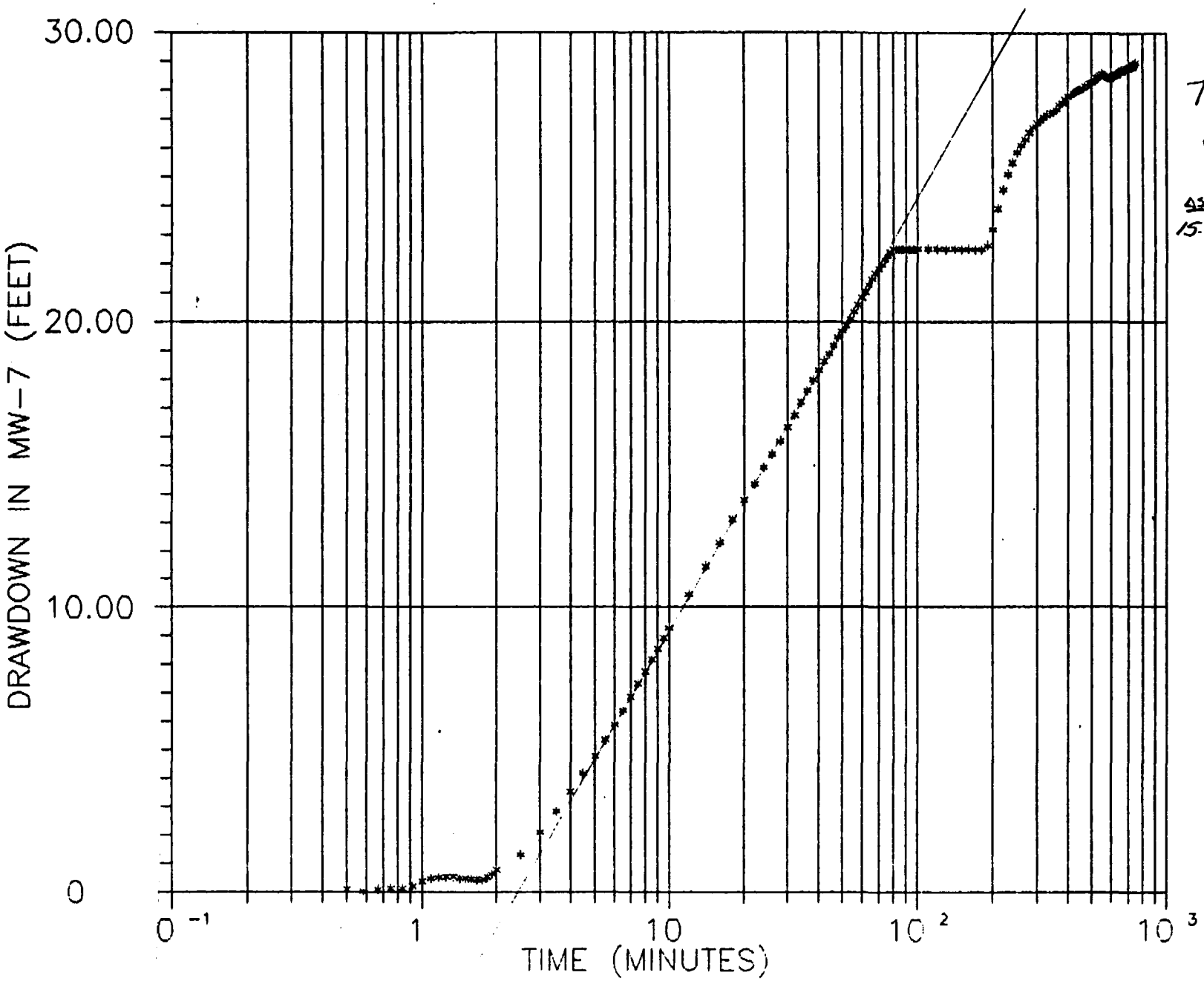
H Yu s t T (p.u)

1 1 0.007 1400 3,080.

$T = \frac{1.84 \times 10^{5}}{s}$ [1.94 gpd]

AR300479

PUMP TE_ NO. 3



$T = \frac{264Q}{\Delta s}$

$Q = 8gpm$

Δs 15.25

$\frac{T(gpd/ft)}{140.}$

AR300480

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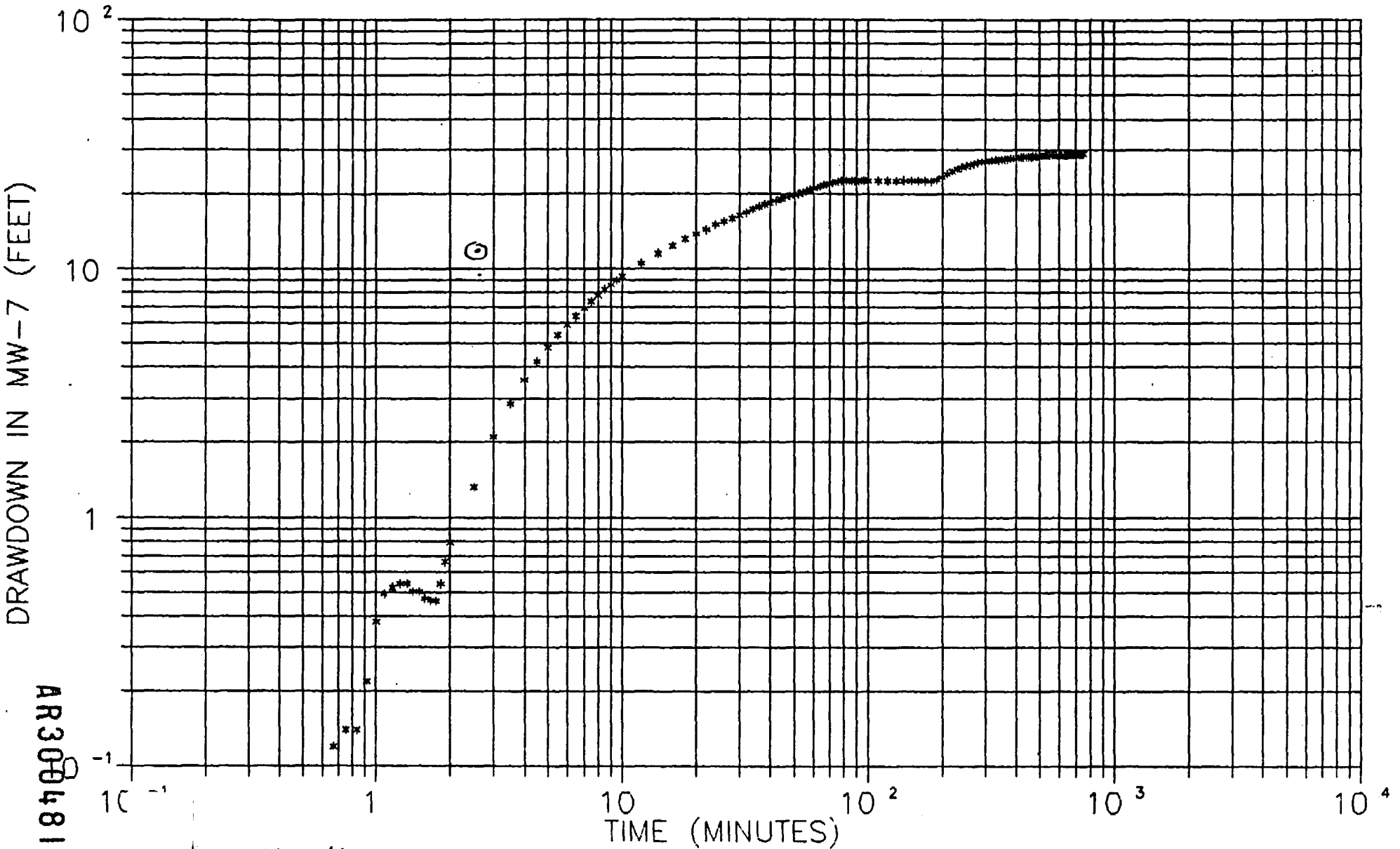

H	Yu	s	t	T(gpm)
1	1	12	27	80

AR300481

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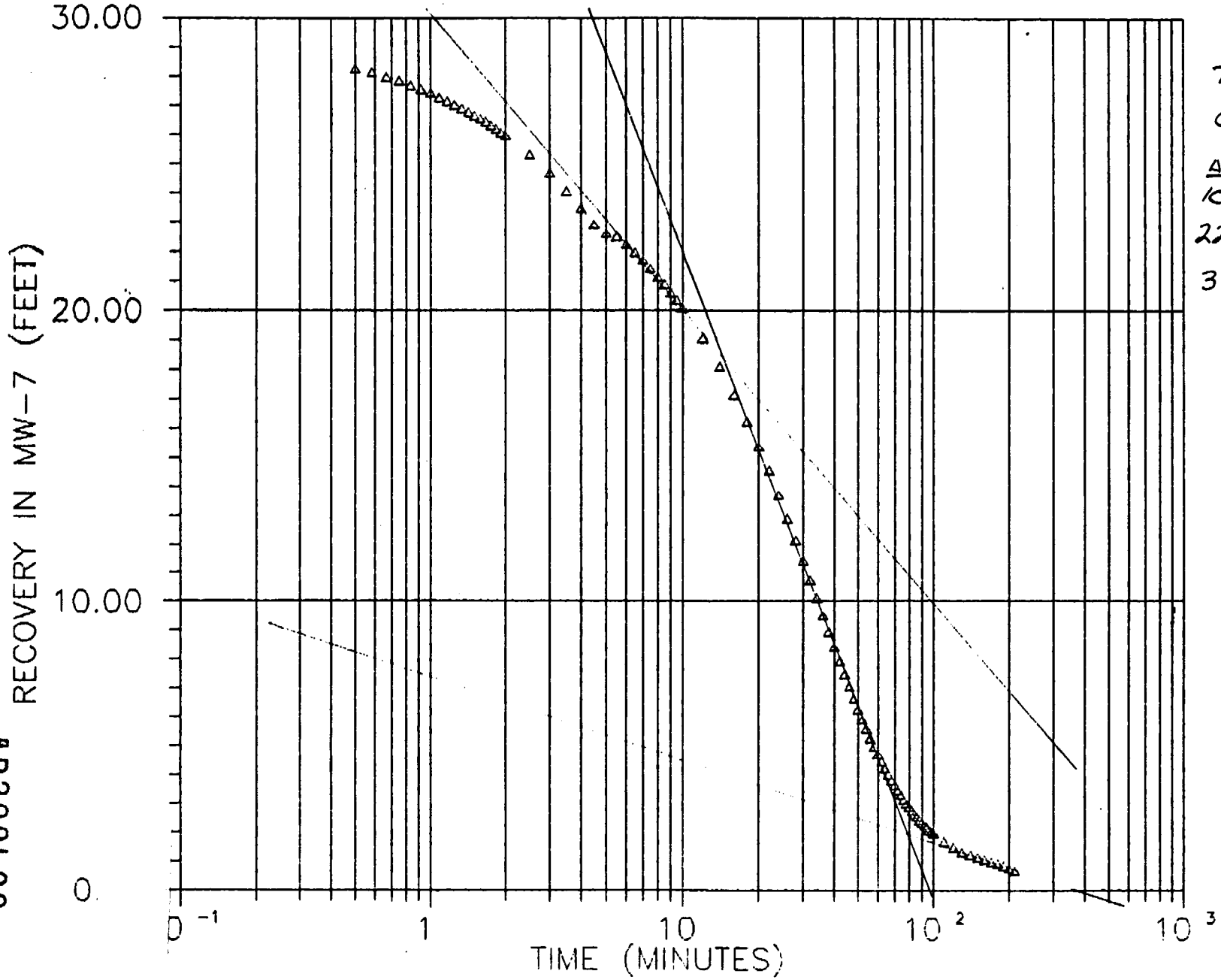


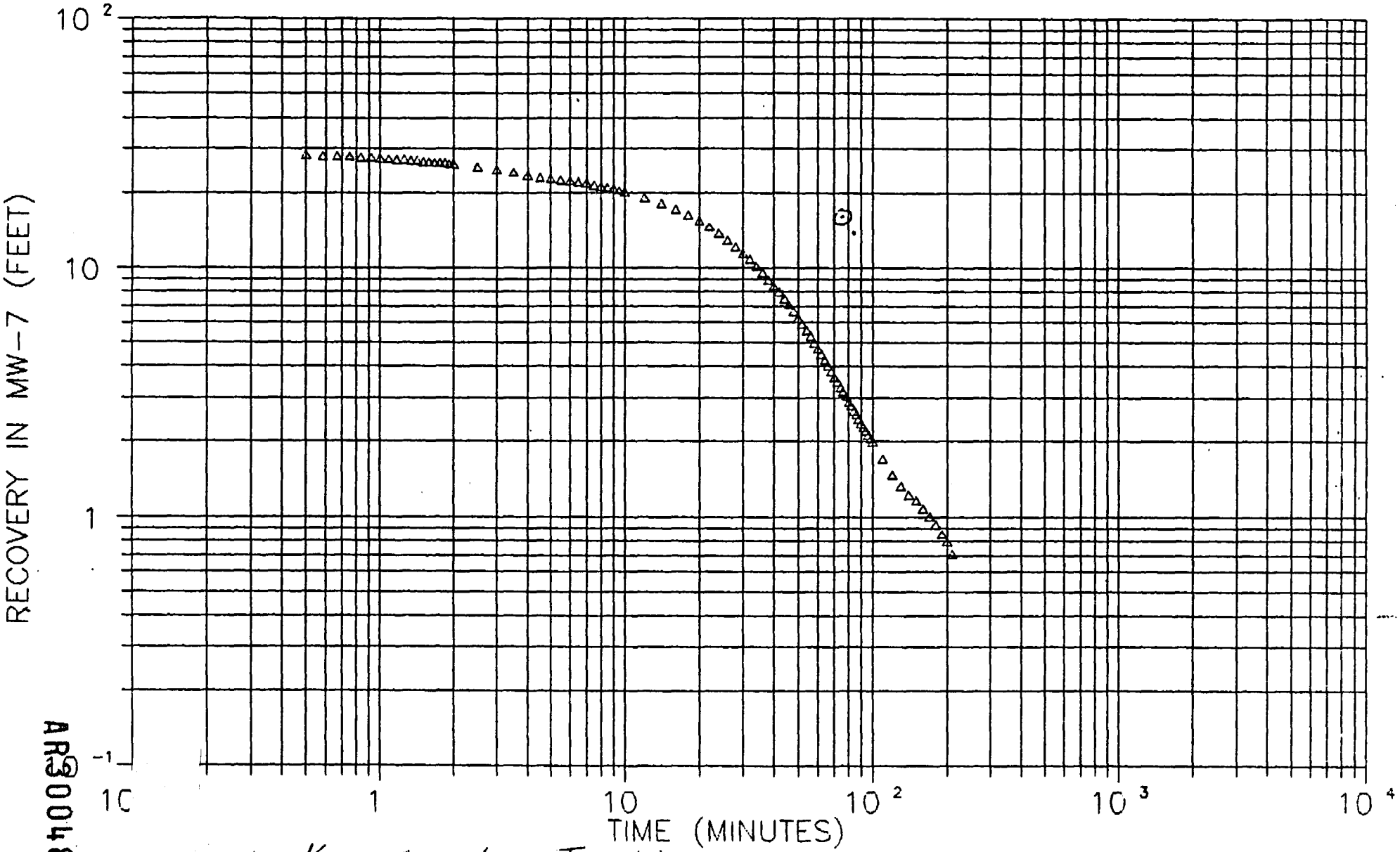
$T = \frac{264Q}{\Delta s}$

Q: 8gpm

Δs	T (gpd/ft)
10	210.
22.5	90.
3	700.

AR300482

PU(' TEST NO. 3



H Yr t T(hr)

1 1 17 78 50.

AR300483

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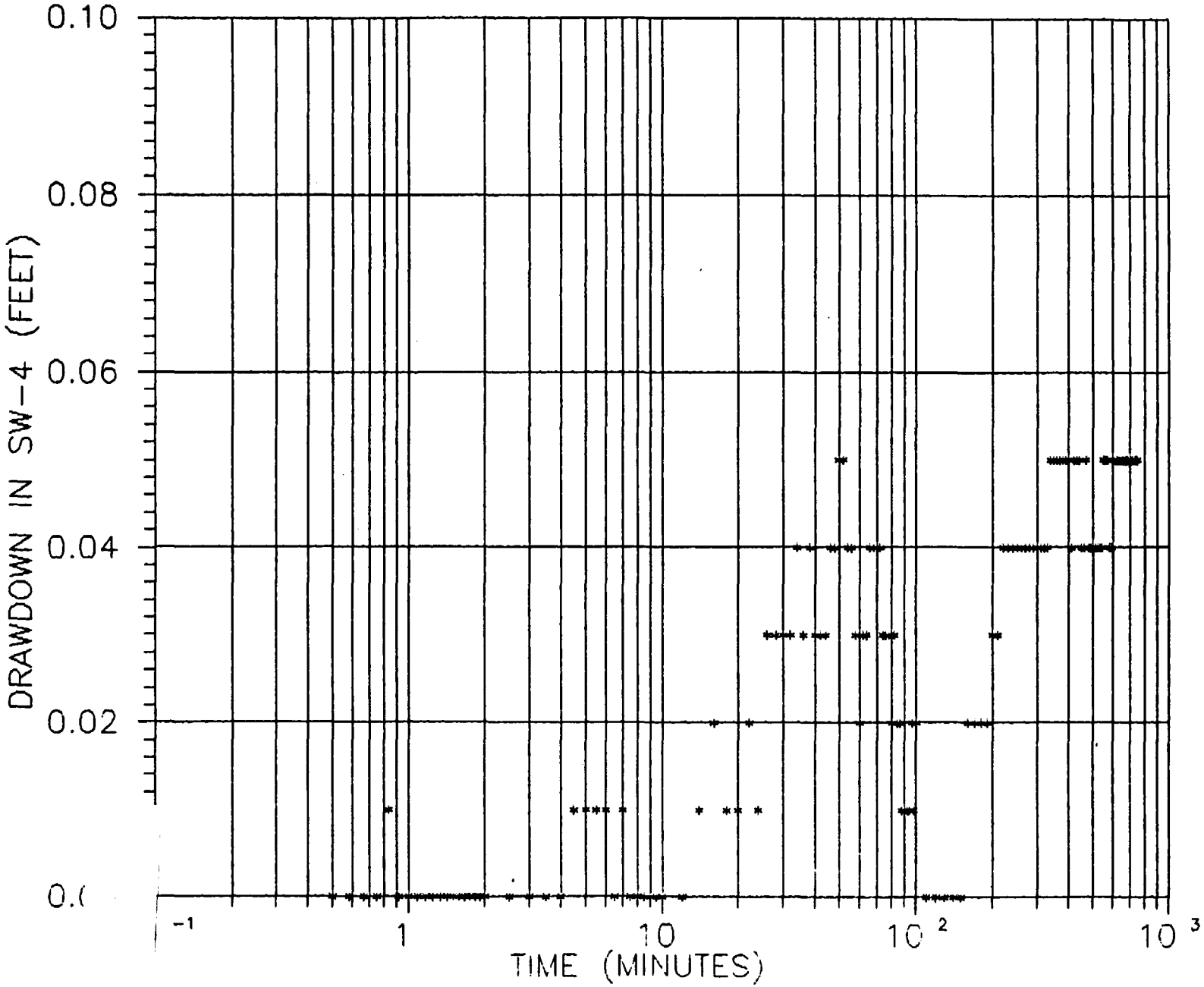

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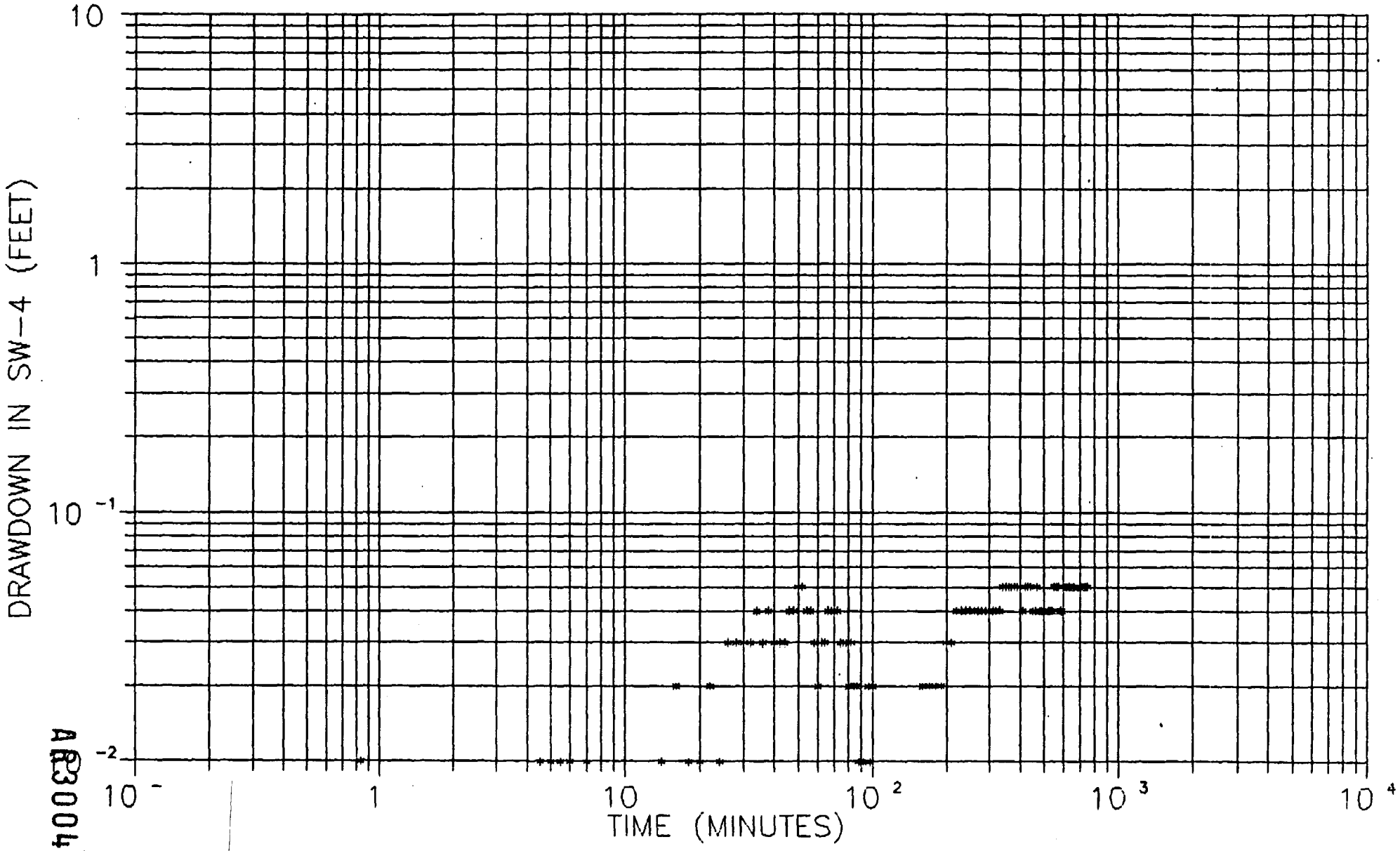

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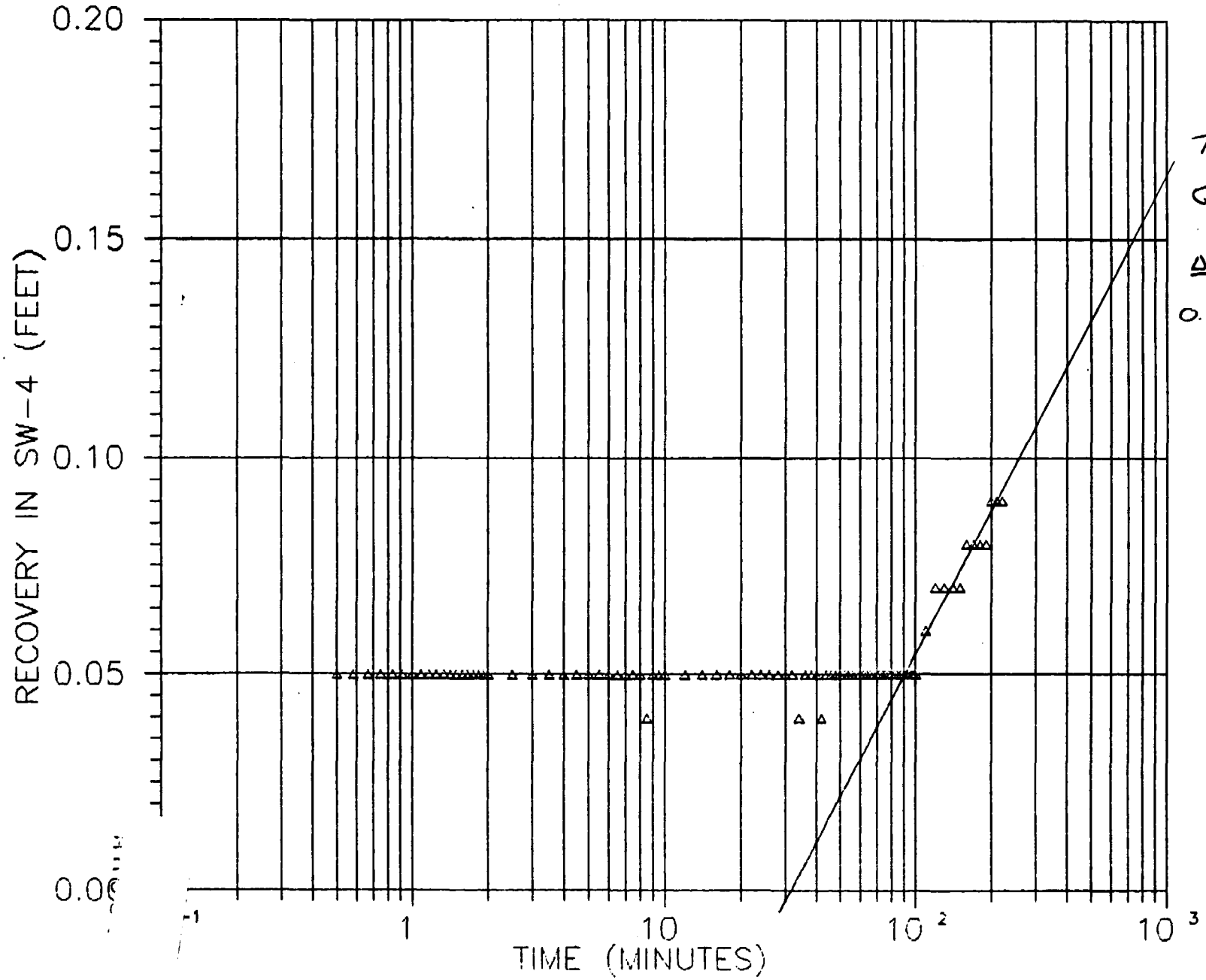

$T = \frac{264Q}{\Delta s}$

Q = 8gpm

Δs	T (gpd/ft)
0.11	19,200

AR300486

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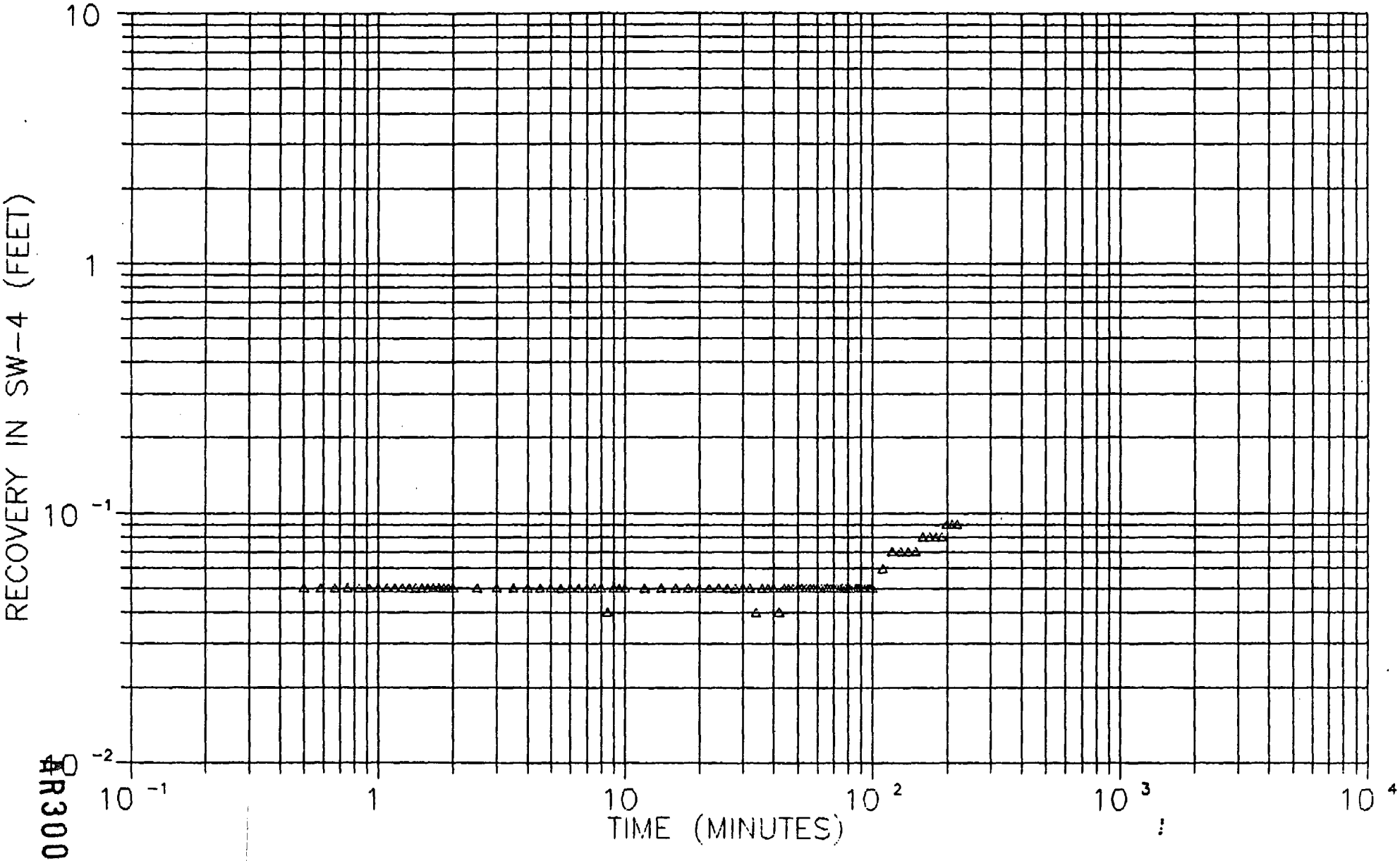

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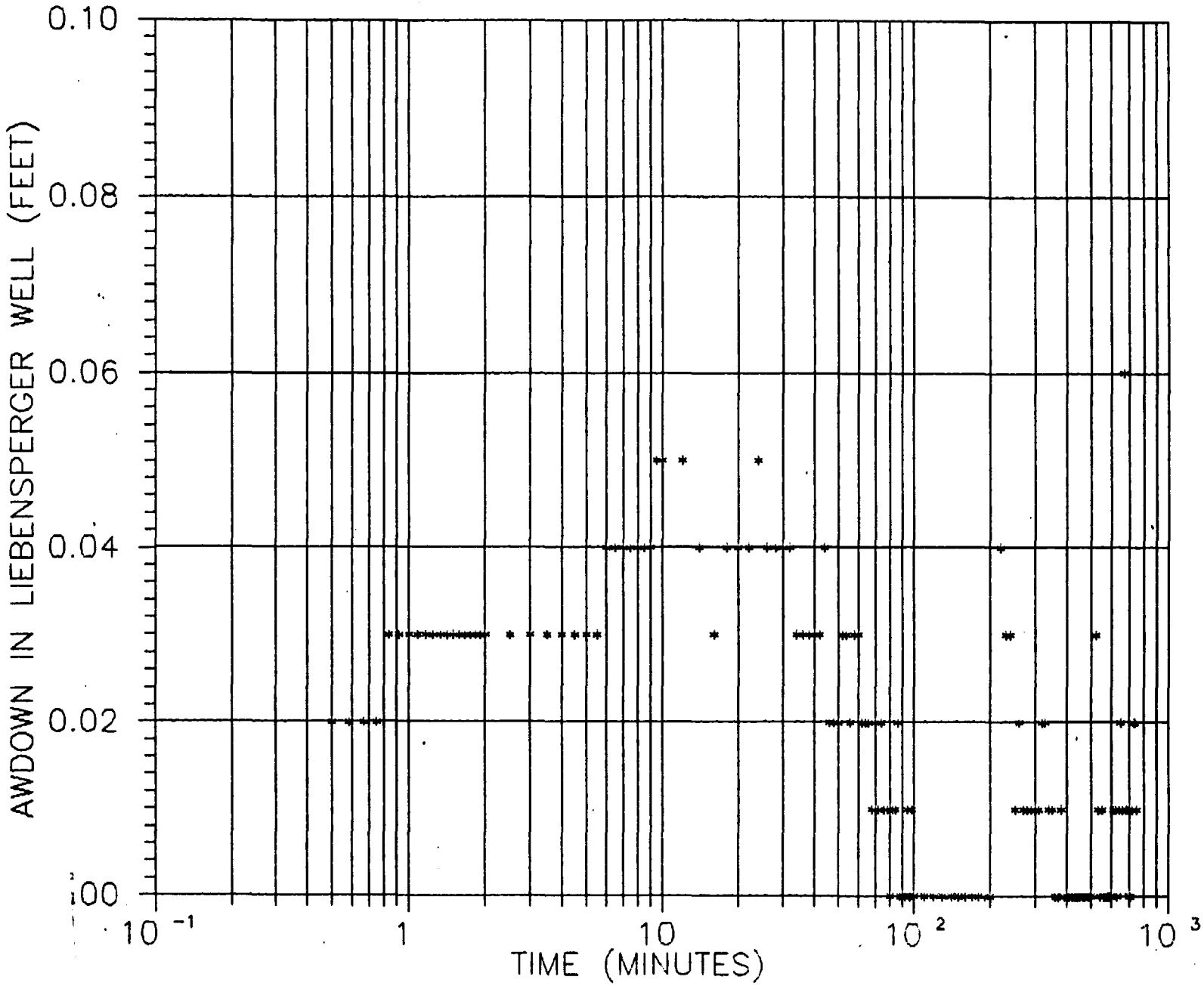

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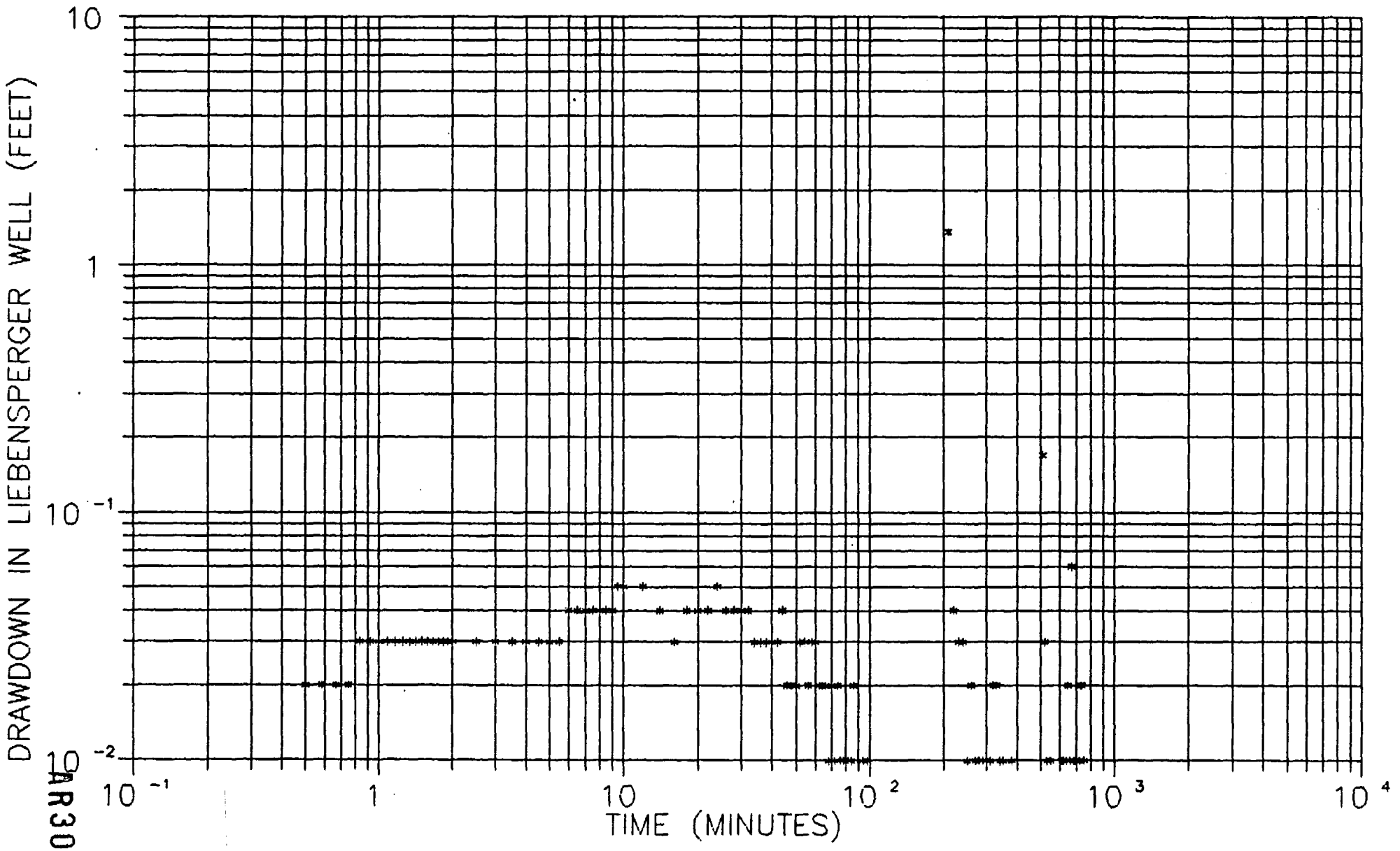

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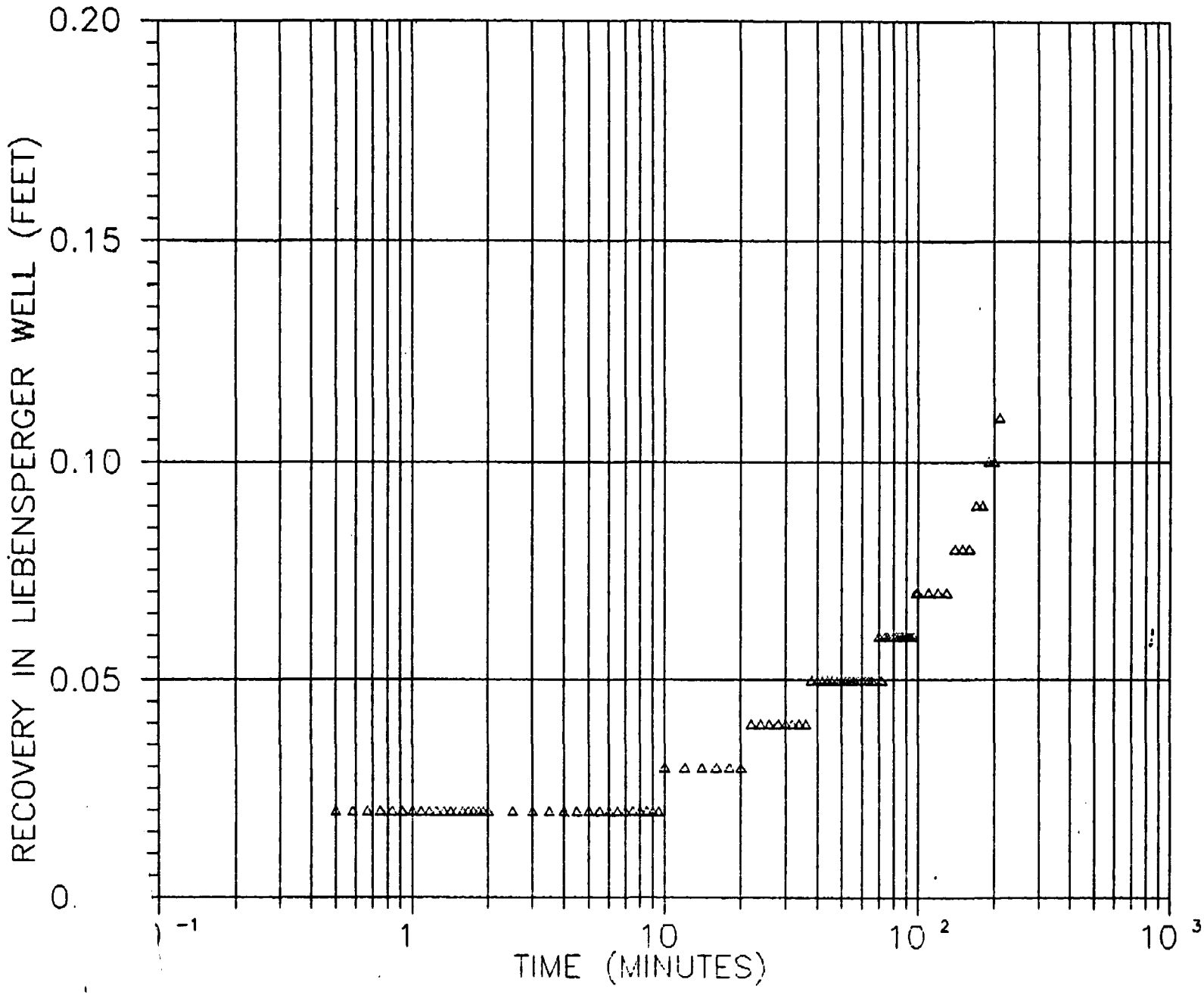

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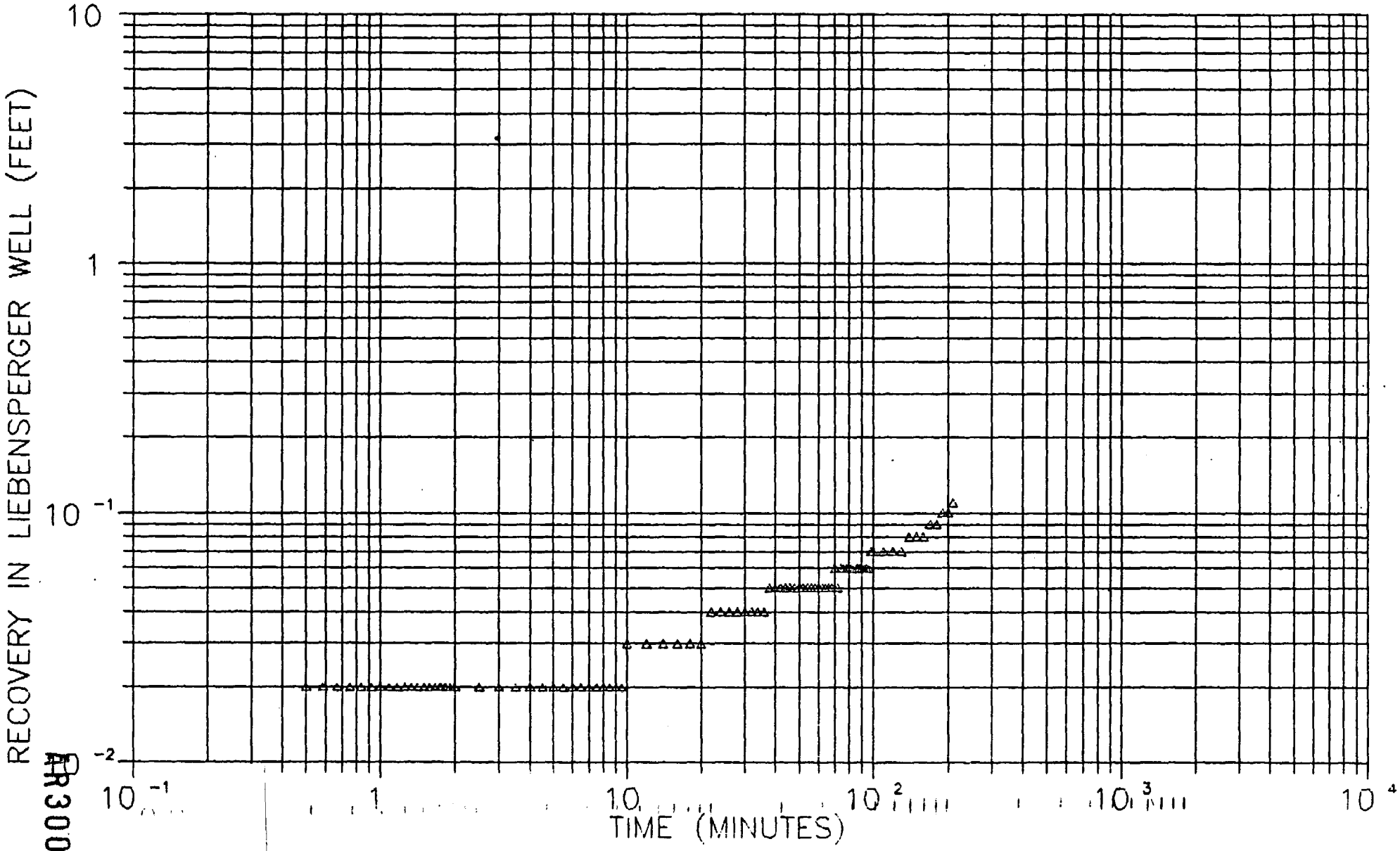

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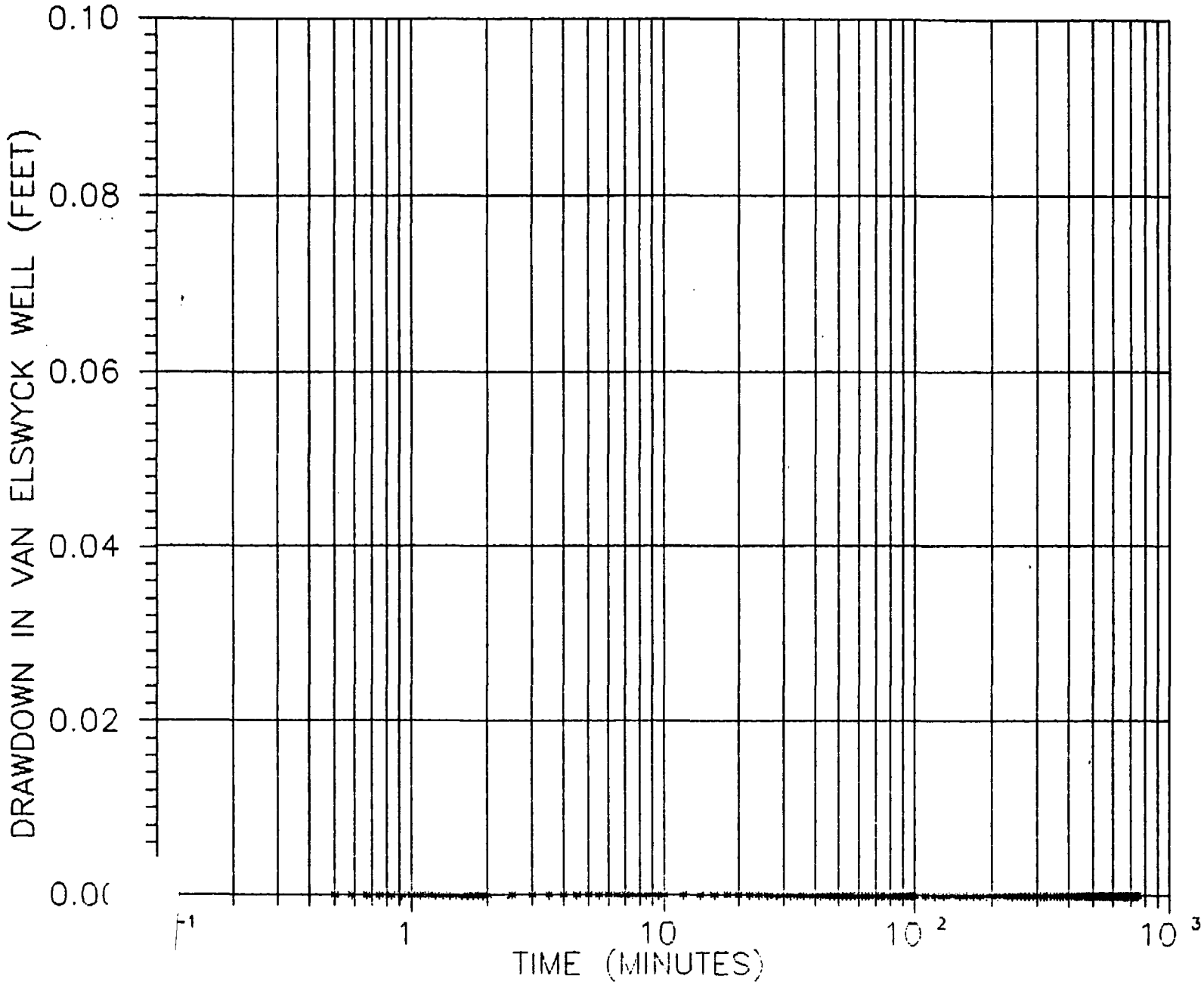

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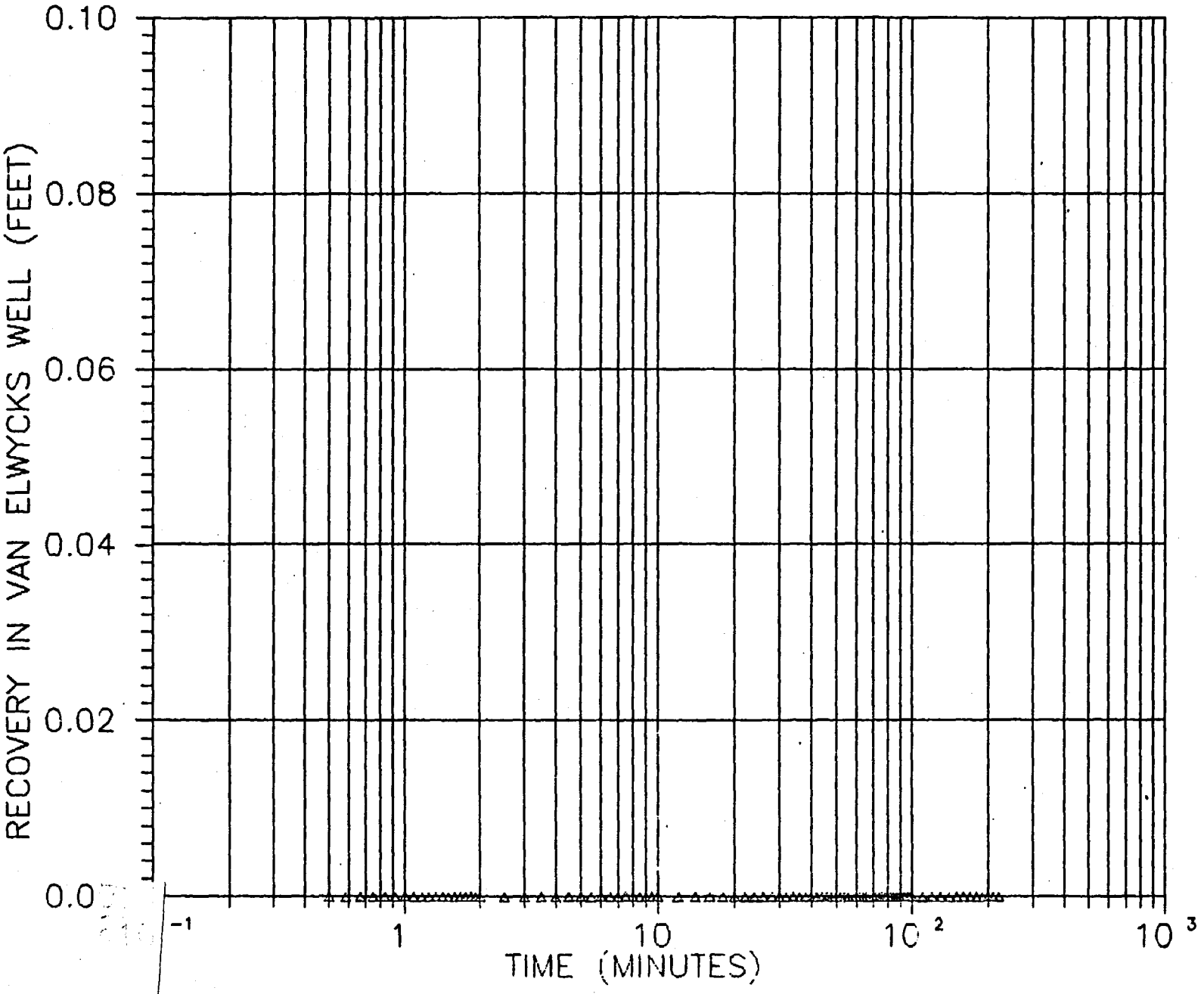

AR300493

APPENDIX D

GEOPHYSICAL LOGS OF BOREHOLES

GEOPHYSICAL INVESTIGATION
BERK'S SAND PIT
LONGSWAMP TOWNSHIP, PENNSYLVANIA

Prepared for
BAKER/TSA

AUGUST 1988

Weston Geophysical
CORPORATION

AR300495

TABLE OF CONTENTS

	Page
LIST OF TABLES	i
LIST OF FIGURES	ii
1.0 INTRODUCTION AND PURPOSE	1
2.0 LOCATIONING AND SURVEY CONTROL	1
3.0 METHOD OF INVESTIGATION	2
3.1 Seismic Refraction	2
3.2 Cross-Hole Seismic Velocity Measurements	3
3.3 Seismic Imaging-Tomography	4
3.4 Borehole Geophysical Logging	4
4.0 DISCUSSION OF RESULTS	5
4.1 Seismic Refraction	5
4.2 Cross-Hole Seismic Velocity Measurements	6
4.3 Seismic Imaging-Tomography	7
4.4 Borehole Geophysical Logging	7
5.0 SUMMARY OF RESULTS	8
TABLE	
FIGURES	
APPENDIX A SEISMIC REFRACTION SURVEY METHOD OF INVESTIGATION	
APPENDIX B IN SITU VELOCITY MEASUREMENTS PROCEDURE	
APPENDIX C BOREHOLE SEISMIC IMAGING METHOD OF INVESTIGATION	
APPENDIX D GEOPHYSICAL LOGS OF BOREHOLES	

LIST OF TABLES

TABLE 1 Summary of Bedrock Velocity Values Measured by Crosshole Technique

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LIST OF FIGURES

FIGURE 1	Plan Map
FIGURE 2	Seismic Refraction Profiles
FIGURE 3	Seismic Imaging Velocity Diagrams
FIGURE 4	Trend of Deep, Low Velocity Bedrock Zone
FIGURE 5	Interpreted Geophysical Logs MW-1, MW-2, MW-9

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1.0 INTRODUCTION & PURPOSE

A geophysical investigation was completed at Berk's Sand Pit, Longswamp Township, Pennsylvania during the weeks of March 28 and April 4, 1988 by Weston Geophysical Corporation.

The purpose of the geophysical study is to supplement field work already completed by:

- Delineating deeply fractured/weathered zones in the bedrock.
- Delineating the depth to the top of bedrock.
- Delineating the depth to the saturated zone.

The investigation was composed of three seismic techniques:

- Surface Seismic Refraction Study
- In-Situ Velocity (Cross-Hole) Measurements
- Seismic Imaging-Tomography

Also, borehole geophysical logs, provided by Baker/TSA, were used to aid in the interpretation of seismic data.

The contents of this report will serve to describe the methods of investigation used to acquire the necessary data and the results of this investigation.

2.0 LOCATIONING AND SURVEY CONTROL

The investigations were conducted at a designated hazardous substance site adjacent to an area called Berk's Sand Pit. Boreholes used during the investigation, as well as surface refraction lines, are shown on Figure 1. Borehole locations were supplied by Baker/TSA and the location of surface refraction lines were determined by measurements from surveyed boreholes. Changes in elevation along surface refraction lines were noted by observations made by Weston's field crew.

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3.0 METHOD OF INVESTIGATION

3.1 Seismic Refraction

The seismic refraction survey method is a means of determining the depths to a refracting horizon and the thickness of major seismic discontinuities overlying a higher velocity refracting horizon. The seismic velocities measured by this technique are directly related to the physical properties of subsurface materials and, therefore, can be used to calculate their mechanical properties (dynamic moduli values), as well as for material identification and stratigraphic correlation.

Interpretations are made from travel time curves showing the measurement of the time required for a compressional seismic wave to travel from the source ("shot") point to each of a group of vibration sensitive geophones. The geophones are located at known intervals (10 and 20 feet) along the ground surface. Small explosive charges were used as seismic sources.

Continuous profiling was accomplished by having the end shot point of one spread (24 geophone array) coincident with the end or intermediate position shot point of the succeeding spread. Four hundred foot spreads were used to obtain adequate penetration of overburden material and weathered bedrock. Offset shots, located 100 feet from each end of the spread, were used to detail conditions at the top of bedrock. Other shot points were located at each end, center and quarter points of each spread.

The geophones were in direct contact with the earth and converted the earth motion resulting from the shot energy into electric signals; a moving coil electromagnetic geophone was used. This type of detector consists of a magnet permanently attached to a spike base which was rigidly fixed to the earth's surface. Suspended within the magnet is a coil-wrapped mass. Relative motion between the magnet and coil produced an electric current, with a voltage proportional to the particle velocity of the ground motion.

The electric current was then carried by cable to the recording instrumentation consisting of a WesComp™ digital field acquisition computer and a Model 780 Universal seismic amplifier. These signals were amplified and filtered to minimize background interference. For each shot, the seismic signal detected by each geophone was recorded on a magnetic disk and printed hard copy. A further discussion of the seismic refraction method of investigation is enclosed as Appendix A.

3.2 Cross-Hole Seismic Velocity Measurements

A cross-hole seismic study was performed utilizing existing wells at the site. The cross-hole program involved a network of geophones placed at different depths in several wells located along two primary sections (Figure 1). One section was oriented along the strike of the bedrock foliation (SW-NE) using Wells MW-7, ERT-3, MW-1, and MW-2. Small shots (blasting caps) were used as the seismic source originating first from MW-7 and then from MW-2. Another section, oriented from northwest to southeast, utilized Wells MW-1, MW-2, MW-9, and MW-4. Shots were set off first in MW-4 and then in MW-1. In these tests, geophones were spaced in the receptor wells to a depth of 150 feet where possible to provide data on deep bedrock conditions.

Measurements were made using geophones containing three orthogonal elements, one vertical and two horizontal. Seismic energy was generated in one hole and detected by geophones in other holes, usually with the geophones and seismic energy source at the same elevation. Since the borings are spaced apart by varying distances, interchanging the seismic energy source and detectors yields different combinations of shot to detector distances, adding data points for velocity control. Velocity is the direct distance traveled divided by the travel time. On a time-distance plot, velocity lines drawn through the individual arrival times tie to time zero at the energy source confirming that the seismic waves have propagated through the same velocity layer. A further discussion of the cross-hole method of investigation is included as Appendix B.

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3.3 Seismic Imaging - Tomography

Borehole seismic imaging (tomographic modelling) was performed to identify zones of low, compressional wave seismic velocity values indicative of extensive weathering and/or fracturing. The technique allows examination of materials outside the borehole in which the instrumentation is located, and also provides a tool for extrapolation of borehole log information. Seismic imaging thus extends the area which can be investigated by boreholes alone, permitting a more thorough investigation of the bedrock.

The seismic imaging survey was completed using existing wells (MW-1, MW-2, MW-9). The seismic imaging survey involved a geophone streamer placed in a well, and seismic sources placed in an adjacent well. The geophone streamer contained 12 sensors spaced 10 feet apart and shots were spaced at 20 foot, vertical intervals.

Two tomographic profiles (representing two-dimensional velocity cross-sections) were generated. One trending southeast-northwest, between boreholes MW-1 and MW-2, another between boreholes MW-2 and MW-9 trending southwest-northeast. Exact shot point and receiver locations are shown with the figures of tomographic contours.

The data were collected with the WesComp digital data acquisition computer and processing unit. Data processing was accomplished with Weston's proprietary tomographic software. A more comprehensive discussion of the seismic imaging method of investigation is included as Appendix C to this report.

3.4 Borehole Geophysical Logging

Boreholes MW-1 through MW-9 were geophysically logged before wells were installed. The logging was performed by Appalachian Coal Surveys of Pittsburgh, Pennsylvania and included the following techniques:

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- Natural gamma
- Three arm caliper
- High resolution (short spaced) gamma-gamma density
- Wall (contact) resistance
- Spontaneous potential (SP)
- Temperature
- Fluid conductivity
- Single point resistivity
- Neutron

Probes containing measuring devices for the various borehole geophysical techniques are attached to the end of a multiconductor, steel wrapped, chemically stable cable and lowered to the bottom of the borehole. Measurements are taken as the tool is pulled slowly to the surface. Data are sent from the tool through the cable to the surface electronics equipment where they are processed and recorded on chart paper.

4.0 DISCUSSION OF RESULTS

4.1 Seismic Refraction

The interpreted seismic refraction profiles as presented on Figure 2 describe a complex subsurface condition with numerous lateral and vertical changes in seismic layering and seismic velocity values. Generalized boring logs for drill holes adjacent to the seismic lines are also shown on the seismic profiles. In general, the seismic refraction data and test borings are in good agreement.

The near surface overburden materials exhibit a wide variation in thickness ranging from 2 feet to as great as 32 feet. This near surface material has a velocity of 1600 to 1800 ft/sec except near the southeast end of Line 1 where a lateral increase in velocity to 2800 ft/sec was detected. Test borings indicate that this near surface material is a combination of soil and saprolite; the 2800 ft/sec material is described as mostly saprolite. Underlying the near

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surface overburden material is a material with a velocity of 4000 to 5000 ft/sec identified by the test borings as weathered bedrock. This layer ranges in thickness from 20 to 40 feet throughout most of the site area.

In general, the velocity of the competent bedrock as determined from surface seismic refraction data is 13,000 to 14,000 ft/sec in the northeasterly strike direction. As expected, the strike velocity is slightly higher than the 12,000 to 13,000 ft/sec velocity measured in the cross strike direction. Significant, local lateral velocity variations in the bedrock were also observed. Two significant low velocity bedrock zones with an estimated bedrock velocity of 8000 to 10,000 ft/sec were identified; they are located on Line 1 between Stations 2+10 and 3+40 and on Line 2 between Stations 5+00 and 5+80. These low velocity zones are indicative of deeply weathered and fractured bedrock. The low velocity zone identified on Line 1 appears to be quite extensive, both laterally and vertically. A fractured bedrock zone with a significant vertical extent is also indicated by boring MW-2.

4.2 Cross-Hole Seismic Velocity Measurements

Cross-hole velocities of the bedrock were measured both parallel and perpendicular to the regional northeast strike of the bedrock. The measured cross-hole velocity values are shown on the seismic profiles (Figure 2) and are presented in tabular form on Table 1.

In the northeast strike direction the bedrock velocity is observed to increase from 13,000 ft/sec to 15,000 ft/sec at approximately elevation 872 feet, the deepest strike direction velocity measurement elevation. Across strike where the velocity measurements extended to elevation 826 feet, the velocity of the bedrock is observed to increase from 13,000 ft/sec to 16,000 ft/sec at approximately elevation 850 feet and then to 18,000 ft/sec at approximately elevation 826 feet. These higher velocities in the 15,000 to 18,000

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ft/sec range are typical of a sound and competent bedrock, relatively massive, and containing few if any weathered and/or fractured zones of significance to ground-water movement.

4.3 Seismic Imaging - Tomography

Seismic imaging of bedrock velocity variations were completed between boreholes MW-1 and MW-2 and between boreholes MW-2 and MW-9. The results of the seismic imaging are presented in the form of tomography - velocity diagrams on Figure 3. The velocity values shown on the diagrams are not absolute velocity values but are relative values to describe changes in the velocity structure. Accordingly, the low velocity zones in the bedrock have been enhanced by shading on the tomography-velocity diagrams.

Below a depth of 60 feet, the depth to competent bedrock in the borehole area, the seismic imaging describes low velocity zones in the vicinity of borehole MW-2. The extent of this low velocity zone from MW-2 towards MW-1 and MW-9 is clearly shown on the tomography diagrams. The trend of the low velocity zone from the seismic imaging is consistent with the trend of the low velocity bedrock zone identified by the surface refraction measurements. The extent of this north-northwesterly trending zone is shown on Figure 4.

4.4 Borehole Geophysical Logging

High resolution density logs, caliper logs and both types of resistivity logs (wall and single point) were used to identify fracture zones which intersected the boreholes. Boreholes MW-2, MW-3, MW-6, and MW-7 showed a high fracture density (greater than 0.1 fractures/foot) and boreholes MW-1, MW-4, MW-5, MW-8 and MW-9 showed only a few fractures. The number of fractures identified is not necessarily related to the hydraulic conductivity of the rock mass since some fractures could be closed or clay filled. Fractures with similar log character were correlated between MW-1, MW-2 and MW-9 (see

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Figure 5) and defined a north-northwest strike direction with a shallow to moderate dip to the east-northeast. Lithologic correlations based on natural gamma and density logs also defined a shallow northeast dip. The geophysical logs for all the boreholes are presented in Appendix D.

Geophysical logs from MW-2 show a very highly fractured zone from just below casing (57 feet) to 104 feet. Below 104 feet the rock appears to be relatively competent with a few widely spaced fractures. Neutron and resistivity logs indicate that this highly fractured zone is water bearing. Analysis of logs from the closest adjacent holes (MW-1 and MW-9) revealed no similar highly fractured zone in either borehole. However, the fractures that were observed in wells MW-1 and MW-9 appear to be water bearing.

Fractures identified in boreholes MW-3, MW-6 and MW-7 occur relatively evenly spaced throughout the interval logged. The fractures appear to be water bearing and commonly occur near lithologic boundaries.

Zones of high natural gamma readings were observed in boreholes MW-1, MW-6 and MW-9. Borehole MW-3 showed consistently high natural gamma readings throughout the hole. These zones of high natural gamma readings are indicative of alteration of the rock to clay and/or mica. These zones tend to be softer, having a consistently larger borehole diameter, and commonly occur adjacent to significant fractures. The fractures provide a conduit for fluids to enhance the alteration process. Extensive alteration is observed in MW-1 and MW-6 in areas where fractures are present.

5.0 SUMMARY OF RESULTS

The seismic velocity measurements, refraction, cross-hole, and tomography, and the borehole geophysical logging describe a bedrock that is extensively weathered and/or fractured to depth. The measured seismic velocity values correlated with hard and competent bedrock

ranged from 13,000 ft/sec to 18,000 ft/sec. Based on the interpretation of the geophysical logs, even the 13,000 ft/sec bedrock is apt to contain fracture zones that could extend to depth through which contaminants could migrate. Below an elevation of approximately 850 feet, the bedrock should become relatively unfractured and unweathered restricting the flow of contaminated ground-water.

Contamination migration could be more concentrated along the deeply weathered/fractured bedrock zone that extends in a north-northwesterly direction as indicated by refraction and tomography measurements in the vicinity of the intersection of seismic Lines 1 and 2 and borehole MW-2. Correlated geophysical logs indicate that there are other fractures with a similar north-northwesterly trend.

TABLE

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TABLE 1

SUMMARY OF BEDROCK VELOCITY VALUES
MEASURED BY CROSSHOLE TECHNIQUE

MEASUREMENT ELEVATION	COMPRESSIONAL WAVE VELOCITY (ft/sec)
Northeast-Southwest Profile (Boreholes MW-1, MW-2, MW-7, ERT-3)	
952	10,500
932	13,000
912	13,000
892	13,000
872	15,000
Northwest-Southeast Profile (Boreholes MW-1, MW-1, MW-4, MW-9)	
926	13,200
906	13,800
886	13,000
866	13,000
846	16,000
826	18,000

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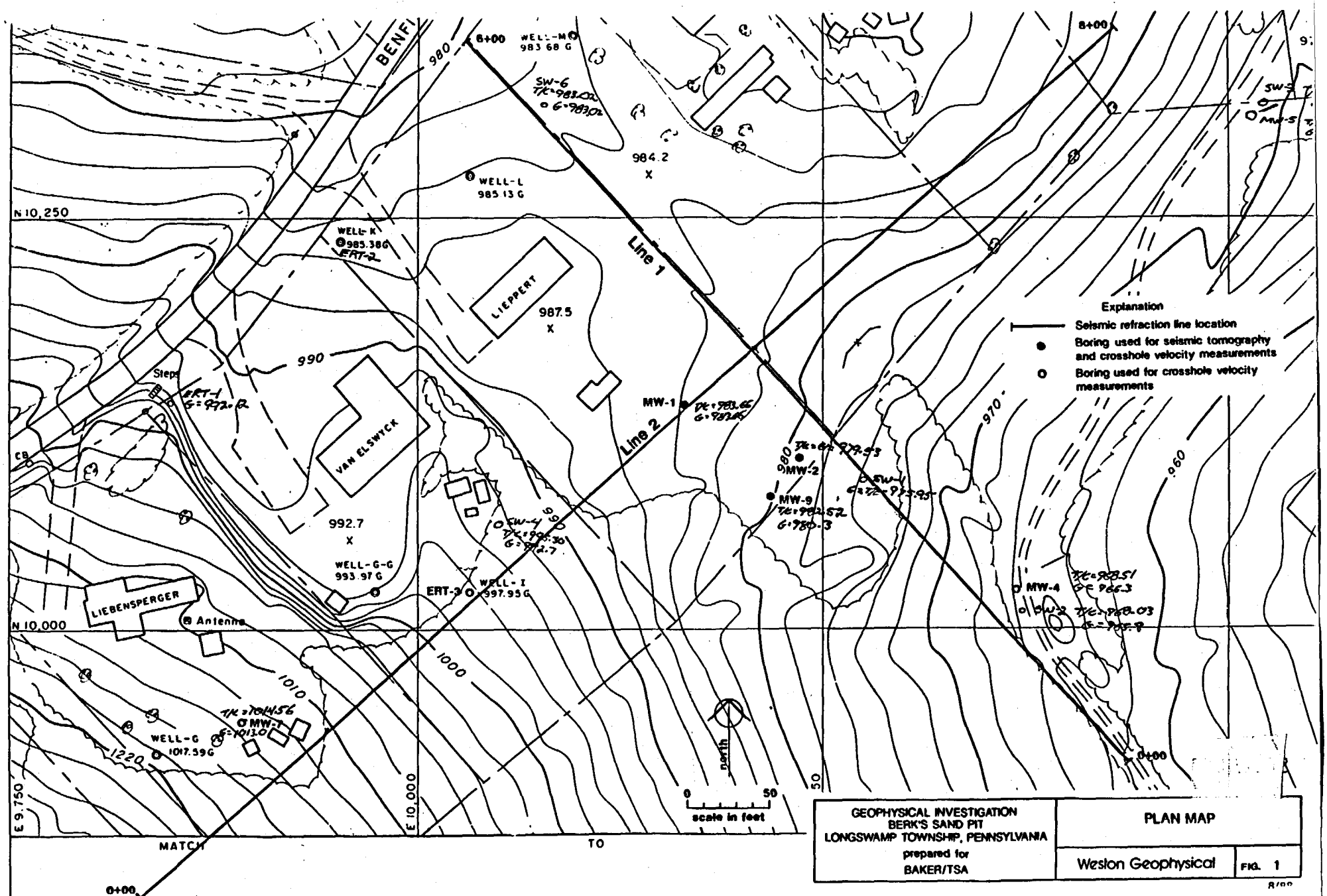
FIGURES


Explanation
Seismic refraction line location
Boring used for seismic tomography and crosshole velocity measurements
Boring used for crosshole velocity measurements
Line 1
Line 2
8+00
0+00
WELL-M 983.68 G
SW-6
984.2
WELL-L 985.13 G
WELL-K 985.38G
ERT-2
LIEPPERT
987.5
990
Steps
ERT-1
VAN ELSWYCK
992.7
WELL-G-G 993.97 G
LIEBENSPERGER
Antenna
ERT-3
WELL-I 997.95G
MW-1
MW-2
MW-9
SW-4
SW-1
SW-5
MW-5
MW-4
SW-2
MW-7
WELL-G 1017.59G
1010
1000
1220
980
970
960
N 10,250
N 10,000
E 9,750
E 10,000
north
0
50
scale in feet
MATCH
TO
GEOPHYSICAL INVESTIGATION
BERK'S SAND PIT
LONGSWAMP TOWNSHIP, PENNSYLVANIA
prepared for
BAKER/TSA
PLAN MAP
Weston Geophysical
FIG. 1

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DOC ID # 102667
PAGE # AR 300512

IMAGERY COVER SHEET
UNSCANNABLE ITEM

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SITE NAME Berks Sand Pit

OPERABLE UNIT OU

SECTION/BOX/FOLDER Administrative Record - Section Volume III A - Filecom

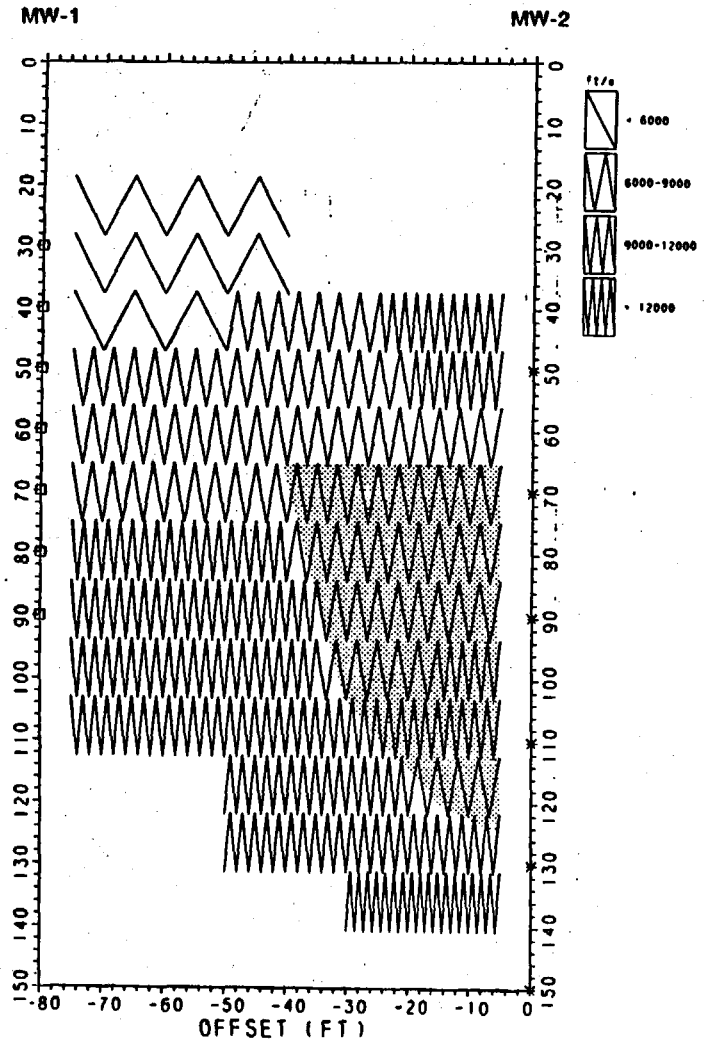
REPORT OR DOCUMENT TITLE Final Remedial Investigation

DATE OF DOCUMENT 9/1/88

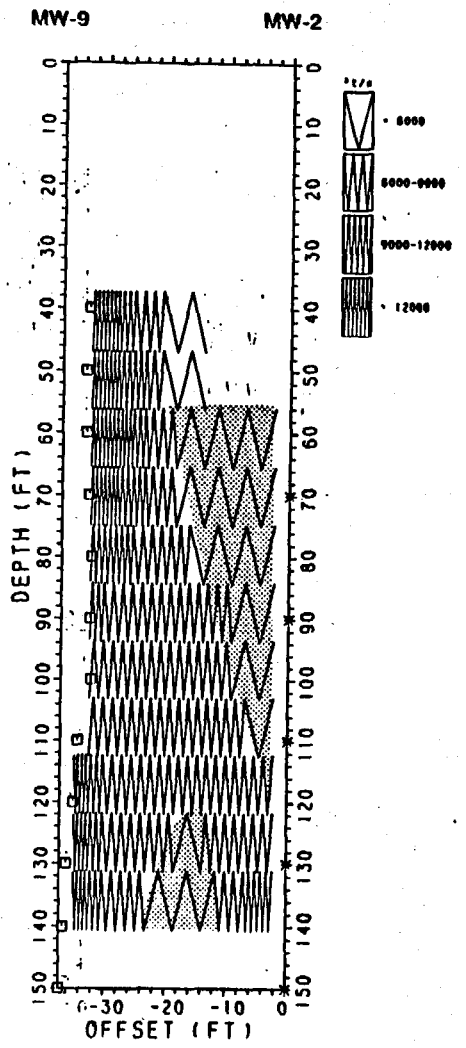
DESCRIPTION OF IMAGERY Seismic Refraction Profiles figure 2

NUMBER AND TYPE OF IMAGERY ITEM(S) 1 Oversized Map

TOMOGRAPHY PLOT MW-1/MW-2



TOMOGRAPHY PLOT MW-9/MW-2



EXPLANATION

* ENERGY SOURCE LOCATION

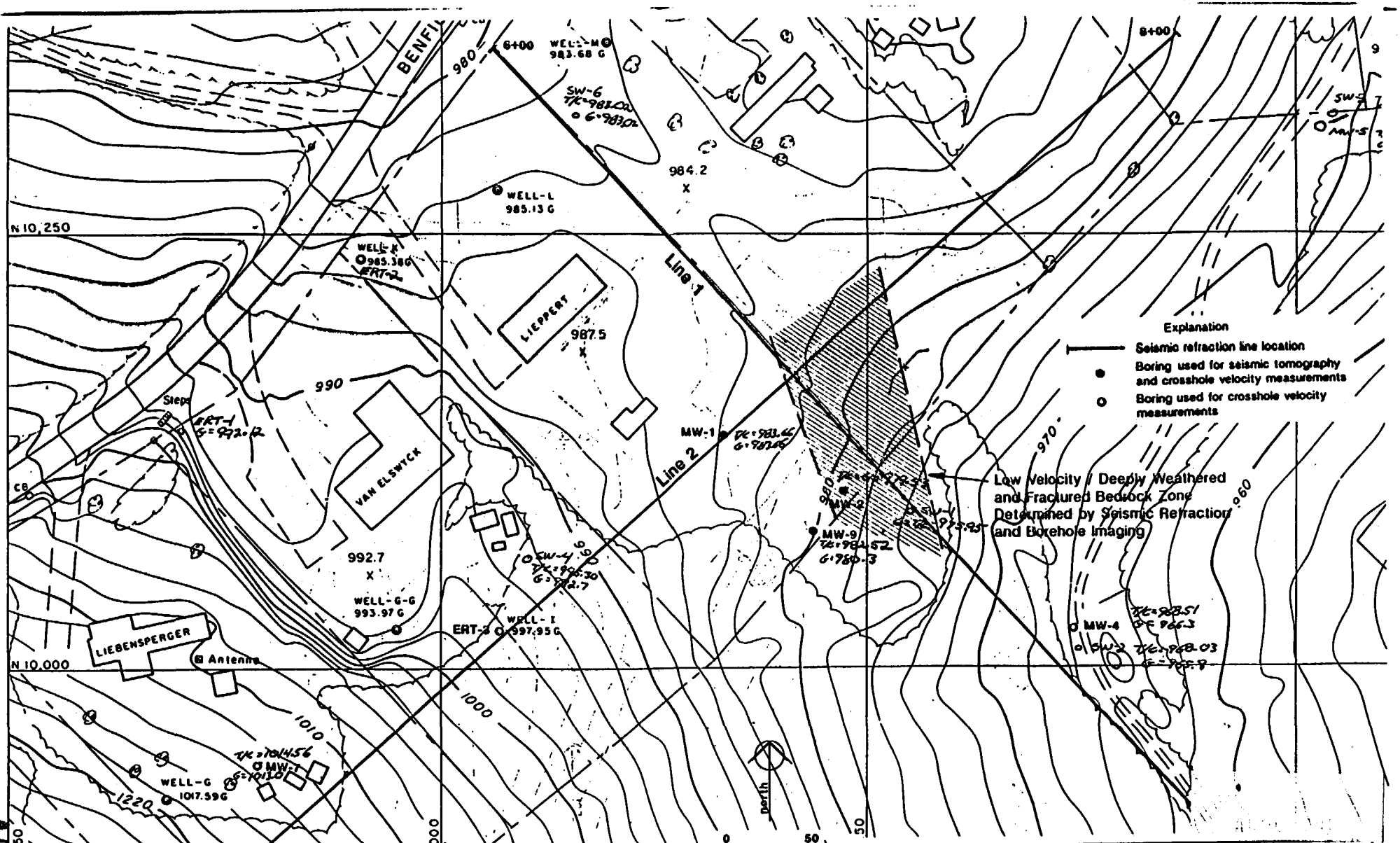
▫ DETECTOR LOCATION

NOTE: SEISMIC VELOCITY VALUES ARE IN FEET/SECOND.

LOW VELOCITY BEDROCK ZONE

GEOPHYSICAL INVESTIGATION BERK'S SAND PIT LONGSWAMP TOWNSHIP, PENNSYLVANIA prepared for BAKER/TSA	SEISMIC IMAGING VELOCITY DIAGRAMS
	Weston Geophysical — FIG. 3

AR300513



GEOPHYSICAL INVESTIGATION
BERK'S SAND PIT
LONGSWAMP TOWNSHIP, PENNSYLVANIA
prepared for
BAKER/TSA

TREND OF DEEP LOW VELOCITY BEDROCK ZONE

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FIG. 4

8/00

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PAGE # AR 300515

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DATE OF DOCUMENT 9/1/88

DESCRIPTION OF IMAGERY Interpreted Geophysical Logs MW-1, MW-2, MW-9

NUMBER AND TYPE OF IMAGERY ITEM(S) 1 Oversized Map

APPENDIX A

SEISMIC REFRACTION SURVEY
METHOD OF INVESTIGATION

GENERAL CONSIDERATIONS

The seismic refraction survey method is a means of determining the depths to a refracting horizon and the thickness of major seismic discontinuities overlying the high-velocity refracting horizon. The seismic velocities measured by this technique can be used to calculate the mechanical properties of subsurface materials [moduli values], as well as for material identification and stratigraphic correlation.

Interpretations are made from travel time curves showing the measurement of the time required for a compressional seismic wave to travel from the source ["shot"] point to each of a group of vibration sensitive devices [seismometers or geophones]. The geophones are located at known intervals along the ground surface, as shown in Diagram A. Various seismic sources may be used, including a drop weight, an air gun, and small explosive charges.

FIELD PROCEDURE FOR DATA ACQUISITION

Weston Geophysical Corporation uses a seismic recording technique of continuous profiling and overlapping spreads for engineering and ground water investigations. The seismic refraction equipment consists of a Weston Geophysical trace amplifier, Model USA780, with either a WesComp™ [a field computer system developed by Weston Geophysical], or a recording oscillograph.

Continuous profiling is accomplished by having the end shot-point of one spread coincident with the end or intermediate position shot-point of the succeeding spread. The spread length used in a refraction survey is determined by the required depth of penetration to the refracting horizon. It is generally possible to obtain adequate penetration when the depth to the refracting horizon is approximately one-third to one-quarter of the spread length.

In general, "shots" are located at each end and at the center of the seismic spread, Diagram B. The configuration of the geophone array and the shot point positions are dependent upon the objectives of the seismic array.

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As mentioned above, seismic energy can be generated by one or more of several sources.

The seismometer or geophone is in direct contact with the earth and converts the earth motion resulting from the shot energy into electric signals; a moving coil electromagnetic geophone is generally used. This type of detector consists of a magnet permanently attached to a spiked base which can be rigidly fixed to the earth's surface. Suspended within the magnet is a coil-wrapped mass. Relative motion between the magnet and coil produces an electric current, with a voltage proportional to the particle velocity of the ground motion.

The electric current is carried by cable to the recording device which provides simultaneous monitoring of each of the individual geophones. The operator can amplify and filter the seismic signals to minimize background interference. For each shot the seismic signals detected by a series of geophones are recorded on either photographic paper or magnetic tape, depending on job requirements. Included on each shot record is a "time break" representing the instant at which the shot was detonated.

INTERPRETATION THEORY

The elastic wave measured in the seismic refraction method, the "P" or compressional wave, is the first arrival of energy from the source at the detector. This elastic wave travels from the energy source in a path causing adjacent solid particles to oscillate in the direction of wave propagation. Diagram A shows a hypothetical subsurface consisting of a lower velocity material above a higher velocity material. At smaller distances between source and detector the first arriving waves will be direct waves that travel near the ground surface through the lower velocity material. At greater distance, the first arrival at the detector will be a refracted wave that has taken an indirect path through the two layers. The refracted wave will arrive before the direct wave at a greater distance along the spread because the time gained in travel through the higher-speed material compensates for the longer

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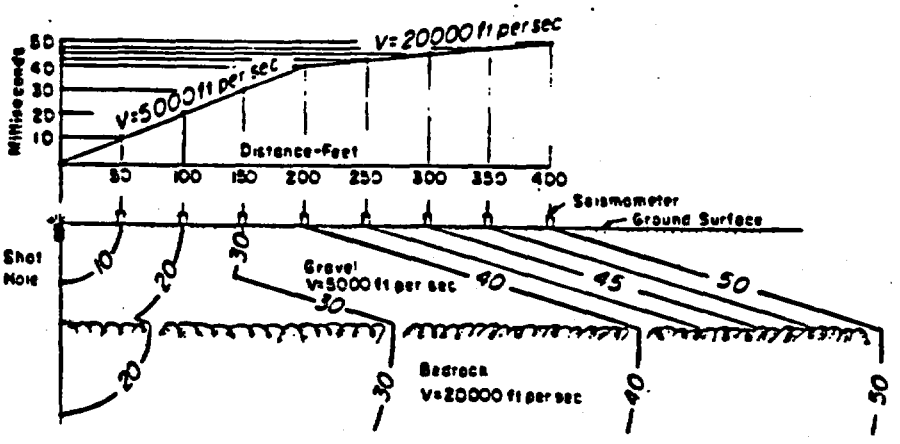
path. Depth computations are based on the ratio of the layer velocities and the horizontal distance from the energy source to the point at which the refracted wave overtakes the direct wave.

Generally the interpretation is by one or more of several methods [W.M. Telford, et al., 1976] ray-tracing, wave front methods, delay times, critical distances. etc. In addition, either a forward or inverse interpretation can be performed using Weston's computer. Since successful refraction interpretation is based on experience, all interpretation of refraction data is performed or thoroughly reviewed by a senior staff geophysicist.

Reference

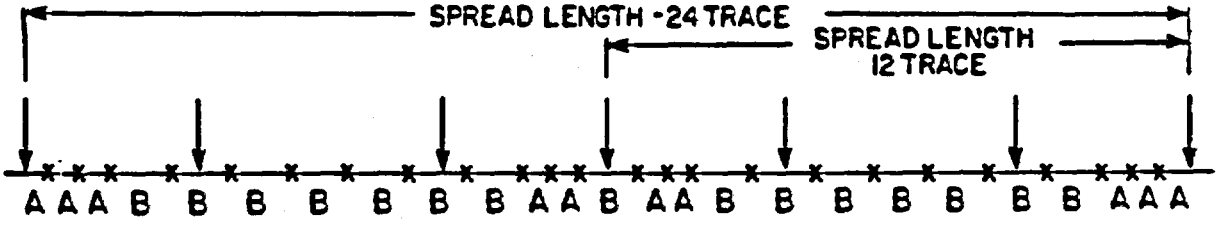
Telford, W.M.; Geldart, L.P.; Sheriff, R.E. and Keys, D.A., 1976, Applied Geophysics: Cambridge University Press.



Plot of Wave Front Advance in Two Layered Problem

Linehan, Daniel, Seismology Applied to Shallow Zone Research, Symposium on Surface and Subsurface Reconnaissance, Special Technical Publication No. 122, American Society for Testing Materials, 1951.

Diagram A



SPREAD LENGTH	GEOPHONE LOCATION A	B
400' - 24 TRACE or 200' - 12 TRACE	10	20
600' - 24 TRACE or 300' - 12 TRACE	15	30
1000 - 24 TRACE or 500' - 12 TRACE	25	50

LEGEND

↓ = GENERAL LOCATION OF "SHOT" POINT

x = GEOPHONE LOCATION

Geophone Interval-Spread Length Relationship

Diagram B

APPENDIX B

IN SITU VELOCITY MEASUREMENTS
CROSS-HOLE PROCEDURE

Detailed in situ measurements of compressional "P" and shear "S" wave velocities, their attenuation and anisotropic effects due to subsurface materials, particularly for thin layers, are best obtained by the cross-hole techniques. Measurements are made using geophones containing three orthogonal elements, one vertical and two horizontal. Seismic energy is generated in one hole and detected by the geophones in four other holes, usually with the seismic energy source and geophones at the same elevation level [Figure 1]. The borings are spaced apart at varying distances so that interchanging the seismic energy source and detectors yields different combinations of shot to detector distances, adding data points for velocity control. Borings which are proposed or existing for other disciplines may be included in the cross-hole array to minimize drilling effort. Field recordings are obtained using a multi-trace [usually 16] field computer system. The seismic signal is amplified, displayed, checked for quality, correlated and summed if desired and finally printed with Weston's field computer system, the WesComp™. Field parameters may be changed if required. Data are stored on magnetic disk or tape and the analog field record is retained for verification. Recordings are normally made at 10-foot intervals by simultaneously raising or lowering the source and detectors. Seismic energy is generated by one or more sources such as a small explosive charge, borehole airgun, mechanical device, etc.

INTERPRETATION

Data obtained from cross-hole tests are the digitized wave forms and times required for both "P" compressional and "S" shear waves to travel from the source to each of the component geophones. The "P" wave is readily identified as the first arrival time to the detector. The arrival of the "S" wave is sometimes less apparent and may require some processing. Traces from all three components of each geophone are examined on the computer system for expected characteristics such as particle motion, amplitude ratios, etc.

For an accurate determination of the velocities, all distances between the source and the geophones must be corrected for drift or misalignment of boreholes. This is normally accomplished by a borehole verticality survey.

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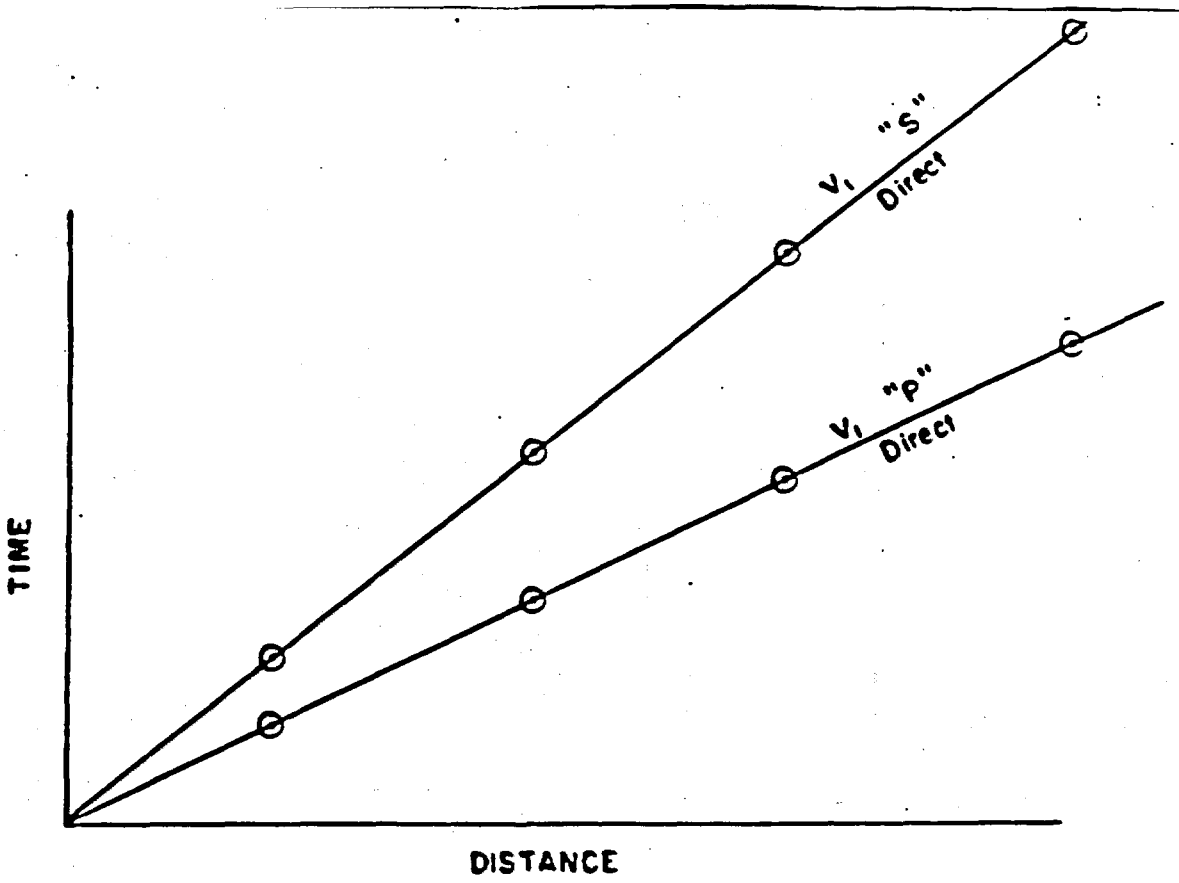
Velocity is the direct distance traveled divided by the travel time. A plot of seismic wave arrival times vs. source to detector distance is shown on Figure 1. It should be noted that the velocity lines drawn through the individual arrival times tie to time zero at the energy source indicating that seismic waves have propagated through the same velocity layer.

If a nearby higher velocity layer exists the wave will refract and travel along that layer. At some distance from the source the least time path from source to detector will become the refracted wave path rather than the direct wave path as shown on Figure 2. The velocities for each layer are shown on the time dis- tance plot. It should be noted that the velocity lines through the layer in which the source is located tie into time zero; however, the velocity lines for the refracted arrivals tie in at a time related to the distance of the refracting layer above or below the source. In such instances, calculations based on Snell's law may be used to compute the distance above or below the source for the adjacent zones of higher velocity material.


TIME
DISTANCE
V_1 "S" Direct
V_1 "p" Direct

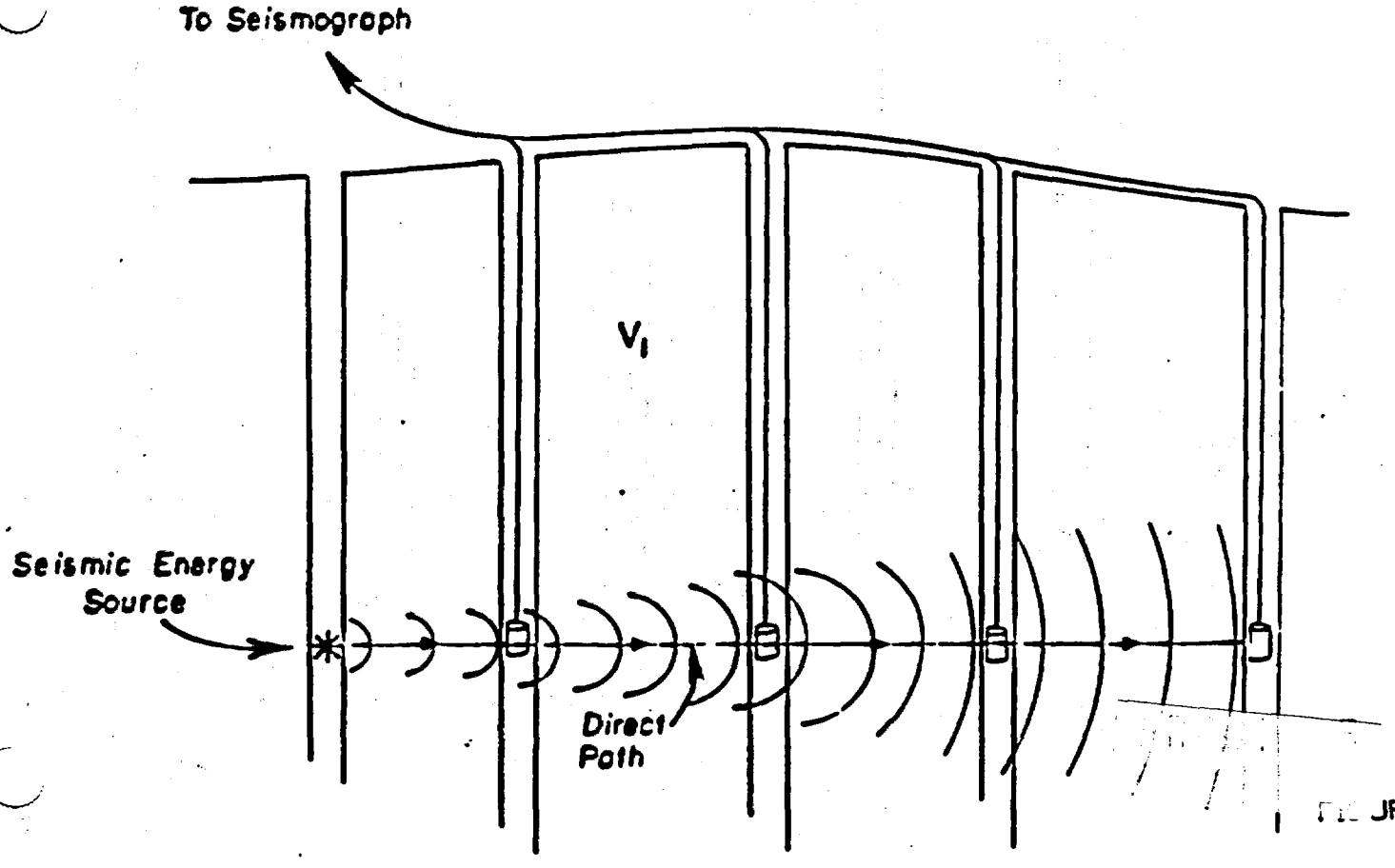
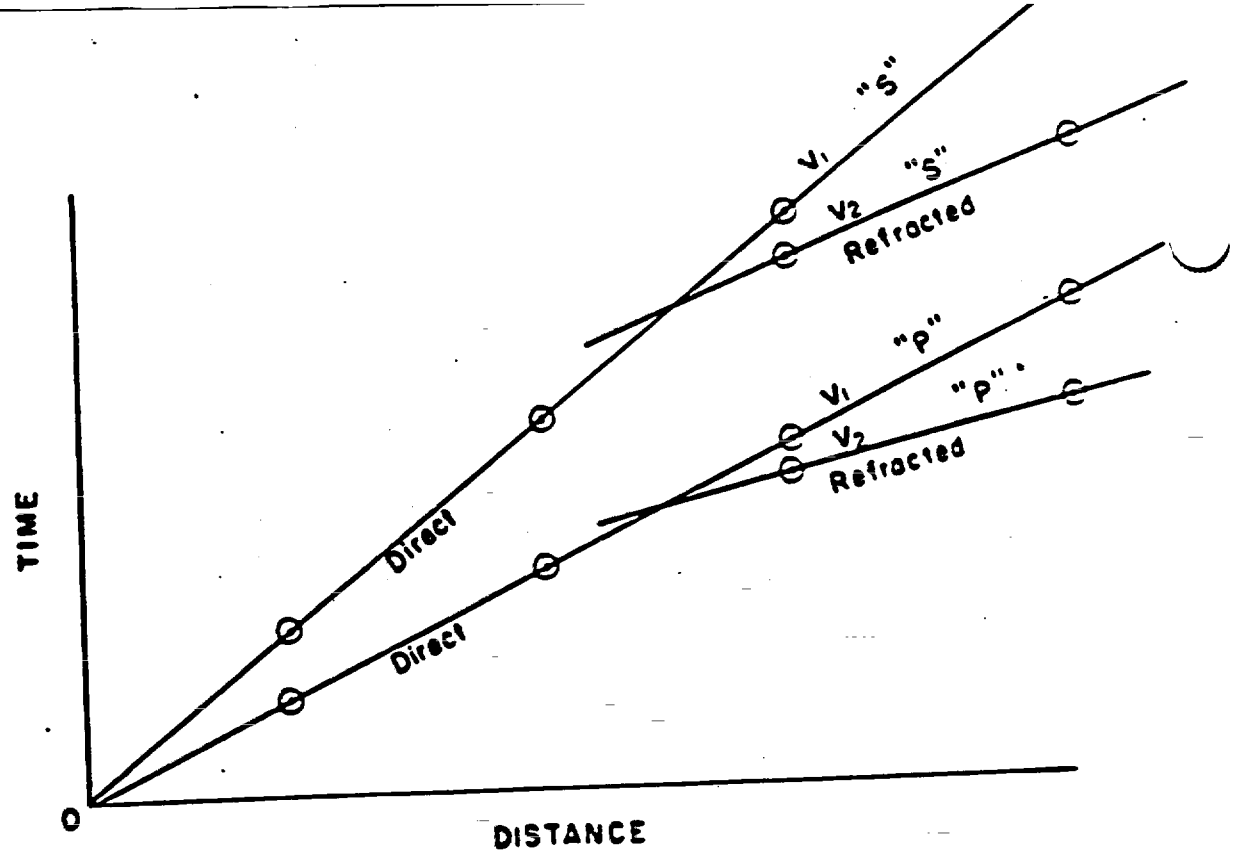

To Seismograph
V_1
Seismic Energy Source
Direct Path

FIGURE 1



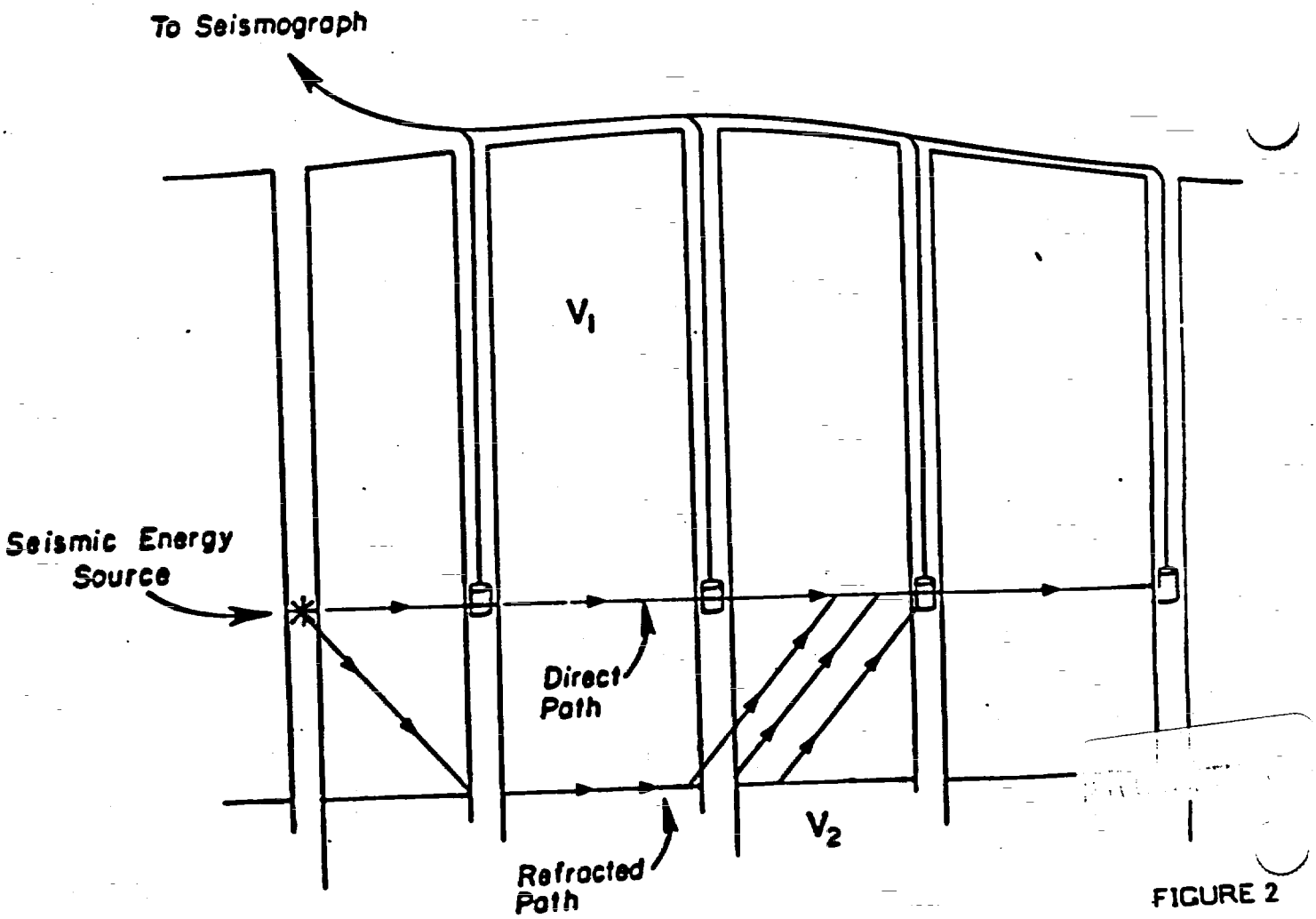


FIGURE 2

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APPENDIX C

BOREHOLE SEISMIC IMAGING
METHOD OF INVESTIGATION

Borehole imaging is a seismic technique used to detect and characterize soil and bedrock conditions such as voiding, weathering, or other conditions associated with deteriorated rock or concrete. The seismic imaging method provides a two or three dimensional representation of seismic velocities in the vicinity of a borehole using energy sources at or near the ground surface and detectors placed in the borehole. Either compressional or shear wave velocities can be obtained using this technique, depending on the seismic source and receivers used and the objectives of the particular investigation. Typical applications of seismic imaging include delineation of sinkholes in karst terrain and identification of voids or weathered concrete in dams or other large structures.

Figure 1 shows a schematic illustration of the seismic imaging method. Seismic sources used during imaging surveys may include explosives, a weight drop system, sledge hammer blows, or a seisgun. Seismic detectors are generally arrays of either geophones or hydrophones, but accelerometers can be used for cases where the source to detector distances are very small. Weston Geophysical records seismic imaging data on a proprietary WesComp™ digital data acquisition and processing system. This acquisition system allows field processing for preliminary data evaluation and interpretation. The field data are stored on magnetic diskette for later playback or further processing using a minicomputer at Weston's offices.

As shown in Figure 1, a void or fractured/weathered zone can be identified when seismic ray paths intersect the anomalous region. Late seismic arrivals are caused by the longer travel paths needed for the seismic waves to go around air-filled voids, or by a slower travel path through loosely filled voids or areas of weathered material. The dimensions of the anomalous velocity zone can be estimated by moving the energy sources to different distances and azimuths and/or by moving the seismic sensors to different locations within the borehole. Cross borehole imaging can significantly increase the number and coverage of seismic ray paths available for analysis. This methodology produces a greater number of ray paths which both intersect and circumvent the anomalous zone, enabling a more accurate estimation of the zone's dimensions.

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Processing of the seismic imaging data requires use of proprietary computer software. The software enables tomographic modelling of the seismic arrival times, analogues to the CAT scan technology used in medical diagnosis. In seismic imaging, tomography is used to generate a graphical representation of the velocity structure in the area investigated. An example of the final product of the seismic imaging technique, a velocity cross section, is included as Figure 2.

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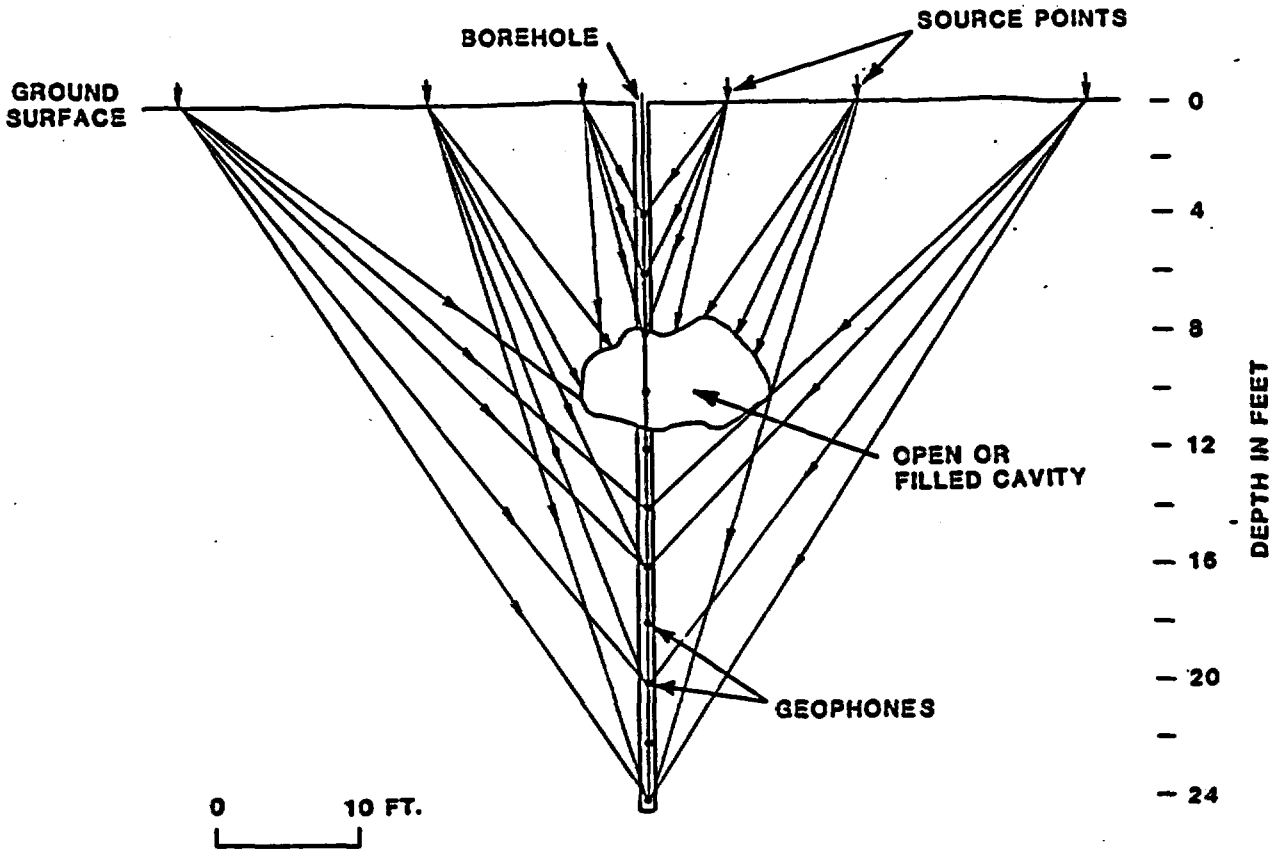
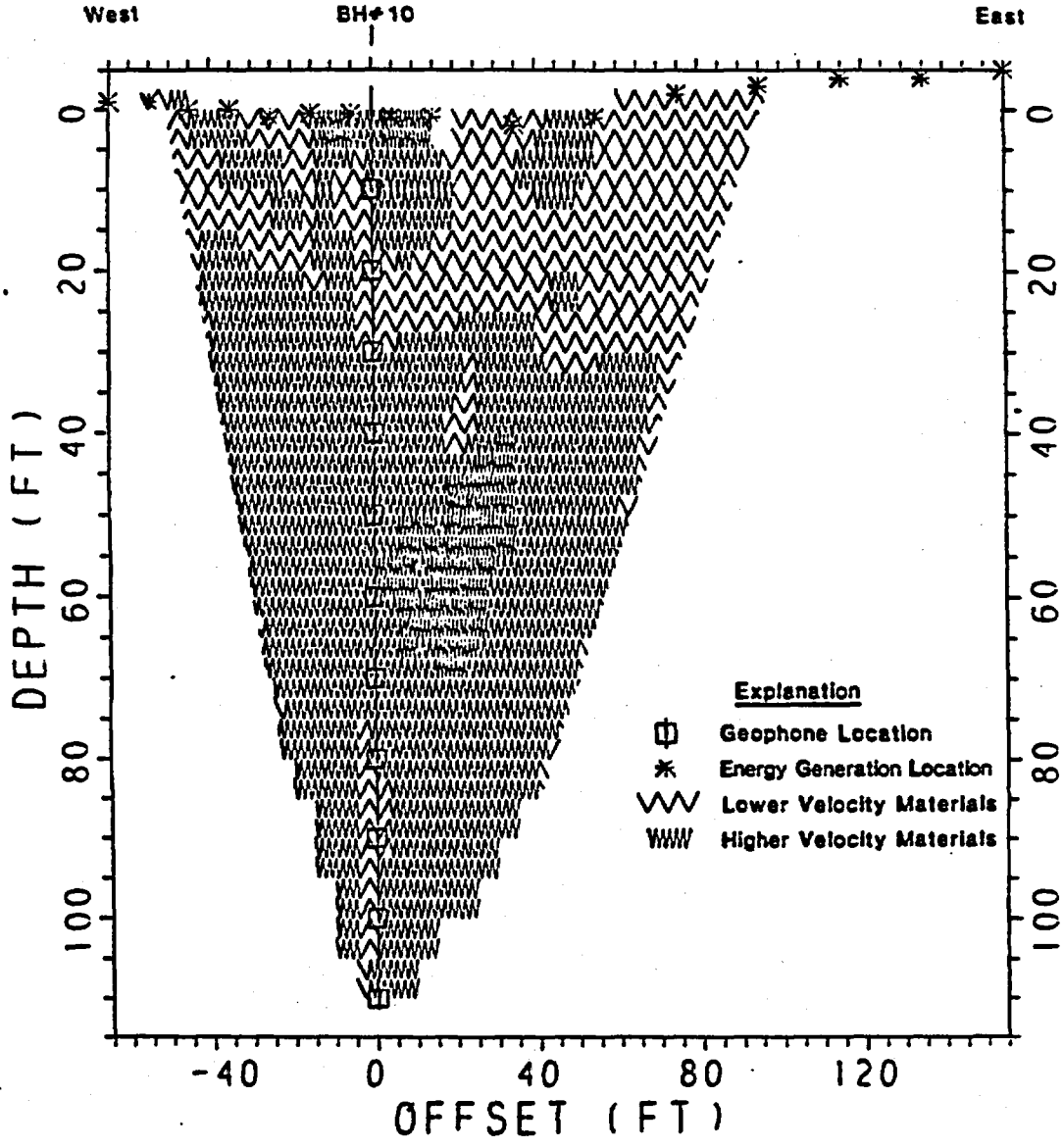


Seismic Ray Paths Impinging On A Void

Figure 1



Graphical Representation Of
Borehole Imaging Results

2

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DESCRIPTION OF IMAGERY Log heads Fig D-5

NUMBER AND TYPE OF IMAGERY ITEM(S) Oversized Map

APPALACHIAN COAL SURVEYS

GEOPHYSICAL BOREHOLE LOG DATA BASE

VERTICALITY ANALYSIS

				BOREHOLE FACTOR:	9
				UNIT #:	61
COMPANY:	BAKER/TSA	LOCATION		OPERATOR:	CBC
HOLE #:	MW-1	GRID:		DATE:	24-Sep-87
DRILL DEPTH:	150 FT.	NORTH:	FT.	DRILLING CO:	PA DRILLING
BIT DIA:	6.0 IN.	EAST:	FT.	DRILLER:	
WATER LEVEL:	25 FT.	ELEV:	FT.	CREW SIZE:	
CASING DEPTH:	52 FT.	COUNTY:	Berks	METHOD:	Rotary
CASING DIA:	6.00 IN.	STATE:	PA	FLUID:	Air
CASING FACTOR:	0.90			DRILLING FACTOR:	1.5

ALL VERTICALITY RECORDS ARE MADE MAGNETICALLY
RESULTS MAY BE INFLUENCED BY LOCAL MAGNETIC
ANOMALIES AND BY WELL CASING (MAGNETIC).

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APPALACHIAN COAL SURVEYS
VERTICALITY ANALYSIS
HOLE # MW-1 UPHOLE TRAVERSE

DEPTH FT.	DEG N-S	DLT LAT	LAT	DEG E-W	DLT DEP	DEP
0	0.009321	0	0	-0.17603	0	0
10	0.522054	0.089441	0.089441	0.210201	0.067372	0.067372
20	-0.48690	-0.08493	-0.00314	0.048321	0.008427	0.057389
30	0.046854	0.008173	-0.00162	-0.20703	-0.03611	0.030703
40	-0.35826	-0.06249	-0.04949	-0.36891	-0.06435	-0.03297
50	-0.01362	-0.00237	-0.03759	0.006141	0.001070	-0.02445
60	-0.03954	-0.00689	-0.03741	0.133821	0.023343	-0.00938
70	-0.83538	-0.14571	-0.17621	-0.27885	-0.04864	-0.05834
80	-0.18930	-0.03301	-0.20834	-0.53535	-0.09337	-0.13413
90	-0.74418	-0.12979	-0.34361	-0.55473	-0.09675	-0.24233
100	-1.21650	-0.21216	-0.51756	-1.05291	-0.18364	-0.41595
110	-1.01010	-0.17616	-0.65634	-1.14411	-0.19953	-0.58558
120	-0.85746	-0.14953	-0.78590	-1.01757	-0.17750	-0.73457
130	-0.95826	-0.16712	-0.90761	-1.57389	-0.27449	-0.99009
140	-1.00818	-0.17580	-1.04018	-1.92045	-0.33491	-1.29012
148	-0.38898	-0.06783	-0.99118	-1.32993	-0.23178	-1.39522

APPALACHIAN COAL SURVEYS
VERTICALITY ANALYSIS
HOLE # MW-1 DOWNHOLE TRAVERSE

DEPTH FT.	DEG N-S	DLT LAT	LAT	DEG E-W	DLT DEP	DEP
0	-0.05747	0	0	-0.04879	0	0
10	-0.61879	-0.09791	-0.09791	-0.39087	-0.05967	-0.05967
20	-0.00247	-0.00043	-0.08999	0.417387	0.072808	0.020257
30	0.630162	0.109926	0.010032	0.001287	0.000224	0.008511
40	0.238482	0.041601	0.044578	-0.17199	-0.03000	-0.01616
50	0.183762	0.032056	0.068742	0.262347	0.045764	0.020815
60	-0.55543	-0.09689	-0.02649	-0.11157	-0.01946	-0.01002
70	-0.69559	-0.12133	-0.13897	0.124407	0.021702	0.009455
80	-0.70615	-0.12317	-0.25062	-0.26433	-0.04610	-0.04007
90	-0.82423	-0.14376	-0.36560	-1.80219	-0.31421	-0.37222
100	-3.08599	-0.53809	-0.86739	-1.48983	-0.25984	-0.58956
110	-0.87127	-0.15186	-0.96856	-2.10087	-0.36628	-0.93361
120	-2.41399	-0.42090	-1.38329	-2.51811	-0.43903	-1.33133
130	-0.74551	-0.12992	-1.45231	-1.83183	-0.31941	-1.61540
140	-3.12727	-0.54525	-1.96092	-2.30835	-0.40251	-1.95734
148	-1.06807	-0.18619	-1.95624	-1.85121	-0.32280	-2.22617

AVERAGE

DEPTH	LATITUDE	DEPARTURE
0	0	0
10	-0.00424	0.00385
20	-0.04657	0.03882
30	0.00420	0.01961
40	-0.00246	-0.02457
50	0.01557	-0.00182
60	-0.03195	-0.00970
70	-0.15760	-0.02444
80	-0.22948	-0.08711
90	-0.35461	-0.30728
100	-0.69248	-0.50276
110	-0.81245	-0.75960
120	-1.08460	-1.03296
130	-1.17997	-1.30275
140	-1.50056	-1.62374
148	-1.47371	-1.81070

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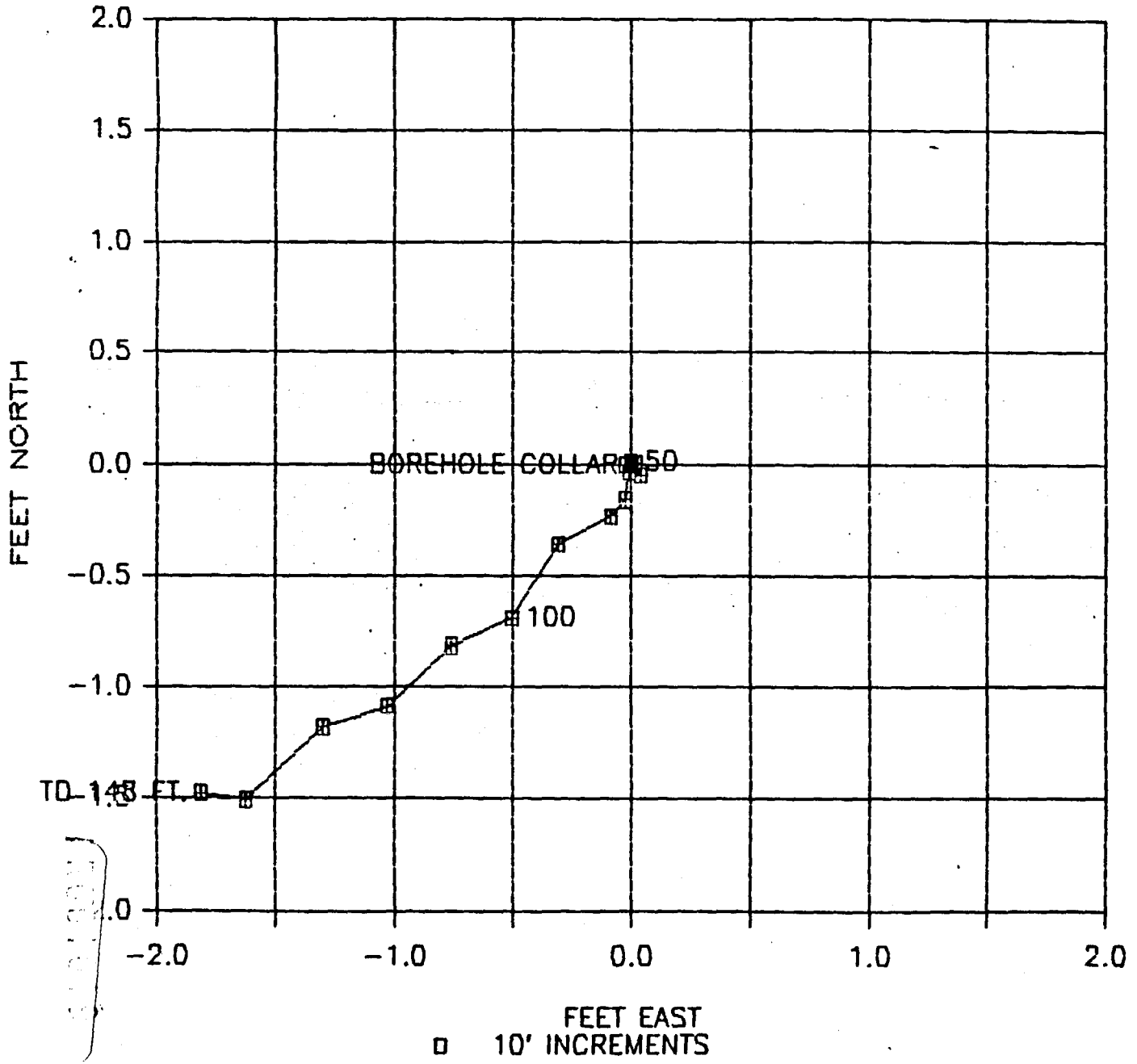
APPALACHIAN COAL SURVEYS

VERTICALITY ANALYSIS MW-1



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APPALACHIAN COAL SURVEYS

GEOPHYSICAL BOREHOLE LOG DATA BASE

VERTICALITY ANALYSIS

						BOREHOLE FACTOR:	9
						UNIT #:	61
COMPANY:	BAKER/TSA	LOCATION				OPERATOR:	CBC
HOLE #:	NW-2	GRID:				DATE:	24-Sep-87
DRILL DEPTH:	300 FT.	NORTH:		FT.		DRILLING CO:	PA DRILLING
BIT DIA:	6.0 IN.	EAST:		FT.		DRILLER:	
WATER LEVEL:	23 FT.	ELEV:		FT.		CREW SIZE:	
CASING DEPTH:	57 FT.	COUNTY:	Berks			METHOD:	Rotary
CASING DIA:	0.90 IN.	STATE:	PA			FLUID:	Air
CASING FACTOR:	0.70					DRILLING FACTOR:	1.5

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APPALACHIAN COAL SURVEYS
VERTICALITY ANALYSIS
HOLE # MV-2 UPHOLE TRAVERSE

DEPTH FT.	DEG N-S	DLT LAT	LAT	DEG E-W	DLT DEP	DEP
0	0.045863	0	0	-0.04718	0	0
10	0.735855	0.120360	0.120360	-0.09149	-0.00773	-0.00773
20	-0.70798	-0.12349	0.022352	0.232265	0.040515	0.011784
30	-0.21550	-0.03759	-0.00800	0.017945	0.003129	0.008229
40	-0.57262	-0.09988	-0.10433	-0.14279	-0.02490	-0.03350
50	0.382575	0.066725	-0.02819	-0.48137	-0.08396	-0.11143
60	-0.57838	-0.10088	-0.11815	-0.79943	-0.13942	-0.23606
70	-0.45454	-0.07928	-0.19054	-0.66491	-0.11597	-0.33128
80	0.325935	0.056844	-0.12863	-0.69569	-0.12133	-0.42748
90	-0.42574	-0.07424	-0.19782	-0.53951	-0.09408	-0.52348
100	-0.12526	-0.02184	-0.21527	-0.56915	-0.09931	-0.58414
110	-1.41838	-0.24730	-0.50874	-0.63527	-0.11072	-0.69240
120	-2.24110	-0.39042	-0.93513	-1.21553	-0.21185	-0.97353
130	-1.27246	-0.22179	-1.16928	-0.41639	-0.07251	-0.98536
140	-1.88110	-0.32767	-1.54312	-0.66605	-0.11603	-1.12955
150	-2.78158	-0.48478	-2.07406	-0.12227	-0.02123	-1.21252
160	-4.16110	-0.72476	-2.73119	-0.60221	-0.10486	-1.33560
170	-4.17742	-0.72767	-3.35552	-1.73423	-0.30212	-1.60483
180	-3.03694	-0.52907	-3.80109	-2.69753	-0.46972	-1.98986
190	-2.85550	-0.49739	-4.28990	-1.48001	-0.25762	-2.13035
200	-4.42318	-0.77083	-5.03324	-1.14485	-0.19943	-2.38735
210	-2.18254	-0.38041	-5.33905	-2.91527	-0.50794	-2.81655
220	-1.93870	-0.33779	-5.70468	-2.36237	-0.41154	-3.10878
230	-1.81390	-0.31600	-6.03488	-1.30331	-0.22691	-3.24981
240	-2.70094	-0.47067	-6.53172	0.263045	0.045937	-3.26501
250	-1.47406	-0.25683	-6.71837	-1.21439	-0.21156	-3.49539
260	-3.08110	-0.53697	-7.24795	-2.27687	-0.39628	-3.95360
270	-3.23854	-0.56407	-7.79340	-1.67951	-0.29245	-4.13702
280	-1.33006	-0.23169	-7.97483	-3.19571	-0.55641	-4.58420
290	-3.75886	-0.65475	-8.52890	-1.39451	-0.24289	-4.85366
292	-2.74702	-0.47858	-8.55610	-2.25635	-0.39305	-5.01869

APPALACHIAN COAL SURVEYS
VERTICALITY ANALYSIS
HOLE # MV-2 DOWNHOLE TRAVERSE

DEPTH FT.	DEG N-S	DLT LAT	LAT	DEG E-W	DLT DEP	DEP
0	0.013378	0	0	-0.00809	0	0
10	0.038678	0.004412	0.004412	0.176626	0.032219	0.032219
20	0.114518	0.019977	0.025405	-0.02971	-0.00518	0.011942
30	-0.16868	-0.02942	-0.00233	-0.07303	-0.01274	0.001408
40	-0.01316	-0.00229	-0.00579	-0.38881	-0.06782	-0.06301
50	-0.27332	-0.04767	-0.05060	0.011326	0.001878	-0.05256
60	-0.48932	-0.08535	-0.10731	-1.33729	-0.23302	-0.27583
70	0.125078	0.021823	-0.08966	-1.11499	-0.19447	-0.45417
80	-0.35780	-0.06241	-0.14704	-0.44239	-0.07702	-0.51507
90	-1.42532	-0.24854	-0.37381	1.227706	0.214077	-0.22746
100	-0.70820	-0.12351	-0.47387	-0.75475	-0.13160	-0.40020
110	-0.64100	-0.11176	-0.55264	2.238886	0.390263	-0.03398
120	-0.98180	-0.17123	-0.75970	-2.08171	-0.36300	-0.38941
130	-2.63876	-0.46013	-1.18633	-0.43099	-0.07508	-0.43684
140	0.202838	0.035358	-1.10426	-2.00989	-0.34986	-0.84671
150	-2.76068	-0.48136	-1.56134	-3.02107	-0.52666	-1.30481
160	-3.60548	-0.62857	-2.13868	0.310006	0.053972	-1.17929
170	-2.45828	-0.42833	-2.54239	-2.21851	-0.38654	-1.64963
180	-5.69924	-0.99274	-3.43681	0.491266	0.085601	-1.55785
190	-1.58948	-0.27702	-3.65039	-3.23539	-0.56352	-2.14183
200	-6.00356	-1.04564	-4.60905	-0.30331	-0.05284	-2.15728
210	-2.17124	-0.37818	-4.89592	-1.42735	-0.24795	-2.44717
220	-4.77860	-0.83254	-5.70268	-1.36351	-0.23753	-2.56249
230	-2.68964	-0.46856	-6.06326	-1.14121	-0.19811	-2.82339
240	-5.35748	-0.93302	-6.98740	-0.90523	-0.15757	-2.87456
250	-3.04772	-0.53095	-7.42403	-0.93373	-0.16251	-3.08397
260	-5.46884	-0.95263	-8.30470	-0.25429	-0.04434	-3.07999
270	-3.56516	-0.62095	-8.83934	-2.00305	-0.34906	-3.45468
280	-3.13220	-0.54566	-9.30637	-0.80377	-0.13980	-3.60223
290	-7.23908	-1.25972	-10.4946	-1.23583	-0.21539	-3.74449
292	-6.69092	-1.16412	-10.5317	-0.42073	-0.07331	-3.76651

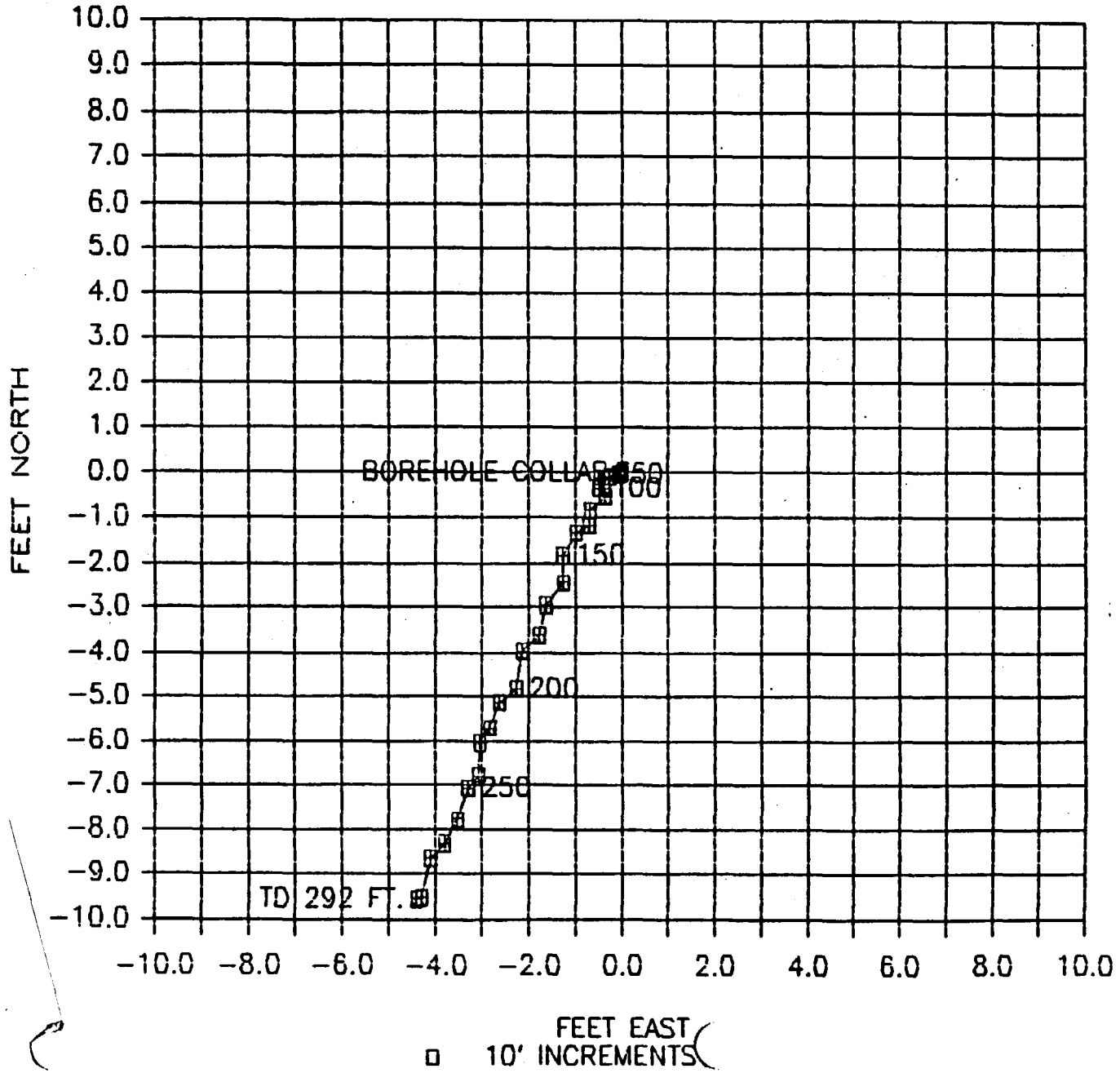
AVERAGE

DEPTH	LATITUDE	DEPARTURE
0	0	0
10	0.06239	0.01224
20	0.02388	0.01186
30	-0.00517	0.00482
40	-0.05507	-0.04826
50	-0.03940	-0.08200
60	-0.11274	-0.25595
70	-0.14011	-0.39273
80	-0.13784	-0.47128
90	-0.28582	-0.37547
100	-0.34458	-0.49218
110	-0.53070	-0.36320
120	-0.84742	-0.68148
130	-1.17781	-0.71110
140	-1.32369	-0.98814
150	-1.81770	-1.25867
160	-2.43494	-1.25745
170	-2.94896	-1.62724
180	-3.61895	-1.77386
190	-3.97015	-2.13610
200	-4.82115	-2.27232
210	-5.12749	-2.63186
220	-5.70368	-2.83564
230	-6.04907	-3.03661
240	-6.76956	-3.06979
250	-7.07120	-3.28968
260	-7.77633	-3.51680
270	-8.31738	-3.79586
280	-8.64060	-4.09322
290	-9.51177	-4.29908
292	-9.54394	-4.39260

AR300540

APPALACHIAN COAL SURVEYS

VERTICALITY ANALYSIS MW-2



AR300541

APPALACHIAN COAL SURVEYS

GEOPHYSICAL BOREHOLE LOG DATA BASE

VERTICALITY ANALYSIS

					BOREHOLE FACTOR:	9
					UNIT #:	61
COMPANY:	BAKER/TSA	LOCATION			OPERATOR:	CBC
HOLE #:	MW-3	GRID:			DATE:	25-Sep-87
DRILL DEPTH:	152 FT.	NORTH:		FT.	DRILLING CO:	PA DRILLING
BIT DIA:	6.0 IN.	EAST:		FT.	DRILLER:	
WATER LEVEL:	39 FT.	ELEV:		FT.	CREW SIZE:	
CASING DEPTH:	32 FT.	COUNTY:	Berks		METHOD:	Rotary
CASING DIA:	6.00 IN.	STATE:	PA		FLUID:	Air
CASING FACTOR:	0.90				DRILLING FACTOR:	1.5

ALL VERTICALITY RECORDS ARE MADE MAGNETICALLY
RESULTS MAY BE INFLUENCED BY LOCAL MAGNETIC
ANOMALIES AND BY WELL CASING (MAGNETIC).

AR300542

APPALACHIAN COAL SURVEYS
VERTICALITY ANALYSIS
HOLE # NW-3 UPHOLE TRAVERSE

DEPTH FT.	DEG N-S	DLT LAT	LAT	DEG E-W	DLT DEP	DEP
0	-0.04620	0	0	0.162762	0	0
10	-0.92296	-0.15293	-0.15293	0.959328	0.138929	0.138929
20	0.565997	0.098722	-0.05553	-0.06895	-0.01203	0.136488
30	0.283757	0.049486	0.008042	-0.99805	-0.17409	-0.02841
40	0.635117	0.110782	0.109636	0.026808	0.004722	-0.02424
50	1.593197	0.277883	0.372804	-0.17953	-0.03131	-0.02489
60	0.919277	0.160335	0.493649	1.304748	0.227511	0.173434
70	0.997997	0.174075	0.656191	-0.17839	-0.03111	0.152305
80	0.817517	0.142598	0.776540	-0.56827	-0.09907	0.032398
90	0.451757	0.078798	0.848326	-0.50329	-0.08776	-0.05432
100	-0.31144	-0.05432	0.810097	-0.30493	-0.05319	-0.13729
110	0.864557	0.150782	0.966428	0.440628	0.076860	-0.07431
120	-0.49960	-0.08714	0.910279	-0.91939	-0.16036	-0.26485
130	-0.22120	-0.03857	0.864193	-0.46111	-0.08042	-0.30944
140	0.651437	0.113583	0.999902	-1.14739	-0.20021	-0.46587
150	-1.20616	-0.21037	0.822362	-1.22263	-0.21327	-0.76609
154	-1.45576	-0.25390	0.666571	-1.69801	-0.29610	-0.76131

APPALACHIAN COAL SURVEYS
VERTICALITY ANALYSIS
HOLE # NW-3 DOWNHOLE TRAVERSE

DEPTH FT.	DEG N-S	DLT LAT	LAT	DEG E-W	DLT DEP	DEP
0	0.046513	0	0	0.032912	0	0
10	-0.25635	-0.05282	-0.05282	-0.04493	-0.01357	-0.01357
20	0.047009	0.008201	-0.02008	-0.27293	-0.04761	-0.04445
30	0.037409	0.006525	-0.00811	0.138601	0.024168	-0.00574
40	1.144289	0.199593	0.165617	-0.26381	-0.04600	-0.05609
50	-0.56835	-0.09913	0.067414	-0.23759	-0.04139	-0.06207
60	1.079969	0.188368	0.243148	0.738241	0.128702	0.049546
70	0.019169	0.003332	0.200033	-1.39583	-0.24345	-0.18970
80	-1.20099	-0.20939	0.014504	0.249181	0.043368	-0.13596
90	0.442529	0.077168	0.056938	-0.09509	-0.01657	-0.11195
100	0.701153	0.122302	0.180504	-0.28547	-0.04983	-0.16336
110	-0.99747	-0.17393	-0.02347	-1.44371	-0.25179	-0.50133
120	-1.98147	-0.34551	-0.30764	0.046261	0.008053	-0.51990
130	0.863969	0.150681	-0.17110	-0.76655	-0.13376	-0.73488
140	-0.91587	-0.15972	-0.33978	-2.31695	-0.40405	-1.11087
150	-2.91939	-0.50901	-0.79447	-1.44485	-0.25199	-1.34515
154	-1.89027	-0.32956	-0.78228	-1.32287	-0.23067	-1.41440

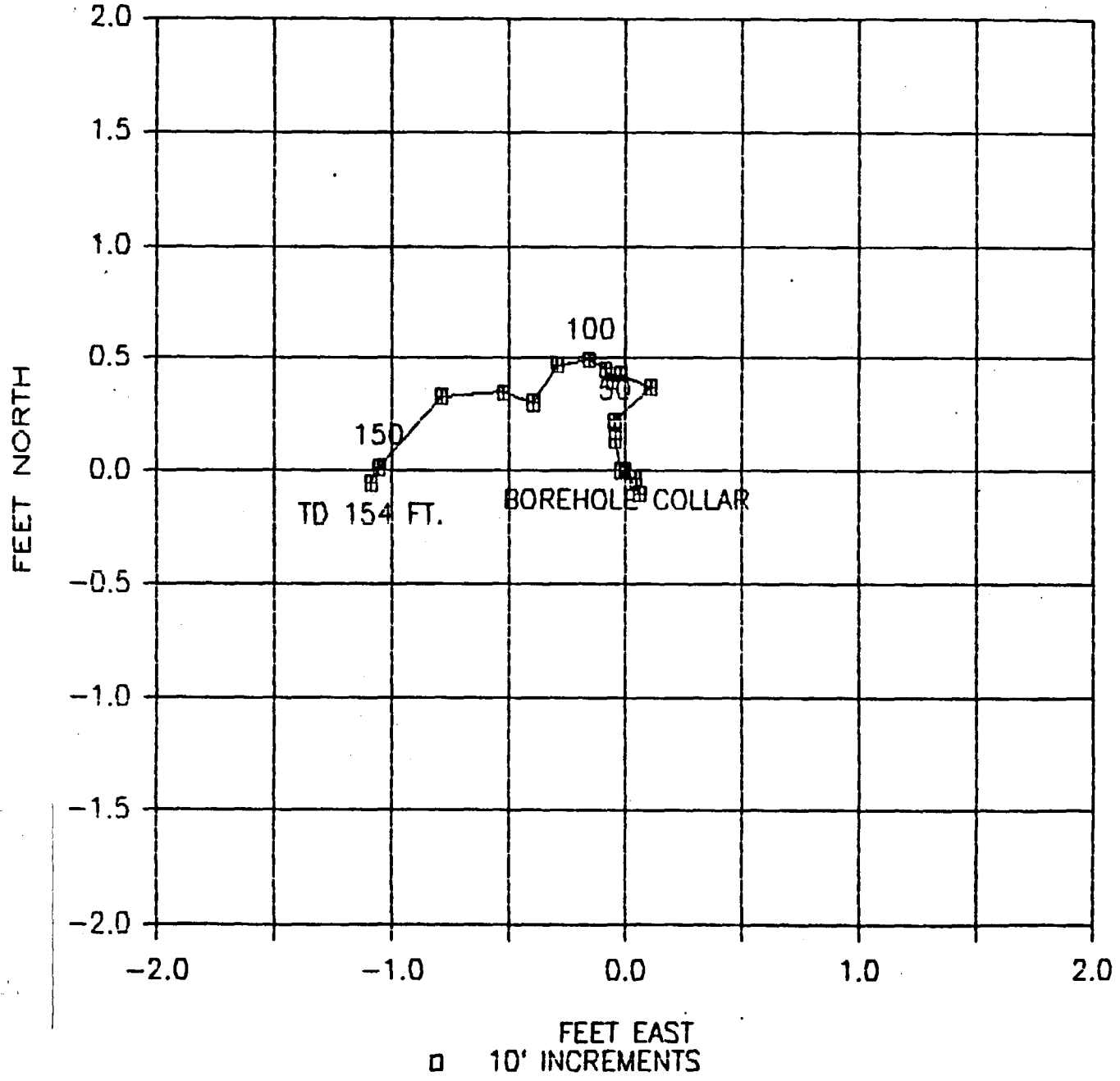
AVERAGE

DEPTH	LATITUDE	DEPARTURE
0	0	0
10	-0.10288	0.06268
20	-0.03781	0.04601
30	-0.00004	-0.01708
40	0.13763	-0.04017
50	0.22011	-0.04349
60	0.36840	0.11149
70	0.42811	-0.01870
80	0.39552	-0.05178
90	0.45263	-0.08314
100	0.49530	-0.15033
110	0.47148	-0.28783
120	0.30132	-0.39238
130	0.34654	-0.52216
140	0.33006	-0.78837
150	0.01395	-1.05562
154	-0.05786	-1.08786

AR300543

APPALACHIAN COAL SURVEYS

VERTICALITY ANALYSIS MW-3



AR300544

APPALACHIAN COAL SURVEYS

GEOPHYSICAL BOREHOLE LOG DATA BASE

VERTICALITY ANALYSIS

				BOREHOLE FACTOR:	9
				UNIT #:	61
COMPANY:	BAKER/TSA	LOCATION		OPERATOR:	CBC
HOLE #:	MW-4	GRID:		DATE:	25-Sep-87
DRILL DEPTH:	150 FT.	NORTH:	FT.	DRILLING CO:	PA DRILLING
BIT DIA:	6.0 IN.	EAST:	FT.	DRILLER:	
WATER LEVEL:	16 FT.	ELEV:	FT.	CREW SIZE:	
CASING DEPTH:	150 FT.	COUNTY:	Berks	METHOD:	Rotary
CASING DIA:	4.00 IN.	STATE:	PA	FLUID:	Air
CASING FACTOR:	0.90			DRILLING FACTOR:	1.5

ALL VERTICALITY RECORDS ARE MADE MAGNETICALLY
RESULTS MAY BE INFLUENCED BY LOCAL MAGNETIC
ANOMALIES AND BY WELL CASING (MAGNETIC).

APPALACHIAN COAL SURVEYS
VERTICALITY ANALYSIS
HOLE # MW-4 UPHOLE TRAVERSE

DEPTH FT.	DEG N-S	DLT LAT	LAT	DEG E-W	DLT DEP	DEP
0	-0.07549	0	0	-0.05203	0	0
10	-0.71049	-0.11076	-0.11076	-0.52451	-0.08241	-0.08241
20	0.224547	0.039165	-0.05541	-0.63965	-0.11156	-0.16939
30	0.578787	0.100950	0.013160	0.998529	0.174150	0.009058
40	0.065187	0.011366	0.052765	-1.22447	-0.21356	-0.18210
50	-0.49353	-0.08608	-0.01763	-1.32251	-0.23067	-0.42975
60	-0.85161	-0.14854	-0.18900	-1.01927	-0.17777	-0.59347
70	0.160227	0.027967	-0.15808	-1.71809	-0.29961	-0.85280
80	0.333027	0.058056	-0.06291	-2.75207	-0.47987	-1.28245
90	-1.03593	-0.18067	-0.29604	-2.02475	-0.35307	-1.63162
100	0.206307	0.035982	-0.24036	-2.06579	-0.36027	-1.95002
110	0.475107	0.082866	-0.18886	-1.13099	-0.19725	-2.14575
120	0.714147	0.124562	-0.08797	-0.90755	-0.15829	-2.28026
130	1.077027	0.187870	0.091463	-0.45269	-0.07896	-2.33364
140	0.370467	0.064624	0.138612	-0.56783	-0.09904	-2.45165
143	0.559587	0.097613	0.181995	-0.57695	-0.10064	-2.44647

APPALACHIAN COAL SURVEYS
VERTICALITY ANALYSIS
HOLE # MW-4 DOWNHOLE TRAVERSE

DEPTH FT.	DEG N-S	DLT LAT	LAT	DEG E-W	DLT DEP	DEP
0	0.102441	0	0	-0.07663	0	0
10	-0.07602	-0.03113	-0.03113	-1.04251	-0.16848	-0.16848
20	-0.08370	-0.01462	-0.02477	0.310668	0.054170	-0.10114
30	0.251334	0.043834	-0.01789	0.710808	0.123947	0.013305
40	0.378054	0.065937	0.058644	-0.94675	-0.16514	-0.13469
50	0.165894	0.028925	0.102857	-0.48733	-0.08501	-0.19699
60	-0.78930	-0.13767	-0.04733	-1.23973	-0.21624	-0.38793
70	0.491334	0.085693	0.064531	-0.72901	-0.12714	-0.50927
80	-0.02034	-0.00358	0.075226	-0.83731	-0.14604	-0.61769
90	1.045254	0.182263	0.213174	-0.20917	-0.03648	-0.66129
100	1.633734	0.284913	0.441061	0.021564	0.003760	-0.65669
110	1.711494	0.298481	0.726361	0.247968	0.043254	-0.60782
120	1.347654	0.235028	0.909714	-0.11341	-0.01978	-0.63472
130	1.379334	0.240581	1.166253	-0.31519	-0.05497	-0.71729
140	0.838854	0.146321	1.299226	-0.39043	-0.06810	-0.75731
143	0.856134	0.149335	1.332573	0.027948	0.004873	-0.75864

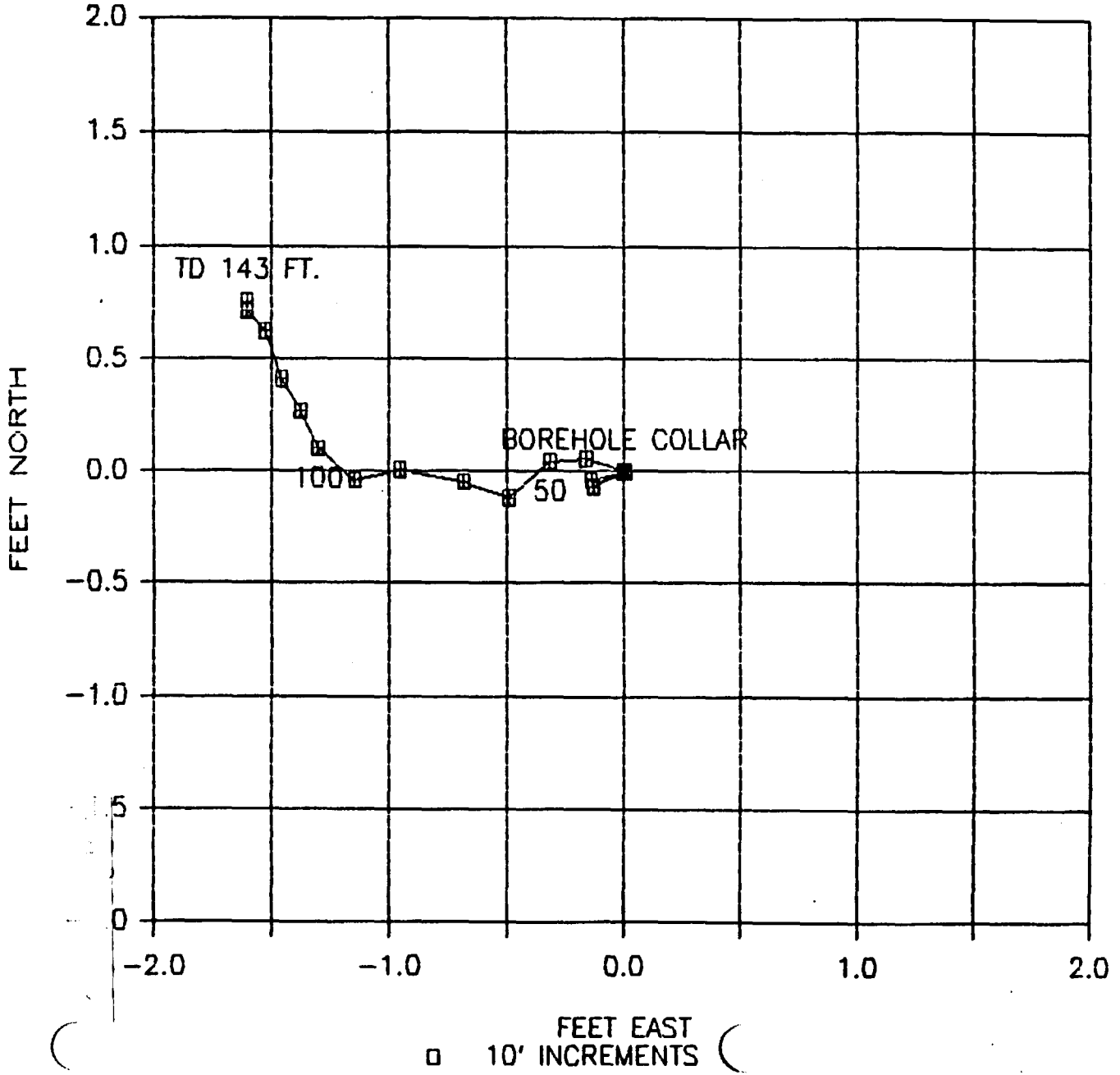
AVERAGE

DEPTH	LATITUDE	DEPARTURE
0	0	0
10	-0.07095	-0.12545
20	-0.04009	-0.13527
30	-0.00237	0.01118
40	0.05570	-0.15840
50	0.04261	-0.31337
60	-0.11817	-0.49071
70	-0.04678	-0.68104
80	0.00615	-0.95007
90	-0.04144	-1.14646
100	0.10035	-1.30336
110	0.26875	-1.37679
120	0.41087	-1.45750
130	0.62886	-1.52547
140	0.71892	-1.60449
143	0.75728	-1.60256

AR300546

APPALACHIAN COAL SURVEYS

VERTICALITY ANALYSIS MW-4



AR300547

APPALACHIAN COAL SURVEYS

GEOPHYSICAL BOREHOLE LOG DATA BASE

VERTICALITY ANALYSIS

					BOREHOLE FACTOR:	9
					UNIT #:	61
COMPANY:	BAKER/TSA	LOCATION			OPERATOR:	CVBC
HOLE #:	MW-5	GRID:			DATE:	25-Sep-87
DRILL DEPTH:	150 FT.	NORTH:		FT.	DRILLING CO:	PA DRILLING
BIT DIA:	6.0 IN.	EAST:		FT.	DRILLER:	
WATER LEVEL:	24 FT.	ELEV:		FT.	CREW SIZE:	
CASING DEPTH:	50 FT.	COUNTY:	Berks		METHOD:	Rotary
CASING DIA:	6.00 IN.	STATE:	PA		FLUID:	Air
CASING FACTOR:	0.90				DRILLING FACTOR:	1.5

ALL VERTICALITY RECORDS ARE MADE MAGNETICALLY
RESULTS MAY BE INFLUENCED BY LOCAL MAGNETIC
ANOMALIES AND BY WELL CASING (MAGNETIC).

AR300548

APPALACHIAN COAL SURVEYS
VERTICALITY ANALYSIS
HOLE # NW-5 UPHOLE TRAVERSE

DEPTH FT.	DEG N-S	DLT LAT	LAT	DEG E-W	DLT DEP	DEP
0	0.221729	0	0	0.123929	0	0
10	0.112939	-0.01898	-0.01898	0.778399	0.114153	0.114153
20	-0.43810	-0.07641	-0.06491	-0.27610	-0.04814	0.061887
30	-0.02434	-0.00424	-0.03867	-0.46762	-0.08156	-0.02161
40	0.357739	0.062400	-0.00423	-0.24760	-0.04319	-0.08860
50	0.140779	0.024557	0.020827	0.173059	0.030188	-0.06393
60	0.304939	0.053192	0.068499	-0.01276	-0.00222	-0.05854
70	0.256939	0.044821	0.107465	-0.09142	-0.01594	-0.07065
80	0.514219	0.089685	0.198161	-0.91678	-0.15991	-0.21420
90	0.308779	0.053851	0.257711	-1.14820	-0.20026	-0.39413
100	0.433579	0.075603	0.355424	-1.14820	-0.20026	-0.57027
110	0.431659	0.075281	0.440089	-1.10146	-0.19209	-0.72076
120	0.851179	0.148433	0.614650	-1.39216	-0.24277	-0.95174
130	0.350059	0.061059	0.629343	-1.58368	-0.27609	-1.25005
140	1.133419	0.197644	0.792167	-0.46192	-0.08049	-1.32670
148	0.163819	0.028559	0.721630	-1.31692	-0.22951	-1.53914

APPALACHIAN COAL SURVEYS
VERTICALITY ANALYSIS
HOLE # NW-5 DOWNHOLE TRAVERSE

DEPTH FT.	DEG N-S	DLT LAT	LAT	DEG E-W	DLT DEP	DEP
0	0.211509	0	0	0.127385	0	0
10	1.329166	0.194912	0.194912	0.884823	0.132094	0.132094
20	-0.91819	-0.16015	0.017121	-1.11701	-0.19482	-0.02311
30	-0.46219	-0.08061	-0.03692	0.018423	0.003212	-0.02223
40	-0.66955	-0.11679	-0.16381	-0.79781	-0.13916	-0.13987
50	-0.47179	-0.08229	-0.22473	-0.52421	-0.09141	-0.23442
60	-0.25387	-0.04428	-0.24428	-0.47291	-0.08247	-0.27251
70	0.132046	0.023033	-0.23219	-0.79097	-0.13797	-0.40248
80	-0.26443	-0.04612	-0.27335	0.266943	0.046564	-0.35785
90	-0.89035	-0.15530	-0.41598	0.289743	0.050539	-0.31740
100	-0.28651	-0.04996	-0.46851	-0.51281	-0.08948	-0.40604
110	1.592206	0.277582	-0.13992	-0.48659	-0.08477	-0.55634
120	-0.38155	-0.06654	-0.25959	-1.38377	-0.24125	-0.82856
130	0.311566	0.054353	-0.21400	-1.34729	-0.23478	-1.06588
140	-0.52459	-0.09150	-0.35026	-1.76180	-0.30689	-1.26712
148	0.572686	0.099817	-0.13994	-1.87055	-0.32613	-1.64022

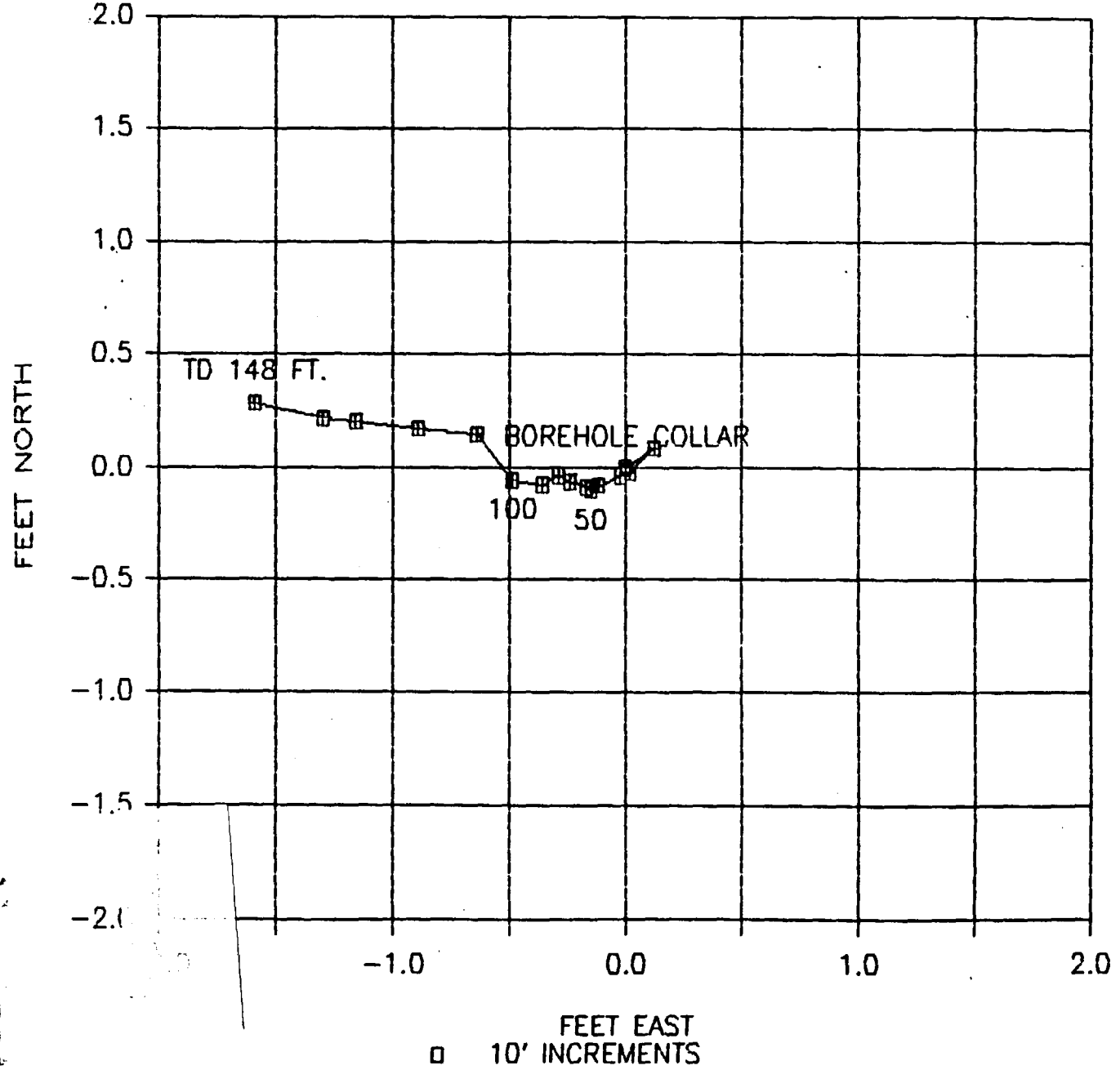
AVERAGE

DEPTH	LATITUDE	DEPARTURE
0	0	0
10	0.08797	0.12312
20	-0.02390	0.01939
30	-0.03780	-0.02193
40	-0.08403	-0.11424
50	-0.10195	-0.14918
60	-0.08789	-0.16553
70	-0.06236	-0.23657
80	-0.03759	-0.28603
90	-0.07914	-0.35577
100	-0.05654	-0.48816
110	0.15008	-0.63856
120	0.17753	-0.89016
130	0.20767	-1.15797
140	0.22095	-1.29692
148	0.29084	-1.58969

AR300549

APPALACHIAN COAL SURVEYS

VERTICALITY ANALYSIS MW-5



AR300550

APPALACHIAN COAL SURVEYS

GEOPHYSICAL BOREHOLE LOG DATA BASE

VERTICALITY ANALYSIS

				BOREHOLE FACTOR:	9
				UNIT #:	61
COMPANY:	BAKER/TSA	LOCATION		OPERATOR:	CBC
HOLE #:	NW-6	GRID:		DATE:	26-Sep-87
DRILL DEPTH:	152 FT.	NORTH:	FT.	DRILLING CO:	PA DRILLING
BIT DIA:	6.0 IN.	EAST:	FT.	DRILLER:	
WATER LEVEL:	21 FT.	ELEV:	FT.	CREW SIZE:	
CASING DEPTH:	66 FT.	COUNTY:	Berks	METHOD:	Rotary
CASING DIA:	6.00 IN.	STATE:	PA	FLUID:	Air
CASING FACTOR:	0.90			DRILLING FACTOR:	1.5

ALL VERTICALITY RECORDS ARE MADE MAGNETICALLY
RESULTS MAY BE INFLUENCED BY LOCAL MAGNETIC
ANOMALIES AND BY WELL CASING (MAGNETIC).

AR300551

APPALACHIAN COAL SURVEYS
VERTICALITY ANALYSIS
HOLE # MW-6 UPHOLE TRAVERSE

DEPTH FT.	DEG N-S	DLT LAT	LAT	DEG E-W	DLT DEP	DEP
0	-0.03641	0	0	-0.04854	0	0
10	-0.21339	-0.03087	-0.03087	-0.13610	-0.01527	-0.01527
20	-0.09723	-0.01696	-0.04550	0.167138	0.029154	0.017972
30	0.447081	0.077986	0.006351	-0.11558	-0.02016	0.008463
40	0.551721	0.096242	0.083827	-0.10418	-0.01817	-0.00899
50	0.566121	0.098751	0.159794	-0.13382	-0.02333	-0.05946
60	0.518121	0.090374	0.243626	-0.19766	-0.03447	-0.12444
70	0.669801	0.116830	0.357767	-0.57158	-0.09970	-0.25584
80	-0.23259	-0.04055	0.298283	-1.47218	-0.25674	-0.53732
90	0.459561	0.080169	0.367221	-1.23620	-0.21555	-0.71837
100	1.374441	0.239681	0.604212	-1.62608	-0.28349	-0.94212
110	1.154601	0.201323	0.801171	-1.94870	-0.33972	-1.21417
120	0.403881	0.070450	0.877975	-3.89924	-0.67975	-1.82724
130	1.678441	0.327550	1.183076	-0.98426	-0.17159	-1.94208
140	0.910761	0.158865	1.347457	-2.70794	-0.47222	-2.35396
150	0.438441	0.076482	1.414718	-2.07068	-0.36115	-2.68219

APPALACHIAN COAL SURVEYS
VERTICALITY ANALYSIS
HOLE # MW-6 DOWNHOLE TRAVERSE

DEPTH FT.	DEG N-S	DLT LAT	LAT	DEG E-W	DLT DEP	DEP
0	0.100676	0	0	0.066487	0	0
10	0.027437	-0.01277	-0.01277	0.208105	0.024700	0.024700
20	-0.18376	-0.03205	-0.03492	-0.53631	-0.09355	-0.06275
30	0.120557	0.021030	-0.01756	0.228625	0.039879	-0.01160
40	1.217837	0.212425	0.184836	1.520245	0.265170	0.233417
50	2.107757	0.367617	0.522336	0.371125	0.064738	0.279796
60	1.984877	0.346192	0.834393	-0.98433	-0.17169	0.107238
70	0.675437	0.117822	0.928794	-1.82223	-0.31780	-0.19332
80	0.176237	0.030732	0.938951	-0.25701	-0.04473	-0.17532
90	0.539117	0.094028	0.997673	-1.74927	-0.30503	-0.47763
100	-1.53352	-0.26740	0.767458	-2.85393	-0.49756	-0.92259
110	3.943277	0.687293	1.421955	-0.25245	-0.04403	-0.99014
120	2.597357	0.452902	1.831686	-2.67381	-0.46624	-1.41709
130	0.357677	0.062436	1.864842	-4.08627	-0.71230	-2.07460
140	1.936877	0.337736	2.259174	1.008385	0.175852	-1.84732
150	2.123117	0.370239	2.577209	-1.13253	-0.19752	-2.05227

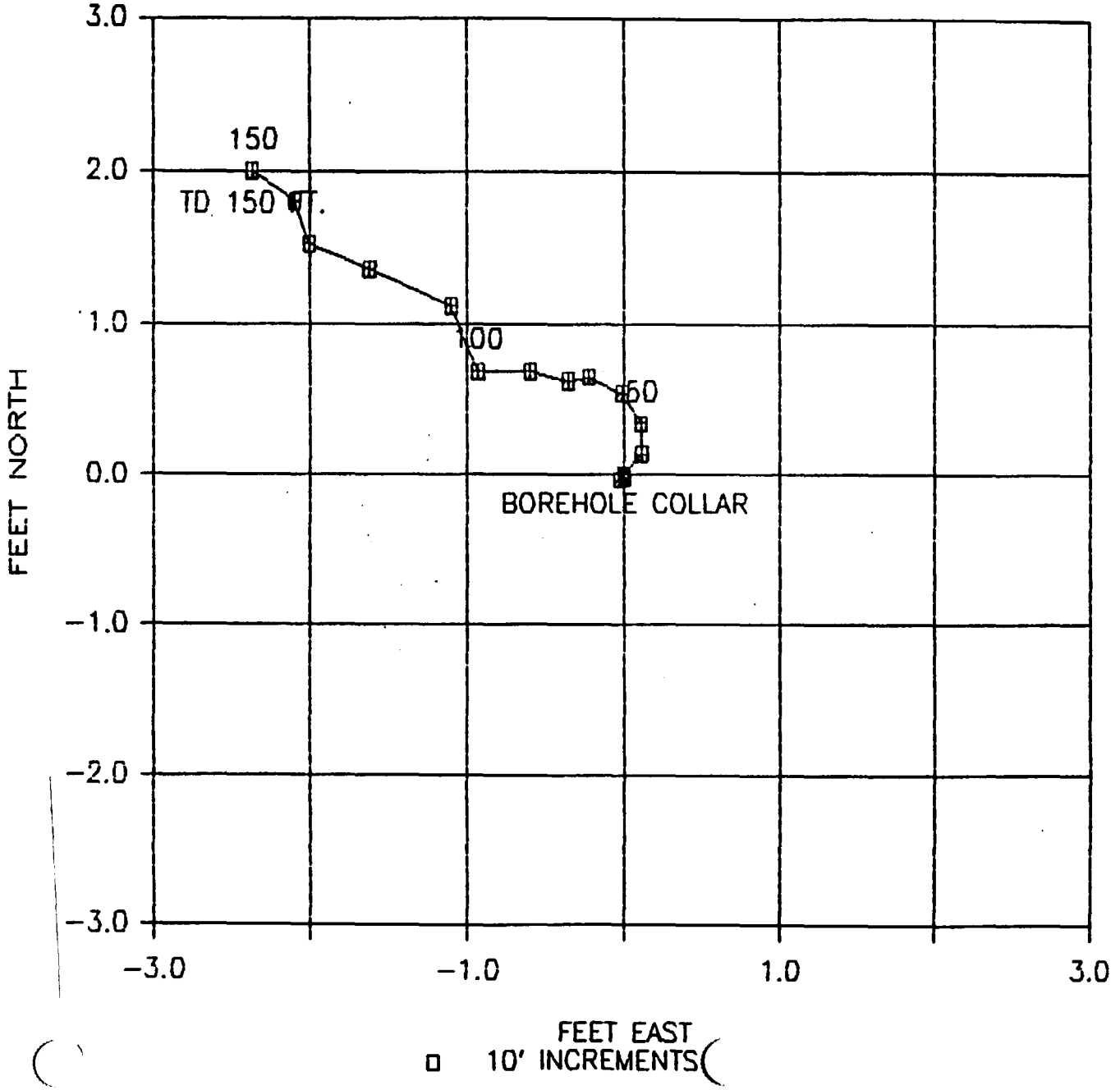
AVERAGE

DEPTH	LATITUDE	DEPARTURE
0	0	0
10	-0.02182	0.00471
20	-0.04022	-0.02239
30	-0.00561	-0.00157
40	0.13433	0.11221
50	0.34107	0.11017
60	0.53901	-0.00860
70	0.64328	-0.22458
80	0.61862	-0.35632
90	0.68245	-0.59800
100	0.68584	-0.93236
110	1.11156	-1.10216
120	1.35483	-1.62217
130	1.52396	-2.00834
140	1.80332	-2.10065
150	1.99596	-2.36724

AR300552

APPALACHIAN COAL SURVEYS

VERTICALITY ANALYSIS MW-6



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APPALACHIAN COAL SURVEYS

GEOPHYSICAL BOREHOLE LOG DATA BASE

VERTICALITY ANALYSIS

						BOREHOLE FACTOR:	8.4
						UNIT #:	61
COMPANY:	BAKER/TSA	LOCATION				OPERATOR:	CBC
HOLE #:	MW-7	GRID:				DATE:	01-Oct-87
DRILL DEPTH:	150 FT.	NORTH:		FT.		DRILLING CO:	PA DRILLING
BIT DIA:	5.6 IN.	EAST:		FT.		DRILLER:	
WATER LEVEL:	51 FT.	ELEV:		FT.		CREW SIZE:	
CASING DEPTH:	34 FT.	COUNTY:	Berks			METHOD:	Rotary
CASING DIA:	6.00 IN.	STATE:	PA			FLUID:	Air
CASING FACTOR:	0.90					DRILLING FACTOR:	1.5

ALL VERTICALITY RECORDS ARE MADE MAGNETICALLY
RESULTS MAY BE INFLUENCED BY LOCAL MAGNETIC
ANOMALIES AND BY WELL CASING (MAGNETIC).

APPALACHIAN COAL SURVEYS
VERTICALITY ANALYSIS
HOLE # NW-7 UPHOLE TRAVERSE

DEPTH FT.	DEG N-S	DLT LAT	LAT	DEG E-W	DLT DEP	DEP
0	0.026539	0	0	-0.19277	0	0
10	0.557852	0.092679	0.092679	-0.73651	-0.09483	-0.09483
20	0.469532	0.081899	0.146842	0.444526	0.077541	-0.01986
30	-0.88022	-0.15352	-0.00461	0.451366	0.078732	0.033638
40	-0.20534	-0.03581	-0.01375	-0.72625	-0.12665	-0.09558
50	0.356252	0.062144	0.054982	0.333946	0.058253	-0.02021
60	0.221852	0.038693	0.101773	0.289486	0.050502	0.014204
70	-1.04726	-0.18265	-0.09472	0.460486	0.080313	0.069880
80	-0.44246	-0.07717	-0.14086	0.198286	0.034595	0.135711
90	-0.71222	-0.12423	-0.24712	-0.79237	-0.13821	0.000296
100	-0.23798	-0.04151	-0.29779	-0.36601	-0.06384	-0.06512
110	-0.33590	-0.05859	-0.35799	-0.58489	-0.10202	-0.15897
120	0.066332	0.011573	-0.35909	0.532306	0.092851	-0.05039
130	-0.37814	-0.06594	-0.39567	0.093406	0.016300	-0.02452
140	-1.08374	-0.18903	-0.56941	-0.35575	-0.06205	-0.10346
150	-0.69110	-0.12055	-0.67701	-0.85393	-0.14895	-0.22654

APPALACHIAN COAL SURVEYS
VERTICALITY ANALYSIS
HOLE # NW-7 DOWNHOLE TRAVERSE

DEPTH FT.	DEG N-S	DLT LAT	LAT	DEG E-W	DLT DEP	DEP
0	0.024805	0	0	-0.06207	0	0
10	0.197976	0.030207	0.030207	-0.48104	-0.07306	-0.07306
20	-0.78794	-0.13743	-0.12428	0.100356	0.017522	-0.01171
30	0.657816	0.114746	-0.00431	0.191556	0.033415	0.010856
40	0.003096	0.000544	-0.02501	-0.32486	-0.05665	-0.03696
50	-0.17066	-0.02974	-0.05975	-0.60644	-0.10575	-0.15794
60	-0.66218	-0.11549	-0.13855	-0.44342	-0.07732	-0.23159
70	-1.38218	-0.24105	-0.34040	-0.54488	-0.09502	-0.29750
80	-1.17002	-0.20407	-0.56270	-1.63358	-0.28490	-0.53679
90	-0.81962	-0.14297	-0.68555	-1.34744	-0.23503	-0.76338
100	-0.70346	-0.12271	-0.79501	-1.45460	-0.25372	-0.99554
110	-0.04970	-0.00867	-0.79009	-1.13996	-0.19884	-1.17600
120	-1.31594	-0.22951	-1.03247	-0.58250	-0.10158	-1.23952
130	-0.87722	-0.15299	-1.16132	-1.23344	-0.21510	-1.47183
140	-0.75530	-0.13174	-1.25922	-0.91766	-0.16003	-1.62900
150	-1.20362	-0.20994	-1.45842	-1.57544	-0.27479	-1.86930

AVERAGE

DEPTH	LATITUDE	DEPARTURE
0	0	0
10	0.06144	-0.08395
20	0.01128	-0.01579
30	-0.00447	0.02225
40	-0.01938	-0.06627
50	-0.00239	-0.08908
60	-0.01839	-0.10870
70	-0.21756	-0.11381
80	-0.35179	-0.20054
90	-0.46634	-0.38155
100	-0.54640	-0.53033
110	-0.57404	-0.66749
120	-0.69578	-0.64496
130	-0.77850	-0.74818
140	-0.91432	-0.86623
150	-1.06772	-1.04793

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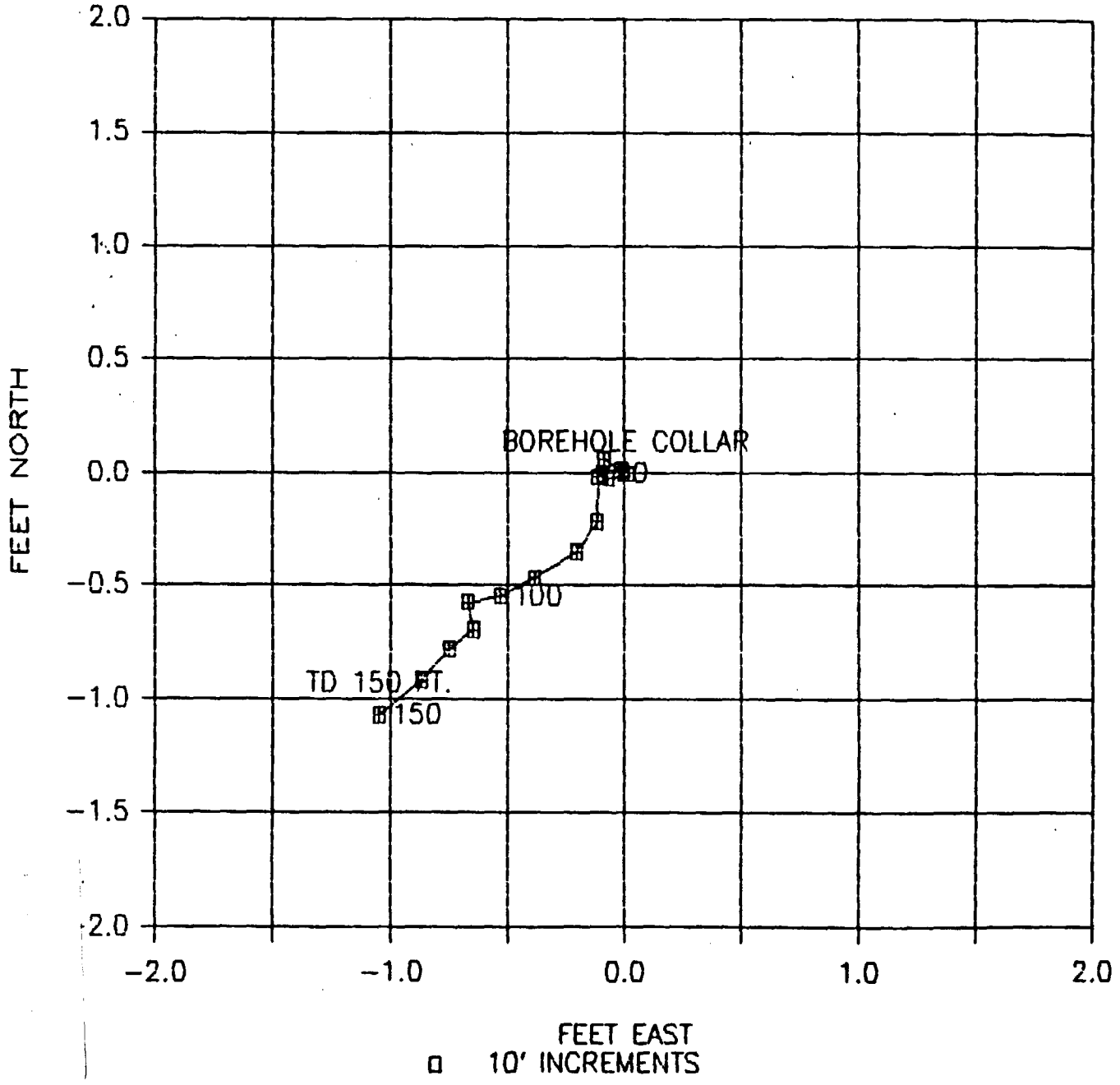
APPALACHIAN COAL SURVEYS

VERTICALITY ANALYSIS MW-7



AR300556

APPALACHIAN COAL SURVEYS

GEOPHYSICAL BOREHOLE LOG DATA BASE

VERTICALITY ANALYSIS

						BOREHOLE FACTOR:	9
						UNIT #:	61
COMPANY:	BAKER/TSA	LOCATION				OPERATOR:	CBC
HOLE #:	NW-8	GRID:				DATE:	25-Sep-87
DRILL DEPTH:	151 FT.	NORTH:		FT.		DRILLING CO:	PA DRILLING
BIT DIA:	6.0 IN.	EAST:		FT.		DRILLER:	
WATER LEVEL:	24 FT.	ELEV:		FT.		CREW SIZE:	
CASING DEPTH:	34 FT.	COUNTY:	Berks			METHOD:	Rotary
CASING DIA:	6.00 IN.	STATE:	PA			FLUID:	Air
CASING FACTOR:	0.90					DRILLING FACTOR:	1.5

ALL VERTICALITY RECORDS ARE MADE MAGNETICALLY
RESULTS MAY BE INFLUENCED BY LOCAL MAGNETIC
ANOMALIES AND BY WELL CASING (MAGNETIC).

AR300557

APPALACHIAN COAL SURVEYS
VERTICALITY ANALYSIS
HOLE # MW-8 UPHOLE TRAVERSE

DEPTH FT.	DEG N-S	DLT LAT	LAT	DEG E-W	DLT DEP	DEP
0	0.133594	0	0	0.030412	0	0
10	-0.02805	-0.02820	-0.02820	-0.74732	-0.13563	-0.13563
20	0.214823	0.037456	0.016929	0.194314	0.033908	-0.06686
30	-0.04053	-0.00706	-0.02331	0.347074	0.060538	-0.00527
40	0.061223	0.010685	-0.04329	1.048174	0.182778	0.174588
50	-0.51669	-0.09011	-0.16842	0.472474	0.082425	0.228843
60	-0.30549	-0.05329	-0.19044	-1.13606	-0.19812	0.079486
70	-0.16533	-0.02883	-0.23370	0.982054	0.171239	0.214206
80	-0.40341	-0.07036	-0.31214	0.127054	0.022182	0.211597
90	-0.28149	-0.04909	-0.40245	0.318574	0.055572	0.243571
100	0.162983	0.028399	-0.36503	-0.11462	-0.01998	0.254468
110	-0.11829	-0.02063	-0.43224	0.306034	0.053385	0.288827
120	-0.28725	-0.05011	-0.46329	-0.06902	-0.01203	0.314636
130	0.545063	0.095069	-0.33526	0.283234	0.049430	0.403496
140	-0.31413	-0.05479	-0.40766	0.098554	0.017198	0.391529
150	-0.40917	-0.07137	-0.45428	0.010774	0.001885	0.425889
151	-0.22581	-0.03938	-0.44705	0.294634	0.051396	0.442926

APPALACHIAN COAL SURVEYS
VERTICALITY ANALYSIS
HOLE # MW-8 DOWNHOLE TRAVERSE

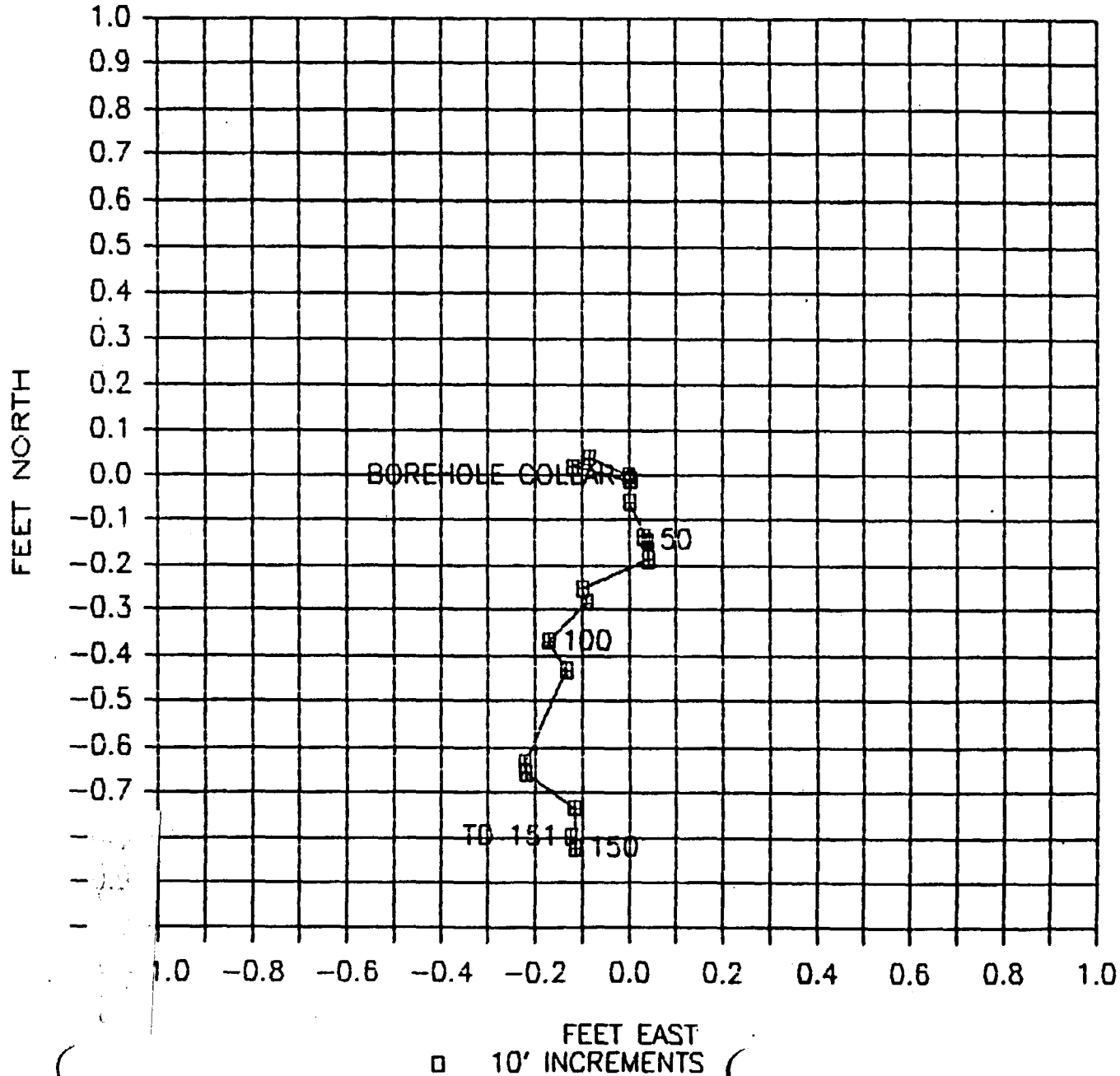
DEPTH FT.	DEG N-S	DLT LAT	LAT	DEG E-W	DLT DEP	DEP
0	-0.01752	0	0	-0.06806	0	0
10	0.596314	0.107069	0.107069	-0.25399	-0.03242	-0.03242
20	-0.35312	-0.06160	0.020728	-1.04401	-0.18207	-0.17201
30	-0.29072	-0.05070	0.003049	0.963520	0.168063	0.011500
40	-0.27728	-0.04834	-0.07840	-0.95851	-0.16712	-0.17119
50	-0.53744	-0.09370	-0.12435	0.219100	0.038229	-0.15131
60	0.020314	0.003482	-0.08463	0.966940	0.168621	-0.01714
70	0.029914	0.005136	-0.13907	-0.74647	-0.13006	-0.13135
80	-0.54608	-0.09524	-0.19609	-1.90357	-0.33171	-0.41006
90	0.040474	0.007048	-0.16455	-0.24259	-0.04221	-0.42449
100	-1.07984	-0.18836	-0.36945	-1.46581	-0.25550	-0.59584
110	-0.50768	-0.08855	-0.43352	0.070900	0.012355	-0.55590
120	-2.06000	-0.35923	-0.80527	-1.32331	-0.23076	-0.75948
130	-1.19600	-0.20859	-0.98016	-0.58345	-0.10177	-0.84203
140	-0.63728	-0.11115	-1.05694	1.277020	0.222735	-0.62452
150	-0.68048	-0.11867	-1.18881	-0.06589	-0.01148	-0.65555
151	-0.51920	-0.09055	-1.14750	-0.37825	-0.06596	-0.69048

AVERAGE

DEPTH	LATITUDE	DEPARTURE
0	0	0
10	0.03943	-0.08403
20	0.01883	-0.11944
30	-0.01013	0.00331
40	-0.06085	0.00170
50	-0.14639	0.03877
60	-0.13764	0.03117
70	-0.18639	0.04142
80	-0.25412	-0.09923
90	-0.28351	-0.09046
100	-0.36725	-0.17069
110	-0.43288	-0.13354
120	-0.63428	-0.22243
130	-0.65771	-0.21927
140	-0.73231	-0.11650
150	-0.82155	-0.11463
151	-0.79728	-0.12378

APPALACHIAN COAL SURVEYS

VERTICALITY ANALYSIS MW-8



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APPALACHIAN COAL SURVEYS

GEOPHYSICAL BOREHOLE LOG DATA BASE

VERTICALITY ANALYSIS

						BOREHOLE FACTOR:	9
						UNIT #:	61
COMPANY:	BAKER/TSA	LOCATION				OPERATOR:	CBC
HOLE #:	MW-9	GRID:				DATE:	24-Sep-87
DRILL DEPTH:	150 FT.	NORTH:		FT.		DRILLING CO:	PA DRILLING
BIT DIA:	6.0 IN.	EAST:		FT.		DRILLER:	
WATER LEVEL:	23 FT.	ELEV:		FT.		CREW SIZE:	
CASING DEPTH:	56 FT.	COUNTY:	Berks			METHOD:	Rotary
CASING DIA:	6.00 IN.	STATE:	PA			FLUID:	Air
CASING FACTOR:	0.90					DRILLING FACTOR:	1.5

ALL VERTICALITY RECORDS ARE MADE MAGNETICALLY
RESULTS MAY BE INFLUENCED BY LOCAL MAGNETIC
ANOMALIES AND BY WELL CASING (MAGNETIC).

APP IAN COAL SURVEYS
VERTICALITY ANALYSIS
HOLE # MW-9 UPHOLE TRAVERSE

DEPTH FT.	DEG N-S	DLT LAT	LAT	DEG E-W	DLT DEP	DEP
0	-0.07878	0	0	0.042510	0	0
10	-0.48932	-0.07161	-0.07161	-0.41245	-0.07936	-0.07936
20	0.291158	0.050786	-0.04275	0.230500	0.040209	-0.04199
30	0.328598	0.057317	0.013737	0.295480	0.051543	-0.00741
40	0.401558	0.070047	0.084298	-0.13543	-0.02362	-0.03467
50	0.461078	0.080431	0.161223	-0.23575	-0.04112	-0.07486
60	0.339158	0.059162	0.212860	-0.19471	-0.03396	-0.10630
70	0.205718	0.035880	0.222797	-0.20953	-0.03655	-0.13415
80	-0.15716	-0.02741	0.208955	0.423160	0.073787	-0.03497
90	-0.32324	-0.05639	0.126956	-0.11605	-0.02024	-0.08033
100	-0.35012	-0.06107	0.044127	0.351340	0.061281	-0.04536
110	-1.40708	-0.24540	-0.23742	-0.24145	-0.04212	-0.11915
120	0.001238	0.000190	-0.22249	-1.50685	-0.26280	-0.35398
130	-0.56324	-0.09823	-0.29827	-1.15345	-0.20115	-0.51503
140	-0.19364	-0.03377	-0.29788	-1.26289	-0.22026	-0.68943
150	-0.07172	-0.01251	-0.31389	-1.19107	-0.20774	-0.89306

APPALA , COAL SURVEYS
VERTICALITY ANALYSIS
HOLE # MW-9 DOWNHOLE TRAVERSE

DEPTH FT.	DEG N-S	DLT LAT	LAT	DEG E-W	DLT DEP	DEP
0	-0.04852	0	0	-0.00209	0	0
10	0.266849	0.055014	0.055014	0.136542	0.024184	0.024184
20	0.003809	0.000663	0.046392	0.168462	0.029385	0.040611
30	-0.29379	-0.05124	0.008466	-0.09829	-0.01714	0.000363
40	-1.69731	-0.29604	-0.26471	1.213842	0.211718	0.213840
50	-1.10979	-0.19357	-0.43910	0.421542	0.073517	0.251139
60	-0.81219	-0.14165	-0.55154	1.038282	0.181084	0.408926
70	0.042209	0.007371	-0.50372	0.884382	0.154235	0.512837
80	-0.25443	-0.04438	-0.55672	0.974442	0.169964	0.701462
90	-0.44931	-0.07837	-0.62094	0.908322	0.158316	0.845428
100	-0.76611	-0.13362	-0.75078	1.294782	0.225768	1.045912
110	-1.03875	-0.18115	-0.91292	0.621042	0.108318	1.113244
120	-0.96483	-0.16828	-1.06838	0.602802	0.105139	1.189719
130	-0.85059	-0.14834	-1.18197	-0.20887	-0.03643	1.126411
140	0.001889	0.000330	-1.19428	-0.82561	-0.14395	1.011649
150	-0.21219	-0.03701	-1.23924	-0.17467	-0.03046	0.994870

AVERAGE

DEPTH	LATITUDE	DEPARTURE
0	0	0
10	-0.00830	-0.02759
20	0.00182	-0.00069
30	0.01110	-0.00352
40	-0.09021	0.08958
50	-0.13894	0.08814
60	-0.16934	0.15131
70	-0.14047	0.18934
80	-0.17389	0.33324
90	-0.24699	0.38255
100	-0.35333	0.50028
110	-0.57518	0.49704
120	-0.64544	0.41787
130	-0.74013	0.30569
140	-0.74608	0.16111
150	-0.77657	0.05090

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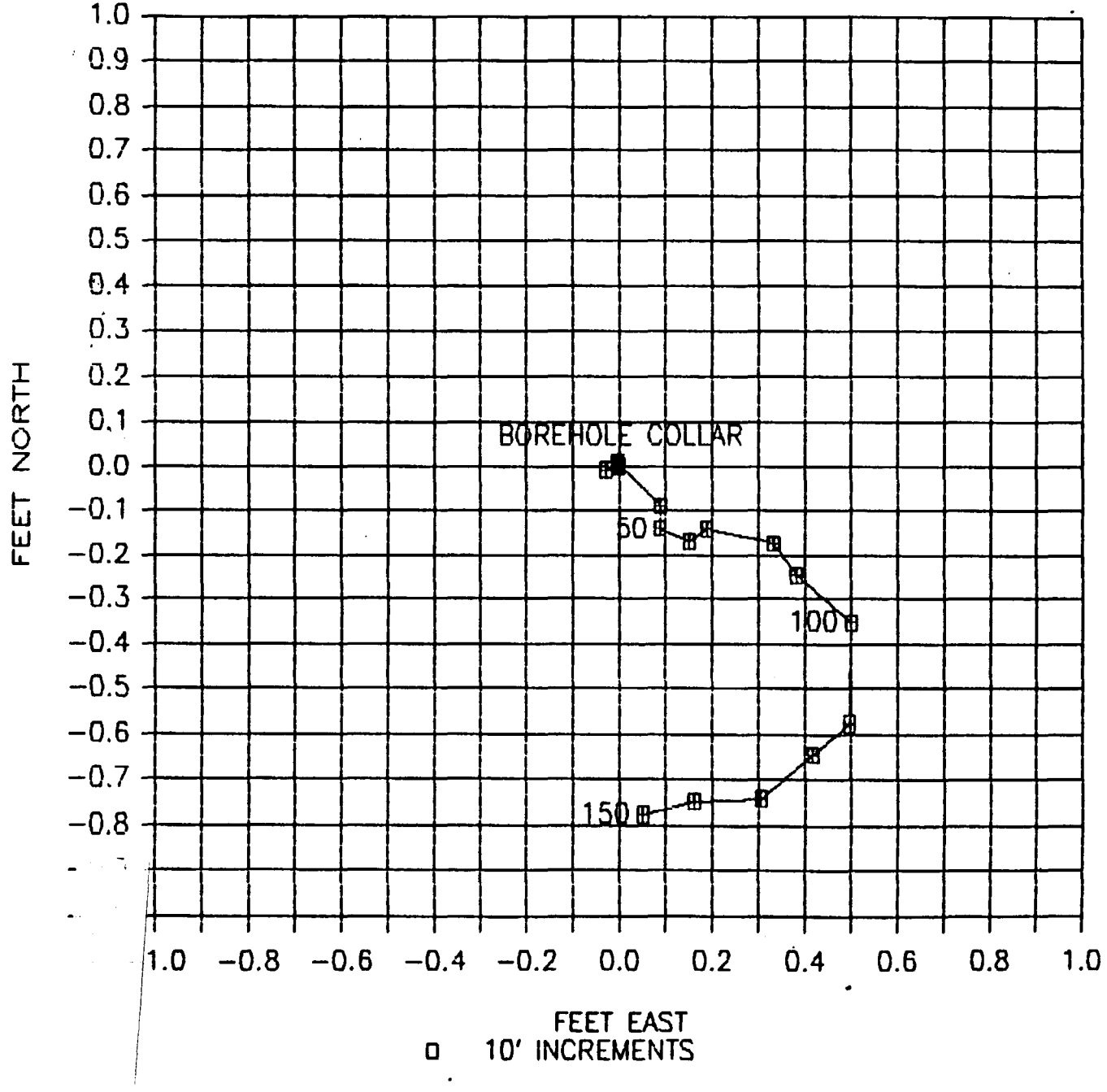
APPALACHIAN COAL SURVEYS

VERTICALITY ANALYSIS MW-9



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E. A TICS

AR300563

APPENDIX E

ANALYTICS

TABLE E.1 BERKS SAND PIT SITE - SOIL DATA

CHEMICALS	STATION/DATE SAMPLED			
	LTB-1 5-7' 09/02/87	LTB-1 COMP 08/29/87	LTB-2 9-10' 09/02/87	LTB-2 COMP 08/29/87
VOLATILE ORGANICS - ug/Kg				
Methylene Chloride	*	*	*	*
Acetone	*	*	*	*
1,1 Dichloroethene	ND	ND	ND	ND
1,1 Dichloroethane	ND	ND	ND	ND
2 Butanone	ND	ND	ND	ND
1,1,1 Trichloroethane	ND	ND	ND	ND
Benzene	ND	ND	ND	ND
Tetrachloroethene	ND	ND	ND	ND
Toluene	ND	ND	*	*
Xylene (total)	ND	ND	ND	ND
SEMI-VOLATILE ORGANICS - ug/Kg				
1,4 Dichlorobenzene	ND	ND	ND	ND
4 Methylphenol	ND	ND	ND	ND
N Nitrosodiphenylamine (1)	ND	ND	ND	ND
Di n butylphthalate	ND	ND	ND	ND
Fluoranthene	ND	ND	ND	ND
bis(2 Ethylhexyl)phthalate	*	ND	ND	ND
Di n octylphthalate	*	ND	ND	ND
Benzo (b) fluoranthene	ND	ND	ND	ND
Benzo (k) fluoranthene	ND	ND	ND	ND
Benzo (a) pyrene	ND	ND	ND	ND
METALS - mg/Kg				
Aluminum	10200.00	10600.00	9610.00	10500.00
Barium	51.00	45.00	63.00	61.00
Beryllium	*	*	1.20	*
Cadmium	ND	ND	ND	ND
Calcium	*	*	*	*
Chromium	7.20	6.90	5.50	6.30
Cobalt	*	*	*	*
Copper	8.90	9.40	5.90	6.30
Iron	13500.00	12100.00	17200.00	11700.00
Lead	5.00	8.50	1.70	6.80
Cyanide	ND	ND	ND	ND
Magnesium	1520.00	1390.00	4650.00	1510.00
Manganese	256.00	214.00	190.00	141.00
Mercury	ND	ND	ND	ND
Nickel	ND	ND	ND	ND
Potassium	ND	ND	1460.00	ND
Selenium	ND	ND	ND	ND
Sodium	ND	ND	ND	ND
Vanadium	15.00	14.00	22.00	12.00
Zinc	29.00	28.00	38.00	25.00

B = Found in blank
ND = Not detected in sample
* = Did not pass QA/QC procedures

AR300565

TABLE E.1 BERKS SAND PIT SITE - SOIL DATA

CHEMICALS	STATION/DATE SAMPLED			
	LTB-3 COMP 08/29/87	LTB-4 5-7' 09/02/87	LTB-4 COMP 08/30/87	LTB-5 COMP 08/30/87
VOLATILE ORGANICS - ug/Kg				
Methylene Chloride	*	*	*	*
Acetone	*	*	*	*
1,1 Dichloroethene	ND	ND	ND	ND
1,1 Dichloroethane	ND	ND	ND	ND
2 Butanone	ND	ND	ND	ND
1,1,1 Trichloroethane	ND	ND	ND	ND
Benzene	ND	ND	ND	ND
Tetrachloroethene	ND	ND	ND	ND
Toluene	*	*	*	ND
Xylene (total)	ND	ND	ND	ND
SEMI-VOLATILE ORGANICS - ug/Kg				
1,4 Dichlorobenzene	ND	ND	ND	ND
4 Methylphenol	ND	ND	ND	ND
N Nitrosodiphenylamine (1)	ND	ND	ND	ND
Di n butylphthalate	ND	ND	ND	ND
Fluoranthene	ND	ND	ND	ND
bis(2 Ethylhexyl)phthalate	ND	*	ND	ND
Di n octylphthalate	ND	ND	ND	ND
Benzo (b) fluoranthene	ND	ND	ND	ND
Benzo (k) fluoranthene	ND	ND	ND	ND
Benzo (a) pyrene	ND	ND	ND	ND
METALS - mg/Kg				
Aluminum	10000.00	7350.00	13300.00	12800.00
Barium	59.00	68.00	*	56.00
Beryllium	*	*	*	1.10
Cadmium	ND	ND	ND	ND
Calcium	*	*	*	*
Chromium	3.80	ND	8.00	5.30
Cobalt	*	ND	*	*
Copper	*	*	6.00	6.60
Iron	11000.00	8370.00	13100.00	12800.00
Lead	4.70	1.20	5.20	3.90
Cyanide	ND	ND	2.20	ND
Magnesium	1210.00	1570.00	1370.00	2250.00
Manganese	197.00	95.00	84.00	101.00
Mercury	ND	ND	ND	ND
Nickel	ND	ND	ND	ND
Potassium	ND	ND	ND	*
Selenium	ND	ND	ND	*
Sodium	ND	ND	ND	ND
Vanadium	*	*	15.00	14.00
Zinc	30.00	34.00	39.00	31.00

B = Found in blank
ND = Not detected in sample
* = Did not pass QA/QC procedures

AR300566

TABLE E.1 BERKS SAND PIT SITE - SOIL DATA

CHEMICALS	STATION/DATE SAMPLED			
	LTB-6 4-6' 09/02/87	LTB-6 6-8' 09/02/87	MW-3 2-4' 08/24/87	MW-3 6-8' 08/24/87
VOLATILE ORGANICS - ug/Kg				
Methylene Chloride	*	*	25.00 B	13.00 B
Acetone	*	*	11.00 B	45.00 B
1,1 Dichloroethene	ND	ND	ND	ND
1,1 Dichloroethane	ND	ND	ND	ND
2 Butanone	ND	ND	ND	ND
1,1,1 Trichloroethane	ND	ND	ND	ND
Benzene	ND	ND	ND	ND
Tetrachloroethene	ND	ND	ND	ND
Toluene	ND	ND	ND	ND
Xylene (total)	ND	ND	ND	ND
SEMI-VOLATILE ORGANICS - ug/Kg				
1,4 Dichlorobenzene	ND	ND	ND	ND
4 Methylphenol	ND	ND	ND	ND
N Nitrosodiphenylamine (1)	ND	ND	ND	ND
Di n butylphthalate	ND	ND	ND	ND
Fluoranthene	ND	ND	ND	ND
bis(2 Ethylhexyl)phthalate	*	ND	*	ND
Di n octylphthalate	ND	ND	*	*
Benzo (b) fluoranthene	ND	ND	ND	ND
Benzo (k) fluoranthene	ND	ND	ND	ND
Benzo (a) pyrene	ND	ND	ND	ND
METALS - mg/Kg				
Aluminum	13500.00	7270.00	8190.00	6340.00
Barium	51.00	*	57.00	55.00
Beryllium	1.00	*	ND	ND
Cadmium	ND	ND	ND	ND
Calcium	*	*	*	*
Chromium	12.00	ND	7.40	ND
Cobalt	*	*	*	ND
Copper	*	*	*	*
Iron	19400.00	10200.00	6500.00	1720.00
Lead	2.70	1.30	4.50	2.80
Cyanide	ND	ND	0.60	ND
Magnesium	4590.00	2660.00	1110.00	*
Manganese	525.00	117.00	145.00	65.00
Mercury	ND	ND	ND	ND
Nickel	14.00	ND	ND	ND
Potassium	2580.00	ND	ND	ND
Selenium	ND	ND	ND	ND
Sodium	ND	ND	ND	ND
Vanadium	30.00	*	*	ND
Zinc	62.00	37.00	14.00	*

B = Found in blank
ND = Not detected in sample
* = Did not pass QA/QC procedures

AR300567

TABLE E.1 BERKS SAND PIT SITE - SOIL DATA

CHEMICALS	STATION/DATE SAMPLED			
	MW-4 12-14' 08/14/87	MW-4 8.0-9.5' 11/03/87	MW-6 18-20' 08/21/87	MW-6 6-8 08/20/87
VOLATILE ORGANICS - ug/Kg				
Methylene Chloride	*	*	*	*
Acetone	*	*	*	*
1,1 Dichloroethene	ND	ND	ND	ND
1,1 Dichloroethane	ND	ND	ND	ND
2 Butanone	ND	ND	ND	ND
1,1,1 Trichloroethane	ND	ND	ND	ND
Benzene	ND	ND	ND	ND
Tetrachloroethene	ND	ND	ND	ND
Toluene	ND	ND	*	ND
Xylene (total)	ND	ND	ND	ND
SEMI-VOLATILE ORGANICS - ug/Kg				
1,4 Dichlorobenzene	ND	ND	ND	ND
4 Methylphenol	ND	ND	ND	ND
N Nitrosodiphenylamine (1)	ND	ND	ND	ND
Di n butylphthalate	ND	ND	ND	ND
Fluoranthene	ND	ND	ND	ND
bis(2 Ethylhexyl)phthalate	ND	ND	ND	ND
Di n octylphthalate	ND	ND	ND	*
Benzo (b) fluoranthene	ND	ND	ND	ND
Benzo (k) fluoranthene	ND	ND	ND	ND
Benzo (a) pyrene	ND	ND	ND	ND
METALS - mg/Kg				
Aluminum	10200.00	*	10200.00	20600.00
Barium	60.00	68.00	80.00	166.00
Beryllium	*	*	2.60	1.60
Cadmium	ND	ND	2.10	ND
Calcium	*	*	*	*
Chromium	15.00	*	16.00	51.00
Cobalt	*	*	16.00	31.00
Copper	8.50	*	15.00	49.00
Iron	14900.00	*	27000.00	36800.00
Lead	*	3.80	9.20	23.00
Cyanide	ND	ND	ND	ND
Magnesium	1980.00	*	2930.00	3720.00
Manganese	214.00	150.00	*	*
Mercury	ND	ND	ND	ND
Nickel	ND	ND	ND	*
Potassium	ND	1670.00	1950.00	1520.00
Selenium	ND	ND	ND	ND
Sodium	ND	*	*	*
Vanadium	17.00	*	73.00	91.00
Zinc	23.00	*	71.00	52.00

B = Found in blank
ND = Not detected in sample
* = Did not pass QA/QC procedures

AR300568

TABLE E.1 BERKS SAND PIT SITE - SOIL DATA

CHEMICALS	STATION/DATE SAMPLED			
	MW-7 4-6' 08/20/87	MW-7 6-8' 08/20/87	MW-8 10-12' 08/24/87	MW-8 4-6' 08/24/87
VOLATILE ORGANICS - ug/Kg				
Methylene Chloride	*	*	41.00 B	22.00 B
Acetone	*	*	7.80 B	ND
1,1 Dichloroethene	ND	ND	ND	ND
1.1 Dichloroethane	ND	ND	ND	ND
2 Butanone	ND	ND	ND	ND
1,1.1 Trichloroethane	ND	ND	ND	ND
Benzene	ND	ND	ND	ND
Tetrachloroethene	ND	ND	ND	ND
Toluene	ND	ND	ND	ND
Xylene (total)	ND	ND	ND	ND
SEMI-VOLATILE ORGANICS - ug/Kg				
1.4 Dichlorobenzene	ND	ND	ND	ND
4 Methylphenol	ND	ND	ND	ND
N Nitrosodiphenylamine (1)	ND	ND	ND	ND
Di n butylphthalate	ND	ND	440.00	*
Fluoranthene	ND	ND	ND	ND
bis(2 Ethylhexyl)phtnalate	ND	ND	6000.00	2100.00 B
Di n octylphthalate	*	*	ND	*
Benzo (b) fluoranthene	ND	ND	ND	ND
Benzo (k) fluoranthene	ND	ND	ND	ND
Benzo (a) pyrene	ND	ND	ND	ND
METALS - mg/Kg				
Aluminum	13200.00	10400.00	9030.00	15000.00
Barium	58.00	58.00	55.00	108.00
Beryllium	*	*	ND	*
Cadmium	ND	ND	ND	ND
Calcium	*	*	*	*
Chromium	7.20	2.40	ND	2.70
Cobalt	*	*	ND	*
Copper	5.50	*	*	*
Iron	14600.00	10600.00	5020.00	5290.00
Lead	4.40	11.00	1.50	2.00
Cyanide	ND	ND	ND	0.69
Magnesium	2420.00	*	2700.00	2640.00
Manganese	*	*	56.00	50.00
Mercury	ND	ND	ND	ND
Nickel	ND	ND	ND	ND
Potassium	1380.00	ND	ND	ND
Selenium	ND	ND	ND	ND
Sodium	ND	ND	ND	ND
Vanadium	17.00	*	*	*
Zinc	24.00	19.00	13.00	*

B = Found in blank
ND = Not detected in sample
* = Did not pass QA/QC procedures

AR300569

TABLE E.1 BERKS SAND PIT SITE - SOIL DATA

CHEMICALS	STATION/DATE SAMPLED			
	TB-10 3.0-4.5' 11/03/87	TB-11 9' 11/02/87	TB-12 5' 11/02/87	TB-2 9- 08/18/87
VOLATILE ORGANICS - ug/Kg				
Methylene Chloride	*	*	*	*
Acetone	*	*	*	*
1,1 Dichloroethene	ND	ND	ND	ND
1,1 Dichloroethane	ND	ND	ND	ND
2 Butanone	ND	ND	ND	ND
1,1,1 Trichloroethane	ND	ND	ND	ND
Benzene	ND	ND	ND	*
Tetrachloroethene	ND	ND	ND	ND
Toluene	ND	ND	ND	ND
Xylene (total)	ND	ND	ND	ND
SEMI-VOLATILE ORGANICS - ug/Kg				
1,4 Dichlorobenzene	ND	ND	ND	ND
4 Methylphenol	ND	ND	ND	ND
N Nitrosodiphenylamine (1)	ND	ND	ND	ND
Di n butylphthalate	ND	ND	ND	ND
Fluoranthene	ND	ND	ND	ND
bis(2 Ethylhexyl)phthalate	*	ND	*	ND
Di n octylphthalate	ND	ND	ND	ND
Benzo (b) fluoranthene	ND	ND	ND	ND
Benzo (k) fluoranthene	ND	ND	ND	ND
Benzo (a) pyrene	ND	ND	ND	ND
METALS - mg/Kg				
Aluminum	*	*	*	3800.00
Barium	66.00	52.00	60.00	62.00
Beryllium	*	*	*	*
Cadmium	ND	ND	ND	ND
Calcium	*	*	*	*
Chromium	4.60	*	*	ND
Cobalt	*	*	*	ND
Copper	*	*	*	*
Iron	*	*	*	7000.00
Lead	20.00	13.00	15.00	4.90
Cyanide	ND	ND	*	1.30
Magnesium	*	*	*	*
Manganese	230.00	136.00	166.00	*
Mercury	ND	2.40	ND	ND
Nickel	ND	ND	ND	ND
Potassium	*	*	*	2010.00
Selenium	ND	ND	ND	ND
Sodium	*	ND	*	ND
Vanadium	*	*	*	*
Zinc	*	*	*	15.00

B = Found in blank
ND = Not detected in sample
* = Did not pass QA/QC procedures

AR300570

TABLE E.1 BERKS SAND PIT SITE - SOIL DATA

CHEMICALS	STATION/DATE SAMPLED			
	TB-3 5-6.5' 08/19/87	TB-4 9-10.5' 08/19/87	TB-5 5-7' 08/19/87	TB-5 9-10.5 08/19/87
VOLATILE ORGANICS - ug/Kg				
Methylene Chloride	*	*	*	*
Acetone	*	*	*	*
1,1 Dichloroethene	ND	ND	ND	ND
1,1 Dichloroethane	ND	ND	ND	ND
2 Butanone	ND	ND	ND	ND
1,1,1 Trichloroethane	ND	ND	ND	ND
Benzene	ND	ND	*	ND
Tetrachloroethene	ND	ND	ND	ND
Toluene	ND	ND	ND	ND
Xylene (total)	ND	ND	ND	ND
SEMI-VOLATILE ORGANICS - ug/Kg				
1,4 Dichlorobenzene	ND	ND	ND	ND
4 Methylphenol	ND	ND	ND	ND
N Nitrosodiphenylamine (1)	ND	ND	ND	ND
Di n butylphthalate	ND	ND	ND	ND
Fluoranthene	ND	ND	ND	ND
bis(2 Ethylhexyl)phthalate	ND	ND	ND	ND
Di n octylphthalate	ND	ND	ND	ND
Benzo (b) fluoranthene	ND	ND	ND	ND
Benzo (k) fluoranthene	ND	ND	ND	ND
Benzo (a) pyrene	ND	ND	ND	ND
METALS - mg/Kg				
Aluminum	4540.00	19800.00	21000.00	5770.00
Barium	66.00	254.00	234.00	62.00
Beryllium	*	*	*	*
Cadmium	ND	ND	ND	ND
Calcium	*	*	*	*
Chromium	ND	75.00	81.00	ND
Cobalt	ND	23.00	42.00	*
Copper	*	78.00	109.00	*
Iron	4870.00	38900.00	42700.00	10100.00
Lead	*	22.00	21.00	2.20
Cyanide	ND	ND	ND	ND
Magnesium	1120.00	15800.00	20700.00	1610.00
Manganese	229.00	*	*	*
Mercury	ND	ND	ND	ND
Nickel	ND	98.00	152.00	ND
Potassium	2260.00	1980.00	1100.00	2050.00
Selenium	ND	ND	ND	ND
Sodium	ND	*	*	ND
Vanadium	*	97.00	99.00	*
Zinc	12.00	71.00	72.00	16.00

B = Found in blank
ND = Not detected in sample
* = Did not pass QA/QC procedures

AR300571

TABLE E.1 BERKS SAND PIT SITE - SOIL DATA

CHEMICALS	STATION/DATE SAMPLED			
	TB-6 11-13' 08/19/87	TB-6 13-14.5' 08/19/87	TB-6 9-11' 08/19/87	TB-7 10 08/19/87
VOLATILE ORGANICS - ug/Kg				
Methylene Chloride	*	*	*	20.00 B
Acetone	*	*	*	*
1,1 Dichloroethene	ND	ND	ND	ND
1,1 Dichloroethane	ND	ND	ND	ND
2 Butanone	ND	ND	ND	ND
1,1,1 Trichloroethane	ND	ND	ND	ND
Benzene	ND	ND	ND	ND
Tetrachloroethene	ND	ND	ND	ND
Toluene	ND	ND	ND	ND
Xylene (total)	ND	ND	ND	ND
SEMI-VOLATILE ORGANICS - ug/Kg				
1,4 Dichlorobenzene	ND	ND	ND	ND
4 Methylphenol	ND	ND	ND	ND
N Nitrosodiphenylamine (1)	ND	ND	ND	ND
Di n butylphthalate	ND	ND	ND	ND
Fluoranthene	ND	ND	ND	ND
bis(2 Ethylhexyl)phthalate	ND	ND	ND	ND
Di n octylphthalate	*	*	*	*
Benzo (b) fluoranthene	ND	ND	ND	ND
Benzo (k) fluoranthene	ND	ND	ND	ND
Benzo (a) pyrene	ND	ND	ND	ND
METALS - mg/Kg				
Aluminum	7340.00	6690.00	7990.00	5540.00
Barium	55.00	52.00	56.00	50.00
Beryllium	*	*	*	*
Cadmium	ND	ND	ND	ND
Calcium	*	*	*	*
Chromium	3.60	ND	ND	ND
Cobalt	*	*	*	ND
Copper	6.20	*	*	*
Iron	10700.00	9730.00	8810.00	4490.00
Lead	3.80	5.00	3.30	2.50
Cyanide	ND	ND	ND	ND
Magnesium	2050.00	1710.00	1300.00	*
Manganese	*	*	*	*
Mercury	ND	ND	0.43	ND
Nickel	ND	ND	ND	ND
Potassium	2050.00	2600.00	2230.00	ND
Selenium	ND	ND	ND	ND
Sodium	ND	ND	ND	ND
Vanadium	*	*	*	*
Zinc	26.00	26.00	21.00	16.00

B = Found in blank
ND = Not detected in sample
* = Did not pass QA/QC procedures

AR300572

TABLE E.1 BERKS SAND PIT SITE - SOIL DATA

CHEMICALS	STATION/DATE SAMPLED			
	TB-7 14-16' 08/19/87	TB-8 10-12 09/10/87	TB-8 2-4' 09/02/87	TB-8 6-8' 09/10/87
VOLATILE ORGANICS - ug/Kg				
Methylene Chloride	*	ND	ND	ND
Acetone	*	ND	ND	ND
1,1 Dichloroethene	ND	ND	ND	ND
1,1 Dichloroethane	ND	ND	ND	ND
2 Butanone	ND	ND	ND	ND
1,1,1 Trichloroethane	ND	ND	ND	ND
Benzene	ND	ND	ND	ND
Tetrachloroethene	ND	ND	ND	ND
Toluene	ND	ND	ND	ND
Xylene (total)	ND	ND	ND	ND
SEMI-VOLATILE ORGANICS - ug/Kg				
1,4 Dichlorobenzene	ND	ND	ND	ND
4 Methylphenol	ND	ND	ND	ND
N Nitrosodiphenylamine (1)	ND	ND	ND	ND
Di n butylphthalate	ND	ND	ND	ND
Fluoranthene	ND	ND	ND	ND
bis(2 Ethylhexyl)phthalate	ND	*	ND	ND
Di n octylphthalate	*	ND	ND	ND
Benzo (b) fluoranthene	ND	ND	ND	ND
Benzo (k) fluoranthene	ND	ND	ND	ND
Benzo (a) pyrene	ND	ND	ND	ND
METALS - mg/Kg				
Aluminum	6950.00	*	*	*
Barium	55.00	*	*	*
Beryllium	*	1.10	*	ND
Cadmium	ND	ND	ND	ND
Calcium	*	*	*	*
Chromium	3.90	ND	2.50	ND
Cobalt	*	*	ND	ND
Copper	*	ND	*	*
Iron	7890.00	*	*	*
Lead	4.40	2.70	3.30	*
Cyanide	ND	ND	ND	ND
Magnesium	1230.00	*	2580.00	*
Manganese	*	248.00	*	*
Mercury	ND	ND	ND	ND
Nickel	ND	ND	ND	ND
Potassium	*	ND	1440.00	ND
Selenium	ND	ND	ND	ND
Sodium	ND	ND	ND	ND
Vanadium	*	*	*	*
Zinc	14.00	22.00	35.00	17.00

B = Found in blank
ND = Not detected in sample
* = Did not pass QA/QC procedures

AR300573

TABLE E.1 BERKS SAND PIT SITE - SOIL DATA

CHEMICALS	STATION/DATE SAMPLED		
	TB-9 12-14' 09/10/87	TB-9 4-6' 09/10/87	TB-9 8-10' 09/10/87
VOLATILE ORGANICS - ug/Kg			
Methylene Chloride	*	ND	ND
Acetone	*	ND	ND
1,1 Dichloroethene	ND	ND	ND
1,1 Dichloroethane	ND	ND	ND
2 Butanone	ND	ND	ND
1,1,1 Trichloroethane	ND	ND	ND
Benzene	ND	ND	ND
Tetrachloroethene	ND	ND	ND
Toluene	ND	*	ND
Xylene (total)	ND	ND	ND
SEMI-VOLATILE ORGANICS - ug/Kg			
1,4 Dichlorobenzene	ND	ND	ND
4 Methylphenol	ND	ND	ND
N Nitrosodiphenylamine (1)	ND	ND	ND
Di n butylphthalate	ND	ND	ND
Fluoranthene	ND	ND	ND
bis(2 Ethylhexyl)phthalate	ND	ND	ND
Di n octylphthalate	ND	ND	ND
Benzo (b) fluoranthene	ND	ND	ND
Benzo (k) fluoranthene	ND	ND	ND
Benzo (a) pyrene	ND	ND	ND
METALS - mg/Kg			
Aluminum	*	*	9260.00
Barium	*	*	54.00
Beryllium	*	*	1.20
Cadmium	ND	ND	ND
Calcium	*	*	*
Chromium	ND	ND	ND
Cobalt	ND	ND	*
Copper	*	*	*
Iron	*	*	12000.00
Lead	1.40	3.10	*
Cyanide	ND	ND	ND
Magnesium	1960.00	1630.00	*
Manganese	*	*	191.00
Mercury	ND	ND	ND
Nickel	ND	ND	ND
Potassium	1540.00	1360.00	1380.00
Selenium	ND	ND	ND
Sodium	ND	ND	ND
Vanadium	*	*	*
Zinc	33.00	23.00	27.00

B = Found in blank
ND = Not detected in sample
* = Did not pass QA/QC procedures

AR300574

TABLE E.2 BERKS SAND PIT SITE - SURFACE SEDIMENT DATA

CHEMICALS	STATION/DATE SAMPLED			
	SP-1 0.0-0.5' 11/17/87	SP-1 0.5-1.0' 11/17/87	SP-1 1.0-1.5' 11/17/87	SP-10 11/18/87
VOLATILE ORGANICS - ug/Kg				
Methylene Chloride	*	13.00 B	*	*
Acetone	*	*	*	*
1,1 Dichloroethene	ND	ND	ND	ND
1,1 Dichloroethane	ND	ND	ND	ND
2 Butanone	ND	ND	ND	ND
1,1,1 Trichloroethane	ND	ND	ND	ND
Benzene	ND	ND	ND	ND
Tetrachloroethene	ND	ND	ND	ND
Toluene	ND	ND	ND	ND
Xylene (total)	ND	ND	ND	ND
SEMI-VOLATILE ORGANICS - ug/Kg				
1,4 Dichlorobenzene	ND	ND	ND	ND
4 Methylphenol	ND	ND	ND	ND
N Nitrosodiphenylamine (1)	ND	ND	ND	ND
Di n butylphthalate	ND	ND	ND	ND
Fluoranthene	ND	ND	ND	ND
bis(2 Ethylhexyl)phthalate	*	ND	ND	ND
Di n octylphthalate	ND	ND	ND	ND
Benzo (b) fluoranthene	ND	ND	ND	ND
Benzo (k) fluoranthene	ND	ND	ND	ND
Benzo (a) pyrene	ND	ND	ND	ND
METALS - mg/Kg				
Aluminum	9850.00	10200.00	13700.00	7180.00
Barium	*	*	119.00	*
Beryllium	*	*	*	*
Cadmium	ND	ND	1.90	ND
Calcium	*	*	17500.00	*
Chromium	12.00	16.00	34.00	8.90
Cobalt	*	*	12.00	*
Copper	ND	ND	68.00	ND
Iron	3220.00	11400.00	28400.00	3870.00
Lead	24.00	19.00	385.00	9.90
Cyanide	ND	ND	ND	ND
Magnesium	*	*	*	*
Manganese	45.00	281.00	982.00	68.00
Mercury	ND	ND	0.42	ND
Nickel	ND	ND	17.00	ND
Potassium	ND	ND	ND	ND
Selenium	*	2.90	2.90	*
Sodium	ND	ND	ND	ND
Vanadium	*	*	*	*
Zinc	23.00	14.00	257.00	36.00

B = Found in blank
ND = Not detected in sample
* = Did not pass QA/QC procedures

AR300575

TABLE E.2 BERKS SAND PIT SITE - SURFACE SEDIMENT DATA

CHEMICALS	STATION/DATE SAMPLED			
	SP-11 0.0-0.5' 11/18/87	SP-11 0.5-1.0' 11/18/87	SP-11 1.0-1.5' 11/18/87	SP-12 11/18/87
VOLATILE ORGANICS - ug/Kg				
Methylene Chloride	*	*	*	29.00 B
Acetone	*	*	*	*
1,1 Dichloroethene	ND	ND	ND	ND
1,1 Dichloroethane	ND	ND	ND	ND
2 Butanone	*	*	*	ND
1,1,1 Trichloroethane	ND	ND	ND	ND
Benzene	ND	ND	ND	ND
Tetrachloroethene	ND	ND	ND	ND
Toluene	ND	*	ND	ND
Xylene (total)	ND	ND	ND	ND
SEMI-VOLATILE ORGANICS - ug/Kg				
1,4 Dichlorobenzene	ND	ND	ND	ND
4 Methylphenol	ND	ND	ND	ND
N Nitrosodiphenylamine (1)	ND	ND	ND	ND
Di n butylphthalate	ND	ND	ND	ND
Fluoranthene	ND	ND	ND	ND
bis(2 Ethylhexyl)phthalate	ND	ND	ND	ND
Di n octylphthalate	ND	ND	ND	ND
Benzo (b) fluoranthene	ND	ND	ND	ND
Benzo (k) fluoranthene	ND	ND	ND	ND
Benzo (a) pyrene	ND	750.00	ND	*
METALS - mg/Kg				
Aluminum	15000.00	10300.00	19900.00	11800.00
Barium	*	64.00	63.00	*
Beryllium	*	*	*	*
Cadmium	ND	ND	ND	ND
Calcium	*	*	*	*
Chromium	14.00	8.20	20.00	9.50
Cobalt	*	*	*	*
Copper	ND	ND	ND	ND
Iron	30400.00	13500.00	15100.00	7570.00
Lead	*	*	*	*
Cyanide	ND	ND	ND	16.00
Magnesium	*	*	*	*
Manganese	*	*	*	*
Mercury	ND	ND	ND	ND
Nickel	ND	ND	ND	ND
Potassium	*	*	ND	ND
Selenium	ND	ND	ND	ND
Sodium	ND	ND	ND	ND
Vanadium	*	*	*	*
Zinc	19.00	16.00	27.00	38.00

B = Found in blank
ND = Not detected in sample
* = Did not pass QA/QC procedures

AR300576

TABLE E.2 BERKS SAND PIT SITE - SURFACE SEDIMENT DATA

CHEMICALS	STATION/DATE SAMPLED			
	SP-13 0.0-0.5' 11/19/87	SP-13 0.5-1.0' 11/19/87	SP-13 1.0-1.5' 11/19/87	SP-2 11/17/87
VOLATILE ORGANICS - ug/Kg				
Methylene Chloride	13.00 B	20.00 B	35.00 B	*
Acetone	*	*	*	*
1,1 Dichloroethene	ND	ND	ND	*
1,1 Dichloroethane	ND	ND	ND	240.00
2 Butanone	ND	ND	*	ND
1,1,1 Trichloroethane	ND	ND	ND	ND
Benzene	ND	ND	ND	ND
Tetrachloroethene	ND	ND	ND	ND
Toluene	ND	ND	ND	ND
Xylene (total)	ND	ND	ND	ND
SEMI-VOLATILE ORGANICS - ug/Kg				
1,4 Dichlorobenzene	ND	ND	ND	ND
4 Methylphenol	ND	ND	ND	*
N Nitrosodiphenylamine (1)	ND	ND	ND	4000.00
Di n butylphthalate	*	ND	ND	ND
Fluoranthene	*	ND	ND	ND
bis(2 Ethylhexyl)phthalate	ND	ND	ND	*
Di n octylphthalate	ND	ND	ND	ND
Benzo (b) fluoranthene	*	ND	ND	ND
Benzo (k) fluoranthene	*	ND	ND	ND
Benzo (a) pyrene	ND	ND	ND	ND
METALS - mg/Kg				
Aluminum	26200.00	15700.00	19500.00	4070.00
Barium	149.00	85.00	100.00	*
Beryllium	*	*	*	*
Cadmium	ND	ND	ND	ND
Calcium	*	*	*	*
Chromium	30.00	18.00	22.00	*
Cobalt	*	*	*	ND
Copper	32.00	19.00	21.00	ND
Iron	28700.00	16800.00	18800.00	2230.00
Lead	*	*	*	79.00
Cyanide	ND	ND	ND	ND
Magnesium	*	*	*	*
Manganese	*	*	*	62.00
Mercury	ND	ND	ND	ND
Nickel	*	ND	*	ND
Potassium	2090.00	*	*	ND
Selenium	ND	ND	*	ND
Sodium	*	ND	ND	ND
Vanadium	*	*	*	*
Zinc	94.00	48.00	39.00	99.00

B = Found in blank
ND = Not detected in sample
* = Did not pass QA/QC procedures

AR300577

TABLE E.2 BERKS SAND PIT SITE - SURFACE SEDIMENT DATA

CHEMICALS	STATION/DATE SAMPLED			
	SP-3 11/17/87	SP-4 0.0-0.5' 11/17/87	SP-4 0.5-1.0' 11/17/87	SP-4 11/17/87
VOLATILE ORGANICS - ug/Kg				
Methylene Chloride	*	*	*	*
Acetone	*	*	*	*
1,1 Dichloroethene	ND	ND	ND	ND
1,1 Dichloroethane	ND	ND	ND	ND
2 Butanone	ND	ND	ND	*
1,1,1 Trichloroethane	ND	ND	*	ND
Benzene	ND	ND	ND	ND
Tetrachloroethene	ND	ND	ND	ND
Toluene	ND	ND	ND	ND
Xylene (total)	ND	ND	ND	ND
SEMI-VOLATILE ORGANICS - ug/Kg				
1,4 Dichlorobenzene	ND	ND	ND	ND
4 Methylphenol	ND	ND	ND	ND
N Nitrosodiphenylamine (1)	ND	ND	ND	ND
Di n butylphthalate	ND	ND	ND	ND
Fluoranthene	ND	ND	ND	ND
bis(2 Ethylhexyl)phthalate	ND	ND	ND	ND
Di n octylphthalate	ND	ND	ND	ND
Benzo (b) fluoranthene	ND	ND	ND	ND
Benzo (k) fluoranthene	ND	ND	ND	ND
Benzo (a) pyrene	ND	ND	ND	ND
METALS - mg/Kg				
Aluminum	6220.00	6480.00	6340.00	10400.00
Barium	*	*	*	51.00
Beryllium	*	*	*	*
Cadmium	ND	ND	ND	ND
Calcium	*	*	*	*
Chromium	12.00	9.50	*	9.40
Cobalt	*	ND	ND	*
Copper	*	ND	ND	*
Iron	18700.00	5340.00	5170.00	10200.00
Lead	36.00	11.00	4.60	4.40
Cyanide	ND	ND	ND	ND
Magnesium	*	*	*	1880.00
Manganese	174.00	35.00	35.00	118.00
Mercury	0.24	ND	ND	ND
Nickel	ND	ND	ND	ND
Potassium	ND	ND	ND	ND
Selenium	ND	ND	ND	ND
Sodium	ND	ND	ND	ND
Vanadium	*	*	*	19.00
Zinc	43.00	25.00	*	29.00

B = Found in blank
ND = Not detected in sample
* = Did not pass QA/QC procedures

AR300578

TABLE E.2 BERKS SAND PIT SITE - SURFACE SEDIMENT DATA

CHEMICALS	STATION/DATE SAMPLED			
	SP-5 11/17/87	SP-6 11/17/87	SP-7 0.0-0.5' 11/17/87	SP-7 0.5-1 11/17/87
VOLATILE ORGANICS - ug/Kg				
Methylene Chloride	*	*	*	*
Acetone	*	*	*	*
1,1 Dichloroethene	ND	ND	ND	ND
1,1 Dichloroethane	ND	ND	ND	ND
2 Butanone	ND	ND	ND	ND
1,1,1 Trichloroethane	ND	ND	ND	ND
Benzene	ND	ND	ND	ND
Tetrachloroethene	ND	ND	ND	ND
Toluene	ND	ND	ND	ND
Xylene (total)	ND	ND	ND	ND
SEMI-VOLATILE ORGANICS - ug/Kg				
1,4 Dichlorobenzene	ND	ND	ND	ND
4 Methylphenol	ND	*	ND	1800.00
N Nitrosodiphenylamine (1)	ND	ND	ND	ND
Di n butylphthalate	*	*	*	ND
Fluoranthene	ND	ND	ND	ND
bis(2 Ethylhexyl)phthalate	ND	*	*	*
Di n octylphthalate	ND	ND	ND	ND
Benzo (b) fluoranthene	ND	ND	ND	ND
Benzo (k) fluoranthene	ND	ND	ND	ND
Benzo (a) pyrene	ND	ND	ND	ND
METALS - mg/Kg				
Aluminum	4980.00	1670.00	6420.00	20800.00
Barium	*	*	*	102.00
Beryllium	*	ND	*	1.60
Cadmium	ND	ND	ND	ND
Calcium	*	*	*	*
Chromium	8.30	*	9.30	33.00
Cobalt	ND	*	*	ND
Copper	ND	ND	*	24.00
Iron	3260.00	2180.00	10700.00	43200.00
Lead	45.00	7.60	53.00	25.00
Cyanide	ND	ND	ND	ND
Magnesium	*	*	*	*
Manganese	67.00	48.00	284.00	112.00
Mercury	ND	ND	ND	ND
Nickel	ND	ND	ND	ND
Potassium	ND	ND	ND	ND
Selenium	ND	ND	ND	ND
Sodium	ND	ND	ND	ND
Vanadium	*	*	*	*
Zinc	75.00	12.00	70.00	39.00

B = Found in blank
ND = Not detected in sample
* = Did not pass QA/QC procedures

AR300579

TABLE E.2 BERKS SAND PIT SITE - SURFACE SEDIMENT DATA

CHEMICALS	STATION/DATE SAMPLED			
	SP-7 1.0-1.5' 11/17/87	SP-8 0.0-0.5' 11/17/87	SP-8 0.5-1.0' 11/17/87	SP-8 1[illegible] 11/17/87
VOLATILE ORGANICS - ug/Kg				
Methylene Chloride	*	*	*	*
Acetone	*	*	*	ND
1,1 Dichloroethene	ND	ND	ND	ND
1,1 Dichloroethane	ND	ND	ND	ND
2 Butanone	ND	ND	ND	ND
1,1,1 Trichloroethane	ND	ND	ND	ND
Benzene	ND	ND	ND	ND
Tetrachloroethene	ND	ND	ND	ND
Toluene	ND	ND	ND	ND
Xylene (total)	ND	ND	ND	ND
SEMI-VOLATILE ORGANICS - ug/Kg				
1,4 Dichlorobenzene	ND	ND	ND	ND
4 Methylphenol	ND	ND	ND	ND
N Nitrosodiphenylamine (1)	ND	ND	ND	ND
Di n butylphthalate	*	ND	ND	ND
Fluoranthene	ND	ND	ND	ND
bis(2 Ethylhexyl)phthalate	ND	ND	ND	ND
Di n octylphthalate	ND	ND	ND	ND
Benzo (b) fluoranthene	ND	ND	ND	ND
Benzo (k) fluoranthene	ND	ND	ND	ND
Benzo (a) pyrene	ND	ND	ND	ND
METALS - mg/Kg				
Aluminum	29700.00	2000.00	18600.00	17900.00
Barium	133.00	*	87.00	92.00
Beryllium	1.70	ND	*	*
Cadmium	ND	ND	ND	ND
Calcium	*	*	*	1340.00
Chromium	41.00	7.20	16.00	20.00
Cobalt	*	ND	*	*
Copper	32.00	ND	9.80	15.00
Iron	38400.00	*	17000.00	13500.00
Lead	27.00	*	16.00	20.00
Cyanide	ND	0.79	ND	ND
Magnesium	*	*	*	*
Manganese	147.00	56.00	145.00	152.00
Mercury	ND	ND	ND	ND
Nickel	14.00	ND	*	9.30
Potassium	ND	ND	ND	ND
Selenium	ND	ND	ND	ND
Sodium	ND	ND	ND	ND
Vanadium	66.00	*	*	*
Zinc	41.00	*	37.00	43.00

B = Found in blank
ND = Not detected in sample
* = Did not pass QA/QC procedures

AR300580

TABLE E.2 BERKS SAND PIT SITE - SURFACE SEDIMENT DATA

CHEMICALS	STATION/DATE SAMPLED		
	SP-9 0.0-0.5' 11/18/87	SP-9 0.5-1.0' 11/18/87	SP-9 1.0-1.5' 11/18/87
VOLATILE ORGANICS - ug/Kg			
Methylene Chloride	21.00 B	*	*
Acetone	*	*	*
1,1 Dichloroethene	ND	ND	ND
1,1 Dichloroethane	ND	ND	ND
2 Butanone	ND	ND	ND
1,1,1 Trichloroethane	ND	ND	ND
Benzene	ND	ND	ND
Tetrachloroethene	ND	ND	ND
Toluene	ND	ND	ND
Xylene (total)	ND	ND	ND
SEMI-VOLATILE ORGANICS - ug/Kg			
1,4 Dichlorobenzene	ND	ND	ND
4 Methylphenol	ND	ND	ND
N Nitrosodiphenylamine (1)	ND	ND	ND
Di n butylphthalate	ND	ND	ND
Fluoranthene	ND	490.00	*
bis(2 Ethylhexyl)phthalate	ND	ND	ND
Di n octylphthalate	ND	ND	ND
Benzo (b) fluoranthene	ND	*	ND
Benzo (k) fluoranthene	ND	*	ND
Benzo (a) pyrene	ND	*	ND
METALS - mg/Kg			
Aluminum	11500.00	4030.00	8030.00
Barium	*	*	64.00
Beryllium	*	*	*
Cadmium	ND	ND	ND
Calcium	*	*	*
Chromium	*	2.70	4.20
Cobalt	ND	ND	ND
Copper	*	ND	6.40
Iron	12900.00	14200.00	26900.00
Lead	28.00	4.20	21.00
Cyanide	ND	ND	ND
Magnesium	*	*	*
Manganese	31.00	35.00	69.00
Mercury	0.30	ND	0.75
Nickel	ND	ND	ND
Potassium	ND	ND	ND
Selenium	330.00	236.00	317.00
Sodium	ND	ND	ND
Vanadium	*	*	*
Zinc	29.00	14.00	29.00

B = Found in blank
ND = Not detected in sample
* = Did not pass QA/QC procedures

AR300581

TABLE E.3 BERKS SAND PIT SITE - RESIDENTIAL WELL DATA

CHEMICALS	STATION/DATE SAMPLED			
	MT VILLAGE 02/17/88	RW-1 05/30/87	RW-1 01/20/88	RW-10 05/31
VOLATILE ORGANICS - ug/L				
Methylene Chloride	ND	*	ND	5.00 B
Acetone	ND	*	ND	*
1,1 Dichloroethene	ND	ND	ND	ND
1,1 Dichloroethane	ND	ND	ND	ND
2 Butanone	ND	ND	ND	ND

TABLE E.3 BERKS SAND PIT SITE - RESIDENTIAL WELL DATA

CHEMICALS	STATION/DATE SAMPLED			
	MT VILLAGE 02/17/88	RW-1 05/30/87	RW-1 01/20/88	RW-10 05/31/87
VOLATILE ORGANICS - ug/L				
Methylene Chloride	ND	*	ND	5.00 B
Acetone	ND	*	ND	*
1,1 Dichloroethene	ND	ND	ND	ND
1,1 Dichloroethane	ND	ND	ND	ND
2 Butanone	ND	ND	ND	ND
1,1,1 Trichloroethane	ND	ND	ND	12.00
Benzene	ND	ND	ND	ND
Tetrachloroethene	ND	ND	ND	ND
Toluene	ND	ND	ND	ND
Xylene (total)	ND	ND	ND	ND
SEMI-VOLATILE ORGANICS - ug/L				
1,4 Dichlorobenzene	ND	ND	ND	ND
4 Methylphenol	ND	ND	ND	ND
N Nitrosodiphenylamine (1)	ND	ND	ND	ND
Di n butylphthalate	ND	ND	*	ND
Fluoranthene	ND	ND	ND	ND
bis(2 Ethylhexyl)phthalate	*	ND	*	ND
Di n octylphthalate	*	ND	ND	ND
Benzo (b) fluoranthene	ND	ND	ND	ND
Benzo (k) fluoranthene	ND	ND	ND	ND
Benzo (a) pyrene	ND	ND	ND	ND
METALS - mg/L				
Aluminum	ND	ND	ND	ND
Barium	*	ND	*	ND
Beryllium	ND	ND	*	ND
Cadmium	ND	ND	ND	ND
Calcium	10900.00	13700.00	*	12800.00
Chromium	ND	ND	ND	ND
Cobalt	ND	ND	ND	ND
Copper	ND	ND	ND	ND
Iron	*	*	*	*
Lead	ND	ND	ND	ND
Cyanide	ND	22.00	ND	14.00
Magnesium	*	5200.00	*	*
Manganese	ND	20.00	*	40.00
Mercury	ND	ND	ND	ND
Nickel	ND	ND	ND	ND
Potassium	ND	*	ND	*
Selenium	ND	ND	ND	ND
Sodium	9270.00	13000.00	16800.00	7000.00
Vanadium	ND	ND	ND	ND
Zinc	27.00	240.00	*	*

B = Found in blank
ND = Not detected in sample
* = Did not pass QA/QC procedures

TABLE E.3 BERKS SAND PIT SITE - RESIDENTIAL WELL DATA

CHEMICALS	STATION/DATE SAMPLED			
	RW-10 02/16/88	RW-11 05/29/87	RW-11 03/14/88	RW-12 02/09/88
VOLATILE ORGANICS - ug/L				
Methylene Chloride	*	6.00 B	*	ND
Acetone	*	*	*	ND
1,1 Dichloroethene	ND	ND	*	ND
1,1 Dichloroethane	ND	ND	ND	ND
2 Butanone	ND	ND	ND	ND
1,1,1 Trichloroethane	*	27.00	21.00	6.10
Benzene	*	ND	ND	ND
Tetrachloroethene	ND	ND	ND	ND
Toluene	*	ND	ND	ND
Xylene (total)	*	ND	ND	ND
SEMI-VOLATILE ORGANICS - ug/L				
1,4 Dichlorobenzene	ND	ND	ND	ND
4 Methylphenol	ND	ND	ND	ND
N Nitrosodiphenylamine (1)	ND	ND	ND	ND
Di n butylphthalate	ND	ND	*	*
Fluoranthene	ND	ND	*	*
bis(2 Ethylhexyl)phthalate	*	33.00	*	*
Di n octylphthalate	*	280.00	*	ND
Benzo (b) fluoranthene	*	ND	ND	ND
Benzo (k) fluoranthene	*	ND	ND	ND
Benzo (a) pyrene	ND	ND	ND	ND
METALS - mg/L				
Aluminum	ND	ND	ND	ND
Barium	*	ND	*	*
Beryllium	*	ND	ND	ND
Cadmium	ND	ND	ND	ND
Calcium	*	7600.00	8500.00	13700.00
Chromium	ND	ND	ND	ND
Cobalt	ND	ND	ND	ND
Copper	ND	ND	ND	43.00
Iron	*	190.00	*	*
Lead	ND	ND	ND	ND
Cyanide	ND	25.60	ND	ND
Magnesium	*	*	*	5280.00
Manganese	ND	*	101.00	17.00
Mercury	ND	ND	ND	ND
Nickel	ND	ND	ND	ND
Potassium	ND	*	*	2460.00
Selenium	ND	ND	ND	ND
Sodium	6890.00	8000.00	9510.00	11200.00
Vanadium	ND	ND	ND	ND
Zinc	*	20.00	*	40.00

B = Found in blank
ND = Not detected in sample
* = Did not pass QA/QC procedures

AR300584

TABLE E.3 BERKS SAND PIT SITE - RESIDENTIAL WELL DATA

CHEMICALS	STATION/DATE SAMPLED			
	RW-13 05/28/87	RW-13 02/10/88	RW-14 02/16/88	RW-15 02/09/88
VOLATILE ORGANICS - ug/L				
Methylene Chloride	6.00 B	*	ND	ND
Acetone	*	*	ND	ND
1,1 Dichloroethene	ND	ND	ND	ND
1,1 Dichloroethane	ND	ND	ND	ND
2 Butanone	ND	ND	ND	ND
1,1,1 Trichloroethane	ND	ND	ND	ND
Benzene	ND	*	ND	ND
Tetrachloroethene	ND	ND	ND	ND
Toluene	ND	*	ND	ND
Xylene (total)	ND	*	ND	ND
SEMI-VOLATILE ORGANICS - ug/L				
1,4 Dichlorobenzene	ND	ND	ND	ND
4 Methylphenol	ND	ND	ND	ND
N Nitrosodiphenylamine (1)	ND	ND	ND	ND
Di n butylphthalate	ND	ND	ND	*
Fluoranthene	ND	ND	ND	ND
bis(2 Ethylhexyl)phthalate	ND	*	*	*
Di n octylphthalate	ND	*	*	ND
Benzo (b) fluoranthene	ND	0.10	ND	ND
Benzo (k) fluoranthene	ND	0.10	ND	ND
Benzo (a) pyrene	ND	ND	ND	ND
METALS - mg/L				
Aluminum	200.00	ND	ND	ND
Barium	ND	*	*	*
Beryllium	ND	ND	*	ND
Cadmium	ND	ND	ND	ND
Calcium	7400.00	10300.00	*	7350.00
Chromium	ND	ND	ND	ND
Cobalt	ND	ND	ND	ND
Copper	ND	ND	ND	29.00
Iron	160.00	*	*	*
Lead	ND	ND	ND	ND
Cyanide	25.20	ND	ND	ND
Magnesium	*	*	6230.00	*
Manganese	60.00	322.00	*	ND
Mercury	ND	ND	ND	ND
Nickel	80.00	ND	ND	ND
Potassium	*	ND	ND	*
Selenium	ND	*	ND	ND
Sodium	*	6150.00	6690.00	6950.00
Vanadium	ND	ND	ND	*
Zinc	1750.00	28.00	*	*

B = Found in blank
ND = Not detected in sample
* = Did not pass QA/QC procedures

TABLE E.3 BERKS SAND PIT SITE - RESIDENTIAL WELL DATA

CHEMICALS	STATION/DATE SAMPLED			
	RW-16 01/20/88	RW-2 05/30/87	RW-2 01/20/88	RW-3 05/31/87
VOLATILE ORGANICS - ug/L				
Methylene Chloride	ND	*	*	*
Acetone	ND	ND	*	ND
1,1 Dichloroethene	ND	ND	8.70	ND
1,1 Dichloroethane	ND	ND	ND	ND
2 Butanone	ND	ND	ND	ND
1,1,1 Trichloroethane	ND	*	47.00	*
Benzene	ND	ND	ND	ND
Tetrachloroethene	ND	ND	*	ND
Toluene	ND	ND	ND	ND
Xylene (total)	ND	ND	ND	ND
SEMI-VOLATILE ORGANICS - ug/L				
1,4 Dichlorobenzene	ND	ND	ND	ND
4 Methylphenol	ND	ND	ND	ND
N Nitrosodiphenylamine (1)	ND	ND	ND	ND
Di n butylphthalate	ND	ND	*	ND
Fluoranthene	ND	ND	*	ND
bis(2 Ethylhexyl)phthalate	*	ND	*	ND
Di n octylphthalate	*	ND	*	ND
Benzo (b) fluoranthene	0.20	ND	*	ND
Benzo (k) fluoranthene	0.20	ND	*	ND
Benzo (a) pyrene	*	ND	ND	ND
METALS - mg/L				
Aluminum	ND	ND	ND	ND
Barium	*	ND	*	ND
Beryllium	ND	ND	ND	ND
Cadmium	ND	ND	ND	ND
Calcium	*	*	*	8600.00
Chromium	ND	ND	ND	ND
Cobalt	ND	ND	ND	ND
Copper	69.00	ND	ND	ND
Iron	*	130.00	*	2030.00
Lead	ND	ND	ND	ND
Cyanide	ND	21.20	ND	22.40
Magnesium	*	*	*	*
Manganese	ND	20.00	ND	140.00
Mercury	ND	ND	ND	ND
Nickel	ND	ND	ND	ND
Potassium	ND	*	ND	*
Selenium	ND	ND	ND	ND
Sodium	6420.00	5000.00	6130.00	7000.00
Vanadium	ND	ND	ND	ND
Zinc	58.00	20.00	24.00	*

B = Found in blank
ND = Not detected in sample
* = Did not pass QA/QC procedures

AR300586

TABLE E.3 BERKS SAND PIT SITE - RESIDENTIAL WELL DATA

CHEMICALS	STATION/DATE SAMPLED			
	RW-3 02/09/88	RW-4 05/31/87	RW-4 03/15/88	RW-4 02/09/88
VOLATILE ORGANICS - ug/L				
Methylene Chloride	ND	400.00 B	ND	11.00 B
Acetone	ND	ND	*	17.00 B
1,1 Dichloroethene	ND	540.00	*	21.00
1,1 Dichloroethane	ND	ND	ND	ND
2 Butanone	ND	ND	ND	ND
1,1,1 Trichloroethane	1400.00	6800.00	*	120.00
Benzene	ND	ND	*	*
Tetrachloroethene	ND	ND	ND	ND
Toluene	ND	ND	*	*
Xylene (total)	*	ND	*	*
SEMI-VOLATILE ORGANICS - ug/L				
1,4 Dichlorobenzene	ND	ND	ND	ND
4 Methylphenol	ND	ND	ND	ND
N Nitrosodiphenylamine (1)	ND	ND	ND	ND
Di n butylphthalate	ND	ND	*	*
Fluoranthene	ND	ND	*	*
bis(2 Ethylhexyl)phthalate	*	ND	*	*
Di n octylphthalate	*	ND	*	*
Benzo (b) fluoranthene	ND	ND	0.20	0.20
Benzo (k) fluoranthene	ND	ND	0.20	0.20
Benzo (a) pyrene	ND	ND	ND	ND
METALS - mg/L				
Aluminum	ND	ND	ND	ND
Barium	*	ND	*	*
Beryllium	ND	ND	ND	ND
Cadmium	ND	ND	ND	ND
Calcium	8950.00	5900.00	7890.00	7870.00
Chromium	ND	ND	ND	ND
Cobalt	ND	ND	ND	ND
Copper	ND	ND	ND	ND
Iron	542.00	1040.00	*	*
Lead	ND	ND	ND	ND
Cyanide	ND	25.20	ND	ND
Magnesium	*	*	*	*
Manganese	166.00	160.00	36.00	34.00
Mercury	ND	ND	ND	ND
Nickel	ND	ND	ND	ND
Potassium	ND	*	ND	ND
Selenium	ND	ND	ND	ND
Sodium	9030.00	7000.00	8770.00	7850.00
Vanadium	*	ND	ND	ND
Zinc	*	50.00	30.00	28.00

B = Found in blank
ND = Not detected in sample
* = Did not pass QA/QC procedures

AR300587

TABLE E.3 BERKS SAND PIT SITE - RESIDENTIAL WELL DATA

CHEMICALS	STATION/DATE SAMPLED			
	RW-5 02/16/88	RW-6 05/28/87	RW-6 01/20/88	RW-7 05/29/87
VOLATILE ORGANICS - ug/L				
Methylene Chloride	*	6.00 B	*	5.00 B
Acetone	*	*	*	*
1,1 Dichloroethene	*	ND	*	ND
1,1 Dichloroethane	ND	ND	ND	ND
2 Butanone	ND	ND	ND	ND
1,1,1 Trichloroethane	*	13.00	16.00	21.00
Benzene	*	ND	ND	ND
Tetrachloroethene	ND	ND	ND	ND
Toluene	*	ND	ND	ND
Xylene (total)	*	ND	ND	ND
SEMI-VOLATILE ORGANICS - ug/L				
1,4 Dichlorobenzene	ND	ND	ND	ND
4 Methylphenol	ND	ND	ND	ND
N Nitrosodiphenylamine (1)	ND	ND	ND	ND
Di n butylphthalate	*	ND	*	ND
Fluoranthene	ND	ND	*	ND
bis(2 Ethylhexyl)phthalate	*	ND	ND	ND
Di n octylphthalate	*	ND	*	ND
Benzo (b) fluoranthene	ND	ND	ND	ND
Benzo (k) fluoranthene	ND	ND	ND	ND
Benzo (a) pyrene	ND	ND	ND	ND
METALS - mg/L				
Aluminum	ND	ND	ND	ND
Barium	*	ND	*	ND
Beryllium	*	ND	ND	ND
Cadmium	ND	ND	ND	ND
Calcium	*	6200.00	*	5200.00
Chromium	ND	ND	ND	ND
Cobalt	ND	ND	ND	ND
Copper	ND	ND	139.00	ND
Iron	*	240.00	205.00	110.00
Lead	ND	ND	*	ND
Cyanide	ND	22.40	ND	26.00
Magnesium	*	*	*	*
Manganese	*	50.00	*	ND
Mercury	ND	ND	ND	ND
Nickel	ND	ND	ND	ND
Potassium	ND	*	ND	*
Selenium	ND	ND	ND	ND
Sodium	5870.00	5000.00	7940.00	9000.00
Vanadium	ND	ND	ND	ND
Zinc	23.00	20.00	32.00	30.00

B = Found in blank
ND = Not detected in sample
* = Did not pass QA/QC procedures

AR300588

TABLE E.3 BERKS SAND PIT SITE - RESIDENTIAL WELL DATA

CHEMICALS	STATION/DATE SAMPLED			
	RW-7 02/11/88	RW-8 02/09/88	RW-9 05/30/87	RW-9 03/15/88
VOLATILE ORGANICS - ug/L				
Methylene Chloride	*	ND	6.00 B	*
Acetone	*	ND	*	*
1,1 Dichloroethene	*	ND	ND	*
1,1 Dichloroethane	ND	ND	ND	ND
2 Butanone	ND	ND	ND	ND
1,1,1 Trichloroethane	*	6.50	ND	*
Benzene	*	ND	ND	*
Tetrachloroethene	ND	ND	ND	ND
Toluene	ND	ND	ND	*
Xylene (total)	*	ND	ND	*
SEMI-VOLATILE ORGANICS - ug/L				
1,4 Dichlorobenzene	16.00	ND	ND	ND
4 Methylphenol	ND	ND	ND	ND
N Nitrosodiphenylamine (1)	ND	ND	ND	ND
Di n butylphthalate	ND	*	ND	ND
Fluoranthene	*	ND	ND	ND
bis(2 Ethylhexyl)phthalate	ND	*	ND	*
Di n octylphthalate	ND	ND	ND	*
Benzo (b) fluoranthene	ND	ND	ND	ND
Benzo (k) fluoranthene	ND	ND	ND	ND
Benzo (a) pyrene	ND	ND	ND	ND
METALS - mg/L				
Aluminum	ND	ND	ND	ND
Barium	*	*	ND	*
Beryllium	ND	ND	ND	ND
Cadmium	ND	ND	ND	ND
Calcium	5720.00	*	5900.00	5140.00
Chromium	ND	ND	ND	ND
Cobalt	ND	ND	ND	ND
Copper	ND	288.00	ND	26.00
Iron	158.00	*	8550.00	*
Lead	ND	ND	ND	ND
Cyanide	ND	ND	21.20	ND
Magnesium	*	*	*	*
Manganese	507.00	ND	270.00	ND
Mercury	ND	ND	ND	ND
Nickel	ND	ND	ND	ND
Potassium	ND	ND	*	ND
Selenium	ND	*	ND	ND
Sodium	8550.00	5540.00	7000.00	7670.00
Vanadium	ND	ND	ND	ND
Zinc	34.00	23.00	*	*

B = Found in blank
ND = Not detected in sample
* = Did not pass QA/QC procedures

TABLE E.3 BERKS SAND PIT SITE - RESIDENTIAL WELL DATA

CHEMICALS	STATION/DATE SAMPLED	
	SUPERFUND 05/29/87	SUPERFUND 02/27/88
VOLATILE ORGANICS - ug/L		
Methylene Chloride	*	ND
Acetone	ND	ND
1,1 Dichloroethene	ND	ND
1,1 Dichloroethane	ND	ND
2 Butanone	ND	ND
1,1,1 Trichloroethane	ND	ND
Benzene	ND	ND
Tetrachloroethene	ND	ND
Toluene	ND	ND
Xylene (total)	ND	ND
SEMI-VOLATILE ORGANICS - ug/L		
1,4 Dichlorobenzene	ND	ND
4 Methylphenol	ND	ND
N Nitrosodiphenylamine (1)	ND	ND
Di n butylphthalate	ND	ND
Fluoranthene	ND	ND
bis(2 Ethylhexyl)phthalate	ND	*
Di n octylphthalate	ND	*
Benzo (b) fluoranthene	ND	ND
Benzo (k) fluoranthene	ND	ND
Benzo (a) pyrene	ND	ND
METALS - mg/L		
Aluminum	ND	ND
Barium	ND	*
Beryllium	ND	ND
Cadmium	ND	ND
Calcium	*	*
Chromium	10.00	ND
Cobalt	ND	ND
Copper	70.00	ND
Iron	210.00	*
Lead	*	ND
Cyanide	12.00	ND
Magnesium	*	1020.00
Manganese	ND	*
Mercury	ND	ND
Nickel	ND	ND
Potassium	*	ND
Selenium	ND	ND
Sodium	*	*
Vanadium	ND	ND
Zinc	220.00	*

B = Found in blank
ND = Not detected in sample
* = Did not pass QA/QC procedures

AR300590

TABLE E.4 BERKS SAND PIT SITE - MONITORING WELL DATA

CHEMICALS	STATION/DATE SAMPLED			
	ERT 1 02/10/88	ERT-1 05/29/87	ERT-2 05/29/87	ERT-2 02/10/88
VOLATILE ORGANICS - ug/L				
Methylene Chloride	*	7.00 B	7.00 B	*
Acetone	*	*	*	*
1,1 Dichloroethene	250.00	ND	ND	*
1,1 Dichloroethane	ND	ND	ND	ND
2 Butanone	ND	ND	ND	ND
1,1,1 Trichloroethane	98.00	5.00	19.00	26.00 B
Benzene	*	ND	ND	*
Tetrachloroethene	ND	ND	ND	ND
Toluene	*	ND	ND	*
Xylene (total)	*	ND	ND	*
SEMI-VOLATILE ORGANICS - ug/L				
1,4 Dichlorobenzene	ND	ND	ND	ND
4 Methylphenol	ND	ND	ND	ND
N Nitrosodiphenylamine (1)	ND	ND	ND	ND
Di n butylphthalate	ND	10.00	ND	*
Fluoranthene	ND	ND	ND	ND
bis(2 Ethylhexyl)phthalate	*	*	*	*
Di n octylphthalate	*	ND	ND	*
Benzo (b) fluoranthene	ND	ND	ND	ND
Benzo (k) fluoranthene	ND	ND	ND	ND
Benzo (a) pyrene	ND	ND	ND	ND
METALS - mg/L				
Aluminum	ND	ND	ND	ND
Barium	*	200.00	ND	*
Beryllium	ND	ND	ND	ND
Cadmium	ND	ND	ND	ND
Calcium	14300.00	19000.00	13100.00	12700.00
Chromium	ND	ND	ND	ND
Cobalt	ND	ND	ND	ND
Copper	ND	ND	ND	ND
Iron	*	21100.00	33100.00	17300.00
Lead	ND	ND	ND	ND
Cyanide	ND	21.20	21.60	ND
Magnesium	*	*	*	*
Manganese	237.00	380.00	290.00	219.00
Mercury	ND	ND	ND	ND
Nickel	ND	ND	250.00	ND
Potassium	ND	*	*	ND
Selenium	ND	ND	ND	ND
Sodium	10800.00	12000.00	11000.00	11800.00
Vanadium	ND	ND	ND	ND
Zinc	40.00	130.00	260.00	89.00

B = Found in blank
ND = Not detected in sample
* = Did not pass QA/QC procedures

AR300591

TABLE E.4 BERKS SAND PIT SITE - MONITORING WELL DATA

CHEMICALS	STATION/DATE SAMPLED			
	ERT-3 05/30/87	ERT-3 02/11/88	MW-1 11/23/87	MW-1 02/04/88
VOLATILE ORGANICS - ug/L				
Methylene Chloride	170.00 B	*	ND	64.00 B
Acetone	*	*	ND	82.00 B
1,1 Dichloroethene	*	250.00	*	48.00
1,1 Dichloroethane	*	ND	*	ND
2 Butanone	ND	ND	ND	ND
1,1,1 Trichloroethane	2900.00	98.00	*	180.00 B
Benzene	ND	6.30 B	ND	*
Tetrachloroethene	ND	6.40	ND	ND
Toluene	ND	7.20 B	ND	*
Xylene (total)	ND	8.40 B	*	*
SEMI-VOLATILE ORGANICS - ug/L				
1,4 Dichlorobenzene	ND	ND	ND	ND
4 Methylphenol	ND	ND	ND	ND
N Nitrosodiphenylamine (1)	ND	ND	ND	ND
Di n butylphthalate	ND	*	ND	ND
Fluoranthene	ND	*	ND	ND
bis(2 Ethylhexyl)phthalate	ND	*	ND	ND
Di n octylphthalate	ND	*	ND	ND
Benzo (b) fluoranthene	ND	ND	ND	ND
Benzo (k) fluoranthene	ND	ND	ND	ND
Benzo (a) pyrene	ND	ND	ND	ND
METALS - mg/L				
Aluminum	ND	ND	*	216.00
Barium	ND	*	*	*
Beryllium	ND	ND	ND	ND
Cadmium	ND	ND	ND	ND
Calcium	8500.00	9190.00	12900.00	*
Chromium	10.00	ND	ND	ND
Cobalt	ND	ND	*	*
Copper	ND	ND	ND	ND
Iron	18900.00	8690.00	*	165.00
Lead	ND	ND	ND	ND
Cyanide	38.00	ND	ND	ND
Magnesium	*	*	*	*
Manganese	290.00	337.00	45.00	*
Mercury	ND	ND	ND	ND
Nickel	40.00	ND	ND	ND
Potassium	*	ND	*	ND
Selenium	ND	ND	ND	ND
Sodium	8000.00	8140.00	12000.00	*
Vanadium	ND	ND	*	*
Zinc	70.00	31.00	*	102.00

B = Found in blank
ND = Not detected in sample
* = Did not pass QA/QC procedures

AR300592

TABLE E.4 BERKS SAND PIT SITE - MONITORING WELL DATA

CHEMICALS	STATION/DATE SAMPLED			
	MW-2 11/23/87	MW-2 02/03/88	MW-2 44'-54' 08/25/87	MW-3 11/23/87
VOLATILE ORGANICS - ug/L				
Methylene Chloride	ND	*	ND	ND
Acetone	ND	*	ND	*
1,1 Dichloroethene	*	48.00 B	*	*
1,1 Dichloroethane	*	ND	*	*
2 Butanone	ND	ND	ND	ND
1,1,1 Trichloroethane	*	90.00 B	82.00	*
Benzene	ND	*	ND	*
Tetrachloroethene	ND	ND	ND	ND
Toluene	ND	*	ND	*
Xylene (total)	ND	*	ND	ND
SEMI-VOLATILE ORGANICS - ug/L				
1,4 Dichlorobenzene	ND	ND	ND	ND
4 Methylphenol	ND	ND	ND	ND
N Nitrosodiphenylamine (1)	ND	ND	ND	ND
Di n butylphthalate	ND	ND	ND	ND
Fluoranthene	ND	ND	ND	ND
bis(2 Ethylhexyl)phthalate	*	*	ND	ND
Di n octylphthalate	ND	*	ND	ND
Benzo (b) fluoranthene	ND	ND	ND	ND
Benzo (k) fluoranthene	ND	ND	ND	ND
Benzo (a) pyrene	ND	ND	ND	ND
METALS - mg/L				
Aluminum	*	*	ND	ND
Barium	*	*	ND	ND
Beryllium	ND	ND	ND	ND
Cadmium	ND	ND	ND	ND
Calcium	15300.00	*	ND	ND
Chromium	ND	ND	ND	ND
Cobalt	*	ND	ND	ND
Copper	ND	ND	ND	ND
Iron	*	*	ND	*
Lead	ND	ND	ND	ND
Cyanide	ND	ND	ND	ND
Magnesium	*	*	ND	*
Manganese	108.00	*	ND	ND
Mercury	ND	ND	ND	ND
Nickel	ND	ND	ND	ND
Potassium	13000.00	9820.00	ND	5570.00
Selenium	ND	ND	ND	ND
Sodium	16500.00	8260.00	ND	*
Vanadium	*	*	ND	*
Zinc	44.00	47.00	ND	*

B = Found in blank
ND = Not detected in sample
* = Did not pass QA/QC procedures

AR300593

TABLE E.4 BERKS SAND PIT SITE - MONITORING WELL DATA

CHEMICALS	STATION/DATE SAMPLED			
	MW-3 02/03/88	MW-4 11/22/87	MW-4 02/01/88	MW-5 11/22/87
VOLATILE ORGANICS - ug/L				
Methylene Chloride	*	ND	*	ND
Acetone	*	ND	*	ND
1,1 Dichloroethene	860.00	*	3500.00	*
1,1 Dichloroethane	ND	*	ND	*
2 Butanone	ND	ND	ND	ND
1,1,1 Trichloroethane	2200.00	*	7300.00	*
Benzene	*	*	*	ND
Tetrachloroethene	*	*	*	ND
Toluene	*	*	*	ND
Xylene (total)	*	ND	50.00 B	ND
SEMI-VOLATILE ORGANICS - ug/L				
1,4 Dichlorobenzene	ND	ND	ND	ND
4 Methylphenol	ND	ND	ND	ND
N Nitrosodiphenylamine (1)	ND	ND	ND	ND
Di n butylphthalate	ND	ND	ND	ND
Fluoranthene	ND	ND	ND	ND
bis(2 Ethylhexyl)phthalate	ND	*	*	ND
Di n octylphthalate	ND	ND	*	ND
Benzo (b) fluoranthene	ND	ND	ND	ND
Benzo (k) fluoranthene	ND	ND	ND	ND
Benzo (a) pyrene	ND	ND	ND	ND
METALS - mg/L				
Aluminum	ND	*	ND	*
Barium	*	*	*	*
Beryllium	ND	ND	*	ND
Cadmium	ND	ND	ND	ND
Calcium	*	8040.00	*	8890.00
Chromium	ND	ND	ND	ND
Cobalt	ND	ND	ND	ND
Copper	ND	ND	ND	ND
Iron	*	*	*	1190.00
Lead	ND	ND	ND	ND
Cyanide	ND	ND	ND	ND
Magnesium	*	*	*	*
Manganese	ND	59.00	*	264.00
Mercury	ND	ND	ND	ND
Nickel	ND	ND	ND	ND
Potassium	ND	5730.00	ND	5180.00
Selenium	ND	ND	ND	ND
Sodium	5620.00	11000.00	9700.00	12300.00
Vanadium	ND	*	ND	*
Zinc	*	41.00	48.00	*

B = Found in blank
ND = Not detected in sample
* = Did not pass QA/QC procedures

AR300594

TABLE E.4 BERKS SAND PIT SITE - MONITORING WELL DATA

CHEMICALS	STATION/DATE SAMPLED			
	MW-5 02/01/88	MW-6 11/22/87	MW-6 02/02/88	MW-7 11/24/87
VOLATILE ORGANICS - ug/L				
Methylene Chloride	ND	ND	*	ND
Acetone	ND	ND	*	ND
1,1 Dichloroethene	120.00 B	*	340.00 B	*
1,1 Dichloroethane	ND	*	ND	*
2 Butanone	ND	ND	ND	*
1,1,1 Trichloroethane	300.00	*	940.00	*
Benzene	*	ND	*	ND
Tetrachloroethene	ND	ND	ND	*
Toluene	*	ND	*	ND
Xylene (total)	*	ND	*	ND
SEMI-VOLATILE ORGANICS - ug/L				
1,4 Dichlorobenzene	ND	ND	ND	ND
4 Methylphenol	ND	ND	ND	ND
N Nitrosodiphenylamine (1)	ND	ND	ND	ND
Di n butylphthalate	ND	ND	ND	ND
Fluoranthene	ND	ND	ND	ND
bis(2 Ethylhexyl)phthalate	*	*	*	ND
Di n octylphthalate	*	ND	*	ND
Benzo (b) fluoranthene	ND	ND	0.30	ND
Benzo (k) fluoranthene	ND	ND	0.30	ND
Benzo (a) pyrene	ND	ND	*	ND
METALS - mg/L				
Aluminum	ND	*	ND	*
Barium	*	*	*	*
Beryllium	ND	ND	ND	ND
Cadmium	ND	ND	ND	ND
Calcium	*	141000.00	*	8500.00
Chromium	ND	18.00	ND	ND
Cobalt	*	*	ND	ND
Copper	ND	165.00	ND	ND
Iron	*	*	*	*
Lead	ND	ND	ND	ND
Cyanide	ND	ND	ND	ND
Magnesium	*	*	*	*
Manganese	ND	1870.00	*	332.00
Mercury	ND	ND	ND	ND
Nickel	ND	115.00	ND	ND
Potassium	ND	24300.00	ND	*
Selenium	ND	ND	ND	ND
Sodium	7670.00	66700.00	6090.00	10500.00
Vanadium	*	*	*	*
Zinc	37.00	*	88.00	22.00

B = Found in blank
ND = Not detected in sample
* = Did not pass QA/QC procedures

AR300595

TABLE E.4 BERKS SAND PIT SITE - MONITORING WELL DATA

CHEMICALS	STATION/DATE SAMPLED			
	MW-7 02/04/88	MW-8 11/24/87	MW-8 02/03/88	MW-9 11/23/87
VOLATILE ORGANICS - ug/L				
Methylene Chloride	*	ND	ND	ND
Acetone	*	ND	ND	ND
1,1 Dichloroethene	1300.00	*	41.00 B	*
1,1 Dichloroethane	ND	ND	ND	*
2 Butanone	ND	ND	ND	ND
1,1,1 Trichloroethane	3700.00	*	*	*
Benzene	*	*	*	*
Tetrachloroethene	25.00	ND	ND	ND
Toluene	*	*	*	ND
Xylene (total)	*	ND	*	ND
SEMI-VOLATILE ORGANICS - ug/L				
1,4 Dichlorobenzene	ND	ND	ND	ND
4 Methylphenol	ND	ND	ND	ND
N Nitrosodiphenylamine (1)	ND	ND	ND	ND
Di n butylphthalate	*	ND	ND	ND
Fluoranthene	ND	ND	ND	ND
bis(2 Ethylhexyl)phthalate	*	*	*	*
Di n octylphthalate	*	ND	*	ND
Benzo (b) fluoranthene	ND	ND	ND	ND
Benzo (k) fluoranthene	ND	ND	ND	ND
Benzo (a) pyrene	ND	ND	ND	ND
METALS - mg/L				
Aluminum	ND	*	ND	ND
Barium	*	*	*	*
Beryllium	ND	ND	ND	ND
Cadmium	ND	ND	ND	ND
Calcium	8600.00	4950.00	*	11300.00
Chromium	ND	ND	ND	ND
Cobalt	ND	ND	ND	ND
Copper	ND	ND	ND	ND
Iron	*	*	*	*
Lead	ND	ND	ND	*
Cyanide	ND	ND	ND	ND
Magnesium	*	*	*	*
Manganese	205.00	20.00	ND	*
Mercury	ND	0.37	ND	0.28
Nickel	ND	ND	ND	ND
Potassium	*	8160.00	ND	*
Selenium	ND	ND	ND	ND
Sodium	9040.00	9730.00	5510.00	14300.00
Vanadium	*	*	ND	*
Zinc	25.00	*	27.00	30.00

B = Found in blank
ND = Not detected in sample
* = Did not pass QA/QC procedures

AR300596

TABLE E.4 BERKS SAND PIT SITE - MONITORING WELL DATA

CHEMICALS	STATION/DATE SAMPLED			
	MW-9 02/03/88	SW-1 01/26/88	SW-2 01/26/88	SW-3 01/25/88
VOLATILE ORGANICS - ug/L				
Methylene Chloride	*	*	*	ND
Acetone	*	*	*	*
1,1 Dichloroethene	1100.00	850.00	220.00	100.00 B
1,1 Dichloroethane	ND	ND	ND	ND
2 Butanone	ND	ND	ND	ND
1,1,1 Trichloroethane	3100.00	1900.00	6500.00	240.00
Benzene	*	*	*	*
Tetrachloroethene	*	ND	*	ND
Toluene	*	*	*	*
Xylene (total)	*	*	*	*
SEMI-VOLATILE ORGANICS - ug/L				
1,4 Dichlorobenzene	ND	ND	ND	ND
4 Methylphenol	ND	ND	ND	ND
N Nitrosodiphenylamine (1)	ND	ND	ND	ND
Di n butylphthalate	*	ND	ND	ND
Fluoranthene	ND	ND	ND	ND
bis(2 Ethylhexyl)phthalate	*	*	*	*
Di n octylphthalate	*	ND	*	*
Benzo (b) fluoranthene	ND	ND	ND	ND
Benzo (k) fluoranthene	ND	ND	ND	ND
Benzo (a) pyrene	ND	ND	ND	ND
METALS - mg/L				
Aluminum	ND	ND	*	*
Barium	*	*	*	*
Beryllium	ND	ND	ND	ND
Cadmium	ND	ND	ND	ND
Calcium	10900.00	11100.00	7310.00	7460.00
Chromium	ND	ND	ND	ND
Cobalt	ND	ND	ND	ND
Copper	ND	ND	ND	ND
Iron	ND	*	146.00	*
Lead	ND	ND	ND	ND
Cyanide	ND	ND	ND	ND
Magnesium	*	*	*	*
Manganese	ND	ND	18.00	*
Mercury	ND	ND	ND	ND
Nickel	ND	ND	ND	ND
Potassium	ND	ND	ND	ND
Selenium	ND	ND	ND	ND
Sodium	11200.00	11000.00	10200.00	7410.00
Vanadium	ND	ND	ND	ND
Zinc	27.00	44.00	*	50.00

B = Found in blank
ND = Not detected in sample
* = Did not pass QA/QC procedures

TABLE E.4 BERKS SAND PIT SITE - MONITORING WELL DATA

CHEMICALS	STATION/DATE SAMPLED			
	SW-4 01/26/88	SW-5 01/26/88	SW-6 01/28/88	SW-7 01/28/88
VOLATILE ORGANICS - ug/L				
Methylene Chloride	*	*	ND	*
Acetone	*	*	*	*
1,1 Dichloroethene	270.00 B	280.00	*	ND
1,1 Dichloroethane	ND	ND	ND	ND
2 Butanone	ND	ND	ND	ND
1,1,1 Trichloroethane	490.00 B	600.00	*	ND
Benzene	*	*	*	*
Tetrachloroethene	*	ND	ND	ND
Toluene	*	*	*	*
Xylene (total)	*	*	*	*
SEMI-VOLATILE ORGANICS - ug/L				
1,4 Dichlorobenzene	ND	ND	ND	ND
4 Methylphenol	ND	ND	ND	ND
N Nitrosodiphenylamine (1)	ND	ND	ND	ND
Di n butylphthalate	*	ND	*	ND
Fluoranthene	*	ND	*	ND
bis(2 Ethylhexyl)phthalate	*	*	ND	*
Di n octylphthalate	*	*	ND	ND
Benzo (b) fluoranthene	ND	ND	ND	ND
Benzo (k) fluoranthene	ND	ND	ND	ND
Benzo (a) pyrene	ND	ND	ND	ND
METALS - mg/L				
Aluminum	ND	ND	ND	*
Barium	*	*	*	*
Beryllium	ND	ND	ND	ND
Cadmium	ND	ND	ND	ND
Calcium	4060.00	13200.00	*	*
Chromium	ND	ND	ND	ND
Cobalt	ND	ND	ND	*
Copper	ND	ND	ND	28.00
Iron	ND	*	*	218.00
Lead	ND	ND	ND	ND
Cyanide	ND	ND	ND	ND
Magnesium	*	*	*	*
Manganese	ND	16.00	*	*
Mercury	ND	ND	ND	ND
Nickel	ND	ND	ND	ND
Potassium	ND	ND	ND	*
Selenium	ND	ND	ND	ND
Sodium	*	12000.00	10500.00	34600.00
Vanadium	ND	ND	*	*
Zinc	*	37.00	23.00	137.00

B = Found in blank
ND = Not detected in sample
* = Did not pass QA/QC procedures

AR300598

TABLE E.5 BERKS SAND PIT SITE - SURFACE WATER DATA

CHEMICALS	STATION/DATE SAMPLED			
	SP-1 11/20/87	SP-1 02/15/88	SP-10 11/20/87	SP-10 02/14/88
VOLATILE ORGANICS - ug/L				
Methylene Chloride	ND	*	ND	*
Acetone	*	*	ND	*
1,1 Dichloroethene	*	990.00	ND	*
1,1 Dichloroethane	*	ND	ND	ND
2 Butanone	ND	ND	ND	ND
1,1,1 Trichloroethane	*	2600.00	*	ND
Benzene	ND	*	ND	ND
Tetrachloroethene	ND	*	ND	ND
Toluene	ND	*	ND	ND
Xylene (total)	ND	*	ND	ND
SEMI-VOLATILE ORGANICS - ug/L				
1,4 Dichlorobenzene	ND	ND	ND	ND
4 Methylphenol	ND	ND	ND	ND
N Nitrosodiphenylamine (1)	ND	ND	ND	ND
Di n butylphthalate	ND	ND	ND	ND
Fluoranthene	ND	ND	ND	ND
bis(2 Ethylhexyl)phthalate	ND	*	ND	*
Di n octylphthalate	ND	*	ND	*
Benzo (b) fluoranthene	ND	ND	ND	ND
Benzo (k) fluoranthene	ND	ND	ND	ND
Benzo (a) pyrene	ND	ND	ND	ND
METALS - mg/L				
Aluminum	2360.00	*	*	ND
Barium	*	*	*	*
Beryllium	ND	ND	ND	ND
Cadmium	ND	ND	5.60	ND
Calcium	*	*	*	*
Chromium	*	ND	ND	ND
Cobalt	*	*	*	ND
Copper	ND	ND	ND	ND
Iron	1760.00	*	155.00	*
Lead	15.00	ND	ND	ND
Cyanide	ND	1300.00	ND	ND
Magnesium	*	*	*	*
Manganese	205.00	16.00	*	*
Mercury	ND	ND	ND	ND
Nickel	ND	ND	ND	ND
Potassium	*	*	ND	ND
Selenium	ND	ND	ND	ND
Sodium	7500.00	855000.00	6080.00	*
Vanadium	*	*	*	ND
Zinc	*	44.00	*	*

B = Found in blank
ND = Not detected in sample
* = Did not pass QA/QC procedures

AR300599

TABLE E.5 BERKS SAND PIT SITE - SURFACE WATER DATA

CHEMICALS	STATION/DATE SAMPLED			
	SP-11 11/20/87	SP-11 02/14/88	SP-12 11/20/87	SP-12 01/20/88
VOLATILE ORGANICS - ug/L				
Methylene Chloride	ND	*	ND	ND
Acetone	ND	*	ND	ND
1,1 Dichloroethene	*	20.00	ND	ND
1,1 Dichloroethane	ND	ND	ND	ND
2 Butanone	ND	ND	ND	ND
1,1,1 Trichloroethane	ND	*	ND	ND
Benzene	ND	*	ND	ND
Tetrachloroethene	*	ND	ND	ND
Toluene	ND	ND	ND	ND
Xylene (total)	ND	ND	ND	ND
SEMI-VOLATILE ORGANICS - ug/L				
1,4 Dichlorobenzene	ND	ND	ND	ND
4 Methylphenol	ND	ND	ND	ND
N Nitrosodiphenylamine (1)	ND	ND	ND	ND
Di n butylphthalate	ND	*	ND	ND
Fluoranthene	ND	ND	ND	ND
bis(2 Ethylhexyl)phthalate	ND	*	ND	*
Di n octylphthalate	ND	*	ND	*
Benzo (b) fluoranthene	ND	ND	ND	ND
Benzo (k) fluoranthene	ND	ND	ND	ND
Benzo (a) pyrene	ND	ND	ND	ND
METALS - mg/L				
Aluminum	*	ND	*	ND
Barium	*	*	*	*
Beryllium	ND	ND	ND	ND
Cadmium	ND	ND	ND	ND
Calcium	6480.00	6020.00	7670.00	*
Chromium	ND	ND	ND	ND
Cobalt	ND	ND	ND	ND
Copper	ND	ND	ND	ND
Iron	158.00	*	*	*
Lead	ND	ND	ND	ND
Cyanide	ND	ND	ND	ND
Magnesium	*	*	5250.00	*
Manganese	17.00	ND	*	ND
Mercury	ND	ND	ND	ND
Nickel	ND	ND	ND	ND
Potassium	ND	ND	ND	ND
Selenium	ND	ND	ND	ND
Sodium	5130.00	*	5910.00	6740.00
Vanadium	ND	ND	ND	*
Zinc	*	*	*	21.00

B = Found in blank
ND = Not detected in sample
* = Did not pass QA/QC procedures

AR300600

TABLE E.5 BERKS SAND PIT SITE - SURFACE WATER DATA

CHEMICALS	STATION/DATE SAMPLED			
	SP-13 01/18/88	SP-2 11/20/87	SP-2 02/15/88	SP-3 11/20/87
VOLATILE ORGANICS - ug/L				
Methylene Chloride	ND	*	*	ND
Acetone	ND	*	*	ND
1,1 Dichloroethene	ND	*	84.00	19.00
1,1 Dichloroethane	ND	*	ND	*
2 Butanone	ND	*	ND	6.40 B
1,1,1 Trichloroethane	ND	*	260.00	64.00
Benzene	ND	*	*	ND
Tetrachloroethene	ND	ND	ND	ND
Toluene	ND	*	*	ND
Xylene (total)	ND	ND	*	ND
SEMI-VOLATILE ORGANICS - ug/L				
1,4 Dichlorobenzene	ND	ND	ND	ND
4 Methylphenol	ND	ND	ND	ND
N Nitrosodiphenylamine (1)	ND	ND	ND	ND
Di n butylphthalate	ND	ND	ND	ND
Fluoranthene	ND	ND	ND	ND
bis(2 Ethylhexyl)phthalate	*	*	*	ND
Di n octylphthalate	*	ND	*	ND
Benzo (b) fluoranthene	ND	ND	ND	ND
Benzo (k) fluoranthene	ND	ND	ND	ND
Benzo (a) pyrene	ND	ND	ND	ND
METALS - mg/L				
Aluminum	ND	517.00	123000.00	1060.00
Barium	*	*	3360.00	*
Beryllium	ND	ND	*	*
Cadmium	ND	ND	48.00	ND
Calcium	*	6340.00	128000.00	*
Chromium	ND	ND	130.00	ND
Cobalt	ND	ND	*	ND
Copper	ND	ND	268.00	ND
Iron	*	769.00	84600.00	1300.00
Lead	ND	15.00	*	*
Cyanide	ND	ND	ND	ND
Magnesium	*	*	24400.00	ND
Manganese	*	77.00	2760.00	73.00
Mercury	ND	ND	1.90	ND
Nickel	ND	ND	219.00	ND
Potassium	ND	ND	ND	ND
Selenium	ND	ND	ND	ND
Sodium	5900.00	5620.00	8690.00	ND
Vanadium	*	ND	266.00	ND
Zinc	*	*	3860.00	*

B = Found in blank
ND = Not detected in sample
* = Did not pass QA/QC procedures

AR300601

TABLE E.5 BERKS SAND PIT SITE - SURFACE WATER DATA

CHEMICALS	STATION/DATE SAMPLED			
	SP-3 02/15/88	SP-4 11/20/87	SP-4 02/15/88	SP-5 11/20/87
VOLATILE ORGANICS - ug/L				
Methylene Chloride	27.00 B	ND	*	ND
Acetone	*	ND	*	ND
1,1 Dichloroethene	41.00	38.00	66.00	ND
1,1 Dichloroethane	ND	*	ND	*
2 Butanone	ND	ND	ND	ND
1,1,1 Trichloroethane	330.00	120.00	240.00	*
Benzene	*	ND	ND	ND
Tetrachloroethene	ND	ND	ND	ND
Toluene	*	ND	ND	ND
Xylene (total)	*	ND	ND	ND
SEMI-VOLATILE ORGANICS - ug/L				
1,4 Dichlorobenzene	ND	ND	ND	ND
4 Methylphenol	ND	ND	ND	ND
N Nitrosodiphenylamine (1)	ND	ND	ND	ND
Di n butylphthalate	ND	ND	ND	ND
Fluoranthene	ND	ND	ND	ND
bis(2 Ethylhexyl)phthalate	*	ND	*	ND
Di n octylphthalate	*	ND	*	*
Benzo (b) fluoranthene	ND	ND	0.30	ND
Benzo (k) fluoranthene	ND	ND	0.30	ND
Benzo (a) pyrene	ND	ND	*	ND
METALS - mg/L				
Aluminum	*	603.00	*	3890.00
Barium	*	*	*	*
Beryllium	ND	ND	ND	*
Cadmium	ND	ND	ND	5.10
Calcium	*	*	*	6900.00
Chromium	*	ND	*	*
Cobalt	*	*	*	*
Copper	ND	ND	ND	*
Iron	*	671.00	183.00	3420.00
Lead	*	8.30	*	62.00
Cyanide	ND	ND	6600.00	ND
Magnesium	*	*	*	*
Manganese	*	67.00	95.00	413.00
Mercury	ND	ND	ND	ND
Nickel	ND	ND	ND	ND
Potassium	7910.00	*	7800.00	*
Selenium	ND	ND	ND	ND
Sodium	1050000.00	6880.00	1000000.00	8500.00
Vanadium	*	*	*	*
Zinc	21.00	*	30.00	*

B = Found in blank
ND = Not detected in sample
* = Did not pass QA/QC procedures

AR300602

TABLE E.5 BERKS SAND PIT SITE - SURFACE WATER DATA

CHEMICALS	STATION/DATE SAMPLED			
	SP-5 02/15/88	SP-6 11/20/87	SP-6 02/13/88	SP-7 11/20/87
VOLATILE ORGANICS - ug/L				
Methylene Chloride	ND	ND	*	ND
Acetone	ND	ND	*	ND
1,1 Dichloroethene	ND	*	*	17.00
1,1 Dichloroethane	9.30	*	ND	*
2 Butanone	ND	ND	ND	ND
1,1,1 Trichloroethane	490.00	*	*	62.00
Benzene	ND	ND	*	ND
Tetrachloroethene	ND	*	ND	ND
Toluene	ND	ND	*	ND
Xylene (total)	*	ND	*	ND
SEMI-VOLATILE ORGANICS - ug/L				
1,4 Dichlorobenzene	ND	ND	ND	ND
4 Methylphenol	ND	ND	ND	ND
N Nitrosodiphenylamine (1)	ND	ND	ND	ND
Di n butylphthalate	ND	ND	ND	ND
Fluoranthene	ND	ND	ND	ND
bis(2 Ethylhexyl)phthalate	*	ND	*	ND
Di n octylphthalate	*	ND	*	ND
Benzo (b) fluoranthene	ND	ND	*	ND
Benzo (k) fluoranthene	ND	ND	*	ND
Benzo (a) pyrene	ND	ND	*	ND
METALS - mg/L				
Aluminum	ND	*	ND	*
Barium	*	*	*	*
Beryllium	ND	ND	*	ND
Cadmium	ND	ND	ND	ND
Calcium	*	6200.00	5140.00	*
Chromium	ND	ND	ND	ND
Cobalt	ND	*	ND	*
Copper	ND	ND	ND	*
Iron	*	111.00	*	469.00
Lead	ND	ND	ND	ND
Cyanide	ND	ND	ND	ND
Magnesium	*	*	*	*
Manganese	ND	9.60	ND	63.00
Mercury	ND	ND	ND	ND
Nickel	ND	ND	ND	ND
Potassium	ND	ND	*	*
Selenium	ND	ND	ND	ND
Sodium	ND	7830.00	855000.00	6610.00
Vanadium	ND	*	ND	*
Zinc	*	*	*	*

B = Found in blank
ND = Not detected in sample
* = Did not pass QA/QC procedures

TABLE E.5 BERKS SAND PIT SITE - SURFACE WATER DATA

CHEMICALS	STATION/DATE SAMPLED			
	SP-7 02/13/88	SP-8 11/20/87	SP-8 02/13/88	SP-9 11/20/87
VOLATILE ORGANICS - ug/L				
Methylene Chloride	*	ND	*	ND
Acetone	*	ND	*	ND
1,1 Dichloroethene	*	*	*	ND
1,1 Dichloroethane	ND	*	ND	ND
2 Butanone	ND	ND	ND	ND
1,1,1 Trichloroethane	*	*	*	*
Benzene	*	ND	*	ND
Tetrachloroethene	ND	*	ND	ND
Toluene	*	ND	*	ND
Xylene (total)	*	ND	*	ND
SEMI-VOLATILE ORGANICS - ug/L				
1,4 Dichlorobenzene	ND	ND	ND	ND
4 Methylphenol	ND	ND	ND	ND
N Nitrosodiphenylamine (1)	ND	ND	ND	ND
Di n butylphthalate	*	ND	*	ND
Fluoranthene	*	ND	ND	ND
bis(2 Ethylhexyl)phthalate	*	ND	*	ND
Di n octylphthalate	*	ND	ND	ND
Benzo (b) fluoranthene	ND	ND	ND	ND
Benzo (k) fluoranthene	ND	ND	ND	ND
Benzo (a) pyrene	ND	ND	ND	ND
METALS - mg/L				
Aluminum	ND	*	ND	*
Barium	*	*	*	*
Beryllium	*	ND	*	ND
Cadmium	ND	ND	ND	ND
Calcium	*	5290.00	*	*
Chromium	ND	ND	ND	ND
Cobalt	ND	*	ND	*
Copper	ND	ND	ND	ND
Iron	*	154.00	*	518.00
Lead	ND	ND	ND	ND
Cyanide	ND	ND	ND	ND
Magnesium	*	*	*	*
Manganese	*	*	ND	42.00
Mercury	ND	ND	ND	ND
Nickel	ND	ND	ND	ND
Potassium	ND	*	ND	*
Selenium	ND	ND	ND	*
Sodium	*	9120.00	*	7510.00
Vanadium	ND	*	ND	*
Zinc	25.00	*	*	*

B = Found in blank
ND = Not detected in sample
* = Did not pass QA/QC procedures

AR300604

TABLE E.5 BERKS SAND PIT SITE - SURFACE WATER DATA

CHEMICALS	STATION/DATE SAMPLED
	SP-9 02/14/88
VOLATILE ORGANICS - ug/L	
Methylene Chloride	*
Acetone	*
1,1 Dichloroethene	*
1,1 Dichloroethane	ND
2 Butanone	ND
1,1,1 Trichloroethane	*
Benzene	ND
Tetrachloroethene	ND
Toluene	ND
Xylene (total)	ND
SEMI-VOLATILE ORGANICS - ug/L	
1,4 Dichlorobenzene	ND
4 Methylphenol	ND
N Nitrosodiphenylamine (1)	ND
Di n butylphthalate	ND
Fluoranthene	ND
bis(2 Ethylhexyl)phthalate	*
Di n octylphthalate	*
Benzo (b) fluoranthene	ND
Benzo (k) fluoranthene	ND
Benzo (a) pyrene	ND
METALS - mg/L	
Aluminum	ND
Barium	*
Beryllium	*
Cadmium	ND
Calcium	*
Chromium	ND
Cobalt	ND
Copper	ND
Iron	*
Lead	ND
Cyanide	15.00
Magnesium	*
Manganese	67.00
Mercury	ND
Nickel	ND
Potassium	ND
Selenium	ND
Sodium	*
Vanadium	ND
Zinc	*

B = Found in blank
ND = Not detected in sample
* = Did not pass QA/QC procedures

AR300605

APPENDIX F

CALCULATIONS

APPENDIX F

CALCULATION OF SHOWER AREA CONCENTRATIONS OF VOLATILE ORGANIC COMPOUNDS (VOCs)

As part of the overall risk assessment process, it was necessary to establish estimates of the expected indoor air concentrations of the Volatile Organic Compounds (VOCs) present in the residential wells and the monitoring wells. This Appendix describes the process, assumptions and relevant data used in making these estimates.

The methodology most appropriate to the problem at hand is that developed by McKone (2). It is capable of relating measured VOC well-water concentrations to expected indoor air concentrations via a process that had been validated with actual measurements. This methodology uses mass transfers from water to air that have been derived from measured data for radon, and then adjusted to account for the difference in mass-transfer properties for VOCs.

The present analysis closely follows the work of McKone. However, the present analysis departs from strict adherence to McKone's model in order to accommodate the specific goals of this project. Our objective is the provision of "worst-case" shower area concentrations of the VOCs found in well water samples. The following describes Baker/TSA's procedure and results relative to this objective.

Model Structure

The approach begins with a three-compartment model of a "typical" home. The specific compartments are:

- the shower area
- the bathroom
- the remainder of the house

The air contaminant levels in the shower area (as well as in the other areas) are dependent on the overall mass-transfers of chemicals into and out of the area. Figure F-1 portrays the model's structure. In Figure F-1, Q_S refers to the amount of chemical released through

AR300607

volatilization of the incoming shower water. The symbols S→B and B→S depict the flow of air from the shower area to the bathroom, and from the bathroom to the shower area, respectively. Similarly H→B, B→H, H→A and A→H portray the air exchange processes throughout the remaining compartments and with the ambient air.

Dynamically, the mass transfer process occurs as follows. Chemicals in the incoming shower water are partially volatilized, increasing the chemical's concentration in the shower compartment. Air flows out of the shower into the bathroom increasing the concentration in the bathroom compartment. Likewise, air flows from the bath to the house increasing the concentration in the rest of the house. From the house, indoor air is discharged to the ambient air. Compensating for the outward flow of air is the influent portion of the cycle. Ambient air influx modifies the house concentration; the transfer of house air into the bathroom modifies the bathroom concentration, and the cycle is completed when bathroom air flows into the shower compartment and modifies the shower concentration. By considering these exchanges as a sequential, cyclic process, it is possible to mathematically simulate and approximate the continuous, simultaneous events that actually occur.

These processes are mathematically described in the following three mass-balance equations:

$$V_S \frac{dC_S(t)}{dt} = Q_S(t)_t + q_{BS}C_B(t) - q_{SB}C_S(t) \qquad (1)$$

$$V_B \frac{dC_B(t)}{dt} = q_{SB}C_S(t) + q_{HB}C_H(t) - q_{BS}C_B(t) - q_{BH}C_B(t) \qquad (2)$$

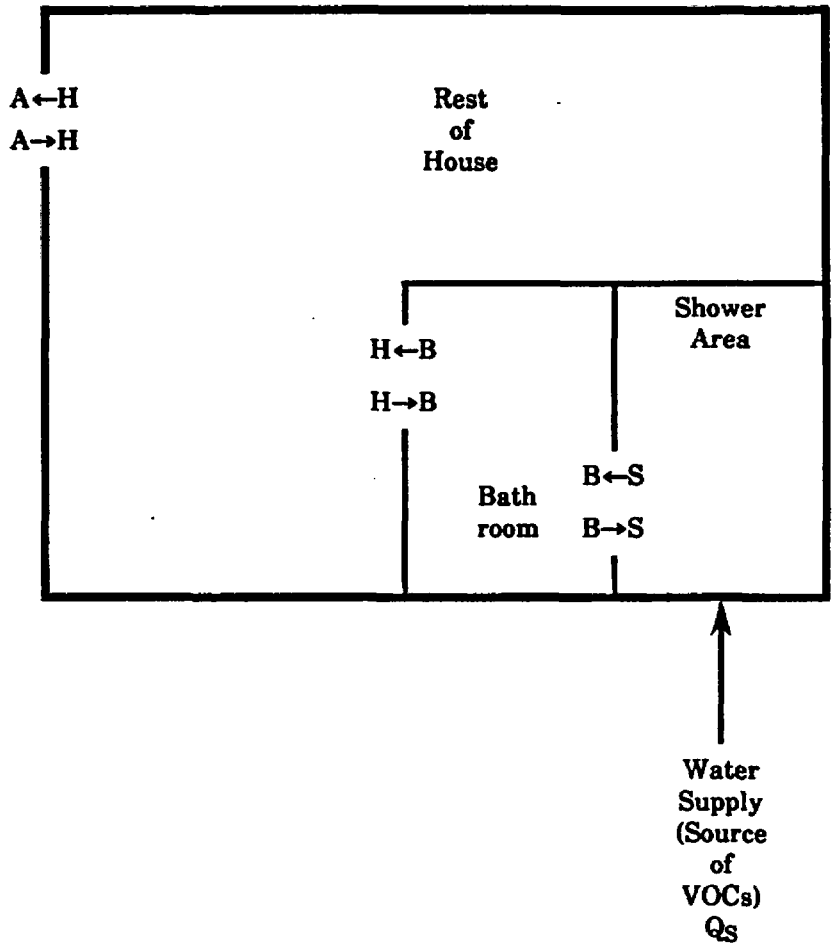
$$V_H \frac{dC_H(t)}{dt} = q_{BH}C_B(t) - q_{HB}C_H(t) - q_{HA}C_H(t) \qquad (3)$$

In these equations, the C's refer to the (time-dependent) concentrations, in mg/l; the V's refer to the compartment volumes, in liters; Q refers to the source strength, in mg/minute; and the subscripts H, B, S, and A refer to house, bath, shower and ambient, respectively. The q's represent air-exchange rates, in L/min.; and the subscripts indicate the source and destination of the exchange. For example, q_{SB} defines the air exchange originating in the shower and ending in the bathroom.

AR300608

Figure F-1

BERKS SAND PIT
INDOOR VOLATILIZATION MODEL USING THREE COMPARTMENTS



AR300609

The complete solution to the problem at hand requires the simultaneous evaluation of equations 1-3 throughout the time period of interest. Baker/TSA solved equations 1-3 by sequentially evaluating the individual air-exchange processes described earlier.

One cycle of the evaluation sequence (shown in Figure F-2) begins with the release of VOCs from incoming shower water, proceeds through "outward" exchanges to the ambient air, continues through "inward" exchanges, and ends with the inward exchange of bathroom air migrating into the shower compartment. It can be seen that the evaluation of an infinitely large number of such cycles utilizing infinitely small time increments will produce the complete solution. It also can be seen that the complete solution can be approximated by evaluating a reasonable number of cycles using a reasonable time for each cycle. For this analysis, Baker/TSA evaluated the cycle at one minute intervals throughout an assumed 90 minutes of shower water flow at a water flow rate of 6.67 liters/minute. This floor rate is derived from the assumptions stated in Table 1 (100 L per shower divided by 15 minutes per shower; and 6 showers per day). Other relevant parameters and assumptions incorporated into our evaluation are based upon McKone's work are also stated in Table F-1. Table F-1 also reproduces the "likely range" for each parameter as cited by McKone. To the extent that we have chosen representative values other than those selected by McKone, such deviations are discussed in the footnotes to the table. The derivation of chemical-specific release parameters is described in the following paragraphs.

Chemical Release Parameters

In all, 24 VOC release estimates were made for a total of five individual chemicals. The well monitoring data provide the basis for the chemicals selected and the number of estimates. Table F-2 contains the relevant measured data for the three VOCs found in monitoring wells, while Table F-3 contains similar data for the two VOCs found in residential wells. This section describes how chemical-specific release rates were derived for use in the simulation model described in the previous section.

In order to quantify the mass transfer rates of VOCs from shower water to air, several parameters are required for each of the following compounds: 1,1-dichloroethene, 1,1,1-trichloroethane, and tetrachloroethene. The parameters required are liquid diffusivities of the VOCs through water, gas diffusivities of the VOCs through air, and Henry's Law Constants -- all at 20°C.

AR300610

Figure F-2

BERKS SAND PIT
THE MASS-TRANSFER CYCLE USED TO EVALUATE SHOWER COMPARTMENT VOC CONCENTRATIONS
(Based on Inter-Compartment Air Exchanges)

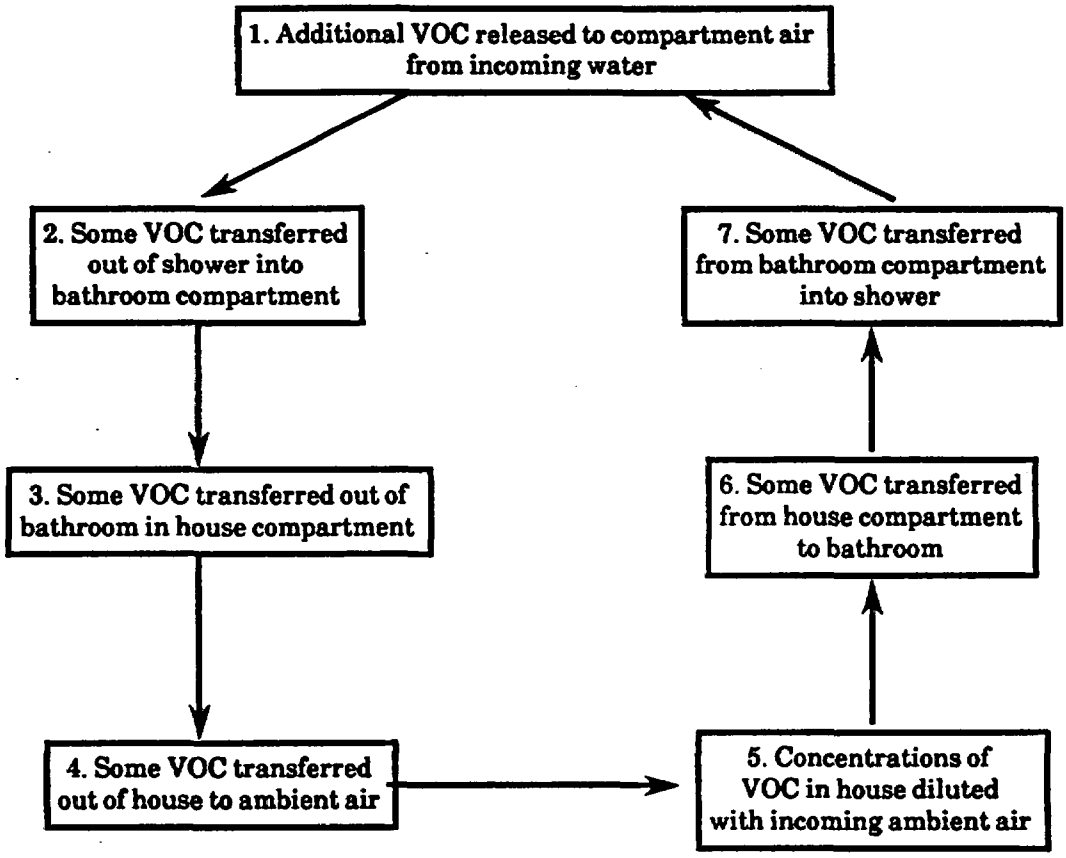


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Table F-1

BERKS SAND PIT
SUMMARY OF PARAMETERS USED TO ESTIMATE SHOWER COMPARTMENT AIR CONCENTRATIONS OF VOCs

Parameter	Value Used	Likely Range[1]
Volume of Shower Compartment	2,000 liters	1,300-3,000 liters
Residence Time of Air in Shower	20 minutes	unknown
Volume of Bathroom	10,000 liters	6,000-50,000 liters
Residence Time of Air in Bathroom	30 minutes	20-60 minutes
Volume of Remaining House	400,000 liters	150,000-700,000 liters
Residence Time of Air in Remainder of House	120 minutes	30-240 minutes
Fraction of Air Leaving Bathroom by Direct Exhaustion to Outdoors	0[2]	0-0.6
Water Used Per Shower (or Bath)	100 liters[3]	25-100 liters
Duration of Each Shower	15 minutes[4]	5-20 minutes
Number of Showers per Day	6[5]	---
Transfer Efficiency of Radon From Shower Water to Shower Compartment Air	0.7	0.3-0.7

(1) Extracted from McKone (see Reference Section).
(2) While McKone assumed a value of 0.1, we assumed no ventilation in order to construct a "worst-case" scenario.
(3) McKone assumed 75 liters.
(4) McKone assumed 10 minutes.
(5) McKone assumed 40 minutes of shower water usage (4 people at 10 minutes each) while we assumed 90 minutes (6 people at 15 minutes each).

AR300612

Table F-2

BERKS SAND PIT
SUMMARY DATA FOR MONITORING WELLS

Chemical	Maximum(1) (µg/l)	Average Total(2) (µg/l)	Average Positive(3) (µg/l)
1,1-Dichloroethene	3,500.00	290.21	598.56
1,1,1-Trichloroethane	7,300.00	932.36	1,538.39
Tetrachloroethane (PCE)	25.00	0.95	15.67

(1) The single highest measured value.
(2) The sum of all concentrations divided by the total number of samples (52).
(3) The sum of all concentrations divided by the number of samples with concentrations greater than detection limits.

AR300613

Table F-3

BERKS SAND PIT
SUMMARY DATA FOR RESIDENTIAL WELLS

Chemical	Maximum(1) (µg/l)	Average Total(2) (µg/l)	Average Positive(3) (µg/l)
1,1-Dichloroethene	540.00	18.99	189.90
1,1,1-Trichloroethane	6,800.00	282.99	707.48

(1) The single highest measured value.
(2) The sum of all concentrations divided by the total number of samples (32).
(3) The sum of all concentrations divided by the number of samples with concentrations greater than detection limits.

AR300614

Liquid Diffusivities

The liquid diffusivities were calculated by the Hayduk and Laudie equation (Equation 4) as outlined on pages 495-7 of Fundamentals of Momentum, Heat, and Mass Transfer (3).

$$D_{AB} = 13.26 \times 10^{-5} \mu_B^{-1.14} V_A^{-0.589}$$

where:

D_{AB} = diffusivity, cm^2/sec

μ_B = viscosity of water, cP

V_A = molal volume of solute at normal boiling point, cm^3/g-mole

$$Viscosity\ of\ water\ at\ 20°C = \frac{993\ Pa-sec}{10^6} \times \frac{10\ Poise}{1\ Pa-sec} \times \frac{100\ cP}{1\ Poise}$$
$$= 0.993\ cP$$

After substituting constants,

$$D_{AB} = 1.3367 \times 10^{-4}\ V_A^{-0.589} \qquad (4)$$

This equation is applicable for dilute solutions of nonelectrolytes in water only. The liquid diffusivities calculated are contained in Table F-4.

Gas Diffusivities

The gas mass diffusivities (Table F-5) were calculated using the Fuller, Schettler, and Giddings correlation as described on pages 490-1 of Fundamentals of Momentum, Heat, and Mass Transfer (Equation 5).

AR300615

Table F-4

BERKS SAND PIT
LIQUID DIFFUSIVITY OF VOCs FOUND IN WELL WATER SAMPLES

VOC	Chemical Formula	V_A(1)	μ_B (at 20°C)	D_{AB}
1,1-Dichloroethene	CH_2CCl_2	80.2	0.993	1.01×10^{-5}
TCA	CH_3CCl_3	105.5	0.993	8.60×10^{-6}
PCE	CCl_2CCl_2	116	0.993	8.13×10^{-6}

(1)

Element	Atomic Volume (cm^3/g mole)
Carbon	14.8
Chlorine	21.6
Hydrogen	3.7

AR300616

Table F-5

BERKS SAND PIT
GAS DIFFUSIVITY OF VOCs INTO AIR

VOC	Chemical Formula	$(\Sigma v)_A$(1)	M_A	T	P	D_{AB}
1,1-Dichloroethene	CH_2CCl_2	76	97	293	1	0.0908
TCA	CH_3CCl_3	97	133	293	1	0.0795
PCE	CCl_2CCl_2	111	166	293	1	0.0738

(1)

Element	Atomic and Structure Diffusion - Volume Increments (v)
Carbon	16.5
Chlorine	1.98
Hydrogen	19.5

AR300617

$$D_{AB} = \frac{10^{-3} T^{1.75} \left(\frac{1}{M_A} + \frac{1}{M_B} \right)^{1/2}}{P \left[(\Sigma v)_A^{1/3} + (\Sigma v)_B^{1/3} \right]^2}$$

D_{AB} = diffusivity, cm^2/sec

T = temperature, K

M_A, M_B = mol. wts. of A and B, respectively.

P = absolute pressure, atm

v = atomic and structural diffusion-volume increments

Notes for Equation 5:

(1) B = air

(2) $M_B = 29$; $(\Sigma v)_B = 20.1$

(3) After substituting constants,

$$D_{AB} = \frac{20.75 \left(\frac{1}{M_A} + 0.0345 \right)^{1/2}}{[(\Sigma v)_A^{1/3} + 2.719]^2} \tag{5}$$

This method is applicable to nonpolar, binary gas systems at lower pressures. Although a few of the compounds studied were slightly polar, they were approximated as being nonpolar. The error in making this assumption was assumed to be negligible.

The Henry's Law Constants listed in Table F-6 were obtained from the referenced sources on the table.

When all three parameters were available for each of the three compounds, it was possible to calculate the transfer efficiencies and, hence, the source terms $Q_S(t)$ for all concentrations of the three VOCs in water.

Following McKone's approach, the transfer efficiencies were calculated using Equation 6. Use of Equation 6 presumes that the VOCs water-to-air transfer efficiency in the shower is proportional to the known transfer efficiency of radon. It further presumes that the proportionality constant is equal to the ratio of the overall mass transfer coefficients at the

AR300618

Table F-6

BERKS SAND PIT
HENRY'S LAW CONSTANT FOR VOCs FOUND IN WELL WATER SAMPLES

Volatile Organic	Henry's Law Constant at 20°C $\frac{\text{atm-m}^3}{\text{mole}}$
1,1-Dichloroethene	1.51×10^{-2} (4)
1,1-Dichloroethane	5.54×10^{-3} (4)
1,2-Dichloroethene	4.05×10^{-3} (4)
1,1,1-Trichloroethane	3.9×10^{-3} (2)
Tetrachloroethene	2.8×10^{-2} (2)

AR300619

gas/liquid interface. The radon transfer efficiency from shower/bath water-to-air (from Table F-1) was substituted into the equation as well as radon's diffusivities and Henry's Law Constant cited by McKone (D_L = 1.4 x 10^{-9} m^2/s; D_A = 2.0 x 10^{-5} m^2/s; H = 70 torr·m^3/mole). It was then possible to calculate the transfer efficiency of each VOC by substituting the calculated diffusivities and Henry's Law Constant (from Tables F-4, F-5, and F-6) into Equation 6.

$$\varnothing^j = \varnothing^{RN} \frac{K(j)}{K(RN)}$$

$$= \varnothing^{RN} \frac{\left(\frac{2.5}{D_L^{2/3}} + \frac{RT}{D_A^{2/3} H}\right)_{RN}}{\left(\frac{2.5}{D_L^{2/3}} + \frac{RT}{D_A^{2/3} H}\right)_j} \tag{6}$$

where:

$\varnothing^j$ = transfer efficiency for VOC "j"

$\varnothing^{RN}$ = transfer efficiency for radon

K(j) = overall mass-transfer coefficient for "j," in mg/sec

K(RN) = overall mass-transfer coefficient for radon, in mg/sec

D_L = diffusion coefficient in water, in m^2/sec

D_A = diffusion coefficient in air, in m^2/sec

H = Henry's Law Constant, in atm-m^3/mole

R = gas constant, 8.21 x 10^{-5} atm-m^3/mole K

T = temperature, in °K

Equation 6 is the direct result of adjusting the theoretical rate of VOC mass transfer in a way that takes into account the expected difference between theory and reality. In McKone, a measured mass transfer efficiency for radon was compared to radon's theoretical mass transfer efficiency (under identical circumstances). Radon measures were used because radon concentrations in both water and air can be measured with great precision at low concentrations. The radon study enhances the reality of the present analysis through the following relationship:

AR300620

$$\frac{\textit{Mass transfer Efficiency of VOC (in present study)}}{\textit{Mass Transfer Efficnecy of Radon (Measured)}} = \frac{\textit{Theoretical Mass Transfer Coefficient of VOCs}}{\textit{Theoretical Mass Transfer Coefficient of Radon}} \tag{6A}$$

Equation 6 is no more than an expanded and rearranged statement of Equation 6A.

The source terms for the shower compartment were calculated using Equation 7 (adapted from McKone).

$$Q_s(t) = \frac{100\ \textit{Liters of Water Used}}{15\ \textit{minutes}} (\varnothing^j)(C_W^j) \tag{7}$$

where:

$Q_s(t)$ is in mg/minute.

C_W^j is the water concentration of VOC "j" in mg/l

The maximum value for the total amount of water consumed by activities in the shower compartment (100L) was taken from Table F-1; this value was then divided by 15 minutes (the duration of a shower per individual) to obtain the water used per minute. $Q_S(t)$ for each of the 24 analyses were then calculated by substituting the amount of water consumed, the calculated transfer efficiencies and each constituent's water concentration into Equation 7. Thus, the "maximum," "average total," and "average positives" concentrations (from Tables F-2 and F-3) for residential wells and monitoring wells for the VOCs were each evaluated and the resultant source terms tabulated.

The calculations for transfer efficiencies and source terms were done using a computer spreadsheet and the printout sheet is attached as Table F-7. These results are summarized in Tables F-8 and F-9.

Results

Using the previously described methodology and incorporating the data derived in the last section, a computer simulation model was created. The model was used to compute minute-

AR300621

TABLE F-7

TRANSFER EFFICIENCY AND SOURCE TERMS
FOR VOC PARAMETERS

BERAS SAND PIT

PARAMETERS USED FOR THE
CALCULATION OF VOCs
RELEASED INDOORS FROM
SHOWER WATER
AT 20 DEG. C

(3/31/88)

VOC	MAXIMUM MONITORING Cw (mg/L)	Dl (M2/SEC)	Da (M2/SEC)	H (ATM-M3/MOL)	VOC TRX EFFICIENCY FROM SHOWER TO AIR	Qs(t) (mg/min)
1.1-Dichloroethane	3.6000	1.01E-09	9.08E-06	1.61E-02	0.5631	13.139
1.1.1-Trichloroethane	7.3000	8.60E-10	7.95E-06	3.80E-03	0.5038	24.518
Tetrachloroethene (PCE)	0.0250	8.13E-10	7.38E-06	2.80E-02	0.4876	0.081

VOC	MAXIMUM RESIDENTIAL Cw (mg/L)	Dl (M2/SEC)	Da (M2/SEC)	H (ATM-M3/MOL)	VOC TRX EFFICIENCY FROM SHOWER TO AIR	Qs(t) (mg/min)
1.1-Dichloroethane	0.6400	1.01E-09	9.08E-06	1.61E-02	0.5631	2.0272
1.1.1-Trichloroethane	6.8000	8.60E-10	7.95E-06	3.80E-03	0.5038	22.8389

VOC	AVG. POSITIVES: MONITORING Cw (mg/L)	Dl (M2/SEC)	Da (M2/SEC)	H (ATM-M3/MOL)	VOC TRX EFFICIENCY FROM SHOWER TO AIR	Qs(t) (mg/min)
1.1-Dichloroethane	0.6890	1.01E-09	9.08E-06	1.61E-02	0.5631	2.2487
1.1.1-Trichloroethane	1.5380	8.60E-10	7.95E-06	3.80E-03	0.5038	5.1656
Tetrachloroethene (PCE)	0.0187	8.13E-10	7.38E-06	2.80E-02	0.4876	0.0510

PAGE 1 OF 2

AR300622

TABLE F-7
- Continued -

TRANSFER EFFICIENCY AND SOURCE TERMS
FOR VOC PARAMETERS

BERKS SAND PIT

PARAMETERS USED FOR THE
CALCULATION OF VOCs
RELEASED INDOORS FROM
SHOWER WATER
AT 20 DEG. C
(CONTINUED)

VOC	AVG. POSITIVES: RESIDENTIAL Cw (mg/L)	Dl (M2/SEC)	Da (M2/SEC)	H (ATM-M3/MOL)	VOC TRA EFFICIENCY FROM SHOWER TO AIR	Qs(t) (mg/min)
1,1-Dichloroethane	0.1899	1.01E-09	9.08E-06	1.51E-02	0.5631	0.7129
1,1,1-Trichloroethane	0.7075	8.60E-10	7.95E-06	3.90E-03	0.5038	2.3763

VOC	AVG. TOTAL MONITORING Cw (mg/L)	Dl (M2/SEC)	Da (M2/SEC)	H (ATM-M3/MOL)	VOC TRA EFFICIENCY FROM SHOWER TO AIR	Qs(t) (mg/min)
1,1-Dichloroethane	0.2902	1.01E-09	9.08E-06	1.51E-02	0.5631	1.0894
1,1,1-Trichloroethane	0.9324	8.60E-10	7.95E-06	3.90E-03	0.5038	3.1316
Tetrachloroethene (PCE)	0.0010	8.13E-10	7.38E-06	2.80E-02	0.4876	0.0031

VOC	AVG. TOTAL RESIDENTIAL Cw (mg/L)	Dl (M2/SEC)	Da (M2/SEC)	H (ATM-M3/MOL)	VOC TRA EFFICIENCY FROM SHOWER TO AIR	Qs(t) (mg/min)
1,1-Dichloroethane	0.0190	1.01E-09	9.08E-06	1.51E-02	0.5631	0.0713
1,1,1-Trichloroethane	0.2830	8.60E-10	7.95E-06	3.90E-03	0.5038	0.9505

AR300623

Table F-8

BERKS SAND PIT
SHOWER WATER SOURCE TERMS AND VOC TRANSFER EFFICIENCIES
CALCULATED FOR MONITORING WELLS

Chemical	Water-to-Air Transfer Efficiency	Maximum (mg/l)	Average Total (mg/l)	Average Positive (mg/l)
1,1-Dichloroethene	0.5631	13.139	1.089	2.249
1,1,1-Trichloroethane	0.5038	24.518	3.132	5.166
Tetrachloroethane (PCE)	0.4876	0.081	0.003	0.051

AR300624

Table F-9

BERKS SAND PIT
SHOWER WATER SOURCE TERMS AND VOC TRANSFER EFFICIENCIES CALCULATED FOR RESIDENTIAL WELLS

Chemical	Water-to-Air Transfer Efficiency	Maximum (mg/l)	Average Total (mg/l)	Average Positive (mg/l)
1,1-Dichloroethene	0.5631	2.027	0.071	0.713
1,1,1-Trichloroethane	0.4876	22.839	0.950	2.376

AR300625

by-minute changes in the three compartments (shower, bath and rest of house). In running the model, it was presumed that (in addition to the assumptions listed in Table F-1):

- The initial concentrations of the VOCs were zero in all compartments.
- The ambient air contained no VOCs.
- The shower water was run continuously for 90 minutes.

Additionally, this analysis made no attempt to quantify VOC releases from any other household use of water. As stated earlier, our objective was to make reasonable estimates of the maximum VOC concentrations likely to be encountered from shower exposure.

In developing the model assumptions, Baker/TSA exercised care in the selection and use of parameters that are not unreasonable, and yet serve to maximize our computational results. Tables F-10 and F-11 reflect the average concentrations for each VOC parameter over the 90 minute period during which water was assumed to be used. Figure F-3 graphically portrays (using the maximum concentration of 1,1,1-trichloroethane observed in any sample; which also represents the highest water concentration of any VOC observed at the site) the minute-by-minute results of our model over a 320 minute period. From this figure, it is readily observed that, indeed, the shower stall represents the principal area of concern.

AR300626

Table F-10

BERKS SAND PIT
SUMMARY OF 90-MINUTE SHOWER AIR CONCENTRATION AVERAGES USING DATA FROM GROUNDWATER MONITORING WELLS

Chemical	Maximum (mg/l)	Average Total (mg/l)	Average Positive (mg/l)
1,1-Dichloroethene	0.1170	0.0054	0.0178
1,1,1-Trichloroethane	0.2183	0.0186	0.0367
Tetrachloroethene (PCE)	0.0007	0.0000	0.0004

AR300627

Table F-11

BERKS SAND PIT
SUMMARY OF 90-MINUTE SHOWER AIR CONCENTRATION AVERAGES USING DATA FROM RESIDENTIAL WELLS

Chemical	Maximum (mg/l)	Average Total (mg/l)	Average Positive (mg/l)
1,1-Dichloroethene	0.0180	0.0006	0.0063
1,1,1-Trichloroethane	0.2033	0.0085	0.0212

AR300628

BERKS SAND PIT -- Air Concentrations

1,1,1-Trichloroethane (Max. Monitoring)

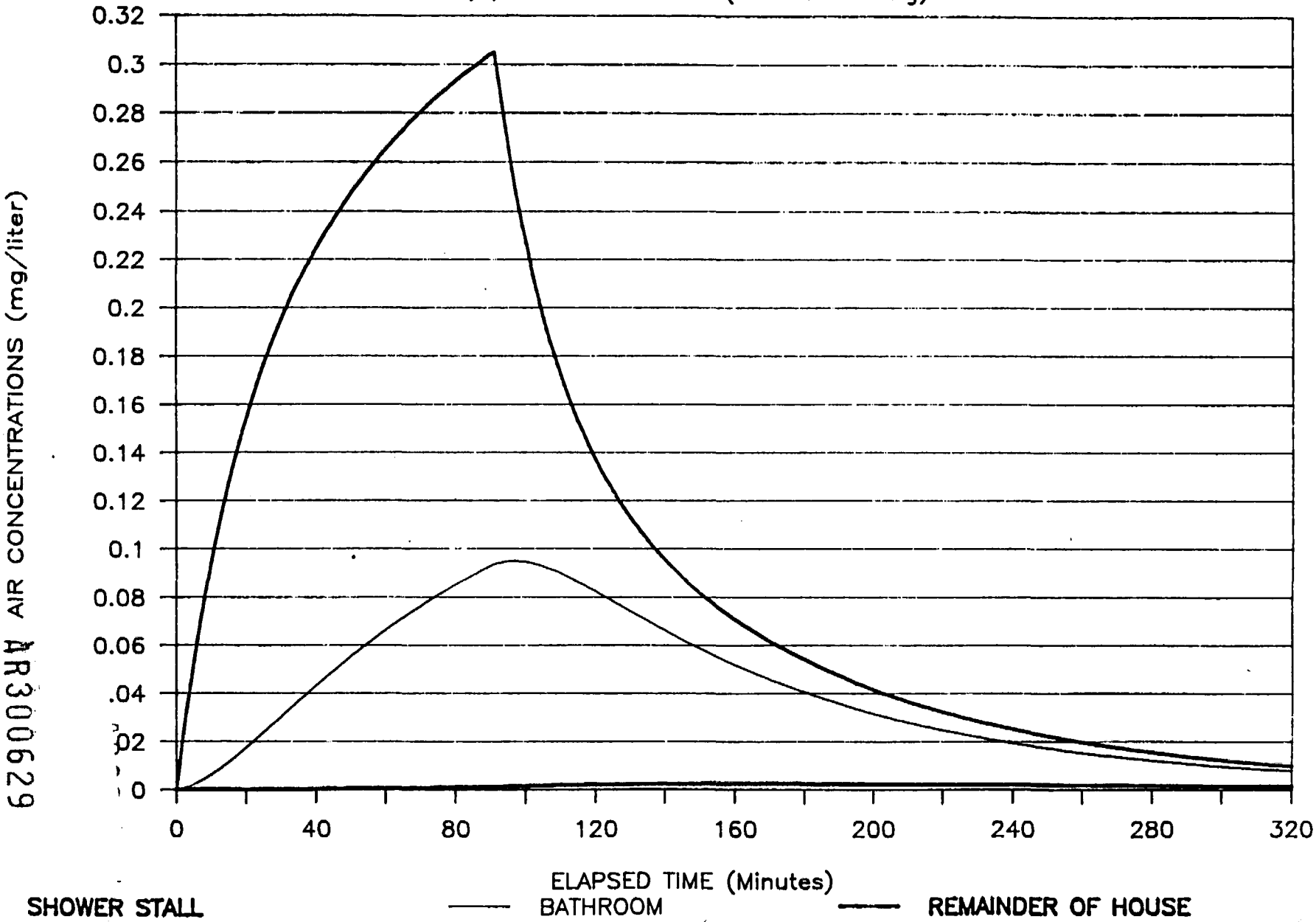

Figure F-3

AR300629

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AR300630