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A Report Prepared for:

Sparton Technology, Inc.
9621 Coors Road NW
Albuquerque, New Mexico

# EFFECTIVENESS OF THE GROUNDWATER RECOVERY WELL SYSTEM
Coors Road Facility
Albuquerque, New Mexico

HLA Job No. 06310,039.12

by


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**Harding Lawson Associates**

Engineering and Environmental Services

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# I INTRODUCTION

In accordance with Section IV.A.1.(a) of the Consent Order, an Interim Measures groundwater recovery well system was installed at the Sparton Technology, Inc. (Sparton) facility located on Coors Road in Albuquerque, New Mexico. This report presents the results of an evaluation of the effectiveness of that recovery system pursuant to the requirements of Section IV.A.1.(a)ii of the Consent Order.

Sparton filed a report evaluating the effectiveness of this system in October, 1989. Both Sparton and U.S. EPA recognized that the October report was hastily prepared due to a misunderstanding of the due date. The October report was discussed in detail at a meeting with U.S. EPa in Dallas on January 10, 1990, at which time U.S. EPA staff provided written comments and made other requests for information associated with the groundwater recovery well system. The written comments were also furnished by U.S. EPA to Sparton by letter dated January 22, 1990.

Based on the constructive comments of U.S. EPA and further review of the October report, we have prepared what is virtually a new report in a different format, rather than simply attempt to revise, change or otherwise patch up the October report. In doing so, we have made every effort to address the substance of the concerns contained in the U.S. EPA written comments and to respond to the other U.S. EPA requests. This new report is submitted to entirely replace the October report.

# II DESCRIPTION OF RECOVERY SYSTEM

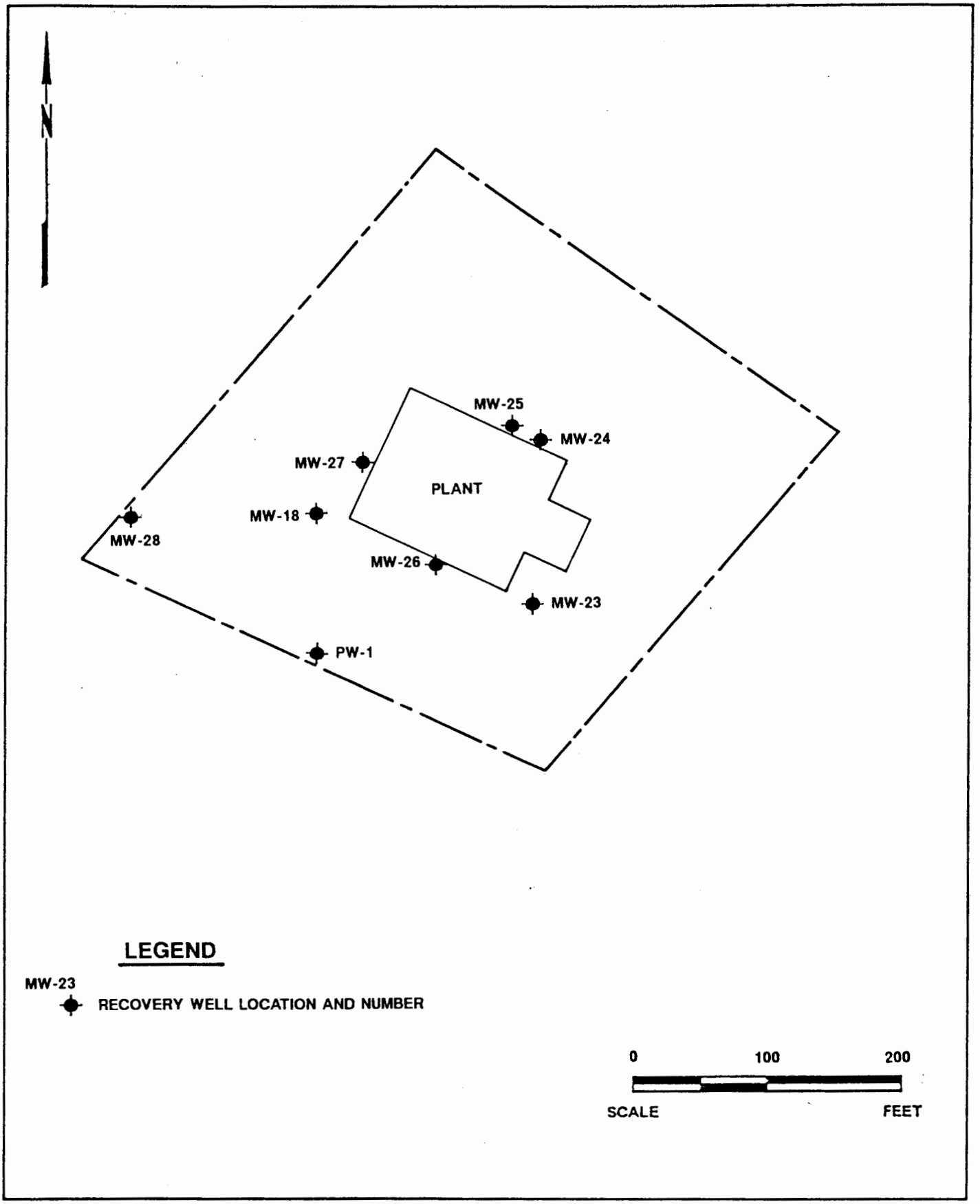
Pursuant to the requirements of the EPA Consent Order, a groundwater recovery system was installed in the upper flow zone as an interim measure. the purpose of this system is to retard the spread of the contaminant plume while the RCRA Facility Investigation (RFI) and the Corrective Measures Study (CMS) are being completed. The approach used to accomplish this goal was to locate a number of onsite recovery wells in the more contaminated portions of the contaminant plume in order to maximize the mass of contaminant removed. This system is not intended to serve as a final solution. The final solution will be determined upon completion of the RFI and CMS.

The recovery system was designed and constructed according to the provisions of the Interim Measures Workplan approved by EPA on March 1, 1989. The system became operational in January of 1989.

The system is comprised of eight wells (PW-1, MW-18, MW-23, MW-24, MW-25, MW-26, MW-27, and MW-28) installed in the upper flow zone of the site (see Figure 1). Compressed air operated pumps were installed in each well. Groundwater extracted at each of these locations is piped to an air stripper system for treatment and ultimate use in the Sparton facility.

The wells are set with the bottom of the well screen located at the top of the aquitard. The depth to the aquitard varies. The screened intervals generally fell within the interval of 60

to 78 feet in depth below ground surface. Construction of the wells varies because the designated wells used for the recovery system were constructed over a four year period. Figure 2 lists the pertinent construction details for each of the eight wells.

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## RECOVERY WELLS

**Sparton Technology, Inc.**

**Albuquerque, New Mexico**

FIGURE **1**

| DRAWN | JOB NUMBER | APPROVED | DATE | REVISED | DATE |
|---|---|---|---|---|---|
| | 6310,039.12 | JSH | 2-5-90 | | |

Figure 2

Recovery System Well Construction Details

| Well No. | Well Diameter (inches) | Well Materials Screen | Well Materials Riser | Screened Interval (ft) | Construction Date |
|---|---|---|---|---|---|
| PW-1 | 10 | PVC | PVC | 60-70 | 9/84 |
| MW-18 | 4 | PVC | PVC | 68-78 | 5/86 |
| MW-23 | 2 | PVC | PVC | 72-77 | 8/86 |
| MW-24 | 2 | PVC | PVC | 68.4-73.4 | 12/86 |
| MW-25 | 2 | PVC | PVC | 67.7-72.7 | 12/86 |
| MW-26 | 2 | SS[1] | PVC | 73-78 | 5/88 |
| MW-27 | 2 | SS | PVC | 67-72 | 5/88 |
| MW-28 | 2 | SS | PVC | 65-70 | 5/88 |

[1] Stainless Steel

# III CONTAMINANT PLUME DESCRIPTION

Since trichloroethene (TCE) is the predominant contaminant, and since there is a more exhaustive historical database of TCE analyses, we have focused on this parameter for the purposes of this evaluation. We feel that this is a fair representation, and that any conclusions drawn from this evaluation would apply equally to other contaminants included in the plume.

Figure 3 shows the configuration of the TCE plume in the 3rd quarter of 1989. Data used to generate this map included both the quarterly groundwater analyses generated under the State (New Mexico) monitoring program (1986 - 1989), and the limited analyses of upper flow zone wells, both on-site and off-site, conducted under the terms of the Consent Order. Figure 3 also reflects our analysis of the direction of groundwater movement in the upper flow zone.

For the on-site wells included in the State program, the high degree of variation in the quarterly data was smoothed by using least squares regression analysis. The resulting regression equation was then used to calculate the "normalized" concentration of TCE in the 3rd quarter of 1989. This technique also allowed the use of historical data for wells which had been plugged and abandoned or had been converted to recovery wells. Based on the historical data, the regression analyses allowed for the calculation of a normalized TCE concentration for each of these wells in the 3rd quarter of 1989.

**TO VIEW THE MAP AND/OR MAPS WITH THIS DOCUMENT, PLEASE CALL THE HAZARDOUS WASTE BUREAU AT 505-476-6000 TO MAKE AN APPOINTMENT**

For wells MW-13 and MW-33 through MW-37, installed as part of the RFI effort, initial and confirmational analyses were averaged, and these averages were also included in the analysis.

Figure 4 shows the resulting TCE concentrations used for each well included in constructing the plume map shown in Figure 3.

Figure 4

TCE Values for 3rd Quarter 1989

| WELL No. | TCE ug/l |
|---|---|
| 6 | 99 |
| 8 | 104 |
| 9 | 3,302 |
| 14 | 3,844 |
| 15 | 131 |
| 16 | 16,908 |
| 18 | 3,384 |
| 21 | 788 |
| 22 | 105 |
| 23 | 9,922 |
| 13 | 630 |
| 33 | 7,250 |
| 34 | 0 |
| 35 | 0 |
| 36 | 9.5 |
| 37 | 1,450 |

# IV BI-WEEKLY WATER LEVEL MEASUREMENTS

Figure 5 presents water level data taken on a bi-weekly monitoring schedule from February, 1989 to September, 1989. These data are used to establish groundwater level trends during the operation of the recovery system. Figure 6 is a summary of the net change in the groundwater table on a bi-weekly basis during that same time period.

While we would expect to see an overall decrease in water level trends as a consequence of the recovery system's effects, Figure 6 illustrates that the opposite has occurred. This reversal is probably attributable to the effects of recharge from the unlined irrigation canal east of Coors Road. The irrigation season typically extends from April through October.

FIGURE 5

SPARTON TECHNOLOGY, INC.
COORS ROAD FACILITY
BIWEEKLY WATER LEVEL MEASUREMENTS

| DATE | MW-7 | MW-9 | MW-12 | MW-13 | MW-14 | MW-15 | MW-16 | MW-17 | MW-19 | MW-20 | MW-21 | MW-22 | MW-29 | MW-30 | MW-31 | MW-32 | MW-33 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Water Level Elevation - Feet Above MSL | | | | | | | | | | | | | | | | |
| 02-23-89 | 4978.48 | 4975.57 | 4975.23 | 4976.51 | 4974.24 | 4976.45 | 4980.07 | 4980.08 | 4974.77 | 4974.47 | 4979.76 | 4979.23 | 4975.82 | 4974.98 | 4974.28 | 4974.37 | 4975.07 |
| 03-08-89 | 4978.40 | 4975.36 | 4975.15 | 4976.35 | 4974.15 | 4976.36 | 4979.87 | 4980.08 | 4974.61 | 4974.84 | 4979.64 | 4979.14 | 4975.82 | 4974.93 | 4974.24 | 4974.78 | 4974.90 |
| 03-21-89 | 4978.81 | 4975.65 | 4975.40 | 4976.76 | 4974.07 | 4976.36 | 4979.82 | 4980.08 | 4974.94 | 4975.05 | 4979.68 | 4979.35 | 4976.11 | 4975.18 | 4974.45 | 4974.99 | 4975.15 |
| 04-06-89 | 4979.15 | 4975.11 | 4975.65 | 4977.18 | 4974.24 | 4976.45 | 4980.10 | 4980.16 | 4975.02 | 4975.17 | 4979.68 | 4979.64 | 4976.28 | 4975.35 | 4974.62 | 4975.12 | 4975.40 |
| 04-21-89 | 4979.31 | 4975.95 | 4975.73 | 4977.18 | 4974.32 | 4976.45 | 4980.07 | 4980.16 | 4975.11 | 4975.26 | 4979.84 | 4979.77 | 4976.44 | 4975.43 | 4974.62 | 4975.12 | 4975.40 |
| 05-03-89 | 4979.40 | 4976.03 | 4975.82 | 4977.18 | 4974.49 | 4976.53 | 4980.07 | 4980.24 | 4975.19 | 4975.34 | 4979.84 | 4979.81 | 4976.44 | 4975.43 | 4974.65 | 4975.16 | 4975.48 |
| 05-17-89 | 4979.65 | 4976.15 | 4975.90 | 4977.26 | 4974.32 | 4976.53 | 4980.10 | 4980.33 | 4975.27 | 4975.34 | 4979.93 | 4979.98 | 4976.61 | 4975.60 | 4974.78 | 4975.20 | 4975.57 |
| 06-01-89 | 4979.73 | 4976.24 | 4975.90 | 4977.43 | 4974.49 | 4976.54 | 4980.07 | 4980.41 | 4975.32 | 4975.42 | 4980.01 | 4979.98 | 4976.69 | 4975.73 | 4974.83 | 4975.24 | 4975.48 |
| 06-13-89 | 4979.90 | 4976.40 | 4976.07 | 4977.64 | 4974.55 | 4976.70 | 4980.32 | 4980.49 | 4975.36 | 4975.51 | 4980.01 | 4980.06 | 4976.86 | 4975.77 | 4974.95 | 4975.37 | 4975.65 |
| 06-30-89 | 4980.06 | 4976.49 | 4976.15 | 4977.60 | 4974.53 | 4976.53 | 4980.16 | 4980.49 | 4975.40 | 4975.59 | 4979.93 | 4980.19 | 4976.94 | 4975.81 | 4975.03 | 4975.45 | 4975.57 |
| 07-12-89 | 4980.40 | 4976.82 | 4976.40 | 4978.01 | 4974.82 | 4976.78 | 4980.57 | 4980.74 | 4975.52 | 4975.76 | 4980.26 | 4980.48 | 4977.19 | 4976.02 | 4975.28 | 4975.62 | 4975.78 |
| 07-28-89 | 4980.40 | 4976.20 | 4976.40 | 4977.93 | 4974.82 | 4976.78 | 4980.82 | 4980.87 | 4975.77 | 4975.76 | 4980.18 | 4980.56 | 4977.07 | 4976.10 | 4975.20 | 4975.62 | 4975.82 |
| 08-10-89 | 4980.06 | 4976.40 | 4976.07 | 4977.60 | 4974.53 | 4976.74 | 4980.68 | 4980.83 | 4975.40 | 4975.59 | 4980.26 | 4980.39 | 4976.69 | 4975.77 | 4974.95 | 4975.45 | 4975.73 |
| 08-24-89 | 4980.48 | 4976.90 | 4976.65 | 4978.18 | 4974.90 | 4976.99 | 4980.74 | 4980.91 | 4975.86 | 4976.01 | 4980.30 | 4980.30 | 4977.44 | 4976.27 | 4975.41 | 4975.78 | 4976.04 |
| 09-07-89 | 4980.65 | 4977.07 | 4976.73 | 4978.43 | 4975.07 | 4977.11 | 4980.82 | 4981.08 | 4976.02 | 4976.09 | 4980.30 | 4980.89 | 4977.44 | 4976.35 | 4975.45 | 4975.87 | 4976.19 |
| 09-21-89 | 4980.90 | 4977.24 | 4976.90 | 4978.46 | 4975.16 | 4977.16 | 4980.91 | 4981.16 | 4976.11 | 4976.13 | 4980.47 | 4981.06 | 4977.61 | 4976.52 | 4975.53 | 4975.87 | 4976.23 |
| 10-05-89 | 4980.90 | 4977.24 | 4976.94 | 4978.47 | 4975.15 | 4977.03 | 4981.07 | 4981.24 | 4976.11 | 4976.13 | 4980.49 | 4981.06 | 4977.53 | 4976.43 | 4975.53 | 4975.91 | 4976.32 |

Figure 6

Net Change in Groundwater Elevations

February to September, 1989

| Well No. | Net Gain (+) or Loss (-) in Groundwater Elevation, in feet |
|---|---|
| MW-7 | +2.42 |
| MW-9 | +1.67 |
| MW-12 | +1.67 |
| MW-13 | +1.95 |
| MW-14 | +0.92 |
| MW-15 | +0.71 |
| MW-16 | +0.84 |
| MW-17 | +1.08 |
| MW-21 | +0.71 |
| MW-22 | +1.83 |

# V EVALUATION OF RADII OF INFLUENCE

The evaluation of pumping test data is based upon the information presented in three reports commonly titled, "Aquifer Testing at the Sparton Technology, Inc., Coors Road Plant Facility, Albuquerque, New Mexico," by Metric Corporation dated April, 1987; May, 1988; and November, 1988 (see Attachment 1). These data were used to calculate an estimate of the radii of influence (capture zone) for all eight of the recovery system wells.

For wells PW-1, MW-18, MW-23, MW-26, MW-27, and MW-28, an assumed storage coefficient of $1 \times 10^{-2}$ was used based upon published data for an unconfined aquifer[(1)]. For well MW-24, a storage coefficient of $2.5 \times 10^{-2}$ was calculated from the distance-drawdown information available. This value was also applied to calculations for MW-25 due to its proximity (32 feet) to MW-24. An evaluation of the pumping test where the pumped well was MW-25 and the observation well was MW-24 was performed. The analysis was done using straight line approximations to determine the transmissivity and maximum radius of influence[(2)]. The maximum radius of influence calculated from this analysis was 130 feet.

The pumping tests in the eight wells yielded between 0.0189 and 0.317 gallons per minute during the various tests. This low range of yields indicates a relatively low transmissivity aquifer. The saturated thickness of the upper flow zone wells, typically 8 feet or less, also reduces the availability of water.

(1) Groundwater, Freeze, R.A. and Cherry, J.A.; pg 61; 1979
(2) Groundwater and Wells, Driscoll, F.G; pg 238 - 241, 1986

The radius of influence ($r_0$) for each well was calculated by using each transmissivity value from each slope of the time-drawdown and recovery data curves and applying this value to the following equation:

$$S = \frac{0.3\ Tt}{r^2_0}$$

Where: S = coefficient of storage (dimensionless)
T = coefficient of transmissivity, in gallons per day per foot, gpd/ft.
t = time since pumping started, in days
$r_0$ = intercept of straight line at zero drawdown, in feet.

Figure 7 presents the maximum values of the calculated radii of influence for the eight recovery wells. Typically, higher radii of influence occur after extended periods of time as reflected in the values used further on in the tests. Attachment 2 presents the calculations for each method of analysis.

The calculated radii of influence for the eight recovery system wells ranged from approximately 4 to 135 feet. This variable radii of influence indicate that there is no overlap of cones of depression. However, the interim recovery well system was not designed to provide a complete hydraulic barrier to contaminant flow, but rather to recover contaminants in the higher areas of concentration based upon our understanding of the plume.

Figure 7

Maximum Calculated Radii of Influence

| Well No. | Radius of Influence (Ft.) |
|---|---|
| PW-1 | 21.8 |
| MW-18 | 42.6 |
| MW-23 | 98.4 |
| MW-24 | 135.0 |
| MW-25 | 48.4 |
| MW-26 | 22.8 |
| MW-27 | 4.35 |
| MW-28 | 20.2 |

Operational pumping rates based on a field test conducted in July, 1989 are listed in Figure 8. The average operational pumping rate from Figure 8 is approximately 38% higher than the average pumping rate during the three various tests. This would suggest a somewhat higher radius of influence than the radius of influence calculated during the analyses of the pumping tests. Although there undoubtedly is some increased radius of influence, the low transmissivities calculated for the aquifer and the low average pumping rates indicate that they are not substantially larger.

Figure 8

Recovery System Discharge Rates

| Well | Discharge Volume (ml) | Discharge Time (s) | Refill Time (s) | Discharge Rate (gpm) | Discharge Rate (gpd) | Percent Total Discharge |
|---|---|---|---|---|---|---|
| 18 | 240 | 1.96 | 10.12 | 0.31 | 453.46 | 16.5% |
| 23 | 455 | 2.52 | 7.92 | 0.69 | 994.74 | 36.2% |
| 24 | 80 | 4.41 | 22.01 | 0.05 | 69.11 | 2.5% |
| 25 | 190 | 4.41 | 22.01 | 0.11 | 164.14 | 6.0% |
| 26 | 60 | 2.52 | 7.92 | 0.09 | 131.17 | 4.8% |
| 27 | 260 | 1.96 | 10.12 | 0.34 | 491.25 | 17.9% |
| 28 | 120 | 2.78 | 19.89 | 0.08 | 120.82 | 4.4% |
| PW-1 | 320 | 2.78 | 19.89 | 0.22 | 322.18 | 11.7% |

TOTAL DISCHARGE 2746.87 (GPD)

Volumes and cycle times taken on 7/18/89
Volume for MW-23 is estimated based on airline reading of 9"

# VI EVALUATION OF MASS REMOVAL

An evaluation of the mass of TCE removed by the recovery system was conducted by estimating the quantity of TCE removed and comparing that to an estimate of the quantity of TCE in the target impact area, that is, the more contaminated area of the contaminant plume.

The area encompassed by the 3,000 ug/l contour (see Figure 3) was selected as the evaluation area. This area represents the more concentrated area of the contaminant plume, and all eight recovery wells are within this contour. The evaluation is based on conditions prevailing during the 3rd quarter of 1989 since the most complete data set is available for that period.

We have assumed that the recovery wells are extracting water with the same TCE concentration as seen in the monitoring wells. Finally, we have assumed a porosity for the upper flow zone of 0.43 based on a fine sand aquifer (Todd, D.K., 1959, Ground Water Hydrology, Figure 2.6, p. 24).

The steps involved in this evaluation are all follows:

1) The average saturated thickness of the aquifer in the impact area was calculated from water level data for wells inside the 3,000 ug/l contour to be 7.6 feet. (See Figure 9).

Figure 9

Saturated Thickness Determination

| Well No. | Water Table Elevation 8-24-89 | Aquitard Elevation ft. msl | Saturated Thickness ft. |
|---|---|---|---|
| MW-9 | 4976.90 | 4968.00 | 8.9 |
| MW-12 | 4976.65 | 4967.81 | 8.8 |
| MW-14 | 4974.90 | 4967.94 | 7.0 |
| MW-16 | 4980.74 | 4974.13 | 6.6 |
| MW-33 | 4976.04 | 4969.11 | 6.9 |
| | | Average | 7.6 |

2) The areas inside the 3,000 ug/l and the 10,000 ug/l contours were determined with a planimeter to be as follows:

| Contour, ug/l | Area, sq.ft |
|---|---|
| 3,000 | 228,480 |
| 10,000 | 78,720 |

Note that the area shown for the 3,000 ug/l contour is the area between the 3,000 and 10,000 ug/l contours.

3) The average concentration within each contour was calculated by averaging the extreme values for each area. Thus, for the area inside the 3,000 ug/l contour, 3,000 and 10,000 were averaged to yield 6,500 ug/l (6.5 ppm). For the area inside the 10,000 ug/l contour, 10,000 was averaged with the concentration at well MW-16, which was assumed to be the maximum, which was 16,900 ug/l. This average was 13,450 ug/l (13.5 ppm).

4) The total mass of TCE inside the 3,000 ug/l contour was then calculated as follows:

$$\text{lbs TCE} = (\text{Area}) \times (\text{Sat. thickness}) \times (\text{Porosity}) \times (62.4 \text{ lbs/cu. ft.}) \times (\text{TCE, ppm}/10^6)$$

| Contour | Area, $ft^2$ | Sat. Thickness ft. | Porosity | TCE,ppm | lbs. TCE |
|---|---|---|---|---|---|
| 3,000 | 228,480 | 7.6 | 0.43 | 6.5 | 303 |
| 10,000 | 78,720 | 7.6 | 0.43 | 13.5 | 217 |
| | | | | Total | 520 |

5) The average daily recovery rate for the system during 1989 was approximately 2,000 gallons per day (gpd). This is shown in Figure 10. During this first year of operation, the system was plagued with several problems which reduced this rate. We expect that this rate will increase to somewhere between 2,600 and 3,000 gpd once these problems are resolved. We have, however, used an average rate of 2,000 gpd for this evaluation.

6) The average TCE concentration at each well was estimated from the contour map (Figure 3) and is shown in Figure 11 along with the percent of total discharge for each well based on a field test conducted in mid-1989. Figure 11 also shows the mass of TCE removed, based on a total discharge rate of 2,000 gpd, to be 44.8 lbs/year.

7) Based on the mass removed (44.8 lbs/yr) and the total mass in the impact area (520 lbs.), the portion of the total mass removed is:

$$(44.8/520) \times 100 = 8.6\%$$

Had the recovery rate averaged 2,600 gpd (see Step 5), the mass recovered would have been 58.2 lbs. or 11.2%.

While we recognize that the mass recovered will diminish with time, we feel that this mass recovery rate represents a significant impact on the contaminant plume in the target area.

Figure 10
Groundwater Recovery Rates
1989

| Month | Gallons Recovered |
|---|---|
| January | 52,400 |
| February | 32,100 |
| March | 59,000 |
| April | 33,100 |
| May | 50,600 |
| June | 83,000 |
| July | 66,000 |
| August | 78,300 |
| September | 87,100 |
| October | 64.100 |
| November | 78,300 |
| December | 53,400 |
| Average | 61,450 gallons/month |

$$\frac{61{,}450}{30 \text{ days/month}} = 2{,}048 \text{ gallons/day}$$

Figure 11

Mass of TCE Recovered

| Recovery Well No. | TCE Concentration (ppm) | % of Total Discharge | Mass of TCE Removed lbs/yr |
|---|---|---|---|
| PW-1 | 3.3 | 11.7 | 2.4 |
| MW-18 | 3.4 | 16.5 | 3.4 |
| MW-23 | 9.9 | 36.2 | 21.8 |
| MW-24 | 16.9 | 2.5 | 2.6 |
| MW-25 | 16.9 | 6.0 | 6.2 |
| MW-26 | 12.0 | 4.8 | 3.5 |
| MW-27 | 3.8 | 17.9 | 4.1 |
| MW-28 | 3.0 | 4.4 | 0.8 |
| | | 100.0 | 44.8 lbs. TCE/yr |

# VII STATISTICAL ANALYSES OF HISTORICAL DATA

Statistical methods were applied to the historical groundwater concentration database generated under the quarterly New Mexico monitoring program. TCE was used as the indicator parameter for these statistical analyses since it is the predominant contaminant, and since there is a more detailed history of TCE concentrations in the database. A summary of these data, by well, is shown in Figure 12, and covers the period from 1986 through 1989.

Upon review of this data, two of the analytical results appeared to be anomalously low and were excluded from all statistical analyses performed. These two results included the 2nd quarter of 1988 for well MW-15 (shown in Figure 12 as "TCE15") and the 3rd quarter of 1988 for well number MW-22 ("TCE22").

The statistical methods employed included linear regression analysis, using the least squares method, and the determination of statistically significant differences between means, using a Student's t-test. A detailed discussion of these methods is beyond the scope of this report, but may be found in any Statistics textbook.

Linear regression was applied to the TCE data from each well in order to "smooth" the high degree of variation in the individual quarterly results and to show the general trend of TCE concentration over time. A sequential "period number" was used as the independent variable in all cases, which is standard practice in time series analysis.

FIGURE 12

SPARTON TECHNOLOGY, INC.
COORS ROAD FACILITY

HISTORICAL TCE CONCENTRATIONS FROM QUARTERLY GROUNDWATER MONITORING DATA

| | | | TCE, ug/l | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| PERIOD | YEAR | QTR | TCE6 | TCE8 | TCE9 | TCE14 | TCE15 | TCE16 | TCE18 | TCE21 | TCE22 | TCE23 |
| 1 | 1986 | 1 | 310 | 100 | 6100 | | | | | | | |
| 2 | 1986 | 2 | 110 | 160 | 8300 | | | | | | | |
| 3 | 1986 | 3 | 420 | 150 | 5000 | | | 20000 | 5400 | | | |
| 4 | 1986 | 4 | 390 | 190 | 5000 | 4900 | 940 | 36000 | 3600 | 2300 | 230 | 7500 |
| 5 | 1987 | 1 | 300 | 84 | 4500 | 5000 | 630 | 21000 | 4000 | 1700 | 170 | 6500 |
| 6 | 1987 | 2 | 320 | 69 | 3600 | 1800 | 580 | 23000 | 3000 | 1400 | 270 | 3700 |
| 7 | 1987 | 3 | 540 | 300 | 6400 | 2100 | 650 | 25000 | 4800 | 2100 | 370 | 3900 |
| 8 | 1987 | 4 | 360 | 150 | 7100 | 2700 | 480 | 28000 | 4300 | 2000 | 240 | 13000 |
| 9 | 1988 | 1 | 280 | 45 | 5500 | 6200 | 370 | 26000 | 3500 | 1800 | 150 | 13000 |
| 10 | 1988 | 2 | 170 | 93 | 4800 | 5000 | 10 | 25000 | 3100 | 1100 | 230 | 11000 |
| 11 | 1988 | 3 | 52 | 66 | 3300 | 5200 | 380 | 26000 | 3800 | 1500 | 63 | 3900 |
| 12 | 1988 | 4 | 99 | 190 | 4200 | 5600 | 250 | 22000 | 4200 | 1300 | 120 | 8000 |
| 13 | 1989 | 1 | 55 | 82 | 4000 | 3300 | 180 | 16000 | | 900 | 110 | |
| 14 | 1989 | 2 | | | 4400 | 4900 | 200 | 14000 | | 520 | 150 | |
| 15 | 1989 | 3 | | | 2500 | 3000 | 200 | 13000 | | 460 | 120 | |
| 16 | 1989 | 4 | | | 2300 | 2200 | 260 | 16000 | | 1100 | 91 | |

Figures 13 through 22 show scatter plots of the data along with the regression line calculated over the entire range of data (1986-1989). As can be seen from these plots, in all cases except one the slope of the regression line is negative, that is to say, the concentrations are decreasing with time due to pumping and to natural dispersion and advection mechanisms. The one exception is found at well MW-23 which regression showed to have a positive slope, or increasing concentration with time through the end of 1988 when this well was converted to a recovery well. This may be due to a buried channelized flow from the source area, or may be the result of the unusually high variation in the data at well MW-23.

A summary of the regression equations for each well, along with the individual regression results is included in Attachment 3.

In order to evaluate the effects of the recovery system, only those wells with quarterly historical data extending through 1989 were selected so that a "before" (pre-recovery system) and "after" (post-recovery system) comparison could be made. These wells included MW-9, MW-14, MW-15, MW-16, MW-21, and MW-22 (see Figure 12).

Since the recovery system was started up in early January 1989, the pre-recovery period used was 1986 through 1988. For the post-recovery period, data from the 3rd quarter of 1988 through the 4th quarter of 1989 were used. The last two quarters of 1988 were included to avoid the potential for a step change in concentration to mask the results of an evaluation

FIGURE 13

MW-6

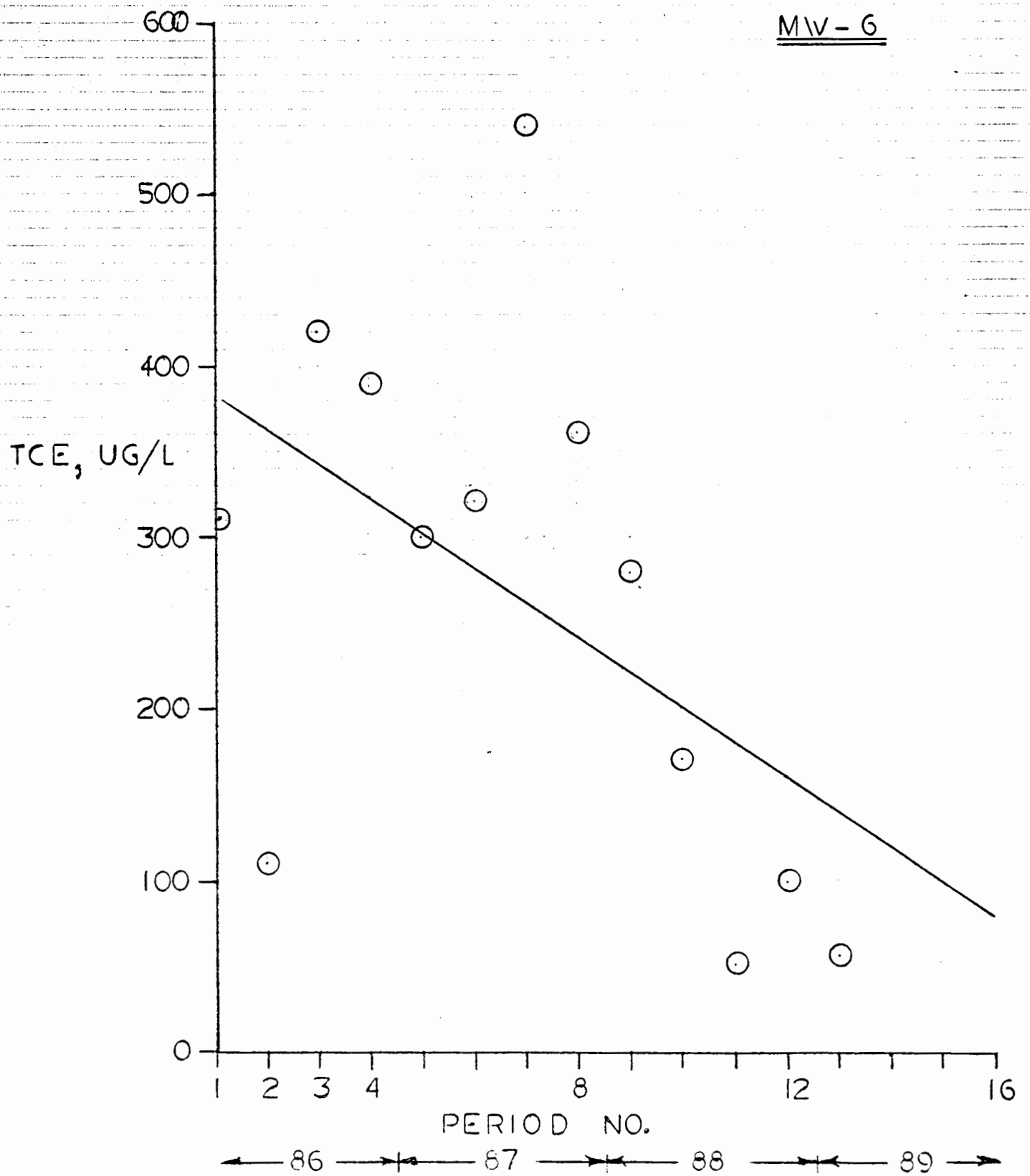
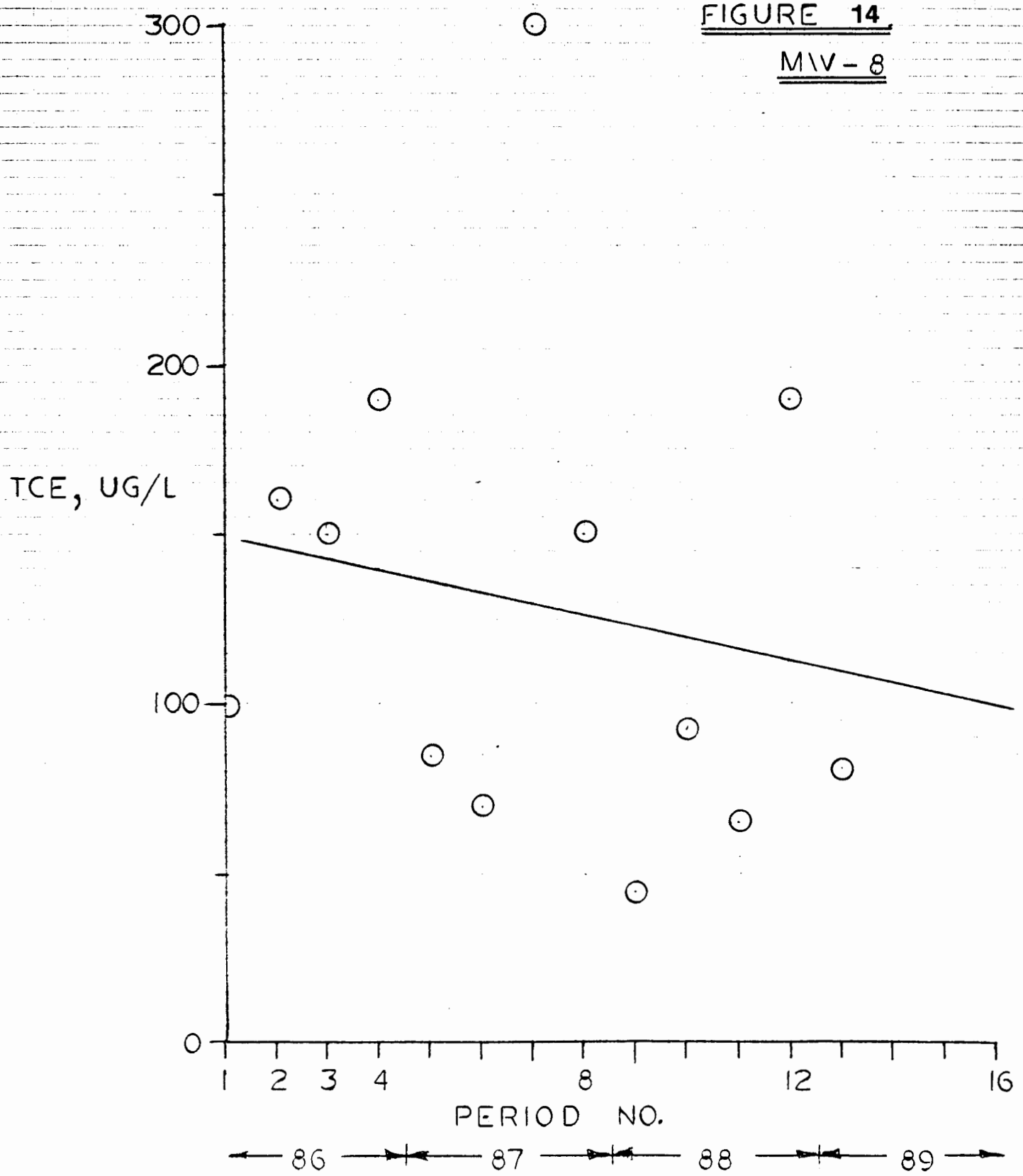


FIGURE 14

MW-8



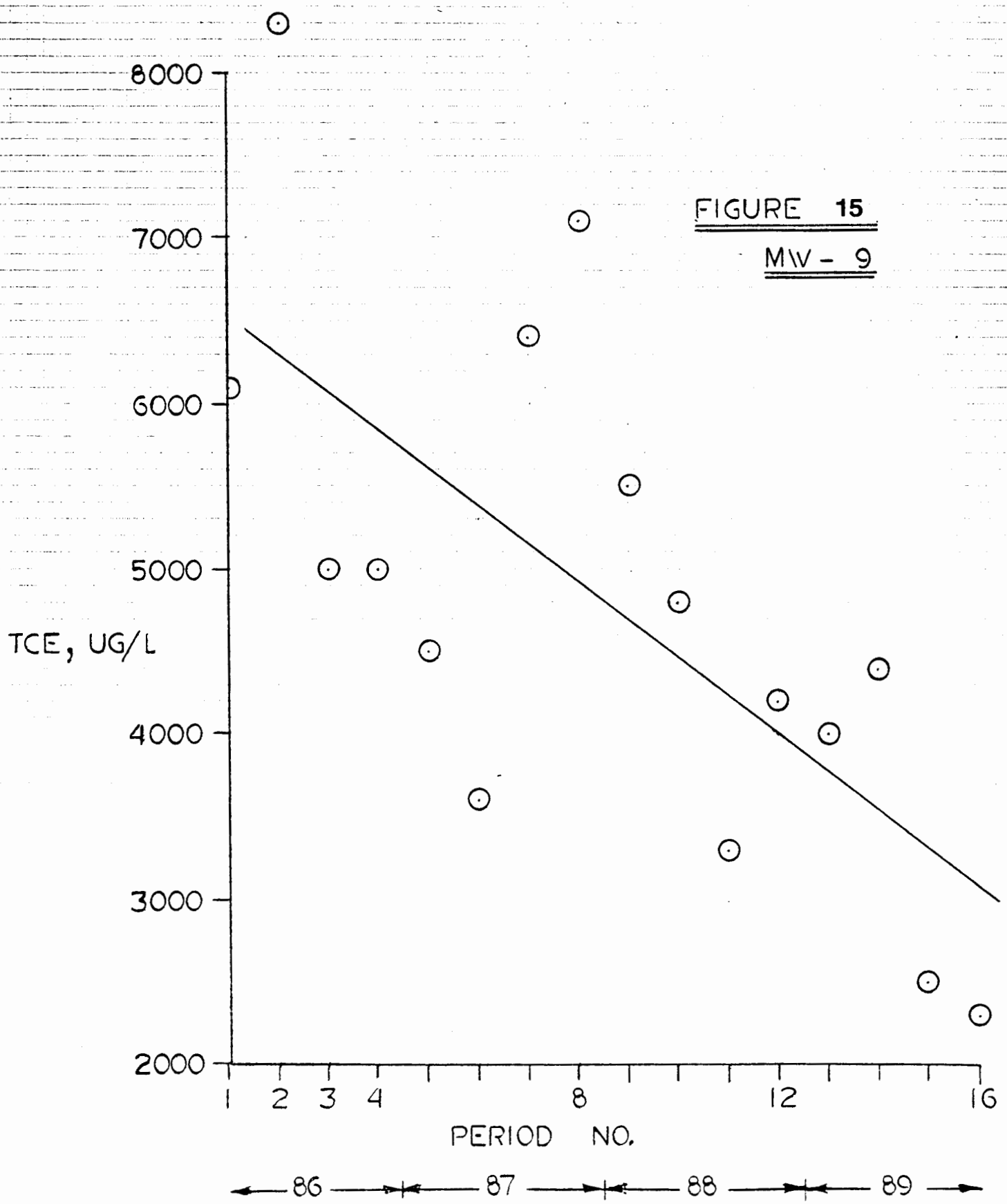


FIGURE 15
MW - 9
8000
7000
6000
5000
4000
3000
2000
TCE, UG/L
1
2
3
4
8
12
16
PERIOD NO.
86
87
88
89

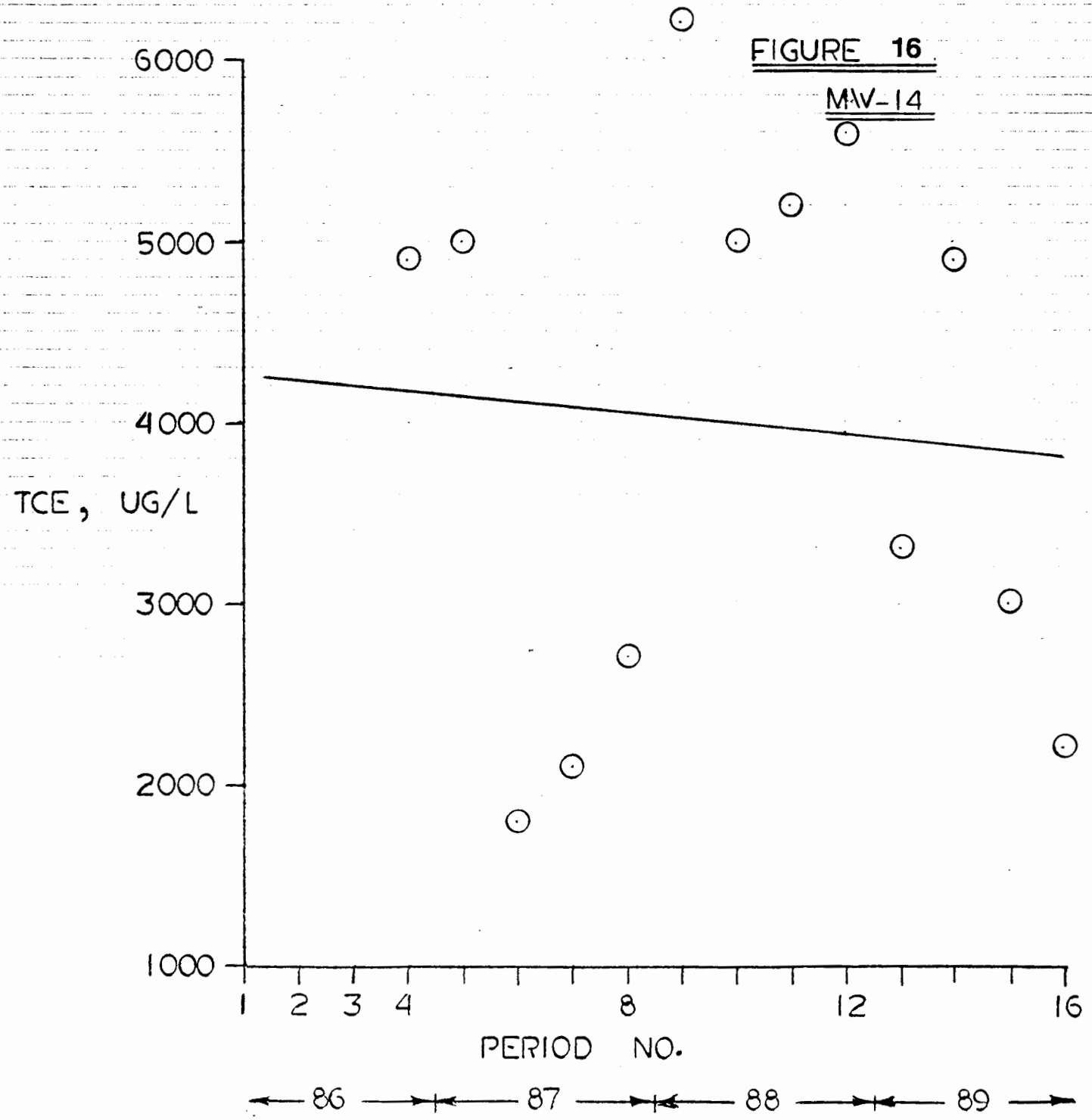



FIGURE 16

MW-14

FIGURE 17

MW-15

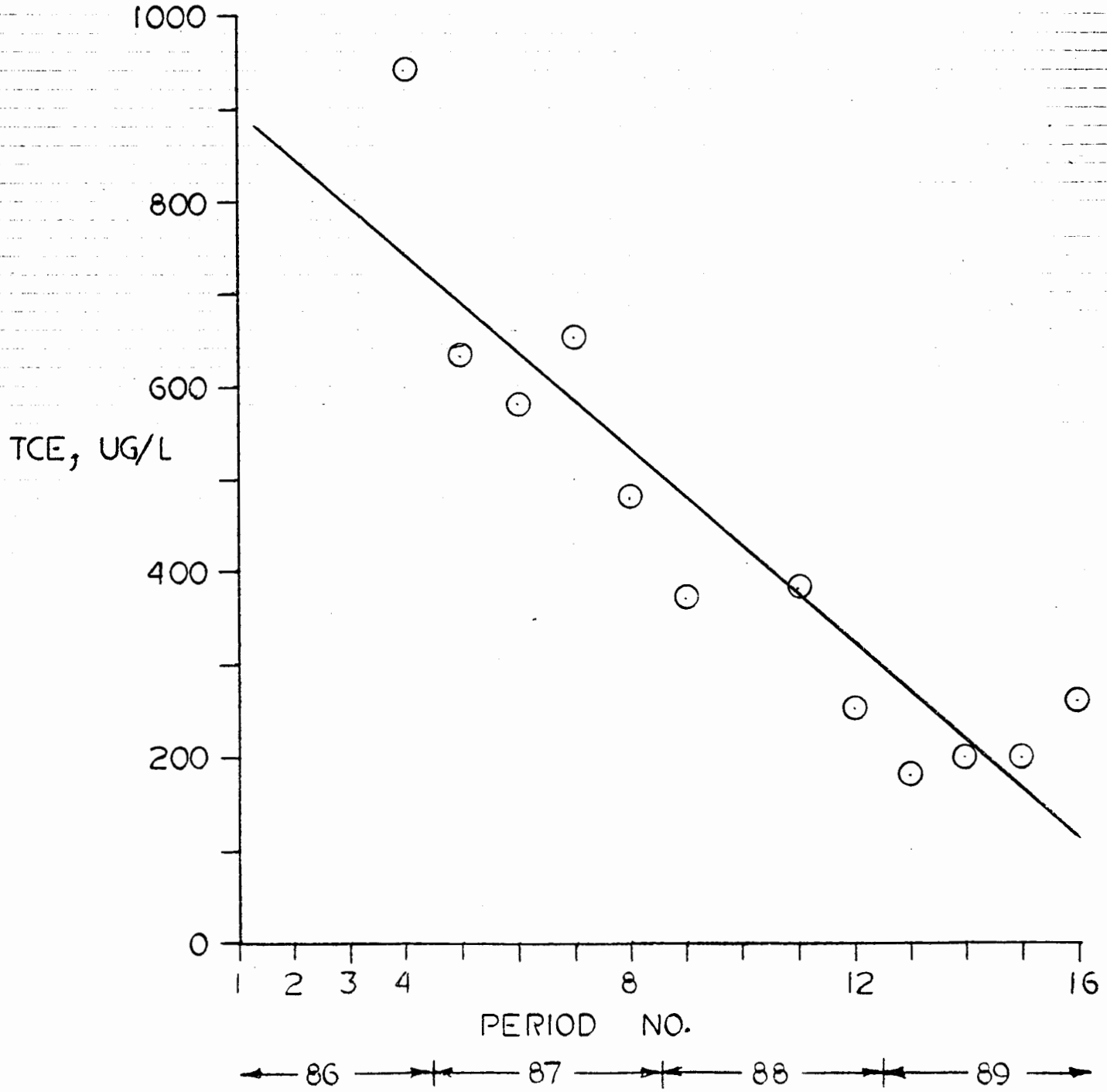


FIGURE 19

MW 18

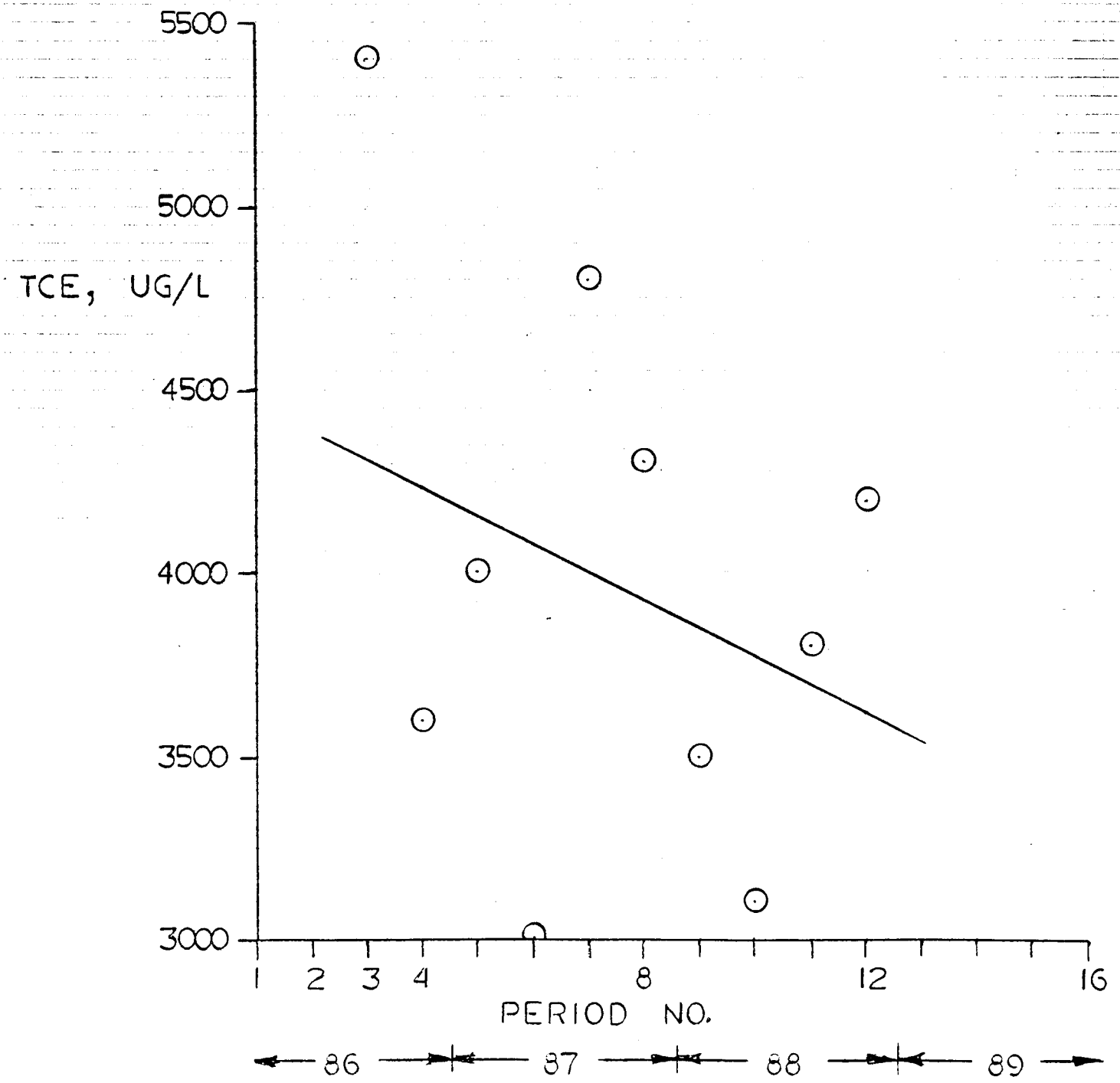


FIGURE 20

MW-21

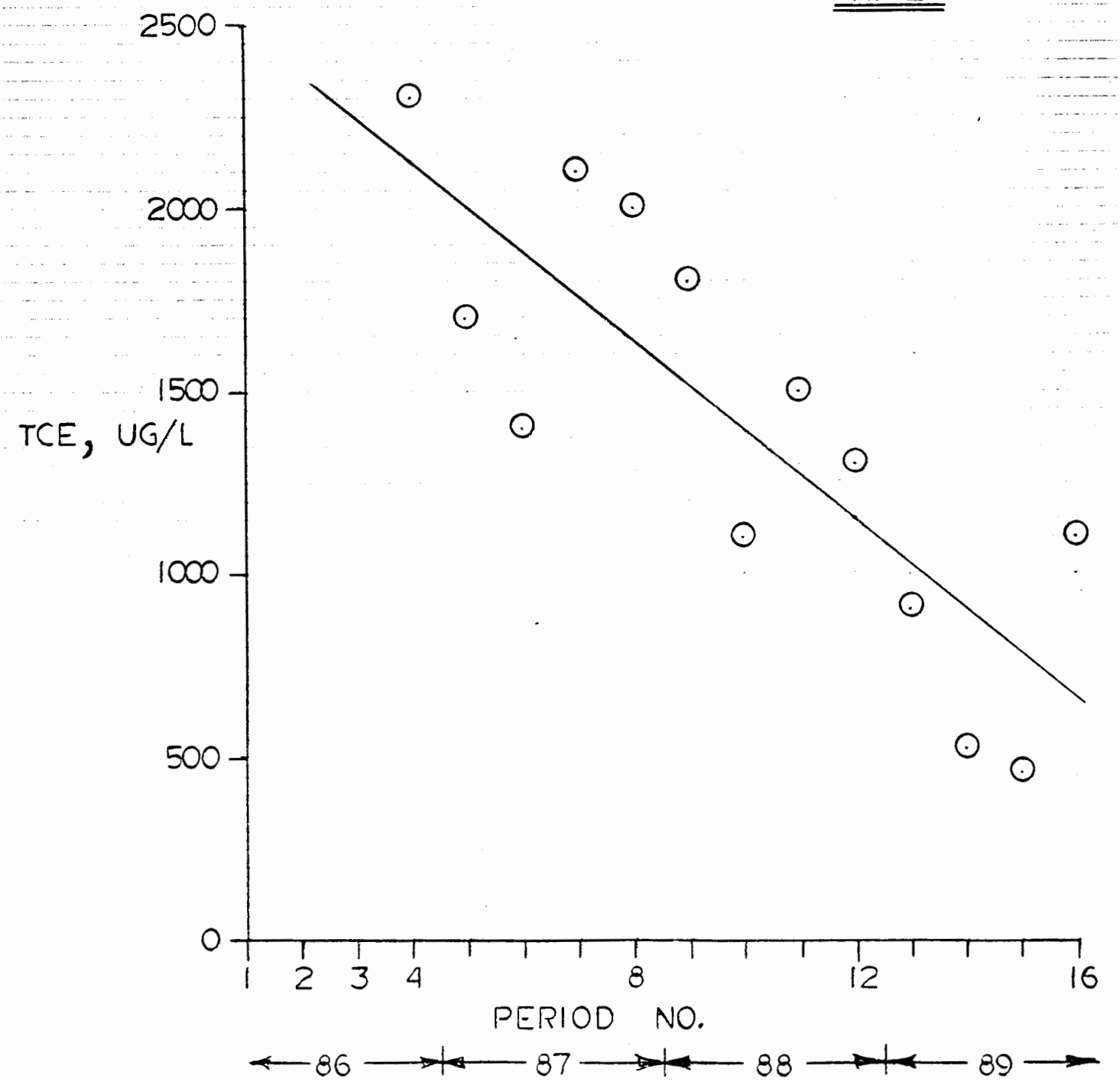


FIGURE 21

MW-22

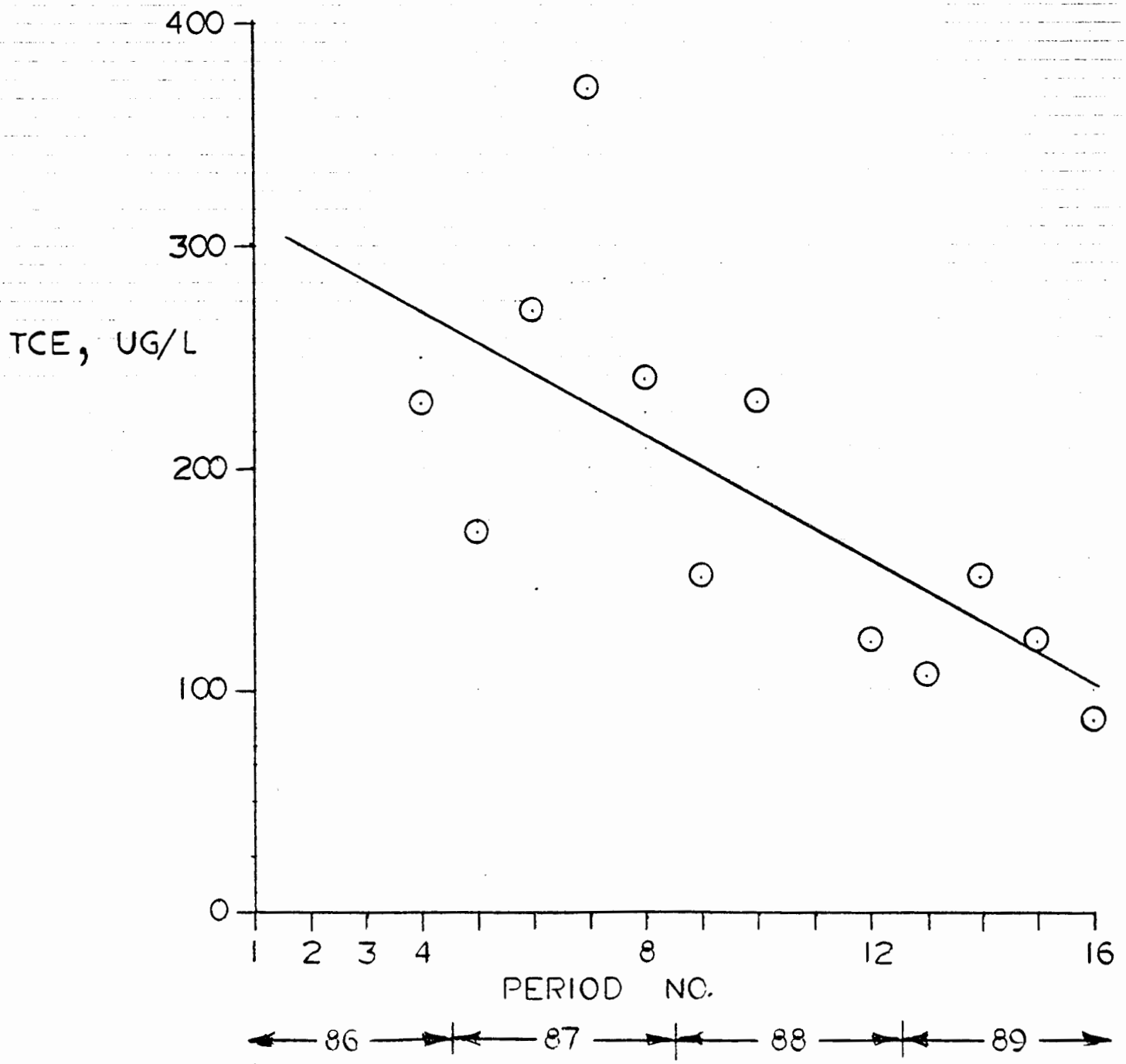
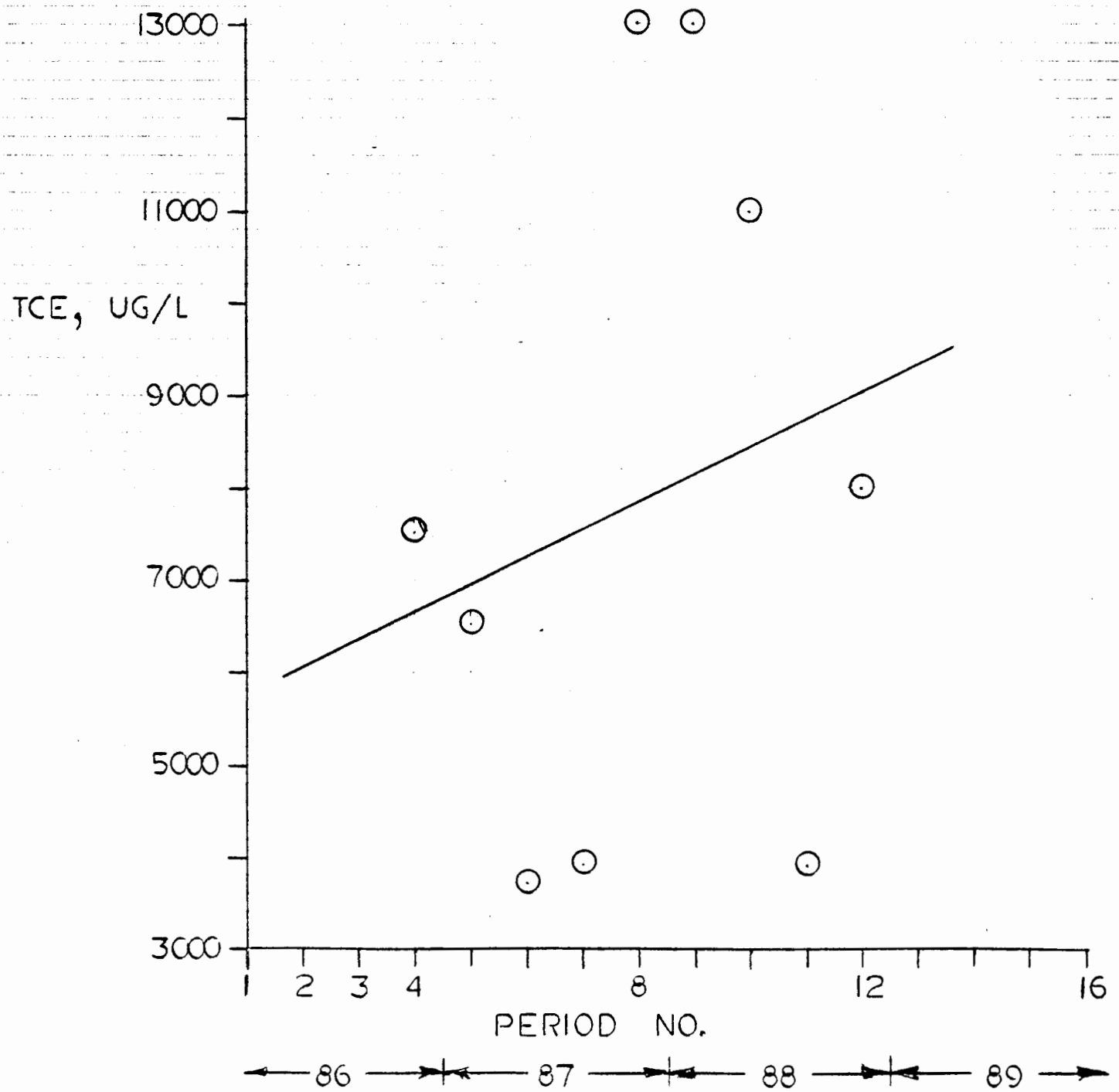


FIGURE 22

MW-23



based on a change in the slope of the regression. A step change is a sudden shift in the order to magnitude of the data, and may or may not be accompanied by a difference in the rate of change or slope of the data.

Using these two groups of data (pre- and post-recovery) for each well, linear regression was applied to each data group, and the resulting rates of change in TCE concentration (regression line slopes) were compared. The results indicate that for four of the six wells examined, the TCE concentration decreased at a faster rate during the post-recovery period. For one of these wells, MW-14, the rate changed from +232 ug/l/quarter during the pre-recovery period to a -606 ug/l/quarter during the post-recovery period; a 90 degree shift in slope. Another significant change in slope was noted at well MW-16 in the source area where the rate of TCE decrease changed from -121 ug/l/quarter in the pre-recovery period to -2257 ug/l/quarter in the post-recovery period.

The remaining two wells showed a slightly lower rate of decrease in the post-recovery period. These wells are MW-15 and MW-22. Neither of these wells is in the immediate vicinity of any recovery well, and well MW-22 is cross-gradient form the source area. Lack of proximity to a recovery well is the apparent reason that these two wells did not show the effects experienced in the other four wells, all of which are in close proximity to a recovery well. Figure 23 shows a comparison of the rates of contaminant decrease for the two periods for each of the six wells. Figures 24 through 29 show the regression lines for each well for both the pre-recovery and post-recovery periods.

FIGURE 23

COMPARISON OF RATES OF CONTAMINANT DECREASE

| WELL NO. | RATE OF CHANGE IN TCE CONCENTRATION, ug/l/quarter * 86 - 88 | 3Q88 - 4Q89 |
|---|---|---|
| 9 | - 190 | - 277 |
| 14 | + 232 | - 606 |
| 15 | - 70 | - 21 |
| 16 | - 121 | - 2257 |
| 21 | - 92 | - 140 |
| 22 | - 12 | - 5 |
| AVERAGE | - 42.2 | - 551.0 |

* As measured by the slope of the least squares regression line.

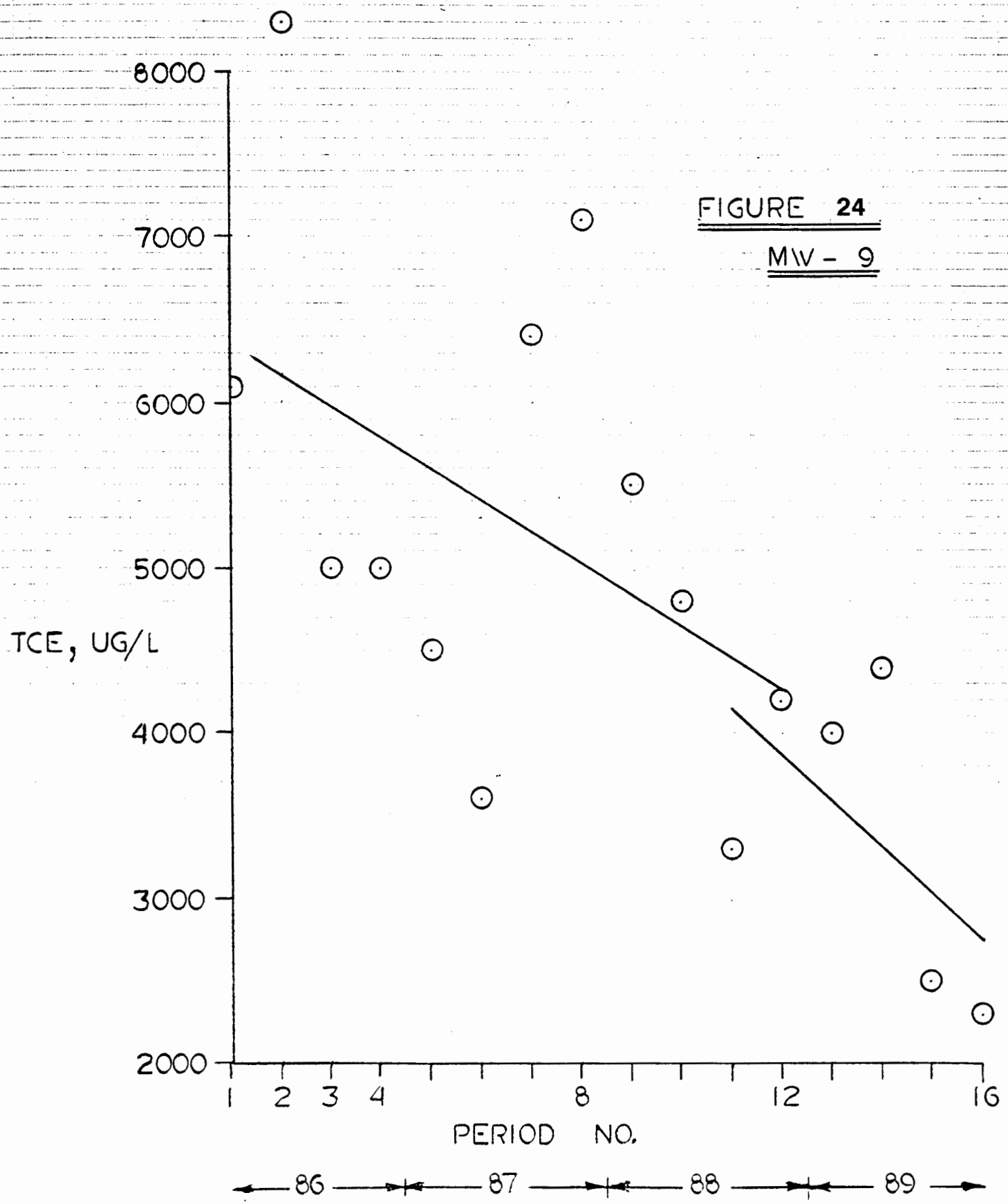



FIGURE 24

MW - 9

FIGURE 25

MW-14

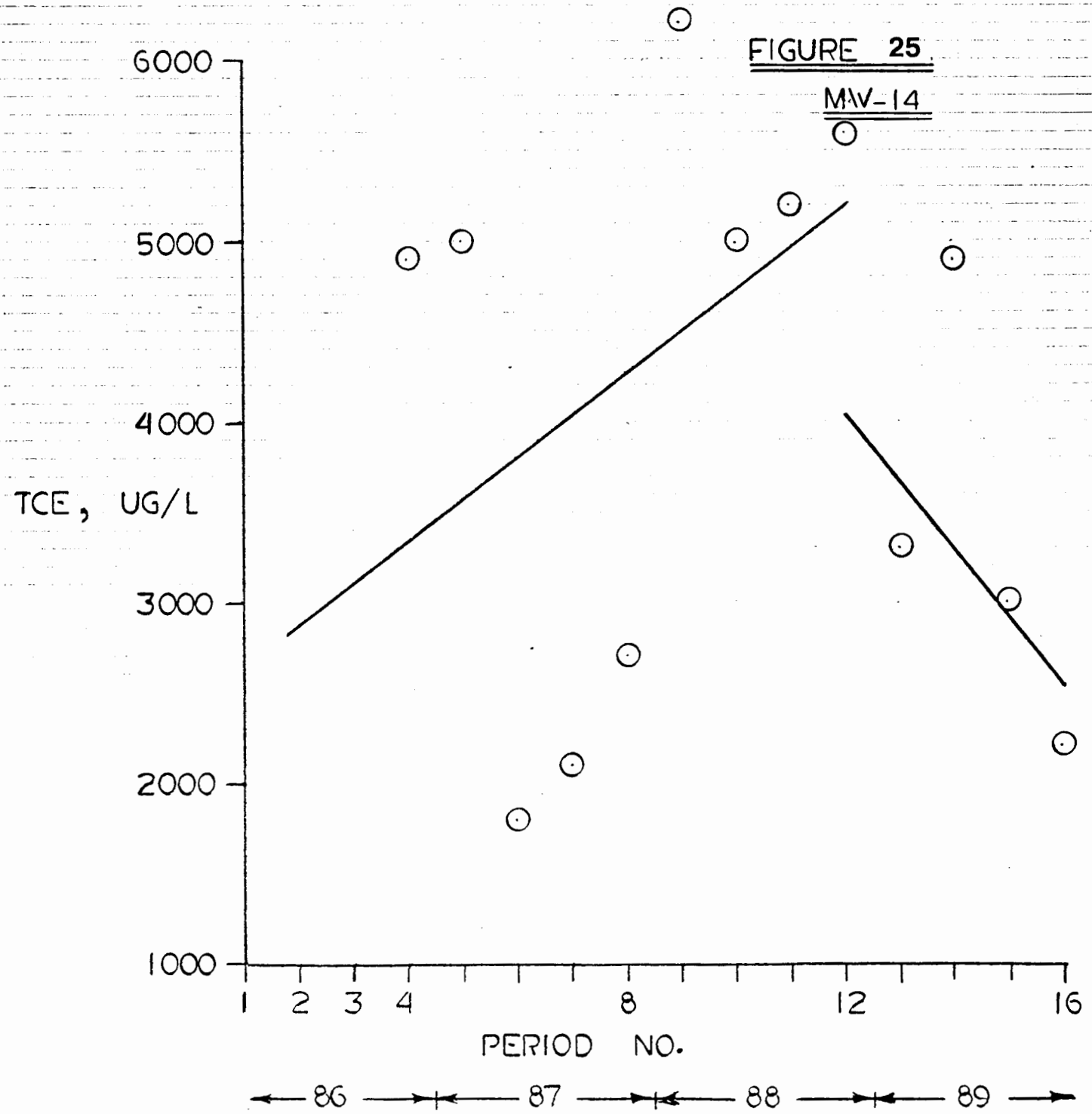


FIGURE 26

MW-15

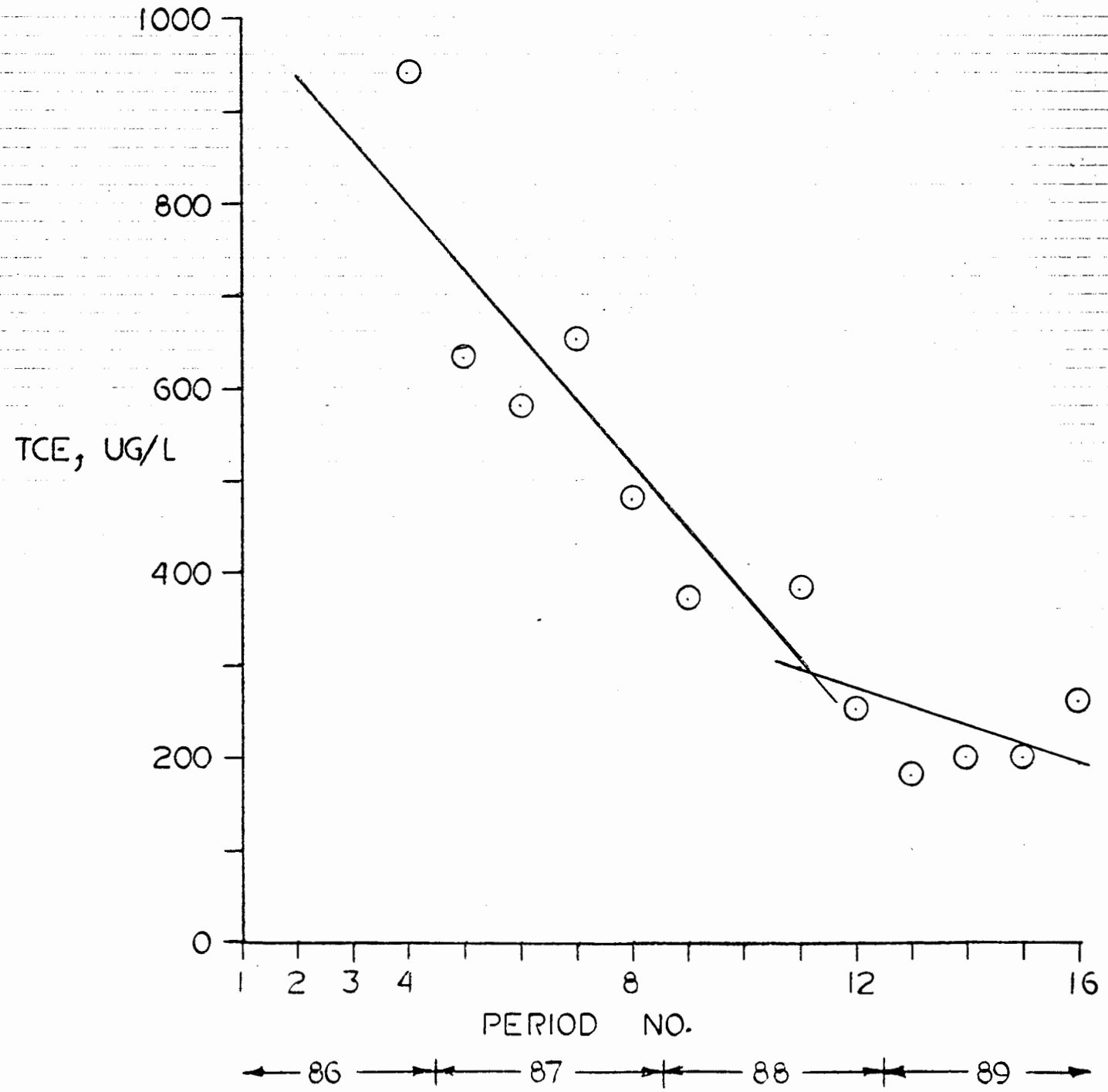


FIGURE 27

MW-16

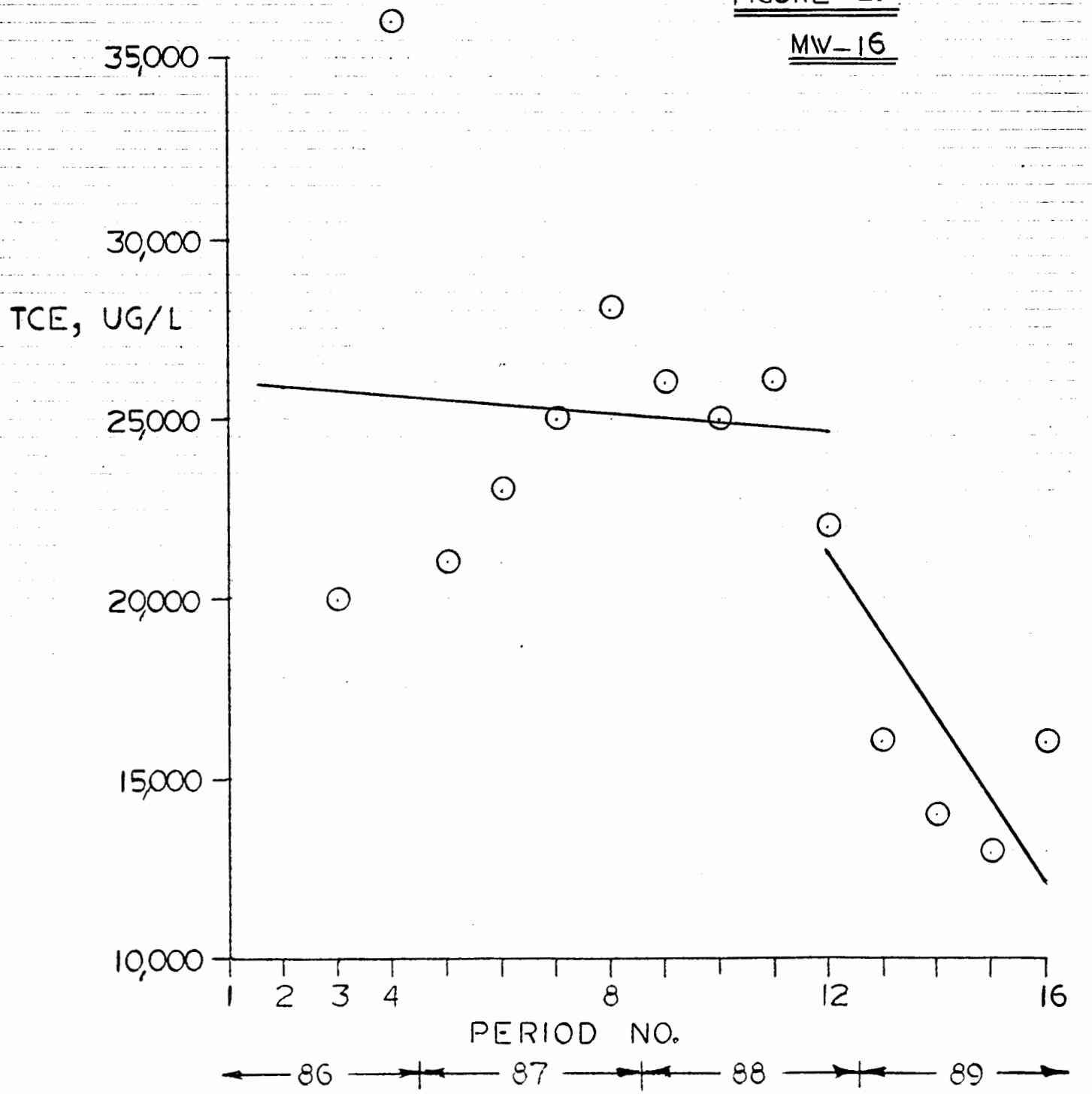


FIGURE 28

MW-21

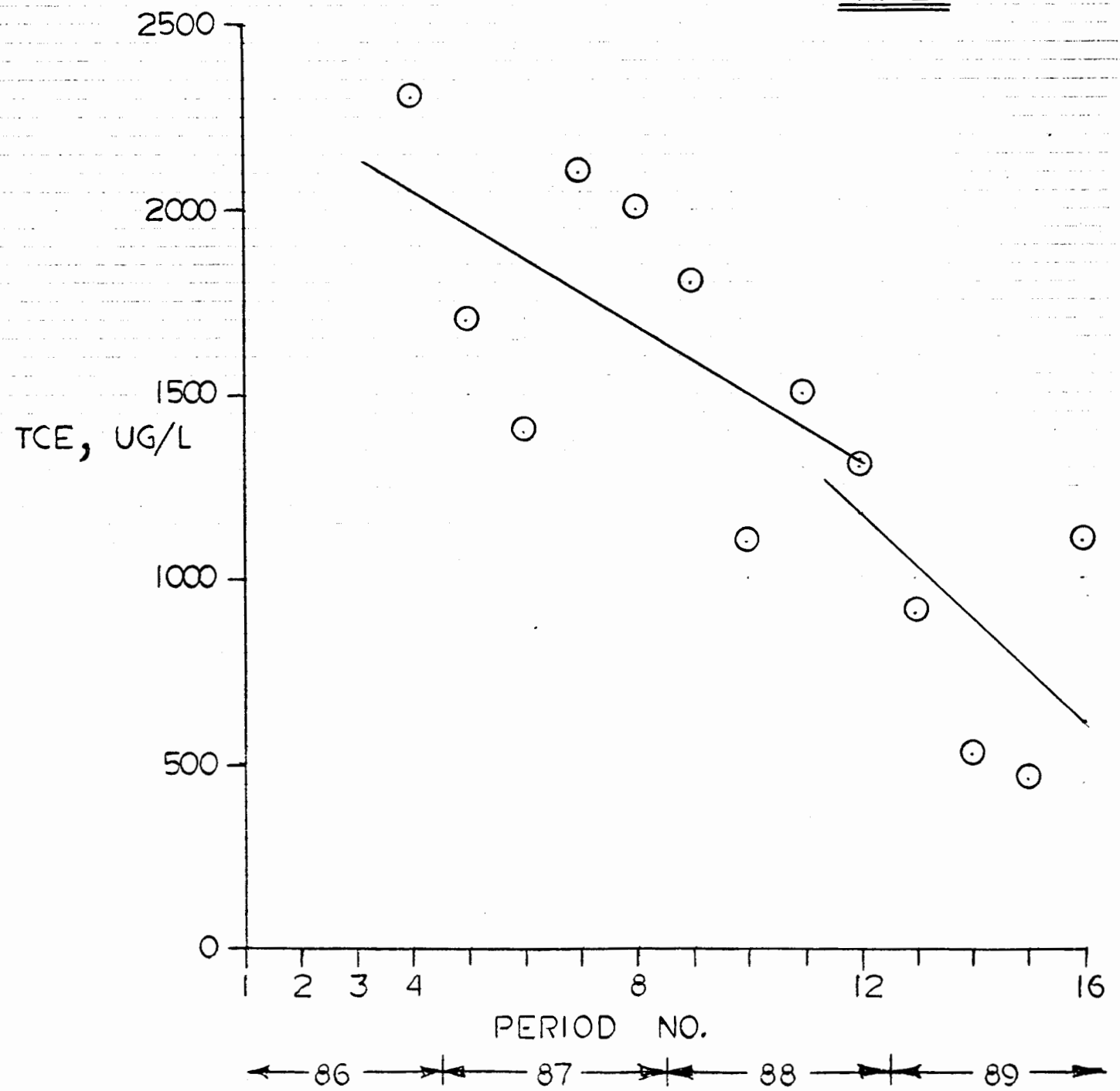
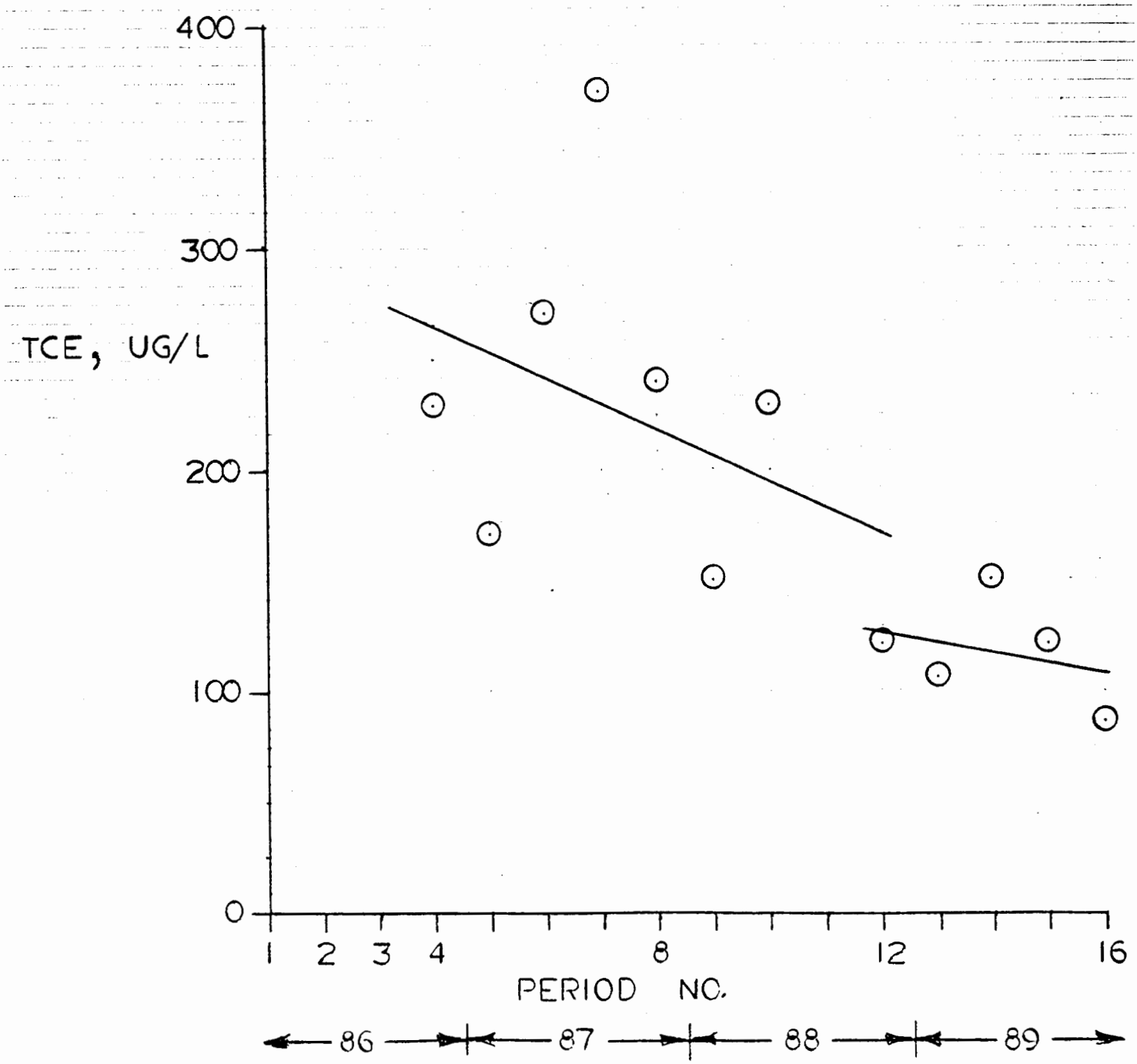


FIGURE 29.

MW-22



Attachment 4 includes the results of the regression analyses for each case.

As can be seen from Figure 23, the average rate of decrease in TCE concentration during the pre-recovery period was 42 ug/l/quarter. This average rate increased over tenfold to 551 ug/l/quarter, due to the effects of the recovery system.

The second statistical method applied to the historical data was the calculation and comparison of means (averages). For each well, a mean concentration was calculated for each of the two periods (pre- and post-recovery). In every case, the mean concentration was lower in the post-recovery period. The two means for each well were then compared, using a Student's t-test, to determine whether the difference between the means was statistically significant or due to the inherent variation in the data. In all but one case the difference was significant at the 95% confidence level. Well MW-14 was the only well where the difference was not significant at the 95% confidence level. This is probably due to the relatively high variance during the post-recovery period.

The average TCE concentration for all six wells during the pre-recovery period was 6,207 ug/l. This dropped to 3,745 ug/l during the post recovery period; a 39.7% decrease. Figure 30 shows this data.

FIGURE 30

STATISTICAL COMPARISON OF MEANS @ 95% CONFIDENCE LEVEL

Historical TCE Concentrations from Quarterly Groundwater Monitoring Data

| PERIOD | YEAR | QTR | TCE6 | TCE8 | TCE9 | TCE14 | TCE15 | TCE16 | TCE18 | TCE21 | TCE22 | TCE23 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | [---------- | | | | TCE, ug/l | | | | | ----------] |
| 1 | 1986 | 1 | 310 | 100 | 6100 | | | | | | | |
| 2 | 1986 | 2 | 110 | 160 | 8300 | | | | | | | |
| 3 | 1986 | 3 | 420 | 150 | 5000 | | | 20000 | 5400 | | | |
| 4 | 1986 | 4 | 390 | 190 | 5000 | 4900 | 940 | 36000 | 3600 | 2300 | 230 | 7500 |
| 5 | 1987 | 1 | 300 | 84 | 4500 | 5000 | 630 | 21000 | 4000 | 1700 | 170 | 6500 |
| 6 | 1987 | 2 | 320 | 69 | 3600 | 1800 | 580 | 23000 | 3000 | 1400 | 270 | 3700 |
| 7 | 1987 | 3 | 540 | 300 | 6400 | 2100 | 650 | 25000 | 4800 | 2100 | 370 | 3900 |
| 8 | 1987 | 4 | 360 | 150 | 7100 | 2700 | 480 | 28000 | 4300 | 2000 | 240 | 13000 |
| 9 | 1988 | 1 | 280 | 45 | 5500 | 6200 | 370 | 26000 | 3500 | 1800 | 150 | 13000 |
| 10 | 1988 | 2 | 170 | 93 | 4800 | 5000 | | 25000 | 3100 | 1100 | 230 | 11000 |
| 11 | 1988 | 3 | 52 | 66 | 3300 | 5200 | 380 | 26000 | 3800 | 1500 | | 3900 |
| 12 | 1988 | 4 | 99 | 190 | 4200 | 5600 | 250 | 22000 | 4200 | 1300 | 120 | 8000 |
| 13 | 1989 | 1 | 55 | 82 | 4000 | 3300 | 180 | 16000 | | 900 | 110 | |
| 14 | 1989 | 2 | | | 4400 | 4900 | 200 | 14000 | | 520 | 150 | |
| 15 | 1989 | 3 | | | 2500 | 3000 | 200 | 13000 | | 460 | 120 | |
| 16 | 1989 | 4 | | | 2300 | 2200 | 260 | 16000 | | 1100 | 91 | |

| | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| pre-recovery no. data points = | n1 | 12 | 9 | 8 | 10 | | 9 | 8 | | |
| pre-recovery mean = | x1 | 5316.6 | 4277.7 | 535 | 25200 | | 1688.8 | 222.5 | =====> | 6206.81 pre-rec. mean |
| pre-recovery std deviation = | s1 | 1455.2 | 1623.8 | 215.07 | 4541.1 | | 398.26 | 78.330 | | |
| post-recovery no. data points = | n2 | 4 | 4 | 4 | 4 | | 4 | 4 | | |
| post-recovery mean = | x2 | 3300 | 3350 | 210 | 14750 | | 745 | 117.75 | =====> | 3745.46 post-rec. mean |
| post-recovery std deviation = | s2 | 1055.1 | 1132.8 | 34.641 | 1500 | | 306.53 | 24.635 | | --- |
| | | | | | | | | | | 39.66 % decrease |
| difference betweem means = | x1-x2 | 2016.6 | 927.77 | 325 | 10450 | | 943.88 | 104.75 | | ========= |
| | d1 | 1379.3 | 1505.9 | 180.94 | 4003.6 | | 375.47 | 66.910 | | |
| | d2 | 0.5773 | 0.6009 | 0.6123 | 0.5916 | | 0.6009 | 0.6123 | | |
| | d1*d2 | 796.37 | 904.94 | 110.80 | 2368.5 | | 225.63 | 40.974 | | |
| (x1-x2)/(d1*d2) = | tc | 2.5323 | 1.0252 | 2.9331 | 4.4119 | | 4.1833 | 2.5564 | | |
| from table of t values @ n1+n2-2 degrees of freedom | t.95 | 2.14 | 2.20 | 2.23 | 2.18 | | 2.20 | 2.23 | | |

---

d1 = SQRT(((n1-1)*(s1^2)+(n2-1)*(s2^2))/(n1+n2-2))
d2 = SQRT((1/n1)+(1/n2))

IF tc > t.95 THEN THE DIFFERENCE BETWEEN THE MEANS IS SIGNIFICANT AT THE 95% CONFIDENCE LEVEL.

In summary, these statistical analyses show that since the recovery system was placed in operation, the average concentration of TCE in the groundwater has decreased approximately 40%. Additionally, the recovery system has accelerated the average rate of decrease of contaminant concentration form 42 ug/l/quarter to 551 ug/l/quarter.

# VIII CONCLUSIONS

The intent of the recovery system is to retard the spread of the contaminant plume during the completion of the RFI and CMS, at which point a final solution may be determined and implemented. Although this evaluation has focused on TCE, it is clear that other contaminants included in the plume are in fact also being removed. This evaluation has shown that the recovery system has accomplished the following:

- reduction of contaminant mass in the target impact area of approximately 9% in one year;
- acceleration of the rate of decrease in contaminant concentration over tenfold;
- reduction of the average concentration of contaminant in the target impact area of approximately 40%.

It is readily apparent from these data the recovery system is accomplishing or exceeding the goals for which it was designed.

We recommend that operation of the current system be maintained until completion of the RFI and CMS, at which time a final solution encompassing the entire contaminant plume may be identified and implemented.

## DISTRIBUTION

1 copy to: Sparton Corporation
2400 East Ganson Street
Jackson, Michigan 49202

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1 copy to: Sparton Technology, Inc.
4901 Rockaway Boulevard, SE
Rio Rancho, New Mexico 87124

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**QUALITY CONTROL REVIEWER:**

Charles R. Glore, C.E.G.
Principal Hydrogeologist

# Attachments

1. Aquifer Testing Reports
2. Radii of Infulence Calculations
3. Regression Analyses: 1986 - 1989
4. Regression Analyses: Pre-recovery -vs- Post-recovery

# Attachment 1

# Aquifer Testing
# at the
# Sparton Technology, Inc.
# Coors Road Plant
# Albuquerque, New Mexico

Prepared by

METRIC Corporation
Albuquerque, New Mexico

APRIL 1987

# AQUIFER TESTING
# AT THE
# SPARTON TECHNOLOGY, INC.
# COORS ROAD PLANT

Aquifer tests were performed in three wells at the Sparton Technology, Inc., Coors Road Plant during March 1987. The purpose of the testing was to estimate the aquifer permeability of the "upper flow zone". The resulting information will be used in design of a pollution recovery well network, and possibly a recharge well network. The "upper flow zone" consists generally of the upper 5 to 10 feet of the saturated zone at the Coors Road site separated from the remainder of the saturated zone by a fine grained aquitard unit.

Pumping tests were conducted in three wells; MW-16 and MW-24 in the pond and sump area on the northwest side of the building, and in MW-18 located about 60 feet west of the west corner of the building.

The tests were conducted as follows:

Well: MW-16
Test Type: Constant Drawdown
Test Drawdown: 2.38 ft
Available Drawdown: 5.4 ft ±
Duration of Pumping: 4325 min ≃ 72 hr
Average Discharge: 0.145 gpm
Observations Taken in Wells: MW-16 (recovery), MW-24, MW-25, MW-17

Well: MW-24
Test Type: Constant Drawdown
Test Drawdown: 3.26 ft
Available Drawdown: 8.1 ft ±
Duration of Pumping: 4390 min ≃ 73 hr
Average Discharge: 0.205 gpm
Observations Taken in Wells: MW-24 (recovery), MW-16, MW-25, MW-17

Well: MW-18
Test Type: Constant Discharge
Maximum Drawdown: 5.02 ft
Available Drawdown: 12.6 ft ±
Duration of Pumping: 2940 min = 49 hr
Average Discharge: 0.264 gpm
Observations Taken in Wells: MW-18

Since wells MW-16 and MW-24 are 2-inch i.d. wells, the tests were conducted using a 1.67-inch o.d. positive displacement pump having a maximum capacity of about 2.5 gpm. The combination of small well diameter (making it difficult to obtain reliable water levels in the pumped well with small drawdowns, i.e., less than 3.5 feet) and low well capacities i.e., less than 0.25 gpm (making it difficult to maintain a constant discharge) resulted in the selection of a constant drawdown test for wells MW-16 and MW-24. Also significant is the fact that MW-16 and MW-24 are only 11.3 feet apart, providing a close observation well for each test.

Well MW-18 is a four-inch diameter well with no close observation wells available. As a result, a constant discharge test was performed on MW-18, with drawdown and recovery measurements taken in the pumped well.

All water level measurements were made with electronic sounders and are felt to be accurate to within ± 0.01 ft.

Volatile organic samples were collected periodically during each of the tests, and metal samples were collected near the end of each test.

The water level and discharge data collected during each test is presented in APPENDIX A.

The results of the aquifer testing are presented in TABLE 1. The constant drawdown data from the pumped wells (MW-16 and MW-24) were analyzed by Lohman, 1972. The residual-drawdown data from the pumped wells and the time-drawdown and residual-drawdown data from the observation wells were analyzed using Jacob plots (wells MW-16, and MW-24 tests) Lohman, 1972 suggests that the recovery method is strictly applicable only to tests of constant discharge and variable drawdown or recovery, however, recovery tests generally give values of T in close agreement with constant drawdown tests.

The testing performed on MW-18 consisted of a constant discharge test with measurements taken in the pumped well. The data were analyzed using Jacob plots.

All of the plots are presented in APPENDIX B.

The time drawdown plots were checked to ensure that $u < 0.05$ and, thus, validate the use of the Jacob solution.

The MW-18 data were checked using a procedure suggested by Schafer, 1978 to establish which portions of the data are casing storage affected.

Based on the previously described testing, it is felt that the best estimate for the permeability (hydraulic conductivity) of the upper flow zone in the pond and sump area is about $5 \times 10^{-3}$ cm/sec. (see TABLE 1). Likewise, the best estimate for the permeability of the upper flow zone in the vicinity of MW-18 is about $3 \times 10^{-4}$ cm/sec. (see TABLE 1).

The residual-drawdown curves (APPENDIX B) show some evidence that a "recharge effect" may be occurring during the pumping period. The residual drawdown curves generally show a t/t'

TABLE 1

Aquifer Testing

Sparton Technology, Inc. Coors Road Plant

| Pumped Well | Observations at | Curve | Apparent T (gpd/ft) | b (ft) | Apparent K (ft/day) | Apparent K (cm/sec) | Comments |
|---|---|---|---|---|---|---|---|
| MW-16 | MW-16 | $\frac{s_w}{Q}$ vs $\frac{t}{r_w^2}$ | 57.3 | 5.4 | 1.41 | $5.000 \times 10^{-4}$ | Represents Grouted Zone Near MW-16 |
| | | Early R-D | 14.1 | 5.4 | 0.35 | $1.23 \times 10^{-4}$ | Represents Grouted Zone Near MW-16 |
| | | Late R-D | 49.1 | 5.4 | 1.22 | $4.29 \times 10^{-4}$ | Represents Grouted Zone Near MW-16 |
| MW-16 | MW-24 | Early T-D | 479 | 5.4 | 11.9 | $4.18 \times 10^{-3}$ | Selected Value |
| | | Early R-D | 2734 | 5.4 | 67.7 | $2.39 \times 10^{-2}$ | "Recharge" Affected |
| | | Late R-D | 781 | 5.4 | 19.3 | $6.82 \times 10^{-3}$ | Good Value |
| MW-24 | MW-24 | $\frac{s_w}{Q}$ vs $\frac{t}{r_w^2}$ | 275 | 8.05 | 4.57 | $1.61 \times 10^{-3}$ | Well Loss Affected |
| | | Early R-D | 22.9 | 8.05 | 0.38 | $1.34 \times 10^{-4}$ | Well Loss Affected |
| | | Late R-D | 846 | 8.05 | 14.0 | $4.96 \times 10^{-3}$ | Selected Value |
| MW-24 | MW-16 | T-D | 773 | 8.05 | 12.8 | $4.53 \times 10^{-3}$ | Selected Value |
| | | Early R-D | 410 | 8.05 | 6.81 | $2.40 \times 10^{-3}$ | Good Value |
| | | Late R-D | 1203 | 8.05 | 20.0 | $7.05 \times 10^{-3}$ | "Recharge" Affected |
| MW-18 | MW-18 | Early T-D | 29.0 | 12.6 | 0.31 | $1.09 \times 10^{-4}$ | Casing Storage Affected |
| | | Late T-D | 87.1 | 12.6 | 0.92 | $3.26 \times 10^{-4}$ | Selected Value |
| | | Early R-D | 131 | 12.6 | 1.39 | $4.90 \times 10^{-4}$ | Casing Storage and Recharge Affected |
| | | Late R-D | 15.2 | 12.6 | 0.16 | $5.69 \times 10^{-5}$ | Casing Storage Affected |

value greater than 2 at zero drawdown, suggesting a "recharge effect". Possible explanations of the apparent "recharge effect" include reduction or reversal of prevailing downward vertical leakage in the cone of depression during the tests or induced flow from a more permeable burried channel(s) existing within the upper flow zone. Evaluation of the analyses of volatile organic samples collected during the pumping tests (see APPENDIX C) indicates that if a "recharge effect" is occurring the recharge water has approximately the same organic contaminant levels as the water adjacent to the well.

# APPENDIX A

# PUMP TEST DATA

Date 3/3/87-3/07/87

# CONSTANT DRAWDOWN AQUIFER TEST

WELL MW-16

DRAWDOWN 2.38'

Static Water Level 66.98"

| time (h:m:s) | t (min) | t' (min) | t/t' | $\frac{t}{r_w^2}$ (m/ft$^2$) | Discharge (gpm) | Total Water Removed (gal) | $\frac{s_w}{Q}$ (ft·m/gal |
|---|---|---|---|---|---|---|---|
| 12:40:00 | 4295 | | | 438590 | 0.115 | 590 gal | 20.7 |
| 13:03:42 | 4319 | | | 441040 | 0.090 | 625 | 26.4 |

Date: 3/3/87-3/07/87

Pumped Well MW-16

Measurements at Well MW-16

Pump Speed: - Q: - gpm

Static Water Level _____

| time (h:m:s) | t (min) | t' (min) | t/t' | Drawdown (ft) | Comments |
|---|---|---|---|---|---|
| 3-46 13:10 | 4325 | 0 | | | |
| 13:17:30 | 4332.5 | 7.5 | 578 | .83 | Pump OFF ~~13:10:00~~ |
| 13:17:44 | 4332.7 | 7.7 | 563 | .76 | |
| 13:17:56 | 4332.9 | 7.9 | 548 | .73 | |
| 13:18:22 | 4333.4 | 8.4 | 516 | .70 | |
| 13:18:34 | 4333.6 | 8.6 | 504 | .68 | |
| 13:18:52 | 4333.9 | 8.9 | 487 | .65 | |
| 13:20:00 | 4335 | 10 | 434 | .55 | |
| 22:00 | 4337 | 12 | 361 | .42 | |
| 24:00 | 4339 | 14 | 310 | .31 | |
| 26:00 | 4341 | 16 | 271 | .24 | |
| 28:00 | 4343 | 18 | 241 | .21 | |
| 13:30:00 | 4345 | 20 | 217 | .15 | |
| 35 | 4350 | 25 | 174 | .09 | |
| 40 | 4355 | 30 | 145 | .06 | |
| 45 | 4360 | 35 | 125 | .04 | |
| 50 | 4365 | 40 | 109 | .03 | |
| 14:00:00 | 4375 | 50 | 87.5 | .03 | |
| 14:10:00 | 4385 | 60 | 73.1 | .02 | |
| 14:20:00 | 4395 | 70 | 62.8 | .02 | |
| 14:30:00 | 4405 | 80 | 55.1 | .02 | |
| 14:40:00 | 4415 | 90 | 49.1 | .02 | |
| 14:50:00 | 4425 | 100 | 44.25 | .02 | |
| 15:00:00 | 4435 | 110 | 40.3 | .01 | |
| 15:20:00 | 4455 | 130 | 34.3 | .01 | |
| 15:40:00 | 4475 | 150 | 29.8 | .01 | |
| 15:58 | 4493 | 168 | 26.7 | 0 | |
| 16:49:56 | 4545 | 220 | 20.7 | .01 | |
| 18:16:09 | 4631 | 306 | 15.1 | .01 | |
| 19:08:00 | 4683 | 358 | 13.1 | .01 | |

Date: 3/3/87-3/07/87

Pumped Well MW-16

Measurements at Well MW-16

Pump Speed: - Q: - gpm

Static Water Level _____

| time (h:m:s) | t (min) | t' (min) | t/t' | Drawdown (ft) | Comments |
|---|---|---|---|---|---|
| 20:26:00 | 4761 | 436 | 10.9 | .01 | |
| 22:22 | 4877 | 552 | 8.8 | .01 | |
| 24:10 | 4985 | 660 | 7.6 | 0 | |
| 2:08 | 5103 | 778 | 6.6 | 0 | |
| 3:27 | 5182 | 857 | 6.0 | .01 | |
| 6:11 | 5346 | 1021 | 5.2 | 0 | |
| 9:10 | 5525 | 1200 | 4.6 | 0 | |
| | | | | | Test Terminated |

Date: 3/3/87-3/07/87

Pumped Well MW-16

Measurements at Well MW-24

Pump Speed: _____ Q: _____ gpm

Static Water Level 67.32'

| time (h:m:s) | t (min) | t' (min) | t/t' | Drawdown (ft) | Comments |
|---|---|---|---|---|---|
| 13:05:00 | 0 | | | 0.00 | Pump ON |
| 13:06:15 | 1 | | | 0.00 | |
| 13:11:52 | 7 | | | 0.05 | |
| 13:18:09 | 13 | | | 0.06 | |
| 13:23:32 | 18.5 | | | 0.06 | |
| 13:26:54 | 22 | | | 0.06 | |
| 13:32:55 | 28 | | | 0.06 | |
| 13:38:03 | 33 | | | 0.07 | |
| 13:42:50 | 38 | | | 0.07 | |
| 13:48:07 | 43 | | | 0.07 | |
| 13:52:40 | 48 | | | 0.08 | |
| 13:57:55 | 53 | | | 0.08 | |
| 14:06:00 | 61 | | | 0.08 | |
| 14:17:10 | 72 | | | 0.10 | |
| 14:25:48 | 81 | | | 0.11 | |
| 14:35:30 | 90.5 | | | 0.11 | |
| 14:46:00 | 101 | | | 0.11 | |
| 14:56:57 | 112 | | | 0.11 | |
| 15:16:04 | 131 | | | 0.11 | |
| 15:35:41 | 151 | | | 0.12 | |
| 16:00:58 | 176 | | | 0.12 | |
| 16:31:03 | 206 | | | 0.12 | |
| 17:00:48 | 236 | | | 0.13 | |
| 18:01:00 | 296 | | | 0.14 | |
| 19:01:22 | 356.5 | | | 0.14 | |
| 19:59:20 | 414.5 | | | 0.15 | |
| 21:01:06 | 476 | | | 0.15 | |
| 22:01:38 | 536.5 | | | 0.15 | |
| 23:01:13 | 596 | | | 0.14 | |
| 24:05:09 | 660 | | | 0.14 | |

Date: 3/3/87-3/07/87

Pumped Well MW-16

Measurements at Well MW-24

Pump Speed: _____ Q: _____ gpm

Static Water Level 67.32'

| time (h:m:s) | t (min) | t' (min) | t/t' | Drawdown (ft) | Comments |
|---|---|---|---|---|---|
| 2:02:30 | 777.5 | | | 0.14 | |
| 4:04:32 | 899.5 | | | 0.14 | |
| 6:03:47 | 1019 | | | 0.14 | |
| 9:00:46 | 1196 | | | 0.13 | |
| 13:06:12 | 1441.0 | | | 0.12 | |
| 13:55:33 | 1490.5 | | | 0.12 | |
| 14:59:33 | 1555.5 | | | 0.13 | |
| 16:13:59 | 1629 | | | 0.12 | |
| 17:00:00 | 1675 | | | 0.13 | |
| 18:01 | 1736 | | | 0.14 | |
| 20:37:00 | 1892 | | | 0.14 | |
| 21:55 | 1970 | | | 0.14 | |
| 23:02 | 2037 | | | 0.13 | |
| 24:03:42 | 2099 | | | 0.12 | |
| 2:01:13 | 2216 | | | 0.13 | |
| 4:03:16 | 2338 | | | 0.13 | |
| 6:04:30 | 2460 | | | 0.14 | |
| 8:01:40 | 2577 | | | 0.13 | |
| 10:00:00 | 2695 | | | 0.13 | |
| 12:00:54 | 2816 | | | 0.12 | |
| 14:07:28 | 2942.5 | | | 0.12 | |
| 16:15:56 | 3071 | | | 0.12 | |
| 18:14:40 | 3190 | | | 0.13 | |
| 20:10:25 | 3305.5 | | | 0.13 | |
| 22:17:00 | 3432 | | | 0.13 | |
| 24:03:49 | 3539 | | | 0.12 | |
| 1:53:37 | 3648.5 | | | 0.13 | |
| 4:02:30 | 3777.5 | | | 0.13 | |
| 5:59:00 | 3894 | | | 0.13 | |
| 8:00:00 | 4015 | | | 0.13 | |

Date: 3/3/87-3/07/87

Pumped Well MW-16

Measurements at Well MW-24

Pump Speed: _____ Q: _____ gpm

Static Water Level _____

| time (h:m:s) | t (min) | t' (min) | t/t' | Drawdown (ft) | Comments |
|---|---|---|---|---|---|
| 10:02:00 | 4137 | | | 0.12 | |
| 12:25:30 | 4281 | | | 0.11 | |
| 13:10:00 | 4325 | 0 | - | 0.08 | Pump OFF ~~Recovery Initiated~~ |
| 13:10:15 | 4325.25 | 0.25 | 17301 | 0.08 | |
| 13:10:30 | 4325.50 | 0.50 | 8651 | 0.085 | |
| 45 | 4325.75 | 0.75 | 5767 | 0.085 | |
| 11:00 | 4326.00 | 1.0 | 4326 | 0.085 | |
| 15 | 4326.25 | 1.25 | 3461 | 0.085 | |
| 30 | 4326.50 | 1.50 | 2904 | 0.085 | |
| 45 | 4326.75 | 1.75 | 2472 | 0.085 | |
| 13:12:00 | 4327.0 | 2.00 | 2163.5 | 0.085 | |
| 12:30 | 4327.5 | 2.50 | 1731 | 0.085 | |
| 13:00 | 4328.0 | 3.00 | 1443 | 0.08 | |
| 13:30 | 4328.5 | 3.50 | 1237 | 0.08 | |
| 14:00 | 4329.0 | 4.00 | 1082 | 0.08 | |
| 14:30 | 4329.5 | 4.50 | 962 | 0.075 | |
| 15:00 | 4330.0 | 5.00 | 866 | 0.075 | |
| 16:00 | 4331.0 | 6.00 | 722 | 0.075 | |
| 17:00 | 4332 | 7.00 | 619 | 0.075 | |
| 18:00 | 4333 | 8.00 | 542 | 0.075 | |
| 19:00 | 4334 | 9.00 | 482 | 0.075 | |
| 13:20:00 | 4335 | 10.00 | 434 | 0.075 | |
| 21:00 | 4336 | 11.00 | 394 | 0.075 | |
| 22:00 | 4337 | 12.00 | 361 | 0.075 | |
| 23:00 | 4338 | 13.00 | 334 | 0.07 | |
| 24:00 | 4339 | 14.00 | 310 | 0.07 | |
| 25:00 | 4340 | 15.00 | 289 | 0.07 | |
| 27:00 | 4342 | 17.00 | 255 | 0.07 | |
| 29:00 | 4344 | 19.00 | 229 | 0.07 | |
| 13:31:00 | 4346 | 21.00 | 207 | 0.07 | |

Date: 3/3/87-3/07/87

Pumped Well MW-16

Measurements at Well MW-24

Pump Speed: _____ Q: _____ gpm

Static Water Level _____

| time (h:m:s) | t (min) | t' (min) | t/t' | Drawdown (ft) | Comments |
|---|---|---|---|---|---|
| 35:00 | 4350 | 25.00 | 174 | 0.065 | |
| 13:40:00 | 4355 | 30.00 | 145 | 0.06 | |
| 13:45:00 | 4360 | 35.00 | 125 | 0.06 | |
| 13:50:00 | 4365 | 40.0 | 109 | 0.06 | |
| 14:00:43 | 4376 | 51.0 | 85.8 | 0.06 | |
| 14:11:05 | 4386 | 61.0 | 71.9 | 0.06 | |
| 14:21:10 | 4396 | 71.0 | 61.9 | 0.05 | |
| 14:31:30 | 4407 | 82.0 | 53.7 | 0.05 | |
| 14:41:31 | 4417 | 92.0 | 48.0 | 0.045 | |
| 14:51:20 | 4426 | 101.0 | 43.8 | 0.045 | |
| 15:01:10 | 4436 | 111.0 | 40.0 | 0.045 | |
| 15:20:53 | 4456 | 131.10 | 34.0 | 0.04 | |
| 15:40:51 | 4476 | 151.10 | 29.6 | 0.04 | |
| 15:55:04 | 4490 | 165.0 | 27.2 | 0.02 | |
| 16:48:34 | 4544 | 219.0 | 20.7 | 0.02 | |
| 18:15:00 | 4630 | 305.0 | 15.1 | 0.02 | |
| 19:07:09 | 4682 | 357.0 | 13.1 | 0.02 | |
| 20:25:11 | 4760 | 435.0 | 10.9 | 0.02 | |
| 22:21 | 4876 | 551.0 | 8.95 | 0.02 | |
| 24:09:00 | 4984 | 659.0 | 7.6 | 0.01 | |
| 2:08 | 5103 | 778.0 | 7.6 | 0.01 | |
| 3:28 | 5183 | 858 | 6.0 | 0.02 | |
| 6:11 | 5346 | 1021 | 5.2 | 0.03 | |
| 9:04 | 5519 | 1194 | 4.6 | 0.04 | Test Terminated |
| | | | | | |
| | | | | | |
| | | | | | |
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| | | | | | |

Date: 3/3/87-3/07/87

Pumped Well MW-16

Measurements at Well MW-25

Pump Speed: _____ Q: _____ gpm

Static Water Level 67.59

| time (h:m:s) | t (min) | t' (min) | t/t' | Drawdown (ft) | Comments |
|---|---|---|---|---|---|
| 13:05:00 | | | | 0.02 | |
| 13:07:53 | 8 | | | 0.02 | |
| 13:13:22 | 8.5 | | | -.04 | |
| 13:20:49 | 16 | | | 0.00 | |
| 13:24:20 | 19.5 | | | 0.00 | |
| 13:30:36 | 26 | | | 0.00 | |
| 13:35:40 | 31 | | | -0.01 | |
| 13:40:27 | 35.5 | | | 0.00 | |
| 13:45:23 | 40.5 | | | -0.01 | |
| 13:50:24 | 45.5 | | | -0.01 | |
| 13:55:40 | 51.0 | | | 0.00 | |
| 14:06:51 | 62 | | | 0.01 | |
| 14:18:03 | 73 | | | 0.01 | |
| 14:26:40 | 82 | | | 0.00 | |
| 14:36:15 | 91 | | | 0.00 | |
| 14:46:53 | 102 | | | 0.01 | |
| 14:57:46 | 113 | | | 0.01 | |
| 15:16:50 | 132 | | | 0.01 | |
| 15:36:20 | 151.5 | | | 0.01 | |
| 16:01:40 | 177 | | | 0.01 | |
| 16:31:40 | 207 | | | 0.01 | |
| 17:01:31 | 236.5 | | | 0.01 | |
| 18:02:00 | 297 | | | 0.03 | |
| 19:02:10 | 357 | | | 0.03 | |
| 20:00:12 | 415 | | | 0.03 | |
| 21:01:55 | 477 | | | 0.02 | |
| 22:02:24 | 537 | | | 0.02 | |
| 23:01:55 | 597 | | | 0.02 | |
| 24:06:07 | 661 | | | 0.03 | |
| 2:04:02 | 779 | | | 0.02 | |

Date: 3/3/87-3/07/87

Pumped Well MW-16

Measurements at Well MW-25

Pump Speed: _____ Q: _____ gpm

Static Water Level 67.59

| time (h:m:s) | t (min) | t' (min) | t/t' | Drawdown (ft) | Comments |
|---|---|---|---|---|---|
| 4:05:31 | 901 | | | 0.03 | |
| 6:06:13 | 1021 | | | 0.03 | |
| 9:01:47 | 1197 | | | 0.04 | |
| 13:06:46 | 1442 | | | 0.00 | |
| 13:56:12 | 1491 | | | 0.01 | |
| 15:00:15 | 1555 | | | 0.01 | |
| 16:15:00 | 1630 | | | 0.01 | |
| 17:01:12 | 1676 | | | 0.02 | |
| 18:01:30 | 1737 | | | 0.02 | |
| 20:38 | 1893 | | | 0.03 | |
| 21:55:30 | 1971 | | | 0.03 | |
| 23:03 | 2038 | | | 0.02 | |
| 24:04:43 | 2100 | | | 0.03 | |
| 2:01:59 | 2217 | | | 0.02 | |
| 4:05:15 | 2340 | | | 0.03 | |
| 6:06:16 | 2461 | | | 0.03 | |
| 8:02:18 | 2577 | | | 0.03 | |
| 10:40:00 | 2735 | | | 0.03 | |
| 12:01:25 | 2816 | | | 0.02 | |
| 14:06:45 | 2942 | | | 0.02 | |
| 16:14:00 | 3069 | | | 0.02 | |
| 18:13:50 | 3189 | | | 0.02 | |
| 20:09:05 | 3304 | | | 0.03 | |
| 22:16:00 | 3431 | | | 0.03 | |
| 24:05 | 3540 | | | 0.02 | |
| 1:54:18 | 3649 | | | 0.02 | |
| 4:03:30 | 3779 | | | 0.02 | |
| 6:00:00 | 3895 | | | 0.02 | |
| 8:02:00 | 4017 | | | 0.02 | |
| 10:03:00 | 4138 | | | 0.02 | |

Date: 3/3/87-3/07-87

Pumped Well MW-16

Measurements at Well MW-25

Pump Speed: _____ Q: _____ gpm

Static Water Level _____

| time (h:m:s) | t (min) | t' (min) | t/t' | Drawdown (ft) | Comments |
|---|---|---|---|---|---|
| 12:27:40 | 4283 | | | 0.01 | |
| 13:10:00 | 4325 | 0 | | 0.00 | Pump OFF |
| 13:23:27 | 4338 | 13 | 333.7 | -0.01 | |
| 13:27:26 | 4342 | 17 | 255.4 | -0.01 | |
| 13:32:00 | 4347 | 22 | 197.6 | -0.01 | |
| 13:35:40 | 4351 | 26 | 167.34 | -0.01 | |
| 13:40:40 | 4356 | 31 | 140.5 | -0.02 | |
| 13:45:45 | 4361 | 36 | 121.1 | -0.02 | |
| 13:50 | 4365 | 40 | 109.1 | -0.02 | |
| 14:01:25 | 4376 | 51 | 85.8 | -0.02 | |
| 14:12:33 | 4388 | 63 | 69.7 | -0.02 | |
| 14:21:50 | 4398 | 73 | 60.2 | -0.02 | |
| 14:33:00 | 4409 | 84 | 52.5 | -0.02 | |
| 14:42:25 | 4418 | 93 | 47.5 | -0.02 | |
| 14:52:26 | 4428 | 103 | 43.0 | -0.02 | |
| 15:01:41 | 4438 | 113 | 39.3 | -0.02 | |
| 15:22:11 | 4458 | 133 | 33.5 | -0.03 | |
| 15:41:40 | 4478 | 153 | 29.3 | -0.02 | |
| 15:58:50 | 4495 | 170 | 26.4 | -0.02 | |
| 16:50:07 | 4546 | 221 | 20.6 | -0.02 | |
| 18:17:02 | 4633 | 308 | 15.0 | -0.02 | |
| 19:09:00 | 4685 | 360 | 13.0 | -0.02 | |
| 20:27 | 4763 | 438 | 10.9 | -0.02 | |
| 22:23 | 4879 | 554 | 8.8 | -0.02 | |
| 24:11 | 4987 | 662 | 7.5 | -0.03 | |
| 2:09 | 5105 | 780 | 6.5 | -0.03 | |
| 3:30 | 5186 | 861 | 6.0 | -0.03 | |
| 6:12 | 5348 | 1023 | 5.2 | -0.03 | |
| 9:12 | 5528 | 1203 | 4.6 | -0.04 | Test Terminated |
| | | | | | |

Date: 3/3/87-3/07/87

Pumped Well MW-16

Measurements at Well MW-17

Pump Speed: _____ Q: _____ gpm

Static Water Level 68.30

| | time (h:m:s) | t (min) | t' (min) | t/t' | Drawdown (ft) | Comments |
|---|---|---|---|---|---|---|
| 3/3 | 13:05:00 | 0 | | | 0 | |
| | 13:09:29 | 4. | | | 0 | |
| | 13:16:03 | 11 | | | 0 | |
| | 13:22:25 | 17 | | | 0 | |
| | 13:25:27 | 20 | | | 0 | |
| | 13:31:43 | 27 | | | 0 | |
| | 13:36:42 | 32 | | | 0 | |
| | 13:41:34 | 37 | | | 0 | |
| | 13:46:50 | 42 | | | 0 | |
| | 13:51:23 | 46 | | | 0 | |
| | 13:56:45 | 52 | | | 0 | |
| | 14:04:37 | 60 | | | 0 | |
| | 14:21:19 | 76 | | | 0 | |
| | 14:30:00 | 85 | | | 0 | |
| | 14L39:26 | 94 | | | 0 | |
| | 14:49:00 | 104 | | | 0 | |
| | 15:00:04 | 115 | | | 0 | |
| | 15:20:06 | 135 | | | 0 | |
| | 15:39:05 | 154 | | | 0 | |
| | 16:05:15 | 180 | | | 0 | |
| | 16:35:27 | 210 | | | 0.00 | |
| | 17:06:00 | 241 | | | 0.01 | |
| | 18:05:41 | 301 | | | 0.01 | |
| | 19:08:12 | 363 | | | 0.02 | |
| | 20:04:18 | 419 | | | 0.01 | |
| | 21:06:30 | 482 | | | 0 | |
| | 22:05:50 | 541 | | | 0 | |
| | 23:05:22 | 600 | | | 0 | |
| 3/4 | 0:06:18 | 661 | | | 0 | |
| | | | | | | |

Date: 3/3/87-3/07/87

Pumped Well MW-16

Measurements at Well MW-17

Pump Speed: _____ Q: _____ gpm

Static Water Level 68.30

| time (h:m:s) | t (min) | t' (min) | t/t' | Drawdown (ft) | Comments |
|---|---|---|---|---|---|
| 2:05:15 | 780 | | | 0 | |
| 4:04:37 | 900 | | | 0 | |
| 9:03:37 | 1099 | | | 0.01 | |
| 13:04:56 | 1440 | | | -0.01 | |
| 14:01:29 | 1496 | | | -0.02 | |
| 15:04:24 | 1559 | | | -0.02 | |
| 16:19:11 | 1634 | | | -0.01 | |
| 17:08:30 | 1684 | | | 0.00 | |
| 18:05:00 | 1740 | | | 0.00 | |
| 20:43 | 1898 | | | 0.00 | |
| 21:59:00 | 1974 | | | 0.00 | |
| 23:07 | 2042 | | | 0.00 | |
| 24:06:03 | 2101 | | | 0.00 | |
| 2:05:14 | 2220 | | | 0.00 | |
| 4:00:15 | 2335 | | | 0.00 | |
| 6:03:17 | 2458 | | | 0.00 | |
| 8:03:40 | 2579 | | | 0.01 | |
| 10:41:11 | 2736 | | | 0.01 | |
| 12:02:35 | 2818 | | | 0.00 | |
| 14:08:55 | 2944 | | | 0.00 | |
| 16:17:16 | 3072 | | | 0.00 | |
| 18:16:30 | 3192 | | | 0.01 | |
| 20:13:00 | 3308 | | | 0.01 | |
| 22:18:00 | 3433 | | | 0.01 | |
| 24:15:00 | 3550 | | | 0.01 | |
| 1:59:00 | 3654 | | | 0.01 | |
| 4:09:00 | 3784 | | | 0.01 | |
| 6:10:00 | 3905 | | | 0.00 | |
| 8:10:00 | 4025 | | | 0.00 | |
| 12:28:40 | 4284 | | | 0.00 | |

Date: 3/3/87-3/07/87

Pumped Well MW-16

Measurements at Well MW-17

Pump Speed: _____ Q: _____ gpm

Static Water Level _____

| time (h:m:s) | t (min) | t' (min) | t/t' | Drawdown (ft) | Comments |
|---|---|---|---|---|---|
| 13:10:00 | 4325 | | | 0.00 | |
| 13:56:05 | 4371 | | | 0.00 | |
| 14:13:15 | 4388 | | | 0 | |
| 14:23:40 | 4399 | | | 0.01 | |
| 14:34:33 | 4410 | | | 0.01 | |
| 14:44:36 | 4420 | | | 0.01 | |
| 14:53:43 | 4429 | | | 0.01 | |
| 15:02:43 | 4438 | | | 0.01 | |
| 15:23:47 | 4459 | | | 0.0 | |
| 15:42:20 | 4477 | | | 0.01 | |
| 15:54:00 | 4489 | | | 0.0 | |
| 16:47:18 | 4542 | | | 0.0 | |
| 18:13:46 | 4629 | | | 0 | |
| 19:05:39 | 4681 | | | 0 | |
| 20:23:45 | 4759 | | | 0 | |
| 22:20:00 | 4875 | | | 0 | |
| 24:08:00 | 4983 | | | 0 | |
| 2:06 | 5101 | | | 0 | |
| 3:20 | 5175 | | | 0 | |
| 6:10 | 5345 | | | -0.01 | |
| 9:33 | 5548 | | | -0.02 | Test Terminated |
| | | | | | |
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Date 3/10/87-3/13/87

# CONSTANT DRAWDOWN AQUIFER TEST

WELL MW-24

DRAWDOWN 3.26' = $S_w$

Static Water Level: 68.40'

| time (h:m:s) | t (min) | t' (min) | t/t' | $\frac{t}{r_w^2}$ (m/ft$^2$) | Discharge (gpm) | Total Water Removed (gal) | $\frac{s_w}{Q}$ (ft·m/gal) |
|---|---|---|---|---|---|---|---|
| 12:16 | 16 | | | 1634 | 0.258 | | 12.6 |
| 12:22 | 22 | | | 2247 | 0.256 | | 12.8 |
| 12:27 | 27 | | | 2757 | 0.251 | | 13.0 |
| 12:31 | 31 | | | 3166 | 0.243 | | 13.4 |
| 12:36 | 36 | | | 3676 | - | | - |
| 12:40 | 40 | | | 4085 | 0.243 | | 13.4 |
| 12:50 | 50 | | | 5106 | 0.235 | | 13.9 |
| 13:01 | 61 | | | 6229 | 0.241 | | 13.5 |
| 13:13 | 73 | | | 7454 | 0.246 | | 13.3 |
| 13:18 | 78 | | | 7965 | 0.241 | | 13.5 |
| 13:34 | 94 | sampled | | 9599 | 0.263 | | 12.4 |
| 14:25 | 145 | | | 14807 | 0.260 | | 12.5 |
| 14:38 | 158 | | | 16134 | 0.270 | | 12.1 |
| 15:01 | 181 | | | 18483 | 0.265 | | 12.3 |
| 15:32 | 212 | | | 21649 | 0.257 | 50 | 12.7 |
| 16:04 | 244 | | | 24916 | 0.248 | | 13.2 |
| 16:36 | 276 | | | 28184 | 0.242 | | 13.5 |
| 17:03 | 303 | | | 30941 | 0.258 | | 12.6 |
| 18:03 | 363 | | | 37068 | 0.255 | | 12.8 |
| 19:03 | 423 | | | 43195 | 0.239 | 100 | 13.6 |
| 20:03 | 483 | | | 49322 | 0.273 | | 11.9 |
| 21:03 | 543 | | | 55449 | 0.252 | | 13.0 |
| 22:03 | 603 | | | 61576 | 0.252 | | 13.0 |
| 23:03 | 663 | | | 67703 | 0.240 | 150 | 13.6 |
| 24:00 | 720 | sampled | | 73524 | 0.231 | | 14.1 |
| 1:00 | 780 | | | 79651 | 0.245 | | 13.3 |
| 2:00 | 840 | | | 85778 | 0.239 | | 13.6 |
| 3:00 | 900 | | | 91905 | 0.244 | 200 | 13.4 |
| 4:00 | 960 | | | 98032 | 0.243 | | 13.4 |
| 5:00 | 1020 | | | 104159 | 0.239 | | 13.6 |

Date 3/10/87-3/13/87

# CONSTANT DRAWDOWN AQUIFER TEST

WELL MW-24

DRAWDOWN 3.26'

Static Water Level: 68.40'

| time (h:m:s) | t (min) | t' (min) | t/t' | $\frac{t}{r_w^2}$ ($m/ft^2$) | Discharge (gpm) | Total Water Removed (gal) | $\frac{s_w}{Q}$ (ft·m/gal) |
|---|---|---|---|---|---|---|---|
| 3/11 6:00 | 1080 | sampled | | 110286 | 0.242 | | 13.5 |
| 7:00 | 1140 | | | 116413 | 0.247 | 250 | 13.2 |
| 8:00 | 1200 | | | 122540 | 0.233 | | 14.0 |
| 9:00 | 1260 | | | 128667 | 0.236 | | 13.8 |
| 10:00 | 1320 | | | 134794 | 0.235 | | 13.9 |
| 11:00 | 1380 | | | 140921 | 0.239 | 300 | 13.6 |
| 12:00 | 1440 | | | 147048 | 0.240 | | 13.6 |
| 13:00 | 1500 | | | 153175 | 0.235 | | 13.9 |
| 14:00 | 1560 | | | 159301 | 0.236 | 350 | 13.8 |
| 15:00 | 1620 | | | 165428 | 0.233 | | 14.0 |
| 16:00 | 1680 | | | 171555 | 0.231 | | 14.1 |
| 17:00 | 1740 | | | 177682 | 0.246 | | 13.3 |
| 18:00 | 1800 | | | 183809 | 0.238 | 400 | 13.7 |
| 19:00 | 1860 | | | 189936 | 0.244 | | 13.4 |
| 20:00 | 1920 | | | 196063 | 0.243 | | 13.4 |
| 21:00 | 1980 | | | 202190 | 0.243 | | 13.4 |
| 22:00 | 2040 | | | 208317 | 0.241 | 450 | 13.5 |
| 23:00 | 2100 | | | 214444 | 0.239 | | 13.6 |
| 24:00 | 2160 | | | 220571 | 0.225 | | 14.5 |
| /12 1:00 | 2220 | | | 226698 | 0.223 | 500 | 14.7 |
| 2:00 | 2280 | | | 232825 | 0.218 | | 15.0 |
| 3:00 | 2340 | | | 238952 | 0.223 | | 14.7 |
| 4:00 | 2400 | | | 245079 | 0.222 | | 14.7 |
| 5:00 | 2460 | | | 251206 | 0.219 | 525 | 14.9 |
| 6:08 | 2528 | | | 258150 | 0.214 | | 15.2 |
| 7:05 | 2585 | | | 263971 | 0.218 | 545 | 15.0 |
| 8:07 | 2647 | | | 270302 | 0.256 | | 12.8 |
| 9:05 | 2705 | | | 276225 | 0.253 | 585 | 12.9 |
| 10:06 | 2766 | | | 282454 | 0.251 | | 13.0 |
| 11:00 | 2820 | | | 287968 | 0.254 | | 12.9 |

Date 3/10/87-3/13/87

# CONSTANT DRAWDOWN AQUIFER TEST

WELL MW-24

DRAWDOWN 3.26'

Static Water Level 68.40'

| time (h:m:s) | t (min) | t' (min) | t/t' | $\frac{t}{r_w^2}$ (m/ft$^2$) | Discharge (gpm) | Total Water Removed (gal) | $\frac{s_w}{Q}$ (ft:m/gal) |
|---|---|---|---|---|---|---|---|
| /12 12:06 | 2886 | sampled | | 294708 | 0.256 | 635 gal | 12.8 |
| 13:04 | 2944 | | | 300631 | 0.258 | | 12.6 |
| 14:03 | 3003 | | | 306655 | 0.249 | | 13.1 |
| 15:06 | 3066 | | | 313089 | 0.236 | | 13.8 |
| 16:03 | 3123 | | | 318909 | 0.231 | | 14.1 |
| 17:04 | 3184 | | | 325138 | 0.233 | | 14.0 |
| 18:04 | 3244 | | | 331265 | 0.227 | | 14.3 |
| 19:01 | 3301 | | | 337086 | 0.232 | 685 gal | 14.0 |
| 20:06 | 3366 | | | 343724 | 0.235 | | 13.9 |
| 21:03 | 3423 | | | 349544 | 0.248 | | 13.2 |
| 22:04 | 3484 | | | 355773 | 0.233 | | 14.0 |
| 23:03 | 3543 | | | 361798 | 0.248 | 735 | 13.2 |
| 24:00 | 3600 | sampled | | 367619 | 0.245 | | 13.3 |
| /13 1:00 | 3660 | | | 373746 | 0.241 | | 13.5 |
| 2:00 | 3720 | | | 379873 | 0.244 | | 13.4 |
| 3:00 | 3780 | | | 386000 | 0.242 | 790 | 13.5 |
| 4:00 | 3840 | | | 392127 | 0.240 | | 13.6 |
| 5:00 | 3900 | | | 398254 | 0.240 | | 13.6 |
| 6:00 | 3960 | | | 404381 | 0.244 | | 13.4 |
| 7:00 | 4020 | | | 410508 | 0.245 | 845 | 13.3 |
| 8:00 | 4080 | | | 416635 | 0.228 | | 14.3 |
| 9:00 | 4140 | | | 422762 | 0.227 | | 14.4 |
| 10:00 | 4200 | | | 428889 | 0.229 | | 14.2 |
| 11:00 | 4260 | | | - | 0.507 | Pump speed to 75 | - |
| 11:11 | 4271 | | | 436139 | 0.226 | | 14.4 |
| 12:00 | 4320 | | | 441143 | 0.220 | | 14.8 |
| 13:00 | 4380 | | | 447270 | 0.209 | | 15.6 |
| 13:10 | 4390 | 0 | | | | 900 | Pump OFF |
| | | | | | | | |
| | | | | | | | |

Date: 3/10/87-3/13/87

Pumped Well MW-24

Measurements at Well MW-24

Pump Speed: - Q: - gpm

Static Water Level 68' 4 3/4"

| time (h:m:s) | t (min) | t' (min) | t/t' | Drawdown (ft) | Comments |
|---|---|---|---|---|---|
| 13:15 | 4395 | 5 | 879 | 0.85 | |
| 13:17 | 4397 | 7 | 628 | 0.72 | |
| 13:17:30 | 4397.5 | 7.5 | 586 | 0.64 | |
| 13:18 | 4398 | 8 | 550 | 0.57 | |
| 13:18:30 | 4398.5 | 8.5 | 517 | 0.48 | |
| 13:19 | 4399 | 9 | 489 | 0.42 | |
| 13:19:30 | 4399.5 | 9.5 | 463 | 0.38 | |
| 13:20 | 4400 | 10 | 440 | 0.32 | |
| 13:20:30 | 4400.5 | 10.5 | 419 | 0.28 | |
| 13:21 | 4401 | 11 | 400 | 0.25 | |
| 13:21:30 | 4401.5 | 11.5 | 383 | 0.22 | |
| 13:22 | 4402 | 12 | 367 | 0.20 | |
| 13:22:30 | 4402.5 | 12.5 | 352 | - | |
| 13:23 | 4403 | 13 | 339 | 0.16 | |
| 13:23:30 | 4403.5 | 13.5 | 326 | 0.15 | |
| 13:24 | 4404 | 14 | 315 | 0.14 | |
| 13:24:30 | 4404.5 | 14.5 | 304 | 0.13 | |
| 13:25 | 4405 | 15 | 294 | 0.10 | |
| 13:25:30 | 4405.5 | 15.5 | 284 | 0.10 | |
| 13:26 | 4406 | 16 | 275 | 0.10 | |
| 13:26:30 | 4406.5 | 16.5 | 267 | 0.10 | |
| 13:27 | 4407 | 17 | 259 | 0.09 | |
| 13:28 | 4408 | 18 | 245 | 0.09 | |
| 13:29 | 4409 | 19 | 232 | 0.09 | |
| 13:30 | 4410 | 20 | 221 | 0.08 | |
| 13:31 | 4411 | 21 | 210 | 0.08 | |
| 13:32 | 4412 | 22 | 201 | 0.07 | |
| 13:33 | 4413 | 23 | 192 | 0.07 | |
| 13:34 | 4414 | 24 | 184 | 0.07 | |
| | | | | | |

Date: 3/10/87-3/13/87

Pumped Well MW-24

Measurements at Well MW-24

Pump Speed: - Q: - gpm

Static Water Level 68' 4 3/4"

| time (h:m:s) | t (min) | t' (min) | t/t' | Drawdown (ft) | Comments |
|---|---|---|---|---|---|
| 13:35:00 | 4415 | 25 | 177 | 0.06 | |
| 13:36 | 4416 | 26 | 170 | 0.06 | |
| 13:37 | 4417 | 27 | 164 | 0.05 | |
| 13:40:00 | 4420 | 30 | 147 | 0.05 | |
| 13:42 | 4422 | 32 | 138 | 0.05 | |
| 13:45 | 4425 | 35 | 126 | 0.05 | |
| 13:46 | 4426 | 36 | 123 | 0.05 | |
| 13:48 | 4428 | 38 | 117 | 0.05 | |
| 13:50 | 4430 | 40 | 111 | 0.05 | |
| 13:55:00 | 4435 | 45 | 99 | 0.05 | |
| 14:00:00 | 4440 | 50 | 89 | 0.04 | |
| 14:10:00 | 4450 | 60 | 74 | 0.04 | |
| 14:20:00 | 4460 | 70 | 64 | 0.04 | |
| 14:30:00 | 4470 | 80 | 56 | 0.03 | |
| 14:40 | 4480 | 90 | 50 | 0.02 | |
| 14:50 | 4490 | 100 | 45 | 0.02 | |
| 14:10 | 4510 | 120 | 38 | 0.02 | |
| 15:35 | 4535 | 145 | 31 | 0.01 | |
| 15:50 | 4550 | 160 | 28 | 0.01 | |
| 16:10 | 4570 | 180 | 25 | 0 | |
| 16:40 | 4600 | 210 | 22 | 0 | |
| 17:10 | 4630 | 240 | 19 | 0 | |
| 17:40 | 4660 | 270 | 17 | 0 | |
| 18:10 | 4690 | 300 | 16 | 0.01 | |
| 19:10 | 4750 | 360 | 13 | 0.02 | |
| | | | | | |
| | | | | | |
| | | | | | |
| | | | | | |
| | | | | | |

Date: 3/10/87-3/13/87

Pumped Well MW-24

Measurements at Well MW-16

Pump Speed: - Q: - gpm

Static Water Level _____

| time (h:m:s) | t (min) | t' (min) | t/t' | Drawdown (ft) | Comments |
|---|---|---|---|---|---|
| 12:00:00 | 0.25 | | | 0.00 | Pump ON |
| | 0.50 | | | 0.00 | |
| | 0.75 | | | 0.00 | |
| | 1.0 | | | 0.00 | |
| | 1.5 | | | 0.00 | |
| | 2.0 | | | 0.00 | |
| | 3.0 | | | 0.01 | |
| | 4.0 | | | 0.02 | |
| | 5.0 | | | 0.03 | |
| | 6.0 | | | 0.03 | |
| | 7.0 | | | 0.04 | |
| | 8.0 | | | 0.04 | |
| | 9.0 | | | 0.05 | |
| | 10.0 | | | 0.06 | |
| | 12.0 | | | 0.06 | |
| | 14.0 | | | 0.06 | |
| | 16.0 | | | 0.06 | |
| | 18.0 | | | 0.06 | |
| | 20.0 | | | 0.08 | |
| | 25.0 | | | 0.08 | |
| 12:30:00 | 30.0 | | | 0.08 | |
| | 35.0 | | | 0.08 | |
| | 42.0 | | | 0.08 | |
| | 45.0 | | | 0.08 | |
| | 50.0 | | | 0.08 | |
| 13:00:00 | 60.0 | | | 0.08 | |
| | 70.0 | | | 0.09 | |
| | 80.0 | | | 0.09 | |
| 13:30:00 | 90.0 | | | 0.10 | |
| | 100 | | | 0.11 | |

Date: 3/10/87-3/13/87

Pumped Well MW-24

Measurements at Well MW-16

Pump Speed: - Q: - gpm

Static Water Level _____

| time (h:m:s) | t (min) | t' (min) | t/t' | Drawdown (ft) | Comments |
|---|---|---|---|---|---|
| | 120 | | | 0.12 | |
| 14:20:00 | 140 | | | 0.12 | |
| | 160 | | | 0.12 | |
| 15:00:00 | 180 | | | 0.13 | |
| | 210 | | | 0.13 | |
| 16:00:00 | 240 | | | 0.14 | |
| | 270 | | | 0.14 | |
| 17:00:00 | 300 | | | 0.14 | |
| 18:00:00 | 360 | | | 0.15 | |
| 19:00 | 420 | | | 0.17 | |
| 20:00 | 480 | | | 0.17 | |
| 21:00 | 540 | | | 0.17 | |
| 22:00 | 600 | | | 0.18 | |
| 23:00 | 660 | | | 0.18 | |
| 24:00 | 720 | | | 0.18 | |
| 1:02 | 782 | | | 0.18 | |
| 2:02 | 842 | | | 0.17 | |
| 3:03 | 903 | | | 0.16 | |
| 4:02 | 962 | | | 0.18 | |
| 5:02 | 1022 | | | 0.18 | |
| 6:02 | 1082 | | | 0.18 | |
| 7:02 | 1144 | | | 0.18 | |
| 8:02 | 1202 | | | 0.19 | |
| 9:02 | 1262 | | | 0.18 | |
| 10:01 | 1321 | | | 0.17 | |
| 11:02 | 1382 | | | 0.18 | |
| 11:45 | 1425 | | | 0.14 | Pump Speed to 40 |
| 12:00 | 1440 | | | 0.15 | Pump Speed to 50 |
| 13:00 | 1500 | | | 0.16 | @ 11:46 |
| 14:00 | 1560 | | | 0.15 | |

Date: 3/10/87-3/13/87

Pumped Well MW-24

Measurements at Well MW-16

Pump Speed: - Q: - gpm

Static Water Level _____

| | time (h:m:s) | t (min) | t' (min) | t/t' | Drawdown (ft) | Comments |
|---|---|---|---|---|---|---|
| 3/11 | 15:00 | 1620 | | | 0.16 | |
| | 16:00 | 1680 | | | 0.16 | |
| | 17:00 | 1740 | | | 0.17 | |
| | 18:00 | 1800 | | | 0.18 | |
| | 19:00 | 1860 | | | 0.19 | |
| | 20:00 | 1920 | | | 0.19 | |
| | 21:00 | 1980 | | | 0.20 | |
| | 22:00 | 2040 | | | 0.20 | |
| | 23:00 | 2100 | | | 0.20 | |
| | 24:00 | 2160 | | | 0.20 | |
| 3/12 | 1:01 | 2221 | | | 0.20 | |
| | 2:01 | 2281 | | | 0.21 | |
| | 3:01 | 2341 | | | 0.20 | |
| | 4:01 | 2401 | | | 0.20 | |
| | 5:01 | 2461 | | | 0.20 | |
| | 6:10 | 2530 | | | 0.20 | |
| | 7:02 | 2582 | | | 0.20 | |
| | 8:04 | 2644 | | | 0.21 | |
| | 9:01 | 2701 | | | 0.22 | |
| | 10:01 | 2761 | | | 0.22 | |
| | 12:05 | 2885 | | | 0.20 | |
| | 13:00 | 2940 | | | 0.19 | |
| | 14:00 | 3000 | | | 0.19 | |
| | 15:02 | 3062 | | | 0.19 | |
| | 16:00 | 3120 | | | 0.19 | |
| | 17:03 | 3183 | | | 0.19 | |
| | 18:00 | 3240 | | | 0.21 | |
| | 19:00 | 3300 | | | 0.21 | |
| | 20:01 | 3361 | | | 0.22 | |
| | 21:00 | 3420 | | | 0.22 | |

Date: 3/10/87-3/13/87

Pumped Well MW-24

Measurements at Well MW-16

Pump Speed: - Q: - gpm

Static Water Level _____

| time (h:m:s) | t (min) | t' (min) | t/t' | Drawdown (ft) | Comments |
|---|---|---|---|---|---|
| 22:00 | 3480 | | | 0.21 | |
| 23:00 | 3540 | | | 0.22 | |
| 0:02 | 3602 | | | 0.22 | |
| 1:01 | 3661 | | | 0.22 | |
| 3:01 | 3781 | | | 0.22 | |
| 4:01 | 3841 | | | 0.22 | |
| 5:01 | 3901 | | | 0.22 | |
| 6:01 | 3961 | | | 0.23 | |
| 7:01 | 4021 | | | 0.23 | |
| 8:01 | 4081 | | | 0.23 | |
| 9:01 | 4141 | | | 0.22 | |
| 10:01 | 4201 | | | 0.20 | |
| 11:01 | 4261 | | | 0.19 | |
| 12:00 | 4320 | | | 0.19 | |
| 13:00 | 4380 | | | 0.16 | |
| 13:00 | 4390 | 0 | - | 0.16 | Pump OFF |
| | 4390.25 | .25 | 17561 | 0.16 | |
| | 4390.50 | .50 | 8781 | 0.16 | |
| | 4390.75 | .75 | 5854 | 0.16 | |
| 13:11 | 4391.0 | 1.0 | 4391 | 0.16 | |
| | 4391.5 | 1.5 | 2928 | 0.16 | |
| 13:12 | 4392.0 | 2.0 | 2196 | 0.16 | |
| | 4392.5 | 2.5 | 1757 | 0.16 | |
| 13:13 | 4393.0 | 3.0 | 1464 | 0.16 | |
| | 4393.5 | 3.5 | 1255 | 0.16 | |
| 13:14 | 4394.0 | 4.0 | 1099 | 0.16 | |
| | 4394.5 | 4.5 | 977 | 0.155 | |
| 13:15 | 4395.0 | 5.0 | 879 | 0.155 | |
| 13:16 | 4396 | 6 | 733 | 0.15 | |
| 13:17 | 4397 | 7 | 628 | 0.15 | |

Date: 3/10/87-3/13/87

Pumped Well MW-24

Measurements at Well MW-16

Pump Speed: - Q: - gpm

Static Water Level _____

| time (h:m:s) | t (min) | t' (min) | t/t' | Drawdown (ft) | Comments |
|---|---|---|---|---|---|
| 13:18 | 4398 | 8 | 550 | 0.15 | |
| 13:19 | 4399 | 9 | 489 | 0.14 | |
| 13:20 | 4400 | 10 | 440 | 0.135 | |
| | 4401 | 11 | 400 | 0.13 | |
| | 4402 | 12 | 367 | 0.125 | |
| | 4404 | 14 | 315 | 0.115 | |
| | 4406 | 16 | 275 | 0.11 | |
| 13:30 | 4408 | 18 | 245 | 0.10 | |
| 13:20 | 4410 | 20 | 221 | 0.10 | |
| | 4415 | 25 | 177 | 0.085 | |
| | 4420 | 30 | 147 | 0.075 | |
| | 4425 | 35 | 126 | 0.065 | |
| | 4430 | 40 | 111 | 0.065 | |
| | 4435 | 45 | 99 | 0.065 | |
| 14:00 | 4440 | 50 | 89 | 0.065 | |
| | 4450 | 60 | 74 | 0.06 | |
| | 4460 | 70 | 64 | 0.06 | |
| 14:30 | 4470 | 80 | 56 | 0.06 | |
| | 4480 | 90 | 50 | 0.055 | |
| 15:00 | 4490 | 100 | 45 | 0.05 | |
| | 4510 | 120 | 38 | 0.05 | |
| | 4534 | 144 | 31 | 0.05 | |
| | 4550 | 160 | 28 | 0.04 | |
| 16:10 | 4570 | 180 | 25 | 0.04 | |
| | 4600 | 210 | 22 | 0.03 | |
| 17:10 | 4630 | 240 | 19 | 0.03 | |
| | 4660 | 270 | 17 | 0.03 | |
| 18:10 | 4690 | 300 | 16 | 0.05 | |
| 19:10 | 4750 | 360 | 13 | 0.06 | End of Test |
| | | | | | |

Date: 3/10/87-3/13/87

Pumped Well MW-24

Measurements at Well MW-25

Pump Speed: - Q: - gpm

Static Water Level _____

| time (h:m:s) | t (min) | t' (min) | t/t' | Drawdown (ft) | Comments |
|---|---|---|---|---|---|
| 12:04 | | | | 0.00 | |
| 12:07 | | | | 0.01 | |
| 12:09 | | | | 0.01 | |
| 12:13 | | | | 0.01 | |
| 12:17 | | | | 0.01 | |
| 12:19 | | | | 0.01 | |
| 12:26 | | | | 0.02 | |
| 12:33 | | | | 0.01 | |
| 12:51 | | | | 0.01 | |
| 13:02 | | | | 0.01 | |
| 13:08 | | | | 0.01 | |
| 13:14 | | | | 0.01 | |
| 13:30 | | | | 0.01 | |
| 13:40 | | | | 0.01 | |
| 14:01 | | | | 0.02 | |
| 14:21 | | | | 0.02 | |
| 14:38 | | | | 0.02 | |
| 15:01 | | | | 0.03 | |
| 15:31 | | | | 0.03 | |
| 16:00 | | | | 0.04 | |
| 16:33 | | | | 0.04 | |
| 17:01 | | | | 0.05 | |
| 18:03 | | | | 0.05 | |
| 19:03 | | | | 0.06 | |
| 20:02 | | | | 0.06 | |
| 21:01 | | | | 0.06 | |
| 22:01 | | | | 0.07 | |
| 23:01 | | | | 0.07 | |
| 24:01 | | | | 0.07 | |
| 1:01 | | | | 0.07 | |

Date: 3/10/87-3/13/87

Pumped Well MW-24

Measurements at Well MW-25

Pump Speed: - Q: - gpm

Static Water Level _____

| | time (h:m:s) | t (min) | t' (min) | t/t' | Drawdown (ft) | Comments |
|---|---|---|---|---|---|---|
| 3/11 | 2:01 | | | | 0.06 | |
| | 3:03 | | | | 0.05 | |
| | 4:02 | | | | 0.05 | |
| | 5:01 | | | | 0.06 | |
| | 6:01 | | | | 0.06 | |
| | 7:02 | | | | 0.07 | |
| | 8:02 | | | | 0.07 | |
| | 9:01 | | | | 0.07 | |
| | 10:01 | | | | 0.07 | |
| | 11:01 | | | | 0.06 | |
| | 12:01 | ± 4320 | | | 0.04 | |
| | 13:01 | | | | 0.05 | |
| | 14:01 | | | | 0.04 | |
| | 15:01 | | | | 0.05 | |
| | 16:01 | | | | 0.05 | |
| | 17:01 | | | | 0.06 | |
| | 18:01 | | | | 0.07 | |
| | 19:01 | | | | 0.08 | |
| | 20:01 | | | | 0.08 | |
| | 21:01 | | | | 0.09 | |
| | 22:01 | | | | 0.08 | |
| | 23:01 | | | | 0.08 | |
| | 24:01 | | | | 0.09 | |
| 3/12 | 1:01 | | | | 0.08 | |
| | 2:01 | | | | 0.09 | |
| | 3:01 | | | | 0.09 | |
| | 4:01 | | | | 0.09 | |
| | 5:01 | | | | 0.09 | |
| | 6:10 | | | | 0.09 | |
| | 7:01 | | | | 0.09 | |

Date: 3/10/87-3/13/87

Pumped Well MW-24

Measurements at Well MW-25

Pump Speed: - Q: - gpm

Static Water Level _____

| | time (h:m:s) | t (min) | t' (min) | t/t' | Drawdown (ft) | Comments |
|---|---|---|---|---|---|---|
| 3/12 | 8:03 | | | | 0.09 | |
| | 9:00 | | | | 0.09 | |
| | 10:01 | | | | 0.09 | |
| | 12:04 | 2 days | | | 0.07 | |
| | 13:01 | | | | 0.06 | |
| | 14:01 | | | | 0.06 | |
| | 15:04 | | | | 0.05 | |
| | 16:01 | | | | 0.07 | |
| | 17:03 | | | | 0.08 | |
| | 18:01 | | | | 0.06 | |
| | 19:01 | | | | 0.07 | |
| | 20:01 | | | | 0.07 | |
| | 21:01 | | | | 0.06 | |
| | 22:01 | | | | 0.07 | |
| | 23:01 | | | | 0.06 | |
| | 24:01 | | | | 0.06 | |
| 3/13 | 1:01 | | | | 0.05 | |
| | 2:01 | | | | 0.07 | |
| | 3:01 | | | | 0.07 | |
| | 4:01 | | | | 0.09 | |
| | 5:01 | | | | 0.09 | |
| | 6:00 | | | | 0.09 - | |
| | 7:01 | | | | 0.07 | |
| | 8:01 | | | | 0.06 | |
| | 9:01 | | | | 0.07 | |
| | 10:01 | | | | 0.06 | |
| | 11:01 | | | | 0.06 | |
| | 12:01 | | | | 0.05 | |
| | 1:00 | = 4320 + 60 | | | 0.05 | |
| | 1:10 | 4380 | | | | Pump OFF |

Date: 3/10/87-3/13/87

Pumped Well MW-24

Measurements at Well MW-25

Pump Speed: - Q: - gpm

Static Water Level _____

| time (h:m:s) | t (min) | t' (min) | t/t' | Drawdown (ft) | Comments |
|---|---|---|---|---|---|
| 13:44 | | | | -0.03 | |
| 13:48 | | | | -0.01 | |
| 13:56 | | | | -0.01 | |
| 14:01 | | | | -0.01 | |
| 14:06 | | | | -0.01 | |
| 14:16 | | | | -0.01 | |
| 14:31 | | | | -0.01 | |
| 14:41 | | | | -0.01 | |
| 14:51 | | | | -0.02 | |
| 15:11 | | | | -0.01 | |
| 15:37 | | | | -0.02 | |
| 15:51 | | | | -0.02 | |
| 16:11 | | | | -0.02 | |
| 16:41 | | | | -0.02 | |
| 17:11 | | | | -0.02 | |
| 17:41 | | | | -0.02 | |
| 18:11 | | | | -0.01 | |
| 19:11 | | | | 0.00 | End of test |
| | | | | | |
| | | | | | |
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| | | | | | |
| | | | | | |

Date: 3/10/87-3/13/87

Pumped Well MW-24

Measurements at Well ,W-17

Pump Speed: - Q: - gpm

Static Water Level

| | time (h:m:s) | t (min) | t' (min) | t/t' | Drawdown (ft) | Comments |
|---|---|---|---|---|---|---|
| 10 | 12:00 | | | | 0.00 | Pump ON |
| | 12:11 | | | | 0.00 | |
| | 12:21 | | | | 0.00 | |
| | 12:31 | | | | -0.01 | |
| | 12:58 | | | | -0.01 | |
| | 13:16 | | | | 0.00 | |
| | 13:32 | | | | 0.00 | |
| | 14:02 | | | | 0.00 | |
| | 14:36 | | | | 0.00 | |
| | 15:03 | | | | 0.00 | |
| | 15:44 | | | | 0.00 | |
| | 16:35 | | | | 0.00 | |
| | 17:04 | | | | 0.02 | |
| | 18:04 | | | | 0.02 | |
| | 19:05 | | | | 0.03 | |
| | 20:06 | | | | 0.02 | |
| | 21:04 | | | | 0.03 | |
| | 22:05 | | | | 0.03 | |
| | 23:03 | | | | 0.03 | |
| | 24:07 | | | | 0.03 | |
| 11 | 1:05 | | | | 0.03 | |
| | 2:06 | | | | 0.03 | |
| | 3:06 | | | | 0.03 | |
| | 4:07 | | | | 0.03 | |
| | 5:07 | | | | 0.03 | |
| | 6:06 | | | | 0.04 | |
| | 7:07 | | | | 0.04 | |
| | 8:03 | | | | 0.02 | |
| | 9:03 | | | | 0.04 | |
| | 10:03 | | | | 0.02 | |

Date: 3/10/87-3/13/87

Pumped Well MW-24

Measurements at Well MW-17

Pump Speed: - Q: - gpm

Static Water Level _____

| | time (h:m:s) | t (min) | t' (min) | t/t' | Drawdown (ft) | Comments |
|---|---|---|---|---|---|---|
| 3-11 | 11:03 | | | | 0.01 | |
| | 12:08 | | | | 0.01 | |
| | 13:03 | | | | -0.01 | |
| | 14:03 | | | | -0.01 | |
| | 15:03 | | | | 0.00 | |
| | 16:03 | | | | -0.01 | |
| | 17:03 | | | | 0.00 | |
| | 18:03 | | | | 0.01 | |
| | 19:03 | | | | 0.02 | |
| | 20:02 | | | | 0.02 | |
| | 21:02 | | | | 0.03 | |
| | 22:03 | | | | 0.02 | |
| | 23:04 | | | | 0.02 | |
| | 24:04 | | | | 0.03 | |
| 12 | 1:04 | | | | 0.03 | |
| | 2:03 | | | | 0.03 | |
| | 3:03 | | | | 0.04 | |
| | 4:03 | | | | 0.04 | |
| | 5:03 | | | | 0.03 | |
| | 6:20 | | | | 0.03 | |
| | 7:03 | | | | 0.05 | |
| | 8:05 | | | | 0.05 | |
| | 9:02 | | | | 0.05 | |
| | 10:03 | | | | 0.05 | |
| | 11:00 | | | | 0.03 | |
| | 12:10 | | | | 0.03 | |
| | 13:03 | | | | -0.01 | |
| | 14:03 | | | | 0.00 | |
| | 15:05 | | | | 0.01 | |
| | 16:05 | | | | 0.01 | |

Date: 3/10/87-3/13/87

Pumped Well MW-24

Measurements at Well MW-17

Pump Speed: - Q: - gpm

Static Water Level _____

| time (h:m:s) | t (min) | t' (min) | t/t' | Drawdown (ft) | Comments |
|---|---|---|---|---|---|
| 17:05 | | | | 0.01 | |
| 18:03 | | | | 0.03 | |
| 19:03 | | | | 0.03 | |
| 20:03 | | | | 0.05 | |
| 21:03 | | | | 0.02 | |
| 22:03 | | | | 0.03 | |
| 23:03 | | | | 0.03 | |
| 24:03 | | | | 0.03 | |
| 1:03 | | | | 0.03 | |
| 2:03 | | | | 0.03 | |
| 3:03 | | | | 0.03 | |
| 4:03 | | | | 0.03 | |
| 5:03 | | | | 0.04 | |
| 6:03 | | | | 0.04 | |
| 7:04 | | | | 0.03 | |
| 8:03 | | | | 0.02 | |
| 9:03 | | | | 0.01 | |
| 10:03 | | | | 0.00 | |
| 11:02 | | | | -0.01 | |
| 12:00 | | | | -0.01 | |
| 13:10 | | | | | Pump OFF |
| 14:03 | | | | -0.01 | |
| 14:22 | | | | -0.01 | |
| 15:39 | | | | 0.00 | |
| 16:12 | | | | -0.01 | |
| 16:44 | | | | 0.00 | |
| 17:05 | | | | 0.00 | |
| 17:12 | | | | 0.01 | |
| 18:12 | | | | 0.01 | |
| 20:30 | | | | 0.02 | End of test |

Date: 3/07/87-3/09-87

Pumped Well MW-18

Measurements at Well MW-18

Pump Speed: _____ Q: 0.25 gpm

Static Water Level _____

| time (h:m:s) | t (min) | t' (min) | t/t' | Drawdown (ft) | Comments |
|---|---|---|---|---|---|
| 11:00 | 0 | | | 0 | Speed 39 |
| | .25 | | | - | |
| | .5 | | | 0.20 | |
| | .75 | | | - | |
| 11:01 | 1.0 | | | 0.35 | |
| | 1.5 | | | 0.55 | |
| 11:02 | 2.0 | | | 0.65 | |
| | 2.5 | | | 0.80 | |
| 11:03 | 3.0 | | | 0.90 | |
| | 3.5 | | | 1.00 | |
| 11:04 | 4.0 | | | 1.10 | |
| | 4.5 | | | 1.18 | |
| 11:05 | 5.0 | | | 1.25 | |
| 11:06 | 6.0 | | | 1.39 | |
| 11:07 | 7.0 | | | 1.51 | |
| 11:08 | 8.0 | | | 1.62 | |
| 11:09 | 9.0 | | | 1.74 | |
| 11:10 | 10.0 | | | 1.85 | |
| 11:11 | 11 | | | 1.96 | 1ℓ/51.04sec |
| 11.14 | 14 | | | 2.30 | Adj to 38 |
| 11.16 | 16 | | | 2.45 | 1ℓ/54.49 |
| 11.18 | 18 | | | 2.57 | Adj to 37 |
| 11:20 | 20 | | | 2.69 | 1ℓ/57.30sec |
| 11:25 | 25 | | | 2.85 | 1ℓ/60.70sec |
| 11:30 | 30 | | | 3.06 | |
| 11:35 | 35 | | | 3.22 | 1ℓ/56.70 |
| 11:40 | 40 | | | 3.38 | 1ℓ/56.82 |
| 11:45 | 45 | | | 3.47 | sampled |
| 11:50 | 50 | | | 3.51 | 1ℓ/59.03sec |
| 12:00 | 60 | | | 3.58 | 1ℓ/58.76sec |

Date: 3/07/87-3/09/87

Pumped Well MW-18

Measurements at Well MW-18

Pump Speed: _____ Q: 0.25± gpm

Static Water Level _____

| time (h:m:s) | t (min) | t' (min) | t/t' | Drawdown (ft) | Comments |
|---|---|---|---|---|---|
| 12:10 | 70 | | | 3.67 | |
| 12:20 | 80 | | | 3.73 | 1ℓ/60.61 |
| 12:30:00 | 90 | | | 3.83 | 1ℓ/56.74 |
| 12:40:00 | 100 | | | 3.87 | 1ℓ/57.83 |
| 13:00:00 | 120 | | | 3.89 | 1ℓ/58.09 |
| 13:20:00 | 140 | | | 3.90 | 1ℓ/58.45 |
| 13:40:00 | 160 | | | 3.96 | 1ℓ/58.23 |
| 14:00:00 | 180 | | | 4.19 | 1ℓ/57.48 |
| 14:30:00 | 210 | | | 4.19 | 1ℓ/56.41 |
| 15:00:00 | 240 | | | 4.30 | 1ℓ/57.03 |
| 15:47:00 | 287 | | | 4.20 | 1ℓ/60.92 |
| 16:00 | 300 | | | 4.24 | |
| 17:00 | 360 | | | 4.04 | 1ℓ/60.56 |
| 18:00 | 420 | | | 3.53 | $H_2O$ sample 66.8 taken |
| 19:00 | 480 | | | 4.02 | 1ℓ/59.67 |
| 20:00 | 540 | | | 3.97 | 1ℓ/61.43 |
| 21:00 | 600 | | | 3.75 | 1ℓ/59.90 |
| 22:00 | 660 | | | 3.27 | 1ℓ/63.18 |
| 23:00 | 720 | | | 4.75 | $H_2O$ sample 61.80 taken |
| 24:00 | 780 | | | 4.42 | 1ℓ/59.24 |
| 1:00 | 840 | | | 4.67 | 1ℓ/60.41 |
| 2:00 | 900 | | | 4.50 | 1ℓ/58.85 |
| 3:00 | 960 | | | 4.23 | 1ℓ/61.07 |
| 4:00 | 1020 | | | 4.20 | 1ℓ/63.46 |
| 5:00 | 1080 | | | 4.11 | 1ℓ/65.20 |
| 6:00 | 1140 | | | 4.55 | 1ℓ/57.15 |
| 7:00 | 1200 | | | 5.02 | 1ℓ/57.40 |
| 8:00 | 1260 | | | 6.56 | 1ℓ/49.55 Adj 61.87 |
| 9:00 | 1320 | | | 5.14 | 1ℓ/58.95 Adj 60.89 |
| 10:00 | 1380 | | | 4.48 | 57.90 |

Date: 3/07/87-3/09-87

Pumped Well MW-18

Measurements at Well MW-18

Pump Speed: _____ Q: 0.25 gpm

Static Water Level _____

| time (h:m:s) | t (min) | t' (min) | t/t' | Drawdown (ft) | Comments |
|---|---|---|---|---|---|
| 11:00 | 1440 | | | 4.50 | sampled 56.97 adj 61.36 |
| 12:00 | 1500 | | | 4.17 | 60.27 |
| 3/8 13:00 | 1560 | | | 4.10 | 1ℓ/60.71 |
| 14:00 | 1620 | | | 3.94 | 1ℓ/61.95 |
| 15:00 | 1680 | | | 4.15 | 1ℓ/58.43 |
| 16:00 | 1740 | | | 3.94 | 1ℓ/61.31 |
| 17:00 | 1800 | | | 4.08 | 1ℓ/60.46 |
| 18:00 | 1860 | | | 3.96 | 1ℓ/58.95 adj 60.06 |
| 19:00 | 1920 | | | 3.92 | 1ℓ/68.45 adj 60.30 |
| 20:00 | 1980 | | | 4.41 | 1ℓ/60.04 |
| 21:00 | 2040 | | | 4.06 | 1ℓ/59.26 |
| 22:00 | 2100 | | | 4.16 | 1ℓ/58.64 |
| 23:00 | 2160 | | | 4.21 | $H_2O$ sample taken 68.54 adj 62.64 |
| 24:00 | 2220 | | | 4.40 | 1ℓ/1:05:43 adj 59.7 |
| 3/9 1:00 | 2280 | | | 4.11 | 61.01 |
| 2:00 | 2340 | | | 4.66 | 58.13 |
| 3:00 | 2400 | | | 5.09 | 60.58 |
| 4:00 | 2460 | | | 5.47 | 57.28 adj 60.06 |
| 5:00 | 2520 | | | 5.52 | 64.70 adj 58.67 |
| 6:00 | 2580 | | | 4.80 | 59.14 |
| 7:00 | 2640 | | | 4.88 | 60.04 |
| 8:00 | 2700 | | | 4.97 | 57.10 adj 61.39 |
| 9:00 | 2760 | | | 4.52 | 59.24 |
| 10:00 | 2820 | | | 5.04 | 58.80 |
| 11:00 | 2880 | | | 4.66 | 67.58 adj 58.95 |
| 12:00 | 2940 | | | 5.02 | Pump OFF |
| | | | | | |
| | | | | | |
| | | | | | |
| | | | | | |

Date: 3/7/87-3/9/87

Pumped Well MW-18

Measurements at Well MW-18

Pump Speed: _____ Q: 0.25± gpm

Static Water Level _____

| time (h:m:s) | t (min) | t' (min) | t/t' | Drawdown (ft) | Comments |
|---|---|---|---|---|---|
| 12:00:15 | 2940.25 | .25 | 11761 | 4.90 | |
| | 2940.5 | .5 | 5881 | 4.81 | |
| | 2940.75 | .75 | 3921 | 4.72 | |
| 12:01 | 2941 | 1.0 | 2941 | 4.63 | |
| | 2941.5 | 1.5 | 1961 | 4.44 | |
| 12:02 | 2942 | 2.0 | 1471 | 4.26 | |
| | 2942.5 | 2.5 | 1177 | 4.09 | |
| 12:03:00 | 2943 | 3.0 | 981 | 3.91 | |
| | 2943.5 | 3.5 | 841 | 3.74 | |
| 12:04:00 | 2944 | 4.0 | 736 | 3.57 | |
| | 2944.5 | 4.5 | 654 | 3.40 | |
| 12:05 | 2945 | 5.0 | 589 | 3.23 | |
| | 2946 | 6 | 491 | 2.89 | |
| | 2947 | 7 | 421 | 2.57 | |
| | 2948 | 8 | 369 | 2.27 | |
| | 2949 | 9 | 328 | 2.03 | |
| 12:10:00 | 2950 | 10 | 295 | 1.79 | |
| | 2952 | 12 | 246 | 1.44 | |
| | 2954 | 14 | 211 | 1.16 | |
| | 2956 | 16 | 185 | .93 | |
| | 2958 | 18 | 164 | .75 | |
| 12:20:00 | 2960 | 20 | 148 | .60 | |
| | 2965 | 25 | 119 | .35 | |
| 12:30:00 | 2970 | 30 | 99.0 | .25 | |
| | 2975 | 35 | 85.0 | .20 | |
| | 2980 | 40 | 74.5 | .17 | |
| | 2985 | 45 | 66.3 | .15 | |
| | 2990 | 50 | 59.8 | .14 | |
| | 3000 | 60 | 50.0 | .11 | |
| | 3010 | 70 | 43.0 | .11 | |

Date: 3/7/87-3/9/87

Pumped Well MW-18

Measurements at Well MW-18

Pump Speed: _____ Q: 0.25± gpm

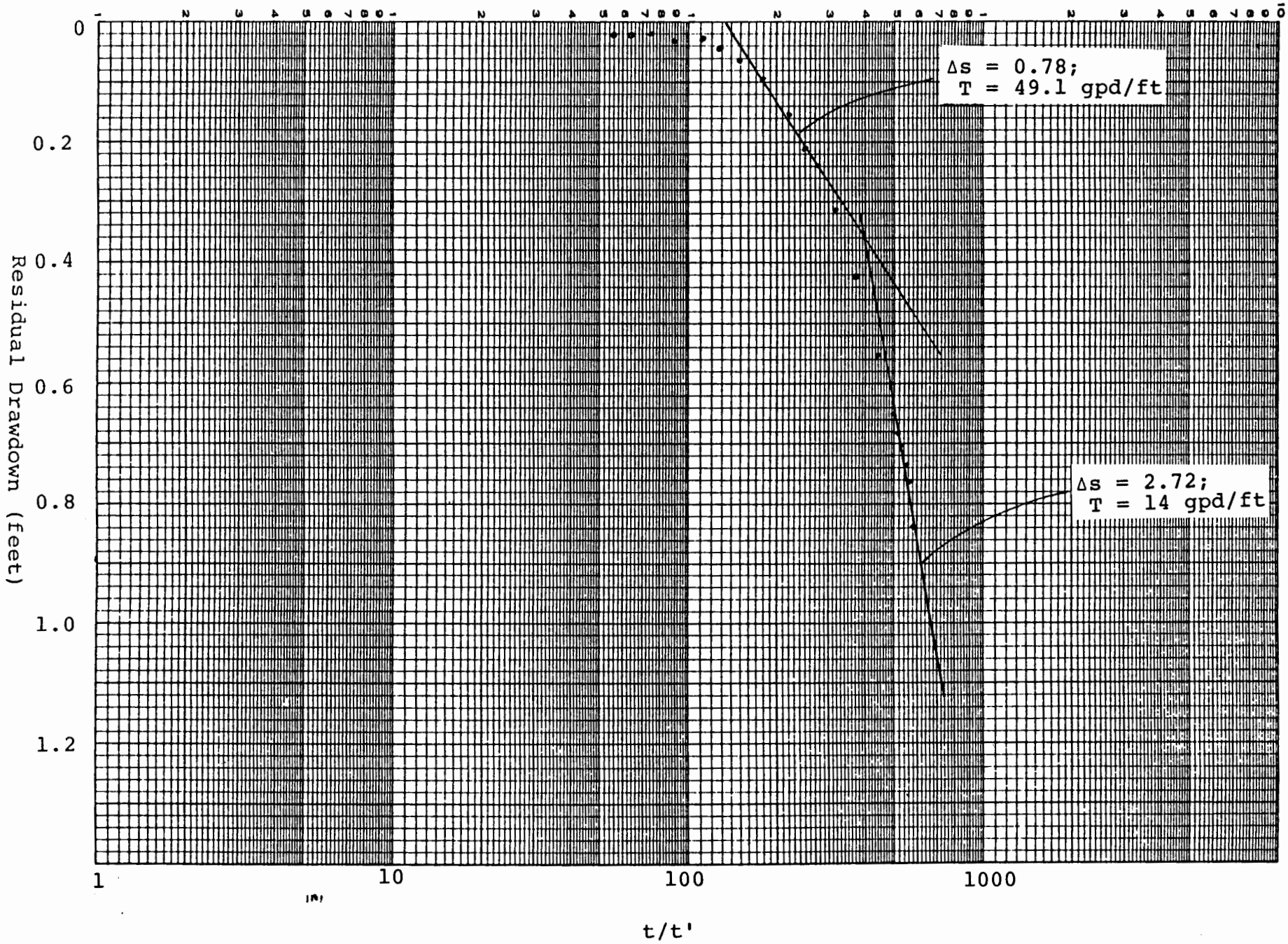
Static Water Level _____

| time (h:m:s) | t (min) | t' (min) | t/t' | Drawdown (ft) | Comments |
|---|---|---|---|---|---|
| 13:20 | 3020 | 80 | 37.8 | .10 | |
| 13:30 | 3030 | 90 | 33.67 | .09 | |
| 13:40 | 3040 | 100 | 30.40 | .12 | |
| 14:00 | 3060 | 120 | 25.50 | .02 | |
| 14:20 | 3080 | 140 | 22.0 | .00 | End of Test |

Pumped Well: MW-16
Observations at Well: MW-16

Residual-Drawdown
Q = 0.145

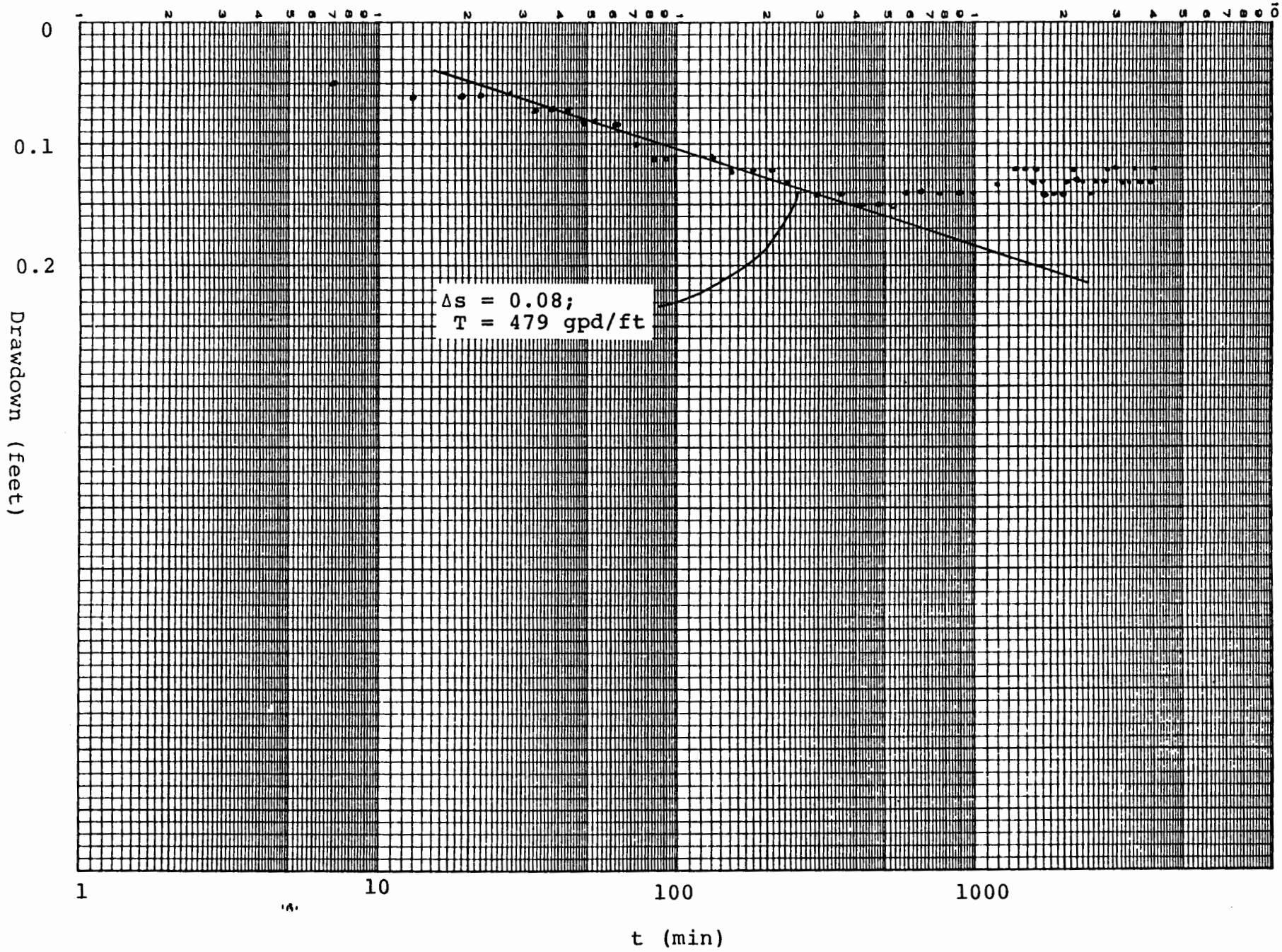
METRIC Corporation
Date: 3-87



Pumped Well : MW-16
Observations at Well : MW-24

Time-Drawdown
Q = 0.145

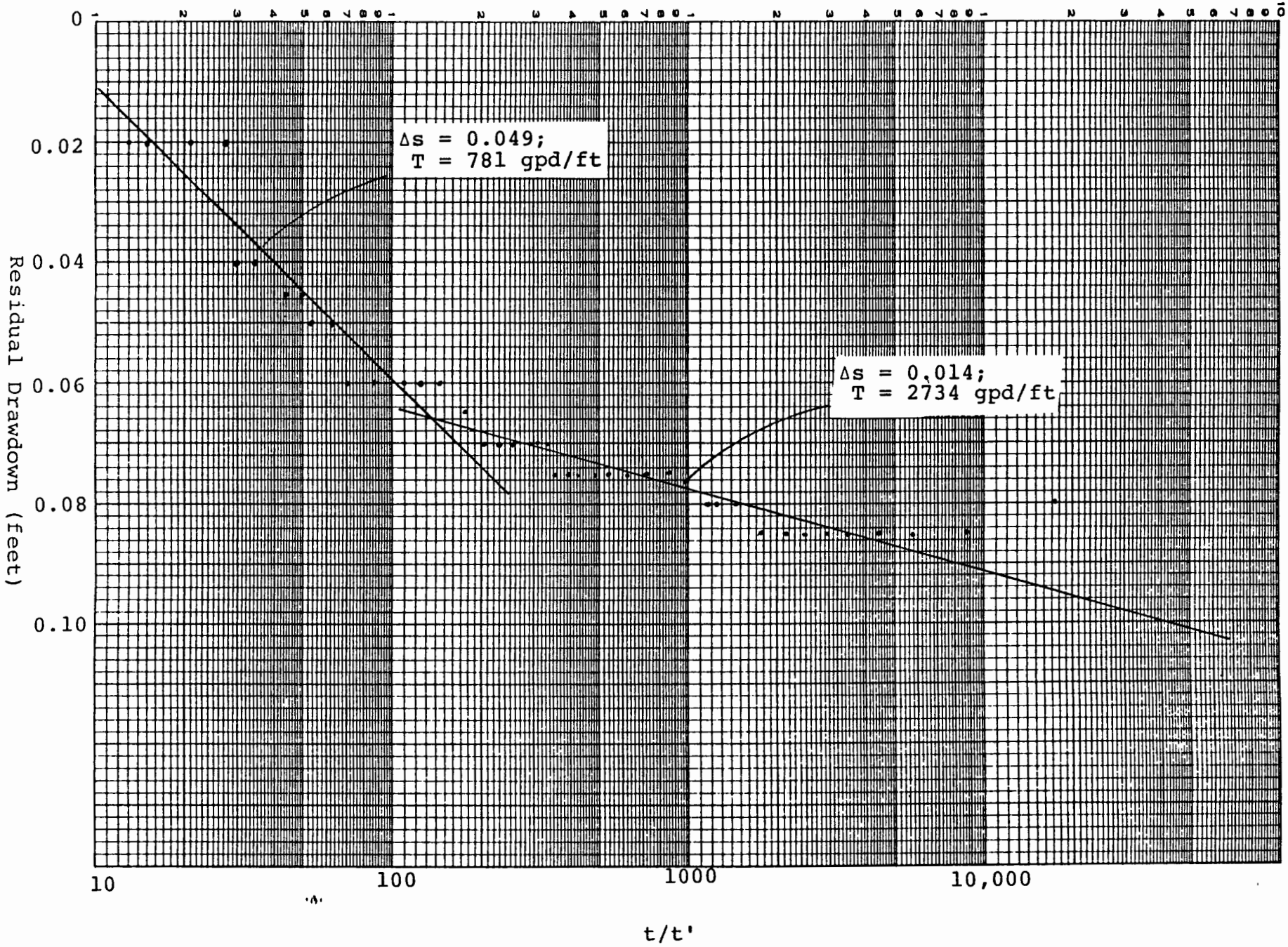
METRIC Corporation
Date: 3-87



Pumped Well: MW-16
Observations at Well: MW-24

Residual-Drawdown
Q = 0.145

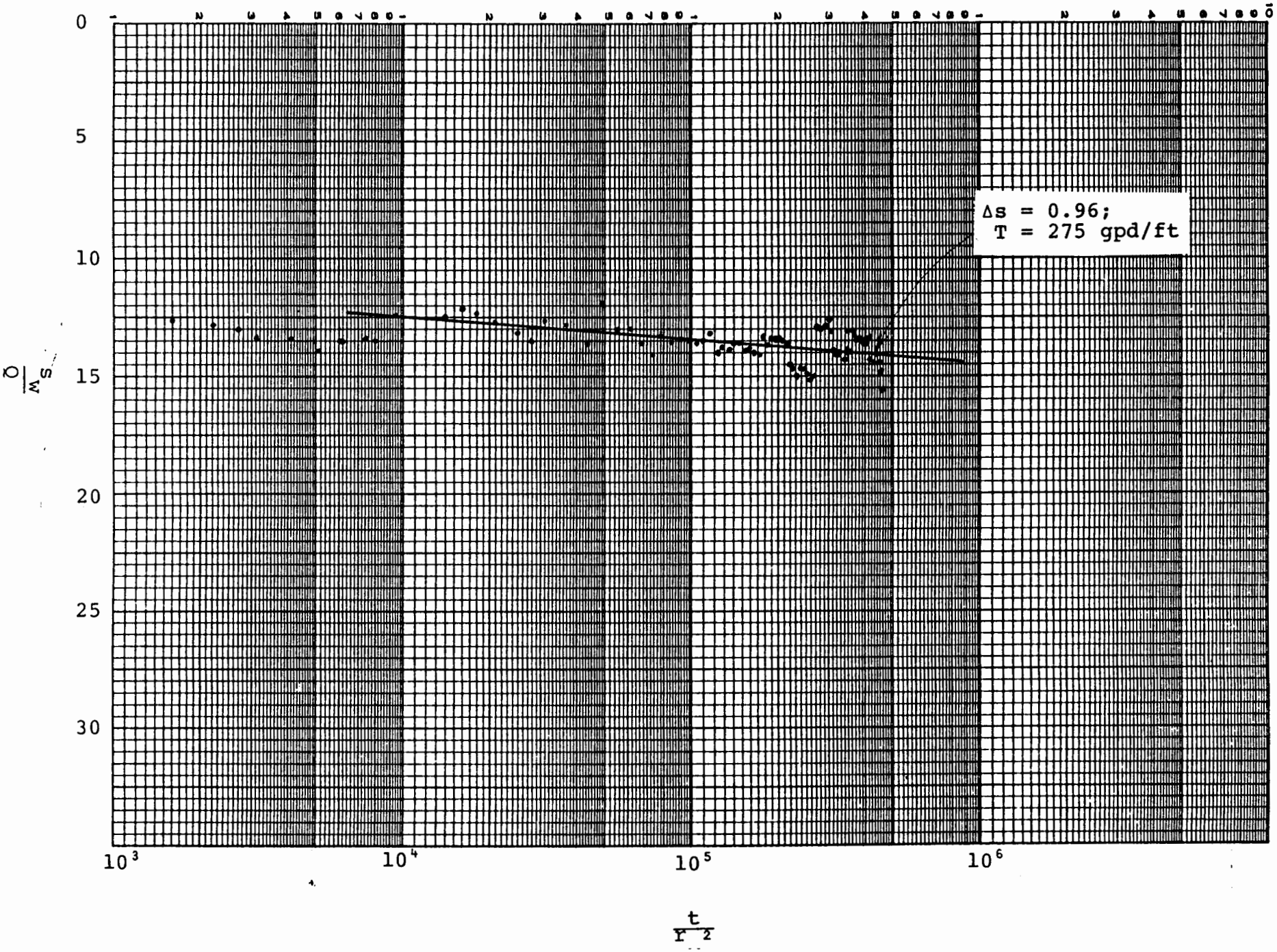
METRIC Corporation
Date: 3/87



Pumped Well MW-24
Observations at Well MW-24

$\frac{s_w}{Q}$ vs $\frac{t}{r_w^2}$  d = 2 3/8"

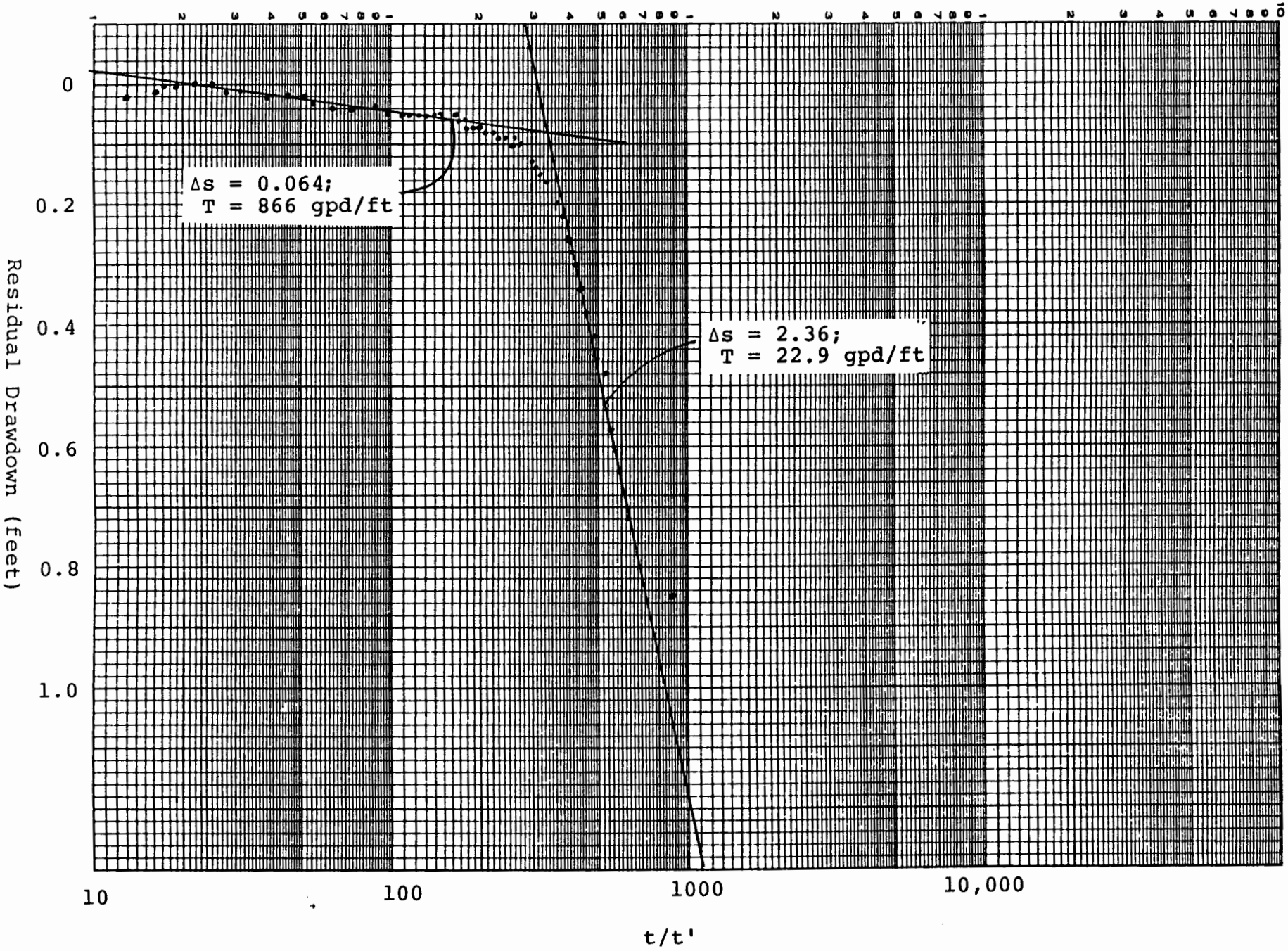
METRIC Corporation
Date: 3-87



Pumped Well: MW-24
Observations at Well: MW-24

Residual-Drawdown
Q = 0.205

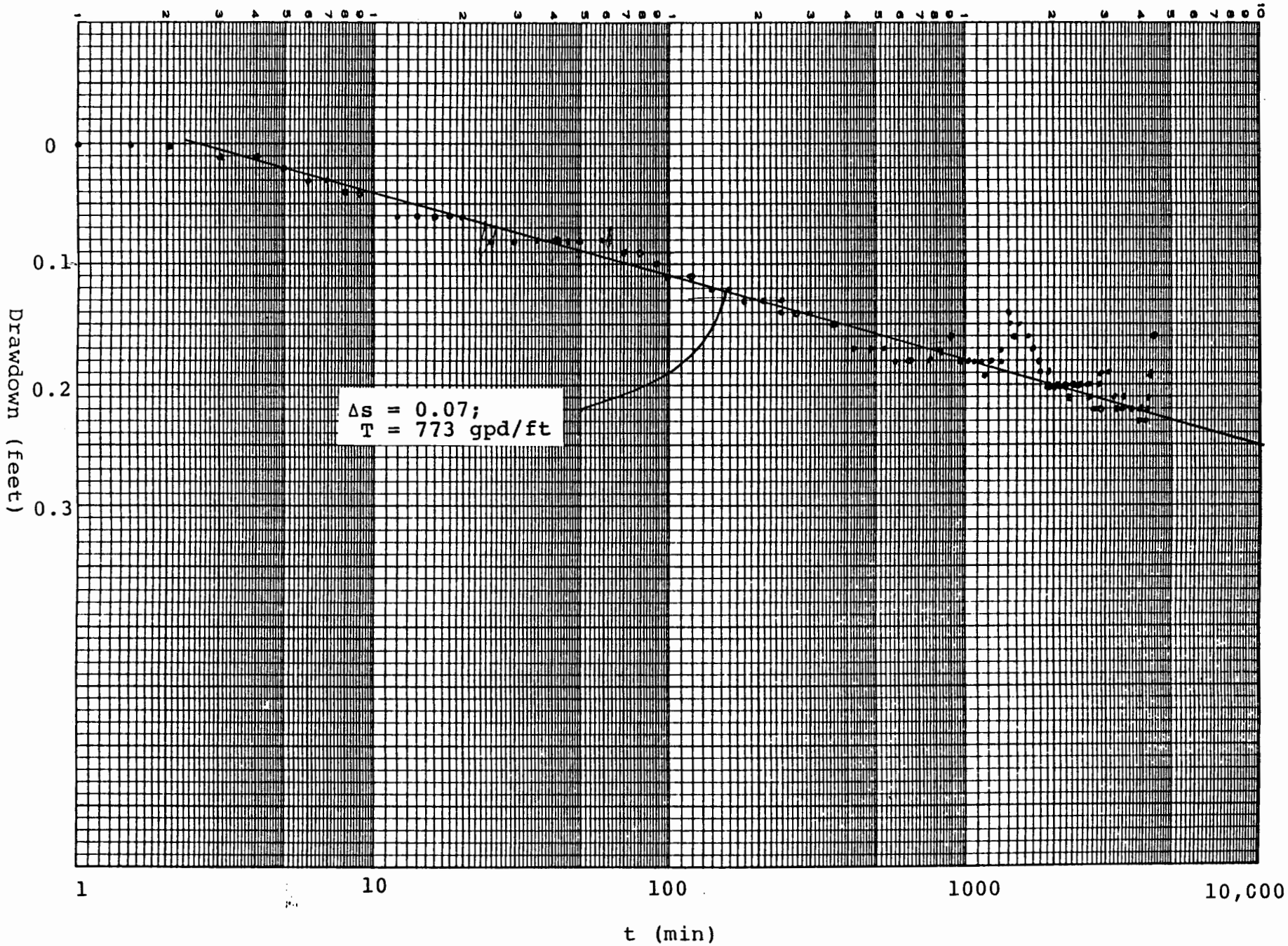
METRIC Corporation
Date: 3-87



Pumped Well: MW-24
Observations at Well : MW-16

Time-Drawdown
Q = 0.205

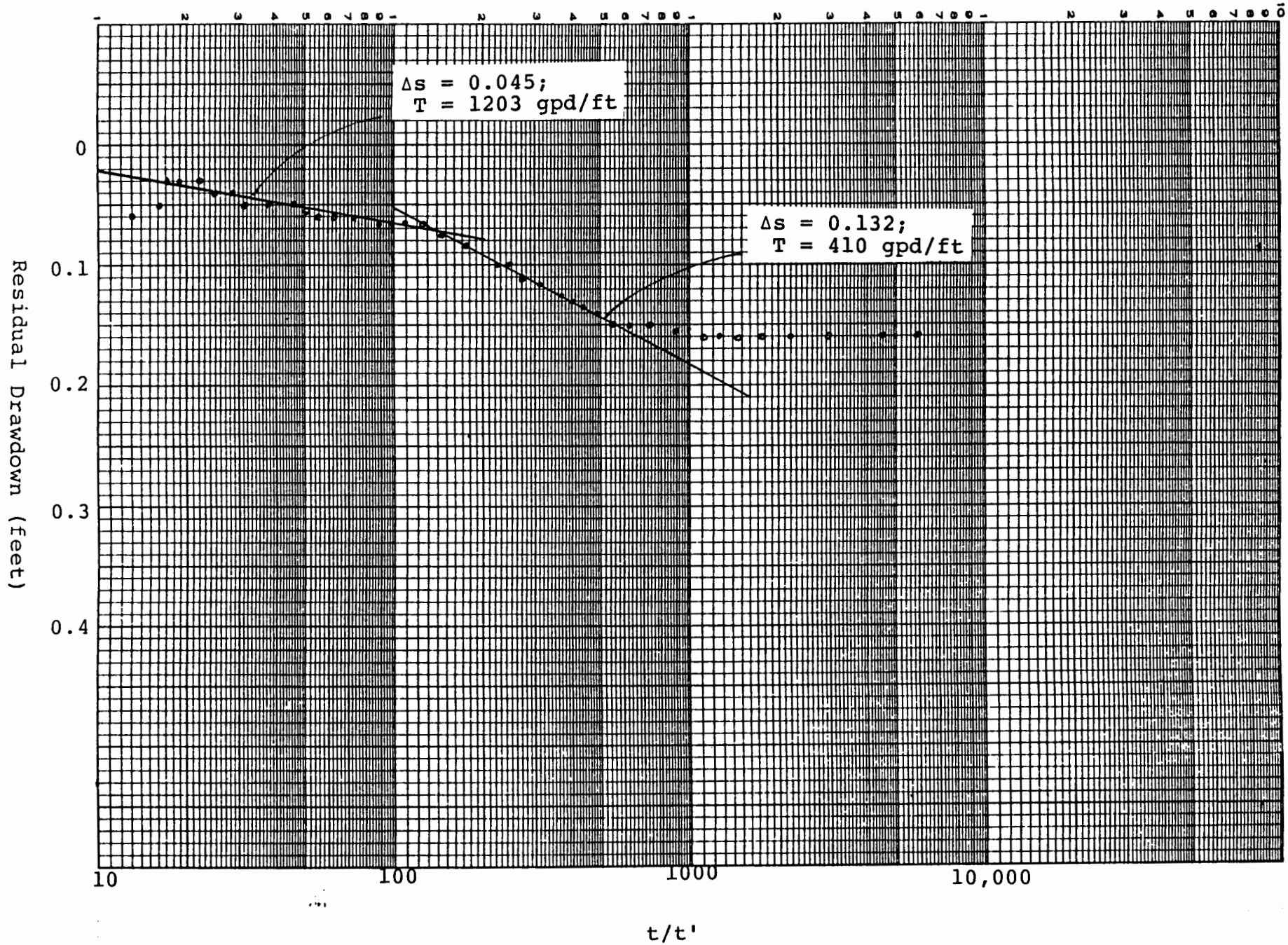
METRIC Corporation
Date: 3-87



Pumped Well: MW-24
Observations at Well: MW-16

Residual-Drawdown
Q = 0.205

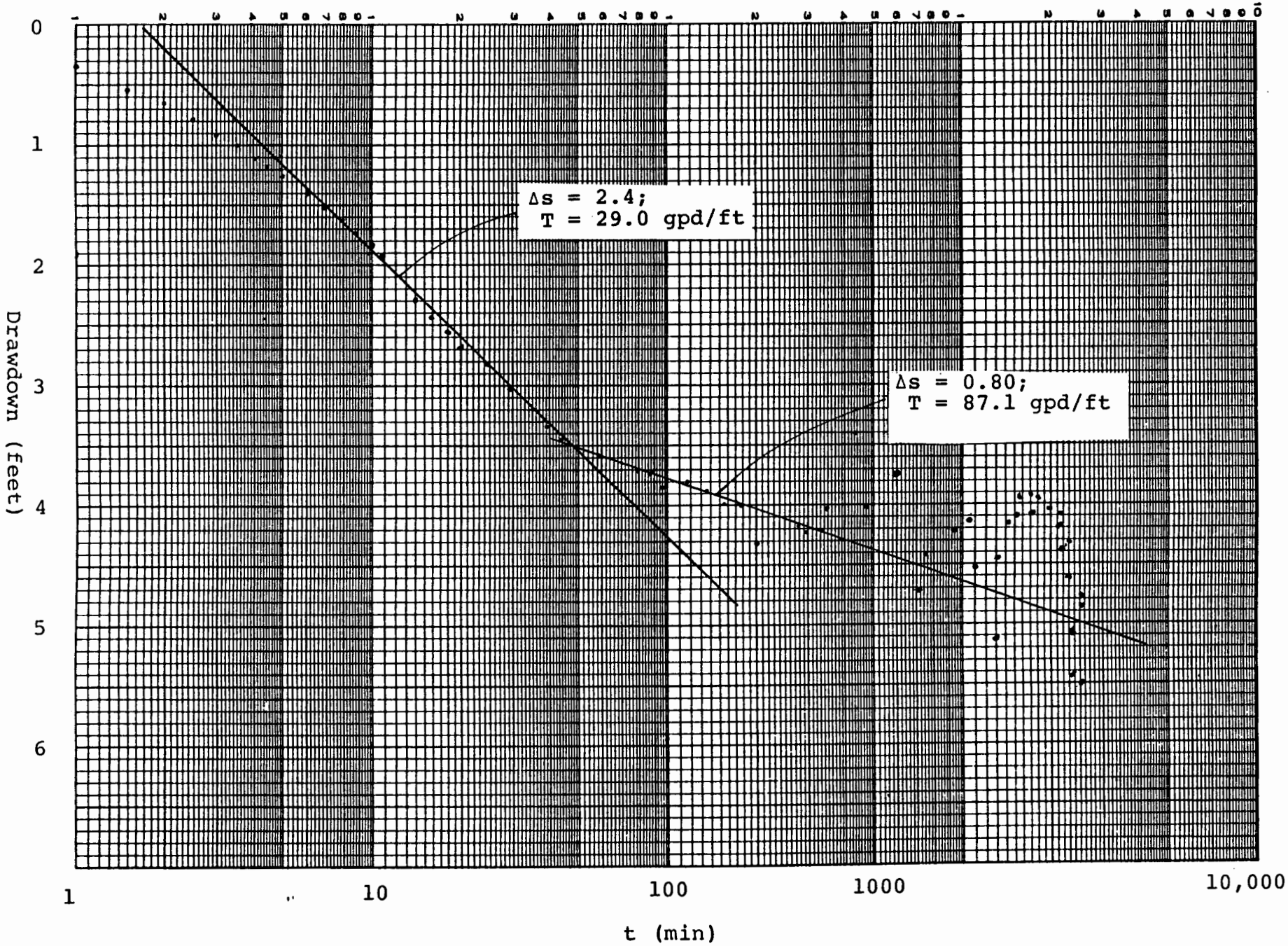
METRIC Corporation
Date: 3-87



Pumped Well: MW-18
Observations at Well: MW-18

Time-Drawdown
Q = 0.264

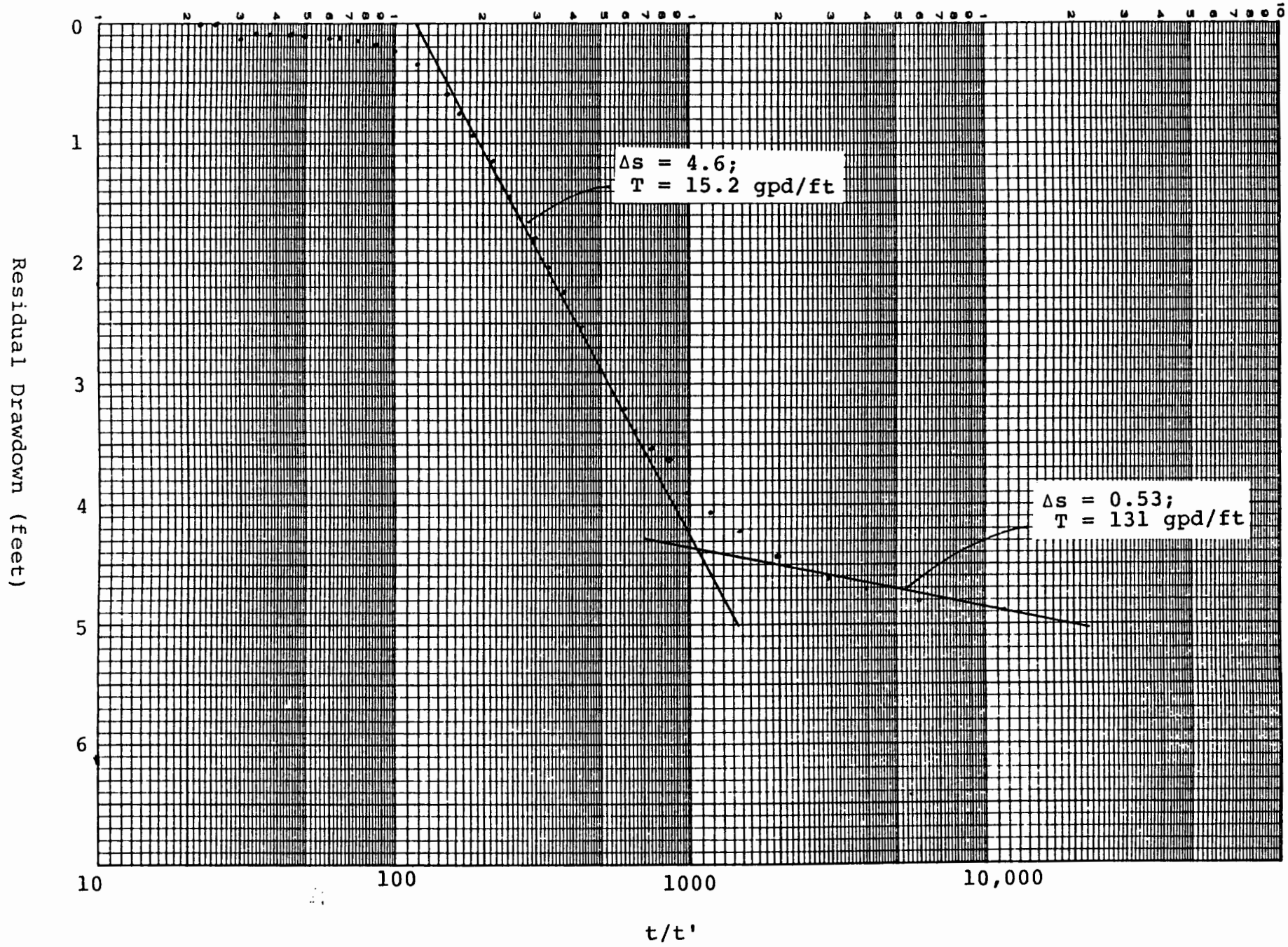
METRIC Corporation
Date: 3-87



Pumped Well: MW-18
Observations at Well: MW-18

Residual-Drawdown
Q = 0.264

METRIC Corporation
Date: 3-87



# APPENDIX C

# WATER QUALITY ANALYSES

ASSAIGAI ANALYTICAL LABORATORIES

TO: Sparton Technology
ATTN: Clovis Martinez
9621 Coors Rd NW
Albuquerque, NM 87114

DATE: 15 April 1987
0428

| ANALYTE | SAMPLE ID/ANALYTICAL RESULTS | | |
|---|---|---|---|
| | MW-16 3/5/87 7:00 am | MW-16 3/6/87 1:00 am | MW-16 3/4/87 1:00 am |
| Methylene Chloride | 23 mg/l | 20 mg/l | 23 mg/l |
| 1,1 Dichloroethylene | 0.92 mg/l | 0.85 mg/l | 1.1 mg/l |
| Trichloroethylene | 13 mg/l | 13 mg/l | 14 mg/l |
| 1,1,1-Trichloroethane | 7.1 mg/l | 11 mg/l | 8.2 mg/l |
| | MW-18 3/8/87 11:00 | MW-18 3/9/87 11:00 | MW-18 3/6/87 10:01 |
| Methylene Chloride | 0.42 mg/l | 0.11 mg/l | 0.48 mg/l |
| 1,1 Dichloroethylene | 0.46 mg/l | 0.88 mg/l | 0.10 mg/l |
| Trichloroethylene | 3.6 mg/l | 6.6 mg/l | 1.3 mg/l |
| 1,1,1-Trichloroethane | 3.5 mg/l | 7.0 mg/l | 0.79 mg/l |
| | MW-24 3/10/87 13:37 | MW-24 3/12/87 12:04 pm | MW-24 3/13/87 0:00 |
| Methylene Chloride | 27 mg/l | 42 mg/l | 51 mg/l |
| 1,1 Dichloroethylene | 2.3 mg/l | 2.0 mg/l | 3.9 mg/l |
| Trichloroethylene | 25 mg/l | 22 mg/l | 5.6 mg/l |
| 1,1,1-Trichloroethane | 4.3 mg/l | 8.5 mg/l | 14 mg/l |

NOMINAL DETECTION LIMITS :

| | |
|---|---|
| Methylene Chloride | 0.1 mg/l |
| 1,1 Dichloroethylene | 0.1 mg/l |
| Trichloroethylene | 0.1 mg/l |
| 1,1,1-Trichloroethane | 0.1 mg/l |

| ANALYTE | SAMPLE ID/ANALYTICAL RESULTS | | | NOMINAL DETECTION LIMITS | | |
|---|---|---|---|---|---|---|
| | MW-16 | MW-18 | MW-24 | | | |
| Cu | 0.03 mg/l | 0.03 mg/l | <0.01 mg/l | 0.002 mg/l | .73 | 3.07 |
| Cr | 0.20 mg/l | <0.05 mg/l | <0.05 mg/l | 0.05 mg/l | 1.37 | 3.42 |
| Ni | 0.73 mg/l | 0.57 mg/l | 0.25 mg/l | 0.01 mg/l | .59 | .71 |
| Mn | 10.6 mg/l | 6.75 mg/l | <0.01 mg/l | 0.01 mg/l | | |
| B | 11.2 mg/l | <0.1 mg/l | 15.7 mg/l | 0.1 mg/l | – | – |
| Cd | <0.01 mg/l | <0.01 mg/l | <0.01 mg/l | 0.01 mg/l | .21 | .31 |

7300 Jefferson, N.E. • Albuquerque, New Mexico 87109 • (505) 345-8964

REFERENCE: "Test Methods for Evaluating Solid Waste, Physical/Chemical Methods", USEPA, SW 846, EMSL-Cincinnati, 1982.

An invoice for services is enclosed. Thank you for contacting Assaigai Laboratories.

Sincerely,

Jennifer W. Smith

Jennifer W. Smith, Ph.D.
Laboratory Director

# BIBLIOGRAPHY

Lohman, S.W., 1972. Ground Water Hydraulics, Geological Survey Professional Paper 708.

Schafer, D.C., 1978. Casing Storage Can Affect Pumping Test Data, The Johnson Drillers Journal.

# Aquifer Testing
# at the
# Sparton Technology, Inc.
# Coors Road Plant
# Albuquerque, New Mexico

Prepared By

METRIC Corporation
Albuquerque, New Mexico

MAY 1988

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COORS ROAD PLANT

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TABLE 4 - SAMPLE ANALYSIS - MW-25

TABLE 5 - SAMPLE ANALYSIS - PW-1

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APPENDIX B - AQUIFER TEST DATA PLOTS

APPENDIX C - WATER QUALITY ANALYSES

# AQUIFER TESTING
# AT THE
# SPARTON TECHNOLOGY, INC.
# COORS ROAD PLANT

Aquifer tests were performed in two wells at the Sparton Technology, Inc., Coors Road Plant during February, 1988. The purpose of the testing was to estimate the aquifer permeability of the "upper flow zone". The resulting information will be used in design of a groundwater recovery system. The "upper flow zone" consists generally of the upper 5 to 10 feet of the saturated zone at the Coors Road site separated from the remainder of the saturated zone by a fine grained aquitard unit.

Pumping tests were conducted in two wells, MW-25 in the pond and sump area on the northeast side of the building and in PW-1 located near the center of the southwest property line.

The tests were conducted as follows:

Well: MW-25
Test Type: Constant Discharge
Test Drawdown: 3.2 ft.
Available Drawdown: 7.3 ft. ±
Duration of Pumping: 4129 min ≈ 69 hr.
Average Discharge: 0.32 gpm
Observations Taken in Wells: MW-25, MW-24

Well: PW-1
Test Type: Constant Discharge
Test Drawdown: 2.26 ft.
Available Drawdown: 4.2 ft. ±
Duration of Pumping: 4174 min ≈ 70 hr.
Average Discharge: 0.13 gpm
Observations Taken in Wells: PW-1, MW-9

Well MW-25, a 2-inch i.d. PVC well with a wirewound stainless steel screen, was pumped with a 1.67-inch o.d. positive displacement pump having a maximum discharge of about 2.5 gpm. Water levels in the pumped well were monitored with an airline and a water monometer using a water/anitfreeze mixture (due to freezing weather) having a specific gravity of 1.06. Water levels in the observation well (MW-24) were monitored with an electronic sounder. All water level measurements were taken to the nearest 0.01 feet.

Well PW-1, a 10-inch i.d. PVC well, was pumped with a 1/2 hp submersible pump having a maximum discharge of about 10 gpm. Water levels in both the pumped well and the observation well (MW-9) were monitored with electronic sounders. All water level measurements were taken to the nearest 0.01 feet.

Water quality samples were collected once per day at a approximate 24 hour intervals, during the aquifer testing and three days after pumping ceased. Pumping tests for both wells were begun on February 23, 1988 and ended on February 26, 1988. The samples collected on February 23 were obtained about one hour after the pumping started. The samples collected on February 26 were obtained about one hour before the pumping was stopped. The February 29 samples were collected about one hour after the pumps were restarted. The purpose of the sampling was to determine whether or not water quality changes with time might be expected when the recovery system is put into operation.

The water level and discharge data collected during each test is presented in APPENDIX A. The results of the aquifer testing are summarized in TABLE 1. The data were analyzed using the Jacob solution (semi-log plots) to the Theis equation (see APPENDIX B).

TABLE 1

AQUIFER TESTING
SPARTON TECHNOLOGY, INC. COORS ROAD PLANT

| Pumped Well | Observations At | Curve | Apparent T (gpd/ft) | Adjusted T (gpd/ft) | b (ft) | ft/day | cm/sec | Comments |
|---|---|---|---|---|---|---|---|---|
| MW-25 | MW-25 | Early T-D | 56.3 | - | 7.3 | 1.03 | $3.64 \times 10^{-4}$ | Near Well |
| | | Late T-D | 281.6 | - | 7.3 | 5.16 | $1.82 \times 10^{-3}$ | Away from Well |
| | | Early R-D | 48.3 | - | 7.3 | 0.885 | $3.12 \times 10^{-4}$ | Near Well |
| | | Late R-D | 337.9 | - | 7.3 | 6.19 | $2.18 \times 10^{-3}$ | Away from Well Selected |
| PW-1 | PW-1 | Late T-D | 22.8 | - | 4.3 1/ | 0.709 | $2.5 \times 10^{-4}$ | Casing Storage Affected |
| | | Late R-D | 22.8 | - | 4.3 1/ | 0.709 | $2.5 \times 10^{-4}$ | Casing Storage Affected |
| Adjusted for Casing Storage Effect | | | | 91.5 | 4.3 1/ | 2.84 | $1 \times 10^{-3}$ | Selected Value |

1/ PW-1 has 2' blank below aquifer

The time-drawdown data were checked to ensure that $u<0.05$ and, thus, validate the use of the Jacob solution. In the equation $u = \frac{1.87r^2S}{Tt}$, u was set equal to 0.05, and the time, t, was determined after which the Jacob solution is valid. TABLE 2 shows that the pumped well data are valid while the observation well data are not, and as a result, were not used in the analysis.

The data were also checked using a procedure suggested by Schafer, 1978 to determine which portions of the data might be casing storage affected. Only the first few minutes of the MW-25 data appear to be casing storage affected, while virtually all of the PW-1 data appears to be casing storage affected. As a result, the selected transmissivity value for PW-1 was adjusted (see TABLE 1) by a procedure also suggested by Schafer, 1978 assuming a well afficiency of 100%. This seems justified since only 0.13 gpm was being pumped from a 10-inch well screen with a substantial open area.

Based on the testing described above, it is felt that the best estimate for the permeability (hydraulic conductivity) of the upper flow zone in the vicinity of MW-25 is about $2 \times 10^{-3}$ cm/sec. (see TABLE 1). Likewise, the best estimate for the permeability of the upper flow zone in the vicinity of PW-1 is about $1 \times 10^{-3}$ cm/sec. (see TABLE 1).

The residual-drawdown curve (APPENDIX B) for PW-1 shows some evidence that a "recharge effect" may be occurring during the pumping period. The residual drawdown curve shows a t/t' value greater than 2 at zero drawdown, suggesting a "recharge effect". Possible explanations of the apparent "recharge effect" include reduction or reversal of prevailing downward vertical leakage in the cone of depression during the test or induced flow from a more permeable burried channel(s) existing within the upper flow zone.

TABLE 2

JACOB VALIDATION

| Well | r (ft.) | T (gpd/ft.) | t (days) | t (min) |
|---|---|---|---|---|
| PW-1 | 0.63 | 91.5 | 0.03 | 46 |
| MW-9 | 20.0 | 91.5 | 32.7 | 47,087 |
| MW-25 | 0.29 | 56.3 | 0.011 | 16 |
| MW-24 | 23.0 | 56.3 | 70.3 | 101,207 |

$$t = \frac{1.87\ r^2}{T}\ S$$

$S = 0.20$

$u = 0.05$

Estimated well capacities have been computed for each of the wells being considered for inclusion in the groundwater recovery system (see TABLE 3). The capacities were computed based on specific capacities observed in testing to date and assuming 100% drawdown. This would tend to yield conservatively high values, however, some of the wells might respond favorably to additional development which could increase the capacities beyond the values presented.

The results of the water quality sampling and analyses are summarized in TABLES 4 and 5 and include APPENDIX C. The solvent concentrations appear to have increased with time during the pumping test of MW-25. This possibly indicates that the area of maximum solvent concentration in the ground water is some short distance away from MW-25.

The elevated, and decreasing with time values of TDS, Hardness, and pH observed in PW-1 during the pumping test (see TABLE 5) are probably the result of the bottom portion of the well having recently been plugged with portland cement.

TABLE 3

ESTIMATED WELL CAPACITY

| Well | Date | Q(gpm) | Drawdown ft. | Specific Capacity (gpm/ft.) | Pumping Time (min.) | Total Water Removed (gal.) | Available Drawdown (ft.) | Estimated Capacity (gpm) |
|---|---|---|---|---|---|---|---|---|
| MW-16 | 3/7/87 | 0.145 | 2.38 | 0.0609 | 4325 | 627 | 5.4 | 0.33 |
| MW-18 | 3/9/87 | 0.264 | 5.02 | 0.0526 | 2940 | 776 | 12.6 | 0.66 |
| MW-23 | 10/23/86 | 0.48 | 7.22 | 0.07 | 32 | 15 | 8.76 | 0.61 |
| MW-24 | 3/13/87 | 0.205 | 3.26 | 0.0629 | 4390 | 900 | 8.1 | 0.51 |
| MW-25 | 2/27/88 | 0.317 | 3.0 | 0.106 | 4129 | 1309 | 7.30 | 0.77 |
| PW-1 | 2/27/88 | 0.13 | 2.12 | 0.06 | 4174 | 543 | 4.3 | 0.26 |
| MW-14 | | | | | | | | 0.75* |
| A | | | | | | | | 0.75* |
| B | | | | | | | | 0.75* |

* Estimated

STOP

TABLE 4

SAMPLE ANALYSIS

MW-25

| Parameter | Date Sampled 2-23-88 | 2-24-88 | 2-25-88 | 2-26-88 | 2-29-88 |
|---|---|---|---|---|---|
| Cyanide (mg/ℓ) | ND | ND | ND | ND | ND |
| TDS (mg/ℓ) | 820 | 960 | 900 | 900 | 860 |
| Hardness (mg/ℓ) | 132 | 253 | 828 | 288 | 288 |
| pH (pH units) | 7.4 | 7.5 | 7.4 | 7.4 | 7.4 |
| Total Chromium (mg/ℓ) | 0.036 | ND | 0.036 | ND | 0.027 |
| Methylene Chloride (ug/ℓ) | 3,800 | 9,400 | 2,800 | 2,700 | 4,200 |
| 1,1-Dichloroethylene (ug/ℓ) | 1,500 | 3,400 | 1,900 | 2,200 | 2,100 |
| 1,1,1-Thrichloroethane (ug/ℓ) | 24,000 | 39,000 | 37,000 | 35,000 | 42,000 |
| Thrichloroethene (ug/ℓ) | 32,000 | 54,000 | 46,000 | 43,000 | 47,000 |

ND - Not Deteched

TABLE 5

SAMPLE ANALYSIS

PW-1

| Parameter | Date Sampled 2-23-88 | 2-24-88 | 2-25-88 | 2-26-88 | 2-29-88 |
|---|---|---|---|---|---|
| Cyanide (mg/ℓ) | ND | ND | ND | ND | ND |
| TDS (mg/ℓ) | 1,200 | 1,000 | 840 | 650 | 680 |
| Hardness (mg/ℓ) | 469 | 352 | 321 | 196 | 179 |
| pH (pH units) | 12 | 11.7 | 11.3 | 10.1 | 11 |
| Total Chromium (mg/ℓ) | 0.033 | 0.029 | 0.031 | 0.026 | 0.029 |
| Methylene Chloride (ug/ℓ) | 16,000 | 16,000 | 11,000 | 10,000 | 10,000 |
| 1,1-Dichloroethylene (ug/ℓ) | 980 | 990 | 560 | 670 | 610 |
| 1,1,1-Thrichloroethane (ug/ℓ) | 2,100 | 2,100 | 1,700 | 1,700 | 1,400 |
| Thrichloroethene (ug/ℓ) | 8,000 | 9,000 | 7,200 | 7,400 | 6,200 |

*ND - Not Detected

# BIBLIOGRAPHY

Schafer, David C., 1978, Casing Storage Can Affect Pump Testing Data, The Johnson Drillers Journal.

# APPENDIX A

# PUMP TEST DATA

2/23 - 2/27

Well MW-25

Q 50 sec/ℓ

Static Water Level

| time (h:m:s) | t (min) | t' (min) | t/t' | Pressure (PSIG) | Drawdown (ft) | Meter (gal) | |
|---|---|---|---|---|---|---|---|
| 16:11:00 | 0 | | | 1.85 | 0.000 | | Pump ON ~~pH & EC~~ sampled |
| 16:11:30 | .5 | | | 1.85 | 0.053 | | |
| 16:12:00 | 1.0 | | | 1.90 | 0.032 | | |
| 16:12:30 | 1.5 | | | 1.90 | 0.021 | | |
| 16:13 | 2.0 | | | 1.90 | -0.021 | | |
| 16:14 | 3.0 | | | 1.80 | 0.329 | | |
| 16:15 | 4.0 | | | 1.75 | 0.445 | | |
| 16:16 | 5.0 | | | 1.65 | 0.594 | | |
| 16:17 | 6.0 | | | 1.20 | 1.283 | | |
| 16:19 | 8.0 | | | -- | 2.915 | | |
| 16:21 | 10.0 | | | -- | 3.265 | | 47sec/ℓ |
| 16:26 | 15.0 | | | -- | 3.710 | | |
| 16:31 | 20.0 | | | | 3.095 | | 47sec/ℓ |
| 16:34:30 | 23.5 | | | | 2.533 | | |
| 16:37:30 | 26.5 | | | | 2.449 | | 52sec/ℓ |
| 16:41 | 30.0 | | | | -- | | |
| 16:56 | 45.0 | | | | 2.555 | | 52sec/ℓ |
| 17:01 | 50.0 | | | | -- | | |
| 17:11 | 60.0 | | | | 3.562 | | |
| 17:21 | 70.0 | | | | 3.042 | | |
| 17:31 | 80.0 | | | | 2.555 | | 40sec/ℓ |
| 17:41 | 90.0 | | | | 3.074 | | 49sec/ℓ |
| 18:01 | 110.0 | | | | 2.714 | | 52sec/ℓ |
| 18:21 | 130.0 | | | | 2.544 | | 52sec/ℓ |
| 18:45 | 154.0 | | | | 2.533 | | 52sec/ℓ |
| 19:20 | 189.0 | | | | 2.745 | | 52sec/ℓ |
| 19:46 | 215.0 | | | | 2.798 | | 51sec/ℓ |
| 21:46 | 335.0 | | | | 2.618 | | |
| 22:46 | 395.0 | | | | 2.873 | | 52sec/ℓ |
| 23:42 | 451.0 | | | | 2.565 | | 52sec/ℓ |
| 24:46 | 515.0 | | | | 2.777 | | 52sec/ℓ |

2/23 - 2/27

Well MW-25

Q 50 sec/ℓ

Static Water Level

| time (h:m:s) | t (min) | t' (min) | t/t' | Pressure (PSIG) | Drawdown (ft) | Meter (gal) | |
|---|---|---|---|---|---|---|---|
| 1:47 | 576.0 | | | | 2.777 | | 52sec/ℓ |
| 2:46 | 635.0 | | | | 2.798 | | 52sec/ℓ |
| 3:47 | 696.0 | | | | 2.841 | | 52sec/ℓ |
| 4:49 | 758.0 | | | | 3.106 | | 50sec/ℓ |
| 5:47 | 816.0 | | | | 2.915 | | 50sec/ℓ |
| 6:49 | 878.0 | | | | 2.830 | | 51sec/ℓ |
| 7:46 | 935.0 | | | | 2.798 | | 52sec/ℓ |
| 8:48 | 997.0 | | | | 2.968 | | 51sec/ℓ |
| 9:43 | 1052.0 | | | | 2.979 | | 52sec/ℓ |
| 10:55 | 1124.0 | | | | 4.229 | | 53sec/ℓ |
| 11:03 | 1132.0 | | | | 3.212 | | 50sec/ℓ |
| 11:54 | 1183.0 | | | | 2.639 | | 50sec/ℓ |
| 13:00 | 1249.0 | | | | 2.597 | | 51sec/ℓ |
| 13:57 | 1306.0 | | | | 2.915 | | 49sec/ℓ |
| 14:51 | 1360.0 | | | | 3.403 | | 50sec/ℓ |
| 15:58 | 1427.0 | | | | 3.169 | | 50sec/ℓ |
| 16:53 | 1482.0 | | | | 3.180 | | 50sec/ℓ |
| 17:48 | 1535.0 | | | | 2.936 | | |
| 19:40 | 1649.0 | | | | 2.904 | | 52sec/ℓ |
| 20:31 | 1700.0 | | | | 3.053 | | 51sec/ℓ |
| 21:46 | 1775.0 | | | | 3.032 | | 49sec/ℓ |
| 22:46 | 1835.0 | | | | 2.618 | | 52sec/ℓ |
| 23:44 | 1893.0 | | | | 2.650 | | 53sec/ℓ |
| 25 24:46 | 1955.0 | | | | 2.523 | | 50sec/ℓ |
| 1:45 | 2014.0 | | | | 2.767 | | 52sec/ℓ |
| 2:45 | 2074.0 | | | | 3.148 | | 51sec/ℓ |
| 3:47 | 2136.0 | | | | 3.010 | | 50sec/ℓ |
| 4:46 | 2195.0 | | | | 2.820 | | 52sec/ℓ |
| 5:41 | 2250.0 | | | | 2.724 | | 50sec/ℓ |
| 6:47 | 2316.0 | | | | 2.703 | | 50sec/ℓ |
| 7:41 | 2370.0 | | | | 3.021 | | 50sec/ℓ |

2/23 - 2/27

Well MW-25

Q 50 sec/ℓ

Static Water Level

| time (h:m:s) | t (min) | t' (min) | t/t' | Pressure (PSIG) | Drawdown (ft) | Meter (gal) | |
|---|---|---|---|---|---|---|---|
| 8:41 | 2430.0 | | | | 2.830 | | 50sec/ℓ |
| 9:45 | 2494.0 | | | | 2.985 | | 55sec/ℓ |
| 10:48 | 2557.0 | | | | | | |
| 11:41 | 2610.0 | | | | 2.894 | | 52sec/ℓ |
| 13:20 | 2709.0 | | | | 2.533 | | 53sec/ℓ |
| 14:50 | 2799.0 | | | | 3.180 | | 54sec/ℓ |
| 15:59 | 2868.0 | | | | 3.127 | | 50sec/ℓ |
| 17:49 | 2978.0 | | | | 2.703 | | 50sec/ℓ |
| 18:46 | 3035.0 | | | | 2.947 | | 50sec/ℓ |
| 19:54 | 3103.0 | | | | 2.947 | | 52sec/ℓ |
| 21:55 | 3224.0 | | | | 3.201 | | 52sec/ℓ |
| 22:56 | 3285.0 | | | | 2.745 | | 50sec/ℓ |
| /26 24:43 | 3392.0 | | | | 3.095 | | 50sec/ℓ |
| 2:40 | 3499.0 | | | | 3.222 | | |
| 4:50 | 3639.0 | | | | 3.106 | | |
| 6:11 | 3720.0 | | | | 3.021 | | 50sec/ℓ |
| 6:48 | 3757.0 | | | | 3.021 | | 51sec/ℓ |
| 8:45 | 3874.0 | | | | 3.010 | | 52sec/ℓ |
| 10:42 | 3991.0 | | | | 2.809 | | 50sec/ℓ |
| 13:00:00 | 4129.0 | 0 | | | 2.894 | | Pump Off |
| 13:00:15 | 4129.25 | 0.25 | 16517.0 | | 2.184 | | |
| 13:00:30 | 4129.5 | 0.50 | 8259.0 | | 1.664 | | |
| 13:00:45 | 4129.75 | 0.75 | 5506.3 | | 1.367 | | |
| 13:01:00 | 4130.0 | 1.00 | 4130.0 | | 1.134 | | |
| 13:01:30 | 4130.5 | 1.5 | 2753.7 | | 0.933 | | |
| 13:02:00 | 4131.0 | 2.0 | 2065.5 | | 0.763 | | |
| 13:02:30 | 4131.5 | 2.5 | 1652.6 | | 0.615 | | |
| 13:03:00 | 4132.0 | 3.0 | 1377.3 | | 0.562 | | |
| 13:03:30 | 4132.5 | 3.5 | 1180.7 | | 0.519 | | |
| 13:04:00 | 4133.0 | 4.0 | 1033.3 | | 0.466 | | |
| 13:04:30 | 4133.5 | 4.5 | 918.6 | | 0.424 | | |

2/23 - 2/27

Well MW-25

Q 50 sec/ℓ

Static Water Level

| time (h:m:s) | t (min) | t' (min) | t/t' | Pressure (PSIG) | Drawdown (ft) | Meter (gal) | |
|---|---|---|---|---|---|---|---|
| 13:05 | 4134.0 | 5.0 | 826.8 | | 0.413 | | |
| 13:06 | 4135.0 | 6.0 | 689.2 | | 0.392 | | |
| 13:07 | 4136.0 | 7.0 | 590.9 | | 0.371 | | |
| 13:08 | 4137.0 | 8.0 | 517.1 | | 0.350 | | |
| 13:09 | 4138.0 | 9.0 | 459.8 | | 0.339 | | |
| 13:10 | 4139.0 | 10.0 | 413.9 | | 0.329 | | |
| 13:12 | 4141.0 | 12.0 | 345.1 | | 0.307 | | |
| 13:14 | 4143.0 | 14.0 | 295.9 | | 0.297 | | |
| 13:16 | 4145.0 | 16.0 | 259.1 | | 0.286 | | |
| 13:18 | 4147.0 | 18.0 | 230.4 | | 0.286 | | |
| 13:20 | 4149.0 | 20.0 | 207.5 | | 0.281 | | |
| 13:25 | 4154.0 | 25.0 | 166.2 | | 0.265 | | |
| 13:30 | 4159.0 | 30.0 | 138.6 | | 0.260 | | |
| 13:35 | 4164.0 | 35.0 | 119.0 | | 0.249 | | |
| 13:40 | 4169.0 | 40.0 | 104.2 | | 0.239 | | |
| 13:45 | 4174.0 | 45.0 | 92.8 | | 0.233 | | |
| 13:50 | 4179.0 | 50.0 | 83.6 | | 0.233 | | |
| 13:55 | 4184.0 | 55.0 | 76.1 | | 0.228 | | |
| 14:00 | 4189.0 | 60.0 | 69.8 | | 0.223 | | |
| 14:20 | 4209.0 | 80.0 | 52.6 | | 0.217 | | |
| 14:40 | 4229.0 | 100.0 | 42.3 | | 0.196 | | |
| 15:10 | 4259.0 | 130.0 | 32.8 | | 0.175 | | |
| 15:40 | 4289.0 | 160.0 | 26.8 | | 0.159 | | |
| 16:10 | 4319.0 | 190.0 | 22.7 | | 0.164 | | |
| 16:40 | 4349.0 | 220.0 | 19.8 | | 9.154 | | |
| 17:00 | 4369.0 | 240.0 | 18.2 | | 0.154 | | |
| 18:00 | 4429.0 | 300.0 | 14.8 | | 0.148 | | |
| 19:00 | 4489.0 | 360.0 | 12.5 | | 0.148 | | |
| 20:00 | 4549.0 | 420.0 | 10.8 | | 0.143 | | |
| 21:00 | 4609.0 | 480.0 | 9.6 | | 0.138 | | |
| 22:00 | 4669.0 | 540.0 | 8.6 | | 0.127 | | |

2/23 - 2/27

Well MW-25

Q 50sec/ℓ

Static Water Level

| time (h:m:s) | t (min) | t' (min) | t/t' | Pressure (PSIG) | Drawdown (ft) | Meter (gal) | |
|---|---|---|---|---|---|---|---|
| 23:00 | 4729.0 | 600.0 | 7.9 | | 0.106 | | |
| /27 24:00 | 4789.0 | 660.0 | 7.3 | | 0.106 | | |
| 1:00 | 4849.0 | 720.0 | 6.7 | | 0.117 | | |
| 2:00 | 4909.0 | 780.0 | 6.3 | | 0.085 | | |
| 3:00 | 4969.0 | 840.0 | 5.9 | | 0.085 | | |
| 4:00 | 5029.0 | 900.0 | 5.6 | | 0.095 | | |
| 5:00 | 5089.0 | 960.0 | 5.3 | | 0.095 | | |
| 6:00 | 5149.0 | 1020.0 | 5.0 | | 0.085 | | |
| 7:00 | 5209.0 | 1080.0 | 4.8 | | 0.085 | | |
| 8:00 | 5269.0 | 1140.0 | 4.6 | | 0.085 | | |
| 9:00 | 5329.0 | 1200.0 | 4.4 | | 0.074 | | |
| 9:50 | 5379.0 | 1250.0 | 4.3 | | 0.053 | | |
| 12:50 | 5559.0 | 1310.0 | 4.2 | | 0.021 | | |
| 15:19 | 5708.0 | 1459.0 | 3.9 | | 0.021 | | |
| 18:00 | 5869.0 | 1620.0 | 3.6 | | 0.048 | | |
| 21:00 | 6049.0 | 1800.0 | 3.4 | | 0.074 | | End of Test |

Date: 2/23 - 2/27

**METRIC Corporation**

Pumped Well MW-25

Measurements at Well MW-24

Pump Speed: _____ Q: 50sec/ℓ

Static Water Level _____

| | time (h:m:s) | t (min) | t' (min) | t/t' | Drawdown (ft) | Comments |
|---|---|---|---|---|---|---|
| 2/23 | 16:36 | 0.0 | | | 0.00 | |
| | 17:04 | 28.0 | | | 0.00 | |
| | 17:14 | 38.0 | | | 0.13 | |
| | 17:24 | 48.0 | | | 0.00 | |
| | 17:32 | 56.0 | | | 0.003 | |
| | 17:43 | 67.0 | | | 0.015 | |
| | 18:04 | 88.0 | | | 0.015 | |
| | 18:20 | 104.0 | | | 0.02 | |
| | 18:48 | 132.0 | | | 0.03 | |
| | 19:24 | 168.0 | | | 0.04 | |
| | 19:47 | 191.0 | | | 0.03 | |
| | 21:52 | 316.0 | | | 0.04 | |
| | 22:46 | 370.0 | | | 0.04 | |
| | 23:45 | 429.0 | | | 0.04 | |
| 2/ 4 | 24:46 | 490.0 | | | 0.04 | |
| | 1:47 | 551.0 | | | 0.05 | |
| | 2:46 | 610.0 | | | 0.05 | |
| | 3:47 | 671.0 | | | 0.055 | |
| | 4:50 | 734.0 | | | 0.06 | |
| | 5:49 | 793.0 | | | 0.07 | |
| | 6:51 | 855.0 | | | 0.07 | |
| | 7:46 | 910.0 | | | 0.08 | |
| | 8:48 | 972.0 | | | 0.07 | |
| | 9:42 | 1026.0 | | | 0.06 | |
| | 10:58 | 1102.0 | | | 0.07 | |
| | 11:48 | 1152.0 | | | 0.07 | |
| | 12:58 | 1222.0 | | | 0.10 | |
| | 13:57 | 1281.0 | | | 0.09 | |
| | 14:50 | 1334.0 | | | 0.06 | |
| | 15:55 | 1399.0 | | | 0.07 | |

Date: 2/23 - 2/27

**METRIC Corporation**

Pumped Well MW-25

Measurements at Well MW-24

Pump Speed: _____ Q: 50sec/ℓ

Static Water Level _____

| time (h:m:s) | t (min) | t' (min) | t/t' | Drawdown (ft) | Comments |
|---|---|---|---|---|---|
| 16:51 | 1455.0 | | | 0.08 | |
| 17:49 | 1513.0 | | | 0.08 | |
| 19:45 | 1629.0 | | | 0.08 | |
| 20:32 | 1676.0 | | | 0.10 | |
| 21:46 | 1750.0 | | | 0.10 | |
| 22:44 | 1808.0 | | | 0.10 | |
| 23:44 | 1868.0 | | | 0.10 | |
| 5 24:43 | 1927.0 | | | 0.06 | |
| 1:42 | 1986.0 | | | 0.11 | |
| 2:43 | 2047.0 | | | 0.10 | |
| 3:43 | 2107.0 | | | 0.10 | |
| 4:45 | 2169.0 | | | 0.11 | |
| 5:40 | 2224.0 | | | 0.11 | |
| 6:46 | 2290.0 | | | 0.12 | |
| 7:42 | 2346.0 | | | 0.13 | |
| 8:40 | 2404.0 | | | 0.12 | |
| 9:47 | 2471.0 | | | 0.11 | |
| 10:48 | 2532.0 | | | 0.10 | |
| 11:43 | 2587.0 | | | 0.11 | |
| 13:22 | 2686.0 | | | 0.09 | |
| 14:52 | 2776.0 | | | 0.11 | |
| 15:58 | 2842.0 | | | 0.11 | |
| 17:48 | 2952.0 | | | 0.12 | |
| 18:48 | 3012.0 | | | 0.11 | |
| 19:53 | 3077.0 | | | 0.12 | |
| 21:58 | 3202.0 | | | 0.13 | |
| 22:57 | 3261.0 | | | 0.14 | |
| 2/ 6 24:43 | 3367.0 | | | 0.13 | |
| 2:41 | 3485.0 | | | 0.12 | |
| 4:50 | 3614.0 | | | 0.13 | |

Date: 2/23 - 2/27

**METRIC Corporation**

Pumped Well MW-25

Measurements at Well MW-24

Pump Speed: _____ Q: 50sec/ℓ

Static Water Level _____

| time (h:m:s) | t (min) | t' (min) | t/t' | Drawdown (ft) | Comments |
|---|---|---|---|---|---|
| 6:12 | 3696.0 | | | 0.14 | |
| 6:48 | 3732.0 | | | 0.15 | |
| 8:44 | 3848.0 | | | 0.16 | |
| 10:40 | 3964.0 | | | 0.14 | |
| 13:00 | 4104.0 | 0 | - | 0.11 | Pump Off (Recovery) |
| 13:00:15 | 4104.25 | 0.25 | 16417.0 | 0.11 | |
| 13:00:30 | 4104.50 | 0.5 | 8209.0 | 0.11 | |
| 13:00:45 | 4104.75 | 0.75 | 5473.0 | 0.11 | |
| 13:01:00 | 4105.0 | 1.0 | 4105.0 | 0.11 | |
| 13:01:30 | 4105.50 | 1.5 | 2737.0 | 0.11 | |
| 13:02:00 | 4106.0 | 2.0 | 2053.0 | 0.11 | |
| 13:02:30 | 4106.50 | 2.5 | 1642.6 | 0.11 | |
| 13:03:00 | 4107.0 | 3.0 | 1369.0 | 0.11 | |
| 13:03:30 | 4107.50 | 3.5 | 1173.6 | 0.11 | |
| 13:04:00 | 4108.0 | 4.0 | 1027.0 | 0.11 | |
| 13:04:30 | 4108.5 | 4.5 | 913.0 | 0.11 | |
| 13:05 | 4109.0 | 5.0 | 821.8 | 0.11 | |
| 13:06 | 4110.0 | 6.0 | 685.0 | 0.11 | |
| 13:07 | 4111.0 | 7.0 | 587.3 | 0.11 | |
| 13:08 | 4112.0 | 8.0 | 514.0 | 0.11 | |
| 13:09 | 4113.0 | 9.0 | 457.0 | 0.105 | |
| 13:10 | 4114.0 | 10.0 | 411.4 | 0.103 | |
| 13:12 | 4116.0 | 12.0 | 343.0 | 0.102 | |
| 13:14 | 4118.0 | 14.0 | 294.1 | 0.10 | |
| 13:16 | 4120.0 | 16.0 | 257.5 | 0.10 | |
| 13:18 | 4122.0 | 18.0 | 229.0 | 0.10 | |
| 13:20 | 4124.0 | 20.0 | 206.2 | 0.095 | |
| 13:25 | 4129.0 | 25.0 | 165.2 | 0.09 | |
| 13:30 | 4134.0 | 30.0 | 137.8 | 0.088 | |
| 13:35 | 4139.0 | 35.0 | 118.3 | 0.085 | |

Date: 2/23 - 2/27

**METRIC Corporation**

Pumped Well PW-1

Measurements at Well PW-1

Pump Speed: _____ Q: 1ℓ/2min

Static Water Level _____

| time (h:m:s) | t (min) | t' (min) | t/t' | Drawdown (ft) | Comments |
|---|---|---|---|---|---|
| 22:05:00 | 3174.0 | | | 1.88 | 1ℓ/2:00min |
| 23:06:00 | 3235.0 | | | 1.88 | 1ℓ/2:00min |
| /26 24:49:00 | 3338.0 | | | 1.92 | 1ℓ/2:00min |
| 2:47:00 | 3456.0 | | | 1.86 | 1ℓ/2:00min |
| 4:59:00 | 3588.0 | | | 1.72 | |
| 5:17:00 | 3606.0 | | | 1.94 | 1ℓ/2:02min |
| 6:54:00 | 3703.0 | | | 2.00 | 1ℓ/2:00min |
| 8:55:00 | 3824.0 | | | 2.26 | 1ℓ/2:00min |
| 10:58:00 | 3947.0 | | | 2.01 | 1ℓ/2:00min |
| 13:34:00 | 4103.0 | | | 2.12 | |
| 14:20:00 | 4149.0 | | | 2.07 | |
| 14:45:00 | 4174.0 | 0 | -- | 1.98 | Pump Off (Recovery) |
| 14:45:15 | 4174.25 | 0.25 | 16697.0 | 1.96 | |
| 14:45:30 | 4174.50 | 0.50 | 8345.0 | 1.95 | |
| 14:45:45 | 4174.75 | 0.75 | 5566.3 | 1.94 | |
| 14:46:00 | 4175.0 | 1.0 | 4175.0 | 1.93 | |
| 14:46:30 | 4175.5 | 1.5 | 2783.7 | 1.91 | |
| 14:47:00 | 4176.0 | 2.0 | 2088.0 | 1.90 | |
| 14:47:30 | 4176.5 | 2.5 | 1670.6 | 1.88 | |
| 14:48:00 | 4177.0 | 3.0 | 1392.3 | 1.87 | |
| 14:48:30 | 4177.3 | 3.5 | 1193.5 | 1.86 | |
| 14:49:00 | 4178.0 | 4.0 | 1044.5 | 1.84 | |
| 14:49:30 | 4178.3 | 4.5 | 928.5 | 1.82 | |
| 14:50:00 | 4179.0 | 5.0 | 835.6 | 1.80 | |
| 14:51:00 | 4180.0 | 6.0 | 696.7 | 1.73 | |
| 14:52:00 | 4181.0 | 7.0 | 597.3 | 1.72 | |
| 14:53:00 | 4182.0 | 8.0 | 522.8 | 1.71 | |
| 14:54:00 | 4183.0 | 9.0 | 464.8 | 1.68 | |
| 14:55:00 | 4184.0 | 10.0 | 418.4 | 1.66 | |
| 14:57:00 | 4186.0 | 12.0 | 348.8 | 1.63 | |

Date: 2/23 - 2/27

**METRIC Corporation**

Pumped Well PW-1

Measurements at Well PW-1

Pump Speed: _____ Q: 1ℓ/2min

Static Water Level _____

| time (h:m:s) | t (min) | t' (min) | t/t' | Drawdown (ft) | Comments |
|---|---|---|---|---|---|
| 14:59:00 | 4188.0 | 14.0 | 299.1 | 1.55 | |
| 15:01:00 | 4190.0 | 16.0 | 261.9 | 1.53 | |
| 15:03:00 | 4192.0 | 18.0 | 232.9 | 1.50 | |
| 15:05:00 | 4194.0 | 20.0 | 209.7 | 1.46 | |
| 15:10:00 | 4199.0 | 25.0 | 168.0 | 1.35 | |
| 15:15:00 | 4204.0 | 30.0 | 140.1 | 1.25 | |
| 15:20:00 | 4209.0 | 35.0 | 120.3 | 1.16 | |
| 15:25:00 | 4214.0 | 40.0 | 105.4 | 1.04 | |
| 15:30:00 | 4219.0 | 45.0 | 93.8 | 0.96 | |
| 15:35:00 | 4224.0 | 50.0 | 84.5 | 0.93 | |
| 15:45:00 | 4234.0 | 60.0 | 70.6 | 0.76 | |
| 16:05:00 | 4254.0 | 80.0 | 53.2 | 0.585 | |
| 16:25:00 | 4274.0 | 100.0 | 42.7 | 0.42 | |
| 16:55:00 | 4304.0 | 130.0 | 33.1 | 0.25 | |
| 17:25:00 | 4334.0 | 160.0 | 27.1 | 0.14 | |
| 17:55:00 | 4364.0 | 190.0 | 23.0 | 0.07 | |
| 18:25:00 | 4394.0 | 220.0 | 20.0 | 0.03 | |
| 18:45:00 | 4414.0 | 240.0 | 18.4 | 0.01 | |
| 19:45:00 | 4474.0 | 300.0 | 14.9 | -0.02 | |
| 20:45:00 | 4534.0 | 360.0 | 12.6 | -0.04 | |
| 21:45:00 | 4594.0 | 420.0 | 10.5 | -0.05 | |
| | | | | | |
| /27 6:20:00 | 5109.0 | 935.0 | 5.5 | -0.04 | End of Test |
| | | | | | |
| | | | | | |
| | | | | | |
| | | | | | |
| | | | | | |
| | | | | | |
| | | | | | |

Date: 2/23 - 2/27

**METRIC Corporation**

Pumped Well PW-1

Measurements at Well MW-9

Pump Speed: _____ Q: 1ℓ/2.00 min

Static Water Level _____

| time (h:m:s) | t (min) | t' (min) | t/t' | Drawdown (ft) | Comments |
|---|---|---|---|---|---|
| 17:11 | 0.0 | | | 0.00 | Pump On |
| 17:23 | 12.0 | | | 0.00 | |
| 17:34 | 23.0 | | | 0.00 | |
| 17:49 | 38.0 | | | 0.01 | |
| 17:59 | 48.0 | | | 0.01 | |
| 18:10 | 59.0 | | | 0.01 | |
| 18:26 | 75.0 | | | 0.00 | |
| 18:58 | 107.0 | | | -0.07 | |
| 19:35 | 144.0 | | | -0.02 | |
| 20:14 | 183.0 | | | -0.07 | |
| 20:50 | 219.0 | | | -0.02 | |
| 22:00 | 289.0 | | | 0.03 | |
| 22:50 | 339.0 | | | 0.03 | |
| 23:51 | 400.0 | | | 0.04 | |
| 24:50 | 459.0 | | | 0.03 | |
| 1:51 | 520.0 | | | 0.03 | |
| 2:52 | 581.0 | | | 0.03 | |
| 3:48 | 637.0 | | | 0.03 | |
| 4:53 | 702.0 | | | 0.03 | |
| 5:53 | 762.0 | | | 0.08 | |
| 6:57 | 826.0 | | | 0.02 | |
| 7:59 | 888.0 | | | 0.03 | |
| 8:55 | 944.0 | | | 0.03 | |
| 9:45 | 994.0 | | | 0.01 | |
| 10:38 | 1047.0 | | | 0.01 | |
| 11:59 | 1128.0 | | | - | |
| 13:05 | 1194.0 | | | 0.02 | |
| 14:04 | 1253.0 | | | 0.01 | |
| 14:56 | 1305.0 | | | 0.00 | |
| 15:44 | 1353.0 | | | 0.01 | |

Date: 2/23 - 2/27

**METRIC Corporation**

Pumped Well PW-1

Measurements at Well MW-9

Pump Speed: _____ Q: 1ℓ/2.00 min

Static Water Level _____

| time (h:m:s) | t (min) | t' (min) | t/t' | Drawdown (ft) | Comments |
|---|---|---|---|---|---|
| 4:57 | 3586.0 | | | 0.04 | |
| 6:19 | 3668.0 | | | 0.04 | |
| 6:55 | 3704.0 | | | 0.04 | |
| 8:57 | 3826.0 | | | 0.05 | |
| 10:56 | 3945.0 | | | 0.04 | |
| 13:34 | 4103.0 | | | 0.03 | |
| 14:20 | 4149.0 | | | -0.07 | |
| 14:45:00 | 4174.0 | 0 | | 0.02 | Pump Off (Recovery) |
| 14:45:15 | 4174.25 | 0.25 | 16697.0 | 0.02 | |
| 14:45:30 | 4174.50 | 0.50 | 8345.0 | 0.02 | |
| 14:45:45 | 4174.75 | 0.75 | 5566.3 | 0.02 | |
| 14:46:00 | 4175.0 | 1.0 | 4175.0 | 0.02 | |
| 14:46:30 | 4175.5 | 1.5 | 2783.7 | 0.02 | |
| 14:47:00 | 4176.0 | 2.0 | 2088.0 | 0.02 | |
| 14:47:30 | 4176.5 | 2.5 | 1670.6 | 0.02 | |
| 14:48:00 | 4177.0 | 3.0 | 1392.3 | 0.02 | |
| 14:48:30 | 4177.5 | 3.5 | 1193.5 | 0.02 | |
| 14:49:00 | 4178.0 | 4.0 | 1044.5 | 0.02 | |
| 14:49:30 | 4178.5 | 4.5 | 928.5 | 0.02 | |
| 14:50 | 4179.0 | 5.0 | 835.6 | 0.02 | |
| 14:51 | 4180.0 | 6.0 | 696.7 | 0.02 | |
| 14:52 | 4181.0 | 7.0 | 597.3 | 0.02 | |
| 14:53 | 4182.0 | 8.0 | 522.8 | 0.02 | |
| 15:54 | 4183.0 | 9.0 | 464.8 | 0.02 | |
| 15:55 | 4184.0 | 10.0 | 418.4 | 0.02 | |
| 14:57 | 4186.0 | 12.0 | 348.8 | 0.02 | |
| 14:59 | 4188.0 | 14.0 | 299.1 | 0.02 | |
| 15:01 | 4190.0 | 16.0 | 261.9 | 0.02 | |
| 15:03 | 4192.0 | 18.0 | 232.9 | 0.02 | |
| 15:05 | 4194.0 | 20.0 | 209.7 | 0.02 | |

Date: 2/23 - 2/27

**METRIC Corporation**

Pumped Well PW-1

Measurements at Well MW-9

Pump Speed: _____ Q: 1ℓ/2.00 min⁻

Static Water Level _____

| time (h:m:s) | t (min) | t' (min) | t/t' | Drawdown (ft) | Comments |
|---|---|---|---|---|---|
| 15:10 | 4199.0 | 25.0 | 168.0 | 0.02 | |
| 15:15 | 4204.0 | 30.0 | 140.1 | 0.019 | |
| 15:20 | 4209.0 | 35.0 | 120.3 | 0.014 | |
| 15:25 | 4214.0 | 40.0 | 105.4 | 0.01 | |
| 15:30 | 4219.0 | 45.0 | 93.8 | 0.01 | |
| 15:35 | 4224.0 | 50.0 | 84.5 | 0.009 | |
| 15:40 | 4229.0 | 55.0 | 76.9 | 0.009 | |
| 15:45 | 4234.0 | 60.0 | 70.6 | 0.009 | |
| 16:05 | 4254.0 | 80.0 | 53.2 | 0.00 | |
| 16:25 | 4274.0 | 100.0 | 42.7 | 0.00 | |
| 16:55 | 4304.0 | 130.0 | 33.1 | 0.00 | |
| 17:25 | 4334.0 | 160.0 | 27.1 | 0.00 | |
| 17:55 | 4364.0 | 190.0 | 23.0 | 0.00 | |
| 18:15 | 4384.0 | 210.0 | 20.9 | 0.00 | |
| 19:15 | 4444.0 | 270.0 | 16.5 | 0.00 | |
| 20:15 | 4504.0 | 330.0 | 13.6 | 0.00 | |
| 21:45 | 4594.0 | 420.0 | 10.5 | 0.00 | |
| | | | | | |
| 6:20 | 5109.0 | 935.0 | 5.5 | 0.00 | End of Test |

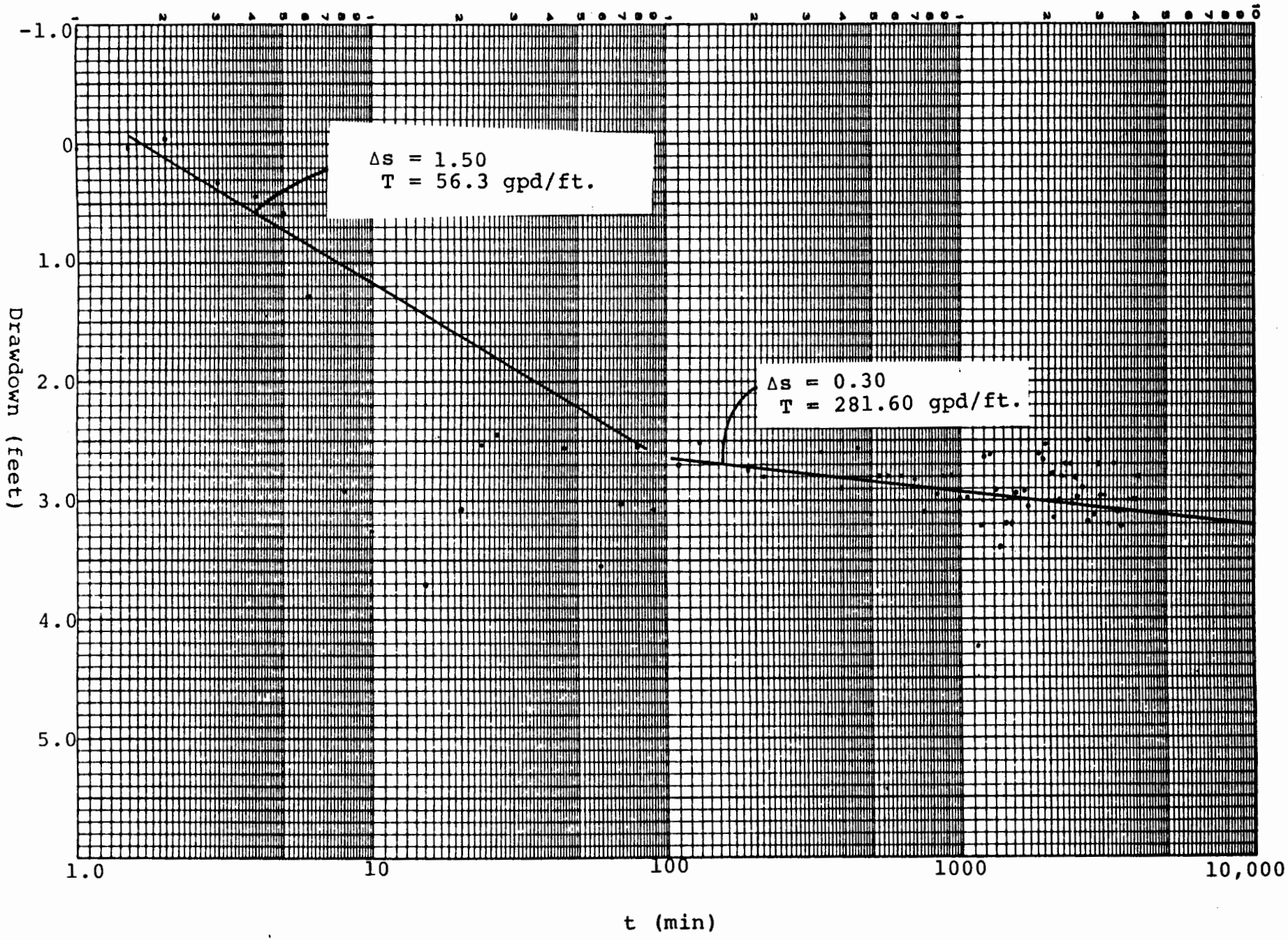
# APPENDIX B

# AQUIFER TEST DATA PLOTS

Pumped Well MW-25
Observations at Well MW-25

Time-Drawdown
Q = 0.32 gpm

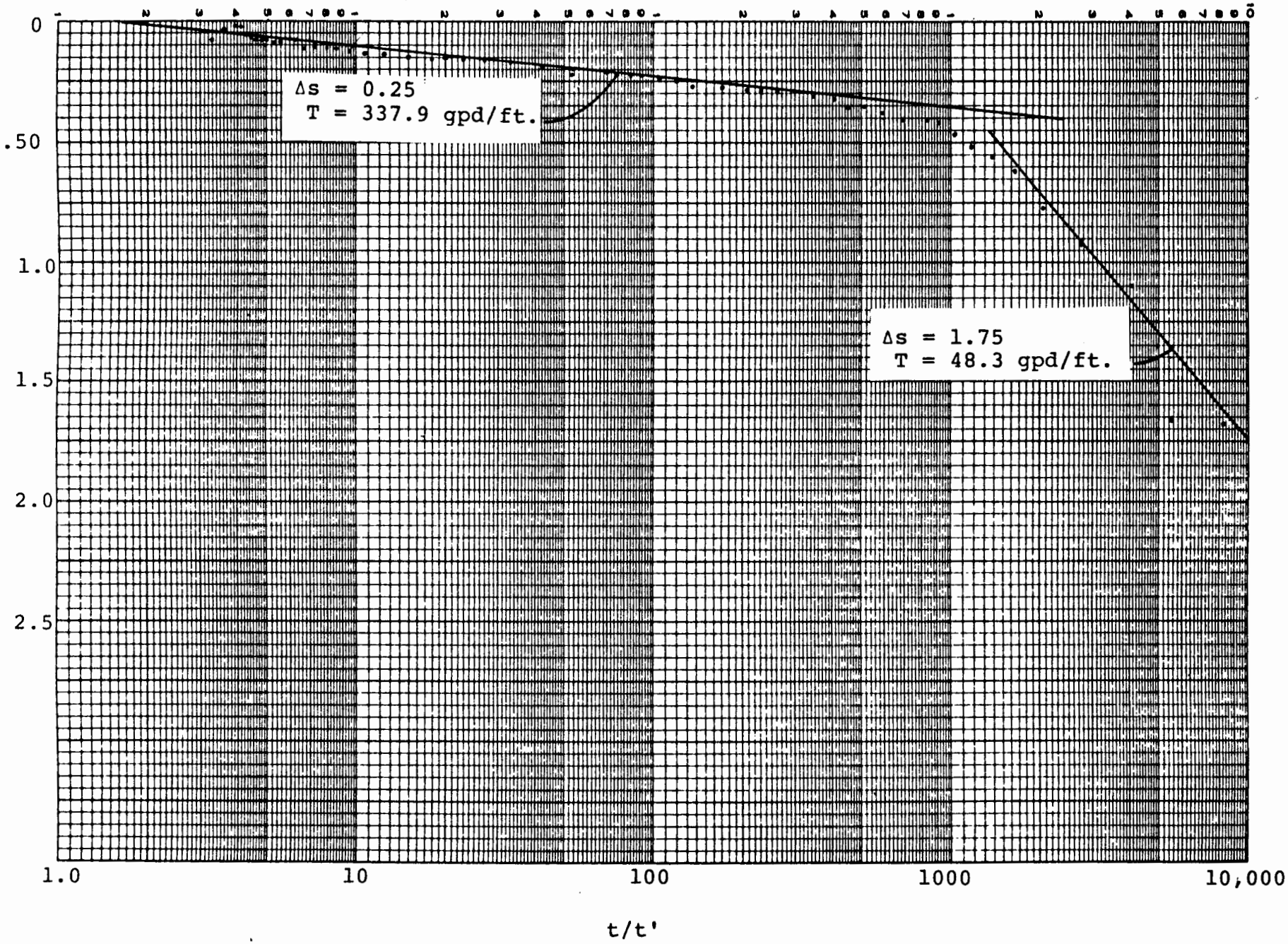
METRIC Corporation
Date: 2/88



Pumped Well MW-25
Observations at Well MW-25

Residual-Drawdown
Q = 0.32 gpm

METRIC Corporation
Date: 2/88

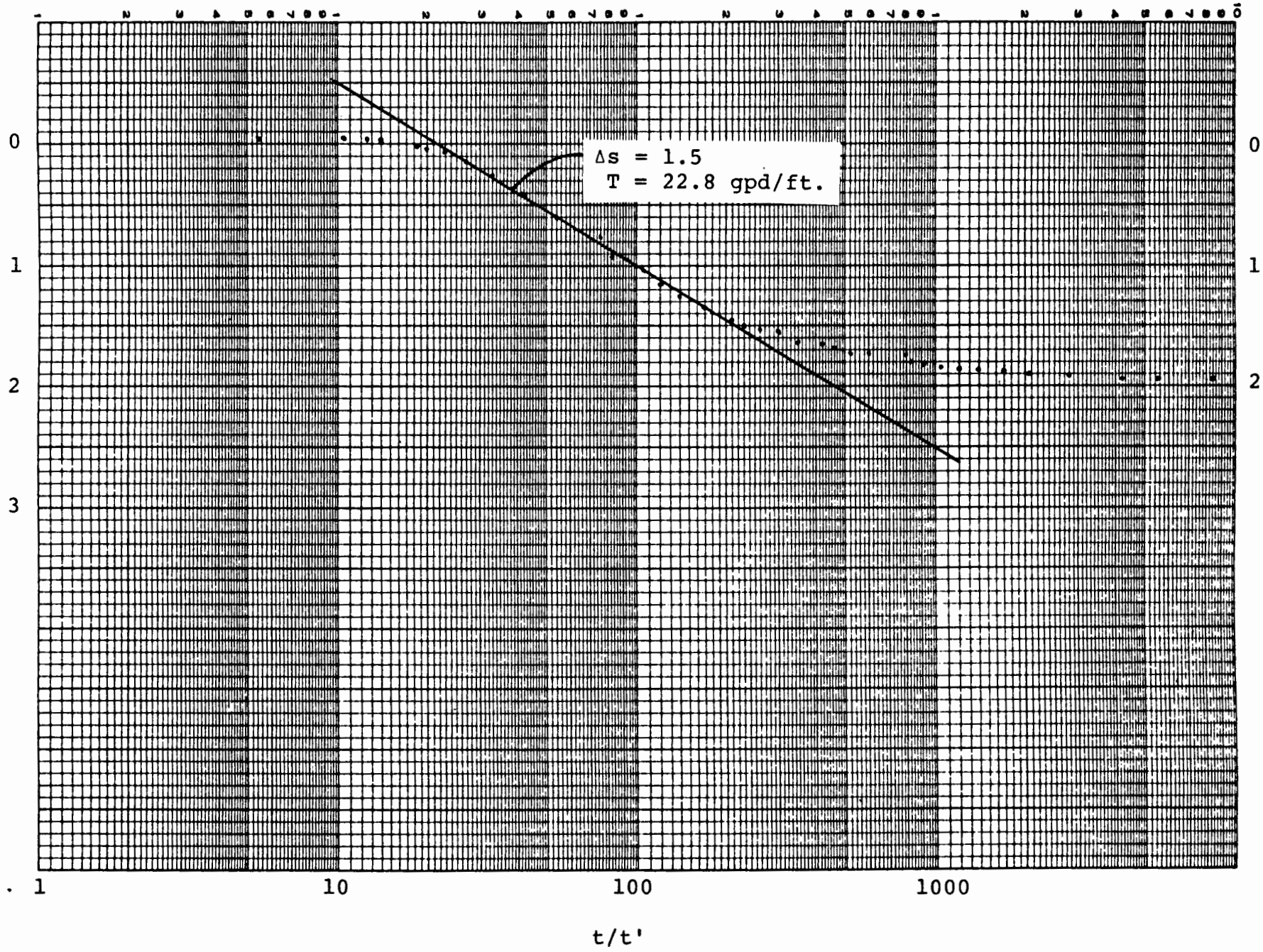



(2.184, 16,517)

Pumped Well PW-1
Observations at Well PW-1

Residual-Drawdown
Q = 0.13gpm

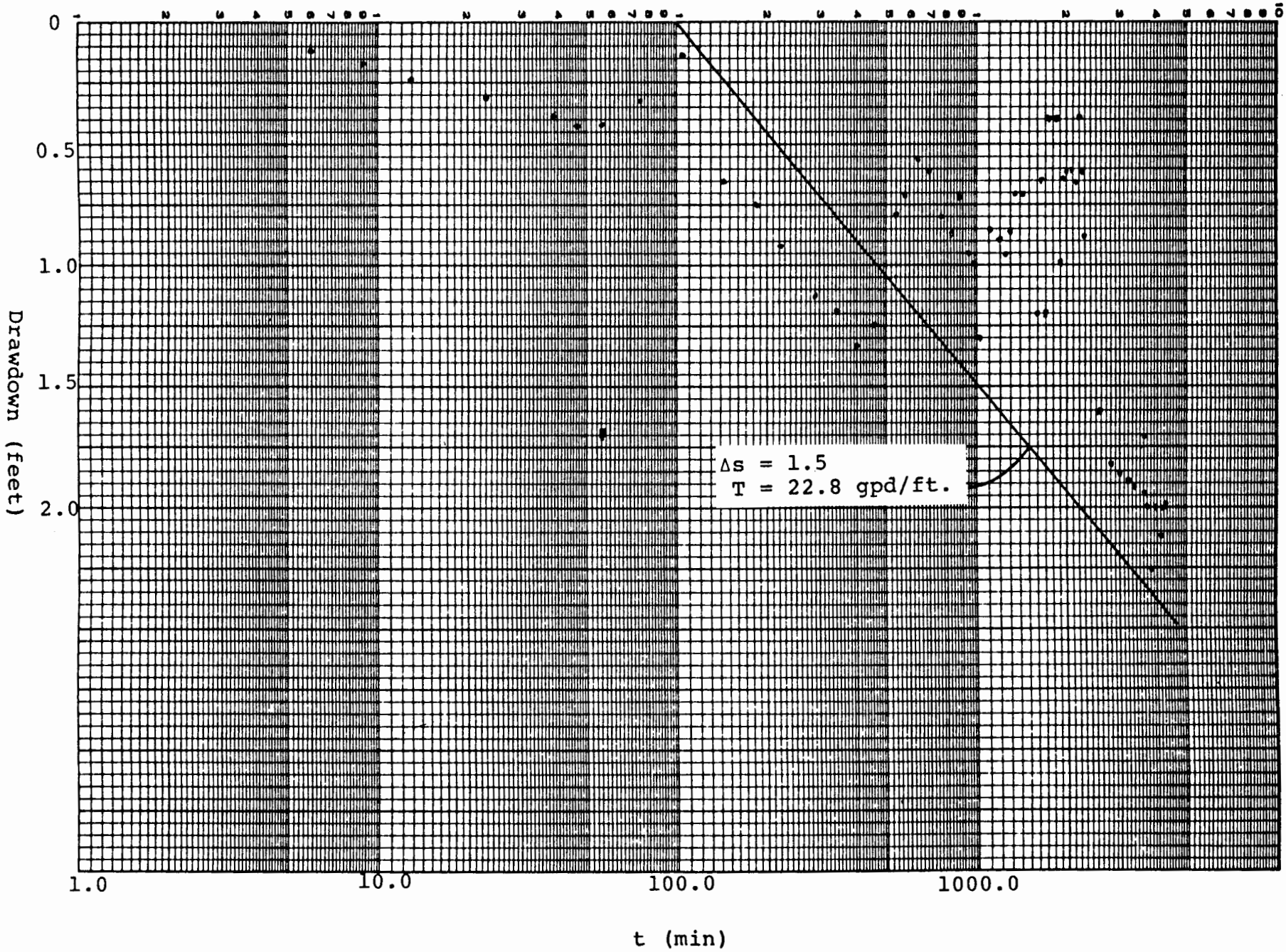
METRIC Corporation
Date: 2/23 - 2/27



Pumped Well PW-1
Observations at Well PW-1

Time-Drawdown
Q = 0.13gpm

METRIC Corporation
Date: 2/23 - 2/27



# APPENDIX C
# WATER QUALITY ANALYSES

2-23

Analytical Technologies, Inc.

MARCH 23, 1988

METRIC CORPORATION
8429 WASHINGTON
ALBUQUERQUE, NM 87111

Accession: 16002

Date Received: 2/24/88

Attention: GARY RICHARDSON

Project: SPARTON

Note: VERBALS CALLED TO PETER METZNER.

Michael G. Barry
Project Manager

Robert V. Woods
Laboratory Manager

RVW/jlf

Note: Samples will be disposed of within 30 days unless otherwise notified.

Analytical Technologies, Inc.

INDICATORS
PROJECT: SPARTON

SAMPLE DATE: 2/23/88
LAB RECEIPT DATE: 2/24/88
MATRIX: WATER

SAMPLE ID: WITH SODIUM HYDROXIDE MW-25
LOCATION:
LAB SAMPLE #: 16002-3
UNITS: mg/l

| ANALYST | ANALYSIS DATE | CONSTITUENT NAME | DILUTION FACTOR | DETECTION LIMIT | RESULT |
|---|---|---|---|---|---|
| DW | 3/10/88 | CYANIDE (CN) | 1 | 0.01 | ND |

* THE LISTED DETECTION LIMITS REFLECT ANY SAMPLE DILUTION.

NOTE: ND = NOT DETECTED
NA = NOT ANALYZED

PROJECT MANAGER: M. Fahey DATE: 3/23/88

Analytical Technologies, Inc.

INDICATORS
PROJECT: SPARTON

SAMPLE DATE: 2/23/88
LAB RECEIPT DATE: 2/24/88
MATRIX: WATER

SAMPLE ID: WITH SODIUM HYDROXIDE PW-1
LOCATION:
LAB SAMPLE #: 16002-7
UNITS: mg/l

| ANALYST | ANALYSIS DATE | CONSTITUENT NAME | DILUTION FACTOR | DETECTION LIMIT | RESULT |
|---|---|---|---|---|---|
| DW | 3/10/88 | CYANIDE (CN) | 1 | 0.01 | ND |

* THE LISTED DETECTION LIMITS REFLECT ANY SAMPLE DILUTION.

NOTE: ND = NOT DETECTED
NA = NOT ANALYZED

PROJECT MANAGER: K. Fairing DATE: 3/23/88

Analytical Technologies, Inc.

INDICATORS
PROJECT: SPARTON

SAMPLE DATE: 2/23/88
LAB RECEIPT DATE: 2/24/88
MATRIX: WATER

SAMPLE ID:RAW MW-25
LOCATION:
LAB SAMPLE #: 16002-1
UNITS: mg/l

| ANALYST | ANALYSIS DATE | CONSTITUENT NAME | DILUTION FACTOR | DETECTION LIMIT | RESULT |
|---|---|---|---|---|---|
| DW | 3/07/88 | TOTAL DISSOLVED SOLIDS | 1 | 20 | 820 |
| JH | 3/15/88 | HARDNESS | 1 | 0.5 | 132 |
| DW | 3/14/88 | CORROSIVITY (pH) | - | --- | 7.4 |

* THE LISTED DETECTION LIMITS REFLECT ANY SAMPLE DILUTION.

NOTE: ND = NOT DETECTED
NA = NOT ANALYZED

PROJECT MANAGER: M. Fabio DATE: 3/23/88

Analytical Technologies, Inc.

INDICATORS
PROJECT: SPARTON

SAMPLE DATE: 2/23/88
LAB RECEIPT DATE: 2/24/88
MATRIX: WATER

SAMPLE ID:RAW PW-1
LOCATION:
LAB SAMPLE #: 16002-5
UNITS: mg/l

| ANALYST | ANALYSIS DATE | CONSTITUENT NAME | DILUTION FACTOR | DETECTION LIMIT | RESULT |
|---|---|---|---|---|---|
| DW | 3/07/88 | TOTAL DISSOLVED SOLIDS | 1 | 20 | 1200 |
| JH | 3/15/88 | HARDNESS | 1 | 0.5 | 469 |
| DW | 3/14/88 | CORROSIVITY (pH) | - | --- | 12 |

* THE LISTED DETECTION LIMITS REFLECT ANY SAMPLE DILUTION.

NOTE: ND = NOT DETECTED
NA = NOT ANALYZED

PROJECT MANAGER: M. Bailey DATE: 3/23/88

Analytical Technologies, Inc

METALS
PROJECT: SPARTON

SAMPLE DATE: 2/23/88
LAB RECEIPT DATE: 2/24/88
MATRIX: WATER

SAMPLE ID: MW-25
LOCATION:
LAB SAMPLE #: 16002-2
UNITS: mg/l

| ANALYST | ANALYSIS DATE | CONSTITUENT NAME | DILUTION FACTOR | DETECTION LIMIT | RESULT |
|---|---|---|---|---|---|
| JH | 3/07/88 | CHROMIUM (Cr Tot) | 1 | 0.020 | 0.036 |

* THE LISTED DETECTION LIMITS REFLECT ANY SAMPLE DILUTION.

NOTE: ND = NOT DETECTED
NA = NOT ANALYZED

PROJECT MANAGER: T. Bailey DATE: 3/23/88

Analytical Technologies, Inc.

METALS
PROJECT: SPARTON

SAMPLE DATE: 2/23/88
LAB RECEIPT DATE: 2/24/88
MATRIX: WATER

SAMPLE ID: PW-1
LOCATION:
LAB SAMPLE #: 16002-6
UNITS: mg/l

| ANALYST | ANALYSIS DATE | CONSTITUENT NAME | DILUTION FACTOR | DETECTION LIMIT | RESULT |
|---|---|---|---|---|---|
| JH | 3/07/88 | CHROMIUM (Cr Tot) | 1 | 0.020 | 0.033 |

* THE LISTED DETECTION LIMITS REFLECT ANY SAMPLE DILUTION.

NOTE: ND = NOT DETECTED
NA = NOT ANALYZED

PROJECT MANAGER: M Barry DATE: 3/23/88

Analytica Technologies, Inc

EPA METHOD 601
PROJECT: SPARTON

SAMPLE DATE: 2/23/88
LAB RECEIPT DATE: 2/24/88
ANALYSIS DATE: 2/25/88
MATRIX: WATER
ANALYST: TMG

SAMPLE ID: MW-25
LOCATION:
LAB SAMPLE #: 16002-4
UNITS: ug/l
DILUTION FACTOR: 1000

| CONSTITUENT NAME | DETECTION LIMIT | RESULT |
|---|---|---|
| CHLOROMETHANE | 200 | ND |
| BROMOMETHANE | 200 | ND |
| DICHLORODIFLUOROMETHANE | 200 | ND |
| VINYL CHLORIDE | 200 | ND |
| CHLOROETHANE | 200 | ND |
| METHYLENE CHLORIDE | 2000 | 3800 |
| TRICHLOROFLUOROMETHANE | 2000 | ND |
| 1,1-DICHLOROETHENE | 200 | 1500 |
| 1,1-DICHLOROETHANE | 200 | ND |
| TRANS-1,2-DICHLOROETHENE | 200 | ND |
| CHLOROFORM | 200 | ND |
| 1,2-DICHLOROETHANE | 200 | ND |
| 1,1,1-TRICHLOROETHANE | 200 | 24,000 |
| CARBON TETRACHLORIDE | 200 | ND |
| BROMODICHLOROMETHANE | 200 | ND |
| 1,2-DICHLOROPROPANE | 200 | ND |
| TRANS-1,3-DICHLOROPROPENE | 200 | ND |
| TRICHLOROETHENE | 200 | 32,000 |
| DIBROMOCHLOROMETHANE | 200 | ND |
| 1,1,2-TRICHLOROETHANE | 200 | ND |
| CIS-1,3-DICHLOROPROPENE | 200 | ND |
| 2-CHLOROETHYLVINYL ETHER | 500 | ND |
| BROMOFORM | 500 | ND |
| 1,1,2,2-TETRACHLOROETHANE | 200 | ND |
| TETRACHLOROETHENE | 200 | ND |
| CHLOROBENZENE | 500 | ND |
| 1,3-DICHLOROBENZENE | 500 | ND |
| 1,2-DICHLOROBENZENE | 500 | ND |
| 1,4-DICHLOROBENZENE | 500 | ND |

% SURROGATE RECOVERY
80.2% BROMOCHLOROMETHANE

COMMENTS: ND = NOT DETECTED
HIGH LEVELS REQUIRED DILUTION.

PROJECT MANAGER: M. Baily

DATE: 3/23/88

Analytical Technologies, Inc

EPA METHOD 601
PROJECT: SPARTON

SAMPLE DATE: 2/23/88
LAB RECEIPT DATE: 2/24/88
ANALYSIS DATE: 2/25/88
MATRIX: WATER
ANALYST: TMG

SAMPLE ID: PW-1
LOCATION:
LAB SAMPLE #: 16002-8
UNITS: ug/l
DILUTION FACTOR: 500

| CONSTITUENT NAME | DETECTION LIMIT | RESULT |
|---|---|---|
| CHLOROMETHANE | 100 | ND |
| BROMOMETHANE | 100 | ND |
| DICHLORODIFLUOROMETHANE | 100 | ND |
| VINYL CHLORIDE | 100 | ND |
| CHLOROETHANE | 100 | ND |
| METHYLENE CHLORIDE | 1000 | 16,000 |
| TRICHLOROFLUOROMETHANE | 1000 | ND |
| 1,1-DICHLOROETHENE | 100 | 980 |
| 1,1-DICHLOROETHANE | 100 | ND |
| TRANS-1,2-DICHLOROETHENE | 100 | ND |
| CHLOROFORM | 100 | ND |
| 1,2-DICHLOROETHANE | 100 | ND |
| 1,1,1-TRICHLOROETHANE | 100 | 2,100 |
| CARBON TETRACHLORIDE | 100 | ND |
| BROMODICHLOROMETHANE | 100 | ND |
| 1,2-DICHLOROPROPANE | 100 | ND |
| TRANS-1,3-DICHLOROPROPENE | 100 | ND |
| TRICHLOROETHENE | 100 | 8,000 |
| DIBROMOCHLOROMETHANE | 100 | ND |
| 1,1,2-TRICHLOROETHANE | 100 | ND |
| CIS-1,3-DICHLOROPROPENE | 100 | ND |
| 2-CHLOROETHYLVINYL ETHER | 250 | ND |
| BROMOFORM | 250 | ND |
| 1,1,2,2-TETRACHLOROETHANE | 100 | ND |
| TETRACHLOROETHENE | 100 | ND |
| CHLOROBENZENE | 250 | ND |
| 1,3-DICHLOROBENZENE | 250 | ND |
| 1,2-DICHLOROBENZENE | 250 | ND |
| 1,4-DICHLOROBENZENE | 250 | ND |

% SURROGATE RECOVERY
101% BROMOCHLOROMETHANE

COMMENTS: ND = NOT DETECTED
HIGH LEVELS REQUIRED DILUTION.

PROJECT MANAGER: M. Baig

DATE: 3/23/88

Analytica Technologies, Inc

EPA METHOD 601
PROJECT: SPARTON

SAMPLE DATE: N/A
LAB RECEIPT DATE: 2/24/88
ANALYSIS DATE: 2/25/88
MATRIX: WATER
ANALYST: TMG

SAMPLE ID: TRIP BLANK
LOCATION:
LAB SAMPLE #: 16002
UNITS: ug/l
DILUTION FACTOR: 1

| CONSTITUENT NAME | DETECTION LIMIT | RESULT |
|---|---|---|
| CHLOROMETHANE | 0.2 | ND |
| BROMOMETHANE | 0.2 | ND |
| DICHLORODIFLUOROMETHANE | 0.2 | ND |
| VINYL CHLORIDE | 0.2 | ND |
| CHLOROETHANE | 0.2 | ND |
| METHYLENE CHLORIDE | 2.0 | 3.4 |
| TRICHLOROFLUOROMETHANE | 2.0 | ND |
| 1,1-DICHLOROETHENE | 0.2 | ND |
| 1,1-DICHLOROETHANE | 0.2 | ND |
| TRANS-1,2-DICHLOROETHENE | 0.2 | ND |
| CHLOROFORM | 0.2 | ND |
| 1,2-DICHLOROETHANE | 0.2 | ND |
| 1,1,1-TRICHLOROETHANE | 0.2 | ND |
| CARBON TETRACHLORIDE | 0.2 | ND |
| BROMODICHLOROMETHANE | 0.2 | ND |
| 1,2-DICHLOROPROPANE | 0.2 | ND |
| TRANS-1,3-DICHLOROPROPENE | 0.2 | ND |
| TRICHLOROETHENE | 0.2 | ND |
| DIBROMOCHLOROMETHANE | 0.2 | ND |
| 1,1,2-TRICHLOROETHANE | 0.2 | ND |
| CIS-1,3-DICHLOROPROPENE | 0.2 | ND |
| 2-CHLOROETHYLVINYL ETHER | 0.5 | ND |
| BROMOFORM | 0.5 | ND |
| 1,1,2,2-TETRACHLOROETHANE | 0.2 | ND |
| TETRACHLOROETHENE | 0.2 | ND |
| CHLOROBENZENE | 0.5 | ND |
| 1,3-DICHLOROBENZENE | 0.5 | ND |
| 1,2-DICHLOROBENZENE | 0.5 | ND |
| 1,4-DICHLOROBENZENE | 0.5 | ND |

COMMENTS: ND = NOT DETECTED

% SURROGATE RECOVERY
83.5% BROMOCHLOROMETHANE

PROJECT MANAGER: [illegible]

DATE: 3/23/88

Analytical Technologies, Inc.

EPA METHOD 601
PROJECT: SPARTON

SAMPLE DATE: N/A
LAB RECEIPT DATE: N/A
ANALYSIS DATE: 2/25/88
MATRIX: WATER
ANALYST: TMG

SAMPLE ID: WATER BLANK
LOCATION:
LAB SAMPLE #: 16002
UNITS: ug/l
DILUTION FACTOR: 1

| CONSTITUENT NAME | DETECTION LIMIT | RESULT |
|---|---|---|
| CHLOROMETHANE | 0.2 | ND |
| BROMOMETHANE | 0.2 | ND |
| DICHLORODIFLUOROMETHANE | 0.2 | ND |
| VINYL CHLORIDE | 0.2 | ND |
| CHLOROETHANE | 0.2 | ND |
| METHYLENE CHLORIDE | 2.0 | 4.1 |
| TRICHLOROFLUOROMETHANE | 2.0 | ND |
| 1,1-DICHLOROETHENE | 0.2 | ND |
| 1,1-DICHLOROETHANE | 0.2 | ND |
| TRANS-1,2-DICHLOROETHENE | 0.2 | ND |
| CHLOROFORM | 0.2 | ND |
| 1,2-DICHLOROETHANE | 0.2 | ND |
| 1,1,1-TRICHLOROETHANE | 0.2 | ND |
| CARBON TETRACHLORIDE | 0.2 | ND |
| BROMODICHLOROMETHANE | 0.2 | ND |
| 1,2-DICHLOROPROPANE | 0.2 | ND |
| TRANS-1,3-DICHLOROPROPENE | 0.2 | ND |
| TRICHLOROETHENE | 0.2 | ND |
| DIBROMOCHLOROMETHANE | 0.2 | ND |
| 1,1,2-TRICHLOROETHANE | 0.2 | ND |
| CIS-1,3-DICHLOROPROPENE | 0.2 | ND |
| 2-CHLOROETHYLVINYL ETHER | 0.5 | ND |
| BROMOFORM | 0.5 | ND |
| 1,1,2,2-TETRACHLOROETHANE | 0.2 | ND |
| TETRACHLOROETHENE | 0.2 | ND |
| CHLOROBENZENE | 0.5 | ND |
| 1,3-DICHLOROBENZENE | 0.5 | ND |
| 1,2-DICHLOROBENZENE | 0.5 | ND |
| 1,4-DICHLOROBENZENE | 0.5 | ND |

COMMENTS: ND = NOT DETECTED

% SURROGATE RECOVERY
96.1% BROMOCHLOROMETHANE

PROJECT MANAGER: T. Barry

DATE: 3/23/88

Analytical Technologies, Inc.

2-24

MARCH 24, 1988

METRIC CORPORATION
8429 WASHINGTON
ALBUQUERQUE, NM 87113

Accession: 16007

Date Received: 2/25/88

Attention: GARY RICHARDSON

Project: SPARTON

Mike Barry
Project Manager

Robert V. Woods
Laboratory Manager

RVW/jlf

Note: Samples will be disposed of within 30 days unless otherwise notified.

Analytical Technologies, Inc.

INDICATORS
PROJECT: SPARTON

SAMPLE DATE: 2/24/88

SAMPLE ID: MW-25 WITH SODIUM HYDROXIDE

LAB RECEIPT DATE: 2/25/88

LOCATION:

MATRIX: H2O

LAB SAMPLE #: 16007-3

UNITS: mg/l

| ANALYST | ANALYSIS DATE | CONSTITUENT NAME | DILUTION FACTOR | DETECTION LIMIT | RESULT |
|---|---|---|---|---|---|
| DW | 3/10/88 | CYANIDE (CN) | 1 | 0.01 | ND |

* THE LISTED DETECTION LIMITS REFLECT ANY SAMPLE DILUTION.

NOTE: ND = NOT DETECTED
NA = NOT ANALYZED

PROJECT MANAGER: EP

DATE: 3/24/88

Analytical Technologies, Inc.

INDICATORS
PROJECT: SPARTON

SAMPLE DATE: 2/24/88

SAMPLE ID: PW-1 WITH SODIUM HYDROXIDE

LAB RECEIPT DATE: 2/25/88

LOCATION:

MATRIX: H2O

LAB SAMPLE #: 16007-8

UNITS: mg/l

| ANALYST | ANALYSIS DATE | CONSTITUENT NAME | DILUTION FACTOR | DETECTION LIMIT | RESULT |
|---|---|---|---|---|---|
| DW | 3/10/88 | CYANIDE (CN) | 1 | 0.01 | ND |

* THE LISTED DETECTION LIMITS REFLECT ANY SAMPLE DILUTION.

NOTE: ND = NOT DETECTED
NA = NOT ANALYZED

PROJECT MANAGER: [illegible] DATE: 3/24/88

Analytical Technologies, Inc.

INDICATORS
PROJECT: SPARTON

SAMPLE DATE: 2/24/88
LAB RECEIPT DATE: 2/25/88
MATRIX: H2O

SAMPLE ID: RAW MW-25
LOCATION:
LAB SAMPLE #: 16007-1
UNITS: mg/l

| ANALYST | ANALYSIS DATE | CONSTITUENT NAME | DILUTION FACTOR | DETECTION LIMIT | RESULT |
|---|---|---|---|---|---|
| DW | 3/07/88 | TOTAL DISSOLVED SOLIDS (TDS) | 1 | 20 | 960 |
| JH | 3/15/88 | HARDNESS | 1 | 0.5 | 253 |
| DW | 3/14/88 | CORROSIVITY (pH) | - | ---- | 7.5 |

* THE LISTED DETECTION LIMITS REFLECT ANY SAMPLE DILUTION.

NOTE: ND = NOT DETECTED
NA = NOT ANALYZED

PROJECT MANAGER: M. Bailey DATE: 3/24/88

Analytical Technologies, Inc.

INDICATORS
PROJECT: SPARTON

SAMPLE DATE: 2/24/88
LAB RECEIPT DATE: 2/25/88
MATRIX: H2O

SAMPLE ID: RAW PW-1
LOCATION:
LAB SAMPLE #: 16007-6
UNITS: mg/l

| ANALYST | ANALYSIS DATE | CONSTITUENT NAME | DILUTION FACTOR | DETECTION LIMIT | RESULT |
|---|---|---|---|---|---|
| DW | 3/07/88 | TOTAL DISSOLVED SOLIDS (TDS) | 1 | 20 | 1000 |
| JH | 3/15/88 | HARDNESS | 1 | 0.5 | 352 |
| DW | 3/14/88 | CORROSIVITY (pH) | - | ---- | 11.7 |

* THE LISTED DETECTION LIMITS REFLECT ANY SAMPLE DILUTION.

NOTE: ND = NOT DETECTED
NA = NOT ANALYZED

PROJECT MANAGER: QW DATE: 3/24/88

Analytical Technologies, Inc

METALS
PROJECT: SPARTON

SAMPLE DATE: 2/24/88
LAB RECEIPT DATE: 2/25/88
MATRIX: H20

SAMPLE ID: MW-25
LOCATION:
LAB SAMPLE #: 16007-2
UNITS: mg/l

| ANALYST | ANALYSIS DATE | CONSTITUENT NAME | DILUTION FACTOR | DETECTION LIMIT | RESULT |
|---|---|---|---|---|---|
| JH | 3/07/88 | CHROMIUM (Cr Tot) | 1 | 0.020 | ND |

* THE LISTED DETECTION LIMITS REFLECT ANY SAMPLE DILUTION.

NOTE: ND = NOT DETECTED
NA = NOT ANALYZED

PROJECT MANAGER: R.W. DATE: 3/24/88

Analytical Technologies, Inc.

METALS
PROJECT: SPARTON

SAMPLE DATE: 2/24/88
LAB RECEIPT DATE: 2/25/88
MATRIX: H20

SAMPLE ID: PW-1
LOCATION:
LAB SAMPLE #: 16007-7
UNITS: mg/l

| ANALYST | ANALYSIS DATE | CONSTITUENT NAME | DILUTION FACTOR | DETECTION LIMIT | RESULT |
|---|---|---|---|---|---|
| JH | 3/07/88 | CHROMIUM (Cr Tot) | 1 | 0.020 | 0.029 |

* THE LISTED DETECTION LIMITS REFLECT ANY SAMPLE DILUTION.

NOTE: ND = NOT DETECTED
NA = NOT ANALYZED

PROJECT MANAGER: M. Bailey DATE: 3/24/88

Analytical Technologies, Inc.

EPA METHOD 601
PROJECT: SPARTON

SAMPLE DATE: 2/24/88
LAB RECEIPT DATE: 2/25/88
ANALYSIS DATE: 3/23/88
MATRIX: H2O
ANALYST: TMG

SAMPLE ID: MW-25
LOCATION:
LAB SAMPLE #: 16007-4
UNITS: ug/l
DILUTION FACTOR: 100

| CONSTITUENT NAME | DETECTION LIMIT | RESULT |
|---|---|---|
| CHLOROMETHANE | 20 | ND |
| BROMOMETHANE | 20 | ND |
| DICHLORODIFLUOROMETHANE | 20 | ND |
| VINYL CHLORIDE | 20 | ND |
| CHLOROETHANE | 20 | ND |
| METHYLENE CHLORIDE | 200 | 9,400 |
| TRICHLOROFLUOROMETHANE | 200 | ND |
| 1,1-DICHLOROETHENE | 20 | 3,700 |
| 1,1-DICHLOROETHANE | 20 | ND |
| TRANS-1,2-DICHLOROETHENE | 20 | ND |
| CHLOROFORM | 20 | ND |
| 1,2-DICHLOROETHANE | 20 | ND |
| 1,1,1-TRICHLOROETHANE | 20 | 39,000 |
| CARBON TETRACHLORIDE | 20 | ND |
| BROMODICHLOROMETHANE | 20 | ND |
| 1,2-DICHLOROPROPANE | 20 | ND |
| TRANS-1,3-DICHLOROPROPENE | 20 | ND |
| TRICHLOROETHENE | 20 | 54,000 |
| DIBROMOCHLOROMETHANE | 20 | ND |
| 1,1,2-TRICHLOROETHANE | 20 | ND |
| CIS-1,3-DICHLOROPROPENE | 20 | ND |
| 2-CHLOROETHYLVINYL ETHER | 50 | ND |
| BROMOFORM | 50 | ND |
| 1,1,2,2-TETRACHLOROETHANE | 20 | ND |
| TETRACHLOROETHENE | 20 | ND |
| CHLOROBENZENE | 50 | ND |
| 1,3-DICHLOROBENZENE | 50 | ND |
| 1,2-DICHLOROBENZENE | 50 | ND |
| 1,4-DICHLOROBENZENE | 50 | ND |

% SURROGATE RECOVERY
97.7% BROMOCHLOROMETHANE

COMMENTS: ND = NOT DETECTED
HIGH LEVELS REQUIRED DILUTION

PROJECT MANAGER: EP

DATE: 3/24/88

Analytical Technologies, Inc.

EPA METHOD 601
PROJECT: SPARTON

SAMPLE DATE: 2/24/88
LAB RECEIPT DATE: 2/25/88
ANALYSIS DATE: 2/26/88
MATRIX: H2O
ANALYST: TMG

SAMPLE ID: PW-1
LOCATION:
LAB SAMPLE #: 16007-9
UNITS: ug/l
DILUTION FACTOR: 500

| CONSTITUENT NAME | DETECTION LIMIT | RESULT |
|---|---|---|
| CHLOROMETHANE | 100 | ND |
| BROMOMETHANE | 100 | ND |
| DICHLORODIFLUOROMETHANE | 100 | ND |
| VINYL CHLORIDE | 100 | ND |
| CHLOROETHANE | 100 | ND |
| METHYLENE CHLORIDE | 1000 | 16000 |
| TRICHLOROFLUOROMETHANE | 1000 | ND |
| 1,1-DICHLOROETHENE | 100 | 990 |
| 1,1-DICHLOROETHANE | 100 | ND |
| TRANS-1,2-DICHLOROETHENE | 100 | ND |
| CHLOROFORM | 100 | ND |
| 1,2-DICHLOROETHANE | 100 | ND |
| 1,1,1-TRICHLOROETHANE | 100 | 2100 |
| CARBON TETRACHLORIDE | 100 | ND |
| BROMODICHLOROMETHANE | 100 | ND |
| 1,2-DICHLOROPROPANE | 100 | ND |
| TRANS-1,3-DICHLOROPROPENE | 100 | ND |
| TRICHLOROETHENE | 100 | 9000 |
| DIBROMOCHLOROMETHANE | 100 | ND |
| 1,1,2-TRICHLOROETHANE | 100 | ND |
| CIS-1,3-DICHLOROPROPENE | 100 | ND |
| 2-CHLOROETHYLVINYL ETHER | 250 | ND |
| BROMOFORM | 250 | ND |
| 1,1,2,2-TETRACHLOROETHANE | 100 | ND |
| TETRACHLOROETHENE | 100 | ND |
| CHLOROBENZENE | 250 | ND |
| 1,3-DICHLOROBENZENE | 250 | ND |
| 1,2-DICHLOROBENZENE | 250 | ND |
| 1,4-DICHLOROBENZENE | 250 | ND |

COMMENTS: ND = NOT DETECTED
HIGH LEVELS REQUIRED DILULTION

% SURROGATE RECOVERY
98.5% BROMOCHLOROMETHANE

PROJECT MANAGER: RU.

DATE: 3/24/88

Analytical Technologies, Inc

EPA METHOD 601
PROJECT: SPARTON

SAMPLE DATE: N/A
LAB RECEIPT DATE: N/A
ANALYSIS DATE: 2/26/88
MATRIX: WATER
ANALYST: TMG

SAMPLE ID: SYSTEM BLANK
LOCATION:
LAB SAMPLE #: 16007
UNITS: ug/l
DILUTION FACTOR: 1

| CONSTITUENT NAME | DETECTION LIMIT | RESULT |
|---|---|---|
| CHLOROMETHANE | 0.2 | ND |
| BROMOMETHANE | 0.2 | ND |
| DICHLORODIFLUOROMETHANE | 0.2 | ND |
| VINYL CHLORIDE | 0.2 | ND |
| CHLOROETHANE | 0.2 | ND |
| METHYLENE CHLORIDE | 2.0 | 2.7 |
| TRICHLOROFLUOROMETHANE | 2.0 | ND |
| 1,1-DICHLOROETHENE | 0.2 | ND |
| 1,1-DICHLOROETHANE | 0.2 | ND |
| TRANS-1,2-DICHLOROETHENE | 0.2 | ND |
| CHLOROFORM | 0.2 | ND |
| 1,2-DICHLOROETHANE | 0.2 | ND |
| 1,1,1-TRICHLOROETHANE | 0.2 | ND |
| CARBON TETRACHLORIDE | 0.2 | ND |
| BROMODICHLOROMETHANE | 0.2 | ND |
| 1,2-DICHLOROPROPANE | 0.2 | ND |
| TRANS-1,3-DICHLOROPROPENE | 0.2 | ND |
| TRICHLOROETHENE | 0.2 | ND |
| DIBROMOCHLOROMETHANE | 0.2 | ND |
| 1,1,2-TRICHLOROETHANE | 0.2 | ND |
| CIS-1,3-DICHLOROPROPENE | 0.2 | ND |
| 2-CHLOROETHYLVINYL ETHER | 0.5 | ND |
| BROMOFORM | 0.5 | ND |
| 1,1,2,2-TETRACHLOROETHANE | 0.2 | ND |
| TETRACHLOROETHENE | 0.2 | ND |
| CHLOROBENZENE | 0.5 | ND |
| 1,3-DICHLOROBENZENE | 0.5 | ND |
| 1,2-DICHLOROBENZENE | 0.5 | ND |
| 1,4-DICHLOROBENZENE | 0.5 | ND |

COMMENTS: ND = NOT DETECTED

% SURROGATE RECOVERY
83.6% BROMOCHLOROMETHANE

PROJECT MANAGER: R.W.

DATE: 3/24/88

Analytical Technologies, Inc.

2-25

22 MARCH 1988

METRIC CORPORATION
8429 WASHINGTON PLACE
ALBUQUERQUE, NM 87113

Accession: 16012

Date Received: 2/26/88

Attention: GARY RICHARDSON

Project: SPARTON

M. Barry
Michael G. Barry
Project Manager

Robert V. Woods
Robert V. Woods
Laboratory Manager

RVW/jlf

Note: Samples will be disposed of within 30 days unless otherwise notified.

Analytical Technologies, Inc.

INDICATORS
PROJECT: SPARTON

SAMPLE DATE:2/25/88
LAB RECEIPT DATE:2/26/88
MATRIX: WATER

SAMPLE ID: MW-25 W/NaOH
LOCATION:
LAB SAMPLE #: 16012-5
UNITS: mg/l

| ANALYST | ANALYSIS DATE | CONSTITUENT NAME | DILUTION FACTOR | DETECTION LIMIT | RESULT |
|---|---|---|---|---|---|
| DW | 3/10/88 | CYANIDE (CN) | 1 | 0.01 | ND |

* THE LISTED DETECTION LIMITS REFLECT ANY SAMPLE DILUTION.

NOTE: ND = NOT DETECTED
NA = NOT ANALYZED

PROJECT MANAGER: M. Perry DATE: 3/22/88

Analytica Technologies, Inc.

INDICATORS
PROJECT: SPARTON

SAMPLE DATE:2/25/88
LAB RECEIPT DATE:2/26/88
MATRIX: WATER

SAMPLE ID: PW-1 W/NaOH
LOCATION:
LAB SAMPLE #: 16012-10
UNITS: mg/l

| ANALYST | ANALYSIS DATE | CONSTITUENT NAME | DILUTION FACTOR | DETECTION LIMIT | RESULT |
|---|---|---|---|---|---|
| DW | 3/10/88 | CYANIDE (CN) | 1 | 0.01 | ND |

* THE LISTED DETECTION LIMITS REFLECT ANY SAMPLE DILUTION.

NOTE: ND = NOT DETECTED
NA = NOT ANALYZED

PROJECT MANAGER: M. Bary DATE: 3/22/88

Analytical Technologies, Inc.

INDICATORS
PROJECT: SPARTON

SAMPLE DATE:2/25/88
LAB RECEIPT DATE:2/26/88
MATRIX:WATER

SAMPLE ID: RAW MW-25
LOCATION:
LAB SAMPLE #:16012-3
UNITS: mg/l

| ANALYST | ANALYSIS DATE | CONSTITUENT NAME | DILUTION FACTOR | DETECTION LIMIT | RESULT |
|---|---|---|---|---|---|
| DW | 3/11/88 | TOTAL DISSOLVED SOLIDS (TDS) | 1 | 20 | 900 |
| JH | 3/15/88 | HARDNESS | 1 | 0.5 | 282 |
| DW | 3/14/88 | CORROSIVITY (pH) | - | ---- | 7.4 |

* THE LISTED DETECTION LIMITS REFLECT ANY SAMPLE DILUTION.

NOTE: ND = NOT DETECTED
NA = NOT ANALYZED

PROJECT MANAGER: M. Baty DATE: 3/22/88

Analytical Technologies, Inc

METALS
PROJECT: SPARTON

SAMPLE DATE:2/25/88
LAB RECEIPT DATE:2/26/88
MATRIX: WATER

SAMPLE ID: PW-1
LOCATION:
LAB SAMPLE #:16012-9
UNITS: mg/l

| ANALYST | ANALYSIS DATE | CONSTITUENT NAME | DILUTION FACTOR | DETECTION LIMIT | RESULT |
|---|---|---|---|---|---|
| JH | 3/07/88 | CHROMIUM (Cr Tot) | 1 | 0.020 | 0.031 |

* THE LISTED DETECTION LIMITS REFLECT ANY SAMPLE DILUTION.

NOTE: ND = NOT DETECTED
NA = NOT ANALYZED

PROJECT MANAGER: M. Bally DATE: 3/22/88

Analytical Technologies, Inc

EPA METHOD 601
PROJECT: SPARTON

SAMPLE DATE:2/25/88
LAB RECEIPT DATE:2/26/88
ANALYSIS DATE:2/26/88
MATRIX: WATER
ANALYST:TMG

SAMPLE ID: MW-25
LOCATION:
LAB SAMPLE #:16012-6
UNITS: ug/l
DILUTION FACTOR: 1000

| CONSTITUENT NAME | DETECTION LIMIT | RESULT |
|---|---|---|
| CHLOROMETHANE | 200 | ND |
| BROMOMETHANE | 200 | ND |
| DICHLORODIFLUOROMETHANE | 200 | ND |
| VINYL CHLORIDE | 200 | ND |
| CHLOROETHANE | 200 | ND |
| METHYLENE CHLORIDE | 2000 | 2800 |
| TRICHLOROFLUOROMETHANE | 2000 | ND |
| 1,1-DICHLOROETHENE | 200 | 1900 |
| 1,1-DICHLOROETHANE | 200 | ND |
| TRANS-1,2-DICHLOROETHENE | 200 | ND |
| CHLOROFORM | 200 | ND |
| 1,2-DICHLOROETHANE | 200 | ND |
| 1,1,1-TRICHLOROETHANE | 200 | 37000 |
| CARBON TETRACHLORIDE | 200 | ND |
| BROMODICHLOROMETHANE | 200 | ND |
| 1,2-DICHLOROPROPANE | 200 | ND |
| TRANS-1,3-DICHLOROPROPENE | 200 | ND |
| TRICHLOROETHENE | 200 | 46000 |
| DIBROMOCHLOROMETHANE | 200 | ND |
| 1,1,2-TRICHLOROETHANE | 200 | ND |
| CIS-1,3-DICHLOROPROPENE | 200 | ND |
| 2-CHLOROETHYLVINYL ETHER | 500 | ND |
| BROMOFORM | 500 | ND |
| 1,1,2,2-TETRACHLOROETHANE | 200 | ND |
| TETRACHLOROETHENE | 200 | ND |
| CHLOROBENZENE | 500 | ND |
| 1,3-DICHLOROBENZENE | 500 | ND |
| 1,2-DICHLOROBENZENE | 500 | ND |
| 1,4-DICHLOROBENZENE | 500 | ND |

% SURROGATE RECOVERY
101 % BROMOCHLOROMETHANE

COMMENTS: ND = NOT DETECTED
HIGHER LEVELS REQUIRED DILUTION

PROJECT MANAGER: M. Bailey

DATE: 3/22/88

Analytical Technologies, Inc.

EPA METHOD 601
PROJECT: SPARTON

SAMPLE DATE:2/25/88
LAB RECEIPT DATE:2/26/88
ANALYSIS DATE:2/26/88
MATRIX: WATER
ANALYST:TMG

SAMPLE ID: PW-1
LOCATION:
LAB SAMPLE #:16012-11
UNITS: ug/l
DILUTION FACTOR: 1000

| CONSTITUENT NAME | DETECTION LIMIT | RESULT |
|---|---|---|
| CHLOROMETHANE | 200 | ND |
| BROMOMETHANE | 200 | ND |
| DICHLORODIFLUOROMETHANE | 200 | ND |
| VINYL CHLORIDE | 200 | ND |
| CHLOROETHANE | 200 | ND |
| METHYLENE CHLORIDE | 2000 | 11000 |
| TRICHLOROFLUOROMETHANE | 2000 | ND |
| 1,1-DICHLOROETHENE | 200 | 560 |
| 1,1-DICHLOROETHANE | 200 | ND |
| TRANS-1,2-DICHLOROETHENE | 200 | ND |
| CHLOROFORM | 200 | ND |
| 1,2-DICHLOROETHANE | 200 | ND |
| 1,1,1-TRICHLOROETHANE | 200 | 1700 |
| CARBON TETRACHLORIDE | 200 | ND |
| BROMODICHLOROMETHANE | 200 | ND |
| 1,2-DICHLOROPROPANE | 200 | ND |
| TRANS-1,3-DICHLOROPROPENE | 200 | ND |
| TRICHLOROETHENE | 200 | 7200 |
| DIBROMOCHLOROMETHANE | 200 | ND |
| 1,1,2-TRICHLOROETHANE | 200 | ND |
| CIS-1,3-DICHLOROPROPENE | 200 | ND |
| 2-CHLOROETHYLVINYL ETHER | 500 | ND |
| BROMOFORM | 500 | ND |
| 1,1,2,2-TETRACHLOROETHANE | 200 | ND |
| TETRACHLOROETHENE | 200 | ND |
| CHLOROBENZENE | 500 | ND |
| 1,3-DICHLOROBENZENE | 500 | ND |
| 1,2-DICHLOROBENZENE | 500 | ND |
| 1,4-DICHLOROBENZENE | 500 | ND |

% SURROGATE RECOVERY
94.3% BROMOCHLOROMETHANE

COMMENTS: ND = NOT DETECTED
HIGHER LEVELS REQUIRED DILUTION

PROJECT MANAGER: M. Bailey

DATE: 3/22/88

Analytical Technologies, Inc.

EPA METHOD 601
PROJECT: SPARTON

SAMPLE DATE:N/A
LAB RECEIPT DATE:N/A
ANALYSIS DATE:2/26/88
MATRIX: WATER
ANALYST:TMG

SAMPLE ID: SYSTEM BLANK
LOCATION:
LAB SAMPLE #:16012
UNITS: ug/l
DILUTION FACTOR: 1

| CONSTITUENT NAME | DETECTION LIMIT | RESULT |
|---|---|---|
| CHLOROMETHANE | 0.2 | ND |
| BROMOMETHANE | 0.2 | ND |
| DICHLORODIFLUOROMETHANE | 0.2 | ND |
| VINYL CHLORIDE | 0.2 | ND |
| CHLOROETHANE | 0.2 | ND |
| METHYLENE CHLORIDE | 2.0 | 2.7 |
| TRICHLOROFLUOROMETHANE | 2.0 | ND |
| 1,1-DICHLOROETHENE | 0.2 | ND |
| 1,1-DICHLOROETHANE | 0.2 | ND |
| TRANS-1,2-DICHLOROETHENE | 0.2 | ND |
| CHLOROFORM | 0.2 | ND |
| 1,2-DICHLOROETHANE | 0.2 | ND |
| 1,1,1-TRICHLOROETHANE | 0.2 | ND |
| CARBON TETRACHLORIDE | 0.2 | ND |
| BROMODICHLOROMETHANE | 0.2 | ND |
| 1,2-DICHLOROPROPANE | 0.2 | ND |
| TRANS-1,3-DICHLOROPROPENE | 0.2 | ND |
| TRICHLOROETHENE | 0.2 | ND |
| DIBROMOCHLOROMETHANE | 0.2 | ND |
| 1,1,2-TRICHLOROETHANE | 0.2 | ND |
| CIS-1,3-DICHLOROPROPENE | 0.2 | ND |
| 2-CHLOROETHYLVINYL ETHER | 0.5 | ND |
| BROMOFORM | 0.5 | ND |
| 1,1,2,2-TETRACHLOROETHANE | 0.2 | ND |
| TETRACHLOROETHENE | 0.2 | ND |
| CHLOROBENZENE | 0.5 | ND |
| 1,3-DICHLOROBENZENE | 0.5 | ND |
| 1,2-DICHLOROBENZENE | 0.5 | ND |
| 1,4-DICHLOROBENZENE | 0.5 | ND |

% SURROGATE RECOVERY
83.6 BROMOCHLOROMETHANE

COMMENTS: ND = NOT DETECTED
HIGHER LEVELS REQUIRED DILUTION

PROJECT MANAGER: M. Bailey

DATE: 3/22/88

Analytical Technologies, Inc.

ACCESSION: 16012

QUALITY CONTROL DATA: 188
METHOD 601/602 & 8010/8020

CLIENT: METRIC CORPORATION
UNITS: ng
ANALYSIS DATE: 2/26/88

| | TRUE VALUE | RESULT |
|---|---|---|
| 1,1-DICHLOROETHENE | 102 | 82.1 |
| CHLOROFORM | 109 | 98.9 |
| 1,1,1-TRICHLOROETHANE | 102 | 110 |
| BROMODICHLOROMETHANE | 118 | 123 |
| TRICHLOROETHENE | 105 | 118 |
| BENZENE | 99.6 | 92.3 |
| TETRACHLOROETHENE | 109 | 118 |
| TOLUENE | 103 | 108 |
| CHLOROBENZENE | 106 | 107 |

PROJECT MANAGER: M. Berry DATE: 3/22/88

Analytical Technologies, Inc

# QUALITY CONTROL DATA

CLIENT: METRIC
DATE(S) RECEIVED: 2/29/88

METHOD:601 UNITS: ug/l
DATE ANALYZED: 3/1/88 ANALYST:TMG

## SPIKE RECOVERY

LAB SAMPLE ID: 16017-1

| PARAMETER | MATRIX % REC | DUPLICATE % REC |
|---|---|---|
| 1,1-DICHLOROETHENE | 104 | 104 |
| CHLOROFORM | 103 | 100 |
| 1,1-TRICHLOROETHANE | 106 | 104 |
| BROMODICHLOROETHANE | 113 | 100 |
| TRICHLOROETHENE | 109 | 116 |
| TETRACHLOROETHANE | 97.9 | 119 |
| BENZENE | 102 | 109 |
| TOLUENE | 100 | 112 |
| CHLOROBENZENE | 92.6 | 113 |

% SURROGATE RECOVERIES

| | | |
|---|---|---|
| 99.5 | % BROMOCHLOROMETHANE | 90.8 |
| 88.4 | % BROMOFLUOROBENZENE | 88.2 |

NOTES: NA = NOT APPLICABLE

PROJECT MANAGER: M. Dalla DATE: 3/22/88

2-26

Analytical Technologies, Inc

22 MARCH 1988

METRIC CORPORATION
8429 WASHINGTON PLACE
ALBUQUERQUE, NM 87113

Accession: 16015

Date Received: 2/29/88

Attention: GARY RICHARDSON

Project: SPARTON

Michael G. Barry
Project Manager

Robert V. Woods
Laboratory Manager

RVW/jlf

Note: Samples will be disposed of within 30 days unless otherwise notified.

Analytical Technologies, Inc.

INDICATORS
PROJECT: SPARTON

SAMPLE DATE:2/26/88
LAB RECEIPT DATE:2/29/88
MATRIX: WATER

SAMPLE ID: MW-25 W/NaOH
LOCATION:
LAB SAMPLE #: 16015-3
UNITS: mg/l

| ANALYST | ANALYSIS DATE | CONSTITUENT NAME | DILUTION FACTOR | DETECTION LIMIT | RESULT |
|---|---|---|---|---|---|
| DW | 3/10/88 | CYANIDE (CN) | 1 | 0.01 | ND |

* THE LISTED DETECTION LIMITS REFLECT ANY SAMPLE DILUTION.

NOTE: ND = NOT DETECTED
NA = NOT ANALYZED

PROJECT MANAGER: [illegible] DATE: 3/22/88

Analytical Technologies, Inc.

INDICATORS
PROJECT: SPARTON

SAMPLE DATE:2/26/88
LAB RECEIPT DATE:2/29/88
MATRIX: WATER

SAMPLE ID: PW-1 W/NaOH
LOCATION:
LAB SAMPLE #: 16015-9
UNITS: mg/l

| ANALYST | ANALYSIS DATE | CONSTITUENT NAME | DILUTION FACTOR | DETECTION LIMIT | RESULT |
|---|---|---|---|---|---|
| DW | 3/10/88 | CYANIDE (CN) | 1 | 0.01 | ND |

* THE LISTED DETECTION LIMITS REFLECT ANY SAMPLE DILUTION.

NOTE: ND = NOT DETECTED
NA = NOT ANALYZED

PROJECT MANAGER: [illegible] DATE: 3/22/88

Analytical Technologies, Inc.

INDICATORS
PROJECT: SPARTON

SAMPLE DATE:2/26/88
LAB RECEIPT DATE:2/29/88
MATRIX:WATER

SAMPLE ID: RAW MW-25
LOCATION:
LAB SAMPLE #:16015-1
UNITS: mg/l

| ANALYST | ANALYSIS DATE | CONSTITUENT NAME | DILUTION FACTOR | DETECTION LIMIT | RESULT |
|---|---|---|---|---|---|
| DW | 3/11/88 | TOTAL DISSOLVED SOLIDS (TDS) | 1 | 20 | 900 |
| JH | 3/15/88 | HARDNESS | 1 | 0.5 | 288 |
| DW | 3/14/88 | CORROSIVITY (pH) | - | ---- | 7.4 |

* THE LISTED DETECTION LIMITS REFLECT ANY SAMPLE DILUTION.

NOTE: ND = NOT DETECTED
NA = NOT ANALYZED

PROJECT MANAGER: [illegible] DATE: 3/22/88

Analytica Technologies, Inc

INDICATORS
PROJECT: SPARTON

SAMPLE DATE:2/26/88
LAB RECEIPT DATE:2/29/88
MATRIX:WATER

SAMPLE ID: RAW PW-1
LOCATION:
LAB SAMPLE #:16015-7
UNITS: mg/l

| ANALYST | ANALYSIS DATE | CONSTITUENT NAME | DILUTION FACTOR | DETECTION LIMIT | RESULT |
|---|---|---|---|---|---|
| DW | 3/11/88 | TOTAL DISSOLVED SOLIDS (TDS) | 1 | 20 | 650 |
| JH | 3/15/88 | HARDNESS | 1 | 0.5 | 196 |
| DW | 3/14/88 | CORROSIVITY (pH) | - | ---- | 10.1 |

* THE LISTED DETECTION LIMITS REFLECT ANY SAMPLE DILUTION.

NOTE: ND = NOT DETECTED
NA = NOT ANALYZED

PROJECT MANAGER: [illegible] DATE: 3/22/88

Analytical Technologies, Inc.

METALS
PROJECT: SPARTON

SAMPLE DATE:2/26/88
LAB RECEIPT DATE:2/29/88
MATRIX: WATER

SAMPLE ID: MW-25
LOCATION:
LAB SAMPLE #:16015-2
UNITS: mg/l

| ANALYST | ANALYSIS DATE | CONSTITUENT NAME | DILUTION FACTOR | DETECTION LIMIT | RESULT |
|---|---|---|---|---|---|
| JH | 3/07/88 | CHROMIUM (Cr Tot) | 1 | 0.020 | ND |

* THE LISTED DETECTION LIMITS REFLECT ANY SAMPLE DILUTION.

NOTE: ND = NOT DETECTED
NA = NOT ANALYZED

PROJECT MANAGER: [illegible] DATE: 3/22/88

Analytical Technologies, Inc.

METALS
PROJECT: SPARTON

SAMPLE DATE:2/26/88
LAB RECEIPT DATE:2/29/88
MATRIX: WATER

SAMPLE ID: PW-1
LOCATION:
LAB SAMPLE #:16015-8
UNITS: mg/l

| ANALYST | ANALYSIS DATE | CONSTITUENT NAME | DILUTION FACTOR | DETECTION LIMIT | RESULT |
|---|---|---|---|---|---|
| JH | 3/07/88 | CHROMIUM (Cr Tot) | 1 | 0.020 | 0.026 |

* THE LISTED DETECTION LIMITS REFLECT ANY SAMPLE DILUTION.

NOTE: ND = NOT DETECTED
NA = NOT ANALYZED

PROJECT MANAGER: T. Fay

DATE: 3/22/88

Analytical Technologies, Inc.

EPA METHOD 601
PROJECT: SPARTON

SAMPLE DATE:2/26/88
LAB RECEIPT DATE:2/29/88
ANALYSIS DATE:3/2/88
MATRIX: WATER
ANALYST:TMG

SAMPLE ID: MW-25
LOCATION:
LAB SAMPLE #:16015-4
UNITS: ug/l
DILUTION FACTOR: 1000

| CONSTITUENT NAME | DETECTION LIMIT | RESULT |
|---|---|---|
| CHLOROMETHANE | 200 | ND |
| BROMOMETHANE | 200 | ND |
| DICHLORODIFLUOROMETHANE | 200 | ND |
| VINYL CHLORIDE | 200 | ND |
| CHLOROETHANE | 200 | ND |
| METHYLENE CHLORIDE | 2000 | 2700 |
| TRICHLOROFLUOROMETHANE | 2000 | ND |
| 1,1-DICHLOROETHENE | 200 | 2200 |
| 1,1-DICHLOROETHANE | 200 | ND |
| TRANS-1,2-DICHLOROETHENE | 200 | ND |
| CHLOROFORM | 200 | ND |
| 1,2-DICHLOROETHANE | 200 | ND |
| 1,1,1-TRICHLOROETHANE | 200 | 35000 |
| CARBON TETRACHLORIDE | 200 | ND |
| BROMODICHLOROMETHANE | 200 | ND |
| 1,2-DICHLOROPROPANE | 200 | ND |
| TRANS-1,3-DICHLOROPROPENE | 200 | ND |
| TRICHLOROETHENE | 200 | 43000 |
| DIBROMOCHLOROMETHANE | 200 | ND |
| 1,1,2-TRICHLOROETHANE | 200 | ND |
| CIS-1,3-DICHLOROPROPENE | 200 | ND |
| 2-CHLOROETHYLVINYL ETHER | 500 | ND |
| BROMOFORM | 500 | ND |
| 1,1,2,2-TETRACHLOROETHANE | 200 | ND |
| TETRACHLOROETHENE | 200 | ND |
| CHLOROBENZENE | 500 | ND |
| 1,3-DICHLOROBENZENE | 500 | ND |
| 1,2-DICHLOROBENZENE | 500 | ND |
| 1,4-DICHLOROBENZENE | 500 | ND |

% SURROGATE RECOVERY
92.9% BROMOCHLOROMETHANE

COMMENTS: ND = NOT DETECTED
HIGHER LEVELS REQUIRED DILUTION

PROJECT MANAGER: [illegible]

DATE: 3/22/88

Analytical Technologies, Inc.

EPA METHOD 601
PROJECT: SPARTON

SAMPLE DATE:2/26/88
LAB RECEIPT DATE:2/29/88
ANALYSIS DATE:3/2/88
MATRIX: WATER
ANALYST:TMG

SAMPLE ID: PW-1
LOCATION:
LAB SAMPLE #:16015-10
UNITS: ug/l
DILUTION FACTOR: 1000

| CONSTITUENT NAME | DETECTION LIMIT | RESULT |
|---|---|---|
| CHLOROMETHANE | 200 | ND |
| BROMOMETHANE | 200 | ND |
| DICHLORODIFLUOROMETHANE | 200 | ND |
| VINYL CHLORIDE | 200 | ND |
| CHLOROETHANE | 200 | ND |
| METHYLENE CHLORIDE | 2000 | 10000 |
| TRICHLOROFLUOROMETHANE | 2000 | ND |
| 1,1-DICHLOROETHENE | 200 | 670 |
| 1,1-DICHLOROETHANE | 200 | ND |
| TRANS-1,2-DICHLOROETHENE | 200 | ND |
| CHLOROFORM | 200 | ND |
| 1,2-DICHLOROETHANE | 200 | ND |
| 1,1,1-TRICHLOROETHANE | 200 | 1700 |
| CARBON TETRACHLORIDE | 200 | ND |
| BROMODICHLOROMETHANE | 200 | ND |
| 1,2-DICHLOROPROPANE | 200 | ND |
| TRANS-1,3-DICHLOROPROPENE | 200 | ND |
| TRICHLOROETHENE | 200 | 7400 |
| DIBROMOCHLOROMETHANE | 200 | ND |
| 1,1,2-TRICHLOROETHANE | 200 | ND |
| CIS-1,3-DICHLOROPROPENE | 200 | ND |
| 2-CHLOROETHYLVINYL ETHER | 500 | ND |
| BROMOFORM | 500 | ND |
| 1,1,2,2-TETRACHLOROETHANE | 200 | ND |
| TETRACHLOROETHENE | 200 | ND |
| CHLOROBENZENE | 500 | ND |
| 1,3-DICHLOROBENZENE | 500 | ND |
| 1,2-DICHLOROBENZENE | 500 | ND |
| 1,4-DICHLOROBENZENE | 500 | ND |

% SURROGATE RECOVERY
95.5% BROMOCHLOROMETHANE

COMMENTS: ND = NOT DETECTED
HIGHER LEVELS REQUIRED DILUTION

PROJECT MANAGER: [illegible]

DATE: 3/22/88

Analytical Technologies, Inc

ACCESSION: 16015

QUALITY CONTROL DATA: 188
METHOD 601/602 & 8010/8020

CLIENT: METRIC CORPORATION
UNITS: ng
ANALYSIS DATE: 3/2/88

| | TRUE VALUE | RESULT |
|---|---|---|
| 1,1-DICHLOROETHENE | 102 | 93.8 |
| CHLOROFORM | 109 | 99.4 |
| 1,1,1-TRICHLOROETHANE | 102 | 100 |
| BROMODICHLOROMETHANE | 118 | 120 |
| TRICHLOROETHENE | 105 | 98.5 |
| BENZENE | 99.6 | 89.5 |
| TETRACHLOROETHENE | 109 | 104 |
| TOLUENE | 103 | 111 |
| CHLOROBENZENE | 100 | 89.5 |

PROJECT MANAGER: T.J. Pally DATE: 3/22/88

Analytical Technologies, Inc

# QUALITY CONTROL DATA

CLIENT: METRIC
DATE(S) RECEIVED: 3/3/88

METHOD: 601 UNITS: ug/l
DATE ANALYZED: 3/11/88 ANALYST: tmg

## SPIKE RECOVERY

LAB SAMPLE ID: 16036

| PARAMETER | MATRIX % REC | DUPLICATE % REC |
|---|---|---|
| 1,1-DICHLOROETHENE | 102 | 104 |
| CHLOROFORM | 103 | 98.9 |
| 1,1,1 TRICHLOROETHANE | 99.9 | 91.9 |
| BROMODICHLOROETHANE | 97.2 | 89.6 |
| TRICHLOROETHENE | 98.5 | 88.3 |
| TETRACHLOROETHANE | 94.1 | 104 |
| BENZENE | 96.0 | 94.9 |
| TOLUENE | 96.0 | 95.6 |
| CHLOROBENZENE | 94.6 | 103 |

% SURROGATE RECOVERIES

| | | |
|---|---|---|
| 106 | % BROMOCHLOROMETHANE | 107% |
| 100 | % BROMOFLUOROBENZENE | 106% |

NOTES: NA = NOT APPLICABLE

PROJECT MANAGER: M. Bailey DATE: 3/22/88

Analytical Technologies, Inc

EPA METHOD 601
PROJECT: SPARTON

SAMPLE DATE: NA
LAB RECEIPT DATE: NA
ANALYSIS DATE: 3/2/88
MATRIX: H20
ANALYST: TMG

SAMPLE ID: SYSTEM BLANK
LOCATION:
LAB SAMPLE #: 16015
UNITS: ug/l
DILUTION FACTOR: 1

| CONSTITUENT NAME | DETECTION LIMIT | RESULT |
|---|---|---|
| CHLOROMETHANE | 0.2 | ND |
| BROMOMETHANE | 0.2 | ND |
| DICHLORODIFLUOROMETHANE | 0.2 | ND |
| VINYL CHLORIDE | 0.2 | ND |
| CHLOROETHANE | 0.2 | ND |
| METHYLENE CHLORIDE | 2.0 | 6.7 |
| TRICHLOROFLUOROMETHANE | 2.0 | ND |
| 1,1-DICHLOROETHENE | 0.2 | ND |
| 1,1-DICHLOROETHANE | 0.2 | ND |
| TRANS-1,2-DICHLOROETHENE | 0.2 | ND |
| CHLOROFORM | 0.2 | ND |
| 1,2-DICHLOROETHANE | 0.2 | ND |
| 1,1,1-TRICHLOROETHANE | 0.2 | ND |
| CARBON TETRACHLORIDE | 0.2 | ND |
| BROMODICHLOROMETHANE | 0.2 | ND |
| 1,2-DICHLOROPROPANE | 0.2 | ND |
| TRANS-1,3-DICHLOROPROPENE | 0.2 | ND |
| TRICHLOROETHENE | 0.2 | ND |
| DIBROMOCHLOROMETHANE | 0.2 | ND |
| 1,1,2-TRICHLOROETHANE | 0.2 | ND |
| CIS-1,3-DICHLOROPROPENE | 0.2 | ND |
| 2-CHLOROETHYLVINYL ETHER | 0.5 | ND |
| BROMOFORM | 0.5 | ND |
| 1,1,2,2-TETRACHLOROETHANE | 0.2 | ND |
| TETRACHLOROETHENE | 0.2 | ND |
| CHLOROBENZENE | 0.5 | ND |
| 1,3-DICHLOROBENZENE | 0.5 | ND |
| 1,2-DICHLOROBENZENE | 0.5 | ND |
| 1,4-DICHLOROBENZENE | 0.5 | ND |

COMMENTS: ND = NOT DETECTED

% SURROGATE RECOVERY
84.6% BROMOCHLOROMETHANE

PROJECT MANAGER: K. Pailly

DATE: 3/22/88

2-29

Analytical Technologies, Inc

22 MARCH 1988

METRIC CORPORATION
8429 WASHINGTON PLACE
ALBUQUERQUE, NM 87113

Accession: 16022

Date Received: 3/01/88

Attention: GARY RICHARDSON

Project: SPARTON

M. Barry
Michael G. Barry
Project Manager

Robert V. Woods
Robert V. Woods
Laboratory Manager

RVW/jlf

Note: Samples will be disposed of within 30 days unless otherwise notified.

Analytical Technologies, Inc.

INDICATORS
PROJECT: SPARTON

SAMPLE DATE:2/29/88
LAB RECEIPT DATE:3/01/88
MATRIX: WATER

SAMPLE ID: MW-25 W/NaOH
LOCATION:
LAB SAMPLE #: 16022-3
UNITS: mg/l

| ANALYST | ANALYSIS DATE | CONSTITUENT NAME | DILUTION FACTOR | DETECTION LIMIT | RESULT |
|---|---|---|---|---|---|
| DW | 3/10/88 | CYANIDE (CN) | 1 | 0.01 | ND |

* THE LISTED DETECTION LIMITS REFLECT ANY SAMPLE DILUTION.

NOTE: ND = NOT DETECTED
NA = NOT ANALYZED

PROJECT MANAGER: [illegible] DATE: 3/22/88

Analytical Technologies, Inc

INDICATORS
PROJECT: SPARTON

SAMPLE DATE:2/29/88
LAB RECEIPT DATE:3/01/88
MATRIX: WATER

SAMPLE ID: PW-1 W/NaOH
LOCATION:
LAB SAMPLE #: 16022-7
UNITS: mg/l

| ANALYST | ANALYSIS DATE | CONSTITUENT NAME | DILUTION FACTOR | DETECTION LIMIT | RESULT |
|---|---|---|---|---|---|
| DW | 3/10/88 | CYANIDE (CN) | 1 | 0.01 | ND |

* THE LISTED DETECTION LIMITS REFLECT ANY SAMPLE DILUTION.

NOTE: ND = NOT DETECTED
NA = NOT ANALYZED

PROJECT MANAGER: M. Daly DATE: 3/22/88

Analytical Technologies, Inc

INDICATORS
PROJECT: SPARTON

SAMPLE DATE:2/29/88
LAB RECEIPT DATE:3/01/88
MATRIX:WATER

SAMPLE ID: RAW MW-25
LOCATION:
LAB SAMPLE #:16022-1
UNITS: mg/l

| ANALYST | ANALYSIS DATE | CONSTITUENT NAME | DILUTION FACTOR | DETECTION LIMIT | RESULT |
|---|---|---|---|---|---|
| DW | 3/11/88 | TOTAL DISSOLVED SOLIDS (TDS) | 1 | 20 | 860 |
| JH | 3/15/88 | HARDNESS | 1 | 0.5 | 288 |
| DW | 3/14/88 | CORROSIVITY (pH) | - | ---- | 7.4 |

* THE LISTED DETECTION LIMITS REFLECT ANY SAMPLE DILUTION.

NOTE: ND = NOT DETECTED
NA = NOT ANALYZED

PROJECT MANAGER: [illegible] DATE: 3/22/88

Analytical Technologies, Inc

INDICATORS
PROJECT: SPARTON

SAMPLE DATE:2/29/88
LAB RECEIPT DATE:3/01/88
MATRIX:WATER

SAMPLE ID: RAW PW-1
LOCATION:
LAB SAMPLE #:16022-5
UNITS: mg/l

| ANALYST | ANALYSIS DATE | CONSTITUENT NAME | DILUTION FACTOR | DETECTION LIMIT | RESULT |
|---|---|---|---|---|---|
| DW | 3/11/88 | TOTAL DISSOLVED SOLIDS (TDS) | 1 | 20 | 680 |
| JH | 3/15/88 | HARDNESS | 1 | 0.5 | 179 |
| DW | 3/14/88 | CORROSIVITY (pH) | - | ---- | 11 |

* THE LISTED DETECTION LIMITS REFLECT ANY SAMPLE DILUTION.

NOTE: ND = NOT DETECTED
NA = NOT ANALYZED

PROJECT MANAGER: M. Pattin DATE: 3/22/88

Analytical Technologies, Inc.

METALS
PROJECT: SPARTON

SAMPLE DATE:2/29/88
LAB RECEIPT DATE:3/01/88
MATRIX: WATER

SAMPLE ID: MW-25
LOCATION:
LAB SAMPLE #:16022-2
UNITS: mg/l

| ANALYST | ANALYSIS DATE | CONSTITUENT NAME | DILUTION FACTOR | DETECTION LIMIT | RESULT |
|---|---|---|---|---|---|
| JH | 3/07/88 | CHROMIUM (Cr Tot) | 1 | 0.020 | 0.027 |

* THE LISTED DETECTION LIMITS REFLECT ANY SAMPLE DILUTION.

NOTE: ND = NOT DETECTED
NA = NOT ANALYZED

PROJECT MANAGER: T. Fahey DATE: 3/22/88

Analytical Technologies, Inc.

METALS
PROJECT: SPARTON

SAMPLE DATE:2/29/88
LAB RECEIPT DATE:3/01/88
MATRIX: WATER

SAMPLE ID: PW-1
LOCATION:
LAB SAMPLE #:16022-6
UNITS: mg/l

| ANALYST | ANALYSIS DATE | CONSTITUENT NAME | DILUTION FACTOR | DETECTION LIMIT | RESULT |
|---|---|---|---|---|---|
| JH | 3/07/88 | CHROMIUM (Cr Tot) | 1 | 0.020 | 0.029 |

* THE LISTED DETECTION LIMITS REFLECT ANY SAMPLE DILUTION.

NOTE: ND = NOT DETECTED
NA = NOT ANALYZED

PROJECT MANAGER: [illegible] DATE: 3/22/88

Analytical Technologies, Inc.

EPA METHOD 601
PROJECT: SPARTON

SAMPLE DATE:2/29/88
LAB RECEIPT DATE:3/01/88
ANALYSIS DATE:3/2/88
MATRIX: WATER
ANALYST:TMG

SAMPLE ID: MW-25
LOCATION:
LAB SAMPLE #:16022-4
UNITS: ug/l
DILUTION FACTOR: 1000

| CONSTITUENT NAME | DETECTION LIMIT | RESULT |
|---|---|---|
| CHLOROMETHANE | 200 | ND |
| BROMOMETHANE | 200 | ND |
| DICHLORODIFLUOROMETHANE | 200 | ND |
| VINYL CHLORIDE | 200 | ND |
| CHLOROETHANE | 200 | ND |
| METHYLENE CHLORIDE | 2000 | 4200 |
| TRICHLOROFLUOROMETHANE | 2000 | ND |
| 1,1-DICHLOROETHENE | 200 | 2100 |
| 1,1-DICHLOROETHANE | 200 | ND |
| TRANS-1,2-DICHLOROETHENE | 200 | ND |
| CHLOROFORM | 200 | ND |
| 1,2-DICHLOROETHANE | 200 | ND |
| 1,1,1-TRICHLOROETHANE | 200 | 42000 |
| CARBON TETRACHLORIDE | 200 | ND |
| BROMODICHLOROMETHANE | 200 | ND |
| 1,2-DICHLOROPROPANE | 200 | ND |
| TRANS-1,3-DICHLOROPROPENE | 200 | ND |
| TRICHLOROETHENE | 200 | 47000 |
| DIBROMOCHLOROMETHANE | 200 | ND |
| 1,1,2-TRICHLOROETHANE | 200 | ND |
| CIS-1,3-DICHLOROPROPENE | 200 | ND |
| 2-CHLOROETHYLVINYL ETHER | 500 | ND |
| BROMOFORM | 500 | ND |
| 1,1,2,2-TETRACHLOROETHANE | 200 | ND |
| TETRACHLOROETHENE | 200 | ND |
| CHLOROBENZENE | 500 | ND |
| 1,3-DICHLOROBENZENE | 500 | ND |
| 1,2-DICHLOROBENZENE | 500 | ND |
| 1,4-DICHLOROBENZENE | 500 | ND |

% SURROGATE RECOVERY
102 % BROMOCHLOROMETHANE

COMMENTS: ND = NOT DETECTED
HIGHER LEVELS REQUIRED DILUTION

PROJECT MANAGER: [illegible]

DATE: 3/22/88

Analytical Technologies, Inc

EPA METHOD 601
PROJECT: SPARTON

SAMPLE DATE:2/29/88
LAB RECEIPT DATE:3/01/88
ANALYSIS DATE:3/2/88
MATRIX: WATER
ANALYST:TMG

SAMPLE ID: PW-1
LOCATION:
LAB SAMPLE #:16022-8
UNITS: ug/l
DILUTION FACTOR: 1000

| CONSTITUENT NAME | DETECTION LIMIT | RESULT |
|---|---|---|
| CHLOROMETHANE | 200 | ND |
| BROMOMETHANE | 200 | ND |
| DICHLORODIFLUOROMETHANE | 200 | ND |
| VINYL CHLORIDE | 200 | ND |
| CHLOROETHANE | 200 | ND |
| METHYLENE CHLORIDE | 2000 | 10000 |
| TRICHLOROFLUOROMETHANE | 2000 | ND |
| 1,1-DICHLOROETHENE | 200 | 610 |
| 1,1-DICHLOROETHANE | 200 | ND |
| TRANS-1,2-DICHLOROETHENE | 200 | ND |
| CHLOROFORM | 200 | ND |
| 1,2-DICHLOROETHANE | 200 | ND |
| 1,1,1-TRICHLOROETHANE | 200 | 1400 |
| CARBON TETRACHLORIDE | 200 | ND |
| BROMODICHLOROMETHANE | 200 | ND |
| 1,2-DICHLOROPROPANE | 200 | ND |
| TRANS-1,3-DICHLOROPROPENE | 200 | ND |
| TRICHLOROETHENE | 200 | 6200 |
| DIBROMOCHLOROMETHANE | 200 | ND |
| 1,1,2-TRICHLOROETHANE | 200 | ND |
| CIS-1,3-DICHLOROPROPENE | 200 | ND |
| 2-CHLOROETHYLVINYL ETHER | 500 | ND |
| BROMOFORM | 500 | ND |
| 1,1,2,2-TETRACHLOROETHANE | 200 | ND |
| TETRACHLOROETHENE | 200 | ND |
| CHLOROBENZENE | 500 | ND |
| 1,3-DICHLOROBENZENE | 500 | ND |
| 1,2-DICHLOROBENZENE | 500 | ND |
| 1,4-DICHLOROBENZENE | 500 | ND |

% SURROGATE RECOVERY
102 % BROMOCHLOROMETHANE

COMMENTS: ND = NOT DETECTED
HIGHER LEVELS REQUIRED DILUTION

PROJECT MANAGER: M. Berry

DATE: 3/22/88

Analytical Technologies, Inc

# QUALITY CONTROL DATA

CLIENT: METRIC
DATE(S) RECEIVED: 3/3/88

METHOD: 601 | UNITS: ug/l
DATE ANALYZED: 3/11/88 | ANALYST: TMG

## SPIKE RECOVERY

LAB SAMPLE ID: 16036

| PARAMETER | MATRIX % REC | DUPLICATE % REC |
|---|---|---|
| 1,1-DICHLOROETHENE | 102 | 104 |
| CHLOROFORM | 103 | 98.9 |
| 1,1,1-TRICHLOROETHANE | 99.9 | 91.9 |
| BROMODICHLOROETHANE | 97.2 | 89.6 |
| TRICHLOROETHENE | 98.5 | 88.3 |
| TETRACHLOROETHANE | 94.1 | 104 |
| BENZENE | 96.0 | 94.9 |
| TOLUENE | 96.0 | 95.6 |
| CHLOROBENZENE | 94.6 | 103 |

% SURROGATE RECOVERIES

| | | |
|---|---|---|
| 106 | % BROMOCHLOROMETHANE | 107% |
| 100 | % BROMOFLUOROBENZENE | 106% |

NOTES: NA = NOT APPLICABLE

PROJECT MANAGER: M. Baly | DATE: 3/22/88

# AQUIFER TESTING
# AT THE
# SPARTON TECHNOLOGY, INC.
# COORS ROAD PLANT
# ALBUQUERQUE, NEW EMXICO

PREPARED BY

METRIC CORPORATON
ALBUQUERQUE, NEW MEXICO

NOVEMBER 18, 1988

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# AQUIFER TESTING
# AT THE
# SPARTON TECHNOLOGY, INC.
# COORS ROAD PLANT

Aquifer tests were performed in four groundwater recovery wells at the Sparton Technology, Inc., Coors Road Plant during September and October 1988. The purpose of the testing was to estimate well capacity and further define aquifer permeability of the "upper flow zone". The well capacities were used to develope estimates of the total capacity of the groundwater recovery system for equipment sizing and water rights requirements. The "upper flow zone" consists generally of the upper 5 to 10 feet of the saturated zone at the Coors Road site separated from the remainder of the saturated zone by a fine grained aquitard unit.

Pumping tests were conducted in four wells, MW-23 and MW-26 located along the south side of the plant building, MW-27 located along the west side of the plant building and MW-28 located at the west property corner. Each of the four wells are included in the groundwater recovery system.

The tests were conducted as follows:

Well: MW-23
Test Type: Constant Discharge
Test Drawdown: 2.5 ft.
Available Drawdown: 7.7 ft.
Duration of Pumping: 72.0 hrs.
Average Discharge: 0.26gpm
Observations Taken in Wells: MW-23

Well: MW-26
Test Type: Constant Discharge
Test Drawdown: 2.5 ft.
Available Drawdown: 13.4 ft.
Duration of Pumping: 71.1 hrs.
Average Discharge: 0.019gpm
Observations Taken in Wells: MW-26

Well: MW-27
Test Type: Constant Discharge
Test Drawdown: 2.2 ft.
Available Drawdown: 8.0 ft.
Duration of Pumping: 70.0 hrs.
Average Discharge: 0.117gpm
Observations Taken In Wells: MW-27

Well: MW-28
Test Type: Constant Discharge
Test Drawdown: 2.67 ft.
Available Drawdown: 4.1 ft.
Duration of Pumping: 72.0 hrs.
Average Discharge: 0.0705gpm
Observations Taken in Wells: MW-28

Each of the pumped wells are 2-inch, i.d. PVC wells with wire-wound stainless steel screens. The wells were installed in 7-inch diameter hollow stem auguer borings. They were pumped with a 1.66-inch o.d. positive displacement piston pump having a maximum discharge of about 2.5gpm. Water levels in the pumped wells were monitored with an airline and a water monometer. All water level measurements were taken to the nearest 0.01 feet. Discharge measurements were made with a graduated cylinder and stop watch.

The water level and discharge data collected during each test are presented in APPENDIX A. The data were analyzed using semi-log plots of time-duration and residual drawdown data (see APPENDIX B).

The time-drawdown data were checked using a procedure suggested by Johnson, 1972 to ensure that $u<0.05$ and, thus, validate the use of the Jacob solution. In the equation $u = \frac{1,87r^2S}{Tt}$, u was set equal to 0.05, and the time, t, was determined after which the Jacob solution is valid. The effective radii of the wells were assumed to be 0.29 ft. because the wells were installed in

7-inch (0.58 ft.) diameter boreholes. TABLE 1 shows that all but the early data are valid. The selected hydraulic conductivities were all determined from data for which the Jacob solution is valid.

The data were also checked using a procedure suggested by Schafer, 1978 to determine which portion of the data might be casing storage affected. The early portion of the time-drawdown data is casing storage affected in each case as shown in TABLE 2.

For determination of aquifer permeability, the residual draw data were used rather than the time-drawdown data because the time-drawdown was affected by fluctuations in the pump discharge and because the residual drawdown data is generally considered to be more reliable when only pumped well data are available as is the case here. Additionally, the middle or late residual drawdown data were used because the early data appears to be casing storage affected.

Based on the above described testing, it is the opinion of the investigators that the best estimate for the permeability (hydraulic conductivity) of the upper flow zone in the vicinity of each of the wells tested is as follows (see TABLE 3):

| Well | Hydraulic Conductivity (cm/sec) |
|---|---|
| MW-23 | $8.54 \times 10^{-4}$ |
| MW-26 | $3.91 \times 10^{-5}$ |
| MW-27 | $9.08 \times 10^{-4}$ |
| MW-28 | $1.07 \times 10^{-3}$ |

TABLE 1

JACOB VALIDATION

| Well | r (ft) | T (gpd/ft) | t days | t min. |
|---|---|---|---|---|
| MW-23 | 0.29 | 139 | 0.0045 | 6.52 |
| MW-26 | 0.29 | 11.1 | 0.057 | 81.6 |
| MW-27 | 0.29 | 154 | 0.0041 | 5.88 |
| MW-28 | 0.29 | 93.1 | 0.0068 | 9.73 |

$$t = \frac{1.87 \quad r^2 \quad S}{uT} = \frac{1.87 \ (.29)^2 \ (.2)}{0.05(T)}$$

$S = 0.20$

$u = 0.05$

TABLE 3

AQUIFER TESTING
SPARTON TECHNOLOGY, INC. COORS ROAD PLANT

| Pumped Well | Observations At | Curve | Apparent T (gpd/ft) | b (ft) | Hydraulic Conductivity ft/day | Hydraulic Conductivity cm/sec | Comments |
|---|---|---|---|---|---|---|---|
| MW-23 | MW-23 | Early T-D | 33.0 | | | | Casing storage affected |
| | | Late T-D | 456 | | | | |
| | | Early R-D | 45.0 | | | | Casing storage affected |
| | | Late R-D | 139 | 7.7 | 2.42 | $8.54 \times 10^{-4}$ | Selected |
| MW-26 | MW-26 | Early T-D | 1.58 | | | | Casing storage affected* |
| | | Late T-D | 24.9 | | | | |
| | | Early R-D | 2.94 | | | | Casing storage affected |
| | | Late R-D | 11.1 | 13.4 | 0.11 | $3.91 \times 10^{-5}$ | Selected |
| MW-27 | MW-27 | Early R-D | 27.3 | | | | |
| | | Late R-D | 154 | 8.0 | 2.57 | $9.08 \times 10^{-4}$ | Selected |
| MW-28 | MW-28 | Early T-D | 18.1 | | | | Casing storage affected |
| | | Middle T-D | 62.0 | | | | |
| | | Late T-D | 19.6 | | | | Impermeable boundary |
| | | Early R-D | 27.8 | | | | Casing storage affected |
| | | Middle R-D | 93.1 | 4.1 | 3.04 | $1.07 \times 10^{-3}$ | Selected |
| | | Late R-D | 12.0 | | | | Impermeable boundary |

* Jacob Solution Not Valid

TABLE 4

ESTIMATED WELL CAPACITIES

| Well # | Pumping Time (hrs) | Drawdown (ft) | Discharge (gpm) | Specific Capacity (gpm/ft) | Available Drawdown (ft) | Estimated Capacity (gpm) |
|---|---|---|---|---|---|---|
| 18 | 49.0 | 5.02 | 0.264 | 0.0526 | 12.6 | 0.66 |
| 23 | 72.0 | 2.47 | 0.260 | 0.1054 | 7.65 | 0.81 |
| 24 | 73.2 | 3.26 | 0.205 | 0.0629 | 8.1 | 0.51 |
| 25 | 68.8 | 3.0 | 0.317 | 0.106 | 7.3 | 0.77 |
| 26 | 71.1 | 2.53 | 0.019 | 0.008 | 13.4 | 0.10 |
| 27 | 70.0 | 2.21 | 0.117 | 0.053 | 8.0 | 0.42 |
| 28 | 72.0 | 2.67 | 0.070 | 0.026 | 4.1 | 0.11 |
| PW-1 | 69.6 | 2.12 | 0.13 | 0.06 | 4.3 | 0.26 |
| | | | | | Total | 3.64 |

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Schafer, David C., 1978, Casing Storage Can Affect Pump Testing Data, The Johnson Drillers Journal.

# APPENDIX A
# PUMP TEST DATA

Date: 9-27-88

**METRIC Corporation**

Pumped Well MW-23

Measurements at Well MW-23

Pump Speed: _____ Q: 0.26417 gpm

Static Water Level _____

| | time (h:m:s) | t (min) | t' (min) | t/t' | Drawdown (ft) | Discharge (min.sec/ℓ) |
|---|---|---|---|---|---|---|
| 9-27 | 8:15:00 | 0 | | | 0 | |
| | 15 | .25 | | | 0.60 | |
| | 30 | .5 | | | 0.59 | |
| | 45 | .75 | | | 0.56 | |
| | 16:00 | 1.0 | | | 0.11 | |
| | 16:30 | 1.5 | | | 0.42 | |
| | 17:00 | 2.0 | | | 0.60 | |
| | 17:30 | 2.5 | | | 0.56 | |
| | 18:00 | 3.0 | | | 0.66 | |
| | 18:30 | 3.5 | | | 0.97 | |
| | 19:00 | 4.0 | | | 0.41 | |
| | 19:30 | 4.5 | | | - | |
| | 20:00 | 5.0 | | | 0.86 | |
| | 21 | 6 | | | 1.88 | |
| | 22 | 7 | | | 2.06 | |
| | 23 | 8 | | | 2.45 | |
| | 24 | 9 | | | 2.16 | |
| | 25 | 10 | | | 2.26 | |
| | 27 | 12 | | | 2.37 | 1'09"/ℓ |
| | 29 | 14 | | | 2.43 | |
| | 31 | 16 | | | 2.42 | |
| | 33 | 18 | | | 2.19 | |
| | 35 | 20 | | | 1.93 | 1'09"/ℓ |
| | 40 | 25 | | | 2.06 | 1'07"/ℓ |
| | 45 | 30 | | | 2.08 | 1'07"/ℓ |
| | 50 | 35 | | | 2.11 | 1'00"/ℓ |
| | 9:00 | 45 | | | 2.41 | 1'00"/ℓ |
| | 9:30 | 75 | | | 2.43 | 55"/ℓ |
| | 10:00 | 105 | | | 2.31 | 1'09" |
| | 10:30 | 135 | | | 2.16 | 1'05" |

Date: 9-27-88

**METRIC Corporation**

Pumped Well MW-23

Measurements at Well MW-23

Pump Speed: _____ Q: _____ gpm

Static Water Level _____

| time (h:m:s) | t (min) | t' (min) | t/t' | Drawdown (ft) | Discharge (min.sec/ℓ) |
|---|---|---|---|---|---|
| 11:00 | 165 | | | 2.75 | 1'0" |
| 12:00 | 225 | | | 2.75 | 47" adj 56" |
| 13:00 | 285 | | | 2.86 | 59" 58" |
| 14:00 | 345 | | | 3.00 | 49" adj |
| 15:00 | 405 | | | 3.01 | 49" adj |
| 16:00 | 465 | | | 2.89 | 59" |
| 17:00 | 525 | | | 2.51 | 1'3" |
| 18:00 | 585 | | | 2.52 | 1'5" |
| 19:00 | 645 | | | 2.46 | 1'16" adj 1'00" |
| 20:00 | 705 | | | 2.51 | 1'01" |
| 21:00 | 765 | | | 2.66 | 1'01" |
| 22:00 | 825 | | | 2.55 | 0'59" |
| 23:00 | 885 | | | 2.39 | 1'02" |
| 24:00 | 945 | | | 2.47 | 1'05" |
| 1:00 | 1005 | | | 2.45 | 1'06" |
| 2:00 | 1065 | | | 2.46 | 1'05" |
| 3:00 | 1125 | | | 2.36 | 1'05" |
| 4:00 | 1185 | | | 2.42 | 1'03" |
| 5:00 | 1245 | | | 2.39 | 1'02" |
| 6:00 | 1305 | | | 2.44 | 1'01" |
| 7:00 | 1365 | | | 2.44 | 1'4" |
| 8:00 | 1425 | | | 2.54 | 1'6" adj |
| 9:00 | 1485 | | | 2.60 | 57" |
| 10:00 | 1545 | | | 2.58 | 55" adj |
| 11:00 | 1605 | | | 2.57 | 56" adj |
| 12:00 | 1665 | | | 2.66 | 1'0" |
| 13:00 | 1725 | | | 2.66 | 58" |
| 14:00 | 1785 | | | 2.70 | 55" adj |
| 15:00 | 1845 | | | 2.62 | 55" adj |
| 16:00 | 1905 | | | 2.63 | 55" adj |

Date: 9-27-88

**METRIC Corporation**

Pumped Well MW-23

Measurements at Well MW-23

Pump Speed: _____ Q: _____ gpm

Static Water Level _____

| | time (h:m:s) | t (min) | t' (min) | t/t' | Drawdown (ft) | Discharge (min·sec/ℓ) |
|---|---|---|---|---|---|---|
| 9-28 | 17:00 | 1965 | | | 2.51 | 60" |
| | 18:00 | 2025 | | | 2.80 | 1'6" adj |
| | 19:00 | 2085 | | | 2.37 | 1'01" |
| | 20:00 | 2145 | | | 2.58 | 1'02" |
| | 21:00 | 2205 | | | 2.51 | 1'05" |
| | 22:00 | 2265 | | | 2.59 | 0'58" |
| | 23:00 | 2325 | | | 2.44 | 1'00" |
| | 24:00 | 2385 | | | 2.43 | 1'00" |
| 9-29 | 1:00 | 2445 | | | 2.46 | 1'03" |
| | 2:00 | 2505 | | | 2.48 | 1'01" |
| | 3:00 | 2565 | | | 2.37 | 1'04" |
| | 4:00 | 2625 | | | 2.53 | 0'58" |
| | 5:00 | 2685 | | | 2.49 | 0'57" |
| | 6:00 | 2745 | | | 2.45 | 1'02" |
| | 7:00 | 2805 | | | 2.56 | 0'57" |
| | 8:00 | 2865 | | | 2.71 | 1'2" |
| | 9:00 | 2925 | | | 2.58 | 1'0" |
| | 10:00 | 2985 | | | 2.52 | 1'0" |
| | 11:00 | 3045 | | | 2.62 | 1'02" |
| | 12:00 | 3105 | | | 2.64 | 58" |
| | 13:00 | 3165 | | | 2.73 | 1'0" |
| | 14:00 | 3225 | | | 2.88 | 52" adj |
| | 15:00 | 3285 | | | 2.55 | 58" |
| | 16:00 | 3345 | | | 2.59 | 56" |
| | 17:00 | 3405 | | | 2.64 | 1' |
| | 18:00 | 3465 | | | 2.71 | 1'6" adj |
| | 19:00 | 3525 | | | 2.60 | 59" |
| | 20:00 | 3585 | | | 2.49 | 59" |
| | 21:00 | 3645 | | | 2.56 | 1'6" |
| | 22:00 | 3705 | | | 2.44 | 58" |

**METRIC Corporation**

Date: 9-27-88

Pumped Well MW-23

Measurements at Well MW-23

Pump Speed: _____ Q: _____ gpm

Static Water Level _____

| | time (h:m:s) | t (min) | t' (min) | t/t' | Drawdown (ft) | Discharge (min·sec/ℓ) |
|---|---|---|---|---|---|---|
| 9-29 | 23:00 | 3765 | | | 2.34 | 1'03" |
| | 24:00 | 3825 | | | 2.65 | 1'05" |
| | 1:00 | 3885 | | | 2.53 | 56" |
| 9-30 | 2:00 | 3945 | | | 2.37 | 1'07" 1'01" |
| | 3:00 | 4005 | | | 2.39 | 1'04" |
| | 4:00 | 4065 | | | 2.58 | 1'02" |
| | 5:00 | 4125 | | | 2.24 | 1'02" |
| | 6:00 | 4185 | | | 2.27 | 1'06" adj |
| | 7:00 | 4245 | | | 2.47 | 58" |
| | 8:00 | 4305 | | | 2.46 | 1'04" |
| | 8:15:15 | 4320.25 | .25 | 17,281 | 1.39 | Pump off @8:15 |
| | :30 | 4320.50 | .50 | 8,641 | 0.83 | |
| | :45 | 4320.75 | .75 | 5,761 | 0.68 | |
| | 8:16:00 | 4321.00 | 1.0 | 4,321 | 0.36 | |
| | 8:16:30 | 4321.5 | 1.5 | 2,881 | 0.19 | |
| | 8:17:00 | 4322.0 | 2.0 | 2,161 | 0.14 | |
| | 8: :30 | 4322.5 | 2.5 | 1,729 | 0.09 | |
| | 8:18:00 | 4323.0 | 3.0 | 1,441 | 0.07 | |
| | :30 | 4323.5 | 3.5 | 1,235 | 0.07 | |
| | 19:00 | 4324.0 | 4.0 | 1,081 | 0.07 | |
| | :30 | 4324.5 | 4.5 | 961 | 0.07 | |
| | 20:00 | 4325.0 | 5.0 | 865 | 0.08 | |
| | 21:00 | 4326 | 6 | 721 | 0.07 | |
| | 22:00 | 4327 | 7 | 618 | 0.06 | |
| | 23:00 | 4328 | 8 | 541 | 0.07 | |
| | 24:00 | 4329 | 9 | 481 | 0.08 | |
| | 25:00 | 4330 | 10 | 433 | 0.09 | |
| | 27:00 | 4332 | 12 | 361 | 0.07 | |
| | 29:00 | 4334 | 14 | 310 | 0.08 | |
| | 30:00 | 4336 | 16 | 271 | 0.08 | |

**METRIC Corporation**

Date: 9-27-88

Pumped Well MW-23

Measurements at Well MW-23

Pump Speed: _____ Q: _____ gpm

Static Water Level _____

| | time (h:m:s) | t (min) | t' (min) | t/t' | Drawdown (ft) | Discharge (min·sec/ℓ) |
|---|---|---|---|---|---|---|
| 9-30 | 33:00 | 4338 | 18 | 241 | 0.05 | |
| | 35:00 | 4340 | 20 | 217 | 0.07 | |
| | 40:00 | 4345 | 25 | 174 | 0.07 | |
| | 45:00 | 4350 | 30 | 145 | 0.07 | |
| | 50:00 | 4355 | 35 | 124 | 0.07 | |
| | 55:00 | 4360 | 40 | 109 | 0.07 | |
| | 9:00 | 4365 | 45 | 97 | 0.07 | |
| | 9:15 | 4380 | 60 | 73 | 0.06 | |
| | 9:30 | 4395 | 75 | 59 | 0.06 | |
| | 10:00 | 4425 | 105 | 42 | 0.06 | |
| | 11:00 | 4485 | 165 | 27 | 0.04 | |
| | 11:30 | 4515 | 195 | 23 | 0.03 | |
| | 13:19 | 4624 | 304 | 15 | 0.03 | |
| | 15:10 | 4735 | 415 | 11 | 0.02 | |
| | 17:01 | 4846 | 526 | 9 | 0.00 | |

Date: 9-14-88

**METRIC Corporation**

Pumped Well MW-26

Measurements at Well MW-26

Pump Speed: _____ Q: 0.01887 gpm

Static Water Level _____

| time (h:m:s) | t (min) | t' (min) | t/t' | Drawdown (ft) | Discharge (min/ℓ) |
|---|---|---|---|---|---|
| 9-14 8:05:00 | 0 | | | 0 | |
| :15 | 0.25 | | | 0.23 | |
| :30 | 0.50 | | | 0.47 | |
| :45 | 0.75 | | | 0.67 | |
| 6:00 | 1.00 | | | 0.93 | |
| :30 | 1.50 | | | 1.37 | |
| 7:00 | 2.00 | | | 1.76 | |
| :30 | 2.50 | | | 2.20 | |
| 8:00 | 3.00 | | | 2.27 | |
| :30 | 3.50 | | | 2.28 | |
| 9:00 | 4.00 | | | 2.28 | |
| :30 | 4.50 | | | 2.29 | |
| 10:00 | 5.00 | | | 2.33 | |
| 11:00 | 6 | | | 2.37 | |
| 12 | 7 | | | 2.41 | |
| 13 | 8 | | | 2.38 | |
| 14 | 9 | | | 2.38 | |
| 15 | 10 | | | 2.41 | |
| 17 | 12 | | | 2.57 | |
| 19 | 14 | | | 2.53 | 14 min/ℓ |
| 21 | 16 | | | 2.52 | |
| 23 | 18 | | | 2.50 | |
| 25 | 20 | | | 2.28 | |
| 30 | 25 | | | 2.44 | |
| 35 | 30 | | | 2.62 | 14 |
| 40 | 35 | | | 2.77 | |
| 50 | 45 | | | 3.03 | 14 |
| 9:00 | 55 | | | 2.71 | 11 |
| 9:20 | 75 | | | 2.61 | 14 |
| 9:40 | 95 | | | 2.48 | 12 |

Date: 9-14-88

**METRIC Corporation**

Pumped Well MW-26

Measurements at Well MW-26

Pump Speed: _____ Q: _____ gpm

Static Water Level _____

| | time (h:m:s) | t (min) | t' (min) | t/t' | Drawdown (ft) | Discharge (min/ℓ) |
|---|---|---|---|---|---|---|
| 9-14 | 10:00 | 115 | | | 3.53 | 8 |
| | 10:30 | 145 | | | 3.48 | 10 |
| | 11:00 | 175 | | | 2.57 | 14, 12 |
| | 11:30 | 205 | | | 2.25 | 11, 14 |
| | 12:00 | 235 | | | 2.83 | 13, 11 |
| | 13:00 | 295 | | | 2.15 | 12, 15 |
| | 14:00 | 355 | | | 3.55 | 12, 11, 13, 12, 9 |
| | 15:00 | 415 | | | 3.72 | 15, 15, 11, 9, 9, 16 |
| | 16:00 | 475 | | | 3.25 | 16, 10, 12 |
| | 17:00 | 535 | | | 3.25 | 11, 10, 9, 11, 11 |
| | 18:00 | 595 | | | 2.85 | 10, 11, 11, 11 |
| | 19:00 | 655 | | | 3.03 | 10, 13, 15, 11 |
| | 20:00 | 715 | | | 2.55 | 10, 13, 15 |
| | 21:00 | 775 | | | 2.42 | 11, 13, 11, 12 |
| | 22:00 | 835 | | | 2.35 | 12, 11, 9, 9 |
| | 23:00 | 895 | | | 2.47 | 13, 12, 14, 11 |
| | 24:00 | 955 | | | 2.88 | 11, 9, 13, 10, 17 |
| -15 | 1:00 | 1015 | | | 2.07 | 16, 12, 17, 17 |
| | 2:00 | 1075 | | | 1.68 | 12, 11, 16 |
| | 3:00 | 1135 | | | 3.24 | 14, 13, 15, 13 |
| | 4:00 | 1195 | | | 1.50 | 11, 9, 10, 9 |
| | 5:00 | 1255 | | | 5.17 | 9, 8, 12, 10 |
| | 6:00 | 1315 | | | 4.75 | 10, 11, 17, 10 |
| | 7:00 | 1375 | | | 4.60 | 13, 11 |
| | 8:00 | 1435 | | | 2.78 | 9, 12, 17 |
| | 9:00 | 1495 | | | 2.26 | |
| | 9:05 | 1500 | | | 2.18 | |
| | 9:10 | 1505 | | | 2.10 | 15 |
| | 9:15 | 1510 | | | 2.76 | |
| | 9:20 | 1515 | | | 1.84 | |

Date: 9-14-88

**METRIC Corporation**

Pumped Well MW-26

Measurements at Well MW-26

Pump Speed: _____ Q: _____ gpm

Static Water Level _____

| | time (h:m:s) | t (min) | t' (min) | t/t' | Drawdown (ft) | Discharge (min/ℓ) |
|---|---|---|---|---|---|---|
| 9-15 | 9:25 | 1520 | | | 2.57 | 14 |
| | 30 | 1525 | | | 3.30 | |
| | 35 | 1530 | | | 2.46 | 13 |
| | 40 | 1535 | | | 2.08 | |
| | 45 | 1540 | | | 2.00 | |
| | 50 | 1545 | | | 1.72 | 15 |
| | 55 | 1550 | | | 2.77 | |
| | 10:00 | 1555 | | | 2.63 | |
| | 05 | 1560 | | | 2.78 | 12 |
| | 10 | 1565 | | | 2.85 | |
| | 15 | 1570 | | | 2.83 | |
| | 20 | 1575 | | | 2.93 | 11 |
| | 25 | 1580 | | | 3.05 | |
| | 30 | 1585 | | | 2.82 | 11 |
| | 35 | 1590 | | | 2.78 | |
| | 40 | 1595 | | | 3.17 | 10 |
| | 45 | 1600 | | | 2.76 | |
| | 50 | 1605 | | | 2.05 | |
| | 55 | 1610 | | | 1.84 | |
| | 11:00 | 1615 | | | 1.92 | |
| | 05 | 1620 | | | 1.77 | 22 |
| | 10 | 1625 | | | 2.30 | |
| | 15 | 1630 | | | 2.65 | |
| | 20 | 1635 | | | 2.54 | |
| | 25 | 1640 | | | 2.20 | |
| | 30 | 1645 | | | 1.99 | 14 |
| | 35 | 1650 | | | 2.90 | |
| | 40 | 1655 | | | 3.14 | |
| | 45 | 1660 | | | 2.07 | |
| | 50 | 1665 | | | 2.44 | 14 |

Date: 9-14-88

**METRIC Corporation**

Pumped Well MW-26

Measurements at Well MW-26

Pump Speed: _____ Q: _____ gpm

Static Water Level _____

| | time (h:m:s) | t (min) | t' (min) | t/t' | Drawdown (ft) | Discharge (min/ℓ) |
|---|---|---|---|---|---|---|
| 9-15 | 11:55 | 1670 | | | 2.59 | |
| | 12:00 | 1675 | | | 2.70 | 12 |
| | 05 | 1680 | | | 2.53 | |
| | 10 | 1685 | | | 2.43 | |
| | 15 | 1690 | | | 2.55 | 13 |
| | 20 | 1695 | | | 2.53 | |
| | 25 | 1700 | | | 2.49 | |
| | 30 | 1705 | | | 2.52 | 14 |
| | 35 | 1710 | | | 2.30 | |
| | 40 | 1715 | | | 2.06 | 14 |
| | 45 | 1720 | | | 2.70 | |
| | 50 | 1725 | | | 2.35 | |
| | 55 | 1730 | | | 1.89 | |
| | 13:00 | 1735 | | | 2.10 | |
| | 05 | 1740 | | | 2.45 | 16 |
| | 10 | 1745 | | | 2.31 | |
| | 15 | 1750 | | | 2.29 | |
| | 20 | 1755 | | | 2.32 | 14 |
| | 25 | 1760 | | | 2.32 | |
| | 30 | 1765 | | | 2.21 | |
| | 35 | 1770 | | | 2.39 | |
| | 40 | 1775 | | | 2.47 | 12 |
| | 45 | 1780 | | | 2.58 | |
| | 50 | 1785 | | | 2.49 | |
| | 55 | 1790 | | | 2.54 | |
| | 14:00 | 1795 | | | 2.55 | 14 |
| | 14:05 | 1800 | | | 2.52 | |
| | 10 | 1805 | | | 2.80 | |
| | 15 | 1810 | | | 1.65 | |
| | 20 | 1815 | | | 2.80 | 15 |

Date: 9-14-88

**METRIC Corporation**

Pumped Well MW-26

Measurements at Well MW-26

Pump Speed: _____ Q: _____ gpm

Static Water Level _____

| time (h:m:s) | t (min) | t' (min) | t/t' | Drawdown (ft) | Discharge (min/ℓ) |
|---|---|---|---|---|---|
| 14:25 | 1820 | | | 2.18 | |
| 30 | 1825 | | | 2.77 | |
| 35 | 1830 | | | 3.36 | 9 |
| 40 | 1835 | | | 3.30 | |
| 45 | 1840 | | | 3.00 | 10 |
| 50 | 1845 | | | 2.83 | |
| 55 | 1850 | | | 1.83 | |
| 15:00 | 1855 | | | 2.74 | 12 |
| 05 | 1860 | | | 2.73 | |
| 10 | 1865 | | | 2.13 | |
| 15 | 1870 | | | 2.48 | 14 |
| 20 | 1875 | | | 3.48 | |
| 25 | 1880 | | | 3.44 | |
| 30 | 1885 | | | 2.92 | |
| 35 | 1890 | | | 3.15 | 15 |
| 40 | 1895 | | | 2.94 | |
| 45 | 1900 | | | 2.91 | |
| 50 | 1905 | | | 2.83 | 14 |
| 55 | 1910 | | | 2.32 | |
| 16:00 | 1915 | | | 2.07 | |
| 05 | 1920 | | | 2.16 | 15.5 |
| 10 | 1925 | | | 2.54 | |
| 15 | 1930 | | | 2.77 | |
| 20 | 1935 | | | 2.62 | 13.5 |
| 25 | 1940 | | | 2.68 | |
| 30 | 1945 | | | 2.44 | |
| 35 | 1950 | | | 2.37 | 14 |
| 40 | 1955 | | | 2.37 | |
| 45 | 1960 | | | 2.61 | Start aerator |
| 50 | 1965 | | | 2.55 | 12.5 |

Date: 9-14-88

**METRIC Corporation**

Pumped Well MW-26

Measurements at Well MW-26

Pump Speed: _____ Q: _____ gpm

Static Water Level _____

| | time (h:m:s) | t (min) | t' (min) | t/t' | Drawdown (ft) | Discharge (min/ℓ) |
|---|---|---|---|---|---|---|
| 9-15 | 16:55 | 1970 | | | 2.57 | |
| | 17:00 | 1975 | | | 2.29 | |
| | 05 | 1980 | | | 2.09 | 16 |
| | 10 | 1985 | | | 2.25 | |
| | 15 | 1990 | | | 2.26 | |
| | 20 | 1995 | | | 2.43 | 12 |
| | 25 | 2000 | | | 3.23 | |
| | 30 | 2005 | | | 3.24 | |
| | 35 | 2010 | | | 3.37 | |
| | 40 | 2015 | | | 3.15 | |
| | 45 | 2020 | | | 3.35 | 10 |
| | 50 | 2025 | | | 4.09 | |
| | 55 | 2030 | | | 4.09 | 10 |
| | 18:00 | 2035 | | | 3.78 | |
| | 05 | 2040 | | | 3.15 | |
| | 10 | 2045 | | | 3.05 | 15 |
| | 15 | 2050 | | | 2.70 | |
| | 20 | 2055 | | | 2.21 | |
| | 25 | 2060 | | | 1.98 | |
| | 30 | 2065 | | | 2.52 | 18 |
| | 35 | 2070 | | | 1.89 | |
| | 40 | 2075 | | | 2.05 | |
| | 45 | 2080 | | | 2.13 | aerator off ready to siphon |
| | 50 | 2085 | | | 2.52 | 14.5 |
| | 55 | 2090 | | | 2.56 | |
| | 19:00 | 2095 | | | 2.43 | 15 |
| | 05 | 2100 | | | 1.92 | |
| | 10 | 2105 | | | 1.48 | |
| | 15 | 2110 | | | 1.28 | |
| | 20 | 2115 | | | 1.87 | 12 |

Date: 9-14-88

**METRIC Corporation**

Pumped Well MW-26

Measurements at Well MW-26

Pump Speed: _____ Q: _____ gpm

Static Water Level _____

| | time (h:m:s) | t (min) | t' (min) | t/t' | Drawdown (ft) | Discharge (min/ℓ) |
|---|---|---|---|---|---|---|
| 9-15 | 19:25 | 2120 | | | 2.73 | |
| | 30 | 2125 | | | 2.49 | 12 |
| | 35 | 2130 | | | 2.78 | |
| | 40 | 2135 | | | 2.98 | 11 |
| | 45 | 2140 | | | 3.10 | |
| | 50 | 2145 | | | 3.06 | |
| | 55 | 2150 | | | 3.00 | 12 |
| | 20:00 | 2155 | | | 3.03 | |
| | 05 | 2160 | | | 2.67 | 12 |
| | 10 | 2165 | | | 2.27 | |
| | 15 | 2170 | | | 2.25 | |
| | 20 | 2175 | | | 2.33 | |
| | 25 | 2180 | | | 1.84 | |
| | 30 | 2185 | | | 2.95 | 11 |
| | 35 | 2190 | | | 3.47 | 9 |
| | 40 | 2195 | | | 3.54 | |
| | 45 | 2200 | | | 2.95 | |
| | 50 | 2205 | | | 2.93 | 12 |
| | 55 | 2210 | | | 3.20 | |
| | 21:00 | 2215 | | | 3.10 | 11 |
| | 05 | 2220 | | | 3.17 | |
| | 10 | 2225 | | | 3.37 | 10 |
| | 15 | 2230 | | | 3.35 | |
| | 20 | 2235 | | | 3.20 | 11 |
| | 25 | 2240 | | | 3.09 | |
| | 30 | 2245 | | | 2.90 | |
| | 35 | 2250 | | | 2.78 | 12 |
| | 40 | 2255 | | | 2.61 | |
| | 45 | 2260 | | | 2.71 | 13 |
| | 50 | 2265 | | | 2.79 | |

Date: 9-14-88

**METRIC Corporation**

Pumped Well MW-26

Measurements at Well MW-26

Pump Speed: _____ Q: _____ gpm

Static Water Level _____

| | time (h:m:s) | t (min) | t' (min) | t/t' | Drawdown (ft) | Discharge (min/ℓ) |
|---|---|---|---|---|---|---|
| 9-15 | 21:55 | 2270 | | | 2.72 | |
| | 22:00 | 2275 | | | 2.85 | 13 |
| | 05 | 2280 | | | 2.81 | |
| | 10 | 2285 | | | 2.50 | |
| | 15 | 2290 | | | 2.43 | 14 |
| | 20 | 2295 | | | 2.16 | |
| | 25 | 2300 | | | 1.93 | 12 |
| | 30 | 2305 | | | 3.05 | |
| | 35 | 2310 | | | 3.10 | 12 |
| | 40 | 2315 | | | 2.96 | |
| | 45 | 2320 | | | 3.15 | |
| | 50 | 2325 | | | 3.12 | 12 |
| | 55 | 2330 | | | 3.48 | |
| | 23:00 | 2335 | | | 3.07 | 11 |
| | 05 | 2340 | | | 2.57 | |
| | 10 | 2345 | | | 3.26 | 12 |
| | 15 | 2350 | | | 3.60 | |
| | 20 | 2355 | | | 3.42 | 10 |
| | 25 | 2360 | | | 3.15 | |
| | 30 | 2365 | | | 3.26 | 11 |
| | 35 | 2370 | | | 3.23 | |
| | 40 | 2375 | | | 3.16 | 11 |
| | 45 | 2380 | | | 3.11 | |
| | 50 | 2385 | | | 2.97 | 12 |
| | 55 | 2390 | | | 2.43 | Pump Off |
| | 24:00 | 2395 | | | 1.88 | |
| | 03 | 2398 | | | 2.08 | |
| | 05 | 2400 | | | 2.20 | |
| | 10 | 2405 | | | 2.40 | |
| | 20 | 2415 | | | 2.35 | |

Date: 9-14-88

**METRIC Corporation**

Pumped Well MW-26

Measurements at Well MW-26

Pump Speed: _____ Q: _____ gpm

Static Water Level _____

| time (h:m:s) | t (min) | t' (min) | t/t' | Drawdown (ft) | Discharge (min/ℓ) |
|---|---|---|---|---|---|
| 24:25 | 2420 | | | 2.18 | 15 |
| 30 | 2425 | | | 2.40 | |
| 35 | | | | 3.01 | 11 |
| 40 | | | | 3.36 | 10 |
| 45 | | | | 3.39 | |
| 50 | | | | 3.48 | |
| 55 | | | | 3.71 | 10 |
| 1:00 | | | | 1.85 | |
| 05 | | | | 2.27 | |
| 10 | | | | 2.53 | 14 |
| 15 | | | | 2.55 | |
| 20 | | | | 2.75 | |
| 25 | | | | 2.80 | |
| 30 | 2485 | | | 2.54 | 13 |
| 35 | | | | 2.61 | |
| 40 | | | | 2.50 | |
| 45 | | | | 2.65 | 12 |
| 50 | | | | 2.71 | |
| 55 | | | | 2.75 | |
| 2:00 | | | | 2.72 | |
| 05 | | | | 2.71 | 15 |
| 10 | | | | 2.40 | |
| 15 | | | | 2.66 | |
| 20 | | | | 2.70 | 12 |
| 25 | | | | 3.07 | 10 |
| 30 | 2545 | | | 3.35 | |
| 35 | | | | 3.05 | |
| 40 | | | | 2.40 | 15 |
| 45 | | | | 2.43 | |
| 50 | | | | 2.55 | 13 |

**METRIC Corporation**

Date: 9-14-88

Pumped Well MW-26

Measurements at Well MW-26

Pump Speed: _____ Q: _____ gpm

Static Water Level _____

| time (h:m:s) | t (min) | t' (min) | t/t' | Drawdown (ft) | Discharge (min/ℓ) |
|---|---|---|---|---|---|
| 55 | | | | 2.45 | 14 |
| 3:00 | | | | 2.61 | |
| 05 | | | | 2.47 | |
| 10 | | | | 2.59 | |
| 15 | | | | 2.65 | 11 |
| 20 | | | | 2.72 | |
| 25 | | | | 1.91 | 11 |
| 30 | 2605 | | | 2.05 | 12 |
| 35 | | | | 2.39 | 13 |
| 40 | | | | 2.51 | |
| 45 | | | | 2.37 | 13 |
| 50 | | | | 2.33 | |
| 55 | | | | 1.99 | |
| 4:00 | | | | 2.60 | |
| 05 | | | | 2.10 | 12 |
| 10 | | | | 2.98 | |
| 15 | | | | 3.25 | 10 |
| 20 | | | | 3.27 | |
| 25 | | | | 3.25 | 11 |
| 30 | 2665 | | | 3.15 | |
| 35 | | | | 3.18 | 11 |
| 40 | | | | 3.11 | |
| 45 | | | | 3.07 | |
| 50 | | | | 2.50 | 12 |
| 55 | | | | 3.02 | |
| 5:00 | | | | 2.93 | 13 |
| 05 | | | | 2.75 | |
| 10 | | | | 2.80 | |
| 15 | | | | 2.60 | |
| 20 | | | | 3.28 | 11 |
| 25 | | | | 3.59 | |

Date: 9-14-88

**METRIC Corporation**

Pumped Well MW-26

Measurements at Well MW-26

Pump Speed: _____ Q: _____ gpm

Static Water Level _____

| | time (h:m:s) | t (min) | t' (min) | t/t' | Drawdown (ft) | Discharge (min/ℓ) |
|---|---|---|---|---|---|---|
| 9-16 | 5:30 | 2725 | | | 2.50 | 13 |
| | 35 | | | | 2.85 | |
| | 40 | | | | 2.46 | |
| | 45 | | | | 3.42 | 11 |
| | 50 | | | | 3.01 | |
| | 55 | | | | 3.54 | 12 |
| | 6:00 | | | | 2.73 | |
| | 05 | | | | 2.87 | 11 |
| | 10 | | | | 3.35 | |
| | 15 | | | | 2.92 | 12 |
| | 20 | | | | 3.25 | |
| | 25 | | | | 2.77 | |
| | 30 | 2785 | | | 2.63 | 13 |
| | 35 | | | | 2.81 | |
| | 40 | | | | 3.26 | 10 |
| | 45 | | | | 3.57 | |
| | 50 | | | | 2.56 | |
| | 55 | | | | 3.14 | 12 |
| | 7:00 | | | | 2.36 | |
| | 05 | | | | 0.98 | |
| | 10 | | | | 2.69 | |
| | 15 | | | | 1.95 | |
| | 20 | | | | 2.82 | 13 |
| | 25 | | | | 2.68 | |
| | 30 | 2845 | | | 2.46 | |
| | 35 | | | | 2.80 | |
| | 40 | | | | 3.08 | |
| | 45 | | | | 2.51 | 14 |
| | 50 | | | | 2.08 | |
| | 55 | | | | 1.90 | |

Date: 9-14-88

**METRIC Corporation**

Pumped Well MW-26

Measurements at Well MW-26

Pump Speed: _____ Q: _____ gpm

Static Water Level _____

| | time (h:m:s) | t (min) | t' (min) | t/t' | Drawdown (ft) | Discharge (min/ℓ) |
|---|---|---|---|---|---|---|
| 9-16 | 8:00 | | | | 2.00 | |
| | 05 | | | | 2.25 | 16 |
| | 10 | | | | 2.48 | |
| | 15 | | | | 3.30 | 10 |
| | 20 | | | | 3.40 | |
| | 25 | | | | 2.62 | |
| | 30 | 2905 | | | 2.24 | 14 |
| | 35 | | | | 1.78 | |
| | 40 | | | | 1.53 | |
| | 45 | | | | 2.21 | 17 |
| | 50 | | | | 2.58 | |
| | 55 | | | | 2.90 | 11 |
| | 9:00 | | | | 3.12 | |
| | 05 | | | | 2.20 | |
| | 10 | | | | 2.03 | |
| | 15 | | | | 2.08 | 17 |
| | 20 | | | | 3.17 | |
| | 25 | | | | 2.29 | |
| | 30 | 2965 | | | 2.32 | |
| | 35 | | | | 2.36 | 14 |
| | 40 | | | | 2.42 | |
| | 45 | | | | 2.38 | |
| | 50 | | | | 2.44 | 14 |
| | 55 | | | | 2.49 | |
| | 10:00 | | | | 2.46 | |
| | 05 | | | | 2.63 | 13 |
| | 10 | | | | 2.59 | |
| | 15 | | | | 2.83 | 12 |
| | 20 | | | | 2.59 | |
| | 25 | | | | 2.29 | |

**METRIC Corporation**

Date: 9-14-88

Pumped Well MW-26

Measurements at Well MW-26

Pump Speed: _____ Q: _____ gpm

Static Water Level _____

| time (h:m:s) | t (min) | t' (min) | t/t' | Drawdown (ft) | Discharge (min/ℓ) |
|---|---|---|---|---|---|
| 9-16 10:30 | 3025 | | | 2.12 | |
| 35 | | | | 2.05 | 15 |
| 40 | | | | 2.17 | |
| 45 | | | | 2.36 | |
| 50 | | | | 2.44 | 14 |
| 55 | | | | 2.27 | |
| 11:00 | | | | 2.09 | |
| 05 | | | | 2.17 | 15 |
| 10 | | | | 2.30 | |
| 15 | | | | 2.36 | |
| 20 | | | | 2.50 | |
| 25 | | | | 2.48 | 13 |
| 30 | 3085 | | | 2.57 | |
| 35 | | | | 2.64 | |
| 40 | | | | 2.70 | 12 |
| 45 | | | | 2.26 | |
| 50 | | | | 2.17 | |
| 55 | | | | 1.93 | 17 |
| 12:00 | | | | 1.86 | |
| 05 | | | | 1.80 | |
| 10 | | | | 1.63 | |
| 15 | | | | 1.86 | 16 |
| 20 | | | | 2.29 | |
| 25 | | | | 2.53 | |
| 30 | 3145 | | | 2.74 | 13 |
| 35 | | | | 2.43 | |
| 40 | | | | 2.46 | |
| 45 | | | | 2.43 | 14 |
| 50 | | | | 2.38 | |
| 55 | | | | 2.48 | |

Date: 9-14-88

**METRIC Corporation**

Pumped Well MW-26

Measurements at Well MW-26

Pump Speed: _____ Q: _____ gpm

Static Water Level _____

| | time (h:m:s) | t (min) | t' (min) | t/t' | Drawdown (ft) | Discharge (min/ℓ) |
|---|---|---|---|---|---|---|
| 9-16 | 13:00 | | | | 2.35 | |
| | 05 | | | | 2.15 | |
| | 10 | | | | 2.19 | |
| | 15 | | | | 2.07 | 16 |
| | 20 | | | | 1.91 | |
| | 25 | | | | 1.18 | |
| | 30 | 3205 | | | | Pump started-adj sucker rod chattering |
| | 35 | | | | | |
| | 40 | | | | 2.80 | |
| | 45 | | | | 2.50 | |
| | 50 | | | | 2.07 | 18 |
| | 55 | | | | 2.03 | |
| | 14:00 | | | | 1.92 | |
| | 05 | | | | 1.99 | 16 |
| | 10 | | | | 1.95 | |
| | 15 | | | | 1.97 | |
| | 20 | | | | 1.93 | |
| | 25 | | | | 1.74 | 18 |
| | 30 | 3265 | | | 2.33 | |
| | 35 | | | | 2.62 | 10 |
| | 40 | | | | 2.87 | |
| | 45 | | | | 1.81 | Power off 2:43:50-2:46:06 |
| | 50 | | | | 2.44 | 12 |
| | 55 | | | | 2.88 | |
| | 15:00 | | | | 3.00 | |
| | 05 | | | | 2.74 | |
| | 10 | | | | 2.54 | 12 |
| | 15 | | | | 2.43 | |
| | 20 | | | | 2.44 | |
| | 25 | | | | 2.47 | |

**METRIC Corporation**

Date: 9-14-88

Pumped Well MW-26

Measurements at Well MW-26

Pump Speed: _____ Q: _____ gpm

Static Water Level _____

| | time (h:m:s) | t (min) | t' (min) | t/t' | Drawdown (ft) | Discharge (min/ℓ) |
|---|---|---|---|---|---|---|
| 9-16 | 15:30 | 3325 | | | 2.39 | |
| | 35 | | | | 2.21 | |
| | 40 | | | | 2.44 | |
| | 45 | | | | 2.27 | |
| | 50 | | | | 2.33 | 13 |
| | 55 | | | | 2.40 | |
| | 16:00 | | | | 2.39 | |
| | 05 | | | | 2.18 | |
| | 10 | | | | 2.28 | 15 |
| | 15 | | | | 2.23 | |
| | 20 | | | | 2.16 | |
| | 25 | | | | 2.13 | 14 |
| | 30 | 3385 | | | 2.37 | |
| | 35 | | | | 2.18 | |
| | 40 | | | | 2.10 | 15 |
| | 45 | | | | 2.14 | |
| | 50 | | | | 2.07 | |
| | 55 | | | | 2.10 | 15 |
| | 17:00 | | | | 1.97 | |
| | 05 | | | | 2.11 | |
| | 10 | | | | 2.07 | |
| | 15 | | | | 1.97 | |
| | 20 | | | | 1.83 | |
| | 25 | | | | 1.79 | 15 |
| | 30 | 3445 | | | 2.87 | |
| | 35 | | | | 2.43 | 12 |
| | 40 | | | | 2.46 | |
| | 45 | | | | 2.56 | |
| | 50 | | | | 2.76 | |
| | 55 | | | | 2.19 | 15 |

Date: 9-14-88

**METRIC Corporation**

Pumped Well MW-26

Measurements at Well MW-26

Pump Speed: _____ Q: _____ gpm

Static Water Level _____

| time (h:m:s) | t (min) | t' (min) | t/t' | Drawdown (ft) | Discharge (min/ℓ) |
|---|---|---|---|---|---|
| 1:30 | 3925 | | | 1.92 | N.R. |
| 35 | | | | 1.66 | |
| 40 | | | | 2.15 | |
| 45 | | | | 2.80 | |
| 50 | | | | 1.30 | 14 |
| 55 | | | | 2.43 | |
| 2:00 | | | | 2.47 | |
| 05 | | | | 2.27 | |
| 10 | | | | 2.31 | |
| 15 | | | | 2.26 | |
| 20 | | | | 2.26 | 13 |
| 25 | | | | 2.65 | |
| 30 | 3985 | | | 2.48 | |
| 35 | | | | 2.23 | 14 |
| 40 | | | | 2.57 | |
| 45 | | | | 2.00 | |
| 50 | | | | 2.32 | 14 |
| 55 | | | | 2.54 | |
| 3:00 | | | | 3.25 | 9 |
| 05 | | | | 2.85 | |
| 10 | | | | 2.90 | |
| 15 | | | | 2.82 | 13 |
| 20 | | | | 2.85 | |
| 25 | | | | 2.29 | 14 |
| 30 | 4045 | | | 2.35 | |
| 35 | | | | 2.90 | 11 |
| 40 | | | | 2.32 | |
| 45 | | | | 2.25 | |
| 50 | | | | 2.08 | |
| 55 | | | | 1.97 | N.R. |

Date: 9-14-88

**METRIC Corporation**

Pumped Well MW-26

Measurements at Well MW-26

Pump Speed: _____ Q: _____ gpm

Static Water Level _____

| time (h:m:s) | t (min) | t' (min) | t/t' | Drawdown (ft) | Discharge (min/ℓ) |
|---|---|---|---|---|---|
| 4:00 | | | | 1.88 | |
| 05 | | | | 1.74 | 14 |
| 10 | | | | 2.77 | |
| 15 | | | | 2.20 | |
| 20 | | | | 1.85 | |
| 25 | | | | 2.53 | 15 |
| 30 | 4105 | | | 2.54 | |
| 35 | | | | 2.39 | 14 |
| 40 | | | | 2.41 | |
| 45 | | | | 2.95 | 14 |
| 50 | | | | 2.58 | |
| 55 | | | | 2.60 | |
| 5:00 | | | | 2.75 | 13 |
| 05 | | | | 2.66 | |
| 10 | | | | 3.45 | |
| 15 | | | | 2.77 | |
| 20 | | | | 2.49 | |
| 25 | | | | 2.15 | |
| 30 | 4165 | | | 2.09 | 15 |
| 35 | | | | 2.40 | |
| 40 | | | | 1.69 | |
| 45 | | | | 1.81 | 15 |
| 50 | | | | 1.91 | |
| 55 | | | | 2.09 | |
| 6:00 | | | | 2.29 | 14 |
| 05 | | | | 3.02 | |
| 10 | | | | 2.15 | |
| 15 | | | | 1.97 | 14 |
| 20 | | | | 2.13 | |
| 25 | | | | 1.98 | |

Date: 9-20-88

**METRIC Corporation**

Pumped Well MW-27

Measurements at Well MW-27

Pump Speed: _____ Q: 0.11741 gpm

Static Water Level _____

| | time (h:m:s) | t (min) | t' (min) | t/t' | Drawdown (ft) | Discharge (min.sec/ℓ) |
|---|---|---|---|---|---|---|
| 9-20 | 10:10:00 | 0 | | | 0 | |
| | 15 | .25 | | | - | |
| | 30 | .5 | | | 0.43 | |
| | 45 | .75 | | | 1.48 | |
| | 10:11:00 | 1 | | | 2.32 | |
| | 30 | 1.5 | | | 3.08 | |
| | 12:00 | 2.0 | | | 3.43 | |
| | 30 | 2.5 | | | 3.67 | |
| | 13:00 | 3.0 | | | 3.78 | |
| | 30 | 3.5 | | | 3.79 | |
| | 14:00 | 4.0 | | | 3.48 | |
| | 30 | 4.5 | | | 3.38 | |
| | 15:00 | 5 | | | 3.48 | |
| | 16:00 | 6 | | | 3.64 | |
| | 17:00 | 7 | | | 3.71 | |
| | 18:00 | 8 | | | 3.66 | |
| | 19:00 | 9 | | | 3.45 | |
| | 20:00 | 10 | | | 3.28 | Discharge 2'16"/ℓ |
| | 22 | 12 | | | 3.04 | |
| | 24 | 14 | | | 2.85 | |
| | 26 | 16 | | | 2.88 | |
| | 28 | 18 | | | 2.78 | |
| | 30 | 20 | | | 2.69 | |
| | 35 | 25 | | | 2.65 | 2'16"/ℓ |
| | 40 | 30 | | | 2.86 | |
| | 45 | 35 | | | 2.80 | 2'10"/ℓ |
| | 50 | 40 | | | 2.98 | |
| | 55 | 45 | | | 2.95 | |
| | 11:00:00 | 50 | | | 3.25 | |
| | 11:10:00 | 60 | | | 2.25 | 2'07"/ℓ |

Date: 9-20-88

**METRIC Corporation**

Pumped Well MW-27

Measurements at Well MW-27

Pump Speed: _____ Q: _____ gpm

Static Water Level _____

| | time (h:m:s) | t (min) | t' (min) | t/t' | Drawdown (ft) | Discharge (min·sec/ℓ) |
|---|---|---|---|---|---|---|
| 9-20 | 11:20 | 70 | | | 2.98 | 2'15"/ℓ |
| | 11:30 | 80 | | | 2.86 | |
| | 11:40 | 90 | | | 2.25 | 2'19"/ℓ |
| | 11:50 | 100 | | | 2.58 | |
| | 12:00 | 110 | | | 2.90 | 2'12"/ℓ |
| | 12:20 | 130 | | | 2.56 | 2'18"/ℓ |
| | 40 | 150 | | | 3.03 | 2'19"/ℓ |
| | 13:00 | 170 | | | 3.25 | 2'17"/ℓ |
| | 30 | 200 | | | 3.13 | 2'13"/ℓ |
| | 14:00 | 230 | | | 2.87 | 2'11"/ℓ |
| | 30 | 260 | | | 2.72 | 2'23"/ℓ |
| | 15:00 | 290 | | | 3.06 | 2'13",2'26",2'9",2'20" |
| | 30 | 320 | | | 2.94 | 2'23", 2'14" |
| | 16:00 | 350 | | | 2.73 | 2'23", 2'19" |
| | 17:00 | 410 | | | 2.68 | 2'7", 26" |
| | 30 | 440 | | | 2.79 | 2'13" |
| | 18:00 | 470 | | | 2.68 | 2'35" adj 2'21" |
| | 19:00 | 530 | | | 2.69 | 2'14", 2'12" |
| | 20:00 | 590 | | | 2.85 | 2'10" |
| | 21:00 | 650 | | | 2.48 | 2'3", 2'25" |
| | 22:00 | 710 | | | 2.70 | 2'8" |
| | 23:00 | 770 | | | 2.66 | 2'15" |
| | 24:00 | 830 | | | 2.72 | 2'0" adj |
| | 1:00 | 890 | | | 2.54 | 2'20" |
| | 2:00 | 950 | | | 2.68 | 2'13" |
| | 3:00 | 1010 | | | 2.75 | 2'10" |
| | 4:00 | 1070 | | | 2.96 | 1'52" adj 2'16" |
| | 5:00 | 1130 | | | 2.88 | 2'10" |
| | 6:00 | 1190 | | | 3.01 | 2'17" |
| | 7:00 | 1250 | | | 3.38 | 1'48" adj 2'15" |

Date: 9-20-88

**METRIC Corporation**

Pumped Well MW-27

Measurements at Well MW-27

Pump Speed: _____ Q: _____ gpm

Static Water Level _____

| | time (h:m:s) | t (min) | t' (min) | t/t' | Drawdown (ft) | Discharge (min·sec/ℓ) |
|---|---|---|---|---|---|---|
| 9-21 | 8:00 | 1310 | | | 3.24 | 2'10"/ℓ |
| | 9:00 | 1370 | | | 2.39 | 2'15"/ℓ |
| | 10:00 | 1430 | | | 2.36 | 2'17"/ℓ |
| | 11:00 | 1490 | | | 2.78 | 2'15"/ℓ |
| | 12:00 | 1550 | | | 2.87 | 2'17"/ℓ |
| | 13:00 | 1610 | | | 2.51 | 2'18"/ℓ |
| | 14:00 | 1670 | | | 2.47 | 2'15"/ℓ |
| | 15:00 | 1730 | | | 2.95 | 2'18"/ℓ |
| | 16:00 | 1790 | | | 3.15 | 2'17"/ℓ |
| | 17:00 | 1850 | | | 3.18 | 2'11"/ℓ |
| | 18:00 | 1910 | | | 3.68 | 2'10"/ℓ |
| | 19:00 | 1970 | | | 3.19 | 2'14" |
| | 20:00 | 2030 | | | 3.04 | 2'3" adj |
| | 21:00 | 2090 | | | 3.00 | 2'11" |
| | 22:00 | 2150 | | | 3.18 | 2'10" |
| | 23:00 | 2210 | | | 2.85 | 2'10" |
| | 24:00 | 2270 | | | 2.77 | 2'22" |
| 9-22 | 1:00 | 2330 | | | 2.81 | 2'11" |
| | 2:00 | 2390 | | | 2.94 | 2'6" |
| | 3:00 | 2450 | | | 2.83 | 2'15" |
| | 4:00 | 2510 | | | 2.88 | 2'27" adj |
| | 5:00 | 2570 | | | 2.66 | 2'14" |
| | 6:00 | 2630 | | | 2.87 | - |
| | 7:00 | 2690 | | | 2.58 | 2'15"/ℓ |
| | 8:00 | 2750 | | | 3.11 | 2'17"/ℓ |
| | 9:00 | 2810 | | | 2.56 | 2'17"/ℓ |
| | 10:00 | 2870 | | | 2.46 | adj to 2'10" |
| | 11:00 | 2930 | | | 2.61 | 2'14' |
| | 12:00 | 2990 | | | 2.71 | 2'12" |
| | 13:00 | 3050 | | | 2.98 | |

Date: 9-20-88

**METRIC Corporation**

Pumped Well MW-27

Measurements at Well MW-27

Pump Speed: _____ Q: _____ gpm

Static Water Level _____

| | time (h:m:s) | t (min) | t' (min) | t/t' | Drawdown (ft) | Discharge (min·sec/ℓ) |
|---|---|---|---|---|---|---|
| 9-22 | 14:00 | 3110 | | | 2.61 | 2'19"/ |
| | 15:00 | 3170 | | | 2.61 | 2'29"/ |
| | 16:00 | 3230 | | | 2.86 | 2'8"/ |
| | 17:00 | 3290 | | | 2.48 | 2'23"/ |
| | 18:00 | 3350 | | | 2.54 | 2'9"/ |
| | 19:00 | 3410 | | | 2.87 | 2'11" |
| | 20:00 | 3470 | | | 3.01 | 2'9" |
| | 21:00 | 3530 | | | 2.83 | 2'28" |
| | 22:00 | 3590 | | | 2.98 | 1'48" adj |
| | 23:00 | 3650 | | | 2.75 | 2'18" |
| | 24:00 | 3710 | | | 2.85 | 2'8" |
| 9-23 | 1:00 | 3770 | | | 2.80 | 2'16" |
| | 2:00 | 3830 | | | 2.54 | 2'17" |
| | 3:00 | 3890 | | | 2.90 | 2'12" |
| | 4:00 | 3950 | | | 3.11 | 2'10" |
| | 5:00 | 4010 | | | 2.93 | 2'7" adj |
| | 6:00 | 4070 | | | 2.80 | 2'19" |
| | 7:00 | 4130 | | | 2.54 | 2'25" adj |
| | 8:00 | 4190 | | | 2.22 | 2'14" |
| | 8:10 | 4200 | | | 1.88 | Stop pump |
| | | | | | | |
| | | | | | | |
| | | | | | | |
| | | | | | | |
| | | | | | | |
| | | | | | | |
| | | | | | | |
| | | | | | | |
| | | | | | | |
| | | | | | | |

Date: 9-20-88

**METRIC Corporation**

RECOVERY

Pumped Well MW-27

Measurements at Well MW-27

Pump Speed: _____ Q: _____ gpm

Static Water Level _____

| | time (h:m:s) | t (min) | t' (min) | t/t' | Drawdown (ft) | Discharge (min·sec/ℓ) |
|---|---|---|---|---|---|---|
| 9-23 | 8:10:00 | 4200 | 0.0 | | 1.88 | |
| | 8:10:15 | 4200.25 | 0.25 | 16801 | 1.10 | |
| | 30 | 4200.50 | 0.50 | 8401 | 0.73 | |
| | 45 | 4200.75 | 0.75 | 5601 | 0.47 | |
| | 11:00 | 4201.00 | 1.00 | 4201 | 0.35 | |
| | 11:30 | 4201.5 | 1.50 | 2801 | 0.20 | |
| | 12:00 | 4202.0 | 2.00 | 2101 | 0.11 | |
| | 12:30 | 4202.5 | 2.50 | 1681 | 0.09 | |
| | 13:00 | 4203.0 | 3.00 | 1401 | 0.07 | |
| | 13:30 | 4203.5 | 3.5 | 1201 | 0.05 | |
| | 14:00 | 4204.0 | 4.0 | 1051 | 0.04 | |
| | 14:30 | 4204.5 | 4.5 | 934 | 0.03 | |
| | 15:00 | 4205.0 | 5.0 | 841 | 0.03 | |
| | 16:00 | 4206 | 6 | 701 | 0.01 | |
| | 17 | 4207 | 7 | 601 | 0.01 | |
| | 18 | 4208 | 8 | 526 | 0.01 | |
| | 19 | 4209 | 9 | 468 | 0.00 | |
| | 20 | 4210 | 10 | 421 | 0.0 | |
| | 22 | 4212 | 12 | 351 | 0.0 | |
| | 24 | 4214 | 14 | 301 | 0.0 | |
| | 26 | 4216 | 16 | 264 | 0.0 | |
| | 28 | 4218 | 18 | 234 | +0.01 | |
| | 8:30 | 4220 | 20 | 211 | +0.02 | |
| | 35 | 4225 | 25 | 169 | +0.02 | |
| | 40 | 4230 | 30 | 141 | +0.02 | |
| | 45 | 4235 | 34 | 121 | +0.03 | |
| | 50 | 4240 | 40 | 106 | +0.03 | |
| | 55 | 4245 | 45 | 94 | +0.02 | |
| | 9:00 | 4250 | 50 | 85 | 0.03 | |
| | 9:10 | 4260 | 60 | 71 | 0.03 | |

Date: 9-20-88

**METRIC Corporation**

Pumped Well MW-27

Measurements at Well MW-27

Pump Speed: _____ Q: _____ gpm

Static Water Level _____

| time (h:m:s) | t (min) | t' (min) | t/t' | Drawdown (ft) | Discharge (min·sec/ℓ) |
|---|---|---|---|---|---|
| 9:20 | 4270 | 70 | 61 | +0.03 | |
| 9:30 | 4280 | 80 | 54 | +0.03 | |
| 10:00 | 4310 | 110 | 39 | +0.03 | |
| 11:27 | | | | | |
| 13:49 | 3497 | 197 | 22 | +0.03 | |
| 16:47 | 4539 | 339 | 13 | +0.07 | |
| | 4717 | 407 | 11 | +0.09 | |

Date: 10-11-88

**METRIC Corporation**

Pumped Well MW-28

Measurements at Well MW-28

Pump Speed: _____ Q: 0.07045 gpm

Static Water Level _____

| time (h:m:s) | t (min) | t' (min) | t/t' | Drawdown (ft) | Discharge (min·sec/ℓ) |
|---|---|---|---|---|---|
| 12:20:00 | 0 | | | 0.05 | |
| :15 | .25 | | | 0.09 | |
| :30 | .50 | | | 0.16 | |
| :45 | .75 | | | 0.18 | |
| 21:00 | 1.0 | | | 0.21 | |
| 21:30 | 1.5 | | | 0.25 | |
| 22:00 | 2.0 | | | 0.31 | |
| 22:30 | 2.5 | | | 0.37 | |
| 23:00 | 3.0 | | | 0.42 | |
| 23:30 | 3.5 | | | 0.45 | |
| 24:00 | 4.0 | | | 0.49 | |
| 24:30 | 4.5 | | | 0.55 | |
| 25:30 | 5 | | | 0.56 | |
| 26 | 6 | | | 0.63 | |
| 27 | 7 | | | 0.70 | |
| 28 | 8 | | | 0.77 | |
| 29 | 9 | | | 0.83 | Reduced motor speed |
| 30 | 10 | | | 0.87 | |
| 12:32 | 12 | | | 0.93 | |
| 12:34 | 14 | | | 0.99 | |
| 36 | 16 | | | 1.04 | |
| 38 | 18 | | | 1.11 | |
| 40 | 20 | | | 1.13 | |
| 45 | 25 | | | 1.20 | 4'12"/ℓ |
| 50 | 30 | | | 1.24 | |
| 55 | 35 | | | 1.23 | |
| 13:00 | 40 | | | 1.28 | 3'02"/ℓ |
| 13:20 | 60 | | | 1.32 | 4'29'/ℓ |
| 13:40 | 80 | | | 1.43 | 4'36"/ℓ |
| 14:00 | 100 | | | | |

Date: 10-11-88

**METRIC Corporation**

Pumped Well MW-28

Measurements at Well MW-28

Pump Speed: _____ Q: _____ gpm

Static Water Level _____

| time (h:m:s) | t (min) | t' (min) | t/t' | Drawdown (ft) | Discharge (min·sec/ℓ) |
|---|---|---|---|---|---|
| 14:30 | 130 | | | 1.44 | 4'32" adj |
| 15:00 | 160 | | | 1.68 | 3'36" adj |
| 15:30 | 190 | | | 1.58 | 5'26" adj |
| 16:00 | 220 | | | 1.71 | 4'50" adj |
| 17:00 | 280 | | | 1.88 | 2'06" adj |
| 18:00 | 240 | | | 1.86 | 3'39" adj |
| 19:00 | 400 | | | 1.73 | 3'49" adj |
| 20:00 | 460 | | | 1.82 | 5'23" adj |
| 21:00 | 520 | | | 1.81 | 3'45" tech adj. |
| 22:00 | 580 | | | 1.94 | 3'38" |
| 23:00 | 640 | | | 2.11 | 3'32" |
| 24:00 | 700 | | | 2.20 | 3'48" |
| 1:00 | 760 | | | 2.20 | 4'00" |
| 2:00 | 820 | | | 2.16 | 3'49" |
| 3:00 | 880 | | | 2.11 | 4'06" |
| 4:00 | 940 | | | 2.18 | 3'55" |
| 5:00 | 1000 | | | 2.19 | 3'47" |
| 6:00 | 1060 | | | 2.30 | 3'47" |
| 7:00 | 1120 | | | 2.21 | 3'47" |
| 8:00 | 1180 | | | 2.33 | 3'47" |
| 9:00 | 1240 | | | 2.30 | 3'43" |
| 10:00 | 1300 | | | 2.43 | 3'44" |
| 11:00 | 1360 | | | 2.52 | 3'46" |
| 12:00 | 1420 | | | 2.59 | 3'45" |
| 13:00 | 1480 | | | 2.69 | 3'43" |
| 14:00 | 1540 | | | 2.45 | 3'42" |
| 15:00 | 1600 | | | 2.48 | 3'43" |
| 16:00 | 1660 | | | 2.50 | 3'46" |
| 17:00 | 1720 | | | 2.52 | 3'43" |
| 18:00 | 1780 | | | 2.54 | 3'44" |

Date: 10-11-88

**METRIC Corporation**

Pumped Well MW-28

Measurements at Well MW-28

Pump Speed: _____ Q: _____ gpm

Static Water Level _____

| | time (h:m:s) | t (min) | t' (min) | t/t' | Drawdown (ft) | Discharge (min·sec/ℓ) |
|---|---|---|---|---|---|---|
| 10/12 | 19:00 | 1840 | | | 2.49 | 3'45" |
| | 20:00 | 1900 | | | 2.66 | 3'44" |
| | 21:00 | 1960 | | | 2.59 | 3'46" |
| | 22:00 | 2020 | | | 2.67 | 3'48" |
| | 23:00 | 2080 | | | 2.39 | 3'52" |
| | 24:00 | 2140 | | | 2.29 | 4'00" |
| | 1:00 | 2200 | | | 2.17 | 4'08" |
| | 2:00 | 2260 | | | 2.62 | 3'46" |
| | 3:00 | 2320 | | | 2.74 | 3'44" |
| | 4:00 | 2380 | | | 2.74 | 3'45" |
| | 5:00 | 2440 | | | 2.63 | 3'48" |
| | 6:00 | 2500 | | | 2.58 | 3'48" |
| | 7:00 | 2560 | | | 2.61 | 3'48" |
| | 8:00 | 2620 | | | 2.68 | 3'48" |
| | 9:00 | 2680 | | | 2.42 | 3'47" |
| | 10:00 | 2740 | | | 2.59 | 3'49" |
| | 11:00 | 2800 | | | 2.68 | 3'47" |
| | 12:00 | 2860 | | | 2.53 | 3'47" |
| | 13:00 | 2920 | | | 2.53 | 3'46" |
| | 14:00 | 2980 | | | 2.51 | 3'46" |
| | 15:00 | 3040 | | | 2.53 | 3'45" |
| | 16:00 | 3100 | | | 2.50 | 3'45" |
| | 17:00 | 3160 | | | 2.69 | 3'44" |
| | 18:00 | 3220 | | | 2.71 | 3'43" |
| | 19:00 | 3280 | | | 2.61 | 3'45" |
| | 20:00 | 3340 | | | 2.65 | 3'42" |
| | 21:00 | 3400 | | | 2.70 | 3'44" |
| | 22:00 | 3460 | | | 2.56 | 3'44" |
| | 23:00 | 3520 | | | 2.66 | 3'44" |
| | 24:00 | 3580 | | | 2.63 | 3'45" |

**METRIC Corporation**

Date: 10-11-88

Pumped Well MW-28

Measurements at Well MW-28

Pump Speed: _____ Q: _____ gpm

Static Water Level _____

| time (h:m:s) | t (min) | t' (min) | t/t' | Drawdown (ft) | Discharge (min.sec/ℓ) |
|---|---|---|---|---|---|
| 1:00 | 3640 | | | 2.68 | 3'48" |
| 2:00 | 3700 | | | 2.59 | 3'48" |
| 3:00 | 3760 | | | 2.54 | 3'49" |
| 4:00 | 3820 | | | 2.57 | 3'49" |
| 5:00 | 3880 | | | 2.66 | 3'50" |
| 6:00 | 3940 | | | 2.46 | 3'54" Hole Cleaned |
| 7:00 | 4000 | | | 2.77 | 3'36" |
| 8:00 | 4060 | | | 2.72 | 3'43" |
| 9:00 | 4120 | | | 2.63 | 3'43" |
| 10:00 | 4180 | | | 2.64 | 3'43" |
| 11:00 | 4240 | | | 2.65 | 3'43" |
| 12:00 | 4300 | | | 2.67 | 3'45" |
| 12:20 | 4320 | 0 | | 2.56 | Pump Off |
| 12:20:15 | 4320.25 | .25 | 17,281 | 2.45 | |
| :20:30 | 4320.50 | .5 | 8,641 | | |
| :20:45 | 4320.75 | .75 | 5,761 | 2.15 | |
| :21:00 | 4321.0 | 1.0 | 4,321 | 2.14 | |
| :21:30 | 4321.5 | 1.5 | 2,881 | 2.11 | |
| :22:00 | 4322.0 | 2.0 | 2,161 | 2.10 | |
| :22:30 | 4322.5 | 2.5 | 1,729 | 2.08 | |
| :23:00 | 4323.0 | 3.0 | 1,444 | 2.06 | |
| :23:30 | 4323.5 | 3.5 | 1,235 | 2.05 | |
| :24:00 | 4324.0 | 4.0 | 1,081 | 2.03 | |
| :24:30 | 4324.5 | 4.5 | 961 | 2.01 | |
| :25:00 | 4325 | 5.0 | 865 | 2.00 | |
| :26 | 4326 | 6 | 721 | 1.97 | |
| :27 | 4327 | 7 | 618 | 1.94 | |
| :28 | 4328 | 8 | 541 | 1.92 | |
| :29 | 4329 | 9 | 481 | 1.89 | |
| :30 | 4330 | 10 | 433 | 1.87 | |

**METRIC**
Corporation

Date: 10-11-88

Pumped Well MW-28

Measurements at Well MW-28

Pump Speed: _____ Q: _____ gpm

Static Water Level _____

| time (h:m:s) | t (min) | t' (min) | t/t' | Drawdown (ft) | Discharge (min·sec/ℓ) |
|---|---|---|---|---|---|
| 12:32 | 4332 | 12 | 361 | 1.82 | |
| 34 | 4334 | 14 | 310 | 1.77 | |
| 36 | 4336 | 16 | 271 | 1.71 | |
| 38 | 4338 | 18 | 241 | 1.66 | |
| 40 | 4340 | 20 | 217 | 1.62 | |
| 50 | 4350 | 30 | 145 | 1.44 | |
| 55 | 4355 | 35 | 124 | 1.33 | |
| 13:00 | 4360 | 40 | 109 | 1.26 | |
| 13:30 | 4390 | 70 | 63 | 0.85 | |
| 14:00 | 4420 | 100 | 44 | 0.56 | |
| 14:30 | 4450 | 130 | 34 | 0.32 | |
| 15:00 | 4480 | 160 | 28 | 0.20 | |
| 16:00 | 4540 | 220 | 21 | 0.07 | |
| 17:00 | 4600 | 280 | 16 | 0.01 | |
| 18:00 | 4660 | 340 | 14 | 0.00 | |
| 19:00 | 4720 | 400 | 12 | 0.00 | |

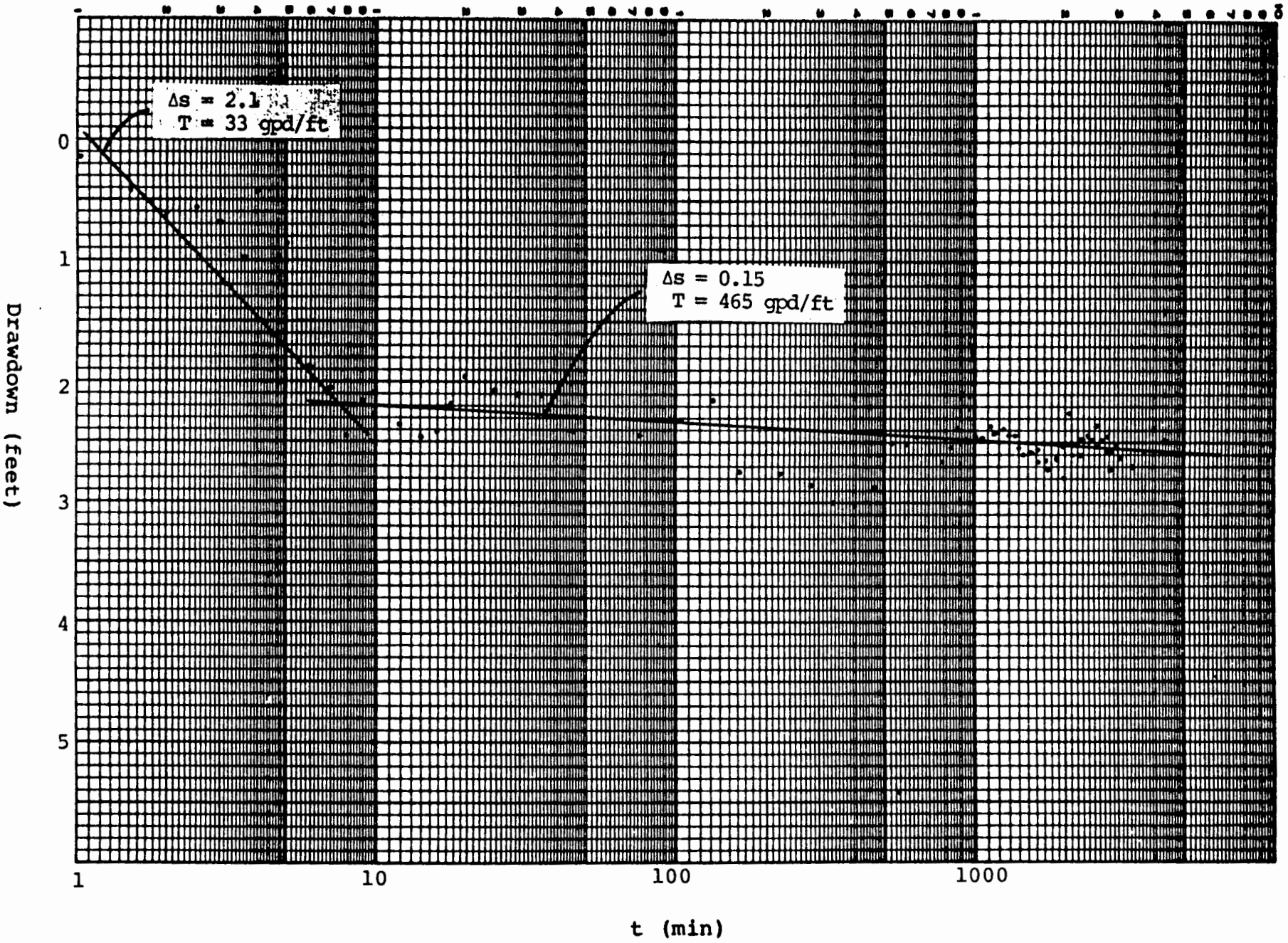
# APPENDIX B

# SEMI-LOG PLOTS

Pumped Well : MW-23
Observations at Well :MW-23

Time-Drawdown
Q = 0.264gpm

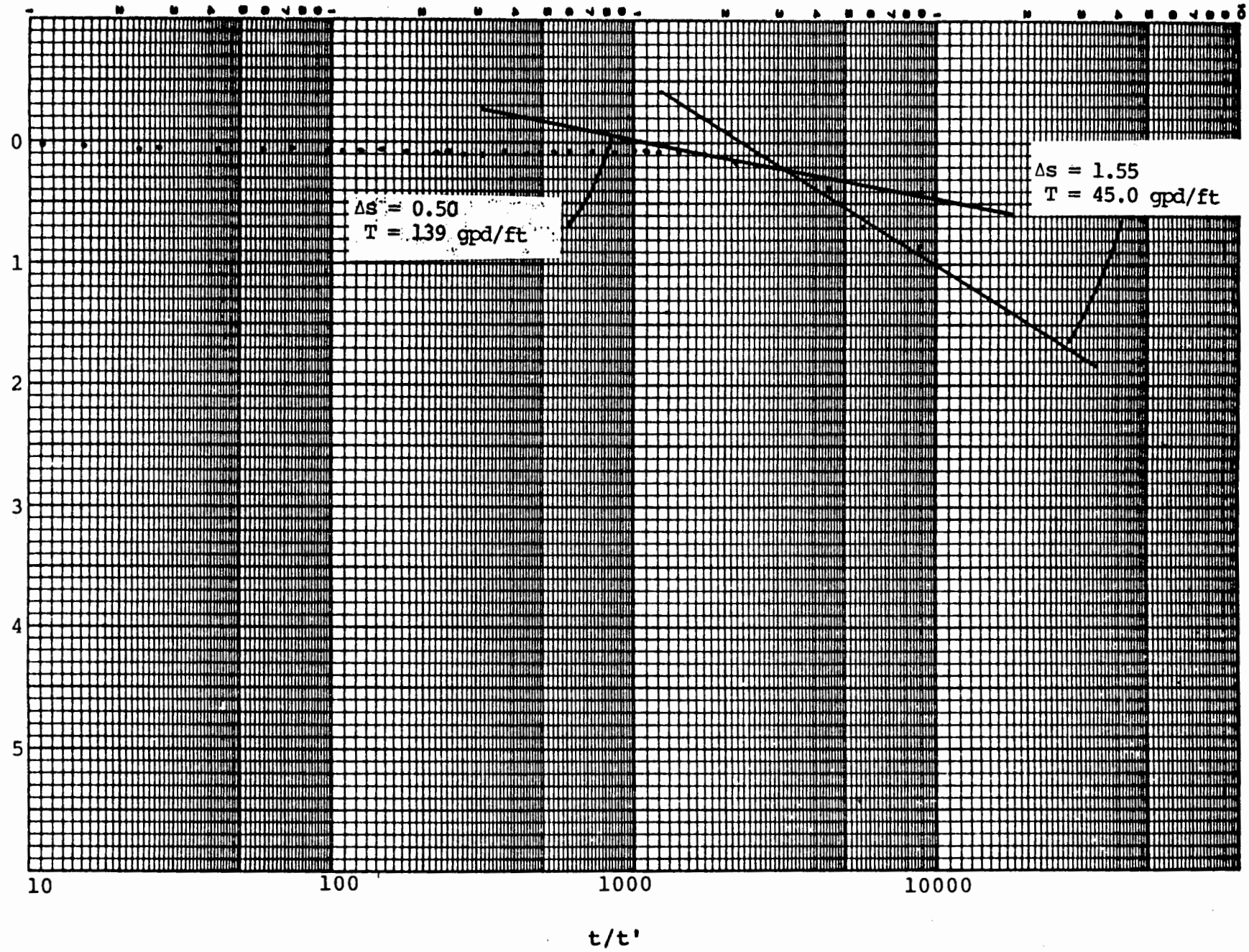
METRIC Corporation
Date: 9-27-88



Pumped Well : MW-23
Observations at Well : MW-23

Residual-Drawdown
Q = 0.264 gpm

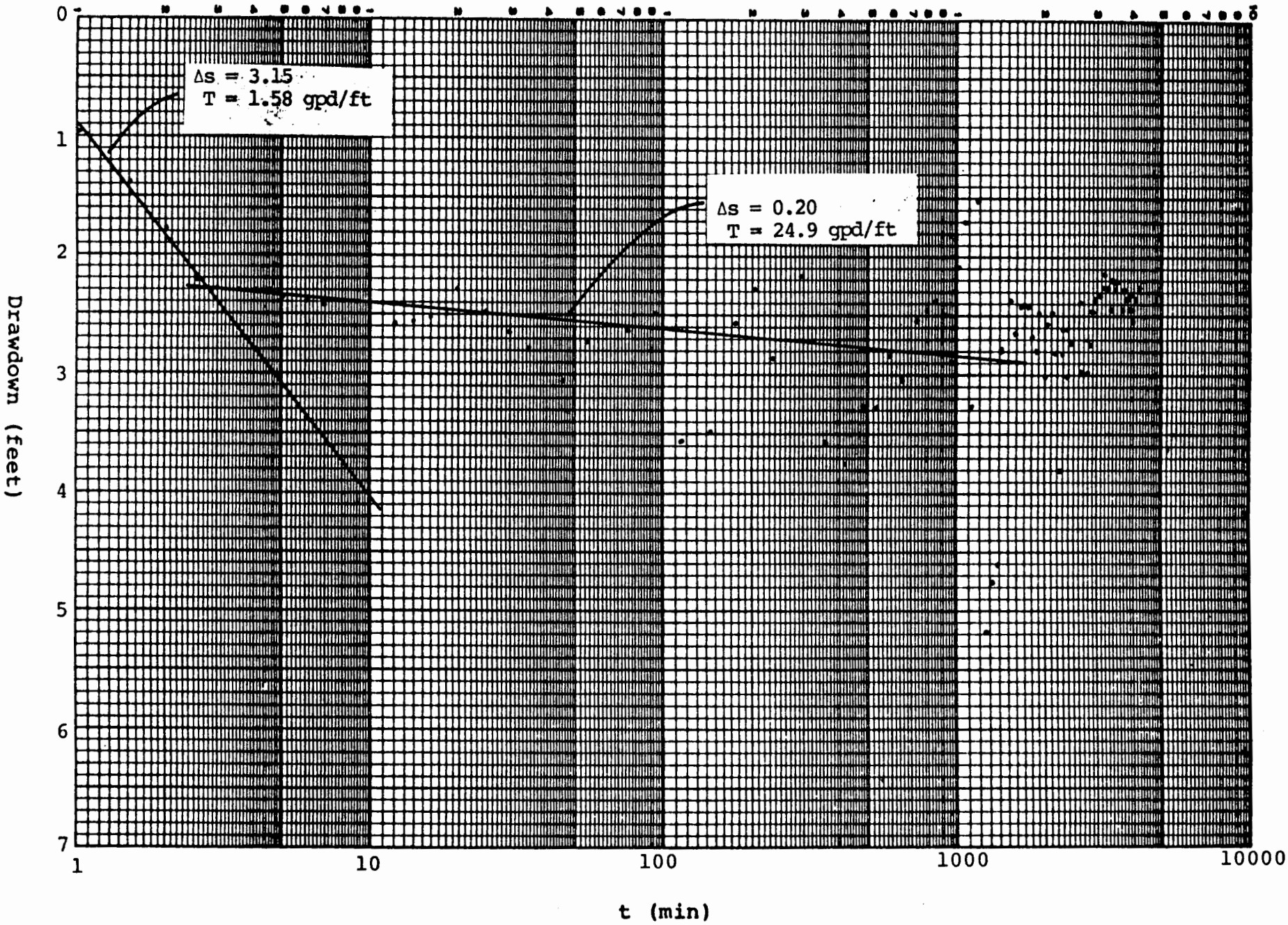
METRIC Corporation
Date: 9-27-88



Pumped Well : MW-26
Observations at Well : MW-26

Time-Drawdown
Q = .0189gpm

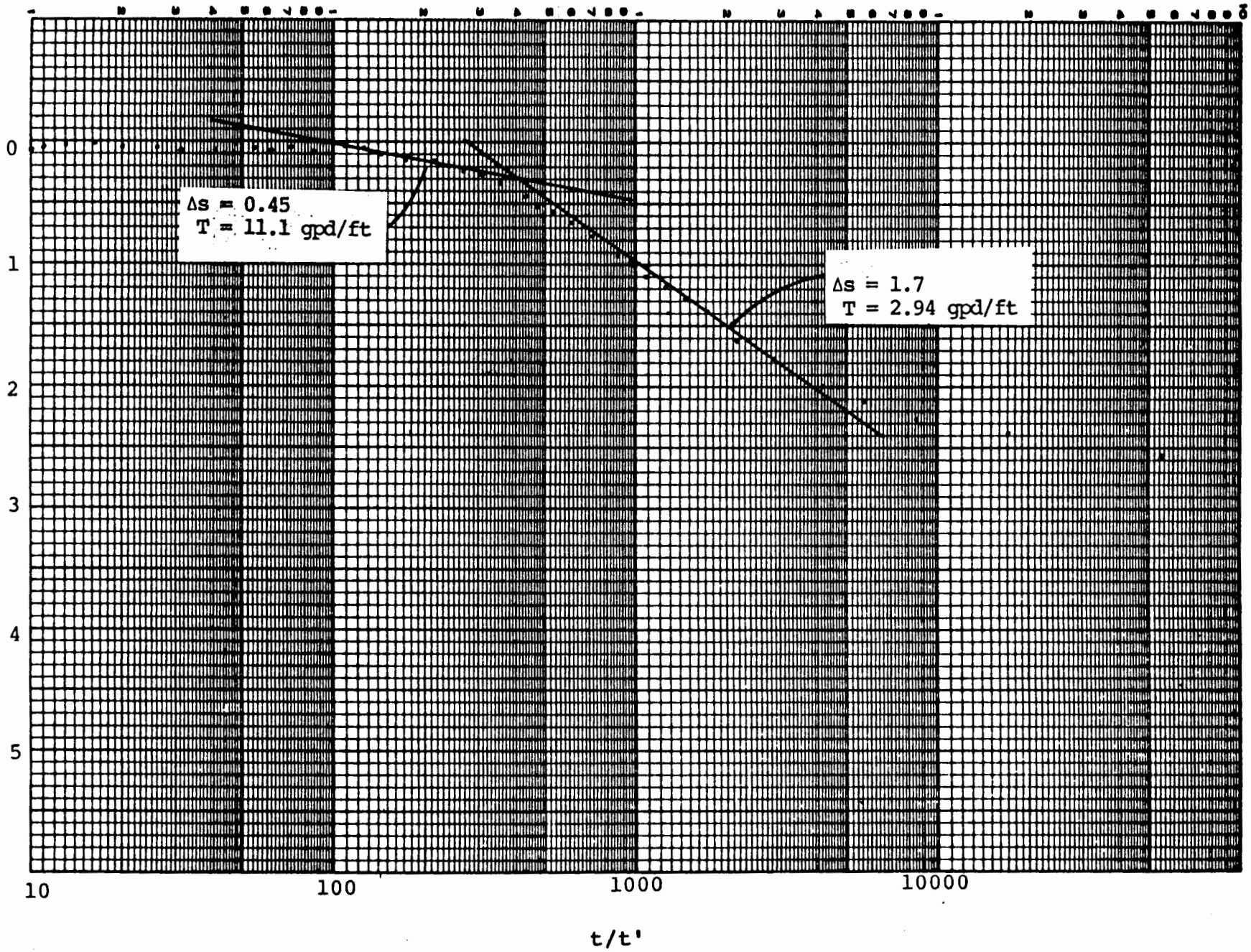
METRIC Corporation
Date: 9-14-88



Pumped Well : MW-26
Observations at Well : MW-26

Residual-Drawdown
Q = .0189gpm

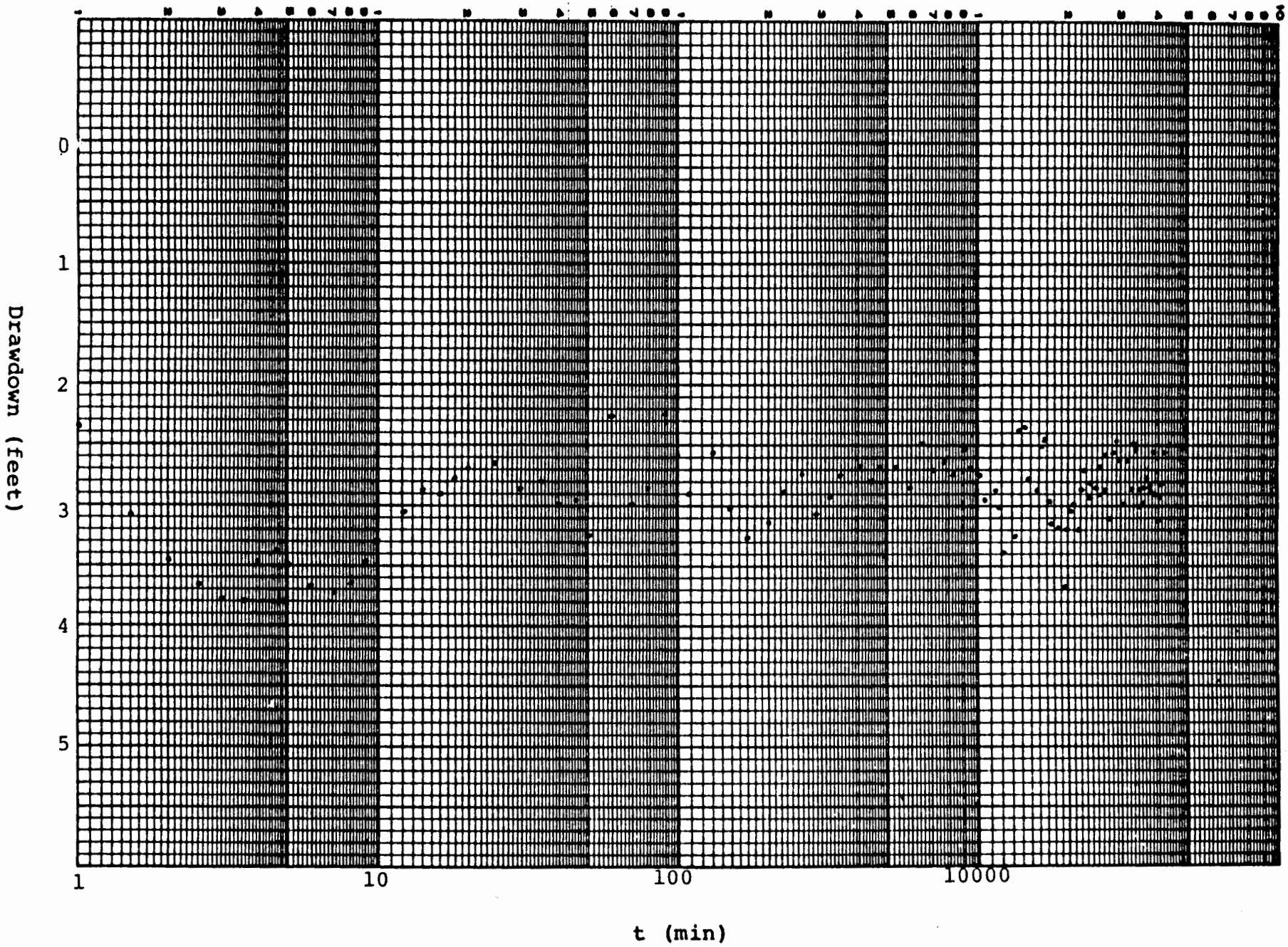
METRIC Corporation
Date: 9-14-88



Pumped Well : MW-27
Observations at Well : MW-27

Time-Drawdown
Q = 0.117gpm

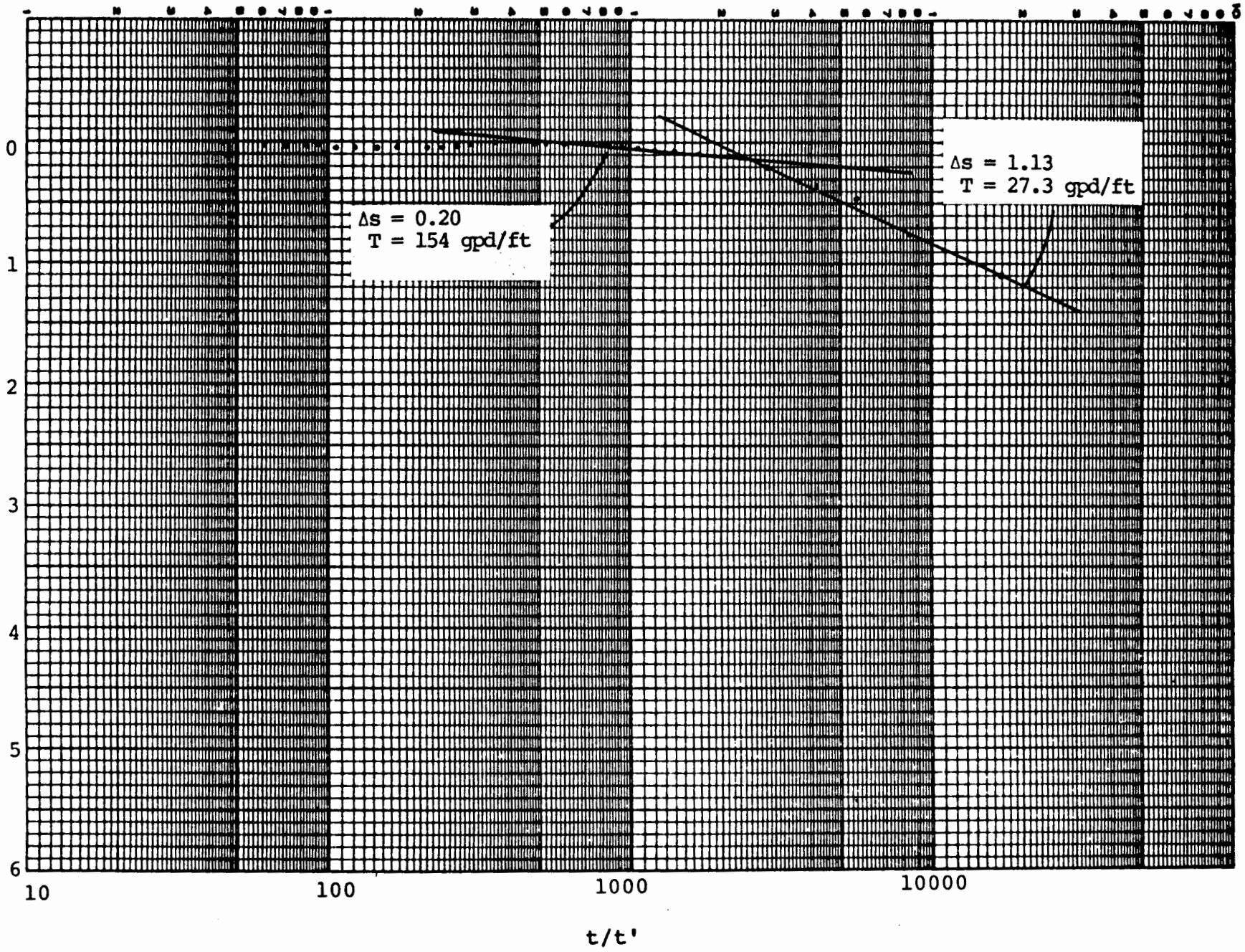
METRIC Corporation
Date: 9-20-88



Pumped Well : MW-27
Observations at Well : MW-27

Residual-Drawdown
Q = 0.117gpm

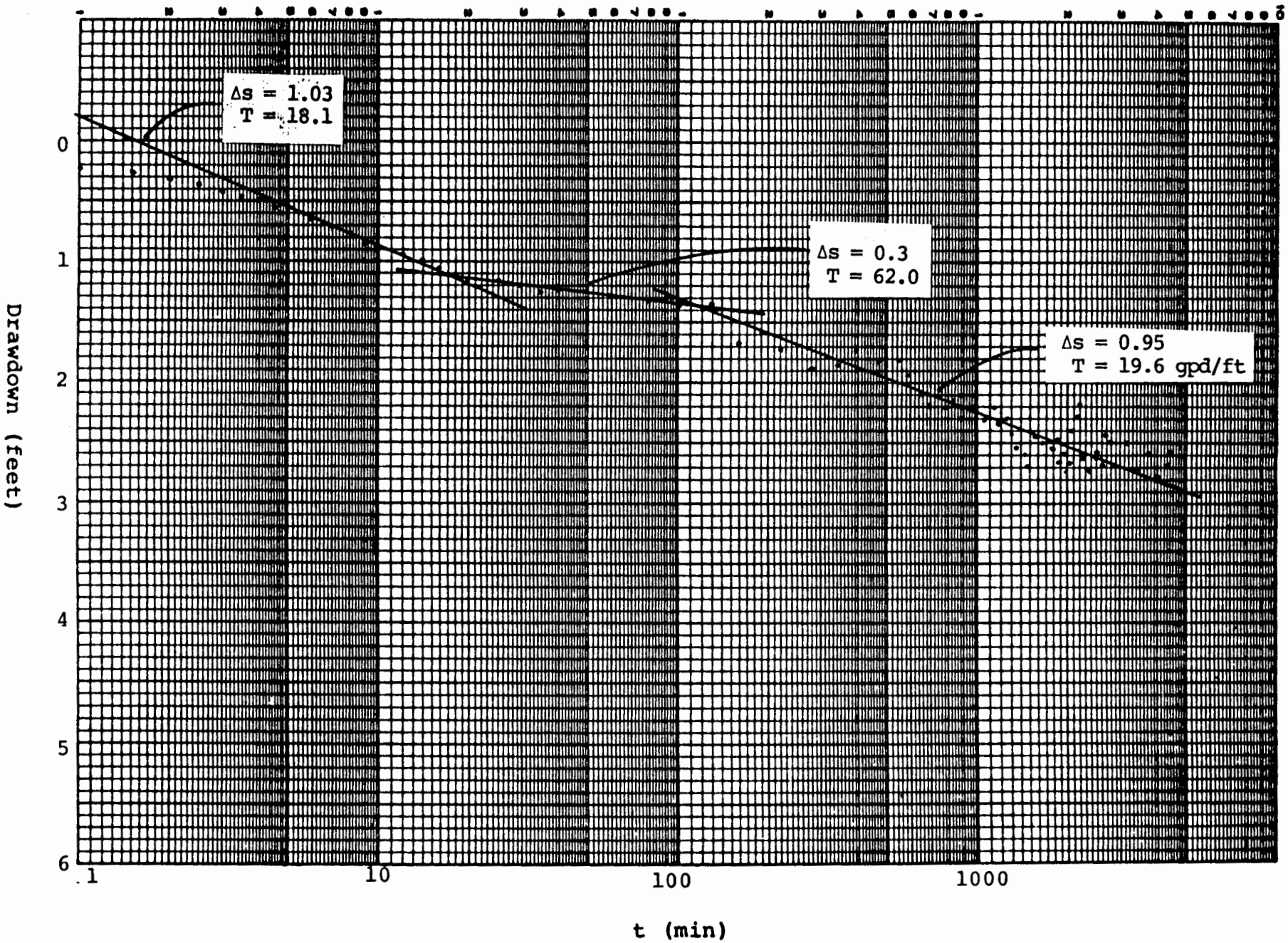
METRIC Corporation
Date: 1-20-88



Pumped Well : MW-28
Observations at Well : MW-28

Time-Drawdown
Q = .0705gpm

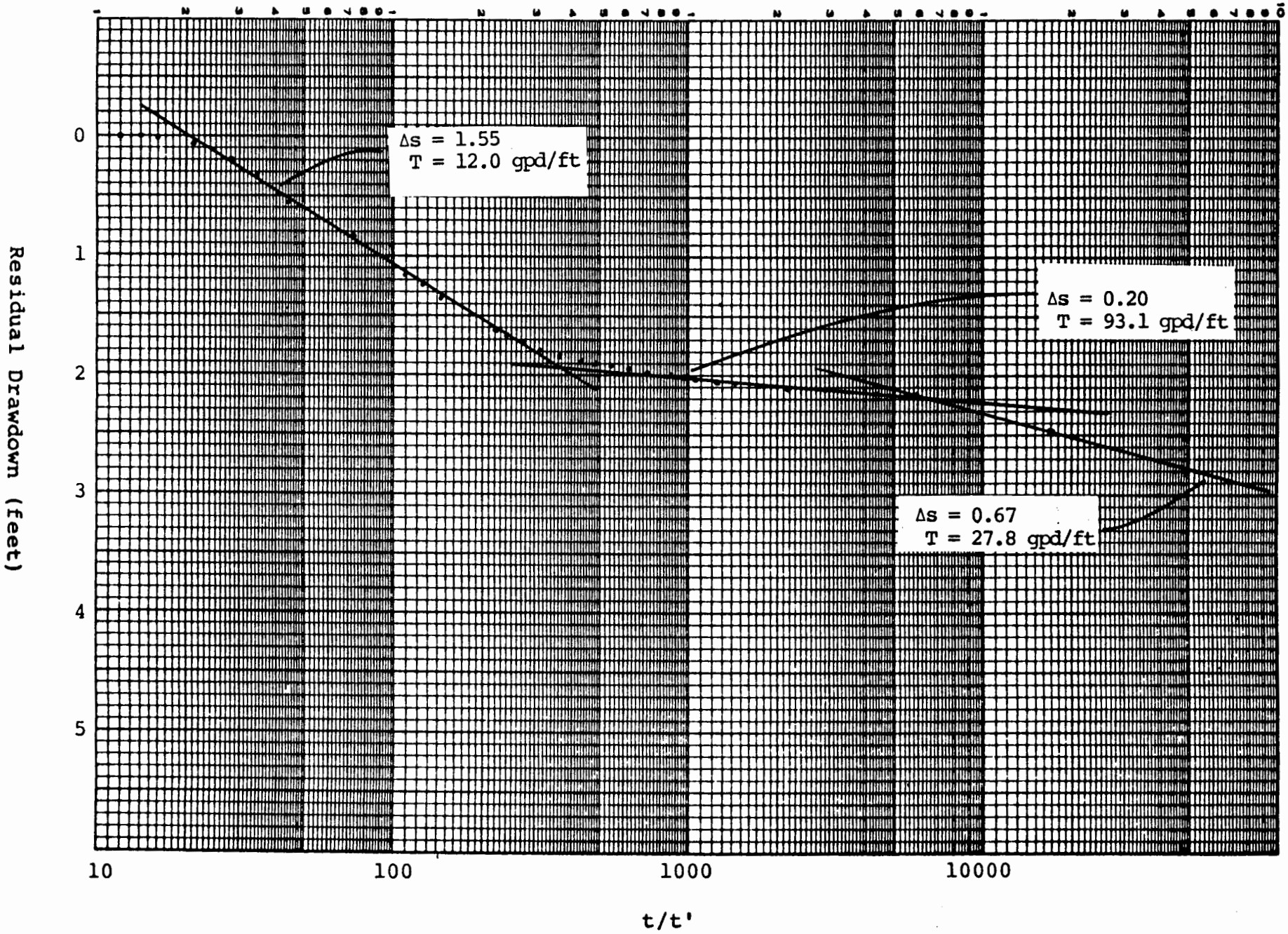
METRIC Corporation
Date: 10-11-88



Pumped Well : MW-28
Observations at Well : MW-28

Residual-Drawdown
Q = 0.0705gpm

METRIC Corporation
Date: 10-11-88



# Attachment 2

- EACH OF THE RECOVERY SYSTEM WELLS HAS BEEN ANALYZED BY ACCEPTED HYDROGEOLOGICAL CALCULATIONS TO DETERMINE THE EFFECTIVE RADIUS OF INFLUENCE ($R_o$). $R_o$ WAS calculated BY TAKING TRANSMISSIVITY VALUES TAKEN FROM TIME-DRAWDOWN CURVES AND APPLYING THESE VALUES TO THE FOLLOWING EQUATION:

$$S = \frac{0.3\,T\,t}{r_o^2}$$

WHERE: $S$ = COEFFICIENT of STORAGE, dimensionless (1)
$T$ = COEFFICIENT OF TRANSMISSIVITY, IN GALLONS PER DAY PER FOOT (GPD/FT.)
$t$ = TIME SINCE PUMPING STARTED, IN DAYS
$r_o$ = Intercept OF STRAIGHT LINE AT ZERO DRAWDOWN, IN FEET.

(1) STORATIVITY HAS BEEN ASSUMED TO BE $1 \times 10^{-2}$ FOR AN UNCONFINED AQUIFER EXCEPT FOR MW-24 and MW-25. A CALCULATED $S = 2.5 \times 10^{-2}$ WAS TAKEN FROM A PLOTTED DISTANCE-DRAWDOWN CURVE FOR MW-24. THIS S VALUE WAS ALSO APPLIED TO MW-25 due TO ITS close PROXIMITY TO MW-24.

**Harding Lawson Associates**
Engineers
and
Geoscientists

SHEET 2 OF 24
JOB NO. 6310,039.12
DATE 1-22-90 (REV.)
COMPUTED BY JSH
CHECKED BY

PROJECT SPARTON TECHNOLOGY
SUBJECT PW-1

$$S = \frac{(0.3)Tt}{r_o^2}$$

① $$0.01 = \frac{(0.3)(22.8)\left(\frac{1000}{1440}\right)}{r_o^2}$$

$$r_o^2 = 475$$

$$r_o = 21.8'$$

REFERENCE: AQUIFER TESTING AT THE SPARTON TECHNOLOGY, INC. COORS ROAD PLANT; MAY, 1988 (METRIC)
TRANSMISSIVITY TAKEN FROM
TIME-DRAWDOWN CURVE

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Geoscientists

SHEET 3 OF 24
JOB NO. 6310,039.12
DATE 1/31/90
COMPUTED BY JSH
CHECKED BY

PROJECT SPARTON TECHNOLOGY
SUBJECT PW-1

$$S = \frac{0.3\,T\,t}{r_o^2}$$

① $$0.01 = \frac{(0.3)(73)\left(\frac{10}{1440}\right)}{r_o^2}$$

$$r_o^2 = 15.2'$$

$$r_o = 3.9'$$

② $$0.01 = \frac{(0.3)(22.9)\left(\frac{100}{1440}\right)}{r_o^2}$$

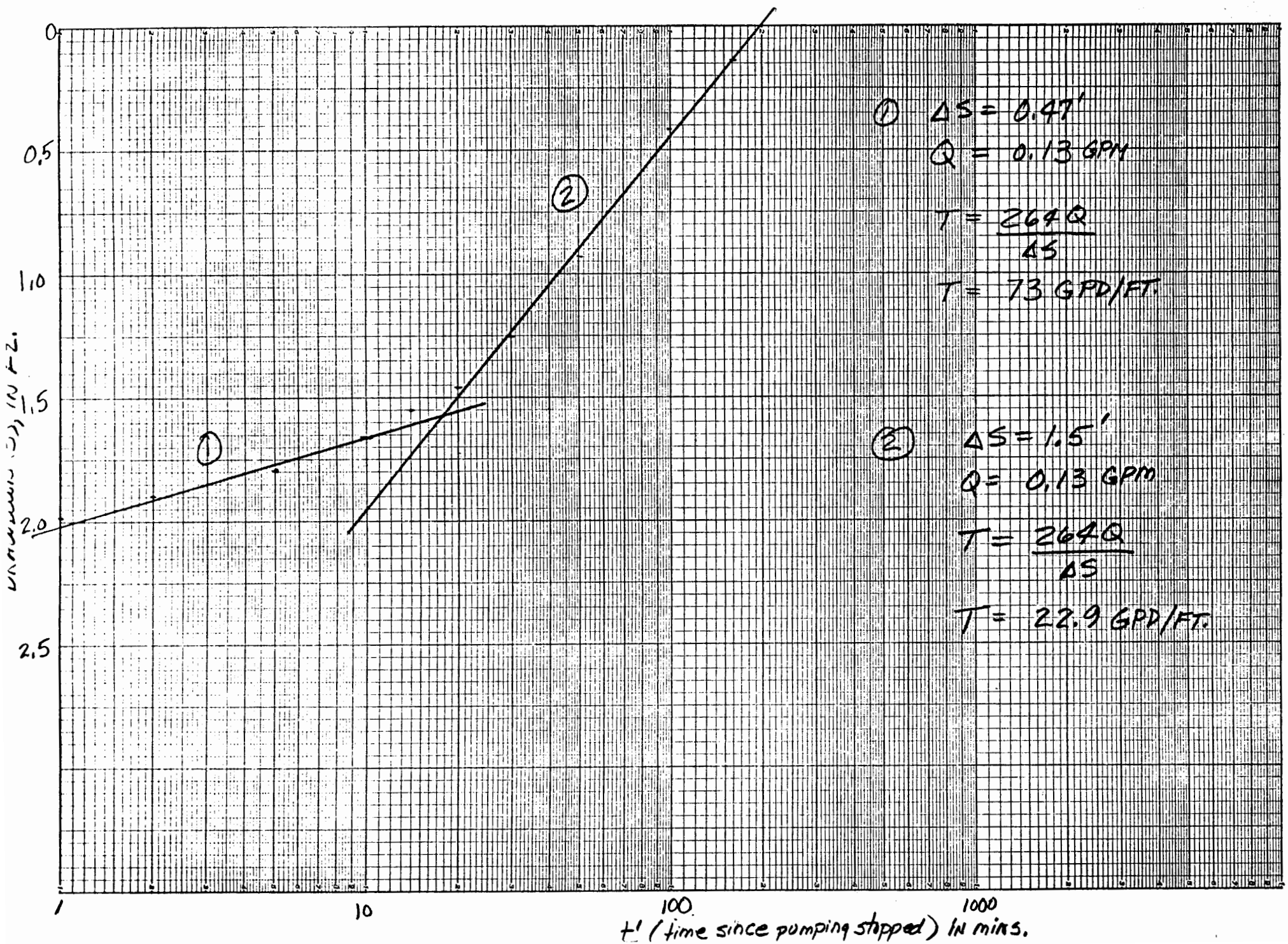
$$r_o^2 = 47.7'$$

$$r_o = 6.9'$$

REFERENCE: AQUIFER TESTING AT THE SPARTON TECHNOLOGY, INC. COORS ROAD PLANT; MAY, 1988 (METRIC)
TRANSMISSIVITY TAKEN FROM ATTACHED RECOVERY DATA

10 DIVISIONS PER INCH (10 DIVISIONS BY FOUR 2 INCH CYCLES RATIO RULING E3 45 HR
Graph Paper
DRAWN FROM CROSS BOOKS NORWOOD MASS U.S.A.
PRINTED

# PW-1




4/24

$$S = \frac{0.3\,T\,t}{r_o^2}$$

① $$0.01 = \frac{(0.3)(29)\left(\frac{100}{1440}\right)}{r_o^2}$$

$$r_o^2 = 60.4$$

$$r_o = 7.8'$$

② $$0.01 = \frac{(0.3)(87.1)\left(\frac{1000}{1440}\right)}{r_o^2}$$

$$r_o^2 = 1814.5$$

$$r_o = 42.6'$$

REFERENCE: AQUIFER TESTING AT THE SPARTON TECHNOLOGY, INC. COORS ROAD PLANT; APRIL, 1987 (METRIC)
TRANSMISSIVITY TAKEN FROM THE TIME-DRAWDOWN CURVE

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Geoscientists

SHEET 6 OF 24
JOB NO. 6310, 039.12
DATE 1/30/90
COMPUTED BY JSH
CHECKED BY

PROJECT SPARTON TECHNOLOGY
SUBJECT MW-18

$$S = \frac{0.3\,T\,t}{r_o^2}$$

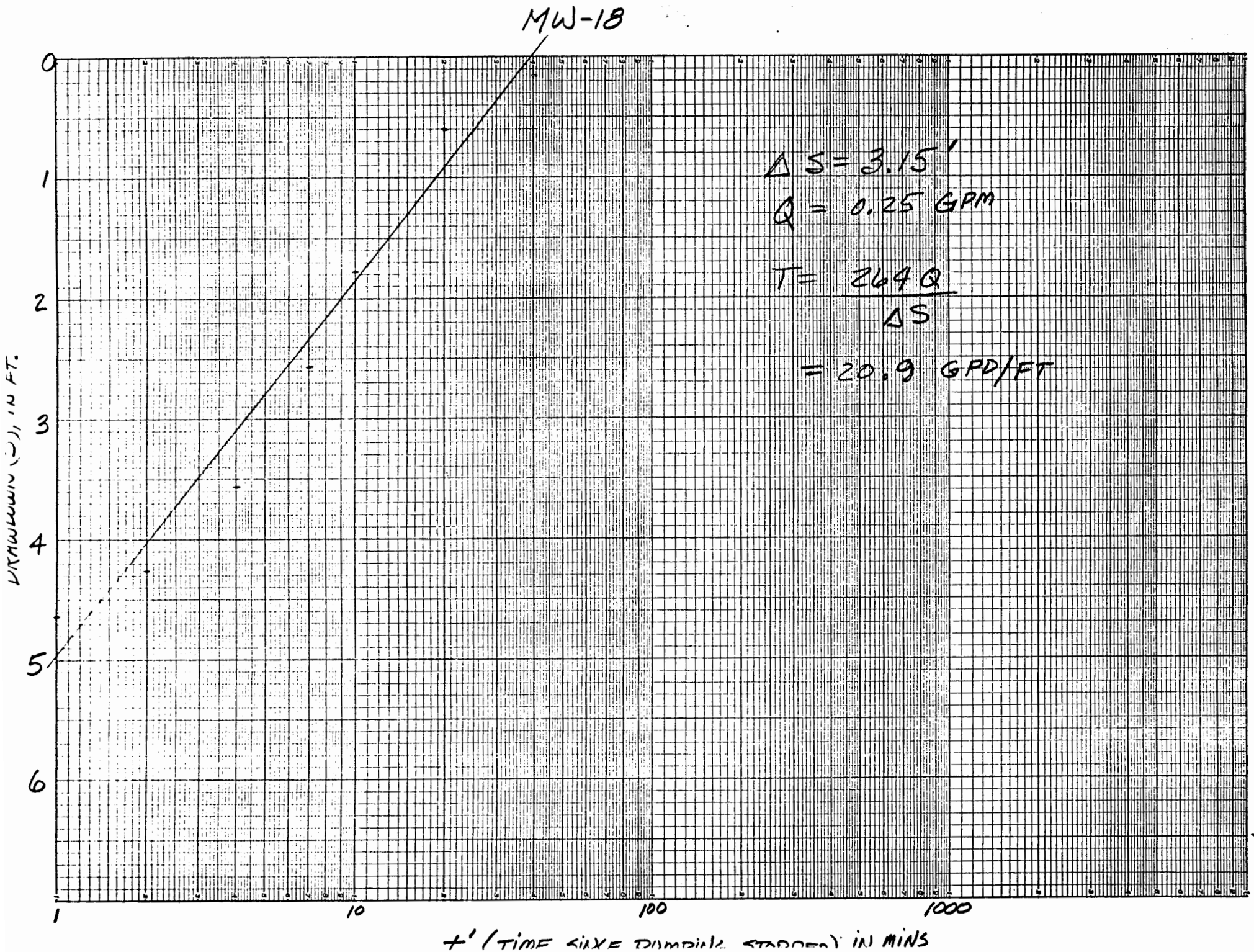
$$0.01 = \frac{(0.3)(20.9)\left(\frac{10}{1440}\right)}{r_o^2}$$

$$r_o^2 = 4.35$$

$$r_o = 2.08'$$

REFERENCE: AQUIFER TESTING AT THE SPARTON TECHNOLOGY, INC. COOES ROAD PLANT: APRIL, 1987 (METRIC)
TRANSMISSIVITY TAKEN FROM THE ATTACHED RECOVERY DATA.

DIRECT FROM CODEX BOOK CO. NORWOOD, MASS 02062
Paper
NTED



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Geoscientists

SHEET 8 OF 24
JOB NO. 06310,039.12
DATE 1-22-90 (REV.)
COMPUTED BY JSH
CHECKED BY

PROJECT SPARTON TECHNOLOGY
SUBJECT MW-23

$$S = \frac{0.3Tt}{r_o^2}$$

① $$0.01 = \frac{(0.3)(33)\left(\frac{10}{1440}\right)}{r_o^2}$$

$$r_o^2 = 6.875$$

$$r_o = 2.6'$$

② $$0.01 = \frac{(0.3)(465)\left(\frac{1000}{1440}\right)}{r_o^2}$$

$$r_o^2 = 9687.5$$

$$r_o = 98.4'$$

REFERENCE: AQUIFER TESTING AT THE SPARTON TECHNOLOGY, INC. COORS ROAD PLANT; NOVEMBER, 1988 (METRIC) TRANSMISSIVITY TAKEN FROM THE TIME-DRAWDOWN CURVE.

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Geoscientists

SHEET 9 OF 24
JOB NO. 6310, 039.12
DATE 1/30/90
COMPUTED BY JSH
CHECKED BY

PROJECT SPARTON TECHNOLOGY
SUBJECT MW-23

$$S = \frac{0.3Tt}{r_o^2}$$

① $$0.01 = \frac{0.3(1659.43)\left(\frac{100}{1440}\right)}{r_o^2}$$

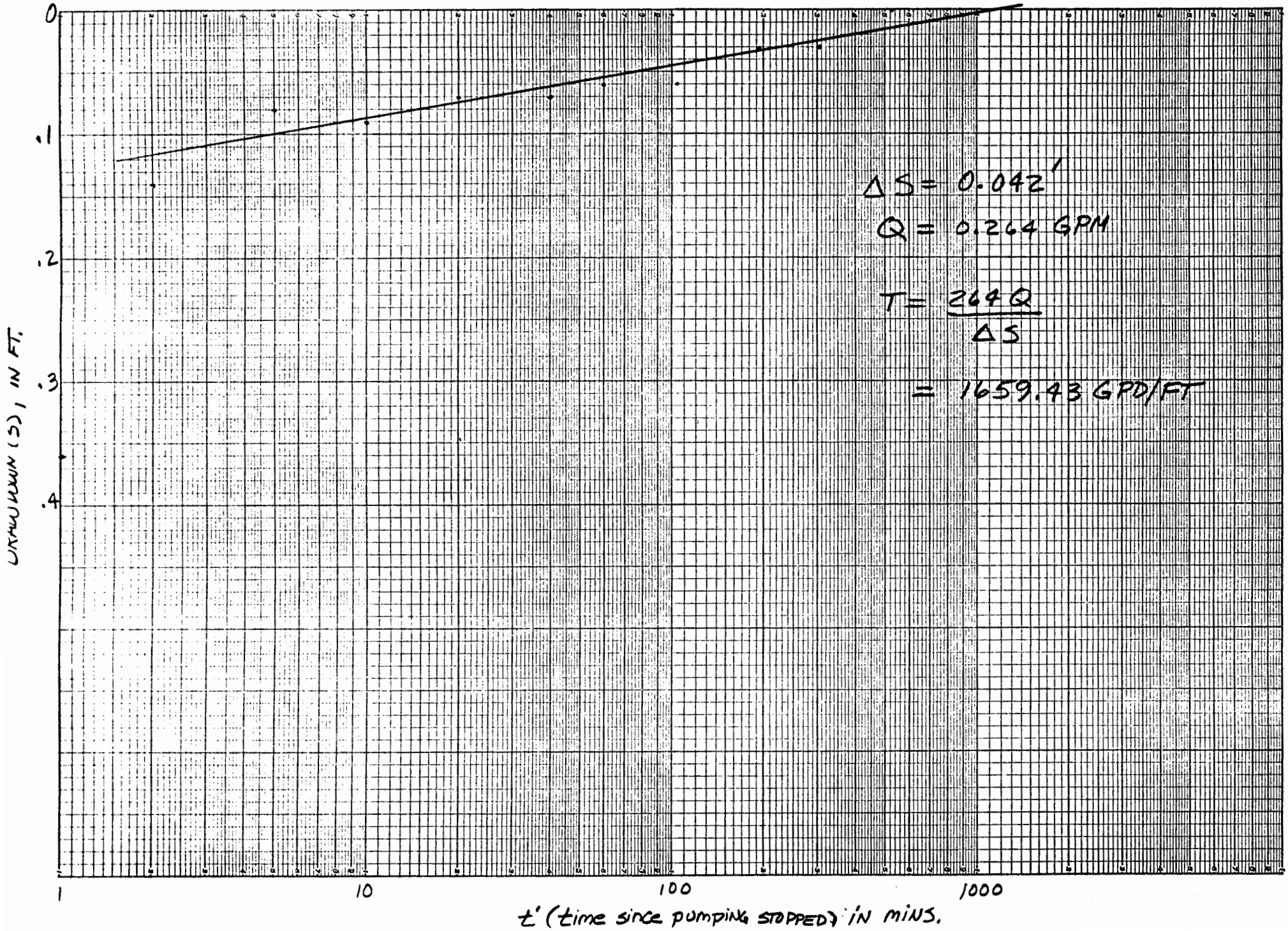
$$r_o^2 = 3457.15$$

$$r_o = 58.8'$$

REFERENCE: AQUIFER TESTING AT THE SPARTON TECHNOLOGY, INC. COORS ROAD PLANT; NOVEMBER, 1988 (METRIC)
TRANSMISSIVITY TAKEN FROM THE ATTACHED RECOVERY DATA

10 DIVISIONS PER INCH 5 CYCLES LOG 2 CYCLES RATIO LOGARIT E3 45 HR DIRECT FROM CODEX BOOK CO NORWOOD MASS U.S.A. PRINTED IN U.S.A.

MW 23




10/24

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Geoscientists

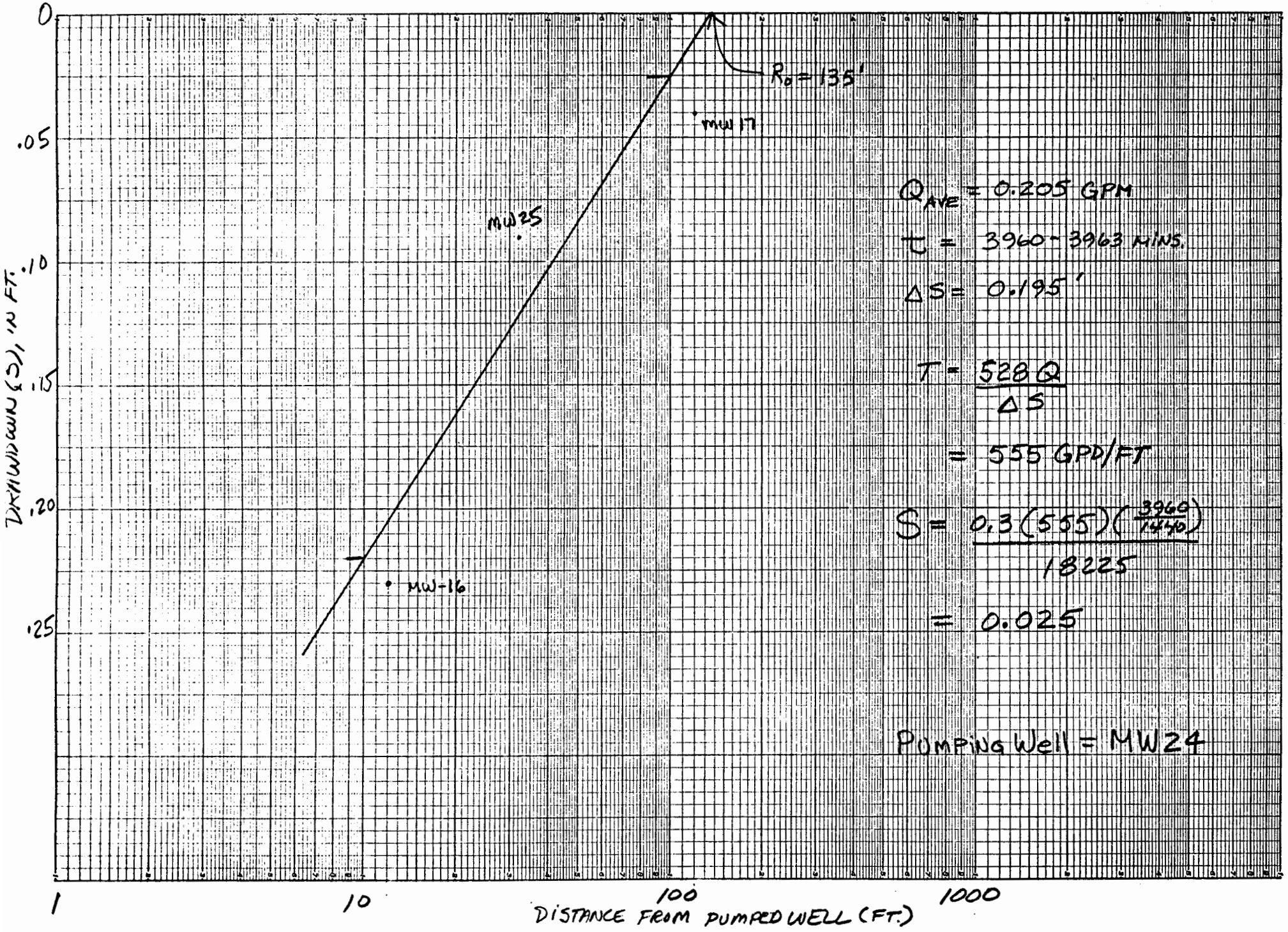
SHEET 11 OF 24
JOB NO. 6310,039.12
DATE 1-22-90
COMPUTED BY JSH
CHECKED BY

PROJECT SPARTON TECHNOLOGY
SUBJECT MW-24

(1) $R_o = 135'$ as derived from THE ATTACHED DISTANCE-DRAWDOWN CURVE

(2) REFERENCE: AQUIFER TESTING AT THE SPARTON TECHNOLOGY, INC. COORS ROAD PLANT; APRIL, 1987 (METRIC)

MW-24




$Q_{AVE} = 0.205$ GPM

$t = 3960 - 3963$ MINS.

$\Delta S = 0.195'$

$$T = \frac{528\,Q}{\Delta S}$$

$= 555$ GPD/FT

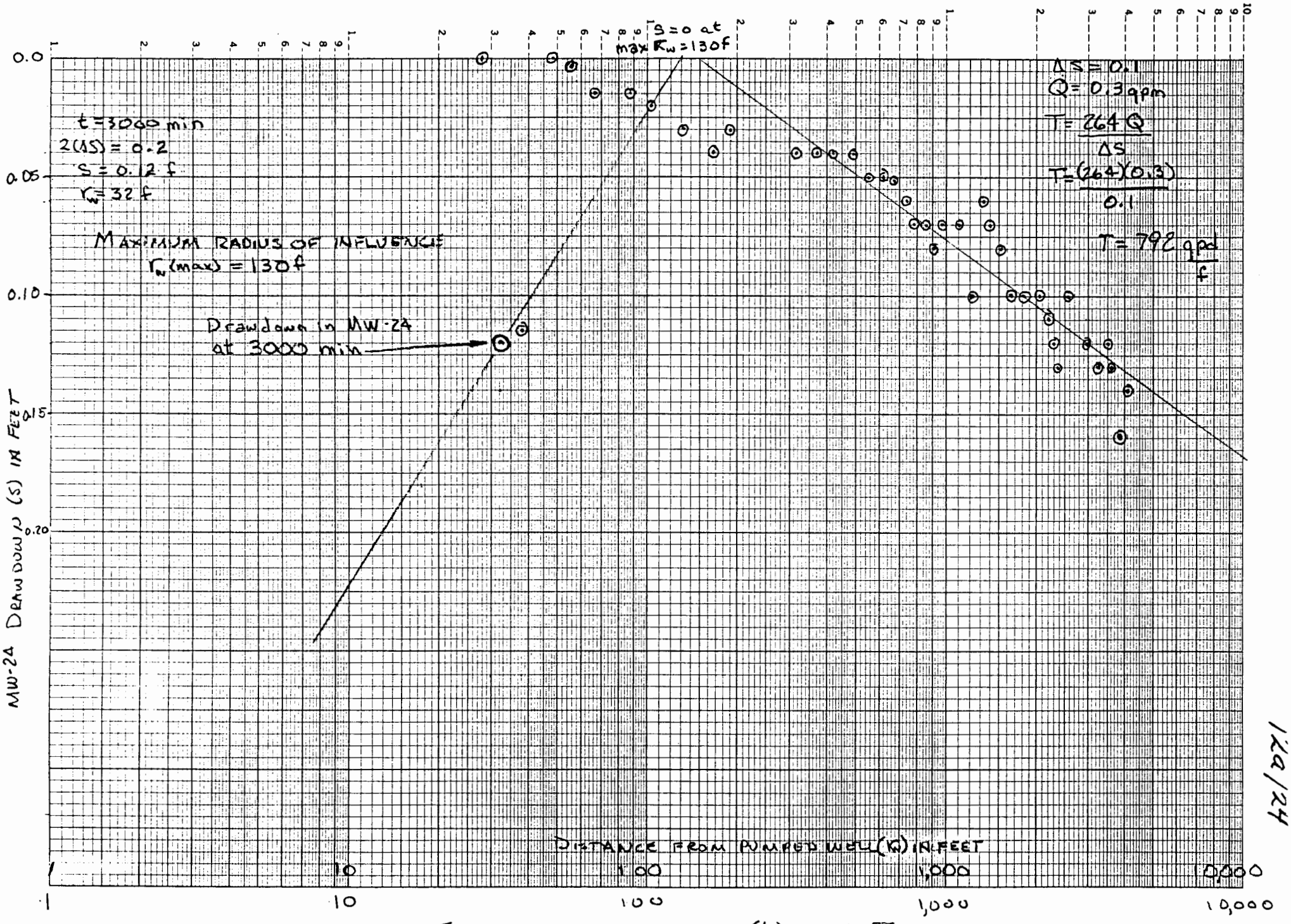
$$S = \frac{0.3\,(555)\left(\frac{3960}{1440}\right)}{18225}$$

$= 0.025$

Pumping Well = MW24

12/24

KEUFFEL & ESSER CO. MADE IN U.S.A. 46 6010




12a/24

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SHEET 13 OF 24
JOB NO. 6310, 039.12
DATE 1-22-90 (REV.)
COMPUTED BY JSH
CHECKED BY

PROJECT SPARTON TECHNOLOGY
SUBJECT MW-25

$$S = \frac{0.3\,Tt}{r_o^2}$$

① $$0.025 = \frac{(0.3)(56.3)\left(\frac{10}{1440}\right)}{r_o^2}$$

$$r_o^2 = 4.69$$

$$r_o = 2.16'$$

② $$0.025 = \frac{(0.3)(281.6)\left(\frac{1000}{1440}\right)}{r_o^2}$$

$$r_o^2 = 2346.67$$

$$r_o = 48.4'$$

REFERENCE: AQUIFER TESTING AT THE SPARTON TECHNOLOGY, INC. COORS ROAD PLANT; MAY, 1988 (METRIC)
TRANSMISSIVITY TAKEN FROM THE TIME-DRAWDOWN CURVE. STORATIVITY TAKEN FROM VALUE ESTABLISHED AT MW-24 WHICH IS 32' FROM MW-25.

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SHEET 14 OF 24
JOB NO. 6310, 039.12
DATE 2-1-90
COMPUTED BY JSH
CHECKED BY

PROJECT SPARTON TECHNOLOGY
SUBJECT MW-25

$$S = \frac{0.3\,T\,t}{r_o^2}$$

$$0.01 = \frac{(0.3)(116.23)\left(\frac{10}{1440}\right)}{r_o^2}$$

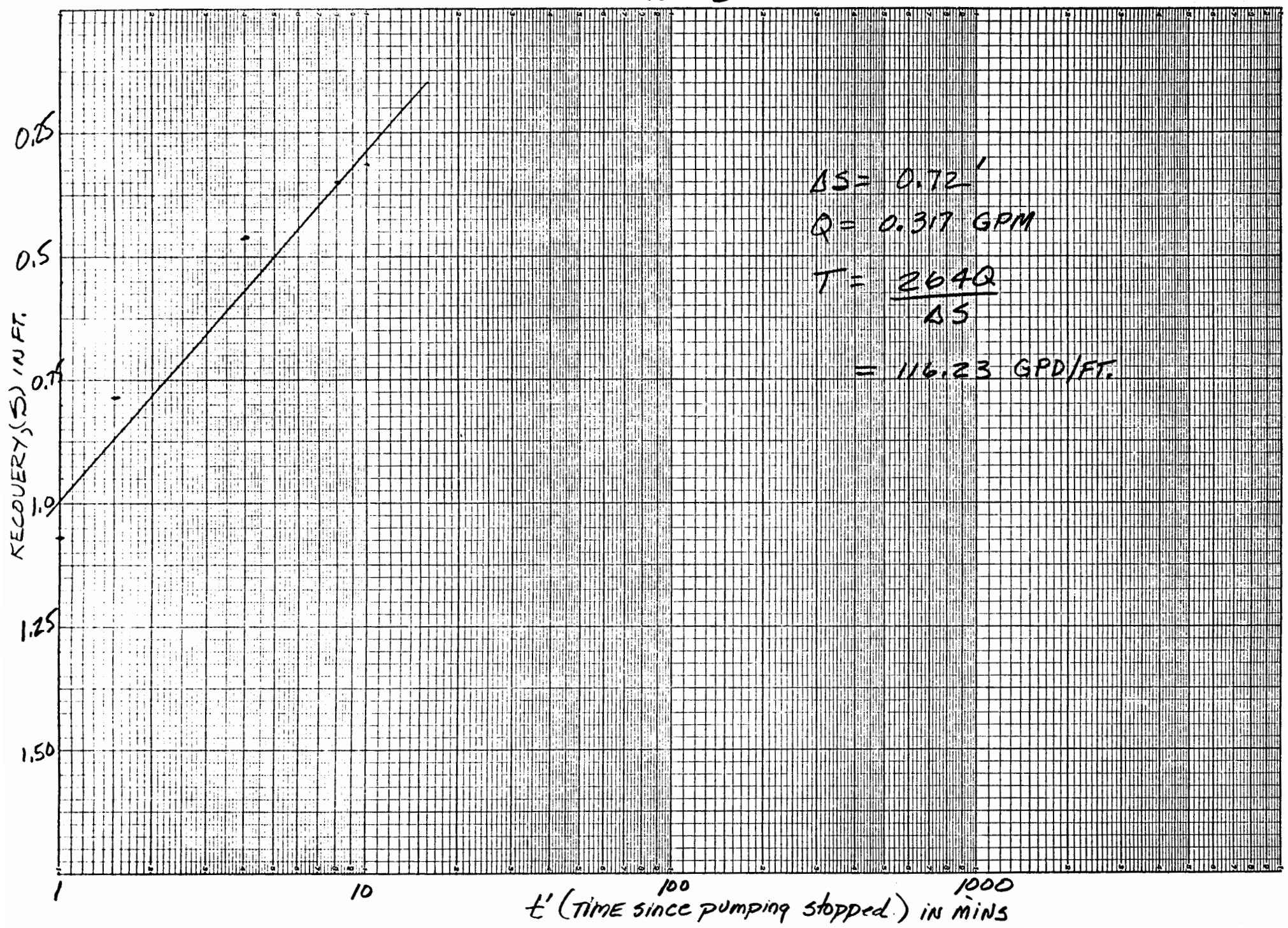
$$r_o^2 = 24.21$$

$$r_o = 4.9'$$

REFERENCE: AQUIFER TESTING AT THE SPARTON TECHNOLOGY, Inc. COORS ROAD PLANT; MAY, 1988 (METRIC)
TRANSMISSIVITY TAKEN FROM THE ATTACHED RECOVERY DATA

10 DIVISIONS PER INCH (5 DIVISIONS PER INCH 2 INCH CYCLES) ASTM RATING E3 45 HR
DIRECT FROM CODEX BOOK CO. NORWOOD MASS. 02062
PRINTED IN U.S.A.

MW-25



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and
Geoscientists

SHEET 16 OF 24
JOB NO. 6310,039.12
DATE 1-22-90 (REV.)
COMPUTED BY JSH
CHECKED BY

PROJECT SPARTON TECHNOLOGY
SUBJECT MW-26

① $$S = \frac{(0.3)Tt}{r_o^2}$$

$$0.01 = \frac{(0.3)(1.58)\left(\frac{10}{1440}\right)}{r_o^2}$$

$$r_o^2 = 0.329$$

$$r_o = 0.57'$$

② $$0.01 = \frac{(0.3)(24.9)\left(\frac{1000}{1440}\right)}{r_o^2}$$

$$r_o^2 = 518.75$$

$$r_o = 22.8'$$

REFERENCE: AQUIFER TESTING AT THE SPARTON TECHNOLOGY, INC COOCS ROAD PLANT; NOVEMBER, 1988 (METRIC) TRANSMISSIVITY TAKEN FROM THE TIME-DRAWDOWN CURVE.

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and
Geoscientists

SHEET 17 OF 24
JOB NO. 6310,039.12
DATE 2-1-90
COMPUTED BY JSH
CHECKED BY

PROJECT SPARTON TECHNOLOGY
SUBJECT MW-26

$$S = \frac{0.3Tt}{r_o^2}$$

$$0.01 = \frac{(0.3)(3.39)\left(\frac{10}{1440}\right)}{r_o^2}$$

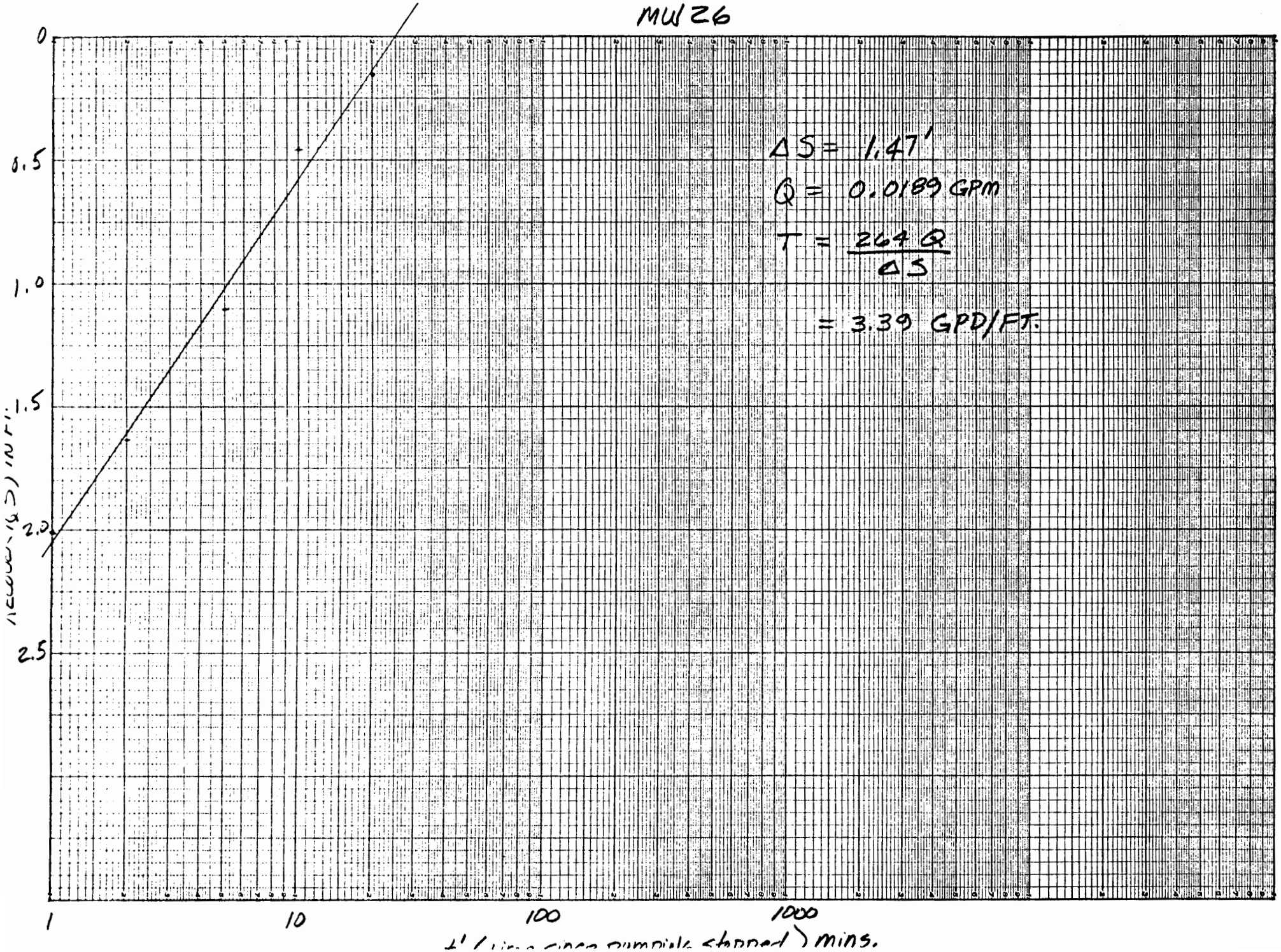
$$r_o^2 = 0.7$$

$$r_o = 0.84'$$

REFERENCE: AQUIFER TESTING AT THE SPARTON TECHNOLOGY, INC. COORS ROAD PLANT; November, 1988 (METRIC) TRANSMISSIVITY TAKEN FROM THE ATTACHED RECOVERY DATA.

E3 50 HR
DIRECT FROM CODEX BOOK CO., NORWOOD, MASS. 02062
Paper

MW26




$\Delta S = 1.47'$

$Q = 0.0189$ GPM

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

$= 3.39$ GPD/FT.

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and
Geoscientists

SHEET 19 OF 24
JOB NO. 6310,039.12
DATE 1-22-90
COMPUTED BY JSH
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PROJECT SPARTON TECHNOLOGY
SUBJECT MW-27

- ANALYSIS CAN NOT BE PERFORMED DUE TO VERY ERRATIC DRAWDOWN PATTERN FROM THE TIME-DRANDOWN CURVE.

REFERENCE: AQUIFER TESTING AT THE SPARTON TECHNOLOGY, INC. COORS ROAD PLANT; NOVEMBER, 1988 (METRIC)

**Harding Lawson Associates**
Engineers
and
Geoscientists

SHEET 20 OF 24
JOB NO. 6310, 039.12
DATE 2-1-90
COMPUTED BY JSH
CHECKED BY

PROJECT SPARTON TECHNOLOGY
SUBJECT MW-27

$$S = \frac{0.3\,T\,t}{r_o^2}$$

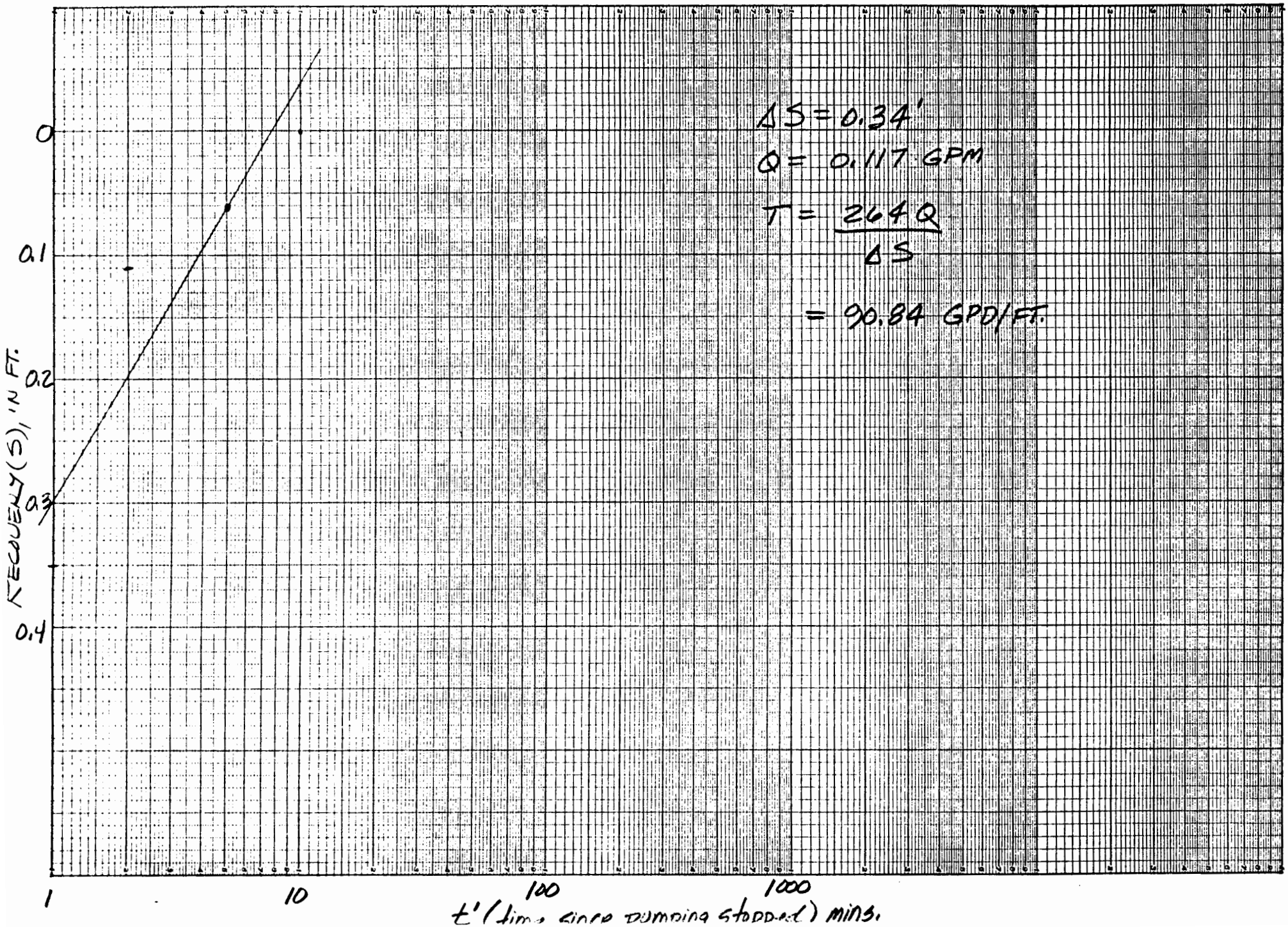
$$0.01 = \frac{(0.3)(90.84)\left(\frac{10}{1440}\right)}{r_o^2}$$

$$r_o^2 = 18.93$$

$$r_o = 4.35'$$

REFERENCE: AQUIFER TESTING AT THE SPARTON FACILITY, INC. COOK ROAD PLANT; NOVEMBER, 1988 (METRIC) TRANSMISSIVITY TAKEN FROM ATTACHED RECOVERY DATA.

MW-27


ΔS = 0.34'
Q = 0.117 GPM
T = 264 Q / ΔS
= 90.84 GPD/FT.
RECOVERY (S), IN FT.
0
0.1
0.2
0.3
0.4
1
10
100
1000
t' (time since pumping stopped) mins.

21/24

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SHEET 22 OF 24
JOB NO. 6310,039.12
DATE 1-22-90 (REV.)
COMPUTED BY JSH
CHECKED BY

PROJECT SPARTON TECHNOLOGY
SUBJECT MW-28

① $$S = \frac{(0.3)(T)t}{r_o^2}$$

$$0.01 = \frac{(0.3)(18.1)\left(\frac{10}{1440}\right)}{r_o^2}$$

$$r_o^2 = 3.77$$

$$r_o = 1.94'$$

② $$0.01 = \frac{(0.3)(62)\left(\frac{100}{1440}\right)}{r_o^2}$$

$$r_o^2 = 129.16$$

$$r_o = 11.37'$$

③ $$0.01 = \frac{(0.3)(19.6)\left(\frac{1000}{1440}\right)}{r_o^2}$$

$$r_o^2 = 408.33$$

$$r_o = 20.2'$$

REFERENCE: AQUIFER TESTING AT THE SPARTON TECHNOLOGY, INC. COOKS ROAD PLANT; NOVEMBER, 1988 (METRIC)
TRANSMISSIVITY TAKEN FROM TIME-DRAWDOWN CURVE

**Harding Lawson Associates**
Engineering
and
Environmental Services

SHEET 23 OF 24
JOB NO. 6310, 039.12
DATE 2-1-90
COMPUTED BY JSH
CHECKED BY

PROJECT SPARTON TECHNOLOGY
SUBJECT MW-28

$$S = \frac{0.3\,T\,t}{r_o^2}$$

① $$0.01 = \frac{(0.3)(68.93)\left(\frac{10}{1440}\right)}{r_o^2}$$

$$r_o^2 = 14.36$$

$$r_o = 3.8'$$

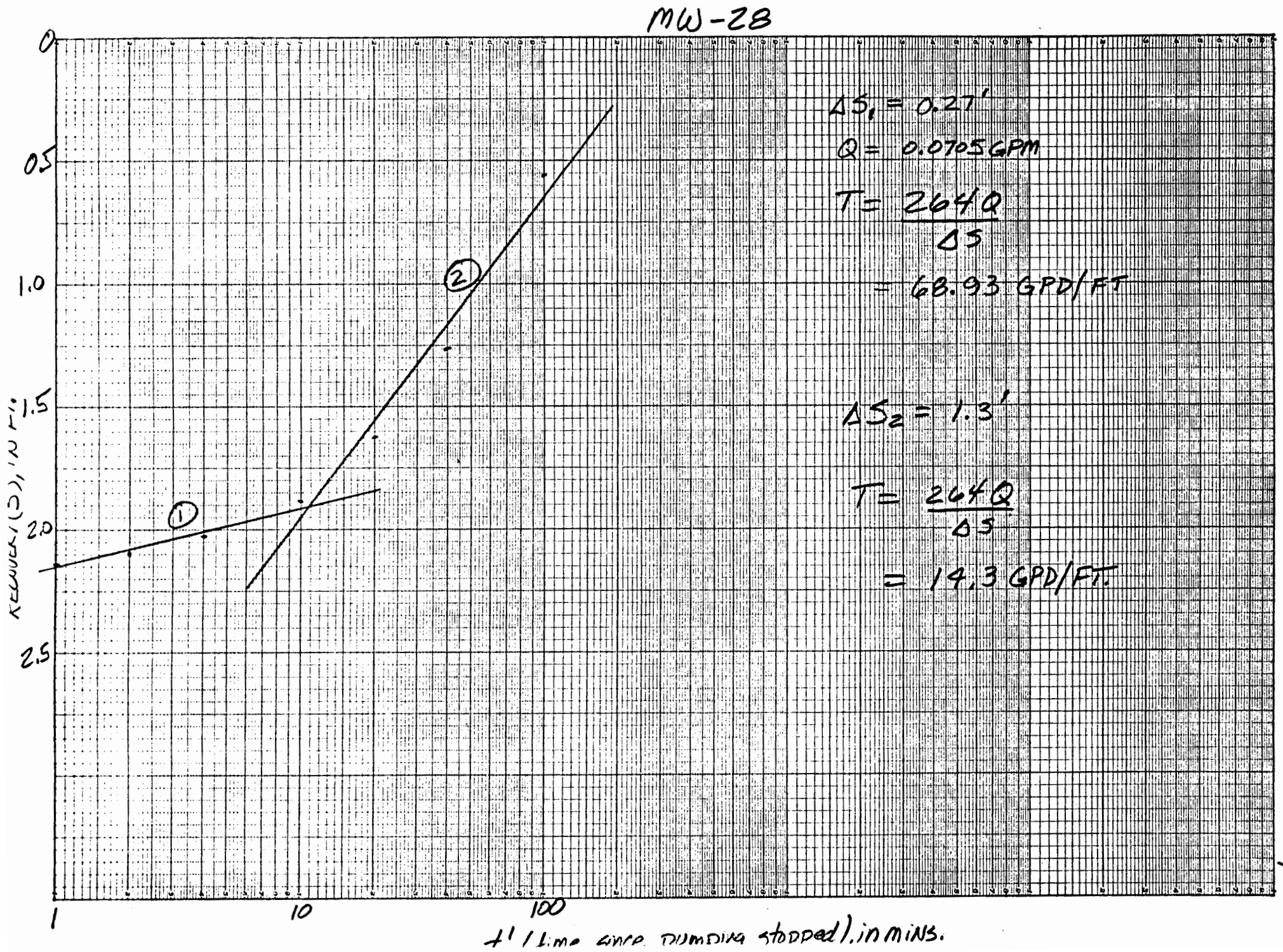
② $$0.01 = \frac{(0.3)(14.3)\left(\frac{100}{1440}\right)}{r_o^2}$$

$$r_o^2 = 29.79$$

$$r_o = 5.46'$$

REFERENCE: AQUIFER TESTING AT THE SPARTON TECHNOLOGY, INC. COORS ROAD PLANT; November, 1988 (METRIC)
TRANSMISSIVITIES TAKEN FROM THE ATTACHED RECOVERY DATA

DIRECT FROM CODEX BOOK CO., NORWOOD, MASS. 02062
PRINTED IN U.S.A.



# Attachment 3

## SUMMARY OF REGRESSION EQUATIONS
## 1986 - 1989

General equation form : Y = Ao + A1 (x)

where Y = TCE, ug/l
x = Period no.
Ao = intercept
A1 = slope

| Well no. | Regression Equation |
|---|---|
| 6 | Y = 404.962 - 20.4231 (x) |
| 8 | Y = 151.538 - 3.1978 (x) |
| 9 | Y = 6787.5 - 232.353 (x) |
| 14 | Y = 4289.01 - 29.6703 (x) |
| 15 | Y = 954.689 - 52.8022 (x) |
| 16 | Y = 31380.2 - 964.835 (x) |
| 18 | Y = 4556.36 - 78.1818 (x) |
| 21 | Y = 2619.34 - 122.088 (x) |
| 22 | Y = 327.161 - 14.0751 (x) |
| 23 | Y = 5446.67 + 298.333 (x) |

COMMAND: REGR  MISSING VALUE TREATMENT: LISTWISE

*** MULTIPLE LINEAR REGRESSION ***

DEPENDENT VARIABLE: TCE6  13 VALID CASES

| | | | |
|---|---|---|---|
| COEFF OF DETERM: | 0.270384 | | |
| ADJUSTED R SQUARE: | 0.204056 | ESTIMATED CONSTANT TERM: | 404.962 |
| MULTIPLE CORR COEFF: | 0.519985 | STANDARD ERR OF ESTIMATE: | 136.464 |

ANALYSIS OF VARIANCE FOR THE REGRESSION:

| SOURCE OF VARIANCE | DEGREES OF FREEDOM | SUM OF SQUARES | MEAN OF SQUARES | F TEST | PROB |
|---|---|---|---|---|---|
| REGRESSION | 1 | 75912.6 | 75912.6 | 4.07643 | 0.0685 |
| RESIDUALS | 11 | 204845 | 18622.3 | | |
| TOTAL | 12 | 280758 | | | |

| VARIABLE | REGRESSION COEFFICIENT | STANDARDIZED COEFFICIENT | STANDARD ERROR | T | PROB |
|---|---|---|---|---|---|
| PERIOD | -20.4231 | -0.519985 | 10.1154 | -2.01902 | 0.0685 |

WHICH COMMAND?

COMMAND: REGR  MISSING VALUE TREATMENT: LISTWISE

*** MULTIPLE LINEAR REGRESSION ***

DEPENDENT VARIABLE: TCE8  13 VALID CASES

COEFF OF DETERM: 0.0312679

ADJUSTED R SQUARE: -0.0567986  ESTIMATED CONSTANT TERM: 151.538

MULTIPLE CORR COEFF: 0.176827  STANDARD ERR OF ESTIMATE: 72.4008

ANALYSIS OF VARIANCE FOR THE REGRESSION:

| SOURCE OF VARIANCE | DEGREES OF FREEDOM | SUM OF SQUARES | MEAN OF SQUARES | F TEST | PROB |
|---|---|---|---|---|---|
| REGRESSION | 1 | 1861.12 | 1861.12 | 0.355049 | 0.5633 |
| RESIDUALS | 11 | 57660.6 | 5241.87 | | |
| TOTAL | 12 | 59521.7 | | | |

| VARIABLE | REGRESSION COEFFICIENT | STANDARDIZED COEFFICIENT | STANDARD ERROR | T | PROB |
|---|---|---|---|---|---|
| PERIOD | -3.19780 | -0.176827 | 5.36670 | -0.595860 | 0.5633 |

WHICH COMMAND?

COMMAND: REGR  MISSING VALUE TREATMENT: LISTWISE

*** MULTIPLE LINEAR REGRESSION ***

DEPENDENT VARIABLE: TCE9  16 VALID CASES

| | | | |
|---|---|---|---|
| COEFF OF DETERM: | 0.472633 | | |
| ADJUSTED R SQUARE: | 0.434964 | ESTIMATED CONSTANT TERM: | 6787.50 |
| MULTIPLE CORR COEFF: | 0.687483 | STANDARD ERR OF ESTIMATE: | 1209.53 |

ANALYSIS OF VARIANCE FOR THE REGRESSION:

| SOURCE OF VARIANCE | DEGREES OF FREEDOM | SUM OF SQUARES | MEAN OF SQUARES | F TEST | PROB |
|---|---|---|---|---|---|
| REGRESSION | 1 | 18355882 | 18355882 | 12.5470 | 0.0033 |
| RESIDUALS | 14 | 20481618 | 1462973 | | |
| TOTAL | 15 | 38837500 | | | |

| VARIABLE | REGRESSION COEFFICIENT | STANDARDIZED COEFFICIENT | STANDARD ERROR | T | PROB |
|---|---|---|---|---|---|
| PERIOD | -232.353 | -0.687483 | 65.5962 | -3.54217 | 0.0033 |

WHICH COMMAND?

COMMAND: REGR  MISSING VALUE TREATMENT: LISTWISE

*** MULTIPLE LINEAR REGRESSION ***

DEPENDENT VARIABLE: TCE14  13 VALID CASES

| | | | |
|---|---|---|---|
| COEFF OF DETERM: | 0.00586258 | | |
| ADJUSTED R SQUARE: | -0.0845135 | ESTIMATED CONSTANT TERM: | 4289.01 |
| MULTIPLE CORR COEFF: | 0.0765675 | STANDARD ERR OF ESTIMATE: | 1571.59 |

ANALYSIS OF VARIANCE FOR THE REGRESSION:

| SOURCE OF VARIANCE | DEGREES OF FREEDOM | SUM OF SQUARES | MEAN OF SQUARES | F TEST | PROB |
|---|---|---|---|---|---|
| REGRESSION | 1 | 160220 | 160220 | 0.0648687 | 0.8037 |
| RESIDUALS | 11 | 27169011 | 2469910 | | |
| TOTAL | 12 | 27329231 | | | |

| VARIABLE | REGRESSION COEFFICIENT | STANDARDIZED COEFFICIENT | STANDARD ERROR | T | PROB |
|---|---|---|---|---|---|
| PERIOD | -29.6703 | -0.0765675 | 116.494 | -0.254693 | 0.8037 |

WHICH COMMAND?

COMMAND: REGR  MISSING VALUE TREATMENT: LISTWISE

*** MULTIPLE LINEAR REGRESSION ***

DEPENDENT VARIABLE: TCE15  12 VALID CASES

| | | | |
|---|---|---|---|
| COEFF OF DETERM: | 0.833126 | | |
| ADJUSTED R SQUARE: | 0.816438 | ESTIMATED CONSTANT TERM: | 954.689 |
| MULTIPLE CORR COEFF: | 0.912757 | STANDARD ERR OF ESTIMATE: | 100.815 |

ANALYSIS OF VARIANCE FOR THE REGRESSION:

| SOURCE OF VARIANCE | DEGREES OF FREEDOM | SUM OF SQUARES | MEAN OF SQUARES | F TEST | PROB |
|---|---|---|---|---|---|
| REGRESSION | 1 | 507429 | 507429 | 49.9254 | 0.0000 |
| RESIDUALS | 10 | 101638 | 10163.8 | | |
| TOTAL | 11 | 609067 | | | |

| VARIABLE | REGRESSION COEFFICIENT | STANDARDIZED COEFFICIENT | STANDARD ERROR | T | PROB |
|---|---|---|---|---|---|
| PERIOD | -52.8022 | -0.912757 | 7.47294 | -7.06579 | 0.0000 |

WHICH COMMAND?

COMMAND: REGR  MISSING VALUE TREATMENT: LISTWISE

*** MULTIPLE LINEAR REGRESSION ***

DEPENDENT VARIABLE: TCE16  14 VALID CASES

| | | | |
|---|---|---|---|
| COEFF OF DETERM: | 0.419903 | | |
| ADJUSTED R SQUARE: | 0.371562 | ESTIMATED CONSTANT TERM: | 31380.2 |
| MULTIPLE CORR COEFF: | 0.648000 | STANDARD ERR OF ESTIMATE: | 4937.74 |

ANALYSIS OF VARIANCE FOR THE REGRESSION:

| SOURCE OF VARIANCE | DEGREES OF FREEDOM | SUM OF SQUARES | MEAN OF SQUARES | F TEST | PROB |
|---|---|---|---|---|---|
| REGRESSION | 1 | 211781319 | 211781319 | 8.68621 | 0.0122 |
| RESIDUALS | 12 | 292575824 | 24381319 | | |
| TOTAL | 13 | 504357143 | | | |

| VARIABLE | REGRESSION COEFFICIENT | STANDARDIZED COEFFICIENT | STANDARD ERROR | T | PROB |
|---|---|---|---|---|---|
| PERIOD | -964.835 | -0.648000 | 327.369 | -2.94724 | 0.0122 |

WHICH COMMAND?

COMMAND: REGR  MISSING VALUE TREATMENT: LISTWISE

*** MULTIPLE LINEAR REGRESSION ***

DEPENDENT VARIABLE: TCE18  10 VALID CASES

| | | | |
|---|---|---|---|
| COEFF OF DETERM: | 0.101239 | | |
| ADJUSTED R SQUARE: | -0.0111058 | ESTIMATED CONSTANT TERM: | 4556.36 |
| MULTIPLE CORR COEFF: | 0.318181 | STANDARD ERR OF ESTIMATE: | 748.058 |

ANALYSIS OF VARIANCE FOR THE REGRESSION:

| SOURCE OF VARIANCE | DEGREES OF FREEDOM | SUM OF SQUARES | MEAN OF SQUARES | F TEST | PROB |
|---|---|---|---|---|---|
| REGRESSION | 1 | 504273 | 504273 | 0.901145 | 0.3703 |
| RESIDUALS | 8 | 4476727 | 559591 | | |
| TOTAL | 9 | 4981000 | | | |

| VARIABLE | REGRESSION COEFFICIENT | STANDARDIZED COEFFICIENT | STANDARD ERROR | T | PROB |
|---|---|---|---|---|---|
| PERIOD | -78.1818 | -0.318181 | 82.3585 | -0.949287 | 0.3703 |

WHICH COMMAND?

COMMAND: REGR  MISSING VALUE TREATMENT: LISTWISE

*** MULTIPLE LINEAR REGRESSION ***

DEPENDENT VARIABLE: TCE21  13 VALID CASES

| | | | |
|---|---|---|---|
| COEFF OF DETERM: | 0.675165 | | |
| ADJUSTED R SQUARE: | 0.645635 | ESTIMATED CONSTANT TERM: | 2619.34 |
| MULTIPLE CORR COEFF: | 0.821684 | STANDARD ERR OF ESTIMATE: | 344.460 |

ANALYSIS OF VARIANCE FOR THE REGRESSION:

| SOURCE OF VARIANCE | DEGREES OF FREEDOM | SUM OF SQUARES | MEAN OF SQUARES | F TEST | PROB |
|---|---|---|---|---|---|
| REGRESSION | 1 | 2712793 | 2712793 | 22.8634 | 0.0006 |
| RESIDUALS | 11 | 1305176 | 118652 | | |
| TOTAL | 12 | 4017969 | | | |

| VARIABLE | REGRESSION COEFFICIENT | STANDARDIZED COEFFICIENT | STANDARD ERROR | T | PROB |
|---|---|---|---|---|---|
| PERIOD | -122.088 | -0.821684 | 25.5330 | -4.78157 | 0.0006 |

WHICH COMMAND?

COMMAND: REGR  MISSING VALUE TREATMENT: LISTWISE

*** MULTIPLE LINEAR REGRESSION ***

DEPENDENT VARIABLE: TCE22  12 VALID CASES

| | | | |
|---|---|---|---|
| COEFF OF DETERM: | 0.484136 | | |
| ADJUSTED R SQUARE: | 0.432549 | ESTIMATED CONSTANT TERM: | 327.161 |
| MULTIPLE CORR COEFF: | 0.695799 | STANDARD ERR OF ESTIMATE: | 61.7980 |

ANALYSIS OF VARIANCE FOR THE REGRESSION:

| SOURCE OF VARIANCE | DEGREES OF FREEDOM | SUM OF SQUARES | MEAN OF SQUARES | F TEST | PROB |
|---|---|---|---|---|---|
| REGRESSION | 1 | 35841.0 | 35841.0 | 9.38495 | 0.0120 |
| RESIDUALS | 10 | 38189.9 | 3818.99 | | |
| TOTAL | 11 | 74030.9 | | | |

| VARIABLE | REGRESSION COEFFICIENT | STANDARDIZED COEFFICIENT | STANDARD ERROR | T | PROB |
|---|---|---|---|---|---|
| PERIOD | -14.0751 | -0.695799 | 4.59447 | -3.06349 | 0.0120 |

WHICH COMMAND?

COMMAND: REGR  MISSING VALUE TREATMENT: LISTWISE

*** MULTIPLE LINEAR REGRESSION ***

DEPENDENT VARIABLE: TCE23  9 VALID CASES

COEFF OF DETERM: 0.0471080

ADJUSTED R SQUARE: -0.0890194  ESTIMATED CONSTANT TERM: 5446.67

MULTIPLE CORR COEFF: 0.217044  STANDARD ERR OF ESTIMATE: 3928.28

ANALYSIS OF VARIANCE FOR THE REGRESSION:

| SOURCE OF VARIANCE | DEGREES OF FREEDOM | SUM OF SQUARES | MEAN OF SQUARES | F TEST | PROB |
|---|---|---|---|---|---|
| REGRESSION | 1 | 5340167 | 5340167 | 0.346058 | 0.5748 |
| RESIDUALS | 7 | 108019833 | 15431405 | | |
| TOTAL | 8 | 113360000 | | | |

| VARIABLE | REGRESSION COEFFICIENT | STANDARDIZED COEFFICIENT | STANDARD ERROR | T | PROB |
|---|---|---|---|---|---|
| PERIOD | 298.333 | 0.217044 | 507.139 | 0.588267 | 0.5748 |

WHICH COMMAND?

# Attachment 4

## SUMMARY OF REGRESSION EQUATIONS
## for
## PRE-RECOVERY and POST-RECOVERY PERIODS

General Equation Form : Y = Ao + Al (x)

where Y = TCE, ug/l
x = Period no.
Ao = intercept
Al = slope

| Well no. | Regression Equations: Pre-recovery | Regression Equations: Post-recovery |
|---|---|---|
| 9 | Y = 6548.48 - 189.510 (x) | Y = 7191.43 - 277.143 (x) |
| 14 | Y = 2424.44 + 231.667 (x) | Y = 12210.5 - 605.714 (x) |
| 15 | Y = 1076.80 - 69.9099 (x) | Y = 526.571 - 20.8571 (x) |
| 16 | Y = 26109.1 - 121.212 (x) | Y = 48304.8 - 2257.14 (x) |
| 21 | Y = 2422.22 - 91.6667 (x) | Y = 2853.33 - 140.000 (x) |
| 22 | Y = 311.554 - 11.6792 (x) | Y = 185.400 - 4.80000 (x) |

# PRE-RECOVERY PERIOD

COMMAND: REGR  MISSING VALUE TREATMENT: LISTWISE
SELECTION: PERIOD < 13

*** MULTIPLE LINEAR REGRESSION ***

DEPENDENT VARIABLE: TCE9  12 VALID CASES

| | | | |
|---|---|---|---|
| COEFF OF DETERM: | 0.220449 | | |
| ADJUSTED R SQUARE: | 0.142494 | ESTIMATED CONSTANT TERM: | 6548.48 |
| MULTIPLE CORR COEFF: | 0.469520 | STANDARD ERR OF ESTIMATE: | 1347.63 |

ANALYSIS OF VARIANCE FOR THE REGRESSION:

| SOURCE OF VARIANCE | DEGREES OF FREEDOM | SUM OF SQUARES | MEAN OF SQUARES | F TEST | PROB |
|---|---|---|---|---|---|
| REGRESSION | 1 | 5135734 | 5135734 | 2.82790 | 0.1236 |
| RESIDUALS | 10 | 18160932 | 1816093 | | |
| TOTAL | 11 | 23296667 | | | |

| VARIABLE | REGRESSION COEFFICIENT | STANDARDIZED COEFFICIENT | STANDARD ERROR | T | PROB |
|---|---|---|---|---|---|
| PERIOD | -189.510 | -0.469520 | 112.694 | -1.68164 | 0.1236 |

WHICH COMMAND?

COMMAND: REGR  MISSING VALUE TREATMENT: LISTWISE
SELECTION: PERIOD < 13

*** MULTIPLE LINEAR REGRESSION ***

DEPENDENT VARIABLE: TCE14  9 VALID CASES

| | | | |
|---|---|---|---|
| COEFF OF DETERM: | 0.152647 | | |
| ADJUSTED R SQUARE: | 0.0315962 | ESTIMATED CONSTANT TERM: | 2424.44 |
| MULTIPLE CORR COEFF: | 0.390700 | STANDARD ERR OF ESTIMATE: | 1598.01 |

ANALYSIS OF VARIANCE FOR THE REGRESSION:

| SOURCE OF VARIANCE | DEGREES OF FREEDOM | SUM OF SQUARES | MEAN OF SQUARES | F TEST | PROB |
|---|---|---|---|---|---|
| REGRESSION | 1 | 3220167 | 3220167 | 1.26102 | 0.2985 |
| RESIDUALS | 7 | 17875389 | 2553627 | | |
| TOTAL | 8 | 21095556 | | | |

| VARIABLE | REGRESSION COEFFICIENT | STANDARDIZED COEFFICIENT | STANDARD ERROR | T | PROB |
|---|---|---|---|---|---|
| PERIOD | 231.667 | 0.390700 | 206.302 | 1.12295 | 0.2985 |

WHICH COMMAND?

COMMAND: REGR  MISSING VALUE TREATMENT: LISTWISE
SELECTION: PERIOD < 13

*** MULTIPLE LINEAR REGRESSION ***

DEPENDENT VARIABLE: TCE15  8 VALID CASES

| | | | |
|---|---|---|---|
| COEFF OF DETERM: | 0.837710 | | |
| ADJUSTED R SQUARE: | 0.810661 | ESTIMATED CONSTANT TERM: | 1076.80 |
| MULTIPLE CORR COEFF: | 0.915265 | STANDARD ERR OF ESTIMATE: | 93.5856 |

ANALYSIS OF VARIANCE FOR THE REGRESSION:

| SOURCE OF VARIANCE | DEGREES OF FREEDOM | SUM OF SQUARES | MEAN OF SQUARES | F TEST | PROB |
|---|---|---|---|---|---|
| REGRESSION | 1 | 271250 | 271250 | 30.9708 | 0.0014 |
| RESIDUALS | 6 | 52549.5 | 8758.26 | | |
| TOTAL | 7 | 323800 | | | |

| VARIABLE | REGRESSION COEFFICIENT | STANDARDIZED COEFFICIENT | STANDARD ERROR | T | PROB |
|---|---|---|---|---|---|
| PERIOD | -69.9099 | -0.915265 | 12.5621 | -5.56514 | 0.0014 |

WHICH COMMAND?

```
COMMAND: REGR      MISSING VALUE TREATMENT: LISTWISE
SELECTION: PERIOD < 13

                 *** MULTIPLE LINEAR REGRESSION ***

DEPENDENT VARIABLE: TCE16                          10 VALID CASES
COEFF OF DETERM:        0.00653083
ADJUSTED R SQUARE:       -0.117653     ESTIMATED CONSTANT TERM:       26109.1
MULTIPLE CORR COEFF:     0.0808135     STANDARD ERR OF ESTIMATE:      4800.88

ANALYSIS OF VARIANCE FOR THE REGRESSION:
                        DEGREES OF     SUM OF      MEAN OF
SOURCE OF VARIANCE      FREEDOM       SQUARES      SQUARES      F TEST      PROB
      REGRESSION           1          1212121      1212121    0.0525901    0.8244
      RESIDUALS            8        184387879     23048485
      TOTAL                9        185600000

                     REGRESSION   STANDARDIZED     STANDARD
VARIABLE            COEFFICIENT    COEFFICIENT       ERROR          T        PROB
PERIOD                 -121.212     -0.0808135      528.560    -0.229325   0.8244

WHICH COMMAND?
```

COMMAND: REGR  MISSING VALUE TREATMENT: LISTWISE
SELECTION: PERIOD < 13

*** MULTIPLE LINEAR REGRESSION ***

DEPENDENT VARIABLE: TCE21  9 VALID CASES

| | | | |
|---|---|---|---|
| COEFF OF DETERM: | 0.397329 | | |
| ADJUSTED R SQUARE: | 0.311233 | ESTIMATED CONSTANT TERM: | 2422.22 |
| MULTIPLE CORR COEFF: | 0.630341 | STANDARD ERR OF ESTIMATE: | 330.524 |

ANALYSIS OF VARIANCE FOR THE REGRESSION:

| SOURCE OF VARIANCE | DEGREES OF FREEDOM | SUM OF SQUARES | MEAN OF SQUARES | F TEST | PROB |
|---|---|---|---|---|---|
| REGRESSION | 1 | 504167 | 504167 | 4.61497 | 0.0688 |
| RESIDUALS | 7 | 764722 | 109246 | | |
| TOTAL | 8 | 1268889 | | | |

| VARIABLE | REGRESSION COEFFICIENT | STANDARDIZED COEFFICIENT | STANDARD ERROR | T | PROB |
|---|---|---|---|---|---|
| PERIOD | -91.6667 | -0.630341 | 42.6704 | -2.14825 | 0.0688 |

WHICH COMMAND?

COMMAND: REGR  MISSING VALUE TREATMENT: LISTWISE
SELECTION: PERIOD < 13

*** MULTIPLE LINEAR REGRESSION ***

DEPENDENT VARIABLE: TCE22  8 VALID CASES

| | | | |
|---|---|---|---|
| COEFF OF DETERM: | 0.158397 | | |
| ADJUSTED R SQUARE: | 0.0181293 | ESTIMATED CONSTANT TERM: | 311.554 |
| MULTIPLE CORR COEFF: | 0.397991 | STANDARD ERR OF ESTIMATE: | 77.6175 |

ANALYSIS OF VARIANCE FOR THE REGRESSION:

| SOURCE OF VARIANCE | DEGREES OF FREEDOM | SUM OF SQUARES | MEAN OF SQUARES | F TEST | PROB |
|---|---|---|---|---|---|
| REGRESSION | 1 | 6803.13 | 6803.13 | 1.12925 | 0.3288 |
| RESIDUALS | 6 | 36146.9 | 6024.48 | | |
| TOTAL | 7 | 42950.0 | | | |

| VARIABLE | REGRESSION COEFFICIENT | STANDARDIZED COEFFICIENT | STANDARD ERROR | T | PROB |
|---|---|---|---|---|---|
| PERIOD | -11.6792 | -0.397991 | 10.9905 | -1.06266 | 0.3288 |

WHICH COMMAND?

# POST-RECOVERY PERIOD

COMMAND: REGR  MISSING VALUE TREATMENT: LISTWISE
SELECTION: PERIOD >=11

*** MULTIPLE LINEAR REGRESSION ***

DEPENDENT VARIABLE: TCE9  6 VALID CASES

| | | | |
|---|---|---|---|
| COEFF OF DETERM: | 0.334780 | | |
| ADJUSTED R SQUARE: | 0.168475 | ESTIMATED CONSTANT TERM: | 7191.43 |
| MULTIPLE CORR COEFF: | 0.578602 | STANDARD ERR OF ESTIMATE: | 817.138 |

ANALYSIS OF VARIANCE FOR THE REGRESSION:

| SOURCE OF VARIANCE | DEGREES OF FREEDOM | SUM OF SQUARES | MEAN OF SQUARES | F TEST | PROB |
|---|---|---|---|---|---|
| REGRESSION | 1 | 1344143 | 1344143 | 2.01305 | 0.2289 |
| RESIDUALS | 4 | 2670857 | 667714 | | |
| TOTAL | 5 | 4015000 | | | |

| VARIABLE | REGRESSION COEFFICIENT | STANDARDIZED COEFFICIENT | STANDARD ERROR | T | PROB |
|---|---|---|---|---|---|
| PERIOD | -277.143 | -0.578602 | 195.333 | -1.41882 | 0.2289 |

WHICH COMMAND?

COMMAND: REGR  MISSING VALUE TREATMENT: LISTWISE
SELECTION: PERIOD >=11

*** MULTIPLE LINEAR REGRESSION ***

DEPENDENT VARIABLE: TCE14  6 VALID CASES

| | | | |
|---|---|---|---|
| COEFF OF DETERM: | 0.673487 | | |
| ADJUSTED R SQUARE: | 0.591858 | ESTIMATED CONSTANT TERM: | 12210.5 |
| MULTIPLE CORR COEFF: | 0.820662 | STANDARD ERR OF ESTIMATE: | 882.151 |

ANALYSIS OF VARIANCE FOR THE REGRESSION:

| SOURCE OF VARIANCE | DEGREES OF FREEDOM | SUM OF SQUARES | MEAN OF SQUARES | F TEST | PROB |
|---|---|---|---|---|---|
| REGRESSION | 1 | 6420571 | 6420571 | 8.25064 | 0.0454 |
| RESIDUALS | 4 | 3112762 | 778190 | | |
| TOTAL | 5 | 9533333 | | | |

| VARIABLE | REGRESSION COEFFICIENT | STANDARDIZED COEFFICIENT | STANDARD ERROR | T | PROB |
|---|---|---|---|---|---|
| PERIOD | -605.714 | -0.820662 | 210.874 | -2.87239 | 0.0454 |

WHICH COMMAND?

COMMAND: REGR  MISSING VALUE TREATMENT: LISTWISE
SELECTION: PERIOD >=11

*** MULTIPLE LINEAR REGRESSION ***

DEPENDENT VARIABLE: TCE15  6 VALID CASES

| | | | |
|---|---|---|---|
| COEFF OF DETERM: | 0.284593 | | |
| ADJUSTED R SQUARE: | 0.105741 | ESTIMATED CONSTANT TERM: | 526.571 |
| MULTIPLE CORR COEFF: | 0.533472 | STANDARD ERR OF ESTIMATE: | 69.1685 |

ANALYSIS OF VARIANCE FOR THE REGRESSION:

| SOURCE OF VARIANCE | DEGREES OF FREEDOM | SUM OF SQUARES | MEAN OF SQUARES | F TEST | PROB |
|---|---|---|---|---|---|
| REGRESSION | 1 | 7612.86 | 7612.86 | 1.59122 | 0.2757 |
| RESIDUALS | 4 | 19137.1 | 4784.29 | | |
| TOTAL | 5 | 26750.0 | | | |

| VARIABLE | REGRESSION COEFFICIENT | STANDARDIZED COEFFICIENT | STANDARD ERROR | T | PROB |
|---|---|---|---|---|---|
| PERIOD | -20.8571 | -0.533472 | 16.5344 | -1.26144 | 0.2757 |

WHICH COMMAND?

COMMAND: REGR  MISSING VALUE TREATMENT: LISTWISE
SELECTION: PERIOD >=11

*** MULTIPLE LINEAR REGRESSION ***

DEPENDENT VARIABLE: TCE16  6 VALID CASES

| | | | |
|---|---|---|---|
| COEFF OF DETERM: | 0.692035 | | |
| ADJUSTED R SQUARE: | 0.615043 | ESTIMATED CONSTANT TERM: | 48304.8 |
| MULTIPLE CORR COEFF: | 0.831886 | STANDARD ERR OF ESTIMATE: | 3149.45 |

ANALYSIS OF VARIANCE FOR THE REGRESSION:

| SOURCE OF VARIANCE | DEGREES OF FREEDOM | SUM OF SQUARES | MEAN OF SQUARES | F TEST | PROB |
|---|---|---|---|---|---|
| REGRESSION | 1 | 89157143 | 89157143 | 8.98848 | 0.0400 |
| RESIDUALS | 4 | 39676190 | 9919048 | | |
| TOTAL | 5 | 128833333 | | | |

| VARIABLE | REGRESSION COEFFICIENT | STANDARDIZED COEFFICIENT | STANDARD ERROR | T | PROB |
|---|---|---|---|---|---|
| PERIOD | -2257.14 | -0.831886 | 752.863 | -2.99808 | 0.0400 |

WHICH COMMAND?

COMMAND: REGR  MISSING VALUE TREATMENT: LISTWISE
SELECTION: PERIOD >=11

*** MULTIPLE LINEAR REGRESSION ***

DEPENDENT VARIABLE: TCE21  6 VALID CASES

| | | | |
|---|---|---|---|
| COEFF OF DETERM: | 0.392478 | | |
| ADJUSTED R SQUARE: | 0.240598 | ESTIMATED CONSTANT TERM: | 2853.33 |
| MULTIPLE CORR COEFF: | 0.626481 | STANDARD ERR OF ESTIMATE: | 364.326 |

ANALYSIS OF VARIANCE FOR THE REGRESSION:

| SOURCE OF VARIANCE | DEGREES OF FREEDOM | SUM OF SQUARES | MEAN OF SQUARES | F TEST | PROB |
|---|---|---|---|---|---|
| REGRESSION | 1 | 343000 | 343000 | 2.58413 | 0.1832 |
| RESIDUALS | 4 | 530933 | 132733 | | |
| TOTAL | 5 | 873933 | | | |

| VARIABLE | REGRESSION COEFFICIENT | STANDARDIZED COEFFICIENT | STANDARD ERROR | T | PROB |
|---|---|---|---|---|---|
| PERIOD | -140.000 | -0.626481 | 87.0905 | -1.60752 | 0.1832 |

WHICH COMMAND?

COMMAND: REGR  MISSING VALUE TREATMENT: LISTWISE
SELECTION: PERIOD >=11

*** MULTIPLE LINEAR REGRESSION ***

DEPENDENT VARIABLE: TCE22  5 VALID CASES

| | | | |
|---|---|---|---|
| COEFF OF DETERM: | 0.126260 | | |
| ADJUSTED R SQUARE: | -0.164986 | ESTIMATED CONSTANT TERM: | 185.400 |
| MULTIPLE CORR COEFF: | 0.355331 | STANDARD ERR OF ESTIMATE: | 23.0536 |

ANALYSIS OF VARIANCE FOR THE REGRESSION:

| SOURCE OF VARIANCE | DEGREES OF FREEDOM | SUM OF SQUARES | MEAN OF SQUARES | F TEST | PROB |
|---|---|---|---|---|---|
| REGRESSION | 1 | 230.400 | 230.400 | 0.433517 | 0.5573 |
| RESIDUALS | 3 | 1594.40 | 531.467 | | |
| TOTAL | 4 | 1824.80 | | | |

| VARIABLE | REGRESSION COEFFICIENT | STANDARDIZED COEFFICIENT | STANDARD ERROR | T | PROB |
|---|---|---|---|---|---|
| PERIOD | -4.80000 | -0.355331 | 7.29018 | -0.658420 | 0.5573 |

WHICH COMMAND?