SUBURBAN HYDROGEOLOGY AND GROUND-WATER GEOCHEMISTRY OF THE ASHPORT SILT LOAM, PAYNE COUNTY, OKLAHOMA

By

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OKLAHOMA

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CHAPTER I

INTRODUCTION

Research Objective

Definition of background water quality poses one of the major problems facing ground-water investigators responsible for maintaining and restoring shallow aquifers. Water quality depends upon the aquifer environment as well as external factors, including vegetative use and human activities. The goal of this research is twofold; characterize hydraulic parameters of a shallow, fine-grained aquifer, and determine effects of hydrogeologic and suburban environments on variations in ground-water geochemistry.

General Approach

This research encompassed a multi-phased program of data collection. Water levels were measured approximately every three days from April 1986 to April 1987. Ground-water hydrographs were used to estimate horizontal and vertical hydraulic gradients, ground-water velocity and specific yield. Ground-water samples were collected and analyzed on at least a weekly basis from April 1986 to February 1987. Several aquifer tests were conducted from

March 1986 to May 1987 to calculate transmissivity, storativity and hydraulic conductivity.

Previous Work at Field Site

The study area is located in a residential neighborhood in northeastern Stillwater, Payne County, Oklahoma. Nitrate fertilizer is commercially applied three times per year. To evaluate effects of the fertilizer on ground-water quality, Hagen (1986) installed 16 monitoring wells, ranging in depth from 8 to 14 feet, in four clusters in the Ashport silt loam. He measured water levels and analyzed ground-water samples for electrical conductivity, pH, temperature and nitrate on a regular basis from July 1985 to mid April 1986. His ground-water data base demonstrates that basic water-quality parameters vary considerably within the 8000 ft^2 monitored area.

Acre (in prep) installed four soil-moisture neutron access tubes beside each cluster of wells and measured soil moisture content with a neutron probe from September 1985 to April 1986. His work illustrates the variability in the soil-moisture profile over the field site.

To sample water that flows through the unsaturated zone, Ross (1987) installed eight soil-water suction lysimeters at depths of 1.5 to 8 feet near one of the well clusters. He analyzed water samples from the lysimeters and adjacent wells for major anions and cations from January to June 1987. His research demonstrates that the soil water and ground water are stratified with respect to nitrate.

Review of Pertinent Literature

Shallow Ground-water Geochemistry

Recent attention has been focused on shallow aquifers due to the relative ease with which they may be contaminated. Articles abound covering all aspects of the ground-water monitoring industry, including well construction, sampling and analytical techniques, and use of statistical methods. Barcelona and others (1985, 1983) review the effects of monitoring well construction and sampling protocol on ground-water quality. Schuller and others (1981) discussed sample collection methods and various factors that affect sample integrity. The U.S. Environmental Protection Agency (EPA) has established standard technical guidelines for monitoring procedures and chemical analyses to ensure consistency and uniformity (U.S. Environmental Protection Agency, 1986; Kopp and McGee, 1983).

Care should be taken to standardize monitoring techniques in order to better explain observed variations of chemical constituents in shallow ground-water. Many articles have been published documenting variations in nitrates and other inorganic and organic constituents. For example, Spalding and Exner (1980) examined inorganic constituents in sand and gravel in the Platte River valley, south-central Nebraska. They discovered that nitrate applied as fertilizer in irrigated areas was transported through the vadose zone to the ground water. They also noted seasonal nitrate variation.

Studies of natural ground-water quality variations have also been published. Hackbarth (1981) documented seasonal variations in three shallow wells in the Athabasca Oil Sands area, Alberta. Although calcium, magnesium and bicarbonate concentrations were low in the spring, they rose rapidly by early summer and decreased again in fall and winter. Hackbarth (1981) attributed the variations to the abundant muskeg vegetation and to CO_2 dissolved in the recharge water. His ground-water samples contained concentrations of bicarbonate on the order of 400 mg/l, which is similar to concentrations measured in this study.

Once data are collected and analyzed according to standard accepted methods, the stage is set for statistical evaluation of the results. Some controversy has been generated regarding which tests are best to use to determine whether a site has been contaminated. Under the auspices of the Resource Conservation and Recovery Act (RCRA), the EPA requires use of Student's t test at the 95 percent probability level to determine the statistical difference between background water and potentially contaminated water.

Student's t test is based on the assumption that the data were sampled from a normally distributed population (Steel and Torrie, 1980). The t statistic is calculated using estimates of two population parameters, the mean and standard deviation. Arguments have been raised suggesting that non-parametric statistical tests, such as the Mann-Whitney U test, are a more effective way to evaluate water quality data. Ross and Elton (1984) state that the Mann-Whitney test is better than Student's t test when sample size is small, the distribution is other than normal and sample variances differ considerably.

Montgomery and others (1987) recently delved into the statistical characteristics of ground-water quality variables. They used available data bases and found that all ground-water constituents were not normally distributed. In a companion article, Harris and others (1987) reviewed appropriate methods of statistical analysis to test for normality and for seasonal variation. They recommend using the skewness coefficient to test for normal distribution and several tests, including Student's t, Mann-Whitney U and analysis of variance, to test for seasonal variations.

Aquifer Test Interpretation Methods

Prior to 1935 constant-rate aquifer test data were analyzed using methods stemming from the equilibrium equation that Thiem (1906) derived using Darcy's law. The disadvantage of Thiem's solution is that it is valid only for pumped aquifers in which steady state conditions have been reached. Most modern interpretation techniques are based on some form of the Theis (1935) equation. Theis used a heat flow analogy to analytically solve the exponential integral equation for radial flow in a confined aquifer under non-equilibrium conditions. His equations may be applied to unconfined aquifers after certain corrections are made to observed drawdown data.

Jacob (1944) and Cooper and Jacob (1946) made some simplifying assumptions and modified the Theis method so that graphic solution of the non-equilibrium equation is more convenient. Franke (1987) recently developed a type curve method of graphic solution based on the Theis equation. Many other modifications have been made to the basic Theis equation to accommodate leakage (Hantush, 1956; Walton, 1962) and recharge (Hantush, 1959; Ferris and others, 1962). These methods and others were summarized in a comprehensive bulletin by Kruseman and DeRidder (1976).

Analysis of unconfined aquifers may be complicated by the phenomenon of delayed yield due to gravity drainage as the cone of depression is dewatered. According to Stallman (1965, p. 311), "analysis of pumping tests made in unconfined aquifers should be a fertile field for anyone slightly inclined toward pessimism." Boulton (1963), Prickett (1965) and Neuman (1975) persevered and derived type curve methods based on the Theis equation to analyze water table aquifers subject to delayed yield.

CHAPTER II

SITE DESCRIPTION

Introduction

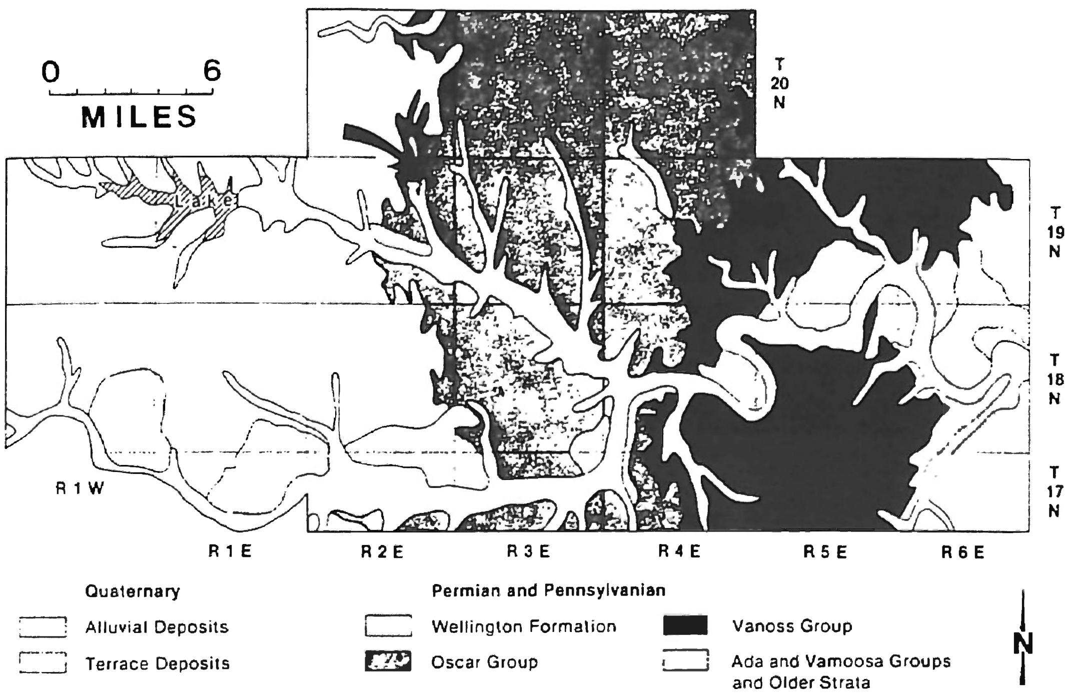
Location

The field site is located in a residential area on the Boomer Creek flood plain 350 feet east of a small unnamed tributary in northeastern Stillwater, Payne County, north-central Oklahoma (Figure 1). Elevation of the study area is about 886 feet above mean sea level. The field site is nearly flat; total relief is less than a half foot (Shaun Conally, personal communication, 1987). About 600 feet to the north of the study site the elevation rises 20 feet. Elevation of the main Boomer Creek bed is approximately 874 feet and elevation of the spillway damming the unnamed tributary is 881.17 feet. As the street names suggest, the site was part of a pecan grove before the subdivision was built in 1972. Several large trees shade the southern property boundary.

Climate

Central Oklahoma receives an average of 34 inches of rainfall and six inches of snow annually (Pettyjohn and

SITE LOCATION MAP



AFTER SOIL CONSERVATION SERVICE
1986

Figure 1. Site Location Map. Arrow Marks Field Site.

others, 1983). Precipitation recorded at the study site equals 15 inches of rain from September to December 1985, 39.6 inches in 1986, and 14 inches of rain and seven inches of snow from January through May 1987 (Appendix A). Most of the rain occurs in the fall and spring. Local convective thunderstorms are always a possibility in the summer. Fall is the major period of aquifer recharge; large cyclonic rainstorms occur and evapotranspiration losses decrease.

Mean daily air temperature for January is 32° F and for July is 82° F (Pettyjohn and others, 1983). There were six days in July and August when temperature equaled or exceeded 100° F in 1985 and 10 days in 1986 (Stillwater climate records, 1985, 1986). Yearly evapotranspiration losses average 30 inches in Payne County (Pettyjohn and others, 1983). The first fall frost occurred on 2 November in 1985 and 11 November in 1986. Minimum air temperatures rise above 40° F after mid to late April (Oklahoma State University, Department of Agronomy, 1985-87).

Hydrogeology

Local Geology

The stratigraphic section of the Boomer Creek flood plain consists of Quaternary alluvium and soil that fill a steep-walled valley cut into Upper Pennsylvanian Doyle Shale of the Oscar Group (Figure 2). The Doyle contains

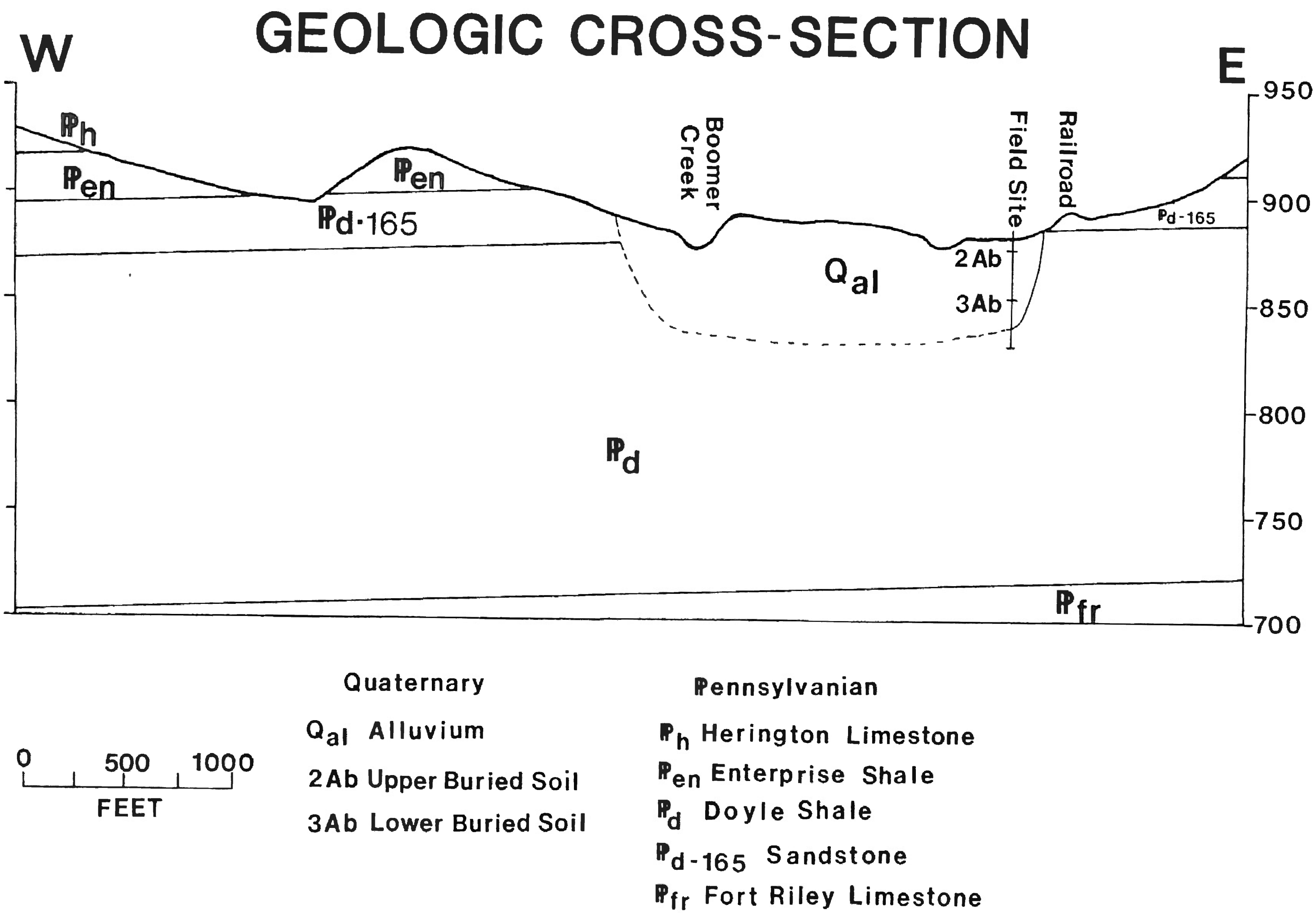


Figure 2. Geologic Cross-Section. Surface Geology after Shelton and others, 1986.

170 feet of interbedded red shale and lenticular fine-grained sandstones, with shale predominating (Shelton and others, 1985). Open vertical joints are common in sandstone and limestone outcrops in Payne County. The joints are extensional in origin and form a conjugate system. Average strike of joints for the entire county is N60E and N50W (Shelton and others, 1985).

Shale and the uppermost sandstone of the Doyle, the Pd-165 sandstone of Shelton and others (1985), crop out near the Atchison, Topeka and Santa Fe railroad tracks 500 feet east of the site. The Quaternary deposits terminate against this bedrock outcrop. Based on interpretation of a 45-foot composite core from the field site, the Quaternary section consists of 35 feet of alluvial fill that overlies an eight-foot lag deposit of gravelly sand. The top 35 feet of the alluvial fill has soil characteristics and is herein referred to as the Ashport silt loam.

Soil Description

The Soil Conservation Service (1986, Map 14) has mapped the surface soil as Ashport silty clay loam. The Soil Conservation Service classifies Ashport soils as fine-silty, mixed thermic Fluventic Haplustolls. Ashport soils originate from alluvial deposits on narrow level flood-plains under native grasses and bottomland hardwoods. Organic matter content is high and the root zone is deep. Ashport soils are well-drained and moderately permeable, although surface runoff is slow due to the low slope. There is virtually no surface runoff at the study site; after large rainstorms ponding occurs in depressions.

Ross (1987) logged a 45-foot composite core recovered from two well sites in the western third of the field area. He interpreted three episodes of soil formation referred to as the surface soil and the upper and lower buried soil profiles. The tops of the two buried soil profiles were picked at depths of 4 and 27.5 feet in the field site core (Figure 3). Organic material in the buried A horizon at four feet has been radiocarbon dated as 1300 +/- 70 years BP (Beta-20144). The buried A horizon at 27.5 feet has been dated as 10,600 +/- 170 years BP (Beta-21505). Based on these dates, the rate of net deposition for the sediments between the two buried A horizons would have been 0.0025 feet/year or 400 years/foot. Rate of net deposition for the modern surface soil would have been 0.0031 feet/year or 325 years/foot.

The surface soil, from land surface to a depth of four feet, consists mainly of reddish brown silt loam with moderate, medium subangular blocky and weak, medium prismatic structure. Root casts are common in the surface soil as well as in both buried soil profiles. Illuviated clays line root casts and coat soil ped faces. The C horizon of the surface soil occurs three feet below land surface and contains stratified fine-grained sand with massive structure.

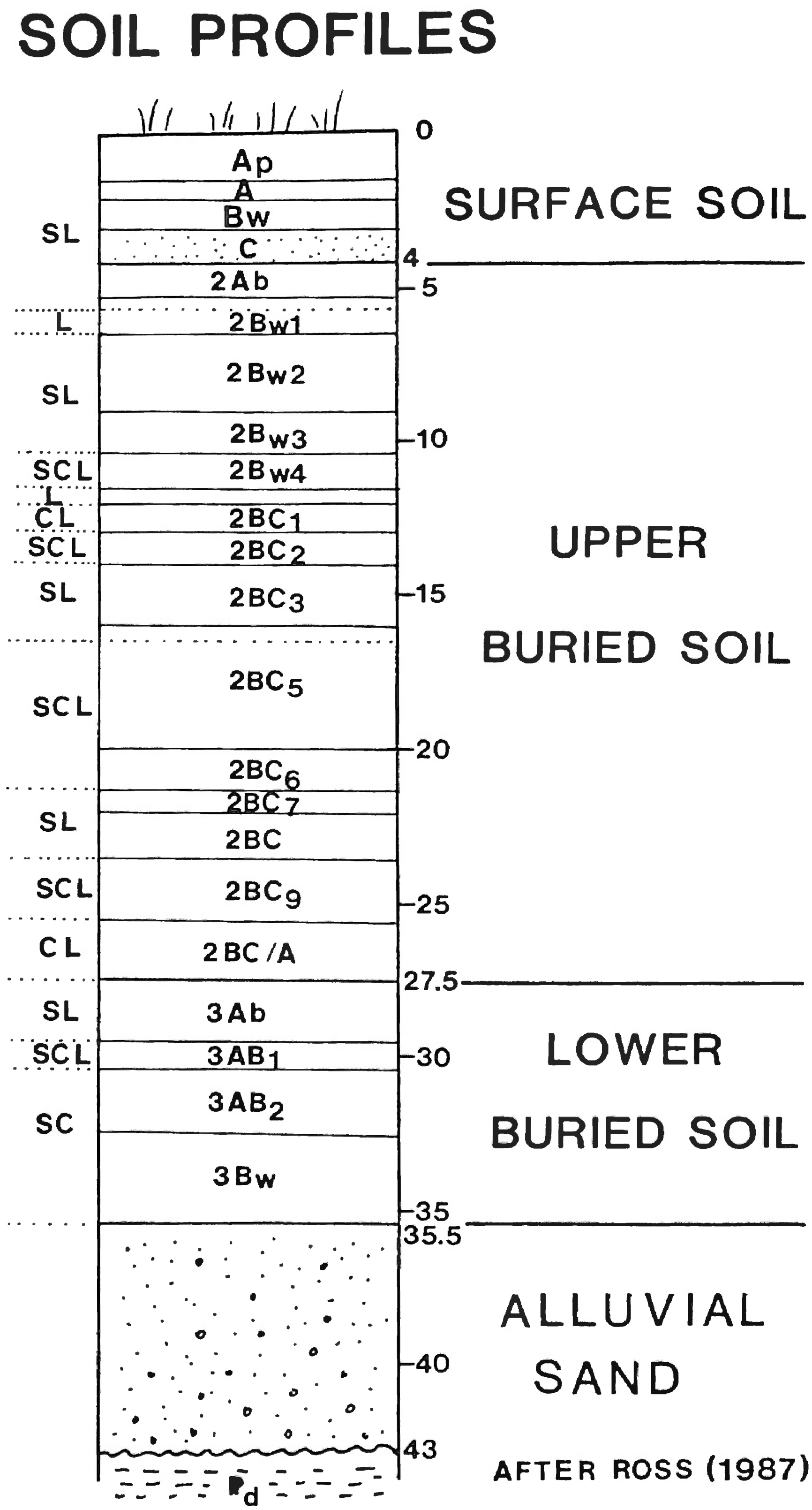


Figure 3. Soil Profiles. SL, Silt Loam; L, Loam; SCL, Silty Clay Loam; CL, Clay Loam; SC, Silty Clay.

The upper buried soil profile extends from 4 to 27.5 feet below land surface. It consists of 23.5 feet of reddish brown loam, silt loam and silty clay loam with moderate to weak, medium subangular blocky structure throughout, and parting to moderate, medium prismatic structure in the upper eight feet. Calcareous nodules and tubules occur from 6 to 10 feet below surface. Manganese nodules, indicative of periodic saturated conditions, occur throughout the core from 5.3 to 30.5 feet. The nodules are common from 5.3 to 9 feet and generally decrease in abundance downward. Mottling, also characteristic of fluctuating water-table conditions, is common from 8 to 11 feet (Ross, 1987).

The top 1.5 feet of the upper buried soil profile is silt loam; below are four fining downward units which may represent periodic widespread flooding of Boomer Creek and its tributaries. The fine-grained nature of the deposits suggests that the area was probably located on the distal floodplain of Boomer Creek. Based on the thicknesses of the units and the estimated rate of deposition of 0.0025 feet/year, flood frequency would have ranged from 1000 to 2500 years. The area is currently located outside the 500-year flood line (Department of Engineering, Stillwater).

The lower buried soil profile occurs from 27.5 to 35.5 feet below land surface. The A and B horizons consist of mottled silt loam, silty clay loam and silty clay with structure similar to the two superjacent profiles. The A and B horizons overlie gravelly alluvial lag sand that was deposited on the weathered surface of the Upper Pennsylvanian Doyle Shale (Ross, 1987).

Urban Features

The field site occupies 26,000 ft^2. Twenty four percent of the total area is covered by concrete driveways and walkways (2525 ft^2) and one-story buildings (3775 ft^2). Concrete slabs underlie the buildings, which do not have basements. Drainspouts direct water from the house.

The main area of interest covers about 8000 ft^2 behind the house. Seven large pecan and hackberry trees line the southern property boundary (Figure 4). The trees range in diameter from approximately 3 to 48 inches. According to his wife, the late Mr. J.C. Barnes planted the pecan grove after which the subdivision was named in the late 1930s. The pecan trees at the field site are smaller in diameter than the large pecans that were part of the original grove and they are probably somewhat younger. The hackberry trees are larger in trunk and dripline diameter than the pecans and are probably as old as Mr. Barnes' pecan grove.

Although trees are certainly not unique to residential "field" sites, sewer, water and gas lines are indigenous to the urban environment. All lines must be located on plats if possible prior to installation of monitoring systems to avoid damage to the property and the field geologist's reputation. In addition, leakage from faulty sewer or

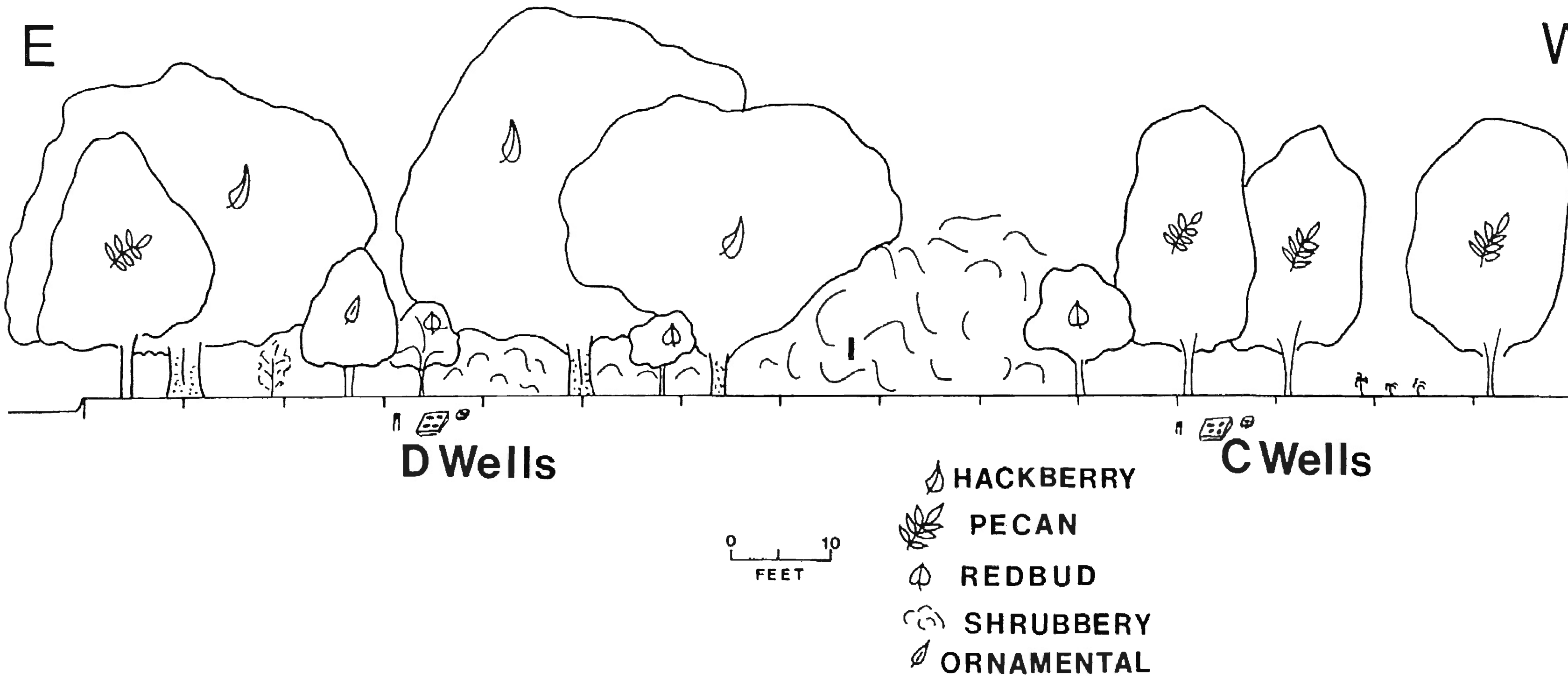


Figure 4. Schematic Drawing of Site Vegetation. View Looking South.

water lines may disrupt natural ground-water flow patterns.

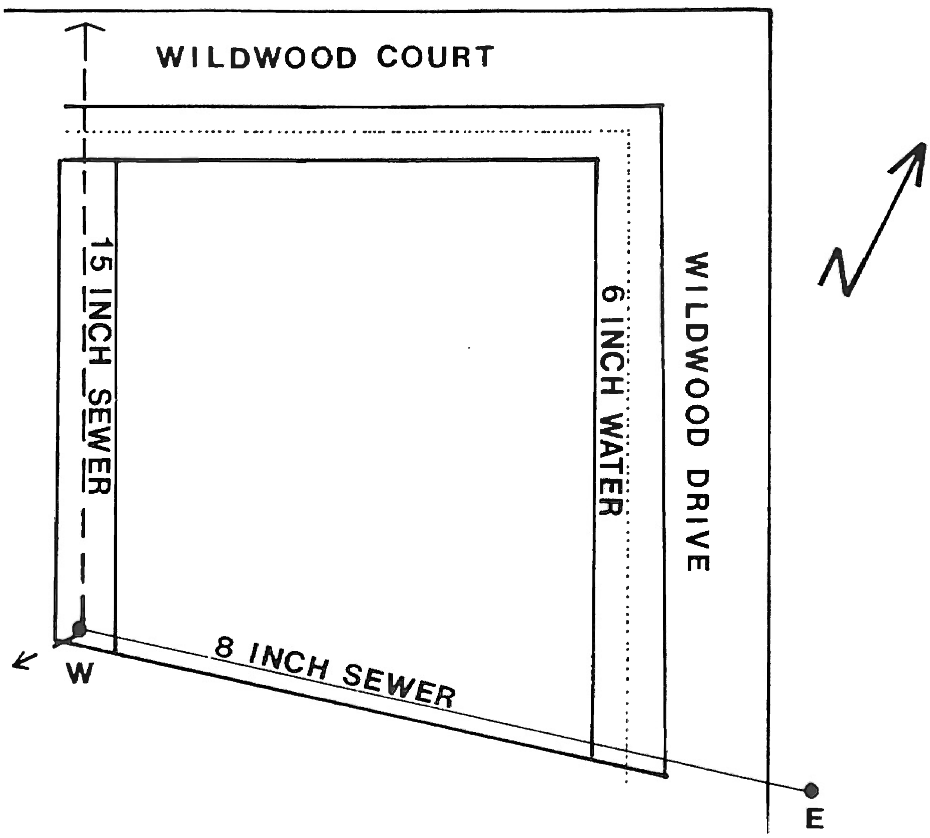
Two city sewer lines and one water line cross the field site (Figure 5). The eight-inch diameter sewer line crosses the back yard about five feet below land surface (City of Stillwater, plat, 1965). The 15-inch line is installed about eight feet below land surface. During most of the year the eight-inch line is above the water table. The 15-inch line is above the water table in the summer and early fall. The water line in the front yard is installed somewhere within the easement between the street and property line (Aaron Green, Department of Engineering, Stillwater, 1987). Service lines for water and gas connect the house to the public lines. Accurate location of the service lines is unknown, but both are located in the northern half of the site.

Monitoring System

Instrumentation

Since the project began in mid 1985, 27 ground-water monitoring wells, four soil moisture neutron probe access tubes and eight soil-water suction lysimeters have been installed in the 8000 ft^2 area of interest. The site is also instrumented with a tipping bucket recording rain gage, a continuously recording barograph, a continuously recording photo intensity meter, one continuously recording Stevens A-35 water level recorder and two In Situ SE1000 electrical pressure transducers.

CITY SEWER AND WATER LINES



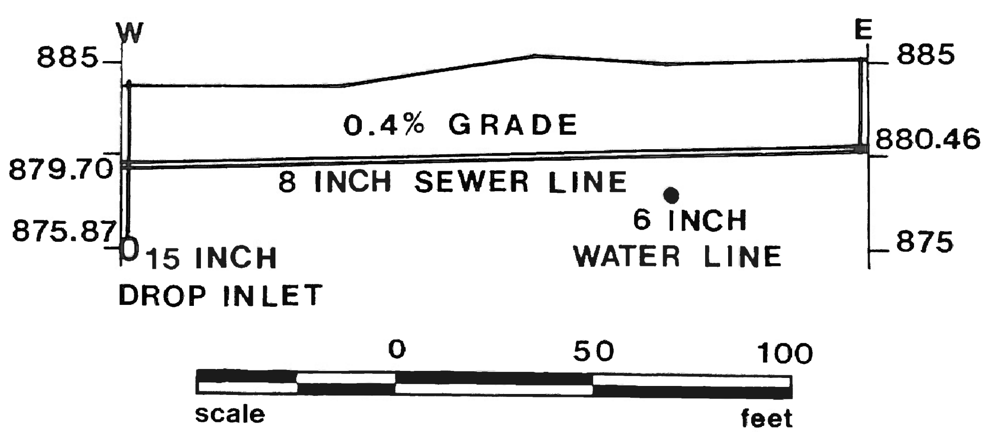


Figure 5. City Sewer and Water Lines. Source: City of Stillwater, Department of Engineering.

Ground-water Monitoring Wells

Hagen (1986) hand-augered 16 ground-water monitoring wells, 8 to 14 feet deep, from June to August 1985. The wells are located in four clusters, named A, C, D, and E (Figure 6). Each cluster contains four two-inch diameter wells with four-inch screened intervals at approximately 8, 9, 10 and 14 feet (Figure 7, Appendix B). The wells are labeled in descending order so that the 1 well is shallowest and the 4 well deepest. Four additional 14-foot wells, one at each cluster, were installed in January 1986. These wells are composite wells that are screened from 7 to 14 feet. They are designated as the 5 wells.

The wells were completed with Schedule 40 PVC plastic pipe which was slotted with a hand saw and wrapped with nylon screen (Hagen, 1986). The slotted interval was sand-packed with medium- to coarse-grained sand. The annular space above the slotted interval was filled with bentonite slurry. The wells are sealed at the surface with a concrete pad. The 5 wells are cemented in a separate pad. The wells were developed by surging and backwashing. Maximum horizontal distance between wells in a cluster is three feet; most are within 1.5 feet of each other. Maximum distance between clusters is 135 feet.

In October 1986 personnel from the U.S. Environmental Protection Agency's Robert S. Kerr Environmental Research Laboratory drilled six eight-inch diameter holes with a

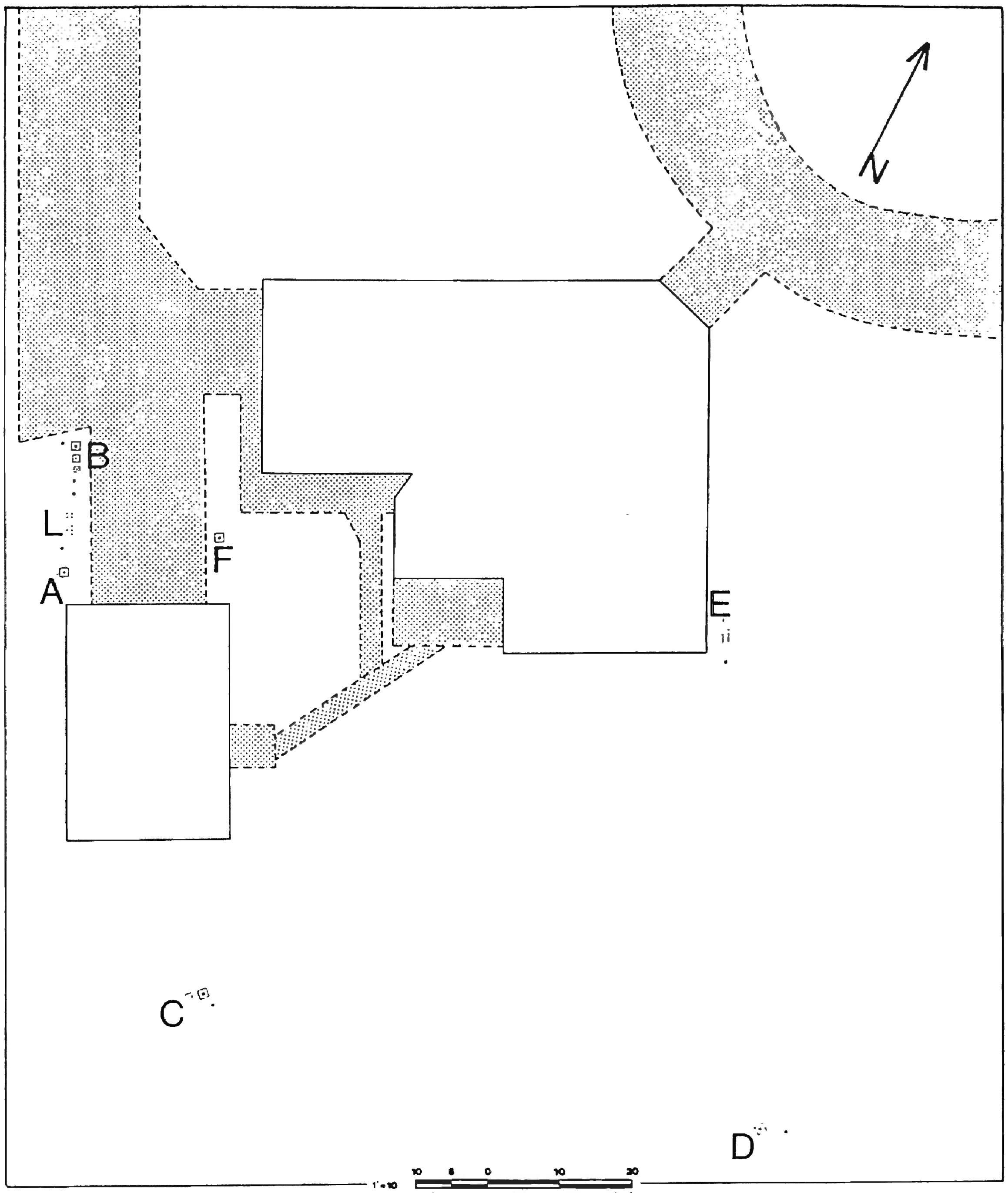


Figure 6. Well Location Map.

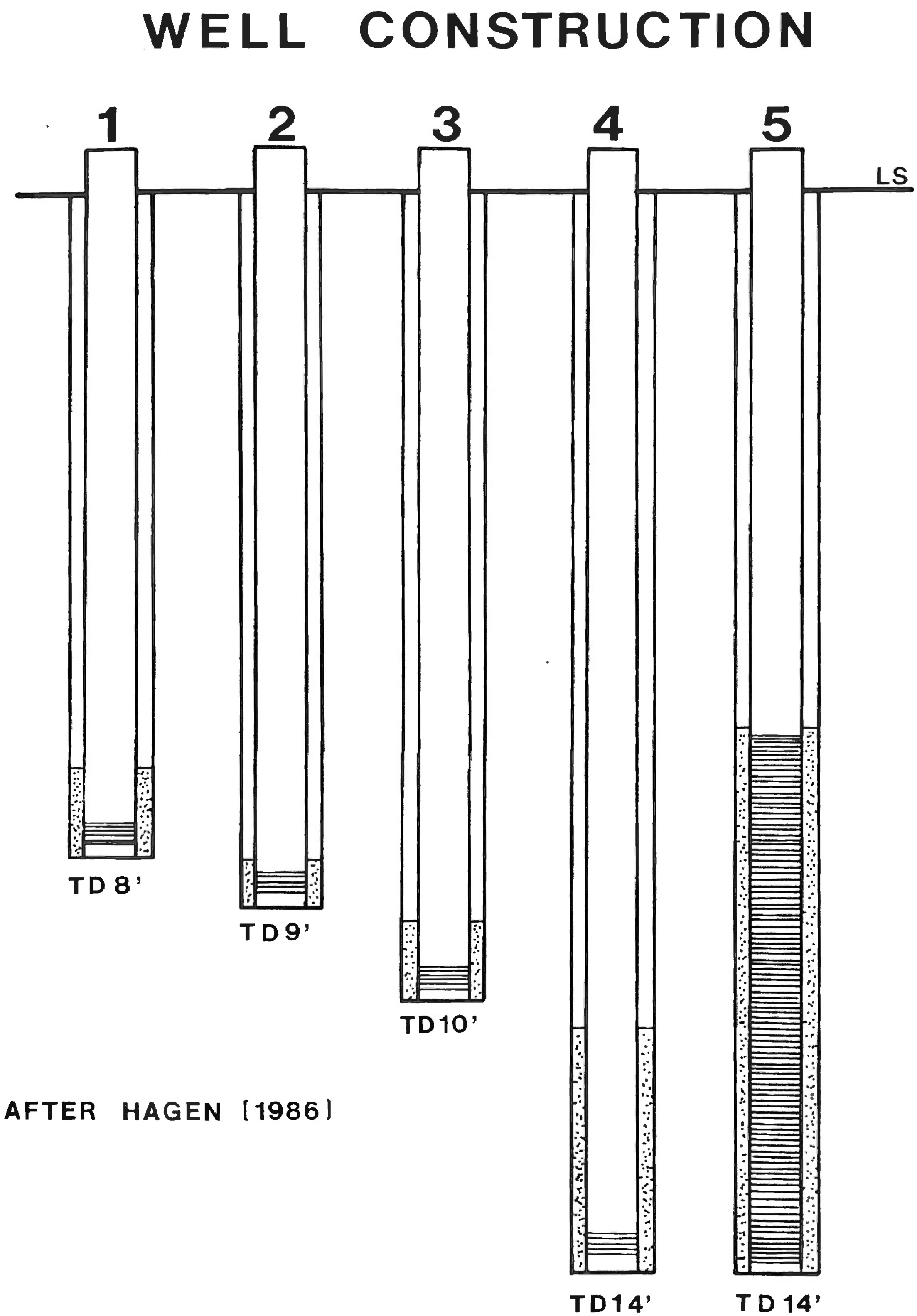


Figure 7. Well Configuration at a Cluster.

hollow-stem auger rig. Four shallow wells were drilled at the B site and one 88-foot hole drilled at the F site. A 50-foot hole was drilled near the B site to be completed as nested piezometers. The hole was continuously cored from 25 to 45 feet.

The B wells range in depth from 6 to 14 feet (Appendix B). Four of the wells are slotted and screened over the bottom four inches of casing. Well B1 is 0.75 inches in diameter, wells B2, B3, and B4 are two inches in diameter and Well B5 is six inches in diameter. Well B5 is a composite well slotted and screened from 4 to 15 feet. Well completion is similar to the methods used by Hagen (1986). The wells were developed by surging.

The F well was cored continuously for the top 30 feet. Although the well was drilled to a total depth of 88 feet, the hole caved in below 40 feet. Two wells were installed in the eight-inch hole. Well F1 is a 40-foot deep four-inch diameter well slotted and screened from 10 to 40 feet. Well F2 is a two-inch diameter well slotted and screened over the same interval. The two wells were wired together before installation so that well loss resulting from pumping water out of the F1 well could be calculated by measuring the water level in the adjacent F2 well. Both wells are constructed from Schedule 40 PVC pipe. The screened interval was sand-packed. Bentonite slurry and cement fill the annular space from 10 feet to surface. Well F1 was developed by pumping until the water was sediment-free. Well F2 is used only for water level measurements and is not developed.

Soil-moisture Neutron Tubes

In September 1985 Acre (in prep), installed four neutron probe access tubes within one to three feet of well sites A, C, D and E. He pounded open-ended EMT thin-walled aluminum tubing, 1.5 inches in diameter, into the ground while hand-augering the inside. The tubes were driven approximately seven feet below ground surface.

Acre (in prep) and Ross (1987) determined soil moisture content using a Troxler Series 3300 Depth Moisture Gauge (neutron probe). The probe emits alpha particles which collide with hydrogen ions in the soil and soil water adjacent to the tube. The probe counts neutrons given off in the collisions. Counts are converted to percent soil moisture using the calibration curve unique to the probe. Radius of probe investigation varies from less than four inches in wet soil to more than 10 inches in dry soil. Soils rich in clay and organic matter may yield optimistic soil-moisture contents due to presence of hydrogen that is unrelated to movable water (Hillel, 1980).

All tubes were monitored periodically from September 1985 to January 1987 (Acre, in prep). The A site was monitored twice weekly from January to June 1987 (Ross, 1987).

Soil-water Suction Lysimeters

To sample water transported through the vadose zone, Ross (1987) installed eight soil-water suction lysimeters within 5 to 8.5 feet of the A site in late fall 1986. The lysimeters range in depth from 1.5 to 8 feet. The lysimeter at eight feet is equivalent in depth to Well A1 and is therefore in the saturated zone during part of the year. Other lysimeters may be in the saturated zone during periods of high water table.

The lysimeters consist of a porous ceramic cup attached to a 9.5-inch section of PVC plastic pipe. Sample chamber volume is approximately 500 ml. Holes in which the lysimeters were placed were drilled using a truck-mounted Giddings probe. Silica flour placed around the zone of the ceramic cup acts as a sand-pack equivalent. The holes were back-filled and sealed with bentonite slurry. The lysimeters were sampled twice weekly from January to June 1987 (Ross, 1987).

CHAPTER III

GROUND-WATER HYDRAULICS

Introduction

Data Base

Water levels were measured with a chalked steel tape marked in increments of hundredths of feet. Since the project began, water levels have been measured every 2.7 days on average. Hagen (1986) measured water levels 89 times from June 1985 to April 1986. In this study water levels were recorded 138 times from April 1986 to April 1987. Pad elevation was surveyed for each well cluster allowing calculation of water-table elevation for each measurement. Water levels and elevations are tabulated in Appendix C. The clustered arrangement of monitoring wells allows the investigator to obtain maximum information regarding horizontal and vertical hydraulic gradients.

Ground-water Hydrographs

Hydrographs were plotted for wells 1, 2, 3 and 4 at the A, C, D and E clusters for the period September 1985 to April 1987. The 4 and 5 wells are the only ones in which the water level may be measured year round. The hydrograph for Well A4 is typical of the 14-foot wells (Figure 8).

Fall is the major period of ground-water recharge. From 10 September to 18 October 1985 water levels rose three feet following a total of 11 inches of rain. From 28 September to 3 October 1986 water levels rose nearly four feet after a total of 9.55 inches of rainfall. The water table rose another four feet from mid October 1986 to mid February 1987 when over 11 inches of rain and seven inches of snow fell. By the end of February 1987 the water table was within three feet of land surface; this is the highest level observed since the study began in June 1985.

Hydraulic Gradients

Horizontal Gradient

Ground water flows generally southward toward Boomer Creek. However, Hagen (1986) documented an unexpected 43° shift in flow direction from S25E in August 1985 to S18W in February 1986. He suggested that evapotranspiration by the trees growing along the southern boundary of the site controlled ground-water flow direction.

To elucidate the problem, water-table maps were constructed using elevations from the 4 wells for each month from April 1986 to June 1987. Based on these maps, the horizontal hydraulic gradient averaged 0.005 foot/foot and ranged from 0.003 to 0.008 foot/foot. These values are similar to the gradients reported by Hagen (1986).

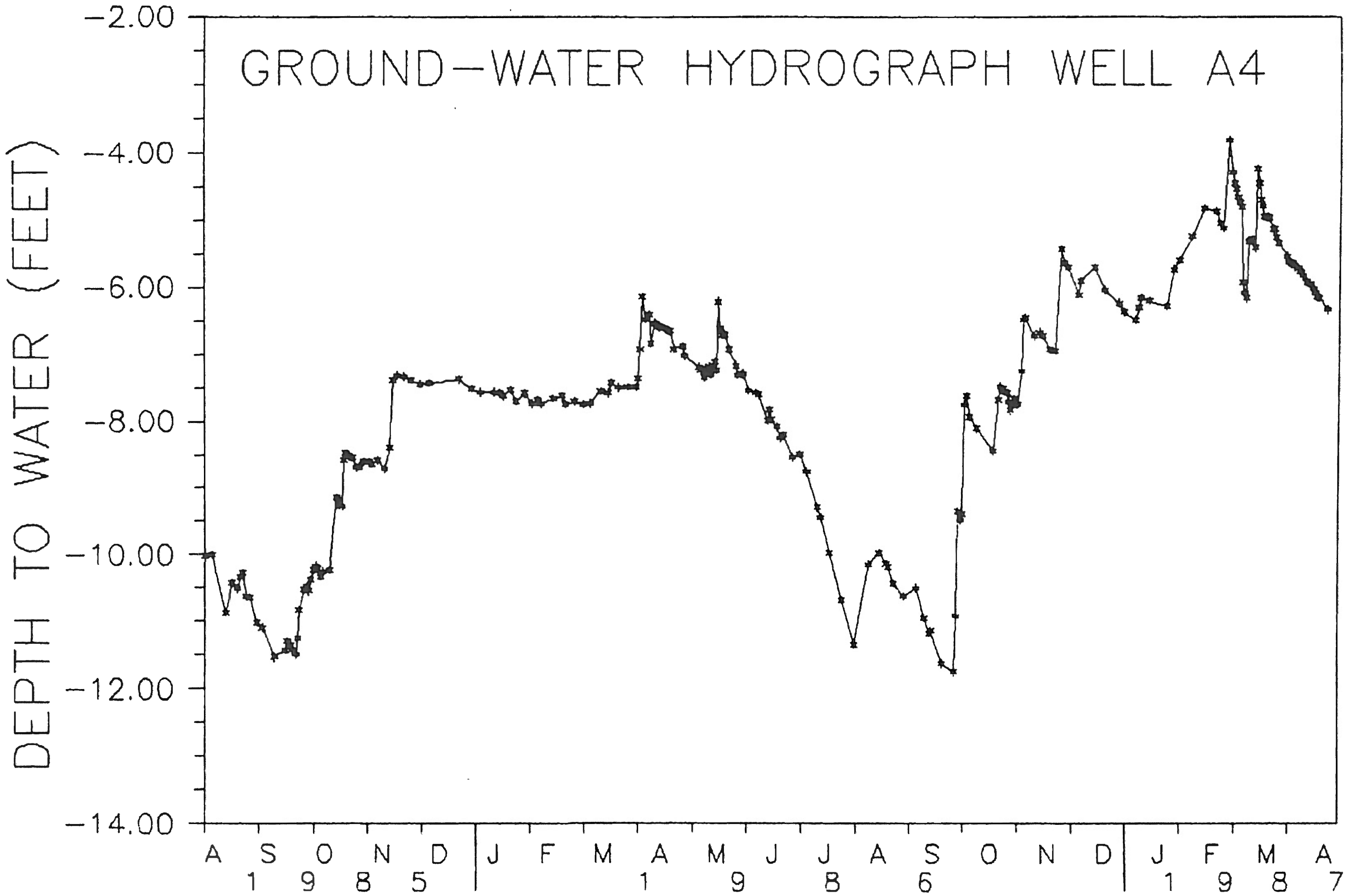


Figure 8. Ground-Water Hydrograph, Well A4, August 1985 to April 1987.

Although there was no apparent correlation of the magnitude of gradient with season, flow direction changed dramatically (Figure 9). From April to May 1986 the flow direction is southwestward. However, between June and July the gradient shifted eastward 76 degrees (Figures 10, 11). The change occurred rapidly during the second week in June when water levels at the C and D sites dropped in relation to levels in the A and E wells (Figure 12). During the summer months, when water levels declined from about 8 to as much as 12 feet below land surface, the ground-water equipotential lines paralleled the trees growing along the southern boundary of the site.

In October 1986 the flow direction began to shift back to the southwest. During the last week in October the water level at the D site rose in relation to the C wells (Figure 13). During the second and third weeks in November water level at the D site rose in relation to the A wells as the gradient shifted back to the west (Figures 13, 14). Depth to the water table in mid November was about seven feet. The first frost on 11 November corresponds to the approximate time of the gradient shift (Oklahoma State University, Department of Agronomy, 1986). The coincidence of the first frost with the shift in ground-water flow direction strongly suggests that vegetative transpiration at the site is significant.

From late fall 1986 to spring 1987 the flow direction remained southwestward. No shift in gradient is evident on

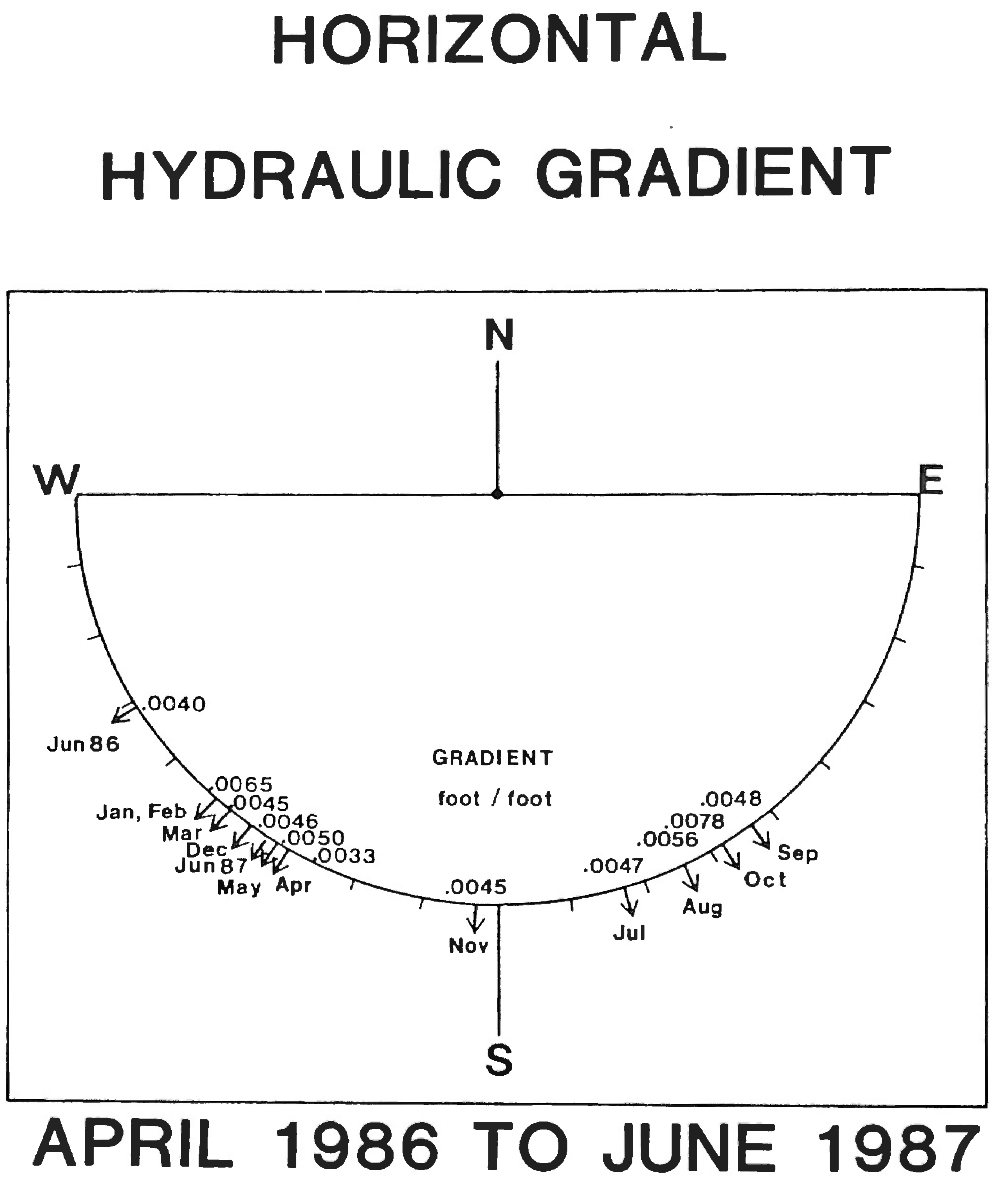


Figure 9. Horizontal Hydraulic Gradient, Direction and Magnitude, April 1985 to June 1987.

WATER ELEVATION MAP
3 JUNE 1986

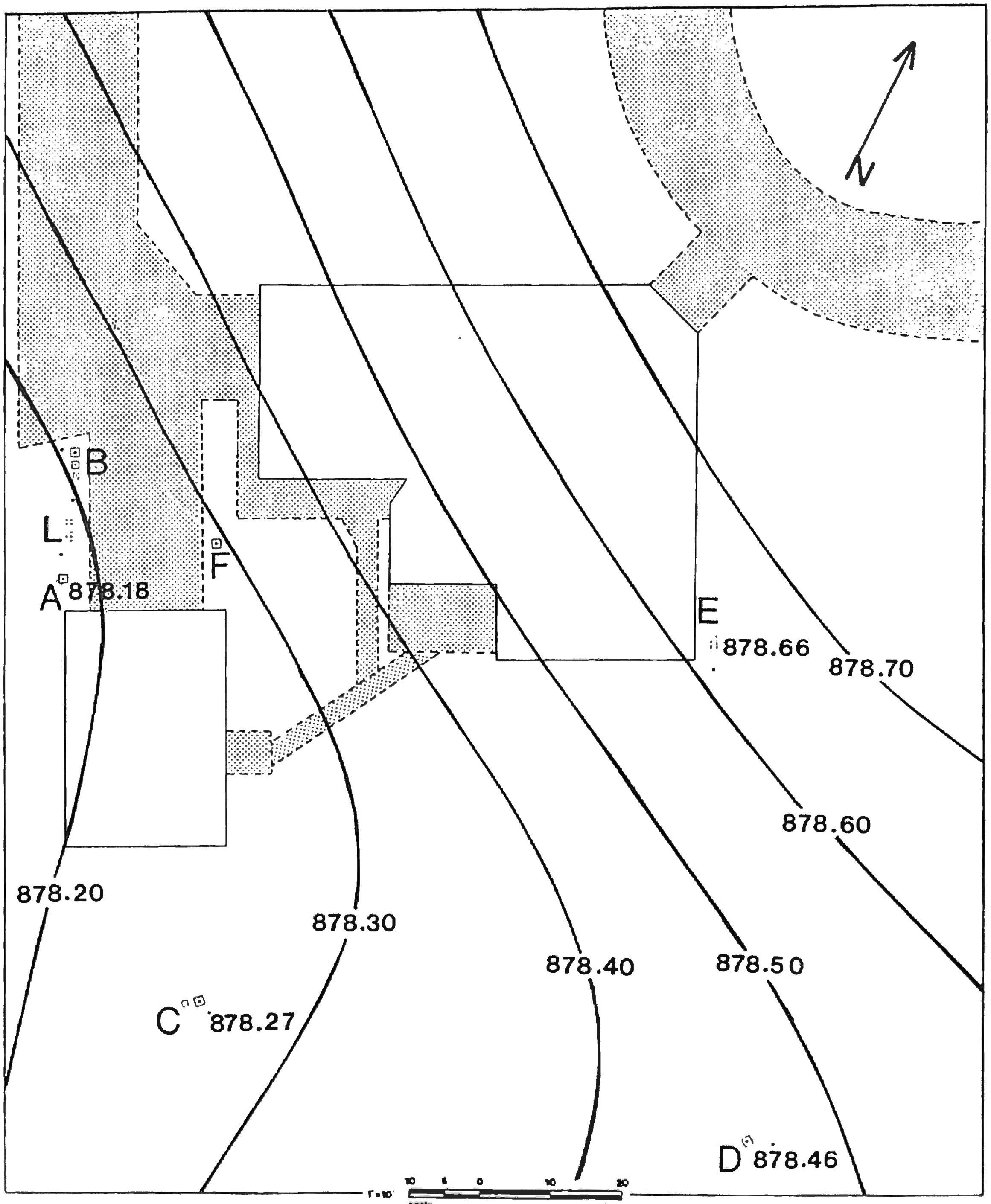


Figure 10. Water Elevation Map, 4 Wells, 3 June 1986. Depth to Water Approximately Eight Feet.

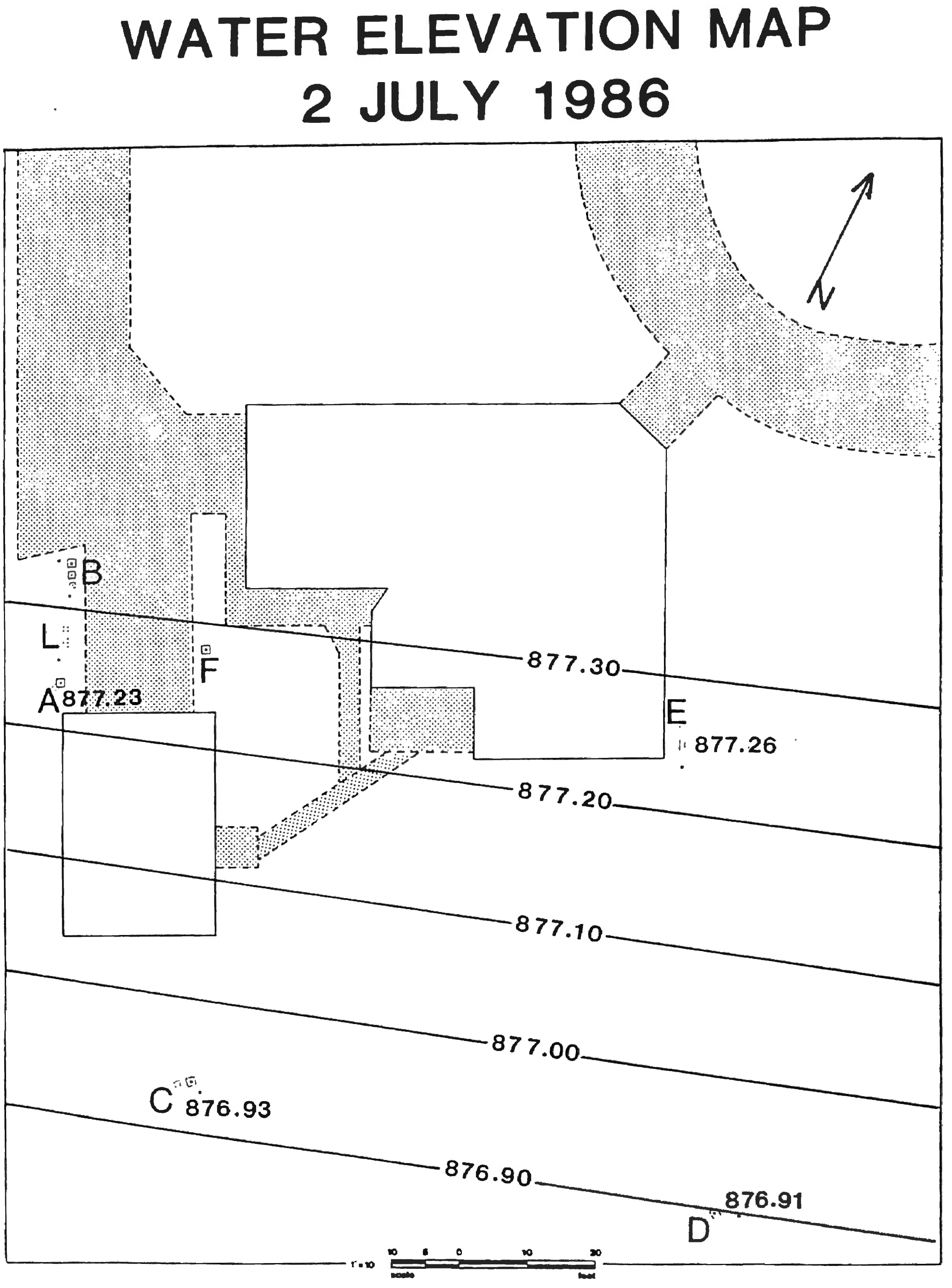


Figure 11. Water Elevation Map, 4 Wells, 2 July 1986. Depth to Water Approximately Nine Feet.

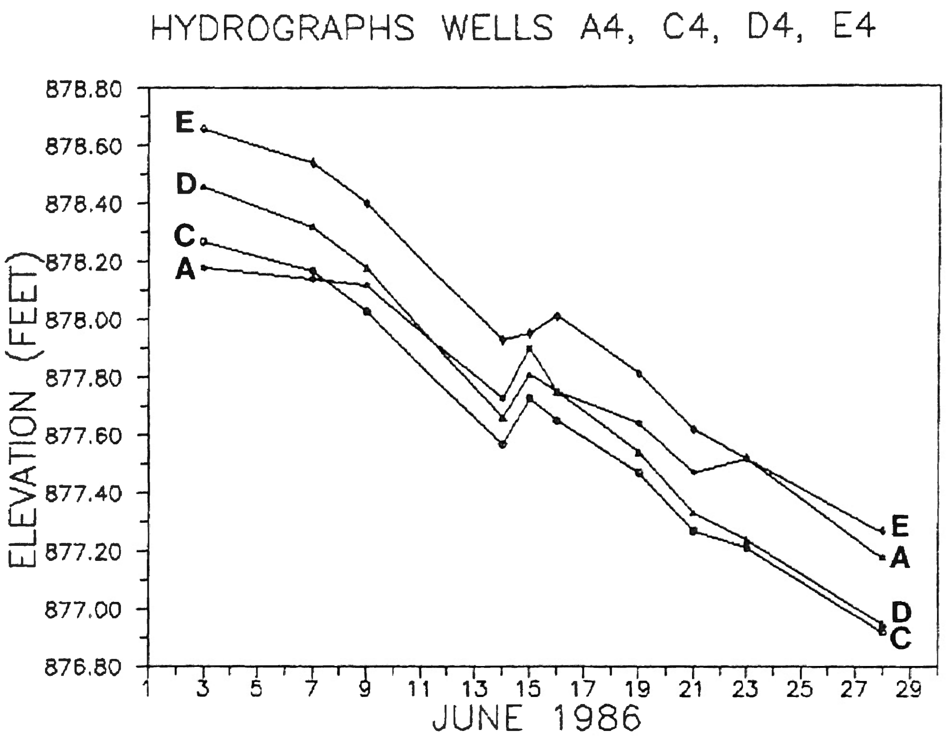


Figure 12. Hydrographs, 4 Wells, June 1986.

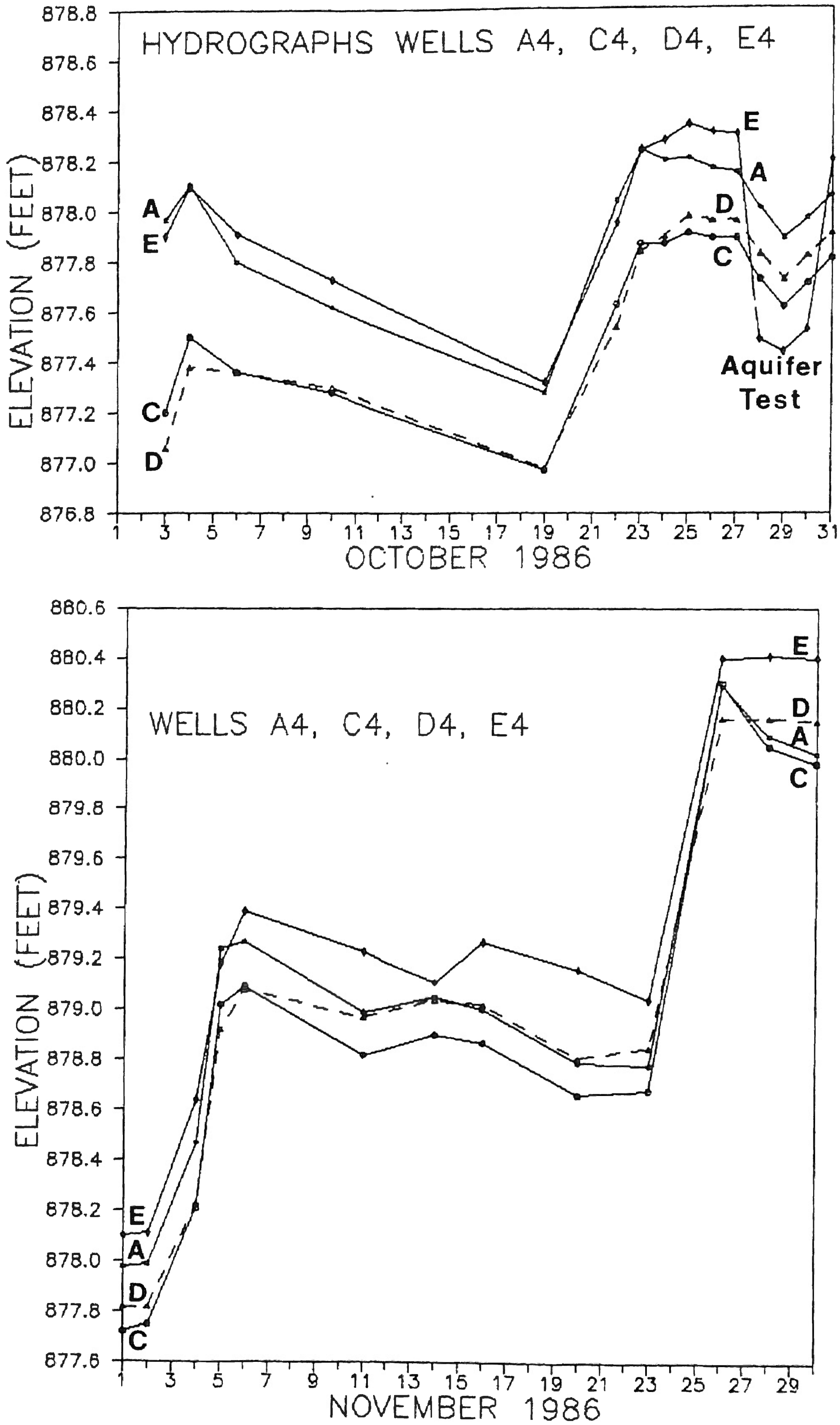


Figure 13. Hydrographs, 4 Wells, October, November 1986.

WATER ELEVATION MAP
1 NOVEMBER 1986

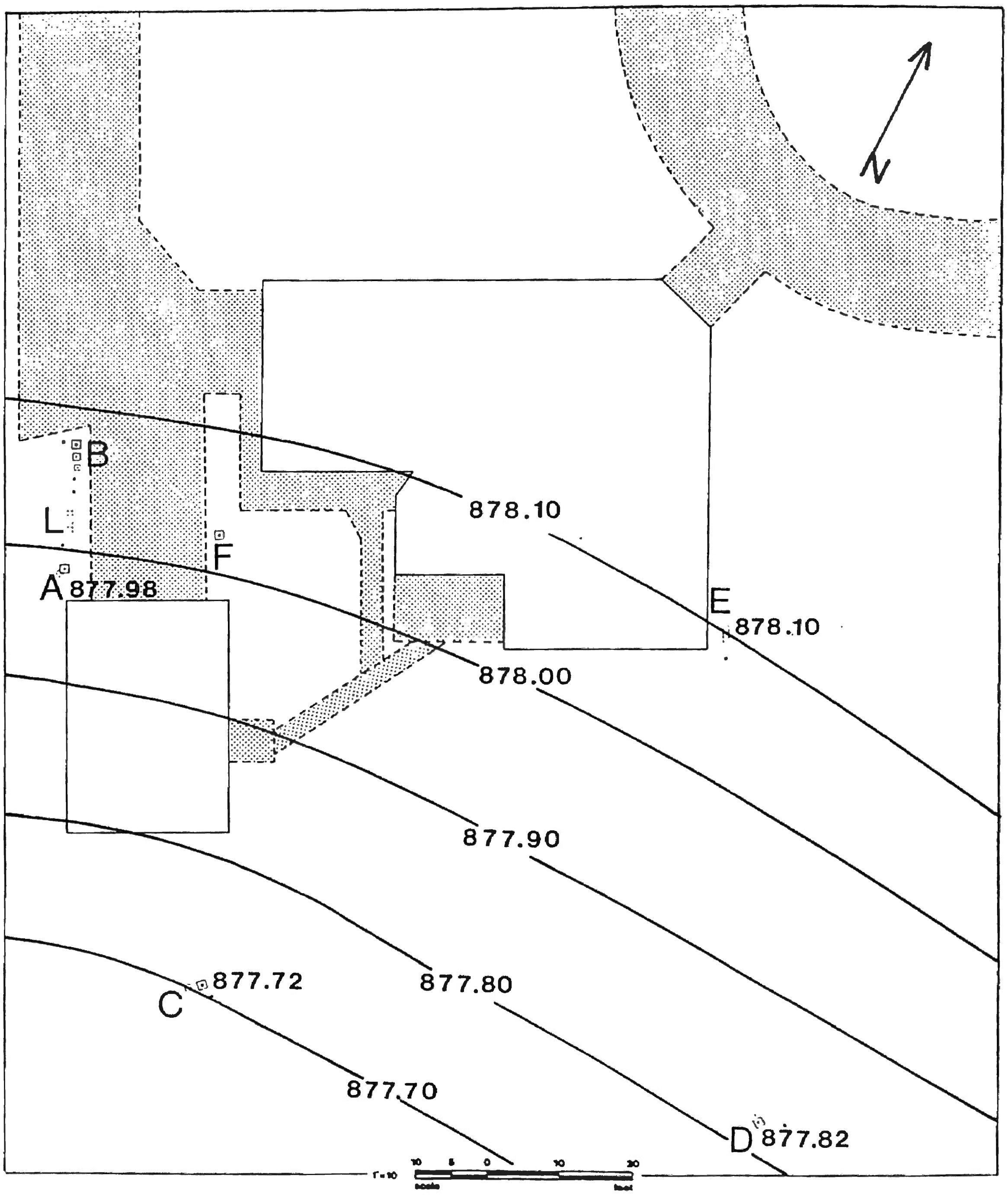


Figure 14. Water Elevation Map, 4 Wells, 1 November 1986. Depth to Water is Approximately Eight Feet.

water-elevation maps for late June 1987 (Figure 15). However, the field site received 3.8 inches more rain in May and June 1987 than in May and June 1986, and water levels in mid July 1987 were as high as 7.5 feet below land surface (Dale Froneberger, personal communication, 1987).

In addition to the possible seasonal vegetative effect on flow direction, the sewer lines that cross the site may also disrupt the water table configuration. Water level measurements in the B wells began in December 1986 when depth to water was about 7.5 feet. When the water level in Well B4 was added to the water table map in January 1987, it became necessary to curve the contour lines around the A and B sites (Figure 16). The curvature became more pronounced in March 1987 when water levels rose to about four feet below land surface (Figure 17).

Flow lines drawn on the elevation maps suggest that a ground-water sink exists on the western edge of the field site. There are no known ground-water withdrawals in the neighborhood; all houses use city water service. It is quite possible that the high water table in early 1987 resulted in water seeping into the 15-inch city sewer line that is buried about eight feet below land surface along the southwestern site boundary. In mid January 1987 several graduate students lifted the sewer manhole cover and noticed that water was seeping out of the northern face of the drop pipe.

WATER ELEVATION MAP 28 JUNE 1987

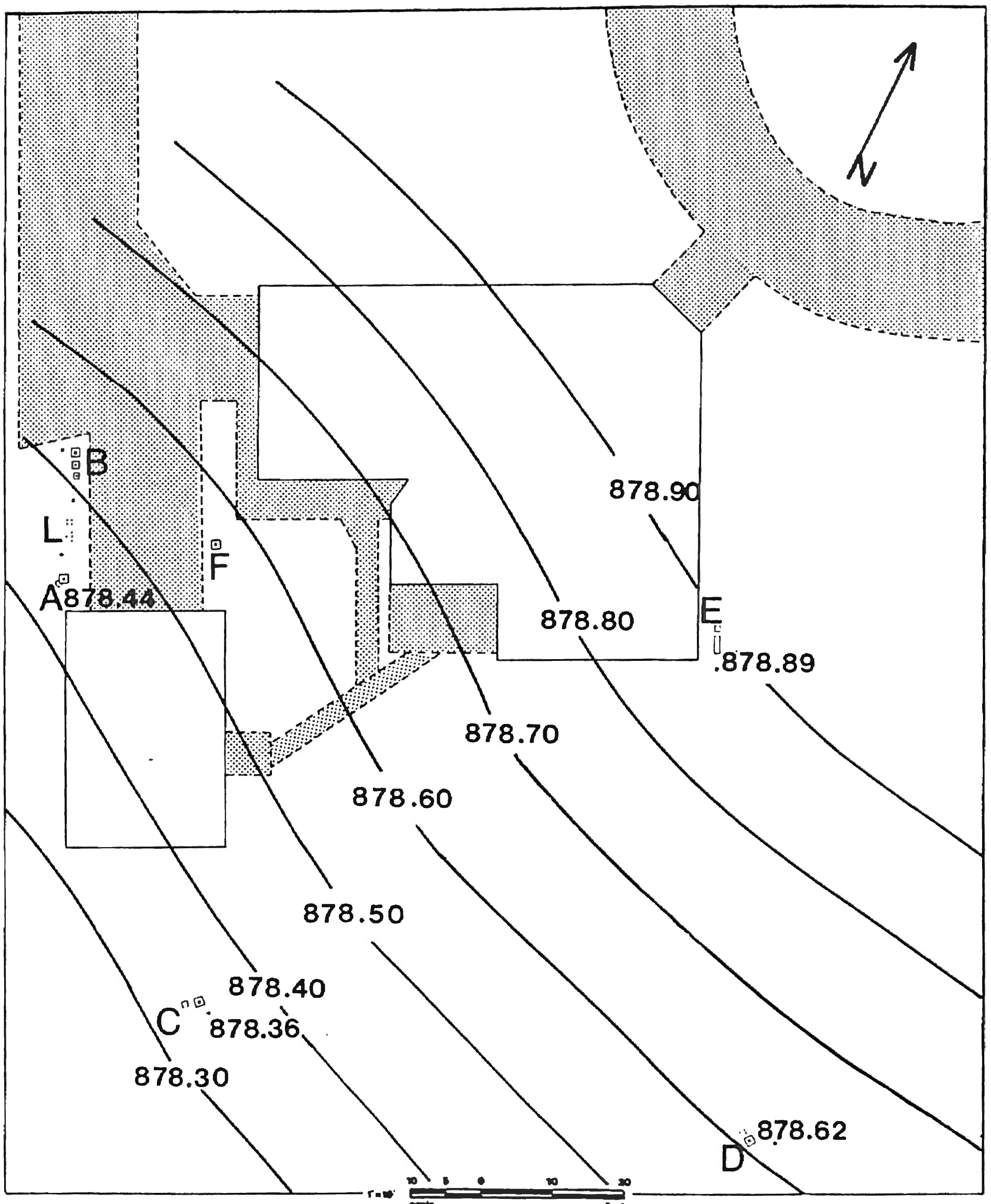


Figure 15. Water Elevation Map, 4 Wells, 28 June 1987. Depth to Water is Approximately 7.5 Feet.

WATER ELEVATION MAP
1 JANUARY 1987

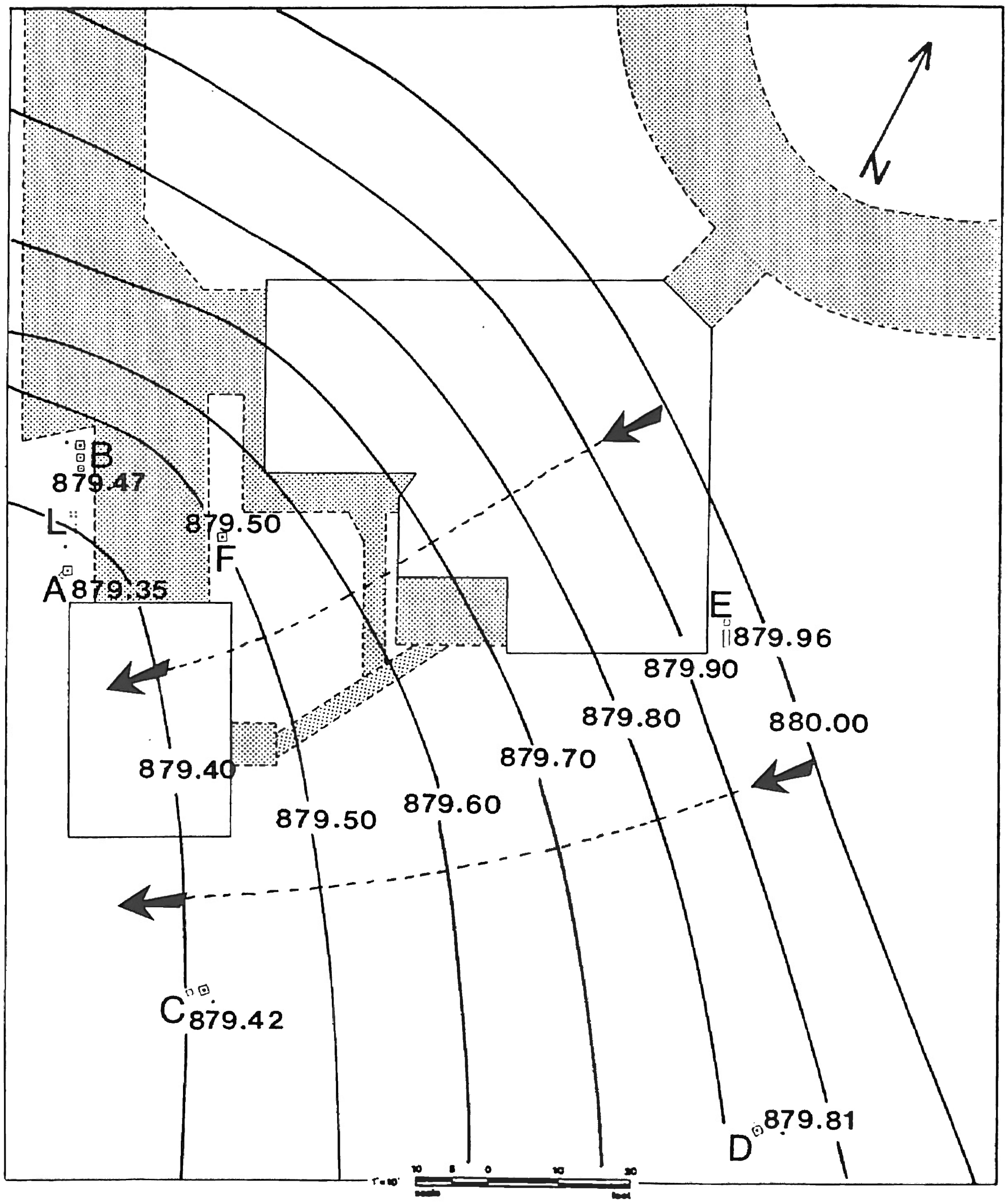


Figure 16. Water Elevation Map, 4 Wells, B4 and F1, 1 January 1987. Depth to Water is Approximately 6.5 Feet. Dashed Lines Indicate Ground-Water Flow Direction.

WATER ELEVATION MAP
8 MARCH 1987

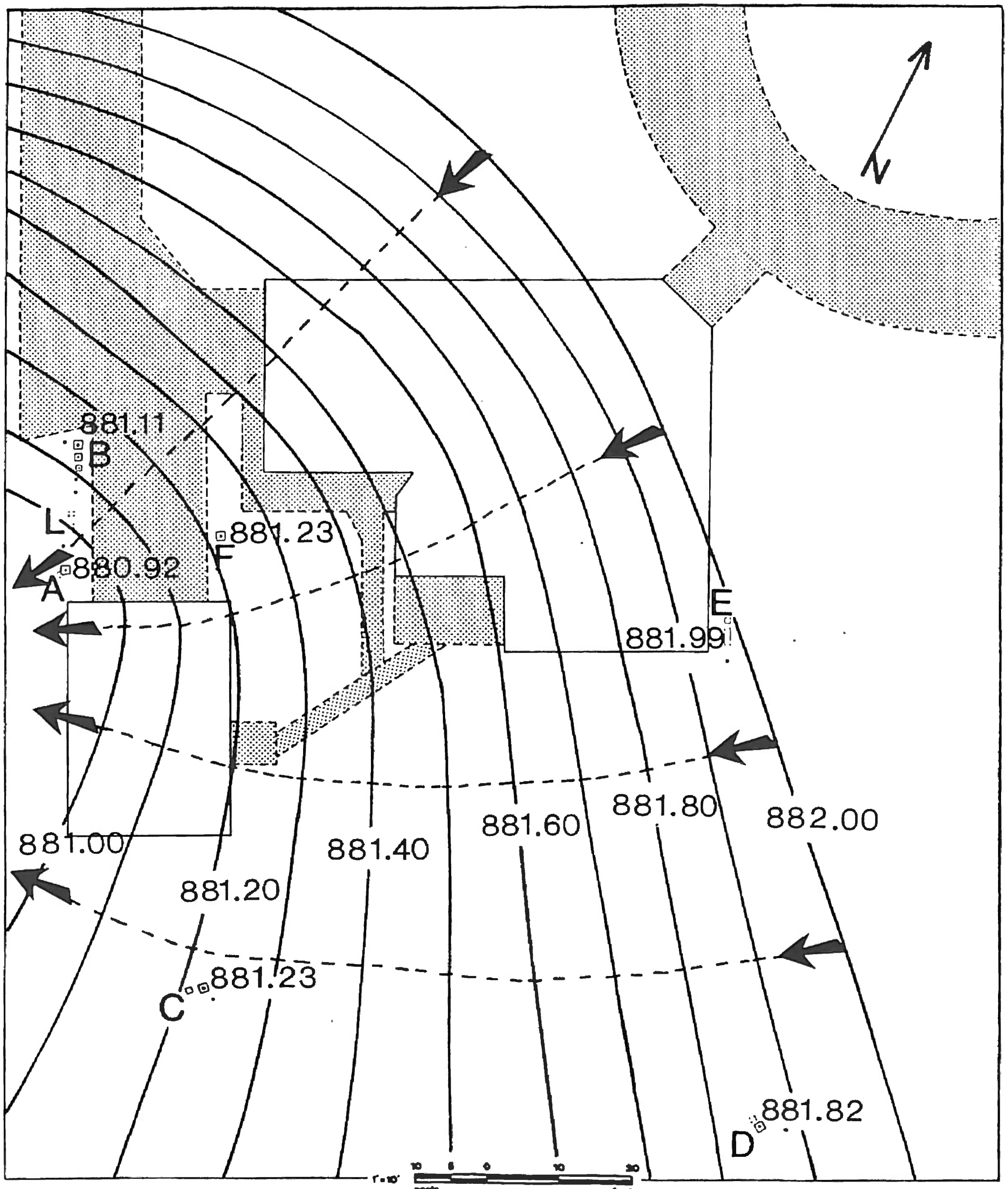


Figure 17. Water Elevation Map, 4 Wells, B4 and F1, 8 March 1987. Depth to Water is Approximately 4.5 Feet. Dashed Lines Indicate Ground-Water Flow Direction.

Baseline Vertical Gradient

During periods of no precipitation in winter and early spring water levels in the shallowest and deepest wells at any cluster were within 0.01 to 0.10 foot of each other. During January, February and late March 1986 water levels were higher in the 4 wells indicating upward water movement. In early May 1987 relative movement was upward at the A and E sites and downward at the D site. There was no consistent trend at the C site where levels in wells C1 and C4 were within 0.02 feet of each other.

Average water-level differences between the 1 and 4 wells at the A, C, D and E sites were calculated for January, February, late March 1986 and early May 1987. To estimate the vertical gradient at each well cluster, the average water-level difference was divided by the distance between the midpoints of the screened intervals in the 1 and 4 wells. The gradients for January, February, late March 1986 and early May 1987 were then averaged together to calculate one baseline value for each well cluster.

Upward hydraulic gradients averaged 0.008, 0.005, 0.008, and 0.006 foot/foot for the A, C, D and E sites, respectively. These values are within the same range as the horizontal gradients measured from April 1986 to June 1987. Downward gradient at the D site in May 1987 was 0.004 foot/foot. Individual gradients ranged from 0.013 foot/foot at the A site in January 1986 to 0.002 foot/foot at the A cluster in May 1987.

Summer Vertical Gradient

During the early summer months in 1986 upward vertical gradients increased at all the sites. However, the increase was especially pronounced at the C and D sites located under the pecan and hackberry trees. In late June 1986 the vertical gradients between the 1 and 4 wells at each cluster were 0.017, 0.013, 0.033, 0.009 foot/foot at the A, C, D, and E sites, respectively. By early July 1986 the water table had dropped and all the 1 wells were dry.

On 1 July 1.33 inches of rain were recorded at the site. Two water-level measurements were taken in the first week in July before the water table declined below the 2 wells. Average upward vertical gradients between the 2 and 4 wells were 0.006, 0.026 and 0.073 foot/foot at the A, C and D sites, respectively. On 2 July there was a 0.132 foot/foot downward gradient at the E site, which is located near a drainspout, but by 6 July the gradient was 0.007 foot/foot upward.

Although more rainfall was recorded in late spring 1987 than in 1986, air temperatures were comparable. There are indications that the upward vertical gradient increased at the C and D sites from May to late June 1987; on 31 May the gradient at the D site was 0.014 foot/foot and on 28 June the gradient was 0.018 foot/foot. As in 1986, gradients at the tree-dominated C and D sites appear to be higher than at the A and E sites.

Vertical Gradient After Precipitation

After significant rain events, water levels in all monitoring wells rise almost immediately. Relative water heights within any well cluster may indicate either upward or downward water movement. Water-level differences between the shallow and deep wells at the A, C, D, and E sites were calculated for 14 recharge events during the period October 1985 to March 1987. Rainfall varied from 0.40 inches falling in a single event to 9.55 inches drenching the area over a six-day period. Vertical gradients after the rainfall events ranged from 0.002-0.348 foot/foot (Figures 18 - 21).

Although vertical gradients in the four well clusters were roughly in the same range for the same recharge events, flow direction varied considerably. The direction of the vertical gradient was downward at the E site, located adjacent to the house drainspout, for all events except one in December 1985. The direction of the vertical gradient was upward at the D site after all events. After two rains in March 1987 water apparently moved downward between wells D1 and D2. However, based on water-level differences, the net water movement from Well D4 to Well D1 was up.

There was no consistent direction of the vertical gradients at the A and C sites. Downward flow occurred

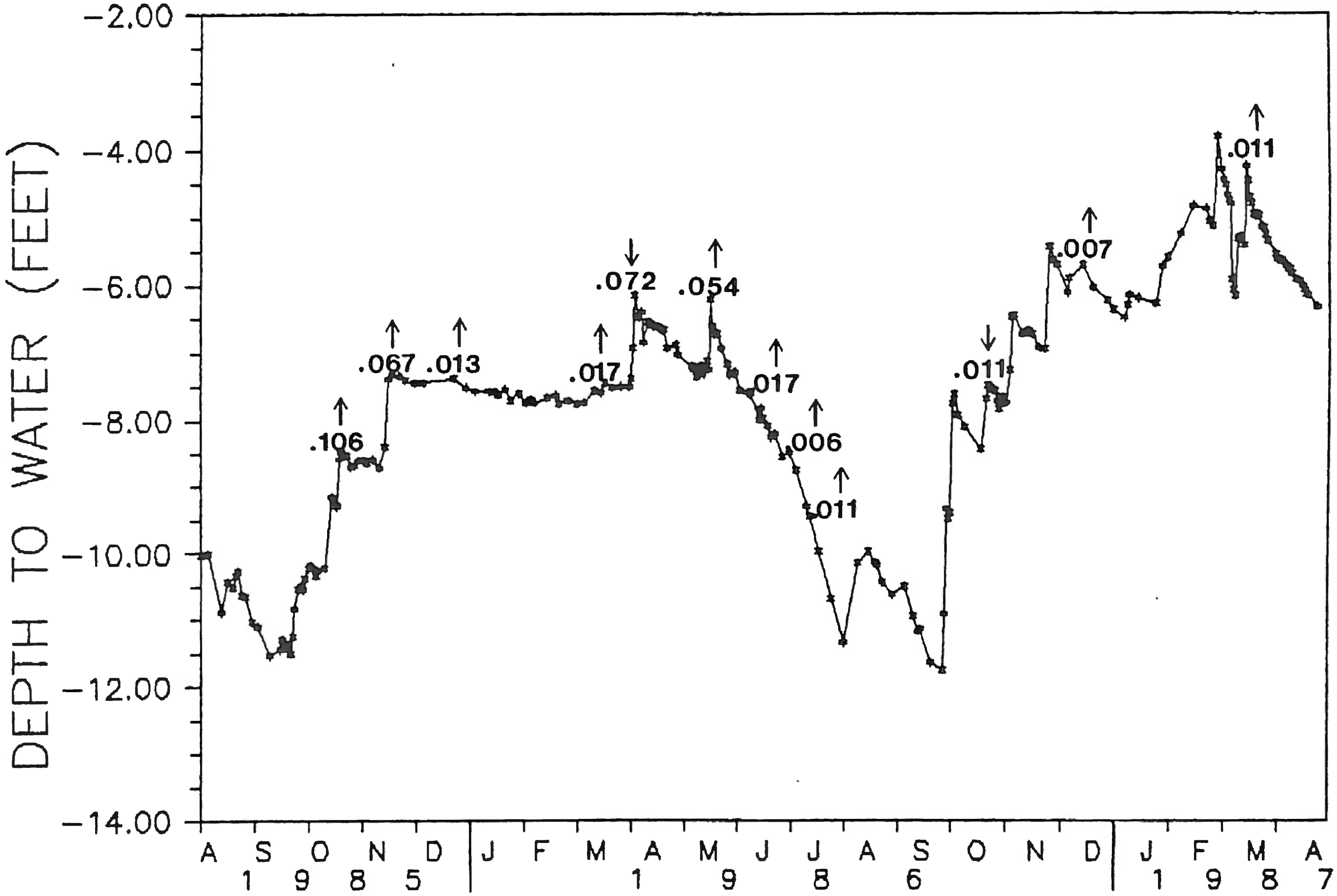


Figure 18. Direction and Magnitude of Vertical Gradient after Recharge Events, A wells.

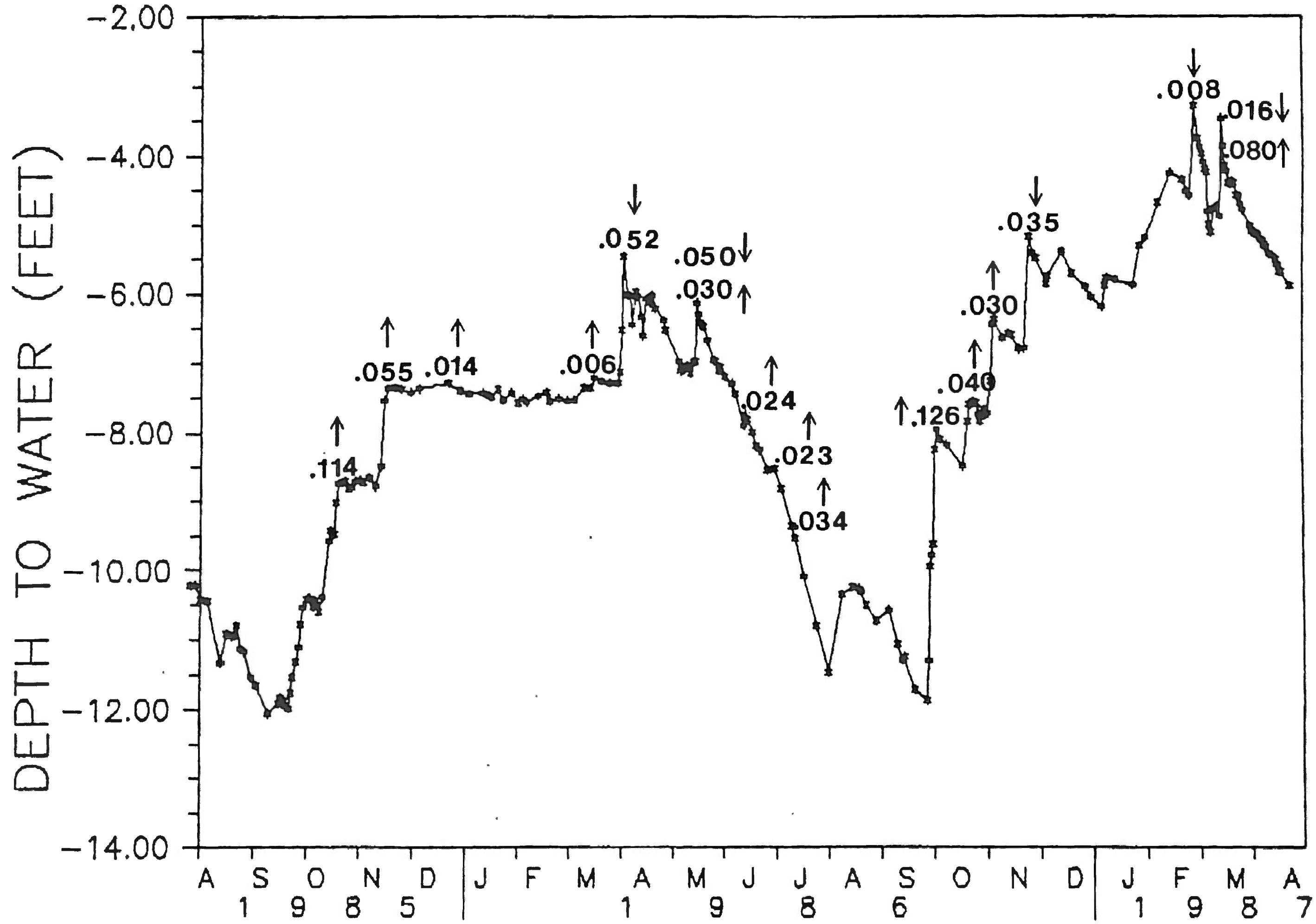


Figure 19. Direction and Magnitude of Vertical Gradient after Recharge Events, C wells.

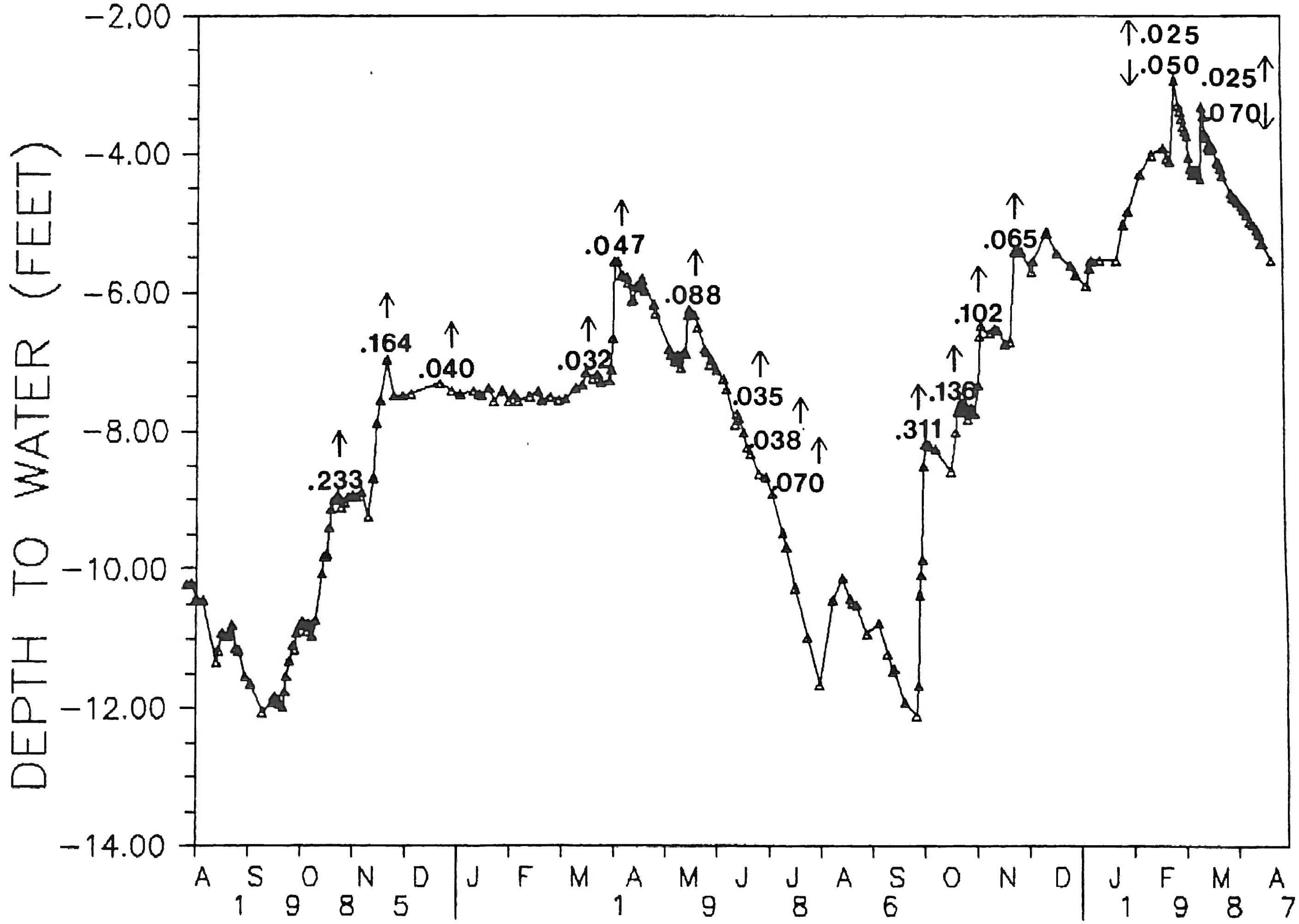


Figure 20. Direction and Magnitude of Vertical Gradient after Recharge Events, D wells.

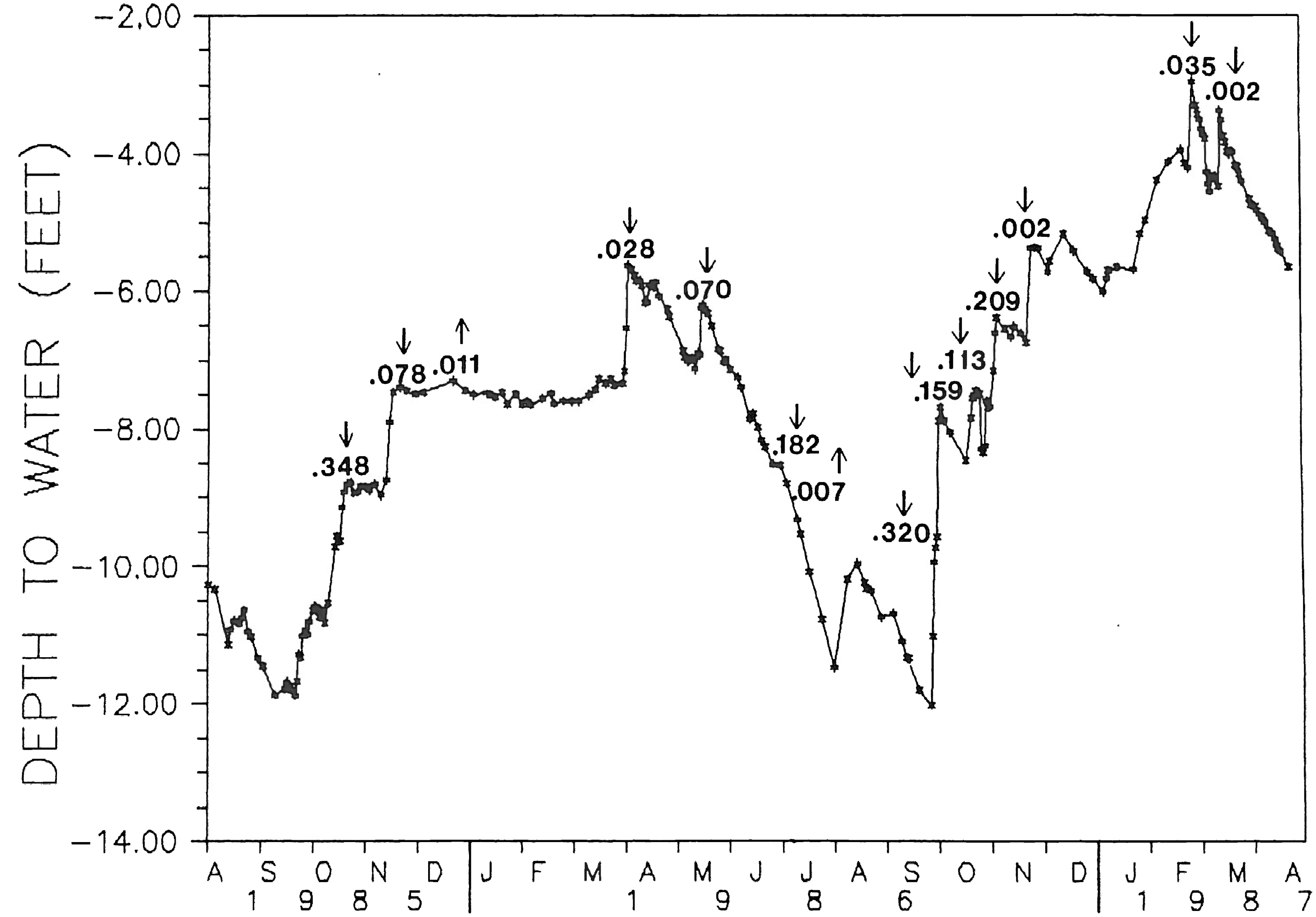


Figure 21. Direction and Magnitude of Vertical Gradient after Recharge Events, E wells.

during the spring and late fall when water levels were generally high and the soil was probably close to saturation. Water levels in Well A3 were sometimes higher than the other A wells. The dreaded specter of poor well construction may have resulted in water flowing along the well casing although the wells are cemented at the surface.

The variability in the direction of the vertical gradient after rainfalls suggests that the field site is recharged both by infiltration and by ground-water underflow. The downward flow direction at the E site clearly indicates that water infiltrates through the unsaturated zone to the water table. The upward flow direction at the D site suggests that underflow is an important recharge mechanism.

Ground-water Velocity

Assumptions

Ground-water levels in shallow unconfined aquifers may fluctuate on a daily basis due to evapotranspiration. The method of calculating ground-water velocity using diurnal water-level fluctuations has been in use in some form at least since the 1930s (White, 1932; Troxell, 1936; Davis and DeWiest, 1966). According to these investigators, the maximum slope of the recovery limb of a daily hydrograph corresponds to the maximum rate of ground-water inflow to the small cone of depression formed around the tree root system during the period of transpiration. Obviously, the ground-water velocities derived using this method reflect some combination of vertical and horizontal velocity components and should be used as generalized figures.

Many variables act in concert and in opposition to produce the composite daily hydrograph that the hydrogeologist interprets. Factors such as wind, temperature, sunlight intensity and humidity influence the quantity of water that vegetation transpires daily. In addition to evapotranspiration, atmospheric pressure (Turk, 1975) and temperature (Haise and Kelley, 1950) may also influence diurnal water table fluctuations.

There are no available data with which to estimate the effect of daily temperature changes at the study area. However, according to the recording barograph at the field site, air pressure does not fluctuate on a daily cyclic basis. Therefore, to estimate ground-water velocity at the study site, it is assumed that the observed daily water-level fluctuations are due mainly to evapotranspiration.

Data Base

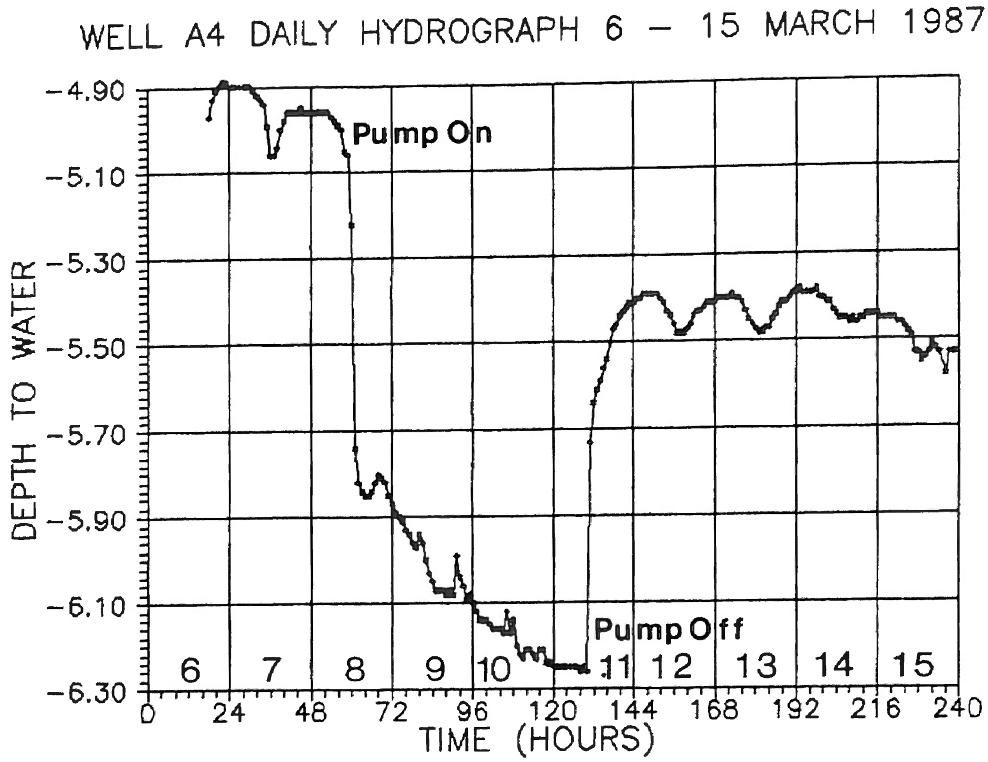
Two SE1000 In Situ electrical pressure transducers record water level measurements in two 14-foot wells every half hour. Hourly data were plotted for a 2 to 10 day period before each aquifer test in late October 1986, early March and mid May 1987. Graphed data were also available from Well C5 for a week in July 1986 from Michael Nelson, an Oklahoma State University geology graduate student. At least one hydrograph was examined from the A, C, D and E sites. The data base used for this study represents diurnal fluctuations for 41 days on seven hydrographs.

Magnitude of Diurnal Fluctuations

The transducer data document diurnal water-level fluctuations on the order of 0.10 to 0.30 foot/day. During any 24-hour period beginning at midnight the water level is either steady or slightly rising until about 6 a.m. Water level begins to decline between 6 and 8 a.m. until reaching a low point from noon to 4 p.m. Water levels recover for the rest of the 24-hour period beginning in late afternoon.

The data evaluated in this study suggest that each well site may possess a characteristic sinusoidal diurnal curve. The spring data plotted for wells D5, A4 and A5 indicate that the fluctuation is more intense at the highly vegetated D site than at the A site, which is grass-covered and located near a small pear tree (Figures 22, 23). The hydrograph peaks are more pronounced at the D site than at the A site, where the recovery curves tend to flatten out around midnight. At the D site there is a hint that the magnitude of the diurnal fluctuation decreases as the water table drops. As water levels fall, evapotranspiration rates decrease (Robinson, 1958; Davis and DeWiest, 1966).

The July curve plotted for Well C5 suggests that evapotranspiration conditions at the C site are similar to



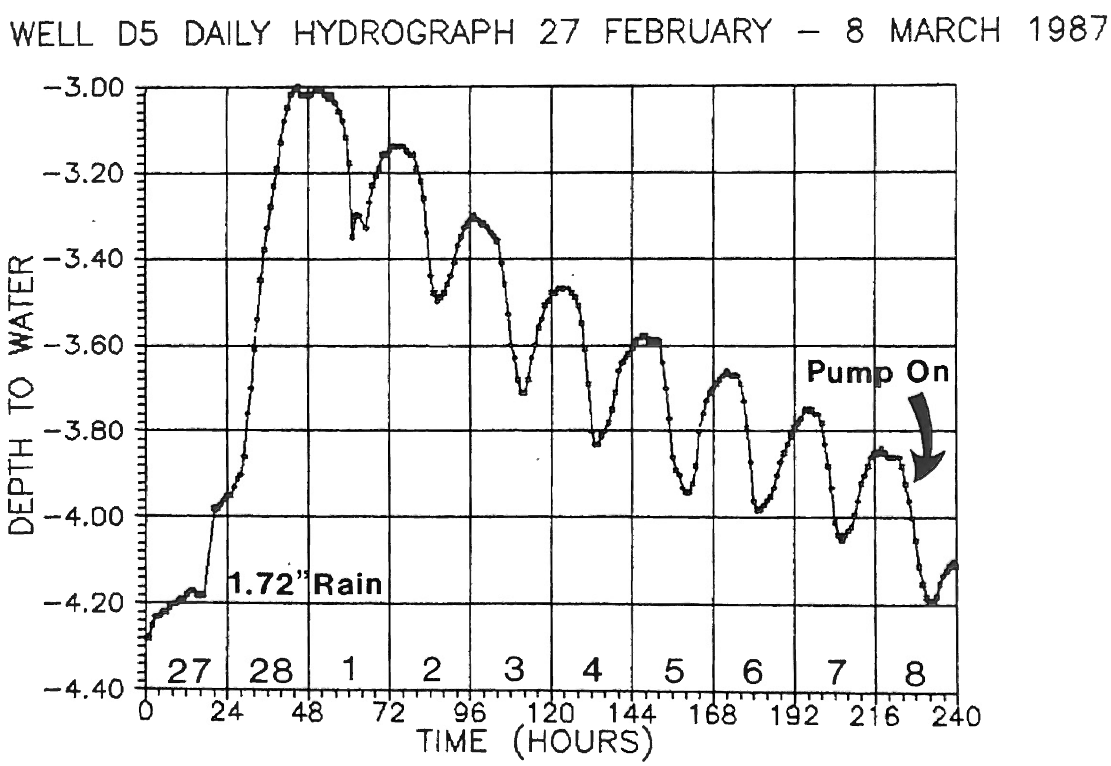
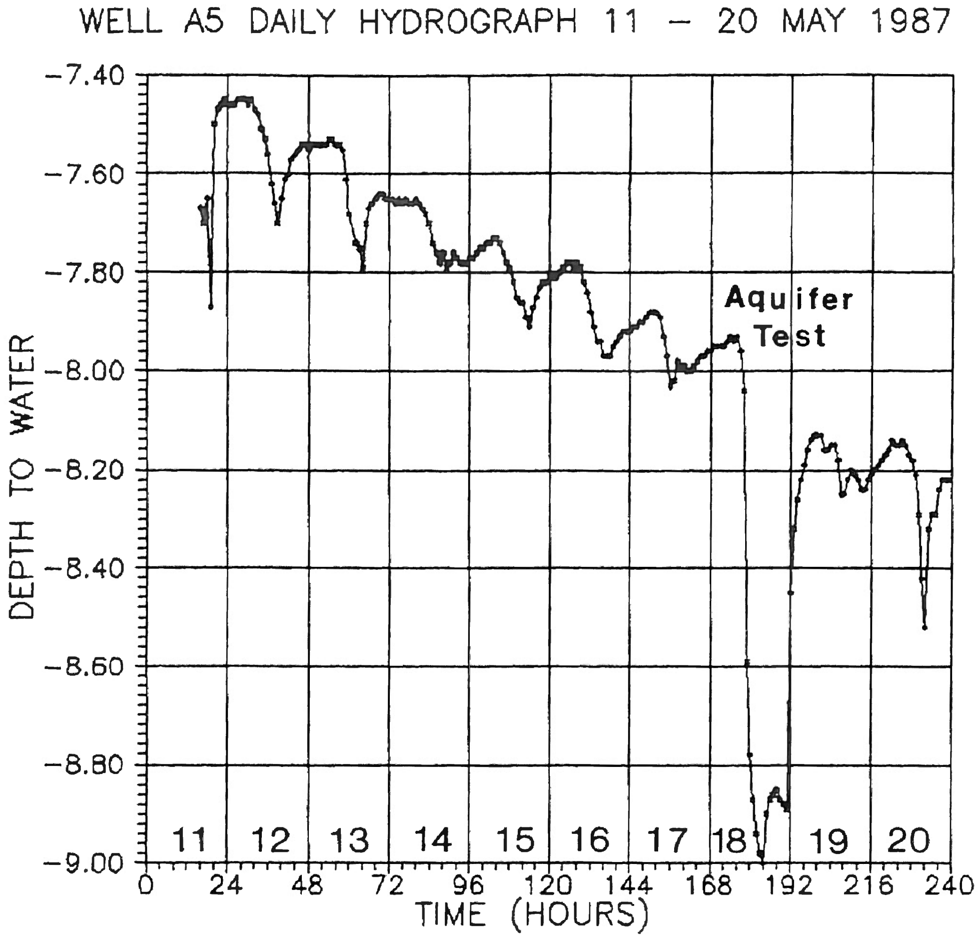


Figure 22. Diurnal Fluctuations, Wells A4 and D5, February - March 1987.



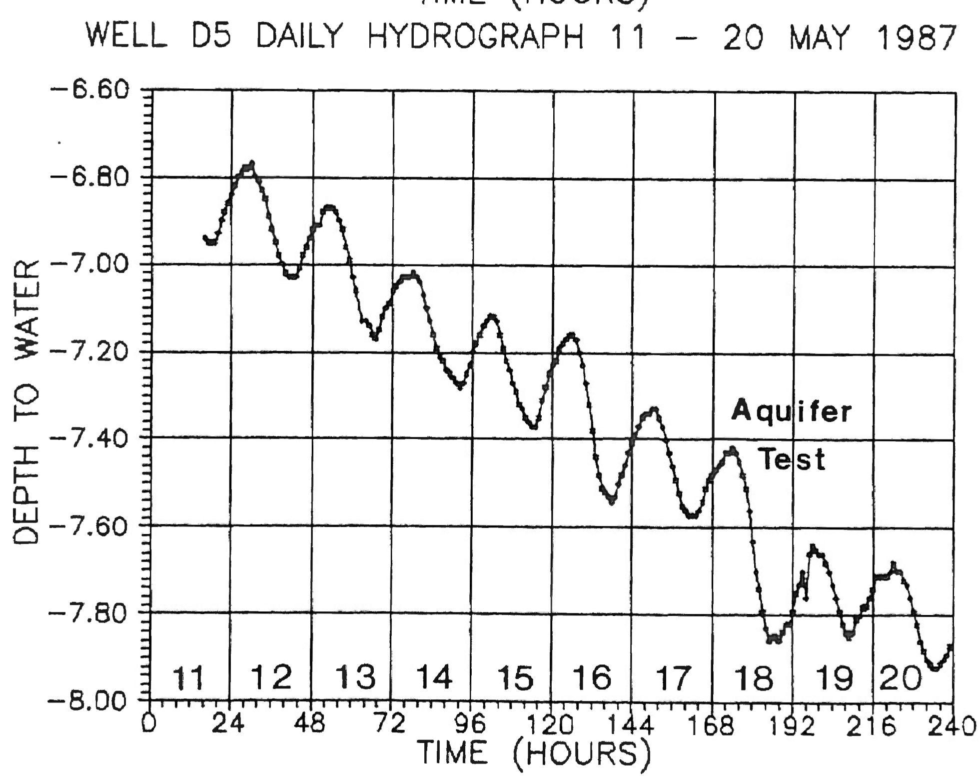


Figure 23. Diurnal Fluctuations, May 1987.

those at the D site, which is consistent with the observed vegetation pattern. The hydrograph recorded from Well E4 in October resembles the hydrographs from the A site (Figure 24). The E site is also grass-covered and is located next to some small shrubs.

Calculation of Ground-water Velocity

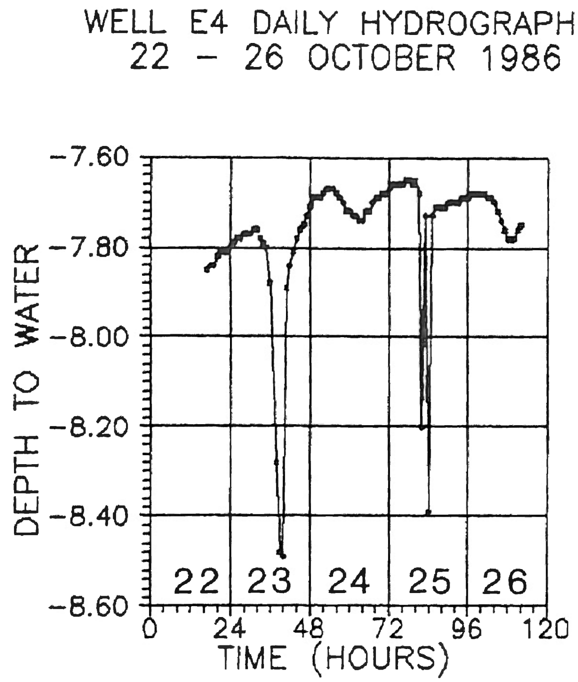
Ground-water velocities were estimated according to the method of Davis and DeWiest (1966, p. 20). The maximum slope for each daily event was calculated. Then the slopes were averaged for each well hydrograph and corrected for the average daily water-table decline from that hydrograph.

Ground-water velocity varied from 0.34 foot/day in Well E4 in October 1986 to 1.12 feet/day in Well C4 in July 1986 (Table I). Daily water-level decline ranged from 0.04 foot/day in October to 0.12 foot/day in July. Although data are limited, calculated ground-water velocities are higher in the C and D wells than the A and E wells.

Specific Yield

Definitions and Assumptions

Porosity is the ratio of the total volume of void space to the total volume of rock or aquifer material. Total porosity may be expressed as the sum of specific yield and specific retention. Specific yield is defined as the ratio of the volume of water that drains by gravity to



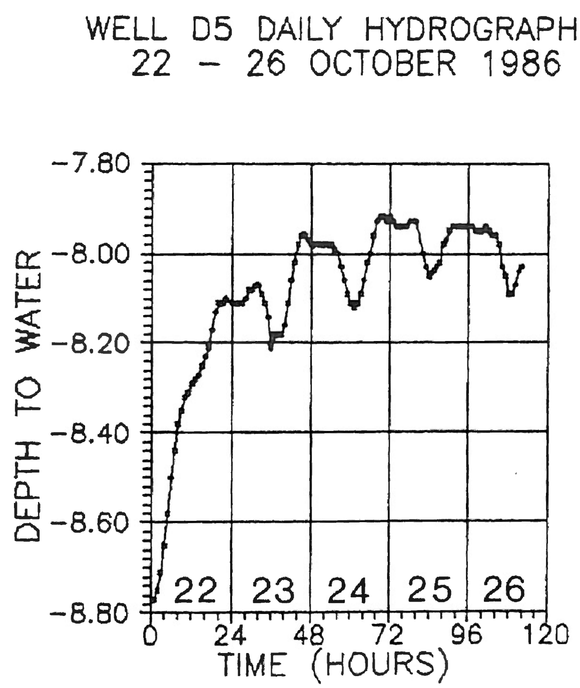


Figure 24. Diurnal Fluctuations, Wells E4, D5, October 1986.

the total rock volume. Specific retention is the ratio of the volume of water retained after gravity drainage to the total rock volume (Heath, 1983). Specific retention is analogous to the concept of field capacity used by agronomists to describe immobile water (Duke, 1972). In this study estimates of specific yield were derived from aquifer tests and from water levels measured before and after rainfall events. Aquifer test data are interpreted in Chapter V.

TABLE I

GROUND-WATER VELOCITY CALCULATED FROM DIURNAL FLUCTUATIONS

WELL	DATE	VBAR	s	n	DECLINE	V
A4	3/12-13/87	0.39	0.01	2	----	0.39
A5	5/12-20/87	0.54	0.31	5	0.06	0.61
C5	7/8-16/86	1.00	0.12	9	0.12	1.12
D5	10/22-26/86	0.85	0.15	3	0.04	0.89
D5	3/1-7/87	0.97	0.30	7	0.09	1.06
D5	5/11-19/87	0.62	0.10	9	0.10	0.72
E4	10/24-26/86	0.34	0.01	2	----	0.34

VBAR = Average velocity for hydrograph, feet/day
s = Standard deviation
n = Number of days measured
DECLINE = Average daily decline for hydrograph, feet/day
V = Estimated ground-water velocity, feet/day

To estimate specific yield, the ratio of rainfall to water-table rise was calculated for several events. When rainfall and water-level rise are measured in consistent units, the rainfall:rise ratio provides an estimate of the fillable porosity of the aquifer (Bouwer, 1978). Due to hysteresis, fillable porosity is less than specific yield.

Other phenomena besides addition of rain water to ground-water storage may cause the water table to rise after a rainfall event. The effect of trapped air causing abnormally high water-level rises after rains has been discussed in the literature (Hooghoudt, 1947; Norum and Luthin, 1968). Meyboom (1967) reported that rise:rainfall ratios of 20:1 (equivalent to a rainfall:rise ratio of 0.05) indicate the presence of trapped air. None of the ratios calculated in this study approached 20:1. Therefore, it will be assumed that observed water level changes that occur after rainfalls are mainly due to addition of water to ground-water storage.

Estimates of specific yield obtained using the rainfall:rise ratio method are time dependent for several reasons. In the classic description of ground-water recharge, the soil-moisture deficit in the unsaturated zone must be satisfied before excess water will drain to the water table (Heath, 1983). Therefore, in the dry seasons when soil moisture is low, a fraction of the rain that falls will provide ground-water recharge. The rainfall:rise ratio method of calculating specific yield will over-estimate the actual value when used under these conditions.

The replenishment of soil moisture has an apparent effect on calculated values of specific yield. However, depth to the water table and the height of the capillary fringe have a real influence on the value of specific yield. Specific yield decreases as the water table rises (Childs, 1960; Duke, 1972; Gillham, 1984). This phenomenon is especially pronounced in fine-grained materials because the capillary fringe is thicker than in coarse-grained sediments.

The capillary fringe is the saturated zone above the water table where the water pressure is less than atmospheric pressure. Because the hydraulic gradient is upward, water held in the capillary fringe does not drain due to gravity; therefore, the specific yield is close to zero. For silt loam soils the height of the capillary fringe may be on the order of several feet. Brooks and Corey (1964, 1966) reported a value of 6.5 feet for the height of the capillary fringe in the Touchet silt loam.

When the water table is high and the capillary fringe is near land surface, specific yield values are low. When the water table and capillary fringe drop, specific yield will be higher. For fine-grained soils specific yield values may be surprisingly high; Brooks and Corey (1964) reported a value of 34.9 percent for the Touchet silt loam and Buckman and Brady (1960) reported a value of 14.6

percent for the Wabash silty clay.

Data Base

To estimate the specific yield of the Ashport silt loam soil at the field site, rainfall:rise ratios were calculated for 19 rainfall events that occurred from October 1985 to March 1987. Water-level rises were measured in the 4 wells at the A, C, D and E sites. For the seven events when a water-level measurement had not been recorded the day immediately before the rainfall, the prior water level was projected as based on the daily decline rate of the water table. After water level rises were calculated for the individual well sites, the four rises were averaged and one rainfall:rise ratio was generated for each rainfall event.

Estimation of Specific Yield

Average values of fillable porosity calculated by the rainfall:rise method range from 9 to 51 percent (Figure 25). Although the results are initially confusing, several general trends are apparent. Fillable porosity decreased during the major fall recharge periods from September to November in 1985 and 1986. As the water table rose from about 10 feet to 7.5 feet fillable porosity decreased from 32 to 14 percent in fall 1985 and from 25 to 14 percent in fall 1986. Soil-moisture data from September 1985 and April 1986 indicate that the soil moisture increased

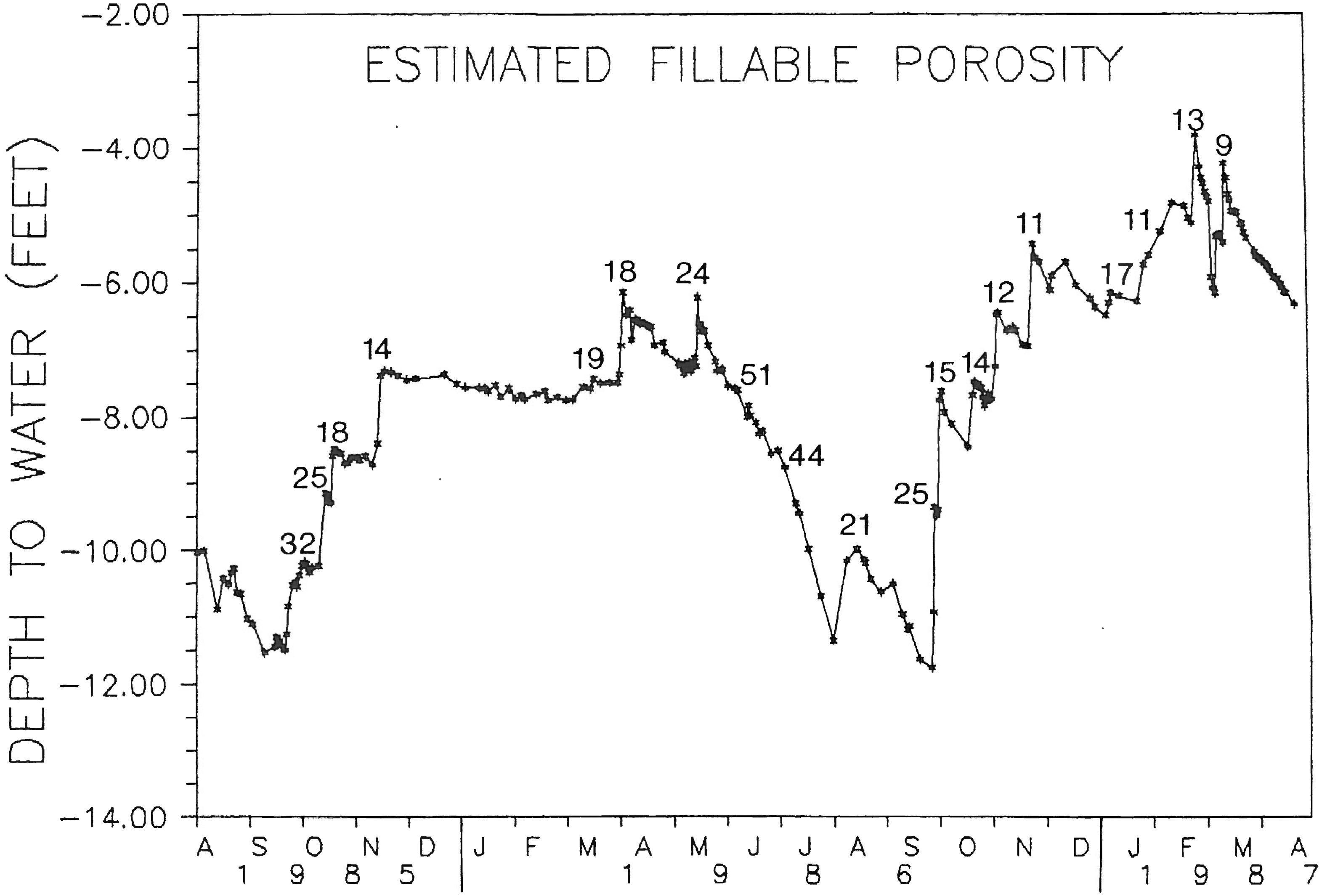


Figure 25. Average Fillable Porosity (Percent) Estimated from Rainfall:Rise Ratio.

significantly from the dry period in September to the wet period in the spring (Acre, in prep). The observed trends in fillable porosity are consistent with the concept of replenishment of soil moisture prior to ground-water recharge.

In November 1986 the water table rose from about 7 feet to 5.5 feet and specific yield values decreased to 11 percent. The trend of rising water levels and declining fillable porosity values continued during winter 1986 and early spring 1987. In March 1987 water levels rose to within three feet of land surface; fillable porosity decreased to a low of 9 percent. Soil-moisture data for the A site in March 1987 indicate that little water was added to the soil moisture before and after the measured rain events (Ross, 1987). The high water table in conjunction with low calculated fillable porosity is consistent with observations by Gillham (1984) and others that specific yield declines when the capillary fringe moves closer to land surface.

The fillable porosities of 44 and 51 percent calculated for two recharge events in June and July 1986 are higher than expected for silt loam soil. The high estimated values of fillable porosity indicate that little of the rainfall actually reached the water table. These data suggest that significant water losses due to evaporation and soil moisture replenishment occur during the summer months.

Although fillable porosity values calculated using the rainfall:rise method vary over a large range, the variations may be explained by simple principles of soil physics. These data clearly demonstrate the time-dependent nature of estimated specific yields. Comparison of soil-moisture values for saturated periods in the spring and dry periods in the summer suggests that specific yield values greater than 25 percent are too high. Specific yield values of nine percent calculated when the water table was very close to land surface are probably too low due to the capillary fringe effect. Therefore, the average specific yield for the aquifer is estimated to range between 10 and 25 percent.

Summary of Hydraulic Data

Several hydraulic parameters have been estimated using ground-water hydrographs and water-table elevation maps. Based on diurnal hydrographs, ground-water velocity is 0.34 to 1.12 feet/day. The amplitude of the daily fluctuations is greater at the C and D sites suggesting that the large trees use more water than grassy vegetation. Although the available data are inconclusive, they suggest that the large trees at the southern edge of the field site partly control the horizontal and vertical hydraulic gradients. The horizontal hydraulic gradient averages 0.005 foot/foot but the direction shifts seasonally so that equipotential lines parallel the trees in the summer. The magnitude of the vertical gradient increases in the summer, especially at the C and D sites under the trees, also suggesting that the trees withdraw more water from the aquifer than grass.

Recommendations for Additional Research

Characterize Regional Hydraulic Regime

The apparent seasonal nature of the ground-water flow direction and the configuration of the water table maps during the summer months strongly suggest that vegetative consumptive use is responsible for the gradient shift. However, the field site must be considered in the larger context of the regional hydraulic regime. No data are available for the stage heights in Boomer Creek or its tributary west of the site. Additional mapping and data gathering is required to determine to what degree consumptive use and regional hydraulics control local flow direction.

Verify Diurnal Fluctuations

Assumptions made regarding the nature of diurnal fluctuations recorded by the electrical pressure transducers greatly simplified calculation of ground-water velocity. It is essential to quantify the error in water levels measured by the pressure transducers. Equipment should be field tested for sensitivity to temperature and barometric changes.

Quantify Soil Moisture

In order to refine the estimate of effective specific yield of the aquifer material, water level measurements should be made before and immediately following rainfalls. Soil-water content should be measured at the same times in order to quantify the amount of recharge to the unsaturated zone and to learn more about the processes governing unsaturated fluid flow. Capillary pressure measurements are necessary in order to determine the height of the capillary fringe.

CHAPTER IV

GROUND-WATER GEOCHEMISTRY

Introduction

Data Base

From mid April 1986 to mid February 1987 ground-water monitoring wells were sampled weekly and after significant recharge events. More than 110 sets of measurements were recorded during the entire monitoring period from July 1985 to February 1987 (Appendix C). On four occasions in April, May, June and July 1986 samples were collected for complete cation/anion analyses. Hagen (1986) documented results of one set of complete analyses for January 1986.

Sampling Procedures

The sampling procedures used in this study are similar to those that Hagen (1986) employed. Prior to sampling, wells were purged with a peristaltic pump capable of producing water at rates of 0.3 to 0.7 gpm. The shallower wells were pumped dry, usually after 5 to 10 minutes, and allowed to recover before they were sampled. During most of the year the 4 and 5 wells could not be pumped dry, therefore, three well volumes of water were removed before sampling.

Hagen (1986) conducted experiments with purging techniques in an attempt to define a representative ground-water sample. His results indicate that temperature, pH and electrical conductivity stabilized after about two well volumes of water were withdrawn. He also observed that pumping as little as 2.5 liters of water (about 2.5 well volumes) from Well A3 caused a drawdown of 0.04 foot in the adjacent Well A2, which is a foot shallower. His study demonstrates that purging techniques in closely spaced well clusters must be very carefully designed.

Samples were collected in 500 ml Nalgene plastic bottles. One sample was taken from each of the shallower wells and the composite wells. Three samples were collected in succession from the 4 wells. Low yields from some of the shallower wells during late spring and fall prevented collection of more water without allowing the wells to recover between samples. When samples were collected for complete analyses, the water was filtered while pumping using an in-line filter equipped with 0.45 micron acetate filter paper.

Analytical Methods

From mid April 1986 to early February 1987 ground-water samples were routinely analyzed for pH, electrical conductivity and bicarbonate and chloride concentrations in a laboratory at the field site. Temperature was measured downhole. Sample pH and electrical conductivity were measured using battery-operated field meters immediately after sample collection. Bicarbonate and chloride concentrations were determined by colorimetric titrations according to EPA Methods 310.1 and 323.5. Bicarbonate titrations were performed as soon as possible after sample collection. A turbidimetric technique was used to measure sulfate concentration according to EPA Method 375.4. Cation concentrations were measured by atomic absorption spectrometry according to EPA Methods 215.1, 242.1, 258.1 and 273.1 (Kopp and McKee, 1983).

Quality Control and Data Reliability

Many sources of variation combine to confound the interpretation of ground-water geochemical data. Obviously the hydrogeologist cannot hope to regulate all the variables involved in any given project. However, analytical and sampling techniques that help to identify some of the unwanted variations in the data set may be employed.

The variability among units treated alike is the statisticians' "sampling error" (Steel and Torrie, 1980, p. 153). In order to investigate the variability between ground-water samples pumped from a single well, successive samples were collected from the 4 wells. The sampling error component is small; there was little variation in concentrations of bicarbonate, chloride or cations analyzed in successive samples collected from the same well.

To determine laboratory analytical error, replicate analyses were run on individual water samples. Analytical error is expressed as the range in replicate concentrations divided by the mean concentration and multiplied by 100 to convert to a percentage. Ten percent error or less was considered acceptable. To characterize the variability associated with measuring bicarbonate and chloride concentrations, duplicate or triplicate analyses were performed on at least one sample from each well cluster nearly every time the analyses were run.

The acid titration for the bicarbonate ion creates an obvious color change that occurs when the pH of the sample reaches 4.5. The color endpoint may be verified with a pH meter. Analytical error for bicarbonate titrations was generally within 5 percent for all replicates. However, due to the subtle and subjective nature of the colorimetric titration for chloride, analytical error may be greater than 20 percent for some samples. Chloride data are suitable for making broad qualitative comparisons; one must not be tempted to draw detailed quantitative conclusions.

For the cation analyses, duplicates of every third sample were prepared for the atomic absorption spectrometer. Every third replicate was run in triplicate. Analytical errors for calcium, magnesium, sodium and potassium generally fell within the acceptable range. Calcium is the most difficult of the four cations to analyze by the atomic absorption method; calcium concentrations exhibited the greatest variations.

As a check on the atomic absorption instrument and the standards, EPA water containing known concentrations of calcium and magnesium was analyzed. Calcium and magnesium concentrations measured for the EPA water were within 10 percent of the stated values. In addition, several samples of water from the field site were chosen to represent "standard field water" to be run with each cation analysis. Analytical results for these samples were within 10 percent of the values obtained the first time the samples were analyzed.

After laboratory work is completed, the cation/anion balance provides another check on reliability of complete analyses. If the balance is more than +/-10 percent, then the interpreter should review the analysis suspiciously. Of the 63 complete analyses performed in spring and summer 1986, 52 cation/anion balances were less than 10 percent (Appendix D). When the balances were greater than 10 percent, they were usually negative, possibly due to analytical errors in measuring calcium or bicarbonate concentrations or to the presence of a significant concentration of an unanalyzed positive ion species.

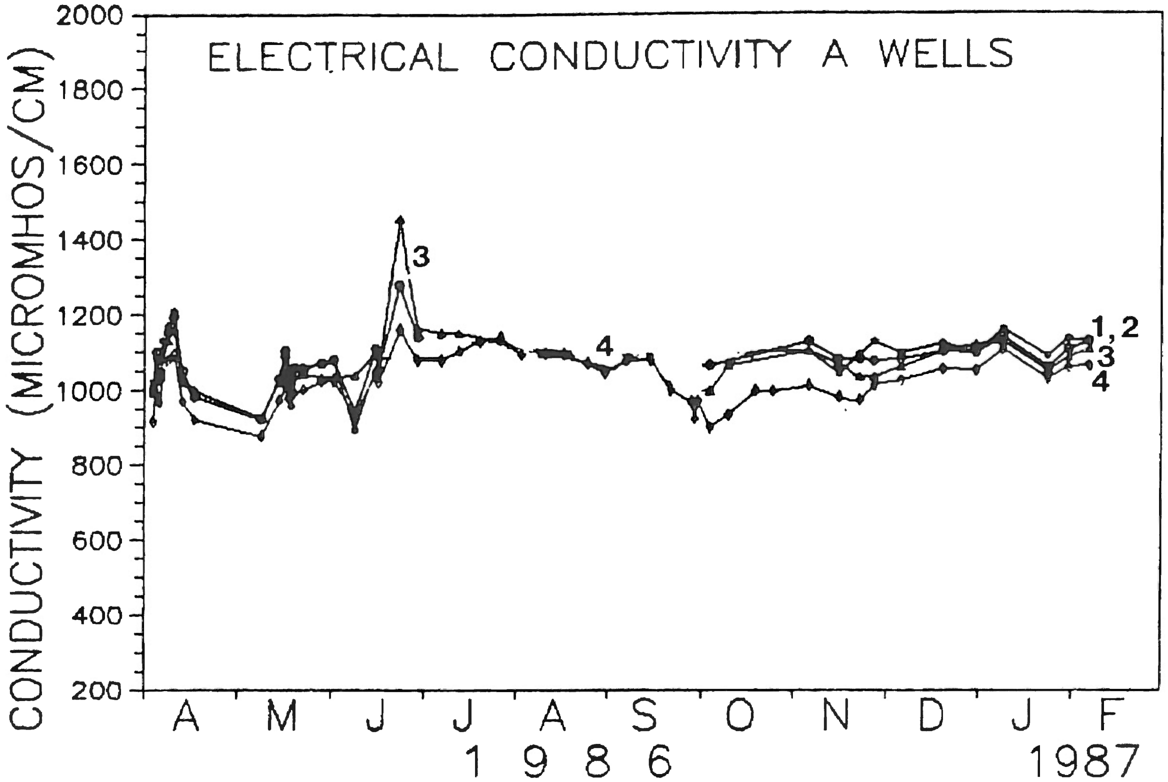
Spatial Variations in Water Quality

General Trends

Ground water in the aquifer at the field site is a high bicarbonate, mixed calcium-magnesium-sodium water. Although the monitored area covers less than 0.2 acres, the observed chemical parameters in the ground water vary considerably both areally and vertically. Site A exhibits the least vertical variation in conductivity and bicarbonate concentrations; the ground water there appears to be homogeneous with respect to the major chemical constituents. However, Ross (1987) and Ross and others (1987) documented consistent vertical stratification of nitrate concentrations at the A site from January to June 1987. In addition to the vertical variation within any particular well cluster, concentrations vary significantly from site to site in the 1, 2 and 3 wells. However, the waters sampled from the 4 wells at all four sites exhibit a more consistent chemical profile.

Electrical Conductivity

In the shallower wells, single conductivity values vary over nearly an order of magnitude, from 255 micromhos/cm in Well E2 to 1979 micromhos/cm in Well C1; average values range from 603 to 1678 micromhos/cm (Figures 26, 27). Conductivity values are consistently highest in the shallow C and D wells, intermediate at the A site and lowest in the shallow E wells. Conductivity decreases with depth at the C and D sites, increases with depth at the E site and decreases slightly with depth at the A site. In the 4 wells, the average conductivity ranges from 987 to



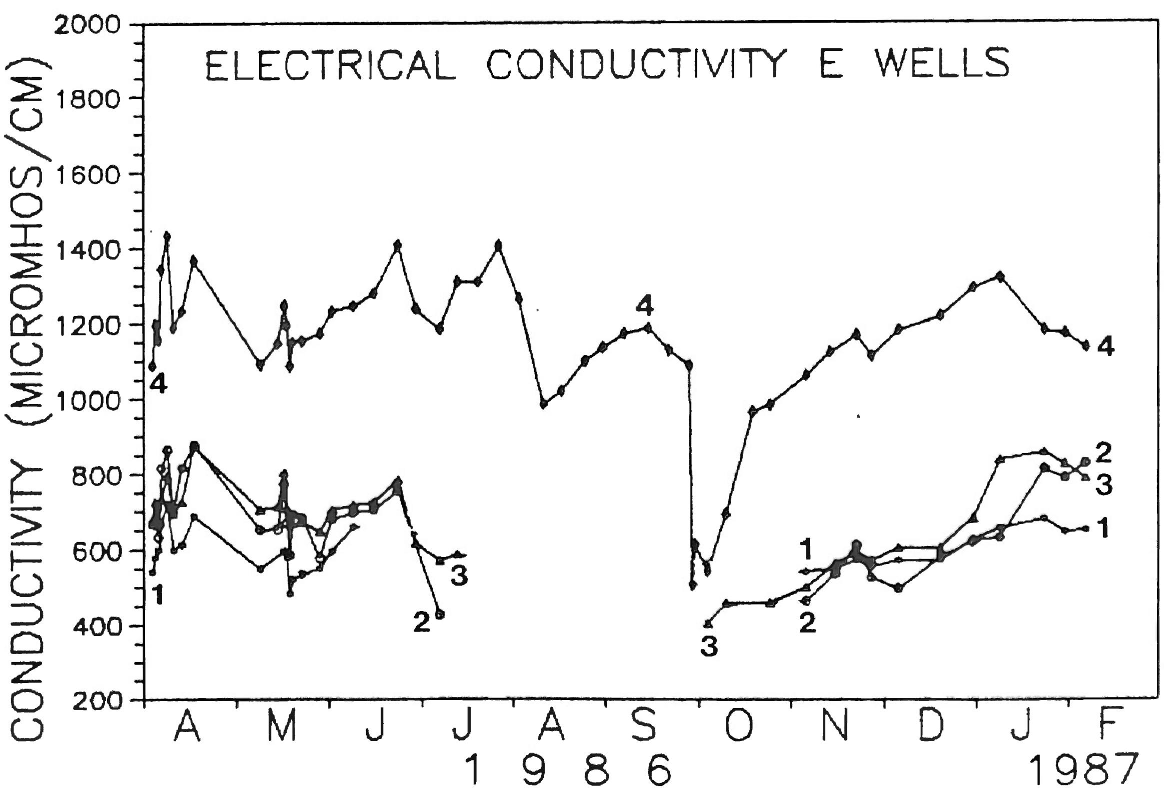


Figure 26. Electrical Conductivity, A and E Wells.

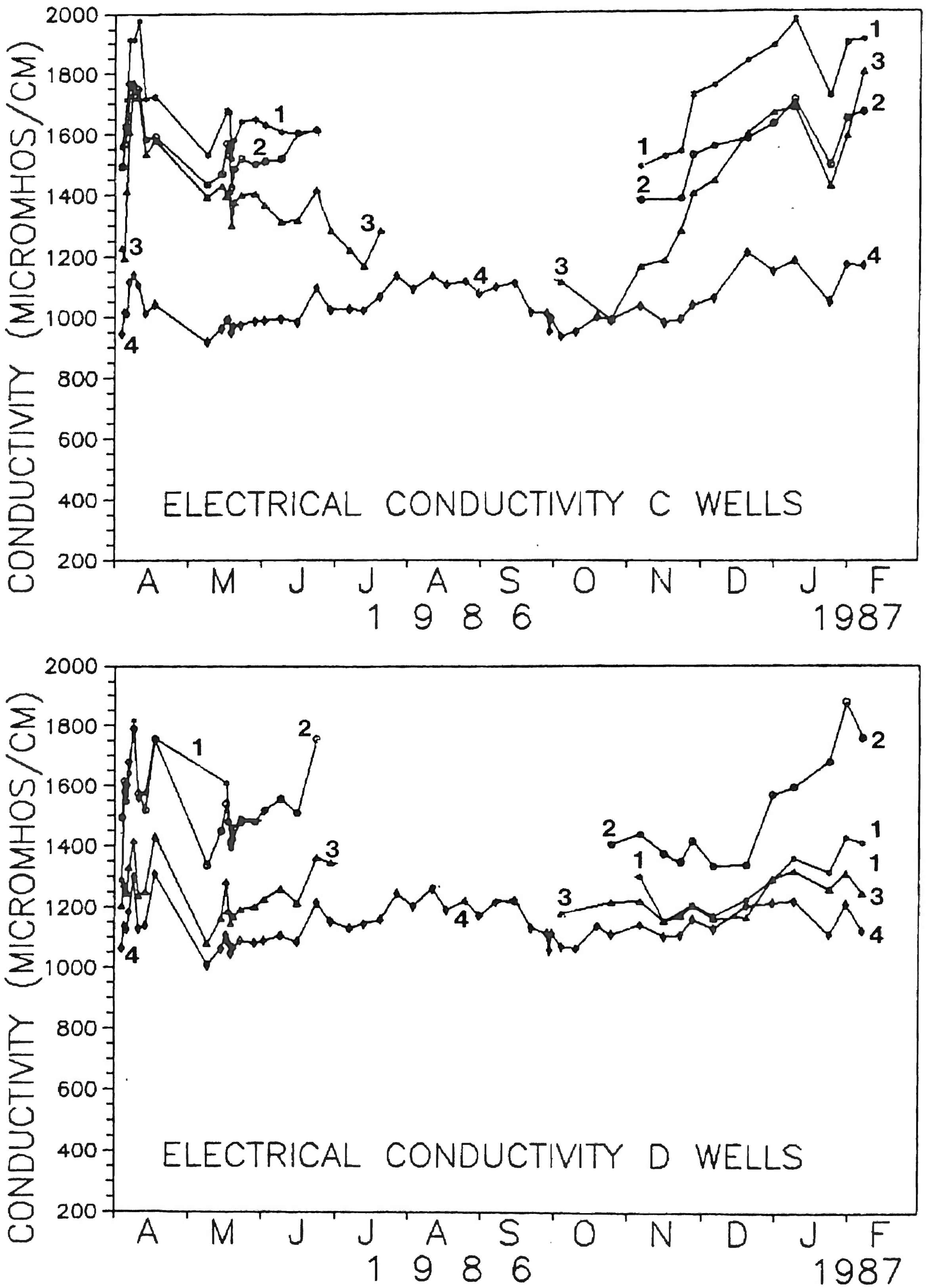


Figure 27. Electrical Conductivity, C and D Wells.

1149 micromhos/cm. However, individual values in Well E4 vary from 508 to 1433 micromhos/cm.

Bicarbonate

Bicarbonate is the major chemical constituent measured in the ground water and composes almost half of the total dissolved solids. Carbon dioxide in the atmosphere or in the soil gas is the apparent source of alkalinity in ground water in the Ashport aquifer. Although CO_2 composes 0.03 percent of the atmosphere by volume, CO_2 volumes in soil gas may be much higher due to vegetative respiration and oxidation of organic matter (Hem, 1985).

As rain water percolates through the vadose zone to the water table, it becomes charged with CO_2 (Rabenhorst, et al, 1984). Carbonic acid forms and dissociates to make bicarbonate ions according to the reaction:

$$CO_2 + H_2O \rightleftharpoons H_2CO_3 \rightleftharpoons H^+ + HCO_3^- \quad (4.1)$$

Carbonic acid in ground water may also dissolve calcite in the aquifer to form bicarbonate:

$$H_2CO_3 + CACO_3 \rightleftharpoons CA^{+2} + 2HCO_3^- \quad (4.2)$$

During periods when evapotranspiration rates increase, the above reactions are driven to the left system (Rabenhorst, et al, 1984):

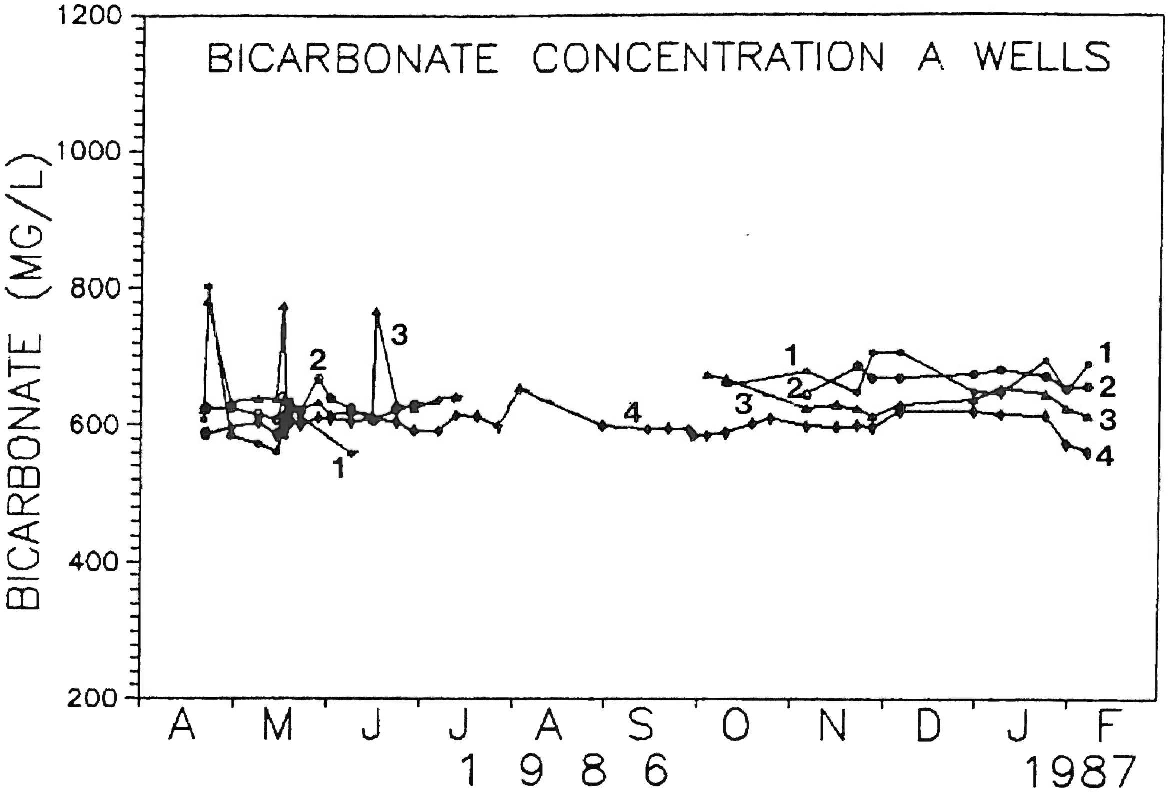
$$CO_2 + H_2O + CACO_3 \leftrightharpoons CA^{+2} + 2HCO_3^- \quad (4.3)$$

Under these conditions, when calcium is present with bicarbonate in solution, calcite may precipitate.

At the study site individual bicarbonate concentrations range from 217 mg/l in Well E3 to 1165 mg/l in Well C2 (Figures 28, 29). Although some of the bicarbonate concentrations seem high, they are within the range of concentrations that may be expected in ground water (Hem, 1985). The spatial distribution of concentrations closely correlates with the conductivity patterns; bicarbonate is highest in the shallow C and D wells, intermediate at the A site and lowest in the shallow E wells. In the shallow wells average bicarbonate concentrations range from 347 mg/l in Well E1 to 1069 mg/l in Well C1. As with conductivity, the average bicarbonate concentrations in the 4 wells vary over a much narrower range, from 593 to 658 mg/l, than in the shallower wells. However, regardless of absolute concentration, bicarbonate represents 42 to 47 percent of the total measured ions in complete analyses performed in January, April, May, June and July 1986.

Chloride

Individual chloride values range over nearly two orders of magnitude, from 4.4 mg/l in Well E1 to 163 mg/l in Well D2 (Figures 30, 31). The vertical distribution of concentrations mirrors the patterns for electrical conductivity and bicarbonate. Average concentrations in the shallow wells range over a wider range, from 9.3 mg/l in Well E1 to 60.9 mg/l in Well D2, than in the 4 wells where



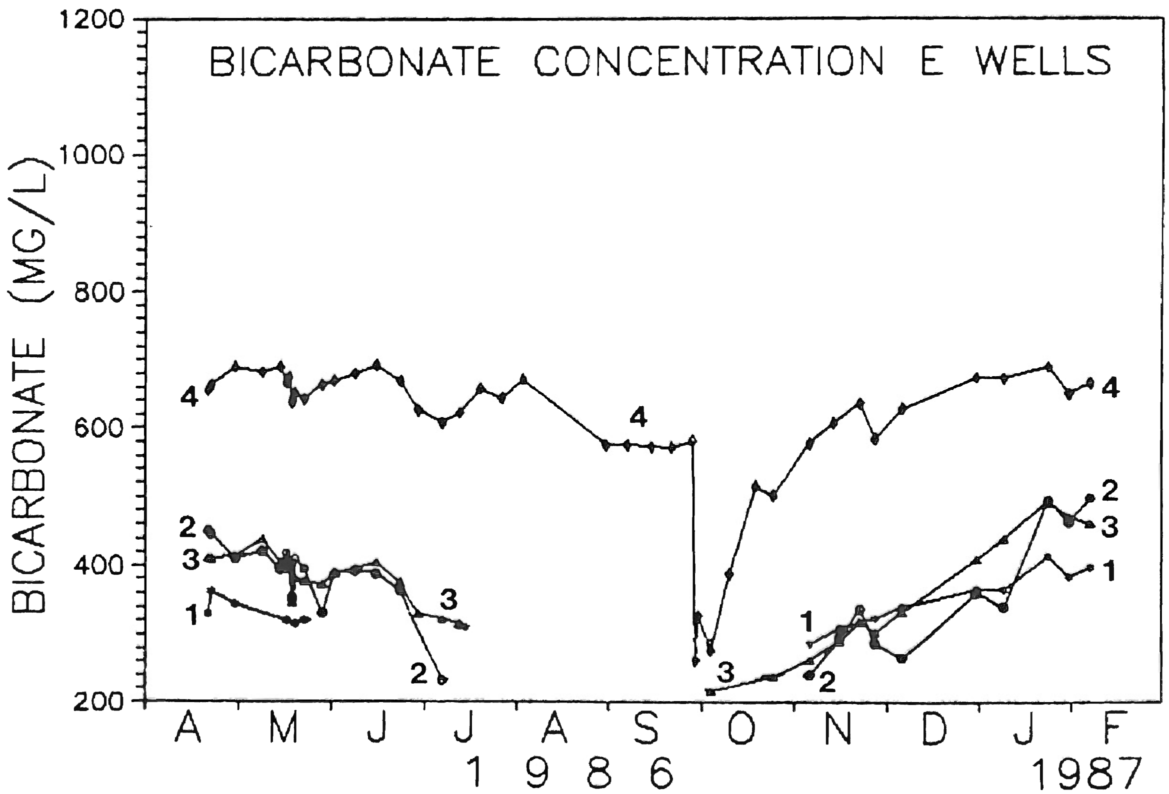
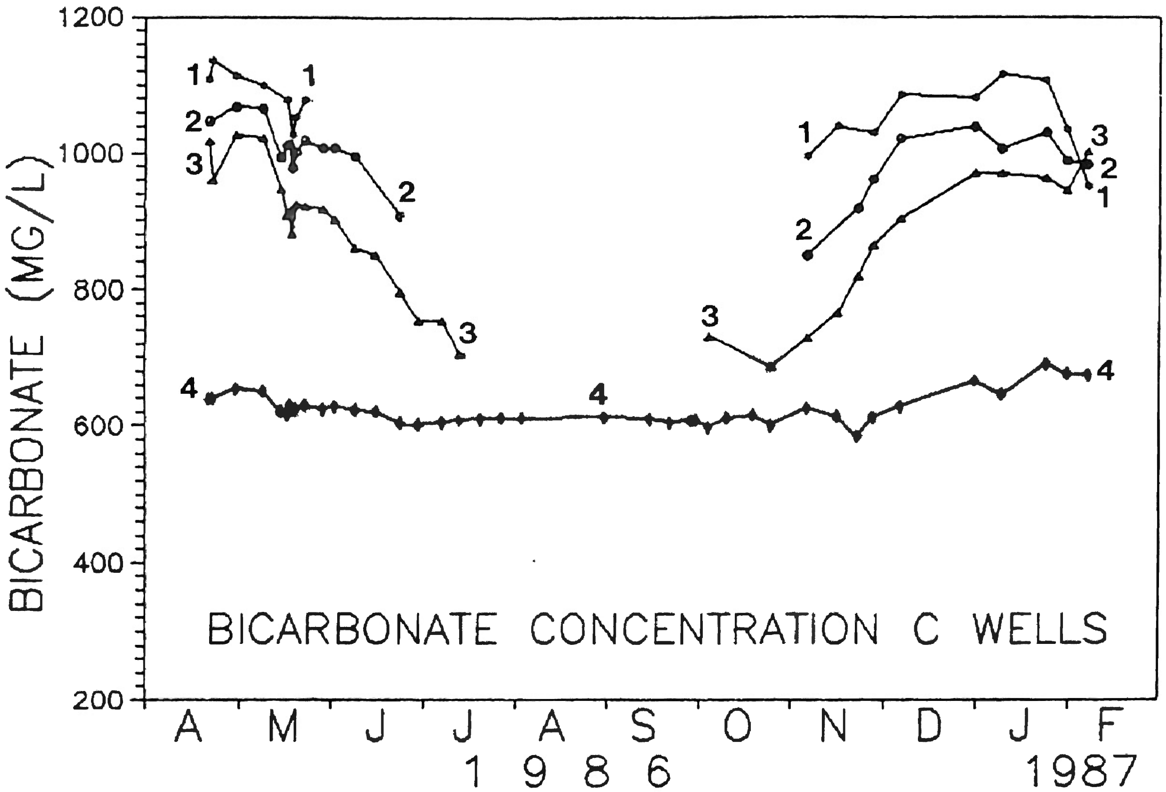


Figure 28. Bicarbonate Concentrations, A and E Wells.



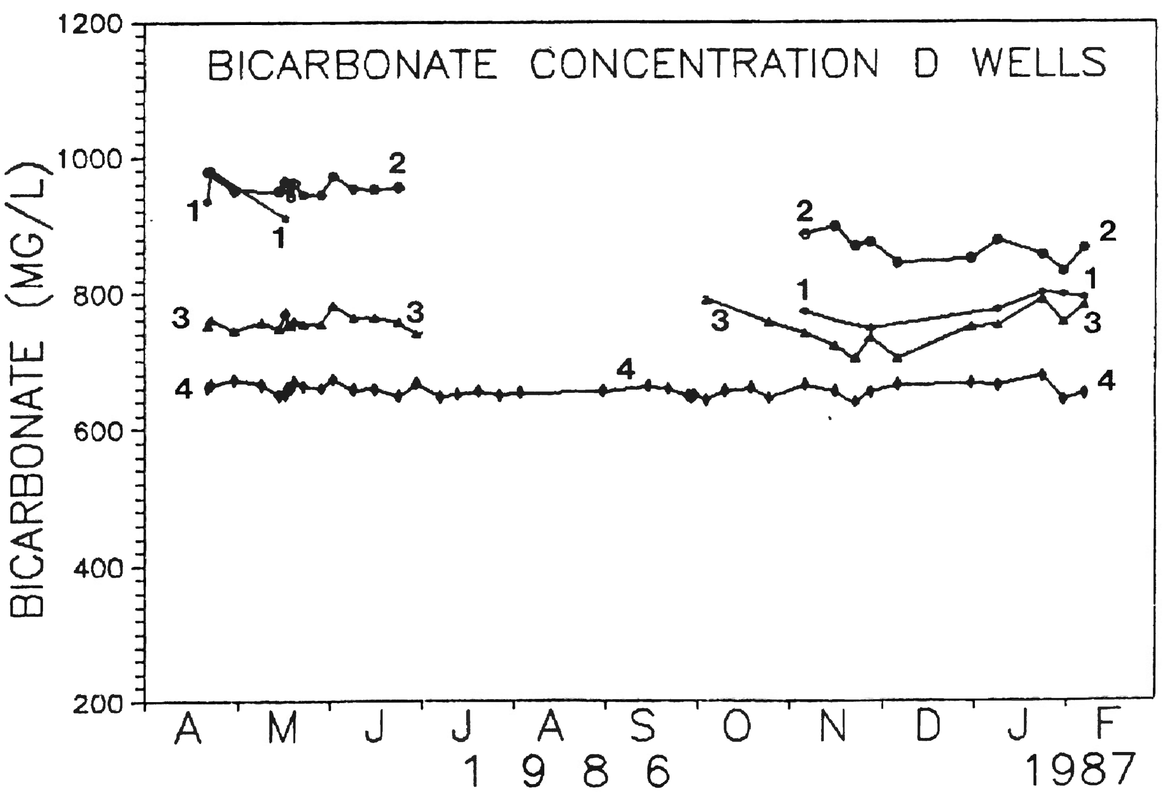
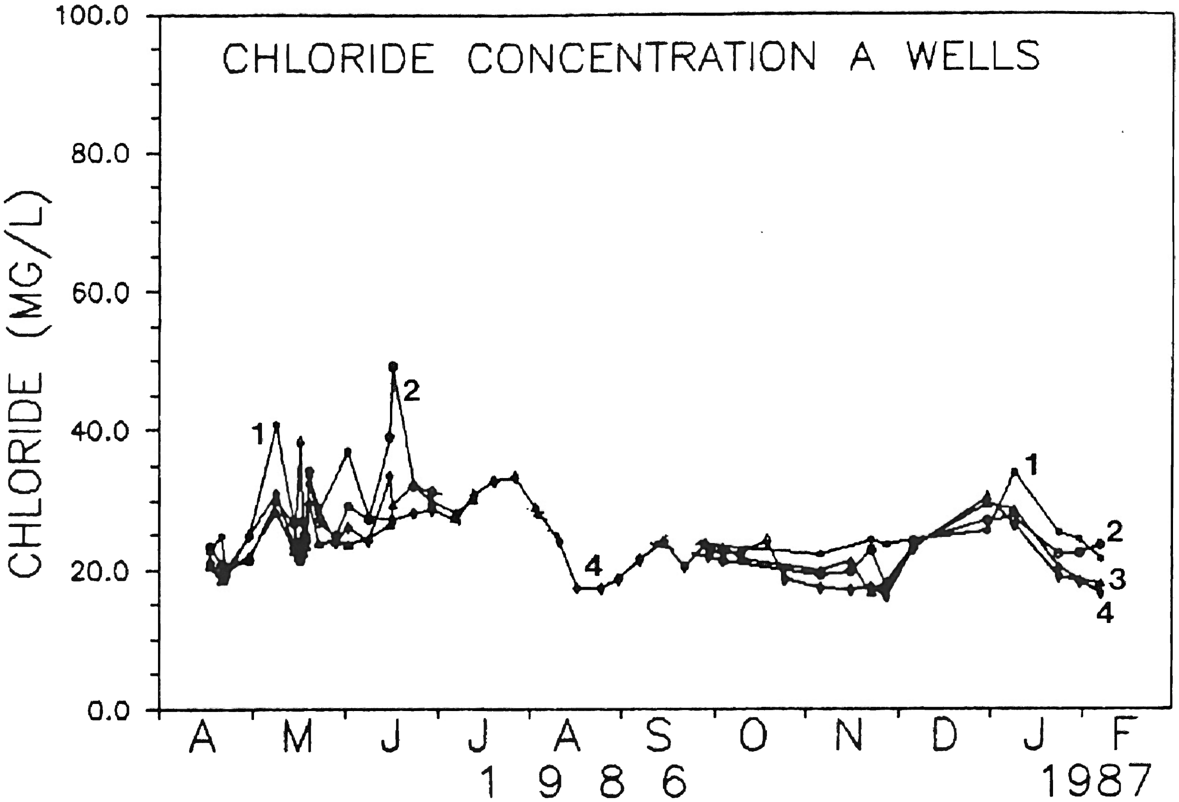


Figure 29. Bicarbonate Concentrations, C and D Wells.



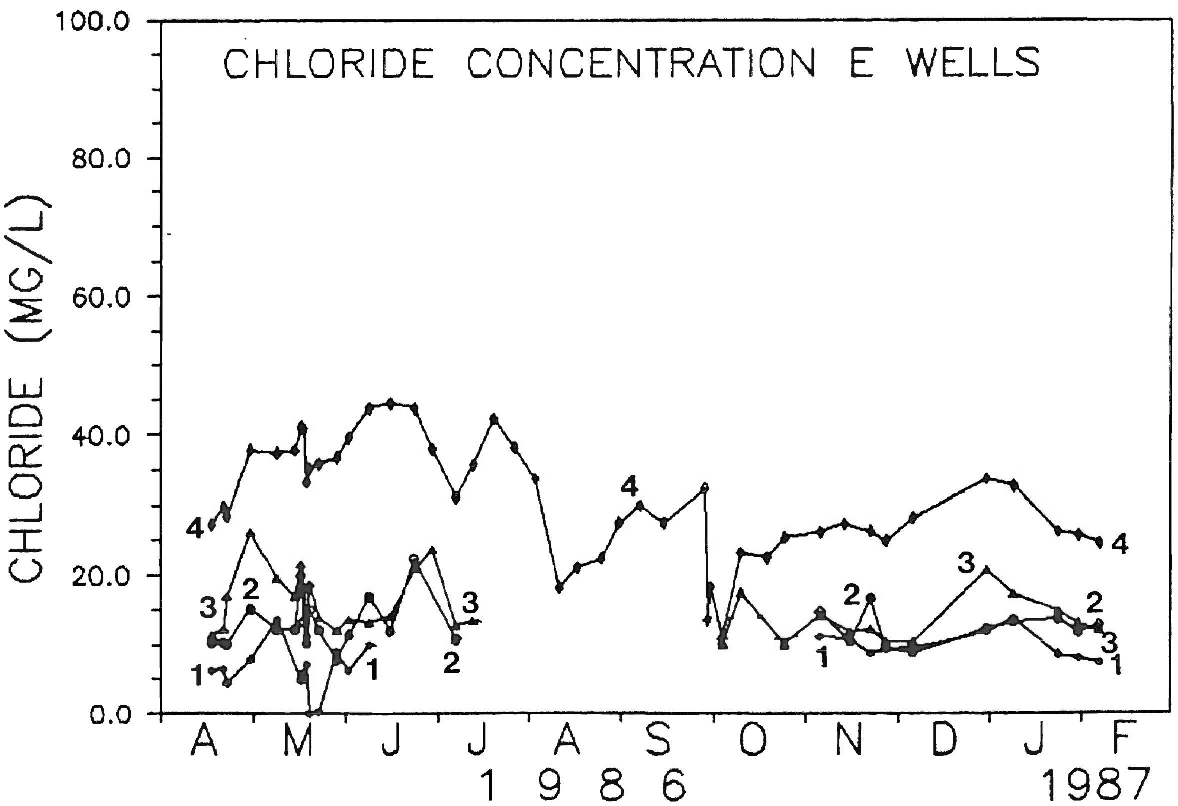


Figure 30. Chloride Concentrations, A and E Wells.

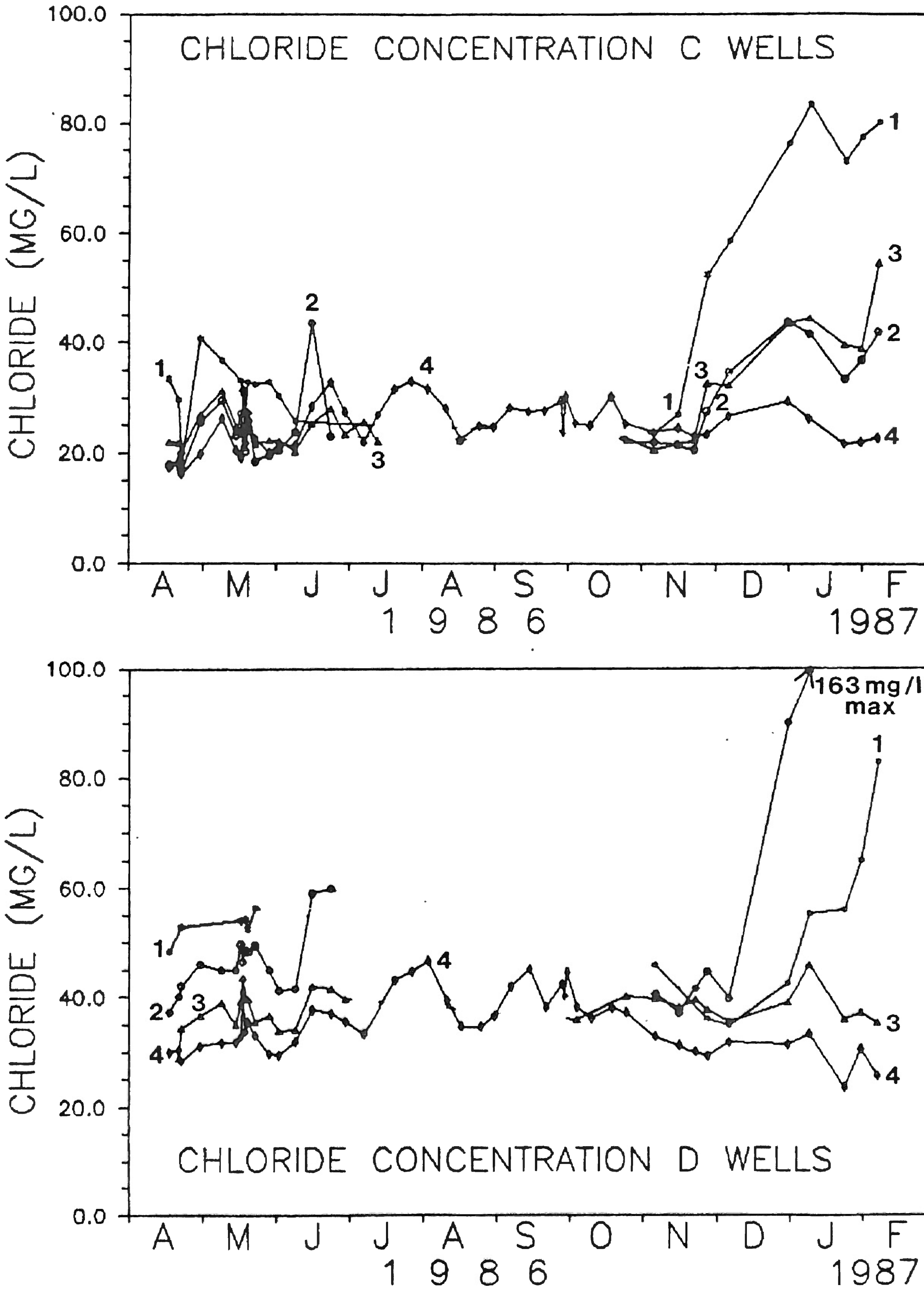


Figure 31. Chloride Concentrations, C and D Wells.

average values vary from 23.8 to 35.1 mg/l.

Cations

Cation and anion concentrations were expressed in milliequivalents per liter and converted to percentages for all the complete chemical analyses (Appendix D). The resulting data for the June ground-water samples were plotted on a triangular Piper (1944) diagram (Figure 32). The cations are scattered in the middle of the calcium-magnesium-sodium triangle and the anions cluster in the bicarbonate corner of the bicarbonate-sulfate-chloride triangle. No trends are evident for the anion data other than the fact that bicarbonate completely dominates the anion chemistry.

To examine the cation data in more detail, the cation triangle was expanded and data were plotted for the May and June ground-water samples (Figures 33, 34). There are no obvious, consistent chemical trends that hold true for every site. For example, calcium decreases with depth at the expense of sodium at the A site suggesting that cation exchange has occurred, and there may be a similar trend at the E site. However, there is no discernible cation exchange pattern with depth at the other sites.

In general the shallower A and E wells plot in the calcium-dominated area of the triangle. Wells of the same depths at the C and D sites cluster in the sodium-dominated area. The A and E samples contain roughly 5 to 20 percent

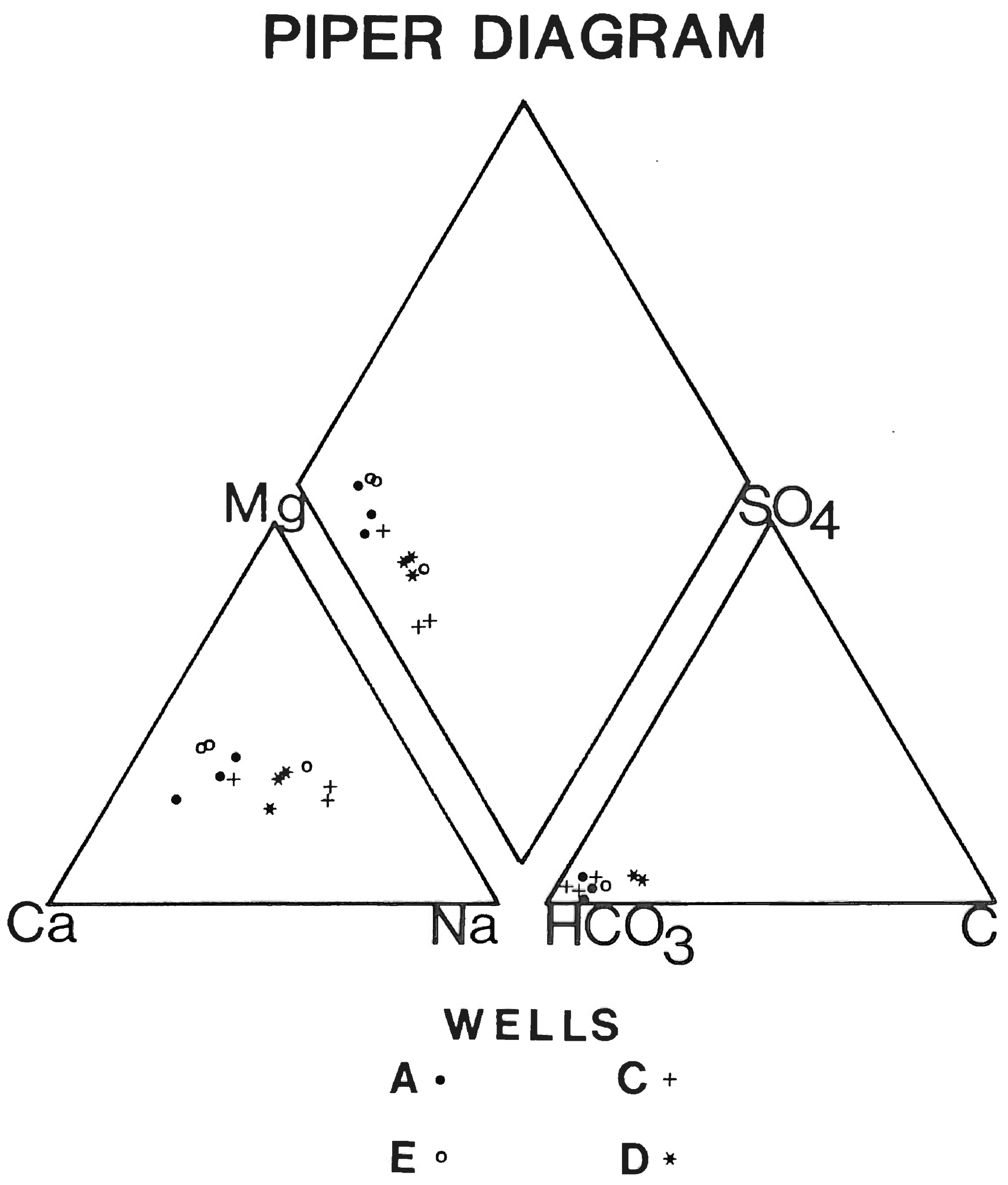


Figure 32. Piper Diagram, June 1986.

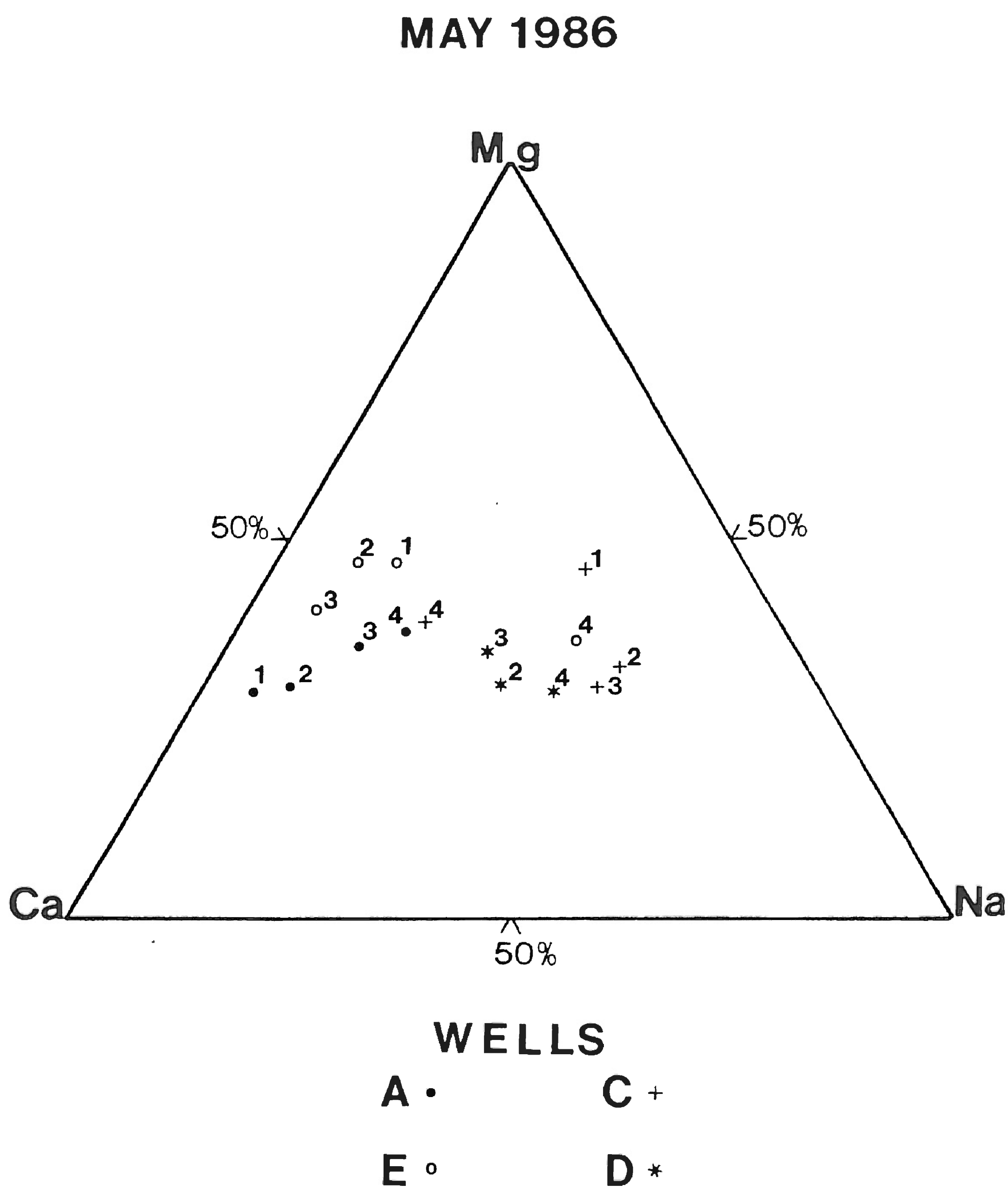


Figure 33. Ternary Cation Diagram, May 1986.

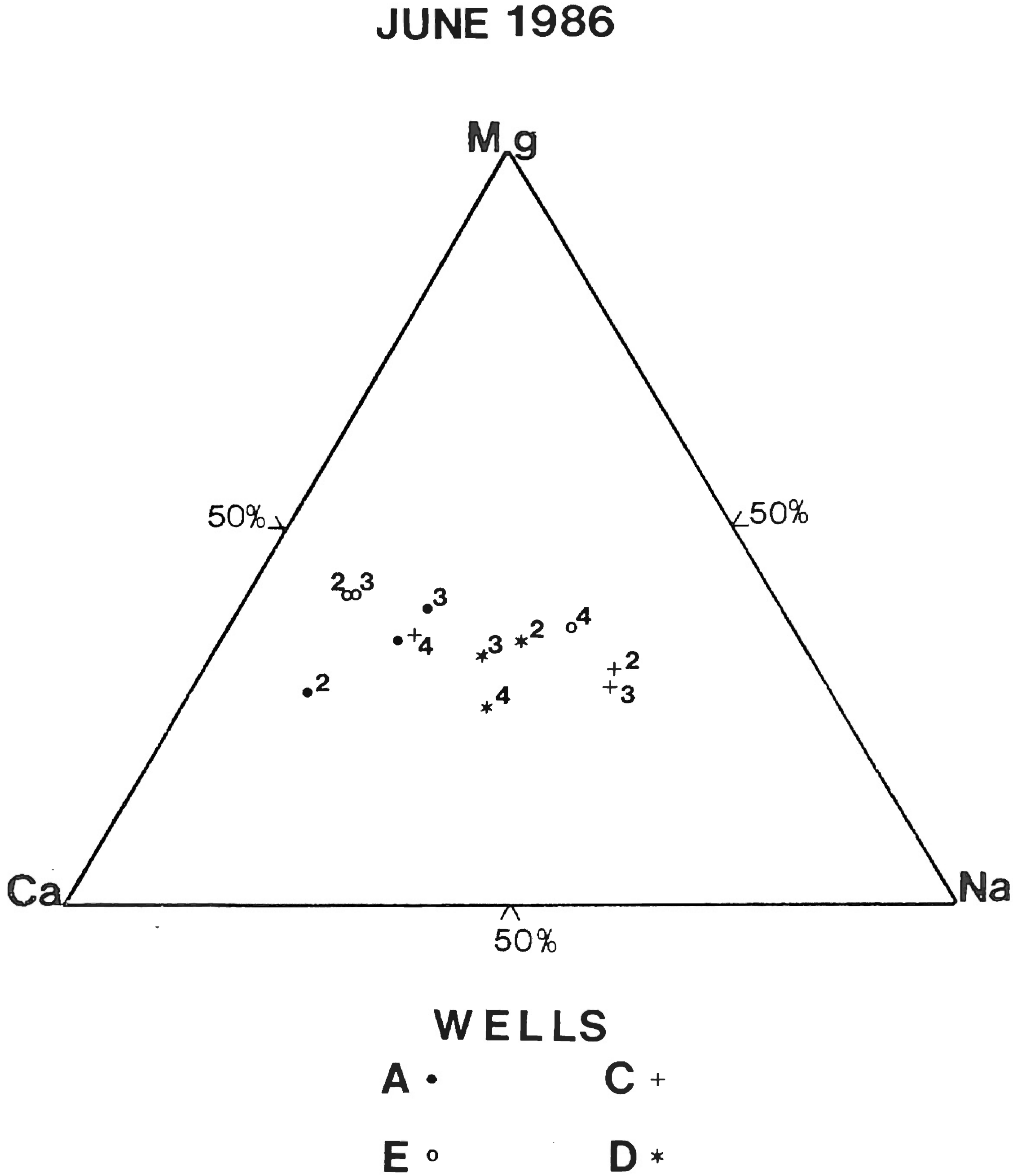


Figure 34. Ternary Cation Diagram, June 1986.

sodium and 40 to 65 percent calcium. Conversely, the C and D samples consist of 30 to 50 percent sodium and 20 to 40 percent calcium. This pattern also holds true for data collected and analyzed by Hagen (1986) for January 1986 (Figure 35).

Temporal Variations in Water Quality

Long-term Variations

Definitive conclusions regarding long-term variations in geochemical parameters at the field site are tenuous due to the relatively short period of data collection. There are gaps in the data for the 1, 2 and 3 wells because they are dry in the summer. Data must be collected for several years to perform a rigorous statistical time series analysis. However, several observations may be made using the available data.

In general the temporal distribution of electrical conductivity mirrors the bicarbonate concentrations. There is no obvious seasonal trend for either parameter in any of the wells at the A site. In the shallow E wells conductivity and bicarbonate concentrations appeared to decrease in late spring 1986 and to increase in fall 1986 and early winter 1987. This pattern is also very much evident in the shallow C wells. At the D site, there was no apparent seasonal variation in bicarbonate concentrations in any of the wells. However, the electrical conductivity values in

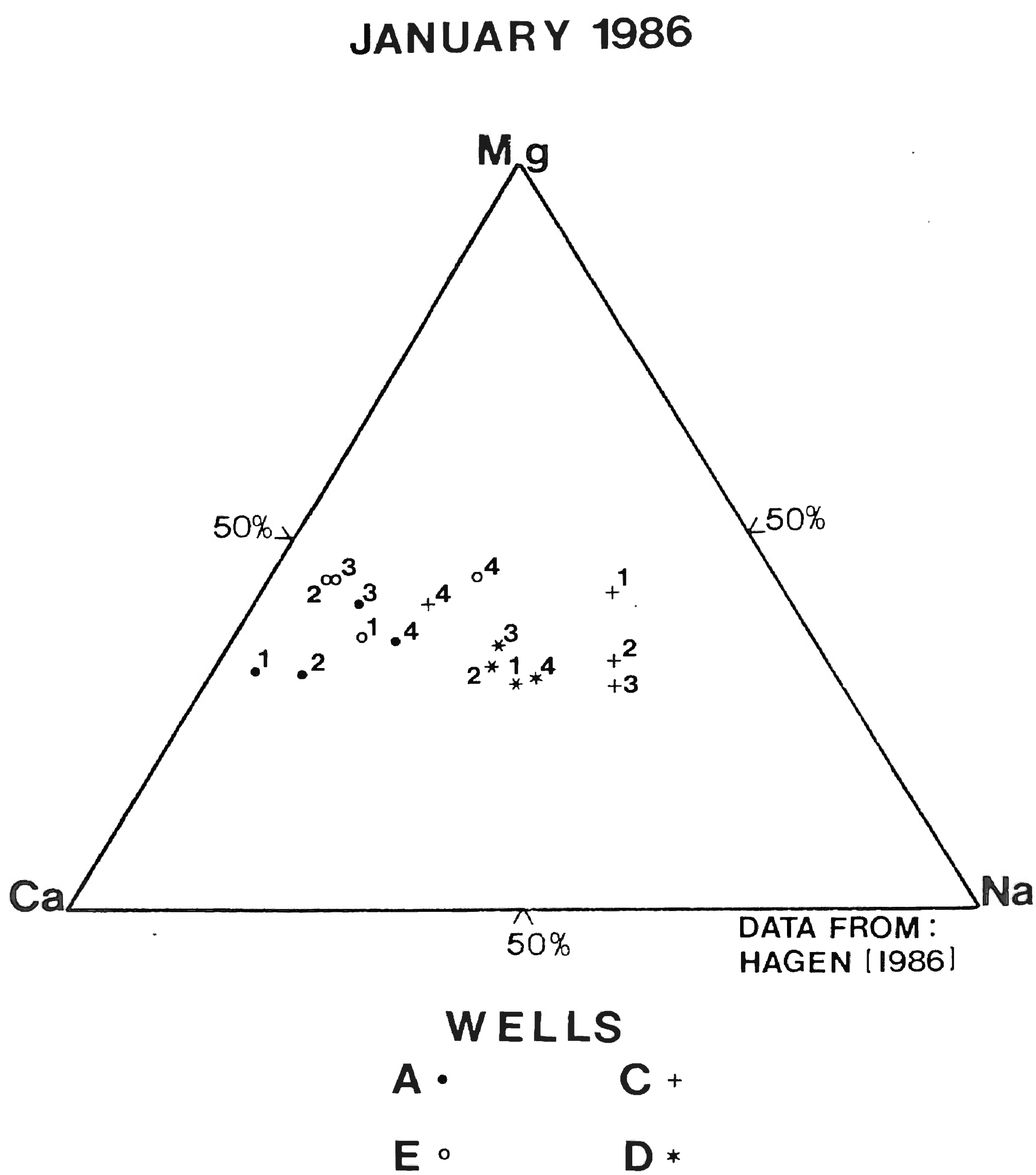


Figure 35. Ternary Cation Diagram, January 1986.

Well D2 begin to increase in late spring and again in late fall and early winter. By February 1987 the conductivity in Well D2 was approximately 400 micromhos/cm greater than in Well D1. Inspection of the chloride graph for the D site reveals that the chloride concentration also increased significantly in Well D2 (Figure 31).

Short-term Variations

Interpretation of the data collected from May 1986 to February 1987 suggests that three major rainstorms, which occurred in May, August and September-October 1986, affected ground-water quality in one or more of the monitoring wells. From 14-17 May 3.18 inches of rain fell at the field site. Water samples were collected on 13, 15, 16, 17, 18 and 21 May. On 8-9 August approximately five inches of rain were recorded. Samples were collected on 2, 10 and 16 August. Nearly 10 inches of rain deluged the site from 28 September to 3 October. The wells were sampled on 28, 29 and 30 September and 4 and 10 October.

When compared to the large well site-to-well site differences in ground-water quality, effects of recharge events on quality are generally minor and ephemeral. As suggested by the persistent downward vertical gradient, wells at the E site are the most susceptible to influence from recharge events. Little dips occurred in the graphed parameters in all of the wells after the May event suggesting that diluted water moved through the soil profile. In

August the water table declined to about 11.5 feet below surface and all wells but the 14-foot wells were dry. There was no apparent effect on conductivity in wells A4, C4 or D4. However, conductivity decreased significantly in Well E4. After the September-October rainstorm, a large decrease in conductivity was measured in Well E4 along with a corresponding decrease in the bicarbonate and chloride concentrations. Wells A4, C4 and D4 showed a slight temporary decrease in conductivity and chloride concentrations. There was no apparent change in the bicarbonate concentrations.

Causes of Variation in Water Quality

Dilution

Chemistry of the ground water at the field site is a complicated function of aquifer stratigraphy and hydraulic characteristics, vegetative influence and urban features. No two sites in the 8000 ft^2 monitored area appear to have the same water quality. Although absolute anion concentrations vary greatly, the total anion percentages are fairly similar for all wells as based on the complete analyses performed in the first half of 1986. This observation suggests that waters with the lower absolute concentrations have been diluted.

Dilution is one major factor that controls groundwater chemistry at the E site, which is located near a downspout draining the roof of the house. Calculated vertical gradients demonstrate that water consistently flows downward after recharge events. After large rains, conductivity, bicarbonate and chloride concentrations decrease as fresh rain water infiltrates through the soil profile to the water table.

Low absolute concentrations and balanced sodium and chloride concentrations in the shallow E wells suggest relatively short ground-water residence times. Although dilution due to the large influx of water from the drain-spout affects the ground-water chemistry, hydraulic characteristics allow water to flow quickly through the soil profile. As shown in the next chapter, calculated transmissivity values apparently increase significantly at the E site; ponding after rain has rarely been observed.

Vegetative CO_2 Production

Grassy vegetation dominates both the A and E sites. The major source of alkalinity in the A and E wells is probably dissociation of carbonic acid formed as CO_2-charged rain water percolates through the soil profile. Although dilution controls bicarbonate concentrations in the shallow E wells, the vertical bicarbonate profile in the A wells is relatively homogeneous. Therefore, the A site will be viewed as a "control" site against which to compare the others.

In contrast to the grassy A and E sites, the C and D wells are installed near several large trees that simulate an intermittently pumped well field. According to Lutz and Chandler (1946, p. 70), higher concentrations of carbonic acid occur near tree roots. Parker (1924) studied the effect of different crops on the CO_2 content of soil gas. He measured an average value of 2.91 percent CO_2 in soil gas from a pot of cowpeas that were planted 57 to 70 days before. His control pots with no crop averaged 0.16 percent CO_2 after the same length of time. Metzger (1928) measured higher concentrations of bicarbonate in soil water extracted from silt loam in contact with plant roots than in soil water sampled two to four inches away from roots. He observed that bicarbonate concentrations increased during the blooming and fruiting stages of crop growth.

The high absolute bicarbonate concentrations in the shallow C and D wells suggest that vegetative production of CO_2 leads to higher bicarbonate concentrations in the shallow ground water under the trees. Concentrations decrease with depth at the C and D sites so that there is a distinct bicarbonate stratification between the 8- and 14-foot wells. Apparently mixing and vertical dilution occur over a rather short interval within the saturated zone.

Water-table Fluctuations

Strong vegetative influence may explain high initial bicarbonate concentrations in the shallow C and D wells. However, the two sites differ in their temporal patterns of bicarbonate concentrations. In the shallow C wells concentrations decreased in late spring 1986 when the water table declined and increased during the fall 1986 recharge period. There is no apparent relationship between season and bicarbonate concentration in the shallow D wells.

To evaluate the influence of the fluctuating water table on bicarbonate concentration, depth to water was plotted against concentration for samples collected from April 1986 to February 1987 (Figures 36 - 39). Concentrations in the 4 wells are remarkably consistent. There is no correlation between bicarbonate and water depth. Well E4 shows more scatter than the other 4 wells due to flushing and dilution after significant rainstorms.

The graphs for wells A1, C3, and possibly E1, E2 and E3 hint that there is a direct relationship between bicarbonate concentration and depth to the water table. Interpretation of these data suggests that the fluctuating water table induces seasonal cycles of carbonate precipitation and dissolution. In late spring and summer when the water table declines due to evapotranspiration, bicarbonate concentrations in the ground water decrease because calcium carbonate is precipitated in the soil. Conversely, during the fall recharge period when the water table rises, infiltration of fresh rain water causes the carbonate equilibrium to shift. Calcium carbonate is then dissolved from the soil and bicarbonate is flushed back into the ground water. The calcareous zone logged from 6 to 10

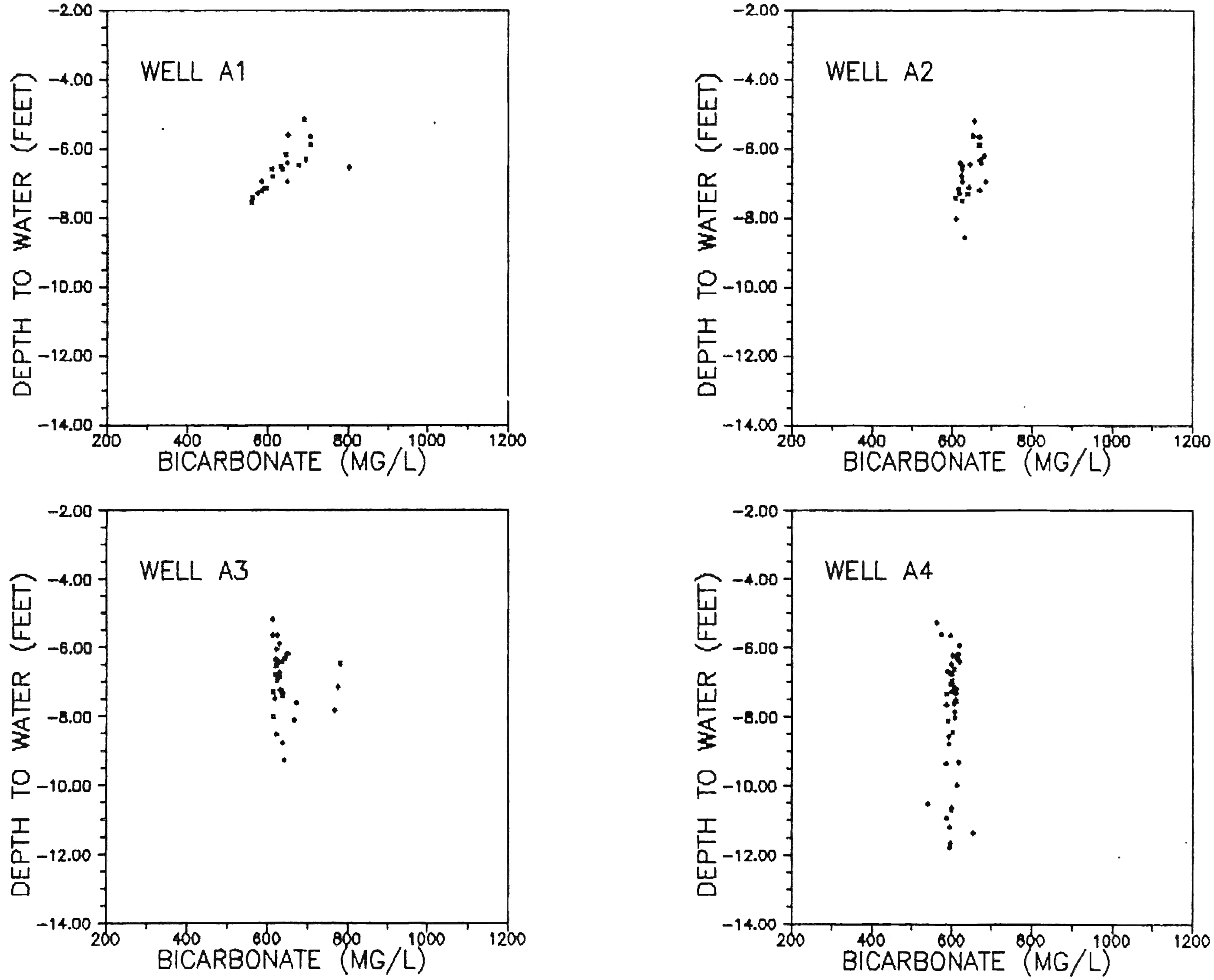


Figure 36. Bicarbonate vs Depth, A Wells.

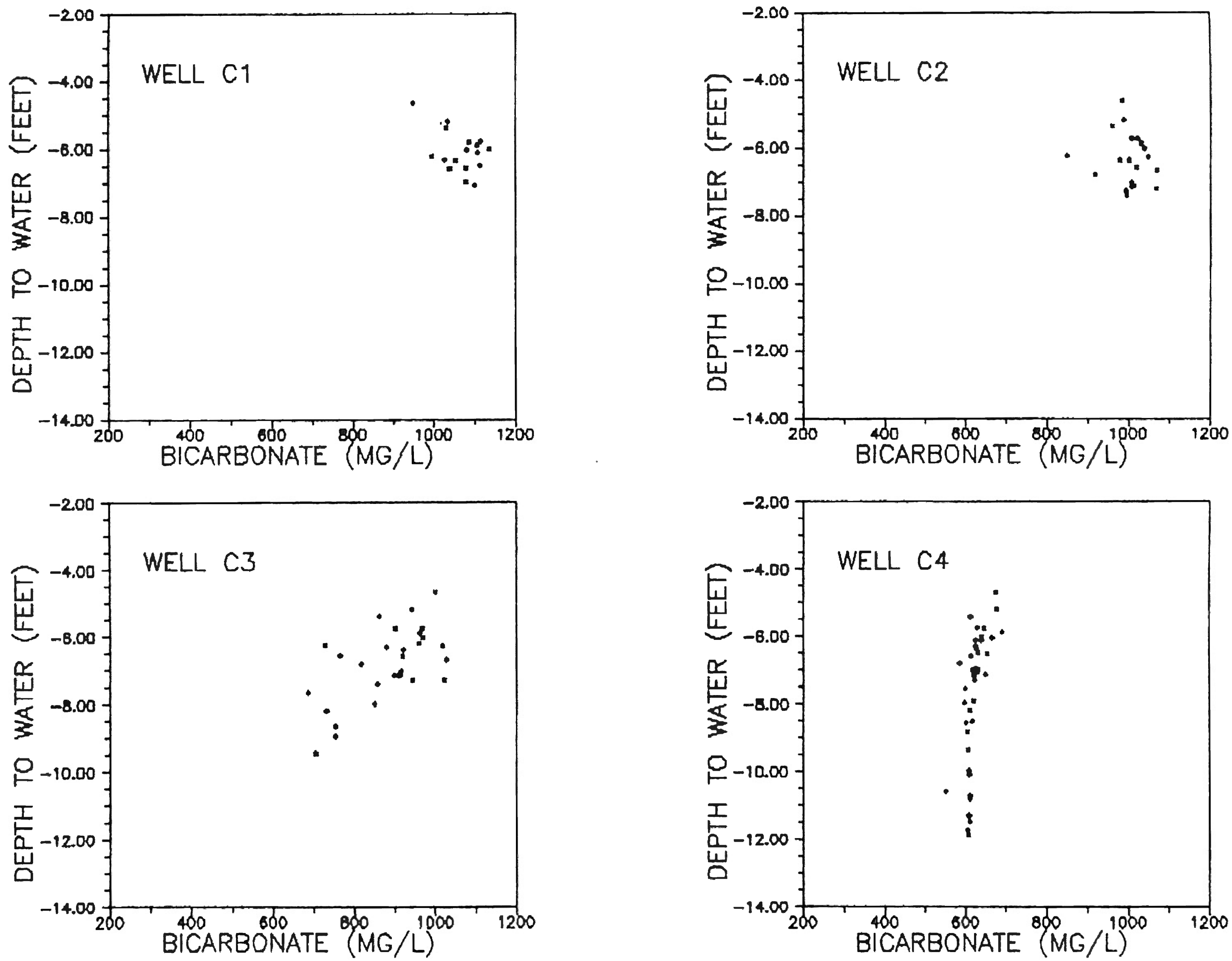


Figure 37. Bicarbonate vs Depth, C Wells.

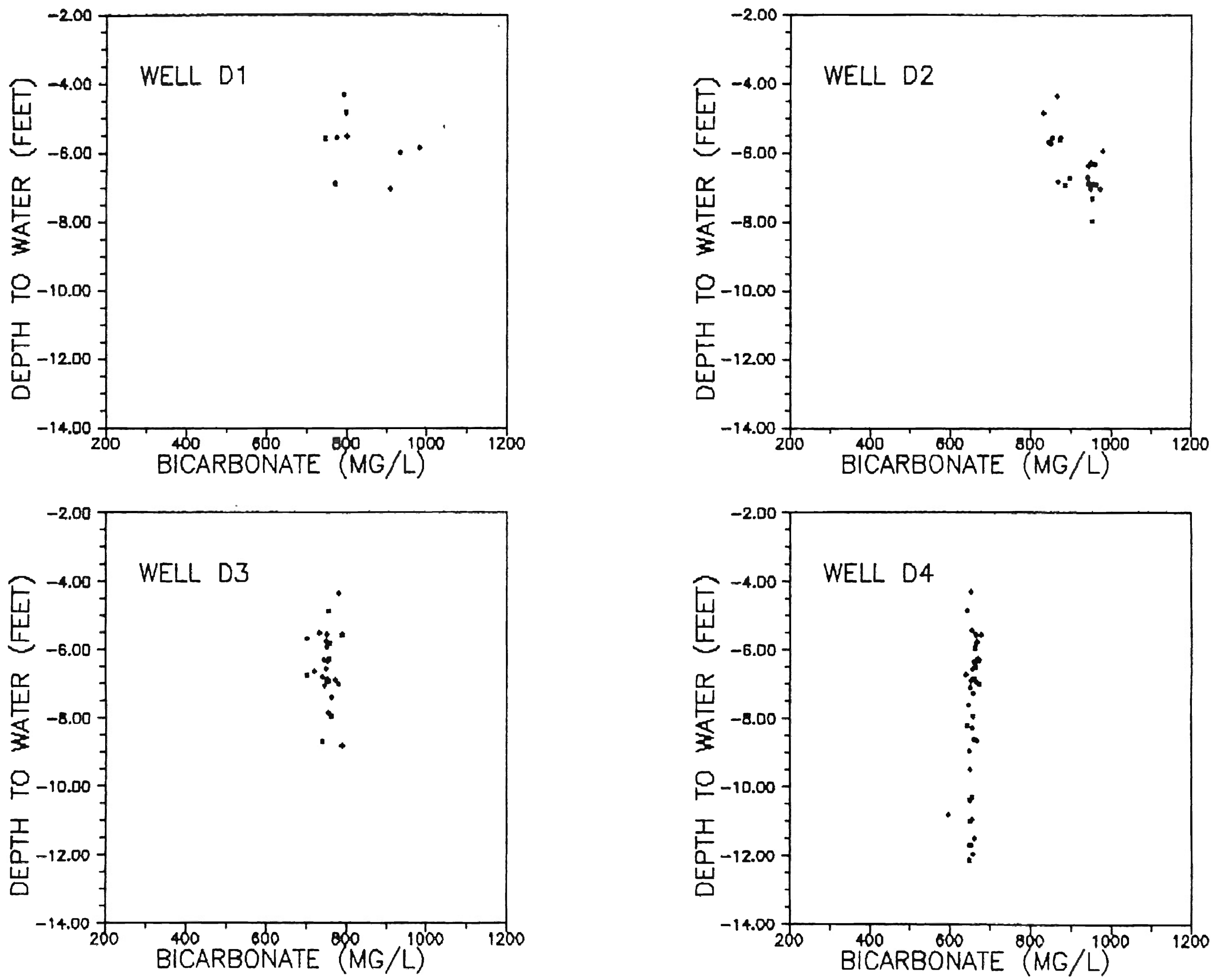


Figure 38. Bicarbonate vs Depth, D Wells.

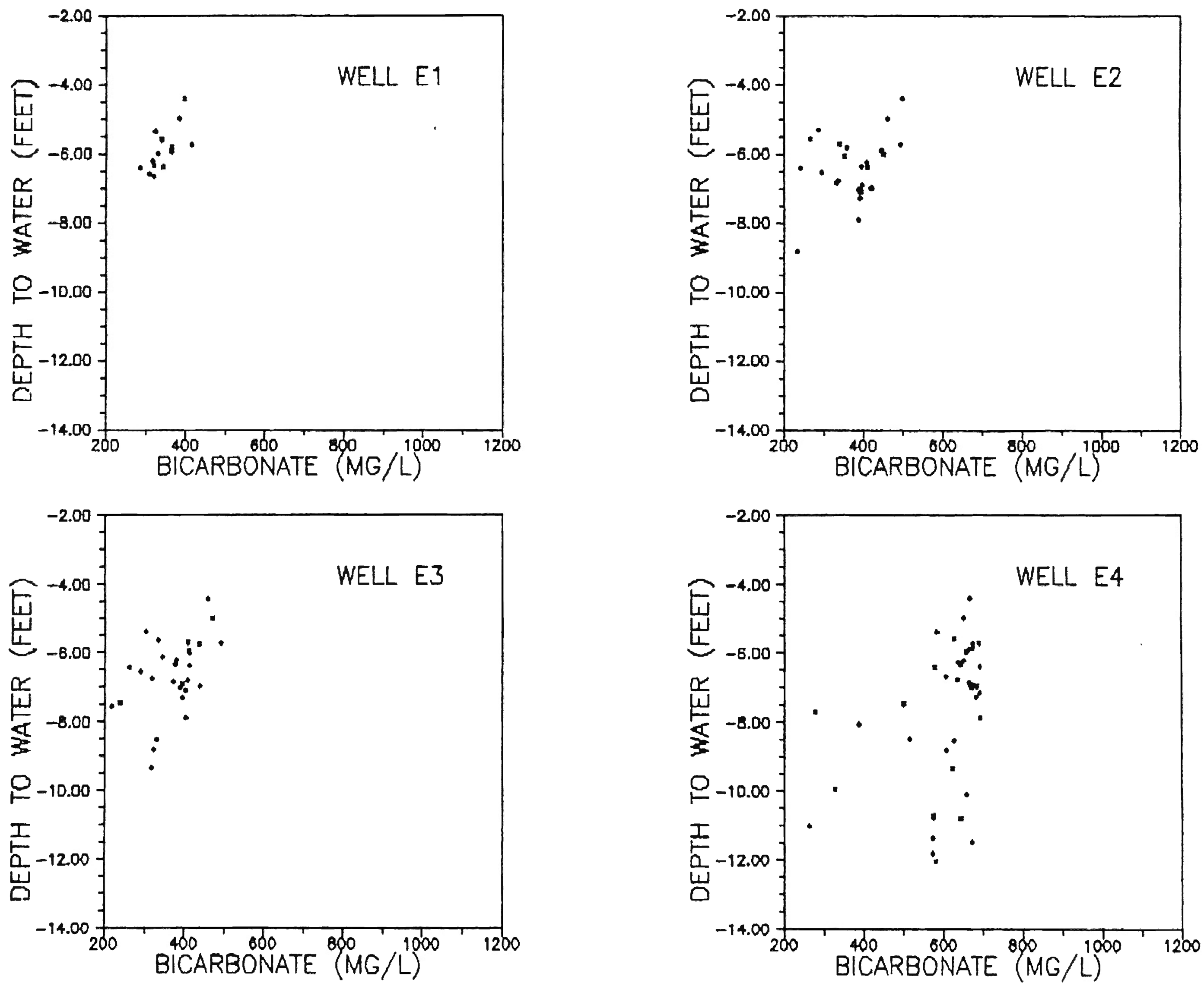


Figure 39. Bicarbonate vs Depth, E Wells.

feet in the soil profile at the A and F sites provides evidence that conditions have been favorable for carbonate precipitation at some of the well sites (Ross, 1987).

To quantify the carbonate solubility in the ground water, data from the complete analyses performed in January 1986 (Hagen, 1986) and April, May, June and July 1986 were entered into the U.S. Geological Survey computer model WATEQF (Plummer and others, 1976). WATEQF is an iterative program that uses mass balance equations to calculate saturation states of common minerals. The key number that WATEQF generates for each mineral is the log of the saturation index. The saturation index is defined as the ratio of the ion activity product to the mineral solubility product.

If the log of the saturation index for a mineral is zero, the solution is in equilibrium with respect to that mineral. If the log of the saturation index is positive, then the solution is oversaturated with respect to the mineral and the mineral may precipitate under favorable conditions. If the ratio is negative, the solution is undersaturated and the mineral may be dissolved.

The log values of the saturation index for calcite at the study area range between -1.0 and 1.0 indicating that the ground water is at or near equilibrium with respect to calcite (Tables II and III). It is important to recognize that WATEQF calculated the log of the saturation index by first calculating the carbonate ion concentration from the

TABLE II

LOG OF CALCITE SATURATION INDEX (S.I.)
A AND E WELLS

DATE	1/23/86	4/20/86	5/15/86	6/22/86	7/26/86
WELL A1					
pH	6.95	6.89	7.24	NO DATA	NO DATA
Log S.I.	0.1450	-0.0017	0.2647		
WELL A2					
pH	6.90	7.00	7.17	7.03	NO DATA
Log S.I.	0.1117	-0.0239	0.1875	0.0688	
WELL A3					
pH	6.95	7.06	7.33	7.58	NO DATA
Log S.I.	0.1180	0.0538	0.3116	0.3854	
WELL A4					
pH	7.00	6.97	NO DATA	6.64	6.65
Log S.I.	0.1072	-0.2225	0.1532	-0.4688	-0.5029
WELL E1					
pH	7.37	7.45	7.74	NO DATA	NO DATA
Log S.I.	-0.1030	-0.0844	-0.0603		
WELL E2					
pH	7.36	7.31	7.74	7.89	NO DATA
Log S.I.	-0.1115	-0.1156	0.2796	0.3643	
WELL E3					
pH	7.32	7.33	7.66	7.64	NO DATA
Log S.I.	-0.2340	-0.1278	0.3107	0.1479	
WELL E4					
pH	7.10	7.19	7.65	7.60	7.35
Log S.I.	-0.1362	-0.1086	0.3215	0.3162	-0.0094
DEPTH TO WATER	-7.60	-6.10	-7.00	-8.20	-10.90
PRIOR RAIN	0"	0.52"	0.15"	1.43"	0.56"
RAIN DATE	-----	4/17	5/14	6/14	7/12

TABLE III

LOG OF CALCITE SATURATION INDEX (S.I.)
C AND D WELLS

DATE	1/23/86	4/20/86	5/15/86	6/22/86	7/26/86
WELL C1					
pH	7.00	7.03	7.44	NO DATA	NO DATA
Log S.I.	-0.0840	-0.0185	0.3108		
WELL C2					
pH	6.78	7.02	7.38	7.50	NO DATA
Log S.I.	-0.2091	-0.0039	0.2910	0.3901	
WELL C3					
pH	6.96	7.03	7.36	7.43	NO DATA
Log S.I.	-0.1990	-0.0445	0.2448	0.2424	
WELL C4					
pH	6.96	7.03	7.49	7.38	7.17
Log S.I.	-0.2034	-0.1513	0.3013	0.2674	-0.0273
WELL D1					
pH	7.18	7.18	NO DATA	NO DATA	NO DATA
Log S.I.	0.2983	0.2836			
WELL D2					
pH	7.19	7.09	7.43	7.72	NO DATA
Log S.I.	0.3718	0.1886	0.5471	0.7784	
WELL D3					
pH	6.95	7.01	7.49	7.46	NO DATA
Log S.I.	-0.1008	-0.0968	0.4250	0.4550	
WELL D4					
pH	7.12	7.10	7.59	7.61	7.30
Log S.I.	-0.0510	-0.1291	0.3452	0.5418	0.0078
DEPTH TO WATER	-7.60	-6.10	-7.00	-8.20	-10.90
PRIOR RAIN	0"	0.52"	0.15"	1.43"	0.56"
RAIN DATE	-----	4/17	5/14	6/14	7/12

pH and the bicarbonate concentrations entered into the program. In addition, because there are no data on the concentration of CO_2 dissolved in the ground water, a value of zero for CO_2 was entered into the program. Therefore, WATEQF results should be regarded as approximations to carbonate solubility. Recognizing these limitations, the WATEQF results suggest that there may be a seasonal cyclic fluctuation in carbonate solubility that is in turn reflected in the ground-water chemistry. The solubility trends for the well sites are similar but each cluster has a slightly different chemical signature.

In January 1986 the ground water was undersaturated with respect to calcite in the C and E wells and the two deeper D wells and was oversaturated with respect to calcite in the A wells and two shallowest D wells. The spring rainy season began in early April 1986. On 17 April 0.56 inches of rain were recorded, and on 20 April samples were collected for complete analyses. Ground water in the A wells became undersaturated with respect to calcite, suggesting that infiltrating rain water diluted the ground water. The other wells, except for the two shallow D wells, were already undersaturated with respect to calcite; dilution effect is therefore difficult to discern. Although the log of the saturation index decreased slightly in the two shallow D wells, the ground water was still oversaturated with respect to calcite.

From April to June 1986 the water table dropped about two feet. Nearly 1.5 inches of rain fell on 14 June, eight days before the samples were collected for the June complete analysis. However, the average rainfall:rise ratio of 51 percent calculated for that event indicates that much of the rain did not reach the water table. Between April and June the ground water became oversaturated with respect to calcite in all wells but the 1 wells, which were dry, and Well A4. The fact that the calcite solubility continued to increase despite the prior rain suggests that the quantity of water that infiltrated to the water table was insignificant.

From mid June to mid July 1986 the water table dropped about 2.5 feet. Only the 14-foot wells were sampled for complete analyses on 26 July. Three rains occurred between the June and July analyses; 2.71 inches of rain were recorded from storms on 23 June and 1 July and 0.56 inches fell on 12 July, two weeks before the July samples were collected. The rains on 23 June and 12 July caused no rise in most of the 14-foot wells and the rainfall:rise ratio for the 1 July event was 44 percent.

Despite evidence that suggests that minor amounts of water actually reached the water table, WATEQF results indicate that carbonate solubility shifted substantially. Wells C4 and E4 became undersaturated with respect to calcite, Well D4 approached equilibrium and Well A4 remained undersaturated. In addition, bicarbonate and calcium concentrations measured in the 14-foot wells decreased slightly from June to July. These data suggest that rain water infiltrated through the unsaturated zone, perhaps through macropores, and diluted the ground water.

Cation Exchange

Anion chemistry has been useful to examine mechanisms that may affect the ground water at the individual well clusters. The cation chemistry may yield information regarding transport of ground water through the aquifer. Two bits of evidence suggest that cation exchange occurs as ground water flows from the relatively up-gradient A and E sites toward the down-gradient C and D wells.

The sodium:chloride ratio is higher in the shallow C and D wells than in the shallow A and E wells. Although the ratio is close to unity at the E site, there is roughly seven times more sodium than chloride in the shallow C wells. In addition, the inverse relationship between the calcium and sodium concentrations in the up-gradient and down-gradient wells suggests that cation exchange occurs as the ground water flows down gradient through the aquifer. Assuming travel distances of 60 to 100 feet between wells and an average interstitial flow velocity of 1.0 foot/day, the ground-water residence time as it flows across the field site is on the order of several months.

The cation exchange theory fits data collected from the shallower wells; however, it is not evident whether it is an important process affecting water quality in the 4 wells. As noted above, the A site appears to be the only well site at which cation exchange may occur with depth.

<u>Sewer Leakage</u>

The high chloride concentrations in the shallow C and D wells strongly suggest that the eight-inch sewer line, which crosses the field site near those wells, is leaking. The line is buried four to five feet below land surface and slopes to the west to drain into the main line that runs across the western edge of the site. The nine-inch storm in September-October 1986 may have damaged the lines because concentrations began to increase in late fall 1986. The maximum chloride concentration of 163 mg/l observed in this study was measured in Well D2 in February 1987.

Chloride concentration in Well D2 continued to rise after data collection for this study ceased, reaching 272 mg/l in mid May 1987 according to Dale Froneberger, an Oklahoma State University geology graduate student. Although the vertical gradients in the D wells had previously indicated upward water movement since the beginning of the project, the gradient reversed direction in mid April 1987 when the water table dropped below 5.3 feet. These data suggest that water began to flow out of the sewer line into the ground water when the water table declined below the base of the line.

Qualitative Statistical Analysis

Descriptive Statistics

Considerable variability has been observed in major constituents in the ground water sampled from the aquifer. The most obvious source of variation is related to the areal and vertical arrangement of the wells. Temporal variations also occur but they are more difficult to identify over the relatively short monitoring period. The ground water appears to be homogeneous with respect to conductivity and bicarbonate concentration at only one well cluster, the A site, within the 8000 ft^2 monitored area.

To better characterize the ground-water samples, descriptive statistics (mean, standard deviation, maximum and minimum) were generated for electrical conductivity, bicarbonate and chloride using the commercial software package MICROSTAT (Tables IV, V, VI). All available data were used, including those measured by Hagen (1986). Sample size (number of measurements) for electrical conductivity ranges from 41 to 113, for bicarbonate, 10 to 48, and for chloride, 15 to 52.

Two important conclusions may be drawn from these simple statistics. The most obvious inference is that the variation in mean concentrations is qualitatively significant. One hardly need perform sophisticated analysis to suppose that a mean conductivity of 614 micromhos/cm (Well E1) does not represent the same population as a sample with

TABLE IV

DESCRIPTIVE STATISTICS AND CHI SQUARE RESULTS FOR ELECTRICAL CONDUCTIVITY

WELL	MIN (#)	MAX (#)	MEAN (#)	s (#)	n	NORMAL @ 95%?
A1	650	1210	1045	85	55	P = 2.4E-2 *
A2	924	1280	1055	62	68	YES
A3	907	1455	1050	72	75	YES
A4	840	1160	987	64	113	YES
C1	1411	1979	1678	131	51	YES
C2	1196	1768	1509	128	56	YES
C3	990	1800	1339	165	78	P = 5.0E-3 **
C4	862	1208	1024	62	111	P = 7.0E-6 **
D1	1157	1881	1512	187	41	YES
D2	1335	1879	1572	133	55	YES
D3	1080	1904	1292	140	68	P = 5.0E-4 **
D4	1008	1329	1149	62	111	YES
E1	437	720	614	62	53	YES
E2	255	879	617	143	66	YES
E3	284	875	603	150	73	YES
E4	508	1433	1005	234	108	P = 1.9E-4 **

(#) = MICROMHOS/CM

s = STANDARD DEVIATION n = NUMBER OF SAMPLES

* SIGNIFICANT AT 95% LEVEL ** SIGNIFICANT AT 99% LEVEL

TABLE V

DESCRIPTIVE STATISTICS AND CHI SQUARE RESULTS
FOR BICARBONATE CONCENTRATIONS

WELL	MIN (#)	MAX (#)	MEAN (#)	s (#)	n	NORMAL @ 95%?
A1	560	802	637	61	21	YES
A2	607	685	639	24	26	P = 2.6E-2 *
A3	613	781	646	44	33	P = 2.3E-6 **
A4	561	653	601	14	47	YES
C1	950	1137	1069	49	18	YES
C2	848	1341	1017	91	24	P = 3.9E-3 **
C3	686	1028	877	98	32	YES
C4	551	691	619	26	48	P = 3.5E-2 *
D1	746	982	845	86	10	YES
D2	832	1016	920	52	24	P = 2.2E-3 **
D3	703	1056	764	59	30	P = 4.3E-7 **
D4	595	742	658	18	47	P = 6.4E-3 **
E1	285	414	347	36	16	YES
E2	232	497	373	69	28	YES
E3	217	491	368	65	32	YES
E4	262	692	593	109	47	P = 2.5E-4 **

(#) = CONCENTRATION IN MG/L

s = STANDARD DEVIATION n = NUMBER OF SAMPLES

* SIGNIFICANT AT 95% LEVEL ** SIGNIFICANT AT 99% LEVEL

TABLE VI

DESCRIPTIVE STATISTICS AND CHI SQUARE RESULTS FOR CHLORIDE CONCENTRATIONS

WELL	MIN (#)	MAX (#)	MEAN (#)	s (#)	n	NORMAL @ 95%?
A1	20.0	40.8	26.9	5.1	23	P = 3.4E-3 **
A2	17.5	49.2	26.1	6.5	30	YES
A3	16.5	32.4	23.4	4.4	34	YES
A4	16.2	38.3	23.8	5.6	52	YES
C1	18.4	83.5	42.9	20.8	23	P = 5.5E-4 **
C2	17.0	43.9	27.1	8.4	27	P = 4.7E-2 *
C3	18.7	54.6	27.5	8.3	33	P = 6.4E-4 **
C4	16.3	33.1	24.8	3.9	52	YES
D1	34.7	82.7	53.6	12.1	15	YES
D2	37.0	163.0	60.9	35.7	27	P = 4.5E-7 **
D3	28.8	45.8	38.3	3.7	30	YES
D4	23.5	46.7	35.1	5.6	50	YES
E1	4.4	14.8	9.3	2.7	24	YES
E2	7.8	22.3	12.7	3.2	29	YES
E3	9.5	26.3	15.1	4.2	34	YES
E4	11.2	44.4	29.9	8.2	50	YES

(#) = CONCENTRATION IN MG/L

s = STANDARD DEVIATION n = NUMBER OF SAMPLES

* SIGNIFICANT AT 95% LEVEL ** SIGNIFICANT AT 99% LEVEL

a mean conductivity of 1678 micromhos/cm (Well C1). Both water samples represent background water quality at the monitored site. Yet, if the down-gradient C well were compared to the up-gradient E well using a Student's t test, then the C well would likely "fail" the test and would be considered to be contaminated.

The second conclusion is that sample variances may differ significantly. Variance is the square of the standard deviation. It is analogous to a yardstick and provides the scale with which to compare sample means. The basic assumption underlying statistical tests that compare means, such as Student's t test or analysis of variance, is that the variances of the populations that have been sampled are equal, or homogeneous.

Homogeneity of variances may be tested using procedures such as Bartlett's test or Cochran's test (Dixon and Mässey, 1969). Cochran's test is designed for the situation when one variance in a group of samples to be compared is much larger than the other variances. The C statistic is easily computed as:

$$C = \text{largest } s_i^2 \, / \, \text{Sum } (s_i^2) \qquad (4.4)$$

where s_i^2 is an individual sample variance. The C value is compared with a table of values that are significant at the 95 and 99 percent levels. If the calculated value exceeds the number in the table, then there is little evidence to support the hypothesis of equal variances.

As an example, consider the variances of the chloride data in the 1 wells. If one desired to compare the chloride means in those wells using an analysis of variance test, he would first examine the variances for homogeneity. The variances are 25.86, 431.88, 146.74, and 7.06 for wells A1, C1, D1 and E1, respectively. The calculated C value is equal to 431.88 divided by 611.54, which is 0.7062. The C value at the 99 percent level for a group of four samples, each with 16 degrees of freedom, is 0.4884 (see Dixon and Massey, 1969, p. 537). The calculated value exceeds 0.4884. Therefore, one cannot support the hypothesis that the variances of the populations are equal; results of statistical tests comparing the chloride means for these wells will be compromised.

Test for Normal Distribution

In addition to homogeneity of variances, comparison of ground-water samples using Student's t test requires that the samples be taken from a population that is normally distributed (Steel and Torrie, 1980). To determine whether the electrical conductivity, bicarbonate and chloride data represent populations with normal distributions, Chi square tests were performed on each well sample using MICROSTAT (Tables IV, V, VI, last column).

When all data points are included in the tests, the Chi square statistic for about one quarter of the samples for each chemical parameter is significant at the 95 or 99 percent level. A significant Chi square value indicates that there is little evidence to support the hypothesis that the population distribution is normal. To avoid drawing conclusions that hinge upon one or two anomalous data points, samples with significant Chi square values were next examined for odd points attributable to analytical error.

The bicarbonate data are most subject to obvious analytical errors due to the titration equipment used in the early days of the monitoring period. No values were eliminated from data sets for wells A2, D2 or E4. Two low points were deleted from the Well C4 data set and the Chi square test was performed again; the new Chi square value is significant at the 99 percent level. However, after omission of one to three points from data sets for wells A3, C2, D3 and D4, the Chi square values are no longer significant. The data were omitted on the basis of highly negative cation/anion balances or on the basis of samples analyzed immediately before and after the questionable points. In general one must be exceedingly cautious about deleting data. This exercise demonstrates the care that must be taken in both the laboratory and the computer room.

The anomalous chloride values in wells C1, C2, C3 and D2 were all attributed to sewer contamination. None was omitted from the data sets and the Chi square results stand as presented in Table VI. Well A1, with a Chi square value significant at the 97.6 percent level, has one conductivity value that is 200 micromhos/cm lower than the other data points. When that single point was deleted from the data set and the Chi square test rerun, the results suggest that the distribution is normal.

The non-normal distributions for the samples that survived the scrutiny for bad data points are either positively skewed with a tail of high concentrations, negatively skewed with a tail of low concentrations or are polymodal. These data illustrate some of the conditions that commonly affect shallow aquifers. For example, the effect of flushing and dilution in Well E4 after rains is reflected in the trimodal distribution of electrical conductivity. The statistical results discussed above are important because they demonstrate that the distributions of chemical parameters in shallow aquifers must not be considered a priori to be normal.

Recommendations for Additional Research

Characterize Anion Geochemistry

This study has established a data base for some of the major chemical constituents in the ground water at the field site. Chemical and hydraulic evidence suggests that sewer leakage contaminates the shallow ground water. To further characterize the effects of the urban environment, samples from all monitoring wells should be analyzed on a regular basis for nitrate, chloride, fluoride and sulfate using an ion chromatograph. Within the constraints of the available resources, samples should be collected and analyzed so that valid statistical techniques may be applied to the data.

Analyze Composite Wells

Ground water analyzed from the 14-foot composite wells appears to be a mixture of the waters sampled from the other wells in each cluster, as well it should. Sets of simultaneous equations may be solved using computer programs to calculate the percentage of water contributed by the 8-, 9-, 10- and 14-foot horizons. These calculations may yield information of the degree of homogeneity and stratification of the aquifer.

Perform Rigorous Statistical Tests

Results of this study suggest that rigorous statistical tests should be performed to compare sample variances and means. Both parametric tests, such as Student's t test and analysis of variance, and non-parametric tests, such as the Mann-Whitney test, should be used to analyze the data. Results of these tests should be compared to determine which is most effective for use with data collected from shallow aquifers.

CHAPTER V

AQUIFER PERFORMANCE

Introduction

Aquifer Testing Methods

Several constant-rate aquifer tests were conducted to determine transmissivity, hydraulic conductivity and storativity. All tests involved pumping water from one well and measuring drawdowns in observation wells. The available variety of monitoring well placement allowed considerable flexibility in designing the aquifer tests.

In spring 1986 three separate tests were performed at the A, C and E sites as part of a graduate class project. Water was pumped from the 14-foot composite well at each site and drawdown measured in the other wells in the same cluster. The wells were pumped with a peristaltic pump at rates of 0.32 to 0.72 gpm. Length of pumping was 60, 140 and 620 minutes for the A, C and E sites, respectively. Hagen (1986) reported his interpretations of these tests and a test performed at the D site.

In late October 1986 the composite E5 well was pumped at an average rate of 1.07 gpm with the peristaltic pump for 4254 minutes (70 hours, 54 minutes). The U.S. Environmental Protection Agency's Robert S. Kerr Environmental Research Laboratory furnished several In Situ electrical pressure transducers that were connected to a computer that recorded drawdowns in the E wells. Periodic hand measurements were made with chalked steel tape in the E wells and the other 14-foot composite wells. Water was discharged into the street where it flowed into a storm drain. The test was terminated after three days due to severe leakage from damaged tubing in the pump heads.

In early March 1987 the 40-foot F1 well was pumped for 4200 minutes (70 hours) at an average rate of 4.4 gpm with an electrical centrifugal suction lift pump. Drawdowns were measured with chalked steel tapes in wells A5 and B4 at regular intervals and in wells C5, D5 and E5 periodically. Water levels were measured in wells B4 and E5 during the recovery period.

In mid May 1987 Well F1 was pumped for 765 minutes (12 hours, 45 minutes) at an average rate of 4.0 gpm with the centrifugal suction lift pump. Drawdowns were measured regularly with chalked steel tapes in wells C5 and E5 and occasionally in wells A5, B4 and D5. The pump failed around midnight terminating the test; no recovery data were measured.

<u>Data Interpretation Methods</u>

One assumption underlying equations commonly used to interpret data from confined aquifers is that aquifer transmissivity remains constant during the test. In unconfined aquifers saturated thickness and transmissivity decrease when sediments in the cone of depression around the pumping well dewater. However, interpretation techniques designed to analyze artesian aquifers may be applied to unconfined aquifers if drawdown data are first corrected for water table conditions. Therefore, all drawdown data were corrected using the equation:

$$s' = s - [s^2 / (2 * m)] \qquad (5.1)$$

where s' is the equivalent artesian drawdown, s is the observed drawdown, and m is the initial saturated thickness penetrated by the observation well (Jacob, 1944).

In addition to correcting for decreasing saturated thickness, drawdown data for tests longer than two hours were adjusted for daily water-level decline. Average daily decline was calculated from water levels measured several days before and after each test, using least squares regression to project a straight line decline during the test period. Original and corrected drawdown data are tabulated in Appendix E along with interpreted graphs.

To calculate aquifer transmissivity and storativity, five techniques were investigated. Theis (1935), Jacob (1946) and Franke (1987) devised methods to analyze confined aquifers, which may be used to interpret corrected water table data under certain conditions. Prickett (1965) and Neuman (1975) developed specific techniques to solve water-table problems.

The Theis equation is used to analyze confined aquifers under non-equilibrium conditions (Theis, 1935). The equations for transmissivity and storativity are based upon two dimensionless parameters, u and W(u). To solve Theis's equation graphically, drawdown is plotted against time on a log-log scale, a type curve matched to the data, and a match point chosen. Transmissivity, in gpd/ft, and storativity are calculated by the equations:

$$T = \frac{114.6 * Q * W(u)}{s} \qquad (5.2)$$

$$S = \frac{T * u * t}{2693 * r^2} \qquad (5.3)$$

where Q is pumping rate in gpm, W(u) and u are the coordinates of the match point on the type curve, s and t are the drawdown and time coordinates of the match point on the graphed curve, and r is the distance between the pumping and observation wells.

The Jacob straight-line method is based on Theis's equation and may be applied to that part of the cone of depression in which steady-shape conditions have been reached (Jacob, 1946; Cooper and Jacob, 1946). This condition is met when the value of u is less than 0.05, which occurs when distance from the pumping well is small or length of pumping time is large. To interpret the data, drawdown is plotted against time on a log-linear scale, a straight line fit to the data and the equations are solved:

$$T = \frac{264 * Q}{\text{delta } s} \qquad (5.4)$$

$$S = \frac{T * t_o}{4790 * r^2} \quad (5.5)$$

where Q and r are as defined above, delta s is the change in observed drawdown over one log cycle and t_o corresponds to the time when the extended straight line intersects the time axis.

Franke's technique is based on the Theis non-equilibrium equation, but uses three dimensionless parameters to solve the equations for transmissivity and storativity, instead of two (Franke, 1987). The three dimensionless parameters are sT/Q, Qt/sr^2, and S, where s is drawdown, T, transmissivity, Q, pumping rate, t, time, r, distance from the pumping well and S, storativity. A type curve is constructed by plotting values of sT/Q and Qt/sr^2 corresponding to u and W(u) for a given value of storativity (Figure 40).

To interpret the data, the quantity Qt/sr^2 is calculated using corrected drawdown data and is plotted against drawdown on a log-log scale. As with the Theis method, Franke's type curve is overlain on the log-log plot and matched to the observed data. The equations used to calculate transmissivity and storativity are:

$$T = (Q / s \text{ (field plot)}) * (sT/Q) \text{ (type curve)} \quad (5.6)$$

$$S = \frac{(Qt/sr^2) \text{ (field plot)}}{(Qt/sr^2) \text{ (type curve)}} \quad (5.7)$$

where "field plot" designates the values on the observed data graph and "type curve" refers to the values on the type curve corresponding to the match point. According to

Franke (1987), one of the advantages of his method over the Theis curve-matching technique is that his type curve need be slid in only one direction, instead of two, in order to match the data.

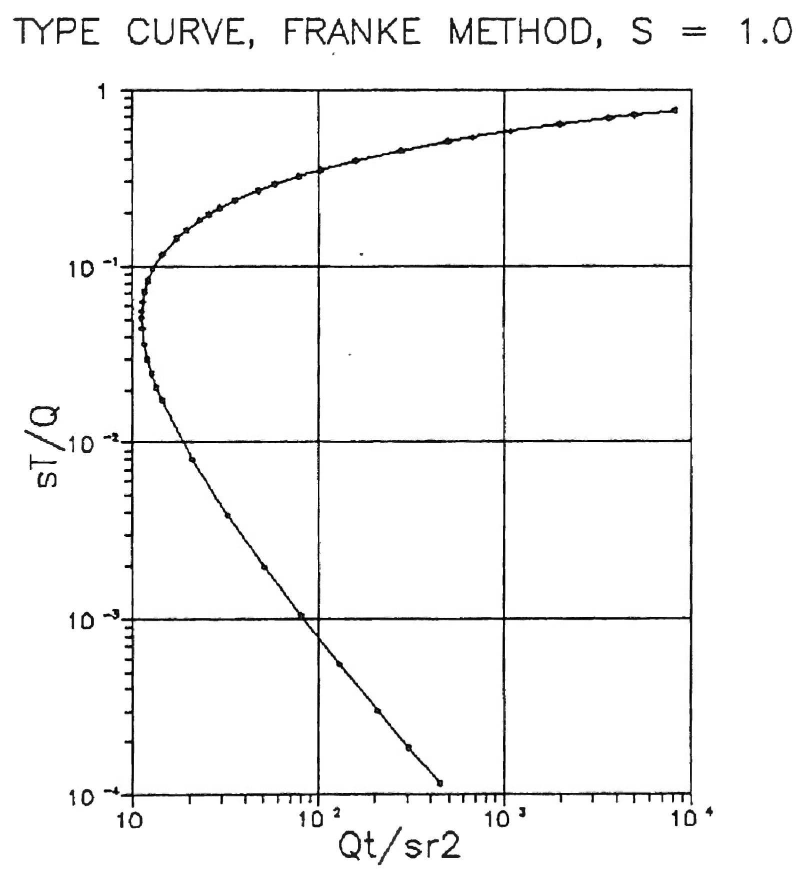


Figure 40. Type Curve, Franke Method, S = 1.0.

The Theis, Jacob and Franke methods may be used to interpret early corrected time-drawdown data in unconfined aquifers. However, most water-table aquifers violate the assumption that all water is discharged instantaneously from ground water storage resulting in drawdown of the potentiometric surface. In unconfined systems the upper part of the aquifer within the cone of depression is actually dewatered. The phenomenon of delayed yield due to gravity drainage affects both shape and interpretation of the observed time-drawdown curve.

If a test is sufficiently long for the delayed yield effect to dissipate, the Prickett (1965) and Neuman (1975) techniques may be used to analyze water-table aquifers. Time-drawdown data are plotted on a log-log scale, and a family of type curves is matched to both the early and late data. Equations similar to Theis's are used to calculate transmissivity and storativity. Transmissivity values calculated from the early and late data should be similar. However, storativity estimated from data measured before gravity drainage ends will be one or two orders of magnitude too low (Driscoll, 1986). Therefore, storativity must be calculated from the late data only.

In addition to measuring drawdowns while pumping, water levels were measured during the recovery period of the March 1987 test. Recovery data were interpreted using techniques outlined in Driscoll (1986). Residual drawdown is calculated as the difference between what the water level would have been without pumping and the observed water level during recovery (Figure 41). Residual drawdown is plotted against the ratio of time since pumping started to time since pumping stopped on a log-linear scale. Transmissivity is calculated using the Jacob equation.

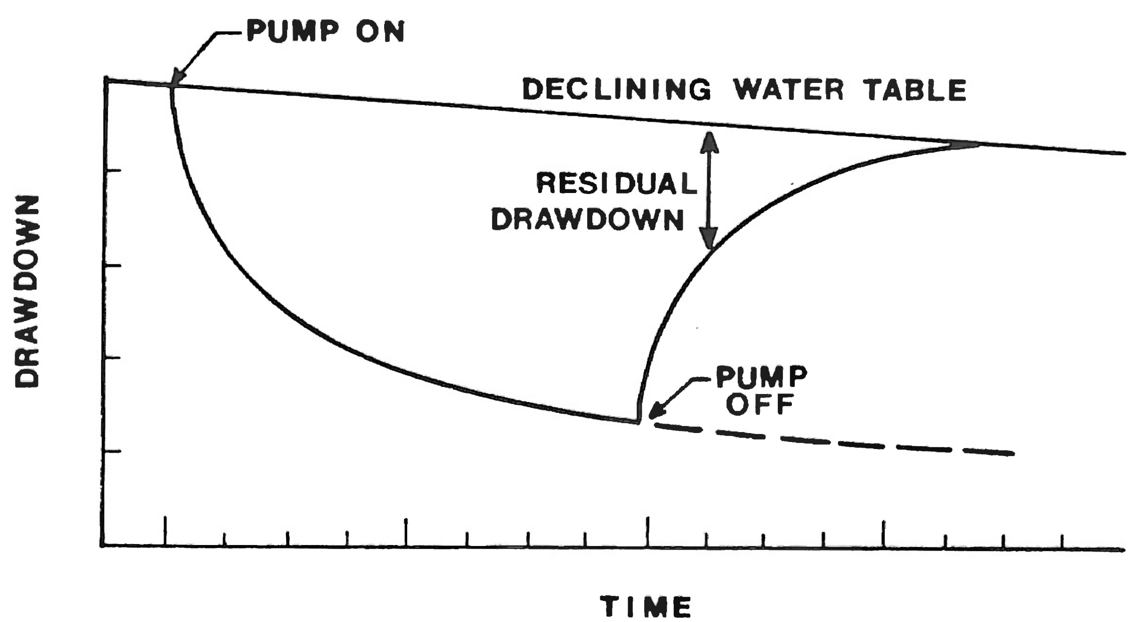


Figure 41. Water Levels During Pumping and Recovery. Modified from Driscoll (1986).

Interpretation of time-drawdown graphs yields information about the aquifer in the immediate vicinity of a given observation well. In addition to plotting time against drawdown for one well, drawdowns recorded at a given time in all observation wells may be plotted against distance from the pumping well. Analysis of distance-drawdown graphs yields an average value of transmissivity for that portion of the aquifer within the cone of depression. Both the Theis and Jacob methods may be used to calculate transmissivity from distance-drawdown graphs.

Pitfalls of Data Interpretation

Transducer Error

Drawdown data recorded by transducers in the October 1986 test do not correspond to water levels measured by hand with chalked steel tape. The wiring for the transducers was strung about 50 feet from the E wells to the main computer sheltered under the patio roof. The lines were subjected to daily temperature changes. In addition, field personnel occasionally stepped on and tripped over the wires. Undoubtedly field performance would be improved by locating the transducer receivers as close as possible to the test site, especially where the hydrogeologist anticipates very small drawdowns. Calculation of transmissivity and storativity using a distance-drawdown graph based on hand measurements is the only interpretation attempted for the October 1986 test data.

Departures from Ideal Drawdown Curves

Corrected drawdowns measured in all tests range from 0.12 to 1.07 feet. Nearly all the time-drawdown data deviate from the Theis type curve after 10 to 500 minutes depending on the distance from the pumped well; less drawdown occurs than predicted by the type curve (Figures 42, 43). There are two possibilities why these data do not conform to the predicted curve. Delayed yield caused by gravity drainage of the sediments in the cone of depression may begin very soon after pumping starts and may last for several days (Walton, 1960). In addition to causing gravity drainage from above, pumping may induce leakage from underlying strata.

The drawdowns observed when Well F1, which penetrates nearly the entire aquifer thickness, was pumped in March and May 1987 are probably influenced by delayed yield. Deviation from the expected curve occurs later in time at the more distant observation wells as the cone of depression spreads. In addition, the storativity calculated from early data are an order of magnitude too small, which is a clear indication of delayed yield (Driscoll, 1986).

The effect of delayed yield limits data interpretation. Gravity drainage did not dissipate after pumping Well F1 at 4.4 gpm for 70 hours in March 1987. Either pumping time was too short or the pumping rate was not high enough to sufficiently stress the aquifer. Because gravity drainage continued for the entire test period, application of the Prickett (1965) and Neuman (1975) methods to data interpretation proved fruitless. Therefore, transmissivity and storativity were calculated by the Theis (1935), Jacob (1946) and Franke (1987) methods using early data.

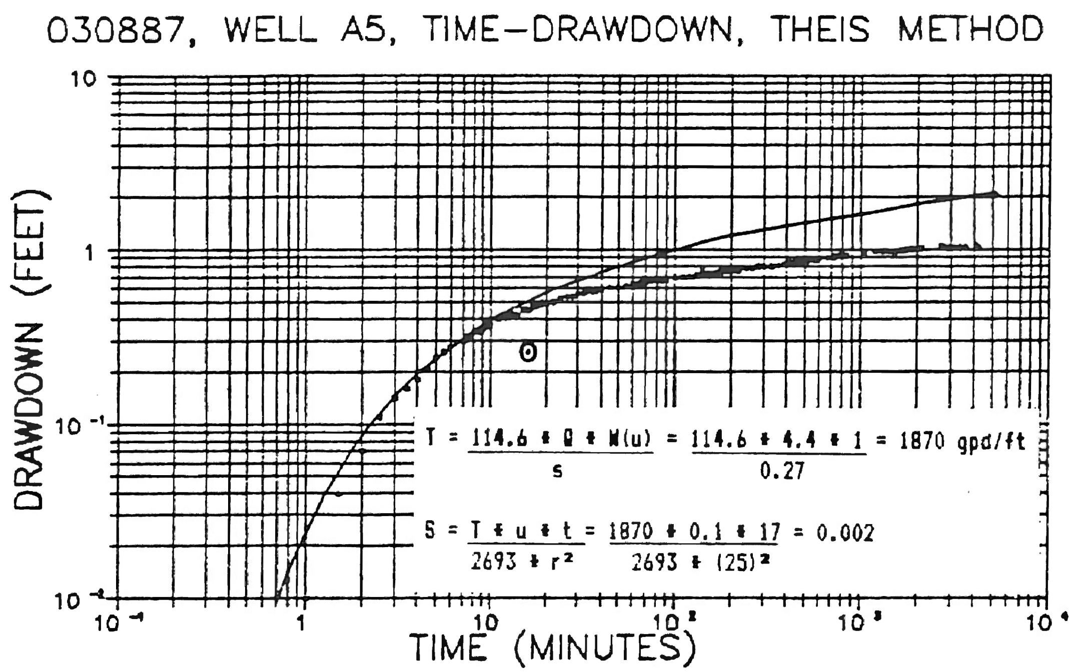


Figure 42. Well A5, March 1987, Deviation from Theis Type Curve after Pumping 12 Minutes.

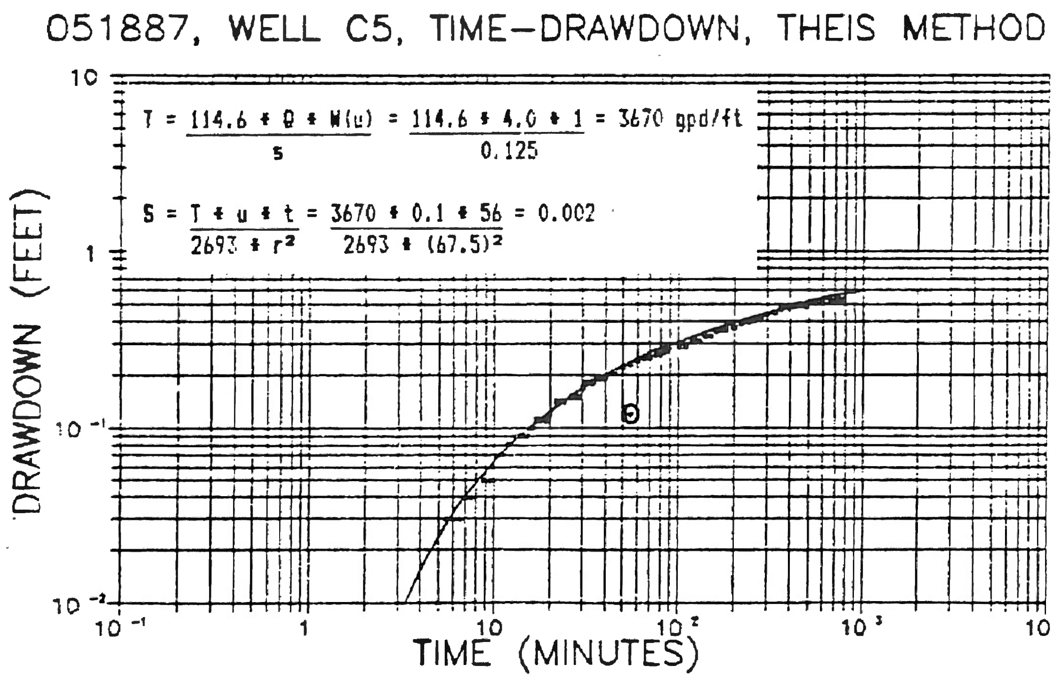


Figure 43. Well C5, May 1987, Deviation from Theis Type Curve after Pumping 500 Minutes.

Anomalous drawdown curves observed when the 14-foot composite wells were pumped in 1986 are probably due to induced leakage. Calculated storativity in the 8-, 9- and 10-foot wells is unrealistically large, sometimes greater than unity, suggesting recharge from underlying horizons.

Aquifer Coefficients

Transmissivity

When the 14-foot 5 wells were pumped in spring 1986, the average transmissivity ranged from 190 gpd/ft in Well A4 to 695 gpd/ft in Well E4 (Table VII). Initial water levels in the 4 wells were 7.5, 7.3 and 6.4 feet below land surface for the A, C and E tests, respectively. Therefore, the penetrated saturated aquifer thickness ranged from 6.5 to 7.6 feet. Transmissivity is lower in these tests than in the spring 1987 tests in which Well F1 was pumped because Well F1 penetrates a greater aquifer thickness than the 5 wells.

When Well F1 was pumped for 4200 minutes in March 1987, average transmissivity varied from 1450 gpd/ft in Well B4 to 4930 gpd/ft in Well D5 (Table VIII). Initial water levels ranged from 3.7 feet below land surface in Well D5 to 4.9 feet below land surface in Well A5. Therefore, penetrated saturated aquifer thickness ranged from 35.1 to 36.3 feet.

When Well F1 was pumped for 765 minutes in May 1987, average transmissivity values calculated for wells C5 and E5 were 3775 gpd/ft and 4375 gpd/ft, respectively (Table IX). Penetrated saturated aquifer thickness in both wells was 32.5 feet. Although saturated thickness was somewhat greater in March 1987 than in May 1987, the transmissivity values calculated for the March test for wells C5 and E5 agree closely with values determined for the May test.

Although transmissivity values calculated from the pumping periods of different tests are similar for the same wells, transmissivities estimated using pumping and recovery data from the March 1987 test are somewhat variable (Table VIII). The average transmissivity value calculated from the pumping period in Well B4 is roughly 90 percent of the transmissivity estimated from the recovery data. However, the transmissivity value calculated from the pumping data for Well E5 is two thirds the value determined using the recovery period data.

The apparent difference in transmissivities calculated using pumping and recovery period data may be related to hysteresis. According to Hillel (1971, p. 67), the hysteresis effect observed in cyclic wetting and drying is more pronounced in coarse-textured rather than fine-grained soils. In addition, although the pumping rate may vary during the pumping period of the test, it is, of course, zero during the recovery period.

Transmissivity apparently increases across the field site from west to east (Figure 44). Calculated trans-

TRANSMISSIVITY MAP
MARCH 1987

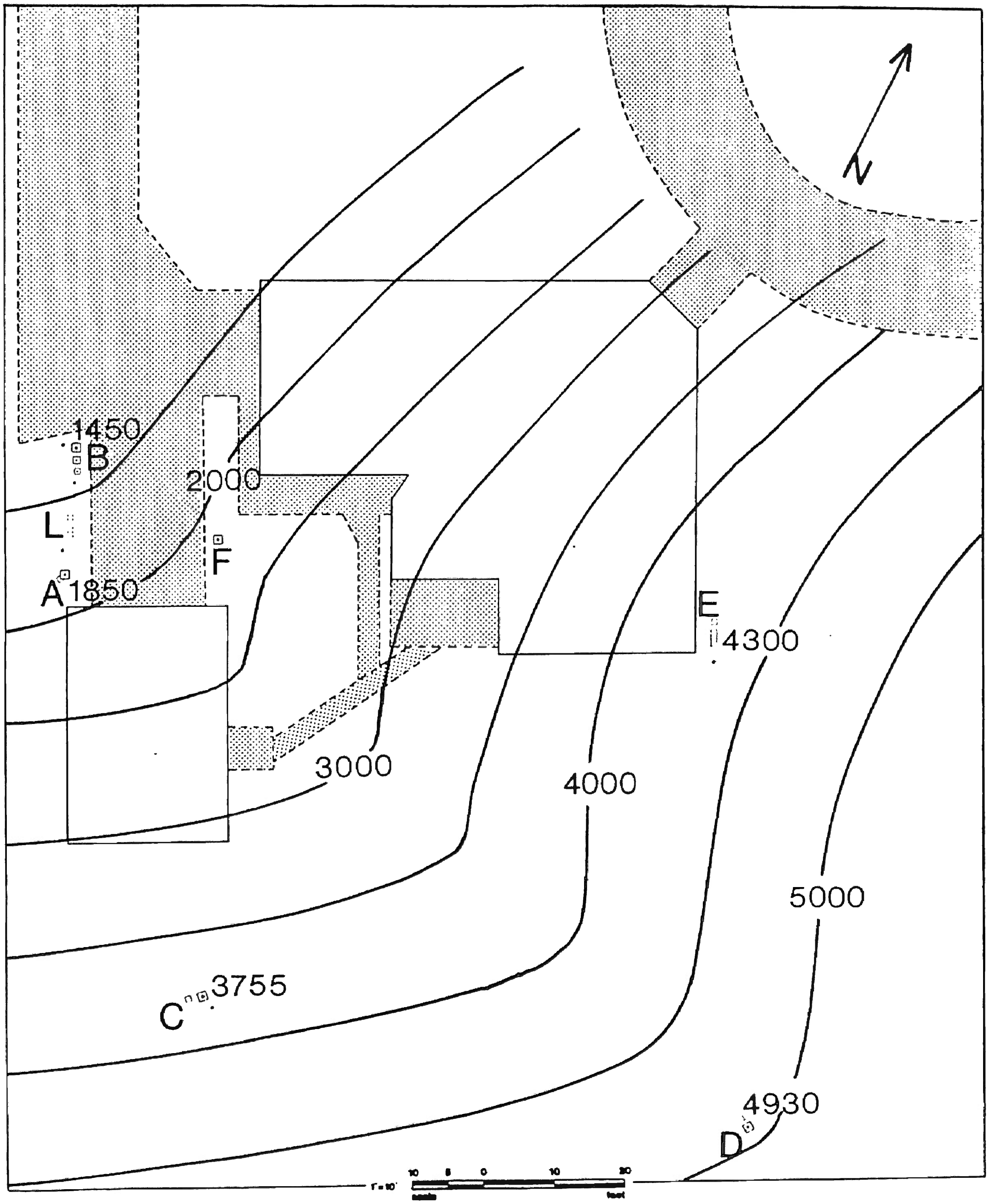


Figure 44. Transmissivity Map, March 1987.
Transmissivity in gpd/ft.

missivity is substantially higher at the E site regardless of which well, F1 or E5, has been pumped. Particle size analyses from land surface to 14 feet indicate that the sand fraction is greater at the D and E sites than at the F site, according to Michael Nelson, an Oklahoma State University geology graduate student. The particle size data suggest that the increase in transmissivity to the east is due to increasing grain size and permeability.

TABLE VII

RESULTS OF AQUIFER TESTS, TIME-DRAWDOWN DATA

SPRING 1986

WELL	DATE	T gpd/ft	S	K gpd/ft^2	Pumped Well	Q gpm	t min
A4	03/22/86				A5	0.32	60
	THEIS	165	0.11	27			
	JACOB	256	0.09	41			
	FRANKE	155	0.13	25			
	MEAN	190	0.11	31			
C4	03/27/86				C5	0.61	140
	THEIS	175	0.07	24			
	JACOB	270	0.05	37			
	FRANKE	155	0.07	21			
	MEAN	200	0.06	27			
E4	04/29/86				E5	0.72	620
	THEIS	690	0.38	103			
	JACOB	790	0.30	118			
	FRANKE	610	0.42	91			
	MEAN	695	0.37	104			

TABLE VIII

RESULTS OF MARCH 1987 TEST, TIME-DRAWDOWN DATA

DATE: 03/8-11/87

PUMPED WELL: F1
RATE: 4.4 GPM
TIME: 4200 MINUTES

WELL		T (GPD/FT)	S	K (GPD/FT^2)
A5	THEIS	1870	0.002	49
	JACOB	2470	0.001	65
	FRANKE	1220	0.002	32
	MEAN	1850	0.002	49
B4	THEIS	1400	0.013	37
	JACOB	1735	0.010	45
	FRANKE	1220	0.014	32
	MEAN	1450	0.012	38
C5	THEIS	3880	0.002	100
	JACOB	3630	0.005	94
	FRANKE	NOT APPLICABLE-LITTLE EARLY DATA		
	MEAN	3755	0.004	97
D5	THEIS	4585	0.008	117
	JACOB	5280	0.007	134
	FRANKE	NOT APPLICABLE-LITTLE EARLY DATA		
	MEAN	4930	0.008	125
E5	THEIS	NOT APPLICABLE- LITTLE EARLY DATA		
	JACOB	4300	0.003	110
	FRANKE	NOT APPLICABLE-LITTLE EARLY DATA		
	MEAN	4300	0.003	110

RECOVERY DATA	T (GPD/FT)	S	K (GPD/FT^2)
B4	1590	-----	42
E5	6830	-----	175

TABLE IX

RESULTS OF MAY 1987 TEST, TIME-DRAWDOWN DATA

DATE: 05/18/87

PUMPED WELL: F1
RATE: 4.0 GPM
TIME: 765 MINUTES

WELL		T (GPD/FT)	S	K (GPD/FT^2)
C5	THEIS	3670	0.002	103
	JACOB	4060	0.001	114
	FRANKE	3600	0.002	101
	MEAN	3775	0.002	106
E5	THEIS	4630	0.002	130
	JACOB	4225	0.002	119
	FRANKE	4265	0.003	120
	MEAN	4375	0.002	123

To estimate the average overall aquifer performance, transmissivity values were determined from four distance-drawdown graphs (Table X). After times ranging from 660 to 4254 minutes, transmissivity averaged 2200 gpd/ft and ranged from 2125 to 2335 gpd/ft. These values fall between the low figure of 1450 gpd/ft at the B site and the high of 4930 gpd/ft estimated for the D site.

Storativity

In unconfined aquifers storativity is roughly equivalent to specific yield; average values range from 0.01 to 0.30 (Freeze and Cherry, 1979). Storativity calculated for the aquifer in the individual tests conducted in spring 1986 ranges from 0.06 in Well C4 to 0.37 in Well E4 (Table VII). These values fall within the range of the specific yield estimates obtained by calculating rainfall:rise ratios.

TABLE X

RESULTS OF AQUIFER TESTS, DISTANCE-DRAWDOWN DATA

DATE	METHOD	T gpd/ft	S	K gpd/ft²	Pumped Well	Q gpm	t min
10/27/86					E5	1.07	4254
	THEIS	2230	0.023	--			
	JACOB	2020	0.027	--			
	MEAN	2125	0.025	--			
03/08/87					F1	4.76	660
	THEIS	2275	0.014	59			
	JACOB	2045	0.009	53			
	MEAN	2160	0.012	56			
03/08/87					F1	4.4	4200
	THEIS	2100	0.028	54			
	JACOB	2325	0.024	60			
	MEAN	2215	0.026	57			
05/18/87					F1	4.0	765
	THEIS	2290	0.007	65			
	JACOB	2375	0.006	67			
	MEAN	2335	0.007	66			

Average storativity calculated from time-drawdown data plotted for the tests in which Well F1 was pumped in March and May 1987 vary from 0.002 to 0.012 (Tables VIII, IX). The effect of gravity drainage is likely to be responsible for the lower than expected storativity values (Driscoll, 1986). Average storativity calculated from the distance-drawdown graphs are also low, from 0.007 to 0.026 (Table X). The low storativity values suggest that longer pumping times are necessary to allow gravity drainage to dissipate.

Hydraulic Conductivity

Hydraulic conductivity was calculated by the equation:

$$K = T / m \tag{5.8}$$

where T is transmissivity derived from the aquifer test data and m is the original saturated thickness in the pumping well. In the individual tests conducted in spring 1986 values of hydraulic conductivity ranged from 27 gpd/ft^2 in Well C4 to 104 gpd/ft^2 in Well E4 (Table VII). The value of 32 gpd/ft^2 for Well D5, derived from a test in which Well D4 was pumped, also falls into this range (Hagen, 1986).

Values of hydraulic conductivity derived from time-drawdown data in the March and May 1987 tests when Well F1 was pumped vary from 38 gpd/ft^2 in Well B4 to 125 gpd/ft^2 in Well D5 (Tables VIII, IX). Aquifer hydraulic conductivity calculated from distance-drawdown data plotted for the March and May 1987 tests averages 60 gpd/ft^2 (Table X).

The March and May 1987 average calculated values for hydraulic conductivity are somewhat higher than those reported in the literature for silt loam and silty clay loam soils. Li and others (1976, in Clapp and Hornberger, 1978) list representative values of saturated hydraulic conductivity for various soil textures. They reported values of 15 gpd/ft^2 for silt loam and loam and 4 gpd/ft^2 for silty clay loam. The average values of hydraulic conductivity calculated for the Ashport silt loam are close to the sandy loam value of 74 gpd/ft^2 quoted from Li and others (1976, in Clapp and Hornberger, 1978).

Hydraulic conductivity values estimated for the A and E sites when the 14-foot wells were pumped are similar to the values calculated when the 40-foot well was pumped. However, when the 14-foot wells were pumped at the C and D sites, the hydraulic conductivity values were substantially lower than when the 40-foot well was pumped. Therefore, the aquifer may be stratified at the C and D sites such that the shallower strata are less permeable than the deeper horizons.

Well Hydraulics

Well Loss

Well loss is the drawdown due to turbulent flow of water into the well screen during pumping (Walton, 1970). In the spring 1987 tests well loss was estimated by measuring water levels with an electric wireline in wells F1 and F2, which represent water heights inside and outside the casing of the pumped well, respectively. Although cascading water caused shorting in the wireline device, a few measurements were made with which to calculate well loss.

After pumping Well F1 for 2740 minutes in March, water level was drawn down 18 feet in Well F1 and 10 feet in Well F2. Therefore, eight feet of drawdown were due to the energy expended in moving the water into the well. Well efficiency is estimated by the equation:

$$WE = s\ (outside) * 100\ /\ s\ (inside) \qquad (5.9)$$

where s (outside) is the drawdown measured outside the well casing and s (inside) is the drawdown measured inside the casing. After 2740 minutes in March, well efficiency was 56 percent. After pumping Well F1 in May for 720 minutes, well efficiency was 76 percent. These data suggest that efficiency decreases as pumping time increases.

<u>Specific Capacity</u>

Specific capacity is the yield of a well per unit of drawdown and is expressed in gpm/foot of drawdown. Actual specific capacity for Well F1 in March 1987 was calculated to be 0.24 gpm/ft after 2740 minutes. The ideal value, obtained by using drawdown measured in Well F2, was 0.44 gpm/ft. In May 1987 the actual and ideal specific capacities were 0.21 and 0.28 gpm/ft, respectively, near the end of the test at 720 minutes.

Specific capacity of Well F1 may be limited by the lift capability of the electrical centrifugal suction lift pump used in the tests. The May 1987 test was terminated due to pump failure; calculated specific capacity is lower than in March 1987 suggesting pump malfunction. Modifying the Theis equation, specific capacity may be estimated by:

$$Q/s = T / [264 * \log \{T * t/2693 * r_w^2 * S\} - 65.5] \quad (5.10)$$

where T is transmissivity in gpd/ft, t is pumping time in minutes, r_w is well radius in feet and S is storativity (W.A. Pettyjohn, personal communication, 1986).

Using values of 2200 gpd/ft for transmissivity and 0.15 for storativity, specific capacity for the March test after 2740 minutes is expected to be 1.5 gpm/ft. The predicted specific capacity for the May test after 720 minutes is 1.7 gpm/ft using the same parameters of transmissivity and storativity. These calculations suggest that Well F1 is capable of yielding six to seven times more water for the same amount of drawdown as measured in the March 1987 test. Expressed in terms of pumping rates, Well F1 should yield water at rates of 25 to 30 gpm.

Recommendations for Additional Research

Well F1 should be pumped sufficiently long with a submersible pump at rates of 10-20 gpm to overcome the gravity drainage effect. Storativity should be calculated using the Neuman (1975) and Prickett (1965) techniques.

CHAPTER VI

SUMMARY AND CONCLUSIONS

General Overview

The goals of this research were to estimate hydraulic parameters of the Ashport silt loam and to examine the influence of hydrogeologic and suburban environments on variations in ground-water geochemistry. Geochemical data, water-level measurements and aquifer test drawdown data were collected and interpreted to characterize the aquifer and the variations in ground-water quality. The estimated hydraulic parameters are reasonable for the aquifer material. The common thread weaving through the geochemical data is the surprising degree of variability within an 8000 ft^2 area.

The grass-covered A site is fairly homogeneous with respect to soil profile, estimated hydraulic parameters, and observed chemical constituents. Average hydraulic conductivity values estimated from aquifer tests range from 31 to 49 gpd/ft^2. The A site may be considered to be a control site for all others in the field area.

On the surface, the E site is similar to the A site. However, the E site is unusual for two reasons; it contains the lowest ion concentrations for the entire study area and the highest transmissivity. One effect of the urban environment becomes immediately obvious. Rain water draining from the downspout adjacent to the site dilutes the shallow ground water. Concentrations of bicarbonate in the shallowest wells are roughly 33 to 67 percent lower than at the A site. Available hydraulic data confirm the flushing effect; calculated vertical gradients consistently indicate that water flows downward after rains.

Transmissivity values at the E site are nearly three times higher than at the A site, which lies about 100 feet to the west. The average hydraulic conductivity is over 100 gpd/ft^2, which is close to values reported for sandy loam. High permeability allows water to drain more quickly through the aquifer. Short ground-water residence times are also reflected in the low ion concentrations in the shallow E wells.

The tree-shaded C and D sites are similar with respect to geochemistry, but differ somewhat in their hydraulic parameters. Electrical conductivity and bicarbonate concentrations in the shallow wells at both sites are nearly twice as high as at the A site. Vegetative production of CO_2 is very likely responsible for the high bicarbonate concentrations. The C and D sites provide excellent examples of natural variability in ground-water geochemistry.

Hydraulic conductivity averages 27 to 97 gpd/ft^2 at the C site and 32 to 125 gpd/ft^2 at the D site. When the

40-foot F1 well is pumped, transmissivity and hydraulic conductivity are over twice as high at sites C and D as they are at site A. Transmissivity apparently increases to the east across the study area from the C wells to the D wells. However, transmissivity values of the top 14 feet of the Ashport silt loam at sites C and D sites are similar to site A, suggesting that permeability increases substantially with depth at sites C and D.

In addition to spatial variation across the study area, substantial temporal diversity in some hydraulic and geochemical parameters has been observed during the monitoring period. The horizontal hydraulic gradient rotates more than 60 degrees seasonally. Gradient deviation is due either to vegetative consumption, to the regional hydraulic regime of Boomer Creek, or to a combination of both. Ground-water geochemistry varies seasonally at the C site. Variation may be due to shifting carbonate equilibria caused by water-table fluctuations.

Conclusions

Substantial variations in ground-water geochemistry have been observed in a year-long monitoring period. Most of the variations may be explained within the framework of the local hydraulic and vegetative conditions. Vegetative CO_2 production leads to higher bicarbonate concentrations in the C and D wells. Sewer leakage probably causes higher chloride concentrations in the C and D wells, which are located along the shallow sewer line. Flushing from the house drainspout locally dilutes the shallow ground water at the E site. High hydraulic conductivity allows diluted water to drain quickly through the aquifer.

Hydraulic conductivity values range from 27 to 125 gpd/ft^2. These values are slightly higher than previously published figures for silt loam, suggesting that soil structure and macropores, such as root casts, are important routes for fluid flow. Transmissivity and hydraulic conductivity apparently increase from west to east across the field site. There may be significant stratification of the aquifer at the C and D sites. The hydraulic parameters calculated from aquifer test drawdown data are reasonable for the aquifer material, indicating that aquifer testing techniques are valid for certain soil profiles.

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APPENDIXES

APPENDIX A

PRECIPITATION

LOTUS DATE	DATE	PRECIPITATION INCHES	MONTHLY TOTAL
31300	10-Sep-85	0.20	
31303	13-Sep-85	1.20	
31304	14-Sep-85	0.20	
31311	21-Sep-85	0.20	
31312	22-Sep-85	1.20	
31313	23-Sep-85	1.10	
31315	25-Sep-85	1.30	
31319	29-Sep-85	0.90	6.30
31330	10-Oct-85	0.40	
31332	12-Oct-85	0.60	
31334	14-Oct-85	2.00	
31338	18-Oct-85	1.80	4.80
31364	13-Nov-85	1.30	
31366	15-Nov-85	1.70	
31381	30-Nov-85	0.30	3.30
31382	01-Dec-85	0.40	
31393	12-Dec-85	0.15	0.55
31483	12-Mar-86	0.90	
31486	15-Mar-86	0.25	
31489	18-Mar-86	0.30	1.45
31503	01-Apr-86	0.53	
31504	02-Apr-86	0.60	
31505	03-Apr-86	0.94	
31506	04-Apr-86	1.57	
31515	13-Apr-86	0.35	
31519	17-Apr-86	0.52	
31522	20-Apr-86	0.11	
31529	27-Apr-86	0.54	5.16
31541	09-May-86	0.72	
31542	10-May-86	0.30	
31543	11-May-86	0.36	
31546	14-May-86	0.15	
31547	15-May-86	0.79	
31549	17-May-86	2.24	
31558	26-May-86	0.27	
31562	30-May-86	0.28	5.11
31565	02-Jun-86	0.19	
31567	04-Jun-86	0.04	
31569	06-Jun-86	0.21	
31577	14-Jun-86	1.43	
31586	23-Jun-86	1.38	3.25
31594	01-Jul-86	1.33	
31603	10-Jul-86	0.07	
31605	12-Jul-86	0.56	1.96
31632	08-Aug-86	3.12	
31633	09-Aug-86	1.86	
31638	14-Aug-86	0.09	
31639	15-Aug-86	0.14	
31640	16-Aug-86	0.04	
31645	21-Aug-86	0.04	

LOTUS DATE	DATE	PRECIPITATION INCHES	MONTHLY TOTAL
31651	27-Aug-86	0.12	
31655	31-Aug-86	0.06	5.47
31669	14-Sep-86	0.04	
31681	26-Sep-86	0.15	
31683	28-Sep-86	0.25	
31684	29-Sep-86	5.41	
31685	30-Sep-86	0.46	6.31
31686	01-Oct-86	0.40	
31687	02-Oct-86	2.39	
31688	03-Oct-86	0.64	
31696	11-Oct-86	0.18	
31706	21-Oct-86	0.42	
31707	22-Oct-86	1.42	5.45
31719	03-Nov-86	0.10	
31720	04-Nov-86	1.79	
31736	20-Nov-86	0.24	
31741	25-Nov-86	2.02	4.15
31747	01-Dec-86	0.06	
31752	06-Dec-86	0.34	
31753	07-Dec-86	0.56	
31754	08-Dec-86	0.30	1.26
31780	03-Jan-87	0.14	
31785	08-Jan-87	0.68	
31786	09-Jan-87	0.20	
31794	17-Jan-87	7.00 SNOWFALL	
31808	31-Jan-87	0.31	1.33 (RAIN)
31813	05-Feb-87	0.73	
31814	06-Feb-87	0.20	
31823	15-Feb-87	0.87	
31826	18-Feb-87	0.18	
31832	24-Feb-87	0.19	
31834	26-Feb-87	0.25	
31836	28-Feb-87	1.72	4.14
31846	10-Mar-87	0.08	
31852	16-Mar-87	0.72	
31853	17-Mar-87	0.62	
31859	23-Mar-87	0.51	1.93
31877	10-Apr-87	0.21	
31880	13-Apr-87	0.02	
31881	14-Apr-87	0.05	
31887	20-Apr-87	0.22	0.52
31902	05-May-87	0.11	
31918	21-May-87	0.12	
31919	22-May-87	0.16	
31920	23-May-87	0.60	
31921	24-May-87	0.16	
31922	25-May-87	0.24	
31924	27-May-87	3.56	
31925	28-May-87	0.85	5.80

APPENDIX B

WELL COMPLETION DATA

Well Specifications Measured in Feet from Concrete Pad

Well	Total Depth	Screened Interval	Diameter
A1	8.5	8.0 - 8.2	2 inches
A2	9.2	8.7 - 8.9	"
A3	10.3	9.9 - 10.1	"
A4	13.8	13.3 - 13.6	"
A5	14.0	7.0 - 14.0	"
B1	6.6	6.1 - 6.4	2 inches
B2	9.1	8.6 - 8.9	"
B3	11.1	10.6 - 10.9	"
B4	13.1	12.6 - 12.9	"
B5	14.0	5.0 - 13.8	6 inches
C1	8.3	7.9 - 8.1	2 inches
C2	9.2	8.9 - 9.1	"
C3	10.6	9.9 - 10.4	"
C4	14.6	14.2 - 14.4	"
C5	14.0	7.0 - 14.0	"
D1	8.2	8.0 - 8.2	2 inches
D2	9.3	9.0 - 9.2	"
D3	10.8	9.9 - 10.4	"
D4	14.2	13.6 - 13.9	"
D5	14.0	7.0 - 14.0	"
E1	8.7	8.3 - 8.5	2 inches
E2	9.7	9.3 - 9.5	"
E3	10.5	10.1 - 10.3	"
E4	14.1	13.6 - 13.9	"
E5	14.0	7.0 - 14.0	"
F1	40.0	10.0 - 40.0	4 inches
F2	40.0	10.0 - 40.0	2 inches

Note: A, C, D, and E Well Specifications from Hagen (1986).

APPENDIX C

WATER LEVELS AND CHEMICAL DATA

[June 1985 to 15 April 1986

from Hagen (1986)]

WELLA1

LOTUS DATE	DATE	DEPTH TO WATER (FT)	ELEVATION FEET	TEMP DEG C	PH	EC UMHOS/CM	HCO3 MG/L	CL MG/L
31204	06-Jun-85	-6.75	878.98	20.6	7.32	650		
31205	07-Jun-85	-6.11	879.62					
31208	10-Jun-85	-6.48	879.25	19.1	6.95	918		
31366	15-Nov-85	-7.75	877.98	19.6	7.17	968		
31368	17-Nov-85	-7.29	878.44	19.4	7.16	1055		
31372	21-Nov-85	-7.33	878.40	19.0	7.20	1062		
31376	25-Nov-85	-7.41	878.32	18.7	7.17	1000		
31381	30-Nov-85	-7.50	878.23	18.0	7.36	1030		
31386	05-Dec-85	-7.51	878.22	17.6	7.39	1021		
31403	22-Dec-85	-7.42	878.31	16.5	7.35	878		
31410	29-Dec-85	-7.58	878.15					
31415	03-Jan-86	-7.62	878.11	14.0	7.59	1044		
31423	11-Jan-86	-7.65	878.08	14.1	7.15	976		
31426	14-Jan-86	-7.67	878.06	13.5	6.72	1016		
31428	16-Jan-86	-7.70	878.03	15.1	6.75	978		
31432	20-Jan-86	-7.68	878.05					
31435	23-Jan-86	-7.79	877.94	13.6	6.95	1049	572	31.7
31440	28-Jan-86	-7.66	878.07	13.3	6.77	1038		
31444	01-Feb-86	-7.80	877.93					
31447	04-Feb-86	-7.73	878.00		6.95	1028		
31449	06-Feb-86	-7.79	877.94	13.6	6.81	1060		
31456	13-Feb-86	-7.74	877.99	12.8	6.86	975		
31461	18-Feb-86	-7.67	878.06					
31463	20-Feb-86	-7.79	877.94	12.8	6.87	1018		
31468	25-Feb-86	-7.76	877.97	14.9	6.96	1030		
31473	02-Mar-86	-7.79	877.94					
31477	06-Mar-86	-7.78	877.95	13.5	6.93	1060		
31483	12-Mar-86	-7.65	878.08		6.76	1066		
31487	16-Mar-86	-7.61	878.12		6.73	1053		
31489	18-Mar-86	-7.44	878.29	13.8	6.87	1168		
31493	22-Mar-86	-7.54	878.19	14.7	6.72	1069		
31498	27-Mar-86	-7.53	878.20	14.2	6.72	1102		
31503	01-Apr-86	-7.47	878.26		6.88	1020		
31504	02-Apr-86	-7.38	878.35		6.85	1083		
31505	03-Apr-86	-6.53	879.20		6.80	1050		
31506	04-Apr-86	-5.76	879.97		6.74	1129		
31508	06-Apr-86	-6.12	879.61		6.81	1170		
31510	08-Apr-86	-6.31	879.42		6.75	1210		
31511	09-Apr-86	-6.42	879.31					
31513	11-Apr-86	-6.46	879.27		6.76	1038		
31514	12-Apr-86	-6.54	879.19					
31516	14-Apr-86	-6.39	879.34					
31517	15-Apr-86	-6.63	879.10	12.1	6.85	1001		22.8
31519	17-Apr-86	-6.49	879.24					
31521	19-Apr-86	-6.59	879.14	15.2	6.80	609		24.9
31522	20-Apr-86	-6.52	879.21		6.89	802		20.0
31524	22-Apr-86	-6.70	879.03					

WELLA1

LOTUS DATE	DATE	DEPTH TO WATER (FT)	ELEVATION FEET	TEMP DEG C	PH	EC UMHOS/CM	HCO3 MG/L	CL MG/L
31529	27-Apr-86	-6.86	878.87					
31530	28-Apr-86	-6.94	878.79		6.93	584		24.9
31538	06-May-86	-7.27	878.46					
31539	07-May-86	-7.29	878.44	17.8	6.78	925	574	40.8
31541	09-May-86	-7.37	878.36					
31542	10-May-86	-7.35	878.38					
31543	11-May-86	-7.35	878.38					
31544	12-May-86	-7.34	878.39					
31545	13-May-86	-7.43	878.30	18.2	7.21	1029	561	26.5
31547	15-May-86	-7.14	878.59		7.24	1090	595	27.1
31548	16-May-86	-7.21	878.52	18.9	7.12	1050	586	25.0
31549	17-May-86	-6.51	879.22	17.8	6.78	1050	633	25.0
31550	18-May-86	-6.59	879.14	17.2		1061	636	32.5
31551	19-May-86	-6.69	879.04					
31552	20-May-86	-6.77	878.96					
31553	21-May-86	-6.80	878.93	17.5	6.57	1058	612	28.2
31555	23-May-86	-6.96	878.77					
31559	27-May-86	-7.24	878.49	17.9				
31560	28-May-86	-7.27	878.46					
31562	30-May-86	-7.36	878.37					
31563	31-May-86	-7.35	878.38	21.9	6.47	1075		37.0
31566	03-Jun-86	-7.48	878.25					
31570	07-Jun-86	-7.55	878.18	19.4	6.68	893	560	27.6
31572	09-Jun-86	-7.67	878.06					
31577	14-Jun-86	-8.15	877.58	18.9				
31578	15-Jun-86	-7.92	877.81	18.9		1086		
31579	16-Jun-86	-8.01	877.72					
31582	19-Jun-86	-8.22	877.51					
31720	04-Nov-86	-7.26	878.47					
31721	05-Nov-86	-6.50	879.23					
31722	06-Nov-86	-6.47	879.26	18.6	6.42	1103	677	22.2
31727	11-Nov-86	-6.73	879.00					
31730	14-Nov-86	-6.67	879.06					
31732	16-Nov-86	-6.73	879.00		6.33	1042		
31736	20-Nov-86	-6.95	878.78					
31739	23-Nov-86	-6.96	878.77	18.8	6.35	1093	648	24.3
31742	26-Nov-86	-5.48	880.25					
31744	28-Nov-86	-5.65	880.08	17.7	6.27	1125	706	23.7
31746	30-Nov-86	-5.73	880.00					
31752	06-Dec-86	-6.13	879.60					
31753	07-Dec-86	-5.89	879.84	16.8	6.26	1097	706	24.3
31761	15-Dec-86	-5.72	880.01					
31767	21-Dec-86	-6.05	879.68	15.1	6.75	1122		
31775	29-Dec-86	-6.27	879.46					
31778	01-Jan-87	-6.40	879.33	14.4	6.47	1095	648	25.5
31784	07-Jan-87	-6.51	879.22					

WELLA1

LOTUS DATE	DATE	DEPTH TO WATER (FT)	ELEVATION FEET	TEMP DEG C	PH	EC UMHOS/CM	HCO3 MG/L	CL MG/L
31786	09-Jan-87	-6.36	879.37					
31787	10-Jan-87	-6.18	879.55	14.1	6.66	1158	644	34.1
31792	15-Jan-87	-6.23	879.50					
31802	25-Jan-87	-6.31	879.42		6.60	1088	694	25.2
31806	29-Jan-87	-5.77	879.96					
31809	01-Feb-87	-5.62	880.11	13.3	6.28	1133	650	24.3
31816	08-Feb-87	-5.17	880.56	12.8	6.31	1125	690	21.6
31823	15-Feb-87	-4.86	880.87					
31830	22-Feb-87	-4.89	880.84					
31832	24-Feb-87	-5.08	880.65					
31834	26-Feb-87	-5.15	880.58					
31837	01-Mar-87	-3.85	881.88					
31839	03-Mar-87	-4.31	881.42					
31840	04-Mar-87	-4.48	881.25					
31841	05-Mar-87	-4.56	881.17					
31842	06-Mar-87	-4.70	881.03					
31843	07-Mar-87	-4.77	880.96					
31844	08-Mar-87	-4.84	880.89					
31845	09-Mar-87	-5.94	879.79					
31846	10-Mar-87	-6.11	879.62					
31847	11-Mar-87	-6.20	879.53					
31848	12-Mar-87	-5.36	880.37					
31849	13-Mar-87	-5.33	880.40					
31850	14-Mar-87	-5.32	880.41					
31852	16-Mar-87	-5.44	880.29					
31853	17-Mar-87	-4.31	881.42					
31854	18-Mar-87	-4.48	881.25					
31855	19-Mar-87	-4.73	881.00					
31856	20-Mar-87	-4.83	880.90					
31857	21-Mar-87	-4.96	880.77					
31858	22-Mar-87	-4.99	880.74					
31859	23-Mar-87	-4.96	880.77					
31860	24-Mar-87	-4.99	880.74					
31862	26-Mar-87	-5.16	880.57					
31863	27-Mar-87	-5.17	880.56					
31864	28-Mar-87	-5.28	880.45					
31865	29-Mar-87	-5.37	880.36					
31870	03-Apr-87	-5.59	880.14					
31871	04-Apr-87	-5.65	880.08					
31873	06-Apr-87	-5.67	880.06					

WELLA2

LOTUS DATE	DATE	DEPTH TO WATER (FT)	ELEVATION FEET	TEMP DEG C	PH	EC UMHOS/CM	HCO3 MG/L	CL MG/L
31205	07-Jun-85	-5.95	879.78	18.6	7.05	975		
31208	10-Jun-85	-6.47	879.26					
31339	19-Oct-85	-8.48	877.25	21.9	6.75	995		
31341	21-Oct-85	-8.52	877.21	21.2	6.96	1010		
31343	23-Oct-85	-8.53	877.20	21.6	7.05	1034		
31345	25-Oct-85	-8.70	877.03					
31347	27-Oct-85	-8.66	877.07					
31349	29-Oct-85	-8.59	877.14	20.8	7.39	988		
31352	01-Nov-85	-8.59	877.14	20.5	7.31	985		
31354	03-Nov-85	-8.64	877.09	20.0	7.40	983		
31357	06-Nov-85	-8.55	877.18	20.5	7.39	938		
31361	10-Nov-85	-8.70	877.03	20.0	7.38	964		
31364	13-Nov-85	-8.50	877.23	20.0	7.43	1060		
31366	15-Nov-85	-7.50	878.23	20.0	7.33	985		
31368	17-Nov-85	-7.31	878.42	19.6	7.23	1080		
31372	21-Nov-85	-7.33	878.40	19.4	7.22	1074		
31376	25-Nov-85	-7.39	878.34	19.0	7.31	1008		
31381	30-Nov-85	-7.44	878.29	18.3	7.34	1053		
31386	05-Dec-85	-7.46	878.27	18.0	7.49	1031		
31403	22-Dec-85	-7.37	878.36	16.5	7.18	948		
31410	29-Dec-85	-7.52	878.21					
31415	03-Jan-86	-7.56	878.17	14.6	7.56	1045		
31423	11-Jan-86	-7.58	878.15	14.8	6.96	1034		
31426	14-Jan-86	-7.60	878.13	14.7	6.73	1027		
31428	16-Jan-86	-7.64	878.09	15.6	6.75	1014		
31432	20-Jan-86	-7.54	878.19					
31435	23-Jan-86	-7.70	878.03	14.1	6.90	1047	609	28.7
31440	28-Jan-86	-7.56	878.17	14.1	6.82	1033		
31444	01-Feb-86	-7.73	878.00					
31447	04-Feb-86	-7.66	878.07		6.91	1072		
31449	06-Feb-86	-7.75	877.98	14.1	6.75	1077		
31456	13-Feb-86	-7.70	878.03	13.8	6.87	971		
31461	18-Feb-86	-7.63	878.10					
31463	20-Feb-86	-7.74	877.99	13.7	6.83	1036		
31468	25-Feb-86	-7.71	878.02	15.9	6.92	1047		
31473	02-Mar-86	-7.74	877.99					
31477	06-Mar-86	-7.73	878.00	13.9	6.93	1043		
31483	12-Mar-86	-7.55	878.18		6.80	1065		
31487	16-Mar-86	-7.56	878.17		6.77	1060		
31489	18-Mar-86	-7.41	878.32	14.4	6.78	1155		
31493	22-Mar-86	-7.49	878.24	15.1	6.94	1100		
31498	27-Mar-86	-7.48	878.25	14.2	6.81	1102		
31503	01-Apr-86	-7.46	878.27		7.04	999		
31504	02-Apr-86	-7.35	878.38		6.89	1101		
31505	03-Apr-86	-6.57	879.16		6.84	1052		
31506	04-Apr-86	-5.78	879.95		6.72	1082		
31508	06-Apr-86	-6.15	879.58		6.90	1154		

WELLA2

LOTUS DATE	DATE	DEPTH TO WATER (FT)	ELEVATION FEET	TEMP DEG C	PH	EC UMHOS/CM	HCO3 MG/L	CL MG/L
31510	08-Apr-86	-6.35	879.38		6.77	1195		
31511	09-Apr-86	-6.45	879.28					
31513	11-Apr-86	-6.49	879.24		6.76	1053		
31514	12-Apr-86	-6.51	879.22					
31516	14-Apr-86	-6.41	879.32					
31517	15-Apr-86	-6.61	879.12	12.4	6.94	983		23.4
31519	17-Apr-86	-6.49	879.24					
31521	19-Apr-86	-6.49	879.24	15.3	6.83		624	20.8
31522	20-Apr-86	-6.55	879.18		7.00		625	20.4
31524	22-Apr-86	-6.73	879.00					
31529	27-Apr-86	-6.85	878.88					
31530	28-Apr-86	-6.96	878.77		6.91		624	21.4
31538	06-May-86	-7.30	878.43					
31539	07-May-86	-7.28	878.45	17.9	6.98	924	616	29.9
31541	09-May-86	-7.42	878.31					
31542	10-May-86	-7.43	878.30					
31543	11-May-86	-7.35	878.38					
31544	12-May-86	-7.37	878.36					
31545	13-May-86	-7.43	878.30	18.0	7.25	1030	607	26.7
31547	15-May-86	-7.11	878.62		7.17	1104	641	21.4
31548	16-May-86	-7.17	878.56	18.9	7.31	1045	615	24.1
31549	17-May-86	-6.41	879.32	17.8		1020	619	24.3
31550	18-May-86	-6.56	879.17	17.0		1059	625	34.3
31551	19-May-86	-6.66	879.07					
31552	20-May-86	-6.73	879.00					
31553	21-May-86	-6.77	878.96	17.3	6.69	1056	622	26.8
31555	23-May-86	-6.96	878.77					
31559	27-May-86	-7.20	878.53	17.7	6.71	1070	668	24.9
31560	28-May-86	-7.24	878.49					
31562	30-May-86	-7.34	878.39					
31563	31-May-86	-7.30	878.43	21.7	6.65	1080	639	29.2
31566	03-Jun-86	-7.44	878.29					
31570	07-Jun-86	-7.51	878.22	19.4	6.80	942	625	27.3
31572	09-Jun-86	-7.64	878.09					
31577	14-Jun-86	-8.03	877.70	18.4	6.53	1110	609	39.0
31578	15-Jun-86	-7.82	877.91	18.6		1055		49.2
31579	16-Jun-86	-7.93	877.80					
31582	19-Jun-86	-8.11	877.62					
31584	21-Jun-86	-8.27	877.46					
31585	22-Jun-86			19.1	7.03	1280	622	32.2
31586	23-Jun-86	-8.23	877.50					
31591	28-Jun-86	-8.57	877.16		6.56	1140	631	31.4
31595	02-Jul-86	-8.51	877.22					
31599	06-Jul-86	-8.81	876.92	20.0				
31688	03-Oct-86	-7.73	878.00					
31689	04-Oct-86	-7.64	878.09	23.2	6.37	1065		21.3

WELLA2

LOTUS DATE	DATE	DEPTH TO WATER (FT)	ELEVATION FEET	TEMP DEG C	PH	EC UMHOS/CM	HCO3 MG/L	CL MG/L
31691	06-Oct-86	-7.93	877.80					
31695	10-Oct-86	-8.12	877.61					
31707	22-Oct-86	-7.64	878.09					
31708	23-Oct-86	-7.49	878.24					
31709	24-Oct-86	-7.53	878.20					
31710	25-Oct-86	-7.52	878.21					
31711	26-Oct-86	-7.55	878.18					
31712	27-Oct-86	-7.57	878.16					
31713	28-Oct-86	-7.72	878.01					
31714	29-Oct-86	-7.84	877.89					
31715	30-Oct-86	-7.76	877.97					
31716	31-Oct-86	-7.67	878.06					
31717	01-Nov-86	-7.75	877.98					
31718	02-Nov-86	-7.74	877.99					
31720	04-Nov-86	-7.19	878.54					
31721	05-Nov-86	-6.50	879.23					
31722	06-Nov-86	-6.46	879.27	19.3	6.52	1128	644	19.3
31727	11-Nov-86	-6.72	879.01					
31730	14-Nov-86	-6.65	879.08					
31732	16-Nov-86	-6.71	879.02		6.48	1080		19.8
31736	20-Nov-86	-6.96	878.77					
31739	23-Nov-86	-6.96	878.77	19.2	6.46	1082	685	22.9
31742	26-Nov-86	-5.48	880.25					
31744	28-Nov-86	-5.65	880.08	18.3	6.30	1075	668	17.5
31746	30-Nov-86	-5.74	879.99					
31752	06-Dec-86	-6.13	879.60					
31753	07-Dec-86	-5.89	879.84	17.4	6.38	1080	668	23.9
31761	15-Dec-86	-5.73	880.00					
31767	21-Dec-86	-6.06	879.67	16.0	6.70	1100		
31775	29-Dec-86	-6.27	879.46					
31778	01-Jan-87	-6.41	879.32	15.6	6.58	1098	673	27.1
31784	07-Jan-87	-6.53	879.20					
31786	09-Jan-87	-6.33	879.40					
31787	10-Jan-87	-6.20	879.53	14.7	6.52	1140	680	27.4
31792	15-Jan-87	-6.24	879.49					
31802	25-Jan-87	-6.32	879.41		6.65	1058	670	22.2
31806	29-Jan-87	-5.77	879.96					
31809	01-Feb-87	-5.63	880.10	14.4	6.23	1106	652	22.3
31816	08-Feb-87	-5.19	880.54	13.2	6.42	1127	656	23.6
31823	15-Feb-87	-4.86	880.87					
31830	22-Feb-87	-4.91	880.82					
31832	24-Feb-87	-5.12	880.61					
31834	26-Feb-87	-5.17	880.56					
31837	01-Mar-87	-3.87	881.86					
31839	03-Mar-87	-4.35	881.38					
31840	04-Mar-87	-4.49	881.24					

WELLA2

LOTUS DATE	DATE	DEPTH TO WATER (FT)	ELEVATION FEET	TEMP DEG C	PH	EC UMHOS/CM	HCO3 MG/L	CL MG/L
31841	05-Mar-87	-4.58	881.15					
31842	06-Mar-87	-4.72	881.01					
31843	07-Mar-87	-4.78	880.95					
31844	08-Mar-87	-4.86	880.87					
31845	09-Mar-87	-5.92	879.81					
31846	10-Mar-87	-6.12	879.61					
31847	11-Mar-87	-6.20	879.53					
31848	12-Mar-87	-5.37	880.36					
31849	13-Mar-87	-5.35	880.38					
31850	14-Mar-87	-5.32	880.41					
31852	16-Mar-87	-5.47	880.26					
31853	17-Mar-87	-4.31	881.42					
31854	18-Mar-87	-4.50	881.23					
31855	19-Mar-87	-4.75	880.98					
31856	20-Mar-87	-4.84	880.89					
31857	21-Mar-87	-4.98	880.75					
31858	22-Mar-87	-5.01	880.72					
31859	23-Mar-87	-4.98	880.75					
31860	24-Mar-87	-5.00	880.73					
31862	26-Mar-87	-5.18	880.55					
31863	27-Mar-87	-5.19	880.54					
31864	28-Mar-87	-5.29	880.44					
31865	29-Mar-87	-5.39	880.34					
31870	03-Apr-87	-5.59	880.14					
31871	04-Apr-87	-5.66	880.07					
31873	06-Apr-87	-5.68	880.05					

WELLA3

LOTUS DATE	DATE	DEPTH TO WATER (FT)	ELEVATION FEET	TEMP DEG C	PH	EC UMHOS/CM	HCO3 MG/L	CL MG/L
31202	04-Jun-85	-7.50	878.23					
31204	06-Jun-85	-6.75	878.98	18.7	7.08	914		
31205	07-Jun-85	-6.07	879.66					
31208	10-Jun-85	-6.50	879.23	18.4	7.05	989		
31242	14-Jul-85	-9.05	876.68					
31334	14-Oct-85	-9.55	876.18	21.0	6.97	1072		
31335	15-Oct-85	-9.14	876.59	18.0	7.05	975		
31336	16-Oct-85	-9.24	876.49					
31337	17-Oct-85	-9.24	876.49	22.1	7.03	1071		
31338	18-Oct-85	-8.96	876.77	22.0	6.92	1116		
31339	19-Oct-85	-8.53	877.20	21.9	6.95	1080		
31341	21-Oct-85	-8.52	877.21	21.6	7.03	1079		
31343	23-Oct-85	-8.53	877.20					
31345	25-Oct-85	-8.67	877.06	21.2	7.16	1048	644	17.4
31347	27-Oct-85	-8.64	877.09					
31349	29-Oct-85	-8.58	877.15	21.3	7.26	1025		
31352	01-Nov-85	-8.58	877.15	21.2	7.20	1028		
31354	03-Nov-85	-8.63	877.10	21.3	7.20	1035		
31357	06-Nov-85	-8.56	877.17	21.0	7.21	997		
31361	10-Nov-85	-8.69	877.04	20.4	7.24	1021		
31364	13-Nov-85	-8.48	877.25	20.8	7.20	1056		
31366	15-Nov-85	-7.53	878.20	21.0	7.33	937		
31368	17-Nov-85	-7.29	878.44	20.1	7.24	1049		
31372	21-Nov-85	-7.34	878.39	19.8	7.43	1056		
31376	25-Nov-85	-7.43	878.30	19.4	7.24	1022		
31381	30-Nov-85	-7.44	878.29	18.8	7.36	1083		
31386	05-Dec-85	-7.42	878.31	18.6	7.32	1053		
31403	22-Dec-85	-7.43	878.30	16.7	7.29	972		
31410	29-Dec-85	-7.52	878.21					
31415	03-Jan-86	-7.57	878.16	15.8	7.51	1091		
31423	11-Jan-86	-7.58	878.15	15.2	7.02	1052		
31426	14-Jan-86	-7.62	878.11	15.2	6.85	1012		
31428	16-Jan-86	-7.65	878.08	16.1	6.83	995		
31432	20-Jan-86	-7.55	878.18					
31435	23-Jan-86	-7.73	878.00	14.8	6.95	967	650	16.5
31440	28-Jan-86	-7.44	878.29	14.5	6.86	1022		
31444	01-Feb-86	-7.76	877.97					
31447	04-Feb-86	-7.68	878.05		6.93	1033		
31449	06-Feb-86	-7.75	877.98	15.5	6.85	1015		
31456	13-Feb-86	-7.69	878.04	14.4	6.86	907		
31461	18-Feb-86	-7.63	878.10					
31463	20-Feb-86	-7.75	877.98	14.2	6.91	979		
31468	25-Feb-86	-7.73	878.00		6.99	1009		
31473	02-Mar-86	-7.74	877.99					
31477	06-Mar-86	-7.75	877.98	14.3	7.00	1013		
31483	12-Mar-86	-7.59	878.14		6.86	1040		
31487	16-Mar-86	-7.58	878.15		6.87	1046		

WELLA3

LOTUS DATE	DATE	DEPTH TO WATER (FT)	ELEVATION FEET	TEMP DEG C	PH	EC UMHOS/CM	HCO3 MG/L	CL MG/L
31489	18-Mar-86	-7.44	878.29	14.7	6.84	1099		
31493	22-Mar-86	-7.51	878.22	15.5	6.93	1084		
31498	27-Mar-86	-7.51	878.22	15.2	6.94	1084		
31503	01-Apr-86	-7.47	878.26		6.97	995		
31504	02-Apr-86	-7.37	878.36		6.90	1025		
31505	03-Apr-86	-6.40	879.33		6.90	1031		
31506	04-Apr-86	-5.65	880.08		6.82	1082		
31508	06-Apr-86	-5.94	879.79		6.95	1131		
31510	08-Apr-86	-6.15	879.58		6.82	1158		
31511	09-Apr-86	-6.34	879.39					
31513	11-Apr-86	-6.36	879.37		6.81	1022		
31514	12-Apr-86	-6.52	879.21					
31516	14-Apr-86	-6.59	879.14					
31517	15-Apr-86	-6.65	879.08	12.6	7.09	983		20.7
31519	17-Apr-86	-6.39	879.34					
31521	19-Apr-86	-6.52	879.21	15.4	6.88		622	18.5
31522	20-Apr-86	-6.45	879.28		7.06		781	19.7
31524	22-Apr-86	-6.61	879.12					
31529	27-Apr-86	-6.74	878.99					
31530	28-Apr-86	-6.86	878.87		7.01		633	22.0
31538	06-May-86	-7.23	878.50					
31539	07-May-86	-7.30	878.43	18.1	7.21	926	638	28.2
31541	09-May-86	-7.35	878.38					
31542	10-May-86	-7.32	878.41					
31543	11-May-86	-7.25	878.48					
31544	12-May-86	-7.29	878.44					
31545	13-May-86	-7.40	878.33	17.7	7.29	1024	639	22.7
31547	15-May-86	-7.12	878.61		7.33	1097	775	22.6
31548	16-May-86	-7.21	878.52	18.9	7.31	1036	633	22.4
31549	17-May-86	-6.34	879.39	17.8		1008	622	23.5
31550	18-May-86	-6.05	879.68	16.9		1037	624	29.9
31551	19-May-86	-6.68	879.05					
31552	20-May-86	-6.75	878.98					
31553	21-May-86	-6.78	878.95	17.2	6.73	1043	622	23.8
31555	23-May-86	-6.89	878.84					
31559	27-May-86	-7.21	878.52	17.5	7.23	1033	634	24.2
31560	28-May-86	-7.23	878.50					
31562	30-May-86	-7.32	878.41					
31563	31-May-86	-7.28	878.45	21.3	6.74	1035	616	23.7
31566	03-Jun-86	-7.35	878.38					
31570	07-Jun-86	-7.47	878.26	19.7	6.51	1037	619	24.6
31572	09-Jun-86	-7.56	878.17					
31577	14-Jun-86	-7.99	877.74	18.1	6.52	1096	615	26.4
31578	15-Jun-86	-7.80	877.93	18.5	6.64	1054	767	29.4
31579	16-Jun-86	-7.86	877.87					
31582	19-Jun-86	-8.06	877.67					

WELLA3

LOTUS DATE	DATE	DEPTH TO WATER (FT)	ELEVATION FEET	TEMP DEG C	PH	EC UMHOS/CM	HCO3 MG/L	CL MG/L
31584	21-Jun-86	-8.23	877.50					
31585	22-Jun-86			18.8	7.58	1455	632	32.4
31586	23-Jun-86	-8.18	877.55					
31591	28-Jun-86	-8.52	877.21		6.89	1163	624	29.9
31595	02-Jul-86	-8.40	877.33					
31599	06-Jul-86	-8.75	876.98	20.0	6.44	1150	639	28.2
31605	12-Jul-86	-9.26	876.47	20.6	6.54	1151	642	30.2
31685	30-Sep-86	-9.39	876.34					
31688	03-Oct-86	-7.61	878.12					
31689	04-Oct-86	-7.60	878.13	23.4	6.46	999	673	23.4
31691	06-Oct-86	-7.91	877.82					
31695	10-Oct-86	-8.09	877.64	23.4	6.51	1062	667	21.6
31704	19-Oct-86	-8.43	877.30					
31707	22-Oct-86	-7.56	878.17					
31708	23-Oct-86	-7.48	878.25					
31709	24-Oct-86	-7.51	878.22					
31710	25-Oct-86	-7.49	878.24					
31711	26-Oct-86	-7.54	878.19					
31712	27-Oct-86	-7.55	878.18					
31713	28-Oct-86	-7.70	878.03					
31714	29-Oct-86	-7.82	877.91					
31715	30-Oct-86	-7.74	877.99					
31716	31-Oct-86	-7.66	878.07					
31717	01-Nov-86	-7.74	877.99					
31718	02-Nov-86	-7.72	878.01					
31720	04-Nov-86	-7.13	878.60					
31721	05-Nov-86	-6.47	879.26					
31722	06-Nov-86	-6.44	879.29	18.1	6.59	1102	624	20.0
31727	11-Nov-86	-6.71	879.02					
31730	14-Nov-86	-6.66	879.07					
31732	16-Nov-86	-6.71	879.02		6.65	1066	630	21.3
31736	20-Nov-86	-6.94	878.79					
31739	23-Nov-86	-6.94	878.79	19.6	6.59	1034	625	16.6
31742	26-Nov-86	-5.46	880.27					
31744	28-Nov-86	-5.64	880.09	18.6	6.43	1035	613	18.4
31746	30-Nov-86	-5.74	879.99					
31752	06-Dec-86	-6.12	879.61					
31753	07-Dec-86	-5.88	879.85	17.7	6.50	1060	630	23.5
31761	15-Dec-86	-5.72	880.01					
31767	21-Dec-86	-6.05	879.68	16.6	6.64	1102		
31775	29-Dec-86	-6.26	879.47					
31778	01-Jan-87	-6.40	879.33	16.9	6.49	1119	636	29.4
31784	07-Jan-87	-6.53	879.20					
31786	09-Jan-87	-6.30	879.43					
31787	10-Jan-87	-6.18	879.55	15.5	6.57	1125	651	28.7
31792	15-Jan-87	-6.22	879.51					

WELLA3

LOTUS DATE	DATE	DEPTH TO WATER (FT)	ELEVATION FEET	TEMP DEG C	PH	EC UMHOS/CM	HCO3 MG/L	CL MG/L
31802	25-Jan-87	-6.30	879.43		6.75	1053	644	20.4
31806	29-Jan-87	-5.77	879.96					
31809	01-Feb-87	-5.62	880.11	15.0	6.33	1083	625	18.6
31816	08-Feb-87	-5.18	880.55	14.5	6.56	1106	613	18.1
31823	15-Feb-87	-4.84	880.89					
31830	22-Feb-87	-4.92	880.81					
31832	24-Feb-87	-5.08	880.65					
31834	26-Feb-87	-5.16	880.57					
31837	01-Mar-87	-3.88	881.85					
31839	03-Mar-87	-4.34	881.39					
31840	04-Mar-87	-4.49	881.24					
31841	05-Mar-87	-4.57	881.16					
31842	06-Mar-87	-4.72	881.01					
31843	07-Mar-87	-4.79	880.94					
31844	08-Mar-87	-4.84	880.89					
31845	09-Mar-87	-5.95	879.78					
31846	10-Mar-87	-6.11	879.62					
31847	11-Mar-87	-6.18	879.55					
31848	12-Mar-87	-5.36	880.37					
31849	13-Mar-87	-5.35	880.38					
31850	14-Mar-87	-5.32	880.41					
31852	16-Mar-87	-5.45	880.28					
31853	17-Mar-87	-4.30	881.43					
31854	18-Mar-87	-4.50	881.23					
31855	19-Mar-87	-4.74	880.99					
31856	20-Mar-87	-4.83	880.90					
31857	21-Mar-87	-4.98	880.75					
31858	22-Mar-87	-5.01	880.72					
31859	23-Mar-87	-4.98	880.75					
31860	24-Mar-87	-5.00	880.73					
31862	26-Mar-87	-5.19	880.54					
31863	27-Mar-87	-5.19	880.54					
31864	28-Mar-87	-5.30	880.43					
31865	29-Mar-87	-5.38	880.35					
31870	03-Apr-87	-5.59	880.14					
31871	04-Apr-87	-5.66	880.07					
31873	06-Apr-87	-5.68	880.05					

WELLA4

LOTUS DATE	DATE	DEPTH TO WATER (FT)	ELEVATION FEET	TEMP DEG C	PH	EC UMHOS/CM	HCO3 MG/L	CL MG/L
31254	26-Jul-85	-9.91	875.82	20.2	7.05	840		
31257	29-Jul-85	-9.81	875.92	20.3	7.09	950		
31260	01-Aug-85	-10.02	875.71	20.7	7.14	975		
31264	05-Aug-85	-10.00	875.73	20.6	7.14	1035		
31272	13-Aug-85	-10.88	874.85					
31275	16-Aug-85	-10.42	875.31	21.1	7.10	1025		
31278	19-Aug-85	-10.51	875.22	20.0	7.09	1045		
31280	21-Aug-85	-10.34	875.39					
31281	22-Aug-85	-10.27	875.46	22.1	7.17	1020	613	31.8
31283	24-Aug-85	-10.62	875.11					
31285	26-Aug-85	-10.65	875.08					
31289	30-Aug-85	-11.02	874.71					
31292	02-Sep-85	-11.10	874.63	21.7	7.14	1013	612	21.8
31299	09-Sep-85	-11.53	874.20	21.7	7.10	999		
31305	15-Sep-85	-11.44	874.29	21.6	7.10	992		
31306	16-Sep-85	-11.29	874.44	21.7	7.10	1020		
31308	18-Sep-85	-11.35	874.38	21.3	7.16	974		
31309	19-Sep-85	-11.43	874.30	22.2	7.17	1011	599	16.8
31311	21-Sep-85	-11.49	874.24	20.8	7.22	931		
31312	22-Sep-85	-11.25	874.48	21.7	7.19	950		
31313	23-Sep-85	-10.84	874.89	20.5	7.17	930		
31315	25-Sep-85	-10.53	875.20	20.6	7.16	953		
31317	27-Sep-85	-10.48	875.25	20.2	7.17	990		
31318	28-Sep-85	-10.55	875.18					
31319	29-Sep-85	-10.38	875.35	19.6	7.14	967		
31321	01-Oct-85	-10.23	875.50	20.0	7.15	964		
31322	02-Oct-85	-10.18	875.55					
31323	03-Oct-85	-10.21	875.52	20.3	7.21	970		
31325	05-Oct-85	-10.34	875.39					
31326	06-Oct-85	-10.26	875.47	20.8	6.99	960		
31328	08-Oct-85			21.3	6.99	945		
31330	10-Oct-85	-10.23	875.50	19.6	7.08	960		
31334	14-Oct-85	-9.15	876.58	20.7	7.14	915		
31335	15-Oct-85	-9.18	876.55	19.0	7.09	892		
31336	16-Oct-85	-9.27	876.46					
31337	17-Oct-85	-9.28	876.45	21.7	7.03	942		
31338	18-Oct-85	-8.59	877.14	21.6	7.08	950		
31339	19-Oct-85	-8.48	877.25	21.6	7.04	914		
31341	21-Oct-85	-8.53	877.20	21.5	7.11	950		
31343	23-Oct-85	-8.54	877.19					
31345	25-Oct-85	-8.70	877.03	21.5	7.15	920	596	16.5
31347	27-Oct-85	-8.68	877.05					
31349	29-Oct-85	-8.61	877.12	21.3	7.25	927		
31352	01-Nov-85	-8.60	877.13	21.2	7.20	935		
31354	03-Nov-85	-8.64	877.09	21.5	7.21	934		
31357	06-Nov-85	-8.59	877.14	21.1	7.26	899		
31361	10-Nov-85	-8.72	877.01	20.6	7.42	877		

WELLA4

LOTUS DATE	DATE	DEPTH TO WATER (FT)	ELEVATION FEET	TEMP DEG C	PH	EC UMHOS/CM	HCO3 MG/L	CL MG/L
31364	13-Nov-85	-8.40	877.33	21.0	7.29	930		
31366	15-Nov-85	-7.39	878.34	20.9	7.31	888		
31368	17-Nov-85	-7.32	878.41	20.6	7.37	933		
31372	21-Nov-85	-7.34	878.39	20.5	7.37	954		
31376	25-Nov-85	-7.40	878.33	20.2	7.38	895		
31381	30-Nov-85	-7.45	878.28	20.0	7.46	920		
31386	05-Dec-85	-7.44	878.29	19.9	7.47	952		
31403	22-Dec-85	-7.38	878.35	18.6	7.44	890		
31410	29-Dec-85	-7.52	878.21					
31415	03-Jan-86	-7.57	878.16	16.9	7.67	1013		
31423	11-Jan-86	-7.57	878.16	17.0	7.15	935		
31426	14-Jan-86	-7.58	878.15	17.5	6.80	994		
31428	16-Jan-86	-7.63	878.10	18.5	6.85	928		
31432	20-Jan-86	-7.54	878.19					
31435	23-Jan-86	-7.71	878.02	16.8	7.00	983	612	17.2
31440	28-Jan-86	-7.59	878.14	16.1	6.93	935		
31444	01-Feb-86	-7.74	877.99					
31447	04-Feb-86	-7.69	878.04	.	6.95	1028		
31449	06-Feb-86	-7.74	877.99	16.0	6.90	995		
31456	13-Feb-86	-7.67	878.06	16.0	6.90	877		
31461	18-Feb-86	-7.63	878.10					
31463	20-Feb-86	-7.75	877.98	15.8	6.92	917		
31468	25-Feb-86	-7.71	878.02		6.96	976		
31473	02-Mar-86	-7.75	877.98					
31477	06-Mar-86	-7.74	877.99	15.7	7.02	969		
31483	12-Mar-86	-7.56	878.17		6.89	983		
31487	16-Mar-86	-7.59	878.14		6.85	968		
31489	18-Mar-86	-7.44	878.29	16.1	6.83	1041		
31493	22-Mar-86	-7.51	878.22	16.5	6.90	1019		
31498	27-Mar-86	-7.50	878.23	16.5	6.84	990		
31503	01-Apr-86	-7.50	878.23	16.0	6.99	917		
31504	02-Apr-86	-7.38	878.35		6.93	1022		
31505	03-Apr-86	-6.93	878.80		6.88	968		
31506	04-Apr-86	-6.15	879.58		6.82	1031		
31508	06-Apr-86	-6.49	879.24		6.96	1077		
31510	08-Apr-86	-6.41	879.32		6.85	1095		
31511	09-Apr-86	-6.85	878.88					
31513	11-Apr-86	-6.55	879.18		6.83	972		
31514	12-Apr-86	-6.56	879.17					
31516	14-Apr-86	-6.61	879.12					
31517	15-Apr-86	-6.60	879.13	12.6	7.19	922		21.1
31519	17-Apr-86	-6.62	879.11					
31521	19-Apr-86	-6.67	879.06	15.9	6.93		589	19.0
31522	20-Apr-86	-6.66	879.07	17.5	6.97		588	18.8
31524	22-Apr-86	-6.93	878.80					
31529	27-Apr-86	-6.89	878.84					

WELLA4

LOTUS DATE	DATE	DEPTH TO WATER (FT)	ELEVATION FEET	TEMP DEG C	PH	EC UMHOS/CM	HCO3 MG/L	CL MG/L
31530	28-Apr-86	-7.03	878.70		7.03		596	24.9
31538	06-May-86	-7.20	878.53					
31539	07-May-86	-7.25	878.48	18.3	7.08	877	604	31.0
31541	09-May-86	-7.36	878.37					
31542	10-May-86	-7.22	878.51					
31543	11-May-86	-7.25	878.48					
31544	12-May-86	-7.20	878.53					
31545	13-May-86	-7.32	878.41	17.9	6.90	973	586	23.1
31547	15-May-86	-7.13	878.60			1012	606	38.3
31548	16-May-86	-7.25	878.48	19.0	7.43	982	597	24.3
31549	17-May-86	-6.22	879.51	17.7		961	601	25.0
31550	18-May-86	-6.61	879.12	16.9		994	605	33.7
31551	19-May-86	-6.72	879.01					
31552	20-May-86	-6.71	879.02					
31553	21-May-86	-6.73	879.00	17.0	6.76	1003	600	28.9
31555	23-May-86	-6.94	878.79					
31559	27-May-86	-7.18	878.55	17.2	7.14	1022	611	24.0
31560	28-May-86	-7.32	878.41					
31562	30-May-86	-7.31	878.42					
31563	31-May-86	-7.30	878.43	21.4	6.76	1024	610	26.1
31566	03-Jun-86	-7.55	878.18					
31570	07-Jun-86	-7.59	878.14	18.4	7.08	929	605	24.1
31572	09-Jun-86	-7.61	878.12					
31577	14-Jun-86	-8.00	877.73	17.3	6.75	1045	608	33.6
31578	15-Jun-86	-7.83	877.90	17.4	7.03	1021	608	27.1
31579	16-Jun-86	-7.98	877.75					
31582	19-Jun-86	-8.09	877.64					
31584	21-Jun-86	-8.26	877.47					
31585	22-Jun-86			17.7	6.64	1160	605	28.2
31586	23-Jun-86	-8.21	877.52					
31591	28-Jun-86	-8.55	877.18		6.80	1079	592	28.7
31595	02-Jul-86	-8.50	877.23					
31599	06-Jul-86	-8.76	876.97	18.7	6.62	1079	591	27.2
31605	12-Jul-86	-9.30	876.43	18.9	6.69	1102	616	30.9
31607	14-Jul-86	-9.45	876.28					
31612	19-Jul-86	-9.98	875.75	19.2	6.73	1130	613	32.9
31619	26-Jul-86	-10.69	875.04	20.0	6.65	1140	598	33.5
31626	02-Aug-86	-11.35	874.38	20.0	6.77	1093	653	29.0
31634	10-Aug-86	-10.16	875.57	20.8	6.63	1094		24.1
31640	16-Aug-86	-9.98	875.75		6.77	1095		17.4
31644	20-Aug-86	-10.15	875.58					
31645	21-Aug-86	-10.19	875.54					
31648	24-Aug-86	-10.44	875.29		6.51	1069		17.3
31654	30-Aug-86	-10.64	875.09		6.42	1046	599	18.7
31661	06-Sep-86	-10.51	875.22		6.93	1075	539	21.5
31666	11-Sep-86	-10.96	874.77					

WELLA4

LOTUS DATE	DATE	DEPTH TO WATER (FT)	ELEVATION FEET	TEMP DEG C	PH	EC UMHOS/CM	HCO3 MG/L	CL MG/L
31669	14-Sep-86	-11.19	874.54	21.7	6.42	1079	594	24.1
31670	15-Sep-86	-11.15	874.58					
31676	21-Sep-86	-11.64	874.09	21.8	6.50	1000	595	20.4
31683	28-Sep-86	-11.76	873.97	21.9	6.66	969	593	23.7
31684	29-Sep-86	-10.93	874.80	21.8	6.56	924	586	22.0
31685	30-Sep-86	-9.35	876.38	22.1	6.47	970	585	22.8
31686	01-Oct-86	-9.49	876.24					
31687	02-Oct-86	-9.40	876.33					
31688	03-Oct-86	-7.76	877.97					
31689	04-Oct-86	-7.62	878.11	22.1	6.59	900	585	22.5
31691	06-Oct-86	-7.93	877.80					
31695	10-Oct-86	-8.11	877.62	22.6	6.66	933	589	22.4
31704	19-Oct-86	-8.45	877.28	21.9	6.50	998	602	24.2
31707	22-Oct-86	-7.69	878.04					
31708	23-Oct-86	-7.49	878.24					
31709	24-Oct-86	-7.53	878.20					
31710	25-Oct-86	-7.52	878.21	21.8	6.72	997	610	18.7
31711	26-Oct-86	-7.56	878.17					
31712	27-Oct-86	-7.58	878.15					
31713	28-Oct-86	-7.72	878.01					
31714	29-Oct-86	-7.84	877.89					
31715	30-Oct-86	-7.76	877.97					
31716	31-Oct-86	-7.67	878.06					
31717	01-Nov-86	-7.75	877.98					
31718	02-Nov-86	-7.74	877.99					
31720	04-Nov-86	-7.26	878.47					
31721	05-Nov-86	-6.49	879.24					
31722	06-Nov-86	-6.46	879.27	21.2	6.80	1011	598	17.3
31727	11-Nov-86	-6.74	878.99					
31730	14-Nov-86	-6.68	879.05					
31732	16-Nov-86	-6.73	879.00	20.7	6.64	981	597	17.1
31736	20-Nov-86	-6.94	878.79					
31739	23-Nov-86	-6.95	878.78	20.2	6.74	973	599	17.6
31742	26-Nov-86	-5.44	880.29					
31744	28-Nov-86	-5.64	880.09	19.5	6.59	1012	596	16.2
31746	30-Nov-86	-5.71	880.02					
31752	06-Dec-86	-6.12	879.61					
31753	07-Dec-86	-5.91	879.82	18.8	6.55	1025	619	23.1
31761	15-Dec-86	-5.71	880.02					
31767	21-Dec-86	-6.05	879.68	17.1	6.78	1055		
31775	29-Dec-86	-6.24	879.49					
31778	01-Jan-87	-6.38	879.35	16.3	7.12	1050	619	30.4
31784	07-Jan-87	-6.50	879.23					
31786	09-Jan-87	-6.31	879.42					
31787	10-Jan-87	-6.16	879.57	17.1	6.59	1104	615	26.4
31792	15-Jan-87	-6.21	879.52					

WELLA4

LOTUS DATE	DATE	DEPTH TO WATER (FT)	ELEVATION FEET	TEMP DEG C	PH	EC UMHOS/CM	HCO3 MG/L	CL MG/L
31802	25-Jan-87	-6.29	879.44		6.78	1029	613	19.0
31806	29-Jan-87	-5.74	879.99					
31809	01-Feb-87	-5.60	880.13	16.4	6.46	1058	573	18.3
31816	08-Feb-87	-5.25	880.48	15.3	6.64	1062	561	16.6
31823	15-Feb-87	-4.83	880.90					
31830	22-Feb-87	-4.87	880.86					
31832	24-Feb-87	-5.06	880.67					
31834	26-Feb-87	-5.13	880.60					
31837	01-Mar-87	-3.82	881.91					
31839	03-Mar-87	-4.30	881.43					
31840	04-Mar-87	-4.45	881.28					
31841	05-Mar-87	-4.53	881.20					
31842	06-Mar-87	-4.67	881.06					
31843	07-Mar-87	-4.75	880.98					
31844	08-Mar-87	-4.81	880.92					
31845	09-Mar-87	-5.93	879.80					
31846	10-Mar-87	-6.09	879.64					
31847	11-Mar-87	-6.17	879.56					
31848	12-Mar-87	-5.33	880.40					
31849	13-Mar-87	-5.31	880.42					
31850	14-Mar-87	-5.29	880.44					
31852	16-Mar-87	-5.42	880.31					
31853	17-Mar-87	-4.25	881.48					
31854	18-Mar-87	-4.46	881.27					
31855	19-Mar-87	-4.71	881.02					
31856	20-Mar-87	-4.80	880.93					
31857	21-Mar-87	-4.95	880.78					
31858	22-Mar-87	-4.98	880.75					
31859	23-Mar-87	-4.95	880.78					
31860	24-Mar-87	-4.98	880.75					
31862	26-Mar-87	-5.14	880.59					
31863	27-Mar-87	-5.15	880.58					
31864	28-Mar-87	-5.27	880.46					
31865	29-Mar-87	-5.35	880.38					
31870	03-Apr-87	-5.55	880.18					
31871	04-Apr-87	-5.63	880.10					
31873	06-Apr-87	-5.64	880.09					

WELLA5

LOTUS DATE	DATE	DEPTH TO WATER (FT)	ELEVATION FEET	TEMP DEG C	PH	EC UMHOS/CM	HCO3 MG/L	CL MG/L
31403	22-Dec-85	-7.39	878.34					
31410	29-Dec-85	-7.50	878.23					
31415	03-Jan-86	-7.57	878.16					
31426	14-Jan-86	-7.61	878.12					
31428	16-Jan-86	-7.64	878.09	18.5	6.91	922		
31432	20-Jan-86	-7.54	878.19					
31435	23-Jan-86	-7.72	878.01	16.4	7.01	892	586	15.6
31440	28-Jan-86	-7.57	878.16	16.1	6.92	938		
31444	01-Feb-86	-7.75	877.98					
31447	04-Feb-86	-7.67	878.06		6.91	955		
31449	06-Feb-86	-7.75	877.98	16.0	6.81	936		
31456	13-Feb-86	-7.68	878.05	16.0	6.89	803		
31461	18-Feb-86	-7.63	878.10					
31463	20-Feb-86	-7.81	877.92	15.6	6.89	1002		
31468	25-Feb-86	-7.76	877.97		6.99	964		
31473	02-Mar-86	-7.73	878.00					
31477	06-Mar-86	-7.76	877.97	15.7	6.99	934		
31483	12-Mar-86	-7.58	878.15		6.93	952		
31487	16-Mar-86	-7.59	878.14		6.89	958		
31489	18-Mar-86	-7.45	878.28	15.7	6.85	1032		
31493	22-Mar-86	-7.52	878.21	16.4	6.92	987		
31498	27-Mar-86	-7.60	878.13	16.5	6.93	980		
31503	01-Apr-86	-7.66	878.07		7.00	903		
31504	02-Apr-86	-7.41	878.32		6.94	1001		
31505	03-Apr-86	-6.71	879.02		6.88	957		
31506	04-Apr-86	-5.80	879.93		6.80	1020		
31508	06-Apr-86	-6.24	879.49		6.97	1057		
31510	08-Apr-86	-6.21	879.52		6.84	1092		
31511	09-Apr-86	-6.50	879.23					
31513	11-Apr-86	-6.36	879.37		6.85	968		
31514	12-Apr-86	-6.42	879.31					
31516	14-Apr-86	-6.60	879.13					
31517	15-Apr-86	-6.63	879.10	12.5	7.14	918		22.0
31519	17-Apr-86	-6.35	879.38					
31521	19-Apr-86	-6.49	879.24	15.7	6.90		587	20.1
31522	20-Apr-86	-6.40	879.33	17.9	7.03		732	21.0
31524	22-Apr-86	-6.61	879.12					
31529	27-Apr-86	-6.71	879.02					
31530	28-Apr-86	-6.84	878.89		6.99		589	21.9
31538	06-May-86	-7.22	878.51					
31539	07-May-86	-7.32	878.41	18.5	7.00	874	595	30.0
31541	09-May-86	-7.32	878.41					
31542	10-May-86	-7.31	878.42					
31543	11-May-86	-7.26	878.47					
31544	12-May-86	-7.30	878.43					
31545	13-May-86	-7.40	878.33	17.9	6.92	970	580	24.5
31547	15-May-86	-7.13	878.60		7.36	988	589	23.1

WELLA5

LOTUS DATE	DATE	DEPTH TO WATER (FT)	ELEVATION FEET	TEMP DEG C	PH	EC UMHOS/CM	HCO3 MG/L	CL MG/L
31548	16-May-86	-7.20	878.53	19.2	7.42	980	589	25.3
31549	17-May-86	-6.31	879.42	17.9		944	593	25.6
31550	18-May-86	-6.56	879.17	17.0		996	603	34.4
31551	19-May-86	-6.68	879.05					
31552	20-May-86	-6.76	878.97					
31553	21-May-86	-6.78	878.95	17.1	6.77	1000	601	28.6
31555	23-May-86	-6.95	878.78					
31559	27-May-86	-7.19	878.54	17.2	7.05	1020	592	26.7
31560	28-May-86	-7.21	878.52					
31562	30-May-86	-7.33	878.40					
31563	31-May-86	-7.31	878.42	20.7	6.72	1015	616	26.9
31566	03-Jun-86	-7.41	878.32					
31570	07-Jun-86	-7.49	878.24	18.4	6.76	935	609	26.7
31572	09-Jun-86	-7.61	878.12					
31577	14-Jun-86	-8.00	877.73	17.3	6.75	1032	612	38.4
31578	15-Jun-86	-7.81	877.92	17.5	6.99	1018	607	31.7
31579	16-Jun-86	-7.91	877.82					
31582	19-Jun-86	-8.08	877.65					
31584	21-Jun-86	-8.26	877.47					
31585	22-Jun-86			17.8	6.73	1165	586	32.0
31586	23-Jun-86	-8.20	877.53					
31591	28-Jun-86	-8.53	877.20		6.75	1098	580	
31595	02-Jul-86	-8.46	877.27					
31599	06-Jul-86	-8.76	876.97	18.7	6.71	1068	572	27.3
31605	12-Jul-86	-9.25	876.48	19.2	6.74	1063	572	31.6
31607	14-Jul-86	-9.40	876.33					
31612	19-Jul-86	-9.93	875.80	19.3	6.81	1073	580	33.8
31619	26-Jul-86	-10.63	875.10	20.3	6.78	1097	580	33.9
31626	02-Aug-86	-11.29	874.44	20.2	6.75	1035	578	34.0
31634	10-Aug-86	-10.08	875.65	21.3	6.67	1064		25.3
31640	16-Aug-86	-9.85	875.88		6.77	1057		17.9
31644	20-Aug-86	-10.07	875.66					
31648	24-Aug-86	-10.36	875.37		6.55	1022		19.0
31654	30-Aug-86	-10.56	875.17		6.51	1005	566	21.6
31661	06-Sep-86	-10.46	875.27		6.94	1024	497	22.8
31666	11-Sep-86	-10.94	874.79					
31669	14-Sep-86	-11.16	874.57	22.0	6.53	1032	557	24.6
31670	15-Sep-86	-11.14	874.59					
31676	21-Sep-86	-11.62	874.11		6.47	955	556	23.5
31683	28-Sep-86	-11.75	873.98	22.1	6.59	931	545	25.7
31684	29-Sep-86				6.59	884	536	27.3
31685	30-Sep-86	-9.35	876.38		6.57	922	537	28.7
31686	01-Oct-86	-9.41	876.32					
31687	02-Oct-86	-9.39	876.34					
31688	03-Oct-86	-7.54	878.19					
31689	04-Oct-86	-7.64	878.09	22.8	6.60	869	539	27.8

WELLA5

LOTUS DATE	DATE	DEPTH TO WATER (FT)	ELEVATION FEET	TEMP DEG C	PH	EC UMHOS/CM	HCO3 MG/L	CL MG/L
31691	06-Oct-86	-7.92	877.81					
31695	10-Oct-86	-8.09	877.64	23.1	6.65	875	540	25.6
31704	19-Oct-86	-8.45	877.28	22.3	6.63	945	550	28.9
31707	22-Oct-86	-7.62	878.11					
31708	23-Oct-86	-7.47	878.26					
31709	24-Oct-86	-7.51	878.22					
31710	25-Oct-86	-7.50	878.23	21.8	6.81	966	574	20.1
31711	26-Oct-86	-7.55	878.18					
31712	27-Oct-86	-7.55	878.18					
31713	28-Oct-86	-7.71	878.02					
31714	29-Oct-86	-7.82	877.91					
31715	30-Oct-86	-7.75	877.98					
31716	31-Oct-86	-7.65	878.08					
31717	01-Nov-86	-7.74	877.99					
31718	02-Nov-86	-7.72	878.01					
31720	04-Nov-86	-7.15	878.58					
31721	05-Nov-86	-6.51	879.22					
31722	06-Nov-86	-6.45	879.28	21.1	6.84	1000	575	19.9
31727	11-Nov-86	-6.73	879.00					
31730	14-Nov-86	-6.67	879.06					
31732	16-Nov-86	-6.72	879.01	20.8	6.74	964	586	19.3
31736	20-Nov-86	-6.94	878.79					
31739	23-Nov-86	-6.92	878.81		6.85	958	587	19.8
31742	26-Nov-86	-5.45	880.28					
31744	28-Nov-86	-5.63	880.10	19.5	6.62	987	578	19.4
31746	30-Nov-86	-5.71	880.02					
31752	06-Dec-86	-6.11	879.62					
31753	07-Dec-86	-5.88	879.85		6.58	1004	604	21.4
31761	15-Dec-86	-5.71	880.02					
31767	21-Dec-86	-6.05	879.68	17.5	6.59	1054		
31775	29-Dec-86	-6.25	879.48					
31778	01-Jan-87	-6.39	879.34	17.5	6.54	1088	613	30.7
31784	07-Jan-87	-6.52	879.21					
31786	09-Jan-87	-6.23	879.50					
31787	10-Jan-87	-6.16	879.57	17.1	6.65	1091	630	26.4
31792	15-Jan-87	-6.21	879.52					
31802	25-Jan-87	-6.28	879.45		6.82	1056	615	20.5
31806	29-Jan-87	-5.74	879.99					
31809	01-Feb-87	-5.62	880.11		6.45	1078	581	18.8
31816	08-Feb-87	-5.15	880.58	15.3	6.65	1091	584	19.2
31823	15-Feb-87	-4.84	880.89					
31830	22-Feb-87	-4.91	880.82					
31834	26-Feb-87	-5.16	880.57					
31837	01-Mar-87	-3.88	881.85					
31839	03-Mar-87	-4.33	881.40					
31840	04-Mar-87	-4.49	881.24					

WELLA5

LOTUS DATE	DATE	DEPTH TO WATER (FT)	ELEVATION FEET	TEMP DEG C	PH	EC UMHOS/CM	HCO3 MG/L	CL MG/L
31841	05-Mar-87	-4.57	881.16					
31842	06-Mar-87	-4.72	881.01					
31843	07-Mar-87	-4.79	880.94					
31844	08-Mar-87	-4.86	880.87					
31845	09-Mar-87	-5.95	879.78					
31846	10-Mar-87	-6.11	879.62					
31847	11-Mar-87	-6.18	879.55					
31848	12-Mar-87	-5.38	880.35					
31849	13-Mar-87	-5.35	880.38					
31850	14-Mar-87	-5.32	880.41					
31852	16-Mar-87	-5.45	880.28					
31853	17-Mar-87	-4.30	881.43					
31854	18-Mar-87	-4.50	881.23					
31855	19-Mar-87	-4.74	880.99					
31856	20-Mar-87	-4.84	880.89					
31857	21-Mar-87	-4.99	880.74					
31858	22-Mar-87	-5.02	880.71					
31859	23-Mar-87	-4.99	880.74					
31860	24-Mar-87	-5.01	880.72					
31862	26-Mar-87	-5.19	880.54					
31863	27-Mar-87	-5.19	880.54					
31864	28-Mar-87	-5.30	880.43					
31865	29-Mar-87	-5.39	880.34					
31870	03-Apr-87	-5.60	880.13					
31871	04-Apr-87	-5.66	880.07					
31873	06-Apr-87	-5.69	880.04					

WELLC1

LOTUS DATE	DATE	DEPTH TO WATER (FT)	ELEVATION FEET	TEMP DEG C	PH	EC UMHOS/CM	HCO3 MG/L	CL MG/L
31208	10-Jun-85	-7.05	878.42	18.3		1411		
31366	15-Nov-85	-7.53	877.94	17.6	7.34	1628		
31372	21-Nov-85	-7.49	877.98	17.5	7.53	1706		
31376	25-Nov-85	-7.45	878.02	17.8	7.50	1602		
31381	30-Nov-85	-7.44	878.03	16.8	7.74	1731		
31386	05-Dec-85	-7.46	878.01	16.4	7.76	1628		
31403	22-Dec-85	-7.29	878.18	14.6	7.56	1661		
31410	29-Dec-85	-7.40	878.07					
31415	03-Jan-86	-7.44	878.03	14.2	7.98	1840		
31423	11-Jan-86	-7.45	878.02	13.4	7.12	1657		
31426	14-Jan-86	-7.48	877.99	13.0	6.99	1690		
31428	16-Jan-86	-7.50	877.97	15.2	7.14	1517		
31432	20-Jan-86	-7.42	878.05					
31435	23-Jan-86	-7.60	877.87	13.0	7.00	1681	1114	30
31440	28-Jan-86	-7.40	878.07	12.8	7.11	1591		
31444	01-Feb-86	-7.59	877.88					
31447	04-Feb-86	-7.53	877.94					
31449	06-Feb-86	-7.60	877.87	15.8	7.21	1475		
31456	13-Feb-86	-7.54	877.93	13.0	7.16	1543		
31461	18-Feb-86	-7.47	878.00					
31463	20-Feb-86	-7.58	877.89	12.8	7.26	1625		
31468	25-Feb-86	-7.56	877.91	16.2	7.28	1647		
31473	02-Mar-86	-7.56	877.91					
31477	06-Mar-86	-7.58	877.89	12.7	7.24	1728		
31483	12-Mar-86	-7.40	878.07		7.18	1668		
31487	16-Mar-86	-7.39	878.08	18.4	7.21	1600		
31489	18-Mar-86	-7.23	878.24	12.9	7.14	1648		
31493	22-Mar-86	-7.32	878.15	13.5	7.32	1703		
31498	27-Mar-86	-7.33	878.14	13.6	7.05	1704		
31503	01-Apr-86	-7.42	878.05		7.25	1559		
31504	02-Apr-86	-7.18	878.29		7.02	1629		
31505	03-Apr-86	-5.93	879.54		7.04	1715		
31506	04-Apr-86	-5.14	880.33		7.04	1915		
31508	06-Apr-86	-5.59	879.88		6.99	1914		
31510	08-Apr-86	-5.83	879.64		6.94	1979		
31511	09-Apr-86	-5.97	879.50					
31513	11-Apr-86	-6.00	879.47		6.93	1717		
31514	12-Apr-86	-6.06	879.41					
31516	14-Apr-86	-6.28	879.19					
31517	15-Apr-86	-6.31	879.16	11.9	7.17	1725		33.5
31519	17-Apr-86	-6.10	879.37					
31521	19-Apr-86	-6.11	879.36	14.4	7.01		1108	29.7
31522	20-Apr-86	-6.01	879.46		7.03		1137	18.4
31524	22-Apr-86	-6.20	879.27					
31529	27-Apr-86	-6.40	879.07					
31530	28-Apr-86	-6.50	878.97		7.24		1114	40.7
31538	06-May-86	-6.97	878.50					

WELLC1

LOTUS DATE	DATE	DEPTH TO WATER (FT)	ELEVATION FEET	TEMP DEG C	PH	EC UMHOS/CM	HCO3 MG/L	CL MG/L
31539	07-May-86	-7.07	878.40	15.8	7.30	1530	1100	36.9
31541	09-May-86	-7.08	878.39					
31542	10-May-86	-7.09	878.38					
31543	11-May-86	-7.03	878.44					
31544	12-May-86	-7.05	878.42					
31545	13-May-86	-7.18	878.29	16.2				
31547	15-May-86	-6.97	878.50		7.44	1679	1079	33.1
31548	16-May-86	-7.02	878.45	17.6	7.41	1672		30.9
31549	17-May-86	-6.33	879.14	15.7		1520	1027	27.8
31550	18-May-86	-6.35	879.12	15.5		1581	1053	32.9
31551	19-May-86	-6.46	879.01					
31552	20-May-86	-6.51	878.96					
31553	21-May-86	-6.56	878.91	15.7	6.90	1642	1079	32.4
31555	23-May-86	-6.73	878.74					
31559	27-May-86	-7.00	878.47	16.3	7.45	1650		32.9
31560	28-May-86	-7.04	878.43					
31562	30-May-86	-7.16	878.31					
31563	31-May-86	-7.12	878.35	17.6	7.04	1633		30.3
31566	03-Jun-86	-7.23	878.24					
31570	07-Jun-86	-7.36	878.11	17.7	7.28	1609		25.8
31572	09-Jun-86	-7.49	877.98					
31577	14-Jun-86	-7.99	877.48	17.4				
31578	15-Jun-86	-7.89	877.58					
31579	16-Jun-86	-7.90	877.57					
31721	05-Nov-86	-6.40	879.07					
31722	06-Nov-86	-6.22	879.25	18.4	6.70	1488	995	23.7
31727	11-Nov-86	-6.56	878.91					
31730	14-Nov-86	-6.55	878.92					
31732	16-Nov-86	-6.59	878.88		6.60	1522	1039	27.2
31736	20-Nov-86	-6.82	878.65					
31739	23-Nov-86	-6.78	878.69	17.2	6.92	1538		
31742	26-Nov-86	-4.95	880.52					
31744	28-Nov-86	-5.38	880.09	16.3	6.56	1725	1030	52.5
31746	30-Nov-86	-5.47	880.00					
31752	06-Dec-86	-5.86	879.61					
31753	07-Dec-86	-5.80	879.67	15.6	6.63	1755	1086	58.7
31761	15-Dec-86	-5.37	880.10					
31767	21-Dec-86	-5.70	879.77	13.8	6.87	1834		
31775	29-Dec-86	-5.89	879.58					
31778	01-Jan-87	-6.03	879.44	13.8	7.05	1885	1080	76.3
31784	07-Jan-87	-6.20	879.27					
31786	09-Jan-87	-5.90	879.57					
31787	10-Jan-87	-5.77	879.70	12.8	6.72	1971	1115	83.5
31792	15-Jan-87	-5.83	879.64					
31802	25-Jan-87	-5.91	879.56		6.98	1720	1106	72.9
31806	29-Jan-87	-5.24	880.23					

WELLC1

LOTUS DATE	DATE	DEPTH TO WATER (FT)	ELEVATION FEET	TEMP DEG C	PH	EC UMHOS/CM	HCO3 MG/L	CL MG/L
31809	01-Feb-87	-5.20	880.27	12.2	6.52	1896	1034	77.5
31816	08-Feb-87	-4.66	880.81	11.7	6.78	1905	950	80.1
31823	15-Feb-87	-4.18	881.29					
31830	22-Feb-87	-4.33	881.14					
31832	24-Feb-87	-4.52	880.95					
31834	26-Feb-87	-4.59	880.88					
31837	01-Mar-87	-3.24	882.23					
31839	03-Mar-87	-3.75	881.72					
31840	04-Mar-87	-3.89	881.58					
31841	05-Mar-87	-3.98	881.49					
31842	06-Mar-87	-4.12	881.35					
31843	07-Mar-87	-4.19	881.28					
31844	08-Mar-87	-4.24	881.23					
31845	09-Mar-87	-4.77	880.70					
31846	10-Mar-87	-4.97	880.50					
31847	11-Mar-87	-5.07	880.40					
31848	12-Mar-87	-4.79	880.68					
31849	13-Mar-87	-4.77	880.70					
31850	14-Mar-87	-4.74	880.73					
31852	16-Mar-87	-4.88	880.59					
31853	17-Mar-87	-3.37	882.10					
31854	18-Mar-87	-3.84	881.63					
31855	19-Mar-87	-4.15	881.32					
31856	20-Mar-87	-4.24	881.23					
31857	21-Mar-87	-4.39	881.08					
31858	22-Mar-87	-4.41	881.06					
31859	23-Mar-87	-4.39	881.08					
31860	24-Mar-87	-4.40	881.07					
31862	26-Mar-87	-4.61	880.86					
31863	27-Mar-87	-4.59	880.88					
31864	28-Mar-87	-4.71	880.76					
31865	29-Mar-87	-4.81	880.66					
31870	03-Apr-87	-5.02	880.45					
31871	04-Apr-87	-5.10	880.37					
31873	06-Apr-87	-5.12	880.35					

WELLC2

LOTUS DATE	DATE	DEPTH TO WATER (FT)	ELEVATION FEET	TEMP DEG C	PH	EC UMHOS/CM	HCO3 MG/L	CL MG/L
31208	10-Jun-85	-7.05	878.42	17.3	7.10	1448		
31349	29-Oct-85	-8.79	876.68					
31352	01-Nov-85	-8.76	876.71	18.6	7.57	1311		
31354	03-Nov-85	-8.78	876.69					
31357	06-Nov-85	-8.75	876.72	18.5	8.01	1243		
31364	13-Nov-85	-8.56	876.91					
31366	15-Nov-85	-7.83	877.64	18.0	7.58	1196		
31368	17-Nov-85	-7.42	878.05	17.9	7.39	1253		
31372	21-Nov-85	-7.41	878.06	17.9	7.55	1314		
31376	25-Nov-85	-7.40	878.07	17.9	7.40	1261		
31381	30-Nov-85	-7.42	878.05	16.9	7.60	1385		
31386	05-Dec-85	-7.43	878.04	16.8	7.61	1348		
31403	22-Dec-85	-7.26	878.21	14.8	7.56	1403		
31410	29-Dec-85	-7.38	878.09					
31415	03-Jan-86	-7.42	878.05	14.6	7.83	1620		
31423	11-Jan-86	-7.42	878.05	13.8	6.96	1493		
31426	14-Jan-86	-7.45	878.02	13.7	6.94	1518		
31428	16-Jan-86	-7.48	877.99	16.0	6.91	1412		
31432	20-Jan-86	-7.38	878.09					
31435	23-Jan-86	-7.58	877.89	13.2	6.78	1530	1165	30.0
31440	28-Jan-86	-7.40	878.07	13.2	6.89	1528		
31444	01-Feb-86	-7.57	877.90					
31447	04-Feb-86	-7.51	877.96					
31449	06-Feb-86	-7.63	877.84	16.4	7.02	1357		
31456	13-Feb-86	-7.51	877.96	13.2	6.99	1452		
31461	18-Feb-86	-7.44	878.03					
31463	20-Feb-86	-7.53	877.94	13.0	6.98	1531		
31468	25-Feb-86	-7.54	877.93	16.4	7.06	1550		
31473	02-Mar-86	-7.54	877.93					
31477	06-Mar-86	-7.54	877.93	12.7	7.07	1624		
31483	12-Mar-86	-7.41	878.06		7.00	1560		
31487	16-Mar-86	-7.37	878.10	18.5	7.03	1503		
31489	18-Mar-86	-7.21	878.26	13.0	6.97	1609		
31493	22-Mar-86	-7.27	878.20	13.6	7.02	1610		
31498	27-Mar-86	-7.31	878.16	13.7	6.94	1543		
31503	01-Apr-86	-7.31	878.16		7.10	1495		
31504	02-Apr-86	-7.14	878.33		7.03	1570		
31505	03-Apr-86	-6.13	879.34		7.00	1626		
31506	04-Apr-86	-5.38	880.09		6.98	1768		
31508	06-Apr-86	-5.80	879.67		6.97	1730		
31510	08-Apr-86	-6.04	879.43		6.95	1752		
31511	09-Apr-86	-6.20	879.27					
31513	11-Apr-86	-6.17	879.30		6.81	1585		
31514	12-Apr-86	-6.24	879.23					
31516	14-Apr-86	-6.47	879.00					
31517	15-Apr-86	-6.42	879.05	12.2	7.13	1594		17.9
31519	17-Apr-86	-6.27	879.20					

WELLC2

LOTUS DATE	DATE	DEPTH TO WATER (FT)	ELEVATION FEET	TEMP DEG C	PH	EC UMHOS/CM	HCO3 MG/L	CL MG/L
31521	19-Apr-86	-6.29	879.18	14.3	6.96		1047	18.2
31522	20-Apr-86	-6.19	879.28		7.02		1341	17.0
31524	22-Apr-86	-6.39	879.08					
31529	27-Apr-86	-6.59	878.88					
31530	28-Apr-86	-6.68	878.79		7.15		1068	25.6
31538	06-May-86	-7.11	878.36					
31539	07-May-86	-7.22	878.25	16.0	7.27	1435	1066	29.5
31541	09-May-86	-7.23	878.24					
31542	10-May-86	-7.23	878.24					
31543	11-May-86	-7.17	878.30					
31544	12-May-86	-7.20	878.27					
31545	13-May-86	-7.28	878.19	16.0	7.31	1470	993	23.1
31547	15-May-86	-7.11	878.36		7.38	1572	1011	27.1
31548	16-May-86	-7.14	878.33	17.3	7.36	1533	1013	23.4
31549	17-May-86	-6.38	879.09	15.5		1426	978	20.3
31550	18-May-86	-6.38	879.09	15.2		1485	1001	25.8
31551	19-May-86	-6.49	878.98					
31552	20-May-86	-6.53	878.94					
31553	21-May-86	-6.59	878.88	15.5	6.88	1519	1019	18.5
31555	23-May-86	-6.72	878.75					
31559	27-May-86	-7.04	878.43	16.1	7.56	1502	1007	19.6
31560	28-May-86	-7.05	878.42					
31562	30-May-86	-7.15	878.32					
31563	31-May-86	-7.16	878.31	17.5	7.05	1512	1007	20.4
31566	03-Jun-86	-7.31	878.16					
31570	07-Jun-86	-7.41	878.06	17.5	6.93	1520	995	23.7
31572	09-Jun-86	-7.54	877.93					
31577	14-Jun-86	-7.98	877.49	16.6	6.96	1606		43.5
31578	15-Jun-86	-7.84	877.63					
31579	16-Jun-86	-7.92	877.55					
31582	19-Jun-86	-8.10	877.37					
31584	21-Jun-86	-8.29	877.18					
31585	22-Jun-86			17.0	7.50	1615	906	23.0
31586	23-Jun-86	-8.38	877.09					
31591	28-Jun-86	-8.62	876.85					
31595	02-Jul-86	-8.64	876.83					
31599	06-Jul-86	-9.00	876.47					
31707	22-Oct-86	-8.05	877.42					
31708	23-Oct-86	-7.69	877.78					
31709	24-Oct-86	-7.67	877.80					
31710	25-Oct-86	-7.63	877.84					
31711	26-Oct-86	-7.63	877.84					
31712	27-Oct-86	-7.62	877.85					
31713	28-Oct-86	-7.76	877.71					
31714	29-Oct-86	-7.87	877.60					
31715	30-Oct-86	-7.79	877.68					

WELLC2

LOTUS DATE	DATE	DEPTH TO WATER (FT)	ELEVATION FEET	TEMP DEG C	PH	EC UMHOS/CM	HCO3 MG/L	CL MG/L
31716	31-Oct-86	-7.69	877.78					
31717	01-Nov-86	-7.76	877.71					
31718	02-Nov-86	-7.75	877.72					
31720	04-Nov-86	-7.42	878.05					
31721	05-Nov-86	-6.30	879.17					
31722	06-Nov-86	-6.24	879.23	17.7	6.74	1380	848	22.1
31727	11-Nov-86	-6.60	878.87					
31730	14-Nov-86	-6.52	878.95					
31732	16-Nov-86	-6.56	878.91					21.6
31736	20-Nov-86	-6.80	878.67					
31739	23-Nov-86	-6.80	878.67	17.5	6.70	1385	918	20.7
31742	26-Nov-86	-4.94	880.53					
31744	28-Nov-86	-5.38	880.09	16.5	6.59	1528	960	27.7
31746	30-Nov-86	-5.46	880.01					
31752	06-Dec-86	-5.85	879.62					
31753	07-Dec-86	-5.74	879.73	15.8	6.58	1556	1021	34.8
31761	15-Dec-86	-5.37	880.10					
31767	21-Dec-86	-5.69	879.78	14.2	6.90	1580		
31775	29-Dec-86	-5.88	879.59					
31778	01-Jan-87	-6.02	879.45	13.9	6.95	1628	1038	43.9
31784	07-Jan-87	-6.14	879.33					
31786	09-Jan-87	-5.97	879.50					
31787	10-Jan-87	-5.73	879.74	13.0	6.70	1707	1006	41.7
31792	15-Jan-87	-5.81	879.66					
31802	25-Jan-87	-5.88	879.59		6.93	1490	1030	33.5
31806	29-Jan-87	-5.24	880.23					
31809	01-Feb-87	-5.19	880.28	12.5	6.55	1647	988	36.9
31816	08-Feb-87	-4.63	880.84	11.9	6.86	1668	983	42.0
31823	15-Feb-87	-4.17	881.30					
31830	22-Feb-87	-4.34	881.13					
31832	24-Feb-87	-4.51	880.96					
31834	26-Feb-87	-4.59	880.88					
31837	01-Mar-87	-3.26	882.21					
31839	03-Mar-87	-3.74	881.73					
31840	04-Mar-87	-3.88	881.59					
31841	05-Mar-87	-3.95	881.52					
31842	06-Mar-87	-4.09	881.38					
31843	07-Mar-87	-4.18	881.29					
31844	08-Mar-87	-4.23	881.24					
31845	09-Mar-87	-4.75	880.72					
31846	10-Mar-87	-4.95	880.52					
31847	11-Mar-87	-5.07	880.40					
31848	12-Mar-87	-4.77	880.70					
31849	13-Mar-87	-4.75	880.72					
31850	14-Mar-87	-4.73	880.74					
31852	16-Mar-87	-4.86	880.61					

WELLC2

LOTUS DATE	DATE	DEPTH TO WATER (FT)	ELEVATION FEET	TEMP DEG C	PH	EC UMHOS/CM	HCO3 MG/L	CL MG/L
31853	17-Mar-87	-3.29	882.18					
31854	18-Mar-87	-3.81	881.66					
31855	19-Mar-87	-4.10	881.37					
31856	20-Mar-87	-4.23	881.24					
31857	21-Mar-87	-4.38	881.09					
31858	22-Mar-87	-4.39	881.08					
31859	23-Mar-87	-4.36	881.11					
31860	24-Mar-87	-4.37	881.10					
31862	26-Mar-87	-4.59	880.88					
31863	27-Mar-87	-4.58	880.89					
31864	28-Mar-87	-4.69	880.78					
31865	29-Mar-87	-4.79	880.68					
31870	03-Apr-87	-5.00	880.47					
31871	04-Apr-87	-5.09	880.38					
31873	06-Apr-87	-5.09	880.38					

WELLC3

LOTUS DATE	DATE	DEPTH TO WATER (FT)	ELEVATION FEET	TEMP DEG C	PH	EC UMHOS/CM	HCO3 MG/L	CL MG/L
31247	19-Jul-85			19.8	7.11	1430		
31251	23-Jul-85			19.3	7.16	1360		
31253	25-Jul-85			20.6	7.20	1175		
31254	26-Jul-85			19.6	7.20	1185		
31257	29-Jul-85			20.3	7.15	1260		
31334	14-Oct-85	-10.10	875.37	18.4	7.02	1338		
31335	15-Oct-85	-9.61	875.86		7.14	1275		
31336	16-Oct-85	-9.62	875.85					
31337	17-Oct-85	-9.70	875.77	19.3	6.98	1560		
31338	18-Oct-85	-9.50	875.97	19.1	7.04	1463		
31339	19-Oct-85	-8.90	876.57	19.2	7.12	1385		
31341	21-Oct-85	-8.84	876.63	19.1	7.11	1506		
31343	23-Oct-85	-8.82	876.65					
31345	25-Oct-85	-8.93	876.54	19.0	7.26	1459	834	18.7
31347	27-Oct-85	-8.89	876.58					
31349	29-Oct-85	-8.81	876.66	18.7	7.16	1249		
31352	01-Nov-85	-8.78	876.69	18.7	7.31	1238		
31354	03-Nov-85	-8.80	876.67	18.9		1380		
31357	06-Nov-85	-8.72	876.75	18.8	7.25	1204		
31361	10-Nov-85	-8.83	876.64	18.2	7.29	1191		
31364	13-Nov-85	-8.55	876.92	18.6	7.25	1282		
31366	15-Nov-85	-7.79	877.68	18.4	7.47	1163		
31368	17-Nov-85	-7.44	878.03	18.3	7.34	1190		
31372	21-Nov-85	-7.43	878.04	18.0	7.41	1211		
31376	25-Nov-85	-7.40	878.07	18.2	7.26	1183		
31381	30-Nov-85	-7.44	878.03	17.4	7.46	1258		
31386	05-Dec-85	-7.45	878.02	17.6	7.43	1180		
31403	22-Dec-85	-7.30	878.17	15.5	7.47	1265		
31410	29-Dec-85	-7.41	878.06					
31415	03-Jan-86	-7.45	878.02	15.6	7.52	1488		
31423	11-Jan-86	-7.44	878.03	14.2	6.96	1234		
31426	14-Jan-86	-7.48	877.99	14.5	6.72	1260		
31428	16-Jan-86	-7.51	877.96	16.7	6.93	1180		
31432	20-Jan-86	-7.41	878.06					
31435	23-Jan-86	-7.59	877.88	13.8	6.96	1271	836	29.1
31440	28-Jan-86	-7.43	878.04	13.7	6.92	1303		
31444	01-Feb-86	-7.59	877.88					
31447	04-Feb-86	-7.52	877.95					
31449	06-Feb-86	-7.59	877.88	16.5	7.02	1126		
31456	13-Feb-86	-7.51	877.96	13.8	7.05	1180		
31461	18-Feb-86	-7.44	878.03					
31463	20-Feb-86	-7.60	877.87	13.7	7.05	1260		
31468	25-Feb-86	-7.55	877.92	15.7	7.02	1300		
31473	02-Mar-86	-7.58	877.89					
31477	06-Mar-86	-7.58	877.89	13.1	7.08	1359		
31483	12-Mar-86	-7.39	878.08		6.98	1007		
31487	16-Mar-86	-7.40	878.07	17.7	7.01	1223		

WELLC3

LOTUS DATE	DATE	DEPTH TO WATER (FT)	ELEVATION FEET	TEMP DEG C	PH	EC UMHOS/CM	HCO3 MG/L	CL MG/L
31489	18-Mar-86	-7.24	878.23	13.3	6.99	1288		
31493	22-Mar-86	-7.29	878.18	13.9	7.03	1313		
31498	27-Mar-86	-7.28	878.19	14.0	6.98	1346		
31503	01-Apr-86	-7.22	878.25		7.08	1232		
31504	02-Apr-86	-7.18	878.29		7.03	1198		
31505	03-Apr-86	-6.33	879.14		6.99	1416		
31506	04-Apr-86	-5.43	880.04		6.99	1611		
31508	06-Apr-86	-5.91	879.56		6.95	1775		
31510	08-Apr-86	-6.18	879.29		6.92	1724		
31511	09-Apr-86	-6.31	879.16					
31513	11-Apr-86	-6.15	879.32		6.80	1535		
31514	12-Apr-86	-6.16	879.31					
31516	14-Apr-86	-6.43	879.04					
31517	15-Apr-86	-6.48	878.99	12.4	7.09	1580		22.1
31519	17-Apr-86	-6.27	879.20					
31521	19-Apr-86	-6.27	879.20	14.2	6.94		1018	21.8
31522	20-Apr-86	-6.19	879.28		7.03		960	20.5
31524	22-Apr-86	-6.37	879.10					
31529	27-Apr-86	-6.59	878.88					
31530	28-Apr-86	-6.68	878.79		7.15		1028	26.9
31538	06-May-86	-7.17	878.30					
31539	07-May-86	-7.27	878.20	16.1	7.45	1392	1022	31.3
31541	09-May-86	-7.27	878.20					
31542	10-May-86	-7.30	878.17					
31543	11-May-86	-7.21	878.26					
31544	12-May-86	-7.25	878.22					
31545	13-May-86	-7.28	878.19	15.9	7.38	1429	946	24.8
31547	15-May-86	-7.14	878.33		7.36	1396	908	24.1
31548	16-May-86	-7.12	878.35	16.8	7.39	1415	914	31.7
31549	17-May-86	-6.31	879.16	15.4		1303	879	23.8
31550	18-May-86	-6.37	879.10	15.1		1375	923	27.5
31551	19-May-86	-6.48	878.99					
31552	20-May-86	-6.53	878.94					
31553	21-May-86	-6.57	878.90	15.2	6.92	1402	921	21.5
31555	23-May-86	-6.71	878.76					
31559	27-May-86	-7.01	878.46	15.7	7.59	1405	917	22.2
31560	28-May-86	-7.04	878.43					
31562	30-May-86	-7.14	878.33					
31563	31-May-86	-7.14	878.33	17.3	7.04	1367	899	22.3
31566	03-Jun-86	-7.29	878.18					
31570	07-Jun-86	-7.38	878.09	17.3	6.91	1315	859	20.3
31572	09-Jun-86	-7.52	877.95					
31577	14-Jun-86	-7.96	877.51	16.1	6.90	1320	850	25.2
31578	15-Jun-86	-7.81	877.66					
31579	16-Jun-86	-7.90	877.57					
31582	19-Jun-86	-8.08	877.39					

WELLC3

LOTUS DATE	DATE	DEPTH TO WATER (FT)	ELEVATION FEET	TEMP DEG C	PH	EC UMHOS/CM	HCO3 MG/L	CL MG/L
31584	21-Jun-86	-8.29	877.18					
31585	22-Jun-86			16.9	7.43	1417	796	28.1
31586	23-Jun-86	-8.35	877.12					
31591	28-Jun-86	-8.64	876.83		6.73	1286	755	23.5
31595	02-Jul-86	-8.63	876.84					
31599	06-Jul-86	-8.92	876.55	17.1	6.71	1222	754	25.7
31605	12-Jul-86	-9.44	876.03	17.4	6.77	1168	705	22.0
31607	14-Jul-86	-9.61	875.86					
31612	19-Jul-86	-10.18	875.29	17.9	6.79	1283		
31688	03-Oct-86	-8.80	876.67					
31689	04-Oct-86	-8.17	877.30	20.0	6.66	1115	732	21.6
31691	06-Oct-86	-8.17	877.30					
31695	10-Oct-86	-8.26	877.21	20.6				
31704	19-Oct-86	-8.53	876.94	20.1				
31707	22-Oct-86	-7.98	877.49					
31708	23-Oct-86	-7.66	877.81					
31709	24-Oct-86	-7.65	877.82					
31710	25-Oct-86	-7.62	877.85	19.6	6.88	990	686	22.9
31711	26-Oct-86	-7.63	877.84					
31712	27-Oct-86	-7.62	877.85					
31713	28-Oct-86	-7.76	877.71					
31714	29-Oct-86	-7.86	877.61					
31715	30-Oct-86	-7.78	877.69					
31716	31-Oct-86	-7.68	877.79					
31717	01-Nov-86	-7.76	877.71					
31718	02-Nov-86	-7.73	877.74					
31720	04-Nov-86	-7.38	878.09					
31721	05-Nov-86	-6.31	879.16					
31722	06-Nov-86	-6.24	879.23	16.5	6.80	1164	729	20.7
31727	11-Nov-86	-6.61	878.86					
31730	14-Nov-86	-6.53	878.94					
31732	16-Nov-86	-6.56	878.91		6.57	1184	766	21.9
31736	20-Nov-86	-6.80	878.67					
31739	23-Nov-86	-6.81	878.66	17.8	6.72	1279	818	22.4
31742	26-Nov-86	-5.01	880.46					
31744	28-Nov-86	-5.39	880.08	16.9	6.60	1403	862	32.8
31746	30-Nov-86	-5.47	880.00					
31752	06-Dec-86	-5.79	879.68					
31753	07-Dec-86	-5.74	879.73	16.2	6.69	1442	902	32.4
31761	15-Dec-86	-5.37	880.10					
31767	21-Dec-86	-5.70	879.77	14.7	6.76	1597		
31775	29-Dec-86	-5.89	879.58					
31778	01-Jan-87	-6.03	879.44	14.3	6.73	1666	970	43.5
31784	07-Jan-87	-6.18	879.29					
31786	09-Jan-87	-5.88	879.59					
31787	10-Jan-87	-5.74	879.73	13.5	6.64	1683	969	44.5

WELLC3

LOTUS DATE	DATE	DEPTH TO WATER (FT)	ELEVATION FEET	TEMP DEG C	PH	EC UMHOS/CM	HCO3 MG/L	CL MG/L
31792	15-Jan-87	-5.81	879.66					
31802	25-Jan-87	-5.89	879.58		6.94	1423	963	39.7
31806	29-Jan-87	-5.25	880.22					
31809	01-Feb-87	-5.18	880.29	13.7	6.53	1590	944	39.0
31816	08-Feb-87	-4.65	880.82	12.2	6.85	1800	1001	54.6
31823	15-Feb-87	-4.18	881.29					
31830	22-Feb-87	-4.34	881.13					
31832	24-Feb-87	-4.51	880.96					
31834	26-Feb-87	-4.57	880.90					
31837	01-Mar-87	-3.24	882.23					
31839	03-Mar-87	-3.73	881.74					
31840	04-Mar-87	-3.86	881.61					
31841	05-Mar-87	-3.96	881.51					
31842	06-Mar-87	-4.09	881.38					
31843	07-Mar-87	-4.18	881.29					
31844	08-Mar-87	-4.22	881.25					
31845	09-Mar-87	-4.77	880.70					
31846	10-Mar-87	-4.96	880.51					
31847	11-Mar-87	-5.06	880.41					
31848	12-Mar-87	-4.77	880.70					
31849	13-Mar-87	-4.75	880.72					
31850	14-Mar-87	-4.72	880.75					
31852	16-Mar-87	-4.86	880.61					
31853	17-Mar-87	-3.33	882.14					
31854	18-Mar-87	-3.83	881.64					
31855	19-Mar-87	-4.14	881.33					
31856	20-Mar-87	-4.22	881.25					
31857	21-Mar-87	-4.37	881.10					
31858	22-Mar-87	-4.40	881.07					
31859	23-Mar-87	-4.36	881.11					
31860	24-Mar-87	-4.37	881.10					
31862	26-Mar-87	-4.58	880.89					
31863	27-Mar-87	-4.58	880.89					
31864	28-Mar-87	-4.69	880.78					
31865	29-Mar-87	-4.78	880.69					
31870	03-Apr-87	-5.00	880.47					
31871	04-Apr-87	-5.09	880.38					
31873	06-Apr-87	-5.09	880.38					

WELLC4

LOTUS DATE	DATE	DEPTH TO WATER (FT)	ELEVATION FEET	TEMP DEG C	PH	EC UMHOS/CM	HCO3 MG/L	CL MG/L
31254	26-Jul-85	-10.22	875.25	18.9	7.17	985		
31257	29-Jul-85	-10.21	875.26	18.6	7.17	1010		
31260	01-Aug-85	-10.42	875.05	18.8	7.17	1030		
31264	05-Aug-85	-10.45	875.02	18.7	7.21	1020		
31272	13-Aug-85	-11.33	874.14					
31275	16-Aug-85	-10.91	874.56	19.3	7.21	998		
31278	19-Aug-85	-10.95	874.52	19.4	7.30	1100	551	24.4
31280	21-Aug-85	-10.94	874.53					
31281	22-Aug-85	-10.80	874.67	19.6	7.17	996	604	24.0
31283	24-Aug-85	-11.13	874.34					
31285	26-Aug-85	-11.17	874.30					
31289	30-Aug-85	-11.53	873.94					
31292	02-Sep-85	-11.65	873.82	19.5	7.27	995	599	22.9
31299	09-Sep-85	-12.06	873.41					
31305	15-Sep-85	-11.91	873.56	19.3	7.12	1034		
31306	16-Sep-85	-11.82	873.65	19.1	7.13	986		
31308	18-Sep-85	-11.87	873.60	19.1	7.23	1011		
31309	19-Sep-85	-11.94	873.53	20.0	7.17	1037	610	20.7
31311	21-Sep-85	-11.98	873.49	18.6	7.27	1028		
31312	22-Sep-85	-11.76	873.71	19.2	7.29	1032		
31313	23-Sep-85	-11.54	873.93	17.8	7.54	995		
31315	25-Sep-85	-11.32	874.15	18.0	7.17	1012		
31317	27-Sep-85	-11.10	874.37	17.6	7.17	979		
31318	28-Sep-85	-10.78	874.69					
31319	29-Sep-85	-10.55	874.92	17.4	7.16	986		
31321	01-Oct-85	-10.43	875.04	17.1	7.14	1008		
31322	02-Oct-85	-10.41	875.06					
31323	03-Oct-85	-10.41	875.06	17.6	7.17	1011		
31325	05-Oct-85	-10.54	874.93					
31326	06-Oct-85	-10.45	875.02	18.5	7.05	1020		
31328	08-Oct-85	-10.60	874.87	19.0	7.07	1006		
31330	10-Oct-85	-10.39	875.08	17.3	7.11	1002		
31334	14-Oct-85	-9.57	875.90	18.2	7.18	995		
31335	15-Oct-85	-9.43	876.04	18.1	7.19	1100		
31336	16-Oct-85	-9.47	876.00					
31337	17-Oct-85	-9.47	876.00	19.0	7.07	1049		
31338	18-Oct-85	-9.02	876.45	18.9	7.11	1041		
31339	19-Oct-85	-8.75	876.72	19.0	7.09	1021		
31341	21-Oct-85	-8.73	876.74	18.9	7.08	1134		
31343	23-Oct-85	-8.71	876.76	19.0	7.06	1037		
31345	25-Oct-85	-8.83	876.64	19.0	7.15	1088	595	22.1
31347	27-Oct-85	-8.80	876.67					
31349	29-Oct-85	-8.72	876.75	18.8	7.16	1014		
31352	01-Nov-85	-8.70	876.77	18.8	7.22	1016		
31354	03-Nov-85	-8.73	876.74	18.8		1061		
31357	06-Nov-85	-8.66	876.81	18.6	7.15	984		
31361	10-Nov-85	-8.79	876.68	18.5	7.22	957		

WELLC4

LOTUS DATE	DATE	DEPTH TO WATER (FT)	ELEVATION FEET	TEMP DEG C	PH	EC UMHOS/CM	HCO3 MG/L	CL MG/L
31364	13-Nov-85	-8.50	876.97	18.6	7.29	1042		
31366	15-Nov-85	-7.54	877.93	18.6	7.31	995		
31368	17-Nov-85	-7.37	878.10	18.5	7.33	967		
31372	21-Nov-85	-7.35	878.12	18.5	7.28	1028		
31376	25-Nov-85	-7.38	878.09	18.7	7.23	981		
31381	30-Nov-85	-7.43	878.04	18.3	7.28	1038		
31386	05-Dec-85	-7.37	878.10	18.1	7.39	981		
31403	22-Dec-85	-7.29	878.18	17.0	7.40	1018		
31410	29-Dec-85	-7.40	878.07					
31415	03-Jan-86	-7.44	878.03	17.5	7.62	1158		
31423	11-Jan-86	-7.43	878.04	15.9	6.88	949		
31426	14-Jan-86	-7.46	878.01	15.9	6.69	962		
31428	16-Jan-86	-7.49	877.98	17.2	6.92	949		
31432	20-Jan-86	-7.38	878.09					
31435	23-Jan-86	-7.54	877.93	15.3	6.96	950	613	28.9
31440	28-Jan-86	-7.43	878.04	15.0	6.97	1023		
31444	01-Feb-86	-7.58	877.89					
31447	04-Feb-86	-7.52	877.95					
31449	06-Feb-86	-7.57	877.90	19.0	7.04	862		
31456	13-Feb-86	-7.48	877.99	15.3	7.00	903		
31461	18-Feb-86	-7.42	878.05					
31463	20-Feb-86	-7.56	877.91	15.2	6.99	944		
31468	25-Feb-86	-7.52	877.95	16.4	6.98	995		
31473	02-Mar-86	-7.54	877.93					
31477	06-Mar-86	-7.54	877.93	14.0	7.09	1007		
31483	12-Mar-86	-7.36	878.11		6.98	1009		
31487	16-Mar-86	-7.36	878.11	19.2	6.97	1002		
31489	18-Mar-86	-7.21	878.26	14.1	6.90	1034		
31493	22-Mar-86	-7.27	878.20	14.5	7.01	1038		
31498	27-Mar-86	-7.29	878.18	15.2	7.00	1013		
31503	01-Apr-86	-7.29	878.18		7.02	947		
31504	02-Apr-86	-7.13	878.34		6.95	1016		
31505	03-Apr-86	-6.53	878.94		6.95	1014		
31506	04-Apr-86	-5.47	880.00		6.96	1116		
31508	06-Apr-86	-6.02	879.45		6.93	1142		
31510	08-Apr-86	-6.04	879.43		6.90	1108		
31511	09-Apr-86	-6.45	879.02					
31513	11-Apr-86	-5.97	879.50		6.80	1014		
31514	12-Apr-86	-6.03	879.44					
31516	14-Apr-86	-6.34	879.13					
31517	15-Apr-86	-6.61	878.86	11.9	7.10	1044		17.5
31519	17-Apr-86	-6.08	879.39					
31521	19-Apr-86	-6.14	879.33	14.4	7.03		639	18.6
31522	20-Apr-86	-6.03	879.44		7.03		640	16.3
31524	22-Apr-86	-6.22	879.25					
31529	27-Apr-86	-6.39	879.08					

WELLC4

LOTUS DATE	DATE	DEPTH TO WATER (FT)	ELEVATION FEET	TEMP DEG C	PH	EC UMHOS/CM	HCO3 MG/L	CL MG/L
31530	28-Apr-86	-6.53	878.94		7.13		654	19.9
31538	06-May-86	-6.99	878.48					
31539	07-May-86	-7.12	878.35	16.0	7.05	919	650	26.3
31541	09-May-86	-7.10	878.37					
31542	10-May-86	-7.08	878.39					
31543	11-May-86	-7.04	878.43					
31544	12-May-86	-7.07	878.40					
31545	13-May-86	-7.16	878.31	15.8	7.36	963	620	20.5
31547	15-May-86	-7.00	878.47		7.49	993	617	19.2
31548	16-May-86	-6.98	878.49	16.8	7.40	994	630	23.8
31549	17-May-86	-6.14	879.33	15.6		949	624	21.9
31550	18-May-86	-6.30	879.17	15.0		970	624	24.6
31551	19-May-86	-6.42	879.05					
31552	20-May-86	-6.46	879.01					
31553	21-May-86	-6.49	878.98	15.1	6.92	975	630	22.7
31555	23-May-86	-6.68	878.79					
31559	27-May-86	-6.97	878.50	15.5	7.58	988	624	20.0
31560	28-May-86	-6.98	878.49					
31562	30-May-86	-7.11	878.36					
31563	31-May-86	-7.07	878.40	17.1	7.00	989	628	21.5
31566	03-Jun-86	-7.20	878.27					
31570	07-Jun-86	-7.30	878.17	17.1	6.92	996	623	21.4
31572	09-Jun-86	-7.44	878.03					
31577	14-Jun-86	-7.90	877.57	15.6	6.87	983	620	28.5
31578	15-Jun-86	-7.74	877.73					
31579	16-Jun-86	-7.82	877.65					
31582	19-Jun-86	-8.00	877.47					
31584	21-Jun-86	-8.20	877.27					
31585	22-Jun-86			16.6	7.38	1097	604	32.9
31586	23-Jun-86	-8.26	877.21					
31591	28-Jun-86	-8.55	876.92		6.92	1024	602	27.4
31595	02-Jul-86	-8.54	876.93					
31599	06-Jul-86	-8.82	876.65	16.5	6.79	1027	605	22.1
31605	12-Jul-86	-9.36	876.11	16.6	6.82	1022	608	26.9
31607	14-Jul-86	-9.53	875.94					
31612	19-Jul-86	-10.10	875.37	16.7	6.61	1067	610	31.6
31619	26-Jul-86	-10.80	874.67	17.5	7.17	1137	611	33.1
31626	02-Aug-86	-11.47	874.00	17.4	6.71	1092	611	31.7
31634	10-Aug-86	-10.36	875.11	17.6	6.66	1135		28.1
31640	16-Aug-86	-10.25	875.22		6.80	1107		22.4
31644	20-Aug-86	-10.28	875.19					
31645	21-Aug-86	-10.32	875.15					
31648	24-Aug-86	-10.52	874.95		6.57	1118		25.0
31654	30-Aug-86	-10.73	874.74		6.38	1078	612	24.7
31661	06-Sep-86	-10.59	874.88		6.77	1098	551	28.3
31666	11-Sep-86	-11.07	874.40					

WELLC4

LOTUS DATE	DATE	DEPTH TO WATER (FT)	ELEVATION FEET	TEMP DEG C	PH	EC UMHOS/CM	HCO3 MG/L	CL MG/L
31669	14-Sep-86	-11.30	874.17	18.7	6.62	1112	610	27.6
31670	15-Sep-86	-11.25	874.22					
31676	21-Sep-86	-11.72	873.75	18.8	6.61	1017	605	27.8
31683	28-Sep-86	-11.87	873.60	18.9	6.62	1011	608	29.5
31684	29-Sep-86	-11.30	874.17	18.7	6.87	952	608	24.0
31685	30-Sep-86	-9.96	875.51	19.1	7.02	996	609	30.4
31686	01-Oct-86	-9.79	875.68					
31687	02-Oct-86	-9.62	875.85					
31688	03-Oct-86	-8.27	877.20					
31689	04-Oct-86	-7.97	877.50	19.2	6.80	934	598	25.5
31691	06-Oct-86	-8.11	877.36					
31695	10-Oct-86	-8.19	877.28	20.2	6.76	949	611	25.1
31704	19-Oct-86	-8.50	876.97	19.1	6.57	999	616	30.3
31707	22-Oct-86	-7.84	877.63					
31708	23-Oct-86	-7.60	877.87					
31709	24-Oct-86	-7.60	877.87					
31710	25-Oct-86	-7.56	877.91	19.1	7.19	987	600	25.4
31711	26-Oct-86	-7.58	877.89					
31712	27-Oct-86	-7.58	877.89					
31713	28-Oct-86	-7.74	877.73					
31714	29-Oct-86	-7.85	877.62					
31715	30-Oct-86	-7.76	877.71					
31716	31-Oct-86	-7.66	877.81					
31717	01-Nov-86	-7.75	877.72					
31718	02-Nov-86	-7.72	877.75					
31720	04-Nov-86	-7.26	878.21					
31721	05-Nov-86	-6.45	879.02					
31722	06-Nov-86	-6.38	879.09	18.7	6.84	1033	626	23.8
31727	11-Nov-86	-6.65	878.82					
31730	14-Nov-86	-6.57	878.90					
31732	16-Nov-86	-6.60	878.87	18.6	6.69	979	613	24.6
31736	20-Nov-86	-6.81	878.66					
31739	23-Nov-86	-6.79	878.68	18.4	6.74	990	585	23.2
31742	26-Nov-86	-5.17	880.30					
31744	28-Nov-86	-5.42	880.05	17.7	6.64	1035	612	23.5
31746	30-Nov-86	-5.49	879.98					
31752	06-Dec-86	-5.86	879.61					
31753	07-Dec-86	-5.75	879.72	17.2	6.60	1059	628	26.8
31761	15-Dec-86	-5.39	880.08					
31767	21-Dec-86	-5.71	879.76	16.2	6.45	1208		
31775	29-Dec-86	-5.90	879.57					
31778	01-Jan-87	-6.05	879.42	16.0	6.60	1146	666	29.5
31784	07-Jan-87	-6.19	879.28					
31786	09-Jan-87	-5.89	879.58					
31787	10-Jan-87	-5.77	879.70	15.1	6.74	1181	646	26.4
31792	15-Jan-87	-5.80	879.67					

WELLC4

LOTUS DATE	DATE	DEPTH TO WATER (FT)	ELEVATION FEET	TEMP DEG C	PH	EC UMHOS/CM	HCO3 MG/L	CL MG/L
31802	25-Jan-87	-5.88	879.59		7.00	1044	691	21.8
31806	29-Jan-87	-5.31	880.16					
31809	01-Feb-87	-5.19	880.28	15.8	6.63	1168	676	22.1
31816	08-Feb-87	-4.69	880.78	13.9	6.91	1165	675	22.9
31823	15-Feb-87	-4.25	881.22					
31830	22-Feb-87	-4.35	881.12					
31832	24-Feb-87	-4.52	880.95					
31834	26-Feb-87	-4.59	880.88					
31837	01-Mar-87	-3.29	882.18					
31839	03-Mar-87	-3.75	881.72					
31840	04-Mar-87	-3.87	881.60					
31841	05-Mar-87	-3.97	881.50					
31842	06-Mar-87	-4.10	881.37					
31843	07-Mar-87	-4.19	881.28					
31844	08-Mar-87	-4.24	881.23					
31845	09-Mar-87	-4.81	880.66					
31846	10-Mar-87	-5.00	880.47					
31847	11-Mar-87	-5.11	880.36					
31848	12-Mar-87	-4.77	880.70					
31849	13-Mar-87	-4.76	880.71					
31850	14-Mar-87	-4.74	880.73					
31852	16-Mar-87	-4.87	880.60					
31853	17-Mar-87	-3.47	882.00					
31854	18-Mar-87	-3.86	881.61					
31855	19-Mar-87	-4.15	881.32					
31856	20-Mar-87	-4.23	881.24					
31857	21-Mar-87	-4.39	881.08					
31858	22-Mar-87	-4.41	881.06					
31859	23-Mar-87	-4.37	881.10					
31860	24-Mar-87	-4.39	881.08					
31862	26-Mar-87	-4.57	880.90					
31863	27-Mar-87	-4.59	880.88					
31864	28-Mar-87	-4.70	880.77					
31865	29-Mar-87	-4.79	880.68					
31870	03-Apr-87	-5.01	880.46					
31871	04-Apr-87	-5.10	880.37					
31873	06-Apr-87	-5.12	880.35					

WELLC5

LOTUS DATE	DATE	DEPTH TO WATER (FT)	ELEVATION FEET	TEMP DEG C	PH	EC UMHOS/CM	HCO3 MG/L	CL MG/L
31423	11-Jan-86	-7.43	878.04					
31426	14-Jan-86	-7.47	878.00					
31428	16-Jan-86	-7.49	877.98	16.6	6.97	1108		
31432	20-Jan-86	-7.39	878.08					
31435	23-Jan-86	-7.58	877.89	14.8	6.94	1110	715	26.9
31440	28-Jan-86	-7.43	878.04	14.8	6.91	1190		
31444	01-Feb-86	-7.59	877.88					
31447	04-Feb-86	-7.52	877.95					
31449	06-Feb-86	-7.59	877.88	17.5	7.00	1008		
31456	13-Feb-86	-7.50	877.97	14.8	6.99	1039		
31461	18-Feb-86	-7.45	878.02					
31463	20-Feb-86	-7.60	877.87	14.7	6.97	1063		
31468	25-Feb-86	-7.51	877.96	16.2	7.03	1123		
31473	02-Mar-86	-7.55	877.92					
31477	06-Mar-86	-7.56	877.91	13.8	7.06	1179		
31483	12-Mar-86	-7.40	878.07		7.04	1127		
31487	16-Mar-86	-7.38	878.09	18.3	6.99	1075		
31489	18-Mar-86	-7.23	878.24	14.0	6.98	1095		
31493	22-Mar-86	-7.30	878.17	14.3	7.00	1185		
31498	27-Mar-86	-7.30	878.17	14.7	6.99	1175		
31503	01-Apr-86	-7.31	878.16		7.13	1023		
31504	02-Apr-86	-7.14	878.33		6.96	1095		
31505	03-Apr-86	-6.42	879.05		6.95	1178		
31506	04-Apr-86	-5.66	879.81		6.97	1356		
31508	06-Apr-86	-5.93	879.54		6.93	1486		
31510	08-Apr-86	-6.07	879.40		6.88	1453		
31511	09-Apr-86	-6.42	879.05					
31513	11-Apr-86	-5.99	879.48		6.79	1293		
31514	12-Apr-86	-6.07	879.40					
31516	14-Apr-86	-6.31	879.16					
31517	15-Apr-86	-6.35	879.12	12.2	7.13	1339		24.5
31519	17-Apr-86	-6.07	879.40					
31521	19-Apr-86	-6.14	879.33	14.2	6.94		847	24.9
31522	20-Apr-86	-6.05	879.42		6.89		792	23.1
31524	22-Apr-86	-6.23	879.24					
31529	27-Apr-86	-6.41	879.06					
31530	28-Apr-86	-6.53	878.94		7.11		868	30.5
31538	06-May-86	-7.02	878.45					
31539	07-May-86	-7.09	878.38	15.8	7.02	1182	856	36.5
31541	09-May-86	-7.10	878.37					
31542	10-May-86	-7.10	878.37					
31543	11-May-86	-7.03	878.44					
31544	12-May-86	-7.07	878.40					
31545	13-May-86	-7.18	878.29	15.8	7.42	1175	767	24.6
31547	15-May-86	-6.97	878.50		7.50	1177	740	30.2
31548	16-May-86	-7.00	878.47	16.7	7.37	1156	755	26.3
31549	17-May-86	-6.21	879.26	15.7		1074	714	24.3

WELLC5

LOTUS DATE	DATE	DEPTH TO WATER (FT)	ELEVATION FEET	TEMP DEG C	PH	EC UMHOS/CM	HCO3 MG/L	CL MG/L
31550	18-May-86	-6.35	879.12	15.0		1118	737	27.8
31551	19-May-86	-6.38	879.09					
31552	20-May-86	-6.49	878.98					
31553	21-May-86	-6.51	878.96	15.0	6.91	1124	755	29.0
31555	23-May-86	-6.69	878.78					
31559	27-May-86	-6.98	878.49	15.4	7.59	1065	685	20.4
31560	28-May-86	-6.99	878.48					
31562	30-May-86	-7.12	878.35					
31563	31-May-86	-7.09	878.38	16.7	6.95	1100	712	23.7
31566	03-Jun-86	-7.21	878.26					
31570	07-Jun-86	-7.32	878.15	17.1	6.89	1089	686	22.3
31572	09-Jun-86	-7.45	878.02					
31577	14-Jun-86	-7.93	877.54	15.6	6.89	1053	677	32.5
31578	15-Jun-86	-7.75	877.72					
31579	16-Jun-86	-7.84	877.63					
31582	19-Jun-86	-8.01	877.46					
31584	21-Jun-86	-8.21	877.26					
31585	22-Jun-86			16.7	7.42	1130	622	33.0
31586	23-Jun-86	-8.28	877.19					
31591	28-Jun-86	-8.56	876.91		6.92	1053	615	23.4
31595	02-Jul-86	-8.55	876.92					
31599	06-Jul-86	-8.85	876.62	16.4	6.81	1043	604	26.4
31605	12-Jul-86	-9.38	876.09		6.85	1032	609	26.8
31607	14-Jul-86	-9.56	875.91					
31612	19-Jul-86	-10.14	875.33	16.7	6.74	1057	615	31.2
31619	26-Jul-86	-10.82	874.65	17.6	7.27	1127	610	32.1
31626	02-Aug-86	-11.49	873.98	17.4	6.78	1085	618	31.4
31634	10-Aug-86	-10.42	875.05	17.6	6.69	1115		29.8
31644	20-Aug-86	-10.30	875.17					
31645	21-Aug-86	-10.33	875.14					
31648	24-Aug-86	-10.50	874.97		6.61	1112		23.6
31654	30-Aug-86	-10.75	874.72		6.51	1076	626	27.3
31661	06-Sep-86	-10.60	874.87		6.74	1095	568	31.8
31666	11-Sep-86	-11.10	874.37					
31669	14-Sep-86	-11.30	874.17	18.8	6.69	1108	612	27.3
31676	21-Sep-86	-11.73	873.74		6.67	1020	614	26.8
31683	28-Sep-86	-11.89	873.58		6.61	1003	606	30.9
31684	29-Sep-86	-11.31	874.16	18.8	6.93	954	616	30.9
31685	30-Sep-86	-9.95	875.52	19.1	7.09	995	605	33.0
31686	01-Oct-86	-9.82	875.65					
31687	02-Oct-86	-9.61	875.86					
31688	03-Oct-86	-8.18	877.29					
31689	04-Oct-86	-8.01	877.46	19.2	6.80	933	608	28.7
31691	06-Oct-86	-8.15	877.32					
31695	10-Oct-86	-8.22	877.25	20.1	6.80	944	604	28.7
31704	19-Oct-86	-8.53	876.94	19.1	6.60	999	612	34.4

WELLC5

LOTUS DATE	DATE	DEPTH TO WATER (FT)	ELEVATION FEET	TEMP DEG C	PH	EC UMHOS/CM	HCO3 MG/L	CL MG/L
31707	22-Oct-86	-7.87	877.60					
31708	23-Oct-86	-7.64	877.83					
31709	24-Oct-86	-7.63	877.84					
31710	25-Oct-86	-7.59	877.88	19.2	6.82	983	605	25.2
31711	26-Oct-86	-7.62	877.85					
31712	27-Oct-86	-7.61	877.86					
31713	28-Oct-86	-7.78	877.69					
31714	29-Oct-86	-7.88	877.59					
31715	30-Oct-86	-7.80	877.67					
31716	31-Oct-86	-7.69	877.78					
31717	01-Nov-86	-7.78	877.69					
31718	02-Nov-86	-7.74	877.73					
31720	04-Nov-86	-7.29	878.18					
31721	05-Nov-86	-6.42	879.05					
31722	06-Nov-86	-6.40	879.07	18.6	6.82	1148	705	23.0
31727	11-Nov-86	-6.67	878.80					
31730	14-Nov-86	-6.59	878.88					
31732	16-Nov-86	-6.62	878.85	18.6	6.67	1064	682	25.3
31736	20-Nov-86	-6.84	878.63					
31739	23-Nov-86	-6.84	878.63	18.2	6.76	1060	650	25.2
31742	26-Nov-86	-5.16	880.31					
31744	28-Nov-86	-5.45	880.02	17.6	6.66	1194	706	28.7
31746	30-Nov-86	-5.51	879.96					
31752	06-Dec-86	-5.89	879.58					
31753	07-Dec-86	-5.75	879.72	17.3	6.59	1247	737	35.7
31761	15-Dec-86	-5.37	880.10					
31767	21-Dec-86	-5.68	879.79	16.1	6.62	1330		
31775	29-Dec-86	-5.94	879.53					
31778	01-Jan-87	-6.06	879.41	15.8	6.56	1414	795	41.1
31784	07-Jan-87	-6.18	879.29					
31786	09-Jan-87	-5.92	879.55					
31787	10-Jan-87	-5.80	879.67	15.0	6.68	1387	760	35.1
31792	15-Jan-87	-5.85	879.62					
31802	25-Jan-87	-5.91	879.56		6.87	1348	860	35.8
31806	29-Jan-87	-5.31	880.16					
31809	01-Feb-87	-5.23	880.24	14.1	6.56	1385	778	34.8
31816	08-Feb-87	-4.69	880.78	13.9	6.87	1414	809	38.0
31823	15-Feb-87	-4.25	881.22					
31830	22-Feb-87	-4.35	881.12					
31832	24-Feb-87	-4.54	880.93					
31834	26-Feb-87	-4.62	880.85					
31837	01-Mar-87	-3.30	882.17					
31839	03-Mar-87	-3.77	881.70					
31840	04-Mar-87	-3.90	881.57					
31841	05-Mar-87	-4.02	881.45					
31842	06-Mar-87	-4.13	881.34					

WELLC5

LOTUS DATE	DATE	DEPTH TO WATER (FT)	ELEVATION FEET	TEMP DEG C	PH	EC UMHOS/CM	HCO3 MG/L	CL MG/L
31843	07-Mar-87	-4.20	881.27					
31844	08-Mar-87	-4.26	881.21					
31845	09-Mar-87	-4.83	880.64					
31846	10-Mar-87	-5.03	880.44					
31847	11-Mar-87	-5.11	880.36					
31848	12-Mar-87	-4.80	880.67					
31849	13-Mar-87	-4.76	880.71					
31850	14-Mar-87	-4.73	880.74					
31852	16-Mar-87	-4.89	880.58					
31853	17-Mar-87	-3.44	882.03					
31854	18-Mar-87	-3.86	881.61					
31855	19-Mar-87	-4.17	881.30					
31856	20-Mar-87	-4.27	881.20					
31857	21-Mar-87	-4.40	881.07					
31858	22-Mar-87	-4.43	881.04					
31859	23-Mar-87	-4.39	881.08					
31860	24-Mar-87	-4.41	881.06					
31862	26-Mar-87	-4.62	880.85					
31863	27-Mar-87	-4.62	880.85					
31864	28-Mar-87	-4.73	880.74					
31865	29-Mar-87	-4.82	880.65					
31870	03-Apr-87	-5.03	880.44					
31871	04-Apr-87	-5.13	880.34					
31873	06-Apr-87	-5.14	880.33					

WELLD1

LOTUS DATE	DATE	DEPTH TO WATER (FT)	ELEVATION FEET	TEMP DEG C	PH	EC UMHOS/CM	HCO3 MG/L	CL MG/L
31376	25-Nov-85	-7.80	877.77					
31381	30-Nov-85	-7.74	877.83	17.0	7.60	1774		
31386	05-Dec-85	-7.69	877.88	16.9	7.63	1759		
31403	22-Dec-85	-7.38	878.19	14.6	7.90	1875		
31410	29-Dec-85	-7.48	878.09					
31415	03-Jan-86	-7.52	878.05		8.07	1881		
31423	11-Jan-86	-7.48	878.09	13.5	7.18	1729		
31426	14-Jan-86	-7.46	878.11	13.6	7.06	1632		
31428	16-Jan-86	-7.51	878.06	15.5	7.05	1569		
31432	20-Jan-86	-7.43	878.14					
31435	23-Jan-86	-7.62	877.95	13.0	7.18	1604	943	67.3
31440	28-Jan-86	-7.44	878.13	13.3	7.11	1446		
31444	01-Feb-86	-7.59	877.98					
31447	04-Feb-86	-7.56	878.01					
31449	06-Feb-86	-7.60	877.97	15.8	7.24	1489		
31456	13-Feb-86	-7.56	878.01	13.0	7.22	1481		
31461	18-Feb-86	-7.46	878.11					
31463	20-Feb-86	-7.53	878.04	12.7	7.29	1486		
31468	25-Feb-86	-7.55	878.02	15.2	7.33	1468		
31473	02-Mar-86	-7.54	878.03					
31477	06-Mar-86	-7.58	877.99	12.9	7.29	1667		
31483	12-Mar-86	-7.55	878.02		7.16	1524		
31487	16-Mar-86	-7.38	878.19	14.4	7.32	1366		
31489	18-Mar-86	-7.22	878.35	13.4	7.23	1516		
31493	22-Mar-86	-7.28	878.29	14.3	7.29	1535		
31496	25-Mar-86	-7.22	878.35					
31498	27-Mar-86	-7.32	878.25	13.4	7.25	1643		
31503	01-Apr-86	-7.37	878.20		7.38	1290		
31504	02-Apr-86	-7.37	878.20		7.20	1582		
31505	03-Apr-86	-6.56	879.01		7.19	1548		
31506	04-Apr-86	-5.83	879.74		7.10	1644		
31508	06-Apr-86	-5.57	880.00		7.17	1819		
31510	08-Apr-86	-5.76	879.81		7.14	1558		
31511	09-Apr-86	-5.86	879.71					
31513	11-Apr-86	-5.81	879.76		7.15	1575		
31514	12-Apr-86	-5.90	879.67					
31516	14-Apr-86	-6.11	879.46					
31517	15-Apr-86	-6.13	879.44	11.5	7.30	1761		48.5
31519	17-Apr-86	-6.04	879.53					
31521	19-Apr-86	-5.98	879.59	14.1	7.35		934	
31522	20-Apr-86	-5.86	879.71		7.18		982	52.9
31524	22-Apr-86	-6.02	879.55					
31529	27-Apr-86	-6.22	879.35					
31530	28-Apr-86	-6.34	879.23					
31538	06-May-86	-6.82	878.75					
31539	07-May-86	-6.96	878.61	16.0				
31541	09-May-86	-6.99	878.58					

WELLD1

LOTUS DATE	DATE	DEPTH TO WATER (FT)	ELEVATION FEET	TEMP DEG C	PH	EC UMHOS/CM	HCO3 MG/L	CL MG/L
31542	10-May-86	-7.04	878.53					
31543	11-May-86	-6.98	878.59					
31544	12-May-86	-6.98	878.59					
31545	13-May-86	-7.07	878.50	16.6				
31547	15-May-86	-7.03	878.54		7.53	1610	909	53.9
31548	16-May-86	-6.95	878.62	16.9				
31549	17-May-86	-6.83	878.74	15.9		1394		54.3
31550	18-May-86	-6.36	879.21	15.5		1423		52.5
31551	19-May-86	-6.40	879.17					
31552	20-May-86	-6.38	879.19					
31553	21-May-86	-6.39	879.18	15.7	7.14	1495		56.3
31555	23-May-86	-6.49	879.08					
31559	27-May-86	-6.89	878.68					
31560	28-May-86	-6.90	878.67					
31562	30-May-86	-7.06	878.51					
31563	31-May-86	-7.02	878.55					
31566	03-Jun-86	-7.15	878.42					
31570	07-Jun-86	-7.32	878.25					
31572	09-Jun-86	-7.45	878.12					
31578	15-Jun-86	-7.96	877.61					
31579	16-Jun-86	-7.99	877.58					
31710	25-Oct-86	-7.94	877.63	19.5				
31711	26-Oct-86	-7.91	877.66					
31712	27-Oct-86	-7.87	877.70					
31720	04-Nov-86	-7.82	877.75					
31721	05-Nov-86	-7.23	878.34					
31722	06-Nov-86	-6.88	878.69	18.8	6.84	1302	772	45.9
31727	11-Nov-86	-6.86	878.71					
31730	14-Nov-86	-6.73	878.84					
31732	16-Nov-86	-6.70	878.87	18.1	7.21	1157		
31736	20-Nov-86	-6.83	878.74					
31739	23-Nov-86	-6.79	878.78	16.0				
31742	26-Nov-86	-5.78	879.79					
31744	28-Nov-86	-5.59	879.98	16.8	6.78	1210	746	36.0
31746	30-Nov-86	-5.52	880.05					
31752	06-Dec-86	-5.74	879.83					
31753	07-Dec-86	-5.69	879.88	15.8	7.02	1174		34.7
31761	15-Dec-86	-5.14	880.43					
31767	21-Dec-86	-5.41	880.16	14.0	7.50	1228		
31775	29-Dec-86	-5.59	879.98					
31778	01-Jan-87	-5.72	879.85	12.5	7.09	1290		42.5
31784	07-Jan-87	-5.90	879.67					
31786	09-Jan-87	-5.83	879.74					
31787	10-Jan-87	-5.58	879.99	12.1	6.97	1360	775	55.1
31792	15-Jan-87	-5.51	880.06					
31802	25-Jan-87	-5.54	880.03	11.0	7.04	1313	801	55.8

WELLD1

LOTUS DATE	DATE	DEPTH TO WATER (FT)	ELEVATION FEET	TEMP DEG C	PH	EC UMHOS/CM	HCO3 MG/L	CL MG/L
31806	29-Jan-87	-5.03	880.54					
31809	01-Feb-87	-4.85	880.72	12.3	6.75	1425	799	64.9
31816	08-Feb-87	-4.33	881.24	14.7	7.01	1410	793	82.7
31823	15-Feb-87	-4.10	881.47					
31830	22-Feb-87	-3.95	881.62					
31832	24-Feb-87	-4.08	881.49					
31834	26-Feb-87	-4.15	881.42					
31837	01-Mar-87	-3.08	882.49					
31839	03-Mar-87	-3.37	882.20					
31840	04-Mar-87	-3.50	882.07					
31841	05-Mar-87	-3.56	882.01					
31842	06-Mar-87	-3.67	881.90					
31843	07-Mar-87	-3.76	881.81					
31844	08-Mar-87	-3.80	881.77					
31845	09-Mar-87	-4.05	881.52					
31846	10-Mar-87	-4.20	881.37					
31847	11-Mar-87	-4.30	881.27					
31848	12-Mar-87	-4.28	881.29					
31849	13-Mar-87	-4.29	881.28					
31850	14-Mar-87	-4.25	881.32					
31852	16-Mar-87	-4.39	881.18					
31853	17-Mar-87	-3.46	882.11					
31854	18-Mar-87	-3.51	882.06					
31855	19-Mar-87	-3.75	881.82					
31856	20-Mar-87	-3.83	881.74					
31857	21-Mar-87	-3.95	881.62					
31858	22-Mar-87	-3.98	881.59					
31859	23-Mar-87	-3.97	881.60					
31860	24-Mar-87	-3.98	881.59					
31862	26-Mar-87	-4.15	881.42					
31863	27-Mar-87	-4.14	881.43					
31864	28-Mar-87	-4.25	881.32					
31865	29-Mar-87	-4.34	881.23					
31870	03-Apr-87	-4.56	881.01					
31871	04-Apr-87	-4.64	880.93					
31873	06-Apr-87	-4.66	880.91					

WELLD2

LOTUS DATE	DATE	DEPTH TO WATER (FT)	ELEVATION FEET	TEMP DEG C	PH	EC UMHOS/CM	HCO3 MG/L	CL MG/L
31366	15-Nov-85	-8.66	876.91	17.8	7.77	1461		
31368	17-Nov-85	-7.93	877.64	17.9	7.63	1580		
31372	21-Nov-85	-7.80	877.77	17.7	7.38	1726		
31376	25-Nov-85	-7.75	877.82	17.5	7.45	1626		
31381	30-Nov-85	-7.71	877.86	17.0	7.55	1705		
31386	05-Dec-85	-7.69	877.88	17.0	7.56	1658		
31403	22-Dec-85	-7.37	878.20	15.0	7.75	1733		
31410	29-Dec-85	-7.46	878.11					
31415	03-Jan-86	-7.50	878.07	15.1	7.79	1859		
31423	11-Jan-86	-7.46	878.11	14.1	7.07	1554		
31426	14-Jan-86	-7.45	878.12	14.2	6.86	1548		
31428	16-Jan-86	-7.49	878.08	16.2	6.94	1501		
31432	20-Jan-86	-7.40	878.17					
31435	23-Jan-86	-7.59	877.98	13.4	7.19	1628	1016	53.8
31440	28-Jan-86	-7.44	878.13	13.7	6.95	1474		
31444	01-Feb-86	-7.59	877.98					
31447	04-Feb-86	-7.49	878.08					
31449	06-Feb-86	-7.56	878.01	15.7	7.14	1545		
31456	13-Feb-86	-7.50	878.07	13.4	7.09	1524		
31461	18-Feb-86	-7.41	878.16					
31463	20-Feb-86	-7.50	878.07	13.1	7.03	1559		
31468	25-Feb-86	-7.50	878.07	15.1	7.12	1567		
31473	02-Mar-86	-7.50	878.07					
31477	06-Mar-86	-7.57	878.00	13.1	7.16	1729		
31483	12-Mar-86	-7.46	878.11		7.05	1631		
31487	16-Mar-86	-7.36	878.21	14.7	7.14	1640		
31489	18-Mar-86	-7.20	878.37	13.7	7.05	1679		
31493	22-Mar-86	-7.25	878.32	14.4	7.16	1682		
31496	25-Mar-86	-7.19	878.38					
31498	27-Mar-86	-7.28	878.29	13.5	7.05	1695		
31503	01-Apr-86	-7.26	878.31		7.14	1494		
31504	02-Apr-86	-7.14	878.43		7.12	1615		
31505	03-Apr-86	-6.51	879.06		7.07	1603		
31506	04-Apr-86	-5.83	879.74		7.05	1681		
31508	06-Apr-86	-5.62	879.95		7.08	1791		
31510	08-Apr-86	-5.74	879.83		7.04	1575		
31511	09-Apr-86	-5.84	879.73					
31513	11-Apr-86	-5.78	879.79		6.99	1520		
31514	12-Apr-86	-5.86	879.71					
31516	14-Apr-86	-6.11	879.46					
31517	15-Apr-86	-6.11	879.46		7.39	1758		37.3
31519	17-Apr-86	-6.00	879.57					
31521	19-Apr-86	-5.95	879.62	14.2	7.14		979	40.1
31522	20-Apr-86	-5.84	879.73		7.09			42.0
31524	22-Apr-86	-5.99	879.58					
31529	27-Apr-86	-6.19	879.38					
31530	28-Apr-86	-6.29	879.28		7.27		950	46.1

WELLD2

LOTUS DATE	DATE	DEPTH TO WATER (FT)	ELEVATION FEET	TEMP DEG C	PH	EC UMHOS/CM	HCO3 MG/L	CL MG/L
31538	06-May-86	-6.80	878.77					
31539	07-May-86	-6.91	878.66	15.9	7.49	1338		45.0
31541	09-May-86	-6.96	878.61					
31542	10-May-86	-7.01	878.56					
31543	11-May-86	-6.93	878.64					
31544	12-May-86	-6.94	878.63					
31545	13-May-86	-7.04	878.53	15.8	7.53	1450	949	45.0
31547	15-May-86	-6.92	878.65		7.43	1541	963	49.8
31548	16-May-86	-6.89	878.68	16.4	7.40	1481	955	46.5
31549	17-May-86	-6.71	878.86	15.7		1413	941	48.7
31550	18-May-86	-6.32	879.25	15.1		1459	961	48.4
31551	19-May-86	-6.34	879.23					
31552	20-May-86	-6.35	879.22					
31553	21-May-86	-6.36	879.21	15.3	7.02	1479	944	49.5
31555	23-May-86	-6.55	879.02					
31559	27-May-86	-6.88	878.69	16.0	7.40	1481	944	45.0
31560	28-May-86	-6.90	878.67					
31562	30-May-86	-7.05	878.52					
31563	31-May-86	-7.02	878.55	16.3	6.91	1518	972	41.2
31566	03-Jun-86	-7.15	878.42					
31570	07-Jun-86	-7.31	878.26	16.8	6.84	1557	953	41.5
31572	09-Jun-86	-7.43	878.14					
31577	14-Jun-86	-7.97	877.60	16.4	6.79	1510	952	59.0
31578	15-Jun-86	-7.85	877.72					
31579	16-Jun-86	-7.89	877.68					
31582	19-Jun-86	-8.10	877.47					
31584	21-Jun-86	-8.32	877.25					
31585	22-Jun-86			16.7	7.72	1758	955	59.9
31586	23-Jun-86	-8.51	877.06					
31591	28-Jun-86	-8.73	876.84					
31595	02-Jul-86	-9.00	876.57					
31599	06-Jul-86	-9.25	876.32					
31707	22-Oct-86	-8.67	876.90					
31708	23-Oct-86	-8.21	877.36					
31709	24-Oct-86	-8.08	877.49					
31710	25-Oct-86	-7.99	877.58	19.5	7.04	1406		
31711	26-Oct-86	-7.91	877.66					
31712	27-Oct-86	-7.89	877.68					
31713	28-Oct-86	-8.00	877.57					
31714	29-Oct-86	-8.07	877.50					
31715	30-Oct-86	-8.00	877.57					
31716	31-Oct-86	-7.92	877.65					
31717	01-Nov-86	-7.98	877.59					
31718	02-Nov-86	-8.00	877.57					
31720	04-Nov-86	-7.82	877.75					
31721	05-Nov-86	-7.20	878.37					

WELLD2

LOTUS DATE	DATE	DEPTH TO WATER (FT)	ELEVATION FEET	TEMP DEG C	PH	EC UMHOS/CM	HCO3 MG/L	CL MG/L
31722	06-Nov-86	-6.93	878.64	18.7	6.84	1439	885	40.5
31727	11-Nov-86	-6.88	878.69					
31730	14-Nov-86	-6.73	878.84					
31732	16-Nov-86	-6.72	878.85	18.3	6.82	1375	897	37.0
31736	20-Nov-86	-6.86	878.71					
31739	23-Nov-86	-6.82	878.75	17.6	6.85	1348	868	41.5
31742	26-Nov-86	-5.77	879.80					
31744	28-Nov-86	-5.63	879.94	17.0	6.74	1417	874	44.7
31746	30-Nov-86	-5.55	880.02					
31752	06-Dec-86	-5.77	879.80					
31753	07-Dec-86	-5.71	879.86	16.1	6.77	1335	844	39.6
31761	15-Dec-86	-5.14	880.43					
31767	21-Dec-86	-5.42	880.15	14.5	7.39	1339		
31775	29-Dec-86	-5.62	879.95					
31778	01-Jan-87	-5.75	879.82	13.9	6.82	1570	850	89.9
31784	07-Jan-87	-5.89	879.68					
31786	09-Jan-87	-5.73	879.84					
31787	10-Jan-87	-5.57	880.00	13.5	6.78	1595	876	99.3
31792	15-Jan-87	-5.52	880.05					
31802	25-Jan-87	-5.56	880.01	11.2	6.97	1680	855	135.0
31806	29-Jan-87	-5.02	880.55					
31809	01-Feb-87	-4.86	880.71	12.5	6.73	1879	832	163.0
31816	08-Feb-87	-4.36	881.21	14.0	7.00	1759	865	155.0
31823	15-Feb-87	-4.12	881.45					
31830	22-Feb-87	-3.98	881.59					
31832	24-Feb-87	-4.13	881.44					
31834	26-Feb-87	-4.20	881.37					
31837	01-Mar-87	-3.13	882.44					
31839	03-Mar-87	-3.42	882.15					
31840	04-Mar-87	-3.54	882.03					
31841	05-Mar-87	-3.60	881.97					
31842	06-Mar-87	-3.74	881.83					
31843	07-Mar-87	-3.79	881.78					
31844	08-Mar-87	-3.84	881.73					
31845	09-Mar-87	-4.07	881.50					
31846	10-Mar-87	-4.21	881.36					
31847	11-Mar-87	-4.31	881.26					
31848	12-Mar-87	-4.31	881.26					
31849	13-Mar-87	-4.30	881.27					
31850	14-Mar-87	-4.28	881.29					
31852	16-Mar-87	-4.41	881.16					
31853	17-Mar-87	-3.53	882.04					
31854	18-Mar-87	-3.57	882.00					
31855	19-Mar-87	-3.79	881.78					
31856	20-Mar-87	-3.85	881.72					
31857	21-Mar-87	-3.98	881.59					

WELLD2

LOTUS DATE	DATE	DEPTH TO WATER (FT)	ELEVATION FEET	TEMP DEG C	PH	EC UMHOS/CM	HCO3 MG/L	CL MG/L
31858	22-Mar-87	-4.01	881.56					
31859	23-Mar-87	-3.99	881.58					
31860	24-Mar-87	-4.01	881.56					
31862	26-Mar-87	-4.17	881.40					
31863	27-Mar-87	-4.16	881.41					
31864	28-Mar-87	-4.27	881.30					
31865	29-Mar-87	-4.37	881.20					
31870	03-Apr-87	-4.57	881.00					
31871	04-Apr-87	-4.65	880.92					
31873	06-Apr-87	-4.67	880.90					

WELLD3

LOTUS DATE	DATE	DEPTH TO WATER (FT)	ELEVATION FEET	TEMP DEG C	PH	EC UMHOS/CM	HCO3 MG/L	CL MG/L
31335	15-Oct-85	-10.08	875.49	17.3	7.38	1585		
31337	17-Oct-85	-10.36	875.21					
31338	18-Oct-85	-10.24	875.33	18.8	7.36	1612		
31339	19-Oct-85	-10.22	875.35	18.9	7.29	1597		
31341	21-Oct-85	-9.76	875.81	18.7	7.33	1904		
31343	23-Oct-85	-9.74	875.83					
31345	25-Oct-85	-9.57	876.00	18.5	7.31	1242	1056	43.9
31347	27-Oct-85	-9.27	876.30					
31349	29-Oct-85	-9.12	876.45	18.6	7.41	1573		
31352	01-Nov-85	-9.02	876.55	18.5	7.35	1459		
31354	03-Nov-85	-9.05	876.52	18.8	7.37	1632		
31357	06-Nov-85	-8.95	876.62	18.4	7.38	1331		
31361	10-Nov-85	-9.00	876.57	17.8	7.43	1338		
31364	13-Nov-85	-8.82	876.75	18.3	7.43	1433		
31366	15-Nov-85	-8.35	877.22	18.0	7.55	1216		
31368	17-Nov-85	-7.71	877.86	17.9	7.45	1289		
31372	21-Nov-85	-7.63	877.94	17.9	7.22	1298		
31376	25-Nov-85	-7.61	877.96	17.7	7.39	1238		
31381	30-Nov-85	-7.59	877.98	17.3	7.55	1264		
31386	05-Dec-85	-7.56	878.01	17.2	7.51	1205		
31403	22-Dec-85	-7.32	878.25	15.3	7.78	1269		
31410	29-Dec-85	-7.42	878.15					
31415	03-Jan-86	-7.46	878.11	15.1	7.92	1378		
31423	11-Jan-86	-7.43	878.14	14.6	6.98	1223		
31426	14-Jan-86	-7.43	878.14	14.7	6.77	1290		
31428	16-Jan-86	-7.48	878.09	16.7	6.82	1187		
31432	20-Jan-86	-7.39	878.18					
31435	23-Jan-86	-7.59	877.98	13.8	6.95	1186	772	45.6
31440	28-Jan-86	-7.37	878.20	14.2	6.84	1189		
31444	01-Feb-86	-7.57	878.00					
31447	04-Feb-86	-7.50	878.07					
31449	06-Feb-86	-7.50	878.07	15.8	7.02	1170		
31456	13-Feb-86	-7.57	878.00	13.8	7.03	1175		
31461	18-Feb-86	-7.44	878.13					
31463	20-Feb-86	-7.51	878.06	13.7	7.02	1240		
31468	25-Feb-86	-7.52	878.05	14.3	7.09	1253		
31473	02-Mar-86	-7.53	878.04					
31477	06-Mar-86	-7.56	878.01	13.4	7.03	1346		
31483	12-Mar-86	-7.45	878.12		6.90	1245		
31487	16-Mar-86	-7.35	878.22	14.5	7.04	1338		
31489	18-Mar-86	-7.18	878.39	13.8	6.96	1338		
31493	22-Mar-86	-7.24	878.33	14.5	7.03	1325		
31496	25-Mar-86	-7.18	878.39					
31498	27-Mar-86	-7.28	878.29	13.7	6.99	1337		
31503	01-Apr-86	-7.21	878.36		7.04	1207		
31504	02-Apr-86	-7.12	878.45		6.96	1278		
31505	03-Apr-86	-6.47	879.10		7.00	1249		

WELLD3

LOTUS DATE	DATE	DEPTH TO WATER (FT)	ELEVATION FEET	TEMP DEG C	PH	EC UMHOS/CM	HCO3 MG/L	CL MG/L
31506	04-Apr-86	-5.70	879.87		6.98	1331		
31508	06-Apr-86	-5.58	879.99		7.05	1420		
31510	08-Apr-86	-5.70	879.87		6.99	1238		
31511	09-Apr-86	-5.83	879.74					
31513	11-Apr-86	-5.75	879.82		6.93	1250		
31514	12-Apr-86	-5.86	879.71					
31516	14-Apr-86	-6.11	879.46					
31517	15-Apr-86	-6.08	879.49		7.33	1433		
31519	17-Apr-86	-6.00	879.57					
31521	19-Apr-86	-5.93	879.64	14.0	7.08		752	28.8
31522	20-Apr-86	-5.82	879.75		7.01		760	34.3
31524	22-Apr-86	-6.00	879.57					
31529	27-Apr-86	-6.18	879.39					
31530	28-Apr-86	-6.31	879.26		7.24		744	36.6
31538	06-May-86	-6.80	878.77					
31539	07-May-86	-6.92	878.65	15.8	7.42	1080	757	38.9
31541	09-May-86	-6.96	878.61					
31542	10-May-86	-6.98	878.59					
31543	11-May-86	-6.96	878.61					
31544	12-May-86	-6.94	878.63					
31545	13-May-86	-7.04	878.53	15.7	7.48	1163	747	35.0
31547	15-May-86	-6.89	878.68		7.49	1286	773	39.2
31548	16-May-86	-6.89	878.68	16.1	7.39	1187	752	43.5
31549	17-May-86	-6.54	879.03	15.5		1146	751	39.9
31550	18-May-86	-6.28	879.29	14.9		1170	758	39.7
31551	19-May-86	-6.32	879.25					
31552	20-May-86	-6.33	879.24					
31553	21-May-86	-6.35	879.22	15.1	6.97	1194	755	35.4
31555	23-May-86	-6.52	879.05					
31559	27-May-86	-6.88	878.69	15.6	7.58	1200	754	36.7
31560	28-May-86	-6.88	878.69					
31562	30-May-86	-7.04	878.53					
31563	31-May-86	-7.00	878.57	15.9	6.99	1226	781	33.9
31566	03-Jun-86	-7.13	878.44					
31570	07-Jun-86	-7.38	878.19	16.4	7.00	1262	764	34.1
31577	14-Jun-86	-7.95	877.62	15.8	7.00	1213	763	41.9
31578	15-Jun-86	-7.81	877.76					
31579	16-Jun-86	-7.87	877.70					
31582	19-Jun-86	-8.07	877.50					
31584	21-Jun-86	-8.29	877.28					
31585	22-Jun-86			16.3	7.46	1365	757	41.4
31586	23-Jun-86	-8.48	877.09					
31591	28-Jun-86	-8.69	876.88			1347	741	39.7
31595	02-Jul-86	-8.79	876.78					
31599	06-Jul-86	-9.01	876.56					
31605	12-Jul-86	-9.61	875.96					

WELLD3

LOTUS DATE	DATE	DEPTH TO WATER (FT)	ELEVATION FEET	TEMP DEG C	PH	EC UMHOS/CM	HCO3 MG/L	CL MG/L
31607	14-Jul-86	-9.79	875.78					
31612	19-Jul-86	-10.40	875.17					
31688	03-Oct-86	-9.63	875.94					
31689	04-Oct-86	-8.79	876.78	19.4	6.66	1182	790	35.9
31691	06-Oct-86	-8.46	877.11					
31695	10-Oct-86	-8.54	877.03	20.6				
31704	19-Oct-86	-8.70	876.87	19.5				
31707	22-Oct-86	-8.52	877.05					
31708	23-Oct-86	-8.00	877.57					
31709	24-Oct-86	-7.91	877.66					
31710	25-Oct-86	-7.83	877.74	19.3	6.82	1218	757	40.1
31711	26-Oct-86	-7.78	877.79					
31712	27-Oct-86	-7.76	877.81					
31713	28-Oct-86	-7.89	877.68					
31714	29-Oct-86	-7.96	877.61					
31715	30-Oct-86	-7.93	877.64					
31716	31-Oct-86	-7.80	877.77					
31717	01-Nov-86	-7.87	877.70					
31718	02-Nov-86	-7.89	877.68					
31720	04-Nov-86	-7.72	877.85					
31721	05-Nov-86	-7.16	878.41					
31722	06-Nov-86	-6.79	878.78	18.8	6.85	1222	741	39.7
31727	11-Nov-86	-6.75	878.82					
31730	14-Nov-86	-6.63	878.94					
31732	16-Nov-86	-6.63	878.94	18.4	6.77	1155	722	38.0
31736	20-Nov-86	-6.80	878.77					
31739	23-Nov-86	-6.74	878.83	18.0	6.84	1173	703	39.4
31742	26-Nov-86	-5.63	879.94					
31744	28-Nov-86	-5.50	880.07	17.3	6.70	1205	734	37.6
31746	30-Nov-86	-5.48	880.09					
31752	06-Dec-86	-5.74	879.83					
31753	07-Dec-86	-5.67	879.90	16.8	6.75	1165	703	35.5
31761	15-Dec-86	-5.16	880.41					
31767	21-Dec-86	-5.44	880.13	14.6	7.22	1168		
31775	29-Dec-86	-5.61	879.96					
31778	01-Jan-87	-5.76	879.81	13.5	6.74	1293	750	39.0
31784	07-Jan-87	-5.90	879.67					
31786	09-Jan-87	-5.77	879.80					
31787	10-Jan-87	-5.54	880.03	14.0	6.76	1318	752	45.8
31792	15-Jan-87	-5.53	880.04					
31802	25-Jan-87	-5.56	880.01	11.6	6.92	1260	790	36.0
31806	29-Jan-87	-5.03	880.54					
31809	01-Feb-87	-4.86	880.71	13.2	6.65	1312	757	37.2
31816	08-Feb-87	-4.34	881.23	14.6	6.98	1248	781	35.2
31823	15-Feb-87	-4.04	881.53					
31830	22-Feb-87	-3.93	881.64					

WELLD3

LOTUS DATE	DATE	DEPTH TO WATER (FT)	ELEVATION FEET	TEMP DEG C	PH	EC UMHOS/CM	HCO3 MG/L	CL MG/L
31832	24-Feb-87	-4.07	881.50					
31834	26-Feb-87	-4.16	881.41					
31837	01-Mar-87	-3.01	882.56					
31839	03-Mar-87	-3.34	882.23					
31840	04-Mar-87	-3.46	882.11					
31841	05-Mar-87	-3.53	882.04					
31842	06-Mar-87	-3.65	881.92					
31843	07-Mar-87	-3.73	881.84					
31844	08-Mar-87	-3.78	881.79					
31845	09-Mar-87	-4.06	881.51					
31846	10-Mar-87	-4.20	881.37					
31847	11-Mar-87	-4.31	881.26					
31848	12-Mar-87	-4.25	881.32					
31849	13-Mar-87	-4.27	881.30					
31850	14-Mar-87	-4.25	881.32					
31852	16-Mar-87	-4.39	881.18					
31853	17-Mar-87	-3.40	882.17					
31854	18-Mar-87	-3.48	882.09					
31855	19-Mar-87	-3.73	881.84					
31856	20-Mar-87	-3.80	881.77					
31857	21-Mar-87	-3.94	881.63					
31858	22-Mar-87	-3.97	881.60					
31859	23-Mar-87	-3.93	881.64					
31860	24-Mar-87	-3.96	881.61					
31862	26-Mar-87	-4.14	881.43					
31863	27-Mar-87	-4.12	881.45					
31864	28-Mar-87	-4.25	881.32					
31865	29-Mar-87	-4.35	881.22					
31870	03-Apr-87	-4.55	881.02					
31871	04-Apr-87	-4.65	880.92					
31873	06-Apr-87	-4.67	880.90					

WELLD4

LOTUS DATE	DATE	DEPTH TO WATER (FT)	ELEVATION FEET	TEMP DEG C	PH	EC UMHOS/CM	HCO3 MG/L	CL MG/L
31254	26-Jul-85	-10.22	875.35	18.6	7.31	1092		
31257	29-Jul-85	-10.21	875.36	18.3	7.30	1125		
31260	01-Aug-85	-10.42	875.15	19.5	7.28	1200		
31264	05-Aug-85	-10.45	875.12	19.8	7.36	1180		
31272	13-Aug-85	-11.33	874.24					
31273	14-Aug-85	-11.17	874.40					
31275	16-Aug-85	-10.91	874.66	18.9	7.22	1150		
31278	19-Aug-85	-10.95	874.62	18.9	7.29	1239		
31280	21-Aug-85	-10.94	874.63					
31281	22-Aug-85	-10.80	874.77	19.8	7.25	1165	677	45.6
31283	24-Aug-85	-11.13	874.44					
31285	26-Aug-85	-11.17	874.40					
31289	30-Aug-85	-11.53	874.04					
31292	02-Sep-85	-11.65	873.92	19.0	7.30	1105	742	43.7
31299	09-Sep-85	-12.06	873.51	18.8	7.19	1162		
31305	15-Sep-85	-11.91	873.66	18.8	7.20	1141		
31306	16-Sep-85	-11.82	873.75	18.8	7.19	1166		
31308	18-Sep-85	-11.87	873.70	19.0	7.26	1165		
31309	19-Sep-85	-11.94	873.63	19.7	7.30	1202	668	34.0
31311	21-Sep-85	-11.98	873.59	18.6	7.28	1132		
31312	22-Sep-85	-11.76	873.81	18.9	7.33	1100		
31313	23-Sep-85	-11.54	874.03	17.5	7.53	1103		
31315	25-Sep-85	-11.32	874.25	17.8	7.22	1094		
31317	27-Sep-85	-11.10	874.47	17.0	7.30	1158		
31318	28-Sep-85	-11.15	874.42					
31319	29-Sep-85	-10.92	874.65	17.0	7.25	1154		
31321	01-Oct-85	-10.81	874.76	16.5	7.24	1163		
31322	02-Oct-85	-10.77	874.80					
31323	03-Oct-85	-10.75	874.82	17.2	7.27	1175		
31325	05-Oct-85	-10.88	874.69					
31326	06-Oct-85	-10.79	874.78	18.3	7.17	1170		
31328	08-Oct-85	-10.96	874.61	18.7	7.17	1151		
31330	10-Oct-85	-10.74	874.83	17.2	7.21	1173		
31334	14-Oct-85	-10.07	875.50	17.8	7.18	1063		
31335	15-Oct-85	-9.82	875.75	17.7	7.23	1112		
31336	16-Oct-85	-9.82	875.75					
31337	17-Oct-85	-9.79	875.78	18.5	7.17	1190		
31338	18-Oct-85	-9.40	876.17	18.5	7.21	1180		
31339	19-Oct-85	-9.13	876.44	18.5	7.18	1173		
31341	21-Oct-85	-9.01	876.56	18.5	7.18	1329		
31343	23-Oct-85	-8.93	876.64					
31345	25-Oct-85	-9.11	876.46	18.5	7.31	1242	656	30.8
31347	27-Oct-85	-9.04	876.53					
31349	29-Oct-85	-8.96	876.61	18.4	7.31	1170		
31352	01-Nov-85	-8.93	876.64	18.4	7.30	1179		
31354	03-Nov-85	-8.96	876.61	18.4	7.26	1245		
31357	06-Nov-85	-8.89	876.68	18.4	7.26	1113		

WELLD4

LOTUS DATE	DATE	DEPTH TO WATER (FT)	ELEVATION FEET	TEMP DEG C	PH	EC UMHOS/CM	HCO3 MG/L	CL MG/L
31361	10-Nov-85	-9.24	876.33	18.2	7.36	1126		
31364	13-Nov-85	-8.68	876.89	18.3	7.41	1199		
31366	15-Nov-85	-7.89	877.68	18.3	7.36	1131		
31368	17-Nov-85	-7.55	878.02	18.2	7.45	1160		
31372	21-Nov-85	-6.98	878.59	18.2	7.34	1197		
31376	25-Nov-85	-7.49	878.08	18.3	7.33	1132		
31381	30-Nov-85	-7.49	878.08	18.3	7.46	1194		
31386	05-Dec-85	-7.46	878.11	17.9	7.45	1113		
31403	22-Dec-85	-7.31	878.26	17.0	7.53	1226		
31410	29-Dec-85	-7.42	878.15					
31415	03-Jan-86	-7.47	878.10	16.6	7.75	1326		
31423	11-Jan-86	-7.42	878.15	15.9	7.08	1111		
31426	14-Jan-86	-7.47	878.10	16.2	6.86	1116		
31428	16-Jan-86	-7.49	878.08	18.0	7.00	1053		
31432	20-Jan-86	-7.37	878.20					
31435	23-Jan-86	-7.57	878.00	15.0	7.12	1044	673	26.7
31440	28-Jan-86	-7.41	878.16	15.1	6.98	1152		
31444	01-Feb-86	-7.57	878.00					
31447	04-Feb-86	-7.47	878.10					
31449	06-Feb-86	-7.57	878.00	17.5	7.14	1058		
31456	13-Feb-86	-7.50	878.07	15.0	7.13	1018		
31461	18-Feb-86	-7.43	878.14					
31463	20-Feb-86	-7.56	878.01	15.0	7.08	1060		
31468	25-Feb-86	-7.51	878.06	15.4	7.17	1115		
31473	02-Mar-86	-7.55	878.02					
31477	06-Mar-86	-7.54	878.03	14.0	7.23	1199		
31483	12-Mar-86	-7.37	878.20		7.10	1129		
31487	16-Mar-86	-7.34	878.23	15.4	7.16	1175		
31489	18-Mar-86	-7.16	878.41	14.5	7.06	1162		
31493	22-Mar-86	-7.24	878.33	15.0	7.11	1163		
31496	25-Mar-86	-7.18	878.39					
31498	27-Mar-86	-7.29	878.28	14.6	7.22	1175		
31503	01-Apr-86	-7.27	878.30		7.15	1065		
31504	02-Apr-86	-7.10	878.47		7.13	1137		
31505	03-Apr-86	-6.67	878.90		7.11	1127		
31506	04-Apr-86	-5.56	880.01		7.08	1185		
31508	06-Apr-86	-5.56	880.01		7.19	1300		
31510	08-Apr-86	-5.75	879.82		7.06	1130		
31511	09-Apr-86	-5.76	879.81					
31513	11-Apr-86	-5.77	879.80		7.03	1140		
31514	12-Apr-86	-5.86	879.71					
31516	14-Apr-86	-6.13	879.44					
31517	15-Apr-86	-6.10	879.47		7.36	1310		29.8
31519	17-Apr-86	-5.90	879.67					
31521	19-Apr-86	-5.94	879.63	14.1	7.19		661	30.3
31522	20-Apr-86	-5.81	879.76		7.10		664	28.3

WELLD4

LOTUS DATE	DATE	DEPTH TO WATER (FT)	ELEVATION FEET	TEMP DEG C	PH	EC UMHOS/CM	HCO3 MG/L	CL MG/L
31524	22-Apr-86	-5.97	879.60					
31529	27-Apr-86	-6.17	879.40					
31530	28-Apr-86	-6.30	879.27		7.28		672	31.0
31538	06-May-86	-6.82	878.75					
31539	07-May-86	-6.91	878.66	15.8	7.50	1008	665	31.7
31541	09-May-86	-6.99	878.58					
31542	10-May-86	-6.96	878.61					
31543	11-May-86	-6.92	878.65					
31544	12-May-86	-6.95	878.62					
31545	13-May-86	-7.09	878.48	16.0	7.58	1062	649	31.7
31547	15-May-86	-6.87	878.70		7.59	1110	651	32.7
31548	16-May-86	-6.88	878.69	16.0	7.54	1086	661	40.7
31549	17-May-86	-6.33	879.24	15.6		1046	659	33.7
31550	18-May-86	-6.25	879.32	14.8		1065	669	35.5
31551	19-May-86	-6.29	879.28					
31552	20-May-86	-6.32	879.25					
31553	21-May-86	-6.33	879.24	14.9	7.09	1090	663	33.0
31555	23-May-86	-6.50	879.07					
31559	27-May-86	-6.82	878.75	15.3	7.66	1081	659	29.6
31560	28-May-86	-6.86	878.71					
31562	30-May-86	-7.04	878.53					
31563	31-May-86	-6.98	878.59	15.7	7.16	1090	673	29.4
31566	03-Jun-86	-7.11	878.46					
31570	07-Jun-86	-7.25	878.32	16.1	7.14	1107	657	31.8
31572	09-Jun-86	-7.39	878.18					
31577	14-Jun-86	-7.91	877.66	15.4	7.13	1085	658	37.7
31578	15-Jun-86	-7.76	877.81					
31579	16-Jun-86	-7.82	877.75					
31582	19-Jun-86	-8.03	877.54					
31584	21-Jun-86	-8.24	877.33					
31585	22-Jun-86			16.8	7.61	1216	648	37.0
31586	23-Jun-86	-8.33	877.24					
31591	28-Jun-86	-8.62	876.95		7.23	1155	667	35.6
31595	02-Jul-86	-8.66	876.91					
31599	06-Jul-86	-8.92	876.65	16.5	7.05	1132	647	33.2
31605	12-Jul-86	-9.48	876.09	16.4	6.86	1146	650	
31607	14-Jul-86	-9.68	875.89					
31612	19-Jul-86	-10.28	875.29	17.0	6.78	1161	655	43.1
31619	26-Jul-86	-10.99	874.58	17.1	7.30	1249	649	44.7
31626	02-Aug-86	-11.67	873.90	17.0	6.83	1205	653	46.7
31634	10-Aug-86	-10.44	875.13	19.1	6.95	1263		39.3
31640	16-Aug-86	-10.14	875.43		6.91	1192		34.6
31644	20-Aug-86	-10.43	875.14					
31645	21-Aug-86	-10.49	875.08					
31648	24-Aug-86	-10.52	875.05		6.73	1222		34.6
31654	30-Aug-86	-10.93	874.64		6.55	1173	655	36.6

WELLD4

LOTUS DATE	DATE	DEPTH TO WATER (FT)	ELEVATION FEET	TEMP DEG C	PH	EC UMHOS/CM	HCO3 MG/L	CL MG/L
31661	06-Sep-86	-10.79	874.78		6.88	1218	595	41.9
31666	11-Sep-86	-11.22	874.35					
31669	14-Sep-86	-11.46	874.11	18.2	6.88	1226	662	45.1
31670	15-Sep-86	-11.43	874.14					
31676	21-Sep-86	-11.92	873.65	18.5	6.83	1134	658	38.1
31683	28-Sep-86	-12.11	873.46	18.8	6.95	1115	648	42.4
31684	29-Sep-86	-11.68	873.89	18.5	6.98	1058	647	40.1
31685	30-Sep-86	-10.37	875.20	18.7	7.43	1114	649	44.6
31686	01-Oct-86	-10.09	875.48					
31687	02-Oct-86	-9.86	875.71					
31688	03-Oct-86	-8.51	877.06					
31689	04-Oct-86	-8.19	877.38	18.7	6.92	1071	642	38.2
31691	06-Oct-86	-8.21	877.36					
31695	10-Oct-86	-8.27	877.30	21.1	7.04	1064	655	36.1
31704	19-Oct-86	-8.59	876.98	18.9	6.74	1139	660	38.0
31707	22-Oct-86	-8.03	877.54					
31708	23-Oct-86	-7.73	877.84					
31709	24-Oct-86	-7.67	877.90					
31710	25-Oct-86	-7.59	877.98	18.7	7.00	1111	645	37.2
31711	26-Oct-86	-7.61	877.96					
31712	27-Oct-86	-7.61	877.96					
31713	28-Oct-86	-7.74	877.83					
31714	29-Oct-86	-7.84	877.73					
31715	30-Oct-86	-7.75	877.82					
31716	31-Oct-86	-7.66	877.91					
31717	01-Nov-86	-7.75	877.82					
31718	02-Nov-86	-7.75	877.82					
31720	04-Nov-86	-7.34	878.23					
31721	05-Nov-86	-6.65	878.92					
31722	06-Nov-86	-6.49	879.08	18.9	6.98	1143	664	32.8
31727	11-Nov-86	-6.60	878.97					
31730	14-Nov-86	-6.53	879.04					
31732	16-Nov-86	-6.55	879.02	18.4	6.86	1104	655	31.1
31736	20-Nov-86	-6.76	878.81					
31739	23-Nov-86	-6.72	878.85	18.1	6.95	1108	639	30.0
31742	26-Nov-86	-5.41	880.16					
31744	28-Nov-86	-5.41	880.16	17.8	6.84	1160	654	29.1
31746	30-Nov-86	-5.42	880.15					
31752	06-Dec-86	-5.71	879.86					
31753	07-Dec-86	-5.55	880.02	17.2	6.84	1129	664	31.7
31761	15-Dec-86	-5.14	880.43					
31767	21-Dec-86	-5.45	880.12	16.1	6.92	1207		
31775	29-Dec-86	-5.62	879.95					
31778	01-Jan-87	-5.76	879.81	16.0	6.82	1215	667	31.2
31784	07-Jan-87	-5.91	879.66					
31786	09-Jan-87	-5.66	879.91					

WELLD4

LOTUS DATE	DATE	DEPTH TO WATER (FT)	ELEVATION FEET	TEMP DEG C	PH	EC UMHOS/CM	HCO3 MG/L	CL MG/L
31787	10-Jan-87	-5.55	880.02	15.3	6.90	1221	663	33.2
31792	15-Jan-87	-5.55	880.02					
31802	25-Jan-87	-5.55	880.02	12.4	7.07	1110	677	23.5
31806	29-Jan-87	-5.03	880.54					
31809	01-Feb-87	-4.85	880.72	14.4	6.80	1210	642	30.4
31816	08-Feb-87	-4.30	881.27	15.9	7.13	1122	651	25.5
31823	15-Feb-87	-4.03	881.54					
31830	22-Feb-87	-3.92	881.65					
31832	24-Feb-87	-4.08	881.49					
31834	26-Feb-87	-4.12	881.45					
31837	01-Mar-87	-2.94	882.63					
31839	03-Mar-87	-3.30	882.27					
31840	04-Mar-87	-3.40	882.17					
31841	05-Mar-87	-3.50	882.07					
31842	06-Mar-87	-3.61	881.96					
31843	07-Mar-87	-3.69	881.88					
31844	08-Mar-87	-3.75	881.82					
31845	09-Mar-87	-4.06	881.51					
31846	10-Mar-87	-4.21	881.36					
31847	11-Mar-87	-4.31	881.26					
31848	12-Mar-87	-4.25	881.32					
31849	13-Mar-87	-4.27	881.30					
31850	14-Mar-87	-4.24	881.33					
31852	16-Mar-87	-4.38	881.19					
31853	17-Mar-87	-3.32	882.25					
31854	18-Mar-87	-3.45	882.12					
31855	19-Mar-87	-3.70	881.87					
31856	20-Mar-87	-3.78	881.79					
31857	21-Mar-87	-3.90	881.67					
31858	22-Mar-87	-3.94	881.63					
31859	23-Mar-87	-3.91	881.66					
31860	24-Mar-87	-3.92	881.65					
31862	26-Mar-87	-4.12	881.45					
31863	27-Mar-87	-4.14	881.43					
31864	28-Mar-87	-4.22	881.35					
31865	29-Mar-87	-4.33	881.24					
31870	03-Apr-87	-4.57	881.00					
31871	04-Apr-87	-4.65	880.92					
31873	06-Apr-87	-4.67	880.90					

WELLD5

LOTUS DATE	DATE	DEPTH TO WATER (FT)	ELEVATION FEET	TEMP DEG C	PH	EC UMHOS/CM	HCO3 MG/L	CL MG/L
31423	11-Jan-86	-6.86	878.71					
31426	14-Jan-86	-7.54	878.03					
31428	16-Jan-86	-7.56	878.01	17.5	7.02	1050		
31432	20-Jan-86	-7.45	878.12					
31435	23-Jan-86	-7.65	877.92	14.7	7.17	1056	685	31.7
31440	28-Jan-86	-7.49	878.08	15.0	6.91	1105		
31444	01-Feb-86	-7.67	877.90					
31447	04-Feb-86	-7.57	878.00					
31449	06-Feb-86	-7.66	877.91	17.5	7.10	1025		
31456	13-Feb-86	-7.54	878.03	14.7	7.09	1028		
31461	18-Feb-86	-7.50	878.07					
31463	20-Feb-86	-7.64	877.93	14.6	7.03	1065		
31468	25-Feb-86	-7.59	877.98	15.2	7.11	1109		
31473	02-Mar-86	-7.56	878.01					
31477	06-Mar-86	-7.61	877.96	14.0	7.12	1200		
31483	12-Mar-86	-7.44	878.13		7.13	1116		
31487	16-Mar-86	-7.42	878.15	15.4	7.12	1163		
31489	18-Mar-86	-7.24	878.33	14.4	7.04	1157		
31493	22-Mar-86	-7.30	878.27	14.8	7.13	1163		
31496	25-Mar-86	-7.26	878.31					
31498	27-Mar-86	-7.35	878.22	14.2	7.14	1158		
31503	01-Apr-86	-7.34	878.23		7.16	1058		
31504	02-Apr-86	-7.17	878.40		7.12	1140		
31505	03-Apr-86	-6.47	879.10		7.10	1134		
31506	04-Apr-86	-5.68	879.89		7.07	1189		
31508	06-Apr-86	-5.43	880.14		7.12	1290		
31510	08-Apr-86	-5.79	879.78		7.06	1128		
31511	09-Apr-86	-5.87	879.70					
31513	11-Apr-86	-5.84	879.73		7.03	1152		
31514	12-Apr-86	-5.93	879.64					
31516	14-Apr-86	-6.19	879.38					
31517	15-Apr-86	-6.18	879.39		7.49	1302		30.5
31519	17-Apr-86	-5.98	879.59					
31521	19-Apr-86	-5.98	879.59	14.2	7.17		661	35.4
31522	20-Apr-86	-5.88	879.69	20.9	6.92		668	29.9
31524	22-Apr-86	-6.04	879.53					
31529	27-Apr-86	-6.24	879.33					
31530	28-Apr-86	-6.37	879.20		7.31		662	45.4
31538	06-May-86	-6.89	878.68					
31539	07-May-86	-7.00	878.57	15.7	7.49	1007	676	34.8
31541	09-May-86	-7.06	878.51					
31542	10-May-86	-7.04	878.53					
31543	11-May-86	-6.99	878.58					
31544	12-May-86	-7.02	878.55					
31545	13-May-86	-7.14	878.43	16.0	7.56	1072	796	35.6
31547	15-May-86	-6.97	878.60		7.54	1111	653	36.3
31548	16-May-86	-6.96	878.61	16.1	7.51	1090	657	35.4

WELLD5

LOTUS DATE	DATE	DEPTH TO WATER (FT)	ELEVATION FEET	TEMP DEG C	PH	EC UMHOS/CM	HCO3 MG/L	CL MG/L
31549	17-May-86	-6.43	879.14	15.5		1045	657	35.0
31550	18-May-86	-6.32	879.25	14.8		1069	667	43.2
31551	19-May-86	-6.37	879.20					
31552	20-May-86	-6.38	879.19					
31553	21-May-86	-6.41	879.16	14.9	7.12	1091	665	35.5
31555	23-May-86	-6.59	878.98					
31559	27-May-86	-6.91	878.66	15.3	7.69	1089	662	31.3
31560	28-May-86	-6.94	878.63					
31562	30-May-86	-7.10	878.47					
31563	31-May-86	-7.05	878.52	15.7	7.14	1099	670	30.3
31566	03-Jun-86	-7.19	878.38					
31570	07-Jun-86	-7.33	878.24	16.0	7.08	1110	659	29.5
31572	09-Jun-86	-7.47	878.10					
31577	14-Jun-86	-7.98	877.59	15.6	7.09	1082	657	40.3
31578	15-Jun-86	-7.82	877.75					
31579	16-Jun-86	-7.89	877.68					
31584	21-Jun-86	-8.32	877.25					
31585	22-Jun-86			16.7	7.55	1238	653	36.1
31586	23-Jun-86	-8.42	877.15					
31591	28-Jun-86	-8.69	876.88		7.21	1153	650	32.8
31595	02-Jul-86	-8.73	876.84					
31599	06-Jul-86	-9.00	876.57	17.0	7.14	1135	648	34.3
31605	12-Jul-86	-9.45	876.12	16.3	6.95	1149	659	
31607	14-Jul-86	-9.64	875.93					
31612	19-Jul-86	-10.22	875.35	17.5	6.85	1175	664	47.2
31619	26-Jul-86	-10.93	874.64	17.0	7.23	1213	650	44.1
31626	02-Aug-86	-11.63	873.94	17.4	6.81	1185	654	47.7
31634	10-Aug-86	-10.39	875.18	19.2	6.87	1272		39.6
31640	16-Aug-86	-10.09	875.48		6.94	1192		34.4
31644	20-Aug-86	-10.39	875.18					
31645	21-Aug-86	-10.46	875.11					
31648	24-Aug-86	-10.48	875.09		6.76	1223		35.9
31654	30-Aug-86	-10.88	874.69		6.67	1171	658	39.0
31661	06-Sep-86	-10.75	874.82		6.93	1215	605	43.0
31666	11-Sep-86	-11.18	874.39					
31669	14-Sep-86	-11.41	874.16	18.3	6.97	1225	670	45.1
31670	15-Sep-86	-11.38	874.19					
31676	21-Sep-86	-11.87	873.70	18.7	6.77	1130	659	40.2
31683	28-Sep-86	-12.06	873.51	18.8	6.85	1108	651	43.1
31684	29-Sep-86	-11.65	873.92		7.12	1057	653	38.0
31685	30-Sep-86	-10.32	875.25		7.15	1123	650	51.0
31686	01-Oct-86	-10.05	875.52					
31687	02-Oct-86	-9.83	875.74					
31688	03-Oct-86	-8.48	877.09					
31689	04-Oct-86	-8.16	877.41		6.91	1075	634	45.4
31691	06-Oct-86	-8.17	877.40					

WELLD5

LOTUS DATE	DATE	DEPTH TO WATER (FT)	ELEVATION FEET	TEMP DEG C	PH	EC UMHOS/CM	HCO3 MG/L	CL MG/L
31695	10-Oct-86	-8.25	877.32	20.7	7.03	1064	657	39.4
31704	19-Oct-86	-8.56	877.01	19.4	6.80	1133	663	38.2
31707	22-Oct-86	-7.99	877.58					
31708	23-Oct-86	-7.71	877.86					
31709	24-Oct-86	-7.63	877.94					
31710	25-Oct-86	-7.56	878.01	19.0	7.01	1110	642	37.4
31711	26-Oct-86	-7.57	878.00					
31712	27-Oct-86	-7.59	877.98					
31713	28-Oct-86	-7.73	877.84					
31714	29-Oct-86	-7.81	877.76					
31715	30-Oct-86	-7.74	877.83					
31716	31-Oct-86	-7.64	877.93					
31717	01-Nov-86	-7.74	877.83					
31718	02-Nov-86	-7.71	877.86					
31720	04-Nov-86	-7.34	878.23					
31721	05-Nov-86	-6.63	878.94					
31722	06-Nov-86	-6.47	879.10	19.0	7.03	1145	654	37.6
31727	11-Nov-86	-6.58	878.99					
31730	14-Nov-86	-6.49	879.08					
31732	16-Nov-86	-6.52	879.05	18.4	6.89	1101	648	31.8
31736	20-Nov-86	-6.74	878.83					
31739	23-Nov-86	-6.71	878.86		6.97	1100	647	33.3
31742	26-Nov-86	-5.39	880.18					
31744	28-Nov-86	-5.39	880.18	17.8	6.86	1146	662	29.6
31746	30-Nov-86	-5.40	880.17					
31752	06-Dec-86	-5.68	879.89					
31753	07-Dec-86	-5.52	880.05		6.81	1144	656	32.9
31761	15-Dec-86	-5.14	880.43					
31767	21-Dec-86	-5.43	880.14	16.1	6.92	1206		
31775	29-Dec-86	-5.62	879.95					
31778	01-Jan-87	-5.75	879.82	15.8	6.80	1246	670	39.3
31784	07-Jan-87	-5.89	879.68					
31786	09-Jan-87	-5.63	879.94					
31787	10-Jan-87	-5.54	880.03	15.1	7.02	1226	659	38.1
31792	15-Jan-87	-5.50	880.07					
31802	25-Jan-87	-5.53	880.04	13.2	7.05	1190	679	36.9
31806	29-Jan-87	-4.98	880.59					
31809	01-Feb-87	-4.84	880.73	14.3	6.83	1279	648	51.2
31816	08-Feb-87	-4.28	881.29	15.7	7.02	1145	651	36.4
31823	15-Feb-87	-3.99	881.58					
31830	22-Feb-87	-3.89	881.68					
31832	24-Feb-87	-4.05	881.52					
31834	26-Feb-87	-4.11	881.46					
31837	01-Mar-87	-2.92	882.65					
31839	03-Mar-87	-3.28	882.29					
31840	04-Mar-87	-3.37	882.20					

WELLDS

LOTUS DATE	DATE	DEPTH TO WATER (FT)	ELEVATION FEET	TEMP DEG C	PH	EC UMHOS/CM	HCO3 MG/L	CL MG/L
31841	05-Mar-87	-3.48	882.09					
31842	06-Mar-87	-3.59	881.98					
31843	07-Mar-87	-3.68	881.89					
31844	08-Mar-87	-3.72	881.85					
31845	09-Mar-87	-4.06	881.51					
31846	10-Mar-87	-4.19	881.38					
31847	11-Mar-87	-4.30	881.27					
31848	12-Mar-87	-4.23	881.34					
31849	13-Mar-87	-4.24	881.33					
31850	14-Mar-87	-4.22	881.35					
31852	16-Mar-87	-4.35	881.22					
31853	17-Mar-87	-3.30	882.27					
31854	18-Mar-87	-3.43	882.14					
31855	19-Mar-87	-3.69	881.88					
31856	20-Mar-87	-3.74	881.83					
31857	21-Mar-87	-3.88	881.69					
31858	22-Mar-87	-3.92	881.65					
31859	23-Mar-87	-3.87	881.70					
31860	24-Mar-87	-3.90	881.67					
31862	26-Mar-87	-4.10	881.47					
31863	27-Mar-87	-4.10	881.47					
31864	28-Mar-87	-4.20	881.37					
31865	29-Mar-87	-4.31	881.26					
31870	03-Apr-87	-4.52	881.05					
31871	04-Apr-87	-4.63	880.94					
31873	06-Apr-87	-4.65	880.92					

WELLE1

LOTUS DATE	DATE	DEPTH TO WATER (FT)	ELEVATION FEET	TEMP DEG C	PH	EC UMHOS/CM	HCO3 MG/L	CL MG/L
31338	18-Oct-85	-7.27	878.52	19.7	7.75	437		
31339	19-Oct-85	-8.07	877.72	20.5	7.86	466		
31364	13-Nov-85	-8.23	877.56					
31366	15-Nov-85	-7.48	878.31	18.2	8.20	622		
31368	17-Nov-85	-7.45	878.34	18.6	8.09	658		
31372	21-Nov-85	-7.47	878.32	18.5	8.23	657		
31376	25-Nov-85	-7.44	878.35	18.4	8.27	648		
31381	30-Nov-85			17.7	8.30	688		
31386	05-Dec-85	-7.52	878.27	17.5	8.18	674		
31403	22-Dec-85	-7.32	878.47	16.2	8.39	686		
31410	29-Dec-85	-7.48	878.31					
31415	03-Jan-86	-7.54	878.25	15.5	8.56	661		
31423	11-Jan-86	-7.53	878.26	15.2	7.44	635		
31426	14-Jan-86	-7.51	878.28	15.1	7.54	580		
31428	16-Jan-86	-7.54	878.25	16.9	7.37	624		
31432	20-Jan-86	-7.54	878.25					
31435	23-Jan-86	-7.69	878.10	14.9	7.37	648	383	11.7
31440	28-Jan-86	-7.49	878.30	14.9	7.33	650		
31444	01-Feb-86	-7.64	878.15					
31447	04-Feb-86	-7.59	878.20					
31449	06-Feb-86	-7.67	878.12	16.8	7.33	619		
31456	13-Feb-86	-7.60	878.19	14.5	7.44	592		
31461	18-Feb-86	-7.51	878.28					
31463	20-Feb-86	-7.57	878.22	14.2	7.42	625		
31468	25-Feb-86	-7.59	878.20	15.7	7.54	679		
31473	02-Mar-86	-7.60	878.19					
31477	06-Mar-86	-7.61	878.18	14.5	7.62	697		
31483	12-Mar-86	-7.57	878.22		7.50	647		
31487	16-Mar-86	-7.45	878.34	15.7	7.68	644		
31489	18-Mar-86	-7.30	878.49	14.9	7.65	635		
31493	22-Mar-86	-7.35	878.44	15.2	7.71	704		
31496	25-Mar-86	-7.30	878.49					
31498	27-Mar-86	-7.36	878.43	14.8	7.43	674		
31503	01-Apr-86	-7.23	878.56		7.84	542		
31504	02-Apr-86	-7.23	878.56		7.47	579		
31505	03-Apr-86	-6.36	879.43		7.37	602		
31506	04-Apr-86	-5.48	880.31		7.34	668		
31508	06-Apr-86	-5.55	880.24		7.33	720		
31510	08-Apr-86	-5.73	880.06		7.44	602		
31511	09-Apr-86	-5.86	879.93					
31513	11-Apr-86	-5.86	879.93		7.61	615		
31514	12-Apr-86	-5.93	879.86					
31516	14-Apr-86	-6.15	879.64					
31517	15-Apr-86	-6.18	879.61	13.5	7.55	688		6.2
31519	17-Apr-86	-6.69	879.10					
31521	19-Apr-86	-6.00	879.79	15.3	7.59		330	6.4
31522	20-Apr-86	-5.92	879.87		7.45		363	4.4

WELLE1

LOTUS DATE	DATE	DEPTH TO WATER (FT)	ELEVATION FEET	TEMP DEG C	PH	EC UMHOS/CM	HCO3 MG/L	CL MG/L
31524	22-Apr-86	-6.10	879.69					
31529	27-Apr-86	-6.20	879.59					
31530	28-Apr-86	-6.38	879.41		7.43		343	8.0
31538	06-May-86	-6.85	878.94					
31539	07-May-86	-6.97	878.82	17.7		550		13.6
31541	09-May-86	-6.92	878.87					
31542	10-May-86	-6.92	878.87					
31543	11-May-86	-6.96	878.83					
31544	12-May-86	-6.98	878.81					
31545	13-May-86	-7.07	878.72	17.3				
31547	15-May-86	-6.67	879.12		7.74	598	320	14.8
31548	16-May-86	-6.92	878.87	17.2	7.86	578		6.0
31549	17-May-86	-5.87	879.92	17.2		483		7.1
31550	18-May-86	-6.20	879.59	16.7		522	316	10.1
31551	19-May-86	-6.27	879.52					
31552	20-May-86	-6.32	879.47					
31553	21-May-86	-6.35	879.44	17.0	7.31	536	320	10.2
31555	23-May-86	-6.53	879.26					
31559	27-May-86	-6.84	878.95	20.8	7.59	549		9.1
31560	28-May-86	-6.91	878.88					
31562	30-May-86	-6.98	878.81					
31563	31-May-86	-7.03	878.76	17.3	7.39	598		6.3
31566	03-Jun-86	-7.16	878.63					
31570	07-Jun-86	-7.32	878.47	17.5	7.20	660		9.9
31572	09-Jun-86	-7.45	878.34					
31577	14-Jun-86	-7.91	877.88					
31578	15-Jun-86	-7.50	878.29					
31579	16-Jun-86	-7.81	877.98					
31582	19-Jun-86	-8.02	877.77					
31584	21-Jun-86	-8.23	877.56					
31586	23-Jun-86	-7.70	878.09					
31685	30-Sep-86	-8.22	877.57					
31686	01-Oct-86	-8.06	877.73					
31688	03-Oct-86	-7.03	878.76					
31689	04-Oct-86	-7.31	878.48					
31707	22-Oct-86	-7.23	878.56					
31708	23-Oct-86	-7.57	878.22					
31709	24-Oct-86	-7.54	878.25					
31710	25-Oct-86	-7.48	878.31					
31711	26-Oct-86	-7.52	878.27					
31712	27-Oct-86	-7.53	878.26					
31713	28-Oct-86	-8.14	877.65					
31714	29-Oct-86	-8.22	877.57					
31715	30-Oct-86	-8.15	877.64					
31716	31-Oct-86	-7.64	878.15					
31717	01-Nov-86	-7.75	878.04					

WELLE1

LOTUS DATE	DATE	DEPTH TO WATER (FT)	ELEVATION FEET	TEMP DEG C	PH	EC UMHOS/CM	HCO3 MG/L	CL MG/L
31718	02-Nov-86	-7.74	878.05					
31720	04-Nov-86	-6.02	879.77					
31721	05-Nov-86	-6.38	879.41					
31722	06-Nov-86	-6.40	879.39	19.6	7.11	543	285	11.2
31727	11-Nov-86	-6.53	879.26					
31730	14-Nov-86	-6.54	879.25					
31732	16-Nov-86	-6.58	879.21	19.2	7.13	551	308	10.8
31736	20-Nov-86	-6.79	879.00					
31739	23-Nov-86	-6.79	879.00	18.6	7.10	570		8.8
31742	26-Nov-86	-5.38	880.41					
31744	28-Nov-86	-5.37	880.42	17.5	6.93	555	323	9.3
31746	30-Nov-86	-5.44	880.35					
31752	06-Dec-86	-5.79	880.00					
31753	07-Dec-86	-5.60	880.19	16.5	7.02	572	340	9.6
31761	15-Dec-86	-5.25	880.54					
31767	21-Dec-86	-5.52	880.27	15.3	7.20	572		
31775	29-Dec-86	-5.75	880.04					
31778	01-Jan-87	-5.94	879.85	15.0	7.06	626	365	11.9
31784	07-Jan-87	-6.07	879.72					
31786	09-Jan-87	-5.84	879.95					
31787	10-Jan-87	-5.81	879.98	14.5	7.09	655	365	13.7
31792	15-Jan-87	-5.71	880.08					
31802	25-Jan-87	-5.75	880.04	13.4	7.02	680	414	8.7
31806	29-Jan-87	-5.22	880.57					
31809	01-Feb-87	-5.00	880.79	15.1	6.85	647	383	8.2
31816	08-Feb-87	-4.43	881.36	14.4	7.13	651	398	7.4
31823	15-Feb-87	-4.09	881.70					
31830	22-Feb-87	-4.00	881.79					
31832	24-Feb-87	-4.20	881.59					
31834	26-Feb-87	-4.27	881.52					
31837	01-Mar-87	-2.77	883.02					
31839	03-Mar-87	-3.35	882.44					
31840	04-Mar-87	-3.48	882.31					
31841	05-Mar-87	-3.57	882.22					
31842	06-Mar-87	-3.70	882.09					
31843	07-Mar-87	-3.79	882.00					
31844	08-Mar-87	-3.85	881.94					
31845	09-Mar-87	-4.30	881.49					
31846	10-Mar-87	-4.48	881.31					
31847	11-Mar-87	-4.60	881.19					
31848	12-Mar-87	-4.41	881.38					
31849	13-Mar-87	-4.39	881.40					
31850	14-Mar-87	-4.38	881.41					
31852	16-Mar-87	-4.52	881.27					
31853	17-Mar-87	-3.37	882.42					
31854	18-Mar-87	-3.55	882.24					

WELLE1

LOTUS DATE	DATE	DEPTH TO WATER (FT)	ELEVATION FEET	TEMP DEG C	PH	EC UMHOS/CM	HCO3 MG/L	CL MG/L
31855	19-Mar-87	-3.80	881.99					
31856	20-Mar-87	-3.87	881.92					
31857	21-Mar-87	-4.01	881.78					
31858	22-Mar-87	-4.05	881.74					
31859	23-Mar-87	-4.02	881.77					
31860	24-Mar-87	-4.02	881.77					
31862	26-Mar-87	-4.22	881.57					
31863	27-Mar-87	-4.24	881.55					
31864	28-Mar-87	-4.35	881.44					
31865	29-Mar-87	-4.45	881.34					
31870	03-Apr-87	-4.70	881.09					
31871	04-Apr-87	-4.80	880.99					
31873	06-Apr-87	-4.82	880.97					

WELLE2

LOTUS DATE	DATE	DEPTH TO WATER (FT)	ELEVATION FEET	TEMP DEG C	PH	EC UMHOS/CM	HCO3 MG/L	CL MG/L
31335	15-Oct-85	-8.68	877.11	19.2	7.90	255		
31336	16-Oct-85	-9.29	876.50					
31338	18-Oct-85	-7.55	878.24	19.7	7.41	299		
31339	19-Oct-85	-8.39	877.40	20.0	7.71	315		
31341	21-Oct-85	-8.74	877.05	20.5	7.73	412		
31343	23-Oct-85	-8.74	877.05					
31345	25-Oct-85	-8.94	876.85	20.2	7.81	502	331	9.1
31347	27-Oct-85	-8.92	876.87					
31349	29-Oct-85	-8.86	876.93	19.7	8.02	491		
31352	01-Nov-85	-8.80	876.99	19.6	8.03	499		
31354	03-Nov-85	-8.89	876.90	20.1	7.91	504		
31357	06-Nov-85	-8.78	877.01	19.9	8.15	465		
31361	10-Nov-85	-8.92	876.87	19.4	7.89	502		
31364	13-Nov-85	-8.34	877.45	19.4	8.02	520		
31366	15-Nov-85	-7.56	878.23	18.5	7.96	392		
31368	17-Nov-85	-7.46	878.33	18.9	7.89	486		
31372	21-Nov-85	-7.44	878.35	18.7	7.97	504		
31376	25-Nov-85	-7.45	878.34	18.7	7.95	493		
31381	30-Nov-85	-7.58	878.21	17.9	8.06	535		
31386	05-Dec-85	-7.52	878.27	17.8	7.95	446		
31403	22-Dec-85	-7.36	878.43	17.2	8.11	523		
31410	29-Dec-85	-7.48	878.31					
31415	03-Jan-86	-7.53	878.26	16.3	8.23	545		
31423	11-Jan-86	-7.51	878.28	15.7	7.25	591		
31426	14-Jan-86	-7.53	878.26	15.8	7.31	561		
31428	16-Jan-86	-7.56	878.23	17.6	7.11	604		
31432	20-Jan-86	-7.49	878.30					
31435	23-Jan-86	-7.67	878.12	15.2	7.36	635	358	14.3
31440	28-Jan-86	-7.48	878.31	15.2	7.21	681		
31444	01-Feb-86	-7.66	878.13					
31447	04-Feb-86	-7.60	878.19					
31449	06-Feb-86	-7.67	878.12	17.5	7.24	663		
31456	13-Feb-86	-7.61	878.18	15.0	7.24	646		
31461	18-Feb-86	-7.50	878.29					
31463	20-Feb-86	-7.61	878.18	14.6	7.28	700		
31468	25-Feb-86	-7.61	878.18	16.6	7.24	766		
31473	02-Mar-86	-7.62	878.17					
31477	06-Mar-86	-7.60	878.19	14.7	7.40	771		
31483	12-Mar-86	-7.54	878.25		7.28	763		
31487	16-Mar-86	-7.46	878.33	16.1	7.36	762		
31489	18-Mar-86	-7.29	878.50	15.2	7.43	762		
31493	22-Mar-86	-7.36	878.43	15.3	7.36	822		
31496	25-Mar-86	-7.30	878.49					
31498	27-Mar-86	-7.38	878.41	15.0	7.28	815		
31503	01-Apr-86	-7.27	878.52		7.37	668		
31504	02-Apr-86	-7.22	878.57		7.35	681		
31505	03-Apr-86	-6.45	879.34		7.35	633		

WELLE2

LOTUS DATE	DATE	DEPTH TO WATER (FT)	ELEVATION FEET	TEMP DEG C	PH	EC UMHOS/CM	HCO3 MG/L	CL MG/L
31506	04-Apr-86	-5.52	880.27		7.24	817		
31508	06-Apr-86	-5.58	880.21		7.23	866		
31510	08-Apr-86	-5.77	880.02		7.26	699		
31511	09-Apr-86	-5.89	879.90					
31513	11-Apr-86	-5.87	879.92		7.33	818		
31514	12-Apr-86	-5.95	879.84					
31516	14-Apr-86	-6.19	879.60					
31517	15-Apr-86	-6.19	879.60		7.38	879		10.2
31519	17-Apr-86	-5.82	879.97					
31521	19-Apr-86	-6.01	879.78	15.3	7.38		450	10.3
31522	20-Apr-86	-5.91	879.88		7.31		445	10.1
31524	22-Apr-86	-6.10	879.69					
31529	27-Apr-86	-6.22	879.57					
31530	28-Apr-86	-6.39	879.40		7.38		410	15.2
31538	06-May-86	-6.86	878.93					
31539	07-May-86	-6.99	878.80	17.6	7.57	652	421	12.2
31541	09-May-86	-7.01	878.78					
31542	10-May-86	-6.97	878.82					
31543	11-May-86	-6.96	878.83					
31544	12-May-86	-7.00	878.79					
31545	13-May-86	-7.10	878.69	17.3	7.79	653	394	12.2
31547	15-May-86	-6.99	878.80		7.74	774	418	19.9
31548	16-May-86	-6.92	878.87	17.0	7.62	669	397	13.3
31549	17-May-86	-6.06	879.73	17.0		587	352	10.2
31550	18-May-86	-6.23	879.56	16.4		692	409	15.0
31551	19-May-86	-6.28	879.51					
31552	20-May-86	-6.32	879.47					
31553	21-May-86	-6.37	879.42	16.7	7.28	682	395	12.1
31555	23-May-86	-6.54	879.25					
31559	27-May-86	-6.85	878.94	20.1	7.66	578	331	7.8
31560	28-May-86	-6.91	878.88					
31562	30-May-86	-7.02	878.77					
31563	31-May-86	-7.03	878.76	17.0	7.11	680	387	11.4
31566	03-Jun-86	-7.13	878.66					
31570	07-Jun-86	-7.29	878.50	17.1	7.57	698	392	16.9
31572	09-Jun-86	-7.43	878.36					
31577	14-Jun-86	-7.90	877.89	17.6	6.85	705	387	12.0
31578	15-Jun-86	-7.39	878.40					
31579	16-Jun-86	-7.80	877.99					
31582	19-Jun-86	-8.01	877.78					
31584	21-Jun-86	-8.20	877.59					
31585	22-Jun-86			18.2	7.89	755	363	22.3
31586	23-Jun-86	-7.47	878.32					
31591	28-Jun-86	-8.04	877.75					
31595	02-Jul-86	-7.96	877.83					
31599	06-Jul-86	-8.83	876.96		7.45	428	232	10.9

WELLE2

LOTUS DATE	DATE	DEPTH TO WATER (FT)	ELEVATION FEET	TEMP DEG C	PH	EC UMHOS/CM	HCO3 MG/L	CL MG/L
31685	30-Sep-86	-8.94	876.85					
31686	01-Oct-86	-9.11	876.68					
31688	03-Oct-86	-7.16	878.63					
31689	04-Oct-86	-7.66	878.13					
31691	06-Oct-86	-7.87	877.92					
31695	10-Oct-86	-8.03	877.76					
31704	19-Oct-86	-8.52	877.27					
31707	22-Oct-86	-7.03	878.76					
31708	23-Oct-86	-7.56	878.23					
31709	24-Oct-86	-7.49	878.30					
31710	25-Oct-86	-7.47	878.32	19.8				
31711	26-Oct-86	-7.45	878.34					
31712	27-Oct-86	-7.52	878.27					
31713	28-Oct-86	-8.13	877.66					
31714	29-Oct-86	-8.21	877.58					
31715	30-Oct-86	-8.14	877.65					
31716	31-Oct-86	-7.62	878.17					
31717	01-Nov-86	-7.72	878.07					
31718	02-Nov-86	-7.71	878.08					
31720	04-Nov-86	-5.02	880.77					
31721	05-Nov-86	-6.40	879.39					
31722	06-Nov-86	-6.42	879.37	19.2	7.00	465	240	14.7
31727	11-Nov-86	-6.59	879.20					
31730	14-Nov-86	-6.56	879.23					
31732	16-Nov-86	-6.52	879.27	19.4	6.90	537	294	10.5
31736	20-Nov-86	-6.78	879.01					
31739	23-Nov-86	-6.77	879.02	18.9	6.96	610	336	16.6
31742	26-Nov-86	-5.27	880.52					
31744	28-Nov-86	-5.33	880.46	17.8	6.92	526	287	9.5
31746	30-Nov-86	-5.42	880.37					
31752	06-Dec-86	-5.64	880.15					
31753	07-Dec-86	-5.58	880.21	17.2	6.80	497	265	8.9
31761	15-Dec-86	-5.19	880.60					
31767	21-Dec-86	-5.36	880.43	15.8	6.89	578		
31775	29-Dec-86	-5.72	880.07					
31778	01-Jan-87	-5.83	879.96	15.5	6.96	620	359	12.2
31784	07-Jan-87	-6.04	879.75					
31786	09-Jan-87	-5.80	879.99					
31787	10-Jan-87	-5.72	880.07	15.3	7.08	630	340	13.3
31792	15-Jan-87	-5.69	880.10					
31802	25-Jan-87	-5.73	880.06	13.8	7.03	815	494	13.6
31806	29-Jan-87	-5.20	880.59					
31809	01-Feb-87	-4.99	880.80	14.9	6.86	790	461	11.8
31816	08-Feb-87	-4.40	881.39	14.1	7.11	829	497	12.8
31823	15-Feb-87	-3.96	881.83					
31830	22-Feb-87	-3.92	881.87					

WELLE2

LOTUS DATE	DATE	DEPTH TO WATER (FT)	ELEVATION FEET	TEMP DEG C	PH	EC UMHOS/CM	HCO3 MG/L	CL MG/L
31832	24-Feb-87	-4.17	881.62					
31834	26-Feb-87	-4.22	881.57					
31837	01-Mar-87	-2.79	883.00					
31839	03-Mar-87	-3.32	882.47					
31840	04-Mar-87	-3.45	882.34					
31841	05-Mar-87	-3.54	882.25					
31842	06-Mar-87	-3.68	882.11					
31843	07-Mar-87	-3.76	882.03					
31844	08-Mar-87	-3.82	881.97					
31845	09-Mar-87	-4.28	881.51					
31846	10-Mar-87	-4.45	881.34					
31847	11-Mar-87	-4.58	881.21					
31848	12-Mar-87	-4.36	881.43					
31849	13-Mar-87	-4.36	881.43					
31850	14-Mar-87	-4.35	881.44					
31852	16-Mar-87	-4.49	881.30					
31853	17-Mar-87	-3.36	882.43					
31854	18-Mar-87	-3.53	882.26					
31855	19-Mar-87	-3.77	882.02					
31856	20-Mar-87	-3.85	881.94					
31857	21-Mar-87	-3.99	881.80					
31858	22-Mar-87	-4.02	881.77					
31859	23-Mar-87	-3.99	881.80					
31860	24-Mar-87	-4.01	881.78					
31862	26-Mar-87	-4.20	881.59					
31863	27-Mar-87	-4.20	881.59					
31864	28-Mar-87	-4.32	881.47					
31865	29-Mar-87	-4.41	881.38					
31870	03-Apr-87	-4.67	881.12					
31871	04-Apr-87	-4.76	881.03					
31873	06-Apr-87	-4.79	881.00					

WELLE3

LOTUS DATE	DATE	DEPTH TO WATER (FT)	ELEVATION FEET	TEMP DEG C	PH	EC UMHOS/CM	HCO3 MG/L	CL MG/L
31334	14-Oct-85	-8.87	876.92	19.4	7.53	297		
31335	15-Oct-85	-9.47	876.32	19.5	7.74	284		
31336	16-Oct-85	-9.57	876.22					
31337	17-Oct-85	-9.57	876.22	20.3	8.01	438		
31338	18-Oct-85	-7.85	877.94	20.0	7.53	310		
31339	19-Oct-85	-8.56	877.23	20.1	7.63	325		
31341	21-Oct-85	-8.81	876.98	20.0	7.67	424		
31343	23-Oct-85	-8.77	877.02					
31345	25-Oct-85	-8.94	876.85	20.2	7.79	426	329	9.5
31347	27-Oct-85	-8.92	876.87					
31349	29-Oct-85	-8.84	876.95	19.8	7.93	427		
31352	01-Nov-85	-8.82	876.97	19.9	8.00	437		
31354	03-Nov-85	-8.87	876.92	19.9	7.74	448		
31357	06-Nov-85	-8.78	877.01	19.9	7.87	416		
31361	10-Nov-85	-8.94	876.85	19.4	7.97	447		
31364	13-Nov-85	-8.49	877.30	19.4	7.88	459		
31366	15-Nov-85	-7.60	878.19	18.9	7.89	398		
31368	17-Nov-85	-7.44	878.35	19.0	7.89	445		
31372	21-Nov-85	-7.38	878.41	18.8	7.87	467		
31376	25-Nov-85	-7.42	878.37	18.9	7.84	456		
31381	30-Nov-85	-7.51	878.28	18.5	7.96	501		
31386	05-Dec-85	-7.45	878.34	18.0	7.94	490		
31403	22-Dec-85	-7.34	878.45	18.2	7.97	518		
31410	29-Dec-85	-7.45	878.34					
31415	03-Jan-86	-7.49	878.30	16.9	8.07	535		
31423	11-Jan-86	-7.47	878.32	16.4	7.22	569		
31426	14-Jan-86	-7.52	878.27	16.3	7.27	549		
31428	16-Jan-86	-7.52	878.27	18.2	7.20	579		
31432	20-Jan-86	-7.45	878.34					
31435	23-Jan-86	-7.64	878.15	15.5	7.32	607	329	17.8
31440	28-Jan-86	-7.61	878.18	15.9	7.20	611		
31444	01-Feb-86	-7.64	878.15					
31447	04-Feb-86	-7.58	878.21					
31449	06-Feb-86	-7.64	878.15	18.0	7.26	605		
31456	13-Feb-86	-7.58	878.21	15.2	7.26	614		
31461	18-Feb-86	-7.48	878.31					
31463	20-Feb-86	-7.64	878.15	14.8	7.35	666		
31468	25-Feb-86	-7.59	878.20	17.1	7.30	703		
31473	02-Mar-86	-7.61	878.18					
31477	06-Mar-86	-7.59	878.20	15.3	7.35	715		
31483	12-Mar-86	-7.45	878.34		7.31	719		
31487	16-Mar-86	-7.44	878.35	16.3	7.32	778		
31489	18-Mar-86	-7.26	878.53	15.6	7.33	820		
31493	22-Mar-86	-7.33	878.46	15.5	7.35	832		
31496	25-Mar-86	-7.28	878.51					
31498	27-Mar-86	-7.35	878.44	15.4	7.29	831		
31503	01-Apr-86	-7.30	878.49		7.39	676		

WELLE3

LOTUS DATE	DATE	DEPTH TO WATER (FT)	ELEVATION FEET	TEMP DEG C	PH	EC UMHOS/CM	HCO3 MG/L	CL MG/L
31504	02-Apr-86	-7.19	878.60		7.30	724		
31505	03-Apr-86	-6.44	879.35		7.32	664		
31506	04-Apr-86	-5.55	880.24		7.25	734		
31508	06-Apr-86	-5.58	880.21		7.25	798		
31510	08-Apr-86	-5.78	880.01		7.32	693		
31511	09-Apr-86	-5.62	880.17					
31513	11-Apr-86	-5.85	879.94		7.30	727		
31514	12-Apr-86	-5.93	879.86					
31516	14-Apr-86	-6.17	879.62					
31517	15-Apr-86	-6.18	879.61		7.39	875		11.3
31519	17-Apr-86	-5.90	879.89					
31521	19-Apr-86	-6.00	879.79	15.4	7.36		412	12.2
31522	20-Apr-86	-5.95	879.84		7.33		410	17.0
31524	22-Apr-86	-6.08	879.71					
31529	27-Apr-86	-6.24	879.55					
31530	28-Apr-86	-6.37	879.42		7.42		413	26.3
31538	06-May-86	-6.84	878.95					
31539	07-May-86	-6.97	878.82	17.7	7.57	704	439	19.5
31541	09-May-86	-7.00	878.79					
31542	10-May-86	-6.99	878.80					
31543	11-May-86	-6.98	878.81					
31544	12-May-86	-6.97	878.82					
31545	13-May-86	-7.08	878.71	17.4	7.71	715	403	17.0
31547	15-May-86	-6.81	878.98		7.66	806	409	21.6
31548	16-May-86	-6.90	878.89	17.0	7.60	708	395	18.2
31549	17-May-86	-6.14	879.65	17.0		589	346	11.7
31550	18-May-86	-6.21	879.58	16.4		668	380	18.8
31551	19-May-86	-6.27	879.52					
31552	20-May-86	-6.30	879.49					
31553	21-May-86	-6.33	879.46	16.7	7.26	673	377	13.9
31555	23-May-86	-6.53	879.26					
31559	27-May-86	-6.84	878.95	19.8	7.67	646	372	12.1
31560	28-May-86	-6.88	878.91					
31562	30-May-86	-7.03	878.76					
31563	31-May-86	-7.01	878.78	16.9	7.31	704	389	13.7
31566	03-Jun-86	-7.14	878.65					
31570	07-Jun-86	-7.30	878.49	17.0	7.62	717	395	13.2
31572	09-Jun-86	-7.40	878.39					
31577	14-Jun-86	-7.87	877.92	17.3	7.13	727	404	14.1
31578	15-Jun-86	-7.50	878.29					
31579	16-Jun-86	-7.77	878.02					
31582	19-Jun-86	-7.99	877.80					
31584	21-Jun-86	-8.18	877.61					
31585	22-Jun-86				7.64	784	375	20.8
31586	23-Jun-86	-8.13	877.66					
31591	28-Jun-86	-8.52	877.27		7.24	617	330	23.7

WELLE3

LOTUS DATE	DATE	DEPTH TO WATER (FT)	ELEVATION FEET	TEMP DEG C	PH	EC UMHOS/CM	HCO3 MG/L	CL MG/L
31595	02-Jul-86	-8.50	877.29					
31599	06-Jul-86	-8.80	876.99	18.7	7.38	572	322	12.8
31605	12-Jul-86	-9.34	876.45	18.9	7.05	588	317	13.5
31607	14-Jul-86	-9.50	876.29					
31612	19-Jul-86	-9.60	876.19					
31685	30-Sep-86	-8.06	877.73					
31686	01-Oct-86	-8.90	876.89					
31688	03-Oct-86	-7.36	878.43					
31689	04-Oct-86	-7.54	878.25	20.9	6.95	406	217	10.1
31691	06-Oct-86	-7.89	877.90					
31695	10-Oct-86	-8.05	877.74	21.6	7.10	457		17.5
31704	19-Oct-86	-8.48	877.31	21.1				
31707	22-Oct-86	-7.31	878.48					
31708	23-Oct-86	-7.53	878.26					
31709	24-Oct-86	-7.49	878.30					
31710	25-Oct-86	-7.44	878.35	20.4	7.44	459	238	10.1
31711	26-Oct-86	-7.47	878.32					
31712	27-Oct-86	-7.48	878.31					
31713	28-Oct-86	-8.17	877.62					
31714	29-Oct-86	-8.24	877.55					
31715	30-Oct-86	-8.17	877.62					
31716	31-Oct-86	-7.61	878.18					
31717	01-Nov-86	-7.71	878.08					
31718	02-Nov-86	-7.70	878.09					
31720	04-Nov-86	-6.56	879.23					
31721	05-Nov-86	-6.51	879.28					
31722	06-Nov-86	-6.42	879.37	19.6	7.13	499	262	14.2
31727	11-Nov-86	-6.52	879.27					
31730	14-Nov-86	-6.61	879.18					
31732	16-Nov-86	-6.54	879.25	19.6	7.03	562	290	11.9
31736	20-Nov-86	-6.78	879.01					
31739	23-Nov-86	-6.76	879.03	19.2	7.09	593	319	12.4
31742	26-Nov-86	-5.38	880.41					
31744	28-Nov-86	-5.39	880.40	18.0	7.02	570	302	10.5
31746	30-Nov-86	-5.44	880.35					
31752	06-Dec-86	-5.73	880.06					
31753	07-Dec-86	-5.62	880.17	17.2	7.04	605	333	10.5
31761	15-Dec-86	-5.21	880.58					
31767	21-Dec-86	-5.39	880.40	16.3	7.04	603		
31775	29-Dec-86	-5.62	880.17					
31778	01-Jan-87	-5.70	880.09	15.9	7.03	682	409	20.7
31784	07-Jan-87	-6.03	879.76					
31786	09-Jan-87	-5.88	879.91					
31787	10-Jan-87	-5.74	880.05	15.4	7.12	838	438	17.2
31792	15-Jan-87	-5.68	880.11					
31802	25-Jan-87	-5.72	880.07	14.2	7.11	859	491	14.9

WELLE3

LOTUS DATE	DATE	DEPTH TO WATER (FT)	ELEVATION FEET	TEMP DEG C	PH	EC UMHOS/CM	HCO3 MG/L	CL MG/L
31806	29-Jan-87	-5.18	880.61					
31809	01-Feb-87	-4.98	880.81	14.9	6.91	828	470	13.1
31816	08-Feb-87	-4.42	881.37	14.4	7.11	790	459	12.1
31823	15-Feb-87	-4.11	881.68					
31830	22-Feb-87	-3.97	881.82					
31832	24-Feb-87	-4.16	881.63					
31834	26-Feb-87	-4.23	881.56					
31837	01-Mar-87	-2.96	882.83					
31839	03-Mar-87	-3.32	882.47					
31840	04-Mar-87	-3.46	882.33					
31841	05-Mar-87	-3.55	882.24					
31842	06-Mar-87	-3.68	882.11					
31843	07-Mar-87	-3.75	882.04					
31844	08-Mar-87	-3.82	881.97					
31845	09-Mar-87	-4.29	881.50					
31846	10-Mar-87	-4.46	881.33					
31847	11-Mar-87	-4.59	881.20					
31848	12-Mar-87	-4.38	881.41					
31849	13-Mar-87	-4.37	881.42					
31850	14-Mar-87	-4.35	881.44					
31852	16-Mar-87	-4.51	881.28					
31853	17-Mar-87	-3.39	882.40					
31854	18-Mar-87	-3.53	882.26					
31855	19-Mar-87	-3.79	882.00					
31856	20-Mar-87	-3.85	881.94					
31857	21-Mar-87	-3.99	881.80					
31858	22-Mar-87	-4.02	881.77					
31859	23-Mar-87	-3.99	881.80					
31860	24-Mar-87	-4.01	881.78					
31862	26-Mar-87	-4.20	881.59					
31863	27-Mar-87	-4.21	881.58					
31864	28-Mar-87	-4.33	881.46					
31865	29-Mar-87	-4.43	881.36					
31870	03-Apr-87	-4.67	881.12					
31871	04-Apr-87	-4.76	881.03					
31873	06-Apr-87	-4.79	881.00					

WELLE4

LOTUS DATE	DATE	DEPTH TO WATER (FT)	ELEVATION FEET	TEMP DEG C	PH	EC UMHOS/CM	HCO3 MG/L	CL MG/L
31260	01-Aug-85	-10.27	875.52	21.9	7.33	840		
31264	05-Aug-85	-10.33	875.46	20.1	7.51	870		
31272	13-Aug-85	-11.14	874.65					
31273	14-Aug-85	-10.93	874.86					
31275	16-Aug-85	-10.79	875.00	20.9	7.31	855		
31278	19-Aug-85	-10.82	874.97	20.5	7.28	850		
31280	21-Aug-85	-10.75	875.04					
31281	22-Aug-85	-10.64	875.15	21.7	7.41	846	546	25.3
31283	24-Aug-85	-10.95	874.84					
31285	26-Aug-85	-11.02	874.77					
31289	30-Aug-85	-11.33	874.46					
31292	02-Sep-85	-11.45	874.34	20.7	7.36	872	503	23.9
31299	09-Sep-85	-11.88	873.91					
31305	15-Sep-85	-11.78	874.01	20.8	7.29	865		
31306	16-Sep-85	-11.68	874.11	20.3	7.18	895		
31308	18-Sep-85	-11.74	874.05	20.1	7.30	880		
31309	19-Sep-85	-11.81	873.98	21.0	7.30	983	497	18.2
31311	21-Sep-85	-11.88	873.91	19.6	7.33	886		
31312	22-Sep-85	-11.67	874.12	20.3	7.42	725		
31313	23-Sep-85	-11.28	874.51	19.7	7.75	637		
31314	24-Sep-85	-11.32	874.47					
31315	25-Sep-85	-11.01	874.78	19.3	7.40	566		
31317	27-Sep-85	-10.94	874.85	19.3	7.46	645		
31318	28-Sep-85	-10.99	874.80					
31319	29-Sep-85	-10.81	874.98	18.5	7.42	611		
31321	01-Oct-85	-10.65	875.14	19.0	7.44	620		
31322	02-Oct-85	-10.59	875.20					
31323	03-Oct-85	-10.60	875.19	19.9	7.47	674		
31325	05-Oct-85	-10.73	875.06					
31326	06-Oct-85	-10.64	875.15	20.7	7.29	771		
31328	08-Oct-85	-10.82	874.97	20.7	7.23	750		
31330	10-Oct-85	-10.53	875.26	18.0	7.35	670		
31334	14-Oct-85	-9.71	876.08	19.4	7.48	580		
31335	15-Oct-85	-9.56	876.23	19.3	7.48	575		
31336	16-Oct-85	-9.62	876.17					
31337	17-Oct-85	-9.62	876.17	20.0	7.31	675		
31338	18-Oct-85	-9.15	876.64	20.0	7.53	605		
31339	19-Oct-85	-8.92	876.87	20.0	7.36	627		
31341	21-Oct-85	-8.81	876.98	20.0	7.32	705		
31343	23-Oct-85	-8.79	877.00					
31345	25-Oct-85	-8.94	876.85	20.0	7.44	697	360	14.8
31347	27-Oct-85	-8.92	876.87					
31349	29-Oct-85	-8.84	876.95	19.8	7.52	815		
31352	01-Nov-85	-8.85	876.94	19.9	7.53	877		
31354	03-Nov-85	-8.90	876.89	19.8	7.42	939		
31357	06-Nov-85	-8.81	876.98	20.0	7.48	858		
31361	10-Nov-85	-8.97	876.82	19.4	7.55	902		

WELLE4

LOTUS DATE	DATE	DEPTH TO WATER (FT)	ELEVATION FEET	TEMP DEG C	PH	EC UMHOS/CM	HCO3 MG/L	CL MG/L
31364	13-Nov-85	-8.75	877.04	19.6	7.72	898		
31366	15-Nov-85	-7.90	877.89	19.5	7.47	835		
31368	17-Nov-85	-7.47	878.32	19.4	7.64	872		
31372	21-Nov-85	-7.39	878.40	19.4	7.55	867		
31376	25-Nov-85	-7.45	878.34	19.4	7.57	840		
31381	30-Nov-85	-7.49	878.30	19.5	7.63	882		
31386	05-Dec-85	-7.46	878.33	18.8	7.66	895		
31403	22-Dec-85	-7.30	878.49	19.1	7.80	931		
31410	29-Dec-85	-7.44	878.35					
31415	03-Jan-86	-7.50	878.29	17.6	7.98	979		
31423	11-Jan-86	-7.48	878.31	17.4	7.07	1045		
31426	14-Jan-86	-7.52	878.27	17.2	7.11	967		
31428	16-Jan-86	-7.53	878.26	19.9	6.97	1046		
31432	20-Jan-86	-7.47	878.32					
31435	23-Jan-86	-7.64	878.15	16.7	7.10	1118	611	31.5
31440	28-Jan-86	-7.48	878.31	16.9	7.07	1185		
31444	01-Feb-86	-7.64	878.15					
31447	04-Feb-86	-7.59	878.20					
31449	06-Feb-86	-7.65	878.14	20.0	7.08	1058		
31456	13-Feb-86	-7.56	878.23	16.0	7.08	1068		
31461	18-Feb-86	-7.48	878.31					
31463	20-Feb-86	-7.63	878.16	15.9	7.13	1127		
31468	25-Feb-86	-7.59	878.20	18.0	7.07	1192		
31473	02-Mar-86	-7.59	878.20					
31477	06-Mar-86	-7.59	878.20	16.0	7.17	1215		
31483	12-Mar-86	-7.50	878.29		7.18	1187		
31487	16-Mar-86	-7.42	878.37	18.3	7.12	1182		
31489	18-Mar-86	-7.27	878.52	16.3	7.16	1267		
31493	22-Mar-86	-7.33	878.46	16.0	7.17	1277		
31496	25-Mar-86	-7.27	878.52					
31498	27-Mar-86	-7.35	878.44	15.4	7.17	1227		
31503	01-Apr-86	-7.33	878.46		7.16	1090		
31504	02-Apr-86	-7.16	878.63		7.17	1199		
31505	03-Apr-86	-6.54	879.25		7.17	1159		
31506	04-Apr-86	-5.63	880.16		7.12	1346		
31508	06-Apr-86	-5.69	880.10		7.20	1433		
31510	08-Apr-86	-5.78	880.01		7.16	1191		
31511	09-Apr-86	-5.87	879.92					
31513	11-Apr-86	-5.85	879.94		7.16	1235		
31514	12-Apr-86	-5.93	879.86					
31516	14-Apr-86	-6.17	879.62					
31517	15-Apr-86	-6.16	879.63		7.54	1370		27.2
31519	17-Apr-86	-5.92	879.87					
31521	19-Apr-86	-5.95	879.84	15.4	7.18		655	29.7
31522	20-Apr-86	-5.88	879.91		7.19		663	28.4
31524	22-Apr-86	-6.08	879.71					

WELLE4

LOTUS DATE	DATE	DEPTH TO WATER (FT)	ELEVATION FEET	TEMP DEG C	PH	EC UMHOS/CM	HCO3 MG/L	CL MG/L
31529	27-Apr-86	-6.27	879.52					
31530	28-Apr-86	-6.37	879.42		7.19		690	37.9
31538	06-May-86	-6.86	878.93					
31539	07-May-86	-6.95	878.84	17.5	7.54	1091	682	37.4
31541	09-May-86	-7.01	878.78					
31542	10-May-86	-6.99	878.80					
31543	11-May-86	-6.97	878.82					
31544	12-May-86	-6.98	878.81					
31545	13-May-86	-7.12	878.67	17.4	7.55	1149	690	37.8
31547	15-May-86	-6.90	878.89		7.65	1248	667	41.1
31548	16-May-86	-6.92	878.87	16.8	7.61	1194	675	40.7
31549	17-May-86	-6.25	879.54	16.7		1087	637	33.2
31550	18-May-86	-6.21	879.58	16.2		1151	650	35.2
31551	19-May-86	-6.27	879.52					
31552	20-May-86	-6.30	879.49					
31553	21-May-86	-6.33	879.46	16.4	7.19	1155	642	35.9
31555	23-May-86	-6.51	879.28					
31559	27-May-86	-6.84	878.95	19.2	7.65	1173	663	36.7
31560	28-May-86	-6.87	878.92					
31562	30-May-86	-7.03	878.76					
31563	31-May-86	-6.99	878.80	16.5	7.17	1233	669	39.6
31566	03-Jun-86	-7.13	878.66					
31570	07-Jun-86	-7.25	878.54	16.5	7.30	1247	680	43.7
31572	09-Jun-86	-7.39	878.40					
31577	14-Jun-86	-7.86	877.93	16.7	7.29	1281	692	44.4
31578	15-Jun-86	-7.84	877.95					
31579	16-Jun-86	-7.78	878.01					
31582	19-Jun-86	-7.98	877.81					
31584	21-Jun-86	-8.17	877.62					
31585	22-Jun-86			17.3	7.60	1409	669	43.7
31586	23-Jun-86	-8.27	877.52					
31591	28-Jun-86	-8.52	877.27		7.19	1240	626	38.0
31595	02-Jul-86	-8.53	877.26					
31599	06-Jul-86	-8.80	876.99	17.6	7.18	1186	607	31.0
31605	12-Jul-86	-9.32	876.47	17.8	7.26	1311	622	35.6
31607	14-Jul-86	-9.53	876.26					
31612	19-Jul-86	-10.09	875.70	18.0	6.80	1310	657	42.2
31619	26-Jul-86	-10.78	875.01	18.3	7.35	1407	643	38.1
31626	02-Aug-86	-11.48	874.31	18.6	6.77	1265	671	33.6
31634	10-Aug-86	-10.20	875.59	17.6	7.00	986		18.2
31640	16-Aug-86	-9.97	875.82		6.87	1021		21.0
31644	20-Aug-86	-10.25	875.54					
31645	21-Aug-86	-10.34	875.45					
31648	24-Aug-86	-10.37	875.42		6.87	1100		22.3
31654	30-Aug-86	-10.75	875.04		6.63	1136	575	27.4
31661	06-Sep-86	-10.70	875.09		6.88	1174	575	29.9

WELLE4

LOTUS DATE	DATE	DEPTH TO WATER (FT)	ELEVATION FEET	TEMP DEG C	PH	EC UMHOS/CM	HCO3 MG/L	CL MG/L
31666	11-Sep-86	-11.10	874.69					
31669	14-Sep-86	-11.34	874.45	19.6	6.87	1188	573	27.4
31670	15-Sep-86	-11.34	874.45					
31676	21-Sep-86	-11.81	873.98	19.8	6.80	1130	572	
31683	28-Sep-86	-12.03	873.76	19.8	6.97	1087	581	32.3
31684	29-Sep-86	-11.02	874.77		7.42	508	262	13.6
31685	30-Sep-86	-9.95	875.84	20.5	6.90	613	327	18.3
31686	01-Oct-86	-9.73	876.06					
31687	02-Oct-86	-9.58	876.21					
31688	03-Oct-86	-7.89	877.90					
31689	04-Oct-86	-7.69	878.10	20.5	7.36	543	277	11.2
31691	06-Oct-86	-7.88	877.91					
31695	10-Oct-86	-8.06	877.73	21.5	7.09	694	387	23.2
31704	19-Oct-86	-8.47	877.32	20.3	6.81	964	514	22.4
31707	22-Oct-86	-7.84	877.95					
31708	23-Oct-86	-7.55	878.24					
31709	24-Oct-86	-7.51	878.28					
31710	25-Oct-86	-7.45	878.34	20.0	7.06	983	500	25.3
31711	26-Oct-86	-7.48	878.31					
31712	27-Oct-86	-7.49	878.30					
31713	28-Oct-86	-8.30	877.49					
31714	29-Oct-86	-8.35	877.44					
31715	30-Oct-86	-8.26	877.53					
31716	31-Oct-86	-7.59	878.20					
31717	01-Nov-86	-7.69	878.10					
31718	02-Nov-86	-7.68	878.11					
31720	04-Nov-86	-7.15	878.64					
31721	05-Nov-86	-6.61	879.18					
31722	06-Nov-86	-6.40	879.39	19.8	6.94	1061	577	26.1
31727	11-Nov-86	-6.56	879.23					
31730	14-Nov-86	-6.68	879.11	19.7	6.94	1124	606	27.3
31732	16-Nov-86	-6.52	879.27					
31736	20-Nov-86	-6.63	879.16					
31739	23-Nov-86	-6.75	879.04	19.5	7.06	1170	635	26.3
31742	26-Nov-86	-5.39	880.40					
31744	28-Nov-86	-5.38	880.41	18.8	6.90	1113	583	24.9
31746	30-Nov-86	-5.39	880.40					
31752	06-Dec-86	-5.74	880.05					
31753	07-Dec-86	-5.57	880.22	18.3	6.85	1181	627	28.1
31761	15-Dec-86	-5.18	880.61					
31767	21-Dec-86	-5.43	880.36	17.3	7.05	1220		
31775	29-Dec-86	-5.74	880.05					
31778	01-Jan-87	-5.83	879.96	17.1	7.05	1293	673	33.6
31784	07-Jan-87	-6.03	879.76					
31786	09-Jan-87	-5.83	879.96					
31787	10-Jan-87	-5.71	880.08	16.4	6.97	1322	672	32.6

WELLE4

LOTUS DATE	DATE	DEPTH TO WATER (FT)	ELEVATION FEET	TEMP DEG C	PH	EC UMHOS/CM	HCO3 MG/L	CL MG/L
31792	15-Jan-87	-5.67	880.12					
31802	25-Jan-87	-5.70	880.09	14.7	7.00	1182	689	26.2
31806	29-Jan-87	-5.18	880.61					
31809	01-Feb-87	-4.97	880.82	16.0	6.80	1173	649	25.7
31816	08-Feb-87	-4.39	881.40	15.3	7.03	1135	665	24.5
31823	15-Feb-87	-4.12	881.67					
31830	22-Feb-87	-3.96	881.83					
31832	24-Feb-87	-4.15	881.64					
31834	26-Feb-87	-4.21	881.58					
31837	01-Mar-87	-2.96	882.83					
31839	03-Mar-87	-3.31	882.48					
31840	04-Mar-87	-3.44	882.35					
31841	05-Mar-87	-3.52	882.27					
31842	06-Mar-87	-3.65	882.14					
31843	07-Mar-87	-3.74	882.05					
31844	08-Mar-87	-3.80	881.99					
31845	09-Mar-87	-4.27	881.52					
31846	10-Mar-87	-4.45	881.34					
31847	11-Mar-87	-4.56	881.23					
31848	12-Mar-87	-4.36	881.43					
31849	13-Mar-87	-4.35	881.44					
31850	14-Mar-87	-4.34	881.45					
31852	16-Mar-87	-4.48	881.31					
31853	17-Mar-87	-3.38	882.41					
31854	18-Mar-87	-3.52	882.27					
31855	19-Mar-87	-3.75	882.04					
31856	20-Mar-87	-3.84	881.95					
31857	21-Mar-87	-3.97	881.82					
31858	22-Mar-87	-4.01	881.78					
31859	23-Mar-87	-3.97	881.82					
31860	24-Mar-87	-3.98	881.81					
31862	26-Mar-87	-4.18	881.61					
31863	27-Mar-87	-4.19	881.60					
31864	28-Mar-87	-4.31	881.48					
31865	29-Mar-87	-4.41	881.38					
31870	03-Apr-87	-4.66	881.13					
31871	04-Apr-87	-4.75	881.04					
31873	06-Apr-87	-4.77	881.02					

WELLES

LOTUS DATE	DATE	DEPTH TO WATER (FT)	ELEVATION FEET	TEMP DEG C	PH	EC UMHOS/CM	HCO3 MG/L	CL MG/L
31423	11-Jan-86	-7.47	878.32					
31426	14-Jan-86	-7.49	878.30					
31428	16-Jan-86	-7.51	878.28	19.7	7.03	923		
31432	20-Jan-86	-7.44	878.35					
31435	23-Jan-86	-7.62	878.17	16.8	7.18	982	549	28.2
31440	28-Jan-86	-7.46	878.33	16.8	7.10	990		
31444	01-Feb-86	-7.63	878.16					
31447	04-Feb-86	-7.57	878.22					
31449	06-Feb-86	-7.65	878.14	19.0	7.17	885		
31456	13-Feb-86	-7.54	878.25	16.0	7.15	894		
31461	18-Feb-86	-7.47	878.32					
31463	20-Feb-86	-7.63	878.16	15.9	7.17	958		
31468	25-Feb-86	-7.58	878.21	18.2	7.16	976		
31473	02-Mar-86	-7.59	878.20					
31477	06-Mar-86	-7.56	878.23	16.1	7.25	1011		
31483	12-Mar-86	-7.44	878.35		7.24	968		
31487	16-Mar-86	-7.42	878.37	18.1	7.18	1160		
31489	18-Mar-86	-7.25	878.54	16.3	7.19	1215		
31493	22-Mar-86	-7.31	878.48	16.2	7.17	1228		
31496	25-Mar-86	-7.25	878.54					
31498	27-Mar-86	-7.35	878.44	16.2	7.15	1216		
31503	01-Apr-86	-7.33	878.46		7.21	1093		
31504	02-Apr-86	-7.16	878.63		7.14	1193		
31505	03-Apr-86	-6.41	879.38		7.14	1021		
31506	04-Apr-86	-5.43	880.36		7.12	1191		
31508	06-Apr-86	-5.57	880.22		7.15	1289		
31510	08-Apr-86	-5.77	880.02		7.10	1074		
31511	09-Apr-86	-5.84	879.95					
31513	11-Apr-86	-5.83	879.96		7.13	1146		
31514	12-Apr-86	-5.91	879.88					
31516	14-Apr-86	-6.14	879.65					
31517	15-Apr-86	-6.15	879.64		7.21	1282		23.3
31519	17-Apr-86	-5.93	879.86					
31521	19-Apr-86	-5.97	879.82	15.3	7.16		616	24.2
31522	20-Apr-86	-5.88	879.91		7.26		795	27.5
31524	22-Apr-86	-6.06	879.73					
31529	27-Apr-86	-6.21	879.58					
31530	28-Apr-86	-6.36	879.43		7.22		609	31.3
31538	06-May-86	-6.84	878.95					
31539	07-May-86	-6.96	878.83	17.6	7.55	1068	654	36.8
31541	09-May-86	-7.00	878.79					
31542	10-May-86	-6.97	878.82					
31543	11-May-86	-6.93	878.86					
31544	12-May-86	-6.96	878.83					
31545	13-May-86	-7.07	878.72	17.8	7.60	1098	625	35.6
31547	15-May-86	-6.86	878.93		7.72	1267	628	36.7
31548	16-May-86	-6.90	878.89	17.0	7.54	1111	641	34.1

WELLES

LOTUS DATE	DATE	DEPTH TO WATER (FT)	ELEVATION FEET	TEMP DEG C	PH	EC UMHOS/CM	HCO3 MG/L	CL MG/L
31549	17-May-86	-6.22	879.57	16.9		964	574	27.5
31550	18-May-86	-6.19	879.60	16.3		1045	593	31.3
31551	19-May-86	-6.25	879.54					
31552	20-May-86	-6.30	879.49					
31553	21-May-86	-6.33	879.46	16.5	7.22	1060	600	32.8
31555	23-May-86	-6.48	879.31					
31559	27-May-86	-6.81	878.98	19.2	7.59	1093	616	31.4
31560	28-May-86	-6.84	878.95					
31562	30-May-86	-6.98	878.81					
31563	31-May-86	-6.95	878.84	16.6	7.17	1154	621	35.8
31566	03-Jun-86	-7.10	878.69					
31570	07-Jun-86	-7.23	878.56	16.7	6.96	1166	632	41.1
31572	09-Jun-86	-7.38	878.41					
31577	14-Jun-86	-7.83	877.96	16.8	7.34	1189	648	42.4
31578	15-Jun-86	-7.67	878.12					
31579	16-Jun-86	-7.77	878.02					
31582	19-Jun-86	-7.95	877.84					
31584	21-Jun-86	-8.16	877.63					
31585	22-Jun-86			17.4	7.55	1333	622	41.9
31586	23-Jun-86	-8.15	877.64					
31591	28-Jun-86	-8.50	877.29		7.18	1155	577	29.8
31595	02-Jul-86	-8.53	877.26					
31599	06-Jul-86	-8.78	877.01	17.8	7.17	1142	577	26.3
31605	12-Jul-86	-9.31	876.48	18.3	7.29	1203	599	34.5
31607	14-Jul-86	-9.51	876.28					
31612	19-Jul-86	-10.05	875.74	18.0	6.89	1186	606	35.7
31619	26-Jul-86	-10.77	875.02	19.2	7.38	1313	636	35.7
31626	02-Aug-86	-11.47	874.32	18.5	6.86	1191	627	37.5
31634	10-Aug-86	-10.15	875.64	17.6	6.95	910		15.8
31640	16-Aug-86	-9.96	875.83		6.90	1081		22.5
31644	20-Aug-86	-10.23	875.56					
31645	21-Aug-86	-10.31	875.48					
31648	24-Aug-86	-10.36	875.43		6.87	1103		22.9
31654	30-Aug-86	-10.75	875.04		6.74	1121	578	27.8
31661	06-Sep-86	-10.68	875.11		6.93	1167	570	30.2
31666	11-Sep-86	-11.08	874.71					
31669	14-Sep-86	-11.32	874.47	19.8	6.96	1175	576	28.6
31670	15-Sep-86	-11.32	874.47					
31676	21-Sep-86	-11.79	874.00	19.8	6.76	1100	572	31.0
31683	28-Sep-86	-12.01	873.78	20.2	6.96	1094	585	36.7
31684	29-Sep-86	-10.76	875.03	20.5	7.29	481	254	12.0
31685	30-Sep-86	-9.83	875.96	20.6	6.90	577	304	21.2
31686	01-Oct-86	-9.69	876.10					
31687	02-Oct-86	-9.54	876.25					
31688	03-Oct-86	-7.70	878.09					
31689	04-Oct-86	-7.67	878.12	20.4	7.22	658	336	13.3

WELLES

LOTUS DATE	DATE	DEPTH TO WATER (FT)	ELEVATION FEET	TEMP DEG C	PH	EC UMHOS/CM	HCO3 MG/L	CL MG/L
31691	06-Oct-86	-7.87	877.92					
31695	10-Oct-86	-8.03	877.76	21.7	7.03	825	476	25.4
31704	19-Oct-86	-8.46	877.33	20.2	6.84	957	511	23.6
31707	22-Oct-86	-7.70	878.09					
31708	23-Oct-86	-7.52	878.27					
31709	24-Oct-86	-7.49	878.30					
31710	25-Oct-86	-7.43	878.36		7.04	1004	534	25.3
31711	26-Oct-86	-7.45	878.34					
31712	27-Oct-86	-7.46	878.33					
31716	31-Oct-86	-7.59	878.20					
31717	01-Nov-86	-7.67	878.12					
31718	02-Nov-86	-7.66	878.13					
31720	04-Nov-86	-7.06	878.73					
31721	05-Nov-86	-6.57	879.22					
31722	06-Nov-86	-6.37	879.42	19.7	6.94	943	517	21.1
31727	11-Nov-86	-6.55	879.24					
31730	14-Nov-86	-6.38	879.41					
31732	16-Nov-86	-6.51	879.28	19.7	6.96	1066	571	
31736	20-Nov-86	-6.75	879.04					
31739	23-Nov-86	-6.74	879.05	19.5	6.95	1104	595	26.3
31742	26-Nov-86	-5.37	880.42					
31744	28-Nov-86	-5.36	880.43	18.9	6.92	995	526	18.0
31746	30-Nov-86	-5.37	880.42					
31752	06-Dec-86	-5.75	880.04					
31753	07-Dec-86	-5.54	880.25	18.7	6.86	1090	593	26.0
31761	15-Dec-86	-5.20	880.59					
31767	21-Dec-86	-5.52	880.27	17.6	6.82	1196		
31775	29-Dec-86	-5.74	880.05					
31778	01-Jan-87	-5.88	879.91	17.7	6.89	1264	654	31.5
31784	07-Jan-87	-6.02	879.77					
31786	09-Jan-87	-5.77	880.02					
31787	10-Jan-87	-5.70	880.09	16.9	6.94	1237	621	31.1
31792	15-Jan-87	-5.65	880.14					
31802	25-Jan-87	-5.69	880.10	15.5	7.01	1163	659	24.7
31806	29-Jan-87	-5.16	880.63					
31809	01-Feb-87	-4.96	880.83	15.6	6.82	1123	632	24.9
31816	08-Feb-87	-4.39	881.40	15.9	7.09	1074	607	21.7
31823	15-Feb-87	-4.10	881.69					
31830	22-Feb-87	-3.96	881.83					
31832	24-Feb-87	-4.12	881.67					
31834	26-Feb-87	-4.21	881.58					
31837	01-Mar-87	-2.94	882.85					
31839	03-Mar-87	-3.29	882.50					
31840	04-Mar-87	-3.41	882.38					
31841	05-Mar-87	-3.52	882.27					
31842	06-Mar-87	-3.66	882.13					

WELLES

LOTUS DATE	DATE	DEPTH TO WATER (FT)	ELEVATION FEET	TEMP DEG C	PH	EC UMHOS/CM	HCO3 MG/L	CL MG/L
31843	07-Mar-87	-3.72	882.07					
31844	08-Mar-87	-3.79	882.00					
31845	09-Mar-87	-4.26	881.53					
31846	10-Mar-87	-4.44	881.35					
31847	11-Mar-87	-4.55	881.24					
31848	12-Mar-87	-4.35	881.44					
31849	13-Mar-87	-4.34	881.45					
31850	14-Mar-87	-4.32	881.47					
31852	16-Mar-87	-4.46	881.33					
31853	17-Mar-87	-3.37	882.42					
31854	18-Mar-87	-3.51	882.28					
31855	19-Mar-87	-3.74	882.05					
31856	20-Mar-87	-3.82	881.97					
31857	21-Mar-87	-3.96	881.83					
31858	22-Mar-87	-3.99	881.80					
31859	23-Mar-87	-3.96	881.83					
31860	24-Mar-87	-3.98	881.81					
31862	26-Mar-87	-4.17	881.62					
31863	27-Mar-87	-4.18	881.61					
31864	28-Mar-87	-4.29	881.50					
31865	29-Mar-87	-4.39	881.40					
31870	03-Apr-87	-4.64	881.15					
31871	04-Apr-87	-4.72	881.07					
31873	06-Apr-87	-4.76	881.03					

APPENDIX D

CATION/ANION BALANCES

WELL A-1 20 APRIL 1986
PH: 6.89
SPECIFIC CONDUCTIVITY: NO DATA

	MG/L	MEQ/L	% CATIONS OR ANIONS	% TOTAL
CA+2	131	6.5369	59	26
MG+2	41	3.3728	31	13
NA+	25	1.0874	10	4
K+	0	0.0000	0	0
HCO3-	802	13.1438	92	52
CL-	20	0.5641	4	2
SO4-2	26	0.5413	4	2

SUM OF CATIONS (MEQ/L): 11.0
SUM OF ANIONS (MEQ/L): 14.2
BALANCE (%): -12.9
SUM OF IONS (MG/L): 1045

WELL A-2 20 APRIL 1986
PH: 7.00
SPECIFIC CONDUCTIVITY: NO DATA

	MG/L	MEQ/L	% CATIONS OR ANIONS	% TOTAL
CA+2	121	6.0379	53	27
MG+2	47	3.8664	34	17
NA+	32	1.3919	12	6
K+	0	0.0000	0	0
HCO3-	625	10.2430	91	45
CL-	20	0.5641	5	2
SO4-2	24	0.4997	4	2

SUM OF CATIONS (MEQ/L): 11.3
SUM OF ANIONS (MEQ/L): 11.3
BALANCE (%): -0.0
SUM OF IONS (MG/L): 869

WELL A-3 20 APRIL 1986
PH: 7.06
SPECIFIC CONDUCTIVITY: NO DATA

	MG/L	MEQ/L	% CATIONS OR ANIONS	% TOTAL
CA+2	102	5.0898	46	21
MG+2	48	3.9487	36	16
NA+	44	1.9139	17	8
K+	0	0.0000	0	0
HCO3-	781	12.7996	93	52
CL-	20	0.5641	4	2
SO4-2	18	0.3748	3	2

SUM OF CATIONS (MEQ/L): 11.0
SUM OF ANIONS (MEQ/L): 13.7
BALANCE (%): -11.3
SUM OF IONS (MG/L): 1013

WELL A-4 20 APRIL 1986
PH: 6.97
SPECIFIC CONDUCTIVITY: NO DATA

	MG/L	MEQ/L	% CATIONS OR ANIONS	% TOTAL
CA+2	84	4.1916	43	21
MG+2	44	3.6196	37	18
NA+	46	2.0009	20	10
K+	0	0.0000	0	0
HCO3-	588	9.6366	91	47
CL-	19	0.5359	5	3
SO4-2	19	0.3956	4	2

SUM OF CATIONS (MEQ/L): 9.8
SUM OF ANIONS (MEQ/L): 10.6
BALANCE (%): -3.7
SUM OF IONS (MG/L): 800

WELL A-5 20 APRIL 1986
PH: 7.03
SPECIFIC CONDUCTIVITY: NO DATA

	MG/L	MEQ/L	% CATIONS OR ANIONS	% TOTAL
CA+2	92	4.5908	47	20
MG+2	41	3.3728	34	15
NA+	43	1.8704	19	8
K+	0	0.0000	0	0
HCO3-	732	11.9966	92	53
CL-	21	0.5923	5	3
SO4-2	19	0.3956	3	2

SUM OF CATIONS (MEQ/L): 9.8
SUM OF ANIONS (MEQ/L): 13.0
BALANCE (%): -13.8
SUM OF IONS (MG/L): 948

WELL C-1 20 APRIL 1986
PH: 7.03
SPECIFIC CONDUCTIVITY: NO DATA

	MG/L	MEQ/L	% CATIONS OR ANIONS	% TOTAL
CA+2	74	3.6926	19	9
MG+2	112	9.2136	47	23
NA+	158	6.8726	35	17
K+	0	0.0023	0	0
HCO3-	1137	18.6341	91	46
CL-	18	0.5077	2	1
SO4-2	59	1.2284	6	3

SUM OF CATIONS (MEQ/L): 19.8
SUM OF ANIONS (MEQ/L): 20.4
BALANCE (%): -1.5
SUM OF IONS (MG/L): 1558

WELL C-2 20 APRIL 1986
PH: 7.02
SPECIFIC CONDUCTIVITY: NO DATA

	MG/L	MEQ/L	% CATIONS OR ANIONS	% TOTAL
CA+2	65	3.2435	20	8
MG+2	70	5.7585	35	14
NA+	171	7.4381	45	19
K+	0	0.0028	0	0
HCO3-	1341	21.9774	93	55
CL-	17	0.4795	2	1
SO4-2	51	1.0618	5	3

SUM OF CATIONS (MEQ/L): 16.4
SUM OF ANIONS (MEQ/L): 23.5
BALANCE (%): -17.7
SUM OF IONS (MG/L): 1715

WELL C-3 20 APRIL 1986
PH: 7.03
SPECIFIC CONDUCTIVITY: NO DATA

	MG/L	MEQ/L	% CATIONS OR ANIONS	% TOTAL
CA+2	77	3.8423	23	11
MG+2	60	4.9358	30	15
NA+	177	7.6991	47	23
K+	0	0.0015	0	0
HCO3-	960	15.7332	90	46
CL-	21	0.5923	3	2
SO4-2	51	1.0618	6	3

SUM OF CATIONS (MEQ/L): 16.5
SUM OF ANIONS (MEQ/L): 17.4
BALANCE (%): -2.7
SUM OF IONS (MG/L): 1346

WELL C-4 20 APRIL 1986
PH: 7.03
SPECIFIC CONDUCTIVITY: NO DATA

	MG/L	MEQ/L	% CATIONS OR ANIONS	% TOTAL
CA+2	81	4.0419	39	18
MG+2	50	4.1132	39	19
NA+	53	2.3054	22	10
K+	0	0.0018	0	0
HCO3-	640	10.4888	91	48
CL-	16	0.4513	4	2
SO4-2	27	0.5621	5	3

SUM OF CATIONS (MEQ/L): 10.5
SUM OF ANIONS (MEQ/L): 11.5
BALANCE (%): -4.7
SUM OF IONS (MG/L): 867

WELL C-5 20 APRIL 1986
PH: 6.89
SPECIFIC CONDUCTIVITY: NO DATA

	MG/L	MEQ/L	% CATIONS OR ANIONS	% TOTAL
CA+2	90	4.4910	33	16
MG+2	59	4.8536	36	17
NA+	94	4.0888	30	15
K+	0	0.0028	0	0
HCO3-	792	12.9799	90	47
CL-	23	0.6487	5	2
SO4-2	35	0.7287	5	3

SUM OF CATIONS (MEQ/L): 13.4
SUM OF ANIONS (MEQ/L): 14.4
BALANCE (%): -3.3
SUM OF IONS (MG/L): 1093

WELL D-1 20 APRIL 1986
PH: 7.18
SPECIFIC CONDUCTIVITY: NO DATA

	MG/L	MEQ/L	% CATIONS OR ANIONS	% TOTAL
CA+2	116	5.7884	34	16
MG+2	64	5.2649	31	15
NA+	139	6.0462	35	17
K+	0	0.0033	0	0
HCO3-	982	16.0938	87	45
CL-	53	1.4949	8	4
SO4-2	46	0.9577	5	3

SUM OF CATIONS (MEQ/L): 17.1
SUM OF ANIONS (MEQ/L): 18.5
BALANCE (%): -4.0
SUM OF IONS (MG/L): 1400

WELL D-2 20 APRIL 1986
PH: 7.09
SPECIFIC CONDUCTIVITY: NO DATA

	MG/L	MEQ/L	% CATIONS OR ANIONS	% TOTAL
CA+2	114	5.6886	34	16
MG+2	65	5.3472	32	15
NA+	127	5.5242	33	16
K+	0	0.0013	0	0
HCO3-	979	16.0446	89	46
CL-	42	1.1847	7	3
SO4-2	41	0.8536	5	2

SUM OF CATIONS (MEQ/L): 16.6
SUM OF ANIONS (MEQ/L): 18.1
BALANCE (%): -4.4
SUM OF IONS (MG/L): 1368

WELL D-3 20 APRIL 1986
PH: 7.01
SPECIFIC CONDUCTIVITY: NO DATA

	MG/L	MEQ/L	% CATIONS OR ANIONS	% TOTAL
CA+2	85	4.2415	33	16
MG+2	54	4.4423	35	17
NA+	94	4.0888	32	15
K+	0	0.0008	0	0
HCO3-	760	12.4555	88	46
CL-	34	0.9590	7	4
SO4-2	35	0.7287	5	3

SUM OF CATIONS (MEQ/L): 12.8
SUM OF ANIONS (MEQ/L): 14.1
BALANCE (%): -5.1
SUM OF IONS (MG/L): 1062

WELL D-4 20 APRIL 1986
PH: 7.10
SPECIFIC CONDUCTIVITY: NO DATA

	MG/L	MEQ/L	% CATIONS OR ANIONS	% TOTAL
CA+2	71	3.5429	30	15
MG+2	44	3.6196	31	15
NA+	107	4.6542	39	19
K+	0	0.0026	0	0
HCO3-	664	10.8822	88	45
CL-	28	0.7898	6	3
SO4-2	35	0.7287	6	3

SUM OF CATIONS (MEQ/L): 11.8
SUM OF ANIONS (MEQ/L): 12.4
BALANCE (%): -2.4
SUM OF IONS (MG/L): 949

WELL D-5 20 APRIL 1986
PH: 6.92
SPECIFIC CONDUCTIVITY: NO DATA

	MG/L	MEQ/L	% CATIONS OR ANIONS	% TOTAL
CA+2	80	3.9920	33	16
MG+2	44	3.6196	30	15
NA+	104	4.5237	37	18
K+	0	0.0051	0	0
HCO3-	668	10.9477	87	44
CL-	30	0.8462	7	3
SO4-2	37	0.7703	6	3

SUM OF CATIONS (MEQ/L): 12.1
SUM OF ANIONS (MEQ/L): 12.6
BALANCE (%): -1.7
SUM OF IONS (MG/L): 963

WELL E-1 20 APRIL 1986
PH: 7.45
SPECIFIC CONDUCTIVITY: NO DATA

	MG/L	MEQ/L	% CATIONS OR ANIONS	% TOTAL
CA+2	55	2.7445	52	23
MG+2	25	2.0566	39	17
NA+	12	0.5220	10	4
K+	0	0.0026	0	0
HCO3-	363	5.9491	92	51
CL-	4	0.1241	2	1
SO4-2	18	0.3748	6	3

SUM OF CATIONS (MEQ/L): 5.3
SUM OF ANIONS (MEQ/L): 6.4
BALANCE (%): -9.5
SUM OF IONS (MG/L): 478

WELL E-2 20 APRIL 1986
PH: 7.31
SPECIFIC CONDUCTIVITY: NO DATA

	MG/L	MEQ/L	% CATIONS OR ANIONS	% TOTAL
CA+2	61	3.0439	46	21
MG+2	39	3.2083	48	22
NA+	10	0.4350	7	3
K+	0	0.0015	0	0
HCO3-	445	7.2930	90	49
CL-	10	0.2821	3	2
SO4-2	26	0.5413	7	4

SUM OF CATIONS (MEQ/L): 6.7
SUM OF ANIONS (MEQ/L): 8.1
BALANCE (%): -9.6
SUM OF IONS (MG/L): 591

WELL E-3 20 APRIL 1986
PH: 7.33
SPECIFIC CONDUCTIVITY: NO DATA

	MG/L	MEQ/L	% CATIONS OR ANIONS	% TOTAL
CA+2	61	3.0439	47	21
MG+2	36	2.9615	46	21
NA+	11	0.4785	7	3
K+	0	0.0005	0	0
HCO3-	410	6.7194	85	47
CL-	24	0.6770	9	5
SO4-2	26	0.5413	7	4

SUM OF CATIONS (MEQ/L): 6.5
SUM OF ANIONS (MEQ/L): 7.9
BALANCE (%): -10.1
SUM OF IONS (MG/L): 568

WELL E-4 20 APRIL 1986
PH: 7.19
SPECIFIC CONDUCTIVITY: NO DATA

	MG/L	MEQ/L	% CATIONS OR ANIONS	% TOTAL
CA+2	62	3.0938	25	12
MG+2	59	4.8536	39	19
NA+	100	4.3498	35	17
K+	0	0.0026	0	0
HCO3-	663	10.8658	85	43
CL-	28	0.7898	6	3
SO4-2	51	1.0618	8	4

SUM OF CATIONS (MEQ/L): 12.3
SUM OF ANIONS (MEQ/L): 12.7
BALANCE (%): -1.7
SUM OF IONS (MG/L): 963

WELL E-5 20 APRIL 1986
PH: 7.26
SPECIFIC CONDUCTIVITY: NO DATA

	MG/L	MEQ/L	% CATIONS OR ANIONS	% TOTAL
CA+2	62	3.0938	27	12
MG+2	57	4.6890	41	18
NA+	83	3.6103	32	14
K+	0	0.0026	0	0
HCO3-	795	13.0291	88	50
CL-	28	0.7898	5	3
SO4-2	48	0.9994	7	4

SUM OF CATIONS (MEQ/L): 11.4
SUM OF ANIONS (MEQ/L): 14.8
BALANCE (%): -13.1
SUM OF IONS (MG/L): 1073

WELL A-1 15 MAY 1986
PH: 7.24
SPECIFIC CONDUCTIVITY: 1090

	MG/L	MEQ/L	% CATIONS OR ANIONS	% TOTAL
CA+2	143	7.1357	64	32
MG+2	41	3.3728	30	15
NA+	16	0.6960	6	3
K+	0	0.0018	0	0
HCO3-	595	9.7513	88	44
CL-	27	0.7616	7	3
SO4-2	30	0.6246	6	3

SUM OF CATIONS (MEQ/L): 11.2
SUM OF ANIONS (MEQ/L): 11.1
BALANCE (%): 0.3
SUM OF IONS (MG/L): 852
IONS AS PERCENT OF SPECIFIC CONDUCTIVITY: 78

WELL A-2 15 MAY 1986
PH: 7.17
SPECIFIC CONDUCTIVITY: 1104

	MG/L	MEQ/L	% CATIONS OR ANIONS	% TOTAL
CA+2	130	6.4870	59	29
MG+2	41	3.3728	31	15
NA+	25	1.0874	10	5
K+	0	0.0008	0	0
HCO3-	641	10.5052	90	47
CL-	21	0.5923	5	3
SO4-2	26	0.5413	5	2

SUM OF CATIONS (MEQ/L): 10.9
SUM OF ANIONS (MEQ/L): 11.6
BALANCE (%): -3.1
SUM OF IONS (MG/L): 884
IONS AS PERCENT OF SPECIFIC CONDUCTIVITY: 80

WELL A-3 15 MAY 1986
PH: 7.33
SPECIFIC CONDUCTIVITY: 1097

	MG/L	MEQ/L	% CATIONS OR ANIONS	% TOTAL
CA+2	100	4.9900	48	21
MG+2	46	3.7841	36	16
NA+	37	1.6094	15	7
K+	0	0.0041	0	0
HCO3-	775	12.7013	92	52
CL-	23	0.6487	5	3
SO4-2	24	0.4997	4	2

SUM OF CATIONS (MEQ/L): 10.4
SUM OF ANIONS (MEQ/L): 13.8
BALANCE (%): -14.3
SUM OF IONS (MG/L): 1005
IONS AS PERCENT OF SPECIFIC CONDUCTIVITY: 92

WELL A-4 15 MAY 1986
PH: 0.00
SPECIFIC CONDUCTIVITY: 1012

	MG/L	MEQ/L	% CATIONS OR ANIONS	% TOTAL
CA+2	86	4.2914	43	20
MG+2	46	3.7841	38	18
NA+	44	1.9139	19	9
K+	0	0.0020	0	0
HCO3-	606	9.9316	86	46
CL-	38	1.0718	9	5
SO4-2	24	0.4997	4	2

SUM OF CATIONS (MEQ/L): 10.0
SUM OF ANIONS (MEQ/L): 11.5
BALANCE (%): -7.0
SUM OF IONS (MG/L): 844
IONS AS PERCENT OF SPECIFIC CONDUCTIVITY: 83

WELL A-5 15 MAY 1986
PH: 7.36
SPECIFIC CONDUCTIVITY: 988

	MG/L	MEQ/L	% CATIONS OR ANIONS	% TOTAL
CA+2	41	2.0459	28	11
MG+2	41	3.3728	46	19
NA+	42	1.8269	25	10
K+	0	0.0087	0	0
HCO3-	589	9.6530	89	53
CL-	23	0.6487	6	4
SO4-2	24	0.4997	5	3

SUM OF CATIONS (MEQ/L): 7.3
SUM OF ANIONS (MEQ/L): 10.8
BALANCE (%): -19.6
SUM OF IONS (MG/L): 760
IONS AS PERCENT OF SPECIFIC CONDUCTIVITY: 77

WELL C-1 15 MAY 1986
PH: 7.44
SPECIFIC CONDUCTIVITY: 1679

	MG/L	MEQ/L	% CATIONS OR ANIONS	% TOTAL
CA+2	64	3.1936	18	8
MG+2	99	8.1441	46	21
NA+	149	6.4811	36	17
K+	0	0.0020	0	0
HCO3-	1079	17.6835	88	47
CL-	33	0.9308	5	2
SO4-2	70	1.4574	7	4

SUM OF CATIONS (MEQ/L): 17.8
SUM OF ANIONS (MEQ/L): 20.1
BALANCE (%): -5.9
SUM OF IONS (MG/L): 1494
IONS AS PERCENT OF SPECIFIC CONDUCTIVITY: 89

WELL C-2 15 MAY 1986
PH: 7.38
SPECIFIC CONDUCTIVITY: 1572

	MG/L	MEQ/L	% CATIONS OR ANIONS	% TOTAL
CA+2	72	3.5928	21	10
MG+2	67	5.5117	33	16
NA+	177	7.6991	46	22
K+	0	0.0028	0	0
HCO3-	1011	16.5691	90	47
CL-	27	0.7616	4	2
SO4-2	54	1.1243	6	3

SUM OF CATIONS (MEQ/L): 16.8
SUM OF ANIONS (MEQ/L): 18.5
BALANCE (%): -4.7
SUM OF IONS (MG/L): 1408
IONS AS PERCENT OF SPECIFIC CONDUCTIVITY: 90

WELL C-3 15 MAY 1986
PH: 7.36
SPECIFIC CONDUCTIVITY: 1396

	MG/L	MEQ/L	% CATIONS OR ANIONS	% TOTAL
CA+2	73	3.6427	25	12
MG+2	55	4.5245	31	14
NA+	153	6.6551	45	21
K+	0	0.0020	0	0
HCO3-	908	14.8810	89	47
CL-	24	0.6770	4	2
SO4-2	53	1.1035	7	4

SUM OF CATIONS (MEQ/L): 14.8
SUM OF ANIONS (MEQ/L): 16.7
BALANCE (%): -5.8
SUM OF IONS (MG/L): 1266
IONS AS PERCENT OF SPECIFIC CONDUCTIVITY: 91

WELL C-4 15 MAY 1986
PH: 7.49
SPECIFIC CONDUCTIVITY: 993

	MG/L	MEQ/L	% CATIONS OR ANIONS	% TOTAL
CA+2	83	4.1417	40	19
MG+2	49	4.0309	39	19
NA+	51	2.2184	21	10
K+	0	0.0020	0	0
HCO3-	617	10.1119	89	47
CL-	19	0.5359	5	2
SO4-2	32	0.6662	6	3

SUM OF CATIONS (MEQ/L): 10.4
SUM OF ANIONS (MEQ/L): 11.3
BALANCE (%): -4.2
SUM OF IONS (MG/L): 851
IONS AS PERCENT OF SPECIFIC CONDUCTIVITY: 86

WELL C-5 15 MAY 1986
PH: 7.50
SPECIFIC CONDUCTIVITY: 1177

	MG/L	MEQ/L	% CATIONS OR ANIONS	% TOTAL
CA+2	79	3.9421	31	15
MG+2	54	4.4423	35	17
NA+	98	4.2628	34	16
K+	0	0.0018	0	0
HCO3-	740	12.1277	88	46
CL-	30	0.8462	6	3
SO4-2	39	0.8120	6	3

SUM OF CATIONS (MEQ/L): 12.6
SUM OF ANIONS (MEQ/L): 13.8
BALANCE (%): -4.3
SUM OF IONS (MG/L): 1040
IONS AS PERCENT OF SPECIFIC CONDUCTIVITY: 88

WELL D-2 15 MAY 1986
PH: 7.43
SPECIFIC CONDUCTIVITY: 1541

	MG/L	MEQ/L	% CATIONS OR ANIONS	% TOTAL
CA+2	122	6.0878	36	17
MG+2	65	5.3472	31	15
NA+	128	5.5677	33	16
K+	0	0.0018	0	0
HCO3-	963	15.7824	87	45
CL-	50	1.4103	8	4
SO4-2	41	0.8536	5	2

SUM OF CATIONS (MEQ/L): 17.0
SUM OF ANIONS (MEQ/L): 18.0
BALANCE (%): -3.0
SUM OF IONS (MG/L): 1369
IONS AS PERCENT OF SPECIFIC CONDUCTIVITY: 89

WELL D-3 15 MAY 1986
PH: 7.49
SPECIFIC CONDUCTIVITY: 1286

	MG/L	MEQ/L	% CATIONS OR ANIONS	% TOTAL
CA+2	94	4.6906	35	17
MG+2	57	4.6890	35	17
NA+	94	4.0888	30	15
K+	0	0.0010	0	0
HCO3-	773	12.6685	87	45
CL-	39	1.1000	8	4
SO4-2	40	0.8328	6	3

SUM OF CATIONS (MEQ/L): 13.5
SUM OF ANIONS (MEQ/L): 14.6
BALANCE (%): -4.0
SUM OF IONS (MG/L): 1097
IONS AS PERCENT OF SPECIFIC CONDUCTIVITY: 85

WELL D-4 15 MAY 1986
PH: 7.59
SPECIFIC CONDUCTIVITY: 1110

	MG/L	MEQ/L	% CATIONS OR ANIONS	% TOTAL
CA+2	70	3.4930	30	15
MG+2	42	3.4551	30	14
NA+	106	4.6107	40	19
K+	0	0.0020	0	0
HCO3-	651	10.6691	87	45
CL-	33	0.9308	8	4
SO4-2	35	0.7287	6	3

SUM OF CATIONS (MEQ/L): 11.6
SUM OF ANIONS (MEQ/L): 12.3
BALANCE (%): -3.2
SUM OF IONS (MG/L): 937
IONS AS PERCENT OF SPECIFIC CONDUCTIVITY: 84

WELL D-5 15 MAY 1986
PH: 7.54
SPECIFIC CONDUCTIVITY: 1111

	MG/L	MEQ/L	% CATIONS OR ANIONS	% TOTAL
CA+2	72	3.5928	31	15
MG+2	43	3.5373	31	15
NA+	101	4.3933	38	18
K+	0	0.0015	0	0
HCO3-	653	10.7019	86	45
CL-	36	1.0154	8	4
SO4-2	36	0.7495	6	3

SUM OF CATIONS (MEQ/L): 11.5
SUM OF ANIONS (MEQ/L): 12.5
BALANCE (%): -3.9
SUM OF IONS (MG/L): 941
IONS AS PERCENT OF SPECIFIC CONDUCTIVITY: 85

WELL E-1 15 MAY 1986
PH: 7.74
SPECIFIC CONDUCTIVITY: 598

	MG/L	MEQ/L	% CATIONS OR ANIONS	% TOTAL
CA+2	32	1.5968	39	16
MG+2	23	1.8921	47	20
NA+	13	0.5655	14	6
K+	0	0.0018	0	0
HCO3-	320	5.2444	93	54
CL-	14	0.3949	7	4
SO4-2	0	0.0000	0	0

SUM OF CATIONS (MEQ/L): 4.1
SUM OF ANIONS (MEQ/L): 5.6
BALANCE (%): -16.3
SUM OF IONS (MG/L): 402
IONS AS PERCENT OF SPECIFIC CONDUCTIVITY: 67

WELL E-2 15 MAY 1986
PH: 7.74
SPECIFIC CONDUCTIVITY: 774

	MG/L	MEQ/L	% CATIONS OR ANIONS	% TOTAL
CA+2	60	2.9940	44	16
MG+2	38	3.1260	46	17
NA+	14	0.6090	9	3
K+	0	0.0015	0	0
HCO3-	418	6.8505	57	36
CL-	20	0.5641	5	3
SO4-2	223	4.6429	39	25

SUM OF CATIONS (MEQ/L): 6.7
SUM OF ANIONS (MEQ/L): 12.1
BALANCE (%): -28.4
SUM OF IONS (MG/L): 773
IONS AS PERCENT OF SPECIFIC CONDUCTIVITY: %100

WELL E-3 15 MAY 1986
PH: 7.66
SPECIFIC CONDUCTIVITY: 806

	MG/L	MEQ/L	% CATIONS OR ANIONS	% TOTAL
CA+2	81	4.0419	52	26
MG+2	38	3.1260	40	20
NA+	15	0.6525	8	4
K+	0	0.0013	0	0
HCO3-	409	6.7030	85	43
CL-	22	0.6205	8	4
SO4-2	29	0.6038	8	4

SUM OF CATIONS (MEQ/L): 7.8
SUM OF ANIONS (MEQ/L): 7.9
BALANCE (%): -0.7
SUM OF IONS (MG/L): 594
IONS AS PERCENT OF SPECIFIC CONDUCTIVITY: 74

WELL E-4 15 MAY 1986
PH: 7.65
SPECIFIC CONDUCTIVITY: 1248

	MG/L	MEQ/L	% CATIONS OR ANIONS	% TOTAL
CA+2	58	2.8942	24	11
MG+2	56	4.6068	37	18
NA+	110	4.7847	39	19
K+	0	0.0018	0	0
HCO3-	667	10.9313	83	43
CL-	41	1.1565	9	5
SO4-2	52	1.0826	8	4

SUM OF CATIONS (MEQ/L): 12.3
SUM OF ANIONS (MEQ/L): 13.2
BALANCE (%): -3.5
SUM OF IONS (MG/L): 984
IONS AS PERCENT OF SPECIFIC CONDUCTIVITY: 79

WELL E-5 15 MAY 1986
PH: 7.72
SPECIFIC CONDUCTIVITY: 1267

	MG/L	MEQ/L	% CATIONS OR ANIONS	% TOTAL
CA+2	57	2.8443	25	12
MG+2	52	4.2777	37	18
NA+	100	4.3498	38	18
K+	0	0.0013	0	0
HCO3-	628	10.2922	83	43
CL-	37	1.0436	8	4
SO4-2	52	1.0826	9	5

SUM OF CATIONS (MEQ/L): 11.5
SUM OF ANIONS (MEQ/L): 12.4
BALANCE (%): -4.0
SUM OF IONS (MG/L): 926
IONS AS PERCENT OF SPECIFIC CONDUCTIVITY: 73

WELL A-2 22 JUNE 1986
PH: 7.03
SPECIFIC CONDUCTIVITY: 1280

	MG/L	MEQ/L	% CATIONS OR ANIONS	% TOTAL
CA+2	143	7.1357	58	30
MG+2	44	3.6196	29	15
NA+	36	1.5659	13	7
K+	0	0.0031	0	0
HCO3-	622	10.1938	87	42
CL-	32	0.9026	8	4
SO4-2	28	0.5830	5	2

SUM OF CATIONS (MEQ/L): 12.3
SUM OF ANIONS (MEQ/L): 11.7
BALANCE (%): 2.7
SUM OF IONS (MG/L): 905
IONS AS PERCENT OF SPECIFIC CONDUCTIVITY: 71

WELL A-3 22 JUNE 1986
PH: 7.58
SPECIFIC CONDUCTIVITY: 1455

	MG/L	MEQ/L	% CATIONS OR ANIONS	% TOTAL
CA+2	78	3.8922	40	18
MG+2	47	3.8664	39	18
NA+	47	2.0444	21	10
K+	0	0.0100	0	0
HCO3-	632	10.3577	92	49
CL-	32	0.9026	8	4
SO4-2	0	0.0000	0	0

SUM OF CATIONS (MEQ/L): 9.8
SUM OF ANIONS (MEQ/L): 11.3
BALANCE (%): -6.9
SUM OF IONS (MG/L): 836
IONS AS PERCENT OF SPECIFIC CONDUCTIVITY: 57

WELL A-4 22 JUNE 1986
PH: 6.64
SPECIFIC CONDUCTIVITY: 1160

	MG/L	MEQ/L	% CATIONS OR ANIONS	% TOTAL
CA+2	102	5.0898	45	23
MG+2	48	3.9487	35	18
NA+	52	2.2619	20	10
K+	0	0.0023	0	0
HCO3-	605	9.9152	88	44
CL-	28	0.7898	7	4
SO4-2	26	0.5413	5	2

SUM OF CATIONS (MEQ/L): 11.3
SUM OF ANIONS (MEQ/L): 11.2
BALANCE (%): 0.2
SUM OF IONS (MG/L): 861
IONS AS PERCENT OF SPECIFIC CONDUCTIVITY: 74

WELL A-5 22 JUNE 1986
PH: 6.73
SPECIFIC CONDUCTIVITY: 1165

	MG/L	MEQ/L	% CATIONS OR ANIONS	% TOTAL
CA+2	97	4.8403	45	22
MG+2	45	3.7019	34	17
NA+	52	2.2619	21	10
K+	0	0.0015	0	0
HCO3-	586	9.6038	87	44
CL-	32	0.9026	8	4
SO4-2	24	0.4997	5	2

SUM OF CATIONS (MEQ/L): 10.8
SUM OF ANIONS (MEQ/L): 11.0
BALANCE (%): -0.9
SUM OF IONS (MG/L): 836
IONS AS PERCENT OF SPECIFIC CONDUCTIVITY: 72

WELL C-2 22 JUNE 1986
PH: 7.50
SPECIFIC CONDUCTIVITY: 1615

	MG/L	MEQ/L	% CATIONS OR ANIONS	% TOTAL
CA+2	75	3.7425	22	11
MG+2	64	5.2649	31	16
NA+	178	7.7426	46	23
K+	0	0.0041	0	0
HCO3-	906	14.8482	91	45
CL-	23	0.6487	4	2
SO4-2	42	0.8744	5	3

SUM OF CATIONS (MEQ/L): 16.8
SUM OF ANIONS (MEQ/L): 16.4
BALANCE (%): 1.2
SUM OF IONS (MG/L): 1288
IONS AS PERCENT OF SPECIFIC CONDUCTIVITY: 80

WELL C-3 22 JUNE 1986
PH: 7.43
SPECIFIC CONDUCTIVITY: 1417

	MG/L	MEQ/L	% CATIONS OR ANIONS	% TOTAL
CA+2	68	3.3932	24	12
MG+2	48	3.9487	28	14
NA+	151	6.5681	47	23
K+	0	0.0020	0	0
HCO3-	796	13.0455	89	46
CL-	28	0.7898	5	3
SO4-2	38	0.7912	5	3

SUM OF CATIONS (MEQ/L): 13.9
SUM OF ANIONS (MEQ/L): 14.6
BALANCE (%): -2.5
SUM OF IONS (MG/L): 1129
IONS AS PERCENT OF SPECIFIC CONDUCTIVITY: 80

WELL C-4 22 JUNE 1986
PH: 7.39
SPECIFIC CONDUCTIVITY: 1097

	MG/L	MEQ/L	% CATIONS OR ANIONS	% TOTAL
CA+2	103	5.1397	43	22
MG+2	52	4.2777	36	18
NA+	56	2.4359	21	10
K+	0	0.0023	0	0
HCO3-	604	9.8988	86	42
CL-	33	0.9308	8	4
SO4-2	31	0.6454	6	3

SUM OF CATIONS (MEQ/L): 11.9
SUM OF ANIONS (MEQ/L): 11.5
BALANCE (%): 1.6
SUM OF IONS (MG/L): 879
IONS AS PERCENT OF SPECIFIC CONDUCTIVITY: 80

WELL C-5 22 JUNE 1986
PH: 7.42
SPECIFIC CONDUCTIVITY: 1130

	MG/L	MEQ/L	% CATIONS OR ANIONS	% TOTAL
CA+2	154	7.6846	51	29
MG+2	53	4.3600	29	16
NA+	69	3.0013	20	11
K+	0	0.0026	0	0
HCO3-	622	10.1938	87	38
CL-	33	0.9308	8	3
SO4-2	31	0.6454	5	2

SUM OF CATIONS (MEQ/L): 15.0
SUM OF ANIONS (MEQ/L): 11.8
BALANCE (%): 12.2
SUM OF IONS (MG/L): 962
IONS AS PERCENT OF SPECIFIC CONDUCTIVITY: 85

WELL D-2 22 JUNE 1986
PH: 7.72
SPECIFIC CONDUCTIVITY: 1758

	MG/L	MEQ/L	% CATIONS OR ANIONS	% TOTAL
CA+2	105	5.2395	32	16
MG+2	68	5.5939	35	17
NA+	123	5.3502	33	16
K+	0	0.0054	0	0
HCO3-	955	15.6513	90	47
CL-	60	1.6924	10	5
SO4-2	0	0.0000	0	0

SUM OF CATIONS (MEQ/L): 16.2
SUM OF ANIONS (MEQ/L): 17.3
BALANCE (%): -3.4
SUM OF IONS (MG/L): 1311
IONS AS PERCENT OF SPECIFIC CONDUCTIVITY: 75

WELL D-3 22 JUNE 1986
PH: 7.46
SPECIFIC CONDUCTIVITY: 1365

	MG/L	MEQ/L	% CATIONS OR ANIONS	% TOTAL
CA+2	112	5.5888	36	19
MG+2	63	5.1826	34	17
NA+	106	4.6107	30	16
K+	0	0.0038	0	0
HCO3-	757	12.4063	87	42
CL-	41	1.1565	8	4
SO4-2	35	0.7287	5	2

SUM OF CATIONS (MEQ/L): 15.4
SUM OF ANIONS (MEQ/L): 14.3
BALANCE (%): 3.7
SUM OF IONS (MG/L): 1114
IONS AS PERCENT OF SPECIFIC CONDUCTIVITY: 82

WELL D-4 22 JUNE 1986
PH: 7.61
SPECIFIC CONDUCTIVITY: 1216

	MG/L	MEQ/L	% CATIONS OR ANIONS	% TOTAL
CA+2	109	5.4391	39	21
MG+2	44	3.6196	26	14
NA+	109	4.7412	34	18
K+	0	0.0031	0	0
HCO3-	648	10.6199	86	41
CL-	37	1.0436	8	4
SO4-2	34	0.7079	6	3

SUM OF CATIONS (MEQ/L): 13.8
SUM OF ANIONS (MEQ/L): 12.4
BALANCE (%): 5.5
SUM OF IONS (MG/L): 981
IONS AS PERCENT OF SPECIFIC CONDUCTIVITY: 81

WELL D-5 22 JUNE 1986
PH: 7.55
SPECIFIC CONDUCTIVITY: 1238

	MG/L	MEQ/L	% CATIONS OR ANIONS	% TOTAL
CA+2	70	3.4930	30	15
MG+2	43	3.5373	31	15
NA+	104	4.5237	39	19
K+	0	0.0028	0	0
HCO3-	653	10.7019	86	45
CL-	36	1.0154	8	4
SO4-2	33	0.6871	6	3

SUM OF CATIONS (MEQ/L): 11.6
SUM OF ANIONS (MEQ/L): 12.4
BALANCE (%): -3.5
SUM OF IONS (MG/L): 939
IONS AS PERCENT OF SPECIFIC CONDUCTIVITY: 76

WELL E-2 22 JUNE 1986
PH: 7.89
SPECIFIC CONDUCTIVITY: 755

	MG/L	MEQ/L	% CATIONS OR ANIONS	% TOTAL
CA+2	58	2.8942	47	22
MG+2	31	2.5502	42	20
NA+	15	0.6525	11	5
K+	0	0.0028	0	0
HCO3-	363	5.9491	85	46
CL-	22	0.6205	9	5
SO4-2	19	0.3956	6	3

SUM OF CATIONS (MEQ/L): 6.1
SUM OF ANIONS (MEQ/L): 7.0
BALANCE (%): -6.6
SUM OF IONS (MG/L): 508
IONS AS PERCENT OF SPECIFIC CONDUCTIVITY: 67

WELL E-3 22 JUNE 1986
PH: 7.64
SPECIFIC CONDUCTIVITY: 784

	MG/L	MEQ/L	% CATIONS OR ANIONS	% TOTAL
CA+2	62	3.0938	47	22
MG+2	34	2.7970	42	20
NA+	17	0.7395	11	5
K+	0	0.0028	0	0
HCO3-	375	6.1458	82	44
CL-	21	0.5923	8	4
SO4-2	36	0.7495	10	5

SUM OF CATIONS (MEQ/L): 6.6
SUM OF ANIONS (MEQ/L): 7.5
BALANCE (%): -6.1
SUM OF IONS (MG/L): 545
IONS AS PERCENT OF SPECIFIC CONDUCTIVITY: 70

WELL E-4 22 JUNE 1986
PH: 7.60
SPECIFIC CONDUCTIVITY: 1409

	MG/L	MEQ/L	% CATIONS OR ANIONS	% TOTAL
CA+2	64	3.1936	25	12
MG+2	57	4.6890	37	18
NA+	108	4.6977	37	18
K+	0	0.0023	0	0
HCO3-	669	10.9641	84	43
CL-	44	1.2411	9	5
SO4-2	44	0.9161	7	4

SUM OF CATIONS (MEQ/L): 12.6
SUM OF ANIONS (MEQ/L): 13.1
BALANCE (%): -2.1
SUM OF IONS (MG/L): 986
IONS AS PERCENT OF SPECIFIC CONDUCTIVITY: 70

WELL A-4 26 JULY 1986
PH: 6.65
SPECIFIC CONDUCTIVITY: 1140

	MG/L	MEQ/L	% CATIONS OR ANIONS	% TOTAL
CA+2	93	4.6407	43	21
MG+2	47	3.8664	35	17
NA+	55	2.3924	22	11
K+	0	0.0018	0	0
HCO3-	598	9.8005	86	44
CL-	34	0.9590	8	4
SO4-2	32	0.6662	6	3

SUM OF CATIONS (MEQ/L): 10.9
SUM OF ANIONS (MEQ/L): 11.4
BALANCE (%): -2.3
SUM OF IONS (MG/L): 859
IONS AS PERCENT OF SPECIFIC CONDUCTIVITY: 75

WELL A-5 26 JULY 1986
PH: 6.78
SPECIFIC CONDUCTIVITY: 1098

	MG/L	MEQ/L	% CATIONS OR ANIONS	% TOTAL
CA+2	84	4.1916	44	20
MG+2	42	3.4551	36	17
NA+	43	1.8704	20	9
K+	0	0.0023	0	0
HCO3-	581	9.5219	86	46
CL-	34	0.9590	9	5
SO4-2	28	0.5830	5	3

SUM OF CATIONS (MEQ/L): 9.5
SUM OF ANIONS (MEQ/L): 11.1
BALANCE (%): -7.5
SUM OF IONS (MG/L): 812
IONS AS PERCENT OF SPECIFIC CONDUCTIVITY: 74

WELL C-4 26 JULY 1986
PH: 7.17
SPECIFIC CONDUCTIVITY: 1137

	MG/L	MEQ/L	% CATIONS OR ANIONS	% TOTAL
CA+2	83	4.1417	40	19
MG+2	51	4.1955	40	19
NA+	49	2.1314	20	10
K+	0	0.0026	0	0
HCO3-	611	10.0136	84	45
CL-	33	0.9308	8	4
SO4-2	45	0.9369	8	4

SUM OF CATIONS (MEQ/L): 10.5
SUM OF ANIONS (MEQ/L): 11.9
BALANCE (%): -6.3
SUM OF IONS (MG/L): 872
IONS AS PERCENT OF SPECIFIC CONDUCTIVITY: 77

WELL C-5 26 JULY 1986
PH: 7.27
SPECIFIC CONDUCTIVITY: 1127

	MG/L	MEQ/L	% CATIONS OR ANIONS	% TOTAL
CA+2	78	3.8922	38	18
MG+2	51	4.1955	41	19
NA+	49	2.1314	21	10
K+	0	0.0020	0	0
HCO3-	610	9.9972	84	45
CL-	32	0.9026	8	4
SO4-2	46	0.9577	8	4

SUM OF CATIONS (MEQ/L): 10.2
SUM OF ANIONS (MEQ/L): 11.9
BALANCE (%): -7.4
SUM OF IONS (MG/L): 866
IONS AS PERCENT OF SPECIFIC CONDUCTIVITY: 77

WELL D-4 26 JULY 1986
PH: 7.30
SPECIFIC CONDUCTIVITY: 1249

	MG/L	MEQ/L	% CATIONS OR ANIONS	% TOTAL
CA+2	63	3.1437	28	13
MG+2	42	3.4551	31	14
NA+	102	4.4368	40	19
K+	0	0.0028	0	0
HCO3-	649	10.6363	82	44
CL-	45	1.2693	10	5
SO4-2	48	0.9994	8	4

SUM OF CATIONS (MEQ/L): 11.0
SUM OF ANIONS (MEQ/L): 12.9
BALANCE (%): -7.8
SUM OF IONS (MG/L): 949
IONS AS PERCENT OF SPECIFIC CONDUCTIVITY: 76

WELL D-5 26 JULY 1986
PH: 7.23
SPECIFIC CONDUCTIVITY: 1211

	MG/L	MEQ/L	% CATIONS OR ANIONS	% TOTAL
CA+2	67	3.3433	30	14
MG+2	42	3.4551	31	14
NA+	100	4.3498	39	18
K+	0	0.0018	0	0
HCO3-	649	10.6363	82	44
CL-	44	1.2411	10	5
SO4-2	50	1.0410	8	4

SUM OF CATIONS (MEQ/L): 11.1
SUM OF ANIONS (MEQ/L): 12.9
BALANCE (%): -7.3
SUM OF IONS (MG/L): 952
IONS AS PERCENT OF SPECIFIC CONDUCTIVITY: 79

WELL E-4 26 JULY 1986
PH: 7.35
SPECIFIC CONDUCTIVITY: 1407

	MG/L	MEQ/L	% CATIONS OR ANIONS	% TOTAL
CA+2	55	2.7445	24	11
MG+2	55	4.5245	39	19
NA+	100	4.3498	37	18
K+	0	0.0018	0	0
HCO3-	643	10.5380	83	43
CL-	38	1.0718	8	4
SO4-2	49	1.0202	8	4

SUM OF CATIONS (MEQ/L): 11.6
SUM OF ANIONS (MEQ/L): 12.6
BALANCE (%): -4.2
SUM OF IONS (MG/L): 940
IONS AS PERCENT OF SPECIFIC CONDUCTIVITY: 67

WELL E-5 26 JULY 1986
PH: 7.38
SPECIFIC CONDUCTIVITY: 1313

	MG/L	MEQ/L	% CATIONS OR ANIONS	% TOTAL
CA+2	55	2.7445	24	11
MG+2	55	4.5245	40	19
NA+	92	4.0018	35	17
K+	0	0.0020	0	0
HCO3-	636	10.4233	81	43
CL-	36	1.0154	8	4
SO4-2	65	1.3533	11	6

SUM OF CATIONS (MEQ/L): 11.3
SUM OF ANIONS (MEQ/L): 12.8
BALANCE (%): -6.3
SUM OF IONS (MG/L): 939
IONS AS PERCENT OF SPECIFIC CONDUCTIVITY: 72

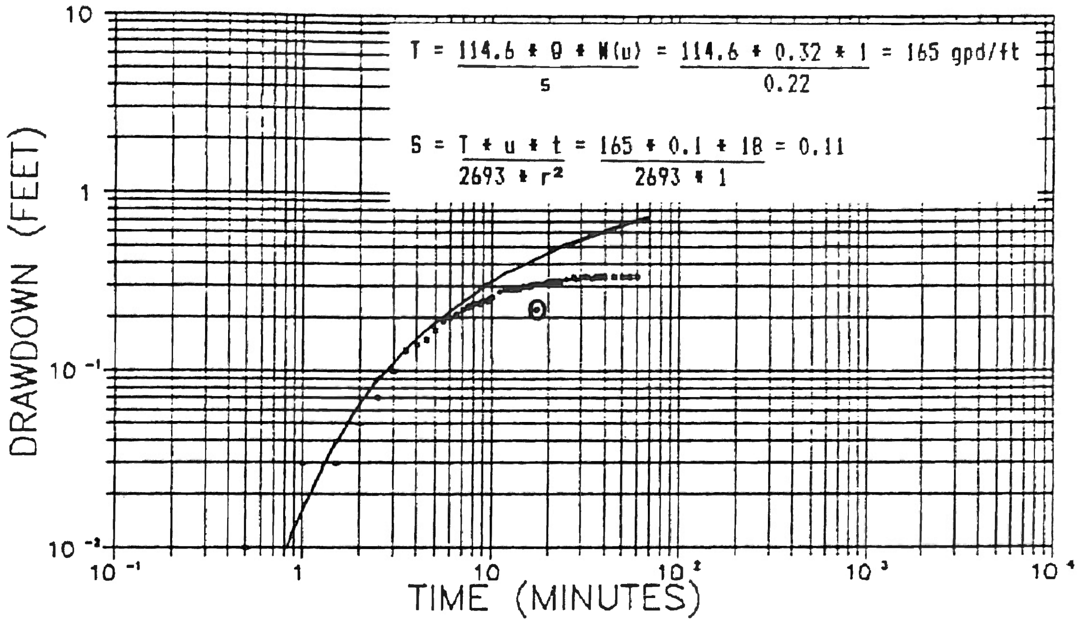
APPENDIX E

AQUIFER TEST DATA

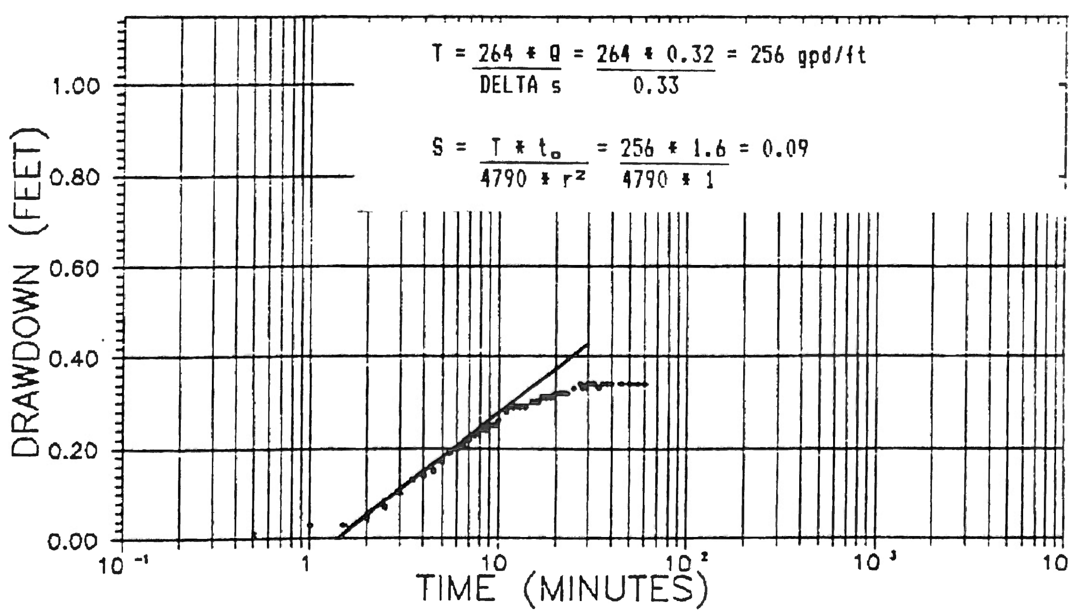
032286, DRAWDOWN DATA WELL A4, PUMPED WELL A5, Q = 0.32 GPM

TIME MINUTES	MEASURED DRAWDOWN FEET	AFTER DECLINE FEET	SPRIME FEET	QT/SR2 NO UNITS
0.5	0.01	0.01	0.01	2.15
1.0	0.03	0.03	0.03	1.44
1.5	0.03	0.03	0.03	2.16
2.0	0.05	0.05	0.05	1.73
2.5	0.07	0.07	0.07	1.54
3.0	0.10	0.10	0.10	1.30
3.5	0.13	0.13	0.13	1.17
4.0	0.14	0.14	0.14	1.24
4.5	0.15	0.15	0.15	1.31
5.0	0.17	0.17	0.17	1.28
5.5	0.19	0.19	0.19	1.27
6.0	0.20	0.20	0.20	1.31
6.5	0.21	0.21	0.21	1.36
7.0	0.22	0.22	0.22	1.39
7.5	0.23	0.23	0.23	1.43
8.0	0.24	0.24	0.24	1.46
8.5	0.25	0.25	0.24	1.49
9.0	0.26	0.26	0.25	1.52
9.5	0.26	0.26	0.25	1.61
10	0.27	0.27	0.26	1.63
11	0.29	0.29	0.28	1.67
12	0.30	0.30	0.29	1.76
13	0.30	0.30	0.29	1.91
14	0.30	0.30	0.29	2.06
15	0.31	0.31	0.30	2.14
16	0.31	0.31	0.30	2.28
17	0.32	0.32	0.31	2.35
18	0.32	0.32	0.31	2.49
19	0.32	0.32	0.31	2.62
20	0.33	0.33	0.32	2.68
21	0.33	0.33	0.32	2.81
22	0.33	0.33	0.32	2.95
23	0.33	0.33	0.32	3.08
25	0.34	0.34	0.33	3.26
27	0.35	0.35	0.34	3.42
28	0.34	0.34	0.33	3.65
30	0.35	0.35	0.34	3.80
32	0.35	0.35	0.34	4.05
34	0.34	0.34	0.33	4.43
36	0.35	0.35	0.34	4.56
38	0.35	0.35	0.34	4.81
40	0.35	0.35	0.34	5.06
45	0.35	0.35	0.34	5.70
50	0.35	0.35	0.34	6.33
55	0.35	0.35	0.34	6.96
60	0.35	0.35	0.34	7.60

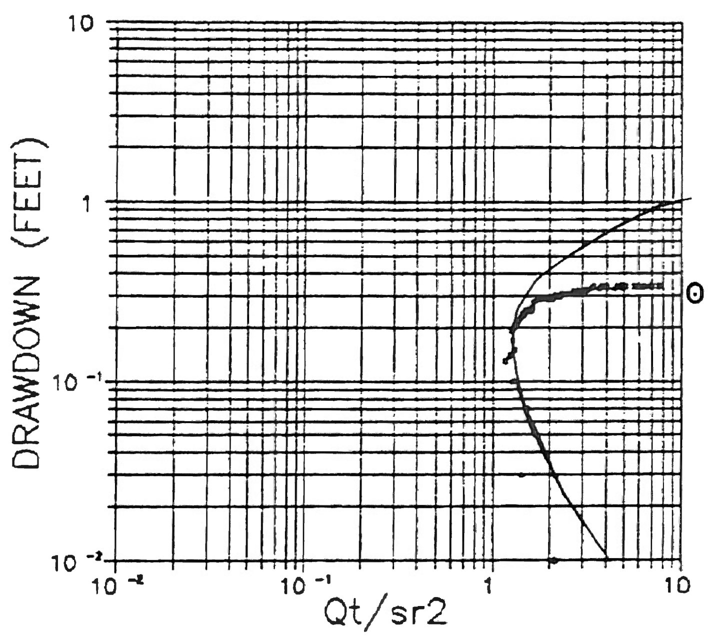
032286, WELL A4, TIME-DRAWDOWN, THEIS METHOD



032286, WELL A4, TIME-DRAWDOWN, JACOB METHOD



032286, WELL A4, TIME–DRAWDOWN
FRANKE METHOD



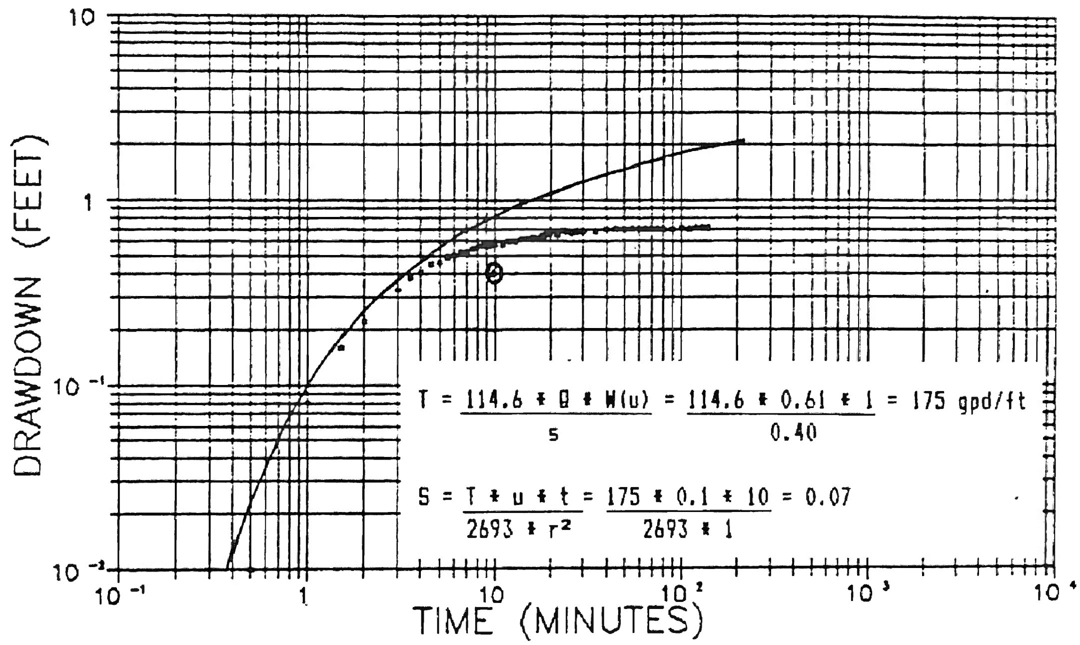
T = Q/s * (sT/Q)(type) * 7.48 = 62/0.3 * 0.1 * 7.48
= 155 gpd/ft

$$S = \frac{Qt/sr2(graph)}{Qt/sr2(type)} = \frac{12.5}{100} = 0.125$$

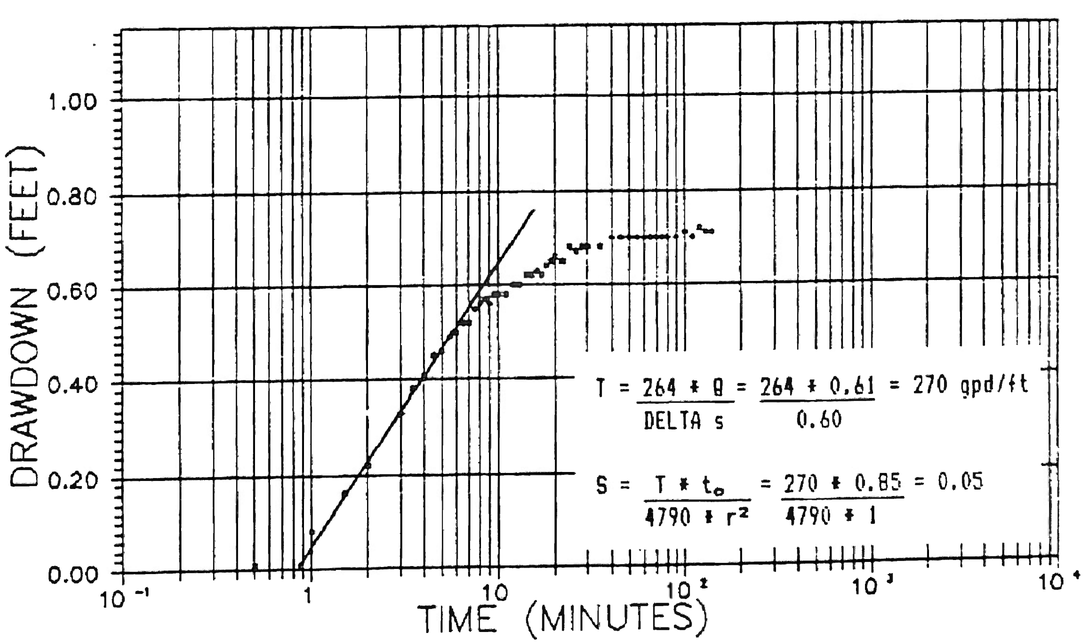
032786, DRAWDOWN DATA WELL C4, PUMPED WELL C5, Q = 0.61 GPM

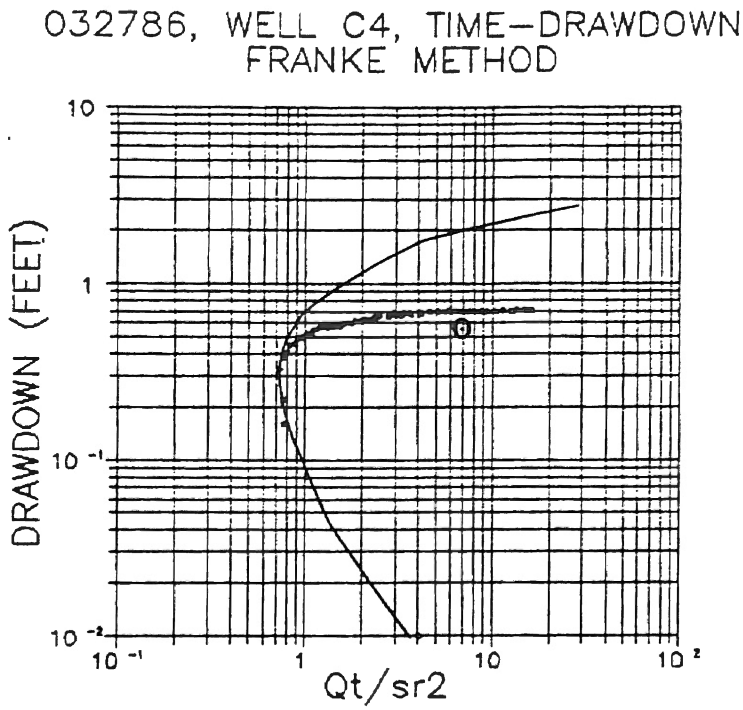
TIME MINUTES	MEASURED DRAWDOWN FEET	AFTER DECLINE FEET	SPRIME FEET	QT/SR2 NO UNITS	TIME MINUTES	MEASURED DRAWDOWN FEET	AFTER DECLINE FEET	SPRIME FEET	QT/SR2 NO UNITS
0.5	0.01	0.01	0.01	4.07	100	0.75	0.75	0.71	11.42
1.0	0.08	0.08	0.08	1.02	110	0.74	0.74	0.70	12.72
1.5	0.16	0.16	0.16	0.77	120	0.76	0.76	0.72	13.53
2.0	0.22	0.22	0.22	0.75	130	0.75	0.75	0.71	14.85
3.0	0.34	0.34	0.33	0.73	140	0.75	0.75	0.71	15.99
3.5	0.39	0.39	0.38	0.75					
4.0	0.42	0.42	0.41	0.80					
4.5	0.46	0.46	0.45	0.82					
5.0	0.48	0.48	0.46	0.88					
5.5	0.51	0.51	0.49	0.91					
6.0	0.52	0.52	0.50	0.97					
6.5	0.54	0.54	0.52	1.02					
7.0	0.54	0.54	0.52	1.09					
7.5	0.57	0.57	0.55	1.11					
8.0	0.58	0.58	0.56	1.17					
8.5	0.59	0.59	0.57	1.22					
9.0	0.58	0.58	0.56	1.31					
9.5	0.60	0.60	0.58	1.34					
10	0.60	0.60	0.58	1.41					
11	0.61	0.61	0.58	1.53					
12	0.63	0.63	0.60	1.62					
13	0.63	0.63	0.60	1.75					
14	0.65	0.65	0.62	1.83					
15	0.65	0.65	0.62	1.96					
16	0.66	0.66	0.63	2.06					
17	0.65	0.65	0.62	2.22					
18	0.67	0.67	0.64	2.29					
19	0.68	0.68	0.65	2.38					
20	0.69	0.69	0.66	2.47					
22	0.68	0.68	0.65	2.76					
24	0.71	0.71	0.68	2.89					
26	0.70	0.70	0.67	3.17					
28	0.72	0.72	0.68	3.32					
30	0.71	0.71	0.68	3.61					
35	0.72	0.72	0.68	4.15					
40	0.74	0.74	0.70	4.63					
45	0.74	0.74	0.70	5.20					
50	0.74	0.74	0.70	5.78					
55	0.74	0.74	0.70	6.36					
60	0.74	0.74	0.70	6.94					
65	0.74	0.74	0.70	7.52					
70	0.74	0.74	0.70	8.10					
75	0.74	0.74	0.70	8.67					
80	0.74	0.74	0.70	9.25					
90	0.74	0.74	0.70	10.41					

032786, WELL C4, TIME-DRAWDOWN, THEIS METHOD



032786, WELL C4, TIME-DRAWDOWN, JACOB METHOD





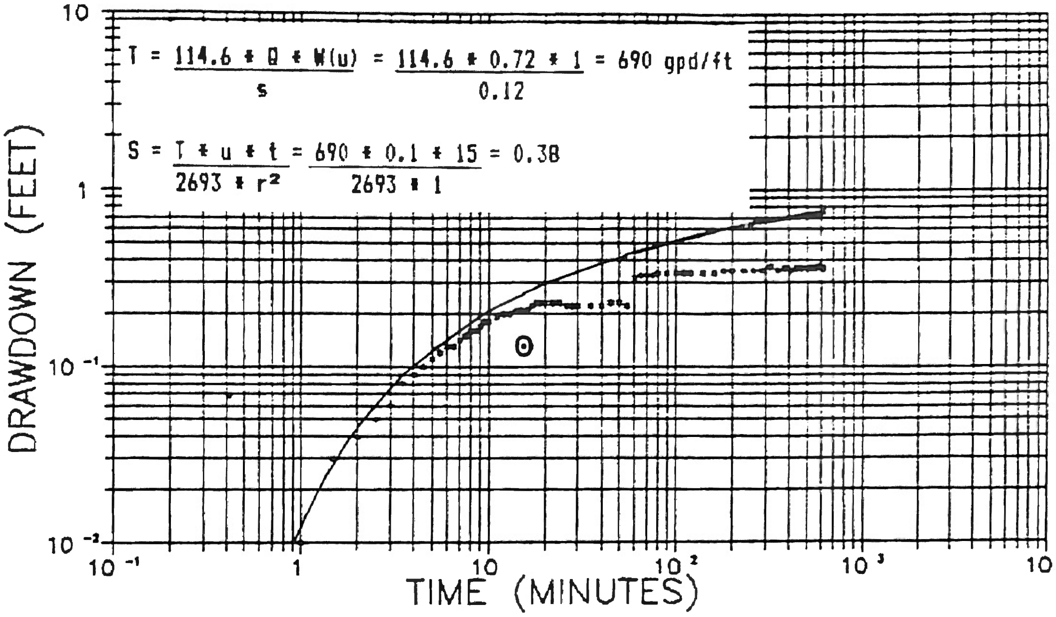
T = Q/s * (sT/Q)(type) * 7.48 = 117/0.56 * 0.1 * 7.48
= 155 gpd/ft

S = Qt/sr2(graph) / Qt/sr2(type) = 7 / 100 = 0.07

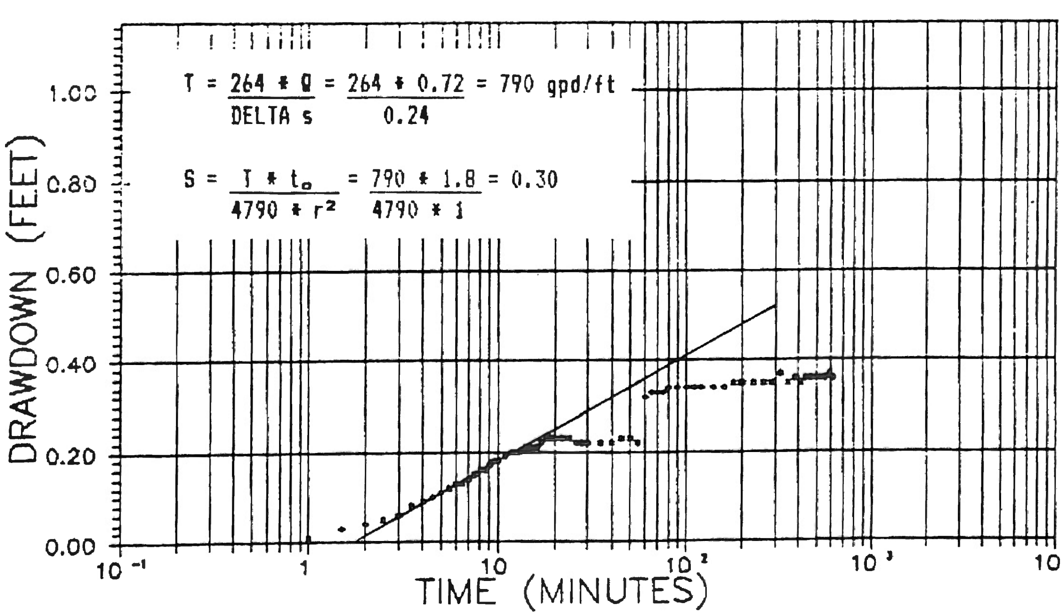
042986, DRAWDOWN DATA WELL E4, PUMPED WELL E5, Q = 0.72 GPM

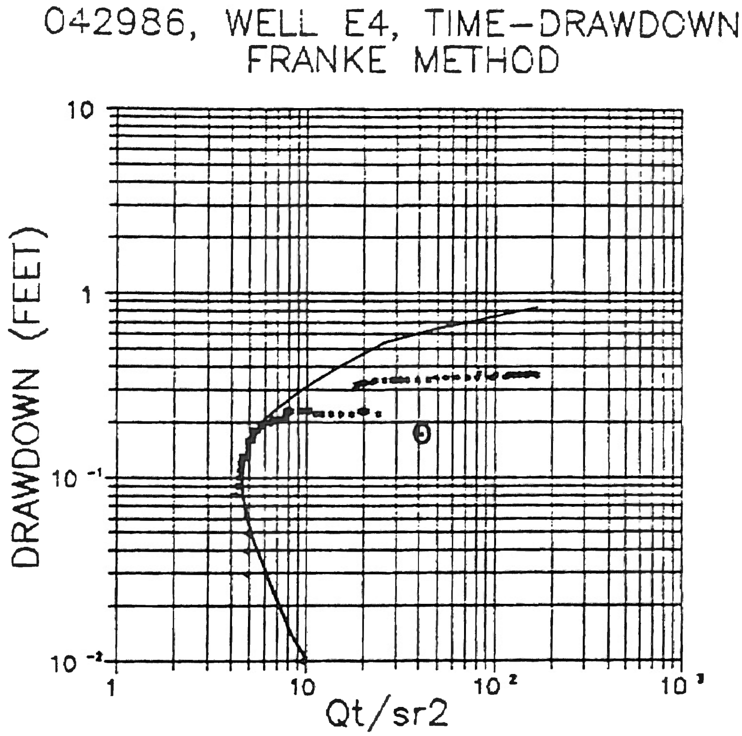
TIME MINUTES	MEASURED DRAWDOWN FEET	AFTER DECLINE FEET	SPRIME FEET	QT/SR2 NO UNITS	TIME MINUTES	MEASURED DRAWDOWN FEET	AFTER DECLINE FEET	SPRIME FEET	QT/SR2 NO UNITS
1.0	0.01	0.01	0.01	9.70	110	0.35	0.35	0.34	31.59
1.5	0.03	0.03	0.03	4.85	120	0.35	0.34	0.34	34.50
2.0	0.04	0.04	0.04	4.85	140	0.36	0.35	0.34	39.25
2.5	0.05	0.05	0.05	4.86	160	0.36	0.35	0.34	44.97
3.0	0.06	0.06	0.06	4.86	180	0.37	0.36	0.35	49.35
3.5	0.08	0.08	0.08	4.26	200	0.37	0.36	0.35	54.97
4.0	0.09	0.09	0.09	4.33	230	0.37	0.36	0.35	63.45
4.5	0.10	0.10	0.10	4.39	260	0.37	0.36	0.35	71.99
5.0	0.11	0.11	0.11	4.43	290	0.37	0.36	0.35	80.59
5.5	0.12	0.12	0.12	4.47	320	0.40	0.39	0.37	82.50
6.0	0.13	0.13	0.13	4.51	350	0.38	0.36	0.35	95.37
6.5	0.13	0.13	0.13	4.88	380	0.39	0.37	0.36	101.21
7.0	0.14	0.14	0.14	4.89	410	0.38	0.36	0.35	112.54
7.5	0.15	0.15	0.15	4.89	440	0.39	0.37	0.36	118.03
8.0	0.16	0.16	0.16	4.90	470	0.39	0.37	0.36	126.53
8.5	0.16	0.16	0.16	5.20	500	0.39	0.37	0.36	135.09
9.0	0.17	0.17	0.17	5.19	530	0.39	0.37	0.36	143.72
9.5	0.18	0.18	0.18	5.18	560	0.40	0.37	0.36	148.45
10	0.18	0.18	0.18	5.45	590	0.41	0.38	0.37	152.97
11	0.19	0.19	0.19	5.68	620	0.40	0.37	0.36	165.52
12	0.20	0.20	0.20	5.90					
13	0.20	0.20	0.20	6.39					
14	0.21	0.21	0.21	6.56					
15	0.21	0.21	0.21	7.03					
16	0.21	0.21	0.21	7.50					
17	0.22	0.22	0.22	7.61					
18	0.23	0.23	0.23	7.71					
19	0.24	0.24	0.23	7.81					
20	0.24	0.24	0.23	8.22					
22	0.23	0.23	0.23	9.43					
24	0.23	0.23	0.23	10.30					
26	0.23	0.23	0.22	11.16					
28	0.23	0.23	0.22	12.02					
30	0.22	0.22	0.22	13.46					
35	0.23	0.23	0.22	15.05					
40	0.23	0.23	0.22	17.21					
45	0.23	0.23	0.23	19.22					
50	0.24	0.24	0.23	20.67					
55	0.23	0.23	0.22	23.74					
60	0.33	0.33	0.32	18.14					
65	0.34	0.34	0.33	19.10					
70	0.34	0.34	0.33	20.58					
75	0.34	0.34	0.33	22.06					
80	0.35	0.35	0.34	22.89					
90	0.35	0.35	0.34	25.78					

042986, WELL E4, TIME–DRAWDOWN, THEIS METHOD



042986, WELL E4, TIME–DRAWDOWN, JACOB METHOD





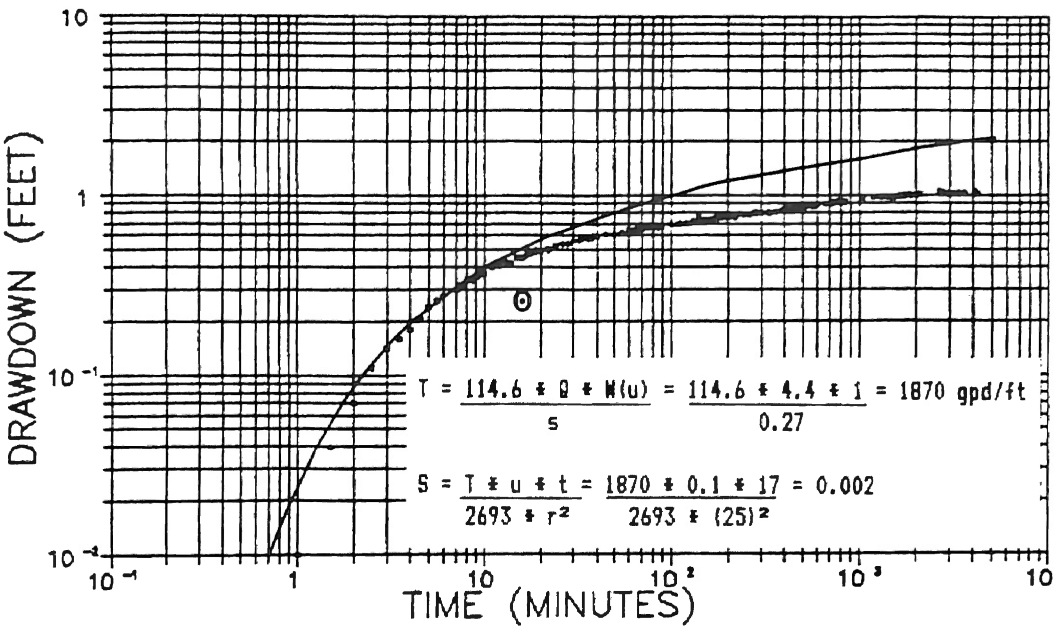
T = Q/s * (sT/Q)(type) * 7.48 = 139/0.17 * 0.1 * 7.48
= 610 gpd/ft

$$S = \frac{Qt/sr2(graph)}{Qt/sr2(type)} = \frac{42}{100} = 0.42$$

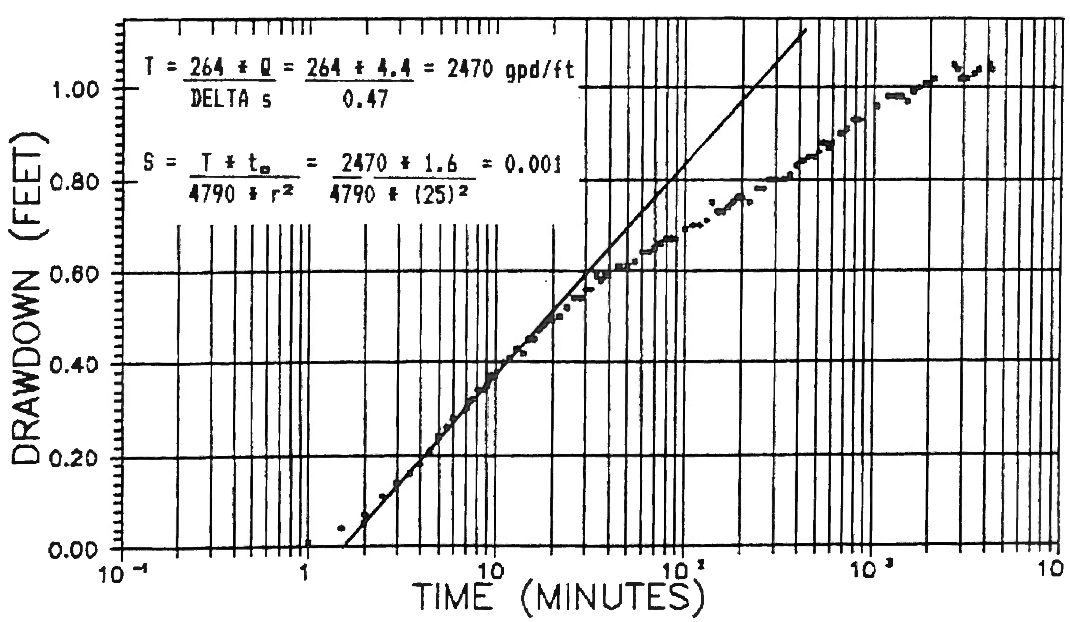
030887. DRAWDOWN DATA WELL A5, PUMPED WELL F1, Q = 4.4 GPM

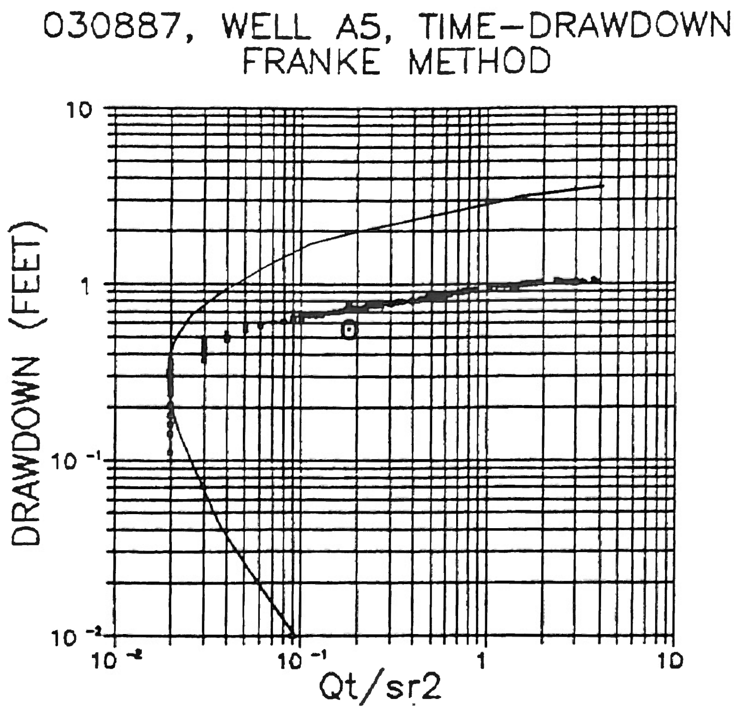
TIME MINUTES	MEASURED DRAWDOWN FEET	AFTER DECLINE FEET	SPRIME FEET	QT/SR2 NO UNITS	TIME MINUTES	MEASURED DRAWDOWN FEET	AFTER DECLINE FEET	SPRIME FEET	QT/SR2 NO UNITS
1.0	0.01	0.01	0.01	0.09	100	0.72	0.71	0.69	0.14
1.5	0.04	0.04	0.04	0.04	110	0.73	0.72	0.70	0.15
2.0	0.07	0.07	0.07	0.03	120	0.74	0.73	0.70	0.16
2.5	0.11	0.11	0.11	0.02	130	0.75	0.74	0.71	0.17
3.0	0.14	0.14	0.14	0.02	140	0.79	0.78	0.75	0.18
3.5	0.16	0.16	0.16	0.02	150	0.77	0.76	0.73	0.19
4.0	0.18	0.18	0.18	0.02	160	0.77	0.76	0.73	0.21
4.5	0.21	0.21	0.21	0.02	170	0.78	0.77	0.74	0.22
5.0	0.24	0.24	0.24	0.02	180	0.79	0.78	0.75	0.23
5.5	0.26	0.26	0.26	0.02	190	0.80	0.79	0.76	0.24
6.0	0.28	0.28	0.28	0.02	200	0.80	0.79	0.76	0.25
7.0	0.31	0.31	0.30	0.02	220	0.80	0.79	0.75	0.27
7.5	0.33	0.33	0.32	0.02	240	0.83	0.82	0.78	0.29
8.0	0.35	0.35	0.34	0.02	260	0.83	0.82	0.78	0.31
8.5	0.35	0.35	0.34	0.02	280	0.85	0.84	0.80	0.33
9.0	0.36	0.36	0.35	0.02	300	0.85	0.83	0.80	0.35
9.5	0.38	0.38	0.37	0.02	330	0.86	0.84	0.80	0.39
10	0.38	0.38	0.37	0.03	360	0.87	0.85	0.81	0.42
11	0.41	0.41	0.40	0.03	390	0.89	0.87	0.83	0.44
12	0.42	0.42	0.41	0.03	420	0.90	0.88	0.84	0.47
13	0.44	0.44	0.43	0.03	450	0.92	0.90	0.85	0.50
14	0.43	0.43	0.42	0.03	480	0.92	0.89	0.85	0.53
15	0.46	0.46	0.45	0.03	510	0.93	0.90	0.86	0.56
16	0.46	0.46	0.45	0.03	540	0.95	0.92	0.88	0.58
17	0.48	0.48	0.47	0.03	570	0.95	0.92	0.87	0.61
18	0.49	0.49	0.48	0.04	600	0.96	0.93	0.88	0.64
19	0.50	0.50	0.49	0.04	660	0.98	0.95	0.90	0.69
20	0.51	0.51	0.49	0.04	720	1.00	0.96	0.91	0.74
22	0.52	0.52	0.50	0.04	780	1.02	0.98	0.93	0.79
24	0.54	0.54	0.52	0.04	840	1.03	0.99	0.93	0.85
26	0.56	0.56	0.54	0.05	1050	1.07	1.02	0.96	1.03
28	0.56	0.56	0.54	0.05	1185	1.10	1.04	0.98	1.14
30	0.58	0.58	0.56	0.05	1300	1.11	1.04	0.98	1.25
32	0.58	0.58	0.56	0.05	1400	1.11	1.04	0.98	1.35
34	0.61	0.61	0.59	0.05	1500	1.11	1.03	0.97	1.45
36	0.60	0.60	0.58	0.06	1620	1.13	1.05	0.99	1.55
38	0.61	0.61	0.59	0.06	1740	1.15	1.06	1.00	1.64
40	0.61	0.61	0.59	0.06	1860	1.17	1.07	1.01	1.73
45	0.63	0.63	0.61	0.07	1980	1.18	1.08	1.01	1.84
50	0.63	0.63	0.61	0.08	2100	1.19	1.08	1.02	1.94
55	0.65	0.65	0.62	0.08	2650	1.26	1.12	1.05	2.37
60	0.67	0.67	0.64	0.09	2775	1.25	1.10	1.04	2.52
65	0.67	0.67	0.64	0.10	2880	1.24	1.09	1.02	2.65
70	0.68	0.68	0.65	0.10	3120	1.25	1.09	1.02	2.87
75	0.69	0.69	0.66	0.11	3360	1.27	1.09	1.03	3.07
80	0.70	0.70	0.67	0.11	3580	1.29	1.10	1.04	3.25
85	0.70	0.70	0.67	0.12	4110	1.33	1.12	1.05	3.69
90	0.70	0.70	0.67	0.13	4200	1.33	1.11	1.04	3.79

030887, WELL A5, TIME-DRAWDOWN, THEIS METHOD



030887, WELL A5, TIME-DRAWDOWN, JACOB METHOD





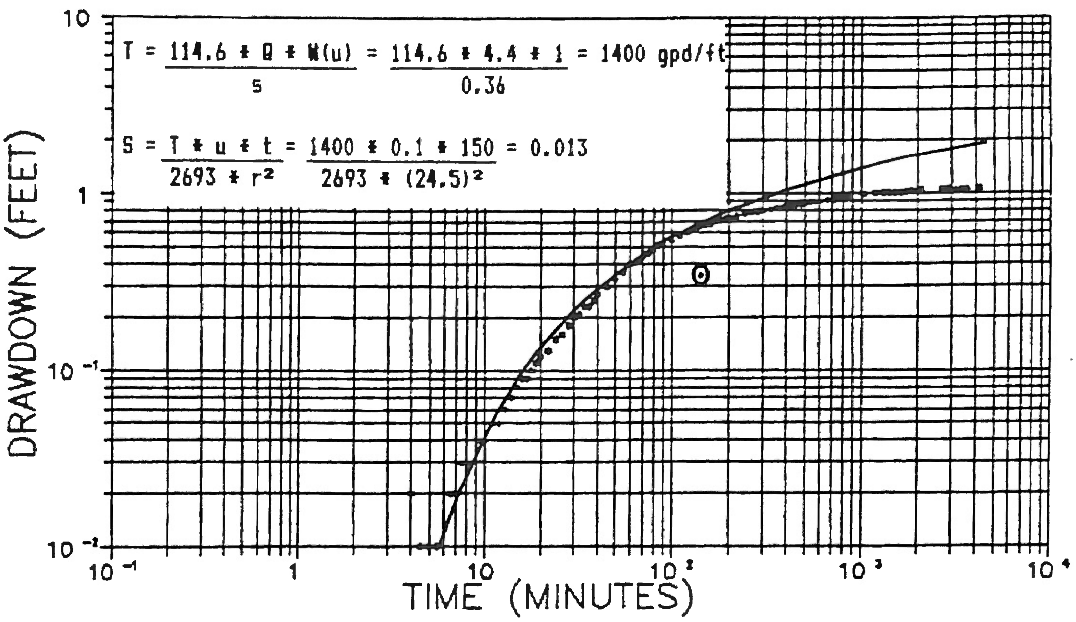
T = Q/s * (sT/Q)(type) * 7.48 = 847/0.52 * 0.1 * 7.48
= 1220 gpd/ft

$$S = \frac{Qt/sr2(graph)}{Qt/sr2(type)} = \frac{0.19}{100} = 0.002$$

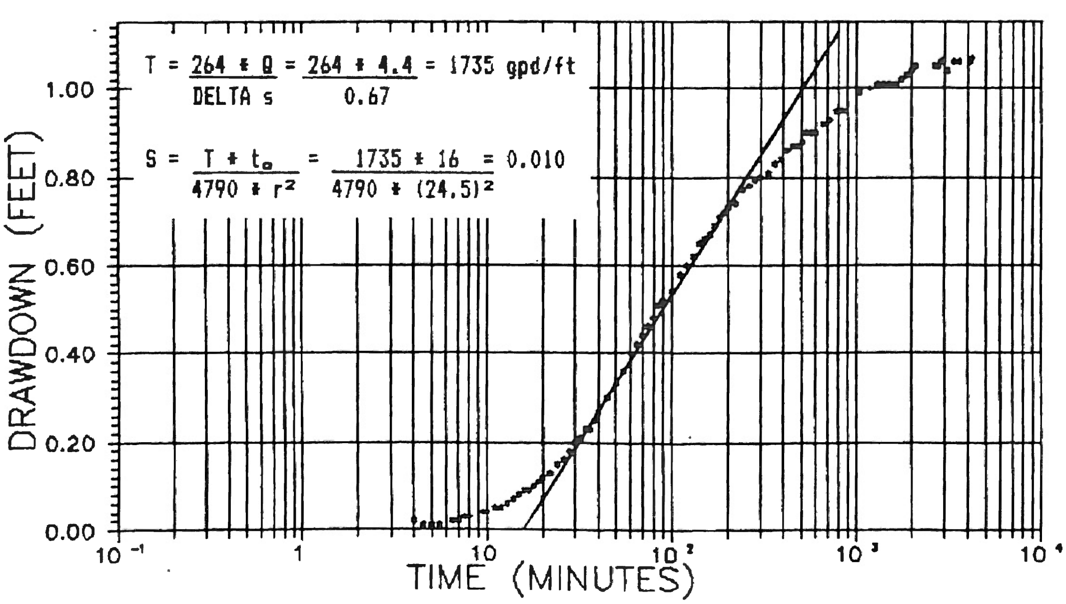
030887, DRAWDOWN DATA WELL B4, PUMPED WELL F1, Q = 4.4 GPM

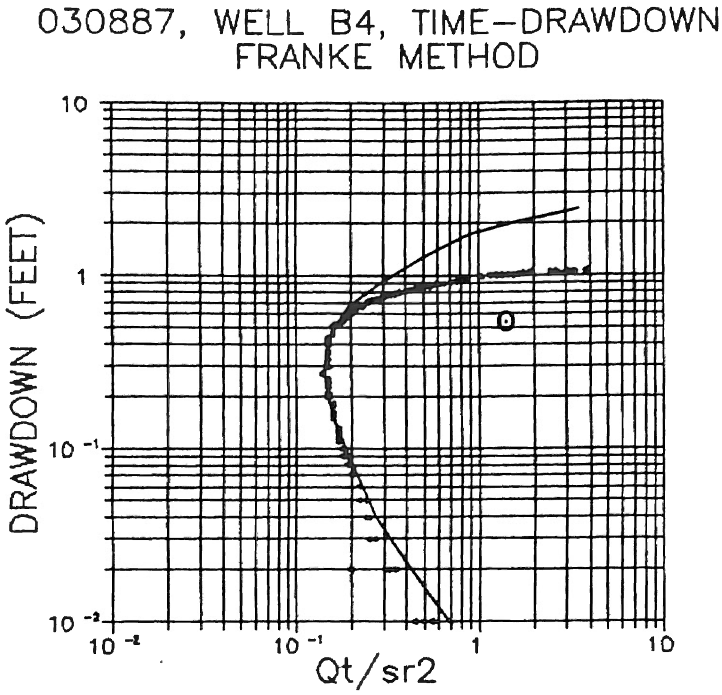
TIME MINUTES	MEASURED DRAWDOWN FEET	AFTER DECLINE FEET	SPRIME FEET	QT/SR2 NO UNITS	TIME MINUTES	MEASURED DRAWDOWN FEET	AFTER DECLINE FEET	SPRIME FEET	QT/SR2 NO UNITS
4.0	0.02	0.02	0.02	0.20	140	0.69	0.68	0.65	0.21
4.5	0.01	0.01	0.01	0.45	150	0.70	0.69	0.66	0.22
5.0	0.01	0.01	0.01	0.50	160	0.71	0.70	0.67	0.23
5.5	0.01	0.01	0.01	0.56	170	0.73	0.72	0.69	0.24
6.5	0.02	0.02	0.02	0.32	180	0.75	0.74	0.71	0.25
7.0	0.02	0.02	0.02	0.35	190	0.77	0.76	0.72	0.26
7.5	0.03	0.03	0.03	0.25	200	0.78	0.77	0.73	0.27
8.0	0.03	0.03	0.03	0.27	220	0.79	0.78	0.74	0.29
9.5	0.04	0.04	0.04	0.24	240	0.82	0.81	0.77	0.31
10	0.04	0.04	0.04	0.25	260	0.83	0.82	0.78	0.33
11	0.05	0.05	0.05	0.22	280	0.85	0.83	0.79	0.35
12	0.05	0.05	0.05	0.24	300	0.86	0.84	0.80	0.37
13	0.06	0.06	0.06	0.22	330	0.87	0.85	0.81	0.40
14	0.07	0.07	0.07	0.20	360	0.90	0.88	0.83	0.42
15	0.08	0.08	0.08	0.19	390	0.91	0.89	0.84	0.45
16	0.09	0.09	0.09	0.18	420	0.93	0.91	0.86	0.48
17	0.09	0.09	0.09	0.19	450	0.94	0.92	0.87	0.51
18	0.10	0.10	0.10	0.18	480	0.95	0.92	0.87	0.54
19	0.11	0.11	0.11	0.17	510	0.96	0.93	0.88	0.57
20	0.12	0.12	0.12	0.17	540	0.98	0.95	0.90	0.59
22	0.13	0.13	0.13	0.17	570	0.99	0.96	0.90	0.62
24	0.15	0.15	0.15	0.16	600	0.99	0.96	0.90	0.65
26	0.16	0.16	0.16	0.16	660	1.01	0.97	0.92	0.71
28	0.18	0.18	0.18	0.16	720	1.03	0.99	0.93	0.76
30	0.20	0.20	0.20	0.15	780	1.05	1.01	0.95	0.81
32	0.21	0.21	0.21	0.15	840	1.06	1.01	0.95	0.86
34	0.23	0.23	0.23	0.15	1050	1.11	1.05	0.99	1.04
36	0.24	0.24	0.23	0.15	1185	1.13	1.07	1.00	1.16
38	0.26	0.26	0.25	0.15	1300	1.15	1.08	1.01	1.26
40	0.28	0.28	0.27	0.14	1400	1.16	1.08	1.01	1.35
45	0.31	0.31	0.30	0.15	1500	1.16	1.08	1.01	1.46
50	0.34	0.34	0.33	0.15	1620	1.17	1.08	1.01	1.57
55	0.37	0.37	0.36	0.15	1740	1.18	1.09	1.02	1.68
60	0.41	0.41	0.40	0.15	1860	1.20	1.10	1.03	1.77
65	0.43	0.43	0.42	0.15	1980	1.22	1.11	1.04	1.87
70	0.46	0.46	0.44	0.15	2100	1.24	1.13	1.05	1.96
75	0.48	0.48	0.46	0.16	2650	1.27	1.13	1.05	2.47
80	0.50	0.50	0.48	0.16	2775	1.27	1.12	1.05	2.60
85	0.53	0.53	0.51	0.16	2880	1.29	1.14	1.06	2.67
90	0.54	0.54	0.52	0.17	3120	1.28	1.11	1.04	2.95
100	0.56	0.55	0.54	0.18	3360	1.32	1.14	1.06	3.10
110	0.61	0.60	0.58	0.19	3580	1.33	1.14	1.06	3.31
120	0.63	0.62	0.60	0.20	4110	1.36	1.14	1.06	3.80
130	0.65	0.64	0.62	0.21	4200	1.37	1.14	1.07	3.86

030887, WELL B4, TIME-DRAWDOWN, THEIS METHOD



030887, WELL B4, TIME-DRAWDOWN, JACOB METHOD





T = Q/s * (sT/Q)(type) * 7.48 = 847/0.52 * 0.1 * 7.48
= 1220 gpd/ft

$$S = \frac{Qt/sr2(graph)}{Qt/sr2(type)} = \frac{1.4}{100} = 0.014$$

DRAWDOWN DATA WELL C5

TIME MINUTES	MEASURED DRAWDOWN FEET	AFTER DECLINE FEET	SPRIME FEET	QT/SR2 NO UNITS
21	0.12	0.12	0.12	0.02
23	0.14	0.14	0.14	0.02
41	0.19	0.19	0.19	0.03
93	0.24	0.24	0.23	0.05
163	0.27	0.26	0.26	0.08
303	0.35	0.34	0.33	0.12
394	0.37	0.35	0.35	0.15
516	0.42	0.40	0.39	0.17
655	0.46	0.43	0.42	0.20
1208	0.59	0.54	0.52	0.30
1613	0.63	0.56	0.55	0.38
1845	0.67	0.59	0.57	0.41
2100	0.72	0.63	0.61	0.44
2650	0.79	0.68	0.65	0.52
3120	0.77	0.64	0.62	0.65
3570	0.82	0.67	0.65	0.71
4110	0.87	0.70	0.67	0.79
4200	0.89	0.71	0.69	0.79

DRAWDOWN DATA WELL D5

TIME MINUTES	MEASURED DRAWDOWN FEET	AFTER DECLINE FEET	SPRIME FEET	QT/SR2 NO UNITS
21	0.03	0.03	0.03	0.03
42	0.03	0.03	0.03	0.06
94	0.06	0.05	0.05	0.07
164	0.08	0.07	0.07	0.09
305	0.12	0.1	0.1	0.11
396	0.16	0.14	0.14	0.11
518	0.18	0.15	0.15	0.13
664	0.22	0.18	0.18	0.14
1214	0.34	0.27	0.27	0.17
1614	0.37	0.28	0.28	0.22
1848	0.39	0.29	0.29	0.25
2100	0.41	0.3	0.29	0.28
2650	0.47	0.33	0.32	0.32
3120	0.48	0.31	0.31	0.39
3570	0.53	0.34	0.33	0.41
4110	0.58	0.36	0.35	0.45
4200	0.58	0.35	0.35	0.46

030887, DRAWDOWN DATA, PUMPED WELL F1
Q = 4.4 GPM

DRAWDOWN DATA WELL E5

TIME MINUTES	MEASURED DRAWDOWN FEET	AFTER DECLINE FEET	SPRIME FEET	QT/SR2 NO UNITS
27	0.10	0.10	0.10	0.03
43	0.13	0.13	0.13	0.04
97	0.18	0.17	0.17	0.07
165	0.21	0.20	0.20	0.10
306	0.27	0.25	0.25	0.15
397	0.29	0.27	0.26	0.18
519	0.34	0.31	0.30	0.21
666	0.38	0.34	0.34	0.24
1220	0.49	0.42	0.41	0.36
1615	0.54	0.45	0.44	0.45
1850	0.60	0.49	0.48	0.47
2100	0.60	0.48	0.47	0.55
2650	0.67	0.52	0.50	0.64
3120	0.68	0.50	0.49	0.78
3570	0.72	0.51	0.50	0.87
4110	0.78	0.54	0.53	0.95
4200	0.78	0.53	0.52	0.98

DRAWDOWN DATA WELL C5

TIME MINUTES	MEASURED DRAWDOWN FEET	AFTER DECLINE FEET	SPRIME FEET	QT/SR2 NO UNITS
21	0.12	0.12	0.12	0.02
23	0.14	0.14	0.14	0.02
41	0.19	0.19	0.19	0.03
93	0.24	0.24	0.23	0.05
163	0.27	0.26	0.26	0.08
303	0.35	0.34	0.33	0.12
394	0.37	0.35	0.35	0.15
516	0.42	0.40	0.39	0.17
655	0.46	0.43	0.42	0.20
1208	0.59	0.54	0.52	0.30
1613	0.63	0.56	0.55	0.38
1845	0.67	0.59	0.57	0.41
2100	0.72	0.63	0.61	0.44
2650	0.79	0.68	0.65	0.52
3120	0.77	0.64	0.62	0.65
3570	0.82	0.67	0.65	0.71
4110	0.87	0.70	0.67	0.79
4200	0.89	0.71	0.69	0.79

DRAWDOWN DATA WELL D5

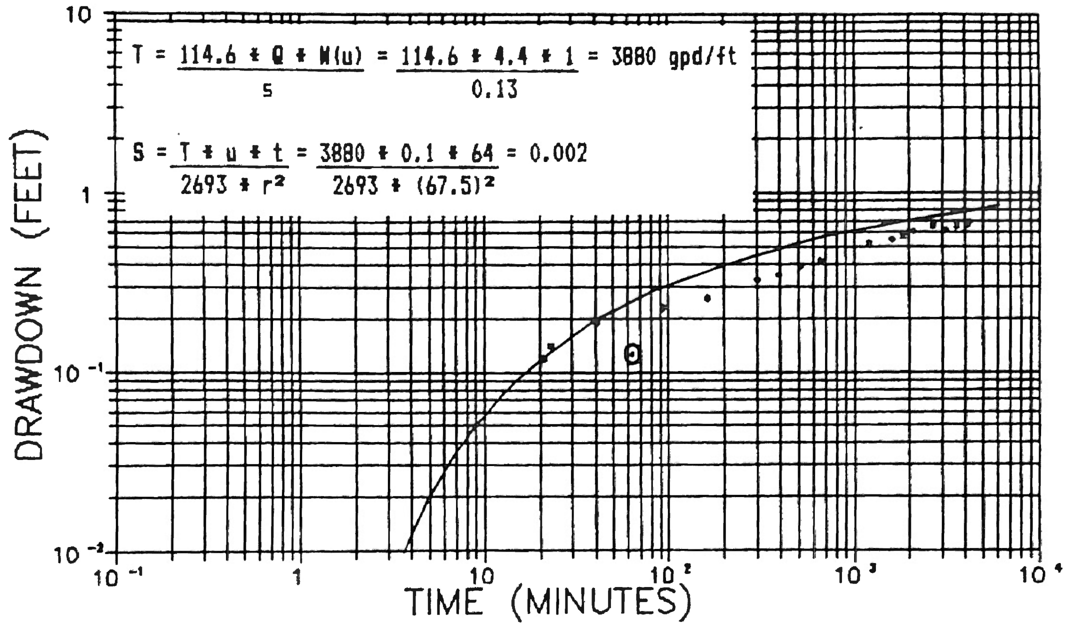
TIME MINUTES	MEASURED DRAWDOWN FEET	AFTER DECLINE FEET	SPRIME FEET	QT/SR2 NO UNITS
21	0.03	0.03	0.03	0.03
42	0.03	0.03	0.03	0.06
94	0.06	0.05	0.05	0.07
164	0.08	0.07	0.07	0.09
305	0.12	0.1	0.1	0.11
396	0.16	0.14	0.14	0.11
518	0.18	0.15	0.15	0.13
664	0.22	0.18	0.18	0.14
1214	0.34	0.27	0.27	0.17
1614	0.37	0.28	0.28	0.22
1848	0.39	0.29	0.29	0.25
2100	0.41	0.3	0.29	0.28
2650	0.47	0.33	0.32	0.32
3120	0.48	0.31	0.31	0.39
3570	0.53	0.34	0.33	0.41
4110	0.58	0.36	0.35	0.45
4200	0.58	0.35	0.35	0.46

030887, DRAWDOWN DATA, PUMPED WELL F1
Q = 4.4 GPM

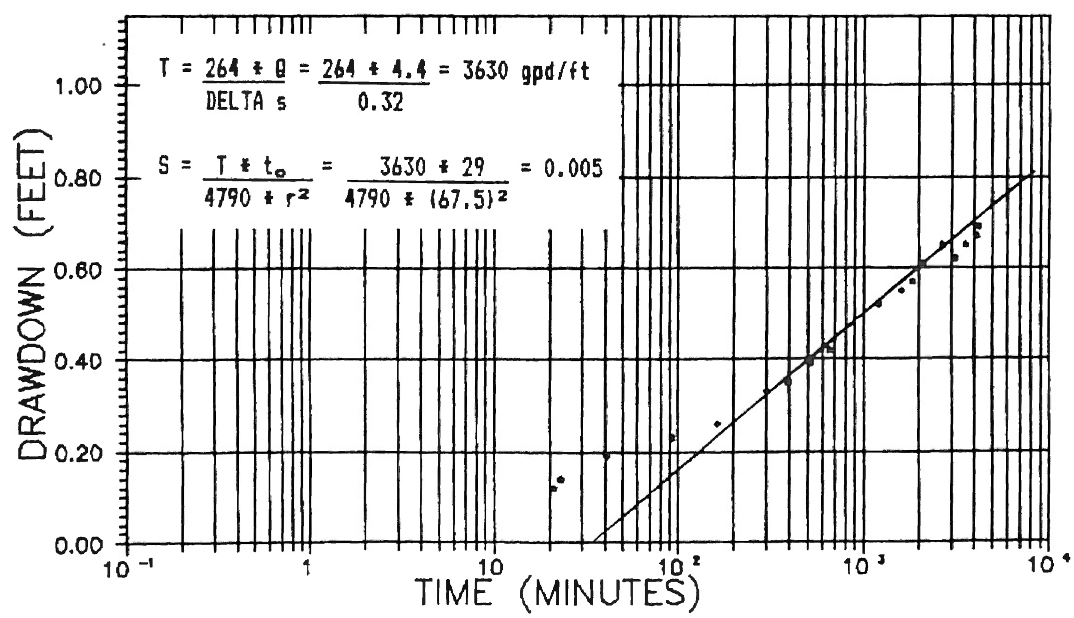
DRAWDOWN DATA WELL E5

TIME MINUTES	MEASURED DRAWDOWN FEET	AFTER DECLINE FEET	SPRIME FEET	QT/SR2 NO UNITS
27	0.10	0.10	0.10	0.03
43	0.13	0.13	0.13	0.04
97	0.18	0.17	0.17	0.07
165	0.21	0.20	0.20	0.10
306	0.27	0.25	0.25	0.15
397	0.29	0.27	0.26	0.18
519	0.34	0.31	0.30	0.21
666	0.38	0.34	0.34	0.24
1220	0.49	0.42	0.41	0.36
1615	0.54	0.45	0.44	0.45
1850	0.60	0.49	0.48	0.47
2100	0.60	0.48	0.47	0.55
2650	0.67	0.52	0.50	0.64
3120	0.68	0.50	0.49	0.78
3570	0.72	0.51	0.50	0.87
4110	0.78	0.54	0.53	0.95
4200	0.78	0.53	0.52	0.98

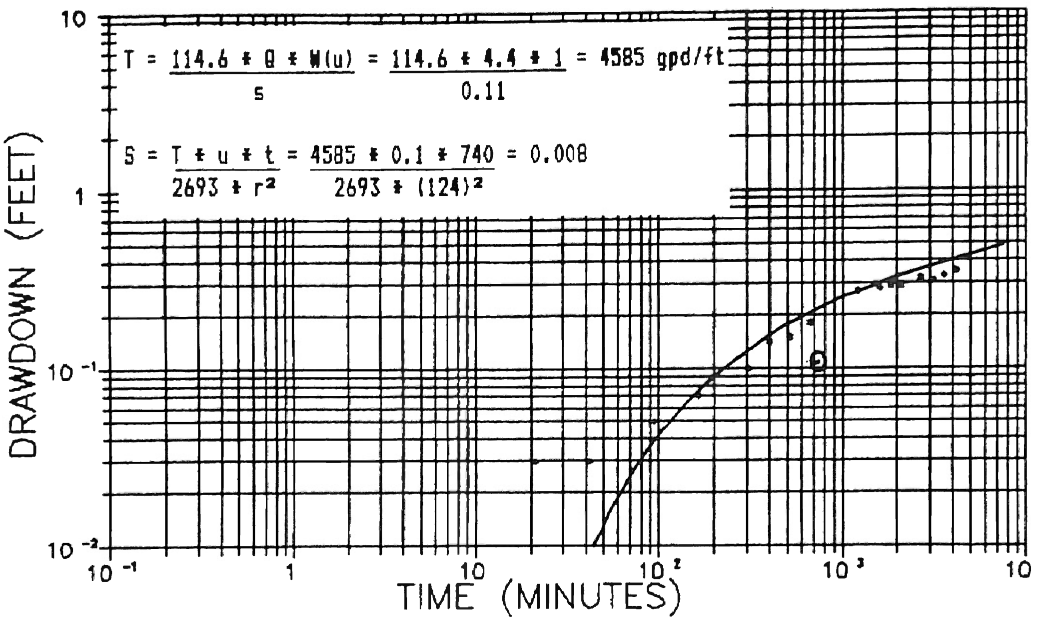
030887, WELL C5, TIME-DRAWDOWN, THEIS METHOD



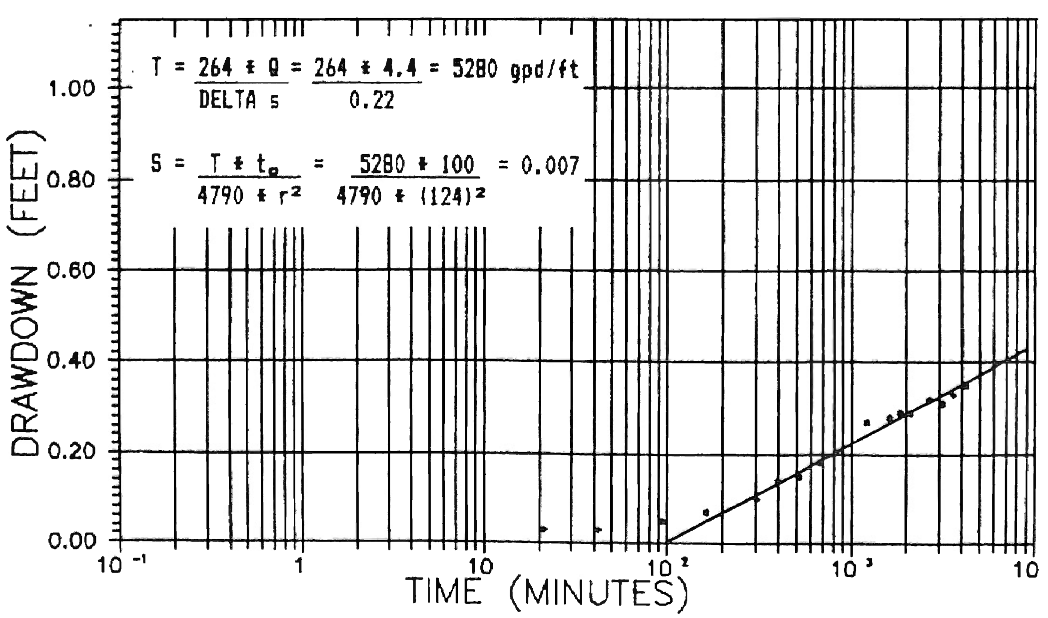
030887, WELL C5, TIME-DRAWDOWN, JACOB METHOD



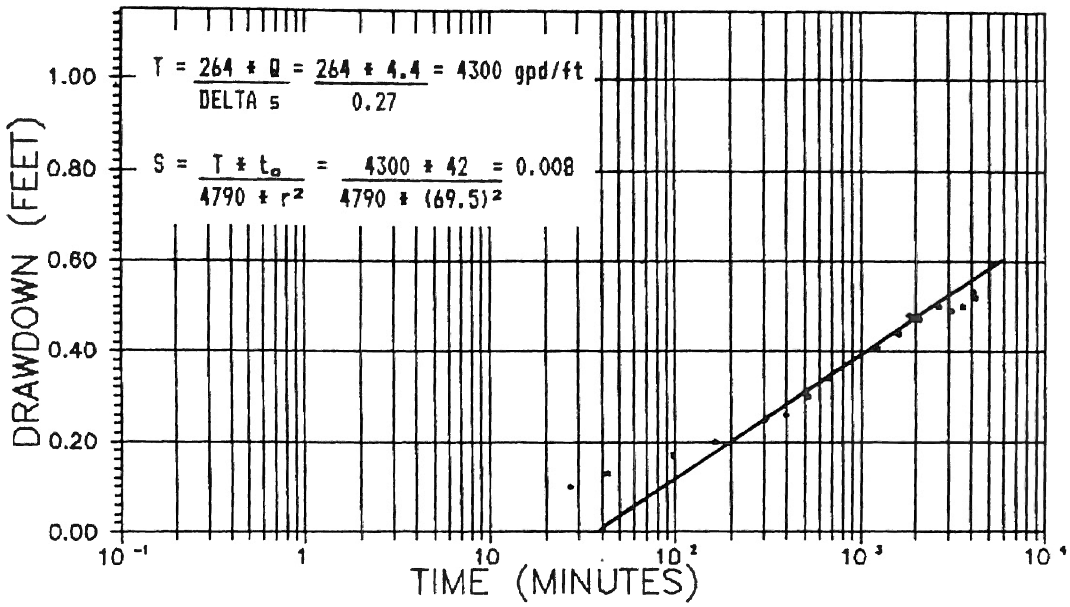
030887, WELL D5, TIME–DRAWDOWN, THEIS METHOD



030887, WELL D5, TIME–DRAWDOWN, JACOB METHOD



030887, WELL E5, TIME-DRAWDOWN, JACOB METHOD



030887. RECOVERY DATA WELL B4, PUMPED WELL F1, Q = 4.4 GPM

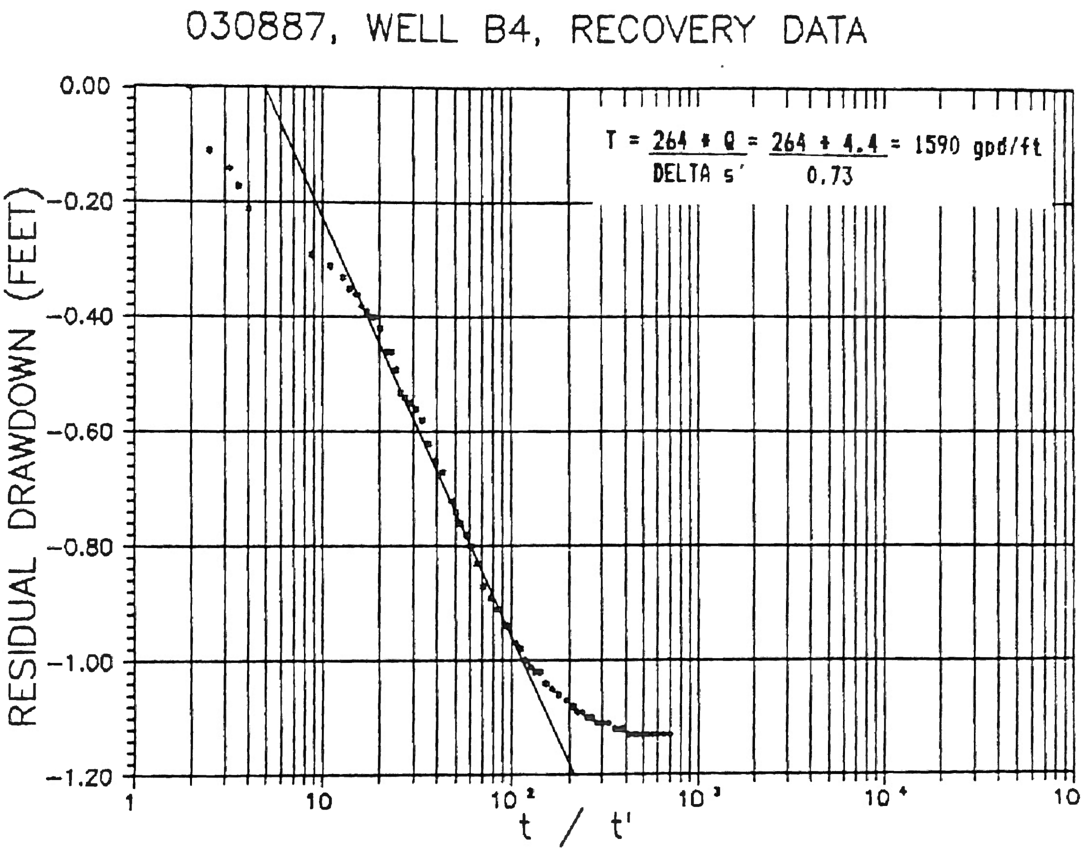
T' MINUTES	T/T' MINUTES	WATER LEVEL FEET	RESIDUAL DRAWDOWN FEET	T' MINUTES	T/T' MINUTES	WATER LEVEL FEET	RESIDUAL DRAWDOWN FEET
6	701.00	6.34	-1.13	60	71.00	6.08	-0.87
6.5	647.15	6.34	-1.13	65	65.62	6.04	-0.83
7	601.00	6.34	-1.13	70	61.00	6.01	-0.80
7.5	561.00	6.34	-1.13	75	57.00	5.99	-0.78
8	526.00	6.34	-1.13	80	53.50	5.97	-0.76
8.5	495.12	6.34	-1.13	85	50.41	5.95	-0.74
9	467.67	6.34	-1.13	90	47.67	5.93	-0.72
9.5	443.11	6.34	-1.13	100	43.00	5.88	-0.67
10	421.00	6.34	-1.13	110	39.18	5.86	-0.65
11	382.82	6.33	-1.12	120	36.00	5.83	-0.62
12	351.00	6.33	-1.12	130	33.31	5.79	-0.58
13	324.08	6.32	-1.11	140	31.00	5.77	-0.56
14	301.00	6.32	-1.11	150	29.00	5.76	-0.55
15	281.00	6.32	-1.11	160	27.25	5.75	-0.54
16	263.50	6.31	-1.10	170	25.71	5.74	-0.53
17	248.06	6.31	-1.10	180	24.33	5.70	-0.49
18	234.33	6.30	-1.09	190	23.11	5.68	-0.46
19	222.05	6.30	-1.09	200	22.00	5.68	-0.46
20	211.00	6.29	-1.08	220	20.09	5.64	-0.42
22	191.91	6.28	-1.07	240	18.50	5.62	-0.40
24	176.00	6.27	-1.06	260	17.15	5.61	-0.39
26	162.54	6.26	-1.05	280	16.00	5.60	-0.38
28	151.00	6.25	-1.04	300	15.00	5.58	-0.36
30	141.00	6.23	-1.02	330	13.73	5.57	-0.35
32	132.25	6.23	-1.02	360	12.67	5.55	-0.33
34	124.53	6.22	-1.01	420	11.00	5.54	-0.31
36	117.67	6.21	-1.00	540	8.78	5.52	-0.29
38	111.53	6.19	-0.98	1380	4.04	5.49	-0.21
40	106.00	6.18	-0.97	1650	3.55	5.46	-0.17
45	94.33	6.15	-0.94	1920	3.19	5.45	-0.14
50	85.00	6.12	-0.91	2820	2.49	5.47	-0.11
55	77.36	6.10	-0.89	4300	1.98	5.43	0.00

T' = TIME SINCE PUMPING STOPPED

T/T' = TIME SINCE PUMPING STARTED / TIME SINCE PUMPING STOPPED

WATER LEVEL = DEPTH TO WATER FROM TOP CASING AFTER PUMPING STOPPED

RESIDUAL DRAWDOWN = INITIAL WATER LEVEL CORRECTED FOR DAILY DECLINE - WATER LEVEL


030887, WELL B4, RECOVERY DATA
RESIDUAL DRAWDOWN (FEET)
0.00
-0.20
-0.40
-0.60
-0.80
-1.00
-1.20
1
10
10 ²
10 ³
10 ⁴
10 ⁵
t / t'
T = 264 * Q = 264 * 4.4 = 1590 gpd/ft
DELTA s' 0.73

030887. RECOVERY DATA WELL E5, PUMPED WELL F1, Q = 4.4 GPM

T' MINUTES	T/T' MINUTES	WATER LEVEL FEET	RESIDUAL DRAWDOWN FEET
6.0	701.00	4.80	-0.53
6.5	647.15	4.79	-0.52
7.0	601.00	4.79	-0.52
7.5	561.00	4.79	-0.52
8.0	526.00	4.79	-0.52
8.5	495.12	4.79	-0.52
9.0	467.67	4.79	-0.52
9.5	443.11	4.79	-0.52
10	421.00	4.79	-0.52
11	382.82	4.80	-0.53
12	351.00	4.78	-0.51
13	324.08	4.77	-0.50
14	301.00	4.77	-0.50
15	281.00	4.77	-0.50
16	263.50	4.77	-0.50
17	248.06	4.77	-0.50
18	234.33	4.76	-0.49
19	222.05	4.76	-0.49
20	211.00	4.76	-0.49
22	191.91	4.75	-0.48
24	176.00	4.74	-0.47
26	162.54	4.74	-0.47
28	151.00	4.74	-0.47
30	141.00	4.73	-0.46
32	132.25	4.73	-0.46
34	124.53	4.73	-0.46
36	117.67	4.72	-0.45
38	111.53	4.72	-0.45
40	106.00	4.71	-0.44
45	94.33	4.71	-0.44
50	85.00	4.70	-0.43
55	77.36	4.69	-0.42

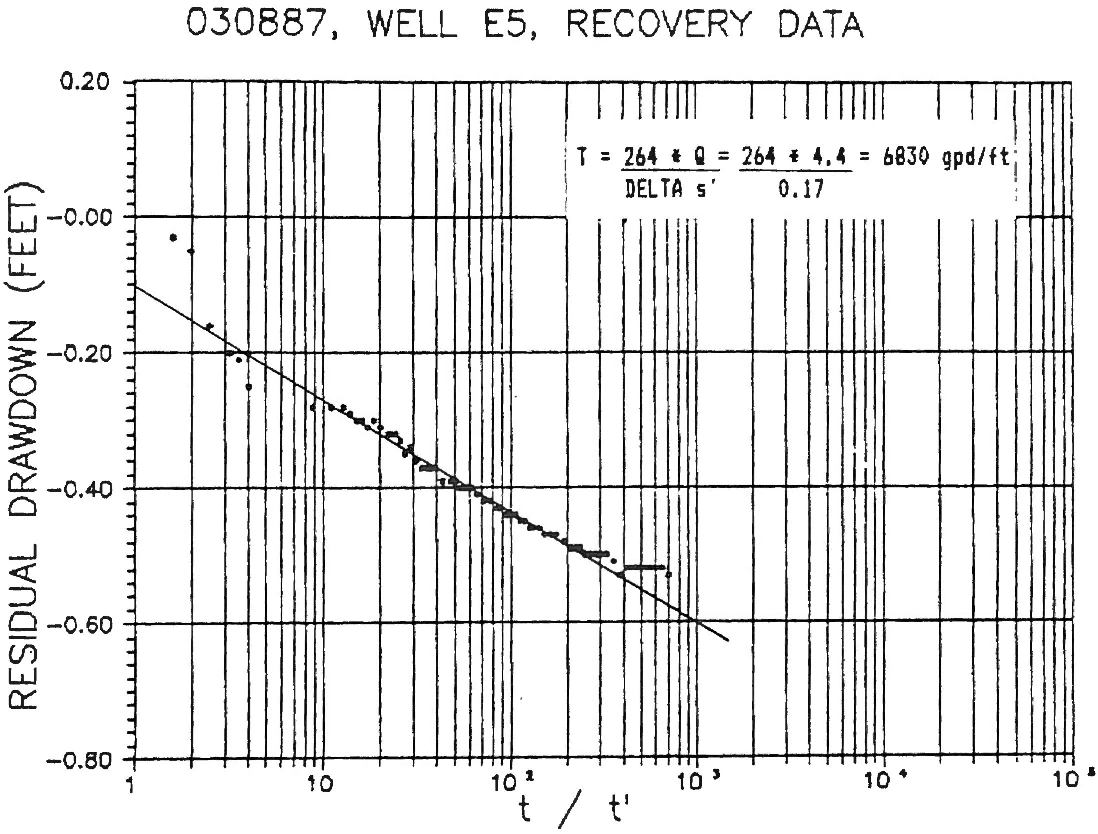
T' MINUTES	T/T' MINUTES	WATER LEVEL FEET	RESIDUAL DRAWDOWN FEET
60	71.00	4.69	-0.42
65	65.62	4.68	-0.41
70	61.00	4.67	-0.40
75	57.00	4.67	-0.40
80	53.50	4.67	-0.40
85	50.41	4.66	-0.39
90	47.67	4.66	-0.39
100	43.00	4.66	-0.39
110	39.18	4.64	-0.37
120	36.00	4.64	-0.37
130	33.31	4.64	-0.37
140	31.00	4.63	-0.36
150	29.00	4.61	-0.34
160	27.25	4.62	-0.35
170	25.71	4.61	-0.33
180	24.33	4.60	-0.32
190	23.11	4.60	-0.32
200	22.00	4.60	-0.32
220	20.09	4.59	-0.31
240	18.50	4.58	-0.30
260	17.15	4.59	-0.31
280	16.00	4.58	-0.30
300	15.00	4.58	-0.30
330	13.73	4.57	-0.29
360	12.67	4.57	-0.28
420	11.00	4.57	-0.28
540	8.78	4.58	-0.28
1380	4.04	4.60	-0.25
1650	3.55	4.57	-0.21
1920	3.19	4.58	-0.20
2820	2.49	4.59	-0.16
4300	1.98	4.57	-0.05
7180	1.58	4.71	-0.03

T' = TIME SINCE PUMPING STOPPED

T/T' = TIME SINCE PUMPING STARTED / TIME SINCE PUMPING STOPPED

WATER LEVEL = DEPTH TO WATER FROM TOP CASING AFTER PUMPING STOPPED

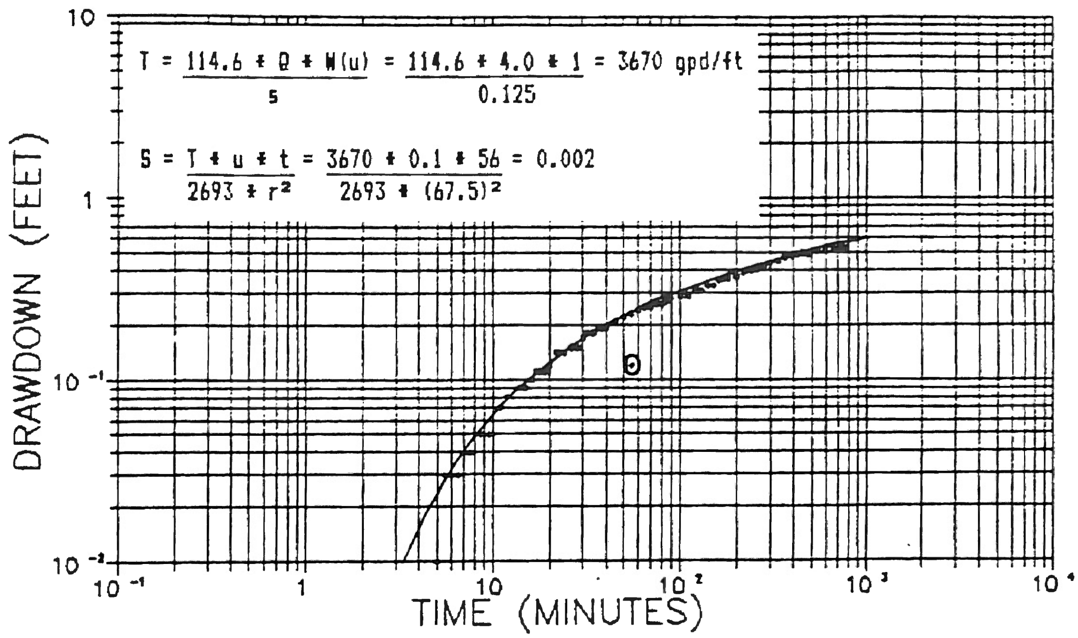
RESIDUAL DRAWDOWN = INITIAL WATER LEVEL CORRECTED FOR DAILY DECLINE - WATER LEVEL


030887, WELL E5, RECOVERY DATA
T = 264 * Q / DELTA s' = 264 * 4.4 / 0.17 = 6830 gpd/ft
RESIDUAL DRAWDOWN (FEET)
0.20
-0.00
-0.20
-0.40
-0.60
-0.80
1
10
10²
10³
10⁴
10⁵
t / t'

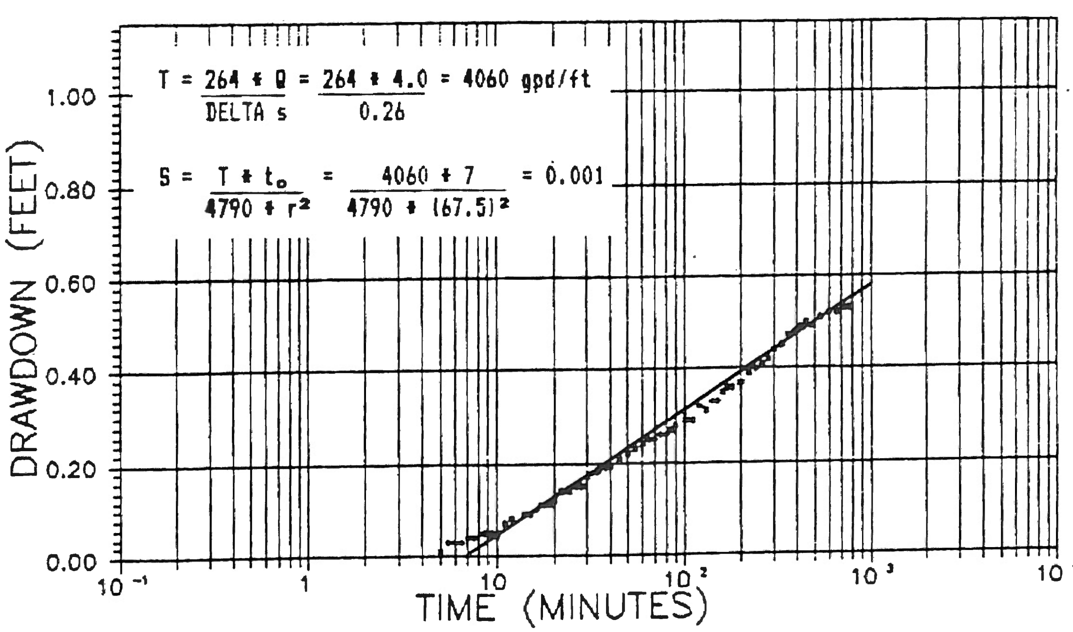
051887. DRAWDOWN DATA WELL C5, PUMPED WELL F1, Q = 4.0 GPM

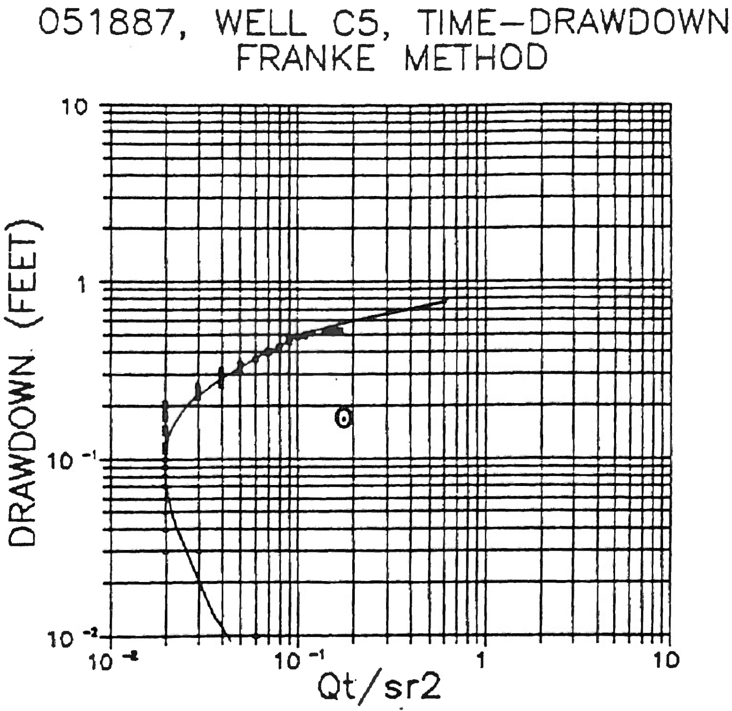
TIME MINUTES	MEASURED DRAWDOWN FEET	AFTER DECLINE FEET	SPRIME FEET	QT/SR2 NO UNITS	TIME MINUTES	MEASURED DRAWDOWN FEET	AFTER DECLINE FEET	SPRIME FEET	QT/SR2 NO UNITS
5	0.01	0.01	0.01	0.06	65	0.26	0.26	0.25	0.03
5.5	0.03	0.03	0.03	0.02	70	0.26	0.26	0.25	0.03
6	0.03	0.03	0.03	0.02	75	0.27	0.27	0.26	0.03
6.5	0.03	0.03	0.03	0.03	80	0.27	0.27	0.26	0.04
7	0.04	0.04	0.04	0.02	85	0.28	0.28	0.27	0.04
7.5	0.04	0.04	0.04	0.02	90	0.29	0.29	0.28	0.04
8.5	0.05	0.05	0.05	0.02	100	0.30	0.29	0.29	0.04
9	0.05	0.05	0.05	0.02	110	0.30	0.29	0.29	0.04
9.5	0.05	0.05	0.05	0.02	120	0.33	0.32	0.32	0.04
10	0.05	0.05	0.05	0.02	130	0.33	0.32	0.31	0.05
11	0.07	0.07	0.07	0.02	140	0.35	0.34	0.33	0.05
12	0.08	0.08	0.08	0.02	150	0.35	0.34	0.33	0.05
14	0.09	0.09	0.09	0.02	160	0.37	0.36	0.35	0.05
15	0.09	0.09	0.09	0.02	170	0.38	0.37	0.36	0.06
16	0.10	0.10	0.10	0.02	180	0.38	0.37	0.36	0.06
17	0.11	0.11	0.11	0.02	200	0.39	0.38	0.37	0.06
18	0.11	0.11	0.11	0.02	220	0.41	0.40	0.39	0.07
19	0.11	0.11	0.11	0.02	240	0.43	0.42	0.40	0.07
20	0.12	0.12	0.12	0.02	260	0.44	0.43	0.41	0.07
22	0.14	0.14	0.14	0.02	280	0.45	0.43	0.42	0.08
24	0.14	0.14	0.14	0.02	300	0.47	0.45	0.44	0.08
26	0.15	0.15	0.15	0.02	330	0.49	0.47	0.45	0.09
28	0.15	0.15	0.15	0.02	360	0.51	0.49	0.47	0.09
30	0.17	0.17	0.17	0.02	390	0.52	0.50	0.48	0.10
32	0.18	0.18	0.18	0.02	420	0.53	0.51	0.49	0.10
34	0.18	0.18	0.18	0.02	450	0.54	0.52	0.50	0.11
36	0.19	0.19	0.19	0.02	480	0.54	0.51	0.49	0.11
38	0.20	0.20	0.19	0.02	540	0.56	0.53	0.51	0.12
40	0.20	0.20	0.19	0.02	600	0.57	0.54	0.52	0.14
45	0.22	0.22	0.21	0.02	660	0.58	0.54	0.52	0.15
50	0.23	0.23	0.22	0.03	720	0.59	0.55	0.53	0.16
55	0.24	0.24	0.23	0.03	765	0.59	0.55	0.53	0.17
60	0.25	0.25	0.24	0.03					

051887, WELL C5, TIME-DRAWDOWN, THEIS METHOD



051887, WELL C5, TIME-DRAWDOWN, JACOB METHOD





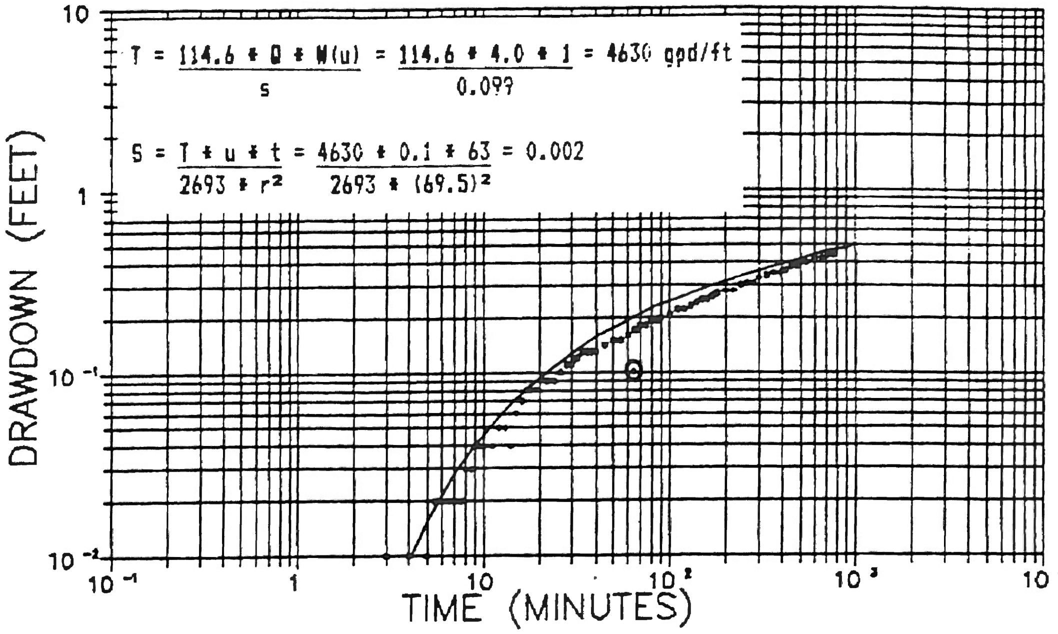
T = Q/s * (sT/Q)(type) * 7.48 = 770/0.16 * 0.1 * 7.48
= 3600 gpd/ft

S = Qt/sr2(graph) / Qt/sr2(type) = 0.19 / 100 = 0.002

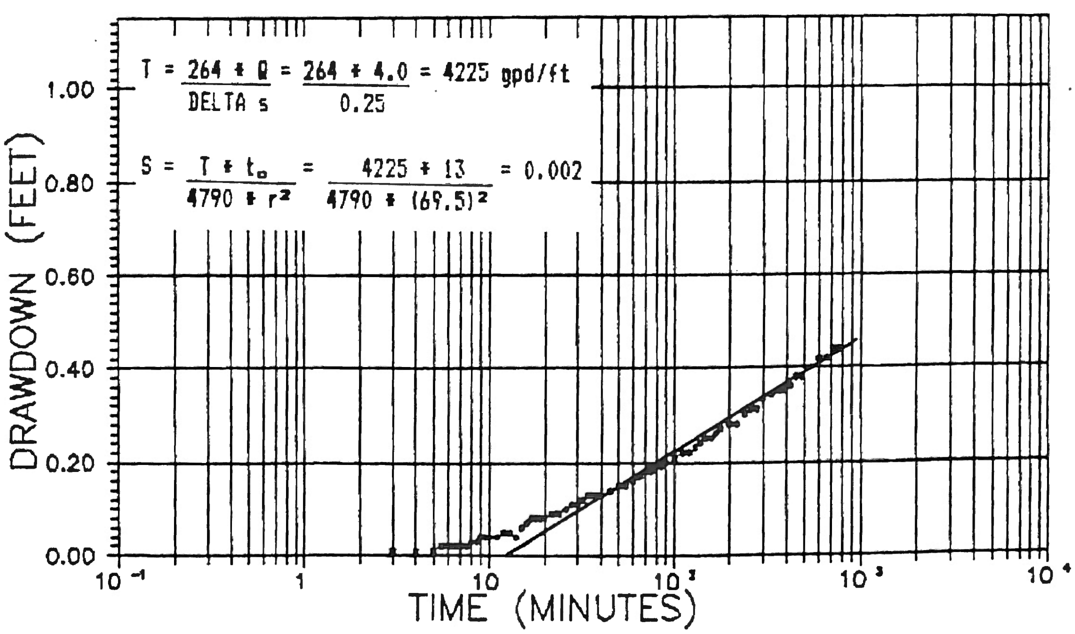
051887, DRAWDOWN DATA WELL E5, PUMPED WELL F1, Q = 4.0 GPM

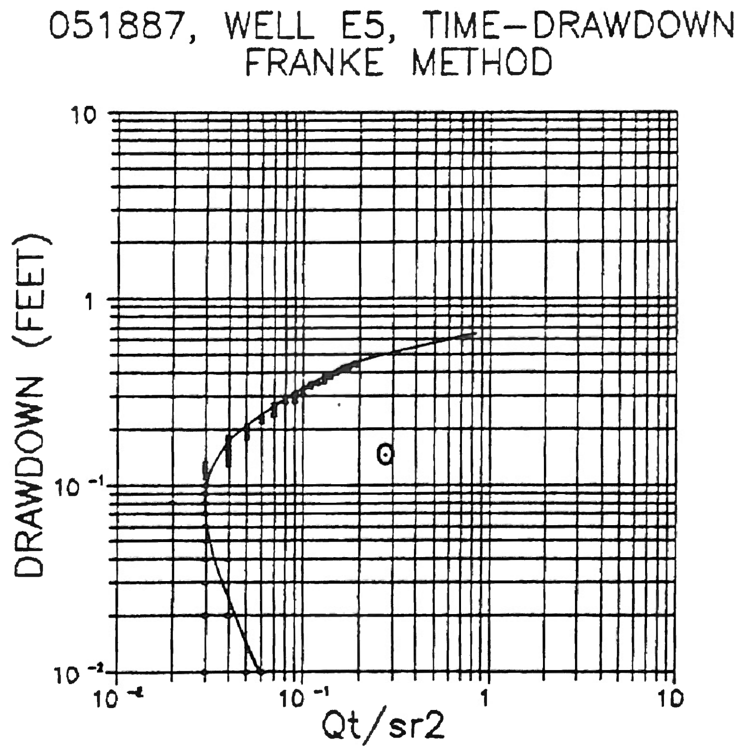
TIME MINUTES	MEASURED DRAWDOWN FEET	AFTER DECLINE FEET	SPRIME FEET	QT/SR2 NO UNITS	TIME MINUTES	MEASURED DRAWDOWN FEET	AFTER DECLINE FEET	SPRIME FEET	QT/SR2 NO UNITS
3	0.01	0.01	0.01	0.03	55	0.16	0.16	0.15	0.04
4	0.01	0.01	0.01	0.05	60	0.17	0.17	0.16	0.04
5	0.01	0.01	0.01	0.06	65	0.18	0.18	0.17	0.04
5.5	0.02	0.02	0.02	0.03	70	0.19	0.19	0.18	0.04
6	0.02	0.02	0.02	0.03	75	0.19	0.19	0.18	0.05
6.5	0.02	0.02	0.02	0.04	80	0.20	0.19	0.19	0.05
7	0.02	0.02	0.02	0.04	85	0.20	0.19	0.19	0.05
7.5	0.02	0.02	0.02	0.04	90	0.21	0.20	0.20	0.05
8	0.03	0.03	0.03	0.03	100	0.22	0.21	0.21	0.05
8.5	0.03	0.03	0.03	0.03	110	0.23	0.22	0.22	0.06
9	0.04	0.04	0.04	0.03	120	0.23	0.22	0.22	0.06
9.5	0.04	0.04	0.04	0.03	130	0.24	0.23	0.23	0.06
10	0.04	0.04	0.04	0.03	140	0.25	0.24	0.24	0.07
11	0.04	0.04	0.04	0.03	150	0.26	0.25	0.25	0.07
12	0.05	0.05	0.05	0.03	160	0.27	0.26	0.25	0.07
13	0.05	0.05	0.05	0.03	170	0.28	0.27	0.26	0.07
14	0.04	0.04	0.04	0.04	180	0.29	0.28	0.27	0.07
15	0.06	0.06	0.06	0.03	200	0.30	0.29	0.28	0.08
16	0.07	0.07	0.07	0.03	220	0.30	0.29	0.28	0.09
17	0.08	0.08	0.08	0.02	240	0.32	0.30	0.30	0.09
18	0.08	0.08	0.08	0.03	260	0.33	0.31	0.31	0.09
19	0.08	0.08	0.08	0.03	280	0.34	0.32	0.31	0.10
20	0.08	0.08	0.08	0.03	300	0.36	0.34	0.33	0.10
22	0.09	0.09	0.09	0.03	330	0.37	0.35	0.34	0.11
24	0.09	0.09	0.09	0.03	360	0.38	0.36	0.35	0.11
26	0.10	0.10	0.10	0.03	390	0.39	0.36	0.35	0.12
28	0.11	0.11	0.11	0.03	420	0.40	0.37	0.36	0.13
30	0.11	0.11	0.11	0.03	450	0.42	0.39	0.38	0.13
32	0.12	0.12	0.12	0.03	480	0.42	0.39	0.38	0.14
34	0.13	0.13	0.13	0.03	540	0.45	0.42	0.40	0.15
36	0.13	0.13	0.13	0.03	600	0.47	0.43	0.42	0.16
38	0.13	0.13	0.13	0.03	660	0.48	0.44	0.42	0.17
40	0.13	0.13	0.13	0.04	720	0.50	0.45	0.44	0.18
45	0.14	0.14	0.14	0.04	765	0.50	0.45	0.44	0.19
50	0.15	0.15	0.15	0.04					

051887, WELL E5, TIME-DRAWDOWN, THEIS METHOD



051887, WELL E5, TIME-DRAWDOWN, JACOB METHOD





T = Q/s * (sT/Q)(type) * 7.48 = 770/0.135 * 0.1 * 7.48
= 4265 gpd/ft

$$S = \frac{Qt/sr2(graph)}{Qt/sr2(type)} = \frac{0.29}{100} = 0.003$$

DISTANCE-DRAWDOWN DATA

102786, DISTANCE-DRAWDOWN DATA, PUMPED WELL E5
@ t = 4254 MINUTES AVERAGE Q = 1.07 GPM

WELL	DISTANCE FEET	DISTANCE SQUARED FEET	t = 4254 SPRIME FEET
A5	101	10200	0.12
C5	100	10000	0.13
D5	78	6085	0.11
E4	1	1	0.67

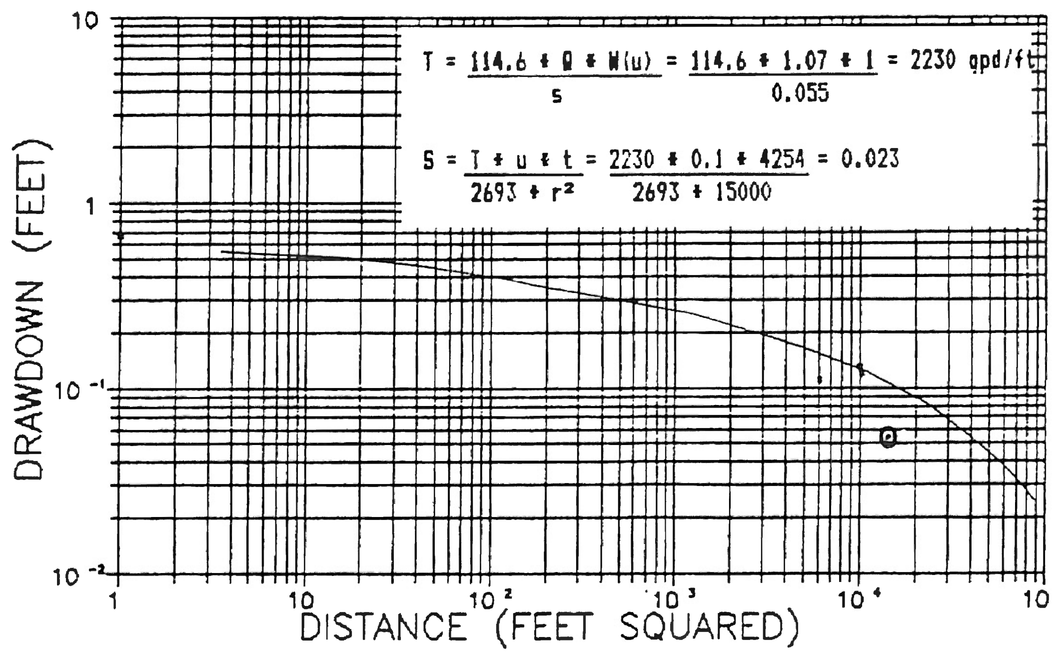
030887, DISTANCE-DRAWDOWN DATA, PUMPED WELL F1
@ t = 660 MINUTES AVERAGE Q = 4.76 GPM
@t = 4200 MINUTES AVERAGE Q = 4.44 GPM

WELL	DISTANCE FEET	DISTANCE SQUARED FEET	t = 660 SPRIME FEET	t = 4200 SPRIME FEET
A5	25.0	625	0.90	1.04
B4	24.5	600	0.91	1.06
C5	67.5	4555	0.42	0.68
D5	124.0	15376	0.18	0.34
E5	69.5	4830	0.33	0.52

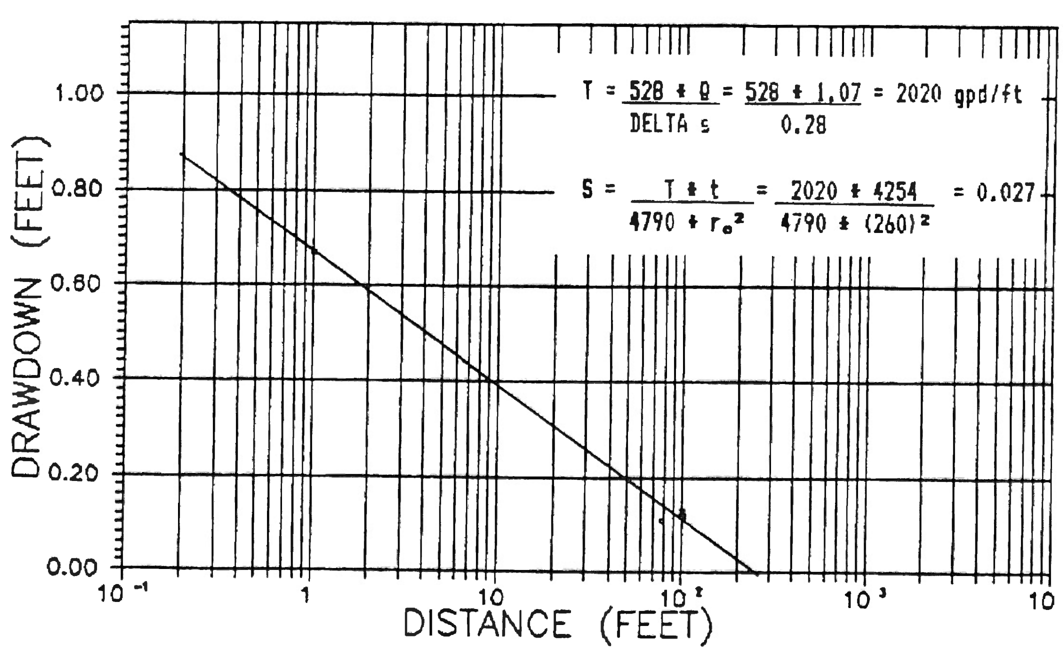
051887, DISTANCE-DRAWDOWN DATA, PUMPED WELL F1
@ t = 765 MINUTES AVERAGE Q = 4.0 GPM

WELL	DISTANCE FEET	DISTANCE SQUARED FEET	t = 765 SPRIME FEET
A5	25.0	625	0.90
B4	24.5	600	0.89
C5	67.5	4555	0.53
D5	124.0	15376	0.28
E5	69.5	4830	0.44

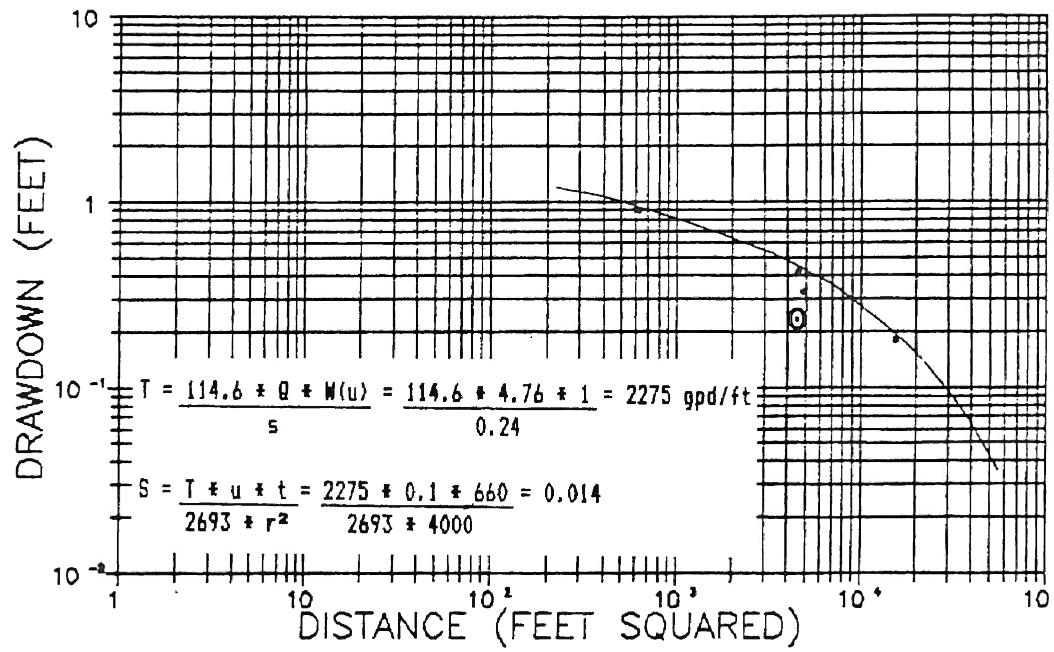
102786, DISTANCE–DRAWDOWN, t = 4254, THEIS METHOD



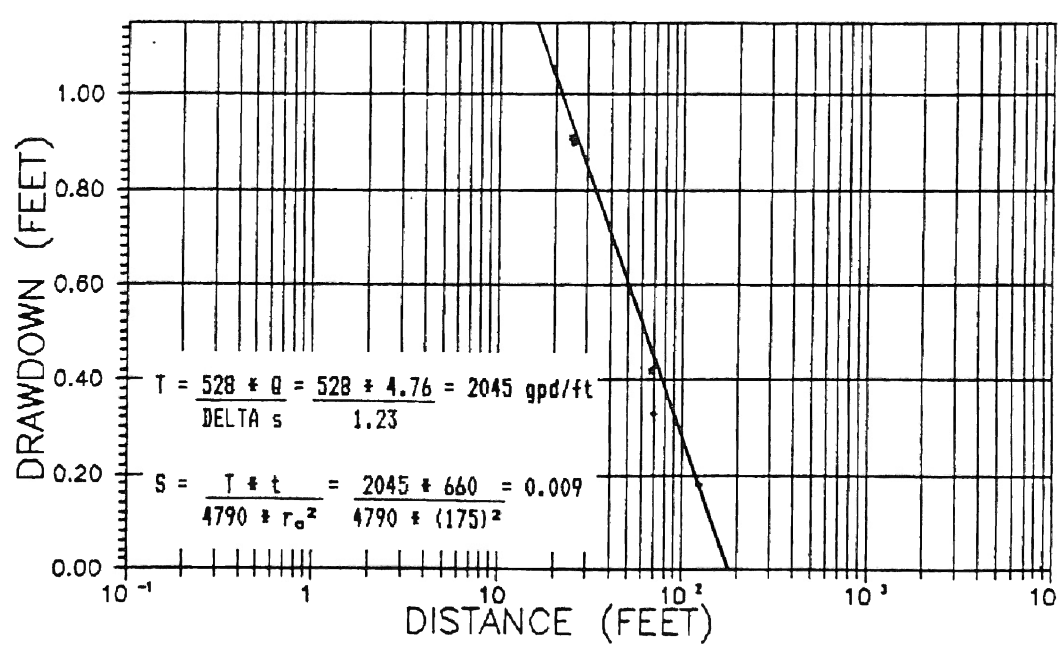
102786, DISTANCE–DRAWDOWN, t = 4254, JACOB METHOD



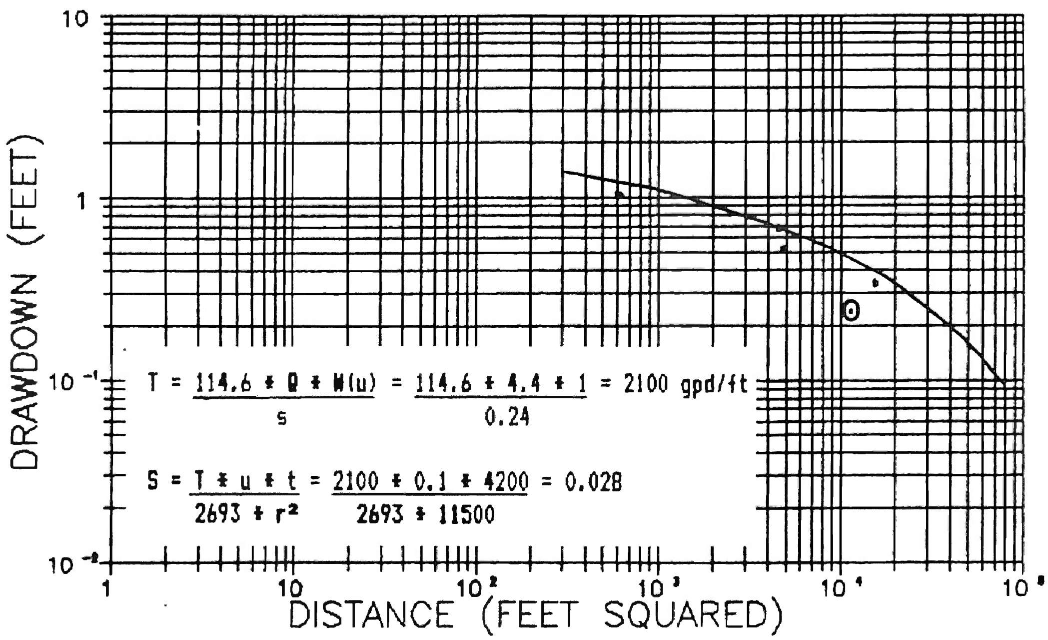
030887, DISTANCE–DRAWDOWN, t = 660, THEIS METHOD



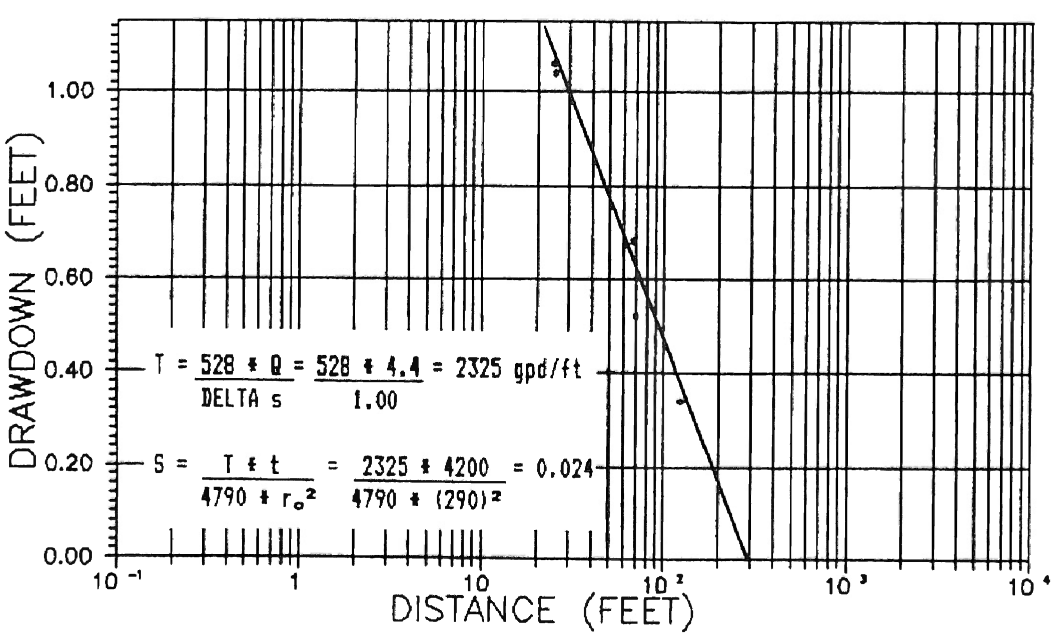
030887, DISTANCE–DRAWDOWN, t = 660, JACOB METHOD



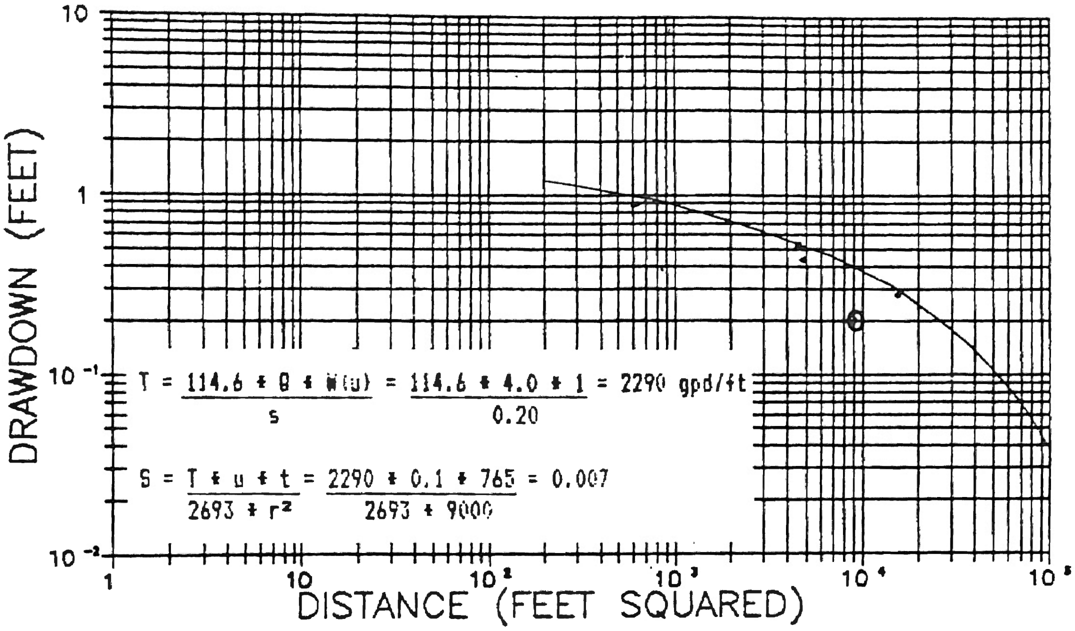
030887, DISTANCE–DRAWDOWN, t = 4200, THEIS METHOD



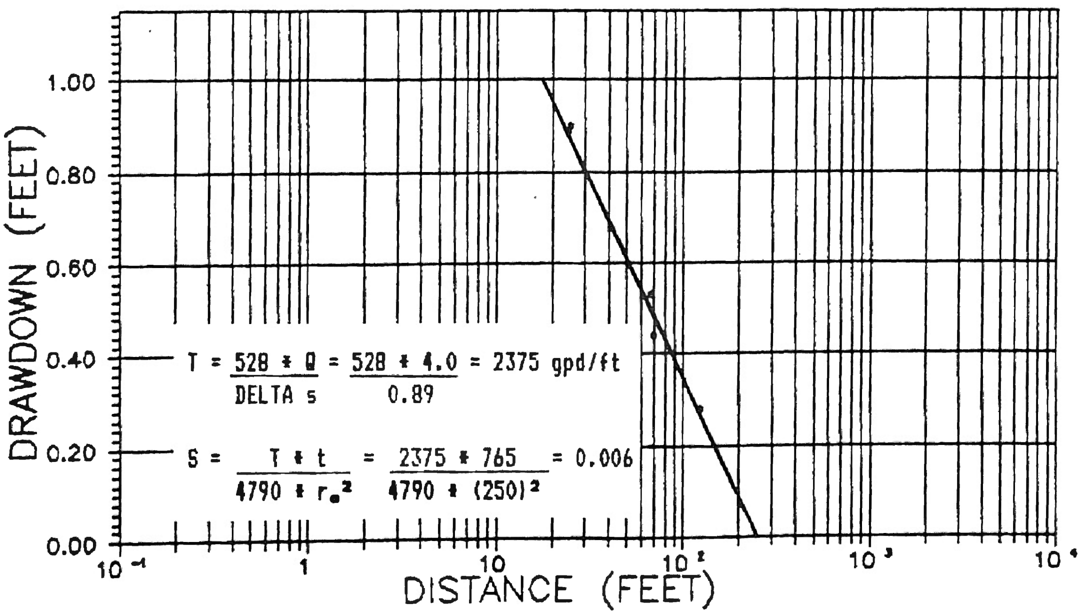
030887, DISTANCE–DRAWDOWN, t = 4200, JACOB METHOD



051887, DISTANCE–DRAWDOWN, t = 765, THEIS METHOD



051887, DISTANCE–DRAWDOWN, t = 765, JACOB METHOD



VITA

Blythe Lynn Hoyle

Candidate for the Degree of

Master of Science

Thesis: SUBURBAN HYDROGEOLOGY AND GROUND-WATER GEOCHEMISTRY OF THE ASHPORT SILT LOAM, PAYNE COUNTY, OKLAHOMA

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Personal Data: Born in Los Angeles, California, 4 July 1954, the daughter of Tonnie A. and Betty L. Hoyle.

Education: Graduated from Tiffin Columbian High School, Tiffin, Ohio, in June 1972; received Bachelor of Science Degree in Geology from Ohio State University in June 1976; received Master of Arts Degree in Geology from the University of Texas at Austin in December 1978; completed requirements for the Master of Science Degree at Oklahoma State University in December 1987.

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Professional Societies: Association of Ground Water Scientists and Engineers, a Division of National Water Well Association.