Report #76

S. S. PAPADOPULOS & ASSOCIATES, INC.

MEMORANDUM

To: Mr. Juan R. Velasquez, UNC Mining and Milling
From: Steven P. Larson, S. S. Papadopulos & Associates, Inc. SPL
Date: December 9, 1983
Copy: Dr. Gale K. Billings, Billings & Associates, Inc.

Subject: UNC Churchrock Mill - Leakage Characteristic of Zone 2

This memorandum summarizes our evaluation of water-level data collected during the first month of operation of the Seepage Cleanup System at the United Nuclear Corporation (UNC) Churchrock Mill. A draft of this memorandum was reviewed by Dr. Gale K. Billings of Billings & Associates and his comments have been included in the text below.

Introduction

The thorium Seepage Cleanup System at the UNC - Churchrock Mill began pumping on November 1, 1983. As of November 28, approximately 1.1 million gallons of seepage have been recovered from 4 wells open to the hydrogeologic unit referred to as Zone 3 of the Upper Gallup Formation. Pursuant to an agreement between UNC and the New Mexico Environmental Improvement Division (NMEID), recovery of seepage from the hydrogeologic unit referred to as Zone 1 of the Upper Gallup Formation was deferred for about 30 days to monitor changes in the water levels of Zone 1 due to pumping in Zone 3. Results of this monitoring were to be used for evaluating the leakage characteristics (specifically vertical permeability) of the finer-grained rock unit referred to as Zone 2 which separates Zone 3 from Zone 1. This memorandum presents the results of the water-level monitoring program as of November 29, 1983 and the interpretation of the data with respect to the vertical permeability of Zone 2. Detailed discussions of overall hydrogeologic conditions and of the thorium seepage recovery system are to be presented in subsequent reports concerning the Seepage Cleanup System.

Results of Water-Level Monitoring

Ground-water levels in the vicinity of the pumping system have been monitored for this specific program since late October of 1983. Fifty-five

wells are included in this monitoring program as shown in Figure 1. The water-level measurements made in these wells between late October and November 29, 1983 and measurements of discharge rate for the pumping wells are tabulated in Attachment 1.

As stated above, a complete evaluation of these data and of the performance of the seepage recovery system will be made in subsequent reports. These reports will be initiated after Zone 1 recovery operations have been under way for a period of approximately 30 days. A brief discussion of the data is presented below to provide background for the analysis concerning vertical permeability or leakage characteristics between Zone 3 and Zone 1.

Pumping from Zone 3 has produced significant water-level declines in many of the wells completed in this zone. The water-level hydrograph for well 609 is presented in Figure 2. This well was selected because it is near the area of pumpage and it is also near monitoring wells 607 and 612 which are completed in Zone 1. In contrast to the water levels in well 609 (Zone 3), the water levels in wells 607 and 612 (Zone 1) have risen gradually during the monitoring period (Figure 3). The rise in water levels has been observed historically and has continued through the monitoring period. Water levels in wells that are located beyond the influence of pumping indicate that the rate of rise during the monitoring period was about 0.02 feet per day in both Zones 1 and 3.

The trend of rising water levels makes the evaluation of water-level declines caused by pumping slightly more complex because small drawdowns may not be discernible from the trend and/or natural fluctuations of the water level. The water-level rise in wells 607 and 612 is essentially the same as the regional trend and thus a water-level decline due to pumping cannot be distinguished. Also, the water levels in well 609 must be corrected for the rising trend in order to calculate the drawdown caused by pumping. Note that since the trend is regional, it does not affect the changes in the gradient of the water levels caused by pumping. Consequently, this rising trend has no effect on the performance of the Seepage Cleanup System.

Leakage Characteristics of Zone 2 (Upper Gallup Formation)

As stated above, the pumping from Zone 3 has not produced distinguishable

effects on water levels in Zone 1. Thus, the absolute leakage characteristics between the two zones cannot be determined from the data. An analysis of the data can be made to provide an estimate of an upper limit for the value of vertical permeability between the two zones.

Since the vertical permeability between Zone 3 and Zone 1 is obviously much less than the horizontal permeability of Zone 3, a disturbance (i.e. water-level change) in Zone 3 will propagate vertically downward toward Zone 1. The rate of propagation can be analyzed in a one-dimensional framework with an origin at the base of Zone 3. The water-level changes in well 609 (Zone 3) can be used to approximate the conditions in Zone 3 near wells 607 and 612 (Zone 1), and theoretical changes in Zone 1 water levels can be calculated for a range of values of vertical permeability.

The water levels in wells 607 and 612 do not show a recognizable deviation from the regional trend. However, a minimum water-level change that would be recognizable can be selected. A change that is larger than this minimum value should be distinguishable in spite of the trend and other fluctuations in the data. The vertical permeability that would produce a calculated response approximately equal to this minimum value represents an upper limit for the value of vertical permeability between Zone 3 and Zone 1.

The theoretical response in Zone 1 caused by the water-level changes in Zone 3 can be calculated using a step response function. The step response function (Ferris, et. al., 1962) is;

$$s(z,t) = s_0 \, \mathrm{erfc}(u)$$

where $s(z,t)$ is the drawdown (or water-level change) at depth, z, and time, t, caused by a drawdown, s_0, at $z=0$ and $t=0$. The function erfc is the complementary error function. The variable u is equal to $(z^2 S_s/4k_z t)^{0.5}$, where k_z is vertical permeability and S_s is specific storage coefficient.

The step response function assumes that the drawdown at $z=0$ occurs instantaneously at $t=0$. The drawdown at the base of Zone 3 near wells 607 and 612 develops at a rate similar to that indicated by the measurements in well 609 (Figure 2). Since the total drawdown does not occur instantaneously, the use of a single-step response function to approximate this drawdwon will tend

to overstate the calculated response in Zone 1 and, consequently, underestimate the upper limit for the vertical permeability of Zone 2. That is, if the exact pattern of drawdown with time in Zone 3 were used, a higher value of vertical permeability would be required to produce a drawdown equivalent to that calculated with the single-step response function. Since the intent of this analysis is to obtain an estimate of the upper limit for the vertical permeability of Zone 2, it is desirable to approximate the drawdown conditions in Zone 3 as closely as possible. This can be accomplished by dividing the drawdown pattern in Zone 3 into a sequence of discrete incremental steps. The effect of each incremental step at time, t, is accumulated to calculate the total drawdown in Zone 2. This procedure, which is based on the principle of convolution, is described in several references (see, for example, Bedinger and Reed, 1964, or Hall and Moench, 1972). In this particular case, the difference in results between an analysis using a single instantaneous step and the results using the convolution procedure are not very large. However, the convolution procedure was used to obtain the results presented in the following paragraphs.

The drawdown in well 609 between 12:00 noon on November 1 and 2:26 PM on November 28 is 6.08 feet. The increase in water level due to the rising trend would be about 0.54 feet for this 27-day period, using a 0.02 feet per day rate of rise. Thus the total drawdown corrected for the trend is about 6.62 feet. The pattern of drawdown in Zone 3 was approximated by a sequence of 48 discrete incremental steps corresponding to each of the available water-level measurements in this well between November 1 and November 28 corrected for the rising trend.

Theoretical drawdowns were calculated for several depths below the base of Zone 3 and for several values of diffusivity, which is the ratio of k_z to S_s. The drawdowns were calculated for a time of 27 days corresponding to the time between initiation of pumping and the last available measurements. These calculations are tabulated below.

Calculated Drawdown in Feet (Zone 1)

Depth, z, in feet	Diffusivity, k_z/S_s, in ft^2/day					
	100	50	20	5	2	1
20	4.8	4.2	3.2	1.2	0.3	.03
45	3.2	2.2	0.9	.03	.00	.00
70	1.9	1.0	.02	.00	.00	.00

Although the distance between the base of Zone 3 and the top of Zone 1 is about 20 feet, calculations were also made for z=45 feet and z=70 feet, which would represent points located near the middle and the base of Zone 1, respectively. Since wells 607 and 612 are open to the entire thickness of Zone 1, their water levels are an average of conditions over the entire thickness of the zone. The calculations at the 45-foot depth are probably most representative of conditions that would occur in a well open to the entire thickness of Zone 1.

The vertical permeability is assumed to be uniform with depth in this analysis. Although the vertical permeability within Zone 1 is probably larger than that of Zone 2, the assumption of uniformity would understate drawdown in Zone 1 and, for a given drawdown, overstate vertical permeability of Zone 2. This assumption is considered appropriate for the purpose of this analysis.

To estimate an upper limit for the value of vertical permeability, a drawdown and a value of specific storage (S_s) must be assumed. If a drawdown of about 0.5 feet or less had occurred in wells 607 and 612 due to pumping in Zone 3, it would have been indiscernible from the trend and other fluctuations in the data. Based on the calculated drawdown at the 45-foot depth (middle of Zone 1), the diffusivity must be less than about 20 ft^2/day. The specific storage coefficient is generally about 10^{-6} per foot (Lohman, 1972). Therefore, the vertical permeability must be less than about 2×10^{-5} ft/day.

The calculations also indicate that if the diffusivity was greater than about 50 ft^2/day, the drawdown that should have occurred in Zone 1 due to pumping would be sufficient to overcome the rising trend and produce a net decline in the water level. Even if the specific storage coefficient were as large as 10^{-5} per foot, the resulting upper limit on vertical permeability would only be 5×10^{-4} ft/day. Values in this range (2×10^{-5} to 5×10^{-4}

ft/day) are generally associated with unweathered silts and clays (see Freeze and Cherry, 1979, p 29). The rocks in Zone 2 are primarily shale with some siltstone and coal.

Conclusions

Water-level declines of more than 6 feet have occurred in Zone 3 due to pumping of the Seepage Cleanup System. Water levels in Zone 1 have risen gradually during this monitoring period, November 1, 1983 to November 28, 1983. The water levels in Zone 1 do not show a discernible response to the pumping in Zone 3. It is estimated that a drawdown greater than about 0.5 feet in Zone 1 due to the pumping should have been discernible. Calculations indicate that the vertical permeability between Zone 3 and Zone 1 must be less than 2×10^{-5} ft^2/day if the drawdown in Zone 1 is less than 0.5 feet.

References

BEDINGER, M. S., and J. E. REED, 1964, **Computing stream-induced ground-water fluctuation**: U. S. Geol. Survey Prof. Paper 501-B, pp. B177-B179.

FERRIS, J. G., D. B. KNOWLES, R. H. BROWN, and R. W. STALLMAN, 1962, **Theory of aquifer tests**: U. S. Geol. Survey Water Supply Paper 1536-E.

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ATTACHMENT 1

Seepage Cleanup System
Monitoring Program Data
October 24, 1983 - November 29, 1983

DATA FROM PUMPING WELLS

Explanation of Abbreviations

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ft - feet

psi - pounds per square inch

gal - gallons

gal/min - gallons per minute

WELL 600

Date (YYMMDD)	Depth to Water (ft)	Remarks
831024	52.90	Measurements taken prior to pumping.
831026	53.12	Same
831028	52.96	Same
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WELL 600

Date (YYMMDD)	Depth to Water (ft)	Remarks
831024	52.90	Measurements taken prior to pumping.
831026	53.12	Same
831028	52.96	Same
831030	52.86	Same

WELL 600

Date (YYMMDD)	Time (HHMM)	Pressure (psi)	Flowmeter Reading (gal)	Measurements of Pumping Rate: Using the Flowmeter (gal/min)	Measurements of Pumping Rate: Using a Calibrated Container (gal/min)	Remarks
831101	1020	19.25	1695.1			
831101	1232	19.26				
831101	1235					Pump on
831101	1238			0.7		
831101	1240	17.77				
831101	1300	15.86				
831101	1301		1711.7			
831101	1303			0.5		Increase Q
831101	1308			0.7		
831101	1323	15.48				
831101	1324		1723.6			
831101	1405		1746.6	0.6		
831101	1407	14.39				
831101	1456	13.77				
831101	1457		1778.3			
831101	1655	13.66	1842.1			
831101	1853	13.81				
831101	1854		1902.0			
831101	2126	15.93	1973.3			
831102	0144	16.92	2092.3			
831102	0851	17.21				
831102	0852		2299.7			Increase Q
831102	1144	16.76				
831102	1145		2377.7			Increase Q
831102	1437	14.90				
831102	1438		2490.3			
831102	1612	15.24				
831102	1614		2545.2			Increase Q
831102	2300	13.58				
831102	2302		2821.0			

WELL 600 (continued)

Date (YYMMDD)	Time (HHMM)	Pressure (psi)	Flowmeter Reading (gal)	Measurements of Pumping Rate: Using the Flowmeter (gal/min)	Measurements of Pumping Rate: Using a Calibrated Container (gal/min)	Remarks
831103	0828	13.51				
831103	0830		3172.2			Increase Q
831103	1613	4.32				
831103	1614		3607.3			Decrease Q
831103	2324	9.83				
831103	2325		3923.1			
831104	0842	9.63				
831104	0843		4315.9	0.6	0.63	
831104	1447	8.83				
831104	1448		4578.7			
831104	2251	8.50				
831104	2252		4924.0			
831105	0855	8.34	5346.6			
831105	0856		5346.6	0.7	0.63	
831105	1648	7.34				
831105	1649		5688.3			
831105	2230	7.70				
831105	2231		5917.1			
831106	0851	7.66				
831106	0852		6330.9	0.7	0.65	
831106	1548	7.00				
831106	1549		6612.8			
831106	2234	7.61				
831106	2235		6874.3			
831107	1009	7.41				
831107	1010		7314.6	0.7	0.73	Increase Q
831107	1628	3.17				
831107	1629		7601.5			Decrease Q
831107	2225	6.02	7840.2			
831108	0948	6.22				

WELL 600 (continued)

Date (YYMMDD)	Time (HHMM)	Pressure (psi)	Flowmeter Reading (gal)	Measurements of Pumping Rate: Using the Flowmeter (gal/min)	Measurements of Pumping Rate: Using a Calibrated Container (gal/min)	Remarks
831108	0949		8283.5	0.7	0.62	Increase Q
831108	1618	6.12				
831108	1619		8536.2			
831108	2207	6.34				
831108	2208		8769.0			
831109	0923	6.10				
831109	0924		9184.8	0.7	0.59	Increase Q
831109	1536	4.98				
831109	1537		9425.2			Decrease Q
831109	2220	5.79				
831109	2221		9678.7			
831110	0842	6.20				
831110	0843		10060.5	0.5	0.63	Increase Q
831110	1515	5.65				
831110	1516		10303.5			
831110	2218	5.85				
831110	2219		10562.8			
831111	0839	5.98				
831111	0840		10937.6	0.7	0.57	
831111	1534	5.25				
831111	1535		11191.8			
831111	2142	5.33				
831111	2144		11418.7			
831112	0911	6.02				
831112	0912		11826.3	0.6	0.63	Increase Q
831112	1544	5.61				
831112	1545		12060.2			
831112	2213	5.74				
831112	2214		12291.3			
831113	0904	7.19				

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Date (YYMMDD)	Time (HHMM)	Pressure (psi)	Flowmeter Reading (gal)	Measurements of Pumping Rate: Using the Flowmeter (gal/min)	Measurements of Pumping Rate: Using a Calibrated Container (gal/min)	Remarks
831113	0905		12663.7	0.5	0.60	Increase Q
831113	1427	6.43				
831113	1428		12850.7			Increase Q
831113	2204	6.56				
831113	2005		13112.7			Increase Q
831114	0843	6.09				
831114	0844		13482.6	0.6	0.61	Increase Q
831114	1515	3.15				
831114	1516		13726.9			
831114	2214	6.34				
831114	2215		13963.0			
831115	0839	6.25				Increase Q
831115	0840		14311.3	0.5	0.61	
831115	1543	4.47				
831115	1544		14565.3			Decrease Q
831115	2216	6.57				
831115	2217		14780.7			Increase Q
831116	0840	8.57				
831116	0841		15123.4			Pump not working. Pull Pump Transducer 11/2 ft. higher
831116	1446	4.62				
831116	1447		15197.7	0.7	0.63	
831116	2155	7.42				
831116	2156		15456.7			
831117	0843	11.24				
831117	0844		15769.0			
831117	1503	3.27				
831117	1504		16028.4	0.4	0.56	
831117	2209	7.69				

WELL 600 (continued)

Date (YYMMDD)	Time (HHMM)	Pressure (psi)	Flowmeter Reading (gal)	Measurements of Pumping Rate: Using the Flowmeter (gal/min)	Measurements of Pumping Rate: Using a Calibrated Container (gal/min)	Remarks
831117	2210		16266.1			Increase Q
831118	0835	10.26				
831118	0836		16561.1	0.5	0.45	
831118	1529	10.52				Increase Q
831118	1530		16742.2			
831119	0935	10.33				
831119	0936		17230.0	0.3	0.60	Increase Q
831119	1605	4.64				
831119	1606		17476.6			Increase Q
831119	2224	3.71				
831119	2225		17718.5			
831120	0910	5.72				
831120	0911		18095.9	0.6	0.58	
831120	1435	5.49				
831120	1436		18285.0			
831120	2240	5.40				
831120	2241		18578.4			
831121	0950	7.52				
831121	0951		18950.2	0.5	0.52	
831122	1005	9.24				
831122	1006		19661.0	0.6	0.46	Increase Q
831122	1626	8.62				Decrease Q
831122	1627		19858.9			
831123	0900	10.41				Increase Q
831123	0901		20304.5	0.5	0.41	
831123	1501	4.07				Decrease Q
831123	1502		20472.7			

WELL 600 (continued)

Date (YYMMDD)	Time (HHMM)	Pressure (psi)	Flowmeter Reading (gal)	Measurements of Pumping Rate: Using the Flowmeter (gal/min)	Measurements of Pumping Rate: Using a Calibrated Container (gal/min)	Remarks
831124	0753	5.23				
831124	0754		21070.5	0.7	0.63	
831124	1449	3.59				Decrease Q
831124	1450		21326.6			
831125	0726	9.23				Increase Q
831125	0727		21813.2	0.5	0.77	
831125	1358	2.20				Decrease Q
831125	1359		22112.6			
831126	0855	2.39				Decrease Q
831126	0856		22878.5	0.9	0.39	
831126	1420	13.74				
831126	1421		22952.1			
831127	0805	10.41				Increase Q
831127	0806		23411.7	0.8	0.79	
831127	1440	3.34				Decrease Q
831127	1441		23756.0			
831128	0803	5.10				
831128	0804		24369.0	0.6	0.57	
831128	1507	4.31				Decrease Q
831128	1508		24604.9			

WELL 608

Date (YYMMDD)	Depth to Water (ft)	Remarks
831024	49.31	Measurements taken prior to pumping.
831026	49.53	Same
831028	49.40	Same

WELL 608

Date (YYMMDD)	Time (HHMM)	Pressure (psi)	Flowmeter Reading (gal)	Measurements of Pumping Rate: Using the Flowmeter (gal/min)	Measurements of Pumping Rate: Using a Calibrated Container (gal/min)	Remarks
831101	1027	21.63	3852.6			
831101	1128	21.64				
831101	1145	21.64				
831101	1200					Pump on
831101	1203			12.0		Decrease Q
831101	1208			10.0		
831101	1209	14.69				
831101	1210		3964.8			
831101	1211		3974.8			
831101	1212	14.44				
831101	1221	13.83				
831101	1228	13.36				
831101	1241		4264.2			
831101	1242			9.6		
831101	1245	12.50				
831101	1318	11.47			10	
831101	1319		4615.3			
831101	1359	10.78	4972.2			
831101	1450	9.86				
831101	1452		5440.1			
831101	1711	08.46				
831101	1712		6636.0			
831101	1848		7409.7			
831101	1850	7.89				
831101	2121	7.42	8603.1			
831102	0147	8.57	10406.1			
831102	0845	16.18				
831102	0846		12112.6			
831102	1038		12192.4			Pump off to fix the hose

WELL 608 (continued)

Date (YYMMDD)	Time (HHMM)	Pressure (psi)	Flowmeter Reading (gal)	Measurements of Pumping Rate: Using the Flowmeter (gal/min)	Measurements of Pumping Rate: Using a Calibrated Container (gal/min)	Remarks
831102	1125		12190.2			Pump on
831102	1130	12.94				
831102	1140			7.4		
831102	1141	9.91				
831102	1158	8.55				
831102	1159		12442.8			
831102	1431	5.56				
831102	1433		13560.2			Decrease Q
831102	1617	7.15				
831102	1619		14233.0			
831102	2309	6.24				
831102	2311		16745.2			
831103	0834	4.84				
831103	0835		20087.5			Decrease Q
831103	1622	7.41				
831103	1623		22369.7			
831103	2330	8.34				
831103	2331		24306.1			
831104	0846	8.28				
831104	0847		26705.4	4.4		
831104	0940				4.1	
831104	1451	8.26				
831104	1452		28259.1			
831104	2255	8.33				
831104	2256		30270.0			
831105	0900	8.12				
831105	0902		32770.8	4.0	4.3	
831105	1702	7.92				
831105	1704		34767.3			

WELL 608 (continued)

Date (YYMMDD)	Time (HHMM)	Pressure (psi)	Flowmeter Reading (gal)	Measurements of Pumping Rate: Using the Flowmeter (gal/min)	Measurements of Pumping Rate: Using a Calibrated Container (gal/min)	Remarks
831105	2237	8.04				
831105	2238		36125.5			
831106	0900	7.90				
831106	0901		38635.3	4.0	4.3	
831106	1552	7.96				
831106	1553		40256.8			
831106	2237	8.24				
831106	2238		41827.0			
831107	1017	8.21				
831107	1018		44499.0	3.8	4.3	Increase Q
831107	1634	6.84				
831107	1635		46110.5			
831107	2229	6.81				
831107	2230		47626.3			
831108	0953	6.49				
831108	0954		50547.8	4.2	4.3	Increase Q
831108	1621	5.33				
831108	1622		52301.3			
831108	2230					Pump on tank not working
831108	2212	4.87				
831108	2213		53891.0			Decrease Q
831109	0927	4.36				
831109	0928		56980.9	4.4	4.6	Decrease Q

WELL 608 (continued)

Date (YYMMDD)	Time (HHMM)	Pressure (psi)	Flowmeter Reading (gal)	Measurements of Pumping Rate: Using the Flowmeter (gal/min)	Measurements of Pumping Rate: Using a Calibrated Container (gal/min)	Remarks
831109	1529	4.58				
831109	1530		58591.3			
831109	2225	5.08				
831109	2226		60394.5			
831110	0850	5.04				
831110	0851		63082.9	4.2	4.6	
831110	1525	5.29				
831110	1526		64760.7			
831110	2215	5.19				Pump at tank - 2230 not working
831110	2216		66501.9			
831111	0843	5.24				
831111	0844		69142.0	4.2	4.0	
831111	1536	4.90				
831111	1537		70891.9			Decrease Q
831111	2146	5.05				
831111	2147		72450.2			
831112	0916	5.44				
831112	0917		75335.0	4.2	4.6	
831112	1541	5.53				
831112	1542		76949.0			
831112	2217	5.47				
831112	2218		78610.5			
831113	0909	5.51				
831113	0910		81287.2	4.1	4.6	
831113	1432	5.35				
831113	1433		82616.5			
831113	2228	5.66				
831113	2229		84461.3			

WELL 608 (continued)

Date (YYMMDD)	Time (HHMM)	Pressure (psi)	Flowmeter Reading (gal)	Measurements of Pumping Rate: Using the Flowmeter (gal/min)	Measurements of Pumping Rate: Using a Calibrated Container (gal/min)	Remarks
831114	0848	5.85				
831114	0849		87010.2	4.0	4.0	
831114	1512	5.77				
831114	1513		88534.0			
831114	2218	5.67				
831114	2219		90215.5			
831115	0844	5.48				
831115	0845		92682.5	4.0	3.5	
831115	1540	5.38				
831115	1541		94330.0			
831115	1800	5.52				
831115	2221	5.52				
831115	2222		95911.4			
831116	0851	5.35				
831116	0852		98420.0	3.8	3.3	
831116	1437	5.33				
831116	1438		99790.4			
831116	2159	5.36				
831116	2200		101525.6			
831117	0838	5.38				
831117	0839		104033.8	3.9	3.3	
831117	1453	5.34				
831117	1454		105498.2			
831117	2213	5.31				
831117	2214		107209.8			
831118	0839	5.38				
831118	0840		109648.8	3.9	4.0	
831118	1532	5.35				
831118	1533		111258.8			
831119	0931	5.26				

WELL 608 (continued)

Date (YYMMDD)	Time (HHMM)	Pressure (psi)	Flowmeter Reading (gal)	Measurements of Pumping Rate: Using the Flowmeter (gal/min)	Measurements of Pumping Rate: Using a Calibrated Container (gal/min)	Remarks
831126	0842	7.00				Increase Q
831126	0843		151451.3	3.7	4.6	
831126	1423	6.42				Increase Q
831126	1424		152743.2			
831127	0755	6.10				Increase Q
831127	0756		156757.1	3.7	4.3	
831127	1445	5.00				
831127	1446		158388.4			
831128	0756	5.32				
831128	0757		162389.5	3.8	4.3	
831128	1513	5.11				
831128	1514		164081.5			

WELL 608 (continued)

Date (YYMMDD)	Time (HHMM)	Pressure (psi)	Flowmeter Reading (gal)	Measurements of Pumping Rate: Using the Flowmeter (gal/min)	Measurements of Pumping Rate: Using a Calibrated Container (gal/min)	Remarks
831119	0932		115455.8	3.8	4.3	
831119	1601	5.14				
831119	1602		116979.5			
831119	2228	5.12				
831119	2229		118479.5			
831120	0906	5.18				
831120	0907		120958.2	3.8	3.5	
831120	1438	5.05				
831120	1439		122250.6			
831120	2244	5.06				
831120	2245		124148.4			
831121	0953	8.68				
831121	0954		126573.0	3.5		Increase Q
831121	1457	7.34				
831121	1458		127616.1		4.3	
831122	0957	7.93				
831122	0958		131487.5	3.0	3.5	Increase Q
831122	1617	7.26				
831122	1618		132799.8			Increase Q
831123	0911	7.66				
831123	0912		136324.8	3.4	3.3	Increase Q
831123	1505	7.40				
831123	1506		137536.9			Increase Q
831124	0800	7.42				
831124	0801		140982.6	3.4	3.8	Increase Q
831124	1454	6.57				
831124	1455		142481.5			
831125	0745	7.82				
831125	0746		145979.7	3.4	4.3	Increase Q
831125	1401	7.20				
831125	1402		147369.8			Increase Q

WELL 610

Date (YYMMDD)	Depth to Water (ft)	Remarks
831024	45.60	Measurements taken prior to pumping.
831026	45.81	Same
831028	45.67	Same
831030	45.59	Same

WELL 610

Date (YYMMDD)	Time (HHMM)	Pressure (psi)	Flowmeter Reading (gal)	Measurements of Pumping Rate: Using the Flowmeter (gal/min)	Measurements of Pumping Rate: Using a Calibrated Container (gal/min)	Remarks
831101	1030	23.09	2798.1			
831101	1309	23.09				
831101	1310					Pump on
831101	1312			20.0		
831101	1313	17.69				
831101	1314		2872.8			
831101	1322		3036.4			Electrical failure pump shut off
831101	1410					Pump back on
831101	1414		3113.7	19.5		
831101	1415	16.34				
831101	1421	14.98				
831101	1422		3267.5			
831101	1426	14.38				
831101	1504		4063.1			
831101	1505	12.17				
831101	1630	9.33				
831101	1633		5715.2			
831101	1859	1.46	8359.0			Decrease Q
831101	1905			15.0		
831101	1915	6.93				
831101	1924	7.35				
831101	1925		8736.5			
831101	2020	6.76				Decrease Q
831101	2115	7.01	10359.2			Decrease Q
831102	0151	5.39	14117.3			Decrease Q
831102	0839	7.36				
831102	0841		18805.2			
831102	1202	6.48				

WELL 610 (continued)

Date (YYMMDD)	Time (HHMM)	Pressure (psi)	Flowmeter Reading (gal)	Measurements of Pumping Rate: Using the Flowmeter (gal/min)	Measurements of Pumping Rate: Using a Calibrated Container (gal/min)	Remarks
831102	1203		21079.0			
831102	1441	6.11				
831102	1443		22860.7			Decrease Q
831102	1621	6.74				
831102	1623		23922.2			
831102	2315	5.52				
831102	2317		28315.3			Decrease Q
831103	0853	5.71				
831103	0854		34067.5			Decrease Q
831103	1628	7.73				
831103	1629		38097.3			
831103	2334	7.56				
831103	2335		41789.7			
831104	0850	7.13				
831104	0851		46556.0	8.7	8.6	
831104	1455	6.50				
831104	1456		49699.3			
831104	2259	6.29				
831104	2300		53834.3			
831105	0906	6.01				
831105	0907		58946.0	8.3	8.6	
831105	1706	5.63				
831105	1707		62961.4			Decrease Q
831105	2241	6.95				
831105	2242		65636.5			
831106	0904	6.82				
831106	0905		70506.4	8.7	7.5	
831106	1555	6.71				
831106	1556		73705.2			
831106	2241	6.97				

WELL 610 (continued)

Date (YYMMDD)	Time (HHMM)	Pressure (psi)	Flowmeter Reading (gal)	Measurements of Pumping Rate: Using the Flowmeter (gal/min)	Measurements of Pumping Rate: Using a Calibrated Container (gal/min)	Remarks
831106	2242		76813.0			
831107	1023	6.47				
831107	1024		82180.7	9.1	7.5	Increase Q
831107	1637	5.74				
831107	1638		85101.2			
831107	2238	5.75				
831107	2239		87878.8			
831108	0959	5.33				
831108	1000		93183.5	8.0	8.6	
831108	1624	4.64				
831108	1625		96208.4			Decrease Q
831108	2217	4.30				
831108	2218		98955.1			Decrease Q
831109	0939	2.72				
831109	0940		104200.8	8.0	8.6	Decrease Q
831109	1524	4.71				
831109	1525		106793.9			
831109	2228	5.58				
831109	2230		109891.2			
831110	0856	5.92				
831110	0857		114388.6	6.8	7.5	
831110	1529	5.91				
831110	1530		117180.0			
831110	2223	6.06				
831110	2224		120096.6			
831111	0849	6.29				
831111	0850		124446.0	7.0	6.7	Increase Q
831111	1540	6.04				
831111	1607		127525.5			

WELL 610 (continued)

Date (YYMMDD)	Time (HHMM)	Pressure (psi)	Flowmeter Reading (gal)	Measurements of Pumping Rate: Using the Flowmeter (gal/min)	Measurements of Pumping Rate: Using a Calibrated Container (gal/min)	Remarks
831111	2154	17.58				Pump off - electrical problem
831112	0915					Pump on
831112	0920	14.75				
831112	0921		129763.5	7.7	7.5	Increase Q
831112	1538	7.60				
831112	1539		132551.1			
831112	2220	7.64				
831112	2221		135365.7			Increase Q
831113	0913	7.61				
831113	0914		139792.2	6.8	7.5	Increase Q
831113	1436	7.46				
831113	1437		141980.1			Increase Q
831113	2211	7.68				
831113	2212		145061.1			Increase Q
831114	0853	7.65				
831114	0854		149349.7	6.6	7.5	Increase Q
831114	1509	5.73				
831114	1510		152021.6			
831114	2221	6.08				Increase Q
831114	2222		155031.2			
831115	0848	6.84				
831115	0849		159257.0	6.5	6.7	
831115	1527	6.33				Increase Q
831115	1528		161979.6			
831115	2224	6.74				Increase Q
831115	2225		164780.8			Increase Q
831116	0855	6.19				
831116	0856		169056.9	6.7	8.6	Increase Q

WELL 610 (continued)

Date (YYMMDD)	Time (HHMM)	Pressure (psi)	Flowmeter Reading (gal)	Measurements of Pumping Rate: Using the Flowmeter (gal/min)	Measurements of Pumping Rate: Using a Calibrated Container (gal/min)	Remarks
831116	1435	5.25				
831116	1436		171423.1			
831116	2201	5.63				
831116	2202		174488.4			
831117	0834	5.74				
831117	0835		178783.4	6.8	7.5	
831117	1450	5.45				
831117	1451		181351.7			
831117	2216	5.69				
831117	2217		184367.7			
831118	0845	6.81				
831118	0846		188526.3	6.4	6.7	Increase Q
831118	1536	7.45				
831118	1537		191136.1			Increas- Q
831119	0926	7.55				
831119	0927		197865.4	7.2	7.5	Increase Q
831119	1558	7.21				
831119	1559		200359.8			Increase Q
831119	2231	6.83				
831119	2232		200887.8			Increase Q
831120	0900	6.27				
831120	0901		207034.2	6.6	7.5	Increase Q
831120	1441	6.41				Increase Q
831120	1442		209256.8			
831120	2247	5.74				
831120	2248		212506.0			
831121	1004	7.19				
831121	1005		216791.2	6.8	7.5	Increase Q
831121	1510	12.08	216978.5			Flowmeter not working - electrical problem

WELL 610 (continued)

Date (YYMMDD)	Time (HHMM)	Pressure (psi)	Flowmeter Reading (gal)	Measurements of Pumping Rate: Using the Flowmeter (gal/min)	Measurements of Pumping Rate: Using a Calibrated Container (gal/min)	Remarks
831121	1515					Working
831121	1516		216978.5		3.3	
831122	0950	5.37				
831122	0951		224910.8	7.0	6.7	
831122	1603	4.26				Decrease Q
831122	1613		227562.1			
831123	0915					Pump not working
831123	0920	12.88				Started pump
831123	0921		230325.6	8.0	7.5	
831123	1513	6.17				
831123	1514		232062.6			Increase Q
831124	0806	1.80				Decrease Q
831124	0807		239386.9	7.0	8.6	
831124	1455					Pump not working
831124	1500	15.79				Started Pump
831124	1501		240831.4			
831124	1530					Decrease Q to 5 gal/min
831125	0754		241195.8			Pump not working
831125	0757	18.11		4.3	4.6	Pump working
831125	0758		241208.4			
831125	1405	14.49				
831125	1407		242907.7			
831126	0848	13.15				Increase Q
831126	0849		247557.5	4.2	3.8	
831126	1426	12.32				Increase Q
831126	1427		249097.1			
831127	0749	8.92				Increase Q

WELL 610 (continued)

Date (YYMMDD)	Time (HHMM)	Pressure (psi)	Flowmeter Reading (gal)	Measurements of Pumping Rate: Using the Flowmeter (gal/min)	Measurements of Pumping Rate: Using a Calibrated Container (gal/min)	Remarks
831127	0750		255361.0	6.0	7.5	
831127	1449	7.36				
831127	1450		258125.0			
831128	0749	6.97				Increase Q
831128	0750		264778.1	6.15	7.5	
831128	1517	2.62				Decrease Q
831128	1518		267866.2			

WELL 613

Date (YYMMDD)	Depth to Water (ft)	Remarks
831024	31.11	Measurements taken prior to pumping.
831026	31.34	Same
831028	31.28	Same

WELL 613

Date (YYMMDD)	Time (HHMM)	Pressure (psi)	Flowmeter Reading (gal)	Measurements of Pumping Rate: Using the Flowmeter (gal/min)	Measurements of Pumping Rate: Using a Calibrated Container (gal/min)	Remarks
831101	1037	21.33	17087.2			
831101	1333	21.32				
831101	1335					Pump On
831101	1336			45.0		
831101	1337		17176.0			
831101	1340	12.76				
831101	1341		17352.0	44.0		
831101	1344	12.20				
831101	1345		17528.8			
831101	1348	11.88				
831101	1432		19590.3			
831101	1433	10.45				
831101	1640	8.94				
831101	1642		25269.2			
831101	1908	7.62				
831101	1911		31752.2			
831101	2157	5.82	38823.2			Decrease Q
831102	0159	9.50	45882.0			
831102	0900	9.64				
831102	0901		57214.3			Increase Q
831102	1208	8.23				
831102	1209		62602.0			
831102	1451	8.04				
831102	1453		67240.2			
831102	1626	8.00				
831102	1627		69887.2			
831102	2326	7.61				
831102	2328		81300.3			
831103	0907	6.74				
831103	0908		96554.7			

WELL 613 (continued)

Date (YYMMDD)	Time (HHMM)	Pressure (psi)	Flowmeter Reading (gal)	Measurements of Pumping Rate: Using the Flowmeter (gal/min)	Measurements of Pumping Rate: Using a Calibrated Container (gal/min)	Remarks
831103	1634	5.95				
831103	1635		108156.1			Decrease Q
831103	2343	6.47				
831103	2344		118514.6			
831104	0906	5.95				
831104	0907		131742.6	24.0		
831104	0935				23.1	Decrease Q
831104	1502	7.08				
831104	1504		139253.8			
831104	2308	6.97				
831104	2309		149309.8			
831105	0917	6.75				
831105	0918		161933.9	22.2	21.4	
831105	1712	6.44				
831105	1714		171820.2			
831105	2225	6.36				
831105	2226		178316.8			
831106	0842	6.14				
831106	0843		191036.3	20.4	21.4	
831106	1541	6.05				
831106	1543		199615.8			
831106	2227	5.97				
831106	2228		207805.7			
831107	1001	5.94				
831107	1002		221661.2	20.0	18.8	
831107	1622	5.79				
831107	1623		229204.5			
831107	2220	5.78				
831107	2221		236226.7			
831108	0939	5.71				
831108	0940		249495.0	19.6	20.0	
831108	1634	6.18				

WELL 613 (continued)

Date (YYMMDD)	Time (HHMM)	Pressure (psi)	Flowmeter Reading (gal)	Measurements of Pumping Rate Using the Flowmeter (gal/min)	Measurements of Pumping Rate Using a Calibrated Container (gal/min)	Remarks
831108	1635		257509.6			
831108	2201	5.70				
831108	2202		3764.1			
831109	0912	5.53				
831109	0913		276528.2	20.0	20.0	
831109	1517	5.58				
831109	1518		283420.2			
831109	2213	5.72				
831109	2215		291221.2			
831110	0837	5.42				
831110	0838		302798.6	18.6	20.0	
831110	1509	5.29				
831110	1510		310247.5			
831110	2209	5.26				
831110	2210		318099.2			
831111	0830	5.13				
831111	0831		329727.0	19.0	20.0	
831111	1528	5.02				
831111	1529		337553.6			
831111	2138	4.99				Decrease Q
831111	2139		344455.5			
831112	0923	5.03				
831112	0924		357562.2	18.6	20.0	
831112	1530	4.94				Decrease Q
831112	1531		364236.4			
831112	2207	4.99				
831112	2208		371495.2			Decrease Q
831113	0846	4.98				
831113	0847		383262.0	18.2	23.1	Decrease Q
831113	1447	5.00				

WELL 613 (continued)

Date (YYMMDD)	Time (HHMM)	Pressure (psi)	Flowmeter Reading (gal)	Measurements of Pumping Rate: Using the Flowmeter (gal/min)	Measurements of Pumping Rate: Using a Calibrated Container (gal/min)	Remarks
831113	1448		389566.2			
831113	2158	6.19				Increase Q
831113	2159		396683.6			
831114	0835	6.30				
831114	0836		406990.4	16.2	18.8	Increase Q
831114	1502	6.14				Increase Q
831114	1503		413320.6			
831114	2209	5.92				
831114	2210		420463.2			
831115	0831	5.84				
831115	0832		430787.9	16.5	17.7	
831115	1520	5.77				
831115	1521		437621.9			
831115	2211	5.77				
831115	2212		444477.9			
831116	0831	5.72				
831116	0833		454921.6	16.5	18.8	
831116	1453	5.58				
831116	1454		461294.3			
831116	2139	5.67				
831116	2150		468262.[illegible]			
831117	0828	5.62				
831117	0829		478926.6	16.5	18.8	
831117	1445	5.67				
831117	1446		485198.4			
831117	2204	5.70				
831117	2205		492431.1			
831118	0828	5.73				
831118	0829		502722.1	16.5	18.8	
831118	1541	5.71				

WELL 613 (continued)

Date (YYMMDD)	Time (HHMM)	Pressure (psi)	Flowmeter Reading (gal)	Measurements of Pumping Rate: Using the Flowmeter (gal/min)	Measurements of Pumping Rate: Using a Calibrated Container (gal/min)	Remarks
831118	1542		509834.3			
831119	0920	5.63				
831119	0921		527213.0	16.5	18.8	
831119	1554	5.57				
831119	1555		533679.6			
831119	2219	5.57				
831119	2220		539997.1			
831120	0853	5.63				
831120	0854		550357.2	16.0	20.0	
831120	1429	5.69				
831120	1430		555811.1			
831120	2254	5.68				During night power failure, UNC turned turned on pumps next morning
831120	2255		563946.2			
831121	0945	6.70				
831121	0946		571860.5		13.0	Flowmeter not working, UNC turned pumps on est. time=1330
831121	1446	8.99				
831121	1447		616.5	13.5	------	New Flowmeter Increase Q
831122	0913	8.97				
831122	0914		15532.5	13.5	13.6	
831122	1630	6.04				
831122	1631		22102.2			
831123	0849	5.43				
831123	0850		39857.5	18.0	25.0	
831123	1520	5.31				

WELL 613 (continued)

Date (YYMMDD)	Time (HHMM)	Pressure (psi)	Flowmeter Reading (gal)	Measurements of Pumping Rate: Using the Flowmeter (gal/min)	Measurements of Pumping Rate: Using a Calibrated Container (gal/min)	Remarks
831123	1521		47025.0			
831124	0744	5.04				
831124	0745		65041.8	18.0	18.8	
831124	1439	4.49				Decrease Q
831124	1440		72801.4			
831125	0806	4.82				Decrease Q
831125	0807		92345.8	17.5	18.8	
831125	1351	5.02				
831125	1352		98547.8			
831126	0912	5.75				
831126	0913		118071.1	17.0	16.7	
831126	1431	5.91				
831126	1432		123378.6			
831127	0740	5.99				
831127	0741		140312.8	16.5	20.0	
831127	1454	5.93				
831127	1455		147400.8			
831128	0741	5.95				
831128	0742		163922.0	16.3	17.7	
831128	1526	5.89				
831128	1527		171520.2			

DATA ON DISCHARGE FROM STORAGE TANK

Explanation of Abbreviations

YYMMDD - Year, month, and day of measurement or observation (first pair of digits is year, second pair is month, and third pair is day).

HHMM - Hour and minute of measurement or observation (first pair of digits is hour and second pair is minute).

gal - gallons

DISCHARGE FROM STORAGE TANK

Date (YYMMDD)	Time (HHMM)	Flowmeter Reading (gal)
831101	1027	3800870
831102	1213	3858450
831104	0940	3946120
831105	0902	3990750
831106	0901	4039510
831107	1018	4081240
831108	0954	4124310
831108	2213	4145590
831109	0928	4168410
831110	0851	4209170
831110	2216	4240230
831111	0844	4251830
831112	0917	4291000
831113	0910	4344410
831114	0849	4388360
831115	0845	4421600
831115	1800	4467920
831116	0852	4478060
831117	0839	4513280
831118	0840	4553140
831119	0932	4571630
831120	0907	4611560
831122	0958	4696990
831123	0912	4726270
831124	0801	4759420
831125	0746	4808030
831126	0843	4836380
831127	0756	4836380
831128	0757	4884410

DATA FROM MONITORING WELLS

Explanation of Abbreviations

YYMMDD - Year, month, and day of measurement or observation (first pair of digits is year, second pair is month, and third pair is day).

HHMMSS - Hour, minute, and second of measurement or observation. If four digits are presented, the first pair of digits is hour and the second pair is minute. If six digits are presented, the first four digits are as described above and the third pair of digits is seconds.

---- - Value not recorded.

ft - feet

Well TWQ-7D

Date (YYMMDD)	Time (HHMMSS)	Depth to Water (Ft.)	Remarks
831107	1123	28.61	
831110	1006	28.83	
831113	0955	28.79	
831117	0918	28.90	
831120	1322	28.64	
831124	1006	29.18	
831127	1322	29.03	

WELL TWQ-8D

Date (YYMMDD)	Time (HHMMSS)	Depth to Water (Ft.)	Remarks
831107	1317	31.08	
831110	1008	31.38	
831113	0957	31.35	
831117	0920	31.45	
831120	1324	31.19	
831124	1010	31.75	
831127	1324	31.57	

WELL TWQ-9D

Date (YYMMDD)	Time (HHMMSS)	Depth to Water (Ft.)	Remarks
831025	----	39.71	
831027	----	39.48	
831030	----	39.36	
831101	0843	39.38	
831101	1943	40.45	
831102	0228	41.50	
831102	0935	42.13	
831102	1540	42.54	
831103	1122	43.73	
831103	1735	43.91	
831104	1312	44.46	
831104	1510	44.44	
831105	1719	44.79	
831106	1106	45.15	
831109	1502	44.64	Pipe run over needs to be surveyed
831110	1103	46.10	
831111	1059	45.62	
831114	1030	44.60	
831116	0935	44.91	
831118	0906	44.61	
831123	1028	44.43	
831125	1059	44.52	
831128	0942	44.53	

WELL 10-D

Date (YYMMDD)	Time (HHMMSS)	Depth to Water (Ft.)	Remarks
831025	----	45.74	
831027	----	45.52	
831030	----	45.38	
831101	0903	45.41	
831101	1719	45.33	
831101	1937	45.33	
831102	0922	45.77	
831102	1537	45.95	
831103	1127	46.63	
831103	1724	46.71	
831104	1125	47.13	
831104	1431	47.13	
831105	1541	47.47	
831106	1057	47.88	
831107	1217	48.05	
831109	1112	48.70	
831111	1047	48.95	
831114	0922	49.35	
831116	0926	49.67	
831118	0917	49.62	
831123	1533	49.93	
831125	1101	49.91	
831128	0947	50.41	

WELL TWQ-11D

Date (YYMMDD)	Time (HHMMSS)	Depth to Water (Ft.)	Remarks
831107	1612	39.85	
831110	1110	39.91	
831113	1015	39.98	
831117	0937	40.14	
831120	1338	39.95	
831124	1123	40.09	
831127	1343	40.03	

WELL TWQ-12D

Date (YYMMDD)	Time (HHMMSS)	Depth to Water (Ft.)	Remarks
831110	1121	40.50	
831113	1035	40.48	
831117	0941	40.45	
831120	1342	40.40	
831124	1128	40.33	
831127	1354	40.29	

WELL 36-05/07

Date (XYMMDD)	Time (HHMMSS)	Depth to Water (Ft.)	Remarks
831110	1050	26.24	
831113	1002	26.19	
831117	0925	26.27	
831120	1333	26.03	
831124	1018	26.57	
831127	1330	26.39	

WELL 36-05/10

Date (YYMMDD)	Time (HHMMSS)	Depth to Water (Ft.)	Remarks
831030	----	27.44	
831102	1020	27.80	
831104	1121	28.57	
831105	1601	28.68	
831106	1018	28.93	
831109	1047	29.34	
831111	0952	29.36	
831114	0943	29.51	
831115	1006	29.66	
831118	0948	29.32	
831123	1133	29.76	
831125	1022	29.60	
831128	1107	29.65	

WELL 105-A

Date (YYMMDD)	Time (HHMMSS)	Depth to Water (Ft.)	Remarks
831110	1004	28.11	
831113	0952	28.06	
831117	0916	28.16	
831120	1320	27.90	
831124	0957	28.23	
831127	1320	28.29	

WELL 106

Date (YYMMDD)	Time (HHMMSS)	Depth to Water (Ft.)	Remarks
831025	----	26.85	
831027	----	26.62	
831030	----	26.49	
831101	1934	26.50	
831102	0233	26.77	
831102	0917	27.15	
831102	1529	27.38	
831103	1131	28.14	
831103	1730	28.25	
831104	1130	28.68	
831104	1424	28.68	
831105	1536	28.96	
831106	1100	29.33	
831107	1616	29.41	
831109	1115	29.96	
831111	1039	30.07	
831114	0915	30.29	
831116	0932	30.48	
831118	0910	30.12	
831123	1051	30.42	
831125	0935	30.41	
831128	0955	30.83	

WELL TWQ-109A

Date (YYMMDD)	Time (HHMMSS)	Depth to Water (Ft.)	Remarks
831107	1304	26.76	*
831110	1055	26.71	
831113	1007	26.69	
831117	0931	26.58	
831120	1330	26.58	
831124	1024	26.75	
831127	1333	26.64	

WELL TWQ-110D

Date (YYMMDD)	Time (HHMMSS)	Depth to Water (Ft.)	Remarks
831107	1302	27.45	
831110	1053	27.60	
831113	1005	27.55	
831117	0929	27.67	
831120	1328	27.45	
831124	1022	27.95	
831127	1335	27.78	

WELL 118

Date (YYMMDD)	Time (HHMMSS)	Depth to Water (Ft.)	Remarks
831108	1609	50.98	
831110	1142	51.30	
831113	1059	51.23	
831115	1110	51.51	
831118	1017	51.31	
831120	1406	51.01	
831122	1413	51.30	
831124	1252	51.48	
831127	1413	51.30	
831129	1045	51.33	

WELL 119

Date (YYMMDD)	Time (HHMMSS)	Depth to Water (Ft.)	Remarks
831110	0943	27.37	
831113	0949	27.37	
831117	0914	27.44	
831120	1317	27.20	
831124	0951	27.67	
831127	1315	27.53	

WELL 120

Date (YYMMDD)	Time (HHMMSS)	Depth to Water (Ft.)	Remarks
831025	----	74.84	
831027	----	74.60	
831030	----	74.51	
831101	0848	74.55	
831101	1352	74.47	
831101	1402	74.47	
831101	1412	74.46	
831101	1422	74.46	
831101	1432	74.47	
831101	1505	74.46	
831101	1535	74.45	
831101	1605	74.46	
831101	1635	74.46	
831101	1930	74.48	
831102	0237	74.48	
831102	0910	74.53	
831102	1533	74.50	
831103	1134	74.55	
831103	1732	74.49	
831104	1132	74.48	
831104	1427	74.42	
831105	1538	74.33	
831106	1103	74.45	
831107	1619	74.23	
831109	1117	74.45	
831111	1042	74.30	
831114	0918	74.20	
831116	0929	74.31	
831118	0914	73.88	
831123	1100	73.93	
831125	0938	73.74	
831128	1000	74.03	

WELL 121

Date (YYMMDD)	Time (HHMMSS)	Depth to Water (Ft.)	Remarks
831025	----	67.29	
831027	----	67.05	
831101	----	66.95	
831104	1238	67.03	
831105	1546	67.10	
831106	1052	67.38	
831107	1230	67.43	
831109	1100	67.92	
831111	1055	68.09	
831114	0929	68.43	
831116	0917	68.80	
831118	0927	68.54	
831123	1435	69.18	
831125	1047	69.13	
831128	1009	69.63	

WELL 122

Date (YYMMDD)	Time (HHMMSS)	Depth to Water (Ft.)	Remarks
831101	----	116.19	
831104	1253	116.03	
831107	1224	115.83	
831110	1128	115.88	
831113	1042	115.55	
831117	0955	115.88	
831120	1353	115.10	
831124	1240	115.40	
831127	1525	115.18	

WELL 123

Date (YYMMDD)	Time (HHMMSS)	Depth to Water (Ft.)	Remarks
831030	----	30.00	
831102	1017	30.20	
831105	1605	30.75	
831106	1016	30.96	
831107	1213	30.92	
831109	1043	31.28	
831111	0950	31.25	
831114	0940	31.33	
831116	1004	31.47	
831118	0945	31.12	
831123	1125	31.50	
831125	1018	31.36	
831128	1103	31.72	

WELL 125

Date (YYMMDD)	Time (HHMMSS)	Depth to Water (Ft.)	Remarks
831025	----	103.90	
831027	----	103.69	
831030	----	103.57	
831101	1550	103.47	
831101	1715	103.47	
831102	1145	103.52	
831102	1229	103.54	
831102	1350	103.53	
831102	1510	103.52	
831103	1004	103.62	
831104	1146	103.41	
831104	1439	103.43	
831105	1554	103.37	
831106	1025	103.51	
831107	1209	103.36	
831109	1053	103.52	
831111	1106	103.45	
831114	0935	103.34	
831116	0942	103.45	
831118	0933	103.02	
831123	1541	103.23	
831125	0948	103.09	
831128	1440	103.32	

WELL 126

Date (YYMMDD)	Time (HHMMSS)	Depth to Water (Ft.)	Remarks
831025	----	57.67	
831027	----	57.43	
831030	----	57.33	
831101	0945	57.36	
831101	1615	57.30	
831102	1207	57.32	
831102	1314	57.33	
831103	1027	57.50	
831103	1659	57.44	
831104	1011	57.54	
831104	1356	57.49	
831105	1610	57.53	
831106	0954	57.75	
831107	1127	57.71	
831109	1017	58.01	
831111	0956	57.98	
831114	0952	58.06	
831116	1014	58.23	
831118	1004	57.85	
831123	1329	58.15	
831125	1007	58.01	
831128	1027	58.35	

WELL 127

Date (YYMMDD)	Time (HHMMSS)	Depth to Water (Ft.)	Remarks
831030	----	90.46	
831102	1216	90.43	
831103	1015	90.53	
831104	1018	90.46	
831105	1614	90.31	
831106	0958	90.46	
831107	1130	90.31	
831109	1023	90.54	
831111	1000	90.44	
831114	0955	90.42	
831116	1017	90.57	
831118	1007	90.16	
831123	1338	90.32	
831125	1001	90.26	
831128	1035	90.61	

WELL 433

Date (YYMMDD)	Time (HHMMSS)	Depth to Water (Ft.)	Remarks
831030	----	70.99	
831104	1319	70.88	
831112	1604	70.76	
831119	0955	70.67	
831126	0948	70.69	

WELL 435

Date (YYMMDD)	Time (HHMMSS)	Depth to Water (Ft.)	Remarks
831030	----	101.24	
831104	1324	101.13	
831112	1600	100.94	
831119	1004	100.88	
831126	0942	100.79	

WELL 438

Date (YYMMDD)	Time (HHMMSS)	Depth to Water (Ft.)	Remarks
831030	----	118.28	
831104	1327	118.19	
831112	1607	117.98	
831119	1010	117.85	
831126	0938	117.78	

WELL 443

Date (YYMMDD)	Time (HHMMSS)	Depth to Water (Ft.)	Remarks
831030	----	122.55	
831104	1332	122.46	
831112	1548	122.24	
831119	1023	122.12	
831126	0930	122.01	

WELL 446

Date (YYMMDD)	Time (HHMMSS)	Depth to Water (Ft.)	Remarks
831030	----	122.03	
831112	1613	121.72	
831119	1017	121.55	
831126	1107	121.48	

WELL 448

Date (YYMMDD)	Time (HHMMSS)	Depth to Water (Ft.)	Remarks
831025	----	101.95	
831027	----	101.74	
831030	----	101.68	
831101	1020	101.68	
831101	1438	101.60	
831101	1448	101.60	
831101	1500	101.60	
831101	1530	101.58	
831101	1400	101.59	
831101	1430	101.59	
831101	1950	101.62	
831102	0937	101.68	
831102	1544	101.64	
831103	1106	101.72	
831104	1112	101.65	
831104	1417	101.57	
831105	1645	101.50	
831106	1045	101.62	
831107	1156	101.48	
831110	1148	101.55	
831113	1046	101.48	
831117	1000	101.39	
031120	1400	100.99	
831124	1307	101.35	
831127	1400	101.02	

WELL 449

Date (YYMMDD)	Time (HHMMSS)	Depth to Water (Ft.)	Remarks
831027	----	Dry	
831030	----	Dry	

WELL 501-A

Date (YYMMDD)	Time (HHMMSS)	Depth to Water (Ft.)	Remarks
831030	1415	Dry	
831108	----	Dry	
831115	1038	Dry	
831122	1413	Dry	

WELL 501-B

Date (YYMMDD)	Time (HHMMSS)	Depth to Water (Ft.)	Remarks
831030	----	160.30	
831102	1351	160.24	
831108	1514	159.74	
831115	1033	160.25	
831122	1027	159.45	
831129	1005	159.18	

WELL 502-A

Date (YYMMDD)	Time (HHMMSS)	Depth to Water (Ft.)	Remarks
831030	----	207.00	
831108	1538	206.60	
831115	1052	206.92	
831122	1046	206.44	
831129	0946	206.45	

WELL 502-B

Date (YYMMDD)	Time (HHMMSS)	Depth to Water (Ft.)	Remarks
831030	----	127.79	
831102	1419	127.79	
831108	1541	127.43	
831115	1055	127.81	
831122	1053	127.44	
831129	0949	127.45	

WELL 503-A

Date (YYMMDD)	Time (HHMMSS)	Depth to Water (Ft.)	Remarks
831030	----	221.70	
831108	1520	221.30	
831115	1043	221.61	
831122	1033	221.02	
831129	0957	220.95	

WELL 503-B

Date (YYMMDD)	Time (HHMMSS)	Depth to Water (Ft.)	Remarks
831030	----	137.06	
831102	1405	137.04	
831108	1528	136.71	
831115	1046	137.07	
831122	1040	136.79	
831129	0953	136.65	

WELL 504-A

Date (YYMMDD)	Time (HHMMSS)	Depth to Water (Ft.)	Remarks
831030	----	226.53	
831108	1421	226.21	
831115	1017	226.38	
831122	1115	225.90	
831129	1024	225.92	

WELL 504-B

Date (YYMMDD)	Time (HHMMSS)	Depth to Water (Ft.)	Remarks
831030	----	131.14	
831105	0956	131.02	
831108	1430	130.24	
831115	1023	131.10	
831122	1121	130.60	
831129	1029	130.57	

WELL 505-A

Date (YYMMDD)	Time (HHMMSS)	Depth to Water (Ft.)	Remarks
831025	------	97.33	
831027	------	97.12	
831030	------	97.03	
831101	113730	97.06	
831101	120700	97.05	
831101	122630	97.04	
831101	124630	97.03	
831101	130430	97.02	
831101	132100	97.01	122230 610 Turned Off
831101	135430	97.01	
831101	143100	96.95	
831101	145600	96.96	
831101	152900	97.00	
831101	155100	97.00	
831101	162200	97.00	
831101	165630	97.00	
831101	214200	97.05	
831102	020200	97.04	
831102	110330	97.07	
831102	120830	97.07	
831102	130330	97.04	
831103	103700	97.11	
831104	103800	97.03	
831105	163000	96.87	
831108	160100	96.70	
831115	110600	97.02	
831122	142600	96.60	
831129	105700	96.52	

WELL 505-B

Date (YYMMDD)	Time (HHMMSS)	Depth to Water (Ft.)	Remarks
831025	------	39.85	
831027	------	39.60	
831030	------	39.51	
831101	114130	39.52	
831101	121000	39.51	
831101	123100	39.50	
831101	125130	39.49	
831101	130830	39.49	
831101	132530	39.48	
831101	135830	39.47	
831101	142900	39.45	
831101	145900	39.43	
831101	153400	39.48	
831101	155400	39.49	
831101	162500	39.51	
831101	163830	39.51	
831101	170000	39.53	
831101	173500	39.65	
831101	200300	39.65	
831101	214530	39.72	
831102	020500	40.00	
831102	110730	40.50	
831102	121230	40.51	
831102	130700	40.52	
831102	145630	40.59	
831103	104200	41.40	
831103	170600	41.50	
831104	104300	41.85	
831104	140700	41.71	
831105	163300	42.11	
831106	101400	42.44	
831107	114300	42.48	
831109	103800	43.01	
831111	101100	43.09	
831114	094600	43.13	
831116	100900	43.35	
831118	095800	43.04	
831123	140100	43.30	
831125	101400	43.01	
831128	105500	43.40	

WELL 505-C

Date (YYMMDD)	Time (HHMMSS)	Depth to Water (Ft.)	Remarks
831025	------	38.02	
831027	------	37.80	
831030	125700	37.68	
831101	114500	37.65	
831101	121430	37.64	
831101	123430	37.63	
831101	125500	37.61	
831101	131200	37.61	
831101	132930	37.59	
831101	140200	37.61	
831101	142500	37.56	
831101	150100	37.55	
831101	153700	37.60	
831101	155830	37.60	
831101	162800	37.59	
831101	170300	37.60	
831102	020800	37.62	
831102	111500	37.66	
831102	121600	37.64	
831102	131030	37.63	
831103	104400	37.68	
831104	104500	37.58	
831105	163500	37.44	
831107	114500	37.45	
831108	155500	37.32	
831115	110400	37.77	
831122	142800	37.53	
831129	105900	37.57	

WELL 505-D

Date (YYMMDD)	Time (HHMMSS)	Depth to Water (Ft.)	Remarks
831025	----	37.21	
831027	----	37.00	
831030	----	36.59	
831104	----	36.88	
831108	1557	36.75	
831115	1102	37.02	
831122	1432	36.86	
831129	1101	36.85	

WELL 506-A/36-01/01

Date (YYMMDD)	Time (HHMMSS)	Depth to Water (Ft.)	Remarks
831030	----	45.03	
831105	1009	45.00	
831110	1015	44.80	
831113	0941	44.66	
831117	0907	44.64	
831120	1313	44.27	
831124	0945	44.74	
831127	1310	44.47	

WELL 517

Date (YYMMDD)	Time (HHMMSS)	Depth to Water (Ft.)	Remarks
831025	------	56.90	
831027	------	56.66	
831030	------	56.54	
831101	113100	56.59	Pump 608 on at noon
831101	120230	56.55	
831101	121800	56.55	Pump 600 on
831101	123900	-----	
831101	124130	56.54	
831101	125930	56.54	
831101	131630	56.52	
831101	134800	56.51	
831101	143500	56.47	
831101	145200	56.49	
831101	151800	56.51	
831101	154100	56.51	
831101	161000	56.51	
831101	164530	56.51	
831101	200700	56.51	
831101	215000	56.59	
831102	021200	56.67	
831102	095600	56.86	
831102	112800	56.86	
831102	125330	56.87	
831103	103200	57.33	
831103	170300	57.37	
831104	103500	57.70	
831104	140500	57.67	
831105	162600	58.00	
831106	101200	58.36	
831107	113900	58.49	
831109	103500	59.09	
831111	100800	59.28	
831114	094900	59.54	
831116	101200	59.81	
831118	100000	59.50	
831123	135200	59.22	
831125	101100	59.77	
831128	105100	60.18	

WELL 518

Date (YYMMDD)	Time (HHMMSS)	Depth to Water (Ft.)	Remarks
831025	------	99.45	
831027	------	99.21	
831030	------	99.13	
831101	100300	99.13	
831101	152300	99.08	
831101	154600	99.08	
831101	161600	99.08	
831101	165030	99.09	
831101	171330	99.09	
831101	174000	99.09	
831101	201500	99.08	
831102	021730	99.12	
831102	100300	99.22	
831102	115730	99.21	
831102	125830	99.20	
831103	102000	99.44	
831103	165300	99.40	
831104	102400	99.59	
831104	140000	99.55	
831105	161700	99.72	
831106	100300	100.03	
831107	113400	100.08	
831109	102800	100.57	
831111	100400	100.73	
831114	100100	101.04	
831116	102100	101.32	
831118	101300	101.06	
831123	134700	101.55	
831125	095600	101.47	
831128	104200	101.91	

WELL 522

Date (YYMMDD)	Time (HHMMSS)	Depth to Water (Ft.)	Remarks
831108	1103	35.99	
831115	1114	36.16	
831122	1417	36.04	
831129	1049	36.04	

WELL 523

Date (YYMMDD)	Time (HHMMSS)	Depth to Water (Ft.)	Remarks
831025	----	40.45	
831027	----	40.32	
831030	----	40.25	
831101	1015	40.27	
831101	1447	40.24	
831101	1502	40.22	
831101	1532	40.23	
831101	1402	40.23	
831101	1432	40.23	
831101	1947	40.26	
831102	0940	40.37	
831102	1546	40.39	
831103	1109	40.66	
831104	1109	40.88	
831104	1420	40.86	
831105	1642	41.06	
831106	1042	41.23	
831107	1159	41.35	
831109	1133	41.65	
831111	1034	41.88	
831114	1022	42.14	
831116	0938	42.37	
831118	0937	42.32	
831123	1153	42.64	
831125	1029	42.69	
831128	1116	42.84	

WELL 601

Date (YYMMDD)	Time (HHMMSS)	Depth to Water (Ft.)	Remarks
831024	----	38.50	
831026	----	38.58	
831028	----	38.55	
831105	1638	38.49	
831106	1040	38.54	
831109	1130	38.69	
831111	1016	38.88	
831114	1025	39.19	
831116	0958	39.44	
831118	0940	39.62	
831123	1148	39.98	
831125	1026	40.16	
831128	1113	40.42	

WELL 606

Date (YYMMDD)	Time (HHMMSS)	Depth to Water (Ft.)	Remarks
831024	----	88.11	
831026	----	88.35	
831028	----	88.24	
831101	1656	88.09	
831102	1126	88.15	
831103	1048	88.23	
831104	1052	88.14	
831110	1145	88.05	
831113	1051	87.90	
831117	1014	87.87	
831120	1411	87.47	
831124	1259	87.84	
831127	1406	87.61	

WELL 607

Date (YYMMDD)	Time (HHMMSS)	Depth to Water (Ft.)	Remarks
831024	------	102.55	
831026	------	102.79	
831028	------	102.67	
831030	------	102.60	
831101	120300	102.55	
831101	121335	102.55	
831101	122720	102.55	
831101	124400	102.56	
831101	125800	102.53	
831101	132300	102.53	
831101	135000	102.52	
831101	140900	102.52	
831101	144200	102.52	
831101	151300	102.52	
831101	153600	102.52	
831101	160500	102.52	
831101	164500	102.50	
831101	173800	102.52	
831101	195600	102.56	
831101	213000	102.58	
831102	014800	102.55	
831102	100000	102.60	
831102	110900	102.59	
831102	114700	102.55	
831103	110400	102.66	
831103	171700	102.58	
831104	105800	102.58	
831104	141200	102.51	
831105	164700	102.43	
831106	103000	102.56	
831107	115300	102.42	
831109	112100	102.57	
831111	102000	102.43	
831114	101500	102.35	
831116	095200	102.45	
831118	095400	101.99	
831123	142000	102.11	
831125	103500	101.92	
831128	143300	102.13	

WELL 609

Date (YYMMDD)	Time (HHMMSS)	Depth to Water (Ft.)	Remarks
831024	------	41.71	
831026	------	41.92	
831028	------	41.79	
831101	120100	41.71	
831101	121020	41.71	
831101	122145	41.65	
831101	123330	41.65	
831101	124800	41.65	
831101	130540	41.65	
831101	132600	41.68	
831101	134600	41.69	
831101	140200	41.70	
831101	142000	41.74	
831101	143800	41.76	
831101	145000	41.80	
831101	150500	41.81	
831101	153000	41.86	
831101	154000	41.88	
831101	155600	41.92	
831101	160900	41.95	
831101	162300	41.97	
831101	163700	42.00	
831101	164700	42.03	
831101	170500	42.08	
831101	172700	42.14	
831101	200000	42.54	
831101	213700	42.81	
831102	015500	43.33	
831102	100900	43.12	
831102	110200	44.05	
831102	111900	44.04	
831102	113200	44.04	
831102	115700	44.05	
831102	123800	44.07	
831102	130400	44.08	
831102	134100	44.10	
831102	142600	44.15	
831102	145100	44.19	
831103	105800	45.46	
831103	171100	45.58	
831104	110400	45.95	
831104	140900	45.94	
831105	165300	46.31	

WELL 609 (continued)

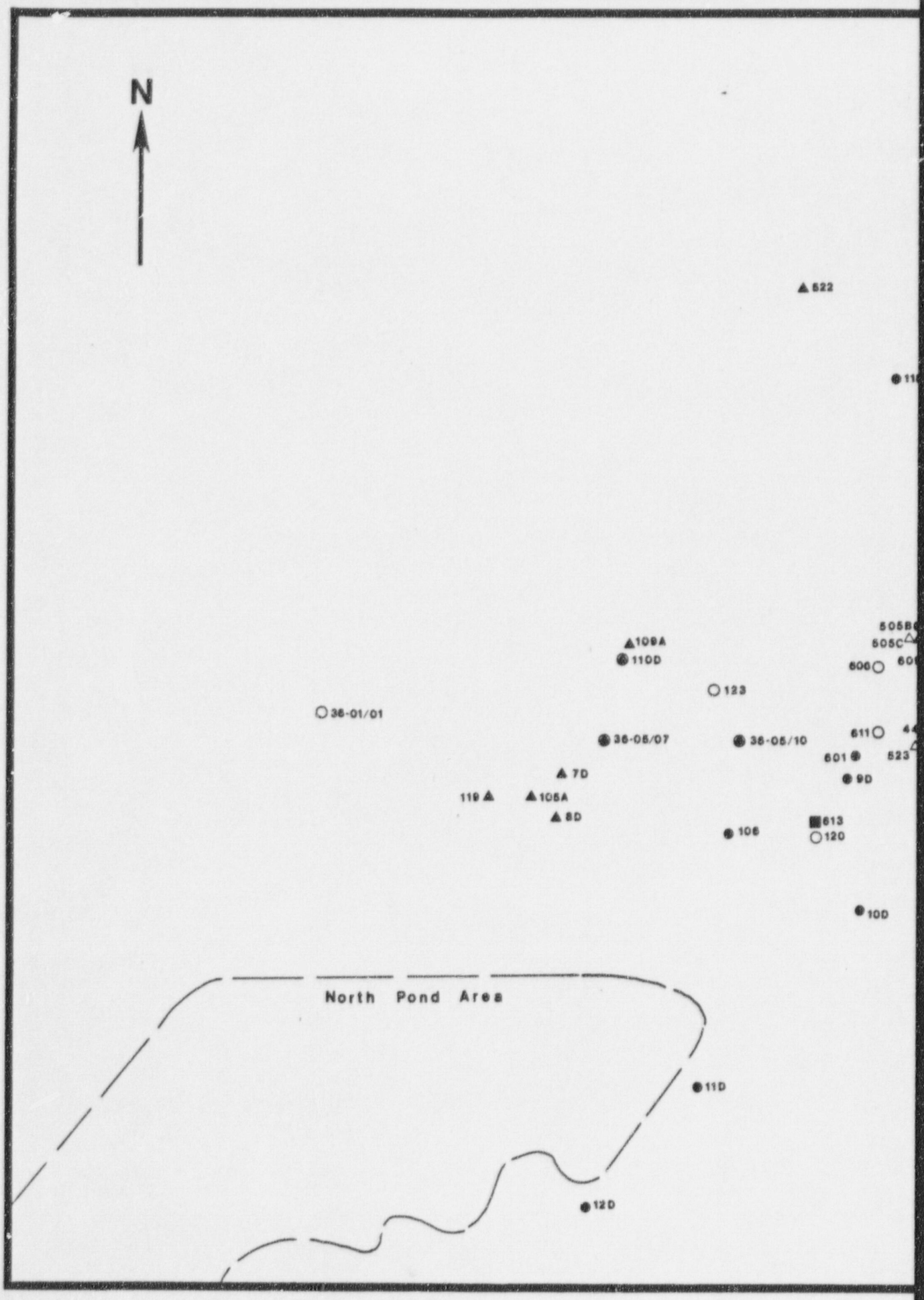
Date (YYMMDD)	Time (HHMMSS)	Depth to Water (Ft.)	Remarks
831106	103500	46.63	
831107	114800	46.61	
831109	112700	47.42	
831111	102800	47.51	
831114	101900	47.52	
831116	095400	47.82	
831118	095600	47.54	
831123	142700	47.54	
831125	103800	47.10	
831128	142600	47.79	

WELL 611

Date (YYMMDD)	Time (HHMMSS)	Depth to Water (Ft.)	Remarks
831024	----	90.46	
831026	----	90.67	
831028	----	90.55	
831030	----	90.51	
831101	1012	90.49	
831102	1002	90.50	
831103	1052	90.54	
831104	1107	90.46	
831107	1202	90.28	
831113	1050	90.21	
831117	1012	90.19	
831120	1415	89.76	
831124	1304	90.12	
831127	1403	89.88	

WELL 612

Date (YYMMDD)	Time (HHMMSS)	Depth to Water (Ft.)	Remarks
831024	------	100.97	
831026	------	101.22	
831028	------	101.10	
831030	------	101.02	
831101	120715	100.97	
831101	121900	100.96	
831101	123100	100.94	
831101	125210	100.96	
831101	131000	100.95	
831101	133000	100.94	
831101	135800	100.96	
831101	141700	100.92	
831101	144500	100.94	
831101	150800	100.94	
831101	153300	100.94	
831101	160000	100.92	
831101	164300	100.92	
831101	173500	100.92	
831101	194900	100.97	
831101	213300	100.98	
831102	014500	100.95	
831102	100500	101.02	
831102	111500	101.01	
831102	124400	100.99	
831102	143000	100.98	
831103	111400	101.08	
831103	171400	100.00	
831104	110100	100.99	
831104	141400	100.92	
831105	165000	100.85	
831106	103200	100.98	
831107	115100	100.85	
831109	112300	100.98	
831111	102600	100.84	
831114	101700	100.75	
831116	094700	100.87	
831118	095200	100.40	
831120	142400	100.52	
831125	103300	100.34	
831128	142900	100.55	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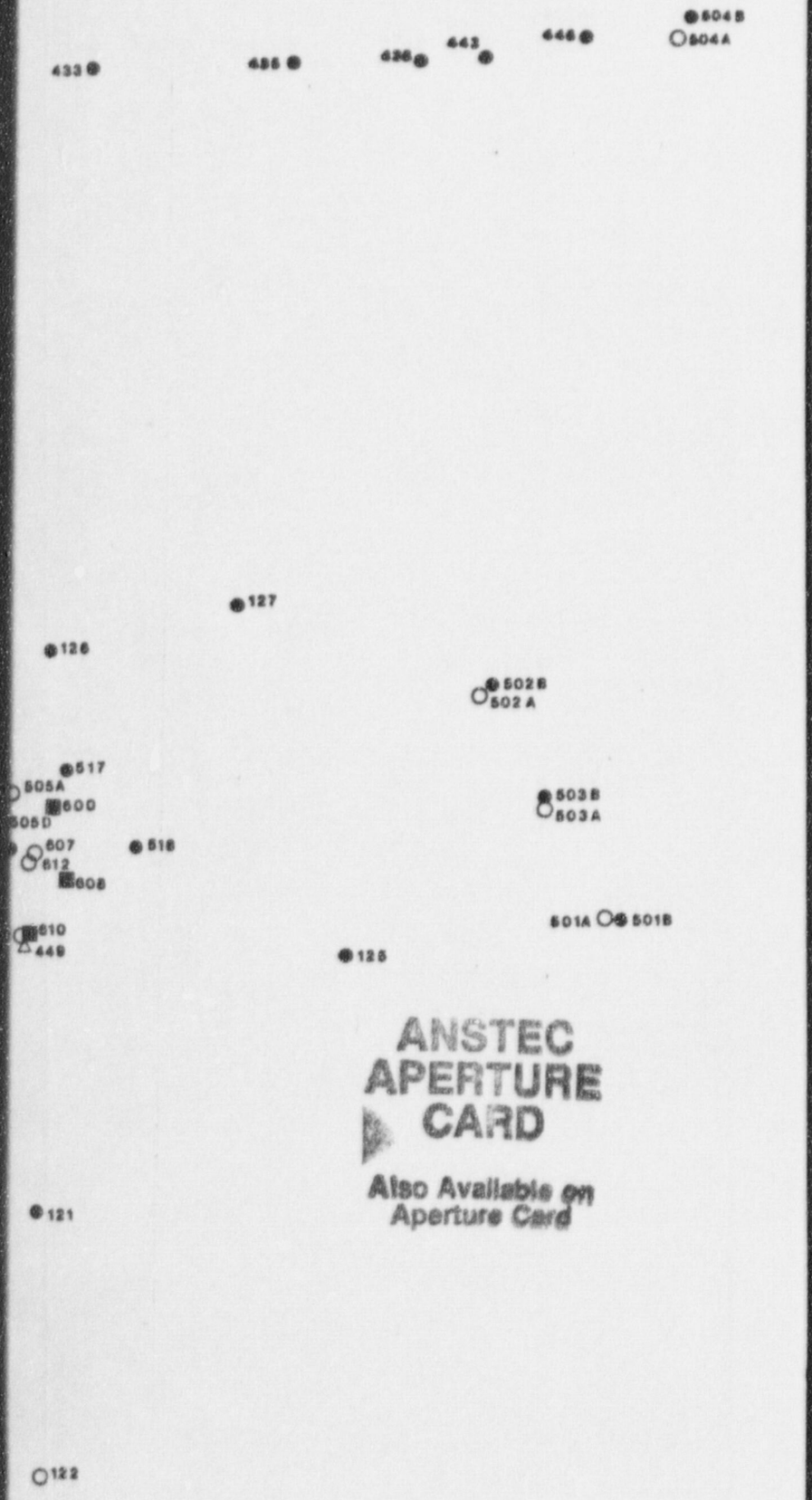
505B
505C
109A
110D
606
123
36-01/01
611
36-05/07
36-05/10
601
523
7D
9D
119
105A
8D
613
106
120
10D
North Pond Area
11D
12D



WELL SYMBOL	HYDROGEOLOGIC UNIT
○	Zone 1
●	Zone 3
■	Zone 3 (Pumping)
△	Torrivio
▲	Alluvium
◉	Composite

0 260
scale feet

S. S. PAPADOPULOS & ASSOCIATES, INC.
CONSULTING GROUND WATER HYDROLOGISTS

FIGURE 1
MONITORING WELL
LOCATION MAP

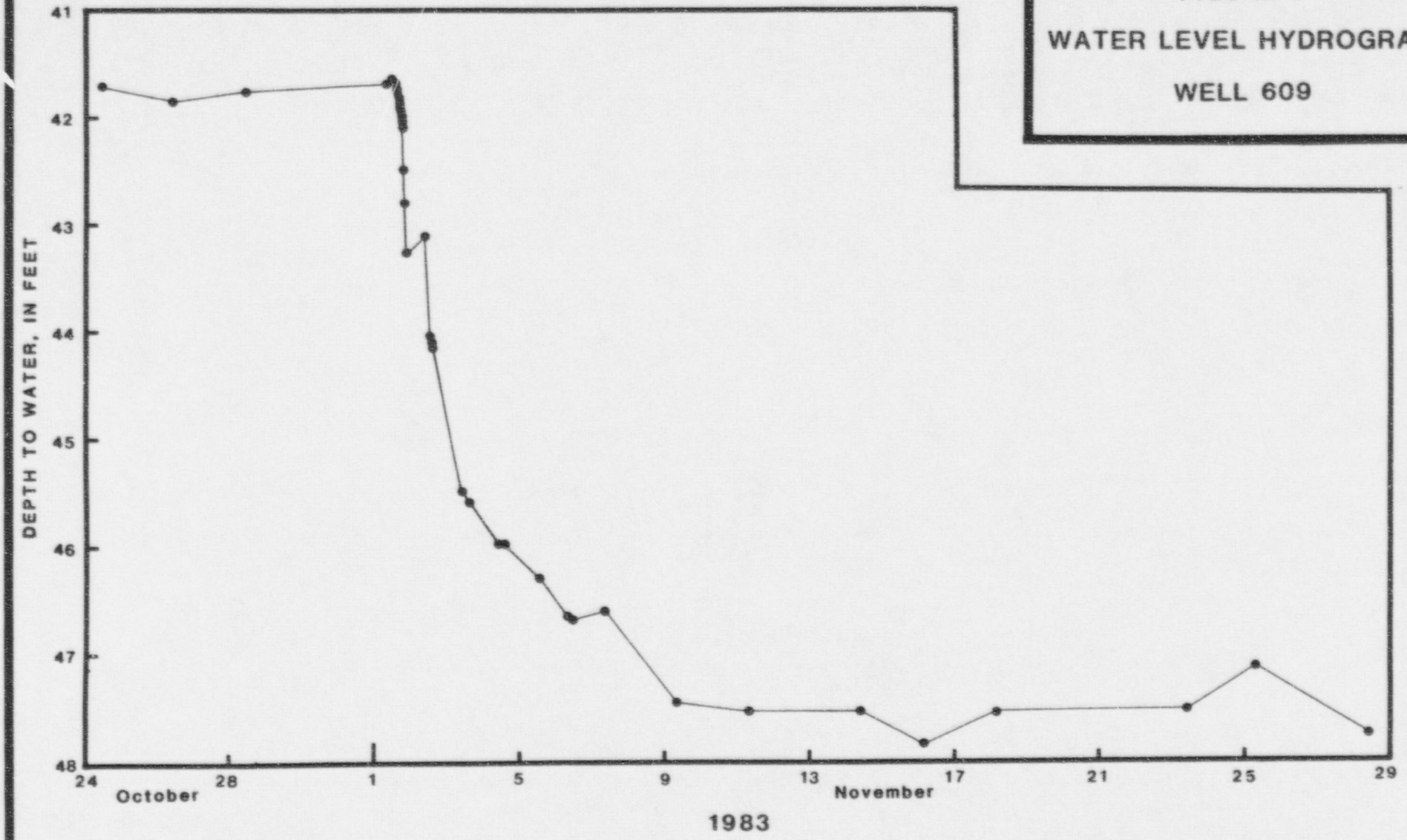
9805010028-01

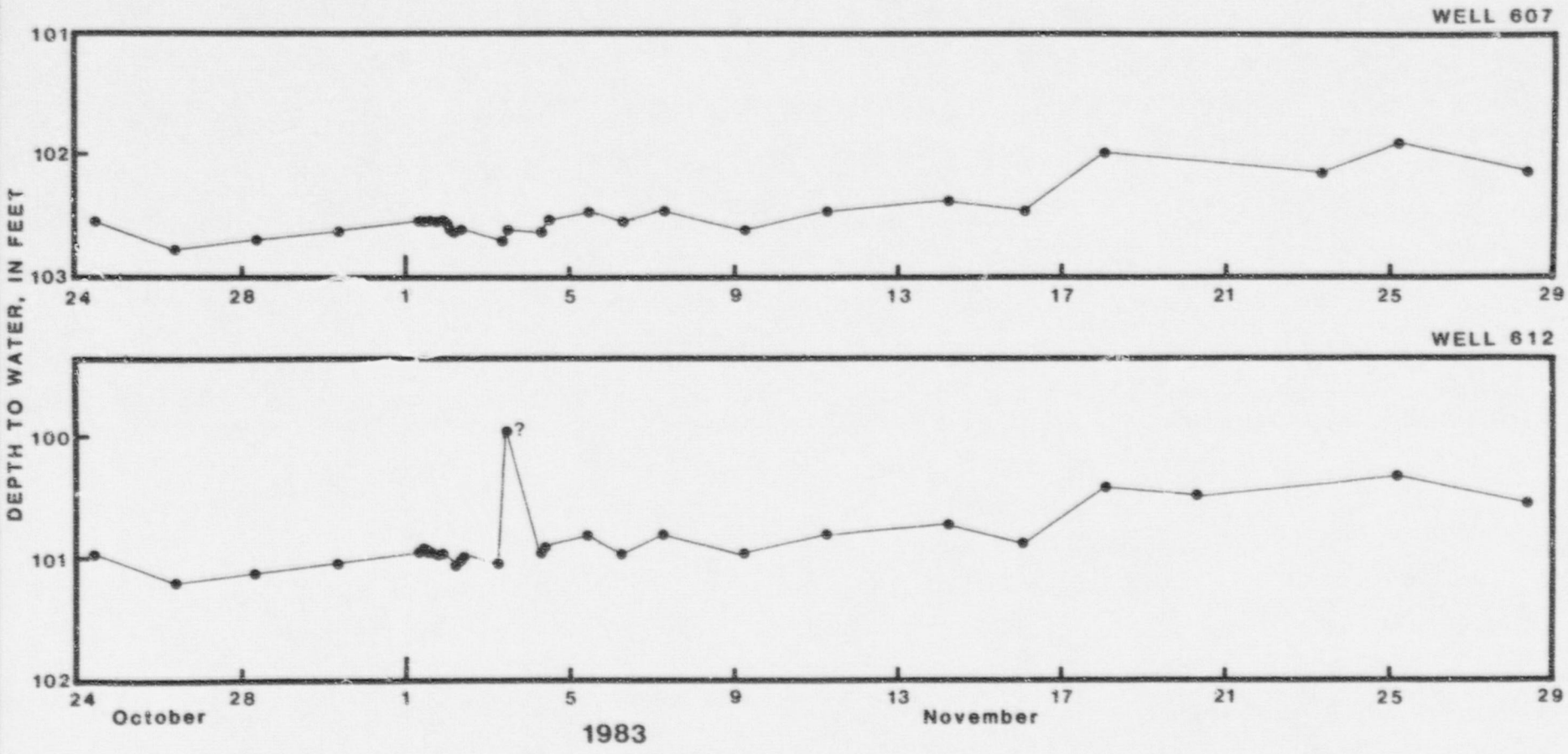
S. S. PAPADOPULOS & ASSOCIATES, INC.
CONSULTING GROUND WATER HYDROLOGISTS

FIGURE 2

WATER LEVEL HYDROGRAPH

WELL 609





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CONSULTING GROUND WATER HYDROLOGISTS

FIGURE 3

WATER LEVEL HYDROGRAPHS

WELLS 607 & 612