REPORT ON THE THIRD SAMPLING

OF THE BRINKLEY PROTOTYPE

ARKANSAS PROTOTYPE
MONITORING PROGRAM

Arkansas Department of Pollution Control & Ecology
February, 1996

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By

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February, 1996

(revised 3/96; 5/96)

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INTRODUCTION

The third ground water quality sampling was completed during August, 1995, for the Brinkley prototype. Ground water monitoring in the area has been conducted at three year intervals with the first sampling in 1989 and the second sampling in 1992. This prototype has been expanded to include additional wells in the Mississippi River Valley alluvium in an area of documented saltwater contamination.

The Brinkley prototype, which lies within the Gulf Coast Physiographic Province, is located in the immediate vicinity of Brinkley, Arkansas in northern Monroe County. This prototype, similar to the Jonesboro prototype sampled earlier in the year, is located within an area that has experienced increased water level declines over a five year period 1984-1989 (Westerfield and Gonthier, 1993).

Ground water quality analyses together with complete well descriptions will be placed in EPA's STORET data storage and retrieval system. This information will be available to all interested parties with access to STORET. Copies of the laboratory analyses have been sent to all interested well owners whether agricultural, domestic, industrial, or public. For the purposes of GIS data collection, all sample sites have been surveyed with the Magellan NAV 5000 PRO; a hand-held GPS C/A-code and carrier phase code receiver. This instrument generally has a horizontal accuracy of approximately 12 meters.

Please refer to the document entitled "Status Report For The Arkansas Prototype Monitoring Program" (April, 1994) for a review of the methodology and geology used in the statewide monitoring program. Location and description of wells and results of the first three sampling periods are listed in the tables at the back of this report. Other reports describing the geology and water quality of the Mississippi River Valley alluvial aquifer include Boswell, Cushing, and Hosman (1968); Broom and Lyford (1982); and Morris and Bush (1986).

FY95 MONITORING

Twenty-seven wells screened in the Quaternary alluvium were sampled for ground water quality during August, 1995. Figure 1 shows the location of wells sampled for ground water quality during the three sampling periods. Six of the twelve wells originally sampled in 1989 were not resampled during the most recent event. The remaining six original wells, along with twenty-one wells not previously sampled, were included in the current study. The twenty-seven alluvial wells had depths ranging from 60 to 160 feet.

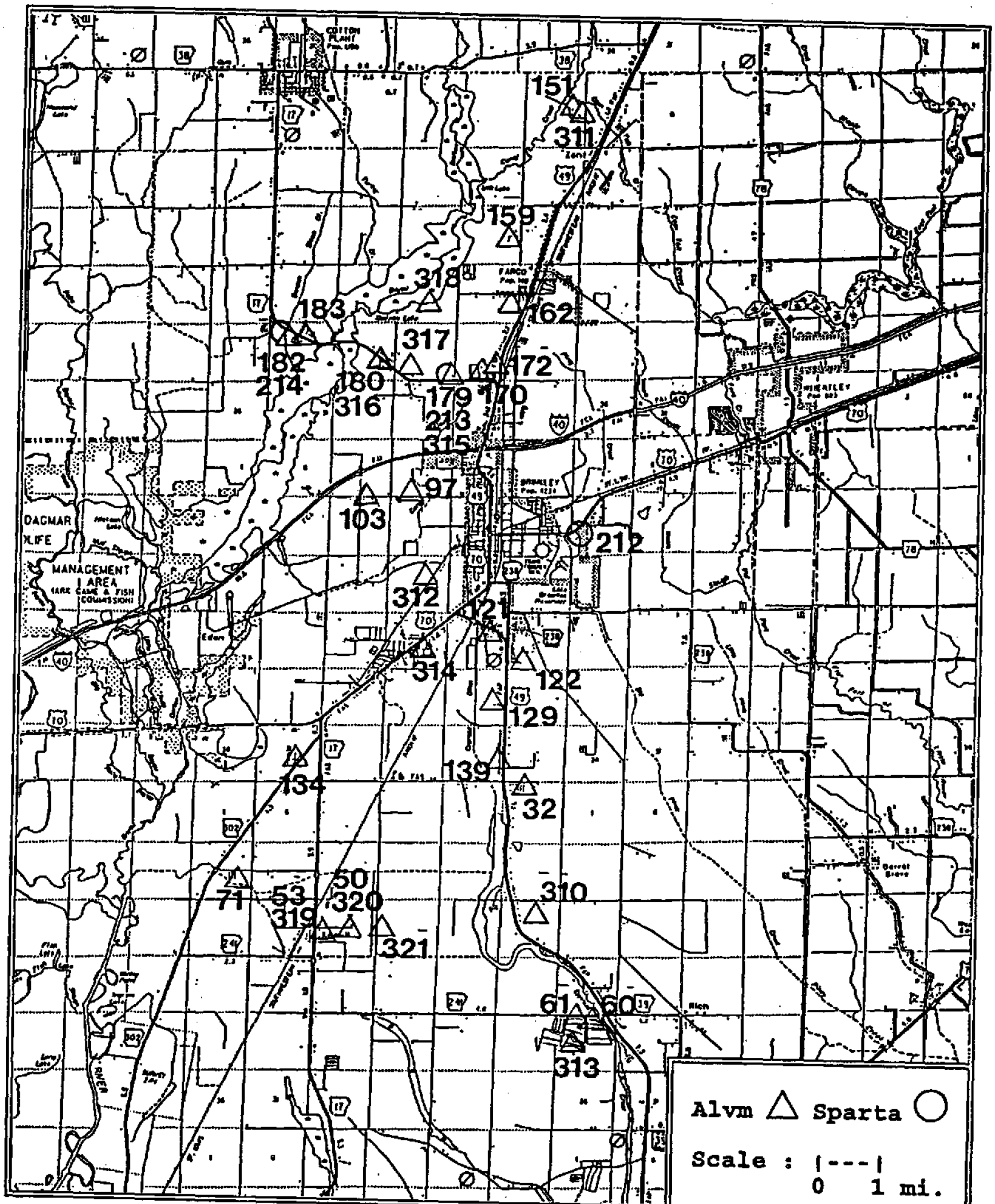

Figure 1. Location of wells sampled for water quality in the Alluvial/Sparta aquifer in the Brinkley area during the three sampling periods. Wells #212, #213, and #214 were sampled in the original USGS study. Note: Alvm = Quaternary alluvium.

The alluvial aquifer near Brinkley ranges in thickness from about 100 to 160 feet, and averages 125 feet. The Sparta aquifer, not sampled during the third sampling event, attains a thickness of approximately 400 feet (Morris and Bush, 1986). The two Sparta wells sampled previously had depths ranging from 408 to 420 feet. Driller's logs were obtained, whenever possible, to verify the presence of grout, depths of wells, screened intervals, and well construction information.

This prototype originally was selected because it represents a community in eastern Arkansas where 100 percent of the population uses ground water to meet community needs and previous studies have shown it to be the site of a large area of contaminated ground water in what was formerly fresh water aquifers. Sampling categories of chemical constituents include both major and trace inorganic constituents, nutrients, total organic carbon, VOCs, and selected pesticides.

The chief source of pollution, as previously mentioned, is contamination of the alluvial aquifer by saltwater intrusion. Other potential sources of pollution are pesticides and nitrates originating from agricultural practices.

GROUND WATER QUALITY

The location and description of wells sampled during the third sampling period are shown in Table 1. Table 2 provides descriptions of six of the original wells which were not sampled during this period. Results of all three sampling periods (1989, 1992, and 1995) are provided in Table 3 with the most recent sampling located at the bottom of each box following the format used in the Status Report (1994).

Ground water from the Quaternary alluvial deposits is generally considered to be a hard to very hard calcium bicarbonate or calcium magnesium bicarbonate containing excessive iron (Boswell et al, 1968). Sodium replaces calcium as the dominant cation in areas where saltwater contamination is evident. This is generally true when the sodium-adsorption-ratio (SAR) exceeds a value of 2.5 (see section entitled "Saltwater Contamination"). Total dissolved solids (TDS) from the latest sampling period ranged from 134.0 to 1332.0 mg/l for the alluvial aquifer, with a median concentration of 652.0 mg/l. Total hardness of ground water, which ranged from 0.00 to 762.0 mg/l, falls into the soft to very hard range, with the latter more prevalent (median concentration - 404.0 mg/l). pH and conductivity were measured in the field at the time the samples were collected. pH ranged from 7.0 to 8.1, and conductivity ranged from 207.0 to 2720.0 μS/cm.

None of the wells exhibited elevated nitrate concentrations and only one well had a value above the detection limit (well #183 - .270 mg/l). Iron and manganese concentrations exceeded the secondary maximum contaminant level (SMCL) established by the EPA in most of the wells (Table 3). Twenty-five wells exceeded the SMCL for iron (300.0 μg/l) and manganese (50.0 μg/l). Nineteen wells exceeded the SMCL for TDS (500.0 mg/l). Six wells exceeded the SMCL for chloride (250.0 mg/l). Chloride concentrations ranged from 4.8 to 581.0 mg/l with a median concentration of 81.2 mg/l (see section entitled "Saltwater Contamination" for a detailed discussion of the relationship between high chloride concentrations and saltwater contamination).

A pesticide scan for the more common pesticides used in rice and soybean production was run for all wells screened in the alluvial aquifer (Table 4). Trace amounts of pesticides were detected in three wells. Molinate (.04898 μg/l) was detected in well #172, as was Methyl-Parathion (.01395 μg/l) in well #310, and Metribuzin (.00744 μg/l) in well #311. These detections were well below the EPA Health Advisory Limits (HAL) established for Methyl Parathion (2.0 μg/l) and Metribuzin (100.0 μg/l) for a 70 kg adult (lifetime). No HAL has been established for Molinate. The driller's log on well #310 indicated that the casing was not grouted although there was a concrete pad at the the wellhead. The well was backfilled with gravel from a depth of 132 feet to the surface. An inspection of the wellsite verified that the land surface does slope away from the wellhead. There were no driller's logs available for well #172 or #311; concrete pads were not observed at either wellhead with well #172 located on flat terrain in a rice field and well #311 located in the backyard of a house with the ground surface sloping toward the rice fields. All wells were analyzed for VOCs as shown in Table 5. There were no detections of VOCs in any of the wells sampled during this period.

NORTHERN MONROE COUNTY - POTENTIALLY CRITICAL AREA?

Ground water withdrawals for all uses in Monroe County (public, domestic, irrigation, etc.) increased from 124.74 MGD to 179.33 MGD between 1985 and 1990 (Holland, 1987; 1993). Deposits of Quaternary age (alluvial aquifer) account for 178.6 MGD of this total (99.6 %) with the remaining (.4 %) coming from the Sparta aquifer. The vast majority of ground water withdrawals from the Quaternary alluvium is used for irrigation. Irrigation of crops accounted for 91.25 percent of total ground water withdrawals in Arkansas during 1990 (Holland, 1993).

As a result of the large-scale withdrawals, several areas in the Gulf Coastal Plain have been considered for designation as critical ground water areas. Critical ground water areas are those areas where the quantity of ground water is rapidly becoming depleted or the quality is being degraded. Figure 2 shows the location of the monitoring area in relation to areas that may potentially be designated as critical by the Arkansas Soil and Water Conservation Commission (AS&WCC). A critical ground water area is designated by the AS&WCC according to the following criteria:

(1) For water table conditions:

(A) Water levels have been reduced such that fifty percent or less of the thickness of the formation, is saturated and average declines of one foot or more have occurred for the preceding five years; or

(B) Ground water quality has been degraded or trends indicate probable future degradation that would render the water unusable as a drinking water source or for the primary use of the aquifer.

SOURCE: AS&WCC (1995)

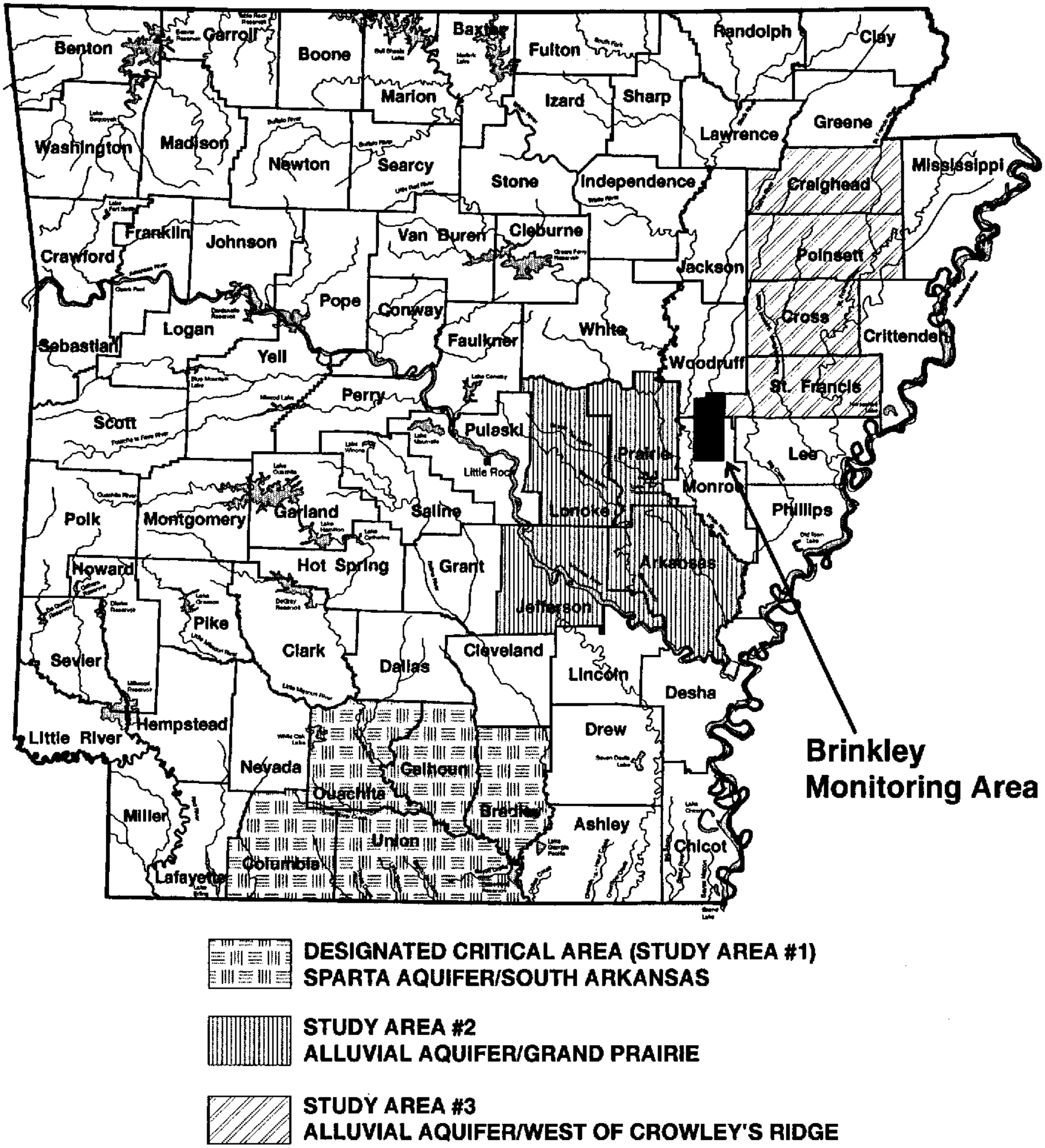

Figure 2. Brinkley Monitoring Area

Location of the monitoring area in relation to areas that may potentially be designated as critical by the Arkansas Soil and Water Conservation Commission.

(2) For artesian conditions:

(A) Potentiometric surface has declined below the top of the formation and average annual declines of one foot or more have occurred for the preceding five years; or

(B) Ground water quality has been degraded or trends indicate probable future degradation that would render the water unusable as a drinking water source or for the primary use of the aquifer.

The report by Westerfield and Gonthier (1993) includes a map showing the change between the spring 1984 and the spring 1989 potentiometric surface surface in the alluvial aquifer. Figure 3 shows the location of the study area in relation to areas of recent water level changes in the alluvial aquifer. As shown on the map, the Brinkley prototype is located in an area that has experienced a 0- to 10-foot decline.

The descriptive statistics for selected parameters for the twenty-seven alluvial wells are listed in Table 6. Water quality parameters that may reflect saltwater contamination include sodium, chloride, boron, and total dissolved solids. The shaded cells represent those parameters which exceed the median values.

SALTWATER CONTAMINATION

An investigation by Morris and Bush (1986) mapped saltwater contamination using water quality data from 217 wells in the alluvial aquifer. A map of the chloride concentration (isochlor) in the alluvial aquifer is shown in Figure 4. Samples with chloride concentrations of 50.0 mg/l or greater are considered to be contaminated by saltwater with the highest concentrations located in two separate areas. One area was centered approximately one and one-half miles north of Brinkley and two miles west of the intersection of Highways 17 and 49; with the other area centered near the Keevil community approximately six miles southwest of Brinkley. The study found that approximately 56 square miles of the alluvial aquifer had been contaminated by saltwater. Saltwater contamination has been a problem since first being recognized in the 1940's.

Their investigation considered three possible sources of contamination as follows: 1) accumulation of dissolved solids from a zone of stagnation within the aquifer; 2) irrigation practices which allow the accumulation of salts through evaporation; and 3) saltwater intrusion from below caused by pumping the upper aquifers. Chemical data collected for the report by Morris and Bush (1986) showed that the chemical composition of the alluvial aquifer was similar to that of the Sparta aquifer in contaminated areas, thereby suggesting that the most likely source of contamination was upward movement into the alluvial aquifer from the underlying Sparta through the thinned or absent Jackson confining unit. The Sparta aquifer, likewise, was contaminated by the deeper Nacatoch aquifer possibly by upward movement of ground water along faults which subsequently have become sealed over time.

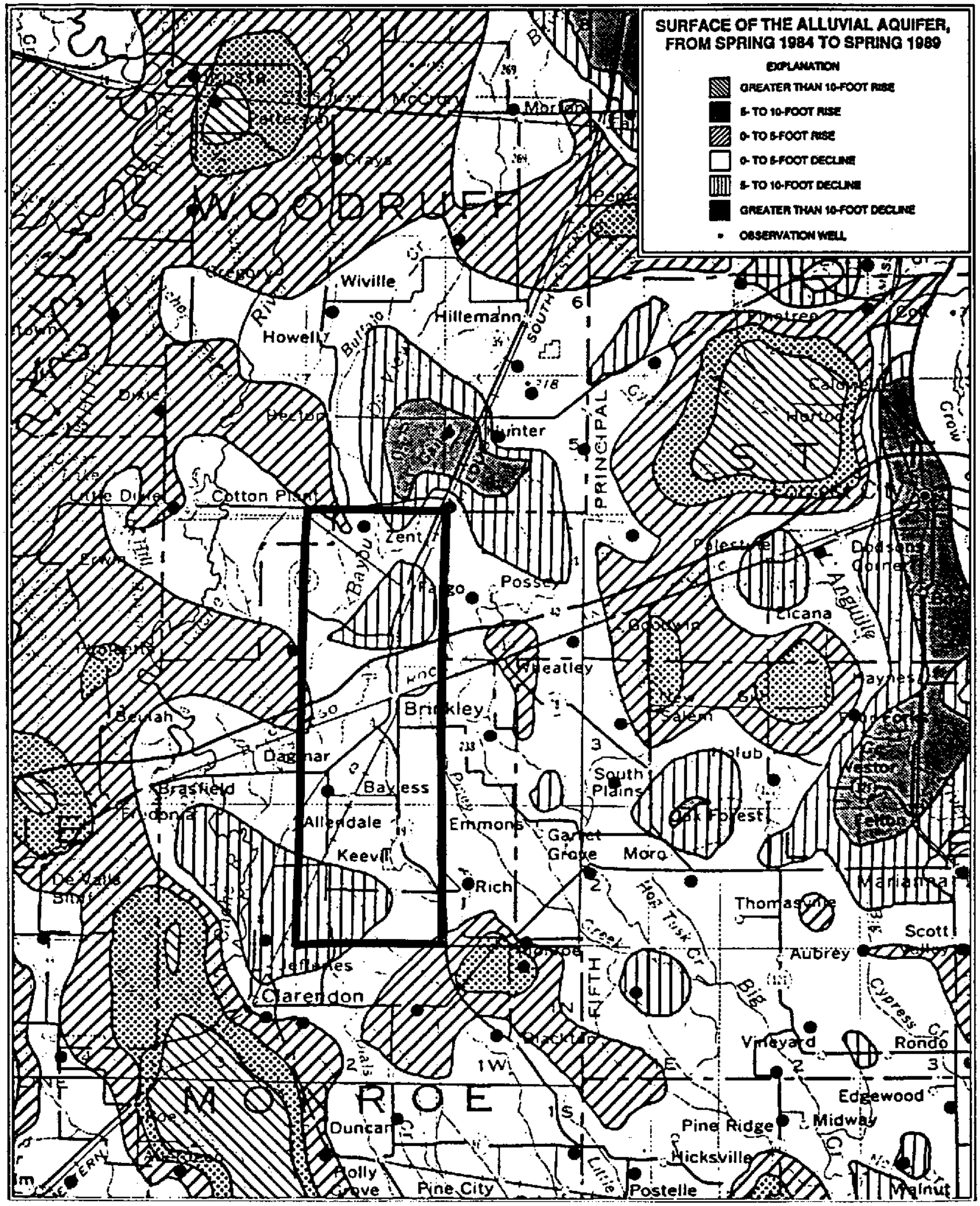

Figure 3. Location of the study area in relation to areas of recent water level changes in the alluvial aquifer (modified from Westerfield and Gonthier, 1993).

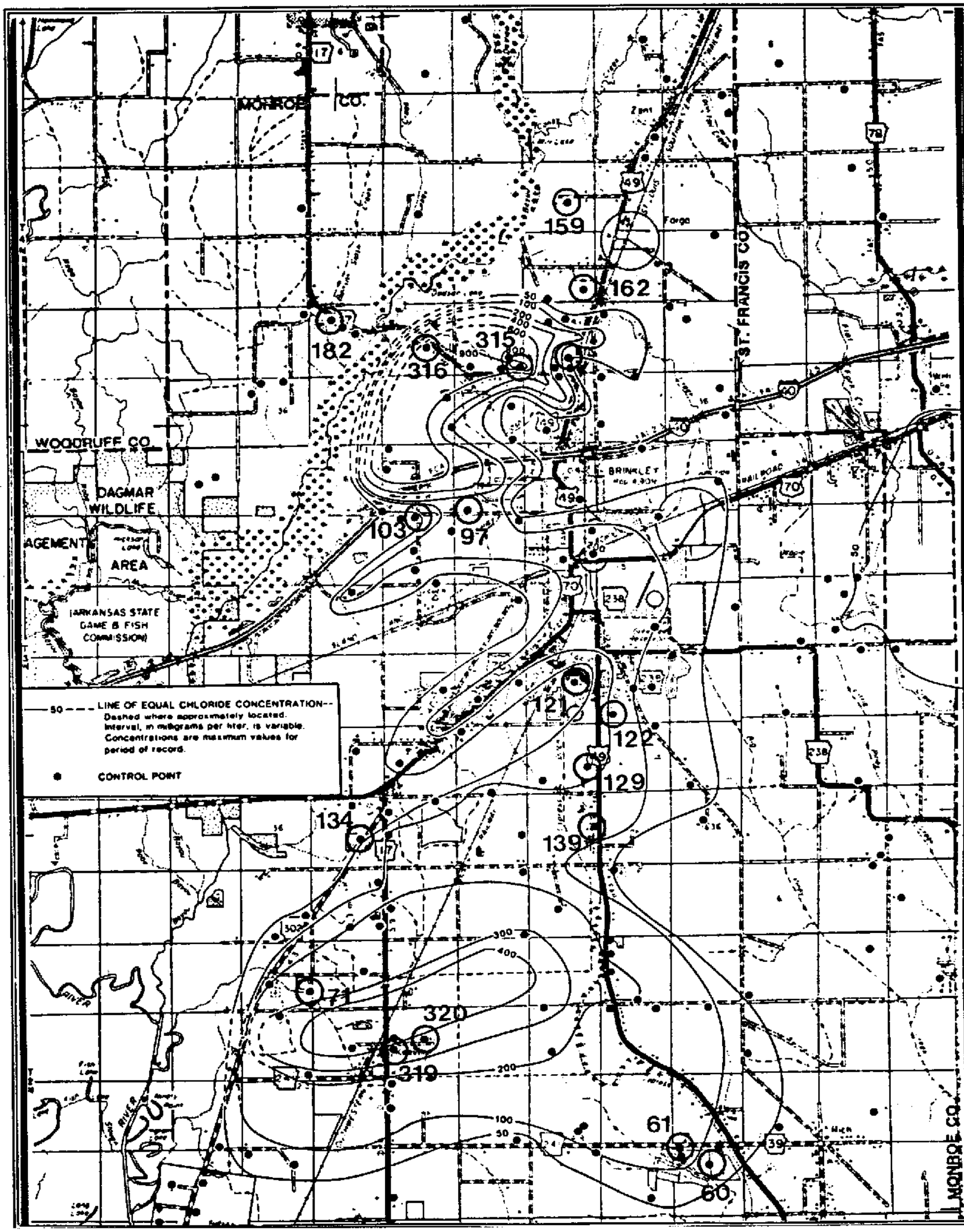

Figure 4. Isochlor map of the alluvial aquifer near Brinkley, Arkansas (from Morris and Bush, 1986). Note: Wells circled were also sampled for the present study or located in close proximity to the wells originally sampled by the USGS.

The present study represents both an effort to monitor changes in ground water quality in the alluvial aquifer over time and to determine if the areal extent of the contamination is expanding. This report concludes that the study by Morris and Bush (1986) adequately explains the most probable cause of the saltwater contamination.

The highest chloride concentration observed in ground water samples taken from the alluvial aquifer during the USGS study was 960.0 mg/l (well #179) in February, 1984. Water samples taken from this same well during the first sampling period (1989) had a chloride concentration of 830.0 mg/l. The highest chloride concentration found in samples from the Sparta aquifer was 1,100.0 mg/l (well #213) in February, 1984. A chloride concentration of 1,000.0 mg/l was observed in this well during the first sampling period (1989). Well #212 had a chloride concentration of 694.0 mg/l in samples taken from the Sparta aquifer during the second sampling period (1992). This compares to a chloride concentration of 380.0 mg/l from the same well taken in September, 1983 by the USGS. The Sparta aquifer was not sampled during the third sampling event (1995) because of problems with accessibility.

A list of wells showing the chloride concentration over time is presented in Table 7. Several wells show little change in concentration over a period of ten to twenty years, while others show an increase or decrease. Wells #315, 316, 319, and 320 (note well locations in Figure 1) were listed because they were located very near the wells originally sampled (wells #179, 180, 53, and 50, respectively), and were in areas of high chloride concentrations noted in the earlier study. Chloride concentrations in these wells, with the exception of well #316 (near old well #180), indicate that the areas that were the most contaminated by high salinity are still the most contaminated. Well #180 had a chloride concentration of 700 mg/l in October, 1975. Well #316, located within 25 feet of abandoned well #180, had a chloride concentration of 126.0 mg/l for the most recent sampling. This same pattern was reflected between August, 1974 (660.0 mg/l) and July, 1975 (270.0 mg/l) for well #180. It is possible that a variability in chloride concentration could be affected by the length of time the well had been pumping prior to sampling. It should be noted that old well #180 had a drilled depth of 128 feet. No driller's log is available for well #316 although a depth of 60 feet is listed in Table 3 (depth given for this report is from second-hand information).

As noted by Morris and Bush (1986), and Huff and Bonck (1993), saltwater may contain excessive amounts of certain elements such as sodium and boron, making it unsuitable for agricultural use. Sodium has the ability to exchange with calcium and magnesium on soil particles thereby damaging the soil structure. This may result in decreased permeability or deflocculation (Huff and Bonck, 1993). The sodium hazard to soils can be evaluated using the sodium-adsorption-ratio (SAR). The SAR is defined by the equation:

$$SAR = \frac{NA^{+}}{\sqrt{\frac{(CA^{2+}) + (MG^{2+})}{2}}}$$

where Na, Ca, and Mg represent the concentration of sodium ions, calcium ions, and magnesium ions in milliequivalents per liter. The SAR's for the wells recently sampled are listed in Table 3. Irrigation waters are usually classified in terms of salinity hazard and sodium hazard utilizing the SAR and conductivity as shown in Figure 5. This diagram, used in the Huff and Bonck (1993) report, is a modification of the one developed by the U.S. Department of Agriculture (Richards, 1954). The sodium hazard for the twenty-seven wells used for the present study ranges from low to high with most of the wells falling within the low sodium hazard category (21 of 27 wells). The salinity hazard ranges from low (2 wells) to very high (2 wells), with high hazard being the most prevalent category (17 of 27 wells).

A number of studies, including Broom, et al (1984), and Morris and Bush (1986), have identified boron as being associated with source waters that contribute to saltwater problems. Boron is essential in plant nutrition, and may be added to fertilizer in small amounts in areas that are deficient in this element. The amount needed is quite small and depends upon the class of plant determined by its sensitivity to boron (sensitive, semitolerant, and tolerant)(Hem, 1989).

The highest concentration of boron in ground water samples taken by the USGS from the alluvial aquifer was found in well #179 (1,900.0 μg/l). The highest concentration found in ground water from the Sparta aquifer was taken from well #213 (1,500.0 μg/l). Boron in ground water samples from the twenty-seven wells sampled in this study ranged from 0.0 to 1,336.0 μg/l with a median concentration of 70.3 μg/l. The highest boron concentrations coincided with the areas most highly contaminated by saltwater.

Least-squares linear regression analysis using LOTUS 123 was run to compare the relationship between various chemical parameters. This method tests the amount of variance between a measured sample of x and y values. R-squared represents the reliability of the regression (a value of 0.0 to 1.0, inclusive). Figure 6, which is a plot of total dissolved solids as a function of specific conductance, shows a very strong linear relationship (R-squared = .98).

The cross-plots of sodium with chloride, and boron with sodium are shown in figures 7 and 8. Both demonstrate a strong linear relationship between the selected elements (R-squared = .74 and .76, respectively). Boron as a function of chloride for the Brinkley prototype (Figure 9) was compared with the same function for the Jonesboro prototype (Figure 10). Three Sparta wells (#212, #213, and #214) originally sampled during the previous USGS study were included in figure 9. Although the best-fit line (R-squared = .64) for this particular cross-plot for the Brinkley prototype does not show as strong a linear relationship as it does for those previously mentioned, it does show a strong contrast with the Jonesboro prototype (R-squared = .01), where saltwater contamination has not been a problem. A closer examination of Figure 9 shows a stronger linear relationship (R-squared = .98) if the four alluvial wells and three Sparta wells located the furthest above the line would be removed from the graph. The four alluvial wells (#315, #316, #317, and #318) are all located in or very near the northernmost area of high salinity. This same pattern is also shown in Figures 7 and 8 (well #129 is the exception in the former figure). The wells were labeled to illustrate the contrast in water chemistry between the wells in the northernmost area of high salinity (wells #315, #316, #317, and #318) and the wells in the southernmost area of high salinity (wells #319, #320, and #321).

It is also interesting to note that the four wells located in the northernmost area of high saliniy line up rather favorably on the graph with the three Sparta wells suggesting similar water chemistry. Although insufficient data exists to prove any one theory, the patterns shown in the previously mentioned graphs may reflect the possibility of more than one source for the saltwater contamination.

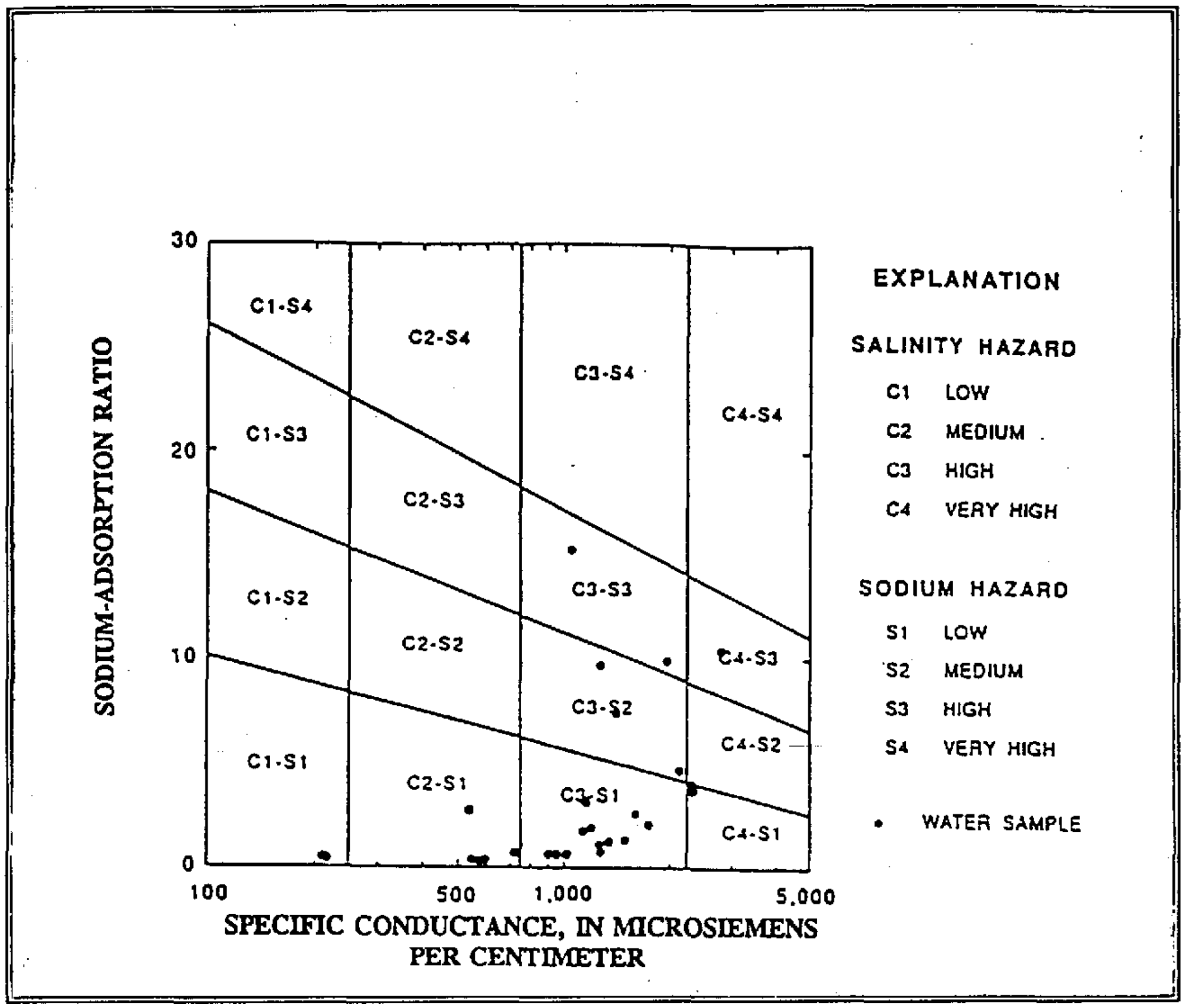

Figure 5. Classification of irrigation waters utilizing the SAR and conductivity ($\mu S/cm$) from twenty-seven alluvial wells near Brinkley, Arkansas (classification diagram from Huff and Bonck, 1993).

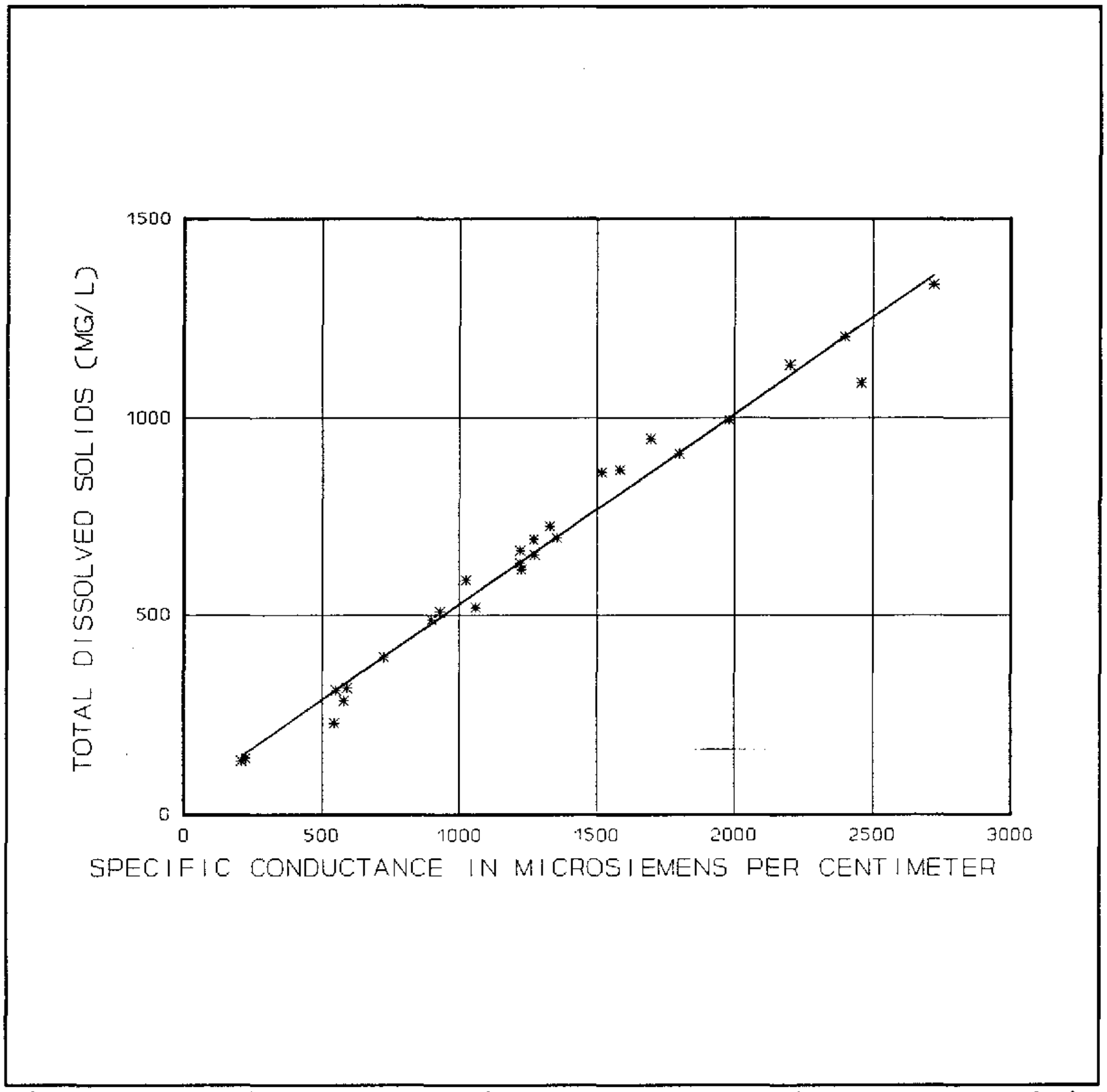

Figure 6. Dissolved solids as a function of specific conductance of water from the alluvial aquifer near Brinkley, Arkansas.

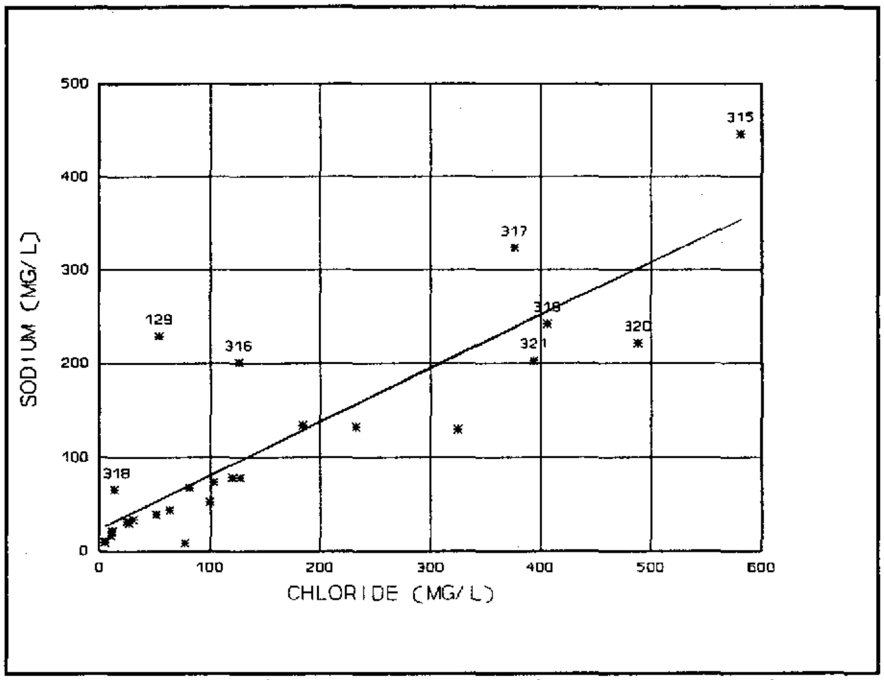

Figure 7. Sodium as a function of chloride. R-squared = .74. Numbers by symbols represent well numbers.

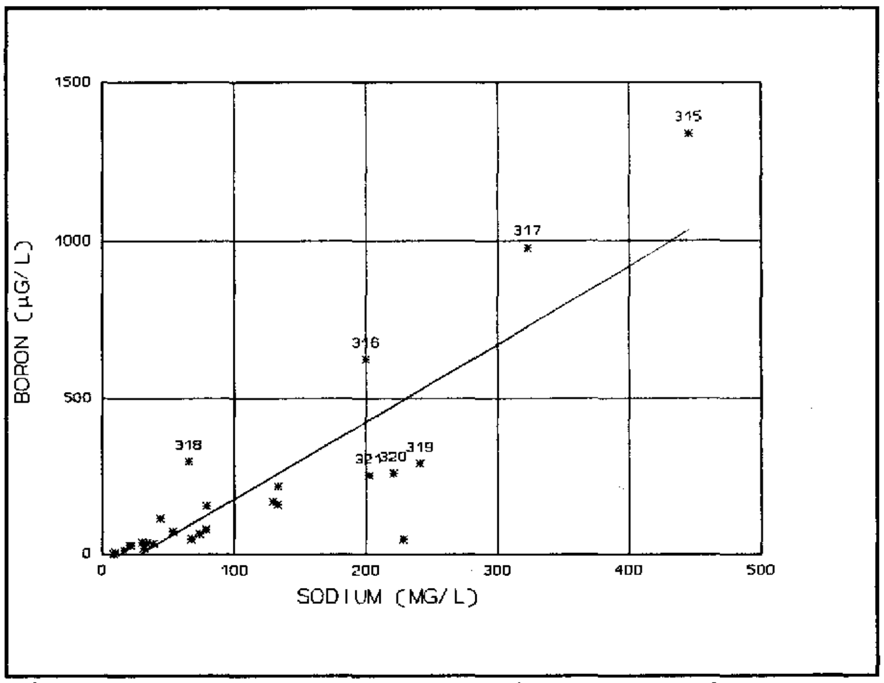

Figure 8. Boron as a function of sodium. R-squared = .76. Numbers by symbols represent well numbers.

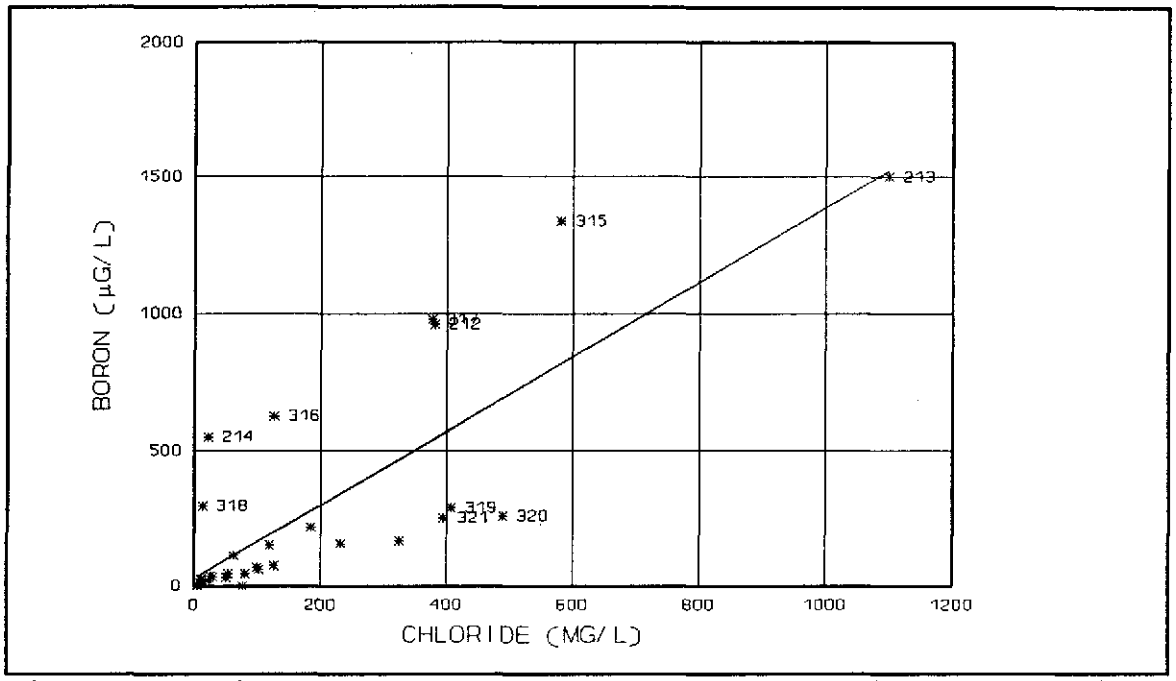

Figure 9. Brinkley prototype. Boron as a function of chloride. R-squared = .64. Numbers by symbols represent well numbers. Wells #212, #213, and #214 are in the Sparta aquifer and were sampled by the USGS in a previous study.

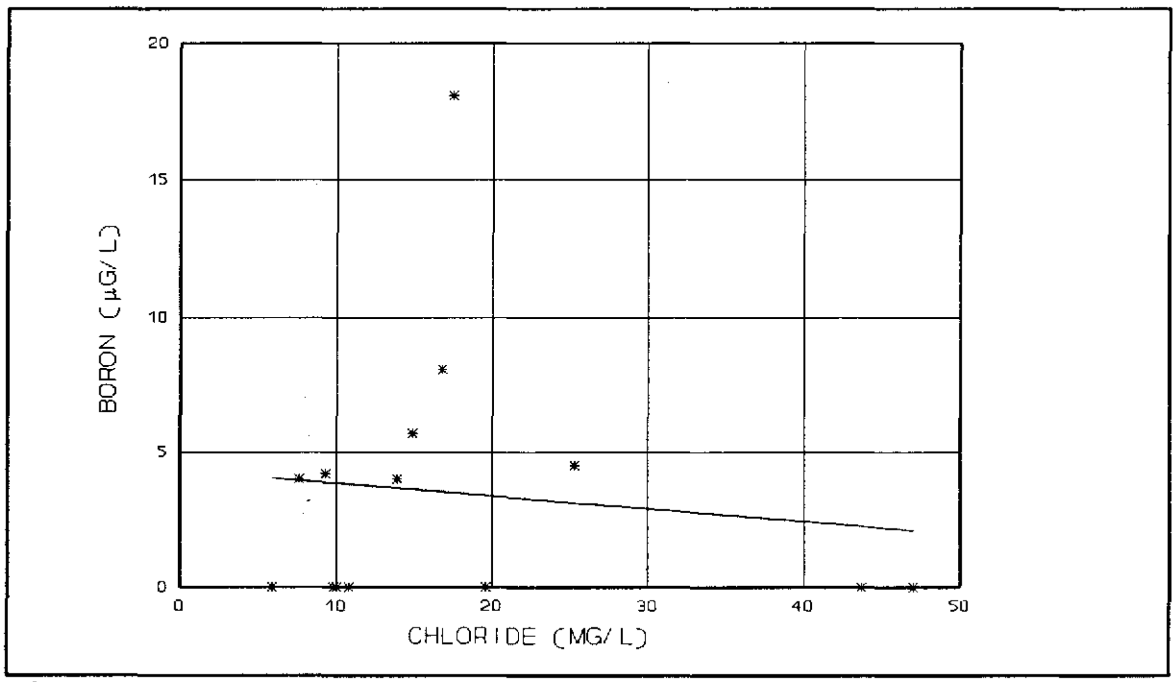

Figure 10. Jonesboro prototype (14 wells). Boron as a function of chloride. R-squared = .01.

SUMMARY AND CONCLUSIONS

The Brinkley prototype was expanded to include additional wells in the Mississippi River Valley alluvium in an area of documented saltwater contamination. The location of the prototype also coincides with an area that has experienced increased water level declines over a five year period (1984-1989), and lies in close proximity to an area that may potentially be designated as critical by the AS&WCC.

Ground water quality is quite variable due to the presence of definable saltwater contamination in much of the study area. Many wells exceeded the SMCL established by the EPA for iron, manganese, and total dissolved solids. Three wells, two irrigation and one domestic, had detections of pesticides used in rice and soybean production. These pesticides were identified as Molinate, Methylparathion, and Metribuzin. The detections were well below the HAL established for the latter two pesticides. No HAL has been established for Molinate.

A comparison of chloride concentrations from selected wells over a period of twenty years indicated some increases as well as decreases. This investigation suggests that the areas that were considered the most contaminated by high salinity are still the most contaminated. Irrigation waters from the twenty-seven wells sampled were classified in terms of salinity hazard and sodium hazard utilizing the SAR and specific conductivity. The sodium hazard for the wells used in the present study ranged from low to high with most of the wells falling within the low sodium hazard category (21 of 27 wells). The salinity hazard ranged from low to very high with high hazard being the most prevalent (17 of 27 wells).

Least-squares linear regression analysis was run to compare the relationship between various chemical parameters. Cross-plots of sodium with chloride and boron both demonstrated strong linear relationships. Boron as a function of chloride, while not exhibiting a strong relationship, did contrast markedly when compared with the same cross-plot of data from the Jonesboro prototype area where saltwater contamination has not been viewed as a problem.

An area of approximately 56 square miles was identified in an earlier USGS study as an area of saltwater contamination. That study concluded that the most likely source of the contamination was the upward movement of saltwater from the underlying Sparta aquifer through the thinned or absent Jackson confining unit. This upward movement was caused by heavy pumpage of the alluvial aquifer. The present study represents both an effort to monitor changes in ground water quality over time, and to determine if the areal extent of the contamination is expanding. Results of the current sampling indicate that the area of contamination is basically of the same configuration as cited in the USGS report. The number of wells utilized for this prototype may be slightly increased in the future. It may be useful to monitor wells considerably further from the area of contamination, such as those located in the vicinity of the city water supply wells.

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BRINKLEY PROTOTYPE

TABLES

Table 1. BRINKLEY PROTOTYPE - LOCATION AND DESCRIPTION OF WELLS THIRD SAMPLING PERIOD

SAMPLE DATE	LOCAL NUMBER	SAMPLE LOCATION NO.	LATITUDE-LONGITUDE	DEPTH	AQFR	USE
8-03-95	02N02W14ACB1	#310	34 47 25.4 91 10 52.1	140'	Alvm	I
8-03-95	03N02W27DAC1	#129	34 50 37.7 91 11 33.8	90'	Alvm	D
8-03-95	03N02W08ABB1	#103	34 53 49.1 91 13 54.1	Unk.	Alvm	D
8-03-95	03N02W23CCD1	#122	34 51 16.1 91 11 04.2	100'	Alvm	D
8-03-95	04N02W15DBA1	#159	34 57 41.3 91 11 28.9	60'	Alvm	I
8-03-95	04N02W02ADD1	#311	34 59 27.3 91 10 12.5	Unk.	Alvm	D
8-03-95	03N02W04CCD1	#97	34 53 49.9 91 13 12.8	160'	Alvm	I
8-22-95	03N02W16ACB1	#312	34 52 42.3 91 12 52.6	@160'	Alvm	I
8-22-95	03N02W34DAD1	#139	34 49 40.0 91 11 28.2	Unk.	Alvm	D

Uses: D = Domestic; I = Irrigation; AQFR = Aquifer; Alvm = Alluvium

Table 1. BRINKLEY PROTOTYPE LOCATION AND DESCRIPTION OF WELLS THIRD SAMPLING PERIOD

SAMPLE DATE	LOCAL NUMBER	SAMPLE LOCATION NO.	LATITUDE-LONGITUDE	DEPTH	AQFR	USE
8-22-95	02N02W25BBA1	#61	34 45 53.1 91 10 16.5	120'	Alvm	A
8-22-95	02N02W25CBB1	#313	34 45 26.2 91 10 22.1	@120'	Alvm	A
8-22-95	02N02W25ABB1	#60	34 45 48.0 91 09 55.3	120'	Alvm	A
8-22-95	04N02W22DAD1	#162	34 56 38.9 91 11 19.9	Unk.	Alvm	I
8-23-95	03N02W22ACD1	#121	34 51 43.0 91 11 43.0	65'	Alvm	D
8-23-95	04N02W30BAD1	#183	34 56 17.0 91 15 04.1	111'	Alvm	P
8-23-95	04N02W30BAC1	#182	34 56 17.4 91 15 14.1	101'	Alvm	P
8-23-95	03N02W21DBD1	#314	34 51 30.5 91 12 47.0	@128'	Alvm	A
8-23-95	02N03W12DAD1	#71	34 48 02.0 91 15 51.2	Unk.	Alvm	A

Uses: Domestic; I = Irrigation; P = Public; A = Aquaculture; Wells #182 and # 183 represent PWS wells #3 and #4, respectively.

Table 1. BRINKLEY PROTOTYPE - LOCATION AND DESCRIPTION OF WELLS
THIRD SAMPLING PERIOD

SAMPLE DATE	LOCAL NUMBER	SAMPLE LOCATION NO.	LATITUDE-LONGITUDE	DEPTH	AQFR	USE
8-23-95	03N02W31DBD1	#134	34 49 48.8 91 14 57.8	132'	Alvm	A
8-23-95	04N02W27DCB1	#172	34 55 45.2 91 11 38.2	Unk.	Alvm	I
8-29-95	04N02W28DDD1	#315	34 55 36.0 91 12 21.6	@120'	Alvm	I
8-29-95	04N02W29DDB1	#316	34 55 48.8 91 13 35.0	@60'	Alvm	I
8-30-95	04N02W28CCA1	#317	34 55 43.6 91 13 08.3	@70'	Alvm	I
8-30-95	04N02W21CDA1	#318	34 56 35.0 91 12 46.0	121'	Alvm	I
8-30-95	02N02W17CBB1	#319	34 47 14.9 91 14 35.9	@120'	Alvm	I
8-30-95	02N02W17DBB1	#320	34 47 16.5 91 13 59.5	@120'	Alvm	I
8-30-95	02N02WCBB1	#321	34 47 16.7 91 13 34.0	Unk.	Alvm	I

Uses: A = Aquaculture; I = Irrigation

Table 2. BRINKLEY PROTOTYPE - LOCATION AND DESCRIPTION OF WELLS NOT SAMPLED DURING THIRD SAMPLING PERIOD

LAST SAMPLED	LOCAL NUMBER	SAMPLE LOCATION NO.	LATITUDE-LONGITUDE	DEPTH	AQFR	USE
2nd	02N02W02BBA1	#32	34 49 25.0 91 11 13.0	125'	Alvm	D
2nd	03N02W12CBC1	#212	34 53 13.0 91 10 14.0	420'	Sparta	U
2nd	04N02W02ACA1	#151	34 59 37.4 91 10 20.4	84'	Alvm	D
2nd	04N02W27CDA1	#170	34 55 40.1 91 11 49.1	82'	Alvm	U
1st	04N02W28DDD3	#179	34 55 36.0 91 12 21.6	137'	Alvm	U
1st	04N02W28DDD4	#213	34 55 36.0 91 12 21.6	408'	Sparta	U

Uses: D = Domestic; U = Unused

Table 3. BRINKLEY PROTOTYPE

Results of the first three sampling periods initiated 6/89, 6/92, and 8/95. "K" indicates actual value is known to be less than value given. T. Rec. = Total Recoverable.

WELL NUMBER	#310	#129	#103	#122	#159	#311	#97	#312
AQUIFER	Alluvial	Alluvial	Alluvial	Alluvial	Alluvial	Alluvial	Alluvial	Alluvial
DEPTH	140'	90'	Unk.	100'	60'	Unk.	160'	@160'
Alk. Total mg/l	- - 444.0	- - 446.0	- - 399.0	- - 469.0	- - 252.0	- - 262.0	- - 437.0	- - 360.0
Al μg/l T. Rec.	- - 16K	- - 16K	- - 16K	- - 16K	- - 16K	- - 16K	- - 16K	- - 16K
As μg/l T. Rec.	- - 5K	- - 5K	- - 5K	- - 5K	- - 5K	- - 5K	- - 5K	- - 5K
B μg/l T. Rec.	- - 157.6	- - 45.2	- - 76.2	- - 70.3	- - 26.8	- - 11.2	- - 152.5	- - 36.2
Ba μg/l T. Rec.	- - 377.3	- - 56.8	- - 285.2	- - 395.8	- - 104.1	- - 67.9	- - 315.9	- - 270.0
Be μg/l T. Rec.	- - 3K	- - 3K	- - 3K	- - 3K	- - 3K	- - 3.2	- - 3K	- - 3K
Ca mg/l T. Rec.	- - 138.0	- - 29.2	- - 106.0	- - 134.0	- - 64.1	- - 64.6	- - 113.0	- - 130.0
Carbon Organic Total mg/l	- - 3.0	- - 2.7	- - 2.8	- - 3.2	- - 3.7	- - 3.0	- - 3.4	- - 2.7
Cd μg/l T. Rec.	- - .5K	- - .5K	- - .5K	- - .5K	- - .5K	- - .5K	- - .5K	- - .5K
Cl mg/l Total	- - 232.0	2.0 56.0 53.7	113.0 103.0 127.0	5.0 110.0 99.5	8.0 8.0 11.0	- - 10.3	- - 120.0	- - 26.5
Co μg/l T. Rec.	- - 3K	- - 3K	- - 3K	- - 3K	- - 3K	- - 3K	- - 3K	- - 3K
Cr μg/l T. Rec.	- - 1K	- - 1K	- - 1K	- - 1K	- - 1K	- - 1K	- - 1K	- - 1K

Table 3. <u>BRINKLEY PROTOTYPE</u>- continued

WELL NUMBER	#310	#129	#103	#122	#159	#311	#97	#312
AQUIFER	Alluvial	Alluvial	Alluvial	Alluvial	Alluvial	Alluvial	Alluvial	Alluvial
DEPTH	140'	90'	Unk.	100'	60'	Unk.	160'	@160'
Cu µg/l T. Rec.	- - 2K	- - 4.1	- - 2K	- - 2K	- - 2K	- - 2.3	- - 2K	- - 2K
Fe µg/l T. Rec.	- - 4030.0	- - 791.0	- - 6140.0	- - 3320.0	- - 1960.0	- - 7150.0	- - 3230.0	- - 3180.0
F mg/l Total	- - .240	- - .230	- - .300	- - .240	- - .220	- - .250	- - .240	- - .210
Hardness Total mg/l	- - 525.0	502.0 - 106.0	416.0 - 386.0	502.0 - 493.0	72.0 - 234.0	- - 215.0	- - 419.0	- - 443.0
Hg µg/l Total	- - .06K	- - .06K	- - .06K	- - .06K	- - .06K	- - .06K	- - .06K	- - .06K
K mg/l T. Rec.	- - 2.7	- - 1.3	- - 1.8	- - 2.1	- - .900	- - 1.2	- - 1.9	- - 1.5
Mg mg/l T. Rec.	- - 44.0	- - 8.0	- - 30.0	- - 39.0	- - 18.0	- - 13.0	- - 33.0	- - 28.7
Mn µg/l T. Rec.	- - 444.0	- - 106.0	- - 466.0	- - 351.0	- - 629.0	- - 501.0	- - 414.0	- - 343.0
Na mg/l T. Rec.	- - 132.4	- - 228.6	- - 78.3	- - 53.0	- - 20.7	- - 16.7	- - 78.8	- - 30.2
Ni µg/l T. Rec.	- - 6K	- - 6K	- - 6K	- - 6K	- - 6K	- - 6K	- - 6K	- - 6K
NH3-N mg/l Total	- - .852	- .680 .116	.060 .420 .494	- .630 .745	.030 .05K .311	- - .170	- - .477	- - .596
NO3-N mg/l Total	- - .02K	.790 .02K .02K	.030 - .02K	.700 .02K .02K	.060 .02K .02K	- - .02K	- - .02K	- - .02K

Table 3. BRINKLEY PROTOTYPE- continued

WELL NUMBER	#310	#129	#103	#122	#159	#311	#97	#312
AQUIFER	Alluvial	Alluvial	Alluvial	Alluvial	Alluvial	Alluvial	Alluvial	Alluvial
DEPTH	140'	90'	Unk.	100'	60'	Unk.	160'	@160'
Phos.-T Ortho mg/l	- - .319	.040 .080 .470	.080 .900 .283	.030 .070 .283	.020 .03K .362	- - .191	- - .260	- - .154
Phos.- Total mg/l	- - .414	- - .486	- - .486	- - .466	- - .476	- - .321	- - .331	- - .408
Pb µg/l T. Rec.	- - 2K	- - 2K	- - 2K	- - 2K	- - 2K	- - 2K	- - 2K	- - 2K
Se µg/l T. Rec.	- - 10K	- - 10K	- - 10K	- - 10K	- - 10K	- - 10K	- - 10K	- - 10K
SO4 mg/l Total	- - 87.5	- - 85.1	7.0 14.0 15.1	- - 54.3	8.0 14.0 22.9	- - 3.9	- - 9.8	- - 49.0
TDS mg/l	- - 948.0	- - 692.0	- - 631.0	- - 695.0	- - 310.0	- - 284.0	- - 663.0	- - 489.0
TSS mg/l	- - 7.0	- - 1K	- - 13.5	- - 5.0	- - 1.5	- - 8.5	- - 5.5	- - 6.0
V µg/l T. Rec.	- - 5.3K	- - 5.3K	- - 5.3K	- - 5.3K	- - 5.3K	- - 5.3K	- - 5.3K	- - 5.3K
Zn µg/l T. Rec.	- - 4.5	- - 5.3	- - 12.1	- - 4.3	- - 3.8	- - 169.0	- - 2K	- - 2K
SAR	- - 2.51	- - 9.65	- - 1.73	- - 1.04	- - .590	- - .500	- - 1.68	- - .620
COND. µS/cm	- - 1694.00	- - 1270.00	- - 1220.00	- - 1355.00	- - 551.00	- - 581.00	- - 1220.00	- - 897.00
pH	- - 7.4	- - 7.4	- - 7.2	- - 7.4	- - 7.6	- - 7.4	- - 7.2	- - 7.3

SAR = Sodium Absorption Ratio
COND. = Conductivity in µS/cm, measured in the field

Table 3. BRINKLEY PROTOTYPE- continued

WELL NUMBER	#139	#61	#313	#60	#162	#121	#183	#182
AQUIFER	Alluvial	Alluvial	Alluvial	Alluvial	Alluvial	Alluvial	Alluvial	Alluvial
DEPTH	Unk.	120'	@120'	120'	Unk.	65'	111'	101
Alk. Total mg/l	- - 426.0	- - 462.0	- - 414.0	- - 464.0	- - 280.0	- - 394.0	- - 88.0	- - 62.0
Al µg/l T. Rec.	- - 16k	- - 16K	- - 16K	- - 16K	- - 16K	- - 16K	- - 16K	- - 16K
As µg/l T. Rec.	- - 25.6	- - 11.4	- - 5K	- - 5.0	- - 5K	- - 5K	- - 5K	- - 5K
B µg/l T. Rec.	- - 112.2	- - 62.1	- - 46.3	- - 3.4K	- - 25.3	- - 31.8	- - 4.3	- - 3.4K
Ba µg/l T. Rec.	- - 186.0	- - 281.0	- - 301.0	- - 4K	- - 155.0	- - 419.0	- - 98.0	- - 110.0
Be µg/l T. Rec.	- - 3K	- - 3K	- - 3K	- - 3K	- - 3K	- - 3K	- - 3K	- - 3K
Ca mg/l T. Rec.	- - .171.0	- - 205.0	- - 177.0	- - .100	- - 97.9	- - 174.0	- - 22.4	- - 29.8
Carbon Organic Total mg/l	- - 2.7	- - 5.0	- - 3.6	- - 3.7	- - 4.3	- - 2.8	- - 2.1	- - 2.8
Cd µg/l T. Rec.	- - .5K	- - .5K	- - .5K	- - .5K	- - .5K	- - .5K	- - .5K	- - .5K
Cl mg/l Total	0.0 - 63.1	- - 103.0	- - 81.2	- - 77.2	- - 11.4	- - 50.8	- - 5.8	7.0 5.0 4.8
Co µg/l T. Rec.	- - 3K	- - 3K	- - 3K	- - 3K	- - 3K	- - 3K	- - 3K	- - 3K
Cr µg/l T. Rec.	- - 1K	- - 1K	- - 1K	- - 1K	- - 1K	- - 1K	- - 1K	- - 1K

Table 3. BRINKLEY PROTOTYPE- continued

WELL NUMBER	#139	#61	#313	#60	#162	#121	#183	#182
AQUIFER	Alluvial	Alluvial	Alluvial	Alluvial	Alluvial	Alluvial	Alluvial	Alluvial
DEPTH	Unk.	120'	@120'	120'	Unk.	65'	111'	101'
Cu µg/l T. Rec.	- - 2K	- - 2K	- - 2K	- - 2K	- - 2K	- - 2K	- - 2K	- - 2K
Fe µg/l T. Rec.	- - 1650.0	- - 2110.0	- - 2710.0	- - 2K	- - 1240.0	- - 286.0	- - 5230.0	- - 4860.0
F mg/l Total	- - .200	- - .190	- - .190	- - .190	- - .220	- - .210	- - .100	- - .120
Hardness Total mg/l	382.0 - 579.0	- - 707.0	- - 608.0	- - -	- - 321.0	- - 579.0	- - 63.0	74.0 - 89.0
Hg µg/l Total	- - .06K	- - .06K	- - .06K	- - .06K	- - .06K	- - .06K	- - .06K	- - .06K
K mg/l T. Rec.	- - 1.9	- - 2.5	- - 2.6	- - .02K	- - 1.3	- - 1.5	- - 1.2	- - 1.1
Mg mg/l T. Rec.	- - 36.8	- - 47.5	- - 40.3	- - .006K	- - 18.7	- - 35.1	- - 1.8	- - 3.5
Mn µg/l T. Rec.	- - 673.0	- - 1030.0	- - 493.0	- - 2K	- - 354.0	- - 1020.0	- - 554.0	- - 558.0
Na mg/l T. Rec.	- - 43.6	- - 73.6	- - 67.3	- - 8.7	- - 22.0	- - 38.8	- - 10.0	- - 9.3
Ni µg/l T. Rec.	- - 6K	- - 6K	- - 6K	- - 6.1	- - 6K	- - 6K	- - 8.7	- - 6K
NH3-N mg/l Total	.920 - 1.1	- - .961	- - .768	- - .899	- - .277	- - .662	- - .118	.010 .05K .131
NO3-N mg/l Total	.010 - .02K	- - .02K	- - .02K	- - .02K	- - .02K	- - .02K	- - .270	.020 1.0 .02K

Table 3. BRINKLEY PROTOTYPE- continued

WELL NUMBER	#139	#61	#313	#60	#162	#121	#183	#182
AQUIFER	Alluvial	Alluvial	Alluvial	Alluvial	Alluvial	Alluvial	Alluvial	Alluvial
DEPTH	Unk.	120'	@120'	120'	Unk.	65'	111'	101'
Phos.-T Ortho mg/l	.280 - .354	- - .143	- - .103	- - .085	- - .178	- - .176	- - .082	.030 .120 .188
Phos.- Total mg/l	- - .522	- - .160	- - .180	- - .129	- - .222	- - .439	- - .129	- - .253
Pb µg/l T. Rec.	- - 2K	- - 2K	- - 2K	- - 2K	- - 2K	- - 2K	- - 2K	- - 2K
Se µg/l T. Rec.	- - 10K	- - 10K	- - 10K	- - 10K	- - 10K	- - 10K	- - 10K	- - 10K
SO4 mg/l Total	34.0 - 80.7	- - 141.0	- - 121.0	- - 189.0	- - 3.5	- - 67.3	- - 15.1	8.0 9.0 13.1
TDS mg/l	- - 652.0	- - 868.0	- - 726.0	- - 862.0	- - 316.0	- - 588.0	- - 134.0	- - 140.0
TSS mg/l	- - 1K	- - 4.0	- - 5.5	- - 2.5	- - 1.5	- - 6.5	- - 1K	- - 2.0
V µg/l T. Rec.	- - 5.3K	- - 5.3K	- - 5.3K	- - 5.3K	- - 5.3K	- - 5.3K	- - 5.3K	- - 5.3K
Zn µg/l T. Rec.	- - 580	- - 2K	- - 2K	- - 2K	- - 2K	- - 10.7	- - 44.5	- - 2.7
SAR	- - .790	- - 1.20	- - 1.19	- - 7.60	- - .540	- - .700	- - .540	- - .420
COND. µS/cm	- - 1273.00	- - 1583.00	- - 1328.00	- - 1517.00	- - 592.00	- - 1024.00	- - 207.00	- - 224.00
pH	- - 7.2	- - 7.4	- - 7.5	- - 7.4	- - 7.6	- - 7.3	- - 7.5	- - 7.5

SAR = Sodium Absorption Ratio
COND. = Conductivity in µS/cm, measured in the field

Table 3. <u>BRINKLEY PROTOTYPE</u>- continued

WELL NUMBER	#314	#71	#134	#172	#315	#316	#317	#318
AQUIFER	Alluvial	Alluvial	Alluvial	Alluvial	Alluvial	Alluvial	Alluvial	Alluvial
DEPTH	@128'	Unk.	132'	Unk.	@120'	@60'	@70'	121'
Alk. Total mg/l	- - 420.0	- - 278.0	- - 320.0	- - 338.0	- - 392.0	- - 278.0	- - 402.0	- - 258.0
Al µg/l T. Rec.	- - 16K	- - 16K	- - 16K	- - 16K	- - 16K	- - 16K	- - 18.5	- - 16K
As µg/l T. Rec.	- - 5K	- - 5K	- - 5K	- - 5K	- - 5K	- - 5K	- - 5K	- - 5K
B µg/l T. Rec.	- - 34.0	- - 216.7	- - 18.6	- - 167.4	- - 1336.0	- - 625.4	- - 978.2	- - 296.4
Ba µg/l T. Rec.	- - 275.0	- - 331.0	- - 275.0	- - 442.0	- - 506.0	- - 76.0	- - 469.0	- - 222.0
Be µg/l T. Rec.	- - 3K	- - 3K	- - 3K	- - 3K	- - 3K	- - 3K	- - 3K	- - 3K
Ca mg/l T. Rec.	- - 161.0	- - 106.0	- - 127.0	- - 239.0	- - 95.7	- - 9.7	- - 57.8	- - 32.4
Carbon Organic Total mg/l	- - 3.6	- - 6.2	- - 4.5	- - 3.2	- - 4.7	- - 4.9	- - 4.6	- - 4.9
Cd µg/l T. Rec.	- - .5K	- - .5K	- - .5K	- - .5K	- - .5K	- - .5K	- - .5K	- - .5K
Cl mg/l Total	- - 30.1	- - 184.0	- - 24.5	- - 325.0	- - 581.0	- - 126.0	- - 376.0	- - 13.1
Co µg/l T. Rec.	- - 3K	- - 3K	- - 3K	- - 3K	- - 3K	- - 3K	- - 3K	- - 3K
Cr µg/l T. Rec.	- - 1K	- - 1K	- - 1K	- - 1K	- - 1K	- - 1K	- - 3.9	- - 1K

Table 3. <u>BRINKLEY PROTOTYPE</u>- continued

WELL NUMBER	#314	#71	#134	#172	#315	#316	#317	#318
AQUIFER	Alluvial	Alluvial	Alluvial	Alluvial	Alluvial	Alluvial	Alluvial	Alluvial
DEPTH	@128'	Unk.	132'	Unk.	@120'	@60	@70'	121'
Cu µg/l T. Rec.	- - 2K	- - 2K	- - 2K	- - 2K	- - 2.5	- - 2K	- - 92.8	- - 2K
Fe µg/l T. Rec.	- - 3020.0	- - 4690.0	- - 3350.0	- - 2660.0	- - 2670.0	- - 356.0	- - 3090.0	- - 730.0
F mg/l Total	- - .220	- - .320	- - .180	- - .180	- - .240	- - 1.1	- - .310	- - .540
Hardness Total mg/l	- - 526.0	- - 330.0	- - 404.0	- - 762.0	- - 335.0	- - 33.0	- - 201.0	- - 123.0
Hg µg/l Total	- - .06K	- - .06K	- - .06K	- - .06K	- - .06K	- - .06K	- - .06K	- - .06K
K mg/l T. Rec.	- - 1.8	- - 2.8	- - 1.3	- - 2.7	- - 6.5	- - 1.8	- - 4.2	- - 2.1
Mg mg/l T. Rec.	- - 30.0	- - 15.8	- - 21.0	- - 40.2	- - 23.4	- - 2.2	- - 13.8	- - 10.3
Mn µg/l T. Rec	- - 308.0	- - 859.0	- - 203.0	- - 650.0	- - 412.0	- - 22.0	- - 182.0	- - 51.0
Na mg/l T. Rec.	- - 33.7	- - 133.4	- - 31.3	- - 129.4	- - 445.5	- - 200.1	- - 323.3	- - 65.3
Ni µg/l T. Rec.	- - 6K	- - 6K	- - 6K	- - 6K	- - 6K	- - 6K	- - 6K	- - 6K
NH3-N mg/l Total	- - .568	- - .551	- - .453	- - .812	- - .934	- - .646	- - 1.7	- - .822
NO3-N mg/l Total	- - .02K	- - .02K	- - .02K	- - .02K	- - .02K	- - .02K	- - .02K	- - .02K

Table 3. <u>BRINKLEY PROTOTYPE</u>- continued

WELL NUMBER	#314	#71	#134	#172	#315	#316	#317	#318
AQUIFER	Alluvial	Alluvial	Alluvial	Alluvial	Alluvial	Alluvial	Alluvial	Alluvial
DEPTH	@128'	Unk.	132'	Unk.	@120'	@60'	@70'	121'
Phos.-T Ortho mg/l	- - .157	- - .096	- - .145	- - .083	- - .229	- - .926	- - .136	- - .152
Phos.- Total mg/l	- - .470	- - .387	- - .491	- - .242	- - .343	- - .761	- - .272	- - .231
Pb μg/l T. Rec.	- - 2K	- - 2K	- - 2K	- - 2K	- - 2K	- - 2K	- - 2K	- - 2K
Se μg/l T. Rec.	- - 10K	- - 10K	- - 10K	- - 10K	- - 10K	- - 10K	- - 10K	- - 10K
SO4 mg/l Total	- - 20.8	- - 10.1	- - 14.1	- - 8.0	- - 10.4	- - 3.5	- - 3.5	- - 2.3
TDS mg/l	- - 508.0	- - 615.0	- - 393.0	- - 909.0	- - 1332.0	- - 518.0	- - 995.0	- - 288.0
TSS mg/l	- - 6.0	- - 9.5	- - 7.0	- - 6.0	- - 14.0	- - 1K	- - 17.5	- - 1K
V μg/l T. Rec.	- - 5.3K	- - 5.3K	- - 5.3K	- - 5.3K	- - 5.3K	- - 5.3K	- - 5.3K	- - 5.3K
Zn μg/l T. Rec.	- - 2K	- - 2K	- - 5.0	- - 2K	- - 2K	- - 4.2	- - 4.3	- - 2K
SAR	- - .640	- - 3.20	- - .680	- - 2.04	- - 10.59	- - 15.14	- - 9.93	- - 2.56
COND. μS/cm	- - 928.00	- - 1225.00	- - 724.00	- - 1798.00	- - 2720.00	- - 1060.00	- - 1980.00	- - 546.00
pH	- - 7.0	- - 7.2	- - 7.4	- - 7.4	- - 7.6	- - 8.1	- - -	- - -

SAR = Sodium Absorption Ratio
COND. = Conductivity in μS/cm, measured in the field

Table 3. BRINKLEY PROTOTYPE- continued

WELL NO.	#319	#320	#321	#32	#212	#151	#170	#179	#213
AQFR	Alluvial	Alluvial	Alluvial	Alluvial	Sparta	Alluvial	Alluvial	Alluvial	Sparta
DEPTH	@120'	@120'	Unk.	125'	420'	84'	82'	137'	408'
Alk. Total mg/l	- - 446.0	- - 448.0	- - 464.0	- - -	57.0 - -	- - -	331.0 - -	- - -	178.0 - -
Al µg/l T. Rec.	- - 16K	- - 16K	- - 16K	- - -	- - -	- - -	- - -	- - -	- - -
As µg/l T. Rec.	- - 5K	- - 5K	- - 5K	- - -	- - -	- - -	- - -	- - -	- - -
B µg/l T. Rec.	- - 290.0	- - 259.4	- - 251.9	- - -	- - -	- - -	- - -	- - -	- - -
Ba µg/l T. Rec.	- - 780.0	- - 999.0	- - 908.0	- - -	- - -	- - -	- - -	- - -	- - -
Be µg/l T. Rec.	- - 3K	- - 3K	- - 3K	- - -	- - -	- - -	- - -	- - -	- - -
Ca mg/l T. Rec.	- - 134.0	- - 170.0	- - 152.0	- - -	- - -	- - -	- - -	- - -	- - -
Carbon Organic Total mg/l	- - 7.2	- - 5.0	- - 4.5	- - -	8.1 -	- - -	4.0 - -	11.6 - -	8.1 - -
Cd µg/l T. Rec.	- - .5K	- - .5K	- - .5K	- - -	- - -	- - -	- - -	- - -	- - -
Cl mg/l Total	- - 406.0	- - 488.0	- - 394.0	3.0 7.0 -	4.0 694.0 -	4.0 45.0 -	114.0 146.0 -	830.0 - -	1000.0 - -
Co µg/l T. Rec.	- - 3K	- - 3K	- - 3K	- - -	- - -	- - -	- - -	- - -	- - -
Cr µg/l T. Rec.	- - 1K	- - 1K	- - 1K	- - -	- - -	- - -	- - -	- - -	- - -

Table 3. <u>BRINKLEY PROTOTYPE</u>- continued

WELL NO.	#319	#320	#321	#32	#212	#151	#170	#179	#213
AQFR	Alluvial	Alluvial	Alluvial	Alluvial	Sparta	Alluvial	Alluvial	Alluvial	Sparta
DEPTH	@120'	@120'	Unk.	125'	420'	84'	82'	137'	408'
Cu µg/l T. Rec.	- - 2.1	- - 2K	- - 2K	- - -	- - -	- - -	- - -	- - -	- - -
Fe µg/l T. Rec.	- - 5910.0	- - 8190.0	- - 7170.0	- - -	- - -	- - -	- - -	- - -	- - -
F mg/l Total	- - .200	- - .190	- - .200	- - -	- - -	- - -	- - -	- - -	- - -
Hard. Total mg/l	- - 489.0	- - 622.0	- - 558.0	340.0 - -	52.0 - -	194.0 - -	452.0 - -	- - -	40.0 - -
Hg µg/l Total	- - .06K	- - .06K	- - .06K	- - -	- - -	- - -	- - -	- - -	- - -
K mg/l T. Rec.	- - 4.9	- - 4.9	- - 4.2	- - -	- - -	- - -	- - -	- - -	- - -
Mg mg/l T. Rec.	- - 37.5	- - 47.9	- - 43.3	- - -	- - -	- - -	- - -	- - -	- - -
Mn µg/l T. Rec.	- - 265.0	- - 367.0	- - 342.0	- - -	- - -	- - -	- - -	- - -	- - -
Na mg/l T. Rec.	- - 241.3	- - 221.0	- - 202.2	- - -	- - -	- - -	- - -	- - -	- - -
Ni µg/l T. Rec.	- - 6K	- - 6K	- - 6K	- - -	- - -	- - -	- - -	- - -	- - -
NH3-N mg/l Total	- - 1.4	- - 1.3	- - 1.3	- .05K -	.260 1.7 -	.240 .460 -	.540 .570 -	.950 - -	1.2 - -
NO3-N mg/l Total	- - .02K	- - .02K	- - .02K	.780 .050 -	.010 .02K -	.010 .02K -	.010 .02K -	.020 - -	.010 - -

Table 3. <u>BRINKLEY PROTOTYPE</u>- continued

WELL NO.	#319	#320	#321	#32	#212	#151	#170	#179	#213
AQFR	Alluvial	Alluvial	Alluvial	Alluvial	Sparta	Alluvial	Alluvial	Alluvial	Sparta
DEPTH	@120'	@120'	Unk.	125'	420'	84'	82'	137'	408'
Phos.-T Ortho mg/l	- - .194	- - .215	- - .194	.030 .040 -	.01K .03K -	.400 .210 -	.180 .140 -	.01K - -	.01K - -
Phos.- Total mg/l	- - .466	- - .435	- - .496	- - -	- .060 -	- - -	- .360 -	- - -	- - -
Pb µg/l T. Rec.	- - 2K	- - 2K	- - 2K	- - -	- - -	- - -	- - -	- - -	- - -
Se µg/l T. Rec.	- - 10K	- - 10K	- - 10K	- - -	- - -	- - -	- - -	- - -	- - -
SO4 mg/l Total	- - 26.4	- - 13.6	- - 22.6	- 17.0 -	1.0 3.0 -	5.0 12.0 -	48.0 63.0 -	3.0 - -	3.0 - -
TDS mg/l	- - 1130.0	- - 1201.0	- - 1087.0	- - -	- - -	- - -	- - -	- - -	- - -
TSS mg/l	- - 15.0	- - 17.5	- - 16.0	- - -	- - -	- - -	- - -	- - -	- - -
V µg/l T. Rec.	- - 5.3K	- - 5.3K	- - 5.3K	- - -	- - -	- - -	- - -	- - -	- - -
Zn µg/l T. Rec.	- - 2K	- - 2K	- - 2.2	- - -	- - -	- - -	- - -	- - -	- - -
SAR	- - 4.75	- - 3.86	- - 3.73	- - -	- - -	- - -	- - -	- - -	- - -
COND. µS/cm	- - 2200.00	- - 2400.00	- - 2460.00	- - -	- - -	- - -	- - -	- - -	- - -
pH	- - -	- - -	- - -	- - -	- - -	- - -	- - -	- - -	- - -

SAR = Sodium Absorption Ratio
COND. = Conductivity in µS/cm, measured in the field

Table 4. BRINKLEY PESTICIDE ANALYSES

Analyses for pesticides , such as those shown below below for well #129, indicated all wells sampled were below detection limits with the exception of trace amounts of Molinate (.04898 μg/l) in well #172; Methyl-Parathion (.01395 μg/l) in well #310; and Metribuzin (.00744 μg/l) in well #311.

Parameter	Detection Limit **	Parameter	Detection Limit **
Molinate	<.00714 μg/l	Prometryn	<.00617 μg/l
Propachlor	<.00670 μg/l	Heptachlor	<.01257 μg/l
Trifluralin	<.00361 μg/l	Terbutryn	<.01602 μg/l
Alpha-BHC	<.01291 μg/l	Metolachlor	<.00411 μg/l
Atraton	<.01519 μg/l	Malathion	<.02383 μg/l
Prometron	<.02091 μg/l	Dipropetryn	<.00902 μg/l
Simazine	<.02101 μg/l	Chlorpyrifos	<.01101 μg/l
Atrazine	<.00789 μg/l	Cyanazine	<.01547 μg/l
Propazine	<.00319 μg/l	Aldrin	<.02442 μg/l
Beta-BHC	<.01525 μg/l	Pendimethalin	<.01414 μg/l
Gamma-BHC	<.01289 μg/l	Heptachlor-Epoxide	<.00776 μg/l
Terbuthylazine	<.01985 μg/l	Endosulfan-I	<.23566 μg/l
Diazinon	<.01876 μg/l	p-p'-DDE	<.00398 μg/l
Fluchloralin	<.00754 μg/l	Dieldrin	<.05917 μg/l
Fonofos	<.00388 μg/l	Endrin	<.03848 μg/l
Delta-BHC	<.01495 μg/l	Endosulfan-II	<.10487 μg/l
Cyprazine	<.00891 μg/l	p-p'-DDD	<.00473 μg/l
Metribuzin	<.00660 μg/l	Endosulfan-Sulfate	<.02104 μg/l
Methyl-Parathion	<.01385 μg/l	p-p'-DDT	<.00446 μg/l
Alachlor	<.01882 μg/l	Hexazinone	<.02700 μg/l
Ametryn	<.00512 μg/l	Methoxychlor	<.00240 μg/l

** Detection Limits may vary somewhat for each analyte from one well sample to another.

Table 5. BRINKLEY PROTOTYPE VOCS ANALYSES

Analyses for the VOCS shown below for all wells indicated no detections.

Parameter	Concentration	Units	Detection Limit
Chloromethane	<2.5	µg/l	2.5
1,1-Dichloroethane	<1	µg/l	1.0
Chlorobenzene	<1	µg/l	1.0
Bromoform	<2.5	µg/l	2.5
1,1,2,2-Tetrachloroethane	<1	µg/l	1.0
Vinyl_Chloride	<2.5	µg/l	2.5
Bromomethane	<2.5	µg/l	2.5
Chloroethane	<2.5	µg/l	2.5
Trichloroflouromethane	<1	µg/l	1.0
1,1-Dichloroethene	<1	µg/l	1.0
Methylene_Chloride	*	µg/l	2.0
Trans-1,2-Dichloroethene	<1	µg/l	1.0
Cis-1,2-Dichloroethene	<1	µg/l	1.0
2,2-Dichloropropane	<1	µg/l	1.0
Bromochloromethane	<1	µg/l	1.0
Chloroform	<1	µg/l	1.0
1,1,1-Trichloroethane	<1	µg/l	1.0
1,2-Dichloroethane	<1	µg/l	1.0
1,1-Dichloropropene	<1	µg/l	1.0
Benzene	<1	µg/l	1.0
Carbon_Tetrachloride	<1	µg/l	1.0
1,2-Dichloropropane	<1	µg/l	1.0
Trichloroethene	<1	µg/l	1.0
Dibromomethane	<1	µg/l	1.0
Bromodichloromethane	<1	µg/l	1.0
Cis-1,3-Dichloropropene	<1	µg/l	1.0
Toluene	<1	µg/l	1.0
Trans-1,3-Dichloropropene	<1	µg/l	1.0
1,1,2-Trichloroethane	<1	µg/l	1.0

Table 5. BRINKLEY PROTOTYPE VOCS ANALYSES- CONTINUED

Parameter	Concentration	Units	Detection Limit
1,3-Dichloropropane	<1	µg/l	1.0
Dibromochloromethane	<1	µg/l	1.0
1,2-Dibromoethane	<1	µg/l	1.0
Tetrachloroethene	<1	µg/l	1.0
1,1,1,2-Tetrachloroethane	<1	µg/l	1.0
Ethyl_Benzene	<1	µg/l	1.0
Styrene	<1	µg/l	1.0
Ortho_Xylene	<1	µg/l	1.0
1,2,3-Trichloropropane	<1	µg/l	1.0
Isopropylbenzene	<1	µg/l	1.0
Bromobenzene	<1	µg/l	1.0
2-Chlorotoluene	<1	µg/l	1.0
N-Propyl_Benzene	<1	µg/l	1.0
4-Chlorotoluene	<1	µg/l	1.0
1,3,5,-Trimethylbenzene	<1	µg/l	1.0
Tert-Butyl_Benzene	<1	µg/l	1.0
1,2,4-Trimethylbenzene	<1	µg/l	1.0
1,3-Dichlorobenzene	<1	µg/l	1.0
Sec-Butyl_Benzene	<1	µg/l	1.0
1,4-Dichlorobenzene	<1	µg/l	1.0
P-Isopropyl_Toluene	<1	µg/l	1.0
1,2-Dichlorobenzene	<1	µg/l	1.0
N-Butyl-Benzene	<1	µg/l	1.0
1,2-Dibromo-3-Chloropropane	<1	µg/l	1.0
1,2,4-Trichlorobenzene	<1	µg/l	1.0
Naphthalene	<1	µg/l	1.0
1,2,3-Trichlorobenzene	<1	µg/l	1.0
Hexachlorobutadiene	<1	µg/l	1.0
Para_Xylene	<1	µg/l	1.0
Meta_Xylene	<1	µg/l	1.0

* Methylene_Chloride detected in samples is a common laboratory contaminant.

Table 6. DESCRIPTIVE STATISTICS - SELECTED WATER QUALITY PARAMETERS 27 ALLUVIAL WELLS - BRINKLEY, ARKANSAS

WELL NO.	Na Total Rec. (mg/l)	Cl Total Rec. (mg/l)	B Total Rec. (µg/l)	Ba Total Rec. (µg/l)	Ca Total Rec. (mg/l)	Fe Total Rec. (µg/l)	K Total Rec. (mg/l)	Mg Total Rec. (mg/l)	Mn Total Rec. (µg/l)	SO4 Total (mg/l)	TDS (mg/l)
310	132.40	232.00	157.60	377.30	138.00	4030.00	2.70	44.00	444.00	87.50	948.00
129	228.60	53.70	45.20	56.80	29.20	791.00	1.30	8.00	106.00	85.10	692.00
103	78.30	127.00	76.20	285.20	106.00	6140.00	1.80	30.00	466.00	15.10	631.00
122	53.00	99.50	70.30	395.80	134.00	3320.00	2.10	39.00	351.00	54.30	695.00
159	20.70	11.00	26.80	104.10	64.10	1960.00	.90	18.00	629.00	22.90	310.00
311	16.70	10.30	11.20	67.90	64.60	7150.00	1.20	13.00	501.00	3.90	284.00
97	78.80	120.00	152.50	315.90	113.00	3230.00	1.90	33.00	414.00	9.80	663.00
312	30.20	26.50	36.20	270.00	130.00	3180.00	1.50	28.70	343.00	49.00	489.00
139	43.60	63.10	112.20	186.00	171.00	1650.00	1.90	36.80	673.00	80.70	652.00
61	73.60	103.00	62.10	281.00	205.00	2110.00	2.50	47.50	1030.00	141.00	868.00
313	67.30	81.20	46.30	301.00	177.00	2710.00	2.60	40.30	493.00	121.00	726.00
60	8.70	77.20	3.4K	4.0K	.10	2.0K	.02K	.006K	2.0K	189.00	862.00
162	22.00	11.40	25.30	155.00	97.90	1240.00	1.30	18.70	354.00	3.50	316.00
121	38.80	50.80	31.80	419.00	174.00	286.00	1.50	35.10	1020.00	67.30	588.00
183	10.00	5.80	4.30	98.00	22.40	5230.00	1.20	1.80	554.00	15.10	134.00
182	9.30	4.80	3.4K	110.00	29.80	4860.00	1.10	3.50	558.00	13.10	140.00

- CONTINUED -

Table 6. DESCRIPTIVE STATISTICS - SELECTED WATER QUALITY PARAMETERS 27 ALLUVIAL WELLS - BRINKLEY,ARKANSAS

WELL NO.	Na Total Rec. (mg/l)	Cl Total Rec. (mg/l)	B Total Rec. (µg/l)	Ba Total Rec. (µg/l)	Ca Total Rec. (mg/l)	Fe Total Rec. (µg/l)	K Total Rec. (mg/l)	Mg Total Rec. (mg/l)	Mn Total Rec. (µg/l)	SO4 Total (mg/l)	TDS (mg/l)
314	33.70	30.10	34.00	275.00	161.00	3020.00	1.80	30.00	308.00	20.80	508.00
71	133.40	184.00	216.70	331.00	106.00	4690.00	2.80	15.80	859.00	10.10	615.00
134	31.30	24.50	18.60	275.00	127.00	3350.00	1.30	21.00	203.00	14.10	393.00
172	129.40	325.00	167.40	442.00	239.00	2660.00	2.70	40.20	650.00	8.00	909.00
315	445.50	581.00	1336.00	506.00	95.70	2670.00	6.50	23.40	412.00	10.40	1332.00
316	200.10	126.00	625.40	76.00	9.70	356.00	1.80	2.20	22.00	3.50	518.00
317	323.30	376.00	978.20	469.00	57.80	3090.00	4.20	13.80	182.00	3.50	995.00
318	65.30	13.10	296.40	222.00	32.40	730.00	2.10	10.30	51.00	2.30	228.00
319	241.30	406.00	290.00	780.00	134.00	5910.00	4.90	37.50	265.00	26.40	1130.00
320	221.00	488.00	259.40	999.00	170.00	8190.00	4.90	47.90	367.00	13.60	1201.00
321	202.20	394.00	251.90	908.00	152.00	7170.00	4.20	43.30	342.00	22.60	1087.00
Total Wells	27	27	27	27	27	27	27	27	27	27	27
Mean	108.83	149.07	197.60	322.52	108.91	3323.11	2.32	25.29	429.55	40.50	663.48
Median	67.30	81.20	70.30	281.00	113.00	3090.00	1.90	28.70	412.00	15.10	652.00
Std. Dev.	107.63	163.54	306.78	243.95	62.24	2196.04	1.43	14.93	263.00	47.47	319.89
Range	8.70-445.5	4.80-581.00	3.4K-1336.00	4.0K-999.00	.10-239.00	2.0K-8190.00	.02K-6.50	.006K-47.90	2.0K-1030.00	2.30-189.00	134.00-1332.00

Note: Shaded cells indicate water quality parameters associated with saltwater contamination exceeding median values.

Table 7. Chloride Concentration Of Selected Wells Over Time

Well No. 129		Well No. 159		Well No. 61	
Sample Date	Concentration (mg/l)	Sample Date	Concentration (mg/l)	Sample Date	Concentration (mg/l)
March, 1985	65.00	August, 1983	16.00	September, 1975	70.00
June, 1989	2.00 *	August, 1984	18.00	June, 1983	88.00
June, 1992	56.00	June, 1989	8.00	June, 1983	110.00
August, 1995	53.7	June, 1992	8.00	August, 1983	84.00
		August, 1995	11.00	August, 1995	103.00
Well No. 103		Well No. 97		Well No. 60	
Sample Date	Concentration (mg/l)	Sample Date	Concentration (mg/l)	Sample Date	Concentration (mg/l)
March, 1985	27.00	June, 1975	100.00	September, 1975	50.00
June, 1989	113.00	September, 1982	110.00	June, 1983	90.00
June, 1992	103.00	July, 1983	100.00	August, 1995	77.20
August, 1995	127.00	August, 1995	120.00		
Well No. 122		Well #139		Well No. 162	
Sample Date	Concentration (mg/l)	Sample Date	Concentration (mg/l)	Sample Date	Concentration (mg/l)
March, 1985	130.00	June, 1983	110.00	June, 1983 ?	18.00
June, 1989	5.00 *	August, 1984	160.00	August, 1995	11.40
June, 1992	110.00	August, 1995	63.10		
August, 1995	99.5				
Well No. 121		Well No. 182		Well No. 71	
Sample Date	Concentration (mg/l)	Sample Date	Concentration (mg/l)	Sample Date	Concentration (mg/l)
March, 1985	28.00	September, 1983	4.30	August, 1975	280.00
August, 1995	50.80	June, 1989	7.00	August, 1995	184.00
		June, 1992	5.00		
		August, 1995	4.80		
Well No. 172		**Well No. 315 ****		**Well No. 316 ****	
Sample Date	**Concentration (mg/l)**	**Sample Date**	**Concentration (mg/l)**	**Sample Date**	**Concentration (mg/l)**
September, 1982	**50.00**	**February, 1984**	**960.00 (#179)**	**August, 1974**	**660.00 (#180)**
August, 1983	**14.00**	**August, 1995**	**581.00 (#315)**	**July, 1975**	**270.00 (#180)**
August, 1995	**325.00**			**October, 1975**	**700.00 (#180)**
				August, 1995	**126.00 (#316)**
Well No. 319 **		**Well No. 320 ****			
Sample Date	**Concentration (mg/l)**	Sample Date	**Concentration (mg/l)**		
September, 1982	**370.00 (#53)**	**September, 1982**	**370.00 (#50)**		
July, 1983	**370.00 (#53)**	**August, 1995**	**488.00 (#320)**		
August, 1995	**406.00 (#319)**				

* Values are questionable
** Well #315, #316, #319, and #320 are in close proximity to old wells #179, #180, #53, and #50, respectively.

Note: Values for wells sampled prior to 1989 are given as dissolved; values for wells sampled subsequently are given as total recoverable. Variability in chloride concentration may be affected by the length of time the well had been pumping prior to sampling.