QUALITY OF WATER IN THE RED RIVER ALLUVIAL AQUIFER, POOL 2, RED RIVER WATERWAY AREA, RUBY, LOUISIANA

By Charles W. Smoot, Ronald C. Seanor, and G.F. Huff

U.S. GEOLOGICAL SURVEY

Water-Resources Investigations Report 94-4228

Prepared in cooperation with the

U.S. ARMY CORPS OF ENGINEERS, VICKSBURG DISTRICT

Baton Rouge, Louisiana

1995

U.S. DEPARTMENT OF THE INTERIOR
BRUCE BABBITT, Secretary

U.S. GEOLOGICAL SURVEY
Gordon P. Eaton, Director

For additional information write to:

District Chief
U.S. Geological Survey
3535 S. Sherwood Forest Blvd., Suite 120
Baton Rouge, LA 70816

Chief, Engineering Division
U.S. Army Corps of Engineers
Vicksburg District
P.O. Box 60, CELMK-ED-FT
Vicksburg, MS 39181

Copies of this report can be purchased from:

U.S. Geological Survey
Earth Science Information Center
Open-File Reports Section
Box 25286, MS 517
Denver Federal Center
Denver, CO 80225

CONTENTS

FIGURES

TABLES

CONVERSION FACTORS, VERTICAL DATUM, AND ABBREVIATED WATER-QUALITY UNITS

Multiply	By	To obtain
inch (in.)	25.4	millimeter
foot (ft)	0.3048	meter
mile (mi)	1.609	kilometer

Temperature in degrees Celsius (°C) can be converted to degrees Fahrenheit (°F) as follows: °F = 1.8 X °C + 32.

Sea level: In this report, "sea level" refers to the National Geodetic Vertical Datum of 1929 (NGVD of 1929)--a geodetic datum derived from a general adjustment of the first-order level nets of both the United States and Canada, formerly called Sea Level Datum of 1929.

Abbreviated water-quality units:

milligrams per liter (mg/L)
microsiemens per centimeter at 25 degrees Celsius (µS/cm)

QUALITY OF WATER IN THE RED RIVER ALLUVIAL AQUIFER, POOL 2, RED RIVER WATERWAY AREA, RUBY, LOUISIANA

By Charles W. Smoot, Ronald C. Seanor, *and* G.F. Huff

Abstract

Small water-quality changes occurred between pre-construction (1973-82) and post-construction (1988-93) sampling periods in the Red River alluvial aquifer within the area affected by pool 2, Red River waterway area, Lock and Dam 2, near Ruby, Louisiana. Of 10 wells with sufficient water-quality data to be statistically evaluated for detectable changes, data for one well indicated an increase in concentration of total hardness; data for two wells indicated an increase and data for four wells indicated a decrease in concentration of dissolved chloride; and data for one well indicated a decrease in the concentration of iron. Several wells had temporal trends which, if continued, could increase the difference in pre- and post-construction median values over time. Some trends began in the pre-construction period and, therefore, could not be attributed to lock and dam construction.

INTRODUCTION

The Red River alluvial aquifer is a relatively undeveloped source of large amounts of fresh ground water within the Red River Valley within the area affected by the impoundment of water by Lock and Dam 2 (pool 2). The structure was completed on the Red River waterway near Ruby, La., in 1988. Untreated water from the aquifer is used for irrigation and domestic use; however, water for public-supply or industrial use requires treatment for reduction or removal of hardness and iron. Because the water has a low and relatively constant temperature (about 20 °C), it is suitable for other uses such as industrial cooling.

The Red River alluvial aquifer is an important resource in the valley, and knowledge of the effects of the construction and operation of Lock and Dam 2 on the quality of water in the aquifer is important. The U.S. Geological Survey, in cooperation with the U.S. Army Corps of Engineers, began a study in 1973 to determine and document the water quality in the aquifer. The study included the systematic collection and analysis of selected water-quality samples from the aquifer including the following sampling periods: (1) prior to completion of construction (pre-construction 1973-82) and (2) after completion of construction (post-construction 1988-93) of the lock and dam structure on the Red River waterway.

Construction of Lock and Dam 2 began in October 1982 and was completed in January 1988. Although construction was completed in 1988, no pre-pool water samples were collected during January 1988. Because Lock and Dam 2 was constructed in a terrace deposit of Pleistocene age outside the Red River Valley, the quality of water in the Red River alluvial aquifer should not have been affected during the construction period. The lock and dam gates were set in January 1988 to hold the Red River at a pool elevation of 58.6 ft (intermediate pool); in February 1989, the pool elevation was increased to 64 ft (full pool).

Purpose and Scope

This report describes the effects of construction and operation of the Red River waterway Lock and Dam 2 on the quality of water in the Red River alluvial aquifer in the pool 2 area. Water-quality changes that occurred between the pre-construction and post-construction periods are documented. Water-quality changes were evaluated using data for hardness of water as calcium carbonate and concentrations of selected dissolved constituents—chloride, iron, and manganese—in water from wells completed in the aquifer.

Description of Study Area

The pool 2 study area (fig. 1) is within the Red River Valley in the State of Louisiana and extends from 2 mi south of Lock and Dam 2 in southeastern Rapides Parish upvalley along the Red River to 6 mi south of Lock and Dam 3 in Natchitoches Parish. Lock and Dam 2 is located 12 mi downstream from Alexandria, La. Lock and Dam 3 is located about 45 realigned miles upstream from Lock and Dam 2. The realigned miles are the river miles after 1989 (post project). The study area includes parts of Grant and Rapides Parishes. The flood plain between Lock and Dam 2 and 3 ranges from 5 to 12 mi in width. The elevation of the valley ranges from 65 ft in southeastern Rapides Parish to 95 ft at Colfax, La. The annual precipitation averages 58 in. at Alexandria and ranges from 36 to 79 in. (Rogers, 1983). The primary land use is agriculture; however, the metropolitan areas of Alexandria, Boyce, and Lecompte occupy a part of the valley.

Previous Studies

Water-quality analyses of water from wells completed in the Red River alluvial aquifer collected through 1978 were compiled in a report by Whitfield (1980). Also in Whitfield's report are maps showing areal distribution of selected water-quality properties and constituents in water from the aquifer. Water-quality data collected from 1978 to 1985 were compiled and tabulated by Smoot and Guillot (1988).

HYDROGEOLOGY

The Red River alluvium lies on the eroded surface sediments of Tertiary age. The alluvium grades from clay and silt at the surface to coarse sand and gravel at the base. The sand and gravel deposits of Pleistocene age in the lower part of the alluvium forms the Red River alluvial aquifer. The overlying surficial clay and silt of Holocene age comprise the confining unit. The thickness of the alluvial aquifer is variable, with an average of 50 ft within the study area and a maximum of about 110 ft (Rogers, 1983).

Water levels in most of the wells completed in the alluvial aquifer within the study area are above the base of the confining unit, indicating that the aquifer is primarily under confined conditions (Smoot and Martin, 1991, sheet 1). Locally, where the confining unit is thin or absent, water-table conditions may prevail during periods of low water level (Whitfield, 1980, p. 6).

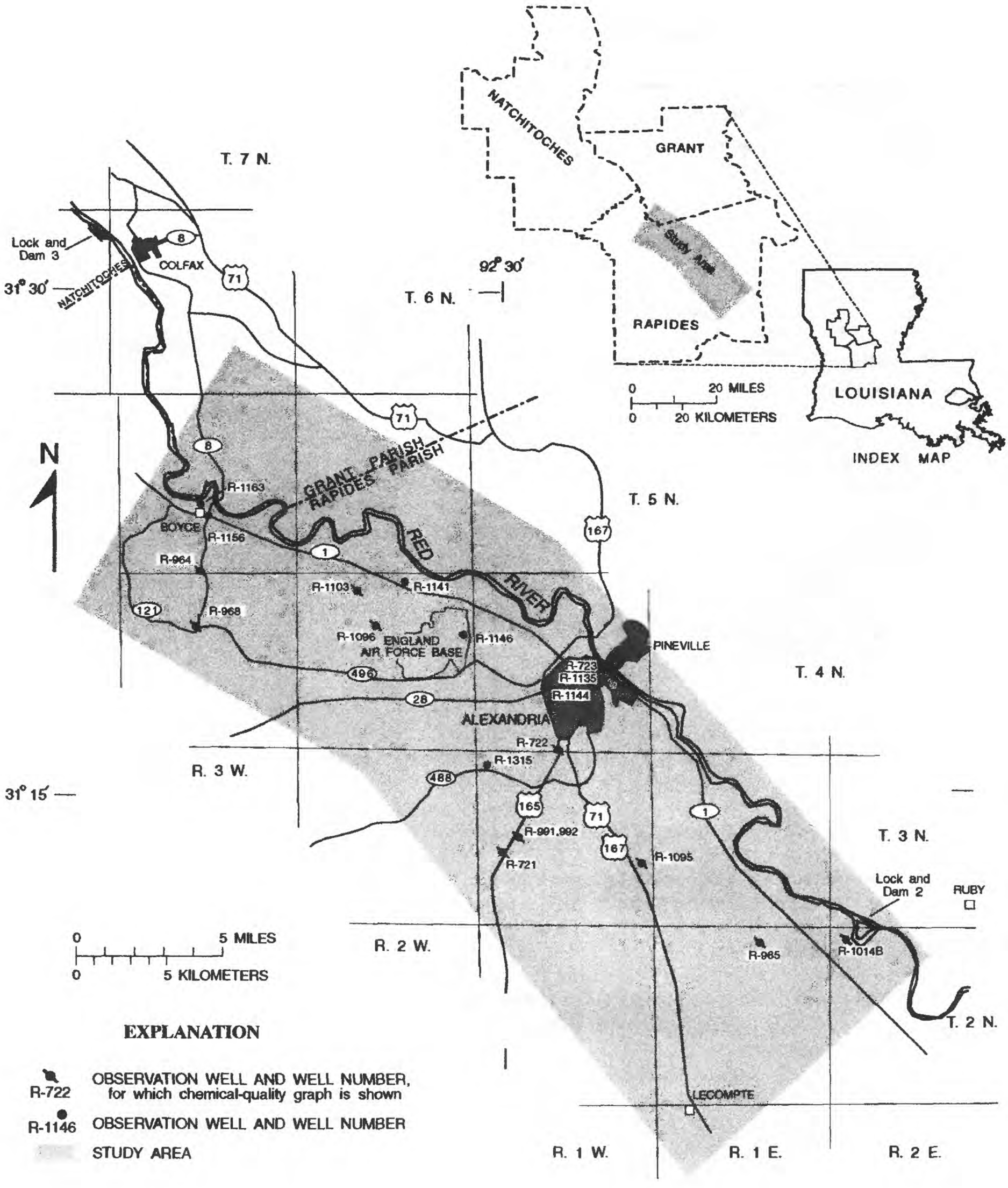

Figure 1. Location of pool 2 study area and selected wells completed in the Red River alluvial aquifer, Louisiana.

Recharge enters the aquifer by infiltration of rainfall in the valley, from lateral movement of water from adjacent sediments of Pleistocene and Tertiary age, and from upward movement of water from underlying aquifers of Tertiary age. Recharge also enters the aquifer in areas near the Red River and its major tributaries during high stream stages (Whitfield, 1980, p. 1).

DATA COLLECTION

Within the study area 12 wells located at 11 sites were sampled periodically between 1973 and 1993. From 1973 to 1987, most of these wells were sampled twice per year; once in the spring (high water) and once in the fall (low water). From 1988 to 1993, these wells were sampled once in the spring. Water samples were collected in 1978-79 and in 1988-93 from six additional wells (R-1135, R-1141, R-1144, R-1146, R-1156, and R-1163), and well R-1315 was sampled from 1988 to 1993.

All the water-quality samples were collected from U.S. Geological Survey observation wells finished with a 3-ft, 0.010-slot screen, using either a suction-type or air lift pump. The samples were collected according to standard methods established for ground-water sampling (American Public Health Association and others, 1980; Brown and others, 1970). Sample preservation and filtration were performed in the field (dependent on the constituent) for later analysis by a U.S. Geological Survey laboratory. Temperature and pH were determined in the field using procedures described by Wood (1976). Also field determination of alkalinity as calcium carbonate and specific conductance was performed on a few samples. The samples were analyzed according to standard methods established for determination of inorganic substances in water (Brown and others, 1970; Fishman and Friedman, 1989). Most of the water-quality samples were analyzed for selected properties and constituents, including total hardness as calcium carbonate and concentrations of dissolved calcium, magnesium, sulfate, chloride, iron, and manganese. In addition to these constituents, the samples collected since 1988 and a few of the earlier samples were analyzed for color and dissolved sodium, potassium, fluoride, silica, and nitrogen.

QUALITY OF WATER

In Rapides Parish, 12 wells were sampled periodically for more than 17 years. The data for these samples document the quality of water in the Red River alluvial aquifer during the pre-construction (1973-82) and post-construction (1988-93) periods of Lock and Dam 2. Water-level and water-quality data collected between 1958 and 1993 are listed in appendix 1. Also used to establish a water-quality data base for the Red River alluvial aquifer during the pre-pool period are data for 60 wells sampled from 1972 to 1978 (Whitfield, 1980).

Variations in total hardness and concentrations of dissolved chloride, iron, and manganese in water from the aquifer as a function of time for 12 wells are shown in figures 2-13. Data are missing for some wells because the screens were encrusted. Also, concentrations of dissolved iron and manganese are not included when the sample was collected by pumping with air because aeration alters these constituents.

Water-quality changes were statistically evaluated for 10 of the 19 wells (completed in the Red River alluvial aquifer) listed in appendix 1. The other 9 wells were not evaluated because of insufficient data. Median values of total hardness and median concentrations of dissolved chloride, iron, and manganese were calculated using data for pre-construction (1973-82) and post-construction (1988-93) sampling periods. Given relatively small data sets, particularly during the post-construction sampling period, a median value gives a more representative time-averaged value than would a mean value by minimizing the effect of outlying data points. A minimum of five data points were required to justify calculation of a median value. Data sets containing less than five values for a particular constituent were insufficient for statistical analysis. The statistical procedure used to establish documentable changes between pre-construction and post-construction sampling periods used the target 90-percent confidence level about the median value. Variation in the exact confidence level is inherent in the use of median rather than mean values. The technique used in calculating the range of values corresponding to the target confidence level is discussed in detail by Iman and Conover (1983, p. 198-202).

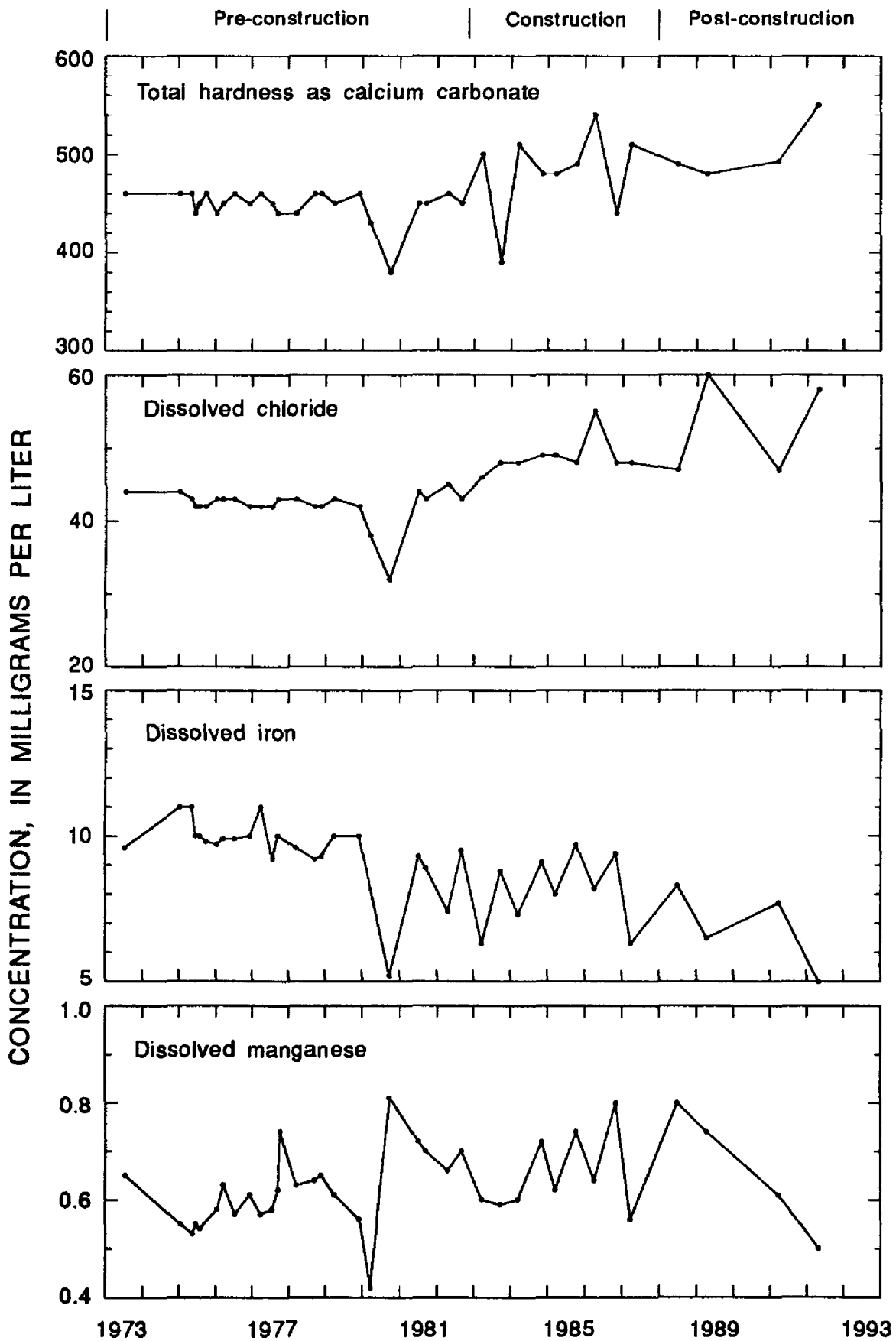

Figure 2. Concentrations of total hardness, dissolved chloride, iron, and manganese in water from well R-721 completed in the Red River alluvial aquifer, from pre-construction (1973-82) to post-construction (1988-92) of Lock and Dam 2 on the Red River, Louisiana.

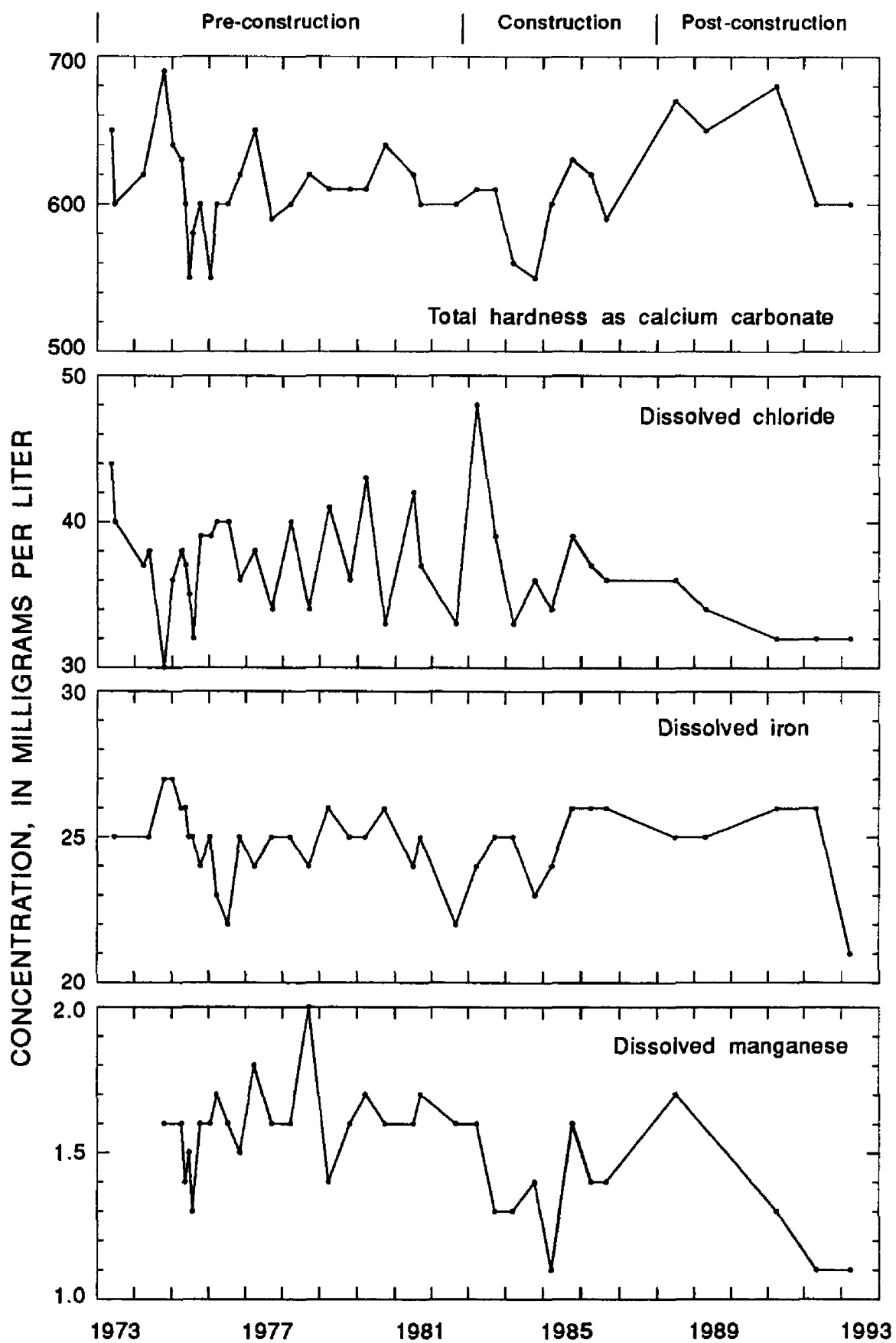

Figure 3. Concentrations of total hardness, dissolved chloride, iron, and manganese in water from well R-722 completed in the Red River alluvial aquifer, from pre-construction (1973-82) to post-construction (1988-93) of Lock and Dam 2 on the Red River, Louisiana.

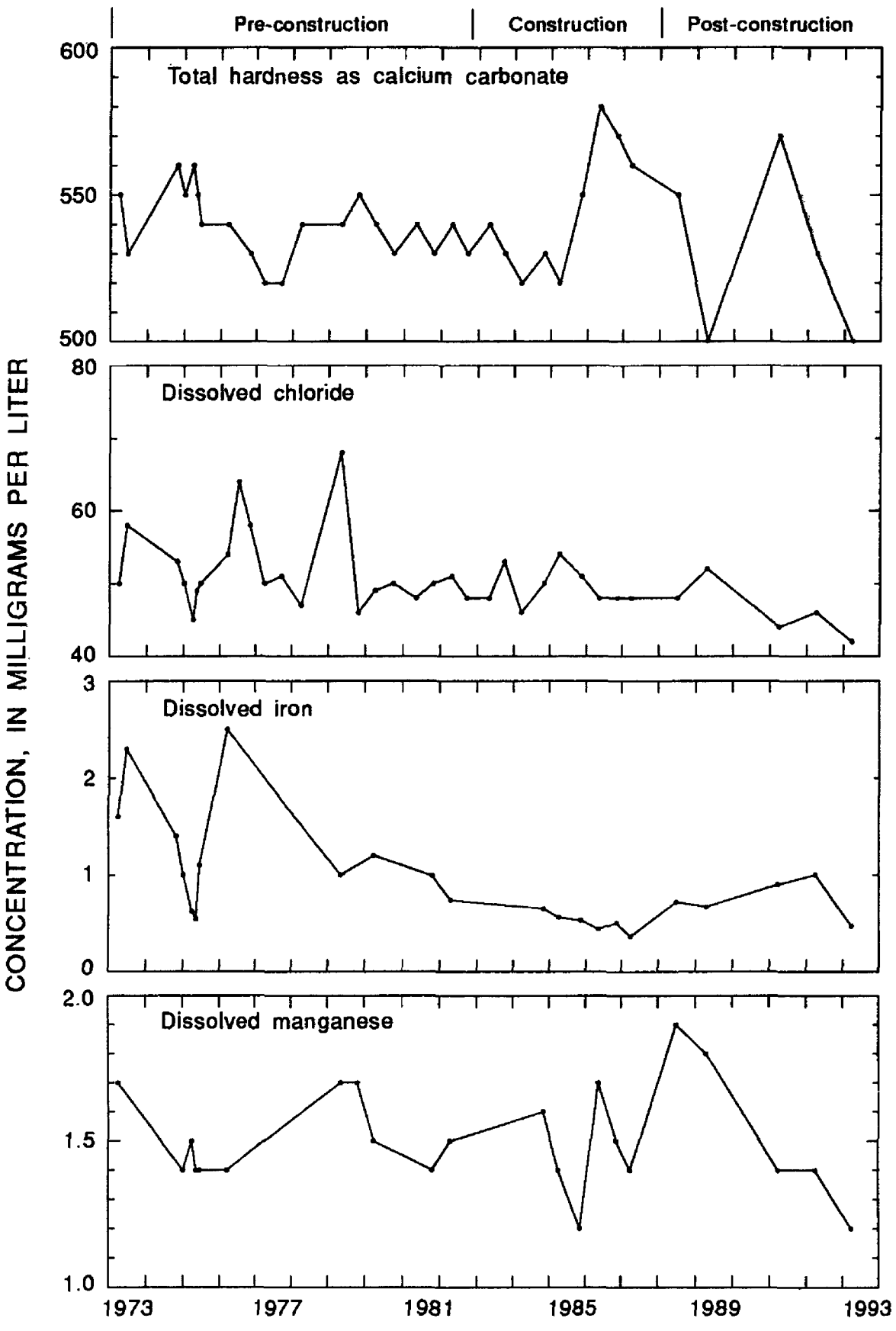

Figure 4. Concentrations of total hardness, dissolved chloride, iron, and manganese in water from well R-723 completed in the Red River alluvial aquifer, from pre-construction (1973-82) to post-construction (1988-93) of Lock and Dam 2 on the Red River, Louisiana.

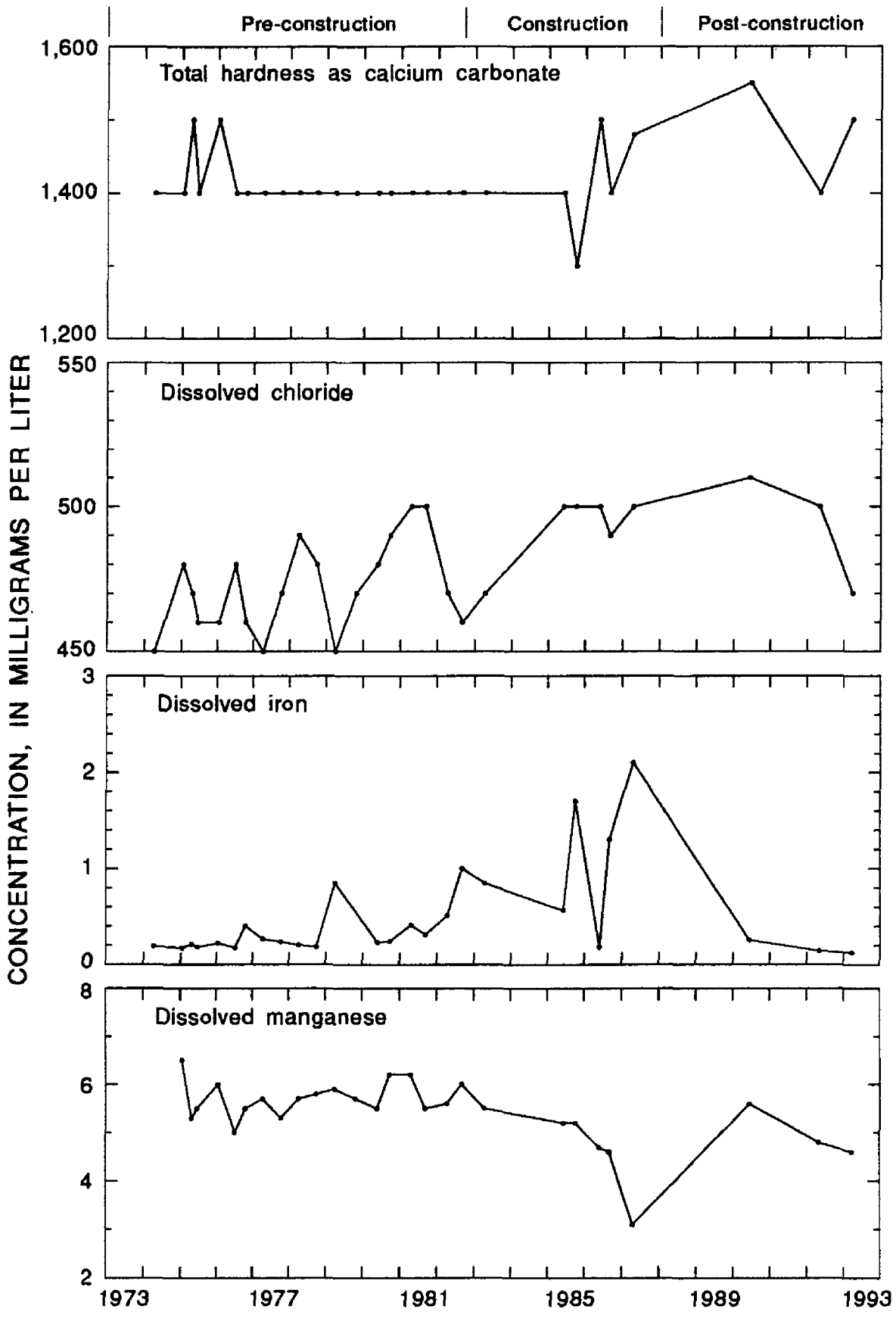

Figure 5. Concentrations of total hardness, dissolved chloride, iron, and manganese in water from well R-964 completed in the Red River alluvial aquifer, from pre-construction (1974-82) to post-construction (1988-93) of Lock and Dam 2 on the Red River, Louisiana.

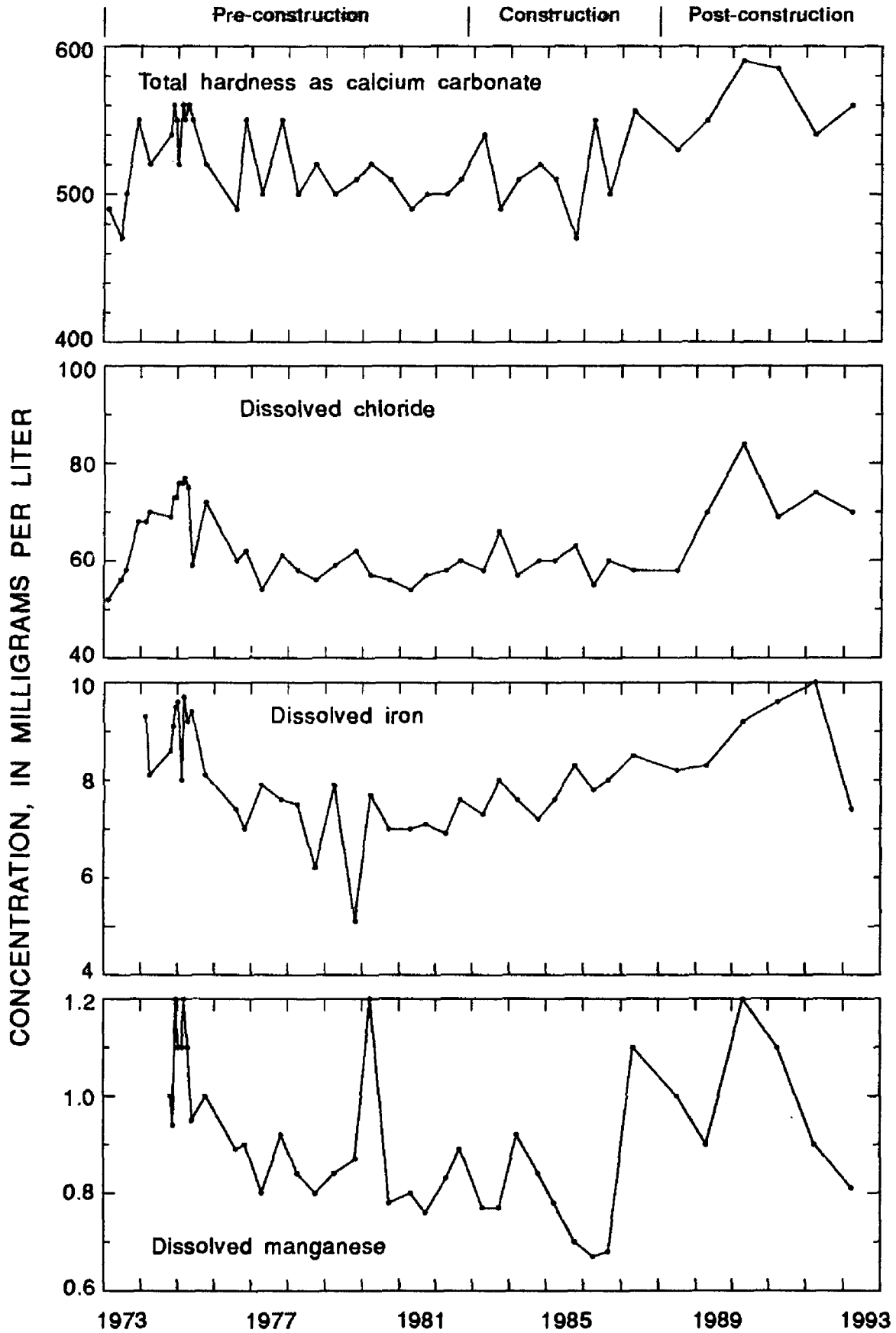

Figure 6. Concentrations of total hardness, dissolved chloride, iron, and manganese in water from well R-965 completed in the Red River alluvial aquifer, from pre-construction (1973-82) to post-construction (1988-93) of Lock and Dam 2 on the Red River, Louisiana.

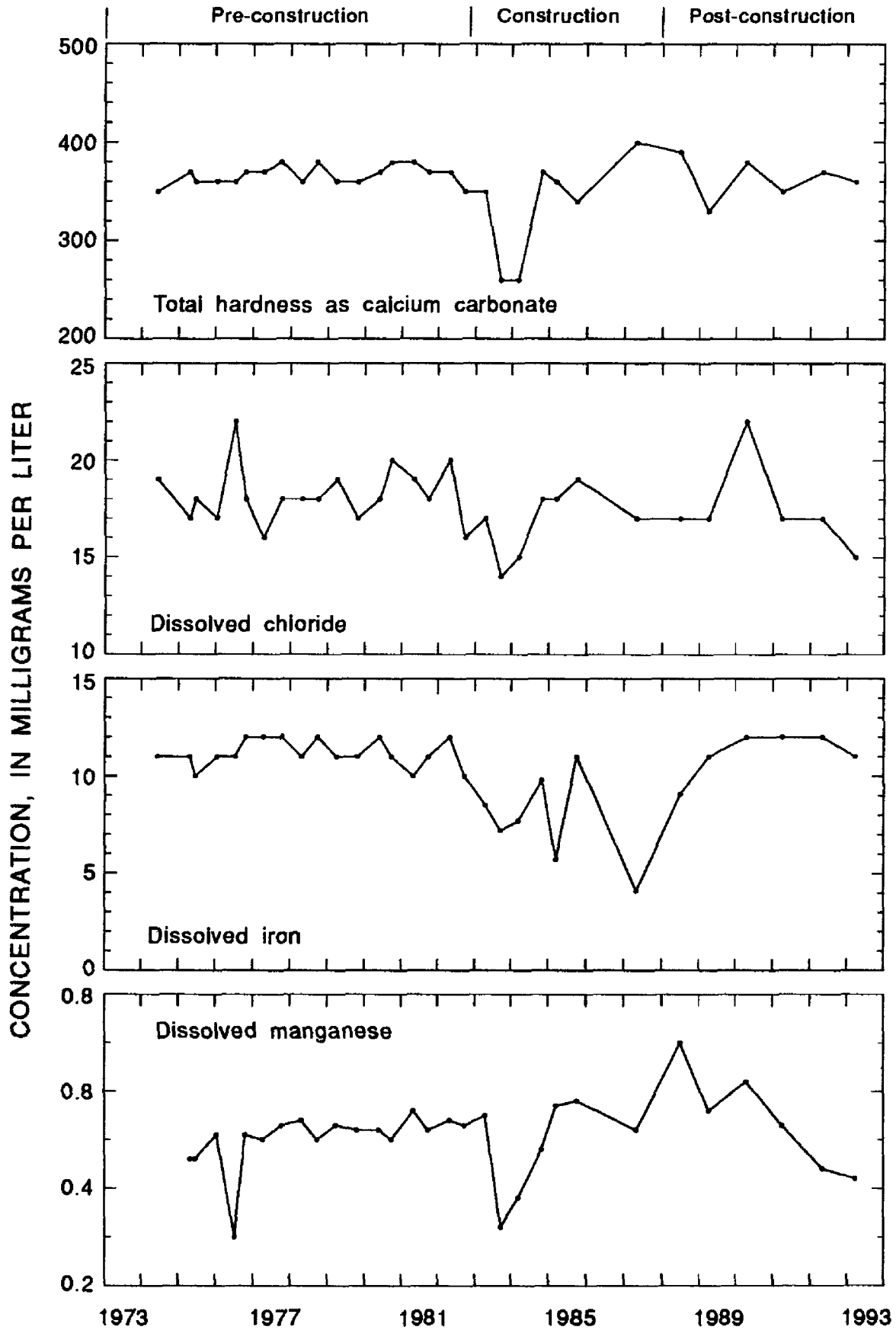

Figure 7. Concentrations of total hardness, dissolved chloride, iron, and manganese in water from well R-968 completed in the Red River alluvial aquifer, from pre-construction (1974-82) to post-construction (1988-93) of Lock and Dam 2 on the Red River, Louisiana.

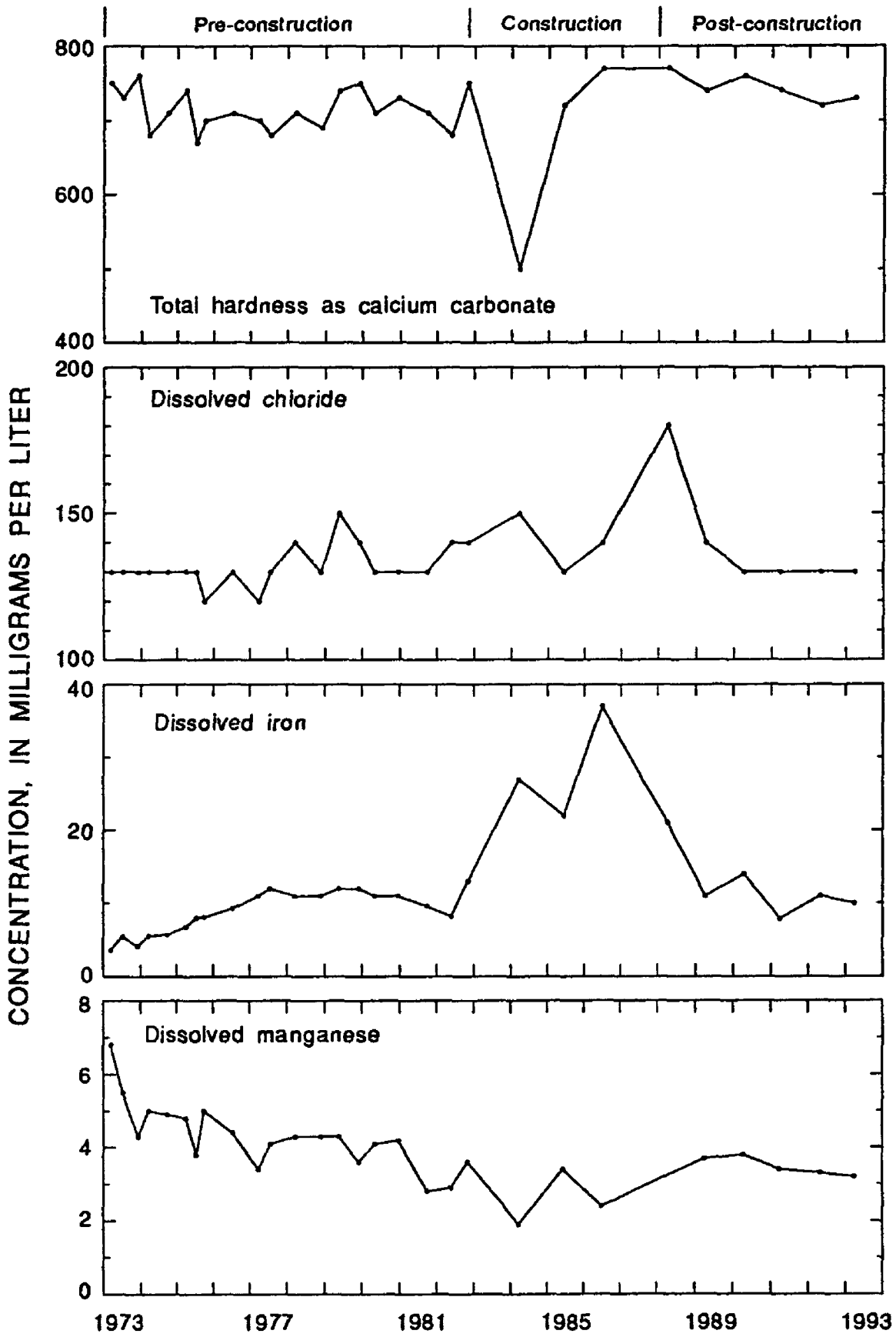

Figure 8. Concentrations of total hardness, dissolved chloride, iron, and manganese in water from well R-991 completed in the Red River alluvial aquifer, from pre-construction (1973-82) to post-construction (1988-93) of Lock and Dam 2 on the Red River, Louisiana.

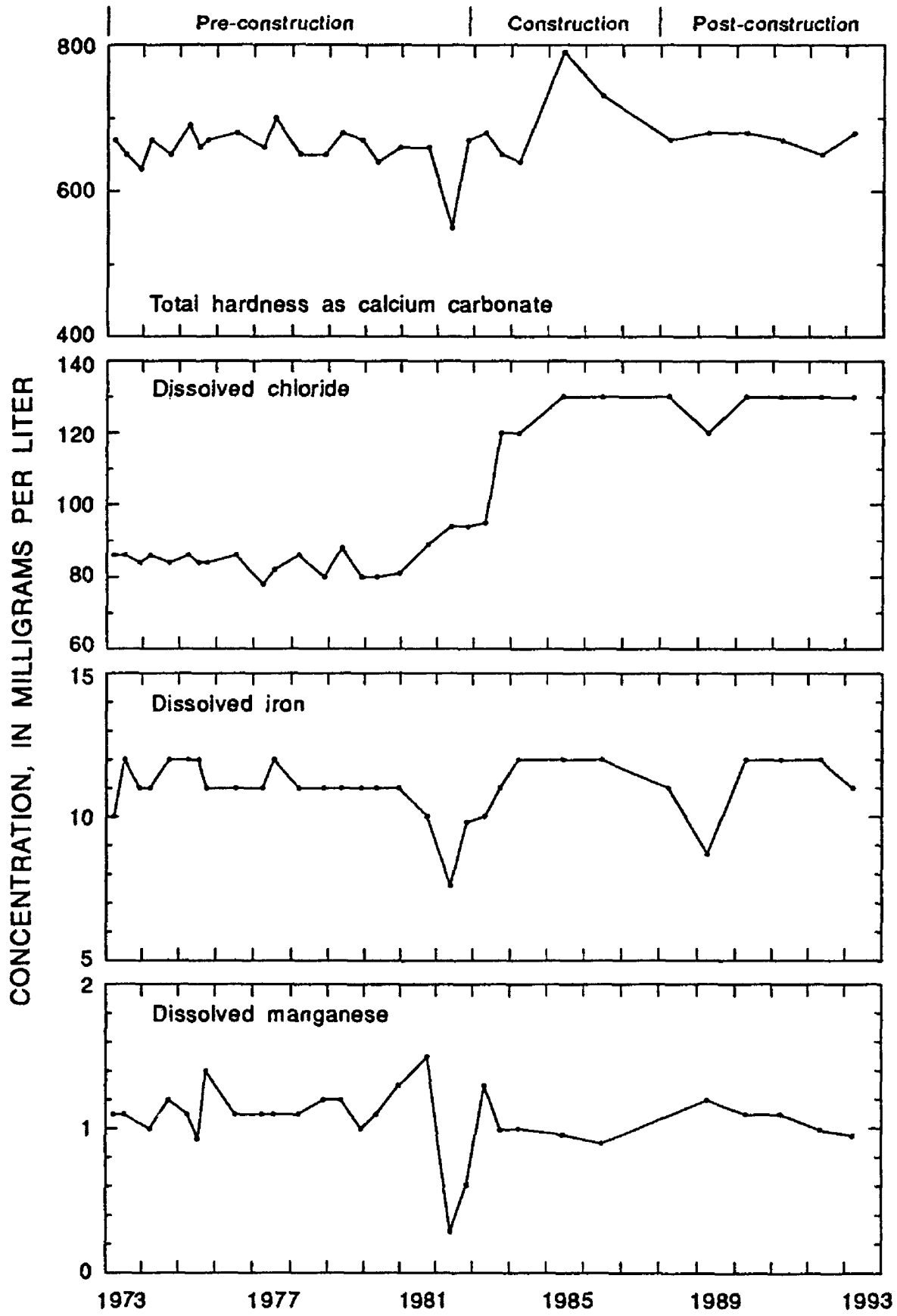

Figure 9. Concentrations of total hardness, dissolved chloride, iron, and manganese in water from well R-992 completed in the Red River alluvial aquifer, from pre-construction (1973-82) to post-construction (1988-93) of Lock and Dam 2 on the Red River, Louisiana.

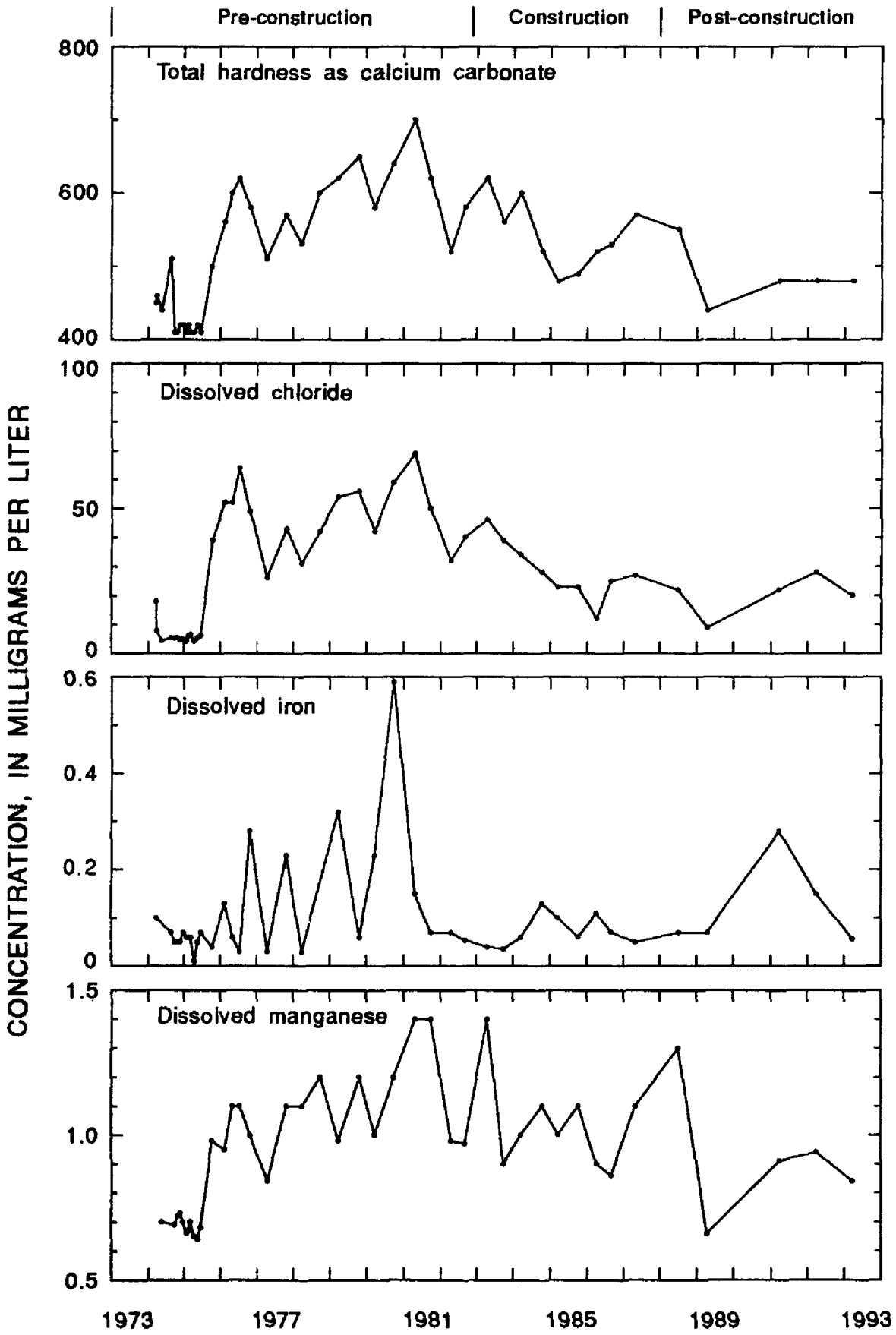

Figure 10. Concentrations of total hardness, dissolved chloride, iron, and manganese in water from well R-1014B completed in the Red River alluvial aquifer, from pre-construction (1974-82) to post-construction (1988-93) of Lock and Dam 2 on the Red River, Louisiana.

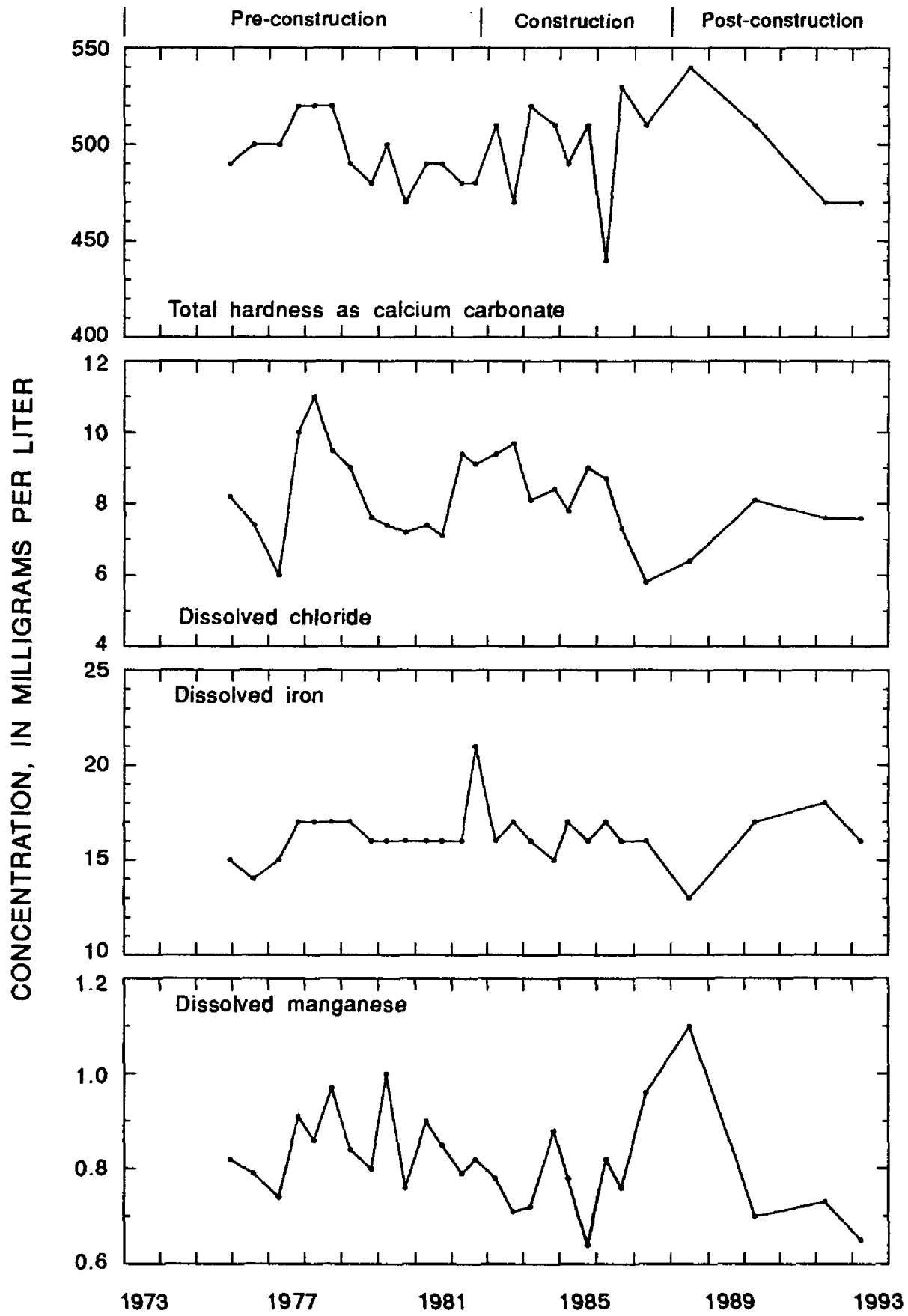

Figure 11. Concentrations of total hardness, dissolved chloride, iron, and manganese in water from well R-1095 completed in the Red River alluvial aquifer, from pre-construction (1975-82) to post-construction (1988-93) of Lock and Dam 2 on the Red River, Louisiana.

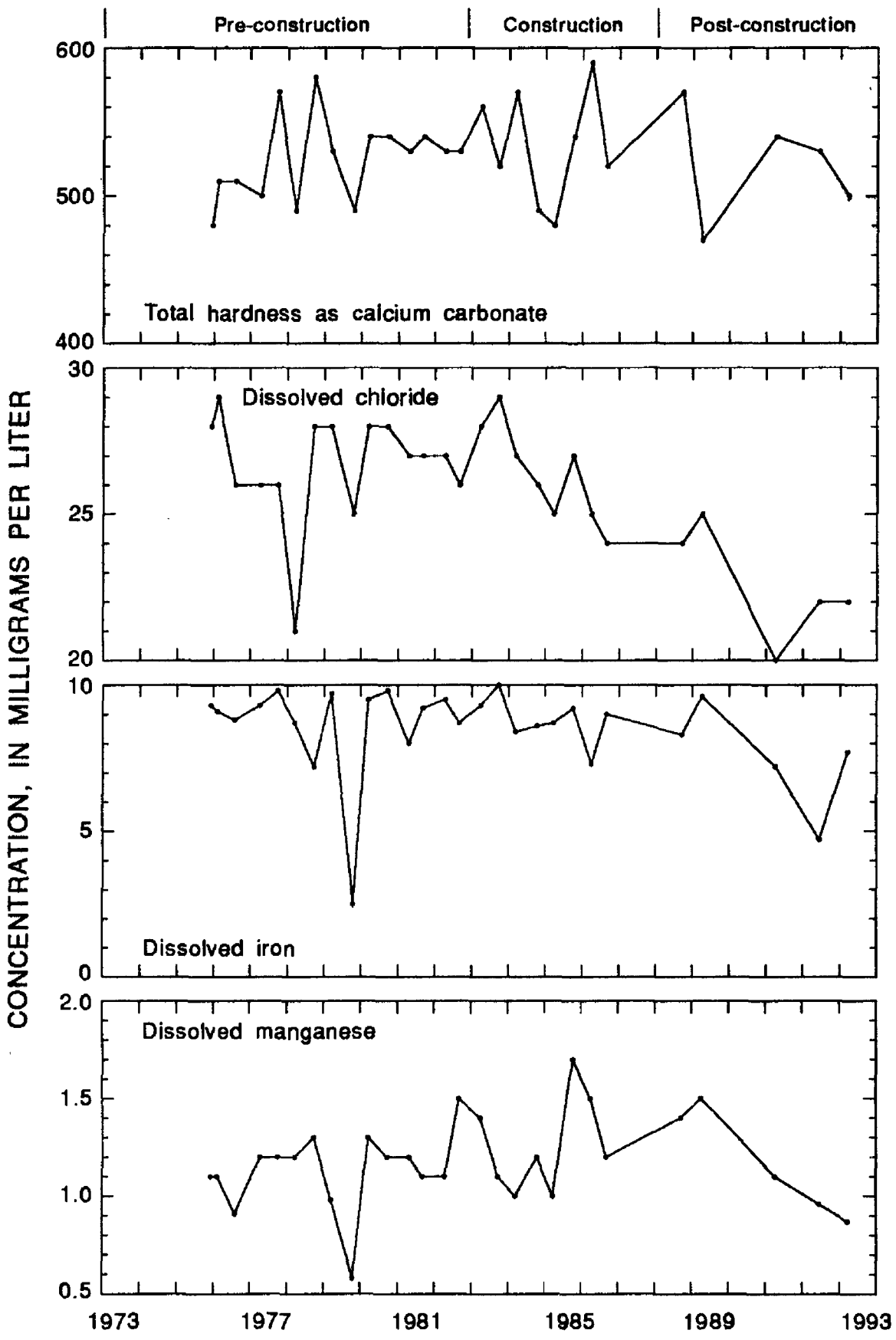

Figure 12. Concentrations of total hardness, dissolved chloride, iron, and manganese in water from well R-1096 completed in the Red River alluvial aquifer, from pre-construction (1975-82) to post-construction (1988-93) of Lock and Dam 2 on the Red River, Louisiana.

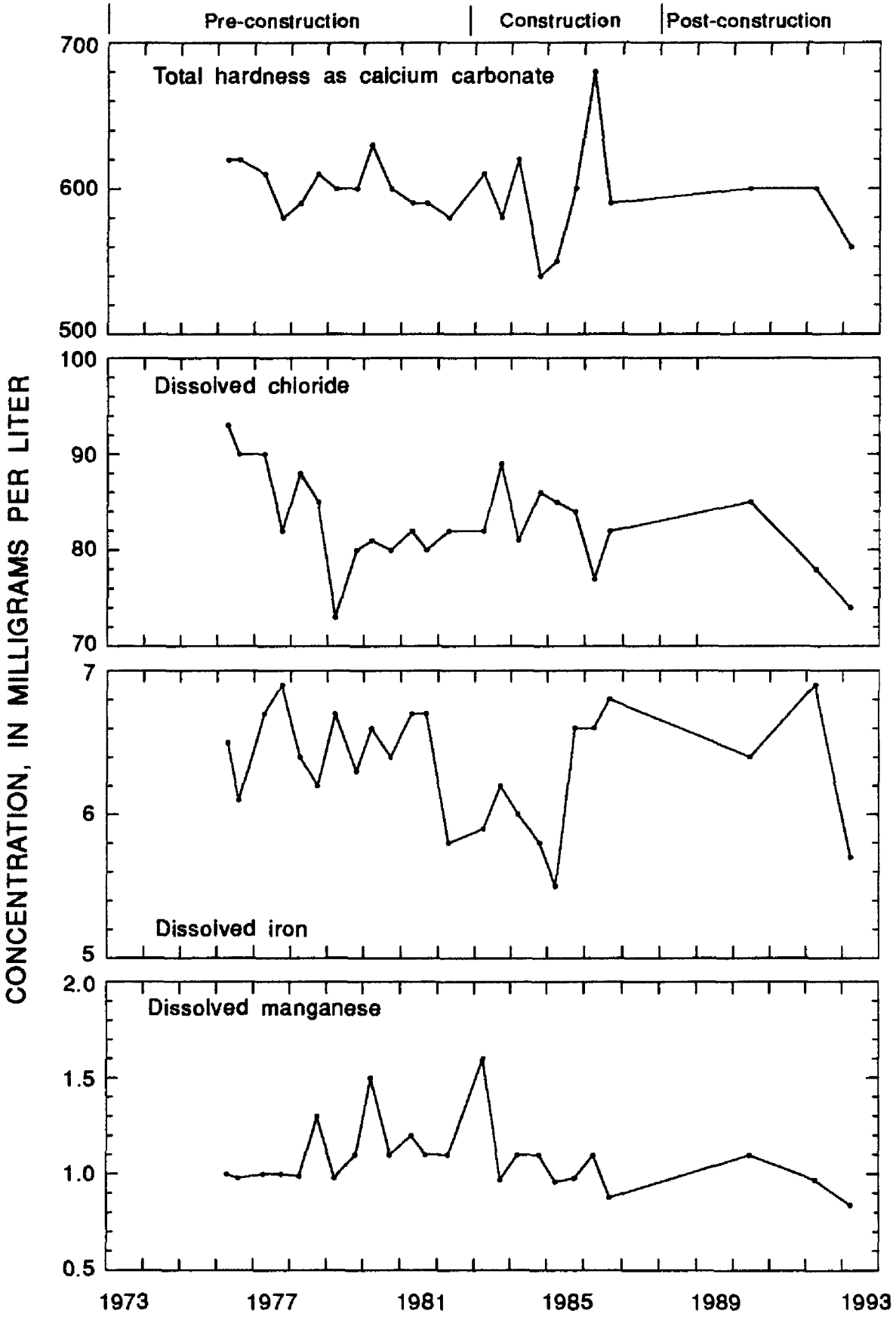

Figure 13. Concentrations of total hardness, dissolved chloride, iron, and manganese in water from well R-1103 completed in the Red River alluvial aquifer, from pre-construction (1976-82) to post-construction (1988-93) of Lock and Dam 2 on the Red River, Louisiana.

If the calculated ranges about the median values overlap, then no documentable difference exists between pre-construction and post-construction sampling periods. If the calculated ranges around the median values of pre-construction and post-construction sampling periods do not overlap and the median value of the post-construction sampling period is greater than the median value of the pre-construction sampling period then a documentable increase has occurred between the pre-construction and post-construction sampling periods. If the calculated ranges around the median values of pre-construction and post-construction sampling periods do not overlap and the median value of the post-construction sampling period is less than the median value of the pre-construction sampling period then a documentable decrease has occurred between the pre-construction and post-construction sampling periods. In instances where a documentable change has occurred between pre-construction and post-construction sampling periods, the magnitude of the change can be approximated by subtracting the pre-construction sampling period median value from the post-construction sampling period median value.

The presence of temporal trends in the data can complicate data analysis. Such a trend in the data extending through pre-construction and post-construction periods could produce a documentable change in water-quality independent of lock and dam construction. Accordingly, documentable changes in water quality identified by statistical analysis were examined for temporal trends. If present, the effects of such trends on changes in water quality were evaluated. In addition to temporal trends, seasonal fluctuations can also adversely affect the ability of the statistical method to determine documentable change in water quality. Accordingly, pre-construction data used for statistical analysis were restricted to the range of months covered by available post-construction data. The generally low number of data points for the post-construction period limits the power of the statistical analysis.

Water-quality changes in the Red River alluvial aquifer were evaluated on the basis of statistical analyses of water samples for total hardness and dissolved chloride, iron, and manganese. Results of statistical analyses are given in tables 1 and 2. In addition to the above constituents, changes in pH, temperature, and sulfate were determined from data collected mostly during 1973-93. Little variation was observed in pH and temperature, whereas sulfate varied considerably during short periods of time. Whitfield (1980) reported that appreciable changes in sulfate may occur within several months following periods of recharge from precipitation. Water samples collected from 1988 to 1993 were analyzed for color; dissolved sodium, potassium, fluoride, silica, and nitrogen; and total nitrogen in addition to the above constituents (appendix 1). Evaluation of water-quality changes was not based on these constituents because no data or minimal data for these constituents were collected during the pre-pool period.

Total Hardness

Documentable differences in concentration of total hardness between the pre-construction and post-construction periods were limited to an increase at well R-721. The change at well R-721 was small (440 mg/L as calcium carbonate) and relatively minor. The increasing trend in hardness at well R-965 and the decreasing trend in total hardness in well R-1014B began following the pre-construction period. If continued, these trends could produce a documentable difference in hardness between pre-construction and post-construction periods at wells R-965 and R-1014B. Data for well R-1095 indicate a possible decreasing trend in hardness for the post-construction period. Additional data are needed to establish the presence or absence of such a trend.

Table 1. Statistical analysis of concentrations of total hardness, dissolved chloride, iron, and manganese in water from selected wells completed in the Red River alluvial aquifer, during pre-construction (1973-82) and post-construction (1988-93) periods of Lock and Dam 2 on the Red River, Louisiana

[mg/L, milligrams per liter; N, number of values in data set; --, no data]

	Pre-construction				Post-construction			
Well no.	Median value (mg/L)	Median range (mg/L)	Confidence level	N	Median value (mg/L)	Median range (mg/L)	Confidence level	N
				Total hardness as calcium carbonate				
R-721	450	440-460	93.46	11	490	480-550	93.76	5
R-722	605	600-620	89.06	10	650	600-680	93.76	5
R-723	540	540-540	89.06	10	540	500-560	78.12	6
R-965	500	500-550	82.04	9	560	540-580	87.50	7
R-968	370	360-370	82.04	9	370	350-390	87.50	7
R-991	710	700-740	78.12	6	740	730-760	78.12	6
R-992	655	640-680	78.12	6	675	670-680	78.12	6
R-1014B	590	530-620	71.10	8	480	480-550	78.12	6
R-1095	495	490-500	78.12	6	510	470-540	93.76	5
R-1096	530	510-540	89.06	10	530	470-570	93.76	5
				Dissolved chloride				
R-721	43	42-43	93.46	11	48	47-60	93.76	5
R-722	40	38-41	89.06	10	32	32-36	93.76	5
R-723	50	48-51	89.06	10	47	44-48	78.12	6
R-965	58	57-59	82.04	9	70	58-74	87.50	7
R-968	18	18-19	82.04	9	17	17-17	87.50	7
R-991	130	130-140	87.50	7	130	130-140	78.12	6
R-992	86	80-88	78.12	6	130	130-130	78.12	6
R-1014B	47	32-54	71.10	8	22	20-27	78.12	6
R-1095	8.2	7.4-9.4	78.12	6	7.6	5.8-8.1	93.76	5
R-1096	27	26-28	93.46	11	22	20-25	93.76	5

Table 1. Statistical analysis of concentrations of total hardness, dissolved chloride, iron, and manganese in water from selected wells completed in the Red River alluvial aquifer, during pre-construction (1973-82) and post-construction (1988-93) periods of Lock and Dam 2 on the Red River, Louisiana--Continued

	Pre-construction				Post-construction			
Well no.	Medisn vsiue (mg/L)	Medisn rsnge (mg/L)	Confidence ievei	N	Medisn vsiue (mg/L)	Median renge (mg/L)	Confidence level	N
				Dissolved iron				
R-721	9.9	9.6-10	82.04	9	6.5	5.0-8.3	93.76	5
R-722	25	24-26	89.06	10	25	21-26	93.76	5
R-723	1.0	.62-1.2	87.50	7	.70	.47-.90	78.12	6
R-965	7.9	7.5-9.2	82.04	9	8.5	8.2-9.6	87.50	7
R-968	11	11-12	82.04	9	11	9.1-12	87.50	7
R-991	11	8.2-11	78.12	6	11	10-14	78.12	6
R-992	11	11-11	78.12	6	12	11-12	78.12	6
R-1014B	.065	.030-.15	71.10	8	.070	.057-.15	78.12	6
R-1095	16	15-17	87.50	7	16	13-18	93.76	5
R-1096	9.2	8.7-9.5	93.46	11	7.7	4.7-9.6	93.76	5
				Dissolved mangsnese				
R-721	.59	.55-.63	89.06	10	.61	.50-.80	93.76	5
R-722	1.6	1.5-1.7	89.06	10	1.2	--	--	4
R-723	1.5	1.4-1.5	87.50	7	1.4	1.4-1.8	78.12	6
R-965	.84	.83-1.1	82.04	9	1.0	.90-1.1	87.50	7
R-968	.52	.46-.54	82.04	9	.53	.44-.62	87.50	7
R-991	4.2	3.4-4.3	78.12	6	3.4	3.2-3.8	93.76	5
R-992	1.1	1.1-1.1	78.12	6	1.1	.95-1.2	93.76	5
R-1014B	1.1	.98-1.1	71.10	8	.93	.84-1.1	78.12	6
R-1095	.84	.79-.90	87.50	7	.73	.65-1.1	93.76	5
R-1096	1.2	1.1-1.3	93.46	11	1.1	.87-1.5	93.76	5

Table 2. Summary of changes in median values of concentrations of total hardness, dissolved chloride, iron, and manganese in water from selected wells completed in the Red River alluvial aquifer, from pre-construction (1973-82) and post-construction (1988-93) periods of Lock and Dam 2 on the Red River, Louisiana

[Concentrations are in milligrams per liter; N, no; Y, yes; I, insufficient data; --, no data; *, no documentable difference]

	Total hardness, as calcium carbonate		Dissolved chloride		Dissolved iron		Dissolved manganese	
Well no.	Documentable difference	Post-construction medisn concentration lsss pre-construction median	Documentable difference	Post-construction median concentration less pre-construction median	Documentsble difference	Post-construction median concentrstion less pre-construction medisn	Documentable difference	Post-construction median concentration less pre-conatruction median
R-721	Y	+40	Y	+5	Y	-3.4	N	*
R-722	N	*	Y	-8	N	*	I	--
R-723	N	*	N	*	N	*	N	*
R-965	N	*	N	*	N	*	N	*
R-968	N	*	Y	-1	N	*	N	*
R-991	N	*	N	*	N	*	N	*
R-992	N	*	Y	+44	N	*	N	*
R-1014B	N	*	Y	-25	N	*	N	*
R-1095	N	*	N	*	N	*	N	*
R-1096	N	*	Y	-5	N	*	N	*

Dissolved Chloride

Documentable increases in dissolved chloride concentration between pre-construction and post-construction sampling periods were limited to wells R-721 and R-992. Documentable decreases were limited to wells R-722, R-968, R-1014B, and R-1096. Documentable differences in chloride concentrations for the two periods were small in wells R-721, R-722, R-968, and R-1096; but were small (ranging from -25 to 44 mg/L) and relatively minor for all five wells. Decreasing temporal trends, which began following the pre-construction sampling period, were indicated for wells R-722 and R-1096. If continued, these trends could produce larger differences between pre-construction and post-construction concentrations.

Temporal trends in chloride concentration were detected at wells R-992, R-964, R-965, and R-1095. Data for well R-992, which is located at an abandoned land fill, indicated that chloride increased between the end of the pre-construction sampling period and the start of the post-construction sampling period. Chloride generally was stable during the pre-construction and post-construction sampling periods. The concentration of chloride at well R-992 started increasing about 1981 (pre-construction) as shown in figure 9. This increasing trend may be associated with the nearby land fill. The chloride in well R-965 indicated a temporal increase beginning near the start of the post-construction sampling period. If continued, this temporal trend could increase the difference between pre-construction and post-construction sampling periods. Data for wells R-964 and R-1095 indicated broad temporal trends, increasing and decreasing, respectively, which extend from the pre-construction sampling period through the post-construction sampling period. If continued, these trends could cause a larger difference in the two periods. However, these differences could not be attributed to lock and dam construction.

Dissolved Iron

Documentable differences in dissolved iron concentration between pre-construction and post-construction sampling periods were limited to a small (3.4 mg/L) and relatively minor decrease at well R-721. A temporal decrease in iron at well R-721 extends from the start of the pre-construction sampling period and through the post-construction sampling period. Thus, the documentable difference between pre-construction and post-construction sampling periods could not be attributed to construction of the lock and dam. Data for well R-965 indicated an increasing trend in iron concentration starting after the pre-construction sampling period. If continued, this trend could produce a larger difference between pre-construction and post-construction sampling periods for well R-965. Fluctuation in the concentration of iron occurred following the pre-construction but before the start of the post-construction sampling periods for wells R-968, R-991, and R-1103. Iron in water from well R-723 decreased until approximately the start of the post-construction sampling period and changed little during the post-construction sampling period. Iron concentration may be beginning a declining temporal trend in well R-1096 in the post-construction sampling period. More data are needed to document the presence or absence of such a trend.

Dissolved Manganese

Well R-722 had insufficient data in the post-construction sampling period to evaluate potential changes in dissolved manganese between pre-construction and post-construction sampling periods. For other well data subjected to statistical analysis, no documentable change in the concentration of manganese was indicated between pre-construction and post-construction sampling periods. Manganese in water from well R-1095 decreased from the pre-construction sampling period and through the post-construction sampling period. Based on available data, any changes in the concentrations of manganese in well R-1095 could not be attributed to construction of the lock and dam. Manganese in water from well R-991 decreased until approximately the start of the post-construction sampling period. However, available post-construction data indicated little or no change in concentration of manganese. Manganese in water from well R-1014B decreased in the post-construction sampling period. If continued, this decreasing temporal trend could increase the difference between pre-construction and post-construction concentrations at well R-1014B.

SUMMARY AND CONCLUSIONS

Small and relatively minor water-quality changes occurred between pre-construction (1973-82) and post-construction (1988-93) sampling periods in the Red River alluvial aquifer within the area affected by pool 2, Red River waterway area, Lock and Dam 2, near Ruby, Louisiana. Of 10 wells with sufficient water-quality data to be statistically evaluated for documentable changes, data for one well indicated an increase in concentration of total hardness; data for two wells indicated an increase and data for four wells indicated a decrease in concentration of dissolved chloride; and data for one well had a documentable decrease in concentration of iron. The single documentable difference in pre- and post-construction median values in concentration of total hardness was an increase of 40 mg/L as calcium carbonate. The documentable change in concentration of dissolved chloride ranged from a decrease of 25 mg/L to an increase of 44 mg/L. The single documentable increase in concentration of dissolved iron was 3.4 mg/L.

Data for several wells had temporal trends which, if continued, should increase the difference in pre- and post-construction median values over time. Some trends began in the pre-construction period and, therefore, could not be attributed to lock and dam construction.

SELECTED REFERENCES

American Public Health Association, American Water Works Association, and Water Pollution Control Federation, 1980, Standard methods for the examination of water and wastewater (15th ed.): New York, American Public Health Association, Inc., 1134 p.

Brown, Eugene, Skougstad, M.W., and Fishman, M.J., 1970, Methods for collection and analysis of water samples for dissolved minerals and gases: U.S. Geological Survey Techniques of Water-Resources Investigations, book 5, chap. A1, 160 p.

Fishman, M.J., and Friedman, L.C., eds., 1989, Methods for determination of inorganic substances in water and fluvial sediments: U.S. Geological Survey Techniques of Water-Resources Investigations, book 5, chap. A1, 545 p.

Inman, R.L., and Conover, W.J., 1983, A modern approach to statistics: New York, John Wiley and Sons, 497 p.

Ludwig, A.H., 1974, Quality of water in the Red River alluvial aquifer, Shreveport to the mouth of the Black River, Louisiana: U.S. Geological Survey Open-File Report, 7 p.

Rogers, J.E., 1983, Preconstruction and simulated postconstruction ground-water levels at urban centers in the Red River navigation project area, Louisiana: U.S. Geological Survey Water-Resources Investigations Report 83-4154, 33 p.

———1988, Red River Waterway Project—Summary of ground-water studies by the U.S. Geological Survey, 1962-85: U.S. Geological Survey Water-Resources Investigations Report 87-4261, 19 p.

Smoot, C.W., and Guillot, J.R., 1988, Water-level measurements 1981-85 and chemical analyses 1978-85, Red River alluvial aquifer, Red River Valley, Louisiana: U.S. Geological Survey Open-File Report 87-541, 261 p.

Smoot, C.W., and Martin, Angel, Jr., 1991, Generalized potentiometric surfaces of the Red River alluvial aquifer, pool 1, Red River waterway area, central Louisiana: U.S. Geological Survey Water-Resources Investigations Report 91-4109, 7 sheets.

U.S. National Oceanic and Atmospheric Administration, 1975-90, Climatological data for Louisiana: Published annually.

Whitfield, M.S., Jr., 1980, Chemical character of water in the Red River alluvial aquifer, Louisiana: U.S. Geological Survey Water-Resources Investigations Open-File Report 80-1018, 95 p.

Wood, W.W., 1976, Guidelines for collection and field analysis of ground-water samples for selected unstable constituents: U.S. Geological Survey Techniques of Water-Resources Investigations, book 1, chap. D2, 24 p.

Appendixes

Appendix 1. Summary of analyses of water from wells completed in the Red River alluvial aquifer, Louisiana, 1958-93
[µS/cm, microsiemens per centimeter at 25° Celsius; °C, degrees Celsius; $CaCO_3$, calcium carbonate; mg/L, milligrams per liter; +, water level above land surface; <, actual value is known to be less than value shown; --, no data]

Well number	Date	Water level below land surface (feet)	Depth of well, total (feet)	Specific conductance (µS/cm)	pH field (standard units)	Temperature of water (°C)	Color (platinum-cobalt units)	Hardness total (mg/L as $CaCO_3$)	Hardness, noncarbonate whole water total field (mg/L as $CaCO_3$)	Calcium, dissolved (mg/L as Ca)	Magnesium, dissolved (mg/L as Mg)
R-721	02-28-58	--	95	--	--	--	--	440	--	--	--
	10-09-58	6.47	95	--	--	20.0	--	440	--	--	--
	07-01-59	10.73	95	--	--	--	--	460	--	--	--
	08-01-59	--	95	--	--	20.5	--	440	--	--	--
	09-01-59	--	95	--	--	21.5	--	500	--	--	--
	10-01-59	--	95	--	--	20.0	--	490	--	--	--
	12-21-59	4.41	95	--	--	--	--	460	--	--	--
	01-29-60	3.46	95	--	--	--	--	440	--	--	--
	02-23-60	3.26	95	--	--	19.5	--	460	--	--	--
	03-24-60	3.63	95	--	--	20.0	--	450	--	--	--
	05-03-60	--	95	--	--	20.0	--	460	--	--	--
	05-31-60	8.65	95	--	--	20.0	--	430	--	--	--
	06-28-60	11.12	95	--	--	20.0	--	440	--	--	--
	04-29-71	--	95	950	--	--	0	490	1	120	45
	07-13-73	--	95	917	6.9	20.0	0	460	0	110	44
	01-16-75	3.22	95	935	7.1	20.0	0	460	8	110	44
	05-15-75	3.70	95	945	6.8	20.0	--	460	--	110	46
	06-21-75	5.52	95	927	6.9	20.0	--	440	--	--	--
	07-28-75	6.74	95	938	6.8	--	--	450	--	--	--
	10-03-75	8.28	95	917	6.9	--	--	460	--	--	--
	01-15-76	3.44	95	937	7.0	20.0	--	440	--	--	--
	03-18-76	4.50	95	914	7.0	20.0	--	450	--	--	--
	07-08-76	4.23	95	923	7.0	--	--	460	--	--	--
	12-08-76	6.13	95	958	7.1	20.0	5	450	0	110	42
	03-28-77	3.80	95	913	6.9	20.0	--	460	--	--	--
	07-20-77	11.30	95	904	6.9	--	--	450	--	--	--
	09-14-77	10.62	95	943	6.9	20.0	--	440	--	--	--
	03-16-78	3.94	95	935	7.0	--	0	440	0	--	--
	09-15-78	11.58	95	--	7.1	--	--	460	--	--	--
	11-21-78	12.42	95	958	6.7	--	--	460	0	--	--
	03-29-79	3.65	95	892	7.0	20.0	--	450	--	--	--
	11-30-79	3.29	95	911	6.8	21.0	--	460	--	--	--
	03-18-80	3.22	95	865	7.0	20.0	--	430	--	--	--
	09-23-60	11.71	95	--	6.9	--	--	380	--	--	--
	06-30-81	7.46	95	--	6.9	20.0	--	450	--	--	--
	09-09-81	11.12	95	--	6.8	20.0	--	450	--	--	--
	04-16-82	4.12	95	--	7.0	20.0	--	460	--	--	--
	08-31-82	10.28	95	--	6.9	20.0	--	450	--	--	--
	03-25-63	2.48	95	--	6.8	20.0	--	500	--	120	49
	09-21-63	5.43	95	--	6.9	20.0	--	390	--	91	40
	03-13-84	2.85	95	--	6.9	21.0	--	510	--	130	45
	11-05-84	3.00	95	--	7.3	--	--	460	--	110	50
	03-18-85	3.42	95	--	7.0	21.0	--	480	--	120	44
	10-07-85	7.87	95	--	7.1	21.0	--	490	--	120	47
	03-31-86	4.08	95	--	7.3	--	--	540	--	130	52
	10-31-86	6.78	95	--	6.8	--	--	440	--	95	50
	03-24-87	2.48	95	970	7.3	--	--	510	--	120	50
	06-27-88	7.07	95	976	7.1	22.0	5	490	--	130	40
	04-17-89	7.28	95	1,090	7.3	--	5	460	--	110	50
	03-25-91	7.22	95	1,030	7.2	--	5	493	--	120	47
	04-29-92	4.03	95	1,090	7.3	--	--	550	--	130	54
R-722	03-10-58	--	85	--	--	20.0	--	620	--	--	--
	10-10-58	5.53	85	--	--	20.0	--	580	--	--	--
	07-13-59	--	85	--	--	--	--	630	--	--	--
	08-01-59	--	85	--	--	21.0	--	570	--	--	--
	09-01-59	--	85	--	--	--	--	630	--	--	--
	10-01-59	--	85	--	--	20.0	--	620	--	--	--
	11-01-59	--	85	--	--	21.0	--	600	--	--	--
	12-21-59	6.64	85	--	--	20.0	--	--	--	--	--
	01-29-60	4.46	85	--	--	20.0	--	--	--	--	--
	02-23-60	2.98	85	--	--	20.0	--	620	--	--	--
	03-24-60	3.17	85	--	--	20.0	--	610	--	--	--
	05-03-60	4.88	85	--	--	20.5	--	610	--	--	--

Appendix 1. Summary of analyses of water from wells completed in the Red River alluvial aquifer, Louisiana, 1958-93--Continued

Sodium, dissolved (mg/L as Na)	Potassium, dissolved (mg/L ss K)	Alkalinity, field (mg/L as $CaCO_3$	Sulfate, dissolved (mg/L as SO_4)	Chloride, dissolved (mg/L as Cl)	Fluoride, dissolved (mg/L as F)	Silica, dissolved (mg/L ae SiO_2)	Solids, sum of constituents, dissolved (mg/L)	Nitrogen, nitrite dissolved (mg/L as N)	Nitrogen, $NO_2 + NO_3$ dissolved (mg/L ss N)	Iron, dissolved (mg/L as Fe)	Manganese, dissolved (mg/L as Mn)
--	--	--	--	48	--	--	--	--	--	--	--
--	--	--	--	48	--	--	--	--	--	--	--
--	--	--	--	44	--	--	--	--	--	--	--
--	--	--	--	--	--	--	--	--	--	--	--
--	--	--	--	44	--	--	--	--	--	--	--
--	--	--	--	48	--	--	--	--	--	--	--
--	--	--	--	48	--	--	--	--	--	--	--
--	--	--	--	48	--	--	--	--	--	--	--
--	--	--	--	46	--	--	--	--	--	--	--
--	--	--	--	48	--	--	--	--	--	--	--
--	--	--	--	46	--	--	--	--	--	--	--
--	--	--	--	48	--	--	--	--	--	--	--
--	--	--	--	48	--	--	--	--	--	--	--
29	1.1	484	0.8	45	0.4	18	550	--	--	--	0.90
32	.9	476	1.2	44	.4	27	540	--	--	9.6	.65
30	1.1	--	.2	44	.4	19	530	--	--	11	.55
--	--	--	.4	43	--	--	--	--	--	11	.53
--	--	--	<1.0	42	--	--	--	--	--	10	.55
--	--	--	<1.0	42	--	--	--	--	--	10	.54
--	--	--	<1.0	42	--	--	--	--	--	9.8	--
31	1.3	--	<1.0	43	--	--	--	--	--	9.7	.58
--	--	--	<1.0	43	--	--	--	--	--	9.9	.63
--	--	--	<1.0	43	--	--	--	--	--	9.9	.57
30	1.4	459	<1.0	42	.4	21	520	--	--	10	.61
--	--	--	.8	42	--	--	--	--	--	11	.57
--	--	558	1.8	42	--	--	--	--	--	9.2	.58
--	--	--	.2	43	--	--	--	--	--	10	.62
--	--	541	<.2	43	--	--	--	--	--	9.6	.63
--	--	--	.4	42	--	--	--	--	--	9.2	.84
--	--	512	<.2	42	--	--	--	--	--	9.3	.65
--	--	--	<.2	43	--	--	--	--	--	10	.61
--	--	--	<.2	42	--	--	--	--	--	10	.56
--	--	--	.2	38	--	--	--	--	--	--	.42
--	--	--	2.4	32	--	--	--	--	--	5.2	.81
--	--	--	.4	44	--	--	--	--	--	9.3	.72
--	--	--	.2	43	--	--	--	--	--	8.9	.70
--	--	--	.6	45	--	--	--	--	--	7.4	.66
--	--	--	.2	43	--	--	--	--	--	9.5	.70
--	--	--	.2	48	--	--	--	--	--	6.3	.60
--	--	--	.6	48	--	--	--	--	--	8.8	.59
--	--	--	.6	48	--	--	--	--	--	7.3	.60
--	--	--	.8	49	--	--	--	--	--	9.1	.72
--	--	--	.8	49	--	--	--	--	--	8	.62
--	--	--	1.6	48	--	--	--	--	--	9.7	.74
--	--	--	4.6	55	--	--	--	--	--	8.2	.64
--	--	--	.6	48	--	--	--	--	--	9.4	.80
--	--	510	.6	48	--	--	--	--	--	6.3	.56
30	1.4	489	8.6	47	.3	25	585	<0.01	<0.02	8.3	.80
31	1.3	522	3.9	60	.5	21	598	<.01	<.02	6.5	.74
30	1.3	499	<.2	47	.4	21	--	<.01	.02	7.7	.61
34	1.5	533	12.0	58	.3	19	634	<.01	<.02	5	.50
--	--	--	--	56	--	--	--	--	--	--	--
--	--	--	--	52	--	--	--	--	--	--	--
--	--	--	--	56	--	--	--	--	--	--	--
--	--	--	--	48	--	--	--	--	--	--	--
--	--	--	--	48	--	--	--	--	--	--	--
--	--	--	--	52	--	--	--	--	--	--	--
--	--	--	--	46	--	--	--	--	--	--	--
--	--	--	--	44	--	--	--	--	--	--	--
--	--	--	--	46	--	--	--	--	--	--	--
--	--	--	--	54	--	--	--	--	--	--	--
--	--	--	--	50	--	--	--	--	--	--	--
--	--	--	--	50	--	--	--	--	--	--	--

Appendix 1. Summary of analyses of water from wells completed in the Red River alluvial aquifer, Louisiana, 1958-93--Continued

Well number	Date	Water level below land surface (feet)	Depth of well, total (feet)	Specific conductance (µS/cm)	pH field (standard units)	Temperature of water (°C)	Color (platinum-cobalt units)	Hardness total (mg/L as $CaCO_3$)	Hardness, noncarbonate whole water total field (mg/L as $CaCO_3$)	Calcium, dissolved (mg/L as Ca)	Magnesium, dissolved (mg/L as Mg)
R-722	05-31-60	5.91	85	--	--	20.5	--	600	--	--	--
	06-28-60	7.12	85	--	--	20.5	--	600	--	--	--
	10-26-70	--	85	--	--	--	--	640	--	--	--
	04-28-71	--	85	--	--	--	--	580	0	130	62
	05-18-73	--	85	--	6.9	--	--	650	--	--	--
	06-20-73	--	85	1,300	6.5	--	--	600	--	--	--
	03-30-74	1.42	85	1,270	7.3	--	--	620	--	--	--
	05-24-74	4.69	85	1,220	7.0	20.5	--	--	--	--	--
	10-17-74	8.43	85	1,230	7.0	21.0	--	690	--	--	--
	01-06-75	4.28	85	1,230	7.2	21.0	--	640	--	--	--
	04-05-75	3.14	85	1,180	6.6	20.5	--	630	--	140	68
	05-15-75	2.33	85	1,260	6.6	20.5	5	600	0	130	68
	06-21-75	3.70	85	--	6.7	20.0	--	550	--	--	--
	07-28-75	4.81	85	1,240	6.6	20.5	--	580	--	--	--
	10-07-75	6.37	85	1,210	6.7	20.0	0	600	0	110	78
	01-15-76	4.57	85	--	7.0	20.5	--	550	--	--	--
	03-18-76	3.00	85	1,220	7.0	20.5	--	600	--	--	--
	07-08-76	3.60	85	1,190	6.8	--	--	600	--	--	--
	11-02-76	7.32	85	1,190	6.8	--	5	620	0	140	63
	03-28-77	2.85	85	1,090	7.0	20.0	--	650	--	--	--
	09-14-77	7.65	85	1,250	6.9	20.0	--	590	--	--	--
	03-22-78	2.65	85	1,100	6.5	20.0	0	600	11	130	68
	09-15-78	8.45	85	1,470	6.6	20.0	--	620	--	--	--
	03-29-79	2.20	85	1,170	6.9	20.5	--	610	--	--	--
	10-18-79	6.59	85	876	6.9	21.5	--	610	--	--	--
	03-18-80	2.55	85	1,220	7.0	20.5	--	610	--	--	--
	09-23-80	8.95	85	--	7.0	--	--	640	--	--	--
	06-30-81	6.28	85	--	7.0	20.5	--	620	--	--	--
	09-09-81	8.75	85	--	6.6	20.5	--	600	--	--	--
	08-31-82	9.68	85	--	6.8	20.5	--	600	--	--	--
	03-22-83	3.16	85	--	6.6	20.5	--	610	--	140	83
	09-21-83	8.12	85	--	6.8	20.0	--	610	--	140	63
	03-13-84	2.78	85	--	6.6	21.0	--	580	--	120	62
	10-11-84	8.82	85	--	8.8	22.0	--	550	--	110	66
	03-19-85	3.29	85	--	6.7	21.0	--	600	--	140	60
	10-07-85	9.52	85	--	7.0	21.0	--	630	--	150	62
	03-31-66	5.45	85	--	6.9	21.0	--	620	--	140	65
	06-26-86	8.62	85	--	6.9	19.5	--	590	--	130	65
	06-28-88	7.87	85	1,300	6.8	21.0	5	670	--	160	65
	04-26-89	4.67	85	1,340	7.0	21.0	10	650	--	160	62
	04-03-91	3.36	85	1,310	6.9	21.0	5	680	--	180	56
	04-29-92	4.48	85	1,240	6.8	--	--	600	--	140	60
	03-26-93	2.70	85	1,310	6.8	21.5	5	600	--	140	60
R- 723	03-11-58	25.44	73	--	--	--	--	540	--	--	--
	10-09-58	--	73	--	--	--	--	480	--	--	--
	04-05-73	--	73	1,130	7.0	--	0	550	31	110	67
	06-20-73	--	73	1,160	7.1	--	--	530	--	--	--
	11-01-74	25.58	73	1,150	--	--	--	560	--	--	--
	01-06-75	16.36	73	1,160	7.1	--	--	550	--	--	--
	04-04-75	10.05	73	1,150	6.9	--	--	560	--	120	62
	05-15-75	7.60	73	1,140	6.4	--	5	550	39	120	60
	06-21-75	10.41	73	1,150	6.7	--	--	540	--	--	--
	03-18-76	16.26	73	1,170	6.8	--	0	540	47	120	57
	07-08-76	22.27	73	--	--	--	--	--	--	--	--
	11-02-76	30.31	73	--	--	--	--	530	64	120	57
	03-28-77	23.98	73	1,130	--	--	--	520	--	--	--
	09-14-77	29.98	73	1,150	--	--	--	520	--	--	--
	03-29-78	24.59	73	1,130	--	--	--	540	--	--	--
	05-09-79	10.75	73	1,060	6.8	--	--	540	--	--	--
	10-18-79	33.32	73	--	--	--	--	550	--	--	--
	03-31-60	18.70	73	1,110	6.7	--	--	540	--	--	--
	09-23-80	33.37	73	--	--	--	--	530	--	--	--
	04-30-81	32.88	73	--	--	--	--	540	--	--	--

Appendix 1. Summary of analyses of water from wells completed in the Red River alluvial aquifer, Louisiana, 1958-93--Continued

Sodium, dissolved (mg/L as Na)	Potassium, dissolved (mg/L as K)	Alkalinity, field (mg/L as $CaCO_3$	Sulfate, dissolved (mg/L as SO_4)	Chloride, dissolved (mg/L as Cl)	Fluoride, dissolved (mg/L as F)	Silica, dissolved (mg/L as SiO_2)	Solids, sum of constituents, dissolved (mg/L)	Nitrogen, nitrite dissolved (mg/L as N)	Nitrogen, $NO_2 + NO_3$ dissolved (mg/L as N)	Iron, dissolved (mg/L as Fe)	Manganese, dissolved (mg/L as Mn)
--	--	--	--	58	--	--	--	--	--	--	--
--	--	--	--	48	--	--	--	--	--	--	--
--	--	--	--	56	--	--	--	--	--	--	--
70	1.6	700	0.4	45	0.6	14	767	--	--	24	2.8
--	--	--	--	44	--	--	--	--	--	--	--
--	--	--	--	40	--	--	--	--	--	25	--
--	--	--	14	37	--	--	--	--	--	--	--
--	--	--	8.4	38	--	--	--	--	--	25	--
--	--	--	4.0	30	--	--	--	--	--	27	1.6
--	--	--	1.4	36	--	--	--	--	--	27	--
--	--	--	1.4	38	--	--	--	--	--	26	1.6
50	1.8	680	.8	37	.3	20	741	<0.01	<0.10	26	1.4
--	--	--	1.4	35	--	--	--	--	--	25	1.5
--	--	--	.2	32	--	--	--	--	--	25	1.3
54	2.2	620	4.2	39	.4	18	705	--	--	24	1.6
85	2.0	--	<1.0	39	--	--	--	--	--	25	1.6
--	--	--	<1.0	40	--	--	--	--	--	23	1.7
--	--	--	.2	40	--	--	--	--	--	22	1.6
51	1.5	700	1.2	36	.3	14	750	--	--	25	1.5
--	--	--	<1.0	38	--	--	--	--	--	24	1.8
--	--	--	7.2	34	--	--	--	--	--	25	1.6
52	2.0	600	.8	40	.3	19	697	--	--	25	1.6
--	--	--	1.4	34	--	--	--	--	--	24	2.0
--	--	--	<.2	41	--	--	--	--	--	26	1.4
--	--	--	.4	36	--	--	--	--	--	25	1.6
--	--	--	<.2	43	--	--	--	--	--	25	1.7
--	--	--	3.2	33	--	--	--	--	--	26	1.6
--	--	--	.2	42	--	--	--	--	--	24	1.6
--	--	--	2.2	37	--	--	--	--	--	25	1.7
--	--	--	.4	33	--	--	--	--	--	22	1.6
--	--	--	.2	48	--	--	--	--	--	24	1.6
--	--	--	.8	39	--	--	--	--	--	25	1.3
--	--	--	.2	33	--	--	--	--	--	25	1.3
--	--	--	.6	36	--	--	--	--	--	23	1.4
--	--	--	.6	34	--	--	--	--	--	24	1.1
--	--	--	1.6	39	--	--	--	--	--	26	1.6
--	--	--	1.6	37	--	--	--	--	--	26	1.4
--	--	--	.8	36	--	--	--	--	--	26	1.4
61	1.8	714	8.8	36	.2	19	807	<.01	<.02	25	1.7
50	1.6	709	.2	34	.5	19	777	<.01	<.02	25	--
50	1.7	734	.8	32	.3	19	807	<.01	.02	26	1.3
50	1.7	690	<.2	32	.4	19	--	<.01	<.02	26	1.1
51	1.5	699	.2	32	.4	20	747	<.01	<.02	21	1.1
--	--	--	--	52	--	--	--	--	--	--	--
--	--	--	--	56	--	--	--	--	--	--	--
51	1.8	513	77	50	.2	30	700	--	--	1.6	1.7
--	--	--	--	58	--	--	--	--	--	2.3	--
--	--	--	--	77	53	--	--	--	--	1.4	--
--	--	--	--	71	50	--	--	--	--	1.0	1.4
--	--	--	74	45	--	--	--	--	--	.62	1.5
52	1.5	508	79	49	.4	28	700	<.01	.09	.54	1.4
--	--	--	73	50	--	--	--	--	--	1.1	1.4
54	2.8	498	77	54	<.1	29	700	--	--	2.5	1.4
--	--	--	--	64	--	--	--	--	--	--	--
52	1.6	482	82	58	.4	28	690	--	--	--	--
--	--	--	79	50	--	--	--	--	--	--	--
--	--	--	83	51	--	--	--	--	--	--	--
--	--	--	74	47	--	--	--	--	--	--	--
--	--	--	52	68	--	--	--	--	--	1.0	1.7
--	--	--	79	46	--	--	--	--	--	--	1.7
--	--	--	62	49	--	--	--	--	--	1.2	1.5
--	--	--	80	50	--	--	--	--	--	--	--
--	--	--	82	48	--	--	--	--	--	--	--

Appendix 1. Summary of analyses of water from wells completed in the Red River alluvial aquifer, Louisiana, 1958-93--Continued

Well number	Date	Water level below land surface (feet)	Depth of well, total (feet)	Specific conductance (µS/cm)	pH field (standard units)	Temperature of water (°C)	Color (platinum-cobalt units)	Hardness total (mg/L as $CaCO_3$)	Hardness, noncarbonate whole water total field (mg/L as $CaCO_3$)	Calcium, dissolved (mg/L as Ca)	Magnesium, dissolved (mg/L as Mg)
R-723	10-22-81	19.35	73	--	6.8	--	--	530	--	--	--
	04-22-82	24.58	73	--	6.8	--	--	540	--	--	--
	09-17-82	33.50	73	--	--	--	--	530	--	--	--
	04-25-83	25.80	73	--	--	--	--	540	--	10	59
	09-27-83	33.95	73	--	--	--	--	530	--	120	57
	03-13-84	18.79	73	--	--	--	--	520	--	120	54
	10-29-84	16.54	73	--	6.8	21.0	--	530	--	120	55
	04-03-85	11.89	73	--	6.8	22.0	--	520	--	110	60
	11-05-85	23.18	73	--	6.8	22.0	--	550	--	120	60
	05-05-86	18.88	73	--	6.9	--	--	580	--	130	63
	11-07-88	22.63	73	--	7.0	21.5	--	570	--	120	65
	03-27-87	11.73	73	1,200	6.9	22.0	--	560	--	120	62
	06-28-88	20.42	73	1,120	6.7	23.0	0	550	--	130	55
	04-20-89	13.82	73	1,130	6.6	22.5	5	500	--	100	61
	03-27-91	15.35	73	1,130	6.7	23.0	5	572	--	130	60
	03-30-92	12.74	73	1,140	6.8	22.0	--	530	--	120	55
	03-24-93	11.59	73	1,130	6.6	22.5	0	500	--	110	55
R-964	05-04-71	--	52	3,400	7.0	--	--	1,400	870	340	130
	11-02-72	--	52	2,830	6.3	--	--	1,300	--	330	120
	04-09-74	1.48	52	3,300	6.8	20.5	--	1,400	--	--	--
	01-16-75	1.85	52	3,420	7.7	19.5	0	1,400	890	340	140
	04-21-75	1.60	52	3,270	6.3	20.5	--	1,500	--	360	140
	06-16-75	1.47	52	3,270	6.1	--	0	1,400	670	350	120
	01-16-76	2.98	52	3,210	6.6	--	0	1,500	910	350	140
	07-06-76	2.72	52	3,240	6.8	--	--	1,400	--	--	--
	10-19-76	6.11	52	3,340	6.8	20.5	0	1,400	960	360	120
	04-13-77	2.47	52	3,240	6.7	20.0	5	1,400	1,100	340	140
	10-10-77	8.00	52	3,290	6.3	20.0	--	1,400	880	--	--
	04-03-78	2.92	52	3,160	6.3	20.0	--	1,400	--	--	--
	09-26-78	7.90	52	3,160	6.6	--	--	1,400	--	--	--
	03-30-79	2.12	52	3,140	6.6	--	--	1,400	--	--	--
	10-19-79	4.91	52	--	6.8	--	--	1,400	--	--	--
	05-21-80	2.17	52	--	6.9	20.0	--	1,400	--	--	--
	09-22-80	7.52	52	--	6.4	20.0	--	1,400	--	--	--
	04-21-81	5.40	52	--	6.6	20.0	--	1,400	--	--	--
	09-10-81	7.80	52	--	8.9	20.0	--	1,400	--	--	--
	04-14-82	5.38	52	--	6.8	20.0	--	1,400	--	--	--
	09-02-82	6.34	52	--	--	--	--	1,400	--	--	--
	04-13-83	1.87	52	--	6.6	--	--	1,400	--	340	140
	06-05-85	3.62	52	--	7.0	20.0	--	1,400	--	320	150
	10-03-85	5.37	52	--	7.1	21.0	--	1,300	--	300	130
	05-27-86	4.07	52	--	6.6	19.5	--	1,500	--	370	150
	09-03-86	6.10	52	--	6.8	20.0	--	1,400	--	320	140
	04-20-87	2.57	52	3,300	6.7	20.5	--	1,480	--	360	140
	06-13-90	6.77	52	3,330	6.8	21.0	0	1,550	--	350	140
	04-30-92	2.76	52	3,240	6.7	21.5	--	1,400	--	340	130
	03-23-93	2.23	52	3,330	6.6	20.5	0	1,500	--	350	140
R-965	11-20-70	--	78	--	--	--	--	--	--	--	--
	11-28-72	--	78	1,040	--	--	--	490	--	120	45
	12-19-72	--	78	1,100	--	--	--	480	--	120	43
	02-13-73	--	78	1,150	--	--	--	490	--	120	47
	06-19-73	--	78	1,050	--	--	--	470	--	110	47
	08-07-73	--	78	--	--	--	--	500	--	--	--
	12-03-73	--	78	1,100	--	--	--	550	--	--	--
	02-15-74	2.38	78	1,110	--	--	--	--	--	--	--
	03-26-74	4.43	78	1,160	--	--	--	520	--	--	--
	10-23-74	9.15	78	1,120	7.1	--	--	540	--	--	--
	11-18-74	8.60	78	1,160	6.7	--	--	560	--	--	--
	12-17-74	4.26	78	1,150	6.6	--	--	550	--	--	--
	01-07-75	2.93	78	1,160	6.7	--	--	520	--	--	--
	02-14-75	3.14	76	1,170	--	--	--	560	--	--	--
	03-06-75	2.80	76	1,150	6.8	--	--	550	--	--	--

Appendix 1. Summary of analyses of water from wells completed in the Red River alluvial aquifer, Louisiana, 1958-93--Continued

Sodium, dissolved (mg/L as Na)	Potassium, dissolved (mg/L as K)	Alkalinity, field (mg/L as $CaCO_3$)	Sulfate, dissolved (mg/L as SO_4)	Chloride, dissolved (mg/L as Cl)	Fluoride, dissolved (mg/L as F)	Silica, dissolved (mg/L as SiO_2)	Solids, sum of constituents, dissolved (mg/L)	Nitrogen, nitrite dissolved (mg/L as N)	Nitrogen, $NO_2 + NO_3$ dissolved (mg/L as N)	Iron, dissolved (mg/L as Fe)	Manganese, dissolved (mg/L as Mn)
--	--	--	80	50	--	--	--	--	--	0.99	1.4
--	--	--	66	51	--	--	--	--	--	.74	1.5
--	--	--	69	48	--	--	--	--	--	--	
--	--	--	72	48	--	--	--	--	--	--	
--	--	--	83	53	--	--	--	--	--	--	
--	--	--	79	46	--	--	--	--	--	--	--
--	--	--	71	50	--	--	--	--	--	.65	1.6
--	--	--	73	54	--	--	--	--	--	.56	1.4
--	--	--	77	51	--	--	--	--	--	.53	1.2
--	--	--	64	48	--	--	--	--	--	.44	1.7
--	--	--	70	48	--	--	--	--	--	.50	1.5
--	--	480	68	48	--	--	--	--	--	.36	1.4
60	1.8	501	74	48	0.2	30	702	<0.01	<0.02	.72	1.9
52	1.6	500	76	52	.4	29	674	<.01	<.02	.67	1.8
48	1.3	513	--	44	.5	28	--	<.01	.02	.9	1.4
51	1.8	509	74	46	.5	25	681	<.01	<.02	1.0	1.4
53	1.4	499	74	42	.4	28	665	<.01	<.02	.47	1.2
200	4.5	510	690	400	.3	16	2,090	--	--	.4	5.1
--	--	--	--	460	--	--	--	--	--	--	--
--	--	--	--	600	450	--	--	--	--	.19	--
210	8.0	510	680	480	.3	17	2,190	--	--	.17	6.5
--	--	--	730	470	--	--	--	--	--	.21	5.3
220	4.8	500	640	460	.2	25	2,130	--	--	.18	5.5
220	4.9	530	670	460	--	22	2,190	--	--	.22	6.0
--	--	--	700	480	--	--	--	--	--	.17	5.0
220	5.1	420	700	460	.3	18	2,140	--	--	.40	5.5
230	6.2	370	680	450	.2	13	2,090	--	--	.26	5.7
--	--	520	650	470	--	--	--	--	--	.23	5.3
--	--	--	630	490	--	--	--	--	--	.2	5.7
--	--	--	450	460	--	--	--	--	--	.18	5.8
--	--	--	650	450	--	--	--	--	--	.65	5.9
--	--	--	510	470	--	--	--	--	--	--	5.7
--	--	--	570	480	--	--	--	--	--	.23	5.5
--	--	--	620	490	--	--	--	--	--	.24	6.2
--	--	--	660	500	--	--	--	--	--	.41	6.2
--	--	--	650	500	--	--	--	--	--	.31	5.5
--	--	--	550	470	--	--	--	--	--	.51	5.6
--	--	--	590	480	--	--	--	--	--	1.0	6.0
--	--	--	650	470	--	--	--	--	--	.85	5.5
--	--	--	660	500	--	--	--	--	--	.56	5.2
--	--	--	640	500	--	--	--	--	--	1.7	5.2
--	--	--	630	500	--	--	--	--	--	.18	4.7
--	--	--	650	490	--	--	--	--	--	1.3	4.6
--	--	536	660	500	--	--	--	--	--	2.1	3.1
220	5.2	551	660	510	.2	21	2,240	<.01	<.02	.25	5.6
210	4.8	529	660	500	.2	21	2,210	<.01	<.02	.14	4.8
230	4.8	526	660	470	.2	21	2,190	<.01	<.02	.12	4.6
--	--	--	--	50	--	--	--	--	--	--	--
--	--	--	--	58	--	--	--	--	--	--	--
--	--	--	--	58	--	--	--	--	--	--	--
--	--	--	--	52	--	--	--	--	--	--	--
--	--	--	--	56	--	--	--	--	--	--	--
--	--	--	--	58	--	--	--	--	--	--	--
--	--	--	22	66	--	--	--	--	--	--	--
--	--	--	17	66	--	--	--	--	--	9.3	--
--	--	--	16	70	--	--	--	--	--	8.1	--
--	--	--	22	69	--	--	--	--	--	6.6	1.0
--	--	--	18	73	--	--	--	--	--	9.1	.94
--	--	--	20	73	--	--	--	--	--	9.5	1.2
--	--	--	23	76	--	--	--	--	--	9.6	1.1
--	--	--	23	76	--	--	--	--	--	8.0	1.1
--	--	--	22	77	--	--	--	--	--	9.7	1.2

Appendix 1. Summary of analyses of water from wells completed in the Red River alluvial aquifer, Louisiana, 1958-93--Continued

Well number	Date	Water level below land surface (feet)	Depth of well, total (feet)	Specific conductance (µS/cm)	pH field (standard units)	Temperature of water (°C)	Color (platinum-cobalt units)	Hardness total (mg/L as $CaCO_3$)	Hardness, noncarbonate whole water total field (mg/L as $CaCO_3$)	Calcium, dissolved (mg/L as Ca)	Magnesium, dissolved (mg/L as Mg)
R-965	04-12-75	2.86	78	1,170	6.7	--	--	560	--	140	52
	05-24-75	3.60	78	1,200	7.1	--	5	550	9	130	54
	10-07-75	7.49	78	1,140	7.2	--	0	520	25	120	54
	08-04-76	5.92	78	1,060	7.0	--	--	490	--	--	--
	11-01-76	10.16	78	1,120	7.1	--	0	550	25	120	60
	04-15-77	4.26	78	1,100	7.1	--	0	500	0	140	36
	10-26-77	9.26	78	1,100	7.1	--	--	550	17	110	--
	04-04-78	5.22	78	1,050	7.0	--	--	500	--	--	--
	09-27-78	10.72	78	1,040	7.0	--	--	520	--	--	--
	03-29-79	3.36	78	1,050	7.1	--	--	500	--	--	--
	10-24-79	7.66	78	--	7.1	--	--	510	--	--	--
	03-19-80	3.43	78	1,070	7.1	--	--	520	--	--	--
	09-23-80	11.87	78	--	7.2	--	--	510	--	--	--
	04-22-81	9.80	78	--	7.0	--	--	490	--	--	--
	09-23-81	12.20	78	--	7.1	--	--	500	--	--	--
	04-15-82	7.80	78	--	7.0	--	--	500	--	--	--
	08-31-82	8.81	78	--	7.1	--	--	510	--	--	--
	04-15-83	2.89	78	--	7.1	--	--	540	--	130	53
	09-21-83	9.20	78	--	7.0	--	--	490	--	130	47
	03-14-84	3.50	76	--	7.1	--	--	510	--	120	51
	10-12-84	8.30	78	--	7.2	--	--	520	--	120	54
	03-19-85	3.72	78	--	6.9	--	--	510	--	130	44
	10-04-85	8.49	78	--	6.8	--	--	470	--	110	47
	04-03-86	5.54	78	--	7.1	--	--	550	--	130	55
	08-27-86	9.98	76	--	7.0	--	--	500	--	110	55
	04-28-87	6.66	78	1,110	6.9	--	--	556	--	140	50
	06-28-88	7.91	78	1,110	7.1	--	5	530	--	140	45
	04-13-89	3.45	78	1,180	7.1	--	10	550	--	130	54
	04-20-90	2.83	78	1,180	7.2	--	5	590	--	150	52
	03-28-91	3.53	78	1,230	7.1	--	0	585	--	150	51
	04-01-92	2.72	78	1,230	7.0	--	--	540	--	130	53
	03-24-93	2.08	78	1,200	7.0	--	0	560	--	140	52
R-968	11-18-70	--	53	--	--	--	--	350	--	--	--
	06-04-74	6.15	53	763	6.8	--	--	350	--	--	--
	04-22-75	4.02	53	760	6.9	21.0	--	370	--	86	38
	06-16-75	3.89	53	757	6.8	21.0	5	360	0	81	39
	01-16-76	5.15	53	760	7.0	--	5	360	0	110	21
	07-08-76	5.28	53	761	7.0	--	--	360	--	--	--
	10-19-76	8.71	53	808	7.0	--	--	370	--	--	--
	04-13-77	4.71	53	765	7.0	--	5	370	0	86	38
	10-10-77	8.04	53	781	--	--	10	380	0	86	39
	04-24-78	5.83	53	742	7.1	--	--	360	--	--	--
	09-26-76	9.94	53	754	7.0	--	--	360	--	--	--
	03-30-79	3.73	53	688	7.0	--	--	360	--	--	--
	10-23-79	7.52	53	--	7.1	21.0	--	360	--	--	--
	05-21-80	3.72	53	--	7.0	20.5	--	370	--	--	--
	09-22-80	10.85	53	--	6.8	20.5	--	360	--	--	--
	04-29-81	8.80	53	--	7.0	20.5	--	360	--	--	--
	09-25-81	10.20	53	--	6.9	20.5	--	370	--	--	--
	04-26-82	7.50	53	--	7.0	20.5	--	370	--	--	--
	09-22-82	8.32	53	--	6.8	20.5	--	350	--	--	--
	04-15-83	3.23	53	--	6.9	20.5	--	350	--	84	35
	09-20-83	7.66	53	--	7.0	20.5	--	260	--	67	22
	03-13-84	3.57	53	--	6.8	20.5	--	260	--	64	24
	10-29-84	5.24	53	--	6.9	21.0	--	370	--	90	35
	03-18-85	3.61	53	--	6.8	21.0	--	360	--	88	34
	10-03-85	7.71	53	--	--	21.0	--	340	--	80	35
	04-28-87	5.24	53	803	7.1	20.5	--	402	--	95	40
	06-27-66	7.37	53	825	6.9	21.0	5	390	--	100	35
	04-05-89	3.42	53	819	7.1	20.5	20	330	--	81	32
	04-18-90	3.90	53	769	7.2	--	5	380	--	89	38
	04-03-91	3.98	53	795	7.0	21.0	5	351	--	81	36
	05-01-92	4.46	53	780	6.9	21.0	--	370	--	86	37
	03-23-93	3.20	53	801	6.9	21.0	15	360	--	84	36

Appendix 1. Summary of analyses of water from wells completed in the Red River alluvial aquifer, Louisiana, 1958-93--Continued

Sodium, dissolved (mg/L as Na)	Potassium, dissolved (mg/L as K)	Alkalinity, field (mg/L as $CaCO_3$)	Sulfate, dissolved (mg/L as SO_4)	Chloride, dissolved (mg/L as Cl)	Fluoride, dissolved (mg/L as F)	Silica, dissolved (mg/L as SiO_2)	Solids, sum of constituents, dissolved (mg/L)	Nitrogen, nitrite dissolved (mg/L as N)	Nitrogen, $NO_2 + NO_3$ dissolved (mg/L as N)	Iron, dissolved (mg/L as Fe)	Manganese, dissolved (mg/L as Mn)
--	--	--	17	75	--	--	--	--	--	9.2	1.1
44	1.5	540	15	59	0.3	26	664	0.20	0.20	9.4	.95
45	2.3	510	14	72	.3	23	645	--	--	8.1	1.0
--	--	--	6.2	60	--	--	--	--	--	7.4	.89
43	2.1	530	14	62	.1	26	650	--	--	7.0	.9
42	2.2	540	6.8	54	.2	40	652	--	--	7.9	.8
--	--	530	9.4	61	--	--	--	--	--	7.6	.92
--	--	--	9.6	58	--	--	--	--	--	7.5	.64
--	--	--	2.4	56	--	--	--	--	--	6.2	.8
--	--	--	5.6	59	--	--	--	--	--	7.9	.84
--	--	--	4.8	62	--	--	--	--	--	5.1	.87
--	--	--	9.0	57	--	--	--	--	--	7.7	1.2
--	--	--	5.6	56	--	--	--	--	--	7.0	.78
--	--	--	5.6	54	--	--	--	--	--	7.0	.8
--	--	--	3.8	57	--	--	--	--	--	7.1	.76
--	--	--	3.2	58	--	--	--	--	--	6.9	.83
--	--	--	4.2	60	--	--	--	--	--	7.6	.89
--	--	--	4.4	58	--	--	--	--	--	7.3	.77
--	--	--	7.7	66	--	--	--	--	--	8.0	.77
--	--	--	5.6	57	--	--	--	--	--	7.6	.92
--	--	--	3.0	60	--	--	--	--	--	7.2	.64
--	--	--	5.0	60	--	--	--	--	--	7.6	.78
--	--	--	9.0	63	--	--	--	--	--	8.3	.7
--	--	--	3.6	55	--	--	--	--	--	7.80	.67
--	--	--	6.4	60	--	--	--	--	--	8.0	.68
--	--	544	11	58	--	--	--	--	--	8.5	1.1
54	1.9	541	14	58	.2	26	673	<0.01	<.02	8.2	1.0
44	1.9	549	15	70	.3	27	681	.02	.04	8.3	.9
44	1.9	570	16	84	.2	27	727	<.01	<.02	9.2	1.2
46	1.7	574	13	69	.3	26	712	<.01	.02	9.6	1.1
46	2.3	567	23	74	.3	29	709	<.01	<.02	10	.9
47	1.7	553	24	70	.2	25	700	<.01	<.02	7.4	.81
--	--	--	--	20	--	--	--	--	--	--	--
--	--	--	.2	19	--	--	--	--	--	11	--
--	--	--	.7	17	--	--	--	--	--	11	.46
30	1.0	390	.6	18	.5	20	431	--	--	10	.46
25	1.2	380	1.0	17	.6	24	439	--	--	11	.51
--	--	--	.4	22	--	--	--	--	--	11	.30
--	--	--	.4	18	--	--	--	--	--	12	.51
32	1.3	430	1.0	16	.8	18	455	--	--	12	.50
29	1.3	410	1.8	18	.5	20	454	--	--	12	.53
--	--	--	6.2	18	--	--	--	--	--	11	.54
--	--	--	<.2	18	--	--	--	--	--	12	.50
--	--	--	<.2	19	--	--	--	--	--	11	.53
--	--	--	1.0	17	--	--	--	--	--	11	.52
--	--	--	4.0	18	--	--	--	--	--	12	.52
--	--	--	2.2	20	--	--	--	--	--	11	.50
--	--	--	.6	19	--	--	--	--	--	10	.56
--	--	--	.4	18	--	--	--	--	--	11	.52
--	--	--	.4	20	--	--	--	--	--	12	.54
--	--	--	3.8	16	--	--	--	--	--	10	.53
--	--	--	.4	17	--	--	--	--	--	8.5	.55
--	--	--	4.3	14	--	--	--	--	--	7.2	.32
--	--	--	.6	15	--	--	--	--	--	7.7	.38
--	--	--	.8	18	--	--	--	--	--	9.8	.48
--	--	--	.8	18	--	--	--	--	--	5.7	.57
--	--	--	1.8	19	--	--	--	--	--	11	.58
--	--	424	.4	17	--	--	--	--	--	4.1	.52
31	2.4	431	<1.0	17	.8	22	469	<.01	<.02	9.1	.70
29	2.8	417	.5	17	.6	21	445	<.01	<.02	11	.56
32	2.6	441	<.2	22	.5	23	--	<.01	<.02	12	.62
32	1.9	442	<.2	17	.6	23	--	<.01	.02	12	.53
29	1.6	434	<.2	17	.6	23	--	<.01	<.02	12	.44
30	1.4	447	<.2	15	.6	24	--	<.01	<.02	11	.42

Appendix 1. Summary of analyses of water from wells completed in the Red River alluvial aquifer, Louisiana, 1958-93--Continued

Well number	Date	Water level below land surface (feet)	Depth of well, total (feet)	Specific conductance (µS/cm)	pH field (standard units)	Temperature of water (°C)	Color (platinum-cobalt units)	Hardness total (mg/L as $CaCO_3$)	Hardness, noncarbonate whole water total field (mg/L as $CaCO_3$)	Calcium, dissolved (mg/L as Ca)	Magnesium, dissolved (mg/L as Mg)
R-991	08-10-72	8.00	76	1,540	7.8	--	5	760	170	170	82
	12-08-72	--	78	1,540	7.8	--	5	760	150	160	88
	03-15-73	+.24	78	1,530	7.7	--	5	750	110	160	85
	07-08-73	4.50	76	--	7.3	--	5	730	97	180	60
	12-06-73	--	76	1,520	6.9	--	0	760	150	160	88
	03-23-74	--	76	1,530	7.2	--	--	680	160	170	63
	09-30-74	7.04	76	1,540	6.4	--	0	710	150	160	76
	04-04-75	.49	78	1,450	6.8	--	5	740	240	160	82
	07-15-75	1.65	76	1,510	6.7	--	5	670	110	160	66
	10-03-75	4.93	76	1,520	6.9	--	0	700	160	160	74
	07-12-76	1.50	76	1,510	6.8	--	--	710	--	--	--
	03-29-77	.26	76	1,560	6.4	--	--	700	73	--	--
	07-20-77	7.65	76	1,540	6.8	--	5	680	--	160	67
	03-16-78	.34	76	1,540	7.0	--	0	710	62	--	--
	11-20-78	8.76	76	1,530	6.8	--	--	690	47	--	--
	05-15-79	2.49	76	--	6.8	--	--	740	--	--	--
	11-30-79	+.12	76	--	7.1	21.0	--	750	110	--	--
	05-01-80	+.31	76	--	7.0	--	--	710	--	--	--
	12-17-80	2.36	76	1,510	7.4	--	--	730	--	--	--
	09-30-81	8.52	76	1,480	--	--	--	710	--	--	--
	05-24-82	3.17	76	--	7.1	--	5	680	260	160	69
	11-03-82	3.75	76	1,530	6.7	--	0	750	150	160	84
	03-23-84	.25	76	1,430	7.1	--	--	500	--	100	60
	06-03-85	3.08	76	--	7.0	--	0	725	150	150	85
	06-24-66	2.05	76	--	6.9	--	--	770	--	160	90
	04-05-88	+.32	76	1,700	6.9	20.0	5	770	160	160	90
	04-05-89	.25	76	1,590	6.9	--	5	740	--	160	82
	04-10-90	.54	76	1,570	6.8	--	5	760	--	170	81
	03-25-91	.25	76	1,510	7.3	--	5	737	--	150	88
	04-29-92	1.07	76	1,540	8.9	--	--	720	--	150	84
	03-25-93	.13	76	1,580	7.0	--	10	730	--	150	86
R-992	07-27-72	8.51	108	--	--	--	--	660	--	--	--
	08-10-72	--	108	1,460	7.7	--	0	680	29	140	80
	12-08-72	--	108	1,420	7.7	--	5	670	16	150	72
	03-15-73	+.24	108	1,450	7.6	--	10	670	0	160	65
	07-06-73	4.49	108	1,440	7.2	--	5	650	0	160	62
	12-06-73	.02	108	1,390	6.8	--	0	630	0	160	56
	03-23-74	--	108	1,440	--	--	5	670	27	160	66
	09-30-74	7.07	108	1,430	6.6	19.5	0	650	21	170	54
	04-04-75	--	108	--	6.8	20.0	7	690	--	170	64
	07-15-75	1.73	108	1,430	6.8	19.5	0	660	20	170	56
	10-03-75	4.97	108	1,420	6.8	19.5	--	870	--	--	--
	07-12-76	1.62	108	1,370	6.9	--	--	680	--	--	--
	03-29-77	.25	108	1,470	6.7	--	--	660	0	--	--
	07-20-77	7.87	108	1,460	6.8	--	--	700	0	--	--
	03-16-78	.35	108	1,440	7.0	--	0	650	0	--	--
	11-20-78	8.77	108	1,450	6.7	--	--	650	0	--	--
	05-15-79	2.50	108	1,360	7.0	--	--	680	--	--	--
	11-30-79	+.08	108	--	7.0	21.0	--	670	0	--	--
	05-01-60	.36	108	--	7.0	--	--	640	--	--	--
	12-17-80	2.36	108	1,420	7.2	--	--	660	--	--	--
	10-01-81	8.56	108	1,460	--	--	--	680	--	--	--
	05-24-82	3.16	108	1,270	7.1	--	0	550	1	120	56
	11-03-82	3.76	108	--	7.0	19.5	0	670	33	170	60
	04-26-83	.57	108	--	--	19.5	--	680	--	170	62
	09-28-83	2.63	108	--	7.1	19.5	--	650	--	160	60
	03-23-84	.29	108	1,460	7.1	19.5	--	640	--	160	59
	06-03-85	3.08	108	--	6.9	19.5	--	788	--	200	70
	06-24-88	2.08	108	--	8.9	20.0	--	730	--	160	69
	04-05-88	+.35	108	1,500	7.0	20.0	5	670	82	170	60
	04-05-89	1.28	108	1,500	6.8	20.0	10	680	--	170	61
	04-10-90	.53	108	1,480	6.8	20.0	0	680	--	160	57
	03-25-91	.87	108	1,490	6.9	20.5	5	672	--	170	60
	04-29-92	1.10	108	1,480	6.8	--	--	650	--	160	60
	03-25-93	.78	108	1,550	6.8	--	5	680	--	170	62

Appendix 1. Summary of analyses of water from wells completed in the Red River alluvial aquifer, Louisiana, 1958-93--Continued

Sodium, dissolved (mg/L as Na)	Potassium, dissolved (mg/L as K)	Alkalinity, field (mg/L as $CaCO_3$)	Sulfate, dissolved (mg/L as SO_4)	Chloride, dissolved (mg/L as Cl)	Fluoride, dissolved (mg/L as F)	Silica, dissolved (mg/L as SiO_2)	Solids, sum of constituents, dissolved (mg/L)	Nitrogen, nitrite dissolved (mg/L as N)	Nitrogen, $NO_2 + NO_3$ dissolved (mg/L as N)	Iron, dissolved (mg/L as Fe)	Manganese, dissolved (mg/L as Mn)
58	1.8	590	92	130	0.5	23	918	--	--	5.1	2.0
56	1.5	620	74	140	1.0	22	924	--	--	5.6	6.3
58	1.8	630	78	130	.5	20	922	--	--	3.6	6.8
60	1.0	620	68	130	.5	22	906	--	--	5.4	5.5
55	1.4	610	56	130	.5	21	889	--	--	4.1	4.3
57	2.2	500	83	130	.6	22	837	--	--	5.5	5.0
40	2.1	570	92	130	.5	20	872	--	--	5.7	4.9
58	1.4	500	93	130	.5	23	861	<0.01	0.57	6.8	4.8
61	1.5	560	76	130	.5	23	866	--	--	8	3.8
52	2.5	550	91	120	.7	23	868	--	--	8.1	5.0
--	--	--	94	130	--	--	--	--	--	9.3	4.4
--	--	630	93	120	--	--	--	--	--	11	3.4
56	2.5	--	95	130	.4	18	--	--	--	12	4.1
--	--	650	99	140	--	--	--	--	--	11	4.3
--	--	640	95	130	--	--	--	--	--	11	4.3
--	--	--	96	150	--	--	--	--	--	12	4.3
--	--	640	90	140	--	--	--	--	--	12	3.6
--	--	--	78	130	--	--	--	--	--	11	4.1
--	--	--	88	130	--	--	--	--	--	11	4.2
--	--	--	80	130	--	--	--	--	--	9.6	2.8
58	2.1	400	56	140	.5	23	760	--	--	8.2	2.9
58	2.1	590	90	140	.3	19	924	--	--	13	3.6
--	--	527	87	150	--	--	--	--	--	27	1.9
60	1.8	575	87	130	.4	30	910	--	--	22	3.4
--	--	--	56	140	--	--	--	--	--	37	2.4
65	1.5	614	86	180	.2	24	998	<.01	<.02	21	--
65	1.4	617	86	140	.7	25	945	.01	<.02	11	3.7
57	1.6	633	76	130	.3	25	938	.01	<.02	14	3.8
62	1.5	617	48	130	.5	24	885	<.01	.02	7.9	3.4
64	1.5	601	84	130	.5	25	914	<.01	<.02	11	3.3
65	1.2	617	85	130	.5	23	929	<.01	<.02	10	3.2
--	--	--	--	86	--	--	--	--	--	--	--
75	3.1	640	61	85	.4	23	865	--	--	10	.86
70	4.9	660	44	84	.5	26	859	--	--	12	1.2
72	2.0	660	53	86	.4	36	861	--	--	10	1.1
72	2.5	660	56	86	.3	24	873	--	--	12	1.1
60	2.4	630	40	84	.1	20	809	--	--	11	--
75	3.2	660	43	86	.4	25	864	--	--	11	1.0
67	4.1	630	51	84	.4	18	837	--	--	12	1.2
73	2.6	--	53	86	.4	23	--	<.01	.90	12	1.1
72	2.7	630	55	84	.2	23	852	--	--	12	.93
--	--	--	--	84	--	--	--	--	--	11	1.4
--	--	--	55	86	--	--	--	--	--	11	1.1
--	--	710	53	78	--	--	--	--	--	11	1.1
--	--	820	53	82	--	--	--	--	--	12	1.1
--	--	740	46	86	--	--	--	--	--	11	1.1
--	--	680	50	80	--	--	--	--	--	11	1.2
--	--	--	50	86	--	--	--	--	--	11	1.2
--	--	700	62	80	--	--	--	--	--	11	1.0
--	--	--	42	80	--	--	--	--	--	11	1.1
--	--	--	58	81	--	--	--	--	--	11	1.3
--	--	--	55	89	--	--	--	--	--	10	1.5
84	3.3	550	28	94	.3	27	733	--	--	7.6	.29
75	3.7	639	55	94	.3	22	874	--	--	9.8	.81
--	--	--	80	95	--	--	--	--	--	10	1.3
--	--	--	86	120	--	--	--	--	--	11	.99
--	--	--	79	120	--	--	--	--	--	12	1.0
--	--	570	92	130	--	--	--	--	--	12	.96
--	--	--	81	130	--	--	--	--	--	12	.9
75	2.9	590	88	130	.4	26	917	<0.01	<.02	11	--
79	2.5	587	83	120	.4	24	902	<0.01	<.02	8.7	1.2
64	2.5	598	82	130	.4	24	912	<0.01	<.02	12	1.1
63	3.0	599	52	130	.4	24	875	<0.01	.02	12	1.1
68	2.7	565	82	130	.4	24	878	<0.01	<.02	12	.99
72	2.4	612	80	130	.3	24	918	<0.01	<.02	11	.95

Appendix 1. Summary of analyses of water from wells completed in the Red River alluvial aquifer, Louisiana, 1958-93--Continued

Well number	Date	Water level below land surface (feet)	Depth of well, total (feet)	Specific conductance (µS/cm)	pH field (standard units)	Temperature of water (°C)	Color (platinum-cobalt units)	Hardness total (mg/L as $CaCO_3$)	Hardness, noncarbonate whole water total field (mg/L as $CaCO_3$)	Calcium, dissolved (mg/L as Ca)	Magnesium, dissolved (mg/L as Mg)
R-1014B	03-15-74	--	55	--	--	--	--	450	--	--	--
	03-25-74	7.25	55	801	6.5	--	--	460	--	--	--
	05-17-74	8.10	55	776	6.4	21.0	0	440	0	110	39
	08-20-74	18.00	55	743	6.9	20.5	--	510	--	--	--
	09-24-74	14.27	55	752	6.9	21.0	5	410	13	110	32
	10-23-74	15.30	55	744	7.1	20.5	--	410	--	--	--
	11-19-74	10.66	55	719	6.8	20.5	--	420	--	--	--
	12-19-74	7.17	55	746	6.7	20.5	--	420	--	--	--
	01-27-75	6.60	55	765	6.9	20.5	--	410	--	--	--
	02-14-75	6.02	55	759	6.8	20.0	--	420	--	--	--
	03-08-75	5.52	55	750	6.8	20.5	--	410	--	--	--
	04-12-75	4.57	55	717	6.6	20.0	--	410	--	80	51
	05-17-75	3.62	55	755	6.5	21.0	5	420	2	82	52
	08-17-75	3.55	55	762	6.6	20.0	--	410	--	--	--
	10-07-75	17.49	55	955	6.7	20.5	0	500	87	100	60
	02-11-76	15.80	55	1,050	6.7	20.5	--	560	--	--	--
	04-28-76	14.40	55	1,140	6.8	20.0	0	600	120	130	67
	07-09-76	14.42	55	1,150	6.9	--	--	620	--	--	--
	10-21-76	21.58	55	1,130	6.8	--	0	580	120	120	67
	04-14-77	8.83	55	956	6.8	20.0	0	510	33	100	63
	10-26-77	22.55	55	1,110	6.8	21.0	--	570	94	120	--
	03-30-78	16.87	55	997	6.7	20.0	--	530	--	--	--
	09-27-78	22.72	55	1,030	--	--	--	600	--	--	--
	03-28-79	9.40	55	1,150	6.9	20.5	--	620	--	--	--
	10-24-79	20.32	55	--	6.9	21.0	--	650	--	--	--
	03-20-80	14.10	55	1,090	6.7	20.5	--	580	--	--	--
	09-24-80	22.50	55	--	6.6	--	--	640	--	--	--
	04-22-81	23.20	55	--	6.7	--	--	700	--	--	--
	09-23-81	12.70	55	--	6.7	--	--	620	--	--	--
	04-15-82	19.50	55	--	6.8	--	--	520	--	--	--
	09-01-82	20.18	55	--	6.8	--	--	580	--	--	--
	04-15-83	8.75	55	--	6.9	20.0	--	620	--	130	71
	09-22-83	21.00	55	--	6.8	--	--	560	--	120	64
	03-14-84	12.05	55	--	6.9	21.0	--	600	--	130	68
	10-12-84	24.58	55	--	6.7	--	--	520	--	100	65
	03-19-85	9.77	55	--	6.9	21.0	--	480	--	100	56
	10-04-85	23.04	55	--	6.9	22.0	--	490	--	100	59
	04-03-86	19.48	55	--	6.9	21.0	--	520	--	110	60
	08-27-86	21.38	55	--	6.9	21.5	--	530	--	100	68
	04-28-87	14.07	55	1,020	7.2	20.5	--	567	--	120	65
	07-01-88	14.74	55	970	6.8	21.0	0	550	100	120	60
	04-13-89	6.01	55	832	7.1	21.0	10	440	--	89	52
	03-28-91	6.16	55	966	6.8	21.0	5	476	--	100	55
	04-01-92	4.36	55	1,020	6.8	21.0	--	480	--	100	58
	03-24-93	5.49	55	989	6.8	21.0	0	480	--	100	55
R-1095	12-08-75	10.45	127	943	6.6	--	5	490	0	120	46
	08-03-76	10.73	127	914	6.9	--	--	500	--	--	--
	04-15-77	10.01	127	960	6.9	20.0	5	500	0	140	36
	10-26-77	14.87	127	988	7.0	20.5	--	520	0	190	12
	04-04-78	10.50	127	932	6.8	20.0	--	520	--	--	--
	09-25-78	14.27	127	1,170	6.9	--	--	520	--	--	--
	03-29-79	8.68	127	945	7.0	20.5	--	490	--	--	--
	10-24-79	12.87	127	--	6.9	20.5	--	480	--	--	--
	03-18-80	9.95	127	912	7.1	20.5	--	500	--	--	--
	09-23-80	13.35	127	--	7.1	20.5	--	470	--	--	--
	04-22-81	14.68	127	--	7.0	20.5	--	490	--	--	--
	09-23-81	15.90	127	--	7.1	20.5	--	490	--	--	--
	04-15-82	13.80	127	--	7.1	20.0	--	480	--	--	--
	08-31-82	15.26	127	--	7.0	20.0	--	480	--	--	--
	03-25-83	9.74	127	--	7.0	20.0	--	510	--	140	40
	09-21-83	13.26	127	--	7.1	20.0	--	470	--	130	35
	03-14-84	8.84	127	--	6.8	20.0	--	520	--	150	35
	11-05-84	--	127	--	7.0	21.0	--	510	--	140	40

Appendix 1. Summary of analyses of water from wells completed in the Red River alluvial aquifer, Louisiana, 1958-93--Continued

Sodium, dissolved (mg/L as Na)	Potassium, dissolved (mg/L as K)	Alkalinity, field (mg/L as $CaCO_3$)	Sulfate, dissolved (mg/L as SO_4)	Chloride, dissolved (mg/L as Cl)	Fluoride, dissolved (mg/L as F)	Silica, dissolved (mg/L as SiO_2)	Solids, sum of constituents, dissolved (mg/L)	Nitrogen, nitrite dissolved (mg/L as N)	Nitrogen, $NO_2 + NO_3$ dissolved (mg/L as N)	Iron, dissolved (mg/L as Fe)	Manganese, dissolved (mg/L as Mn)
--	--	--	--	18	--	--	--	--	--	--	--
--	--	--	21	7.8	--	--	--	--	--	0.10	--
12	0.5	--	18	4.4	0.5	20	461	--	--	--	0.70
--	--	--	16	5.4	--	--	--	--	--	.07	--
3.0	.2	390	17	5.2	.1	20	423	--	--	.05	.69
--	--	--	17	5.4	--	--	--	--	--	.05	.72
--	--	--	18	4.7	--	--	--	--	--	.05	.73
--	--	--	17	4.9	--	--	--	--	--	.07	.70
--	--	--	18	4.3	--	--	--	--	--	.06	.66
--	--	--	18	6.0	--	--	--	--	--	.06	.67
--	--	--	18	6.6	--	--	--	--	--	.06	.70
--	--	--	18	4.2	--	--	--	--	--	<.01	.65
10	.4	420	18	5.4	.8	21	441	<0.01	0.16	.05	.64
--	--	--	18	6.1	--	--	--	--	--	.07	.66
9.0	.5	410	28	39	.5	21	507	--	--	.04	.98
--	--	--	38	52	--	--	--	--	--	.13	.95
20	.6	480	48	52	.7	21	625	--	--	.06	1.1
--	--	--	54	64	--	--	--	--	--	.03	1.1
20	.6	460	42	49	.1	24	601	--	--	.28	1.0
13	4.5	480	32	26	.4	19	546	--	--	.03	.64
--	--	480	46	43	--	--	--	--	--	.23	1.1
--	--	--	34	31	--	--	--	--	--	.03	1.1
--	--	--	40	42	--	--	--	--	--	--	1.2
--	--	--	41	54	--	--	--	--	--	.32	.98
--	--	--	26	56	--	--	--	--	--	.06	1.2
--	--	--	49	42	--	--	--	--	--	.23	1.0
--	--	--	51	59	--	--	--	--	--	.59	1.2
--	--	--	54	69	--	--	--	--	--	.15	1.4
--	--	--	49	50	--	--	--	--	--	.07	1.4
--	--	--	43	32	--	--	--	--	--	.07	.98
--	--	--	37	40	--	--	--	--	--	.05	.97
--	--	--	43	46	--	--	--	--	--	.04	1.4
--	--	--	46	39	--	--	--	--	--	.03	.90
--	--	--	42	34	--	--	--	--	--	.06	1.0
--	--	--	44	28	--	--	--	--	--	.13	1.1
--	--	--	38	23	--	--	--	--	--	.10	1.0
--	--	--	39	23	--	--	--	--	--	.06	1.1
--	--	--	23	12	--	--	--	--	--	.11	.90
--	--	--	42	25	--	--	--	--	--	.07	.86
--	--	456	47	27	--	--	--	--	--	.05	1.1
25	1.0	446	48	22	.6	21	576	.13	2.2	.07	1.30
17	1.4	439	22	8.9	.4	21	485	.08	2.2	.07	.66
22	<1.0	444	--	22	.4	18	--	.15	10	.28	.91
28	.80	450	44	28	.5	22	612	.16	14	.15	.94
30	.46	437	38	20	.4	20	580	.10	12	.06	.84
25	2.7	540	<1.0	8.2	1.0	16	540	--	--	15	.82
--	--	--	<1.0	7.4	--	--	--	--	--	14	.79
24	2.7	550	<1.0	6.0	.2	34	569	--	--	15	.74
23	3.6	590	1.8	10	.3	30	645	--	--	17	.91
--	--	--	<.2	11	--	--	--	--	--	17	.86
--	--	--	5.4	9.5	--	--	--	--	--	17	.97
--	--	--	<.2	9.0	--	--	--	--	--	17	.64
--	--	--	4.8	7.6	--	--	--	--	--	16	.60
--	--	--	<.2	7.4	--	--	--	--	--	16	1.0
--	--	--	7.2	7.2	--	--	--	--	--	16	.76
--	--	--	.8	7.4	--	--	--	--	--	16	.90
--	--	--	.4	7.1	--	--	--	--	--	16	.85
--	--	--	.2	9.4	--	--	--	--	--	16	.79
--	--	--	.2	9.1	--	--	--	--	--	21	.82
--	--	--	.4	9.4	--	--	--	--	--	16	.78
--	--	--	1.6	9.7	--	--	--	--	--	17	.71
--	--	--	.8	8.1	--	--	--	--	--	16	.72
--	--	--	.6	8.4	--	--	--	--	--	15	.88

Appendix 1. Summary of analyses of water from wells completed in the Red River alluvial aquifer, Louisiana, 1958-93--Continued

Well number	Date	Water level below land surface (feet)	Depth of well, total (feet)	Specific conductance (µS/cm)	pH field (standard units)	Temperatura of water (°C)	Color (platinum-cobalt units)	Hardness total (mg/L as $CaCO_3$)	Hardness, noncarbonate whole water total field (mg/L as $CaCO_3$)	Calcium, dissolved (mg/L as Ca)	Magnesium, dissolved (mg/L as Mg)
R-1095	03-25-85	8.71	127	--	6.9	21.0	--	490	--	140	35
	10-04-85	13.09	127	--	6.7	20.5	--	510	--	140	40
	03-31-86	10.20	127	--	6.9	20.5	--	440	--	120	35
	08-26-86	13.37	127	--	6.9	21.0	--	530	--	140	43
	04-28-87	9.16	127	973	7.1	20.0	--	514	--	140	40
	07-01-88	14.16	127	950	6.9	20.5	5	540	0	150	40
	04-20-90	6.51	127	987	7.2	20.5	0	510	--	140	40
	04-01-92	7.57	127	997	6.9	21.0	--	470	--	130	36
	03-24-93	6.84	127	991	6.9	21.0	--	470	--	130	36
R-1096	12-08-75	7.06	104	1,150	6.6	--	0	480	0	110	51
	02-13-76	6.49	104	1,150	7.1	20.0	--	510	--	--	--
	08-06-76	6.88	104	1,160	7.1	--	--	510	--	--	--
	04-12-77	5.75	104	1,180	6.8	--	0	500	0	110	55
	10-03-77	10.46	104	1,180	6.6	--	0	570	0	120	66
	03-22-78	6.94	104	1,180	6.5	--	--	490	--	--	--
	09-26-78	10.79	104	1,140	6.9	--	--	580	--	--	--
	03-21-79	4.24	104	1,160	7.1	--	--	530	--	--	--
	10-19-79	8.54	104	--	7.6	--	--	490	--	--	--
	03-18-80	5.04	104	--	7.1	20.5	--	540	--	--	--
	09-22-80	10.97	104	--	7.0	20.5	--	540	--	--	--
	04-21-81	11.39	104	--	7.1	20.5	--	530	--	--	--
	09-10-81	12.52	104	--	7.3	20.5	--	540	--	--	--
	04-14-82	11.70	104	--	7.1	20.5	--	530	--	--	--
	09-02-82	11.82	104	--	7.0	--	--	530	--	--	--
	03-31-83	4.32	104	--	6.8	--	--	560	--	120	64
	09-21-83	9.21	104	--	7.0	--	--	520	--	110	59
	03-15-84	4.79	104	--	7.1	--	--	570	--	120	65
	10-16-84	10.03	104	--	6.8	--	--	490	--	98	60
	03-25-85	4.58	104	--	7.2	--	--	480	--	100	57
	10-07-85	9.75	104	--	6.7	--	--	540	--	110	64
	04-03-86	7.35	104	--	7.1	--	--	590	--	110	76
	09-03-86	10.00	104	--	6.9	--	--	520	--	100	66
	09-20-88	9.94	104	1,160	6.9	21.0	5	570	0	130	60
	04-06-89	4.29	104	1,230	6.9	20.0	5	470	--	95	56
	04-03-91	5.64	104	1,150	6.9	20.5	0	539	--	130	52
	06-12-92	6.96	104	1,150	6.8	--	--	530	--	120	57
	03-22-93	5.80	104	1,190	6.8	21.0	10	500	--	110	54
R-1103	04-16-76	6.04	88	1,410	6.9	20.0	5	620	18	130	72
	08-06-76	7.11	88	1,430	7.1	--	--	620	--	--	--
	04-12-77	5.52	88	1,420	6.9	20.0	--	610	0	--	--
	10-03-77	12.20	88	1,410	6.9	20.0	0	580	120	140	56
	04-04-78	7.29	88	1,180	6.7	20.0	--	590	--	--	--
	09-26-78	12.16	88	1,370	6.9	--	--	610	--	--	--
	03-21-79	3.99	66	1,250	6.9	20.0	--	600	--	--	--
	10-19-79	8.61	88	--	7.0	21.0	--	600	--	--	--
	03-18-80	5.02	66	1,360	6.9	20.5	--	630	--	--	--
	09-22-80	12.62	88	--	6.9	--	--	600	--	--	--
	04-21-81	11.33	88	--	7.0	--	--	590	--	--	--
	09-10-81	13.02	88	--	7.0	--	--	590	--	--	--
	04-14-82	10.97	88	--	6.9	--	--	580	--	--	--
	03-31-83	4.17	88	--	6.7	--	--	610	--	130	70
	09-21-83	10.50	66	--	6.9	--	--	580	--	130	61
	03-15-84	4.67	88	--	6.7	--	--	620	--	140	65
	10-16-84	11.10	88	--	6.7	--	--	540	--	110	65
	03-25-85	5.20	66	--	7.0	--	--	550	--	120	60
	10-03-85	11.05	88	--	7.5	21.0	--	600	--	130	66
	04-03-86	7.99	88	--	7.0	20.5	--	684	--	150	75
	09-03-86	11.40	66	--	7.0	--	--	590	--	120	70
	08-13-90	3.09	88	1,400	6.7	22.0	5	600	--	140	60
	03-31-92	2.96	88	1,390	7.0	20.5	--	600	--	140	60
	03-22-93	2.69	66	1,380	6.9	20.5	0	560	--	130	58

Appendix 1. Summary of analyses of water from wells completed in the Red River alluvial aquifer, Louisiana, 1958-93--Continued

Sodium, dissolved (mg/L as Na)	Potasium, dissolved (mg/L as K)	Alkalinity, field (mg/L as $CaCO_3$)	Sulfate, dissolved (mg/L ss SO_4)	Chloride, dissolved (mg/L es Cl)	Fluoride, dissolved (mg/L as F)	Silica, dissolved (mg/L as SiO_2)	Solids, sum of consti-tuents, dissolvsd (mg/L)	Nitrogen, nitrite dissolved (mg/L ss N)	Nitrogen, $NO_2 + NO_3$ dissolved (mg/L ss N)	Iron, dissolved (mg/L as Fe)	Mangs-nese, dissolved (mg/L as Mn)
--	--	--	0.2	7.8	--	--	--	--	--	17	0.78
--	--	--	1.2	9.0	--	--	--	--	--	16	.64
--	--	--	.6	8.7	--	--	--	--	--	17	.82
--	--	--	.4	7.3	--	--	--	--	--	16	.76
		569	.6	5.8	--	--	--	--	--	16	.96
--	--										
23	2.5	570	14	6.4	0.4	26	618	<0.01	<0.02	13	1.1
22	2.3	655	<.2	8.1	.2	28	--	<.01	<.02	17	.70
22	2.4	572	<.2	7.6	.2	30	--	<.01	<.02	18	.73
23	2.2	564	<.2	7.6	.2	28	--	<.01	<.02	16	.65
		580	52	28	1.0	32	712	--	--	9.3	1.1
78	2.4										
--	--	--	44	29	--	--	--	--	--	9.1	1.1
--	--	--	52	26	--	--	--	--	--	8.8	.91
73	2.6	600	50	26	.3	59	746	--	--	9.3	1.2
67	3.0	590	28	26	.3	31	708	--	--	9.8	1.2
		--	52	21	--	--	--	--	--	8.7	1.2
--	--										
--	--	--	59	28	--	--	--	--	--	7.2	1.3
--	--	--	56	28	--	--	--	--	--	9.7	.98
--	--	--	19	25	--	--	--	--	--	2.5	.58
--	--	--	48	28	--	--	--	--	--	9.5	1.3
		--	54	28	--	--	--	--	--	9.8	1.2
--	--										
--	--	--	54	27	--	--	--	--	--	8	1.2
--	--	--	54	27	--	--	--	--	--	9.2	1.1
--	--	--	45	27	--	--	--	--	--	9.5	1.1
--	--	--	47	26	--	--	--	--	--	8.7	1.5
--	--	--	51	28	--	--	--	--	--	9.3	1.4
--	--	--	55	29	--	--	--	--	--	10	1.1
--	--	--	51	27	--	--	--	--	--	8.4	1.0
--	--	--	45	26	--	--	--	--	--	8.6	1.2
--	--	--	44	25	--	--	--	--	--	8.7	1.0
--	--	--	46	27	--	--	--	--	--	9.2	1.7
--	--	--	39	25	--	--	--	--	--	7.3	1.5
--	--	--	40	24	--	--	--	--	--	9	1.2
80	2.2	616	46	24	.5	32	754	<.01	<.02	8.3	1.4
72	2.1	603	46	25	.4	32	701	<.01	<.02	9.6	1.5
61	2.5	602	32	20	.3	30	697	<.01	.02	7.2	1.1
63	2.6	564	52	22	.4	30	703	<.01	<.02	4.7	.96
66	2.0	604	54	22	.3	33	712	<.01	<.02	7.7	.87
89	2.6	600	66	93	.5	25	844	--	--	6.5	1.0
--	--	--	65	90	--	--	--	--	--	6.1	.96
--	--	640	63	90	--	--	--	--	--	6.7	1.0
90	3.2	650	25	82	.4	28	822	--	--	6.9	1.0
--	--	--	45	88	--	--	--	--	--	6.4	.99
--	--	--	54	85	--	--	--	--	--	6.2	1.3
--	--	--	61	73	--	--	--	--	--	6.7	.98
--	--	--	50	80	--	--	--	--	--	6.3	1.1
--	--	--	53	81	--	--	--	--	--	6.6	1.5
--	--	--	50	80	--	--	--	--	--	6.4	1.1
--	--	--	56	82	--	--	--	--	--	6.7	1.2
--	--	--	55	80	--	--	--	--	--	6.7	1.1
--	--	--	46	82	--	--	--	--	--	5.8	1.1
--	--	--	52	82	--	--	--	--	--	5.9	1.6
--	--	--	57	89	--	--	--	--	--	6.2	.97
--	--	--	55	81	--	--	--	--	--	8	1.1
--	--	--	50	86	--	--	--	--	--	5.8	1.1
--	--	--	48	85	--	--	--	--	--	5.5	.96
--	--	--	54	84	--	--	--	--	--	6.8	.98
--	--	--	51	77	--	--	--	--	--	6.6	1.1
--	--	--	48	82	--	--	--	--	--	8.8	.88
87	2.4	703	69	85	.4	29	902	<.01	<.02	6.4	1.1
90	2.5	634	52	78	.5	24	835	<.01	<.02	6.9	.97
91	2.1	621	48	74	.4	28	810	<.01	<.02	5.7	.84

Appendix 1. Summary of analyses of water from wells completed in the Red River alluvial aquifer, Louisiana, 1958-93--Continued

Well number	Date	Water level below land surface (feet)	Depth of well, total (feet)	Specific conductance (µS/cm)	pH field (standard units)	Temperature of water (°C)	Color (platinum-cobalt units)	Hardness total (mg/L as $CaCO_3$)	Hardness, noncarbonate whole water total field (mg/L as $CaCO_3$)	Calcium, dissolved (mg/L as Ca)	Magnesium, dissolved (mg/L as Mg)
R-1135	07-14-78	20.15	85	936	6.6	--	--	440	--	--	--
	03-31-80	9.90	85	1,010	6.8	--	--	430	--	--	--
	04-01-88	7.75	85	1,020	6.7	21.0	5	410	0	100	40
	04-06-89	3.45	85	1,070	6.7	21.5	0	390	--	96	37
	04-19-90	1.42	85	1,010	6.8	21.0	5	440	--	110	40
	03-27-91	7.04	85	1,030	6.6	22.0	5	403	--	97	39
	03-30-92	5.14	85	1,040	6.6	21.5	--	390	--	100	34
	03-25-93	5.24	85	1,040	--	22.5	5	410	--	100	40
R-1141	08-30-76	16.88	87	1,290	6.7	20.5	--	540	--	--	--
	04-04-80	6.63	87	--	6.9	20.0	--	520	--	--	--
	04-04-88	5.50	87	1,160	7.0	20.0	--	600	0	140	60
	04-17-89	6.63	87	1,100	7.0	--	5	510	--	120	52
	06-13-90	4.39	87	1,070	7.0	22.0	--	520	--	120	53
	03-27-91	7.27	87	1,060	6.9	20.0	5	510	--	120	51
	08-12-92	8.56	87	1,070	6.8	20.0	--	500	--	110	54
	03-22-93	4.60	87	1,030	6.8	20.5	0	480	--	110	49
R-1144	09-01-78	12.97	95	941	6.8	20.5	--	430	--	--	--
	04-01-80	5.60	95	--	6.9	20.5	--	410	--	--	--
	04-21-88	7.30	95	808	7.0	21.0	10	--	170	120	--
	04-17-89	8.00	95	809	7.1	21.5	10	420	--	120	29
	04-11-90	6.92	95	813	7.1	21.0	0	420	--	120	29
	03-25-91	7.41	95	815	7.0	22.0	5	398	--	110	30
	03-30-92	7.25	95	781	7.0	21.0	--	390	--	110	29
	03-22-93	7.24	95	632	6.9	21.5	5	400	--	110	30
R-1146	08-30-78	9.36	64	1,290	6.9	20.5	--	570	--	--	--
	03-24-80	3.40	64	1,070	7.0	--	--	560	--	--	--
	04-26-89	4.66	64	--	6.9	20.0	5	600	--	130	66
	04-18-90	2.32	64	1,060	7.0	19.5	0	580	--	120	69
	03-27-91	4.14	64	1,100	6.8	20.0	5	588	--	120	70
	08-12-92	5.78	64	1,120	6.7	20.5	5	600	--	120	72
	03-23-93	3.04	64	1,110	6.9	20.0	0	550	--	110	67
R-1156	04-25-78	15.48	105	1,400	6.6	20.5	--	410	--	--	--
	12-26-79	15.49	105	1,460	6.8	21.0	--	430	--	--	--
	11-07-86	15.88	105	--	7.1	20.0	--	460	--	120	40
	04-20-87	11.39	105	1,490	6.8	20.5	--	444	--	120	35
	06-27-88	15.19	105	1,460	6.5	21.0	5	450	--	130	30
	04-18-90	4.48	105	1,490	7.1	21.0	5	470	--	130	35
	05-01-92	12.31	105	1,500	6.7	21.5	--	440	--	120	34
	03-23-93	6.52	105	1,510	6.6	21.0	10	410	--	110	33
R-1163	05-21-60	13.72	93	--	7.0	--	--	200	--	--	--
	04-04-88	13.67	93	993	6.5	--	5	180	0	51	12
	04-05-89	14.05	93	1,010	6.4	--	--	170	--	48	12
	04-18-90	11.01	93	946	6.6	--	0	160	--	46	12
	04-03-91	12.56	93	951	6.3	--	5	160	--	46	11
	05-01-92	11.52	93	940	6.4	--	--	160	--	47	11
	03-23-93	11.18	93	955	6.4	--	0	160	--	46	10
R-1315	04-01-88	+1.38	75	1,020	7.2	19.5	--	510	0	120	50
	04-26-89	.56	75	1,030	7.1	20.0	5	500	--	120	48
	04-11-90	+.65	75	1,000	7.2	20.0	0	460	--	110	48
	03-28-91	+.39	75	1,020	7.2	20.0	5	472	--	110	46
	04-01-92	.77	75	1,040	7.1	20.0	--	440	--	100	46
	03-25-93	1.36	75	1,040	--	20.0	--	440	--	100	45

Appendix 1. Summary of analyses of water from wells completed in the Red River alluvial aquifer, Louisiana, 1958-93--Continued

Sodium, dissolved (mg/L es Na)	Potassium, dissolved (mg/L as K)	Alkalinity, field (mg/L as $CaCO_3$	Sulfate, dissolved (mg/L as SO_4)	Chloride, dissolved (mg/L as Cl)	Fluoride, dissolved (mg/L as F)	Silica, dissolved (mg/L as SiO_2)	Solids, sum of constituents, dissolved (mg/L)	Nitrogen, nitrite dissolved (mg/L as N)	Nitrogen, $NO_2 + NO_3$ dissolved (mg/L as N)	Iron, dissolved (mg/L as Fe)	Manganese, dissolved (mg/L as Mn)
--	--	--	44	46	--	--	--	--	--	3.3	0.67
--	--	--	44	43	--	--	--	--	--	6.3	.54
80	4.4	482	40	40	0.2	21	621	<0.01	0.02	6.7	--
75	4.4	480	39	41	.4	39	627	<.01	.02	7.1	.40
68	4.6	495	37	50	.2	38	652	<.01	<.02	6.9	.47
68	4.9	487	20	40	.3	38	607	<.01	.02	7.5	.43
70	4.6	484	42	40	.3	37	626	<.01	<.02	7.8	.42
66	4.1	469	40	34	.3	37	610	<.01	<.02	6.6	.40
--	--	--	74	24	--	--	--	--	--	5.3	.42
--	--	--	65	24	--	--	--	--	--	5.8	.42
55	1.7	538	85	34	.2	20	725	<.01	<.02	6.2	--
48	1.7	511	76	27	.3	24	661	<.01	<.02	5.6	.34
45	1.7	532	56	25	.2	26	651	<.01	<.02	5.1	--
46	1.5	556	47	22	.3	24	651	<.01	.02	5.4	.33
45	1.9	507	63	19	.3	26	628	<.01	<.02	4.8	.31
46	1.4	505	62	17	.3	26	619	<.01	<.02	4.6	.26
--	--	--	<0.2	15	--	--	--	--	--	15	.22
--	--	--	<.2	9.6	--	--	--	--	--	17	.32
12	1.8	460	--	5.7	.2	21	--	<.01	<.02	15	--
11	1.8	452	<.1	5.5	.3	20	240	<.01	<.02	16	.44
14	1.8	466	<.1	12	.4	20	--	<.01	<.02	16	.50
14	1.6	457	<.2	13	.3	20	--	<.01	.02	16	.41
21	2.0	456	<.2	13	.3	21	--	<.01	<.02	15	.28
19	1.3	458	<.2	10	.3	22	--	<.01	<.02	12	.24
--	--	--	42	16	--	--	--	--	--	.76	1.4
--	--	--	47	15	--	--	--	--	--	1.0	1.3
28	.6	560	45	20	.4	25	655	<.01	<.02	1.6	.92
32	1.0	592	32	27	.4	25	664	<.01	<.02	1.7	1.4
31	<1.0	575	31	20	.5	24	--	<.01	.02	1.7	1.2
30	1.0	591	49	18	.5	24	672	<.01	<.02	1.5	1.2
31	.7	558	52	22	.4	24	644	<.01	<.02	1.5	1.2
--	--	--	5.2	140	--	--	--	--	--	12	3.1
--	--	--	<.2	130	--	--	--	--	--	12	2.4
--	--	--	.6	140	--	--	--	--	--	13	2.6
--	--	633	.8	140	--	--	--	--	--	13	3.2
170	5.9	631	14	130	.4	36	909	<.01	<.02	12	2.8
170	5.5	659	.2	150	.4	36	938	<.01	<.02	13	2.3
160	4.8	638	<.2	130	.5	39	--	<.01	<.02	13	2.3
160	4.7	631	<.2	140	.4	39	--	<.01	<.02	12	2.2
--	--	--	13	120	--	--	--	--	--	26	2.4
130	4.7	360	6.8	110	.1	16	569	<.01	<.02	23	--
130	4.8	337	.2	110	.1	40	572	<.01	.03	23	1.9
120	4.8	362	<.2	120	<.2	42	--	.01	<.02	24	1.7
120	4.8	359	<.2	100	.2	40	--	.01	.02	24	2.0
120	4.8	345	<.2	100	.1	44	--	<.01	<.02	26	1.6
120	4.5	337	<.2	100	.1	45	--	.01	<.02	21	1.5
55	1.8	575	7.4	20	.4	22	631	<.01	<.02	10	--
47	1.6	564	1.0	21	.4	17	625	<.01	<.02	10	.59
47	2.1	577	1.6	30	.5	17	612	<.01	<.02	11	.56
46	1.5	575	.4	20	.6	17	601	<.01	.02	12	.48
48	1.9	573	.2	20	.6	18	592	<.01	<.02	13	.42
46	1.5	536	.3	19	.6	17	564	<.01	<.02	11	.38

Appendix 2. Analyses of water from wells completed in local water yielding strata in the Red River alluvial confining unit in Rapides Parish

[µS/cm, microsiemens per centimeter at 25° Celsius; °C, degrees Celsius; mg/L, milligrams per liter; $CaCO_3$, calcium carbonate; +, water level above land surface; <, actual value is known to be less than value shown; --, no data]

Well number	Date	Water level below land surface (feet)	Depth of well, total (feet)	Specific conductance (µS/cm)	pH field (standard units)	Temperature of water (°C)	Color (platinum-cobalt units)	Hardness total (mg/L as $CaCO_3$)	Hardness, noncarbonate whole water total field (mg/L as $CaCO_3$)	Calcium, dissolved (mg/L as Ca)	Magnesium, dissolved (mg/L as Mg)
R- 963P	04-13-89	4.30	16	821	7.4	--	0	430	--	91	50
	04-16-90	3.02	16	811	7.4	--	0	470	--	96	56
	03-28-91	5.55	16	869	7.4	--	5	490	--	110	52
	04-01-92	3.30	16	875	7.0	--	--	480	--	100	55
	03-24-93	2.42	16	847	7.7	--	0	470	--	100	53
R- 965P	04-13-89	4.10	16	567	7.3	--	0	270	--	59	29
	04-20-90	3.55	16	561	7.4	--	5	270	--	59	29
	03-28-91	3.30	16	733	7.6	--	5	320	--	65	38
	04-01-92	3.40	16	619	7.1	--	--	280	--	62	31
	03-24-93	2.71	16	794	7.1	--	0	410	--	90	46
R- 968P	04-05-89	3.30	19	870	7.2	--	0	450	--	91	54
	04-18-90	2.25	19	832	7.4	--	0	480	--	100	57
	04-03-91	4.05	19	846	7.1	--	5	450	--	90	55
	05-01-92	3.92	19	610	7.3	--	--	460	--	96	53
	03-23-93	.98	19	808	7.1	--	0	440	--	91	51
R- 991P	04-05-88	.39	20	1,600	7.0	20.0	5	780	19	180	80
	04-05-89	.85	20	1,910	6.8	19.0	5	910	--	210	93
	04-10-90	1.26	20	1,880	6.7	--	0	920	--	230	84
	03-25-91	.72	20	1,990	6.8	21.0	5	970	--	240	91
	04-29-92	1.74	20	1,710	6.9	--	--	610	--	200	76
	03-25-93	.93	20	1,690	6.6	19.5	0	780	--	190	75
R-1135P	04-01-88	6.08	33	872	7.2	19.0	5	430	0	80	55
	04-06-89	3.70	33	895	7.0	--	5	410	--	73	56
	04-19-90	1.76	33	841	7.1	--	0	420	--	75	56
	03-27-91	7.43	33	832	6.9	22.0	5	400	--	73	52
	03-30-92	5.60	33	835	7.0	22.0	--	390	--	71	52
	03-25-93	5.37	33	814	6.6	--	0	390	--	73	51
R-1141P	04-04-88	1.00	14	916	7.2	--	5	460	0	76	65
	04-17-89	3.30	14	696	7.1	20.0	5	400	--	84	59
	04-20-90	2.60	14	838	7.3	19.5	0	390	--	69	54
	03-27-91	3.65	14	853	7.0	--	10	400	--	66	56
	06-12-92	4.61	14	889	7.1	--	--	440	--	76	60
	03-22-93	1.35	14	880	7.0	21.0	0	430	--	76	58
R-1144P	04-21-88	7.05	24	693	7.2	--	5	340	0	80	35
	04-17-89	6.01	24	695	7.1	--	--	320	--	71	34
	04-11-90	6.70	24	711	7.3	--	0	350	--	76	37
	03-25-91	7.26	24	762	7.0	--	5	350	--	80	37
	03-30-92	7.00	24	738	7.1	--	--	--	--	--	34
	03-22-93	7.01	24	713	7.0	--	0	340	--	77	35
R-1146P	06-13-88	7.20	13	1,190	6.9	--	0	670	--	160	85
	04-26-89	3.40	13	1,370	7.0	19.0	5	700	--	150	80
	04-18-90	1.20	13	1,060	7.2	--	0	600	--	140	61
	03-27-91	1.30	13	1,320	6.9	22.0	0	740	--	180	71
	06-12-92	3.83	13	1,350	7.0	--	--	700	--	160	72
	03-23-93	.50	13	1,340	7.2	--	--	700	--	160	74
R-1163P	04-04-88	+.10	11	862	6.9	16.0	5	480	3	110	50
	04-05-89	1.10	11	822	7.0	16.0	--	410	--	97	40
	04-18-90	.95	11	831	7.0	19.0	0	460	--	110	50
	04-03-91	.90	11	845	6.8	19.0	5	490	--	120	47
	05-01-92	2.12	11	835	6.6	20.0	--	470	--	110	46
	03-23-93	.32	11	865	6.7	19.0	0	450	--	100	48
R-1315P	04-01-88	.10	24	1,120	7.1	20.0	0	530	0	90	75
	04-28-89	1.80	24	1,180	7.1	20.0	--	550	--	90	78
	04-11-90	.87	24	1,170	7.1	20.0	5	550	--	91	79
	03-28-91	.95	24	1,220	7.0	20.5	5	530	--	92	72
	04-01-92	.25	24	1,290	7.0	20.0	--	540	--	87	79
	03-25-93	.02	24	1,290	--	--	0	560	--	92	81

Appendix 2. Analyses of water from wells completed in local water yielding strata in the Red River alluvial confining unit in Rapides Parish--Continued

Sodium, dissolved (mg/L as Na)	Potassium, dissolved (mg/L as K)	Alkalinity, field (mg/L as $CaCO_3$)	Sulfate, dissolved (mg/L as SO_4)	Chloride, dissolved (mg/L as Cl)	Fluoride, dissolved (mg/L as F)	Silica, dissolved (mg/L as SiO_2)	Solids, sum of constituents, dissolved (mg/L)	Nitrogen, nitrite dissolved (mg/L as N)	Nitrogen, $NO_2 + NO_3$ dissolved (mg/L as N)	Iron, dissolved (mg/L as Fe)	Manganese, dissolved (mg/L as Mn)
10	0.80	456	19	1.5	0.5	19	466	<0.01	<0.02	0.10	1.1
11	1.0	469	28	5.8	.6	19	500	<.01	<.02	.24	.73
14	<1.0	477	15	3.1	.6	16	--	<.01	.02	.57	.48
15	.90	481	22	2.4	.7	20	508	<.01	<.02	--	.57
14	.63	480	22	2.3	.5	16	497	<.01	<.02	.04	.49
16	.80	206	91	7.3	.4	25	354	<.01	<.02	.56	1.3
15	1.1	212	95	9.7	.4	25	362	<.01	<.02	.29	.56
16	<1.0	229	100	12	.4	24	--	<.01	.02	.08	1.2
14	1.3	198	120	10	.5	28	387	<.01	<.02	--	.65
15	.81	201	180	18	.4	25	497	<.01	<.02	.36	.58
14	.70	483	16	3.1	.5	24	495	<.01	<.02	.33	1.8
13	1.0	519	14	4.0	.4	24	527	<.01	<.02	.12	2.3
11	<1.0	489	8.0	5.0	.6	23	--	<.01	.02	.27	2.0
11	.80	475	13	3.6	.6	23	488	<.01	<.02	.77	1.7
11	.51	480	13	3.6	.6	22	482	<.01	<.02	.42	1.4
100	.70	767	120	62	.2	24	1,030	<.01	.02	2.1	--
96	.90	822	140	120	.3	27	1,180	<.01	<.02	--	3.6
90	1.0	862	150	120	.3	27	1,220	<.01	.17	--	3.3
91	1.5	871	110	140	.3	26	1,230	<.01	.05	2.7	3.3
88	1.0	811	110	74	.3	26	1,070	<.01	<.02	2.1	2.7
89	.65	823	100	64	.3	25	1,040	<.01	<.02	1.4	2.4
32	.80	435	44	12	.5	--	496	<.01	.09	--	--
31	.60	444	42	14	.6	21	506	<.01	<.02	.16	1.2
32	1.0	448	44	14	.5	22	515	<.01	<.02	.05	1.4
26	<1.0	429	17	11	.6	21	--	<.01	.02	.16	1.4
28	.80	424	40	11	.7	20	479	<.01	<.02	.09	1.3
30	.49	407	37	12	.6	21	470	<.01	<.02	.06	1.1
39	.50	479	56	6.1	.4	39	572	<.01	.05	--	--
40	.60	462	44	5.5	.6	20	511	<.01	<.02	.05	.31
39	1.0	474	48	5.1	.5	20	521	<.01	<.02	.04	.23
35	<1.0	453	37	3.7	.6	19	--	<.01	.03	.47	.20
35	.90	468	46	3.7	.6	20	523	<.01	<.02	.19	.23
36	.49	457	44	4.2	.6	20	514	<.01	<.02	.06	.22
21	1.3	367	--	13	.2	--	380	<.01	.03	1.9	--
22	1.1	370	.80	10	.4	33	396	<.01	<.02	.89	.52
26	1.2	415	.60	12	.4	34	441	<.01	.26	1.7	.50
32	1.0	440	<.20	4.0	.4	32	--	<.01	.02	2.9	.56
26	1.2	441	1.2	2.6	.4	30	--	<.01	.02	6.6	.48
25	.90	402	1.0	3.4	.3	32	417	<.01	<.02	1.2	.38
40	.90	682	40	10	.2	19	751	<.01	<.02	4.1	2.7
39	.80	741	40	13	.4	20	796	<.01	<.02	5.4	2.6
33	1.0	660	60	12	.4	19	727	<.01	<.02	3.1	1.7
36	<1.0	723	45	13	.4	17	--	<.01	.02	2.1	1.9
39	1.1	711	67	12	.5	22	807	--	--	4.4	2.8
40	.75	740	52	12	.5	22	612	<.01	<.02	4.5	2.5
13	1.1	478	16	6.6	.2	17	501	<.01	<.02	.62	--
13	1.6	443	3.2	11	.4	16	450	<.01	.02	.60	1.6
13	1.3	480	16	14	.2	16	510	<.01	<.02	.74	1.1
13	.90	466	16	14	.4	16	509	<.01	<.02	.78	1.4
14	1.0	477	18	11	.4	17	507	<.01	<.02	.72	1.1
13	.93	470	14	8.9	.4	17	486	<.01	<.02	.89	1.1
70	.80	567	37	32	.7	39	698	<.01	.11	.90	--
66	.70	588	36	36	.7	22	684	<.01	<.02	.14	1.7
67	1.0	588	40	54	.6	22	709	<.01	<.02	.20	1.4
64	<1.0	596	37	46	.9	21	--	<.01	.02	.33	1.5
75	1.0	596	61	52	.9	23	738	<.01	<.02	.20	1.5
--	.65	579	64	52	.8	21	--	<.01	<.02	.05	1.4