U.S. Department of the Interior
U.S. Geological Survey

Prepared in cooperation with the
Louisiana Department of Natural Resources

Scientific Investigations Map 3339

Introduction

The Catahoula aquifer is an important source of fresh groundwater in an area of central Louisiana that includes parts of Catahoula, Concordia, Grant, La Salle, Natchitoches, Rapides, Sabine, Tensas, and Vernon Parishes. In 2010, about 3.96 million gallons per day (Mgal/d) (table 1) were withdrawn from the Catahoula aquifer in Louisiana (Sargent, 2011). About 89 percent (3.51 Mgal/d) of the water was withdrawn for public-supply use (B.P. Sargent, U.S. Geological Survey, written commun., 2013), and about 49 percent (1.93 Mgal/d) was withdrawn in Catahoula Parish.

Additional knowledge about the effects of withdrawals on water levels and flow directions in the Catahoula aquifer is needed to assess the current condition of the aquifer. The most recent potentiometric map constructed for the Catahoula aquifer in Louisiana was published more than 25 years ago (Martin and Whiteman, 1986). An updated potentiometric map is needed to spatially visualize water levels and the effects of pumping and to delineate cones of depression, water-level gradients, and flow paths.

In 2012, the U.S. Geological Survey (USGS) in cooperation with the Louisiana Department of Natural Resources began a study to document current water levels in selected aquifers in Louisiana. This report presents water-level data and a map that illustrates the potentiometric surface of the Catahoula aquifer in 2013. The data were collected during the period May to September 2013. The potentiometric-surface map (fig. 1) can be used for determining the direction of groundwater flow, hydraulic gradients, and effects of withdrawals on water levels. Water-level data collected for this study are stored in the USGS National Water Information System and are on file at the USGS office in Baton Rouge, La.

Table 1. Groundwater withdrawals from the Catahoula aquifer in the study area, 2005 and 2010 (Sargent 2007, 2011).

Parish	Withdrawals by parish (million gallons per day)	
	1990	2010
Catahoula	1.14	1.93
Concordia	0.32	0.41
Grant	0.47	0.61
La Salle	0.07	0.16
Natchitoches	0.03	0.03
Rapides	0.51	0.59
Sabine	0.06	0.05
Vernon	0.14	0.18
Total	2.74	3.96

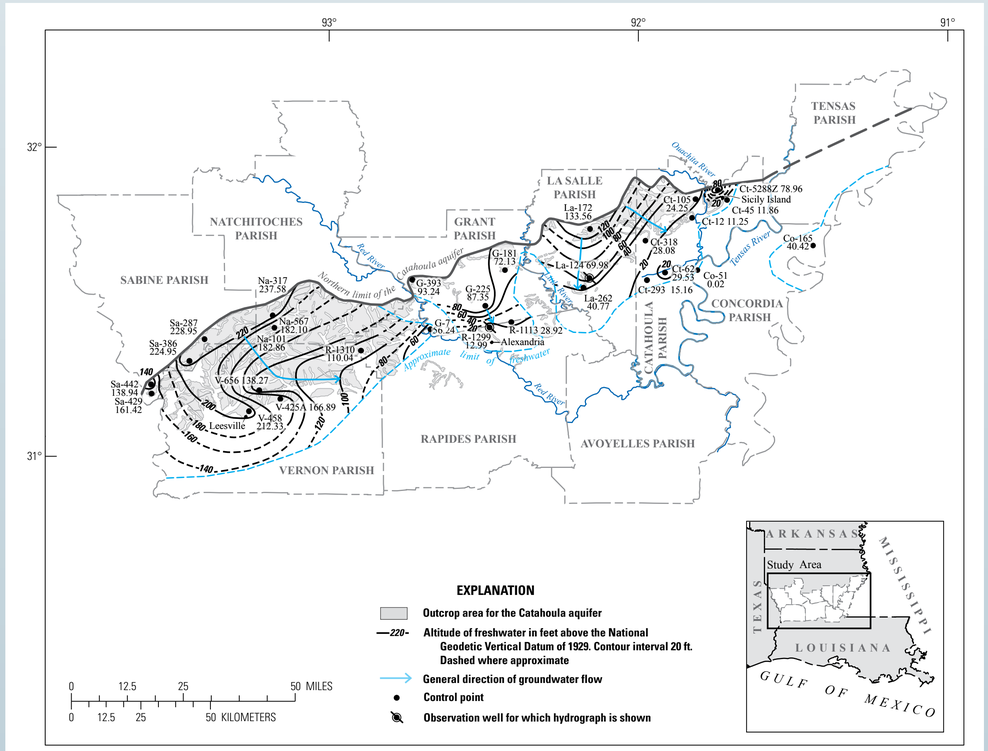

Figure 1. Potentiometric surface of the Catahoula aquifer in central Louisiana, 2013.

Hydrogeology

The Catahoula aquifer crops out in a narrow band across north-central Louisiana (fig. 1). This band is broken by alluvial deposits in the valleys of the Red, Little, and Ouachita Rivers that have incised into the aquifer. In Grant, La Salle, and Catahoula Parishes, the Catahoula aquifer is overlain by a thin veneer of Quaternary terrace deposits in upland areas between major stream valleys. South of this outcrop-subcrop area, the aquifer dips towards the south and southeast, is overlain and confined by clays of the Lena Member of the Fleming Formation, and is underlain by clays of the Vicksburg and Jackson Groups (fig. 2). Saltwater ridges under the Red, Little, and Tensas River Valleys divide the freshwater extents of the Catahoula aquifer and limit the flow of freshwater between these areas (Gaydos and others, 1973). The small area of freshwater in the aquifer in northeastern Concordia Parish and southeastern Tensas Parish is part of a large area of freshwater in the Catahoula aquifer in Mississippi.

The Catahoula aquifer generally ranges in thickness from about 50 feet (ft) in the outcrop area to about 450 ft in southern Vernon Parish. Sand beds in the aquifer are generally discontinuous, lenticular, and interbedded with silts and clays (Martin and Whiteman, 1986). The sands of the aquifer are typically white to light gray and range from very fine to very coarse grained, with various degrees of sorting (Newcome and others, 1963).

Beneath the upland areas, within the outcrop-subcrop area, water-table conditions commonly occur in the upper part of the Catahoula aquifer. The lower part of the aquifer beneath the upland areas and the full thickness of the aquifer beneath the alluvium are generally under artesian conditions (Martin and Whiteman, 1986).

Recharge to the Catahoula aquifer is primarily from infiltration of rainfall in the upland outcrop-subcrop area and leakage from underlying aquifers. Discharge is to streams and small springs and from wells. The depths of wells screened in the Catahoula aquifer generally range from less than 200 ft below land surface in upland areas to 1,880 ft deep along the downdip limit of freshwater in Rapides Parish.

System	Series	Stratigraphic unit	Hydrogeologic unit	
			Central Louisiana	
			Aquifer system or confining unit	Aquifer or confining unit
Quaternary	Pleistocene	Red River alluvial deposits Mississippi River alluvial deposits Northern Louisiana terrace deposits Unnamed Pleistocene deposits	Chicot aquifer or surficial confining unit	
Tertiary	Pliocene	Fleming Formation: Blounts Creek Member	Evangeline aquifer or surficial confining unit	
	?			
	Miocene	Castor Creek Member	Castor Creek confining unit	
		Williamson Creek Member Dough Hills Member Carnahan Bayou Member	Jasper aquifer system or surficial confining unit	Williamson Creek aquifer Dough Hills confining unit Carnahan Bayou aquifer
		Lena Member	Lena confining unit	
	?			
	Oligocene	Catahoula Formation	Catahoula aquifer	
		Vicksburg Group, undifferentiated	No freshwater occurs in older aquifers	
Eocene		Jackson Group, undifferentiated		

(modified from Lovelace and others, 1995)

Figure 2. Hydrogeologic column of aquifers in central Louisiana.

Potentiometric Surface

The potentiometric surface of the Catahoula aquifer (fig. 1) was constructed by using the altitude of water levels measured at 29 wells during the period May through September 2013 (table 2). Water levels were measured by using a steel or electric tape marked with 0.01-ft graduations. Water-level measurements were reported to 0.01 ft. Wells in which water levels were measured were not being pumped at the time of measurement. Two or more measurements were collected at each well to ensure the water level was static. The altitude of water levels ranged from 0.02 ft above the National Geodetic Vertical Datum of 1929 (NGVD 29) in well Co-51 to 238 ft above NGVD 29 in well Na-317 (table 2). Groundwater movement in the Catahoula aquifer is generally to the southeast and towards discharge areas beneath the Sabine, Red, Little, and Tensas River Valleys (fig. 1). Much of the water flowing southward in areas between the river valleys is discharged by upward leakage through the confining layer to overlying sediments (Martin and Whiteman, 1986).

A visual comparison with the generalized potentiometric map of the Catahoula aquifer for 1980 (Martin and Whiteman, 1986) indicates that water levels in most areas of the aquifer generally declined about 20 ft between 1980 and 2013. The hydrograph for well La-124 (depth of 365 ft), located in La Salle Parish, shows seasonal fluctuations and about a 27-ft decline since 1971, when the well was drilled (fig. 3). The hydrograph for well R-1299 (depth of 1,060 ft), located in central Rapides Parish, also shows seasonal fluctuations but shows a much larger decline of about 67 ft since the well was drilled in 1986 (fig. 4). Withdrawals from the Catahoula aquifer increased about 45 percent (2.74 to 3.96 Mgal/d) during the period 2005–10 (Sargent, 2007), primarily for public supply. The largest withdrawal increase was in Catahoula Parish (table 1).

Table 2. Water-level data used to construct the potentiometric-surface map of the Catahoula aquifer in central Louisiana, May–September 2013.

[NGVD 29, National Geodetic Vertical Datum of 1929]

Well number	Well depth (in feet)	Water level (in feet below land surface)	Water level (in feet above NGVD 29)	Date measured
Catahoula Parish				
Ct-12	405	88.75	11.25	07-16-13
Ct-45	229	54.14	11.86	07-24-13
Ct-62	736	25.47	29.53	07-16-13
Ct-105	189	25.75	24.25	07-24-13
Ct-293	402	36.84	15.16	07-16-13
Ct-318	346	61.92	28.08	07-16-13
Ct-5288Z	220	146.04	78.96	07-24-13
Concordia Parish				
Co-51	740	54.98	0.02	07-29-13
Co-165	335	25.58	40.42	07-29-13
Grant Parish				
G-7	560	23.76	56.24	05-21-13
G-181	353	140.87	72.13	05-22-13
G-225	473	102.65	87.35	06-26-13
G-393	75	28.76	93.24	07-15-13
La Salle Parish				
La-124	365	91.02	69.98	07-30-13
La-172	97	46.44	133.56	07-29-13
La-262	431	149.23	40.77	06-26-13
Natchitoches Parish				
Na-101	270	115.14	182.86	05-21-13
Na-317	254	122.42	237.58	07-01-13
Na-567	220	115.90	182.10	05-21-13
Rapides Parish				
R-1113	852	147.08	28.92	05-23-13
R-1299	1,060	147.01	12.99	07-24-13
R-1310	535	99.96	110.04	05-21-13
Sabine Parish				
Sa-287	208	81.05	228.95	09-25-13
Sa-386	131	17.05	224.95	07-02-13
Sa-429	356	105.58	161.42	09-25-13
Sa-442	210	61.06	138.94	09-25-13
Vernon Parish				
V-425A	1,792	138.11	166.89	06-04-13
V-458	1,200	27.67	212.33	05-20-13
V-656	1,478	241.73	138.27	09-25-13

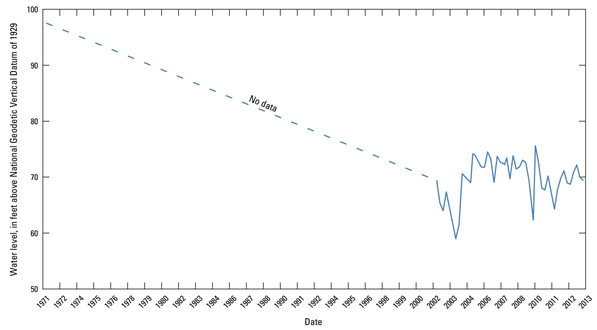

Figure 3. Hydrograph of well La-124, La Salle Parish, Louisiana.

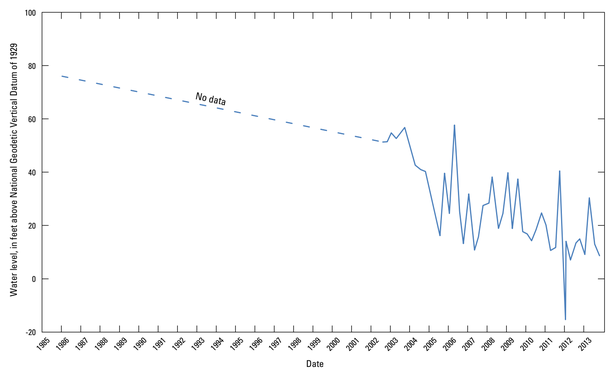

Figure 4. Hydrograph of well R-1299, Rapides Parish, Louisiana.

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2015

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For sale by U.S. Geological Survey, Information Services, Box 25286, Federal Center, Denver, CO 80225, 1-888-ASK-USGS

Digital files available at http://dx.doi.org/10.3133/sim3339

Suggested citation: Fendick, R.B., Jr., and Carter, Kayla, 2015, Potentiometric surface of the Catahoula aquifer in central Louisiana, 2013: U.S. Geological Survey Scientific Investigations Map 3339, 1 sheet, http://dx.doi.org/10.3133/sim3339.

Printed on recycled paper

ISSN 2329-1311 (print)
ISSN 2329-132X (online)
http://dx.doi.org/10.3133/sim3339