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QUALITY OF WATER FROM SHALLOW WELLS IN URBAN RESIDENTIAL AND LIGHT COMMERCIAL AREAS IN LAFAYETTE PARISH, LOUISIANA, 2001 THROUGH 2002

Water-Resources Investigations Report 03-4118

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

Front cover: Drilling operations in urban residential and light commercial settings in Lafayette, Louisiana

Background and lower left photographs by Roland W. Tollett, U.S. Geological Survey
Lower right photograph by Robert B. Fendick, Jr., U.S. Geological Survey

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Baton Rouge, Louisiana

2004

U.S. DEPARTMENT OF THE INTERIOR
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U.S. GEOLOGICAL SURVEY
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Information regarding the National Water-Quality Assessment (NAWQA) Program is available on the Internet via the World Wide Web. You may connect to the NAWQA Home Page using the Universal Resource Locator (URL) at:

http://water.usgs.gov/nawqa

FOREWORD

The U.S. Geological Survey (USGS) is committed to serve the Nation with accurate and timely scientific information that helps enhance and protect the overall quality of life and facilitates effective management of water, biological, energy, and mineral resources. Information on the quality of the Nation's water resources is of critical interest to the USGS because it is so integrally linked to the long-term availability of water that is clean and safe for drinking and recreation and that is suitable for industry, irrigation, and habitat for fish and wildlife. Escalating population growth and increasing demands for the multiple water uses make water availability, now measured in terms of quantity *and* quality, even more critical to the long-term sustainability of our communities and ecosystems.

The USGS implemented the National Water-Quality Assessment (NAWQA) Program to support national, regional, and local information needs and decisions related to water-quality management and policy. Shaped by and coordinated with ongoing efforts of other Federal, State, and local agencies, the NAWQA Program is designed to answer: What is the condition of our Nation's streams and ground water? How are the conditions changing over time? How do natural features and human activities affect the quality of streams and ground water, and where are those effects most pronounced? By combining information on water chemistry, physical characteristics, stream habitat, and aquatic life, the NAWQA Program aims to provide science-based insights for current and emerging water issues. NAWQA results can contribute to informed decisions that result in practical and effective water-resource management and strategies that protect and restore water quality.

Since 1991, the NAWQA Program has implemented interdisciplinary assessments in more than 50 of the Nation's most important river basins and aquifers, referred to as Study Units. Collectively, these Study Units account for more than 60 percent of the overall water use and population served by public water supply and are representative of the Nation's major hydrologic landscapes, priority ecological resources, and agricultural, urban, and natural sources of contamination.

Each assessment is guided by a nationally consistent study design and methods of sampling and analysis. The assessments thereby build local knowledge about water-quality issues and trends in a particular stream or aquifer while providing an understanding of how and why water quality varies regionally and nationally. The consistent, multi-scale approach helps to determine if certain types of water-quality issues are isolated or pervasive and allows direct comparisons of how human activities and natural processes affect water quality and ecological health in the Nation's diverse geographic and environmental settings. Comprehensive assessments on pesticides, nutrients, volatile organic compounds, trace metals, and aquatic ecology are developed at the national scale through comparative analysis of the Study-Unit findings.

The USGS places high value on the communication and dissemination of credible, timely, and relevant science so that the most recent and available knowledge about water resources can be applied in management and policy decisions. We hope this NAWQA publication will provide you the needed insights and information to meet your needs and thereby foster increased awareness and involvement in the protection and restoration of our Nation's waters.

The NAWQA Program recognizes that a national assessment by a single program cannot address all water-resource issues of interest. External coordination at all levels is critical for a fully integrated understanding of watersheds and for cost-effective management, regulation, and conservation of our Nation's water resources. The Program, therefore, depends extensively on the advice, cooperation, and information from other Federal, State, interstate, Tribal, and local agencies, non-government organizations, industry, academia, and other stakeholder groups. The assistance and suggestions of all are greatly appreciated.

Robert M. Hirsch
Associate Director for Water

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CONVERSION FACTORS, DATUMS, ABBREVIATED WATER-QUALITY UNITS, AND ACRONYMS

Multiply	By	To obtain
inch (in.)	25.4	millimeter (mm)
inch per year (in/yr)	25.4	millimeter per year (mm/yr)
foot (ft)	0.3048	meter (m)
mile (mi)	1.609	kilometer (km)
million gallons per day (Mgal/d)	3,785	cubic meters per day (m^3/d)

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

Horizontal coordinate information in this report is referenced to the North American Datum of 1983.

Vertical coordinate information in this report is referenced to the National Geodetic Vertical Datum of 1929 (NGVD 29)--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:

micrograms per liter (µg/L)
microsiemens per centimeter at 25 degrees Celsius (µS/cm)
milligrams per liter (mg/L)
millimeters (mm)
nephelometric turbidity units (NTU)
picocuries per liter (pCi/L)
picograms per kilogram (pg/kg)
standard units (S.U.)

Acronyms:

ACAD, Acadian-Pontchartrain (Study Unit)
DOC, dissolved organic carbon
DOTD, Louisiana Department of Transportation and Development
HA, Health Advisory
MCL, Maximum Contaminant Level
MCLG, Maximum Contaminant Level Goal
MDL, Method Detection Limit
MMM, Multimedia Mitigation (Program)
NAWQA, National Water-Quality Assessment (Program)
SMCL, Secondary Maximum Contaminant Level
USEPA, U.S. Environmental Protection Agency
USGS, U.S. Geological Survey
VOC, volatile organic compound

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By Robert B. Fendick, Jr., and Roland W. Tollett

ABSTRACT

In 2001-02, the U.S. Geological Survey installed and sampled 28 shallow wells in urban residential and light commercial areas in Lafayette Parish, Louisiana, for a land-use study in the Acadian-Pontchartrain Study Unit of the National Water-Quality Assessment (NAWQA) Program. The wells were installed in the Chicot aquifer system, the primary source of water for irrigation and public-water supplies in southwestern Louisiana. The purpose of this report is to describe the quality of water from the 28 shallow wells and to relate that water quality to natural factors and to human activities. Ground-water samples were analyzed for general ground-water properties and about 240 water-quality constituents, including dissolved solids, major inorganic ions, trace elements, nutrients, dissolved organic carbon (DOC), radon, chlorofluorocarbons, selected stable isotopes, pesticides, pesticide degradation products, and volatile organic compounds (VOC's).

Dissolved-solids concentrations for two wells exceeded the U.S. Environmental Protection Agency Secondary Maximum Contaminant Level of 500 mg/L (milligrams per liter). Concentrations for major inorganic ions, trace elements, pesticides, degradation products, and VOC's were less than the Maximum Contaminant Levels for drinking water. Manganese concentrations for 18 wells exceeded the Secondary Maximum Contaminant Level of 50 micrograms per liter. Arsenic concentrations increased with depth and with increased pH, bicarbonate, calcium, and magnesium concentrations. Six pesticides and three degradation products were detected in the ground-water samples. Ten VOC's also were detected in the ground-water samples. One nutrient concentration (that for nitrite plus nitrate) was greater than 2 mg/L, a level that might indicate contamination from human activities, and was greater than the Maximum Contaminant Level of 10 mg/L. The median DOC concentration was an estimated 0.3 mg/L, which indicated naturally-occurring DOC conditions in the shallow ground water in Lafayette Parish. Quality-control samples indicated no bias in ground-water data from collection or analysis.

Radon concentrations for 19 of 20 wells sampled were greater than the U.S. Environmental Protection Agency Maximum Contaminant Level of 300 picocuries per liter (piC/L). Radon concentrations ranged from 280 to 2,220 piC/L and had a median of 389 piC/L. Radon concentrations were correlated moderately and inversely to the depth to the top of the screened interval. Chlorofluorocarbons indicated the apparent age of the ground water varied with water level and ranged from about 12 to 50 years.

The Mann-Whitney rank-sum test was used to compare water-quality data in the Chicot aquifer system between four groups of wells from three NAWQA studies. The means for most constituents were less for the urban wells than for wells in the rice-growing areas. The larger dissolved-solids concentrations, particularly sodium and chloride, for samples from wells in the rice-growing areas might be a result of heavy irrigation pumpage in southwestern Louisiana that causes movement of the constituents from deeper ground-water sources. The means for most constituents were greater for the urban wells than for wells in the outcrop area of the Chicot aquifer system and less for the urban wells than for wells south of the outcrop area. Because concentrations of dissolved solids and other chemical constituents generally increase along ground-water flow paths, concentrations of many of the selected chemical constituents were expected to be larger for samples from the urban wells than from wells in the outcrop area. The larger concentrations for samples from the wells south of the outcrop area compared to those for the urban wells might be explained similarly. The wells south of the outcrop area are deeper than the urban wells, thus increasing the time the water has to react with aquifer sediments. The lack of correlation between the four groups of wells suggests that spatial distribution of wells and the depth to the top of the screened interval affected the quality of water in shallow wells in southwestern Louisiana.

INTRODUCTION

Ground water is one of the Nation's most important resources and is the source of drinking water for about 50 percent of the population, or about 130 million United States residents (U.S. Geological Survey, 1999b). Therefore, in 1991, the U.S. Geological Survey (USGS) began full implementation of the National Water-Quality Assessment (NAWQA) Program to describe the status and trends in the quality of the Nation's surface- and ground-water resources and to determine the natural and human-related factors that affect water quality (Hirsch and others, 1988; Gilliom and others, 1995). More than 50 major river basins or aquifer systems, referred to as Study Units, have been identified for investigation as part of the NAWQA Program. Together, these basins and aquifer systems include water resources available to more than 60 percent of the population and encompass about one-half of the land area in the conterminous United States. Knowledge of the quality of the Nation's surface- and ground-water resources is important for the protection of human and aquatic health and for the management of land and water resources and the conservation and regulation of those resources.

Ground-water studies in the NAWQA Program include (1) subunit surveys, which are designed to assess the water quality of major aquifer systems within a Study Unit; and (2) land-use studies, which are designed to assess the quality of recently recharged ground water associated with regionally extensive combinations of land use and hydrogeologic conditions (Gilliom and others, 1995). During 1997-2002, two subunit surveys (one for the Chicot aquifer system and one for the Chicot equivalent aquifer system) and two land-use studies (an agriculture study and an urban study) were completed for the Acadian-Pontchartrain (ACAD) Study Unit of the NAWQA Program. The ACAD Study Unit encompasses most of southern Louisiana and a small part of southwestern Mississippi (fig. 1).

A land-use study was begun in 2001 for urban residential and light commercial areas in Lafayette Parish, Louisiana. Objectives of the study were to assess the occurrence and distribution of water-quality constituents in recently recharged ground water (generally less than 20- to 30-years old) associated with urban land use in the study area and to gain an understanding of the natural and human-related factors that affect ground-water quality. Data from the study can be compared to data from similar studies throughout the United States to assess the quality of the Nation's water resources, to determine any long-term changes in water quality, and to identify the natural and human-related factors that might affect water quality (Gilliom and others, 1998).

Lafayette Parish was selected for the urban land-use study because the city of Lafayette is the seventh fastest growing city in Louisiana (U.S. Census Bureau, 2002) and because the urban residential and light commercial areas of Lafayette Parish overlie the Chicot aquifer system. The Chicot aquifer system is the primary source of water for irrigation and public-water supplies in southwestern Louisiana, including Lafayette Parish, and, in 1988, was declared a Sole Source Aquifer by the U.S. Environmental Protection Agency (USEPA) (U.S. Environmental Protection Agency, 2002d). This designation recognizes that the aquifer system is the sole or principal source of drinking water for the area and also recognizes that no alternative sources of drinking water are reasonably available should the aquifer system become contaminated. Water in the Chicot aquifer system is vulnerable to the effects of land-surface activities in many areas of Lafayette Parish because of shallow depths to ground water. Vertical leakage through the surficial confining unit that overlies the aquifer system and large ground-water withdrawals for public supply and irrigation near pumping centers might contribute to the potential for downward migration of contaminants.

Purpose and Scope

The purpose of this report is to describe the quality of water from 28 shallow wells in urban residential and light commercial areas in Lafayette Parish and to relate that water quality to natural factors, such as depth to ground water, and to human activities, such as pesticide and fertilizer use. Ground-water samples from the wells were analyzed for 6 general ground-water properties, dissolved solids, 10 major inorganic ions, 23 trace elements, 6 nutrients, dissolved organic carbon (DOC), radon, chlorofluorocarbons (CFC's), selected stable isotopes, 102 pesticides and pesticide degradation products, and 85 volatile organic compounds (VOC's). The Spearman rank correlation test was used to determine whether significant correlations existed between selected physical properties and chemical constituents and the number of pesticides and VOC's detected, and the Mann-Whitney rank-sum test was used to compare the quality of water in the Chicot aquifer system in urban areas to the quality of water in the Chicot aquifer system in agricultural (rice-growing) and rural areas. Although the shallow wells sampled for this report are not used as a drinking-water source, many of the constituents in the water are regulated in public drinking-water supplies by the USEPA. These standards can be used as a frame of reference to evaluate the water quality. The 28 shallow wells are referred to as urban (URB) wells in discussion of selected statistical results.

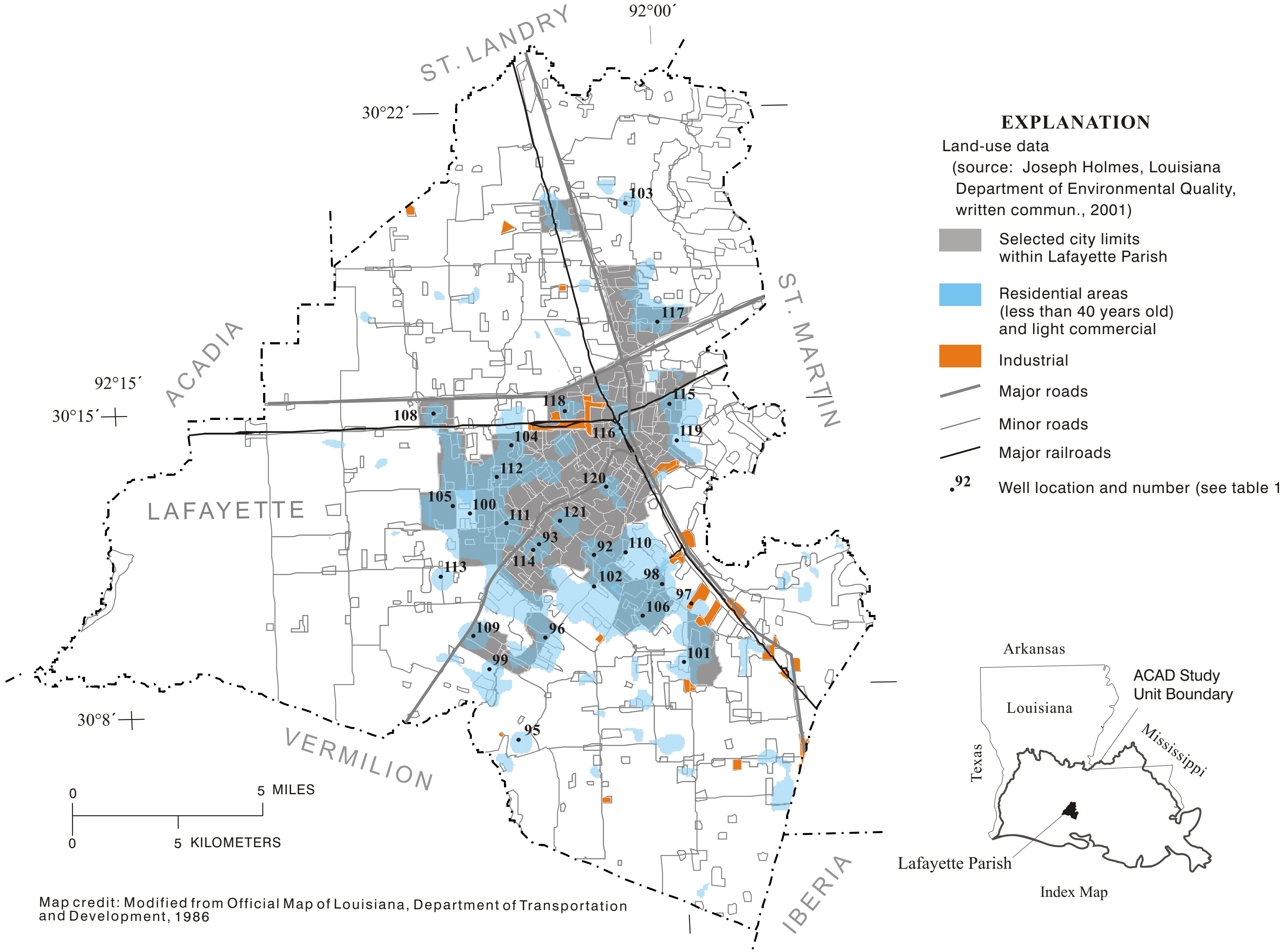


Figure 1. Study area and well locations in urban residential and light commercial areas in Lafayette Parish, Louisiana.

Acknowledgments

The authors express appreciation to Ms. Hazel D. Myers, Mayor of Scott, and to landowners in the study area for allowing the USGS to install and sample wells located on their property. The authors also thank Terry Huval (Lafayette Utilities System, Director of Utilities) and Don Broussard (Lafayette Utilities System, Water Operations Manager) for their cooperation and participation in the installation of the wells.

DESCRIPTION AND CLIMATE OF LAFAYETTE PARISH

Lafayette Parish is located in southwestern Louisiana (fig. 1). Land-surface elevations in the parish range from about 15 to 80 feet above NGVD 29. Lafayette Parish is drained primarily by the Vermilion River.

The climate in southwestern Louisiana is humid and subtropical. Annual rainfall at the Lafayette Regional Airport averaged 62.2 inches for 1971-2000 (Elizabeth Mons, Louisiana State Office of Climatology, written commun., 2000). Total rainfall at the airport for 2001 was 75.6 inches, which is 13.4 inches greater than the 30-year normal for 1971-2000, and total rainfall at the airport for January through October 2002 was 65.6 inches, which also is greater than the 30-year normal for 1971-2000. The average temperature at the airport for 2001 was 67.9° F, which is 0.4° F less than the 30-year normal for 1971-2000.

Hydrogeologic Setting

The Chicot aquifer system is a thick sequence of interbedded clays, silts, sands, and gravels and underlies most of southwestern Louisiana, including Lafayette Parish, and parts of eastern Texas. The sediments, deposited in deltaic and near-shore marine environments during the Pleistocene Epoch, dip and thicken southward to the Gulf Coast (Lovelace, 1999) and are characterized by massive beds of coarse sand and gravel separated by beds of clay. The sands generally are several hundred feet thick and are separated in places by thick discontinuous clays (Nyman and others, 1990). Recharge to the Chicot aquifer system occurs (1) from downward percolation of water in the outcrop area, which is about 40 miles northwest of Lafayette Parish; (2) through the Atchafalaya aquifer east of Lafayette Parish (fig. 2); (3) from vertical leakage through surficial clay units; and (4) to a lesser extent, from upward leakage from the underlying Evangeline aquifer (Lovelace, 1999).

Overlying the Chicot aquifer system is a layer of clay that acts as a surficial confining unit. The confining unit is areally extensive throughout most of southwestern Louisiana and generally averages about 100 feet in thickness. In Lafayette Parish, the surficial confining unit ranges from less than 40 feet to about 160 feet in thickness and generally is less than 80 feet thick beneath the city of Lafayette (B.P. Sargent, USGS, written commun., 2002). The confining unit once was thought to be an impermeable layer, but ground-water model results indicate that as much as 6 inches per year of water, primarily infiltration from the surface, recharges the Chicot aquifer system near major pumping centers (Nyman and others, 1990, p. 33).

<table>
<tr><th rowspan="3">System</th><th rowspan="3">Series</th><th colspan="4">Hydrogeologic units</th></tr>
<tr><th rowspan="2">Aquifer system or confining unit</th><th>Aquifer or confining unit</th><th rowspan="2">Aquifer or aquifer system</th><th>Aquifer</th></tr>
<tr><th>Southwestern Louisiana (rice-growing area) and western Lafayette Parish</th><th>Eastern Lafayette Parish (urban area)</th></tr>
<tr><td rowspan="3">Quaternary</td><td rowspan="3">Pleistocene</td><td rowspan="3">Chicot aquifer system or surficial confining unit</td><td>Chicot surficial confining unit or shallow sand</td><td>Mississippi River alluvial aquifer</td><td>Atchafalaya aquifer</td></tr>
<tr><td>Upper sand</td><td rowspan="2">Chicot aquifer system</td><td>Upper sand</td></tr>
<tr><td>Lower sand</td><td>Lower sand</td></tr>
<tr><td rowspan="2">Tertiary</td><td>Pliocene
?</td><td rowspan="2" colspan="4">Evangeline aquifer</td></tr>
<tr><td>Miocene</td></tr>
</table>

Figure 2. Partial column of hydrogeologic units in Lafayette Parish, Louisiana (modified from Nyman, 1989; Lovelace, 1999).

Land Use, Water Use, and Population

Soybean and rice agriculture combined is the major land use in Lafayette Parish. That land use is followed by urban land use in amount of area (fig. 3). During 1999-2000, ground water in Lafayette Parish was used primarily for public supply and rice irrigation. The Chicot aquifer system supplied about 38 Mgal/d of ground water to the parish (Sargent, 2002). Of that, more than 21 Mgal/d was used for public supply and almost 9 Mgal/d was used for rice irrigation. In 2001, the city of Lafayette had a population of 116,000 and Lafayette Parish had a population of about 190,000 (U.S. Census Bureau, 2002).

METHODS

NAWQA guidelines used to design the land-use study discussed in this report are described in USGS Circular 1112 (Gilliom and others, 1995). NAWQA ground-water protocols (Lapham and others, 1997; Koterba, 1998) were followed during data collection. Standardization of the data-collection protocols was intended to produce a nationally consistent data base for statistically valid interpretations. However, because of local conditions, modification of the national protocols sometimes was necessary. The following sections describe how the protocols were applied and, when necessary, how they were modified.

Well-Site Selection

Well-site selection criteria followed the criteria published in Squillace and Price (1996). The criteria originally required that the sites be located (1) where the shallow aquifer in Lafayette Parish is used as a source of drinking water and (2) where urban residential and light commercial areas (fig. 1) were developed between 1970 and the 1990's. The second criterion later was modified to include urban residential areas developed between 1960 and 1998 because a larger geographic area was needed to space the required number of wells. After the urban residential and light commercial area boundaries were determined, a computer-generated program (Scott, 1990) was used to divide the total area selected into 30 equal-area cells. The program then randomly selected locations in each of the 30 cells. A field inventory of the potential sites was performed to determine the approximate percentage of urban residential and light commercial area within a 1,640 foot radius of each site. In a few instances, permission was not obtained to drill a well near the selected point and the search was expanded to nearby areas within the cell. A total of 28 wells were drilled in the urban residential and light commercial areas in Lafayette Parish (fig. 1).

Well Installation, Well Construction, and Water Levels

The shallow wells were drilled between May and November 2001. The wells were drilled by USGS personnel using hollow-stem augers and a truck-mounted drill rig. All wells were constructed according to NAWQA guidelines (Lapham and others, 1997) and according to Louisiana State regulations (Louisiana Department of Environmental Quality and Louisiana Department of Transportation and Development, 2000). Wells were constructed using 2-inch outside-diameter polyvinyl chloride (PVC) flush threaded casing and screens. Annular spaces around the well screens were sand packed, and then the annular spaces above the screened intervals were sealed with bentonite and cemented to land surface to prevent downward migration of surficial fluids. Cuttings brought to the surface during drilling were visually inspected to describe the lithology at each drill site. Drilling equipment was pressure washed and steam cleaned before being moved to the next drill site to prevent potential cross contamination between wells.

All wells were developed using a combination of pumping and surging to remove as much sediment as possible. The developing tools consisted of an electrically operated pump, 5/8-inch outside-diameter high-density polyethylene tubing, a PVC foot valve, and a PVC surge block. The tubing, foot valve, and surge block were dedicated to individual wells to prevent possible cross contamination. Wells were developed until discharging water cleared. Development times ranged from about 2 hours to as many as 15 hours per well.

The wells ranged in depth from 11 to 79 feet below land surface and had a median depth of 58.5 feet (table 1). Water levels ranged from 2.50 to 61.55 feet below land surface. Borehole lithology was determined from inspection of drill cuttings obtained from above the screened water-bearing sediment. Interlayering and changes in sediment size occurred on scales ranging from inches to tens of feet. Sediment sizes consisted of clay, silt, sand, and some gravel.

Ground-Water Sample Collection and Processing

All wells were sampled from December 2001 through March 2002. Wells were purged and sampled using a portable, stainless steel submersible

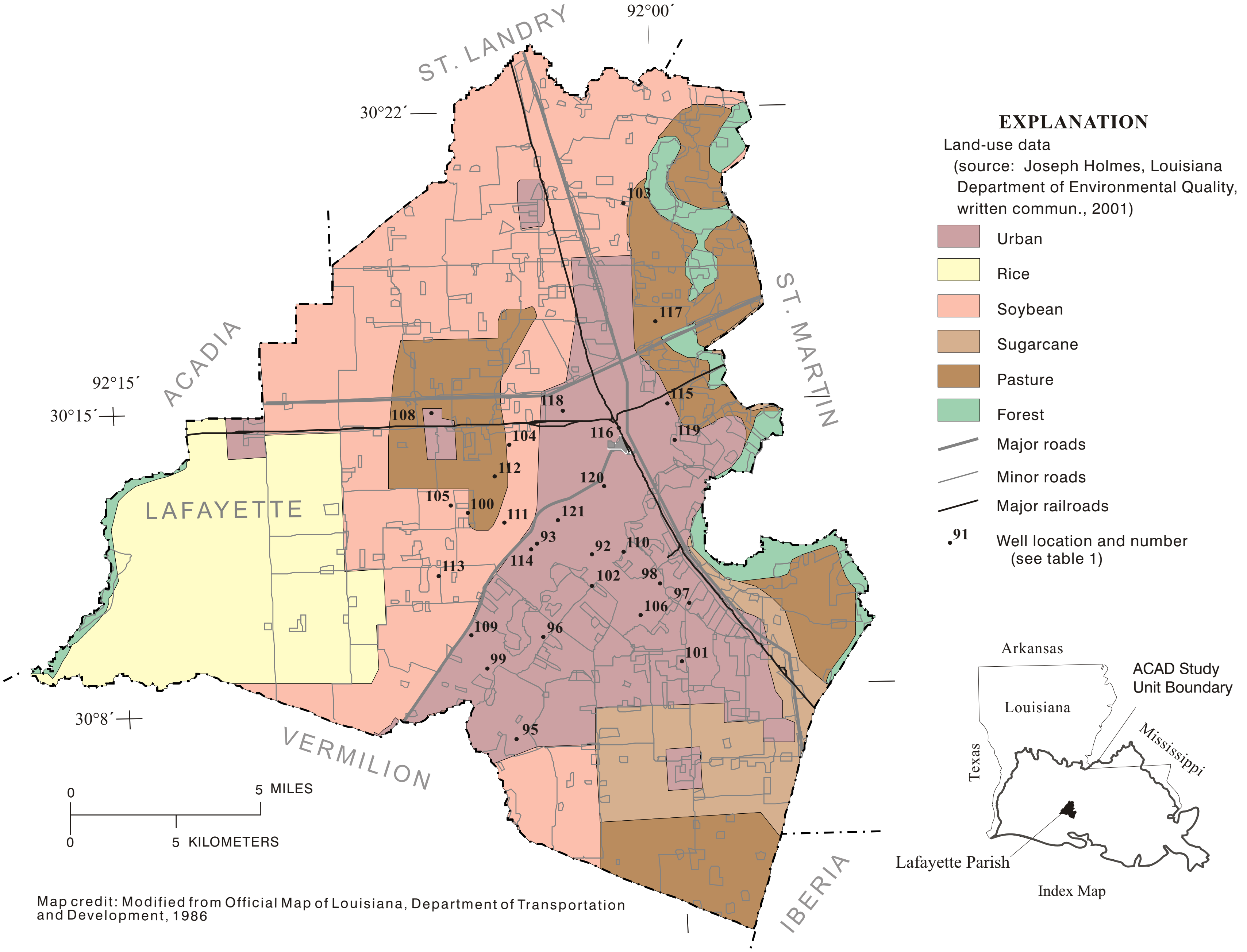


Figure 3. Major land-use types in Lafayette Parish, Louisiana.

Table 1. Site and construction information for selected shallow wells in urban residential and light commercial areas in Lafayette Parish, Louisiana, 2001-02

[All wells were constructed of 2-inch polyvinyl chloride casings and screen; ACAD, Acadian-Pontchartrain Study Unit of the National Water-Quality Assessment Program; DOTD, Louisiana Department of Transportation and Development; USGS, U.S. Geological Survey; NGVD 29, National Geodetic Vertical Datum of 1929]

ACAD well number (fig. 1)	DOTD local well number	USGS site identification number	Water-level measurement and sample date	Date well constructed	Land-surface elevation above NGVD 29 (feet)	Well depth (feet below land surface)	Water level (feet below land surface)	Depth to top of screen (feet below land surface)	Depth to bottom of screen (feet below land surface)	Sample depth (feet below land surface)	ACAD well number (fig. 1)
92	Lf-9913Z	301058092015001	2/06/02	5/15/01	32	11	2.50	6	11	5	92
93	Lf-9914Z	301114092031901	12/20/01	5/23/01	30	50	42.01	40	50	45	93
95	Lf-9968Z	300643092040301	12/04/01	7/30/01	20	45	33.63	35	45	37	95
96	Lf-9969Z	300906092031301	12/05/01	7/31/01	26	54	37.35	44	54	43	96
97	Lf-9973Z	300946091591601	1/208/02	8/03/01	38	49	39.57	39	49	43	97
98	Lf-9974Z	301014092000102	2/06/02	9/05/01	36	21	5.70	11	21	10	98
99	Lf-9998Z	300825092044501	12/05/01	8/14/01	25	59	41.51	49	59	48	99
100	Lf-9975Z	301202092050501	12/04/01	8/20/01	29	67	45.90	57	67	56	100
101	Lf-9976Z	300824091593201	1/23/02	8/21/01	34	51	36.16	41	51	40	101
102	Lf-9999Z	301015092015001	3/14/02	8/22/01	31	59	37.64	49	59	48	102
103	Lf-10000Z	301907092003401	2/07/02	8/28/01	56	79	61.55	69	79	68	103
104	Lf-10001Z	301336092035401	12/03/01	9/12/01	32	63	47.95	53	63	52	104
105	Lf-10009Z	301213092053501	1/30/02	9/13/01	29	57	47.91	47	57	50	105
106	Lf-10010Z	300932092003701	2/04/02	9/25/01	33	51	38.52	41	51	40	106
108	Lf-10012Z	301424092055801	12/06/01	10/01/01	36	74	54.63	64	74	63	108
109	Lf-10013Z	300916092051901	2/11/02	10/09/01	27	56	42.39	46	56	45	109
110	Lf-10014Z	301100092005801	1/22/02	10/10/01	26	45	34.59	35	45	38	110
111	Lf-10015Z	301147092040701	1/29/02	10/22/01	31	62	45.00	52	62	51	111
112	Lf-10016Z	301253092042001	12/19/01	10/23/01	31	76	48.30	66	76	65	112
113	Lf-10017Z	301035092055801	1/29/02	10/24/01	25	66	45.00	56	66	55	113
114	Lf-10180Z	301107092033001	12/19/01	10/25/01	28	64	42.50	54	64	53	114
115	Lf-10181Z	301425091593901	1/30/02	10/25/01	42	58	43.29	48	58	47	115
116	Lf-10026Z	301355092005601	2/14/02	10/29/01	39	65	45.96	55	65	54	116
117	Lf-10027Z	301619091595301	12/11/01	11/05/01	25	44	28.54	34	44	33	117
118	Lf-10028Z	301421092022901	2/07/02	11/05/01	39	67	49.81	57	67	56	118
119	Lf-10029Z	301332091593001	2/04/02	10/31/01	37	60	48.29	50	60	51	119
120	Lf-10030Z	301234092012401	12/11/01	11/10/01	30	56	44.95	46	56	48	120
121	Lf-10031Z	301148092024101	2/13/02	11/10/01	32	61	43.77	51	61	50	121

pump attached to a Teflon discharge line and Teflon-coated power lines with stainless steel fittings. Before sample collection, the wells were purged of three casing volumes to remove stagnant water. Specific conductance, pH, temperature, and dissolved oxygen were measured about every 5 minutes in a flow-through chamber until stable readings were obtained. Turbidity also was measured at this time using a portable turbidity meter. After stable readings were obtained for the physical properties, water was redirected to the clean sampling chamber where samples were collected immediately. Ground-water samples were collected and processed according to protocols described in Koterba and others (1995). To minimize the risk of sample contamination, all sample collection and preservation took place in dedicated environmental sampling chambers that consisted of clear polyethylene bags supported by a PVC frame. Polyethylene bags that formed the sample-collection and -preservation chambers were replaced between each sample-collection site. After all samples were collected at a well, sampling equipment was cleaned with a nonphosphate detergent wash followed by a tap-water rinse and deionized-water rinses. A final methanol rinse was used to clean the pesticide sampling equipment. All sampling equipment was stored in clean plastic bags or containers for transport between sample-collection sites.

Most ground-water samples were chilled and shipped to the National Water Quality Laboratory (NWQL) in Lakewood, Colorado, for analysis. Constituents, analytical methods, and references are listed in table 2.

Quality-Control Data Analysis

Quality-control (QC) data were collected to insure sample-collection, sample-processing, and laboratory-analysis procedures did not introduce bias into results and to determine the variability associated with collection and analysis of samples. QC samples collected included field-blank samples, replicate environmental samples, and field- and laboratory-spike samples (Mueller and others, 1997). Field-blank samples were collected to verify that decontamination procedures were sufficient and that collection and analysis procedures did not contaminate the samples. Replicate environmental samples were collected to assess the effects of sample collection and laboratory analysis on measurement variability. The spike samples (field and laboratory) were environmental samples to which known concentrations of the analytes of interest were added to determine the accuracy and precision of organic analyses, the stability of analytes during typical holding times, and whether characteristics of the environmental sample might interfere with the analysis.

Field-blank samples were collected and analyzed at two sites for concentrations of major inorganic ions, trace elements, nutrients, DOC,

Table 2. Methods used to analyze ground-water samples from selected shallow wells in urban residential and light commercial areas in Lafayette Parish, Louisiana

[AA, atomic absorption spectrometry; ICP, inductively coupled plasma; MS, mass spectrometry; UV, ultraviolet; ^{2}H, deuterium; ^{1}H, hydrogen; ^{18}O, oxygen-18; ^{16}O, oxygen-16; C, carbon]

Constituent	Analytical method	Reference
Major inorganic ions	AA, colorimetry, or ICP	Fishman and Friedman (1989) and Fishman (1993)
Trace elements	AA or ICP-MS	Faires (1993), McLain (1993), and Garbarino (1999)
Nutrients	Colorimetry	Fishman (1993), U.S. Environmental Protection Agency (1993), and Patton and Truitt (2000)
Dissolved organic carbon	UV-persulfate oxidation and infrared spectrometry	Brenton and Arnett (1993)
Radon	Liquid scintillation	American Society for Testing and Materials (1996)
Chlorofluorocarbons	Gas chromatography with electron capture device	Busenberg and Plummer (1992)
$^{2}H/^{1}H$	Hydrogen equilibrium and mass spectrometry	Coplen and others (1991)
$^{18}O/^{16}O$	Carbon dioxide equilibrium and mass spectrometry	Epstein and Mayeda (1953)
Pesticides and pesticide degradation products	Solid-phase extraction using a C-18 cartridge and gas chromatography/mass spectrometry	Zaugg and others (1995)
	Determination of low concentrations of acetochlor in water by automated solid-phase extraction and gas chromatography with mass selective detection	Lindley and others (1996)
	Graphitized carbon-based solid-phase extraction and high-performance liquid chromatography/mass spectrometry	Furlong and others (2001)
Volatile organic compounds	Purge and trap capillary gas chromatography/mass spectrometry	Rose and Schroeder (1995)

pesticides, and VOC's. Few water-quality constituents analyzed for were detected in the field-blank samples. Major inorganic ion and DOC concentrations were less than the analytical reporting limits, and most trace-element concentrations were at or less than the analytical reporting limits. The copper concentration in one field-blank sample was 3.4 µg/L, slightly greater than the analytical reporting limit and less than the concentrations in most of the environmental samples. No nutrients, pesticides, or VOC's were detected in the field-blank samples. The results of the field-blank sample analyses indicated decontamination procedures were adequate to prevent contamination of samples.

Replicate environmental samples were collected at three sites for concentrations of all constituents. The relative percent difference between the environmental sample and the corresponding replicate sample was calculated by multiplying 100 by the absolute value of the difference between the environmental and replicate concentrations divided by the summation of the environmental and replicate concentrations. The relative percent difference between the environmental samples and the corresponding replicate samples typically was less than 5 percent. One value for cobalt (11 percent), two values for copper (11 and 14 percent), and one value for nickel (20 percent) exceeded 10 percent. Results of the replicate environmental sample analyses indicated an acceptable degree of laboratory precision and reproducibility.

Field- and laboratory-spike samples were collected from two wells. Spike solutions that contained known amounts of pesticides were added to two environmental samples in the field and to two replicate environmental samples at the NWQL. VOC samples were spiked using the same procedure. Mean recovery of pesticides and VOC's from the field-spike and field-spike replicate samples ranged from 61 to 119 percent. Mean recovery of pesticides and VOC's from the laboratory-spike samples was within the NWQL control limits. Results of the spike-sample analyses indicated sampling and analysis procedures adequately detected the compounds analyzed for and no major matrix interferences existed.

QUALITY OF WATER FROM SHALLOW WELLS IN URBAN RESIDENTIAL AND LIGHT COMMERCIAL AREAS

The quality of water from the 28 shallow wells screened in the Chicot aquifer system or surficial confining unit in the urban residential and light commercial areas is discussed in the following sections in relation to USEPA water-quality standards established for public-supply drinking water (U.S. Environmental Protection Agency, 2002b). Water-quality standards were determined by USEPA for physical properties and chemical constituents that might have adverse effects on human health or affect the odor, appearance, or desirability of water. Although the shallow wells installed for the land-use study are not used for a drinking-water source, concentrations of selected constituents in the water were compared to the USEPA Maximum Contaminant Levels (MCL's), Secondary Maximum Contaminant Levels (SMCL's), and Health Advisories (HA's) to provide a frame of reference. An MCL is the maximum permissible level for a contaminant in drinking water that is delivered to any user of a public-water system, and an SMCL is a nonenforceable Federal guideline regarding aesthetic effects (taste or odor) or cosmetic effects (tooth or skin coloration) of drinking water. An HA is a nonenforceable guideline that serves as an estimate of acceptable concentrations of a chemical constituent on the basis of health-effects information and provides technical guidance for Federal, State, and local officials.

General Ground-Water Properties

Data for six general ground-water properties (specific conductance, pH, water temperature, turbidity, dissolved oxygen, and alkalinity) were collected from the shallow wells. Measurements of the properties were made at the time of sample collection. A statistical summary for the general ground-water properties is listed in table 3 with applicable water-quality standards. The median value for specific conductance (field) was 281 µS/cm, and values ranged from 93 to 956 µS/cm. The median value for pH (field) was 6.5 standard units. The SMCL for pH is 6.5 to 8.5 standard units (U.S. Environmental Protection Agency, 2002b). Values for 10 of the 28 wells sampled were less than 6.5 standard units. The median value for turbidity was 1.8 nephelometric turbidity units (NTU), and water from nine wells had concentrations that exceeded the MCL of 5.0 NTU (U.S. Environmental Protection Agency, 2002b). Dissolved oxygen concentrations were less than 1.0 mg/L in water from 15 of the 25 wells sampled and ranged from 0.3 to 6.6 mg/L (appendix 1). The alkalinity (field), as $CaCO_3$, ranged from 35 to 390 mg/L. Values for specific conductance, pH, and alkalinity were typical for the Chicot aquifer system (Nyman, 1989). General ground-water properties for the 28 wells sampled are listed in appendix 1.

Table 3. Summary statistics and Federal guidelines and standards for general ground-water properties and selected water-quality data from shallow wells in urban residential and light commercial areas in Lafayette Parish, Louisiana, 2001-02

[All chemical constituents are dissolved unless otherwise noted. MCL, Maximum Contaminant Level; SMCL, Secondary Maximum Contaminant Level; HA, Health Advisory; USEPA, U.S. Environmental Protection Agency; µS/cm, microsiemens per centimeter at 25 degrees Celsius; °C, degrees Celsius; ---, no value available; mg/L, milligrams per liter; E, estimated; µg/L, micrograms per liter; <, less than; ND, not detected; pCi/L, picocuries per liter; AMCL, Alternate Maximum Contaminant Level]

Property or constituent	Number of detections/ number of samples	Analytical reporting level	Median of all samples	Minimum detection	Maximum detection	Federal guideline or standard[a]			Number of wells exceeding USEPA drinking-water standard
						MCL	SMCL	HA	
General ground-water properties									
Specific conductance, field, in µS/cm	28/28	1	281	93	956	---	---	---	---
pH, field, in standard units	28/28	0.1	6.5	5.8	7.4	---	6.5-8.5	---	[b]10
Water temperature, in °C	28/28	0.1	21.3	16.1	23.7	---	---	---	---
Turbidity, in nephelometric turbidity units (NTU)	27/28	0.1	1.8	0.40	120	5.0	---	---	9
Dissolved oxygen, in mg/L	25/25	0.1	0.6	0.3	6.6	---	---	---	---
Alkalinity as $CaCO_3$, field, in mg/L	28/28	1	120	35	390	---	---	---	---
Dissolved solids and major inorganic ions, in mg/L									
Dissolved solids, residue on evaporation, 180°C	28/28	10	184	80	588	---	500	---	2
Calcium, as Ca	28/28	0.01	23	5.8	98	---	---	---	---
Magnesium, as Mg	28/28	0.01	7.6	1.4	27	---	---	---	---
Sodium, as Na	28/28	0.10	21	5.9	87	---	---	---	---
Potassium, as K	28/28	0.1	1.9	1.2	12	---	---	---	---
Bicarbonate, as HCO_3 (calculated)	28/28	1	140	43	480	---	---	---	---
Sulfate, as SO_4	28/28	0.30	3.0	E0.1	17	---	250	---	0
Chloride, as Cl	28/28	0.30	8.6	2.4	170	---	250	---	0
Fluoride, as F	28/28	0.1	0.3	E0.1	0.5	4.0	2.0	---	0
Bromide, as Br	28/28	0.03	0.10	0.04	0.52	---	---	---	---
Trace elements, in µg/L									
Aluminum, as Al	11/28	1.0	<1	1	20	---	50-200	---	0
Antimony, as Sb	24/28	0.048	E0.04	E0.03	0.27	6	---	---	0
Arsenic, as As	28/28	0.18	1.5	0.3	5.7	10	---	---	0
Barium, as Ba	28/28	1.0	98	30	240	2,000	---	---	0
Beryllium, as Be	0/28	0.06	<0.06	ND	ND	4	---	---	0
Boron, as B	28/28	7.0	30	10	60	---	---	600	0
Cadmium, as Cd	23/28	0.037	0.05	E0.02	0.40	5	---	---	0
Chromium, as Cr	16/28	0.8	E0.5	E0.4	20	[c]100	---	---	0
Cobalt, as Co	28/28	0.015	0.9	0.1	10	---	---	---	---
Copper, as Cu	28/28	0.23	4	E0.2	280	[d]1,300	1,000	---	0
Iron, as Fe	10/27	10	<10	E5.9	70	---	300	---	0
Lead, as Pb	10/28	0.08	<0.08	E0.05	0.17	15	---	---	0
Lithium, as Li	28/28	0.30	10	0.8	20	---	---	---	---
Manganese, as Mn	27/28	0.18	160	E2	1,700	---	50	---	18
Molybdenum, as Mo	27/28	0.2	0.8	E0.1	5	---	---	40	0
Nickel, as Ni	28/28	0.06	1	0	6	---	---	100	0
Silica, as SiO_2	28/28	0.13	37	11	60	---	---	---	---
Selenium, as Se	19/28	0.33	E0.2	E0.2	3	50	---	---	0
Silver, as Ag	0/28	1.0	<1	ND	ND	---	100	---	0
Strontium, as Sr	28/28	0.08	120	30	410	---	---	4,000	0
Thallium, as Tl	10/28	0.041	<0.04	E0.02	E0.04	2	---	0.5	0
Uranium, as U	23/28	0.018	0.07	E0.01	3.2	[e]20	---	---	0
Vanadium, as V	28/28	0.21	2.7	0.5	6.6	---	---	---	---

Table 3. Summary statistics and Federal guidelines and standards for general ground-water properties and selected water-quality data from shallow wells in urban residential and light commercial areas in Lafayette Parish, Louisiana, 2001-02—Continued

Property or constituent	Number of detections/ number of samples	Analytical reporting level	Median of all samples	Minimum detection	Maximum detection	Federal guideline or standard[a]			Number of wells exceeding USEPA drinking-water standard
						MCL	SMCL	HA	
Nutrients and dissolved organic carbon, in mg/L									
Ammonia, as N	7/28	0.041	<0.04	E0.02	0.06	---	---	30	0
Ammonia plus organic nitrogen, as N	12/28	0.10	<0.10	E0.05	E0.10	---	---	---	---
Nitrite plus nitrate, as N	19/28	0.060	0.14	E0.02	22	10	---	---	1
Nitrite, as N	5/28	0.008	<0.01	E0.01	0.05	1.0	---	---	0
Phosphorus, as P	28/28	0.0044	0.30	0.04	0.58	---	---	---	---
Orthophosphorus, as P	28/28	0.018	0.30	0.04	0.55	---	---	---	---
Dissolved organic carbon, as C	25/28	0.33	E0.3	E0.2	1.6	---	---	---	---
Radon, in pCi/L									
Radon	20/20	1	389	280	2,220	[f]300 or 4,000 (AMCL)	---	---	19 above MCL; 0 above AMCL

[a]U.S. Environmental Protection Agency, 2002b.
[b]Number of values less than 6.5 standard units.
[c]Total concentration.
[d]U.S. Environmental Protection Agency Maximum Contaminant Level Goal (MCLG).
[e]Under review.
[f]The U.S. Environmental Protection Agency has an established Maximum Contaminant Level (MCL) for radon in ground water of 300 picocuries per liter (pCi/L) for states without a Multimedia Mitigation (MMM) program and an Alternate Maximum Contaminant Level (AMCL) of 4,000 pCi/L for states with an MMM program.

Dissolved Solids and Major Inorganic Ions

Dissolved solids are an important indicator of water quality and, in uncontaminated ground water, are the result of natural dissolution of rocks and sediments. A statistical summary for dissolved solids and major inorganic ions is listed in table 3 with applicable water-quality standards. The dissolved-solids concentrations for the 28 wells sampled ranged from 80 to 588 mg/L and had a median of 184 mg/L, which was less than the 500-mg/L SMCL (U.S. Environmental Protection Agency, 2002b). Water from two wells had dissolved-solids concentrations that were greater than the SMCL. Although ground water containing more than 500 mg/L dissolved solids is undesirable for drinking water and irrigation, it is used in many areas of the country where less-mineralized water is not available. Sulfate, chloride, and fluoride were the only major inorganic ions with established water-quality standards, and all concentrations were less than those standards (table 3) (U.S. Environmental Protection Agency, 2002b). Dissolved solids and major inorganic ion concentrations in water from the 28 wells sampled are listed in appendix 2.

Water types were summarized with a Piper diagram on the basis of the percentages of eight major inorganic ions in water from the 28 wells (fig. 4). The water types were classified as mixed cation bicarbonate (27 wells) and mixed anion chloride (1 well). Mixed cation types had two or more cations for which the percent of each was greater than 20 percent of the total cations. Mixed anion types had two or more anions for which the percent of each was greater than 20 percent of the total anions. Calcium was the highest percentage cation in 21 wells, and sodium was the highest percentage cation in seven wells. Bicarbonate was the highest percentage anion in 27 wells, and chloride was the highest percentage anion in one well. Sulfate concentrations were low in most of the ground-water samples. The percentages of major inorganic ions were similar for all wells except well number 101, which had a higher percentage of sodium than the other wells, and well number 109, which had a higher percentage of chloride than the other wells. Few water types were identified, indicating little to moderate variability in the lithology of the shallow sediments in Lafayette Parish.

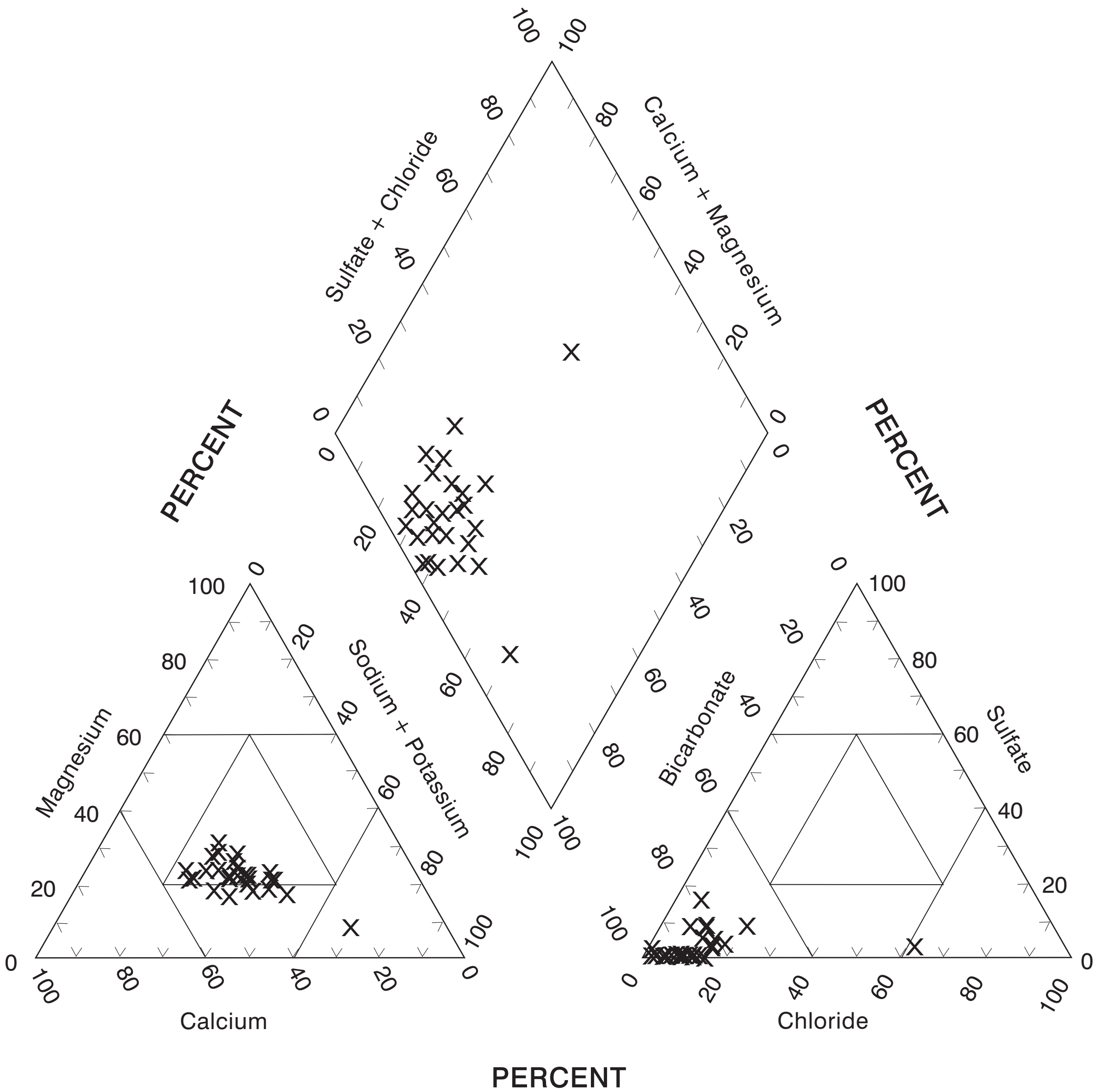


Figure 4. Piper diagram showing percentages of major inorganic ions in water from selected shallow wells in urban residential and light commercial areas in Lafayette Parish, Louisiana, 2001-02.

Trace Elements

Trace elements generally are present in water at concentrations of less than 1,000 µg/L (Drever, 1988, p. 326), and most trace elements detected in ground water are metals or semi-metallic elements produced from the weathering of minerals. The trace-element concentrations for the 28 wells sampled were less than 1,000 µg/L except for two manganese concentrations. A statistical summary for trace elements is listed in table 3 with applicable water-quality standards. Of the 23 trace elements analyzed for, 9 were detected in water from all 28 wells sampled and 2 (beryllium and silver) were not detected in any wells (table 3). No trace-element concentrations were greater than the MCL's or HA's, and only one trace element, manganese, had concentrations that were greater than the SMCL. The maximum manganese concentration was 1,700 µg/L, and manganese concentrations for 18 wells exceeded the SMCL of 50 µg/L. Trace-element concentrations in water from the 28 wells sampled are listed in appendix 3.

Nutrients

Nutrients are nitrogen- or phosphorus-containing compounds that are necessary for plant growth and important for animal nutrition (Mueller and others, 1995). Although these compounds do occur naturally, concentrations in ground or surface water can be increased through human activities such as fertilizer applications, sewerage and septic effluent, and atmospheric deposition from industrial emissions. Nitrate, one of the most widespread contaminants of ground water, is highly soluble, very mobile, and susceptible to leaching through the soil with infiltrating water (Hallberg and Keeney, 1993). Excessive nitrate concentrations may cause adverse human-health effects, such as methemoglobinemia (blue baby syndrome) (Hem, 1985, p. 125), and excessive nitrogen and phosphorus concentrations may cause adverse environmental effects, such as eutrophication of surface-water bodies (Hem, 1985). Nitrate concentrations in uncontaminated water usually are relatively small (generally less than 2 mg/L), and larger concentrations may indicate possible contamination from human activities (Mueller and Helsel, 1996).

A statistical summary for nutrients is listed in table 3 with applicable water-quality standards. The nutrient concentrations for the 28 wells sampled were low except for one nitrite plus nitrate concentration. Ammonia was detected in water from 7 (25 percent) of the 28 wells sampled, and concentrations ranged from an estimated value of 0.02 mg/L to 0.06 mg/L. Ammonia plus organic nitrogen was detected in water from 12 of the 28 wells sampled, and concentrations ranged from an estimated value of 0.05 mg/L to an estimated value of 0.10 mg/L. Nitrite plus nitrate was detected in 19 of the 28 wells sampled, and concentrations ranged from an estimated value of 0.02 mg/L to 22 mg/L and had a median of 0.14 mg/L. The maximum concentration of 22 mg/L from one well, well number 109, was greater than the MCL of 10 mg/L (U.S. Environmental Protection Agency, 2002b) and was the only nutrient concentration that exceeded a water-quality standard. The nitrite concentration for the same well was 0.05 mg/L, so all of the nitrite plus nitrate was assumed to be nitrate. The elevated nitrate concentration might be a result of a hydrologic connection to a nearby urban drainage ditch. Nitrite was detected in five wells, and the maximum concentration was 0.05 mg/L. Phosphorus and orthophosphate concentrations ranged from 0.04 to 0.58 mg/L. Nutrient concentrations in water from the 28 wells sampled are listed in appendix 4.

Dissolved Organic Carbon

The amount of organic carbon present in ground water might have an effect on microbial communities in an aquifer and, in turn, affect the concentration of redox-sensitive constituents such as dissolved oxygen, trace elements, and nutrients (Hem, 1985). DOC was detected in water from 25 of the 28 wells sampled. The maximum concentration was 1.6 mg/L, and the median concentration was an estimated value of 0.3 mg/L (table 3). DOC concentrations of about 0.5 mg/L typically occur naturally in ground water, and concentrations can increase with human activity (Drever, 1997). The median concentration of an estimated 0.3 mg/L in water from the 28 wells sampled indicated naturally-occurring DOC conditions. DOC concentrations in water from the 28 wells sampled are listed in appendix 4.

Radon

Radon-222 is a gas produced by the natural decay of uranium that is present in small quantities in certain rock and sediment types. Radon gas is soluble in water and is transported in ground water. The USEPA has established an MCL for radon in ground water of 300 pCi/L for states without a Multimedia Mitigation (MMM) program and an Alternate Maximum Contaminant Level (AMCL) of 4,000 pCi/L for states with an MMM program (U.S. Environmental Protection Agency, 2002c). The USEPA recommends treating ground water that has radon concentrations greater than 300 pCi/L. When radon gas is exposed to air, such as when ground water is pumped from an aquifer and used indoors, the radon diffuses into the air where it can be inhaled. About 1 to 2 percent of radon in indoor air comes from drinking water (U.S. Environmental Protection Agency, 2002a). Although the entire State of Louisiana is classified in the lowest national risk zone, Zone 3, for radon, a 1990 survey of Louisiana homes indicated 10 of 1,314 homes had elevated levels (greater than 4 pCi/L) of radon in the indoor air (Louisiana Department of Environmental Quality, 1990).

Radon-222 (radon) was sampled from 20 of the 28 wells (table 3). The radon concentrations in the ground-water samples ranged from 280 to 2,220 pCi/L and had a median of 389 pCi/L. Radon concentrations in water from 19 wells were greater than the MCL (fig. 5), and all radon concentrations were less than the AMCL (table 3) (U.S. Environmental Protection Agency, 2002b). Radon concentrations for the 20 wells sampled are listed in appendix 5.

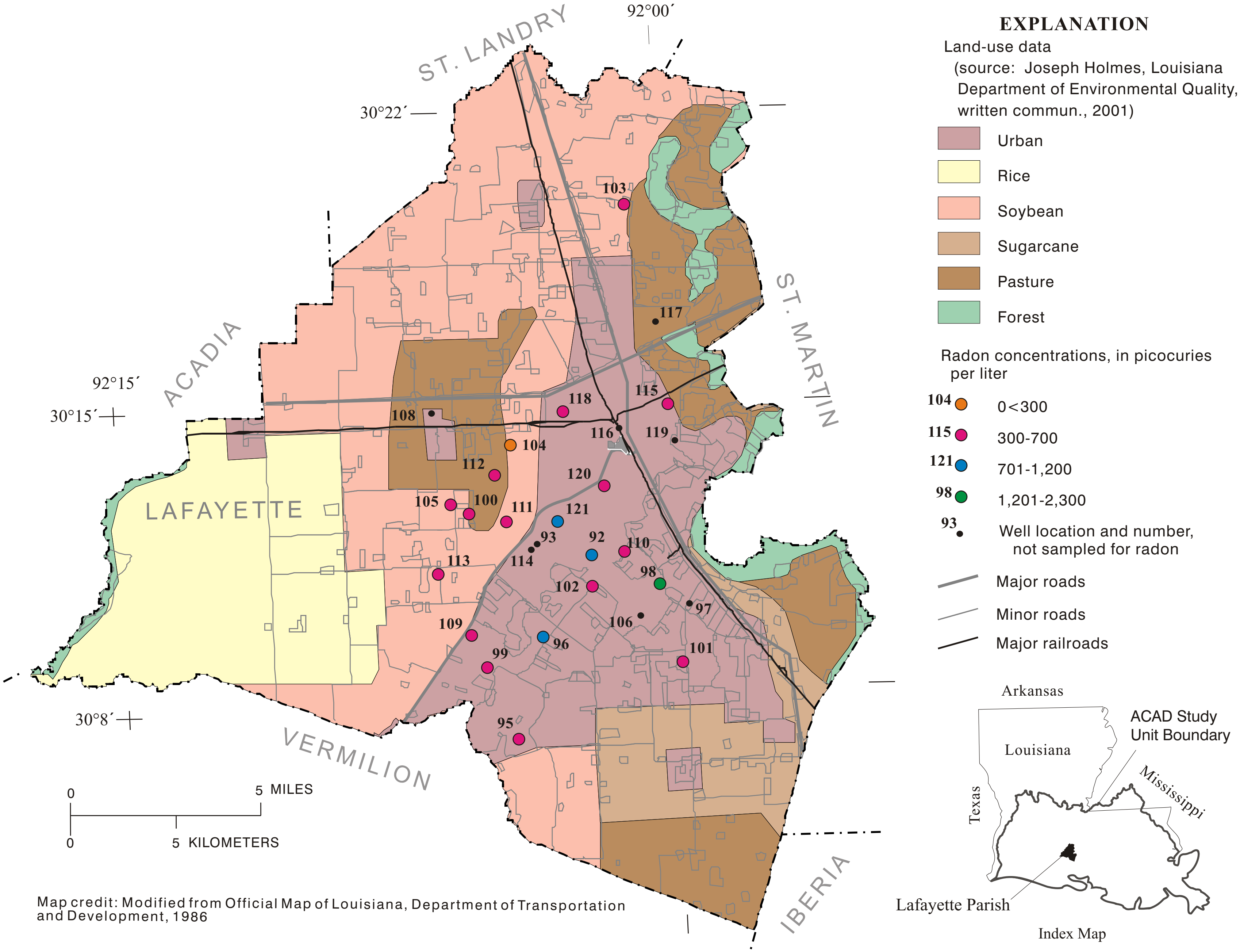


Figure 5. Radon concentrations in water from selected shallow wells in urban residential and light commercial areas in Lafayette Parish, Louisiana, 2001-02.

Chlorofluorocarbons and Stable Isotopes

Concentrations of CFC's, including CFC-11, CFC-113, and CFC-12 were determined in water from nine wells, and stable isotopes of hydrogen ($^{2}H/^{1}H$) and oxygen ($^{18}O/^{16}O$) were determined in water from six wells. The data for the wells sampled are listed in appendix 5. CFC's were used to estimate the apparent age of water in nine wells. Stable isotopes were collected and analyzed along with CFC's to more accurately determine the apparent age of the ground water. CFC's are stable, synthetic organic compounds developed in the early 1930's to replace ammonia and sulfur dioxide in the refrigeration process (Plummer and Friedman, 1999). Production of dichlorodifluoromethane (CFC-12) began in 1931 and was followed by production of trichlorofluoromethane (CFC-11) in 1936. The presence of measurable concentrations of CFC's in a water sample indicates the sample contains some post-1940 water--water recharged prior to 1940. Chemical processes, such as microbial degradation and sorption during transit, and physical processes, such as mixing with older water, can affect the concentration of CFC's; thus, the term apparent is used to qualify the ground-water age. The determined apparent age of ground water from the nine wells ranged from about 12 to 50 years and had a median of less than 32 years. As shown in figure 6, the age of the ground water varied with water level.

Pesticides and Pesticide Degradation Products

Pesticides are chemicals used to control unwanted vegetation, insects, and fungi. They are applied primarily to cropland in rural areas but also are used on lawns, gardens, and rights-of-way. The widespread use of pesticides creates the potential for the movement of pesticides or their degradation products into shallow ground water. The presence of pesticides in ground water indicates an effect from human activities on ground-water quality and is a human-health concern for those using ground water as a drinking-water supply.

Pesticides or degradation products were detected in water from 6 of the 28 wells sampled. Three wells had one pesticide detected, one well had two pesticides detected, one well had one pesticide and one degradation product detected, and one well had three degradation products detected (fig. 7). The maximum concentration for the pesticides and degradation products was an estimated value of 0.06 µg/L (deethyldeisopropylatrazine), and all concentrations were less than the applicable drinking-water standards (table 4) (U.S. Environmental Protection Agency, 2002b). Of the 91 pesticides analyzed for, 6 were detected in the samples; and, of the 11 degradation products analyzed for, 3 were detected in the samples. One herbicide, atrazine, had a concentration (0.008 µg/L) that was greater than an estimated value. Pesticide concentrations for the wells sampled are listed in appendix 6, and degradation product concentrations are listed in appendix 7.

Volatile Organic Compounds

VOC's were detected in water from 18 of the 28 wells sampled. Seven wells had one compound detected, six wells had two compounds detected, two wells had three compounds detected, two wells had four compounds detected, and one well had five compounds detected (fig. 7). The maximum concentration for the VOC's detected was 0.38 µg/L (chloroform), and all concentrations were less than the applicable drinking-water standards (table 4) (U.S. Environmental Protection Agency, 2002b). Of the 85 VOC's analyzed for, 10 were detected in the samples. Of those 10, seven were detected more than once. Five VOC's had concentrations that were greater than estimated values. Carbon disulfide was the most frequently detected VOC (11 samples) and had a maximum concentration of 0.22 µg/L. Toluene was the second most frequently detected VOC (10 samples) and had a maximum concentration of 0.28 µg/L. VOC concentrations for the 28 wells sampled are listed in appendix 8.

STATISTICAL ANALYSES OF WATER-QUALITY DATA

Statistical Techniques

The Spearman rank correlation test (SAS Institute Inc., 1990) was used to determine if a relation existed between selected physical properties and chemical constituents (depth to the top of the screened interval and water level, specific conductance, pH, alkalinity, dissolved solids, calcium, magnesium, bicarbonate, arsenic, uranium, and radon) and the number of pesticides and VOC's detected. Correlation analysis assesses not only the relation between two variables but also the strength of the relation (Helsel and Hirsch, 1993). The Spearman rank correlation test was selected because water-quality data usually are nonparametric and the number of samples was greater than 20 (Helsel and Hirsch, 1993).

The Spearman rank correlation test calculates a probability statistic (p-value) and a correlation coefficient (rho). The probability statistic relates to a

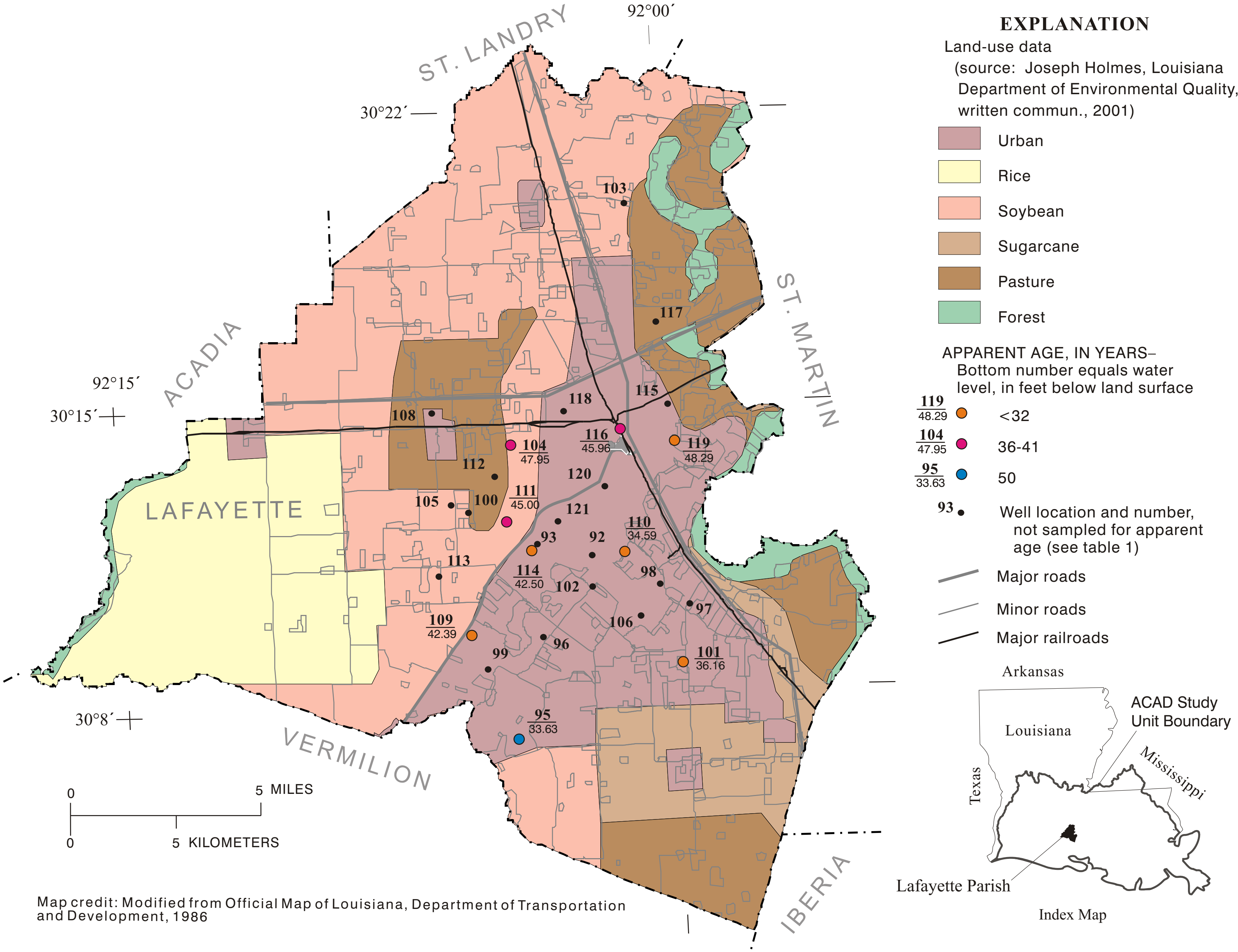


Figure 6. Apparent ages of water from selected shallow wells in urban residential and light commercial areas in Lafayette Parish, Louisiana, 2001-02.

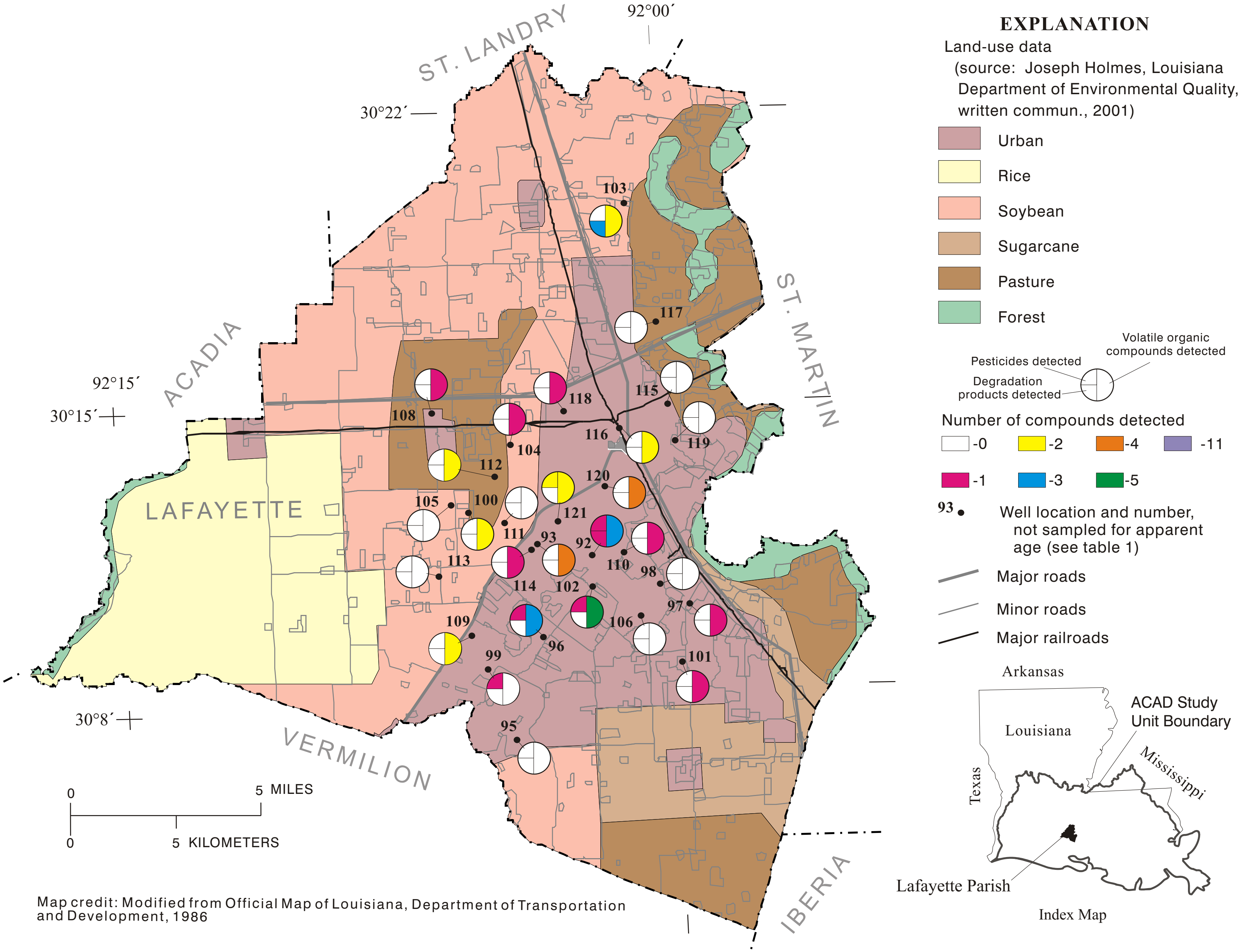


Figure 7. Number of pesticides, degradation products, and volatile organic compounds detected in water from selected shallow wells in urban residential and light commercial areas in Lafayette Parish, Louisiana, 2001-02.

Table 4. Summary statistics and Federal guidelines for pesticides and degradation products and volatile organic compounds in water from selected shallow wells in urban residential and light commercial areas in Lafayette Parish, Louisiana, 2001-02

[All concentrations are in micrograms per liter; USEPA, U.S. Environmental Protection Agency; MCL, Maximum Contaminant Level; E, estimated; HA, Health Advisory; ---, no value available; DP, degradation product]

Constituent	Number of detections/ samples	Analytical reporting level	Minimum detection	Maximum detection	Drinking water standard	Type of standard[a]	Number of wells exceeding USEPA drinking-water standard
Pesticides							
Atrazine	1/28	0.009	0.008	0.008	3	MCL	0
Bentazon	1/28	0.01	E0.05	E0.05	200	HA	0
Imazaquin	1/28	0.0261	E0.026	E0.026	---	---	---
Imazethapyr	1/28	0.017	E0.005	E0.005	---	---	---
Imidacloprid	1/28	0.0068	E0.0095	E0.0095	---	---	---
Prometon	1/28	0.015	E0.012	E0.012	100	HA	0
Degradation products							
Deethylatrazine (DP of atrazine)	2/28	0.028	E0.004	E0.006	---	---	---
Deethyldeisopropylatrazine (DP of atrazine)	1/28	0.01	E0.06	E0.06	---	---	---
Deisopropylatrazine (DP of atrazine)	1/28	0.04	E0.01	E0.01	---	---	---
Volatile organic compounds							
Benzene	2/28	0.021	E0.01	E0.03	5.0	MCL	0
Carbon disulfide	11/28	0.07	E0.02	0.22	---	---	---
Chloroform	4/28	0.02	E0.01	0.38	[b]80.0	MCL	0
4-Isopropyl-1-methylbenzene	2/28	0.12	E0.01	E0.04	---	---	---
MTBE (Methyl tert-butyl ether)	1/28	0.17	0.2	0.2	40 (taste) 20 (odor)	HA	0
Tetrachloroethylene	4/28	0.027	E0.007	E0.10	5.0	MCL	0
Toluene	10/28	0.05	E0.01	0.28	1,000	MCL, HA	0
Trichloroethylene (TCE)	1/28	0.038	E0.03	E0.03	5.0	MCL	0
Trichlorofluoromethane	1/28	0.09	1.1	1.1	2,000	HA	0
m- and p-Xylene	2/28	0.06	E0.01	E0.03	10,000	MCL, HA	0

[a]U.S. Environmental Protection Agency, 2002b
[b]Under review

confidence level, and the correlation coefficient describes the strength of the correlation and how the variables (physical properties and chemical constituents) vary. A positive correlation coefficient means that as the value of one variable increases, the values of the other variables also increase. A negative or inverse correlation coefficient means that as the value of one variable increases, the values of the other variables decrease (Helsel and Hirsch, 1993). The 95-percent confidence level used in this report indicated a 95-percent probability (p equal to or less than 0.05) that a correlation was statistically significant. Variables that had correlation coefficients of 0.6 or greater were considered strongly correlated, variables that had correlation coefficients between 0.4 and 0.6 were considered moderately correlated, and variables that had correlation coefficients of 0.4 or less were considered weakly correlated. Concentrations that were less than the reporting limit were assigned a value of one-half the reporting limit so they would not rank equal to that of a measured value.

The Mann-Whitney rank-sum test (SAS Institute Inc., 1990) with an alpha value of 0.05 was used to compare the depth to the top of the screened interval and selected physical-property and chemical-constituent (specific conductance, pH, dissolved solids, calcium, sodium, bicarbonate, chloride, iron, and radon) data for wells in the urban area to data for wells in other parts of the Chicot aquifer system. Data for the 28 urban wells (URB) described in this report were compared to data for 27 wells in southwestern Louisiana in rice-growing areas (RIC), data for 9 domestic wells in southwestern Louisiana in the outcrop area of the Chicot aquifer system (SWO), and data for 21 domestic wells in southwestern Louisiana south of the outcrop area of the Chicot aquifer system (SWS) (fig. 8). The nonparametric testing procedure was used to compare means of rank-transformed data for paired groups of wells (URB-RIC, URB-SWO, and URB-SWS). The RIC wells were part of a NAWQA ACAD agriculture land-use study in which rice was the targeted crop (Tollett and Fendick, 2003), and the SWO and SWS wells were part of a NAWQA ACAD subunit survey (Tollett and others, 2003). Well number 32 (fig. 8) was located outside the ACAD Study Unit boundary but, for this report, was considered to be part of the SWO group.

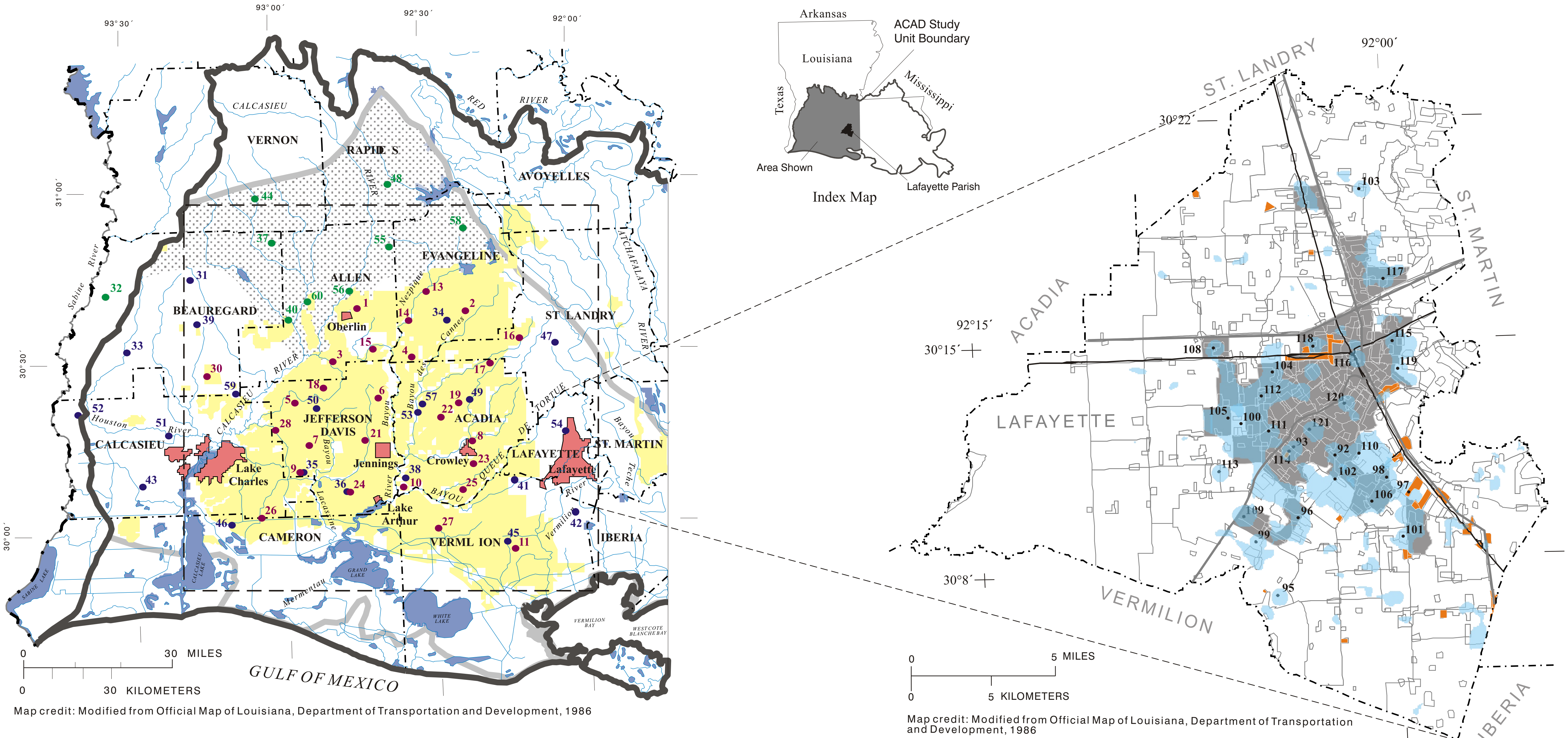
Correlations Between Selected Physical Properties and Chemical Constituents Using Spearman Rank Correlation Test

Correlations between selected physical properties and chemical constituents (depth to the top of the screened interval and water level; specific conductance, pH, alkalinity, dissolved solids, calcium, magnesium, bicarbonate, arsenic, uranium, and radon) and the number of pesticides and VOC's detected in water samples are listed in table 5. The depth to the top of the screened interval was correlated weakly to pH, alkalinity, calcium, magnesium, dissolved solids, and bicarbonate, indicating that the ionic strength of water generally increased with depth. Arsenic concentrations were correlated moderately to the depth to the top of the screened interval, specific conductance, dissolved solids, calcium, and magnesium and strongly to pH and bicarbonate. Arsenic concentrations increased with depth and with pH, bicarbonate, calcium, and magnesium concentrations. Uranium concentrations were correlated weakly to the depth to the top of the screened interval, and radon concentrations were correlated moderately and inversely to the depth to the top of the screened interval. High radon concentrations in the rice-growing areas also were correlated weakly to the depth to the top of the screened interval (Tollett and Fendick, 2003). The number of pesticides detected was correlated moderately to the number of VOC's detected, possibly indicating that shallow ground water in Lafayette Parish is susceptible to contamination by land-surface activities. The number of pesticides and VOC's detected did not show a relation to the depth to the top of the screened interval, indicating that pesticide and VOC detections were not influenced by depth but more likely were influenced by land use near a well and shallow sediment or soil composition.

Table 5. Results of Spearman rank correlation test for selected physical properties and chemical constituents in water from selected shallow wells in urban residential and light commercial areas in Lafayette Parish, Louisiana, 2001-02

[VOC's, volatile organic compounds; <, less than; >, greater than; -, inversely related]

Variables	Number of sample pairs	Probability statistic	Correlation coefficient
Depth to top of screened interval and pH	28	0.032	0.40
Depth to top of screened interval and alkalinity, calcium, and magnesium	28	<.05	.38
Depth to top of screened interval and dissolved solids	28	.076	.34
Depth to top of screened interval and bicarbonate	28	.065	.35
Arsenic and depth to top of screened interval	28	<.001	.59
Arsenic and specific conductance	28	.002	.55
Arsenic and pH and bicarbonate	28	<.001	>.63
Arsenic and dissolved solids	28	.003	.54
Arsenic and calcium	28	.004	.53
Arsenic and magnesium	28	.011	.47
Uranium and depth to top of screened interval	28	.053	.37
Radon and depth to top of screened interval	20	.036	-.47
Radon and water level	20	.049	-.44
Number of pesticides detected and number of VOC's detected	28	.029	.41
Depth to top of screened interval and number of pesticides detected	28	.873	.03
Depth to top of screened interval and number of VOC's detected	28	.571	.11



EXPLANATION

Land-use data (source: Joseph Holmes, Louisiana Department of Environmental Quality, written commun., 2001)

- Rice-growing area
- Water
- Outcrop area of the Chicot aquifer system in the Acadian-Pontchartrain (ACAD) Study Unit (Nyman, 1984, pl.1)
- Rice study area
- 24 Rice-growing area study (RIC) well location and number
- 44 Subunit survey study well, location and number, in the outcrop area (SWO) of the Chicot aquifer system
- 34 Subunit survey study well, location and number, south of the outcrop area (SWS) of the Chicot aquifer system
- Boundary of freshwater in the Chicot aquifer system in the ACAD Study Unit (Smoot, 1986)

EXPLANATION

Land-use data (source: Joseph Holmes, Louisiana Department of Environmental Quality, written commun., 2001)

- Selected city limits within Lafayette Parish
- Residential areas (less than 40 years old) and light commercial
- Industrial
- Major roads
- Minor roads
- Major railroads
- 92 Well location and number (urban-URB)

Figure 8. Well locations in southwestern Louisiana for land-use studies and subunit survey study in the Acadian-Pontchartrain Study Unit.

Comparison of Depth to Top of Screened Interval and Selected Physical-Property and Chemical-Constituent Data Using Mann-Whitney Rank-Sum Test

Comparison of the depth to the top of the screened interval and selected physical-property and chemical-constituent data (fig. 9) indicated the quality of water in the URB wells was significantly different from the quality of water in the RIC, SWO, and SWS wells for most variables. Except for the depth to the top of the screened interval and iron, the means of the rank-transformed data for all physical properties and chemical constituents were less for the URB wells than for the RIC wells. The means for the depth to the top of the screened interval were greater for the URB wells than for the RIC wells, and the means for iron were not significantly different for the two groups of wells. The larger dissolved-solids values, particularly for sodium and chloride (fig. 9), for the RIC wells might be a result of heavy irrigation pumpage in the rice-growing areas in southwestern Louisiana that causes movement of the constituents from deeper ground-water sources (Nyman, 1984; Lovelace, 1999). The means for all variables except the depth to the top of the screened interval and iron were greater for the URB wells than for the SWO wells, and the means for all variables except radon were less for the URB wells than for the SWS wells. The means for the depth to the top of the screened interval were less for the URB wells than for the SWO wells, and the means for iron for the two groups of wells were not significantly different. Radon concentrations for the URB wells were greater than for the SWS wells. Ground-water movement generally is to the south in southwestern Louisiana (Harder and others, 1967). Thus, because concentrations of dissolved solids and other chemical constituents generally increase along ground-water flow paths (Nyman, 1989), concentrations of many of the selected chemical constituents were expected to be larger for the URB wells than for the SWO wells. As water moves through an aquifer, acidic waters react with aquifer sediments, thus increasing the concentrations of dissolved ions with increasing distance from the recharge area. The larger constituent concentrations for the SWS wells compared to those for the URB wells might be explained similarly. The SWS wells are deeper than the URB wells, thus increasing the time the water has to react with aquifer sediments. The lack of correlation between the four groups of wells suggests that spatial distribution of the wells and the depth to the top of the screened interval affected the quality of water in shallow wells in southwestern Louisiana.

SUMMARY AND CONCLUSIONS

In 2001-02, the U.S. Geological Survey installed and sampled 28 shallow wells in the Chicot aquifer system in urban residential and light commercial areas in Lafayette Parish, Louisiana, for a land-use study in the Acadian-Pontchartrain Study Unit of the National Water-Quality Assessment Program. The objective of the study was to assess the occurrence and distribution of water-quality constituents in recently recharged ground water associated with urban land use and to gain an understanding of the natural and human-related factors that affect ground-water quality. Lafayette Parish overlies the Chicot aquifer system, which is the primary source of water for irrigation and public-water supplies in southwestern Louisiana and is vulnerable to the effects of land-surface activities because of shallow depths to ground water. Well depths ranged from 11 to 79 feet below land surface, and water levels ranged from 2.50 to 61.55 feet below land surface. The purpose of this report is to describe the quality of water from the 28 shallow wells and to relate that water quality to natural factors and to human activities.

Ground-water samples were analyzed for general ground-water properties and about 240 water-quality constituents, including dissolved solids, major inorganic ions, trace elements, nutrients, dissolved organic carbon (DOC), radon, chlorofluorocarbons, selected stable isotopes, pesticides, pesticide degradation products, and volatile organic compounds (VOC's). Quality-control samples indicated no bias in ground-water data from collection or analysis. Values for the general ground-water properties were typical of those obtained in previous studies of the Chicot aquifer system. Dissolved-solids concentrations for two wells exceeded the U.S. Environmental Protection Agency Secondary Maximum Contaminant Level (SMCL) of 500 milligrams per liter (mg/L). Concentrations of all major inorganic ions were less than the Maximum Contaminant Levels (MCL's) and SMCL's for drinking water.

Concentrations of all trace elements, except manganese, were less than 1,000 micrograms per liter (µg/L), and all were less than the MCL's. Manganese concentrations for 18 wells exceeded the SMCL of 50 µg/L. No trace-element concentrations were greater than the health advisory levels.

One nutrient concentration (that for nitrite plus nitrate) was greater than 2 mg/L, a level that might indicate contamination from human activities, and

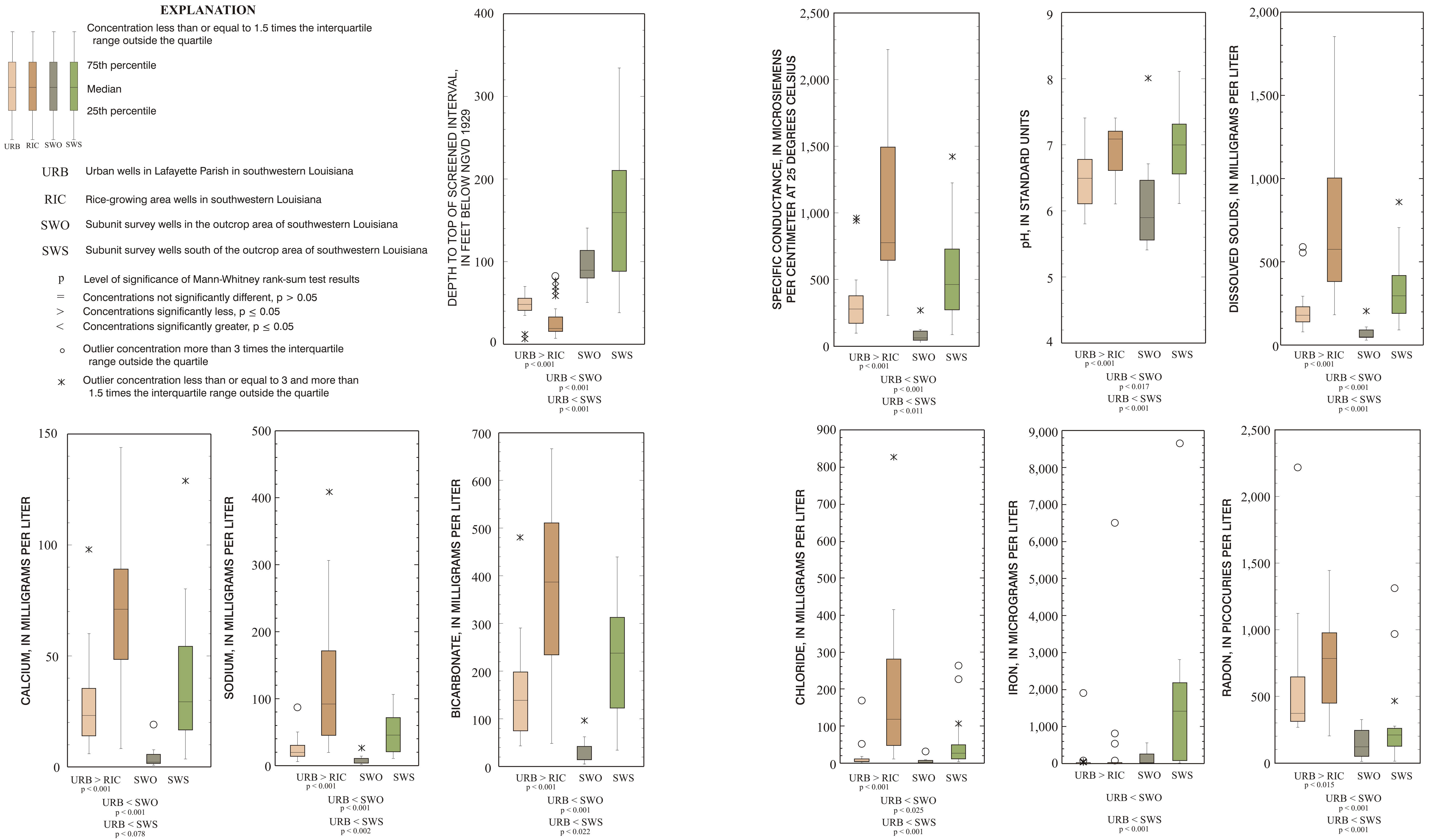


Figure 9. Comparison of depth to top of screened interval and selected general ground-water properties and water-quality constituents between wells in southwestern Louisiana for land-use studies and subunit survey study in the ACAD Study Unit.

was greater than the U.S. Environmental Protection Agency MCL of 10 mg/L. The median DOC concentration was an estimated 0.3 mg/L, which indicated naturally-occurring DOC conditions in the shallow ground water in Lafayette Parish. Radon concentrations for 19 of 20 wells sampled were greater than the U.S. Environmental Protection Agency MCL of 300 picocuries per liter (pCi/L), and all were less than the alternate maximum contaminant level of 4,000 pCi/L. Radon concentrations ranged from 280 to 2,220 pCi/L and had a median of 389 pCi/L.

The maximum concentration for pesticides and pesticide degradation products was an estimated value of 0.06 µg/L (deethyldeisopropylatrazine), and all concentrations were less than the drinking-water standards. Of the 91 pesticides analyzed for, 6 were detected in the ground-water samples; and, of the 11 pesticide degradation products analyzed for, 3 were detected in the ground-water samples. One herbicide, atrazine, had a concentration (0.008 µg/L) that was greater than an estimated value. The maximum concentration for the VOC's detected was 0.38 µg/L, and all concentrations were less than the drinking-water standards. Of the 85 VOC's analyzed for, 10 were detected in the ground-water samples. Of those 10, 7 were detected more than once. Five VOC's had concentrations greater than estimated values. Carbon disulfide was the most frequently detected VOC (11 samples) and had a maximum concentration of 0.22 µg/L. Toluene was the second most frequently detected compound (10 samples) and had a maximum concentration of 0.28 µg/L.

The depth to the top of the screened interval was correlated weakly to pH, alkalinity, calcium, magnesium, dissolved solids, and bicarbonate, indicating that the ionic strength of water generally increased with depth. Arsenic concentrations were correlated moderately to the depth to the top of the screened interval, specific conductance, dissolved solids, calcium, and magnesium and strongly to pH and bicarbonate. Arsenic concentrations increased with depth and with pH, bicarbonate, calcium, and magnesium concentrations. Uranium concentrations were correlated weakly to the depth to the top of the screened interval, and radon concentrations were correlated moderately and inversely to the depth to the top of the screened interval. Chlorofluorocarbons were used to estimate the apparent age of water in nine wells. The determined apparent age ranged from about 12 to 50 years and had a median of less than 32 years. This indicated the age of the ground water varied with depth and water level. The number of pesticides detected was correlated moderately to the number of VOC's detected, possibly indicating that shallow ground water in Lafayette Parish is susceptible to contamination by land-surface activities. The number of pesticides and VOC's detected did not show a relation to the depth to top of the screened interval.

The Mann-Whitney rank-sum test was used to compare the depth to the top of the screened interval and selected general-property and chemical-constituent (specific conductance, pH, dissolved solids, calcium, sodium, bicarbonate, chloride, iron, and radon) data for urban (URB) wells to data for wells in rice-growing areas (RIC), domestic wells in the outcrop area of the Chicot aquifer system (SWO), and domestic wells south of the outcrop area of the Chicot aquifer system (SWS). Comparisons indicated the quality of water in the URB wells was significantly different from the quality of water in the RIC, SWO, and SWS wells for most variables. The means for all variables were less for the URB wells than for the RIC wells except for the depth to the top of the screened interval and iron. The larger dissolved-solids values, particularly for sodium and chloride, for the RIC wells might be a result of heavy irrigation pumpage in the rice-growing areas in southwestern Louisiana that causes movement of the constituents from deeper ground-water sources. The means for most variables were greater for the URB wells than for the SWO wells and less for the URB wells than for the SWS wells. Because concentrations of dissolved solids and other chemical constituents generally increase along ground-water flow paths, concentrations of many of the selected chemical constituents were expected to be larger for the URB wells than for the SWO wells. The larger concentrations for the SWS wells compared to those for the URB wells might be explained similarly. The SWS wells are deeper than the URB wells, thus increasing the time the water has to react with aquifer sediments. The lack of correlation between the four groups of wells suggests that spatial distribution of wells and the depth to the top of the screened interval affected the quality of water in shallow wells in southwestern Louisiana.

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APPENDIXES

1. General ground-water properties of water from selected shallow wells in urban residential and light commercial areas in Lafayette Parish, Louisiana, 2001-02

2. Dissolved solids and major inorganic ion concentrations in water from selected shallow wells in urban residential and light commercial areas in Lafayette Parish, Louisiana, 2001-02

3. Trace-element concentrations in water from selected shallow wells in urban residential and light commercial areas in Lafayette Parish, Louisiana, 2001-02

4. Nutrients and dissolved organic carbon concentrations in water from selected shallow wells in urban residential and light commercial areas in Lafayette Parish, Louisiana, 2001-02

5. Radon, chlorofluorocarbons, and stable isotope concentrations in water from selected shallow wells in urban residential and light commercial areas in Lafayette Parish, Louisiana, 2001-02

6. Pesticide concentrations in water from selected shallow wells in urban residential and light commercial areas in Lafayette Parish, Louisiana, 2001-02

7. Concentrations of pesticide degradation products in water from selected shallow wells in urban residential and light commercial areas in Lafayette Parish, Louisiana, 2001-02

8. Concentrations of volatile organic compound in water from selected shallow wells in urban residential and light commercial areas in Lafayette Parish, Louisiana, 2001-02

Appendix 1. General ground-water properties of water from selected shallow wells in urban residential and light commercial areas in Lafayette Parish, Louisiana, 2001-02

[ACAD, Acadian-Pontchartrain Study Unit of the National Water-Quality Assessment Program; DOTD, Louisiana Department of Transportation and Development; USGS, U.S. Geological Survey; µS/cm, microsiemens per centimeter at 25 degrees Celsius; °C, degrees Celsius; mm, millimeters; mg/L, milligrams per liter; ---, no data]

ACAD well number (fig. 1)	DOTD local well number	USGS site identification number	Sample date	Specific conductance, field (µS/cm)	Specific conductance, laboratory (µS/cm)	pH, field (standard units)	pH, laboratory (standard units)	Air temperature (°C)	Water temperature (°C)
92	Lf-9913Z	301058092015001	2/06/02	155	181	6.4	6.6	8.0	17.4
93	Lf-9914Z	301114092031901	12/20/01	492	493	7.3	7.4	18.0	16.1
95	Lf-9968Z	300643092040301	12/04/01	206	214	6.5	6.8	23.5	21.5
96	Lf-9969Z	300906092031301	12/05/01	364	368	6.5	6.9	20.0	21.3
97	Lf-9973Z	300946091591601	1/28/02	93	96	5.9	6.1	25.0	21.3
98	Lf-9974Z	301014092000102	2/06/02	100	107	5.8	6.1	8.0	20.7
99	Lf-9998Z	300825092044501	12/05/01	936	940	6.8	7.1	21.5	21.9
100	Lf-9975Z	301202092050501	12/04/01	431	447	6.9	7.2	20.5	22.9
101	Lf-9976Z	300824091593201	1/23/02	170	179	6.5	7.0	22.0	22.3
102	Lf-9999Z	301015092015001	3/14/02	437	445	7.4	7.8	26.0	22.4
103	Lf-10000Z	301907092003401	2/07/02	107	113	6.0	6.4	10.0	19.2
104	Lf-10001Z	301336092035401	12/3/01	311	316	6.7	7.1	24.0	20.5
105	Lf-10009Z	301213092053501	1/30/02	239	247	6.5	6.9	23.0	22.4
106	Lf-10010Z	300932092003701	2/04/02	250	263	6.6	7.0	15.0	19.9
108	Lf-10012Z	301424092055801	12/06/01	375	379	6.4	7.0	21.0	22.9
109	Lf-10013Z	300916092051901	2/11/02	956	1,000	6.5	6.6	13.0	19.2
110	Lf-10014Z	301100092005801	1/22/02	316	318	6.1	6.2	18.0	21.3
111	Lf-10015Z	301147092040701	1/29/02	336	345	6.6	6.8	25.0	22.3
112	Lf-10016Z	301253092042001	12/19/01	365	370	7.1	7.5	17.0	21.5
113	Lf-10017Z	301035092055801	1/29/02	471	480	7.3	7.5	25.0	22.8
114	Lf-10180Z	301107092033001	12/19/01	316	328	6.6	6.9	20.5	21.6
115	Lf-10181Z	301425091593901	1/30/02	123	128	5.8	6.1	23.0	23.2
116	Lf-10026Z	301355092005601	2/14/02	216	217	6.5	6.5	15.0	20.5
117	Lf-10027Z	301619091595301	12/11/01	168	171	6.1	6.3	14.0	19.0
118	Lf-10028Z	301421092022901	2/07/02	290	308	6.8	7.3	13.0	20.2
119	Lf-10029Z	301332091593001	2/04/02	143	154	6.0	6.3	15.0	20.6
120	Lf-10030Z	301234092012401	12/11/01	169	171	5.8	6.2	14.0	18.5
121	Lf-10031Z	301148092024101	2/13/02	272	279	6.7	7.0	22.0	23.7

Appendix 1. General ground-water properties of water from selected shallow wells in urban residential and light commercial areas in Lafayette Parish, Louisiana, 2001-02—Continued

ACAD well number (fig. 1)	Air pressure (mm Hg)	Turbidity (nephelometric turbidity units)	Dissolved oxygen (mg/L)	Dissolved oxygen (percent)	Acid neutralizing capacity, fixed end-point titration, field (mg/L as $CaCO_3$)	Alkalinity, incremental titration, field (mg/L as $CaCO_3$)	Alkalinity, fixed end-point titration, laboratory (mg/L as $CaCO_3$)
92	761	27	0.5	5	57	54	58
93	---	120	---	---	---	240	250
95	767	.90	.7	8	92	98	98
96	767	7.2	.5	6	170	160	170
97	762	24	5.8	65	35	35	38
98	761	2.9	.3	3	40	38	41
99	767	.70	.4	4	400	390	420
100	767	1.8	1.1	13	190	200	210
101	762	.40	6.6	76	71	67	79
102	759	34	1.4	16	210	200	230
103	765	1.8	4.0	43	36	38	43
104	767	.60	.5	6	140	130	150
105	761	.80	1.8	21	86	92	99
106	770	8.6	1.3	14	120	120	130
108	767	1.1	.8	10	160	100	160
109	771	.60	.6	6	120	120	130
110	764	3.8	1.7	19	120	120	130
111	763	.70	.4	5	140	140	160
112	763	.70	.5	6	170	160	170
113	763	---	.4	4	230	240	250
114	763	.50	.5	5	160	160	160
115	761	5.3	3.5	41	46	48	51
116	769	1.8	.3	4	87	85	---
117	763	13	---	---	62	60	62
118	765	7.2	.3	3	140	140	150
119	770	1.0	4.5	50	54	57	60
120	764	1.0	---	---	69	63	55
121	767	4.6	.4	5	120	120	130

Appendix 2. Dissolved solids and major inorganic ion concentrations in water from selected shallow wells in urban residential and light commercial areas in Lafayette Parish, Louisiana, 2001-02

[Numbers below the chemical names are the Chemical Abstracts Service (CAS) numbers. ACAD, Acadian-Pontchartrain Study Unit of the National Water-Quality Assessment Program; DOTD, Louisiana Department of Transportation and Development; USGS, U.S. Geological Survey; °C, degrees Celsius; mg/L, milligrams per liter; E, estimated]

ACAD well number (fig. 1)	DOTD local well number	USGS site identification number	Sample date	Dissolved solids, residue at 180°C (mg/L) no CAS number	Calcium (mg/L as Ca) 7440-70-2	Magnesium (mg/L as Mg) 7439-95-4
92	Lf-9913Z	301058092015001	2/06/02	98	15	3.9
93	Lf-9914Z	301114092031901	12/20/01	294	37	14
95	Lf-9968Z	300643092040301	12/04/01	160	14	5.4
96	Lf-9969Z	300906092031301	12/05/01	226	29	9.0
97	Lf-9973Z	300946091591601	1/28/02	86	5.8	2.1
98	Lf-9974Z	301014092000102	2/06/02	80	8.9	2.7
99	Lf-9998Z	300825092044501	12/05/01	556	98	27
100	Lf-9975Z	301202092050501	12/04/01	274	38	12
101	Lf-9976Z	300824091593201	1/23/02	148	5.9	1.4
102	Lf-9999Z	301015092015001	3/14/02	260	38	16
103	Lf-10000Z	301907092003401	2/07/02	106	7.2	2.3
104	Lf-10001Z	301336092035401	12/03/01	202	28	9.3
105	Lf-10009Z	301213092053501	1/30/02	162	18	6.2
106	Lf-10010Z	300932092003701	2/04/02	178	20	7.0
108	Lf-10012Z	301424092055801	12/06/01	230	30	11
109	Lf-10013Z	300916092051901	2/11/02	588	60	26
110	Lf-10014Z	301100092005801	1/22/02	208	24	8.0
111	Lf-10015Z	301147092040701	1/29/02	212	27	8.3
112	Lf-10016Z	301253092042001	12/19/01	206	38	9.3
113	Lf-10017Z	301035092055801	1/29/02	286	49	11
114	Lf-10180Z	301107092033001	12/19/01	192	26	7.3
115	Lf-10181Z	301425091593901	1/30/02	106	9.6	4.4
116	Lf-10026Z	301355092005601	2/14/02	156	15	6.0
117	Lf-10027Z	301619091595301	12/11/01	126	14	3.2
118	Lf-10028Z	301421092022901	2/07/02	190	23	10
119	Lf-10029Z	301332091593001	2/04/02	140	9.2	3.0
120	Lf-10030Z	301234092012401	12/11/01	146	14	2.9
121	Lf-10031Z	301148092024101	2/13/02	172	25	9.4

Appendix 2. Dissolved solids and major inorganic ion concentrations in water from selected shallow wells in urban residential and light commercial areas in Lafayette Parish, Louisiana, 2001-02—Continued

ACAD well number (fig. 1)	Sodium (mg/L as Na) 7440-23-5	Potassium (mg/L as K) 7440-09-7	Bicarbonate, dissolved (calculated) (mg/L as HCO_3) no CAS number	Sulfate (mg/L as SO_4) 14808-79-8	Chloride (mg/L as Cl) 16887-00-6	Fluoride (mg/L as F) 16984-48-8	Bromide (mg/L as Br) 24959-67-9	Silica (mg/L as SiO_2) 7631-86-9
92	8.6	3.6	65	6.7	11	0.2	0.05	11
93	42	2.4	290	7.1	4.2	.4	.08	30
95	21	1.9	120	1.1	8.3	.3	.06	44
96	27	1.2	200	2.8	10	.4	.05	36
97	8.5	2.3	43	3.9	3.6	E.1	.04	38
98	5.9	1.4	47	7.5	2.4	.2	.07	21
99	50	1.8	480	17	53	.3	.43	32
100	34	1.8	240	E.1	19	.4	.10	36
101	21	12	82	1.2	5.2	.3	.08	44
102	28	5.8	250	1.2	6.4	.3	.07	26
103	10	1.5	46	4.1	2.5	.2	.07	44
104	22	1.5	160	1.4	11	.3	.08	38
105	21	2.9	110	6.5	12	.3	.16	39
106	21	6.2	150	1.6	2.4	.2	.04	41
108	30	2.2	130	2.4	19	.4	.13	37
109	87	4.0	140	14	170	.4	.39	37
110	26	2.7	140	4.5	16	.2	.52	43
111	30	2.3	170	1.2	14	.3	.10	37
112	21	2.7	200	3.0	12	.3	.09	31
113	37	1.7	290	.5	10	.2	.06	30
114	30	1.6	190	1.1	7.2	.3	.06	36
115	7.2	1.7	59	3.6	5.0	.2	.09	44
116	14	4.4	100	9.8	8.8	.3	.18	43
117	13	1.6	74	3.2	9.8	.2	.06	35
118	22	1.7	170	.7	6.4	.4	.05	35
119	16	1.4	70	.4	7.5	.2	.05	60
120	14	1.3	77	11	7.7	.2	.12	52
121	17	2.0	150	1.1	7.1	.5	.07	34

Appendix 3. Trace-element concentrations in water from selected shallow wells in urban residential and light commercial areas in Lafayette Parish, Louisiana, 2001-02

[Numbers below the chemical names are the Chemical Abstracts Service (CAS) numbers. ACAD, Acadian-Pontchartrain Study Unit of the National Water-Quality Assessment Program; DOTD, Louisiana Department of Transportation and Development; USGS, U.S. Geological Survey; µg/L, micrograms per liter; <, less than; E, estimated; ---, no data]

ACAD well number (fig. 1)	DOTD local well number	USGS site identification number	Sample date	Aluminum (µg/L as Al) 7429-90-5	Antimony (µg/L as Sb) 7440-36-0	Arsenic (µg/L as As) 7440-38-2	Barium (µg/L as Ba) 7440-39-3	Beryllium (µg/L as Be) 7440-41-7	Boron (µg/L as B) 7440-42-8
92	Lf-9913Z	301058092015001	2/06/02	2	0.06	0.4	240	<0.06	20
93	Lf-9914Z	301114092031901	12/20/01	2	.22	1.7	120	<.06	40
95	Lf-9968Z	300643092040301	12/04/01	<1	<.05	1.1	80	<.06	30
96	Lf-9969Z	300906092031301	12/05/01	2	.10	2.3	100	<.06	30
97	Lf-9973Z	300946091591601	1/28/02	<1	E.03	.8	40	<.06	10
98	Lf-9974Z	301014092000102	2/06/02	1	<.05	.3	100	<.06	20
99	Lf-9998Z	300825092044501	12/05/01	<1	.08	1.5	230	<.06	50
100	Lf-9975Z	301202092050501	12/04/01	<1	.07	2.1	110	<.06	30
101	Lf-9976Z	300824091593201	1/23/02	9	E.03	1.5	30	<.06	20
102	Lf-9999Z	301015092015001	3/14/02	<1	.27	1.7	130	<.06	40
103	Lf-10000Z	301907092003401	2/07/02	<1	E.03	.6	34	<.06	20
104	Lf-10001Z	301336092035401	12/03/01	<1	.06	3.0	100	<.06	20
105	Lf-10009Z	301213092053501	1/30/02	<1	.06	1.3	73	<.06	30
106	Lf-10010Z	300932092003701	2/04/02	16	.05	1.4	100	<.06	20
108	Lf-10012Z	301424092055801	12/06/01	<1	E.04	1.9	120	<.06	30
109	Lf-10013Z	300916092051901	2/11/02	<1	E.04	.5	240	<.06	40
110	Lf-10014Z	301100092005801	1/22/02	2	E.03	.7	97	<.06	30
111	Lf-10015Z	301147092040701	1/29/02	<1	.06	1.5	100	<.06	20
112	Lf-10016Z	301253092042001	12/19/01	<1	.07	2.1	110	<.06	20
113	Lf-10017Z	301035092055801	1/29/02	2	E.03	5.6	140	<.06	40
114	Lf-10180Z	301107092033001	12/19/01	<1	<.05	1.9	95	<.06	50
115	Lf-10181Z	301425091593901	1/30/02	2	<.05	.8	40	<.06	20
116	Lf-10026Z	301355092005601	2/14/02	<1	E.04	5.7	84	<.06	30
117	Lf-10027Z	301619091595301	12/11/01	1	E.03	.5	45	<.06	40
118	Lf-10028Z	301421092022901	2/07/02	<1	.05	1.9	75	<.06	30
119	Lf-10029Z	301332091593001	2/04/02	2	E.04	.5	41	<.06	20
120	Lf-10030Z	301234092012401	12/11/01	<1	E.05	1.5	72	<.06	60
121	Lf-10031Z	301148092024101	2/13/02	<1	.05	.8	96	<.06	20

Appendix 3. Trace-element concentrations in water from selected shallow wells in urban residential and light commercial areas in Lafayette Parish, Louisiana, 2001-02—Continued

ACAD well number (fig. 1)	Cadmium (µg/L as Cd) 7440-43-9	Chromium (µg/L as Cr) 740-47-3	Cobalt (µg/L as Co) 7440-48-4	Copper (µg/L as Cu) 7440-50-8	Iron (µg/L as Fe) 7439-89-6	Lead (µg/L as Pb) 7439-92-1	Lithium (µg/L as Li) 7439-93-2	Manganese (µg/L as Mn) 7439-96-5
92	<0.04	<0.8	0.1	0.6	<10	<0.08	0.8	30
93	.05	<.8	1.1	.4	<10	<.08	20	730
95	.04	<.8	1.4	.3	<10	<.08	6.0	110
96	E.03	E.4	1.6	.4	30	.12	10	320
97	E.04	6	.3	22	<10	<.08	8.1	5
98	.09	<.8	1.6	.3	E5.9	<.08	2.1	340
99	.19	<.8	3.1	.6	<10	.08	20	1,700
100	.12	E.5	3.0	.3	<10	<.08	10	580
101	<.04	20	.1	5	<10	<.08	20	<2
102	.22	<.8	10	280	<10	.15	20	800
103	.04	6	.1	11	20	<.08	7.4	7
104	.06	E.5	1.5	.4	<10	E.05	7.2	160
105	.05	1	.6	26	<10	<.08	10	85
106	.18	2	.5	2	<10	<.08	20	49
108	.12	<.8	2.5	.4	<10	.17	5.4	160
109	.40	E.5	2.9	64	E6.8	.15	20	1,100
110	.10	10	.1	9	E9.0	E.05	20	6
111	.08	<.8	1.2	12	<10	<.08	10	220
112	E.02	E.6	.4	E.2	40	<.08	10	270
113	<.04	<.8	.2	12	70	<.08	10	390
114	.09	<.8	1.2	.3	<10	<.08	6.9	170
115	.04	4	.2	12	<10	<.08	10	12
116	<.04	<.8	1.1	6	---	E.07	20	320
117	<.04	8	.1	E.2	<10	<.08	8.2	E2
118	.05	<.8	1.2	8	30	E.05	10	740
119	E.04	8	.1	11	10	<.08	10	7
120	.04	4	.1	.4	<10	E.08	20	4
121	.07	E.6	.5	19	E6.1	<.08	8.0	65

Appendix 3. Trace-element concentrations in water from selected shallow wells in urban residential and light commercial areas in Lafayette Parish, Louisiana, 2001-02—Continued

ACAD well number (fig. 1)	Molybdenum (µg/L as Mo) 7439-98-7	Nickel (µg/L as Ni) 7440-02-0	Selenium (µg/L as Se) 7782-49-2	Silver (µg/L as Ag) 7440-22-4	Strontium (µg/L as Sr) 7440-24-6	Thallium (µg/L as Tl) 7440-28-0	Uranium (µg/L as U) 7440-61-0	Vanadium (µg/L as V) 7440-62-2	Zinc (µg/L as Zn) 7440-66-6
92	0.2	1	E0.2	<1	160	E0.03	E0.02	0.8	<1
93	4	1	.4	<1	160	<.04	1.4	5.8	2
95	1	1	E.2	<1	130	<.04	E.01	3.4	<1
96	1	1	E.2	<1	90	E.04	.47	2.6	<1
97	E.1	2	E.3	<1	40	E.03	E.01	2.0	1
98	E.1	3	E.2	<1	100	<.04	<.02	1.1	1
99	1	1	.4	<1	280	E.02	3.2	2.4	<1
100	5	2	<.3	<1	160	E.03	.63	6.5	<1
101	.5	1	.5	<1	120	E.02	.07	3.9	<1
102	4	3	<.3	<1	140	<.04	.76	1.9	3
103	.5	4	E.2	<1	30	<.04	E.01	1.7	2
104	.7	1	<.3	<1	220	<.04	.11	2.8	<1
105	.5	1	3	<1	110	<.04	.03	3.8	2
106	1	6	<.3	<1	160	<.04	.04	3.5	<1
108	1	2	2	<1	240	<.04	.27	3.9	<1
109	.7	3	1	<1	410	<.04	.08	2.3	1
110	E.2	2	<.3	<1	130	<.04	.03	6.6	<1
111	.6	2	2	<1	140	E.02	.09	3.6	10
112	3	1	E.2	<1	120	E.03	.25	.8	<1
113	2	0	<.3	<1	120	<.04	2.0	2.6	1
114	.9	1	2	<1	180	<.04	.10	3.8	<1
115	E.1	3	.5	<1	30	<.04	<.02	4.5	1
116	2	1	<.3	<1	60	<.04	<.02	.9	1
117	<.2	1	.4	<1	40	<.04	E.01	1.3	<1
118	1	1	<.3	<1	70	E.02	.07	.5	<1
119	.3	4	.6	<1	30	<.04	<.02	4.4	<1
120	E.1	2	2	<1	60	E.03	<.02	2.3	1
121	2	2	<.3	<1	130	<.04	.10	3.5	<1

Appendix 4. Nutrients and dissolved organic carbon concentrations in water from selected shallow wells in urban residential and light commercial areas in Lafayette Parish, Louisiana, 2001-02

[Numbers below the chemical names are the Chemical Abstracts Service (CAS) numbers. ACAD, Acadian-Pontchartrain Study Unit of the National Water-Quality Assessment Program; DOTD, Louisiana Department of Transportation and Development; USGS, U.S. Geological Survey; mg/L, milligrams per liter; <, less than; E, estimated]

ACAD well number (fig. 1)	DOTD local well number	USGS site identification number	Sample date	Nitrogen, ammonia, dissolved (mg/L as N) 7664-41-7	Nitrogen, ammonia plus organic, dissolved (mg/L as N) 17778-88-0	Nitrogen, nitrite plus nitrate, dissolved (mg/L as N) N/A	Nitrogen, nitrite (mg/L as N) 14797-65-0	Phosphorus, dissolved (mg/L as P) 7732-14-0	Orthophosphate, dissolved (mg/L as P) 14265-44-2	Carbon, organic, dissolved (mg/L as C) no CAS number
92	Lf-9913Z	301058092015001	2/06/02	<0.04	E0.07	E0.05	<0.01	0.04	0.04	1.6
93	Lf-9914Z	301114092031901	12/20/01	<.04	E.09	.13	E.01	.10	.09	.7
95	Lf-9968Z	300643092040301	12/04/01	<.04	<.10	.19	E.01	.54	.55	<.3
96	Lf-9969Z	300906092031301	12/05/01	E.03	E.10	<.05	<.01	.32	.32	.4
97	Lf-9973Z	300946091591601	1/28/02	<.04	<.10	<.05	<.01	.21	.19	E.2
98	Lf-9974Z	301014092000102	2/06/02	<.04	E.06	E.05	<.01	.07	.07	.4
99	Lf-9998Z	300825092044501	12/05/01	E.02	E.07	1.9	.03	.31	.31	1.2
100	Lf-9975Z	301202092050501	12/04/01	<.04	<.10	<.05	<.01	.31	.31	E.2
101	Lf-9976Z	300824091593201	1/23/02	<.04	<.10	.55	<.01	.47	.45	<.3
102	Lf-9999Z	301015092015001	3/14/02	.06	E.10	<.05	<.01	.19	.17	.7
103	Lf-10000Z	301907092003401	2/07/02	<.04	<.10	1.3	<.01	.15	.14	E.2
104	Lf-10001Z	301336092035401	12/03/01	<.04	E.05	<.05	<.01	.49	.48	E.2
105	Lf-10009Z	301213092053501	1/30/02	<.04	<.10	.51	<.01	.38	.35	E.3
106	Lf-10010Z	300932092003701	2/04/02	<.04	<.10	.38	<.01	.42	.43	.6
108	Lf-10012Z	301424092055801	12/06/01	<.04	<.10	.61	.03	.39	.38	.4
109	Lf-10013Z	300916092051901	2/11/02	<.04	E.07	22	.05	.25	.26	<.3
110	Lf-10014Z	301100092005801	1/22/02	<.04	<.10	.43	<.01	.23	.24	.5
111	Lf-10015Z	301147092040701	1/29/02	<.04	<.10	.14	<.01	.31	.29	E.3
112	Lf-10016Z	301253092042001	12/19/01	<.04	E.06	E.02	<.01	.20	.17	E.3
113	Lf-10017Z	301035092055801	1/29/02	.06	E.08	<.05	<.01	.23	.21	.7
114	Lf-10180Z	301107092033001	12/19/01	E.02	<.10	.10	<.01	.47	.44	E.3
115	Lf-10181Z	301425091593901	1/30/02	<.04	<.10	.43	<.01	.24	.22	E.3
116	Lf-10026Z	301355092005601	2/14/02	.05	E.07	<.05	<.01	.58	.10	.4
117	Lf-10027Z	301619091595301	12/11/01	<.04	<.10	.86	<.01	.09	.09	E.2
118	Lf-10028Z	301421092022901	2/07/02	E.03	E.06	<.05	<.01	.43	.44	E.2
119	Lf-10029Z	301332091593001	2/04/02	<.04	<.10	.30	<.01	.30	.30	E.3
120	Lf-10030Z	301234092012401	12/11/01	<.04	<.10	.87	<.01	.46	.46	E.2
121	Lf-10031Z	301148092024101	2/13/02	<.04	<.10	<.05	<.01	.28	E.27	E.2

Appendix 5. Radon, chlorofluorocarbons, and stable isotope concentrations in water from selected shallow wells in urban residential and light commercial areas in Lafayette Parish, Louisiana, 2001-02

[Numbers below the chemical names are the Chemical Abstracts Service (CAS) numbers. ACAD, Acadian-Pontchartrain Study Unit of the National Water-Quality Assessment Program; DOTD, Louisiana Department of Transportation and Development; USGS, U.S. Geological Survey; pCi/L, picocuries per liter; pg/kg, picograms per kilogram; ratio per mil, parts per thousand; ---, no data; <, less than]

ACAD well number (fig. 1)	DOTD local well number	USGS site identification number	Sample date	Radon-222, total (pCi/L) 14859-67-7	Radon-222, 2-sigma precision estimate (pCi/L)	CFC-11 trichloro-fluoromethane (pg/kg) 75-69-4	CFC-113 trichlorotri-fluoroethane (pg/kg) 76-13-1	CFC-12 dichlorodi-fluoromethane (pg/kg) 75-71-8	Apparent ground-water age (years)	Hydrogen 2/1 ratio (ratio per mil) no CAS number	Oxygen 18/16 ratio (ratio per mil) no CAS number
92	Lf-9913Z	301058092015001	2/06/02	1,130	36	---	---	---	---	---	---
95	Lf-9968Z	301114092031901	12/04/01	335	22	---	---	---	---	---	---
95	Lf-9968Z	300643092040301	7/17/02	---	---	7.0	0	5.8	50	-17.1	-3.51
96	Lf-9969Z	300906092031301	12/05/01	1,080	32	---	---	---	---	---	---
98	Lf-9974Z	300946091591601	2/06/02	2,220	47	---	---	---	---	---	---
99	Lf-9998Z	301014092000102	12/05/01	307	21	---	---	---	---	---	---
100	Lf-9975Z	300825092044501	12/04/01	360	23	---	---	---	---	---	---
101	Lf-9976Z	301202092050501	1/23/02	331	23	---	---	---	---	---	---
101	Lf-9976Z	300824091593201	7/16/02	---	---	52	4.4	340	<32	-17.3	-3.53
102	Lf-9999Z	301015092015001	3/14/02	454	21	---	---	---	---	---	---
103	Lf-10000Z	301907092003401	2/07/02	403	28	---	---	---	---	---	---
104	Lf-10001Z	301336092035401	12/03/01	280	21	---	---	---	---	---	---
104	Lf-10001Z	301213092053501	7/17/02	---	---	9.3	0	30	40	-19.2	-3.89
105	Lf-10009Z	300932092003701	1/30/02	425	26	---	---	---	---	---	---
109	Lf-10013Z	301424092055801	2/11/02	699	28	---	---	---	---	---	---
109	Lf-10013Z	300916092051901	8/01/02	---	---	10	0	100	<25	---	---
110	Lf-10014Z	301100092005801	1/22/02	522	28	---	---	---	---	---	---
110	Lf-10014Z	301147092040701	7/17/02	---	---	690	15	330	20	-18.8	-3.87
111	Lf-10015Z	301253092042001	1/29/01	323	22	---	---	---	---	---	---
111	Lf-10015Z	301035092055801	7/12/02	---	---	17.0	0	38	36	-18.7	-3.70
112	Lf-10016Z	301107092033001	12/19/01	474	24	---	---	---	---	---	---
113	Lf-10017Z	301425091593901	1./29/02	312	22	---	---	---	---	---	---
114	Lf-10180Z	301355092005601	8/01/02	---	---	2.8	0	195	12	---	---
115	Lf-10181Z	301619091595301	1/30/02	375	25	---	---	---	---	---	---
116	Lf-10026Z	301421092022901	7/18/02	---	---	9.3	0	17	41	-19.4	3.86
118	Lf-10028Z	301332091593001	2/07/02	319	26	---	---	---	---	---	---
119	Lf-10029Z	301234092012401	7/18/02	---	---	130	4.1	230	<30	-21.4	-4.22
120	Lf-10030Z	301148092024101	12/11/01	367	25	---	---	---	---	---	---
121	Lf-10031Z	301058092015001	2/13/02	829	30	---	---	---	---	---	---

Appendix 6. Pesticide concentrations in water from selected shallow wells in urban residential and light commercial areas in Lafayette Parish, Louisiana, 2001-02

[All concentrations are in micrograms per liter. Numbers below the chemical names are the Chemical Abstracts Service (CAS) numbers. Detections are shown in bold. ACAD, Acadian-Pontchartrain Study Unit of the National Water-Quality Assessment Program; DOTD, Louisiana Department of Transportation and Development; USGS, U.S. Geological Survey; H, herbicide; I, insecticide; <, less than; F, fungicide; E, estimated; ---, no data]

ACAD well number (fig. 1)	DOTD local well number	USGS site identification number	Sample date	Acetochlor H 34256-82-1	Acifluorfen H 50594-66-6	Alachlor H 15972-60-8	Aldicarb I 116-06-3	Atrazine H 1912-24-9	Azinphos-methyl I 86-50-0	Bendiocarb I 22781-23-3
92	Lf-9913Z	301058092015001	2/06/02	<0.006	<0.01	<0.004	<0.04	<0.01	<0.050	<0.025
93	Lf-9914Z	301114092031901	12/20/01	<.004	<.01	<.002	<.04	<.009	<.050	<.025
95	Lf-9968Z	300643092040301	12/04/01	<.004	<.01	<.002	<.04	<.009	<.050	<.025
96	Lf-9969Z	300906092031301	12/05/01	<.004	<.01	<.002	<.04	<.009	<.050	<.025
97	Lf-9973Z	300946091591601	1/28/02	<.006	<.01	<.004	<.04	<.009	<.050	<.025
98	Lf-9974Z	301014092000102	2/06/02	<.006	<.01	<.004	<.04	<.009	<.050	<.025
99	Lf-9998Z	300825092044501	12/05/01	<.004	<.01	<.002	<.04	<.009	<.050	<.025
100	Lf-9975Z	301202092050501	12/04/01	<.004	<.01	<.002	<.04	<.009	<.050	<.025
101	Lf-9976Z	300824091593201	1/23/02	<.006	<.01	<.004	<.04	<.009	<.050	<.025
102	Lf-9999Z	301015092015001	3/14/02	<.006	<.01	<.004	<.04	**.008**	<.050	<.025
103	Lf-10000Z	301907092003401	2/07/02	<.006	<.01	<.004	<.04	<.009	<.050	<.025
104	Lf-10001Z	301336092035401	12/03/01	<.004	<.01	<.002	<.04	<.009	<.050	<.025
105	Lf-10009Z	301213092053501	1/30/02	<.006	<.01	<.004	<.04	<.009	<.050	<.025
106	Lf-10010Z	300932092003701	2/04/02	<.006	<.01	<.004	<.04	<.009	<.050	<.025
108	Lf-10012Z	301424092055801	12/06/01	<.004	<.01	<.002	<.04	<.009	<.050	<.025
109	Lf-10013Z	300916092051901	2/11/02	<.006	<.01	<.004	<.04	<.009	<.050	<.025
110	Lf-10014Z	301100092005801	1/22/02	<.006	<.01	<.004	<.04	<.007	<.050	<.025
111	Lf-10015Z	301147092040701	1/29/02	<.006	<.01	<.004	<.04	<.009	<.050	<.025
112	Lf-10016Z	301253092042001	12/19/01	<.004	<.01	<.002	<.04	<.007	<.050	<.025
113	Lf-10017Z	301035092055801	1/29/02	<.006	<.01	<.004	<.04	<.009	<.050	<.025
114	Lf-10180Z	301107092033001	12/19/01	<.004	<.01	<.002	<.04	<.007	<.050	<.025
115	Lf-10181Z	301425091593901	1/30/02	<.006	<.01	<.004	<.04	<.009	<.050	<.025
116	Lf-10026Z	301355092005601	2/14/02	<.006	<.01	<.004	<.04	<.009	<.050	<.025
117	Lf-10027Z	301619091595301	12/11/01	<.004	<.01	<.002	<.04	<.007	<.050	<.025
118	Lf-10028Z	301421092022901	2/07/02	<.006	<.01	<.004	<.04	<.009	<.050	<.025
119	Lf-10029Z	301332091593001	2/04/02	<.006	<.01	<.004	<.04	<.009	<.050	<.025
120	Lf-10030Z	301234092012401	12/11/01	<.004	<.01	<.002	<.04	<.009	<.050	<.025
121	Lf-10031Z	301148092024101	2/13/02	<.006	<.01	<.004	<.04	<.009	<.050	<.025

Appendix 6. Pesticide concentrations in water from selected shallow wells in urban residential and light commercial areas in Lafayette Parish, Louisiana, 2001-02—Continued

ACAD well number (fig. 1)	Benfluralin H 1861-40-1	Benomyl F 17804-35-2	Bensulfuron methyl H 83055-99-6	Bentazon H 25057-89-0	Bromacil H 314-40-9	Bromoxynil H 1689-84-5	Butylate H 2008-41-5	Carbaryl I 63-25-2	Carbofuran I 1563-66-2	Chloramben methyl ester H 133-90-4
92	<0.010	<0.004	<0.0158	<0.01	<0.03	<0.02	<0.002	<0.041	<0.020	<0.02
93	<.010	<.004	<.0158	<.01	<.03	<.02	<.002	<.041	<.020	<.02
95	<.010	<.004	<.0158	<.01	<.03	<.02	<.002	<.041	<.020	<.02
96	<.010	<.004	<.0158	<.01	<.03	<.02	<.002	<.041	<.020	<.02
97	<.010	<.004	<.0158	<.01	<.03	<.02	<.002	<.041	<.020	<.02
98	<.010	<.004	<.0158	<.01	<.03	<.02	<.002	<.041	<.020	<.02
99	<.010	<.004	<.0158	E.05	<.03	<.02	<.002	<.041	<.020	<.02
100	<.010	<.004	<.0158	<.01	<.03	<.02	<.002	<.041	<.020	<.02
101	<.010	<.004	<.0158	<.01	<.03	<.02	<.002	<.041	<.020	<.02
102	<.010	<.004	<.0158	<.01	<.03	<.02	<.002	<.041	<.020	<.02
103	<.010	<.004	<.0158	<.01	<.03	<.02	<.002	<.041	<.020	<.02
104	<.010	<.004	<.0158	<.01	<.03	<.02	<.002	<.041	<.020	<.02
105	<.010	<.004	<.0158	<.01	<.03	<.02	<.002	<.041	<.020	<.02
106	<.010	<.004	<.0158	<.01	<.03	<.02	<.002	<.041	<.020	<.02
108	<.010	<.004	<.0158	<.01	<.03	<.02	<.002	<.041	<.020	<.02
109	<.010	<.004	<.0158	<.01	<.03	<.02	<.002	<.041	<.020	<.02
110	<.010	<.004	<.0158	<.01	<.03	<.02	<.002	<.041	<.020	<.02
111	<.010	<.004	<.0158	<.01	<.03	<.02	<.002	<.041	<.020	<.02
112	<.010	<.004	<.0158	<.01	<.03	<.02	<.002	<.041	<.020	<.02
113	<.010	<.004	<.0158	<.01	<.03	<.02	<.002	<.041	<.020	<.02
114	<.010	<.004	<.0158	<.01	<.03	<.02	<.002	<.041	<.020	<.02
115	<.010	<.004	<.0158	<.01	<.03	<.02	<.002	<.041	<.020	<.02
116	<.010	<.004	<.0158	<.01	<.03	<.02	<.002	<.041	<.020	<.02
117	<.010	<.004	<.0158	<.01	<.03	<.02	<.002	<.041	<.020	<.02
118	<.010	<.004	<.0158	<.01	<.03	<.02	<.002	<.041	<.020	<.02
119	<.010	<.004	<.0158	<.01	<.03	<.02	<.002	<.041	<.020	<.02
120	<.010	<.004	<.0158	<.01	<.03	<.02	<.002	<.041	<.020	<.02
121	<.010	<.004	<.0158	<.01	<.03	<.02	<.002	<.041	<.020	<.02

Appendix 6. Pesticide concentrations in water from selected shallow wells in urban residential and light commercial areas in Lafayette Parish, Louisiana, 2001-02—Continued

ACAD well number (fig. 1)	Chlorimuron H 90982-32-4	Chlorothalonil F 1897-45-6	Chlorpyrifos I 2921-88-2	Clopyralid H 1702-17-6	Cyanazine H 21725-46-2	Cycloate H 1134-23-2	2,4-D H 94-75-7	Dacthal (DCPA) H 1861-32-1	Dacthal, monoacid H 887-54-7	2,4-DB H 94-82-6
92	<0.010	<0.04	<0.005	<0.01	<0.018	<0.01	<0.02	<0.003	<0.01	<0.02
93	<.010	<.04	<.005	<.01	<.018	<.01	<.02	<.003	<.01	<.02
95	<.010	<.04	<.005	<.01	<.018	<.01	<.02	<.003	<.01	<.02
96	<.010	<.04	<.005	<.01	<.018	<.01	<.02	<.003	<.01	<.02
97	<.010	<.04	<.005	<.01	<.018	<.01	<.02	<.003	<.01	<.02
98	<.010	<.04	<.005	<.01	<.018	<.01	<.02	<.003	<.01	<.02
99	<.010	<.04	<.005	<.01	<.018	<.01	<.02	<.003	<.01	<.02
100	<.010	<.04	<.005	<.01	<.018	<.01	<.02	<.003	<.01	<.02
101	<.010	<.04	<.005	<.01	<.018	<.01	<.02	<.003	<.01	<.02
102	<.010	<.04	<.005	<.01	<.018	<.01	<.02	<.003	<.01	<.02
103	<.010	<.04	<.005	<.01	<.018	<.01	<.02	<.003	<.01	<.02
104	<.010	<.04	<.005	<.01	<.018	<.01	<.02	<.003	<.01	<.02
105	<.010	<.04	<.005	<.01	<.018	<.01	<.02	<.003	<.01	<.02
106	<.010	<.04	<.005	<.01	<.018	<.01	<.02	<.003	<.01	<.02
108	<.010	<.04	<.005	<.01	<.018	<.01	<.02	<.003	<.01	<.02
109	<.010	<.04	<.005	<.01	<.018	<.01	<.02	<.003	<.01	<.02
110	<.010	<.04	<.005	<.01	<.018	<.01	<.02	<.003	<.01	<.02
111	<.010	<.04	<.005	<.01	<.018	<.01	<.02	<.003	<.01	<.02
112	<.010	<.04	<.005	<.01	<.018	<.01	<.02	<.003	<.01	<.02
113	<.010	<.04	<.005	<.01	<.018	<.01	<.02	<.003	<.01	<.02
114	<.010	<.04	<.005	<.01	<.018	<.01	<.02	<.003	<.01	<.02
115	<.010	<.04	<.005	<.01	<.018	<.01	<.02	<.003	<.01	<.02
116	<.010	<.04	<.005	<.01	<.018	<.01	<.02	<.003	<.01	<.02
117	<.010	<.04	<.005	<.01	<.018	<.01	<.02	<.003	<.01	<.02
118	<.010	<.04	<.005	<.01	<.018	<.01	<.02	<.003	<.01	<.02
119	<.010	<.04	<.005	<.01	<.018	<.01	<.02	<.003	<.01	<.02
120	<.010	<.04	<.005	<.01	<.018	<.01	<.02	<.003	<.01	<.02
121	<.010	<.04	<.005	<.01	<.018	<.01	<.02	<.003	<.01	<.02

Appendix 6. Pesticide concentrations in water from selected shallow wells in urban residential and light commercial areas in Lafayette Parish, Louisiana, 2001-02—Continued

ACAD well number (fig. 1)	Diazinon I 333-41-5	Dicamba H 1918-00-9	Dichlorprop H 120-36-5	Dieldrin I 60-57-1	Dinoseb H 88-85-7	Diphenamid H 957-51-7	Disulfoton I 298-04-4	Diuron H 330-54-1	2,4-D methyl ester H 1928-38-7	EPTC H 759-94-4	Ethalfluralin H 55283-68-6
92	<0.005	<0.01	<0.01	<0.005	<0.01	<0.03	<0.021	<0.01	<0.009	<0.002	<0.009
93	<.005	<.01	<.01	<.005	<.01	<.03	<.021	<.01	<.009	<.002	<.009
95	<.005	<.01	<.01	<.005	<.01	<.03	<.021	<.01	<.009	<.002	<.009
96	<.005	<.01	<.01	<.005	<.01	<.03	<.021	<.01	<.009	<.002	<.009
97	<.005	<.01	<.01	<.005	<.01	<.03	<.021	<.01	<.009	<.002	<.009
98	<.005	<.01	<.01	<.005	<.01	<.03	<.021	<.01	<.009	<.002	<.009
99	<.005	<.01	<.01	<.005	<.01	<.03	<.021	<.01	<.009	<.002	<.009
100	<.005	<.01	<.01	<.005	<.01	<.03	<.021	<.01	<.009	<.002	<.009
101	<.005	<.01	<.01	<.005	<.01	<.03	<.021	<.01	<.009	<.002	<.009
102	<.005	<.01	<.01	<.005	<.01	<.03	<.021	<.01	<.009	<.002	<.009
103	<.005	<.01	<.01	<.005	<.01	<.03	<.021	<.01	<.009	<.002	<.009
104	<.005	<.01	<.01	<.005	<.01	<.03	<.021	<.01	<.009	<.002	<.009
105	<.005	<.01	<.01	<.005	<.01	<.03	<.021	<.01	<.009	<.002	<.009
106	<.005	<.01	<.01	<.005	<.01	<.03	<.021	<.01	<.009	<.002	<.009
108	<.005	<.01	<.01	<.005	<.01	<.03	<.021	<.01	<.009	<.002	<.009
109	<.005	<.01	<.01	<.005	<.01	<.03	<.021	<.01	<.009	<.002	<.009
110	<.005	<.01	<.01	<.005	<.01	<.03	<.021	<.01	<.009	<.002	<.009
111	<.005	<.01	<.01	<.005	<.01	<.03	<.021	<.01	<.009	<.002	<.009
112	<.005	<.01	<.01	<.005	<.01	<.03	<.021	<.01	<.009	<.002	<.009
113	<.005	<.01	<.01	<.005	<.01	<.03	<.021	<.01	<.009	<.002	<.009
114	<.005	<.01	<.01	<.005	<.01	<.03	<.021	<.01	<.009	<.002	<.009
115	<.005	<.01	<.01	<.005	<.01	<.03	<.021	<.01	<.009	<.002	<.009
116	<.005	<.01	<.01	<.005	<.01	<.03	<.021	<.01	<.009	<.002	<.009
117	<.005	<.01	<.01	<.005	<.01	<.03	<.021	<.01	<.009	<.002	<.009
118	<.005	<.01	<.01	<.005	<.01	<.03	<.021	<.01	<.009	<.002	<.009
119	<.005	<.01	<.01	<.005	<.01	<.03	<.021	<.01	<.009	<.002	<.009
120	<.005	<.01	<.01	<.005	<.01	<.03	<.021	<.01	<.009	<.002	<.009
121	<.005	<.01	<.01	<.005	<.01	<.03	<.021	<.01	<.009	<.002	<.009

Appendix 6. Pesticide concentrations in water from selected shallow wells in urban residential and light commercial areas in Lafayette Parish, Louisiana, 2001-02—Continued

ACAD well number	Ethopropos I 13194-48-4	Fenuron H 101-42-8	Flumetsulam H 98967-40-9	Fluometuron H 2164-17-2	Fonofos I 944-22-9	HCH, alpha I 319-84-6	Imazaquin H 81335-37-7	Imazethapyr H 81335-77-5	Imidacloprid I 13826-41-3	Lindane I 58-89-9
92	<0.005	<0.03	<0.011	<0.03	<0.003	<0.005	<0.016	<0.017	<0.0068	<0.004
93	<.005	<.03	<.011	<.03	<.003	<.005	<.016	<.017	<.0068	<.004
95	<.005	<.03	<.011	<.03	<.003	<.005	<.016	<.017	<.0068	<.004
96	<.005	<.03	<.011	<.03	<.003	<.005	E.026	<.017	<.0068	<.004
97	<.005	<.03	<.011	<.03	<.003	<.005	<.016	<.017	<.0068	<.004
98	<.005	<.03	<.011	<.03	<.003	<.005	<.016	<.017	<.0068	<.004
99	<.005	<.03	<.011	<.03	<.003	<.005	<.016	<.017	<.0068	<.004
100	<.005	<.03	<.011	<.03	<.003	<.005	<.016	<.017	<.0068	<.004
101	<.005	<.03	<.011	<.03	<.003	<.005	<.016	<.017	<.0068	<.004
102	<.005	<.03	<.011	<.03	<.003	<.005	<.016	<.017	<.0068	<.004
103	<.005	<.03	<.011	<.03	<.003	<.005	<.016	<.017	<.0068	<.004
104	<.005	<.03	<.011	<.03	<.003	<.005	<.016	<.017	<.0068	<.004
105	<.005	<.03	<.011	<.03	<.003	<.005	<.016	<.017	<.0068	<.004
106	<.005	<.03	<.011	<.03	<.003	<.005	<.016	<.017	<.0068	<.004
108	<.005	<.03	<.011	<.03	<.003	<.005	<.016	<.017	<.0068	<.004
109	<.005	<.03	<.011	<.03	<.003	<.005	<.016	<.017	<.0068	<.004
110	<.005	<.03	<.011	<.03	<.003	<.005	<.016	<.017	<.0068	<.004
111	<.005	<.03	<.011	<.03	<.003	<.005	<.016	<.017	<.0068	<.004
112	<.005	<.03	<.011	<.03	<.003	<.005	<.016	<.017	<.0068	<.004
113	<.005	<.03	<.011	<.03	<.003	<.005	<.016	<.017	<.0068	<.004
114	<.005	<.03	<.011	<.03	<.003	<.005	<.016	<.017	<.0068	<.004
115	<.005	<.03	<.011	<.03	<.003	<.005	<.016	<.017	<.0068	<.004
116	<.005	<.03	<.011	<.03	<.003	<.005	<.016	<.017	<.0068	<.004
117	<.005	<.03	<.011	<.03	<.003	<.005	<.016	<.017	<.0068	<.004
118	<.005	<.03	<.011	<.03	<.003	<.005	<.016	<.017	<.0068	<.004
119	<.005	<.03	<.011	<.03	<.003	<.005	<.016	<.017	<.0068	<.004
120	<.005	<.03	<.011	<.03	<.003	<.005	<.016	<.017	<.0068	<.004
121	<.005	<.03	<.011	<.03	<.003	<.005	<.016	E.005	E.0095	<.004

Appendix 6. Pesticide concentrations in water from selected shallow wells in urban residential and light commercial areas in Lafayette Parish, Louisiana, 2001-02—Continued

ACAD well number	Linuron H 330-55-2	Malathion I 121-75-5	MCPA H 94-74-6	MCPB H 94-81-5	Metalaxyl F 57837-19-1	Methiocarb I 2032-65-7	Methomyl I 16752-77-5	Methyl parathion I 298-00-0	Metolachlor H 51218-45-2	Metribuzin H 21087-64-9
92	<0.035	<0.027	<0.02	<0.01	<0.020	<0.01	<0.0044	<0.006	<0.013	<0.006
93	<.035	<.027	<.02	<.01	<.020	<.01	<.0044	<.006	<.013	<.006
95	<.035	<.027	<.02	<.01	<.020	<.01	<.0044	<.006	<.013	<.006
96	<.035	<.027	<.02	<.01	<.020	<.01	<.0044	<.006	<.013	<.006
97	<.035	<.027	<.02	<.01	<.020	<.01	<.0044	<.006	<.013	<.006
98	<.035	<.027	<.02	<.01	<.020	<.01	<.0044	<.006	<.013	<.006
99	<.035	<.027	<.02	<.01	<.020	<.01	<.0044	<.006	<.013	<.006
100	<.035	<.027	<.02	<.01	<.020	<.01	<.0044	<.006	<.013	<.006
101	<.035	<.027	<.02	<.01	<.020	<.01	<.0044	<.006	<.013	<.006
102	<.035	<.027	<.02	<.01	<.020	<.01	<.0044	<.006	<.013	<.006
103	<.035	<.027	<.02	<.01	<.020	<.01	<.0044	<.006	<.013	<.006
104	<.035	<.027	<.02	<.01	<.020	<.01	<.0044	<.006	<.013	<.006
105	<.035	<.027	<.02	<.01	<.020	<.01	<.0044	<.006	<.013	<.006
106	<.035	<.027	<.02	<.01	<.020	<.01	<.0044	<.006	<.013	<.006
108	<.035	<.027	<.02	<.01	<.020	<.01	<.0044	<.006	<.013	<.006
109	<.035	<.027	<.02	<.01	<.020	<.01	<.0044	<.006	<.013	<.006
110	<.035	<.027	<.02	<.01	<.020	<.01	<.0044	<.006	<.013	<.006
111	<.035	<.027	<.02	<.01	<.020	<.01	<.0044	<.006	<.013	<.006
112	<.035	<.027	<.02	<.01	<.020	<.01	<.0044	<.006	<.013	<.006
113	<.035	<.027	<.02	<.01	<.020	<.01	<.0044	<.006	<.013	<.006
114	<.035	<.027	<.02	<.01	<.020	<.01	<.0044	<.006	<.013	<.006
115	<.035	<.027	<.02	<.01	<.020	<.01	<.0044	<.006	<.013	<.006
116	<.035	<.027	<.02	<.01	<.020	<.01	<.0044	<.006	<.013	<.006
117	<.035	<.027	<.02	<.01	<.020	<.01	<.0044	<.006	<.013	<.006
118	<.035	<.027	<.02	<.01	<.020	<.01	<.0044	<.006	<.013	<.006
119	<.035	<.027	<.02	<.01	<.020	<.01	<.0044	<.006	<.013	<.006
120	<.035	<.027	<.02	<.01	<.020	<.01	<.0044	<.006	<.013	<.006
121	<.035	<.027	<.02	<.01	<.020	<.01	<.0044	<.006	<.013	<.006

Appendix 6. Pesticide concentrations in water from selected shallow wells in urban residential and light commercial areas in Lafayette Parish, Louisiana, 2001-02—Continued

ACAD well number	Metsulfuron methyl H 74223-64-6	Molinate H 2212-67-1	Napropamide H 15299-99-7	Neburon H 555-37-3	Nicosulfuron H 111991-09-4	Norflurazon H 27314-13-2	Oryzalin H 19044-88-3	Oxamyl I 23135-22-0	Parathion I 56-38-2	Pebulate H 1114-71-2
92	<0.0250	<0.002	<0.007	<0.01	<0.013	<0.02	<0.02	<0.01	<0.010	<0.004
93	<.0250	<.002	<.007	<.01	<.013	<.02	<.02	<.01	<.007	<.002
95	---	<.002	<.007	<.01	<.013	<.02	<.02	<.01	<.007	<.002
96	<.0250	<.002	<.007	<.01	<.013	<.02	<.02	<.01	<.007	<.002
97	<.0250	<.002	<.007	<.01	<.013	<.02	<.02	<.01	<.010	<.004
98	<.0250	<.002	<.007	<.01	<.013	<.02	<.02	<.01	<.010	<.004
99	<.0250	<.002	<.007	<.01	<.013	<.02	<.02	<.01	<.007	<.002
100	---	<.002	<.007	<.01	<.013	<.02	<.02	<.01	<.007	<.002
101	<.0250	<.002	<.007	<.01	<.013	<.02	<.02	<.01	<.010	<.004
102	<.0250	<.002	<.007	<.01	<.013	<.02	<.02	<.01	<.010	<.004
103	<.0250	<.002	<.007	<.01	<.013	<.02	<.02	<.01	<.010	<.004
104	<.0250	<.002	<.007	<.01	<.013	<.02	<.02	<.01	<.007	<.002
105	<.0250	<.002	<.007	<.01	<.013	<.02	<.02	<.01	<.010	<.004
106	<.0250	<.002	<.007	<.01	<.013	<.02	<.02	<.01	<.010	<.004
108	<.0250	<.002	<.007	<.01	<.013	<.02	<.02	<.01	<.007	<.002
109	<.0250	<.002	<.007	<.01	<.013	<.02	<.02	<.01	<.010	<.004
110	<.0250	<.002	<.007	<.01	<.013	<.02	<.02	<.01	<.010	<.004
111	<.0250	<.002	<.007	<.01	<.013	<.02	<.02	<.01	<.010	<.004
112	<.0250	<.002	<.007	<.01	<.013	<.02	<.02	<.01	<.007	<.002
113	<.0250	<.002	<.007	<.01	<.013	<.02	<.02	<.01	<.010	<.004
114	<.0250	<.002	<.007	<.01	<.013	<.02	<.02	<.01	<.007	<.002
115	<.0250	<.002	<.007	<.01	<.013	<.02	<.02	<.01	<.010	<.004
116	<.0250	<.002	<.007	<.01	<.013	<.02	<.02	<.01	<.010	<.004
117	<.0250	<.002	<.007	<.01	<.013	<.02	<.02	<.01	<.007	<.002
118	<.0250	<.002	<.007	<.01	<.013	<.02	<.02	<.01	<.010	<.004
119	<.0250	<.002	<.007	<.01	<.013	<.02	<.02	<.01	<.010	<.004
120	<.0250	<.002	<.007	<.01	<.013	<.02	<.02	<.01	<.007	<.002
121	<.0250	<.002	<.007	<.01	<.013	<.02	<.02	<.01	<.010	<.004

Appendix 6. Pesticide concentrations in water from selected shallow wells in urban residential and light commercial areas in Lafayette Parish, Louisiana, 2001-02—Continued

ACAD well number	Pendimethalin H 40487-42-1	cis-Permethrin I 52341-33-0	Phorate I 298-02-2	Picloram H 1918-02-1	Prometon H 1610-18-0	Pronamide H 23950-58-5	Propachlor H 1918-16-7	Propanil H 709-98-8	Propargite I 2312-35-8	Propham H 122-42-9	Propiconazole F 60207-90-1
92	<0.022	<0.006	<0.011	<0.02	E0.012	<0.004	<0.010	<0.011	<0.023	<0.01	<0.021
93	<.010	<.006	<.011	<.02	<.015	<.004	<.010	<.011	<.023	<.01	<.021
95	<.010	<.006	<.011	<.02	<.015	<.004	<.010	<.011	<.023	<.01	<.001
96	<.010	<.006	<.011	<.02	<.015	<.004	<.010	<.011	<.023	<.01	<.021
97	<.022	<.006	<.011	<.02	<.015	<.004	<.010	<.011	<.023	<.01	<.021
98	<.022	<.006	<.011	<.02	<.015	<.004	<.010	<.011	<.023	<.01	<.021
99	<.010	<.006	<.011	<.02	<.015	<.004	<.010	<.011	<.023	<.01	<.021
100	<.010	<.006	<.011	<.02	<.015	<.004	<.010	<.011	<.023	<.01	<.021
101	<.022	<.006	<.011	<.02	<.015	<.004	<.010	<.011	<.023	<.01	<.021
102	<.022	<.006	<.011	<.02	<.015	<.004	<.010	<.011	<.023	<.01	<.021
103	<.022	<.006	<.011	<.02	<.015	<.004	<.010	<.011	<.023	<.01	<.021
104	<.010	<.006	<.011	<.02	<.015	<.004	<.010	<.011	<.023	<.01	<.021
105	<.022	<.006	<.011	<.02	<.015	<.004	<.010	<.011	<.023	<.01	<.021
106	<.022	<.006	<.011	<.02	<.015	<.004	<.010	<.011	<.023	<.01	<.021
108	<.010	<.006	<.011	<.02	<.015	<.004	<.010	<.011	<.023	<.01	<.021
109	<.022	<.006	<.011	<.02	<.015	<.004	<.010	<.011	<.023	<.01	<.021
110	<.022	<.006	<.011	<.02	<.015	<.004	<.010	<.011	<.023	<.01	<.021
111	<.022	<.006	<.011	<.02	<.015	<.004	<.010	<.011	<.023	<.01	<.021
112	<.010	<.006	<.011	<.02	<.015	<.004	<.010	<.011	<.023	<.01	<.021
113	<.022	<.006	<.011	<.02	<.015	<.004	<.010	<.011	<.023	<.01	<.021
114	<.010	<.006	<.011	<.02	<.015	<.004	<.010	<.011	<.023	<.01	<.021
115	<.022	<.006	<.011	<.02	<.015	<.004	<.010	<.011	<.023	<.01	<.021
116	<.022	<.006	<.011	<.02	<.015	<.004	<.010	<.011	<.023	<.01	<.021
117	<.010	<.006	<.011	<.02	<.015	<.004	<.010	<.011	<.023	<.01	<.021
118	<.022	<.006	<.011	<.02	<.015	<.004	<.010	<.011	<.023	<.01	<.021
119	<.022	<.006	<.011	<.02	<.015	<.004	<.010	<.011	<.023	<.01	<.021
120	<.010	<.006	<.011	<.02	<.015	<.004	<.010	<.011	<.023	<.01	<.021
121	<.022	<.006	<.011	<.02	<.015	<.004	<.010	<.011	<.023	<.01	<.021

Appendix 6. Pesticide concentrations in water from selected shallow wells in urban residential and light commercial areas in Lafayette Parish, Louisiana, 2001-02—Continued

ACAD well number	Propoxur I 204-043-8	Siduron H 1982-49-6	Simazine H 122-34-9	Sulfometruron methyl H 74222-97-2	Tebuthiuron H 34014-18-1	Terbacil H 5902-51-2	Terbufos I 13071-79-9	Thiobencarb H 28249-77-6	Tri-allate H 2303-17-5	Tribenuron methyl H 101200-48-0	Triclopyr H 55335-06-3	Trifluralin H 1582-09-8
92	<0.01	<0.017	<0.005	<0.009	<0.006	<0.01	<0.017	<0.005	<0.002	---	<0.02	<0.009
93	<.01	<.017	<.011	<.009	<.006	<.01	<.017	<.005	<.002	---	<.02	<.009
95	<.01	<.017	<.011	<.009	<.006	<.01	<.017	<.005	<.002	---	<.02	<.009
96	<.01	<.017	<.011	<.009	<.006	<.01	<.017	<.005	<.002	<0.01	<.02	<.009
97	<.01	<.017	<.005	<.009	<.006	<.01	<.017	<.005	<.002	---	<.02	<.009
98	<.01	<.017	<.005	<.009	<.006	<.01	<.017	<.005	<.002	---	<.02	<.009
99	<.01	<.017	<.011	<.009	<.006	<.01	<.017	<.005	<.002	<.01	<.02	<.009
100	<.01	<.017	<.011	<.009	<.006	<.01	<.017	<.005	<.002	---	<.02	<.009
101	<.01	<.017	<.005	<.009	<.006	<.01	<.017	<.005	<.002	---	<.02	<.009
102	<.01	<.017	<.005	<.009	<.016	<.01	<.017	<.005	<.002	---	<.02	<.009
103	<.01	<.017	<.005	<.009	<.006	<.01	<.017	<.005	<.002	---	<.02	<.009
104	<.01	<.017	<.011	<.009	<.006	<.01	<.017	<.005	<.002	<.01	<.02	<.009
105	<.01	<.017	<.005	<.009	<.006	<.01	<.017	<.005	<.002	---	<.02	<.009
106	<.01	<.017	<.005	<.009	<.006	<.01	<.017	<.005	<.002	---	<.02	<.009
108	<.01	<.017	<.011	<.009	<.006	<.01	<.017	<.005	<.002	<.01	<.02	<.009
109	<.01	<.017	<.005	<.009	<.006	<.01	<.017	<.005	<.002	---	<.02	<.009
110	<.01	<.017	<.005	<.009	<.016	<.01	<.017	<.005	<.002	---	<.02	<.009
111	<.01	<.017	<.005	<.009	<.006	<.01	<.017	<.005	<.002	---	<.02	<.009
112	<.01	<.017	<.011	<.009	<.016	<.01	<.017	<.005	<.002	---	<.02	<.009
113	<.01	<.017	<.005	<.009	<.006	<.01	<.017	<.005	<.002	---	<.02	<.009
114	<.01	<.017	<.011	<.009	<.016	<.01	<.017	<.005	<.002	---	<.02	<.009
115	<.01	<.017	<.005	<.009	<.006	<.01	<.017	<.005	<.002	---	<.02	<.009
116	<.01	<.017	<.005	<.009	<.006	<.01	<.017	<.005	<.002	---	<.02	<.009
117	<.01	<.017	<.011	<.009	<.016	<.01	<.017	<.005	<.002	---	<.02	<.009
118	<.01	<.017	<.005	<.009	<.006	<.01	<.017	<.005	<.002	---	<.02	<.009
119	<.01	<.017	<.005	<.009	<.006	<.01	<.017	<.005	<.002	---	<.02	<.009
120	<.01	<.017	<.011	<.009	<.006	<.01	<.017	<.005	<.002	<.01	<.02	<.009
121	<.01	<.017	<.005	<.009	<.006	<.01	<.017	<.005	<.002	---	<.02	<.009

Appendix 7. Concentrations of pesticide degradation products in water from selected shallow wells in urban residential and light commercial areas in in Lafayette Parish, Louisiana, 2001-02

[All concentrations are in micrograms per liter. Numbers below the chemical names are the Chemical Abstracts Service (CAS) numbers. ACAD, Acadian-Pontchartrain Study Unit of the National Water-Quality Assessment Program; DOTD, Louisiana Department of Transportation and Development; USGS, U.S. Geological Survey; DP, degradation product; <, less than; E. estimated]

ACAD well number (fig. 1)	DOTD local well number	USGS site identification number	Sample date	Aldicarb sulfone DP (aldicarb) 1646-88-4	Aldicarb sulfoxide DP (aldicarb) 1646-87-3	3-hydroxy-carbofuran DP (carbofuran) 16655-82-6	DDE, p,p' DP (DDT) 72-55-9	Deethylatrazine DP (atrazine) 6190-65-4
92	Lf-9913Z	301058092015001	2/06/02	<0.02	<0.01	<0.01	<0.003	E0.004
93	Lf-9914Z	301114092031901	12/20/01	<.02	<.01	<.01	<.003	<.028
95	Lf-9968Z	300643092040301	12/04/01	<.02	<.01	<.01	<.003	<.028
96	Lf-9969Z	300906092031301	12/05/01	<.02	<.01	<.01	<.003	<.028
97	Lf-9973Z	300946091591601	1/28/02	<.02	<.01	<.01	<.003	<.028
98	Lf-9974Z	301014092000102	2/06/02	<.02	<.01	<.01	<.003	<.028
99	Lf-9998Z	300825092044501	12/05/01	<.02	<.01	<.01	<.003	<.028
100	Lf-9975Z	301202092050501	12/04/01	<.02	<.01	<.01	<.003	<.028
101	Lf-9976Z	300824091593201	1/23/02	<.02	<.01	<.01	<.003	<.028
102	Lf-9999Z	301015092015001	3/14/02	<.02	<.01	<.01	<.003	<.006
103	Lf-10000Z	301907092003401	2/07/02	<.02	<.01	<.01	<.003	E.006
104	Lf-10001Z	301336092035401	12/03/01	<.02	<.01	<.01	<.003	<.028
105	Lf-10009Z	301213092053501	1/30/02	<.02	<.01	<.01	<.003	<.028
106	Lf-10010Z	300932092003701	2/04/02	<.02	<.01	<.01	<.003	<.028
108	Lf-10012Z	301424092055801	12/06/01	<.02	<.01	<.01	<.003	<.028
109	Lf-10013Z	300916092051901	2/11/02	<.02	<.01	<.01	<.003	<.028
110	Lf-10014Z	301100092005801	1/22/02	<.02	<.01	<.01	<.003	<.006
111	Lf-10015Z	301147092040701	1/29/02	<.02	<.01	<.01	<.003	<.028
112	Lf-10016Z	301253092042001	12/19/01	<.02	<.01	<.01	<.003	<.006
113	Lf-10017Z	301035092055801	1/29/02	<.02	<.01	<.01	<.003	<.028
114	Lf-10180Z	301107092033001	12/19/01	<.02	<.01	<.01	<.003	<.006
115	Lf-10181Z	301425091593901	1/30/02	<.02	<.01	<.01	<.003	<.028
116	Lf-10026Z	301355092005601	2/14/02	<.02	<.01	<.01	<.003	<.028
117	Lf-10027Z	301619091595301	12/11/01	<.02	<.01	<.01	<.003	<.006
118	Lf-10028Z	301421092022901	2/07/02	<.02	<.01	<.01	<.003	<.028
119	Lf-10029Z	301332091593001	2/04/02	<.02	<.01	<.01	<.003	<.028
120	Lf-10030Z	301234092012401	12/11/01	<.02	<.01	<.01	<.003	<.028
121	Lf-10031Z	301148092024101	2/13/02	<.02	<.01	<.01	<.003	<.028

Appendix 7. Concentrations of pesticide degradation products in water from selected shallow wells in urban residential and light commercial areas in Lafayette Parish, Louisiana,

ACAD well number (fig. 1)	Deethyldeisopropylatrazine DP (atrazine) 3397-62-4	Deisopropylatrazine DP (atrazine) 1007-28-9	2,6-Diethylaniline DP (alachlor) 579-66-8	2-Hydroxyatrazine DP (atrazine) 2163-68-0	3-Ketocarbofuran DP (carbofuran) 16709-30-1	3 (4-chlorophenyl)-1-methyl urea DP (neburon) 5352-88-5
92	<0.01	<0.04	<0.006	<0.008	<1.50	<0.0242
93	<.01	<.04	<.002	<.008	<1.50	<.0242
95	<.01	<.04	<.002	<.008	<1.50	<.0242
96	<.01	<.04	<.002	<.008	<1.50	<.0242
97	<.01	<.04	<.006	<.008	<1.50	<.0242
98	<.01	<.04	<.006	<.008	<1.50	<.0242
99	<.01	<.04	<.002	<.008	<1.50	<.0242
100	<.01	<.04	<.002	<.008	<1.50	<.0242
101	<.01	<.04	<.006	<.008	<1.50	<.0242
102	<.01	<.04	<.006	<.008	<1.50	<.0242
103	E.06	E.01	<.006	<.008	<1.50	<.0242
104	<.01	<.04	<.002	<.008	<1.50	<.0242
105	<.01	<.04	<.006	<.008	<1.50	<.0242
106	<.01	<.04	<.006	<.008	<1.50	<.0242
108	<.01	<.04	<.002	<.008	<1.50	<.0242
109	<.01	<.04	<.006	<.008	<1.50	<.0242
110	<.01	<.04	<.006	<.008	<1.50	<.0242
111	<.01	<.04	<.006	<.008	<1.50	<.0242
112	<.01	<.04	<.002	<.008	<1.50	<.0242
113	<.01	<.04	<.006	<.008	<1.50	<.0242
114	<.01	<.04	<.002	<.008	<1.50	<.0242
115	<.01	<.04	<.006	<.008	<1.50	<.0242
116	<.01	<.04	<.006	<.008	<1.50	<.0242
117	<.01	<.04	<.002	<.008	<1.50	<.0242
118	<.01	<.04	<.006	<.008	<1.50	<.0242
119	<.01	<.04	<.006	<.008	<1.50	<.0242
120	<.01	<.04	<.002	<.008	<1.50	<.0242
121	<.01	<.04	<.006	<.008	<1.50	<.0242

Appendix 8. Concentrations of volatile organic compounds in water from selected shallow wells in urban residential and light commercial areas in Lafayette Parish, Louisiana, 2001-02

[All concentrations are in micrograms per liter. Numbers below the chemical names are the Chemical Abstracts Service (CAS) numbers. Detections are shown in bold. ACAD, Acadian-Pontchartrain Study Unit of the National Water-Quality Assessment Program; DOTD, Louisiana Department of Transportation and Development; USGS, U.S. Geological Survey; <, less than; E, estimated]

ACAD well number (fig. 1)	DOTD local well number	USGS site identification number	Sample date	Acetone (2-propanone) 67-64-1	Acrylonitrile (2-propenenitrile) 107-13-1	Benzene 71-43-2	Bromobenzene 108-86-1	Bromochloro-methane 74-97-5	Bromodichloro-methane 75-27-4	Bromoethene (Vinyl bromide) 593-60-2
92	Lf-9913Z	301058092015001	2/06/02	<7	<1	<0.04	<0.04	<0.07	<0.05	<0.1
93	Lf-9914Z	301114092031901	12/20/01	<7	<1	E.01	<.04	<.07	<.05	<.1
95	Lf-9968Z	300643092040301	12/04/01	<7	<1	<.04	<.04	<.07	<.05	<.1
96	Lf-9969Z	300906092031301	12/05/01	<7	<1	<.04	<.04	<.07	<.05	<.1
97	Lf-9973Z	300946091591601	1/28/02	<7	<1	<.04	<.04	<.07	<.05	<.1
98	Lf-9974Z	301014092000102	2/06/02	<7	<1	<.04	<.04	<.07	<.05	<.1
99	Lf-9998Z	300825092044501	12/05/01	<7	<1	<.04	<.04	<.07	<.05	<.1
100	Lf-9975Z	301202092050501	12/04/01	<7	<1	<.04	<.04	<.07	<.05	<.1
101	Lf-9976Z	300824091593201	1/23/02	<7	<1	<.04	<.04	<.07	<.05	<.1
102	Lf-9999Z	301015092015001	3/14/02	<7	<1	E.03	<.04	<.07	<.05	<.1
103	Lf-10000Z	301907092003401	2/07/02	<7	<1	<.04	<.04	<.07	<.05	<.1
104	Lf-10001Z	301336092035401	12/03/01	<7	<1	<.04	<.04	<.07	<.05	<.1
105	Lf-10009Z	301213092053501	1/30/02	<7	<1	<.04	<.04	<.07	<.05	<.1
106	Lf-10010Z	300932092003701	2/04/02	<7	<1	<.04	<.04	<.07	<.05	<.1
108	Lf-10012Z	301424092055801	12/06/01	<7	<1	<.04	<.04	<.07	<.05	<.1
109	Lf-10013Z	300916092051901	2/11/02	<7	<1	<.04	<.04	<.07	<.05	<.1
110	Lf-10014Z	301100092005801	1/22/02	<7	<1	<.04	<.04	<.07	<.05	<.1
111	Lf-10015Z	301147092040701	1/29/02	<7	<1	<.04	<.04	<.07	<.05	<.1
112	Lf-10016Z	301253092042001	12/19/01	<7	<1	<.04	<.04	<.07	<.05	<.1
113	Lf-10017Z	301035092055801	1/29/02	<7	<1	<.04	<.04	<.07	<.05	<.1
114	Lf-10180Z	301107092033001	12/19/01	<7	<1	<.04	<.04	<.07	<.05	<.1
115	Lf-10181Z	301425091593901	1/30/02	<7	<1	<.04	<.04	<.07	<.05	<.1
116	Lf-10026Z	301355092005601	2/14/02	<7	<1	<.04	<.04	<.07	<.05	<.1
117	Lf-10027Z	301619091595301	12/11/01	<7	<1	<.04	<.04	<.07	<.05	<.1
118	Lf-10028Z	301421092022901	2/07/02	<7	<1	<.04	<.04	<.07	<.05	<.1
119	Lf-10029Z	301332091593001	2/04/02	<7	<1	<.04	<.04	<.07	<.05	<.1
120	Lf-10030Z	301234092012401	12/11/01	<7	<1	<.04	<.04	<.07	<.05	<.1
121	Lf-10031Z	301148092024101	2/13/02	<7	<1	<.04	<.04	<.07	<.05	<.1

Appendix 8. Concentrations of volatile organic compounds in water from selected shallow wells in urban residential and light commercial areas in Lafayette Parish, Louisiana, 2001-02—Continued

ACAD well number (fig. 1)	Bromoform 75-25-2	Bromomethane (Methyl bromide) 74-83-9	Butylbenzene 104-51-8	sec-Butylbenzene 135-98-8	tert-Butylbenzene 98-06-6	Carbon disulfide 75-15-0	Chlorobenzene 108-90-7	Chloroethane 75-00-3	Chloroform (Trichloromethane) 67-66-3	Chloromethane (methyl chloride) 74-87-3
92	<0.06	<0.3	<0.2	<0.03	<0.05	<0.07	<0.03	<0.1	E0.07	<0.2
93	<.06	<.3	<.2	<.03	<.05	E.03	<.03	<.1	<.02	<.2
95	<.06	<.3	<.2	<.03	<.05	<.07	<.03	<.1	<.02	<.2
96	<.06	<.3	<.2	<.03	<.05	E.04	<.03	<.1	<.02	<.2
97	<.06	<.3	<.2	<.03	<.05	<.07	<.03	<.1	E.01	<.2
98	<.06	<.3	<.2	<.03	<.05	<.07	<.03	<.1	<.02	<.2
99	<.06	<.3	<.2	<.03	<.05	<.07	<.03	<.1	<.02	<.2
100	<.06	<.3	<.2	<.03	<.05	**.11**	<.03	<.1	<.02	<.2
101	<.06	<.3	<.2	<.03	<.05	E.03	<.03	<.1	<.02	<.2
102	<.06	<.3	<.2	<.03	<.05	E.03	<.03	<.1	<.02	<.2
103	<.06	<.3	<.2	<.03	<.05	<.07	<.03	<.1	E.02	<.2
104	<.06	<.3	<.2	<.03	<.05	E.06	<.03	<.1	<.02	<.2
105	<.06	<.3	<.2	<.03	<.05	<.07	<.03	<.1	<.02	<.2
106	<.06	<.3	<.2	<.03	<.05	<.07	<.03	<.1	<.02	<.2
108	<.06	<.3	<.2	<.03	<.05	E.06	<.03	<.1	<.02	<.2
109	<.06	<.3	<.2	<.03	<.05	E.02	<.03	<.1	<.02	<.2
110	<.06	<.3	<.2	<.03	<.05	<.07	<.03	<.1	<.02	<.2
111	<.06	<.3	<.2	<.03	<.05	<.07	<.03	<.1	<.02	<.2
112	<.06	<.3	<.2	<.03	<.05	**.22**	<.03	<.1	<.02	<.2
113	<.06	<.3	<.2	<.03	<.05	<.07	<.03	<.1	<.02	<.2
114	<.06	<.3	<.2	<.03	<.05	<.07	<.03	<.1	<.02	<.2
115	<.06	<.3	<.2	<.03	<.05	<.07	<.03	<.1	<.02	<.2
116	<.06	<.3	<.2	<.03	<.05	<.07	<.03	<.1	<.02	<.2
117	<.06	<.3	<.2	<.03	<.05	<.07	<.03	<.1	<.02	<.2
118	<.06	<.3	<.2	<.03	<.05	E.07	<.03	<.1	<.02	<.2
119	<.06	<.3	<.2	<.03	<.05	<.07	<.03	<.1	<.02	<.2
120	<.06	<.3	<.2	<.03	<.05	<.07	<.03	<.1	**.38**	<.2
121	<.06	<.3	<.2	<.03	<.05	E.02	<.03	<.1	<.02	<.2

Appendix 8. Concentrations of volatile organic compounds in water from selected shallow wells in urban residential and light commercial areas in Lafayette Parish, Louisiana, 2001-02—Continued

ACAD well number (fig. 1)	3-Chloropropene 107-05-1	2-Chlorotoluene 95-49-8	4-Chlorotoluene 106-43-4	Dibromo-chloromethane 124-48-1	1,2-Dibromo-3-chloropropane 96-12-8	1,2-Dibromo-ethane 106-93-4	Dibromo--methane 74-95-3	1,2-Dichloro-benzene 95-50-1	1,3-Dichloro-benzene 541-73-1	1,4-Dichloro-benzene 106-46-7
92	<0.1	<0.03	<0.05	<0.2	<0.5	<0.04	<0.05	<0.03	<0.03	<0.05
93	<.1	<.03	<.05	<.2	<.5	<.04	<.05	<.03	<.03	<.05
95	<.1	<.03	<.05	<.2	<.5	<.04	<.05	<.03	<.03	<.05
96	<.1	<.03	<.05	<.2	<.5	<.04	<.05	<.03	<.03	<.05
97	<.1	<.03	<.05	<.2	<.5	<.04	<.05	<.03	<.03	<.05
98	<.1	<.03	<.05	<.2	<.5	<.04	<.05	<.03	<.03	<.05
99	<.1	<.03	<.05	<.2	<.5	<.04	<.05	<.03	<.03	<.05
100	<.1	<.03	<.05	<.2	<.5	<.04	<.05	<.03	<.03	<.05
101	<.1	<.03	<.05	<.2	<.5	<.04	<.05	<.03	<.03	<.05
102	<.1	<.03	<.05	<.2	<.5	<.04	<.05	<.03	<.03	<.05
103	<.1	<.03	<.05	<.2	<.5	<.04	<.05	<.03	<.03	<.05
104	<.1	<.03	<.05	<.2	<.5	<.04	<.05	<.03	<.03	<.05
105	<.1	<.03	<.05	<.2	<.5	<.04	<.05	<.03	<.03	<.05
106	<.1	<.03	<.05	<.2	<.5	<.04	<.05	<.03	<.03	<.05
108	<.1	<.03	<.05	<.2	<.5	<.04	<.05	<.03	<.03	<.05
109	<.1	<.03	<.05	<.2	<.5	<.04	<.05	<.03	<.03	<.05
110	<.1	<.03	<.05	<.2	<.5	<.04	<.05	<.03	<.03	<.05
111	<.1	<.03	<.05	<.2	<.5	<.04	<.05	<.03	<.03	<.05
112	<.1	<.03	<.05	<.2	<.5	<.04	<.05	<.03	<.03	<.05
113	<.1	<.03	<.05	<.2	<.5	<.04	<.05	<.03	<.03	<.05
114	<.1	<.03	<.05	<.2	<.5	<.04	<.05	<.03	<.03	<.05
115	<.1	<.03	<.05	<.2	<.5	<.04	<.05	<.03	<.03	<.05
116	<.1	<.03	<.05	<.2	<.5	<.04	<.05	<.03	<.03	<.05
117	<.1	<.03	<.05	<.2	<.5	<.04	<.05	<.03	<.03	<.05
118	<.1	<.03	<.05	<.2	<.5	<.04	<.05	<.03	<.03	<.05
119	<.1	<.03	<.05	<.2	<.5	<.04	<.05	<.03	<.03	<.05
120	<.1	<.03	<.05	<.2	<.5	<.04	<.05	<.03	<.03	<.05
121	<.1	<.03	<.05	<.2	<.5	<.04	<.05	<.03	<.03	<.05

Appendix 8. Concentrations of volatile organic compounds in water from selected shallow wells in urban residential and light commercial areas in Lafayette Parish, Louisiana, 2001-02—Continued

ACAD well number (fig. 1)	trans-1,4-Dichloro-2-butene 110-57-6	Dichlorodifluoro-methane 75-71-8	1,1-Dichloroethane 75-34-3	1,2-Dichloroethane 107-06-2	1,1-Dichloro-ethylene 75-35-4	cis-1,2-Dichloro-ethylene 156-59-2	trans-1,2-Dichloro-ethylene 156-60-5	Dichloromethane (Methylene chloride) 75-09-2	1,2-Dichloro-propane 78-87-5	1,3-Dichloro-propane 142-28-9
92	<0.7	<0.2	<0.04	<0.1	<0.04	<0.04	<0.03	<0.2	<0.03	<0.1
93	<.7	<.2	<.04	<.1	<.04	<.04	<.03	<.2	<.03	<.1
95	<.7	<.2	<.04	<.1	<.04	<.04	<.03	<.2	<.03	<.1
96	<.7	<.2	<.04	<.1	<.04	<.04	<.03	<.2	<.03	<.1
97	<.7	<.2	<.04	<.1	<.04	<.04	<.03	<.2	<.03	<.1
98	<.7	<.2	<.04	<.1	<.04	<.04	<.03	<.2	<.03	<.1
99	<.7	<.2	<.04	<.1	<.04	<.04	<.03	<.2	<.03	<.1
100	<.7	<.2	<.04	<.1	<.04	<.04	<.03	<.2	<.03	<.1
101	<.7	<.2	<.04	<.1	<.04	<.04	<.03	<.2	<.03	<.1
102	<.7	<.2	<.04	<.1	<.04	<.04	<.03	<.2	<.03	<.1
103	<.7	<.2	<.04	<.1	<.04	<.04	<.03	<.2	<.03	<.1
104	<.7	<.2	<.04	<.1	<.04	<.04	<.03	<.2	<.03	<.1
105	<.7	<.2	<.04	<.1	<.04	<.04	<.03	<.2	<.03	<.1
106	<.7	<.2	<.04	<.1	<.04	<.04	<.03	<.2	<.03	<.1
108	<.7	<.2	<.04	<.1	<.04	<.04	<.03	<.2	<.03	<.1
109	<.7	<.2	<.04	<.1	<.04	<.04	<.03	<.2	<.03	<.1
110	<.7	<.2	<.04	<.1	<.04	<.04	<.03	<.2	<.03	<.1
111	<.7	<.2	<.04	<.1	<.04	<.04	<.03	<.2	<.03	<.1
112	<.7	<.2	<.04	<.1	<.04	<.04	<.03	<.2	<.03	<.1
113	<.7	<.2	<.04	<.1	<.04	<.04	<.03	<.2	<.03	<.1
114	<.7	<.2	<.04	<.1	<.04	<.04	<.03	<.2	<.03	<.1
115	<.7	<.2	<.04	<.1	<.04	<.04	<.03	<.2	<.03	<.1
116	<.7	<.2	<.04	<.1	<.04	<.04	<.03	<.2	<.03	<.1
117	<.7	<.2	<.04	<.1	<.04	<.04	<.03	<.2	<.03	<.1
118	<.7	<.2	<.04	<.1	<.04	<.04	<.03	<.2	<.03	<.1
119	<.7	<.2	<.04	<.1	<.04	<.04	<.03	<.2	<.03	<.1
120	<.7	<.2	<.04	<.1	<.04	<.04	<.03	<.2	<.03	<.1
121	<.7	<.2	<.04	<.1	<.04	<.04	<.03	<.2	<.03	<.1

Appendix 8. Concentrations of volatile organic compounds in water from selected shallow wells in urban residential and light commercial areas in Lafayette Parish, Louisiana, 2001-02—Continued

ACAD well number (fig. 1)	2,2-Dichloropropane 594-20-7	1,1-Dichloropropene 563-58-6	cis-1,3-Dichloropropene 10061-01-5	trans-1,3-Dichloropropene 10061-02-6	Diethyl ether 60-29-7	Diisopropyl ether 108-20-3	Ethylbenzene 100-41-4	Ethyl tert-butyl ether (ETBE) 637-92-3	Ethyl methacrylate 97-63-2	O-Ethyl toluene 611-14-3
92	<0.05	<0.05	<0.09	<0.09	<0.2	<0.1	<0.03	<0.05	<0.2	<0.06
93	<.05	<.05	<.09	<.09	<.2	<.1	<.03	<.05	<.2	<.06
95	<.05	<.05	<.09	<.09	<.2	<.1	<.03	<.05	<.2	<.06
96	<.05	<.05	<.09	<.09	<.2	<.1	<.03	<.05	<.2	<.06
97	<.05	<.05	<.09	<.09	<.2	<.1	<.03	<.05	<.2	<.06
98	<.05	<.05	<.09	<.09	<.2	<.1	<.03	<.05	<.2	<.06
99	<.05	<.05	<.09	<.09	<.2	<.1	<.03	<.05	<.2	<.06
100	<.05	<.05	<.09	<.09	<.2	<.1	<.03	<.05	<.2	<.06
101	<.05	<.05	<.09	<.09	<.2	<.1	<.03	<.05	<.2	<.06
102	<.05	<.05	<.09	<.09	<.2	<.1	<.03	<.05	<.2	<.06
103	<.05	<.05	<.09	<.09	<.2	<.1	<.03	<.05	<.2	<.06
104	<.05	<.05	<.09	<.09	<.2	<.1	<.03	<.05	<.2	<.06
105	<.05	<.05	<.09	<.09	<.2	<.1	<.03	<.05	<.2	<.06
106	<.05	<.05	<.09	<.09	<.2	<.1	<.03	<.05	<.2	<.06
108	<.05	<.05	<.09	<.09	<.2	<.1	<.03	<.05	<.2	<.06
109	<.05	<.05	<.09	<.09	<.2	<.1	<.03	<.05	<.2	<.06
110	<.05	<.05	<.09	<.09	<.2	<.1	<.03	<.05	<.2	<.06
111	<.05	<.05	<.09	<.09	<.2	<.1	<.03	<.05	<.2	<.06
112	<.05	<.05	<.09	<.09	<.2	<.1	<.03	<.05	<.2	<.06
113	<.05	<.05	<.09	<.09	<.2	<.1	<.03	<.05	<.2	<.06
114	<.05	<.05	<.09	<.09	<.2	<.1	<.03	<.05	<.2	<.06
115	<.05	<.05	<.09	<.09	<.2	<.1	<.03	<.05	<.2	<.06
116	<.05	<.05	<.09	<.09	<.2	<.1	<.03	<.05	<.2	<.06
117	<.05	<.05	<.09	<.09	<.2	<.1	<.03	<.05	<.2	<.06
118	<.05	<.05	<.09	<.09	<.2	<.1	<.03	<.05	<.2	<.06
119	<.05	<.05	<.09	<.09	<.2	<.1	<.03	<.05	<.2	<.06
120	<.05	<.05	<.09	<.09	<.2	<.1	<.03	<.05	<.2	<.06
121	<.05	<.05	<.09	<.09	<.2	<.1	<.03	<.05	<.2	<.06

Appendix 8. Concentrations of volatile organic compounds in water from selected shallow wells in urban residential and light commercial areas in Lafayette Parish, Louisiana, 2001-02—Continued

ACAD well number (fig. 1)	Hexachlorobutadiene 87-68-3	Hexachloroethane 67-72-1	2-Hexanone 591-78-6	Isopropylbenzene 98-82-8	4-Isopropyl-1-methyl-benzene (p-Isopropyl toluene) 99-87-6	Methyl acrylate 96-33-3	Methyl acrylonitrile 126-98-7	Methyl tert-Butyl ether (MTBE) 1634-04-4	2-Butanone (Methyl ethyl ketone) 78-93-3
92	<0.1	<0.2	<0.7	<0.06	E0.01	<2	<0.6	**0.2**	<5
93	<.1	<.2	<.7	<.06	<.07	<2	<.6	<.2	<5
95	<.1	<.2	<.7	<.06	<.07	<2	<.6	<.2	<5
96	<.1	<.2	<.7	<.06	E.04	<2	<.6	<.2	<5
97	<.1	<.2	<.7	<.06	<.07	<2	<.6	<.2	<5
98	<.1	<.2	<.7	<.06	<.07	<2	<.6	<.2	<5
99	<.1	<.2	<.7	<.06	<.07	<2	<.6	<.2	<5
100	<.1	<.2	<.7	<.06	<.07	<2	<.6	<.2	<5
101	<.1	<.2	<.7	<.06	<.07	<2	<.6	<.2	<5
102	<.1	<.2	<.7	<.06	<.07	<2	<.6	<.2	<5
103	<.1	<.2	<.7	<.06	<.07	<2	<.6	<.2	<5
104	<.1	<.2	<.7	<.06	<.07	<2	<.6	<.2	<5
105	<.1	<.2	<.7	<.06	<.07	<2	<.6	<.2	<5
106	<.1	<.2	<.7	<.06	<.07	<2	<.6	<.2	<5
108	<.1	<.2	<.7	<.06	<.07	<2	<.6	<.2	<5
109	<.1	<.2	<.7	<.06	<.07	<2	<.6	<.2	<5
110	<.1	<.2	<.7	<.06	<.07	<2	<.6	<.2	<5
111	<.1	<.2	<.7	<.06	<.07	<2	<.6	<.2	<5
112	<.1	<.2	<.7	<.06	<.07	<2	<.6	<.2	<5
113	<.1	<.2	<.7	<.06	<.07	<2	<.6	<.2	<5
114	<.1	<.2	<.7	<.06	<.07	<2	<.6	<.2	<5
115	<.1	<.2	<.7	<.06	<.07	<2	<.6	<.2	<5
116	<.1	<.2	<.7	<.06	<.07	<2	<.6	<.2	<5
117	<.1	<.2	<.7	<.06	<.07	<2	<.6	<.2	<5
118	<.1	<.2	<.7	<.06	<.07	<2	<.6	<.2	<5
119	<.1	<.2	<.7	<.06	<.07	<2	<.6	<.2	<5
120	<.1	<.2	<.7	<.06	<.07	<2	<.6	<.2	<5
121	<.1	<.2	<.7	<.06	<.07	<2	<.6	<.2	<5

Appendix 8. Concentrations of volatile organic compounds in water from selected shallow wells in urban residential and light commercial areas in Lafayette Parish, Louisiana, 2001-02—Continued

ACAD well number (fig. 1)	Methyl iodide (Iodo-methane) 74-88-4	Methyl methacrylate 80-62-6	4-Methyl-2-pentanone (Methyl isobutyl ketone) 108-10-1	Naphthalene 91-20-3	tert-Pentyl methyl ether 994-05-8	n-Propylbenzene 103-65-1	Styrene (Ethenylbenzene) 100-42-5	1,1,1,2-Tetrachloro-ethane 630-20-6	1,1,2,2-Tetrachloro-ethane 79-34-5	Tetrachloro-ethylene 127-18-4
92	<0.2	<0.3	<0.4	<0.5	<0.1	<0.04	<0.04	<0.03	<0.09	<0.027
93	<.2	<.3	<.4	<.5	<.1	<.04	<.04	<.03	<.09	<.027
95	<.2	<.3	<.4	<.5	<.1	<.04	<.04	<.03	<.09	<.027
96	<.2	<.3	<.4	<.5	<.1	<.04	<.04	<.03	<.09	<.027
97	<.2	<.3	<.4	<.5	<.1	<.04	<.04	<.03	<.09	<.027
98	<.2	<.3	<.4	<.5	<.1	<.04	<.04	<.03	<.09	<.027
99	<.2	<.3	<.4	<.5	<.1	<.04	<.04	<.03	<.09	<.027
100	<.2	<.3	<.4	<.5	<.1	<.04	<.04	<.03	<.09	<.027
101	<.2	<.3	<.4	<.5	<.1	<.04	<.04	<.03	<.09	<.027
102	<.2	<.3	<.4	<.5	<.1	<.04	<.04	<.03	<.09	E.012
103	<.2	<.3	<.4	<.5	<.1	<.04	<.04	<.03	<.09	E.070
104	<.2	<.3	<.4	<.5	<.1	<.04	<.04	<.03	<.09	<.027
105	<.2	<.3	<.4	<.5	<.1	<.04	<.04	<.03	<.09	<.027
106	<.2	<.3	<.4	<.5	<.1	<.04	<.04	<.03	<.09	<.027
108	<.2	<.3	<.4	<.5	<.1	<.04	<.04	<.03	<.09	<.027
109	<.2	<.3	<.4	<.5	<.1	<.04	<.04	<.03	<.09	<.027
110	<.2	<.3	<.4	<.5	<.1	<.04	<.04	<.03	<.09	E.009
111	<.2	<.3	<.4	<.5	<.1	<.04	<.04	<.03	<.09	<.027
112	<.2	<.3	<.4	<.5	<.1	<.04	<.04	<.03	<.09	<.027
113	<.2	<.3	<.4	<.5	<.1	<.04	<.04	<.03	<.09	<.027
114	<.2	<.3	<.4	<.5	<.1	<.04	<.04	<.03	<.09	<.027
115	<.2	<.3	<.4	<.5	<.1	<.04	<.04	<.03	<.09	<.027
116	<.2	<.3	<.4	<.5	<.1	<.04	<.04	<.03	<.09	<.027
117	<.2	<.3	<.4	<.5	<.1	<.04	<.04	<.03	<.09	<.027
118	<.2	<.3	<.4	<.5	<.1	<.04	<.04	<.03	<.09	<.027
119	<.2	<.3	<.4	<.5	<.1	<.04	<.04	<.03	<.09	<.027
120	<.2	<.3	<.4	<.5	<.1	<.04	<.04	<.03	<.09	E.007
121	<.2	<.3	<.4	<.5	<.1	<.04	<.04	<.03	<.09	<.027

Appendix 8. Concentrations of volatile organic compounds in water from selected shallow wells in urban residential and light commercial areas in Lafayette Parish, Louisiana, 2001-02—Continued

ACAD well number (fig. 1)	Tetrachloromethane 56-23-5	Tetrahydrofuran 109-99-9	1,2,3,4-Tetramethylbenzene (Prehnitene) 488-23-3	1,2,3,5-Tetramethylbenzene (Isodurene) 527-53-7	1,2,3-Trichlorobenzene 87-61-6	1,2,4-Trichlorobenzene 120-82-1	1,1,1-Trichloroethane 71-55-6	1,1,2-Trichloroethane 79-00-5	Trichloroethylene (TCE) 79-01-6
92	<0.06	<2	<0.2	<0.2	<0.3	<0.1	<0.03	<0.06	<0.04
93	<.06	<2	<.2	<.2	<.3	<.1	<.03	<.06	E.03
95	<.06	<2	<.2	<.2	<.3	<.1	<.03	<.06	<.04
96	<.06	<2	<.2	<.2	<.3	<.1	<.03	<.06	<.04
97	<.06	<2	<.2	<.2	<.3	<.1	<.03	<.06	<.04
98	<.06	<2	<.2	<.2	<.3	<.1	<.03	<.06	<.04
99	<.06	<2	<.2	<.2	<.3	<.1	<.03	<.06	<.04
100	<.06	<2	<.2	<.2	<.3	<.1	<.03	<.06	<.04
101	<.06	<2	<.2	<.2	<.3	<.1	<.03	<.06	<.04
102	<.06	<2	<.2	<.2	<.3	<.1	<.03	<.06	<.04
103	<.06	<2	<.2	<.2	<.3	<.1	<.03	<.06	<.04
104	<.06	<2	<.2	<.2	<.3	<.1	<.03	<.06	<.04
105	<.06	<2	<.2	<.2	<.3	<.1	<.03	<.06	<.04
106	<.06	<2	<.2	<.2	<.3	<.1	<.03	<.06	<.04
108	<.06	<2	<.2	<.2	<.3	<.1	<.03	<.06	<.04
109	<.06	<2	<.2	<.2	<.3	<.1	<.03	<.06	<.04
110	<.06	<2	<.2	<.2	<.3	<.1	<.03	<.06	<.04
111	<.06	<2	<.2	<.2	<.3	<.1	<.03	<.06	<.04
112	<.06	<2	<.2	<.2	<.3	<.1	<.03	<.06	<.04
113	<.06	<2	<.2	<.2	<.3	<.1	<.03	<.06	<.04
114	<.06	<2	<.2	<.2	<.3	<.1	<.03	<.06	<.04
115	<.06	<2	<.2	<.2	<.3	<.1	<.03	<.06	<.04
116	<.06	<2	<.2	<.2	<.3	<.1	<.03	<.06	<.04
117	<.06	<2	<.2	<.2	<.3	<.1	<.03	<.06	<.04
118	<.06	<2	<.2	<.2	<.3	<.1	<.03	<.06	<.04
119	<.06	<2	<.2	<.2	<.3	<.1	<.03	<.06	<.04
120	<.06	<2	<.2	<.2	<.3	<.1	<.03	<.06	<.04
121	<.06	<2	<.2	<.2	<.3	<.1	<.03	<.06	<.04

Appendix 8. Concentrations of volatile organic compounds in water from selected shallow wells in urban residential and light commercial areas in Lafayette Parish, Louisiana, 2001-02—Continued

ACAD well number (fig. 1)	Trichlorofluoro-methane 75-69-4	1,2,3-Trichloro-propane 96-18-4	1,1,2-Trichlorotrifluoroethane (freon 113) 76-13-1	1,2,3-Trimethyl-benzene 526-73-8	1,2,4-Trimethyl-benzene 95-63-6	1,3,5-Trimethyl-benzene 108-67-8	Toluene 108-88-3	Vinyl chloride 75-01-4	m- and p-Xylene no CAS number	o-Xylene 95-47-6
92	<0.09	<0.2	<0.06	<0.1	<0.06	<0.04	<0.05	<0.1	<0.06	<0.07
93	<.09	<.2	<.06	<.1	<.06	<.04	.28	<.1	<.06	<.07
95	<.09	<.2	<.06	<.1	<.06	<.04	<.05	<.1	<.06	<.07
96	<.09	<.2	<.06	<.1	<.06	<.04	E.02	<.1	<.06	<.07
97	<.09	<.2	<.06	<.1	<.06	<.04	<.05	<.1	<.06	<.07
98	<.09	<.2	<.06	<.1	<.06	<.04	<.05	<.1	<.06	<.07
99	<.09	<.2	<.06	<.1	<.06	<.04	<.05	<.1	<.06	<.07
100	<.09	<.2	<.06	<.1	<.06	<.04	E.01	<.1	<.06	<.07
101	<.09	<.2	<.06	<.1	<.06	<.04	<.05	<.1	<.06	<.07
102	<.09	<.2	<.06	<.1	<.06	<.04	E.04	<.1	E.03	<.07
103	<.09	<.2	<.06	<.1	<.06	<.04	<.05	<.1	<.06	<.07
104	<.09	<.2	<.06	<.1	<.06	<.04	<.05	<.1	<.06	<.07
105	<.09	<.2	<.06	<.1	<.06	<.04	<.05	<.1	<.06	<.07
106	<.09	<.2	<.06	<.1	<.06	<.04	<.05	<.1	<.06	<.07
108	<.09	<.2	<.06	<.1	<.06	<.04	<.05	<.1	<.06	<.07
109	<.09	<.2	<.06	<.1	<.06	<.04	E.02	<.1	<.06	<.07
110	<.09	<.2	<.06	<.1	<.06	<.04	<.05	<.1	<.06	<.07
111	<.09	<.2	<.06	<.1	<.06	<.04	<.05	<.1	<.06	<.07
112	<.09	<.2	<.06	<.1	<.06	<.04	E.01	<.1	<.06	<.07
113	<.09	<.2	<.06	<.1	<.06	<.04	<.05	<.1	<.06	<.07
114	<.09	<.2	<.06	<.1	<.06	<.04	E.01	<.1	<.06	<.07
115	<.09	<.2	<.06	<.1	<.06	<.04	<.05	<.1	<.06	<.07
116	<.09	<.2	<.06	<.1	<.06	<.04	E.01	<.1	E.01	<.07
117	<.09	<.2	<.06	<.1	<.06	<.04	<.05	<.1	<.06	<.07
118	<.09	<.2	<.06	<.1	<.06	<.04	<.05	<.1	<.06	<.07
119	<.09	<.2	<.06	<.1	<.06	<.04	<.05	<.1	<.06	<.07
120	**1.1**	<.2	<.06	<.1	<.06	<.04	E.02	<.1	<.06	<.07
121	<.09	<.2	<.06	<.1	<.06	<.04	E.01	<.1	<.06	<.07