In cooperation with the
City of Baton Rouge and East Baton Rouge Parish

Water-Quality Characteristics of Urban Storm Runoff at Selected Sites in East Baton Rouge Parish, Louisiana, February 1998 Through April 2002

Water-Resources Investigations Report 03-4212

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

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By C. Paul Frederick

U.S. GEOLOGICAL SURVEY

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CITY OF BATON ROUGE and

EAST BATON ROUGE PARISH

Baton Rouge, Louisiana

2003

U.S. DEPARTMENT OF THE INTERIOR

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1-5. Maps showing location of the:

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CONVERSION FACTORS AND ABBREVIATED WATER-QUALITY UNITS

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)
cubic foot (ft^3)	0.02832	cubic meter (m^3)
acre	4,047	square meter (m^2)
mile (mi)	1.609	kilometer (km)
gallon (gal)	0.003785	cubic meter (m^3)
pound per year (lb/yr)	0.4536	kilogram per year (kg/yr)
pounds per acre per year [(lb/acre)/yr]	1.121	kilograms per hectare per year [(kg/ha)/yr]

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

Abbreviated water-quality units:

colonies per 100 milliliters (cols/100 mL)
microsiemens per centimeter at 25 degrees Celsius (µS/cm)
milligrams per liter (mg/L)
micrograms per liter (µg/L)

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***By* C. Paul Frederick**

ABSTRACT

Water was sampled at four watersheds for continued evaluation of urban storm runoff in East Baton Rouge Parish, Louisiana, during February 1998 through April 2002. Eighteen samples were collected from four watersheds representing land uses characterized predominantly as established commercial, industrial, new commercial, and residential. Results of water-quality analyses enabled calculation of event-mean concentrations and estimated annual contaminant loads and yields of storm runoff from nonpoint sources for 12 water-quality properties and constituents. The following water-quality data are reported: physical and chemical-related properties, fecal coliform and enterococci bacteria, major inorganic ions, nutrients, trace elements, and organic compounds.

The residential land-use is the largest of the watersheds (550 acres), which resulted in high estimated annual contaminant loads compared to other watersheds for 8 of the 12 water-quality properties and constituents. This may indicate that the size of the watershed and runoff from residences with their associated contaminants had substantial effects on annual loads within this land use. The industrial land-use area had the highest estimated annual contaminant loads for metals, followed by the residential land-use area. However, when comparing yields among the watersheds, the industrial watershed had the highest yield for 9 of the 12 water-quality properties and constituents, whereas the residential watershed had the lowest yield for 7 of the 12. The industrial watershed yielded more metals per acre per year than any other watershed. Zinc yields were 2.71 pounds per acre per year from the industrial watershed, compared to 0.35 pounds per acre per year from the residential watershed, which was the lowest of all the watersheds. Lead concentrations exceeded the U.S. Environmental Protection Agency Maximum Contaminant Level of 15 μg/L (micrograms per liter) for drinking water standards in 10 of 18 samples. Low-level concentrations of mercury were detected twice at both the new commercial and residential sites, with all concentrations at or just above reporting limits. The average dissolved phosphorus concentrations from each land use were two to four times higher than the U.S. Environmental Protection Agency criterion of 0.05 milligrams per liter. Diazinon, which is widely used as a general-purpose insecticide for lawns and gardens, was detected in all 18 samples. The maximum diazinon concentration detected, 2.7 μg/L, was from the residential site. Malathion, another insecticide used on lawns, gardens, and plants, also was detected at least once from each site, but all concentrations were below the minimum detection limit of 0.1 μg/L.

INTRODUCTION

Since the 1960's, urban storm runoff has been known to have potentially adverse effects on the water quality of receiving waters. The work of Weibel and others (1964) and Makepeace and others (1995) indicated that elevated concentrations of various chemical constituents were present in urban storm runoff. During dry periods, contaminants accumulate on land surfaces until they are mobilized by precipitation, washed into the urban drainage system, and eventually discharged into receiving waters as storm runoff. Generally, the contaminants carried by storm runoff do not come from a single identifiable source. This contamination comes from multiple or diffuse sources and is referred to as nonpoint-source contamination. The volume of urban storm runoff increases as metropolitan areas expand and as rural land is developed for residences, commercial businesses, industrial facilities, shopping centers, and recreational areas.

The Federal Clean Water Act, which was amended in 1987, mandated that the U.S. Environmental Protection Agency (USEPA) develop a permitting program to mitigate nonpoint-source contamination in urban storm runoff. Consequently, Federal stormwater regulations (U.S. Environmental Protection Agency, 1991), in accordance with the permit application process of the National Pollutant Discharge Elimination System (NPDES), require cities that have a population of 100,000 or more to characterize the quantity and quality of their storm runoff. In 2002, the estimated population of the City of Baton Rouge was 228,000. The estimated population of the Baton Rouge metropolitan area was 413,000 (U.S. Bureau of the Census, 2002).

The urban storm-runoff regulations mandated by the USEPA require continued monitoring of data collection sites following their initial characterization for quantity and quality of storm runoff by the City of Baton Rouge, East Baton Rouge Parish. As in any metropolitan area, municipal storm-sewer systems (MS4) have been installed to provide drainage for developed areas. Although discharge from the MS4 often has lower concentrations of many pollutants than discharge from industrial and municipal waste water, the pollutant concentrations associated with discharge from the MS4 can have significant effects on water quality. To meet technical data requirements of the USEPA stormwater permit application for the Baton Rouge metropolitan area, the U.S. Geological Survey (USGS) entered into a cooperative agreement with the City of Baton Rouge and East Baton Rouge Parish government in 1992. The City of Baton Rouge and East Baton Rouge Parish have a combined governmental system. Through the 1992 agreement, a data-collection network was established to characterize the quantity and quality of urban storm runoff from watersheds in different land-use areas within East Baton Rouge Parish. From April 1993 to June 1995, the USGS collected data used for the initial characterization of storm-runoff quantity and quality for the City/Parish of East Baton Rouge (Demcheck and others, 1998). In 1997, this information was used for the design of representative sampling for continued monitoring of data-collection sites, as required by USEPA (U.S. Environmental Protection Agency, 1997). Within this design, the undeveloped land-use site was discontinued, and the fifth site was relocated to represent highway land use.

Purpose and Scope

This report describes continued evaluation of water-quality characteristics of urban storm runoff from watersheds that represent different types of land use in East Baton Rouge Parish. Sites were selected in established commercial, industrial, new commercial, and residential land uses. Rainfall, streamflow, and water-quality data collected at four of the five sites during storms are presented. Eighteen samples were collected during February 1998 through April 2002. The reported water-quality properties and constituents include physical and chemical-related properties, fecal coliform and enterococci bacteria, major inorganic ions, nutrients, trace metals, and organic compounds. Average event-mean concentrations (EMC's) of 12 selected water-quality properties and constituents were used to estimate both individual storm and annual storm-runoff loads and yields. Average EMC's were calculated by using the EMC's for storms collected from each watershed representing a particular land use. Urbanization can change the natural flow of surface water and intrude more sediment, nutrients, and contaminants to the environment. The USGS will continue monitoring selected land uses to gather information on water-quality conditions in urban watersheds, which could aid other communities in similar environmental settings.

General Description of Study Area

East Baton Rouge Parish (fig. 1) covers an area of approximately 293,000 acres between the Mississippi River and the Amite River. The parish has an extensive levee system along the Mississippi River; therefore, no substantial drainage occurs from East Baton Rouge Parish into the Mississippi River. Most of the parish is within the watershed of the Amite River. The Amite River flows generally southeastward to Lake Maurepas, Lake Pontchartrain, and the Gulf of Mexico.

The climate of East Baton Rouge Parish is humid-subtropical, but subject to continental polar fronts during the winter. Warm, moist air from the Gulf of Mexico provides abundant moisture during late spring and summer. The summer is characterized by hot temperatures and intense but brief thunderstorms generating greater amounts of runoff than in winter. The fall, late September through November, is usually warm and relatively dry. The winter is generally cool and mild. Winter rainfall associated with passing cold fronts can last hours or days, but is less intense than in summer, and the ground may remain saturated for days. (J.M. Grymes III, Louisiana Office of State Climatology, written commun., 1993; Elizabeth Mons, Louisiana Office of State Climatology, written commun., 2002).

Acknowledgments

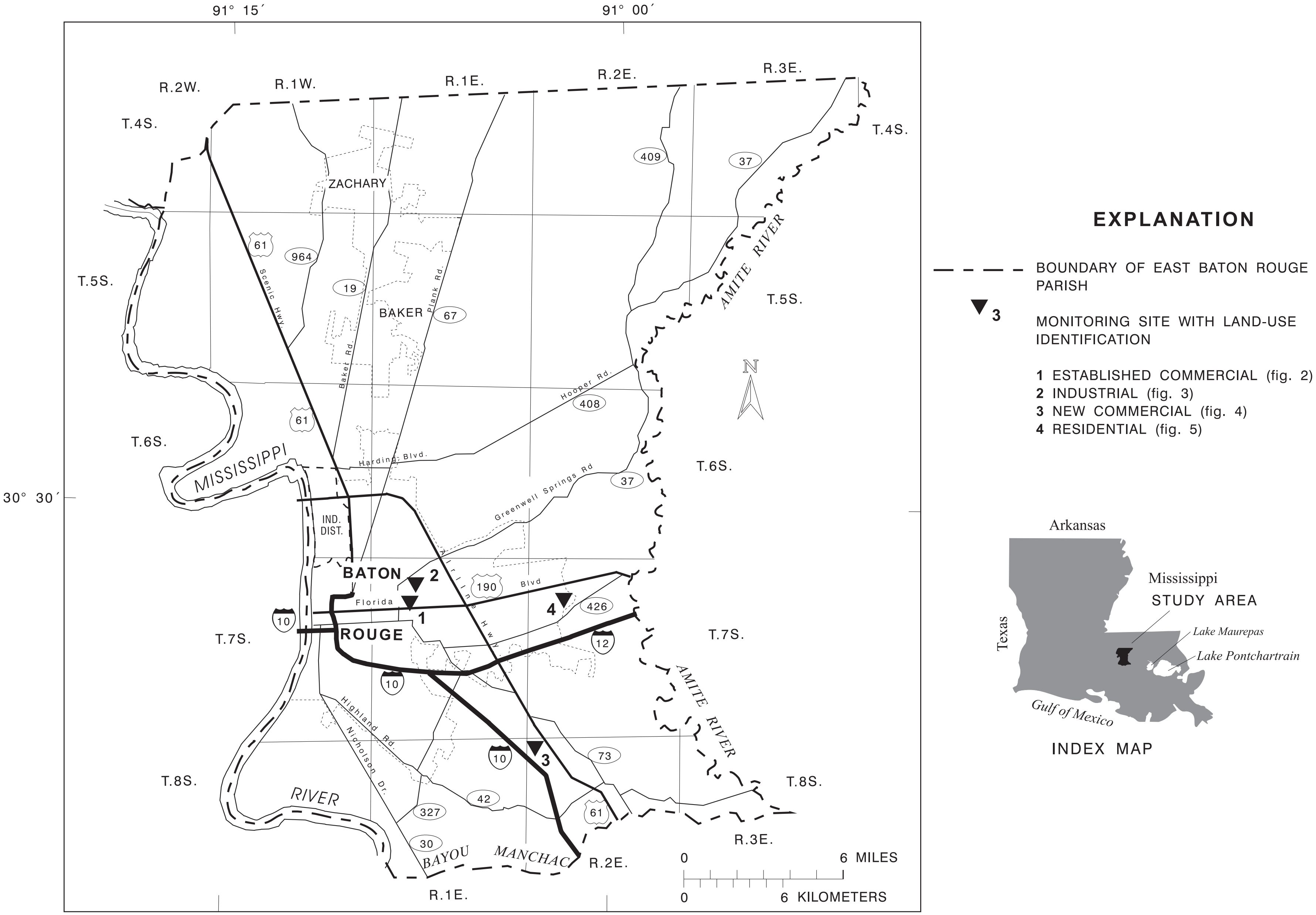
The author thanks Jorge M. Ferrer and Tran Nguyen of the Department of Public Works, City of Baton Rouge, for their advice and support throughout this project. Appreciation also is extended to Elizabeth Mons of the Louisiana Office of State Climatology for providing updated rainfall records for East Baton Rouge Parish.

METHODS OF STUDY

Representative sampling consisted of a smaller subset of properties and constituents than needed for the initial characterization. The smaller subset provided data useful in generating long-term averages and trends in the constituents collected, along with the amount of storm runoff from each site. Results of the representative sampling and water-quality analyses were used to determine EMC's and estimated annual contaminant loads of 12 selected water-quality properties and constituents in storm runoff. The EMC is determined from the analysis of flow-weighted composite samples.

Definitions

For the purposes of this report, permit regulations stipulate that runoff must be sampled from a storm greater than 0.1 in. in magnitude that occurs at least 72 hours from the previously measurable storm (U.S. Environmental Protection Agency, 1997, pt. V. A. 4. c). The 72-hour storm interval is waived where discharge is not measurable and rainfall is less than 0.1 in. during the season when sampling is being done. Also, for this permit, three seasons were defined for this geographic region: December to April, May to August, and September to November.



Map credit: Modified from Official Map of Louisiana, Louisiana Department of Transportation and Development, 1986

Figure 1. Sites in the storm-runoff monitoring network for East Baton Rouge Parish, Louisiana, 1998-2002.

Site Selection

Initially (1997), five sampling sites were selected to represent the different types of land use in East Baton Rouge Parish. The land uses represented were established commercial, industrial, new commercial, residential, and highway. However, in December 1997, a truck overturned and spilled ethylene dichloride (EDC) upstream from the highway gaging station; therefore, no discharge rating was developed to begin initial characteristic sampling of this site.

Watershed size was an important factor in site selection. The watershed had to be large enough to provide a minimum 3-hour discharge period for storm runoff, but small enough to represent a single dominant land use. If the discharge was less than 3 hours, subsamples of the discharge were collected until the volume of runoff diminished, or the level of the stream declined below the sample intake line. To meet these requirements, the selected watersheds were at least 60 acres but no more than 600 acres.

Data Collection and Analysis

The water-quality-data-collection network consisted of four monitoring sites that received storm runoff from four watersheds (fig. 1). A monitoring station was constructed at each of the four sites and equipped with a rain gage, datalogger, and sampler. During the initial characterization phase of storm runoff, a relation between the amount of precipitation that fell on a watershed and the volume of runoff discharged from that watershed was determined. This same relation was used during the representative sampling, which enabled the automatic sampler to be programmed so that subsamples could be collected and composited to be representative of flow, while ensuring that the capacity of the sampler would not be exceeded during the initial 3 hours of sustained discharge.

The subsamples were stored on-site in as many as four 1-gal containers during the collection process. Once sampling was completed, the four 1-gal containers were removed, chilled, and transported to the USGS laboratory in Baton Rouge for processing and preservation.

No data are presented for the highway land-use site due to the EDC spill in 1997. In 1999, samples for analysis of volatile organic compounds were collected to ensure a safe working level of EDC had been reached.

Precipitation

The intensity and duration of precipitation were measured for each site by a tipping-bucket rain gage at the monitoring station. The rain gage was installed at a site which was unobstructed by overhead objects within 45 degrees of the collection funnel. Precipitation amounts were recorded at 15-minute intervals and summed to obtain the cumulative precipitation measurement. Precipitation data were assumed to represent the entire watershed.

Streamflow

Gage height was measured and recorded at each monitoring station using a pressure-sensitive, bubbler-regulated stage gage. The bubbler regulator maintained a constant rate of air flowing through a tube that extended from the monitoring station to an orifice at the bottom of the channel. As stage rose, greater pressure was required to maintain a constant flow rate through the tube. Pressure changes were measured, converted to gage height, and recorded by the datalogger. Gage-height measurements with this system were affected minimally by rapid changes in temperature.

Streamflow and storm-runoff volumes were quantified at each monitoring station using a stage-discharge rating. Manual discharge measurements were made at various gage heights using either a Price AA or pygmy meter and the 0.6-depth or 0.2- and 0.8-depth method (Buchanan and Somers, 1969; Rantz and others, 1982). The various gage heights and their respective discharge volumes were entered into the datalogger, and a three-point interpolation method was used to create the stage-discharge rating. Using this stage-discharge rating, the datalogger then computed both instantaneous discharge and total discharge volume during an entire storm.

Water Quality

Samples of storm runoff were collected for each watershed by automated samplers, which collected flow-weighted or proportional composite samples for at least the initial 3 hours of each storm. If the discharge was less than 3 hours, subsamples of the discharge were collected until the volume of runoff diminished, or the level of the stream declined below the sample intake line. Each sampler was programmed according to individual land-use characteristics. The rain gage, datalogger, and sampler were integrated to compose a reliable, automatic data-collection system that was programmed according to the watershed's characteristics, such as size, amount of impervious area, and land use. The rain gage transmitted a pulse to the datalogger each time 0.01 in. of rainfall was collected. When 0.1 in. of rainfall fell in 0.5 hours, or a predetermined stage was reached, the datalogger activated the sampler to collect a 0.2-gal subsample. This process continued until the capacity of the sampler was met or the volume of runoff diminished. Aeration and exposure of samples to contamination during sample collection were minimized by use of a peristaltic pump. The result was a representative sample proportionally equivalent to the volume of storm runoff from that watershed. To be considered a representative composite sample, at least a 2-gal sample was collected.

Project personnel measured selected properties and manually collected water samples for analysis of selected constituents. The measurements and depth-integrated samples were collected in the appropriate containers by wading the stream during the first hour of runoff from the watershed. Specific conductance, pH, water temperature, and dissolved oxygen were measured. Samples collected manually were analyzed for biochemical oxygen demand, concentrations of fecal coliform and enterococci bacteria, and oil and grease. After collection, the samples were transported to the USGS laboratory in Baton Rouge for further preparation and processing or analysis.

Water samples were composited with a fluoropolymer splitter. The cone splitter was used to prepare representative subsamples for the appropriate chemical analyses. Samples for dissolved inorganic, nutrient, and trace-element analyses were passed through 0.45-micrometer nitrocellulose filters and treated with the appropriate preservative(s) for later analysis at the USGS National Water-Quality Laboratory in Denver, Colorado, using methods described by Fishman and Friedman (1989). All water samples for analysis were stored at 4^{o}C until shipped. Samples collected for analysis of fecal coliform and enterococci bacteria were collected in a sterilized glass bottle and processed within 4 hours of collection. Bacteria samples were analyzed at the USGS laboratory in Baton Rouge using the membrane-filter method described by Britton and Greeson (1988).

Quality Assurance and Quality Control

The purpose of the quality assurance and control procedures was to ensure the accuracy of the data. These procedures included the collection of replicate samples, equipment-blank samples, and the compilation of percent-recovery data. During the sample-splitting process, replicate storm-runoff samples were collected simultaneously to check the precision of laboratory techniques and sample-splitting. Two replicate samples were processed on July 28, 2001, one from the new commercial site and the other from the residential site. Equipment blanks of inorganic-free and organic-free water were passed through sample-collection equipment from each site to ensure proper cleaning of all equipment in contact with previous storm-runoff samples. Replicate and equipment-blank samples were preserved and processed in the same manner as storm-runoff samples. Standard forms were developed and used to document field data collection, to request analytical services, and to provide a chain of custody when shipping water samples.

Calculation of Estimated Annual Contaminant Load

An equation referred to as the "simple method" (U.S. Environmental Protection Agency, 1992), adapted from Schueler (1987), was used to estimate annual contaminant loads for urban watersheds in East Baton Rouge Parish. The "simple method" is described in detail and provides a quick and reasonable estimate of loads for the NPDES Permit (U.S. Environmental Protection Agency, 1992, sect. 5.4.3, p. 5-14). Values of annual rainfall, watershed characteristics, and a selected water-quality concentration are used in the equation to estimate annual contaminant loads. The "simple method" equation for estimation of annual contaminant loads in storm runoff is:

$$L_i = \left[\frac{(P)(CF)(Rv_i)}{12}\right](C_i)(A_i)(2.72) \qquad (1)$$

where:

L_i is annual contaminant load for site *i*, in lb/yr;

P is average annual precipitation, in in/yr;

CF is a correction factor that adjusts for storms where no runoff occurs (a value of 0.9 was used);

Rv_i is runoff coefficient for the watershed of site *i*;

C_i is average event-mean concentration (EMC) of contaminant at site *i*, in mg/L; and

A_i is watershed area for site *i*, in acres.

WATERSHED CHARACTERISTICS AND SITE DESCRIPTION

The frequency of sampling for the selected watersheds was determined by the occurrence of storms. Rainfall data obtained for the period 1997-2001, showed that East Baton Rouge Parish had an average annual rainfall of 54.9 in., 8.2 in. below the 30-year normal average of 63.1 in., (Elizabeth Mons, Louisiana Office of State Climatology, written commun., 2002). Based on monthly Palmer Drought Severity Indices, 1998-2001, much of East Baton Rouge Parish was in moderate to severe drought conditions. For 1997-2001, 9 of the 12 monthly averages were below 30-year normal averages for East Baton Rouge Parish. Due to drought conditions, fewer storms occurred within each watershed, causing an unequal distribution of samples collected from each site.

East Baton Rouge Parish consists of about 22.5 percent developed land (table 1). About 3.5 percent of the developed land is established and new commercial; 2.3 percent is industrial; and 16.7 percent is residential (Wilbur Smith Associates, 1992). Runoff coefficients also were calculated for the four watersheds and are presented in table 1.

Table 1. Coefficient used in the computation of annual contaminant load and summary of land use in East Baton Rouge Parish, Louisiana

Primary land use[1]	**Land use for East Baton Rouge Parish (1988)**[2]		**Runoff coefficient (Rv_i) for network watershed**
	Acres	**Percent of total**	
Established commercial	4,909	1.75	0.99 (site 1)
Industrial	6,488	2.30	.81 (site 2)
New commercial	4,909	1.75	.51 (site 3)
Residential	47,430	16.7	.39 (site 4)
TOTAL[3]	63,700	22.5	N/A[4]

[1] Land used for agriculture is not included in this summary.
[2] Land-use summary from Wilbur Smith Associates (1992).
[3] Rounded number.
[4] N/A, not applicable.

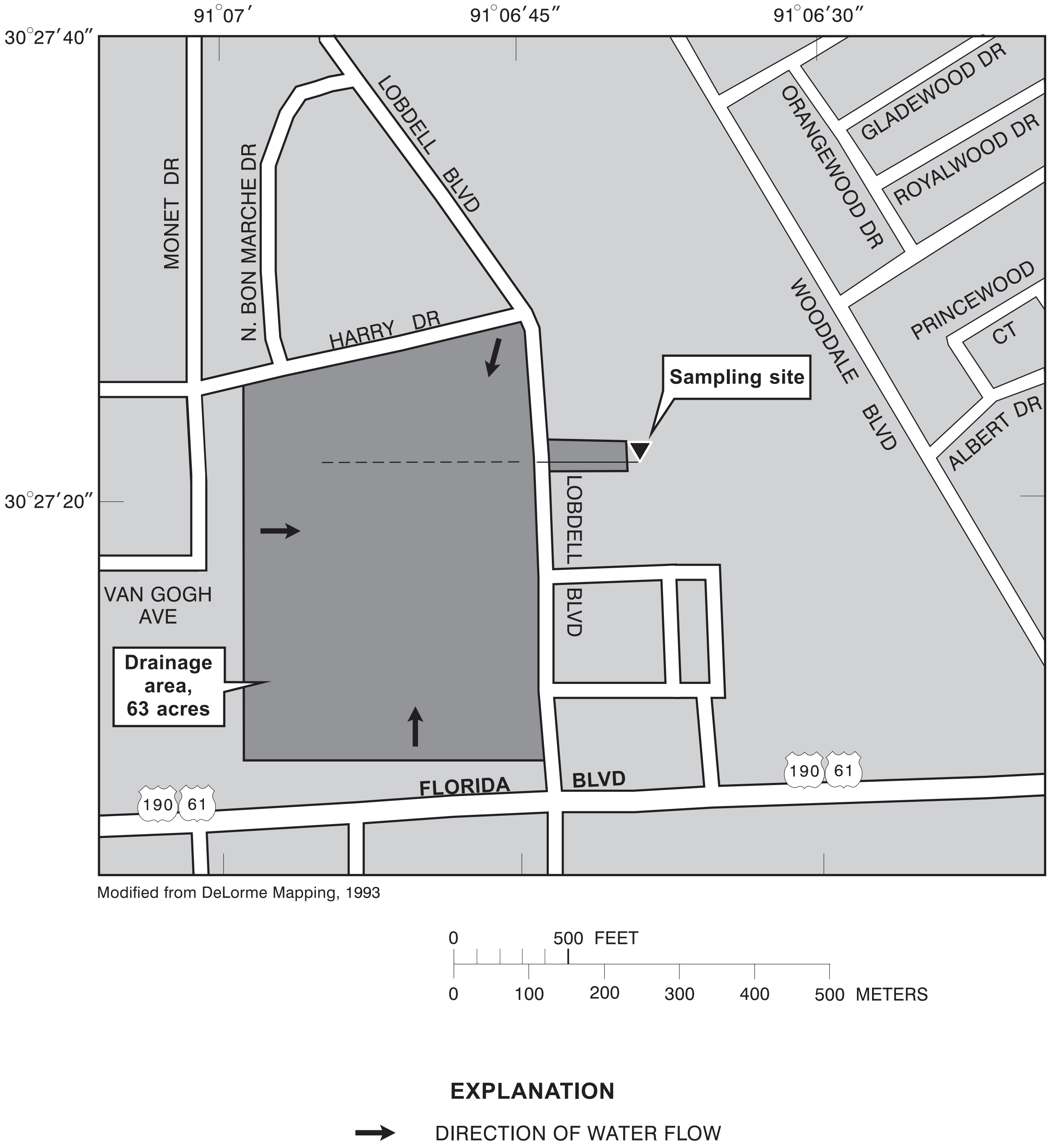
The four sites selected to represent the watersheds were located in areas that were safely accessible during storms and darkness. The channel type was documented, as well as any culverts, ditches, and drains that control flow. Project personnel extensively surveyed the watersheds using city and parish maps and on-site observations to determine acreage, land use, and directions of drainage.

Site 1, located in the established commercial land-use area, was at an open-channel, unlined drainage canal at Lobdell Boulevard (fig. 2). The sampling site was approximately 400 ft downstream from a double 5-ft by 4-ft box culvert under Lobdell Boulevard. The drainage canal received storm runoff from this 63-acre watershed through storm drains located along Harry Drive, Lobdell Boulevard, and within a shopping center parking lot. Runoff from four storms was collected for this land use.

Site 2, located in the industrial land-use area, was at an open-channel, unlined drainage canal at Tom Drive, 0.1 mi east of Wooddale Boulevard (fig. 3). The sampling site was downstream from a double 7-ft by 5-ft box culvert at Tom Drive. The drainage canal received storm runoff from this 109-acre watershed through storm drains located along Wooddale Boulevard, South Choctaw Drive, Tom Drive, and at various industrial businesses, warehouses, and distribution centers. Runoff from three storms was collected for this land use.

Site 3, located in a new and rapidly developing commercial area (new commercial) of East Baton Rouge Parish, was at an open-channel, concrete-lined drainage canal (fig. 4). The site received storm runoff from this 157-acre watershed through drains located along Industriplex Boulevard, Sunbelt Court, and Exchequer Street, as well as small ditches. Runoff from six storms was collected for this land use.

Site 4, located in the residential land-use area, was at an open-channel, concrete-lined drainage canal at Goodwood Boulevard, about 0.5 mi east of South Sherwood Forest Boulevard (fig. 5). The drainage canal received storm runoff from this 550-acre watershed through storm drains underlying streets. The sampling site was just upstream from a double 9-ft by 7-ft box culvert under Goodwood Boulevard. Most of the storm drains in this watershed were built from the late 1960's to early 1970's. This area included mostly single-family residences. Runoff from five storms was collected for this land use.



Modified from DeLorme Mapping, 1993

Figure 2. Established commercial land-use area, Lobdell Boulevard, Baton Rouge, Louisiana, 1998.

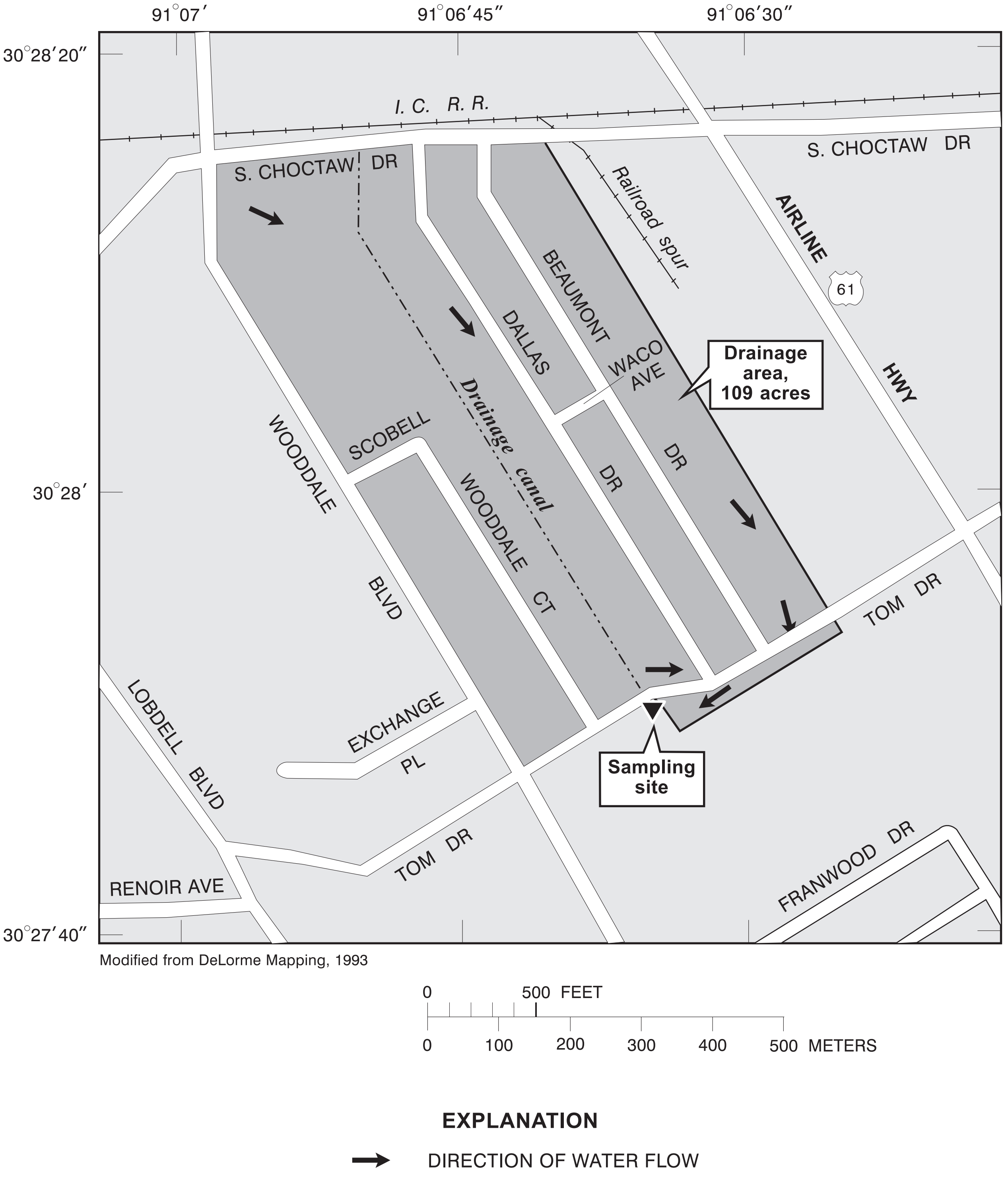
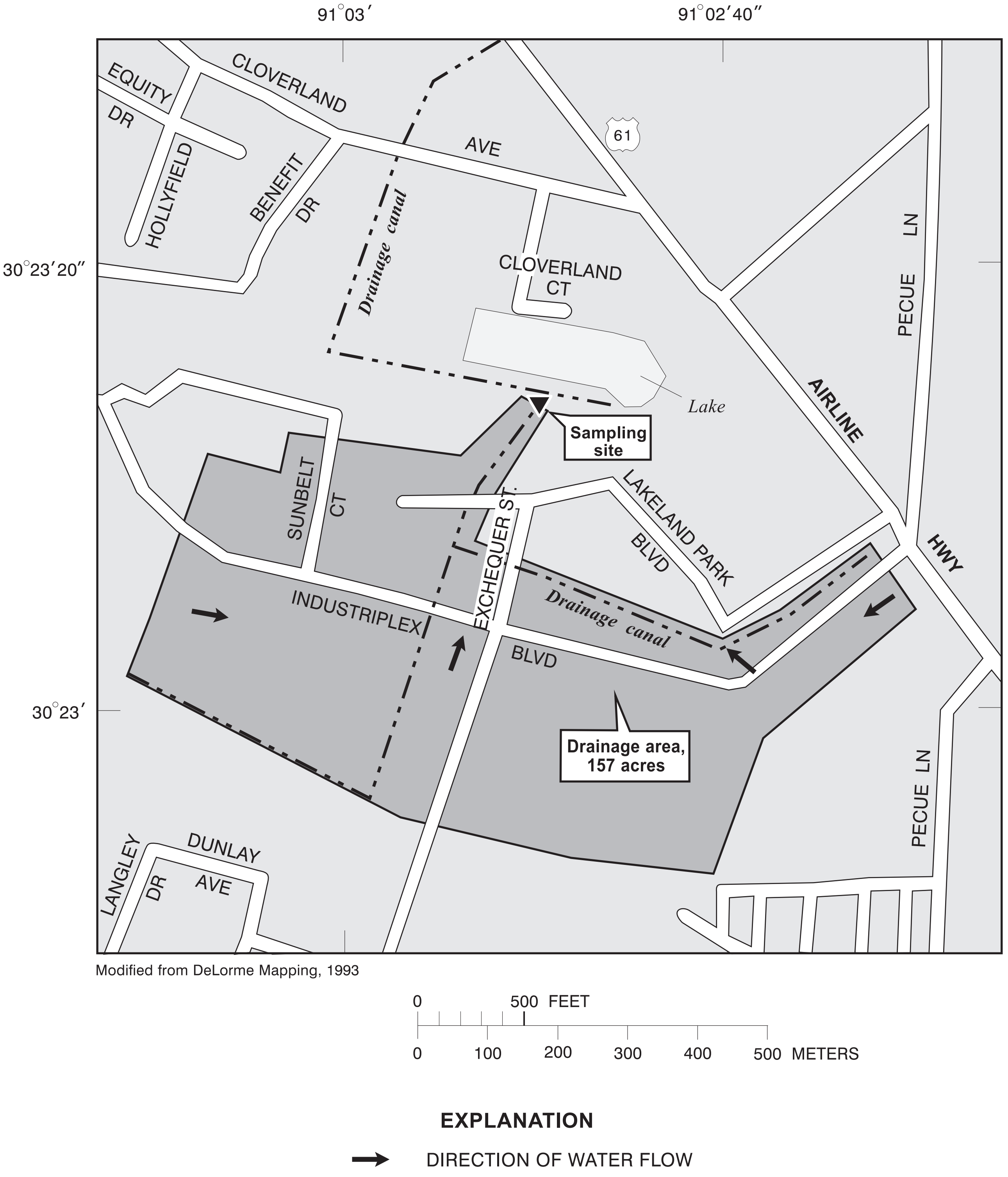
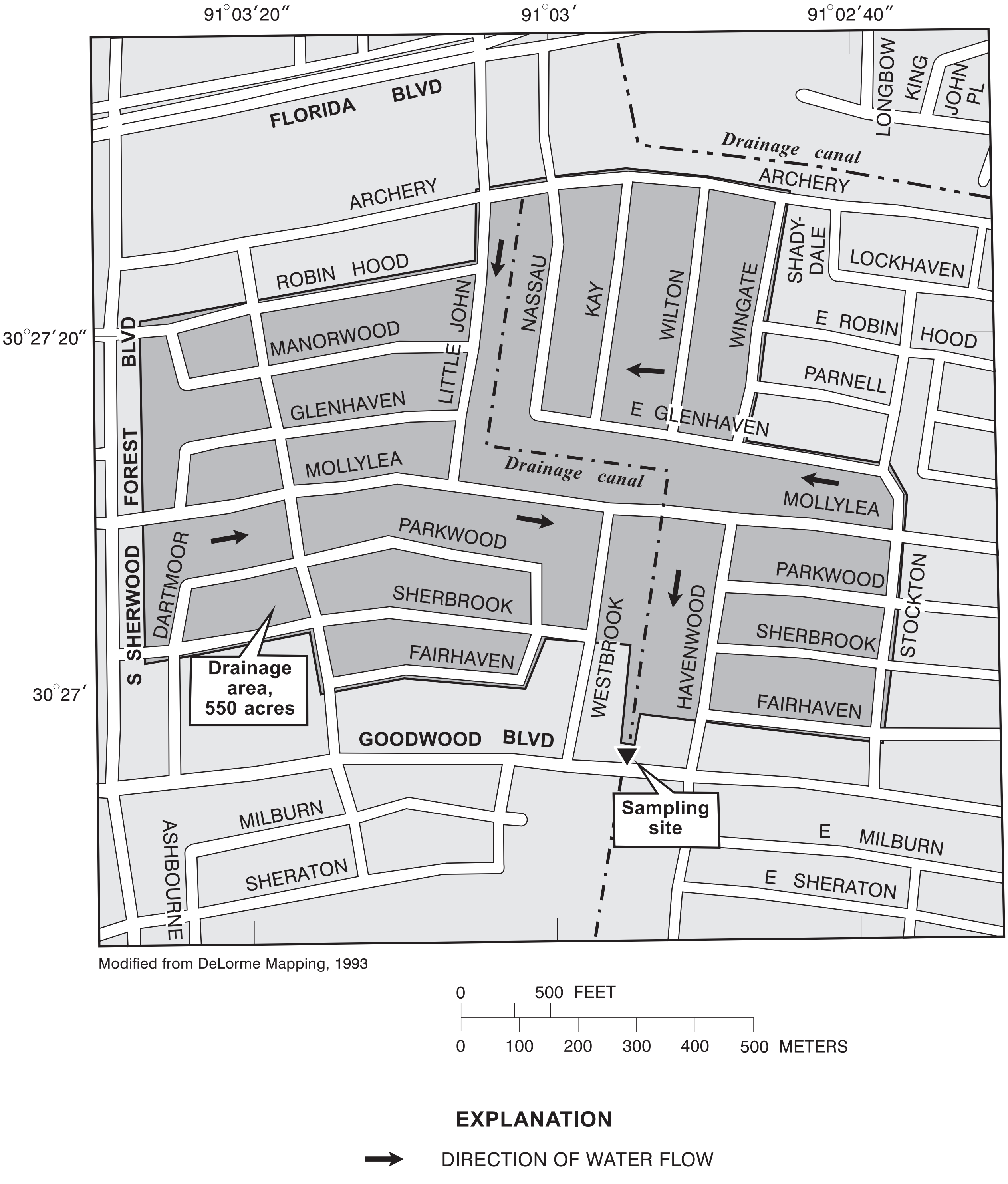


Figure 3. Industrial land-use area, Tom Drive, Baton Rouge, Louisiana, 1998.



Modified from DeLorme Mapping, 1993

Figure 4. New commercial land-use area, Sunbelt Court, Baton Rouge metropolitan area, Louisiana, 1998.



Modified from DeLorme Mapping, 1993

Figure 5. Residential land-use area, Goodwood Boulevard, Baton Rouge, Louisiana, 1998.

WATER-QUALITY CHARACTERISTICS OF URBAN STORM RUNOFF

A total of 18 water-quality samples were collected from the four watersheds in East Baton Rouge Parish during February 1998 through April 2002. At the established commercial site, four stormwater samples were collected (appendix 1A). Nutrient concentrations for total nitrogen ranged from 0.73 to 2.3 mg/L; ammonia plus organic (Kjeldahl) nitrogen, 0.43 to 1.7 mg/L; total phosphorus, 0.06 to 0.31 mg/L; and dissolved phosphorus, 0.03 to 0.22 mg/L. Fecal coliform bacteria are used as indicators of the sanitary conditions of waters because they originate from the intestinal tracts of warmblooded animals. Fecal coliform concentrations ranged from 1,100 to 100,000 cols/100 mL. Enterococci bacteria are indicators for recreational waters. Enterococci concentrations ranged from 4,930 to 5,000 cols/100 mL. Lead was detected in all four samples, with concentrations ranging from 5.7 to 40 μg/L, with one sample exceeding than the USEPA Maximum Contaminant Level (MCL) of 15 μg/L for drinking water. No mercury was detected. Diazinon, which is widely used as a general-purpose insecticide for lawn and gardens, was detected in four samples, ranging in concentrations from 0.01 to 0.79 μg/L. Malathion, an insecticide used on lawns, gardens, and plants, was detected at 0.01 μg/L in two samples at concentrations below the minimum detection limit of 0.1 μg/L. Total polychlorinated biphenyls (PCB's) were detected in two of four samples at concentrations ranging from 0.12 to 0.2 μg/L, just above the reporting limit of 0.1 μg/L. No oil and grease was detected.

At the industrial site, three stormwater samples were collected (appendix 1B). Nutrient concentrations for total nitrogen ranged from 1.2 to 2.6 mg/L; ammonia plus organic (Kjeldahl) nitrogen, 0.71 to 1.7 mg/L; total phosphorus, 0.15 to 0.47 mg/L; and dissolved phosphorus, 0.04 to 0.22 mg/L. All three lead concentrations were at least 5 times the MCL of 15 mg/L. Fecal coliform concentrations ranged from 520 to 80,000 cols/100 mL. Enterococci concentrations ranged from 630 to 2,200 cols/100 mL. Analysis for bacteria from the May 10, 1999, storm was unsuccessful due to incubation problems. Cadmium was detected twice and was higher than the reporting limits of 1 μg/L. Copper was detected in three samples, with concentrations 2 to 3 times higher than the reporting limit of 10 μg/L. No mercury was detected. Diazinon was detected in all three samples, with concentrations ranging from 0.05 to 0.17 μg/L. Malathion was detected once at 0.01 μg/L. Oil and grease was detected three times, with the highest concentration at 5 mg/L. Oil and grease is an indicator that oils and petrochemicals are present, but could include thousands of organic compounds, making it difficult to set any criteria. Total PCB's were detected in two of the three samples, at concentrations of 0.12 and 0.23 μg/L.

At the new commercial site, six stormwater samples were collected (appendix 1C). Nutrient concentrations for total nitrogen ranged from 1.5 to 3.2 mg/L; ammonia plus organic (Kjeldahl) nitrogen, 0.93 to 2.4 mg/L; total phosphorus, 0.21 to 0.70 mg/L; and dissolved phosphorus, 0.09 to 0.32 mg/L. Fecal coliform concentrations ranged from 460 to 10,800 cols/100 mL. Enterococci concentrations ranged from 370 to 6,800 cols/100 mL. Cadmium was detected in three samples at concentrations ranging from 0.19 to 1.2 mg/L. Lead was detected in all six samples at concentrations ranging from 6.4 to 45 μg/L, with only one sample exceeding the MCL of 15 μg/L. Mercury was detected twice at concentrations of 0.02 and 0.04 μg/L. Diazinon was detected in six samples, ranging in concentration from 0.01 to 0.17 μg/L. Malathion was detected once at 0.01 μg/L. Oil and grease was detected four times, with the highest concentration at 5 mg/L. Total PCB's were detected once at the reporting limit of 0.1 μg/L.

At the residential site, five stormwater samples were collected (appendix 1D). Nutrient concentrations for total nitrogen ranged from 2.2 to 4.6 mg/L; ammonia plus organic (Kjeldahl) nitrogen, 1.6 to 4.1 mg/L; total phosphorus, 0.26 to 0.54 mg/L; and dissolved phosphorus, 0.16 to 0.26 mg/L. Fecal coliform concentrations ranged from 3,400 to 134,000 cols/100 mL. Enterococci concentrations ranged from 440 to 10,600 cols/100 mL. Cadmium was detected in three samples at concentrations less than 0.70 mg/L. Lead concentrations exceeded the MCL of 15 mg/L in all five samples, ranging from 17 to 29 mg/L. Mercury was detected at concentrations of 0.06 and 0.07 μg/L. Diazinon was detected in all five samples, ranging from 0.18 to 2.7 μg/L; 2.7 μg/L was the maximum concentration detected in samples from all sites. Malathion was detected three times at concentrations of 0.02, 0.04, and 0.07 μg/L. Oil and grease was detected four times, with the highest concentration at 4 mg/L. No PCB's were detected.

Average Event Mean Concentrations for Selected Properties and Constituents

The average EMC's of 12 properties and constituents for which estimated annual contaminant loads were calculated are listed in table 2. The industrial land-use site had the highest average EMC's in 6 of the 12 properties and constituents, with 4 of these being metals. The residential land-use site had the highest average EMC's for total suspended solids, 263 mg/L, and nutrients: total nitrogen, 2.9 mg/L; ammonia plus organic nitrogen (Kjeldahl nitrogen), 2.5 mg/L; total phosphorus, 0.44 mg/L; and dissolved phosphorus, 0.20 mg/L. The established commercial land-use site had the lowest average EMC's for total suspended solids, 71 mg/L, and nutrients: total nitrogen, 1.4 mg/L; ammonia plus organic nitrogen, 1.0 mg/L; total phosphorus, 0.18 mg/L; and dissolved phosphorus, 0.12 mg/L. The average dissolved phosphorus concentrations from each land use were two to four times the U.S. Environmental Protection Agency criterion of 0.05 milligrams per liter.

Table 2. Average event-mean concentration for selected water-quality properties and constituents for four land-use areas within a storm-runoff monitoring network in East Baton Rouge Parish, Louisiana, 1998-2002

[Concentrations are in milligrams per liter. °C, degrees Celsius; ROE, residue on evaporation; <, less than]

Water-quality property or constituent	Average event-mean concentration			
	Established commercial	Industrial	New commercial	Residential
Chemical oxygen demand	26	45	34	38
Biochemical oxygen demand, 5 day	5.4	6.5	7.7	6.0
Total dissolved solids, ROE at 180°C	47	86	51	46
Total suspended solids, residue at 105°C	71	225	131	263
Nitrogen, total as N	1.4	1.9	2.2	2.9
Nitrogen, ammonia plus organic (Kjeldahl), total as N	1.0	1.2	1.6	2.5
Phosphorus, total as P	.18	.31	.35	.44
Phosphorus, dissolved as P	.12	.13	.15	.20
Cadmium, total recoverable as Cd	<.001	.001	<.001	<.001
Copper, total recoverable as Cu	.003	.03	.004	.01
Lead, total recoverable as Pb	.02	.08	.01	.02
Zinc, total recoverable as Zn	.08	.30	.18	.08

Estimated Annual Contaminant Load for Selected Properties and Constituents

Estimated annual contaminant loads are listed in table 3. The residential land use is the largest of the watersheds (550 acres) where contaminant loads for 8 of the 12 water-quality properties and constituents were highest, with 4 of these being nutrients. The established commercial land use is the smallest of the watersheds (63 acres), and estimated annual contaminant loads were the lowest of all the watersheds. This may indicate that the size of the watershed and runoff from residences with their associated contaminants had substantial effects on annual loads within this land use. The industrial watershed had the highest estimated annual contaminant loads for metals, followed by the residential land use. Zinc had the highest metal load (296 lbs/yr) in the industrial watershed, compared to 194 lbs/yr in the residential watershed. However, when comparing yields among each watershed (table 3), the industrial watershed had the highest yields for 9 of the 12 properties and constituents, whereas the residential watershed had the lowest yields for 7 of the 12. Nutrient yields in the residential watershed were lowest for total nitrogen, total phosphorus, and dissolved phosphorus. Metals from the industrial watershed yielded more per acre per year than any other watershed. Zinc yields were 2.71 lb/acre/yr in the industrial watershed, compared to 0.35 lb/acre/yr in the residential watershed, which was the lowest of all the watersheds. Results of the water-quality analyses are listed in appendixes 1A-1D, and the minimum detection levels of selected water-quality properties and constituents are listed in appendix 2.

Table 3. Estimated annual contaminant loads and yields for selected water-quality properties and constituents for four land-use areas within a storm-runoff monitoring network in East Baton Rouge Parish, Louisiana, 1998-2002

[Loads are in pounds per year. Yields are in pounds per acre per year. °C, degrees Celsius; ROE, residue on evaporation; <, less than]

Water-quality property or constituent	Annual loads and yields for watersheds							
	Established commercial		Industrial		New commercial		Residential	
	Load	Yield	Load	Yield	Load	Yield	Load	Yield
Chemical oxygen demand	18,200	289	44,600	409	30,700	196	89,700	163
Biochemical oxygen demand, 5 day	3,790	60.2	6,410	58.8	6,990	44.5	14,200	25.8
Total dissolved solids, ROE at 180°C	32,700	519	84,900	779	46,300	295	109,000	198
Total suspended solids, residue at 105°C	49,200	781	223,000	2,040	118,000	752	624,000	130
Nitrogen, total as N	1,010	16.0	1,830	16.8	1,990	12.7	6,680	12.2
Nitrogen, ammonia plus organic (Kjeldahl), total as N	730	11.6	1,220	11.2	1,430	9.11	5,840	10.6
Phosphorus, total as P	124	1.97	307	2.82	315	2.01	1,040	1.89
Phosphorus, dissolved as P	86	1.37	127	1.16	136	.87	470	.86
Cadmium, total recoverable as Cd	<1	<1	1	.009	<1	<1	<1	<1
Copper, total recoverable as Cu	2	.032	31	.28	3	.019	17	.031
Lead, total recoverable as Pb	12	.19	75	.69	13	.083	55	.1
Zinc, total recoverable as Zn	59	.94	296	2.71	163	1.04	194	.35

ANALYSIS OF QUALITY-CONTROL DATA

At least one equipment blank for each site was processed with the same detection limits as stormwater samples. Results indicated all constituent concentrations were less than reporting limits. A replicate sample for trace metals was collected from the new commercial and residential land-use sites July 28, 2001. After processing the environmental and replicate samples for the new commercial site, an equipment blank was collected from the cone splitter before processing the environmental and replicate samples for the residential site. The equipment blank results were less than reporting limits. Environmental and replicate analyses are presented in table 4.

Table 4. Analysis of quality-control data for two land-use areas in East Baton Rouge Parish, Louisiana, July 28, 2001

[<, less than]

Constituent	Concentration (micrograms per liter)			
	New commercial		Residential	
	Environmental	Replicate	Environmental	Replicate
Cadmium, total recoverable as Cd	1.1	0.48	0.35	0.24
Copper, total recoverable as Cu	<20	<20	21	11.3
Lead, total recoverable as Pb	13	12	29	21
Nickel, total recoverable as Ni	5.4	7	4.3	4.5
Zinc, total recoverable as Zn	150	153	133	72

Summary

Water was sampled at four watersheds for continued evaluation of urban storm runoff in East Baton Rouge Parish, Louisiana, during February 1998 through April 2002. Eighteen samples were collected from four watersheds representing land uses characterized predominantly as established commercial, industrial, new commercial, and residential. Results of water-quality analyses enabled calculation of event-mean concentrations and estimated annual contaminant loads and yields of storm runoff from nonpoint sources for 12 water-quality properties and constituents. The following water-quality data are reported: physical and chemical-related properties, fecal coliform and enterococci bacteria, major inorganic ions, nutrients, trace elements, and organic compounds.

The frequency of sampling for the selected watersheds was determined by the occurrence of storms. Automatic samplers were used to collect samples of storm runoff for each land use for at least the initial 3 hours of each storm. If the discharge was less than 3 hours, subsamples of the discharge were collected until the volume of runoff diminished, or until the level of the stream declined below the sample intake line. Manual samples were collected during the first hour and analyzed for specific conductance, field pH, water temperature, dissolved oxygen, biochemical oxygen demand, fecal coliform and enterococci bacteria, and oil and grease. Due to drought conditions, fewer storms occurred within each watershed, causing an unequal distribution of samples collected from each site.

The residential land-use site is the largest of the watersheds (550 acres), which resulted in high estimated annual contaminant loads in 8 of the 12 water-quality properties and constituents. This may indicate that the size of the watershed and runoff from residences with their associated contaminants had substantial effects on annual loads within this land use. The industrial land use had the highest estimated annual contaminant loads for metals, followed by the residential land use. Zinc had the highest metal load in the industrial land use at 296 pounds per year, compared to 194 pounds per year at the residential watershed. However, when comparing yields among each watershed, the industrial watershed had the highest yields for 9 of the 12 water-quality properties and constituents, whereas the residential watershed had the lowest yield for 7 of the 12. Nutrient yields in the residential watershed were lowest for total nitrogen, total phosphorus, and dissolved phosphorus. The industrial watershed yielded more metals per acre per year than any other watershed. Zinc yields were 2.71 pounds per acre per year from the industrial watershed, compared to 0.35 pounds per acre per year from the residential watershed, which was the lowest of all the watersheds. Lead exceeded the U.S. Environmental Protection Agency Maximum Contaminant Level of 15 µg/L (micrograms per liter) for drinking water standards in 10 of 18 samples. Low level concentrations of mercury were detected twice at both the new commercial and residential sites, with all concentrations at or just above reporting limits of 0.02 µg/L. The average dissolved phosphorus concentrations from each land use were two to four times the U.S. Environmental Protection Agency criterion of 0.05 milligrams per liter. Diazinon, which is widely used as a general-purpose insecticide for lawn and gardens, was detected in all 18 samples. The maximum diazinon concentration detected, 2.7 µg/L, was from the residential site. Malathion, another insecticide used on lawns, gardens, and plants, also was detected at least once from each site, but all concentrations were below the minimum detection limit of 0.1 µg/L.

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APPENDIXES: RUNOFF AND WATER-QUALITY DATA

1. Runoff and Water-Quality Data
    - 1A-1D. Summary of runoff and water-quality data from a drainage canal at:
        - 1A. Lobdell Boulevard in an established commercial land-use area, Baton Rouge, Louisiana during selected storms, February 15, 1998-May 10, 1999
        - 1B. Tom Drive in an industrial land-use area, Baton Rouge, Louisiana, during selected storms, February 15, 1998-May 10, 1999
        - 1C. Sunbelt Court in a new commercial land-use area, Baton Rouge metropolitan area, Louisiana, during selected storms, July 24, 1998-April 8, 2002
        - 1D. Goodwood Boulevard in a residential land-use area, Baton Rouge, Louisiana, during selected storms, July 22, 1998-April 8, 2002
2. Minimum detection levels of water-quality properties and constituents

Appendix 1A. Summary of runoff and water-quality data from a drainage canal at Lobdell Boulevard in an established commercial land-use area, Baton Rouge, Louisiana, during selected storms, February 15, 1998-May 10, 1999

[--, no data; <, less than]

Water-quality property or constituent	Beginning date of storm			
	2-15-98	**8-14-98**	**10-6-98**	**5-10-99**
Runoff volume				
Discharge (cubic feet)	142,300	227,300	258,200	310,000
Specific conductance				
Specific conductance (microsiemens per centimeter at 25 degrees Celsius)	35	41	120	48
pH and alkalinity				
pH (standard units)	6.9	6.7	7.9	6.8
Alkalinity, laboratory, as calcium carbonate (milligrams per liter)	7.2	19	47	8.4
Temperature				
Temperature, water (degrees Celsius)	13.0	26.0	27.0	21.0
Dissolved oxygen and oxygen demand (milligrams per liter)				
Dissolved oxygen	7.0	8.6	6.5	8.5
Chemical oxygen demand	17	13	19	56
Biochemical oxygen demand, 5-day	1.5	8.4	4.3	7.5
Fecal indicator bacteria (colonies per 100 milliliters)				
Fecal coliform, 0.65-micrometer filter	1,100	[a]100,000	9,600	[b]--
Enterococci, 0.45-micrometer filter	5,000	4,930	5,000	[b]--
Dissolved and suspended solids (milligrams per liter)				
Total dissolved solids, residue on evaporation at 180 degrees Celsius	28	20	84	55
Suspended solids, residue at 105 degrees Celsius	35	146	58	43
Nutrients (milligrams per liter)				
Nitrogen, total as N	.73	1.4	1.4	2.3
Nitrogen, ammonia plus organic (Kjeldahl), total as N	.43	1.1	.95	1.7
Phosphorus, total as P	.06	.12	.31	.22
Phosphorus, dissolved as P	.03	.04	.22	.20
Trace metals (micrograms per liter)				
Cadmium, total recoverable as Cd	1.28	<1	<1	<1
Chromium, total recoverable as Cr	<5	<5	<5	<5
Copper, total recoverable as Cu	<10	<10	13	<10
Lead, total recoverable as Pb	14	40	5.7	11
Mercury, total recoverable as Hg	<.1	<.1	<.1	<.1
Nickel, total recoverable as Ni	1.2	3.4	3.4	2.2
Zinc, total recoverable as Zn	47	91	91	109
Organic compounds				
Oil and grease, total recoverable, gravimetric (milligrams per liter)	<1	<1	<1	<1
Pesticides (micrograms per liter)				
Diazinon, total	.01	.79	.03	.68
Malathion, total	.01	.01	<.01	<.01
Polychlorinated biphenyls, total (micrograms per liter)	.12	.2	<.1	<.1

[a] Results based on colony count outside the acceptable range (non-ideal colony count).

[b] Analysis for bacteria from the May 10, 1999, storm was unsuccessful due to incubation problems.

Appendix 1B. Summary of runoff and water-quality data from a drainage canal at Tom Drive in an industrial land-use area, Baton Rouge, Louisiana, during selected storms, February 15, 1998-May 10, 1999

[--, no data; <, less than]

	Beginning date of storm		
Water-quality property or constituent	**2-15-98**	**8-14-98**	**5-10-99**
Runoff volume			
Discharge (cubic feet)	470,000	308,100	461,500
Specific conductance			
Specific conductance (microsiemens per centimeter at 25 degrees Celsius)	266	70	105
pH and alkalinity			
pH (standard units)	7.8	7.8	8.2
Alkalinity, laboratory, as calcium carbonate (milligrams per liter)	92	33	52
Temperature			
Temperature, water (degrees Celsius)	13.0	25.0	22.0
Dissolved oxygen and oxygen demand (milligrams per liter)			
Dissolved oxygen	7.1	8.6	7.9
Chemical oxygen demand	45	17	73
Biochemical oxygen demand, 5-day	5.3	8.5	5.5
Fecal indicator bacteria (colonies per 100 milliliters)			
Fecal coliform, 0.65-micrometer filter	520	[a]80,000	[b]--
Enterococci, 0.45-micrometer filter	630	2,200	[b]--
Dissolved and suspended solids (milligrams per liter)			
Total dissolved solids, residue on evaporation at 180 degrees Celsius	108	51	98
Suspended solids, residue at 105 degrees Celsius	186	324	165
Nutrients (milligrams per liter)			
Nitrogen, total as N	1.2	1.8	2.6
Nitrogen, ammonia plus organic (Kjeldahl), total as N	.71	1.3	1.7
Phosphorus, total as P	.15	.31	.47
Phosphorus, dissolved as P	.04	.12	.22
Trace metals (micrograms per liter)			
Cadmium, total recoverable as Cd	2.5	1.2	<1
Chromium, total recoverable as Cr	<5	<5	<5
Copper, total recoverable as Cu	26	34	33
Lead, total recoverable as Pb	75	78	75
Mercury, total recoverable as Hg	<.1	<.1	<.1
Nickel, total recoverable as Ni	170	32	801
Zinc, total recoverable as Zn	236	364	297
Organic compounds			
Oil and grease, total recoverable, gravimetric (milligrams per liter)	3	5	4
Pesticides (micrograms per liter)			
Diazinon, total	.07	.17	.05
Malathion, total	.01	<.01	<.01
Polychlorinated biphenyls, total (micrograms per liter)	.12	.23	<.1

[a] Results based on colony count outside the acceptable range (non-ideal colony count).

[b] Analysis for bacteria from the May 10, 1999, storm was unsuccessful due to incubation problems.

Appendix 1C. Summary of runoff and water-quality data from a drainage canal at Sunbelt Court in a new commercial land-use area, Baton Rouge metropolitan area, Louisiana, during selected storms, July 24, 1998-April 8, 2002

[E, estimated; <, less than]

Water-quality property or constituent	Beginning date of storm					
	7-24-98	10-6-98	3-2-99	9-1-99	7-28-01	4-8-02
Runoff volume						
Discharge (cubic feet)	487,000	136,000	459,000	159,000	300,500	291,500
Specific conductance						
Specific conductance (microsiemens per centimeter at 25 degrees Celsius)	51	212	103	86	43	178
pH and alkalinity						
pH (standard units)	7.5	8.6	7.9	7.4	7.0	7.1
Alkalinity, laboratory, as calcium carbonate (milligrams per liter)	18	81	52	26	15	37
Temperature						
Temperature, water (degrees Celsius)	30.5	26.0	17.0	32.0	27.0	18.2
Dissolved oxygen and oxygen demand (milligrams per liter)						
Dissolved oxygen	6.6	5.6	7.9	6.5	6.7	8.3
Chemical oxygen demand	14	25	78	22	42	22
Biochemical oxygen demand, 5-day	6.5	5.6	11.2	8.7	6.5	7.9
Fecal indicator bacteria (colonies per 100 milliliters)						
Fecal coliform, 0.65-micrometer filter	460	10,800	3,400	3,400	8,700	4,500
Enterococci, 0.45-micrometer filter	6,130	6,800	1,200	370	1,900	2,600
Dissolved and suspended solids (milligrams per liter)						
Total dissolved solids, residue on evaporation at 180 degrees Celsius	41	104	20	54	44	44
Suspended solids, residue at 105 degrees Celsius	92	54	250	95	182	112
Nutrients (milligrams per liter)						
Nitrogen, total as N	1.5	1.8	2.7	1.6	2.5	3.2
Nitrogen, ammonia plus organic (Kjeldahl), total as N	.95	1.4	2.4	.93	2.0	1.8
Phosphorus, total as P	.24	.45	.70	.22	.27	.21
Phosphorus, dissolved as P	.15	.32	.11	.13	.09	.10
Trace metals (micrograms per liter)						
Cadmium, total recoverable as Cd	<1	<1	1.2	<1	1.1	.19
Chromium, total recoverable as Cr	<5	<5	<5	<5	<5	<1
Copper, total recoverable as Cu	<10	<10	21	E7	<20	E8
Lead, total recoverable as Pb	8.9	6.6	45	7	13	6.4
Mercury, total recoverable as Hg	<.1	<.1	<.1	<.1	.04	.02
Nickel, total recoverable as Ni	3.5	3.2	11	5	5.4	3.5
Zinc, total recoverable as Zn	124	107	506	106	150	89
Organic compounds						
Oil and grease, total recoverable, gravimetric (milligrams per liter)	2	4	2	<1	5	<7
Pesticides (micrograms per liter)						
Diazinon, total	.04	.02	.03	.04	E.01	.17
Malathion, total	<.01	<.01	<.01	.01	<.03	<.1
Polychlorinated biphenyls, total (micrograms per liter)	<.1	.1	<.1	<.1	<.1	<.1

Appendix 1D. Summary of runoff and water-quality from a drainage canal at Goodwood Boulevard in a residential land-use area, Baton Rouge, Louisiana, during selected storms, July 22, 1998-April 8, 2002

[E, estimated; <, less than]

Water-quality property or constituent	Beginning date of storm				
	7-22-98	**11-10-98**	**10-8-99**	**7-28-01**	**4-8-02**
Runoff volume					
Discharge (cubic feet)	400,000	165,900	398,700	856,500	423,300
Specific conductance					
Specific conductance (microsiemens per centimeter at 25 degree Celsius)	48	71	33	29	48
pH and alkalinity					
pH (standard units)	7.1	7.1	7.0	6.7	6.0
Alkalinity, laboratory, as calcium carbonate (milligrams per liter)	12	22	12	5.9	8.8
Temperature					
Temperature, water (degrees Celsius)	29.0	20.0	21.5	26.5	17.7
Dissolved oxygen and oxygen demand (milligrams per liter)					
Dissolved oxygen	6.5	8.6	8.2	6.7	8.7
Chemical oxygen demand	17	<10	50	64	58
Biochemical oxygen demand, 5-day	2.3	7.1	7.2	6.7	6.5
Fecal indicator bacteria (colonies per 100 milliliters)					
Fecal coliform, 0.65-micrometer filter	[a]10,200	29,000	3,400	[b]134,000	[c]28,000
Enterococci, 0.45-micrometer filter	[a]10,600	3,500	440	480	[c]3,900
Dissolved and suspended solids (milligrams per liter)					
Total dissolved solids, residue on evaporation at 180 degrees Celsius	50	65	28	40	47
Suspended solids, residue at 105 degrees Celsius	122	298	336	225	332
Nutrients (milligrams per liter)					
Nitrogen, total as N	2.2	2.6	2.7	2.6	4.6
Nitrogen, ammonia plus organic (Kjeldahl), total as N	1.6	2.0	2.4	2.2	4.1
Phosphorus, total as P	.26	.40	.48	.54	.52
Phosphorus, dissolved as P	.16	.18	.19	.20	.26
Trace elements (micrograms per liter)					
Cadmium, total recoverable as Cd	<1	<1	.69	.35	.24
Chromium, total recoverable as Cr	<5	<5	<5	<5	<1
Copper, total recoverable as Cu	<10	<10	<20	21	E14
Lead, total recoverable as Pb	17	28	17	29	26
Mercury, total recoverable as Hg	<.1	<.1	<.3	.06	.07
Nickel, total recoverable as Ni	4.3	3.1	3.5	4.3	4.5
Zinc, total recoverable as Zn	41	74	85	133	76
Organic compounds					
Oil and grease, total recoverable, gravimetric (milligrams per liter)	2	4	2	3	<7
Pesticides (micrograms per liter)					
Diazinon, total	.18	.65	.59	.33	2.7
Malathion, total	.02	<.02	.04	<.03	E.07
Polychlorinated biphenyls, total (micrograms per liter)	<.1	<.1	<.1	<.1	<.1

[a] Results based on colony count outside the acceptable range (non-ideal colony count).
[b] Results based on a 1:100 dilution.
[c] Results based on a 1:10 dilution.

Appendix 2. Minimum detection levels of water-quality properties and constituents

Water-quality property or constituent	Minimum detection level
Specific conductance	
Specific conductance (microsiemens per centimeter at 25 degrees Celsius)	1
pH and alkalinity	
pH, laboratory (standard units)	0.1
Alkalinity, laboratory, as calcium carbonate (milligrams per liter)	1
Oxygen demand (milligrams per liter)	
Chemical oxygen demand	10
Dissolved and suspended solids (milligrams per liter)	
Total dissolved solids, residue on evaporation at 180 degrees Celsius	1
Suspended solids, residue at 105 degrees Celsius	1
Nutrients (milligrams per liter)	
Nitrogen, total as N	.05
Nitrogen, ammonia plus organic (Kjeldahl), total as N	.2
Phosphorus, total as P	.01
Phosphorus, dissolved as P	.01
Trace metals (micrograms per liter)	
Cadmium, total recoverable as Cd	1
Chromium, total recoverable as Cr	5
Copper, total recoverable as Cu	5
Lead, total recoverable as Pb	1
Mercury, total recoverable as Hg	.02
Nickel, total recoverable as Ni	1
Zinc, total recoverable as Zn	10
Organic compounds	
Oil and grease, total recoverable, gravimetric (milligrams per liter)	1
Pesticides (micrograms per liter)	
Diazinon, total	.02
Malathion, total	.1
Polychlorinated biphenyls, total (micrograms per liter)	.1