# Sampling Strategy and Selected Water-Quality and Bottom-Material Data for the Deer Creek, Mississippi, Synoptic Study

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## INTRODUCTION

The Deer Creek Basin, in northwestern Mississippi, is located in the Mississippi River Alluvial Plain, an area locally referred to as the Mississippi Delta. Deer Creek begins at Lake Bolivar at Scott, north of Greenville, and empties into the Yazoo River north of Vicksburg (fig. 1). The channel meanders from north to south and is 164 miles long. The drainage area at the mouth is about 110 square miles. The basin drains a largely rural, agricultural landscape, but includes small communities such as Scott, Leland, Hollandale, Rolling Fork, Cary, and Valley Park. Flow in the upper part of the basin is semi-regulated by several small weirs. Much of the Deer Creek channel below Greenville is "perched" or elevated formed by natural levees such that overland runoff drains away from the main channel, and only local runoff drains into the main channel. Flow is diverted into Rolling Fork Creek at Rolling Fork, which is located near the center of the basin. The Deer Creek channel below Rolling Fork is actually a series of small "lakes" or cutoffs created by earthen crossings underlain with culverts. Many of the culverts are partially filled with sediment or have inadequate cross-sectional area to convey flow from Rolling Fork to the mouth of the creek at the Yazoo River. Illegal trash dumping, failing septic systems, and agricultural runoff are well documented in the basin, especially in the lower part.

The U.S. Army Corps of Engineers, the U.S. Fish and Wildlife Service, the Mississippi Department of Environmental Quality (MDEQ), the Yazoo-Mississippi Delta Joint Water Management District, and the U.S. Geological Survey (USGS) have initiated a restoration effort for the Deer Creek Basin. Before restoration efforts began in the basin, the USGS conducted a synoptic study in September 2002 to collect baseline water-quality, bottom-material, habitat-assessment, and macroinvertebrate data in Deer Creek. This report describes the sampling strategy for the Deer Creek synoptic study, including site selection, sampling methods, quality-assurance and quality-control methods, and listing of analytes and laboratories. This report also includes selected water-quality and bottom-material data collected during the Deer Creek synoptic study.

### Site Selection

Water-quality data were collected at 47 sites during the 2002 Deer Creek synoptic study (table 1, figure 1). Physical properties (turbidity, dissolved oxygen, pH, specific conductance, and temperature) were collected at all sites. Water-quality, bottom-material, habitat-assessment, and macroinvertebrate data were collected at 6 sites (shaded gray in table 1, numbered in figure1). These six sites (hereafter referred to as primary sites) were selected at key locations in the Deer Creek Basin based on the following information:

- Deer Creek at Scott, MS (site 1, figure 1) – This site is at the second channel crossing (local road) downstream from Lake Bolivar and was sampled to characterize the water quality of Deer Creek flowing out of the lake.
- Deer Creek East of Leland, MS (site 2, figure 1) – This site is within the city limits of Leland, MS, where a USGS real-time flow and water-quality-monitoring gage is currently installed (U.S. Geological Survey, 2003a).
- Deer Creek near Hollandale, MS (site 3, figure 1) – This site is at a former U.S. Army Corp of Engineers gaging station. Thus, historical stage, flow, and water quality data are available for the site (U.S. Army Corps of Engineers, 1995).
- Deer Creek at Rolling Fork, MS (site 4, figure 1) – This site is slightly upstream of the diversion of Deer Creek into Rolling Fork Creek.
- Deer Creek at Cary and at Valley Park, MS (sites 5 and 6, figure 1) – These sites were selected based on the availability of historical flow and water-quality data.

**Sampling Methods**

A multi-probe was used to measure physical properties such as turbidity, dissolved oxygen, pH, specific conductance, and water temperature. For sites with culverts or with minimal accessibility, physical properties were measured near the center of the channel. For sites with bridge crossings, the stream width was sub-divided into equal-width sections (at least 5 sections), and physical properties were measured near the water surface at each section. Where applicable, a bottom reading was also included for each equal-width section. Calibration of the multi-probe followed guidelines outlined in Wilde and Radtke (1998). The instruments were calibrated each morning and at the end of each sampling day. The final calibration for each constituent was required to meet measurement-performance criteria shown in Table 2.

At the six primary sites, water and bottom-material samples were collected from bridges, boats, or by wading using appropriate sampling equipment and established depth- and width-integrating techniques (Shelton, 1994). Sample collection, processing, and preservation followed protocols outlined in the National Field Manual for the Collection of Water-Quality Data (Wilde and Radtke, 1998). For each water sample, approximately 6 liters of water was collected and composited into a Teflon churn splitter. The composite sample was churned about 10 times before sub-sampling into analyses bottles, which were then packed in ice and shipped in coolers to laboratories for the various chemical analyses. For each bottom-material sample, approximately 500 milligrams (mg) of sample was collected and shipped to the laboratory for analysis.

Habitat assessment procedures were modified by MDEQ from an earlier assessment for streams in mountainous regions to fit the low-gradient glide/pool streams in the Mississippi Alluvial Plain (Barbour and Stribling, 1994; Florida Department of Environmental Protection, 1996). The biological field team selected a representative stream section and measured 100- to 500-meter (m) reaches depending on channel size at each site. The upstream (US) and downstream (DS) limits of the reach were marked with flagging labeled with the stream name, US or DS end, date, and samplers' initials. The actual assessment included visual inspection of 50 m on either side of the marked reach with the biological team documenting general characteristics and scored assessments (Barbour and Stribling, 1994; Florida Department of Environmental Protection, 1996). Macroinvertebrate samples were collected according to two different methods – natural habitat (woody debris, cut-banks, and bottom material) and artificial habitat (Hester-Dendy artificial substrate). Macroinvertebrate samples were analyzed by Tetra Tech, Inc. Presentation of habitat assessment and macroinvertebrate data are beyond the scope of this report.

**Quality-Assurance and Quality-Control Methods**

The Mississippi USGS office participates in the National Field Quality Assurance Program (NFQA) once each year. The USGS Ocala Water Quality and Research Laboratory in Ocala, FL, prepares water samples with known values of pH, alkalinity, and specific conductance. Field personnel perform a blind analysis on the samples for comparison to known values (Crawford, 1999). All Mississippi field personnel participating in the Deer Creek study successfully completed the NFQA for 2002.

Prior to sample collection, all equipment that came into contact with the sample water and bottom material was cleaned with a 0.2 percent non-phosphate detergent, rinsed with deionized water, air dried, wrapped in aluminum foil, and stored in a dust-free environment. All equipment (churn splitter, tubing, and bottles) was placed in plastic bags to prevent contamination. Teflon bottles were covered with nitrile gloves to keep the sampling chamber free of foreign materials. At the end of each sampling day, the churn splitters and tubing were cleaned thoroughly by using the non-phosphate solution, followed by a series of washes alternating tap water and deionized water.

Quality-control samples were collected to assess bias and variability for the set of environmental samples. Field equipment blank samples were collected to assess bias in the data set that could be caused by contamination of field equipment. One set of equipment blanks were run for the Deer Creek synoptic study. Replicate samples were collected to assess variability in the environmental data set due to random errors. One duplicate water sample was collected at the Deer Creek at Scott, MS, site. Habitat assessment duplicates were run at the Deer Creek at Scott, MS, and at the Deer Creek at Valley Park, MS, sites.

**Lists of Analytes and Laboratories**

A complete list of all analytes that were performed on the water-quality and bottom-material samples collected at the six primary sites is presented in Table 3. Four different USGS laboratories were used for the Deer Creek synoptic study (analytical methods and detection limits for each analyte are available online, and web pages for each laboratory are listed in the references section):

1. National Water Quality Laboratory in Denver, CO (U.S. Geological Survey, 2003b) – Water samples were analyzed for pesticides (herbicides, insecticides, and degradation products) dissolved organic carbon, and total particulate carbon.

Bottom-material samples were analyzed for historically-used organochlorine pesticides.

2. Ocala Water Quality and Research Laboratory in Ocala, FL (U.S. Geological Survey, 2003c) – Water samples were analyzed for nutrients (dissolved and total), major ions, trace elements, and total organic carbon.
3. Louisiana District Sediment Laboratory in Baton Rouge, LA (U.S. Geological Survey, 2003d) – Water samples were analyzed for suspended sediment.
4. Organic Geochemistry Research Laboratory in Lawrence, KS (U.S. Geological Survey 2003e) – Water samples were analyzed for the herbicide glyphosate and two degradation products.

## WATER QUALITY AND BOTTOM MATERIAL DATA

Physical properties for all sites are presented in Table 4, selected nutrient values collected at the six primary sites are presented in Table 5, and organochlorine values for bottom-material samples collected at the six primary sites are presented in Table 6. The remaining water-quality data are available online within the USGS databases (U.S. Geological Survey, 2003f).

## DISCLAIMER

The use of brand names in this paper is for identification purposes only and does not constitute endorsement by the U.S. Government.

## REFERENCES

Barbour, M.T., and Stribling, J.B., 1994, A technique for assessing stream habitat structure, *in* Riparian ecosystems in the humid U.S.: Functions, values and management, 1993, Proceedings: Washington D.C., National Association of Conservation Districts, p. 156-178.

Crawford, Kent, 1999, Quality science, quality service: Accessed February 2003 at **URL http://pa.water.usgs.gov/keystone_ws99/quality.html.**

Florida Department of Environmental Protection, 1996, Standard operating procedures for biological assessment, variously paginated.

U.S. Army Corps of Engineers, 1995, Stages and discharges of the Mississippi River and tributaries in the Vicksburg District – 1995: U.S. Army Engineer District, Vicksburg Corps of Engineers, 339 p.

Shelton, L.R., 1994, Field guide for collecting and processing stream-water quality samples do the National Water-Quality Assessment Program: U.S. Geological Survey Open-File Report 94-455, 42 p.

U.S. Geological Survey, 2003a, USGS 0728875070 DEER CREEK EAST OF LELAND, MS, provisional data: USGS Mississippi District Local Real-Time Data, at **URL http://ms.waterdata.usgs.gov/nwis/uv/?site_no=0728875070&PARAmeter_cd=00065,00060.**

U.S. Geological Survey, 2003b, USGS National Water Quality Laboratory home page, at **URL http://nwql.usgs.gov/Public/Public.html.**

U.S. Geological Survey, 2003c, USGS Ocala Water Quality and Research Laboratory web page, at **URL http://owqrl.er.usgs.gov/.**

U.S. Geological Survey, 2003d, USGS Louisiana District Sediment Laboratory, at **URL http://la.water.usgs.gov/.**

U.S. Geological Survey, 2003e, USGS Organic Geochemistry Research Laboratory at **URL http://ks.water.usgs.gov//Kansas/reslab/.**

U.S. Geological Survey, 2003f, Water quality data for Mississippi: USGS National Water Information System Web (NWIS Web), at **URL http://ms.waterdata.usgs.gov/nwis/qw.**

Wilde, F.D. and Radtke, D.B., 1998, National field manual for the collection of water-quality data: U.S. Geological Survey Techniques of Water-Resources Investigations, book 9.

**Table 1.**—Map number, station number and name, locations, and constituents for sites sampled as part of the Deer Creek, synoptic study, September 2002

[USGS, U.S. Geological Survey; SR1, State Road 1; SE, southeast; SW; southwest; NE, northeast; NR, near; NW, northwest; AB, above; all sites located in Mississippi; latitude and longitude values presented as XXXXXX are XX° XX' XX"]

| Map number (fig. 1) | USGS station number | Station name | Latitude | Longitude | Physical properties | Water sample, bottom-material sample, and habitat assessment |
|---|---|---|---|---|---|---|
| | 333554091045000 | DEER CREEK AT SR1 AT SCOTT | 333554 | 910450 | x | |
| 1 | 7288730 | DEER CREEK AT SCOTT | 333546 | 910441 | x | x |
| | 333534091042000 | DEER CREEK AT WEIR AT SCOTT | 333534 | 910420 | x | |
| | 333447091023600 | DEER CREEK SE OF SCOTT | 333447 | 910236 | x | |
| | 333353091013600 | DEER CREEK NORTH OF FORKLAND | 333353 | 910136 | x | |
| | 333141091005500 | DEER CREEK AT FORKLAND | 333141 | 910055 | x | |
| | 333058090590400 | DEER CREEK AT PRISCILLA, | 333058 | 905904 | x | |
| | 333008090594500 | DEER CREEK SW OF PRISCILLA | 333008 | 905945 | x | |
| | 332733091001600 | DEER CREEK AT METCALFE | 332733 | 910016 | x | |
| | 332638090585900 | DEER CREEK SE OF METCALFE | 332638 | 905859 | x | |
| | 332541090552100 | DEER CREEK NE OF STONEVILLE | 332541 | 905521 | x | |
| | 332515090543400 | DEER CREEK AT STONEVILLE | 332515 | 905434 | x | |
| | 332440090543600 | DEER CREEK SOUTH OF STONEVILLE | 332440 | 905436 | x | |
| 2 | 728875070 | DEER CREEK EAST OF LELAND | 332404 | 905331 | x | x |
| | 332249090542600 | DEER CREEK SOUTH OF LELAND | 332249 | 905426 | x | |
| | 332008090533200 | DEER CREEK NR BURDETTE | 332008 | 905332 | x | |
| | 331611090523600 | DEER CREEK AT ARCOLA | 331611 | 905236 | x | |
| | 331304090521800 | DEER CREEK AT ESTILL | 331304 | 905218 | x | |
| | 331127090512600 | DEER CREEK NORTH OF HOLLANDALE | 331127 | 905126 | x | |
| | 7288768 | DEER CREEK AT HOLLANDALE | 331010 | 905102 | x | |
| 3 | 7288770 | DEER CREEK NR HOLLANDALE | 330859 | 905047 | x | x |
| | 330632090523900 | DEER CREEK AT PERCY | 330632 | 905239 | x | |
| | 330414090514400 | DEER CREEK AT PANTHER BURN | 330414 | 905144 | x | |
| | 330238090500200 | DEER CREEK AT VICKLAND | 330238 | 905002 | x | |
| | 330028090511000 | DEER CREEK NR NITTA YUMA | 330028 | 905110 | x | |
| | 325821090502300 | DEER CREEK AT ANGUILLA | 325821 | 905023 | x | |
| | 325754090511100 | DEER CREEK NR ANGUIL | 325754 | 905111 | x | |
| | 325554090525000 | DEER CREEK NORTH OF ROLLING FORK | 325554 | 905250 | x | |
| 4 | 325427090524500 | DEER CREEK AT ROLLING FORK | 325427 | 905245 | x | x |
| | 325251090531900 | DEER CREEK SOUTH OF ROLLING FORK | 325251 | 905319 | x | |
| | 325218090532500 | DEER CREEK NORTH OF EGREMONT | 325218 | 905325 | x | |
| | 325200090533700 | DEER CREEK NR EGREMONT | 325200 | 905337 | x | |
| | 325034090542100 | DEER CREEK SOUTH OF EGREMONT | 325034 | 905421 | x | |
| | 324951090544900 | DEER CREEK NORTH OF CARY | 324951 | 905449 | x | |
| 5 | 7288740 | DEER CREEK AT CARY | 324903 | 905517 | x | x |
| | 324728090570600 | DEER CREEK SW OF CARY | 324728 | 905706 | x | |
| | 324552090573000 | DEER CREEK NW OF BLANTON | 324552 | 905730 | x | |
| | 324509090554700 | DEER CREEK AT BLANTON | 324509 | 905547 | x | |
| | 324159090555000 | DEER CREEK NR ONWARD | 324159 | 905550 | x | |

**Table 1.—**Map number, station number and name, locations, and constituents for sites sampled as part of the Deer Creek, synoptic study, September 2002

| Map number (fig. 1) | USGS station number | Station name | Latitude | Longitude | Physical properties | Water sample, bottom-material sample, and habitat assessment |
|---|---|---|---|---|---|---|
| | 324202090562700 | DEER CREEK SOUTH OF ONWARD | 324202 | 905627 | x | |
| | 7288790 | DEER CREEK NR VALLEY PARK | 324016 | 905413 | x | |
| | 323915090513900 | DEER CREEK NORTH OF VALLEY PARK | 323915 | 905139 | x | |
| | 323821090513900 | DEER CREEK AB VALLEY PARK | 323821 | 905139 | x | |
| 6 | 323805090514700 | DEER CREEK AT VALLEY PARK | 323805 | 905147 | x | x |
| | 323437090502100 | DEER CREEK NR HARDEE | 323437 | 905021 | x | |
| | 323223090491400 | DEER CREEK EAST OF FLOWEREE | 323223 | 904914 | x | |
| | 323244090492300 | DEER CREEK NR FLOWEREE | 323244 | 904923 | x | |

**Table 2.** Day-end calibration measurement criteria

[GPS, global positioning system; m, meters; %, percent, mg/L, milligrams per liter; C, Celsius; µS/cm, microsiemens per centimeter; all criteria are dependent upon range of measurement for a specific multi-probe]

| Measurement Property | Accuracy |
|---|---|
| GPS | ± 15 m |
| Dissolved oxygen | The greater value of ± 2% of reading or ± 0.2 mg/L for 0-20 mg/L |
| pH | ± 0.2 standard units |
| Temperature | ± 0.15°C or ± 0.10°C |
| Specific conductance | ± 0.5% + 1 µS/cm or the greater value of ± 1% of reading or + 1µS/cm |
| Turbidity | ±2% |

**Table 3.—**Listing of all analytes determined at USGS laboratories for water-quality and bottom-material samples collected at six primary sites of the Deer Creek synoptic study, September 2002

[OWQRL, Ocala Water Quality and Research Laboratory; NTU, nephlometric turbidity units; µS/cm, microsiemens per centimeter; C, Celsius; mg/L, milligrams per liter; NWQL, National Water Quality Laboratory; mL, milliliters; µg/L, micrograms per liter; LDSL, Louisiana District Sediment Laboratory; OGRL, Organic Geochemistry Research Laboratory; µg/kg, micrograms per kilogram]

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**Additional Field or Laboratory Constituents (Water)**

Color (platinum-cobalt) - OWQRL
Turbidity (NTU) - OWQRL
pH, laboratory, standard units- OWQRL
Specific conductance, laboratory, µS/cm at 25º C - OWQRL
Alkalinity, water, unfiltered, laboratory, mg/L as $CaCO_3$- OWQRL
Carbon, organic, total, mg/L as C - OWQRL
Carbon, organic, dissolved, mg/L as C - NWQL
Carbon, inorganic + organic, particulate, total, mg/L as C - NWQL
Biochemical oxygen demand, 5-day, mg/L, at 20º C – Mississippi District
Chemical oxygen demand, high level, mg/L - OWQRL
Fecal coliform, colonies per 100 mL – Mississippi District
Chlorophyll-a, phytoplankton, µg/L - OWQRL
Sediment, suspended, mg/L - LDSL
Residue, total, non filterable, mg/L - OWQRL
Solids, residue on evaporation at 180º C, dissolved, mg/L - OWQRL

**Major Ions (Dissolved in Water, mg/L) - OWQRL**

Calcium (as Ca)
Magnesium (as Mg)
Potassium (as K)
Sodium (as Na)
Chloride (as Cl)
Fluoride (as F)
Sulfate (as $SO_4$)

**Nutrients (Water, mg/L) - OWQRL, except where noted**

Nitrogen, ammonia, dissolved (as N)
Nitrogen, ammonia, total (as N)
Nitrogen, ammonia plus organic, dissolved (as N)
Nitrogen, ammonia plus organic, total (as N)
Nitrogen, nitrite plus nitrate, dissolved (as N)
Nitrogen, nitrite plus nitrate, total (as N)
Nitrogen, nitrite, dissolved (as N)
Nitrogen, nitrite, total (as N)
Nitrogen, particulate, water, filtered, suspended, (NWQL)
Phosphorus, orthophosphate, dissolved (as P)
Phosphorus, orthophosphate, total (as P)
Phosphorus, dissolved (as P)
Phosphorus, total (as P)

**Trace metals (Dissolved in Water, µg/L) - OWQRL**

Aluminum (as Al)
Antimony (as Sb)
Arsenic (as As)
Beryllium (as Be)
Boron (as B)
Cadmium (as Cd)
Chromium (as Cr)
Cobalt (as Co)
Copper (as Cu)
Iron (as Fe)
Lead (as Pb)
Manganese (as Mn)
Mercury (as Hg)
Molybdenum (as Mo)
Nickel (as Ni)
Selenium (as Se)
Silver (as Ag)
Strontium (as Sr)
Thallium (as Tl)
Vanadium (as V)
Zinc (as Zn)

**Table 3.—**Listing of all analytes determined at USGS laboratories for water-quality and bottom-material samples collected at six primary sites of the Deer Creek synoptic study, September 2002 … *continued*

**Pesticides and Degradates (Dissolved in water, µg/L) – NWQL, except where noted**

| | | | |
|---|---|---|---|
| 2,4-d methyl ester | chlorothalonil | glyphosate (OGRL) | pebulate |
| 2,4-d | chlorpyrifos | hdroxyatrazine | pendimethalin |
| 2,4-db | clopyralid | imazaquin | permethrin, cis |
| 2,6-diethylaniline | cyanazine | imazethapyr | phorate |
| 3-hydroxy-carbofuran | cycloate | imidacloprid | picloram |
| 3-ketocarbofuran | dacthal | lindane | prometon |
| acetochlor | DCPA | linuron | pronamide |
| acifluorfen | deethylatrazine | malathion | propachlor |
| alachlor | deethyldeisopropyl | MCPA | propanil |
| aldicarb sulfone | atrazine | MCPB | propargite |
| aldicarb sulfoxide | deisopropyl atrazine | metalaxyl | propham |
| amino methyl- | diazinon | methiocarb | propiconazole |
| phosphonic acid | dicamba | methomyl | propoxur |
| (OGRL) | dichlorprop | methyl azinphos | siduron |
| atrazine | dieldrin | methyl parathion | simazine |
| bendiocarb | dinoseb | metolachlor | sulfometruron methyl |
| benfluralin | diphenamid | metribuzinl | tebuthiuron |
| benomyl | disulfoton | metsulfuron-methyl | terbacil |
| bensulfuron-methyl | diuron | molinate | terbufos |
| bentazon | EPTC | napropamide | thiobencarb |
| bromacil | ethalfluralin | neburon | triallate |
| bromoxynil | ethopropl | nicosulfuron | tribenuron |
| butylate | fenuron | norflurazon | triclopyr |
| carbaryl | flumetsulam | oryzalin | trifluralin |
| carbofuran | fluometuron | oxamyl | urea, 3(4- |
| chloramben | fonofos | p,p' DDE | chlorophenyl) |
| chlorimuron | glufosinate (OGRL) | parathion | methyl |

**Organochlorines in Bottom Material (µg/kg, dry weight) - NWQL**

| | | |
|---|---|---|
| Aldrin | Heptachlor | o,p'-DDT |
| Chlordane, technical | Lindane | p,p'-DDD |
| Dieldrin | Methoxychlor | p,p'-DDE |
| Endosulfane I | Mirex | p,p'-DDT |
| Endrin | o,p'-DDD | Gross PCB’s |
| Heptachlor epoxide | o,p'-DDE | Toxaphene |

**Table 4.**—Measurements of physical properties for the Deer Creek synoptic study, September 2002

[mg/L, milligrams per liter; µS/cm, microsiemens per centimeter; C, Celsius; all sites located in Mississippi; SR1, State Road 1; SE, southeast; SW; southwest; NE, northeast; nr, near; NW, northwest; AB, above; values in bold are means (medians for pH) for field measurements collected with depth and width at sites with bridge crossings]

| Station name | Turbidity, nephelo-metric turbidity units | Dissolved oxygen (mg/L) | pH, Standard units | Specific conductance (µS/cm at 25 degrees C) | Temperature, water (degrees C) |
|---|---|---|---|---|---|
| Deer Creek at SR1 at Scott | **19** | **6.1** | **8.0** | **160** | **30.0** |
| Deer Creek at Scott | 17 | 4.4 | 7.2 | 167 | 29.5 |
| Deer Creek at Weir at Scott | **4.2** | **3.8** | **7.0** | **181** | **27.5** |
| Deer Creek SE of Scott | N/A | 4.4 | 7.2 | 290 | 29.5 |
| Deer Creek North of Forkland | 15 | 5.6 | 7.6 | 463 | 29.0 |
| Deer Creek at Forkland | **31** | **7.2** | **8.3** | **432** | **31.5** |
| Deer Creek at Priscilla | **92** | **10.4** | **8.5** | **389** | **32.0** |
| Deer Creek SW of Priscilla | **22** | **6.1** | **7.9** | **370** | **28.5** |
| Deer Creek at Metcalfe | 17 | 7.7 | 7.9 | 435 | 29.0 |
| Deer Creek SE of Metcalfe | **8.7** | **5.2** | **7.7** | **425** | **27.0** |
| Deer Creek NE of Stoneville | **25** | **6.3** | **7.8** | **425** | **28.0** |
| Deer Creek at Stoneville | **30** | **8.2** | **8.2** | **571** | **31.0** |
| Deer Creek South of Stoneville | **20** | **7.6** | **8.0** | **479** | **31.5** |
| Deer Creek East of Leland | 28 | 6.9 | 7.7 | 500 | 29.5 |
| Deer Creek South of Leland | **24** | **5.4** | **7.7** | **431** | **27.5** |
| Deer Creek nr Burdette | **16** | **5.2** | **7.8** | **454** | **28.5** |
| Deer Creek at Arcola | **18** | **4.8** | **7.5** | **328** | **29.0** |
| Deer Creek at Estill | **15** | **5.7** | **7.5** | **270** | **30.0** |
| Deer Creek North of Hollandale | **12** | **6.5** | **7.6** | **192** | **30.5** |
| Deer Creek at Hollandale | 20 | 7.4 | 7.5 | 190 | 31.0 |
| Deer Creek nr Hollandale | 31 | 4.9 | 7.2 | 163 | 28.0 |
| Deer Creek at Percy | **32** | **4.4** | **7.0** | **155** | **29.5** |
| Deer Creek at Panther Burn | **11** | **5** | **7.1** | **144** | **29.0** |
| Deer Creek at Vickland | **12** | **6.7** | **7.2** | **128** | **30.0** |
| Deer Creek nr Nitta Yuma | **18** | **8.1** | **7.8** | **211** | **31.0** |
| Deer Creek at Anguilla | 18 | 6.4 | 7.6 | 384 | 29.5 |
| Deer Creek nr Anguilla | **13** | **7** | **7.6** | **250** | **29.5** |
| Deer Creek North of Rolling Fork | N/A | N/A | N/A | N/A | N/A |
| Deer Creek at Rolling Fork | 92 | 5.3 | 7.3 | 235 | 26.0 |
| Deer Creek South of Rolling Fork | N/A | N/A | N/A | N/A | N/A |
| Deer Creek North of Egremont | 140 | 5.5 | 7.2 | 109 | 31.0 |
| Deer Creek nr Egremont | N/A | 1.9 | 6.6 | 106 | 32.0 |
| Deer Creek South of Egremont | 34 | 5.3 | 7.1 | 210 | 29.0 |

**Table 4.—**Measurements of physical properties for the Deer Creek synoptic study, September 2002

| Station name | Turbidity, nephelo-metric turbidity units | Dissolved oxygen (mg/L) | pH, Standard units | Specific conductance (µS/cm at 25 degrees C) | Temperature, water (degrees C) |
|---|---|---|---|---|---|
| Deer Creek North of Cary | 55 | 3.1 | 6.8 | 121 | 28.5 |
| Deer Creek at Cary | 50 | 7.9 | 7.0 | 176 | 28.0 |
| Deer Creek SW of Cary | 38 | 5.3 | 7.4 | N/A | 29.5 |
| Deer Creek NW of Blanton | **16** | **4** | **7.0** | **124** | **30.0** |
| Deer Creek at Blanton | **23** | **3.9** | **6.8** | **144** | **27.0** |
| Deer Creek nr Onward | **29** | **6.6** | **7.2** | **92** | **30.5** |
| Deer Creek South of Onward | N/A | N/A | N/A | N/A | N/A |
| Deer Creek nr Valley Park | **56** | **7.7** | **7.8** | **85** | **32.0** |
| Deer Creek North of Valley Park | N/A | 10.3 | 7.5 | 113 | 32.0 |
| Deer Creek AB Valley Park | 46 | 8.1 | 7.6 | 102 | 31.0 |
| Deer Creek at Valley Park | 16 | 1.4 | 6.5 | 102 | 26.5 |
| Deer Creek nr Hardee | **63** | **2.2** | **7.0** | **200** | **26.0** |
| Deer Creek East of Floweree | N/A | N/A | N/A | N/A | N/A |
| Deer Creek nr Floweree | 16 | 3.1 | 6.4 | 126 | 28.5 |

**Table 5.—**Selected nutrient values for the six primary sites of the Deer Creek synoptic study, September 2002

[N, nitrogen; P, phosphorus; all sites are in Mississippi; values are in milligrams per liter; <, less than]

| Station Name | Dissolved ammonia (as N) | Total ammonia plus organic nitrogen (as N) | Dissolved nitrite plus nitrate (as N) | Dissolved ortho-phosphorus (as P) | Total phosphorus (as P) |
|---|---|---|---|---|---|
| Deer Creek at Scott | 0.08 | 1.6 | 0.04 | 0.10 | 0.24 |
| Deer Creek East Of Leland | 0.02 | 0.9 | <0.02 | 0.07 | 0.12 |
| Deer Creek Nr Hollandale | 0.01 | 1.0 | <0.02 | 0.07 | 0.22 |
| Deer Creek At Rolling Fork | 0.02 | 1.3 | <0.02 | 0.24 | 0.42 |
| Deer Creek At Cary | 0.02 | 1.1 | <0.02 | 0.03 | 0.18 |
| Deer Creek At Valley Park | 0.01 | 3.9 | <0.02 | <0.01 | 0.34 |

**Table 6.—**Organochlorine data for bottom-material samples collected at the six primary sites of the Deer Creek synoptic study, September 2002

[All sites are in Mississippi; <, less than; values listed are in micrograms per kilogram dry weight; all values above detection limits are in bold; E, estimated*]

| Station Name | Lindane | Heptachlor | Aldrin | Heptachlor Epoxide | Technical Chlordane | Endosulfan I |
|---|---|---|---|---|---|---|
| Deer Creek at Scott | <0.2 | <0.2 | <0.30 | **<1.00** | <3.0 | <0.2 |
| Deer Creek East of Leland | <0.2 | <0.2 | <0.2 | <0.2 | <3.0 | <0.2 |
| Deer Creek at Holland | <0.2 | <0.2 | <0.2 | <0.2 | <3.0 | <0.2 |
| Deer Creek at Rolling Fork | <0.2 | <0.2 | **<0.55** | <0.2 | <3.0 | <0.2 |
| Deer Creek at Cary | <0.2 | <0.2 | <0.2 | <0.2 | <3.0 | <0.2 |
| Deer Creek at Valley Park | <0.4 | <0.4 | <0.4 | <0.4 | <6.0 | <0.4 |

| Station Name | Dieldrin | Endrin | p,p-DDE | p,p-DDD | p,p-DDT | p,p-Methoxychlor |
|---|---|---|---|---|---|---|
| Deer Creek at Scott | **4.67** | **<5.30** | **209** | **137** | **<3.65** | <2.5 |
| Deer Creek East of Leland | <0.2 | **6.09** | **617** | **260** | **28.2** | <2.5 |
| Deer Creek at Holland | <0.2 | **6.68** | **567** | **70.8** | **E4.55** | <2.5 |
| Deer Creek at Rolling Fork | <0.2 | **5.42** | **199** | **81.7** | **24.8** | <2.5 |
| Deer Creek at Cary | <0.2 | <0.2 | **11.7** | **6.06** | **1.23** | <2.5 |
| Deer Creek at Valley Park | <0.4 | **2.11** | **132** | **35.0** | **11.7** | <5.0 |

| Station Name | Mirex | Toxaphene | Gross PCB's | o,p-DDE | o,p-DDD | o,p-DDT |
|---|---|---|---|---|---|---|
| Deer Creek at Scott | <0.2 | <50 | **E15.1** | <0.2 | **32.2** | **<4.55** |
| Deer Creek East of Leland | <0.2 | <50 | **25.4** | **22.2** | **43.5** | **8.99** |
| Deer Creek at Holland | <0.2 | <50 | **E22.2** | **13.7** | **14.0** | **5.98** |
| Deer Creek at Rolling Fork | <0.2 | <50 | **E7.25** | **3.47** | **E9.95** | **6.24** |
| Deer Creek at Cary | <0.2 | <50 | <5.0 | <0.2 | **0.55** | <0.5 |
| Deer Creek at Valley Park | <0.4 | <100 | <10.0 | **4.76** | **6.25** | **2.78** |

* Some of the results listed were reported with an "E," or estimated, qualifier. Typical reasons the E qualifier is used include matrix interference or breakdown, analyte confirmed but below reporting limit, or analyte confirmed above standards based on a dilution of the sample. All of the estimated data are considered valid.

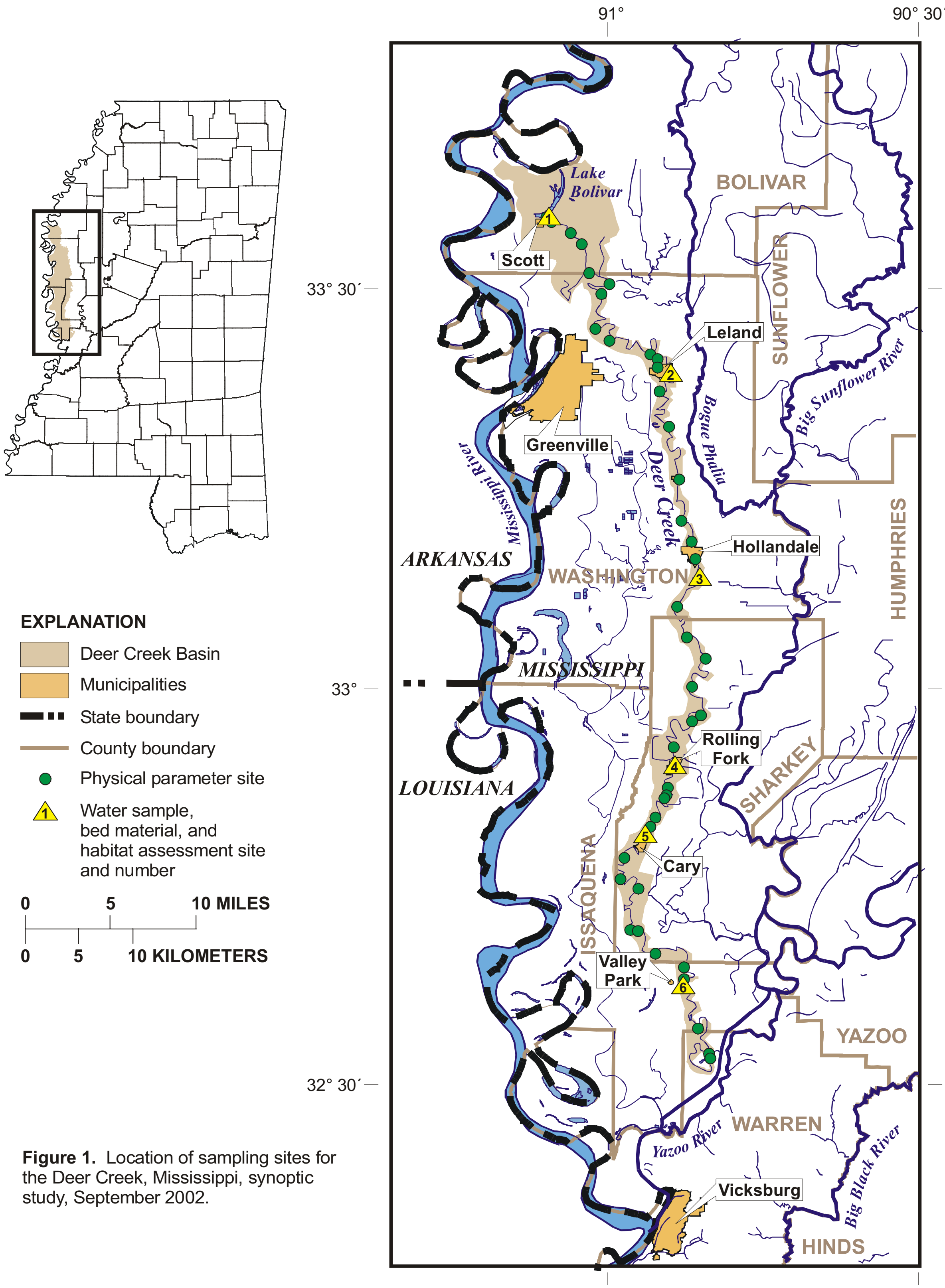


**Figure 1.** Location of sampling sites for the Deer Creek, Mississippi, synoptic study, September 2002.