

## INTRODUCTION

Kincaid Reservoir, formed from an earthen dam built in 1972 in central Louisiana, is used for water-based activities such as water skiing, fishing, boating, and swimming. An understanding of current hydrologic conditions of Kincaid Reservoir and other reservoirs and lakes in Louisiana is essential to the management and protection of these valuable natural resources. Water quality and quantity are important concerns to those who use these bodies of water for municipal, recreational, agricultural, or industrial purposes. Current and accurate information regarding the physical and chemical-related properties and conditions of freshwater reservoirs and lakes in Louisiana is fundamental to planners and managers for evaluating these resources. In October 1996, the U.S. Geological Survey, in cooperation with the Louisiana Department of Transportation and Development, began a study to conduct a bathymetric survey and determine the physical and chemical-related properties of Kincaid Reservoir.

The purpose of this report is to present the results of the bathymetric survey and the results of vertical profiles of physical and chemical-related properties, including depth, water temperature, dissolved oxygen (DO), specific conductance, and pH. Hydrographic surveying software was used for combining differential global positioning system (DGPS) information with digital survey fathometer data to accurately map the bathymetry of the reservoir. The bathymetric map was produced using geographic information systems (GIS), and lines of equal depth of water were reviewed and edited for accuracy and consistency. On-site physical and chemical-related properties were measured at the three selected locations using a water-quality monitor. This report is one in a series of planned map reports describing current bathymetry and physical and chemical-related properties of reservoirs and lakes in Louisiana.

## Description of Study Area

Kincaid Reservoir (fig. 1) is located in northwestern Rapides Parish about 8.5 miles west of Alexandria, Louisiana. A 1997 census estimated a population of 127,855 for Rapides Parish and 50,726 for the City of Alexandria (Northeast Louisiana University, Uniform Resource Locator accessed December 1, 1998). This area has a subtropical transitional climate with a mean annual rainfall of 58.5 inches and a mean annual temperature of 66.2°F (degrees Fahrenheit) (Jay Grymes, Louisiana Office of State Climatology, written commun., 1998).

Kincaid Reservoir has a drainage area of 34.9 square miles and receives inflow from Sibley Branch, Walker Branch, Valentine Creek, and Lamotte Creek. The earthen dam has a top elevation of 105.3 feet above sea level and is 5,200 feet in length. The reservoir level is controlled by a 100-foot-long spillway at a crest elevation of 94.7 feet above sea level that discharges into Bayou Boeuf. The maximum design discharge for the spillway is 23,510 cubic feet per second (Ray Elifami, Louisiana Department of Transportation and Development, written and oral commun., 1998). Approximately half of the reservoir-surface area has stumpy remnants of the once densely forested basin. Boat access is limited with well-demarcated channels. Boat ramps are available at three locations on the reservoir.

## Acknowledgments

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## BATHYMETRY

Bathymetric data for Kincaid Reservoir were collected during June 17-18, 1997. Accurate position and depth data were obtained to comprehensively describe the bathymetry of the reservoir; 84,398 data points of latitude, longitude, and depth were recorded. The bathymetry of the reservoir is shown in figure 1; water depths are referenced to the water-surface elevation of 92.24 feet above sea level, which existed throughout the bathymetric survey. The bathymetry of the reservoir is highly varied, indicating that various stream channels preexist the reservoir.

Equipment used during the bathymetric survey included a Starlink DNAV-212 DGPS, an Odom digital survey fathometer, and HYPACK software. The DGPS measured spatial position in latitude and longitude with routine accuracy of 5 feet; horizontal control points were established at the beginning and rechecked at the end of each survey day to maintain that accuracy. The survey fathometer measured the depth with routine accuracy of 0.1 foot; the fathometer was calibrated at the start and verified at the end of each survey day to maintain that accuracy. The HYPACK software was used for survey planning, survey execution, and storage and editing of data. Data were exported to ARC/INFO for drawing lines of equal depth of water and subsequent reviewing and editing of the results.

Surface area and volume spatial analyses also were performed within ARC/INFO. The water-surface area of Kincaid Reservoir was 1,680 acres, and the water volume was 21,600 acre-feet. The depth-surface area and depth-volume relations are shown in figure 2. The average depth of the reservoir was 12.9 feet, with a depth of 15.0 feet or greater over

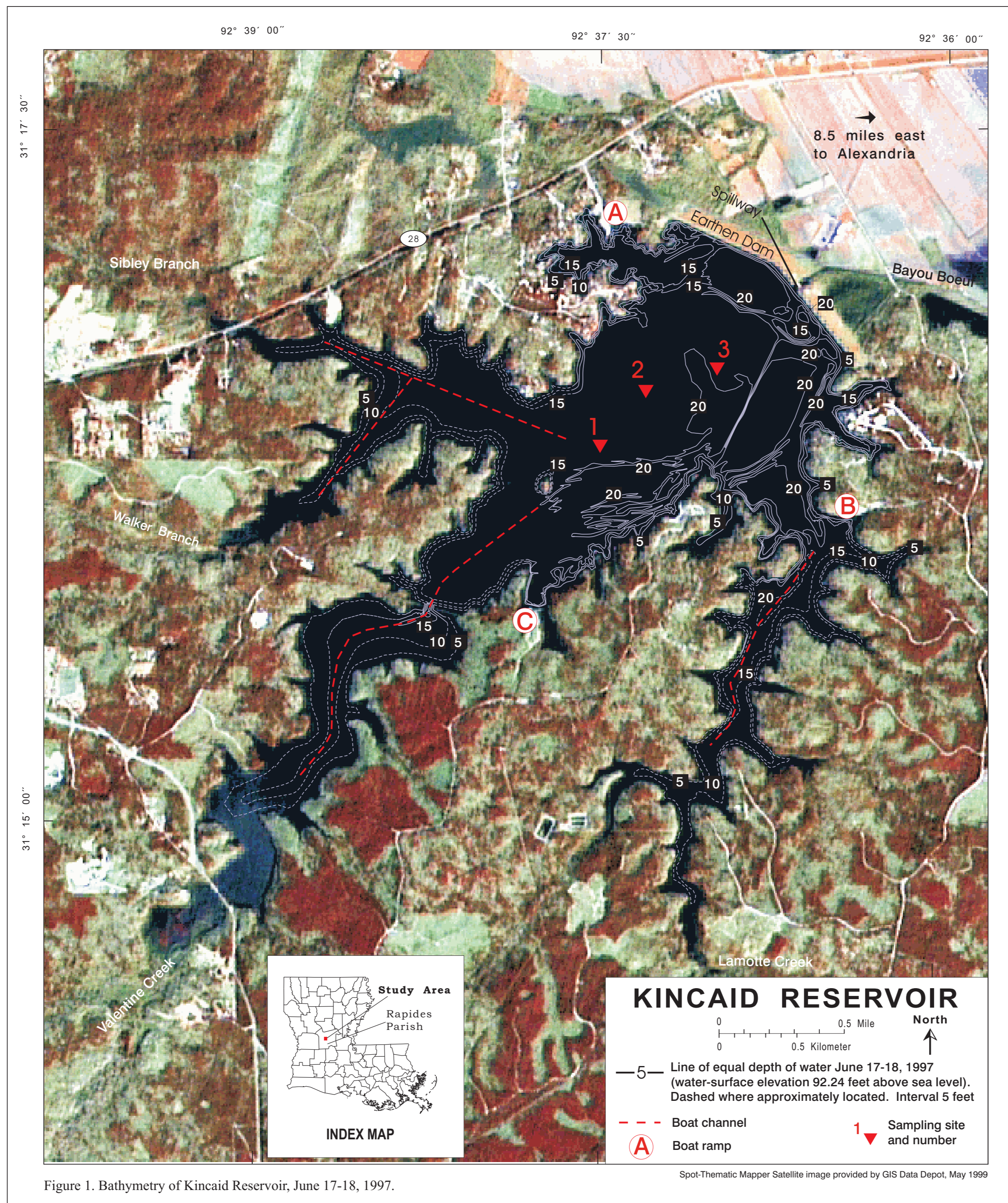


Figure 1. Bathymetry of Kincaid Reservoir, June 17-18, 1997.

more than 50 percent of the reservoir-surface area. Greatest depths are located in the northeastern part of the reservoir near the spillway.

## PHYSICAL AND CHEMICAL-RELATED PROPERTIES

Data on physical and chemical-related properties were collected on September 22, 1997, at selected sites in Kincaid Reservoir. At these sites (1, 2, and 3 in fig. 1), multiple points along a vertical profile were sampled to establish the occurrence and depth of stratification. The HYDROLAB, a water-quality monitor, was calibrated at the beginning of the day prior to physical and chemical-related property data collection.

Data were collected along a vertical profile from above the reservoir bed to 1.6 feet below the water surface, with additional sampling points within the stratification zone. The deepest measurements at the three sampling sites were 14.8 feet at site 1, 16.1 feet at site 2, and 16.4 feet at site 3. Water temperature

decreased with depth from approximately 86°F from the surface to the deepest measurement of 80.4°F at 16.4 feet (fig. 3).

Chemical-related properties indicated a distinct stratification of the lake existed on September 22, 1997. Shallow-water DO concentrations ranged from 6.0 to 6.4 mg/L (milligrams per liter), and decreased substantially at depths from 10 to 13 feet below the water surface. Concentrations of DO vary considerably with depth, location, and season (Demas, 1985). The criterion for DO is 5 mg/L for freshwater aquatic life (Louisiana Department of Environmental Quality, 1998, p. 128; U.S. Environmental Protection Agency, 1976; 1986). Water visibility, measured with a Secchi disk, was 3.8 feet.

Specific conductance profiles showed stratification beginning at an approximate depth of 12 feet. The specific conductance remained constant at 39.0 µS/cm (microsiemens per centimeter at 25 degrees Celsius) from the surface to about 12 feet, then increased with depth; bottom-water measurements ranged from 69 to 116 µS/cm. The pH was about 6.3 (standard units) near the surface, and generally decreased with depth.

## REFERENCES

- Demas, C.R., 1985, A limnological study of Lake Bruin, Louisiana: Louisiana Department of Transportation and Development, Office of Public Works Water Resources Technical Report no. 38, 96 p.
- Louisiana Department of Environmental Quality, 1998, Water quality regulations in Environmental Regulatory Code: Baton Rouge, Louisiana, Louisiana Administrative Code, title 33, part IX, p. 128.
- Northeast Louisiana University, Center for Business and Economic Research, Louisiana parishes and municipalities July 1, 1997 population estimates published in January 1996: accessed December 1, 1998, at URL <http://leap.nlu.edu/POPHS/pop1997.txt>
- U.S. Environmental Protection Agency, 1976, Quality criteria for water: Washington, D.C., U.S. Environmental Protection Agency, 256 p.

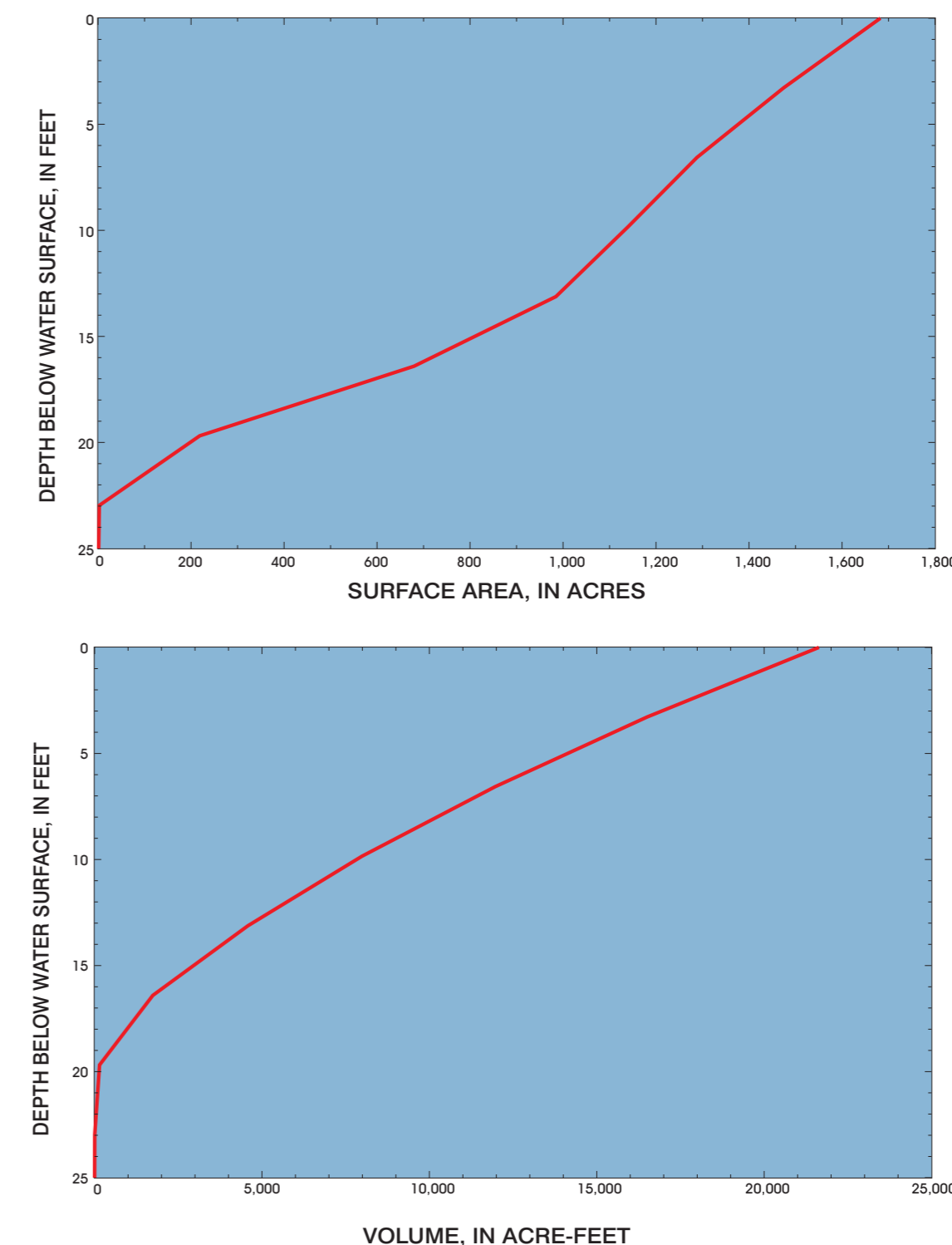


Figure 2. Depth-surface area and depth-volume relations for Kincaid Reservoir. Water-surface elevation was 92.24 feet above sea level during the bathymetric survey of June 17-18, 1997.

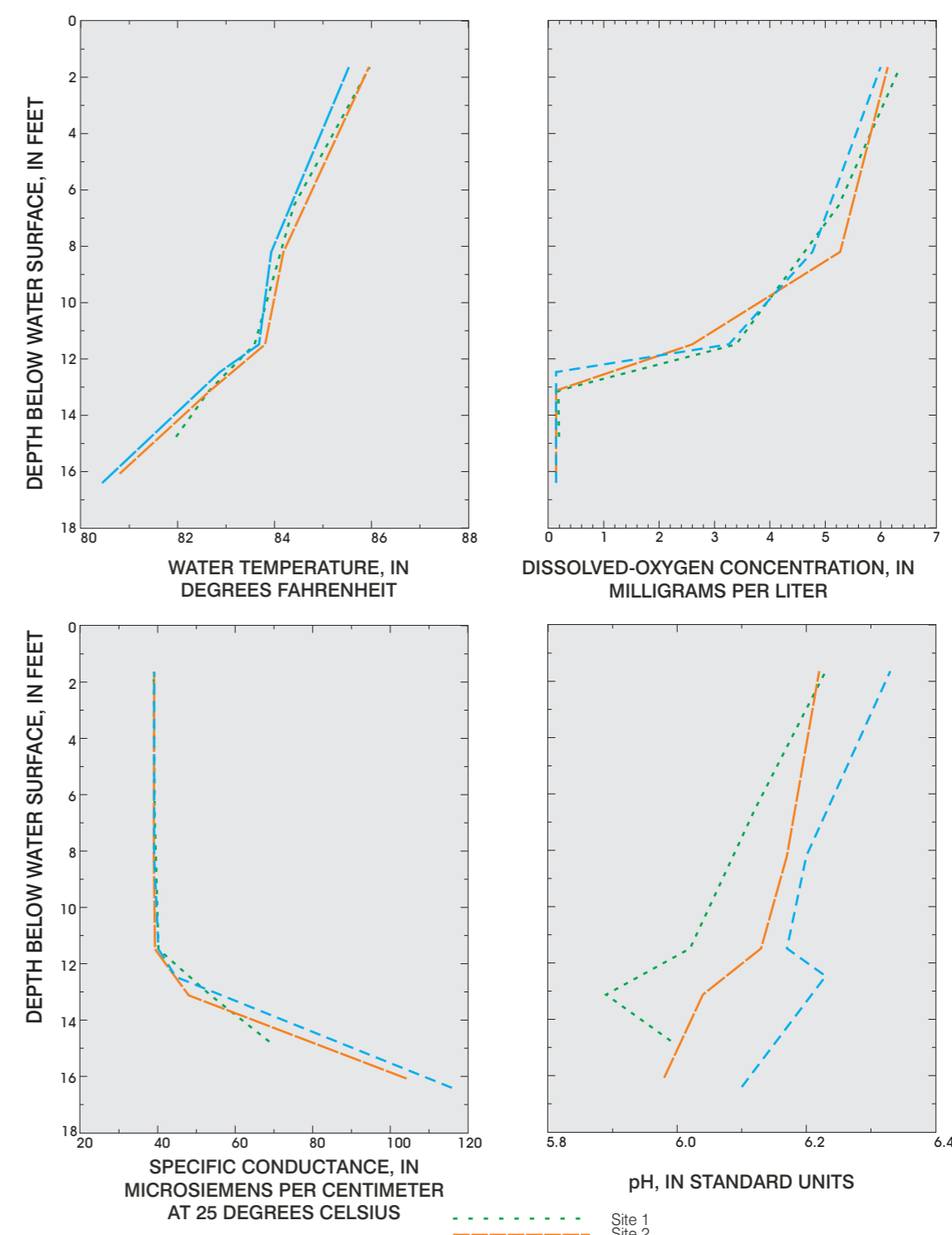


Figure 3. Variation of water temperature, dissolved-oxygen concentration, specific conductance, and pH at Kincaid Reservoir, September 22, 1997.

-----1986, Quality criteria for water: Washington, D.C., U.S. Environmental Protection Agency [variously paged].

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

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