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SCIENTIFIC INVESTIGATIONS MAP 3037
Bathymetric contours of Central Park Lake,
Jones County, Iowa—SHEET 2 of 7
Linhart, S.M., and Lund, K.D., 2008, Bathymetric Contour Maps of Lakes Surveyed in Iowa in 2005

Abstract

The U.S. Geological Survey, in cooperation with the Iowa Department of Natural Resources, conducted bathymetric surveys on seven lakes in Iowa during 2005 (Arrowhead Pond, Central Park Lake, Lake Keomah, Manteno Park Pond, Lake Miami, Springbrook Lake, and Yellow Smoke Lake). The surveys were conducted to provide the Iowa Department of Natural Resources with information for the development of total maximum daily load limits, particularly for estimating sediment load and deposition rates. The bathymetric surveys provide a baseline for future work on sediment loads and deposition rates for these lakes. All of the lakes surveyed in 2005 are man-made lakes with fixed spillways.

Bathymetric data were collected using boat-mounted, differential global positioning system, echo depth-sounding equipment, and computer software. Data were processed with commercial hydrographic software and exported into a geographic information system for mapping and calculating area and volume. Lake volume estimates ranged from 47,784,000 cubic feet (1,100 acre-feet) at Lake Miami to 2,595,000 cubic feet (60 acre-feet) at Manteno Park Pond. Surface area estimates ranged from 5,454,000 square feet (125 acres) at Lake Miami to 558,000 square feet (13 acres) at Springbrook Lake.

Introduction

Bathymetric mapping can provide useful information for water-quality managers to address a variety of issues on Iowa's lakes and reservoirs. The Iowa Water Science Center of the United States Geological Survey (USGS) began a lake bathymetric mapping program in June 2001 on Lake Delhi in east central Iowa, which resulted in a published bathymetric map and report (Schnoebelen and others, 2003). The USGS, in cooperation with the Iowa Department of Natural Resources (IDNR), conducted a bathymetric survey of Central Park Lake in 2005 to provide the IDNR with information for the development of total maximum daily load limits (TMDLs), particularly for estimating sediment load and deposition rates. The bathymetric contours also can provide a baseline for future work on sediment load and deposition rates for Central Park Lake.

Central Park Lake is located in east-central Iowa about 6 miles (mi) east of Anamosa and 7 miles south of Monticello in Jones County, in Central Park, and is used primarily for recreational activities. Central Park Lake receives flow from an intermittent unnamed creek from the west. Discharge from Central Park Lake is through a bottom outlet at the dam on the west end of the lake into Mineral Creek.

Methods

Bathymetry data were collected on September 13, 2005. Bathymetric mapping was accomplished using boat-mounted global positioning system (GPS), echo depth-sounding equipment, and computer software. The GPS allowed for accuracies of about 3.28 feet (ft) (approximately 1 meter) in the horizontal direction. The echo sounder emits sound pulses that are reflected off the lake bottom and received by a transducer. The echo sounder transmitted at a frequency of 200 kilohertz; water depths were determined by the echo sounder based on the speed of sound in water compensated for temperature (Specialty Devices, Inc., 2003). In some areas of the lake, the depth limitations (less than 3.3 ft) of the echo-sounding equipment necessitated determining the depths manually at target points using a measuring device marked in 0.10-ft increments. Using the echo sounder, the bathymetry data were collected along planned transect lines spaced 50 ft apart. Individual data-collection locations along a transect line generally were 5 to 10 ft apart. The depth data later were converted to elevation, in the post-processing software (Coastal Oceanographics, Inc., 2002), by subtracting the depths at each location from the reference surface elevation of the lake. The reference surface elevation was determined on the day of bathymetric data collection by measuring from a reference point of known elevation near the boat ramp. The elevation of the reference point was determined using a combination of GPS and standard surveying techniques. The bathymetry data then were filtered (fig.1) to reduce the density of data points and entered into geographic information system (GIS) software to produce a three-dimensional surface of the lake-bottom elevations. The three-dimensional surface was contoured, and the contours were adjusted manually to correct for interpretive errors. (See the Central Park Lake metadata at *http://water.usgs.gov/lookup/getgislist* for a more detailed explanation of methods used to collect and process the bathymetric data.)

Quality Assurance

A bar check on the echo sounder was performed at the beginning of the day of data collection following established protocols (U.S. Army Corps of Engineers, 1994, Chapter 9). This was done to ensure that the echo sounder was calibrated correctly. The bar check involved suspending a 2-ft-diameter flat aluminum plate directly below the echo sounder. The suspension line was marked in 5-ft increments. An initial calibration was made at 5 ft by entering the speed of sound in water, and adjusting the offset of the transducer in the computer software. The offset is the draft of the transducer below the lake surface. The aluminum plate was then lowered in 5-ft increments, depending on the range of depths expected to be encountered, and adjustments in the speed of sound were made until depth readings and the depth of the aluminum plate agreed to within approximately 0.1 ft.

A second independent bathymetry data set was collected for a smaller area of Central Park Lake. The control data set was used to estimate the precision (repeatability) of the sounding data collected with the echo sounder, to estimate the accuracy of the interpolation in the three-dimensional surface, and to estimate the accuracy of the contours (Wilson and Richards, 2006). Within 1.0 ft of each other there were 20 paired data and control points with a calculated Root Mean Square Error (RMSE) of 0.27 ft. At corresponding locations there were 1,368 paired three-dimensional surface elevations and control points with a calculated RMSE of 0.42 ft, and within 0.50 ft of each other there were 28 paired contours and control points with a calculated RMSE of 0.48 ft.

Bathymetric Contours

The water-surface elevation of Central Park Lake was 946.7 ft above North American Vertical Datum of 1988 (NAVD88) on September 13, 2005. Generally, the water depth increases toward the dam (fig. 2). The deepest part of the lake is located approximately 100 ft southwest of the dam near the middle of the lake, and the lowest elevation measured was 930.3 ft (16.4 ft deep). The average elevation of the lake bottom based on the three-dimensional surface was 940.5 ft (6.2 ft deep). The slope of the lake bottom generally is greatest along the dam. Data from this survey indicate that the total surface area of Central Park Lake, at a water-surface elevation of 946.7 ft, is approximately 988,000 square feet (ft^2) (23 acres) and the total water volume of Central Park Lake is approximately 6,173,000 cubic feet (ft^3) (142 acre-ft).

References

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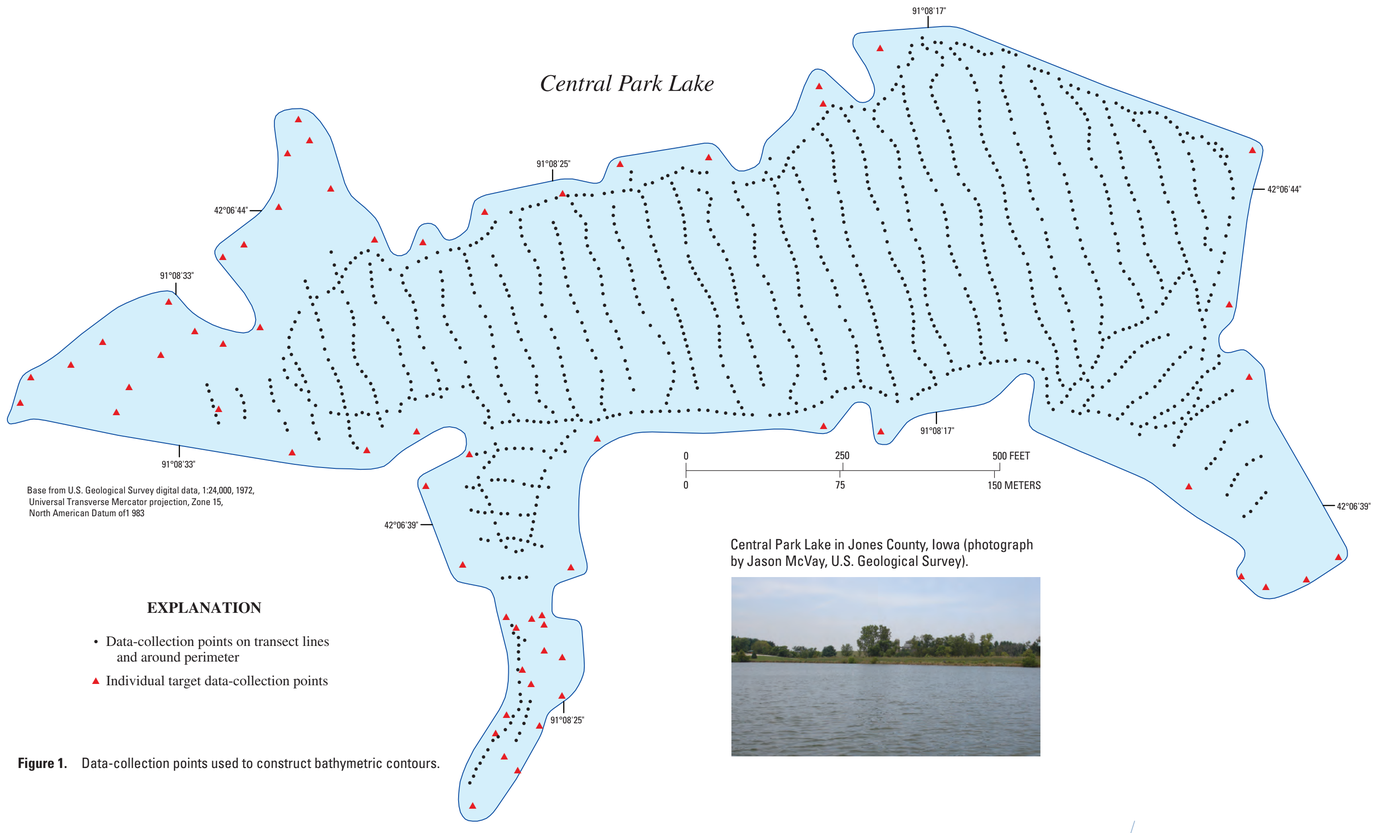

Figure 1. Data-collection points used to construct bathymetric contours.

Central Park Lake in Jones County, Iowa (photograph by Jason McVay, U.S. Geological Survey).

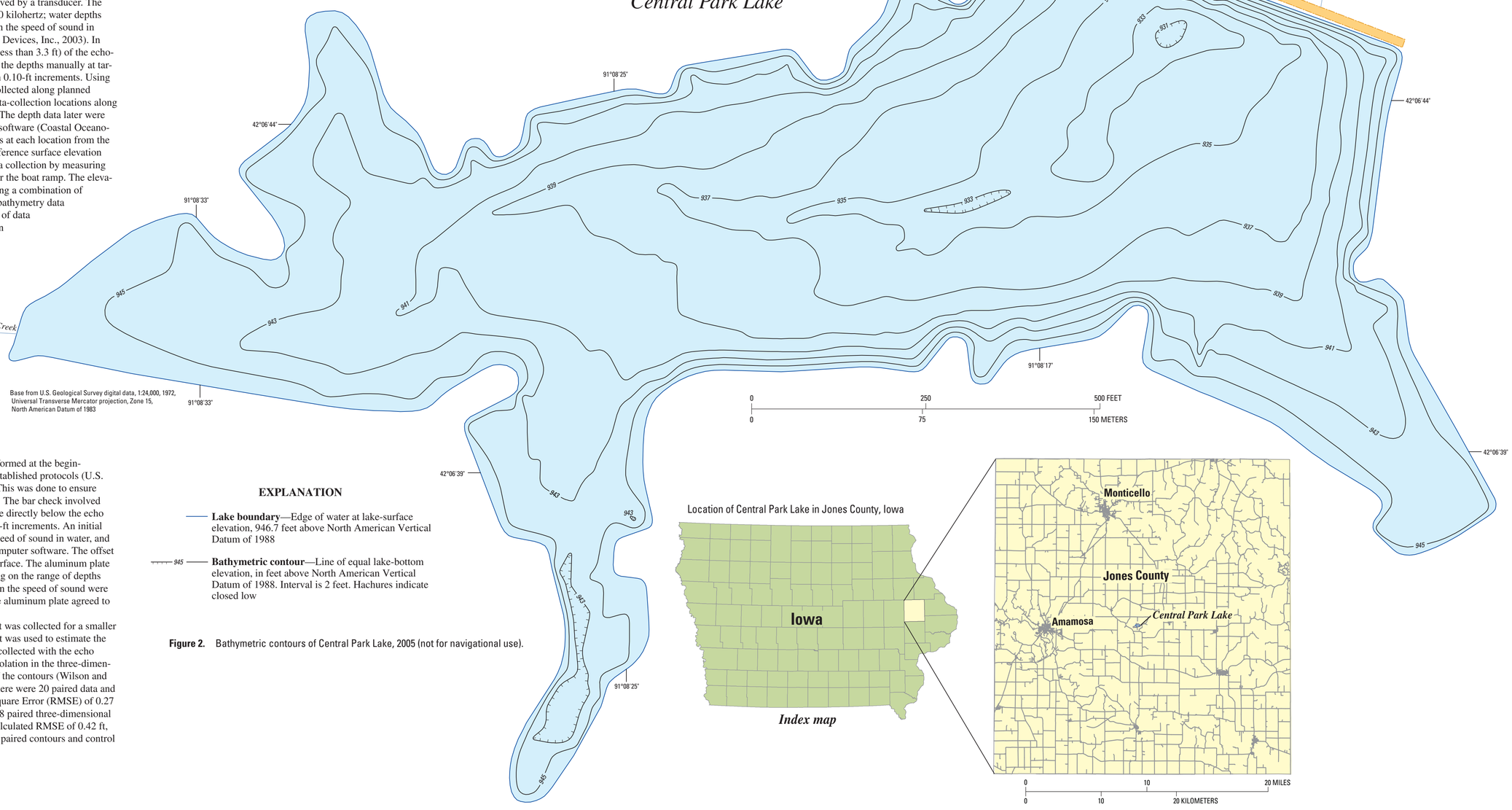

Figure 2. Bathymetric contours of Central Park Lake, 2005 (not for navigational use).

Bathymetric Contours for Central Park Lake, Jones County, Iowa

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