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SCIENTIFIC INVESTIGATIONS MAP 2933–B
Bathymetric contours for Easter Lake, Polk County—SHEET 2 OF 4
Linhart, S.M., and Lund, K.D., 2006, Bathymetric contour maps for lakes surveyed in Iowa in 2003

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 U.S. Geological Survey (USGS) began a lake bathymetric mapping program in June 2001 on Lake Delhi in east central Iowa resulting 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 Easter Lake during 2003. The purpose of the bathymetric survey is to provide the IDNR with information for the development of total maximum daily load (TMDL) limits, in particular, 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 Easter Lake.

Easter Lake was constructed in 1967 and is located in the southeast portion of the city of Des Moines, Iowa. Easter Lake is located in Easter Lake Park and is used primarily for recreational activities. Easter Lake is fed by Yeader Creek from the west and unnamed creeks from the south and southwest. Discharge from Easter Lake is over a fixed spillway at the dam on the northeast end of the lake into Yeader Creek.

Methods

Bathymetry data were collected on July 30, 2003. Bathymetric mapping was accomplished using boat-mounted, global positioning system (GPS) equipment, 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 pulses of sound that are reflected off the lake bottom and then received by a transducer. The echo sounder transmitted at a frequency of 200 kilohertz, and water depths were determined by the echo sounder based on speed of sound in water compensated for temperature (Specialty Devices, Inc., 2003). In some areas of the lake, due to the depth limitations (less than 3.3 ft) of the echo-sounding equipment, depths were determined 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 4 to 8 ft apart. The depth data were later 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 by measuring down, on the day of bathymetric data collection, from a reference point at the dam with a known elevation. The elevation of the reference point was obtained from the Polk County Engineers Office (oral commun., 2003). The bathymetry data were then filtered (fig. 1) to reduce the density of data points and then input into geographic information system (GIS) software to produce a three-dimensional surface of the lake-bottom elevations. The three-dimensional surface was then contoured and the contours were then adjusted manually to correct for interpretive errors. See the Easter Lake metadata 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 each 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 involves suspending a 2-ft-diameter flat aluminum plate directly below the echo sounder. The suspension line is marked in 5-ft increments. An initial calibration is made at 5 ft by entering the speed of sound in water (based on water temperature) and then 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 is then lowered in 5-ft increments (depending on the range of depths expected to be encountered on the day of data collection), and adjustments in the speed of sound are made until depth readings and the depth of the aluminum plate agree to within approximately 0.1 ft.

Bathymetric Contours

The water-surface elevation of Easter Lake was 813.0 ft above NGVD29 (National Geodetic Vertical Datum of 1929) on July 30, 2003. In general, the depth of water increases toward the dam (fig. 2). The deepest portion of the lake is located in the center of the channel at the upper end of the dam with the lowest elevation measured being 793.0 ft (20.0 ft deep). The average elevation of the lake bottom based on the three-dimensional surface is 805.0 ft (8.0 ft deep). The slope of the lake bottom is greatest in the area near the dam. The slope of the lake bottom is more gradual in the western end of the lake. Data from this survey show that the surface area of Easter Lake, at a water-surface elevation of 813.0 ft, is approximately 7,582,000 ft^2 (174 acres) and water volume of Easter Lake is approximately 61,026,000 ft^3 (1,400 acre-ft).

References

Coastal Oceanographics, Inc., 2002, Hydrographic Survey Software, User's Manual, Hypack Max: Coastal Oceanographics, Inc., Middlefield, Conn., various pagination.

Schnoebelen, D.J., McVay, J.C., Barnes, K.K., and Becher, K.D., 2003, Bathymetric Mapping, Sediment Quality, and Water Quality of Lake Delhi, Iowa, 2001–02: U.S. Geological Survey Water-Resources Investigations Report 03–4085, 38 p.

Specialty Devices, Inc., 2003, Bathymetric Survey System BSS+5 with Omnistar Manual: Specialty Devices, Inc., Plano, Tex., 38 p.

U.S. Army Corps of Engineers, 1994, Engineering and design: Hydrographic survey EM 1110–2–1003, chap. 9–3, p. 9–4 to 9–9.

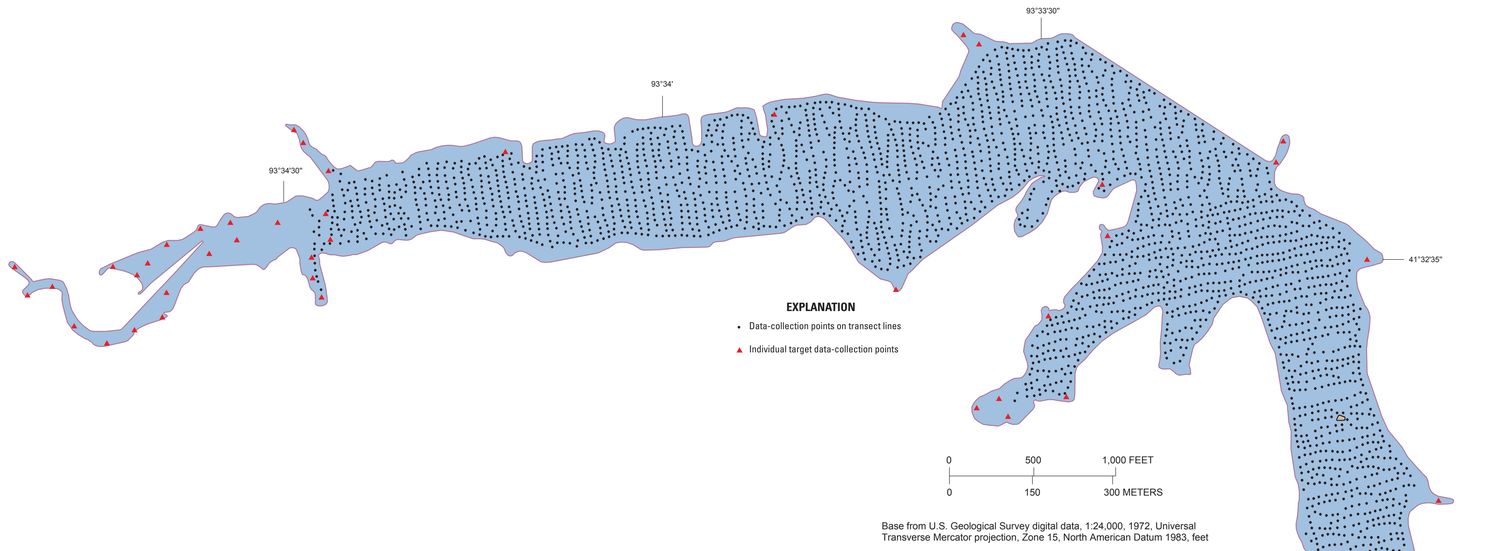

Figure 1. Data-collection points used to construct bathymetric contours.

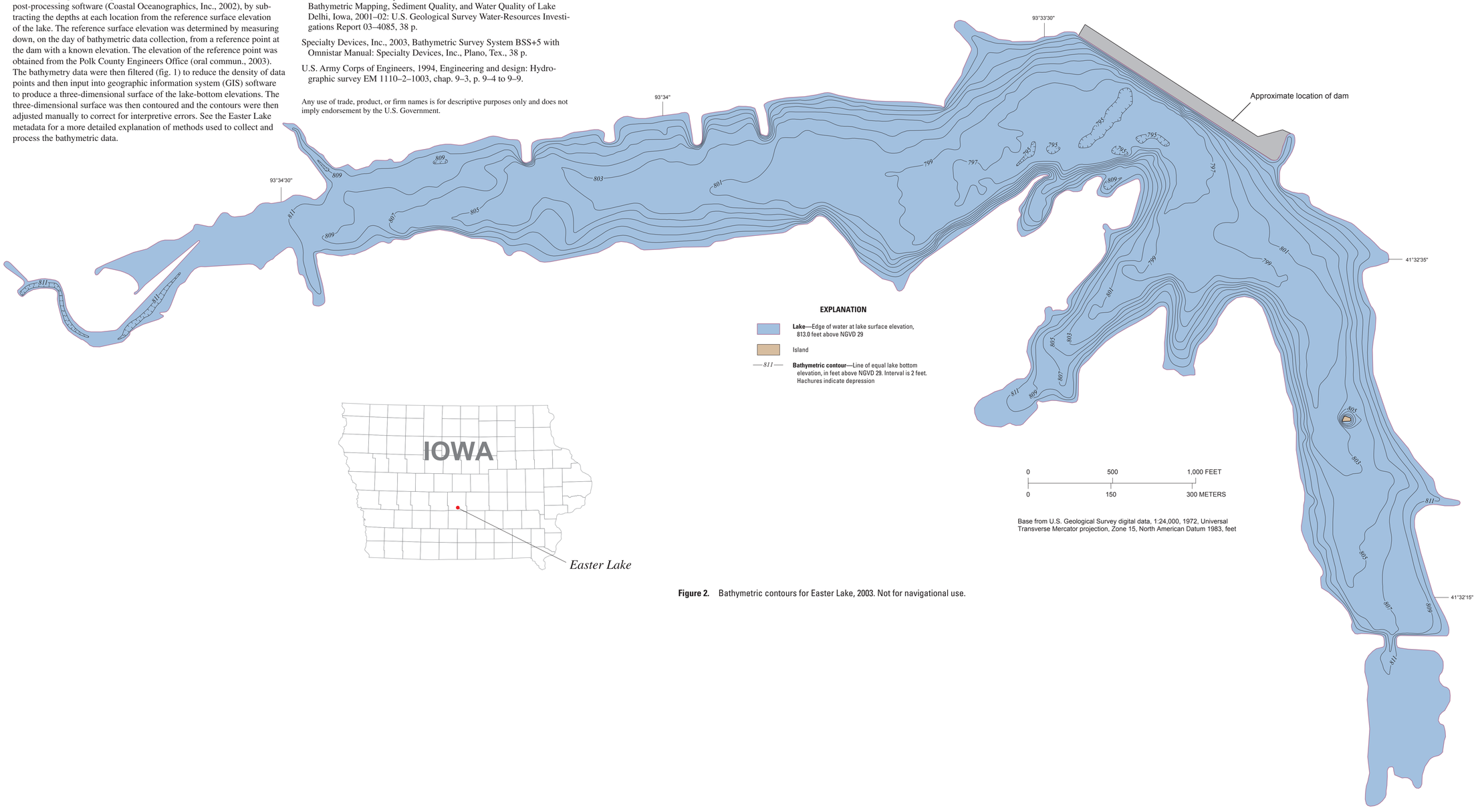

Figure 2. Bathymetric contours for Easter Lake, 2003. Not for navigational use.

Bathymetric Contours for Easter Lake, Polk County, Iowa

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