U.S. DEPARTMENT OF THE INTERIOR
U.S. GEOLOGICAL SURVEY

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IOWA DEPARTMENT OF NATURAL RESOURCES

SCIENTIFIC INVESTIGATIONS MAP 2933–C
Bathymetric contours for Lake Macbride, Johnson County—SHEET 3 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 Lake Macbride 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 Lake Macbride.

Lake Macbride was constructed in 1937 and is located in east-central Iowa, 2 miles west of Solon in Johnson County. In 1955, when Coralville Reservoir was built, the dam for Lake Macbride was raised 28 feet (ft). Lake Macbride is located in Lake Macbride State Park and is used primarily for recreational activities. Mill Creek feeds into the north arm of Lake Macbride. Jordon Creek feeds into the south arm of Lake Macbride. Discharge from Lake Macbride is over a fixed spillway at the dam on the west end into Coralville Reservoir.

Methods

Bathymetry data were collected on various days between July 2 and August 14, 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 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 100 ft apart. Individual data-collection locations along a transect line generally were 5 to 10 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 each day of bathymetric data collection, from a reference point at the dam with a known elevation. The elevation of the reference point was determined, using standard surveying techniques, by leveling from a nearby benchmark. 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 Lake Macbride 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 Lake Macbride was 711.8 ft above NAVD88 (North American Vertical Datum of 1988) between July 2 and August 14, 2003. In general, the depth of water increases toward the dam (fig. 2). The deepest portion of the lake is located approximately 300 ft upstream from the dam. The lowest elevation measured was 666.8 ft (45 ft deep). The average elevation of the lake bottom is 696.3 ft (15.5 ft deep). The slope of the lake bottom is greatest in the area near the dam along the south shoreline. The slope of the lake bottom becomes more gradual toward the middle and along the north and south arms toward the east. Data from this survey show that the surface area of Lake Macbride, at a water-surface elevation of 711.8 ft, is approximately 38,118,000 ft^2 (875 acres) and water volume of Lake Macbride is approximately 590,501,000 ft^3 (13,600 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.

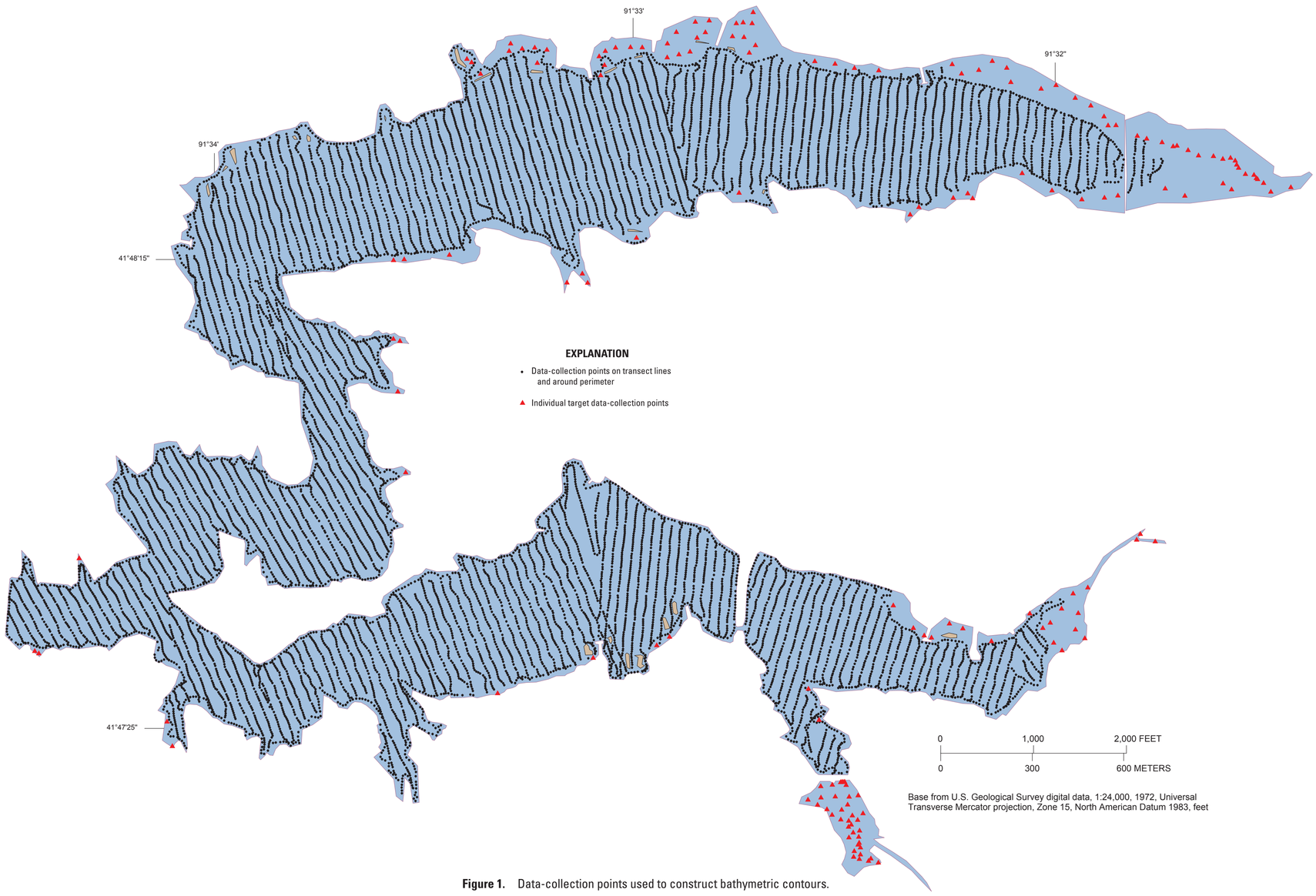

Figure 1. Data-collection points used to construct bathymetric contours.

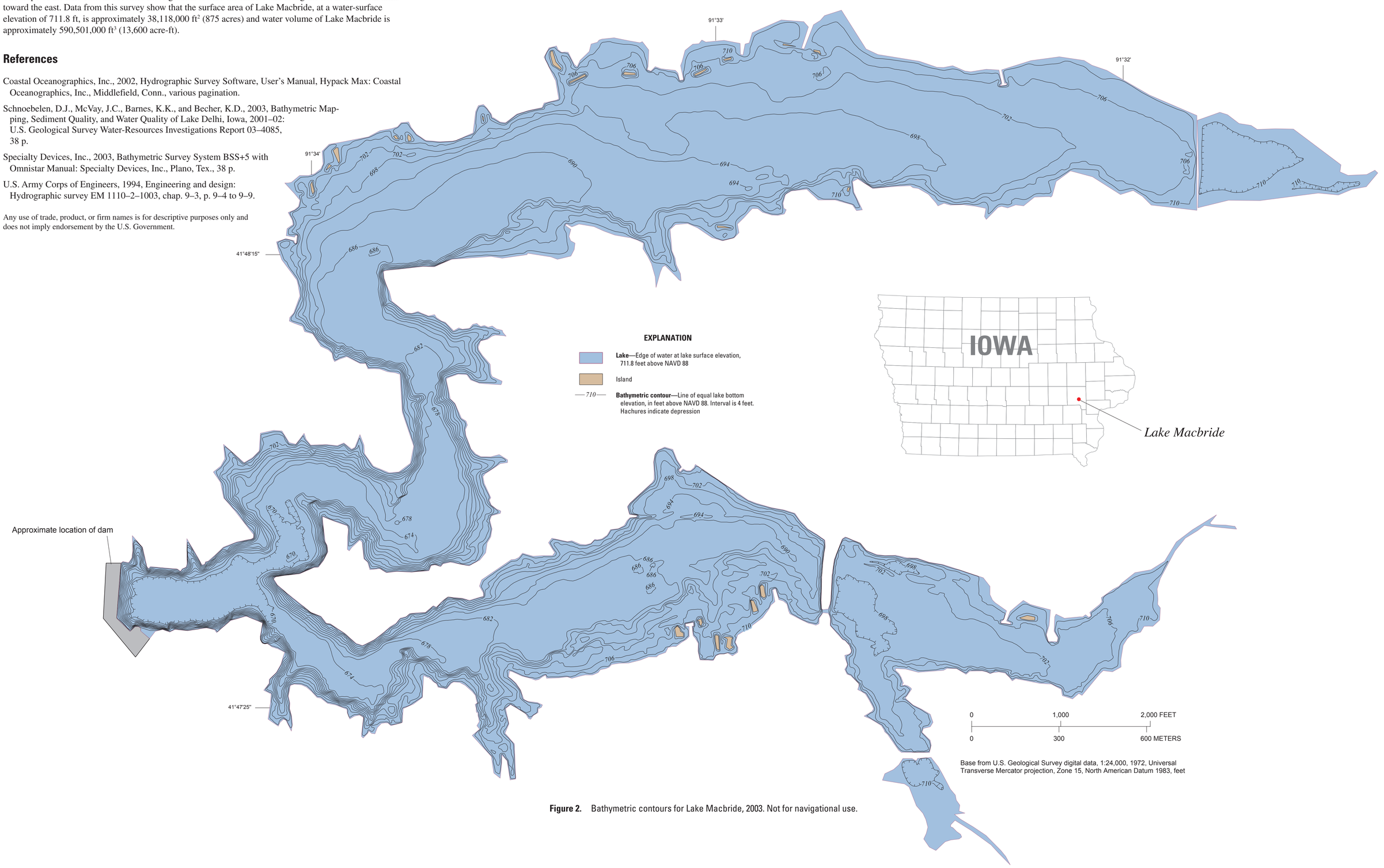

Figure 2. Bathymetric contours for Lake Macbride, 2003. Not for navigational use.

Bathymetric Contours for Lake Macbride, Johnson County, Iowa

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