FATHOMETER DATA FROM BART LAKE AND LAKE DOROTHY NEAR JUNEAU, ALASKA, 1988-89

by Harold R. Seitz and Donald S. Thomas

U.S. GEOLOGICAL SURVEY
Open-File Report 90-152

Prepared in cooperation with the
ALASKA ENERGY AUTHORITY

Juneau, Alaska
1990

DEPARTMENT OF THE INTERIOR

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ILLUSTRATIONS

CONVERSION FACTORS

For readers who may prefer to use metric (International System) units rather than inch-pound units, the conversion factors for the terms used in this report are listed below:

Multiply inch-pound unit	By	To obtain metric unit
foot (ft)	0.3048	meter (m)
mile (mi)	1.609	kilometer (km)
acre	0.4047	hectare
square mile (mi^2)	2.590	square kilometer (km^2)

ALTITUDE DATUM

Sea level:

In this report "sea level" refers to the National Geodetic Vertical Datum of 1929 (NGVD 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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ABSTRACT

Several studies have assessed the feasibility of hydropower generation by a tap of Lake Dorothy, about 20 miles south of Juneau. One of the proposed alignments, a tunnel to transmit water from Lake Dorothy to a powerhouse at tidewater, crosses Bart Lake. Fathometer surveys showed that Bart Lake is a relatively symmetrical, bowl-shaped depression with a maximum depth of 543 feet and that Lake Dorothy is a north-south elongated depression with steep sides and a maximum depth of 569 feet.

INTRODUCTION

Lake Dorothy is located about 20 mi southeast of Juneau, in an undeveloped area south of Taku Inlet (fig. 1). It occupies a linear, glacially eroded depression at an elevation of 2,400 ft above sea level. Several studies have assessed the feasibility of hydropower generation by a tap of Lake Dorothy (U.S. Bureau of Reclamation 1949, 1955; and Ebasco Services Inc., 1984).

Alternative alignments for an 11-foot diameter tunnel to transmit water from Lake Dorothy to a powerhouse located at tidewater of Taku Inlet have been proposed (fig. 2). Alignment 3, which provides the shortest route to a powerhouse, would tap the lake at a point beneath the middle of the western shoreline. Bart Lake is located on alignment 3, between Lake Dorothy and Taku Inlet. The depth and bottom configuration of Bart Lake, a cirque lake with a surface area of 250 acres at 986 ft elevation, were not defined in earlier studies. In late 1988, the U.S. Geological Survey (USGS), in cooperation with the Alaska Energy Authority (AEA), made fathometer surveys of Bart Lake and the part of Lake Dorothy in the vicinity of the proposed tap. This report presents results of the fathometer surveys.

FATHOMETER SURVEYS

A fathometer survey of Bart Lake was made on December 13, 1988. Because of inclement weather and the freezing over of Lake Dorothy, however, a survey of this lake was not completed until August 1, 1989.

The nearest road access to Bart Lake and Lake Dorothy is at Thane, 5 mi south of Juneau. From this point, helicopters were used to transport a 15-foot skiff and motor, microwave positioning equipment, recording fathometer, and USGS personnel to the lakes. Targets for the digital distance measuring unit, a Decca-520[1] (Del-Norte Technology, undated), were set at the edges of both lakes, and base lines were established by measuring the distance between the two targets. The Decca-520

1. Use of trade names in this report is for identification purposes only and does not constitute endorsement by the U.S. Geological Survey.

and recording fathometer were mounted in the skiff, and several transects were taken across each lake. The recording fathometer has a point marker, permitting the recording of two readings from the Decca-520 that correspond to the distances from a point on the lake to the two targets.

Depth readings along the transects and additional miscellaneous readings were used to develop the contours of the bottoms (bathymetry) of Bart Lake and Lake Dorothy. Soundings of 200-foot depths were made to verify the accuracy of the fathometer readings. Representative cross sections across each lake were determined from the resultant bathymetric maps.

RESULTS

The fathometer survey revealed that Bart Lake has a maximum depth of 543 ft. A drift line of debris shows that lake levels have reached about 10 ft higher than the December 1988 level, probably during periods of high runoff. The bathymetric map (fig. 3) and cross sections A-A' and B-B' (figs. 4 and 5) show Bart Lake to be a relatively symmetrical, bowl-shaped depression. Cross section A-A' is roughly coincident with tunnel alignment 3, as it would pass under Bart Lake.

The fathometer survey of Lake Dorothy was done at lake level elevation of 2,421.42 ft and indicated a maximum depth of 569 ft (1,852 bottom elevation). The maximum lake level recorded at the Lake Dorothy gaging station was 2,422.51 ft elevation on October 2, 1987 (U.S. Geological Survey, 1988). The bathymetric map of the northern two-thirds of Lake Dorothy (fig. 6) and cross sections N-N' (fig. 7) and A-A' through D-D' (figs. 8-11) show that Lake Dorothy is a north-south elongated depression with steep sides. Cross section C-C' is located approximately where the lake tap would be placed for tunnel alignment 3, along the west side of Lake Dorothy.

REFERENCES CITED

Del-Norte Technology, undated, Digital distance measuring unit 520--operators handbook: Euless, Texas, Del Norte Technology, Inc., 20 p.

Ebasco Services Inc., 1984, Juneau 20-year power supply plan-volume 1: Report submitted to Alaska Electric Light and Power Company, 16 p.

U.S. Bureau of Reclamation, 1949, Lake Dorothy Project, Alaska: Alaska Investigations Office, U.S. Bureau of Reclamation report, 54 p.

_____1955, Status report on the Lake Dorothy project, Alaska: Alaska District, U.S. Bureau of Reclamation report, 48 p.

U.S. Geological Survey, 1988, Water resources data for Alaska, water year 1988: U.S. Geological Survey Water-Data Report AK-88-1, 196 p.

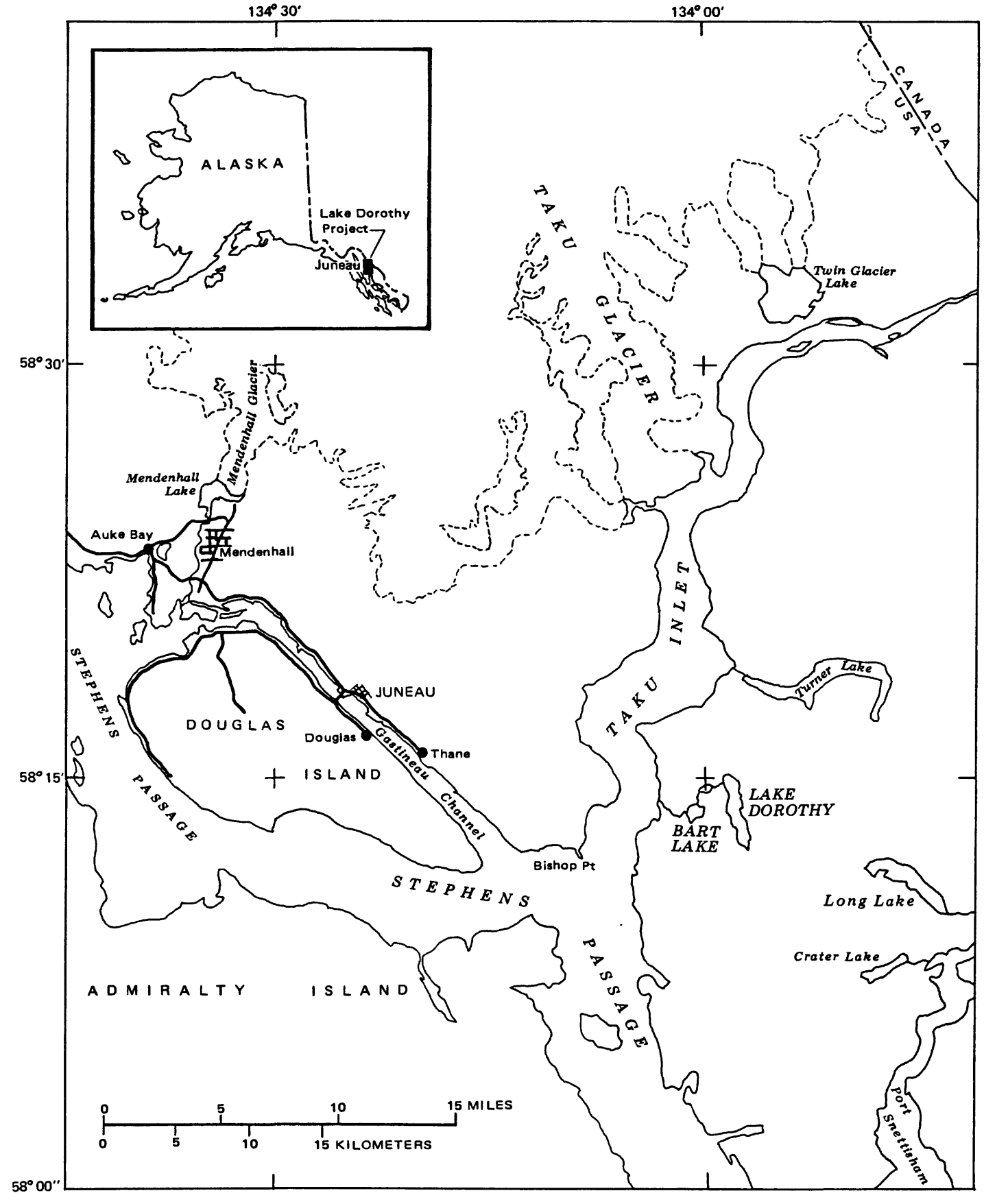


Figure 1.--Location of Lake Dorothy and Bart Lake.

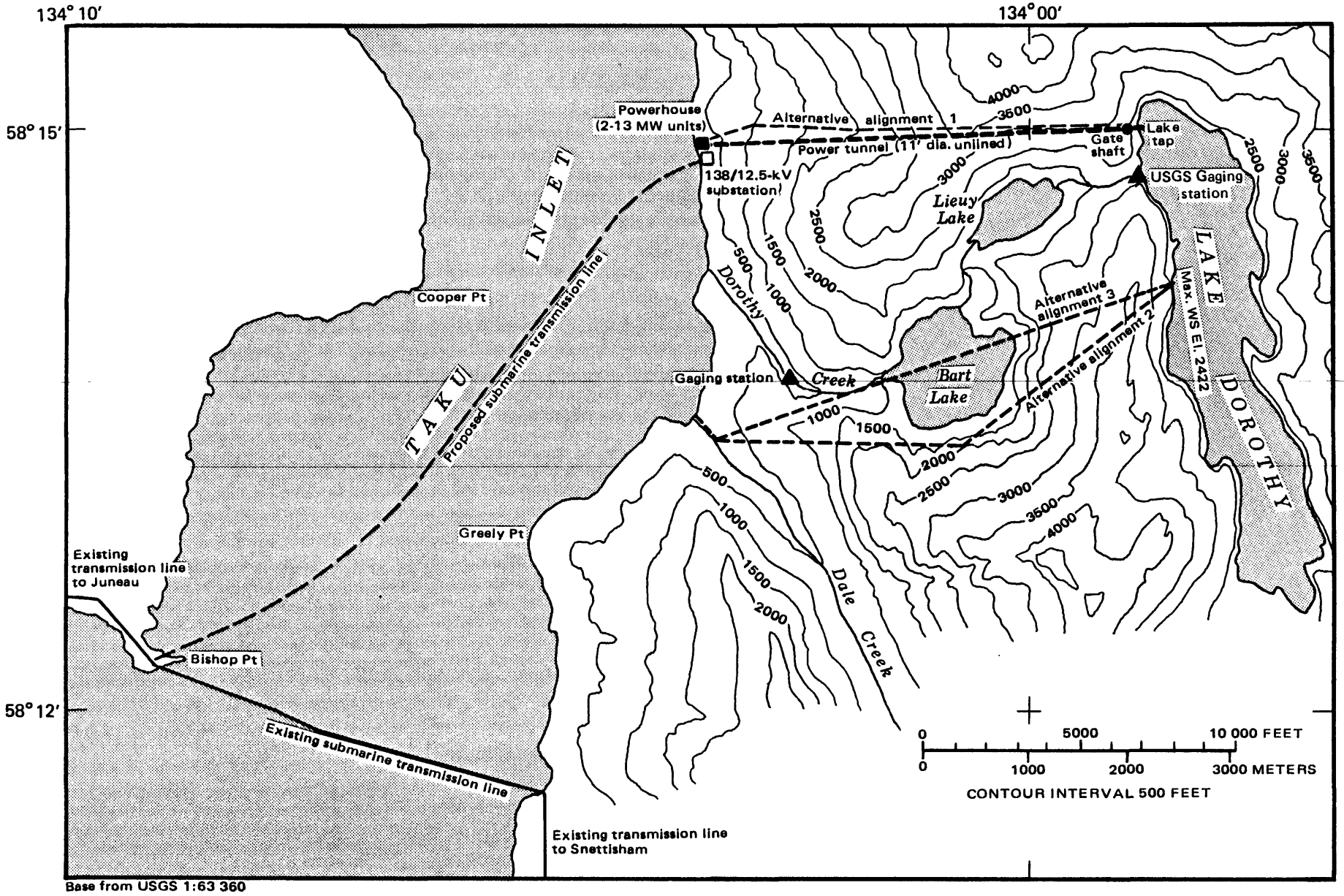
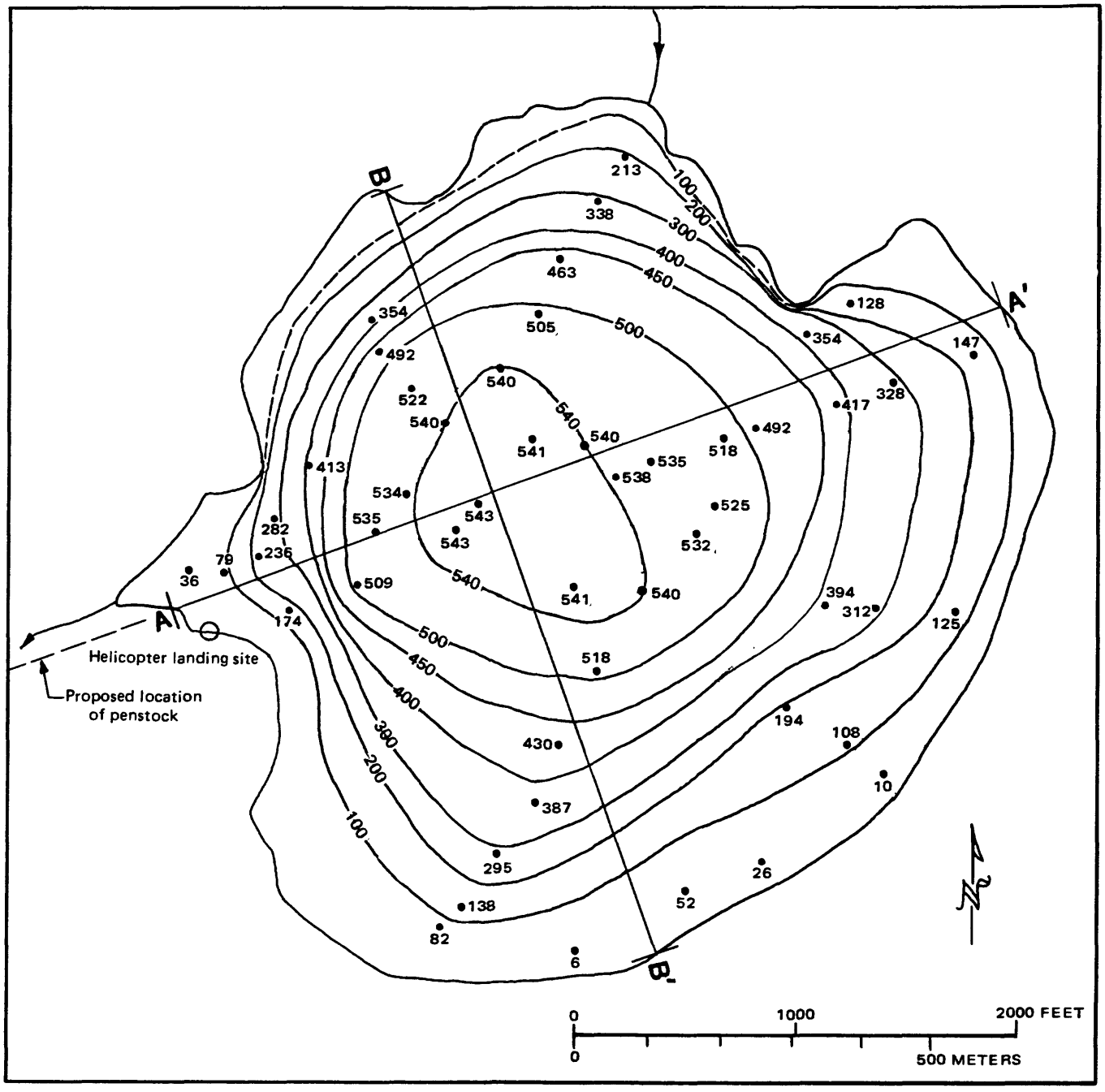


Figure 2. -- Proposed alternative tunnel alignments from Lake Dorothy to tidewater on Taku Inlet.



EXPLANATION

400 —— LINES OF EQUAL DEPTH, IN FEET BELOW SURFACE, INTERVAL IS VARIABLE. DASHED WHERE UNCERTAIN

A —— A' LINE OF CROSS SECTION (FIGS. 4 AND 5)

• 541 FATHOMETER INDICATED DEPTH, IN FEET

Figure 3. -- Bathymetric map of Bart Lake, constructed from fathometer survey of December 13, 1988.

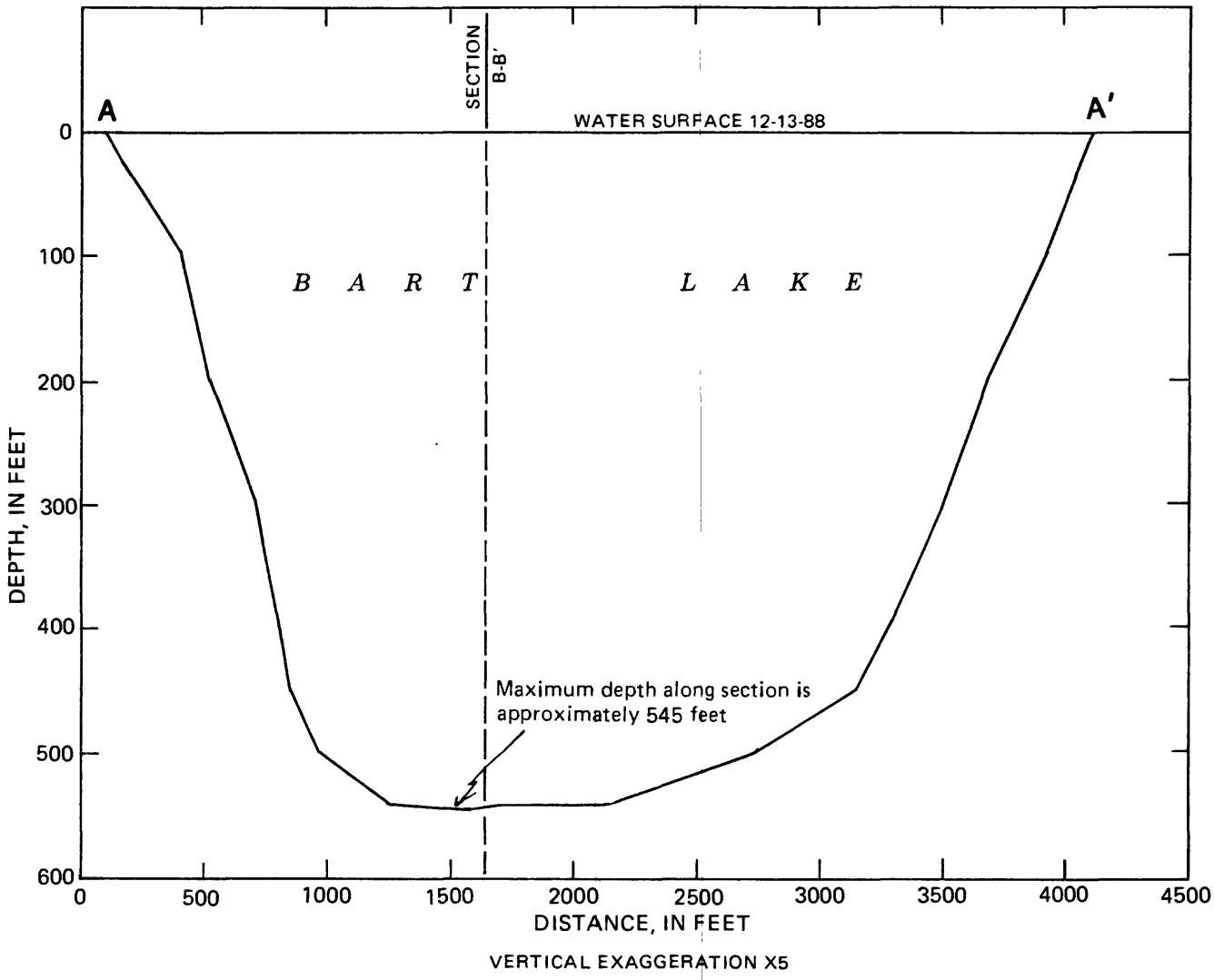


Figure 4. --Bart Lake cross section A-A', along alternative alignment 3. (See figure 3.)

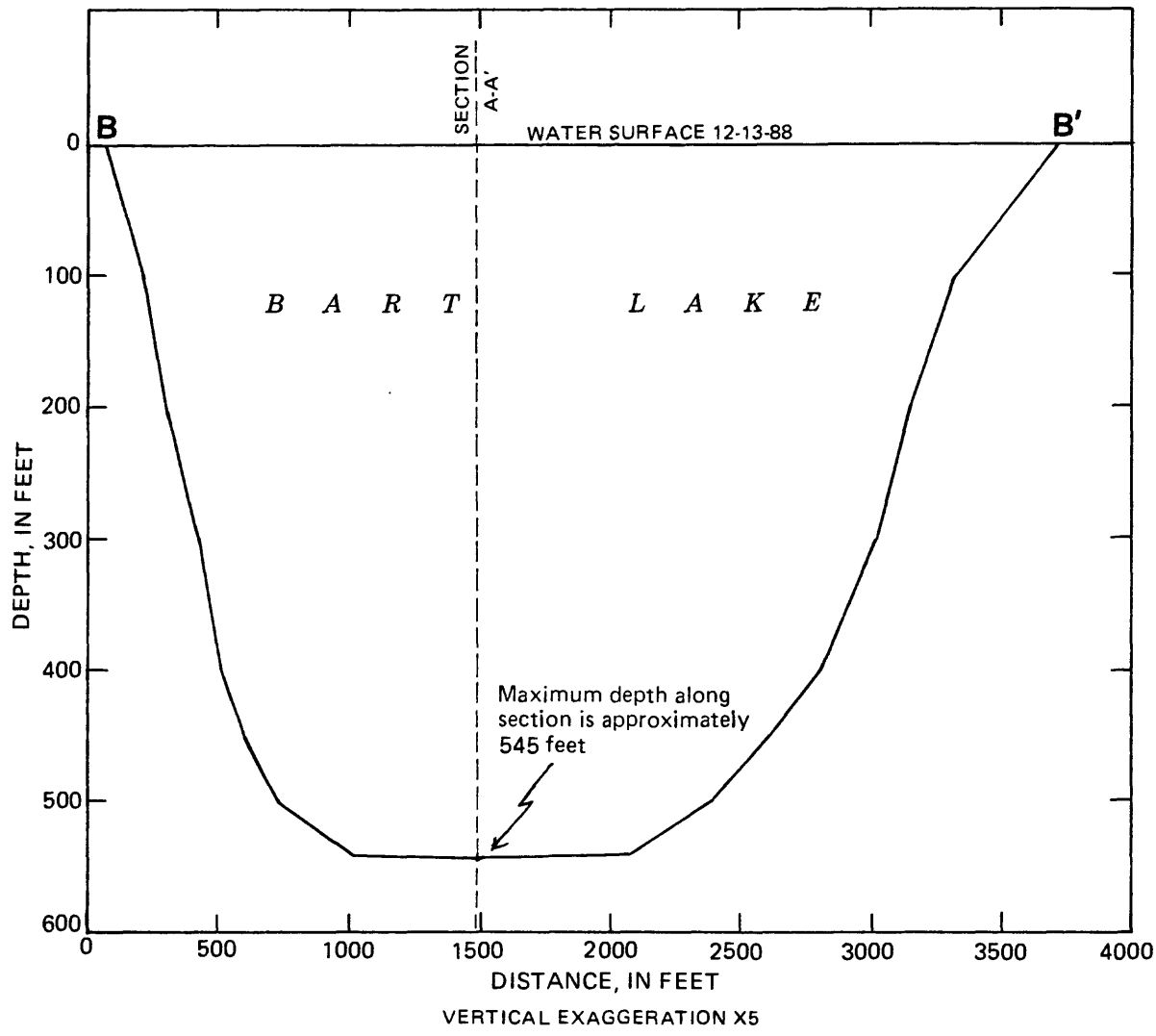


Figure 5. -- Bart Lake cross section B-B', at 90° angle to cross section A-A'. (See figure 3.)

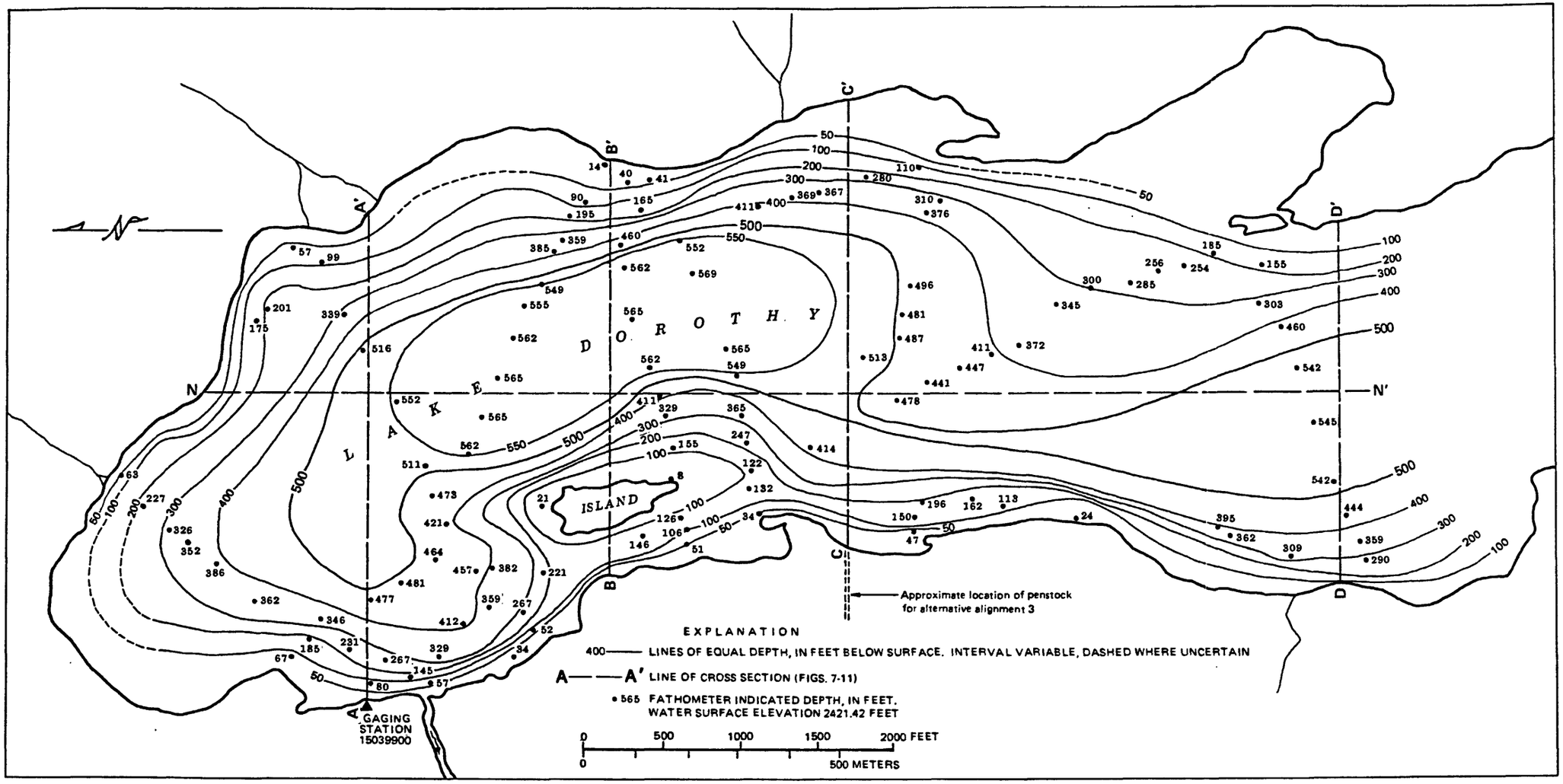


Figure 6. -- Bathymetric map of Lake Dorothy, constructed from fathometer survey of August 1, 1989.

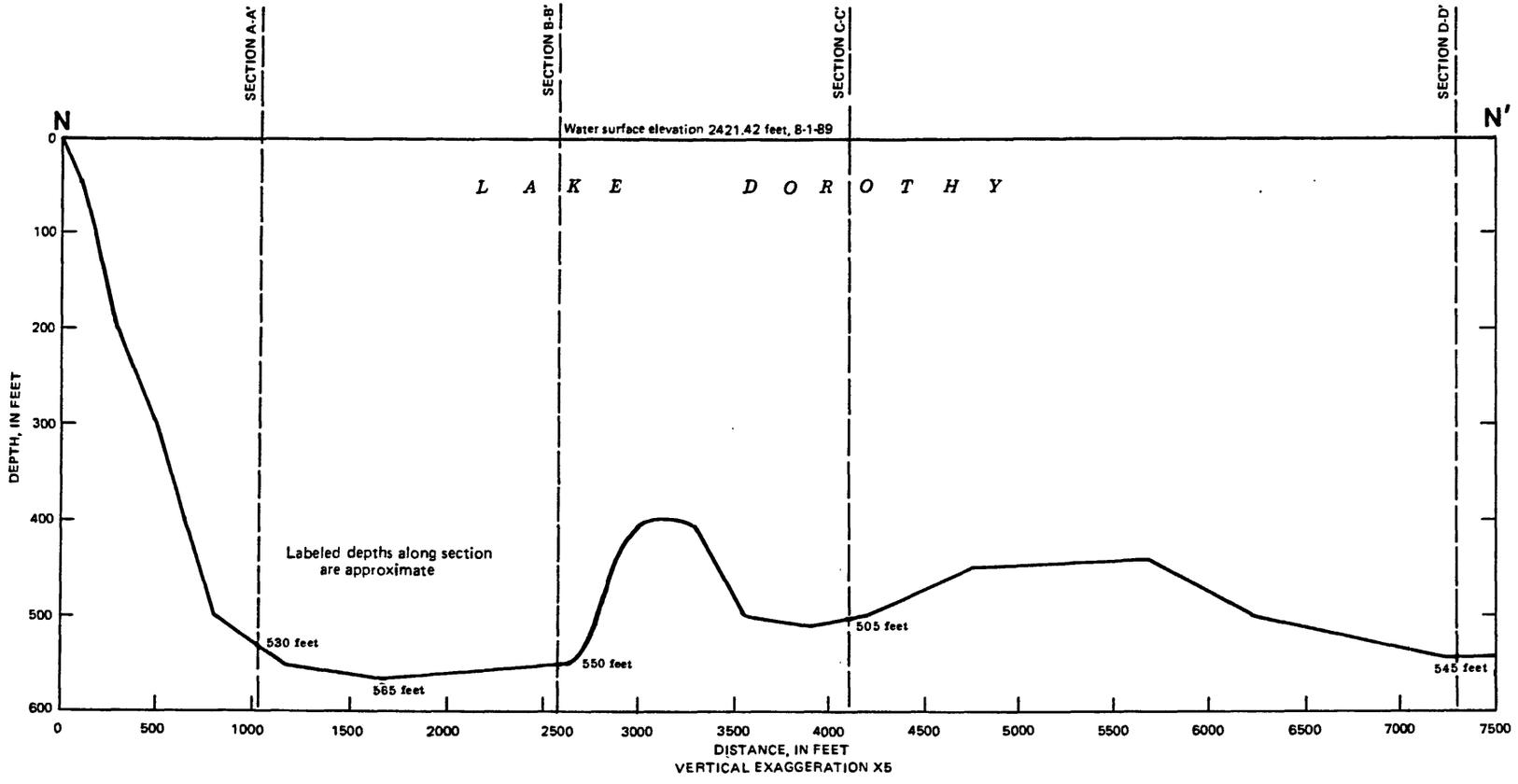


Figure 7. -- Lake Dorothy cross section N-N', along north-south alignment. (See figure 6.)

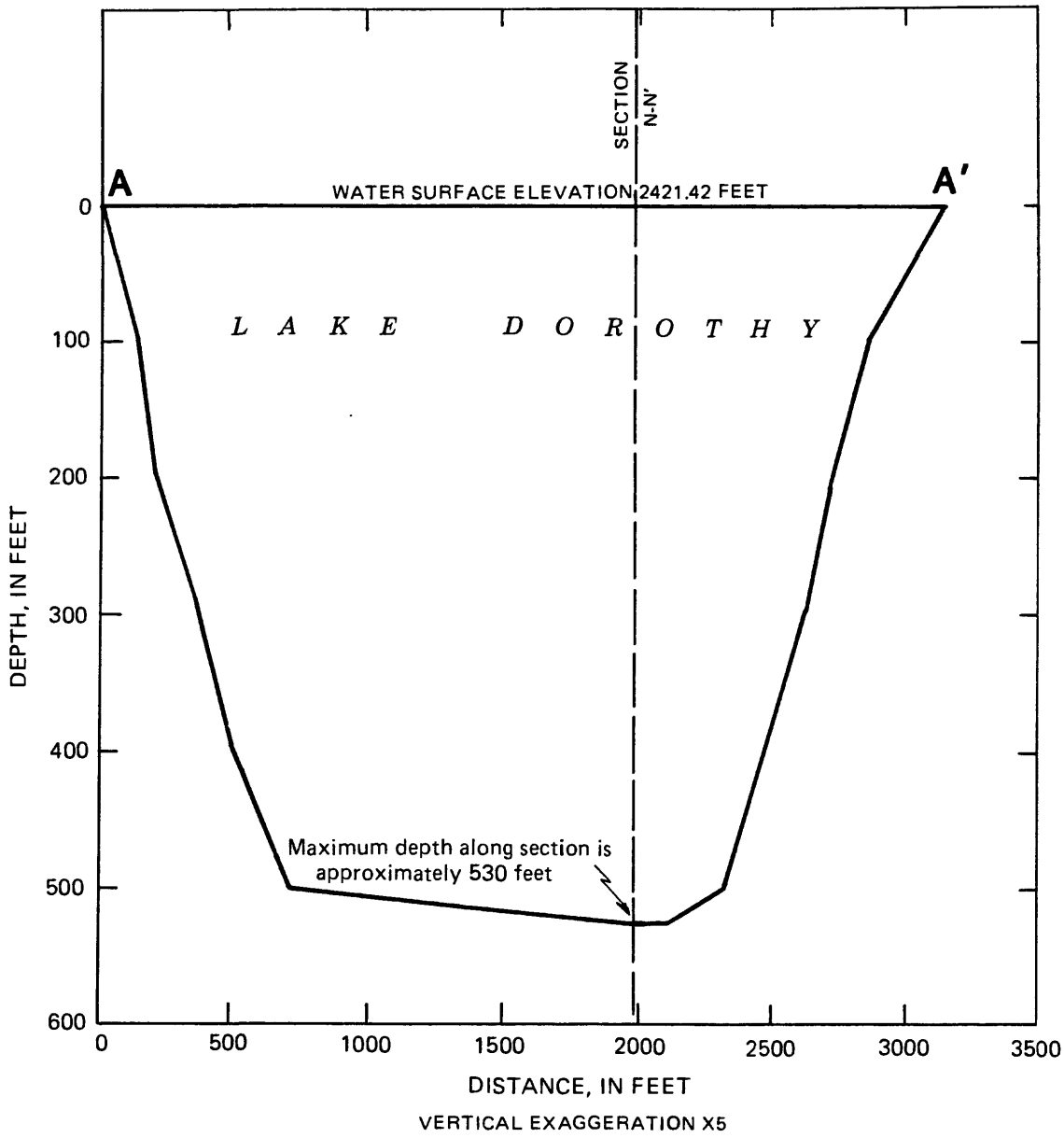


Figure 8. -- Lake Dorothy cross section A-A', at 90° angle to cross section N-N'. (See figure 6.)

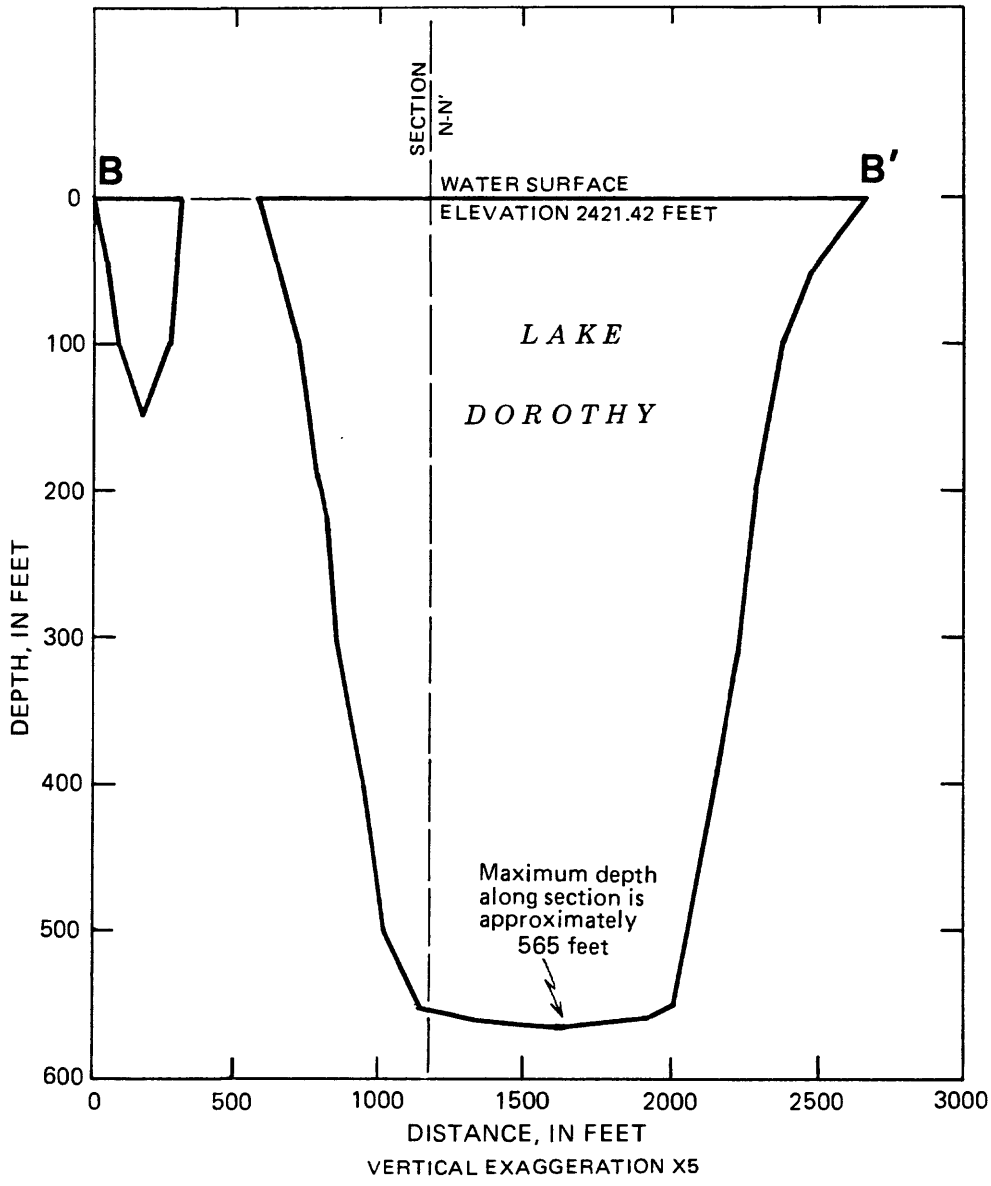


Figure 9. -- Lake Dorothy cross section B-B', at 90° angle to cross section N-N'. (See figure 6.)

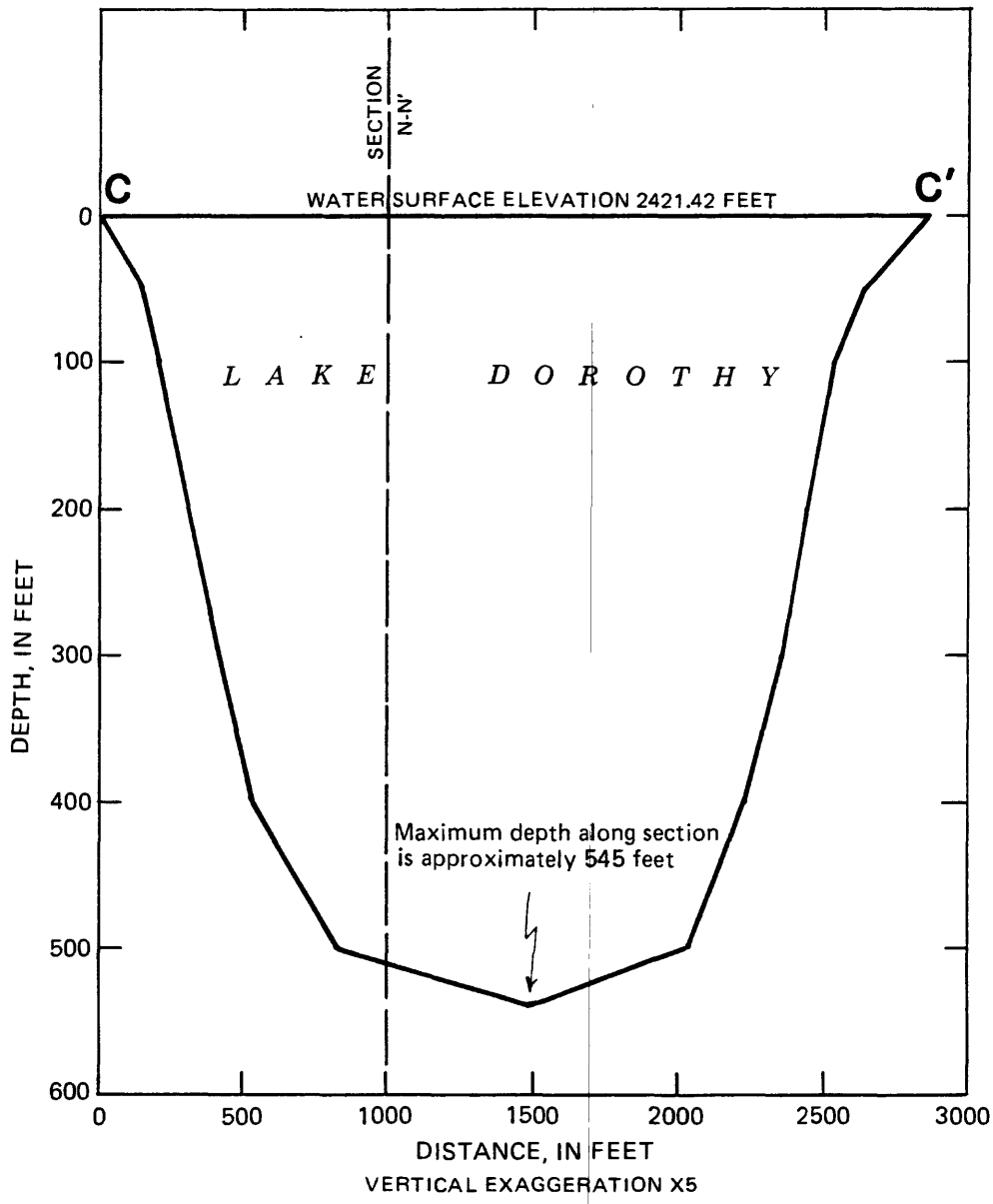


Figure 10. -- Lake Dorothy cross section C-C', at 90° angle to cross section N-N'. (See figure 6.)

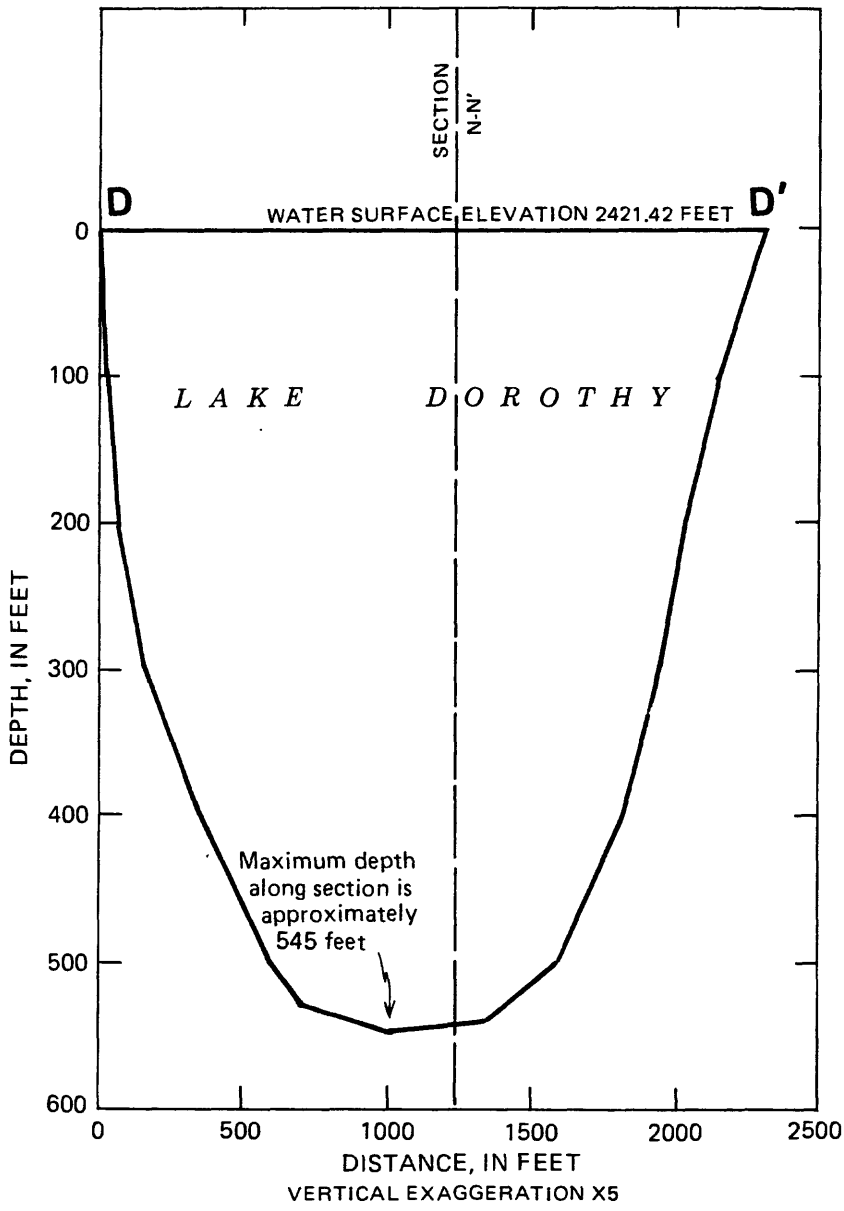


Figure 11.-- Lake Dorothy cross section D-D', at 90° angle to cross section N-N'. (See figure 6.)