Fountain Lake Sediment Depth Investigation

Chain of Lakes Sediment Study Albert Lea, Minnesota

Prepared for

Shell Rock River Watershed District

May 2006

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Wenck File #1323-05

Prepared for:

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1.0 Introduction

1.1 INTRODUCTION

The Shell Rock River Watershed District (District) is under taking efforts to make watershed wide improvements to the Shell Rock River basin. The result of these improvements is will be improve water quality and increase the recreational opportunities in the streams and lakes of the basin. Wenck Associates, Inc. (Wenck) was tasked by the District to examine the sediment depths of four lakes and the feasibility of dredging in Bancroft Bay. This report focuses on the historical and current sediment depths within the main basin of Fountain Lake and Edgewater Bay in Albert Lea, MN (Figure 1).

1.2 BACKGROUND

In 1973 National Biocentric prepared *A Study of Albert Lea Lake Watershed* for the City of Albert Lea and Freeborn County Commissioners. As part of this study, sampling was conducted on Fountain Lake investigating water chemistry, sediment chemistry, sediment volumes and biological organisms (phytoplankton, zooplankton and benthic invertebrates). A figure from the 1973 report displaying the estimated sediment depths within Fountain Lake and Edgewater Bay is included in Appendix A along with a table of estimated sediment volumes. These sampling locations were used as a baseline for the 2006 field investigations.

2.0 Methods

2.1 SAMPLING LOCATIONS

Sketches from the 1973 Study of Albert Lea Lake Watershed of Fountain Lake and Edgewater Bay were scanned and converted to image files. The image files were imported into ESRI's ArcMap v 9.1 and then geo-referenced to the MDNR lake boundaries, with the 2003 FSA aerial photograph as a background. Using the geo-referenced 1973 sketches, a point file of the historical depth probes was created in ArcMap and that point file was imported into a field GPS unit. On the lake, the locations of the historical probes were found using the GPS unit (Appendix B, Photograph 1). In some cases the location of the depth probe was offset compared to the historical location due to thin ice in channel areas or near aerators.

2.2 SEDIMENT DEPTHS

Using a power ice auger a hole was drilled in the ice and a survey rod was used to measure the water depth from the top of the ice to the top of the sediment and recorded to the nearest half foot. To measure the sediment depth a machined 0.5 in ID aluminum metal rods was used. The total rod was 25 ft in length and divided into five 5 ft sections, each of which could be attached to each other using a system of pins and clamps. The rod was plugged at the end to keep it from filling with sediment. At each probe location three sections of the rod (15 ft) were connected and advanced into the sediment. The rod was advanced through human effort only (i.e. no pounding or hammering of the rod with tools). If 15 feet of rod was not enough to reach the bottom of the sediment, additional rod sections were added until the bottom was reached. The bottom of the sediment was determined as the point of refusal (i.e. point at which the rod could not be further advanced through human effort). The point of refusal was typically one of two possibilities: 1) a firm clay like layer or 2) a hard sand bottom. These conditions were determined to be the "bottom" of sediment because it was the intent of the probing investigation to find the bottom of

the soft organic sediments most likely to be dredged from the lake. The total depth of sediment was then determined by subtracting the depth of the water and the amount of the rod remaining above the ice from the total road length (Appendix B, Photograph 2). For example, if the water depth was 4 feet and there was 3 feet of a 15-foot rod remaining above the ice then the sediment depth was 8 feet [15 – (4 + 3) = 8]. The sediment depth was recorded to the nearest half foot. The consistency of the sediment and weather sand was encountered was also noted.

2.3 LAKE ELEVATION

The lake elevation for Fountain Lake was measured on February 21, 2006 to be 1214.6 ft. The lake elevation was used in conjunction with the depth probe data to determine the elevation of the lake bottom at the sample points and also the elevation of the bottom of the sediments.

3.0 Findings and Conclusions

3.1 SAMPLE LOCATIONS

The sketches from the 1973 report contained 25 sediment depth points in the main basin of Fountain Lake and five points in Edgewater Bay. During field efforts in 2006 a total of 31 sediment probes were conducted in Fountain Lake (Figure 2) and 17 probes were conducted in Edgewater Bay (Figure 3).

3.2 RESULTS

Observed water depths in 2006 averaged 7.6 ft in Fountain Lake and 6.0 ft in Edgewater Bay. The top layer of sediment at all probe locations was very soft organic silt. In most cases the depth of refusal was a silty-clay layer, which the sample probe could not be advanced through. In other cases a firm sand layer was encountered under the organic silt. In Fountain Lake a sand bottom was encountered at six probe locations and at two probe locations in Edgewater Bay in 2006. Submerged vegetation was not observed at any of the sediment probe locations. Sediment depth probes were not conducted in Dane Bay due to unsafe ice conditions.

3.3 CONCLUSIONS

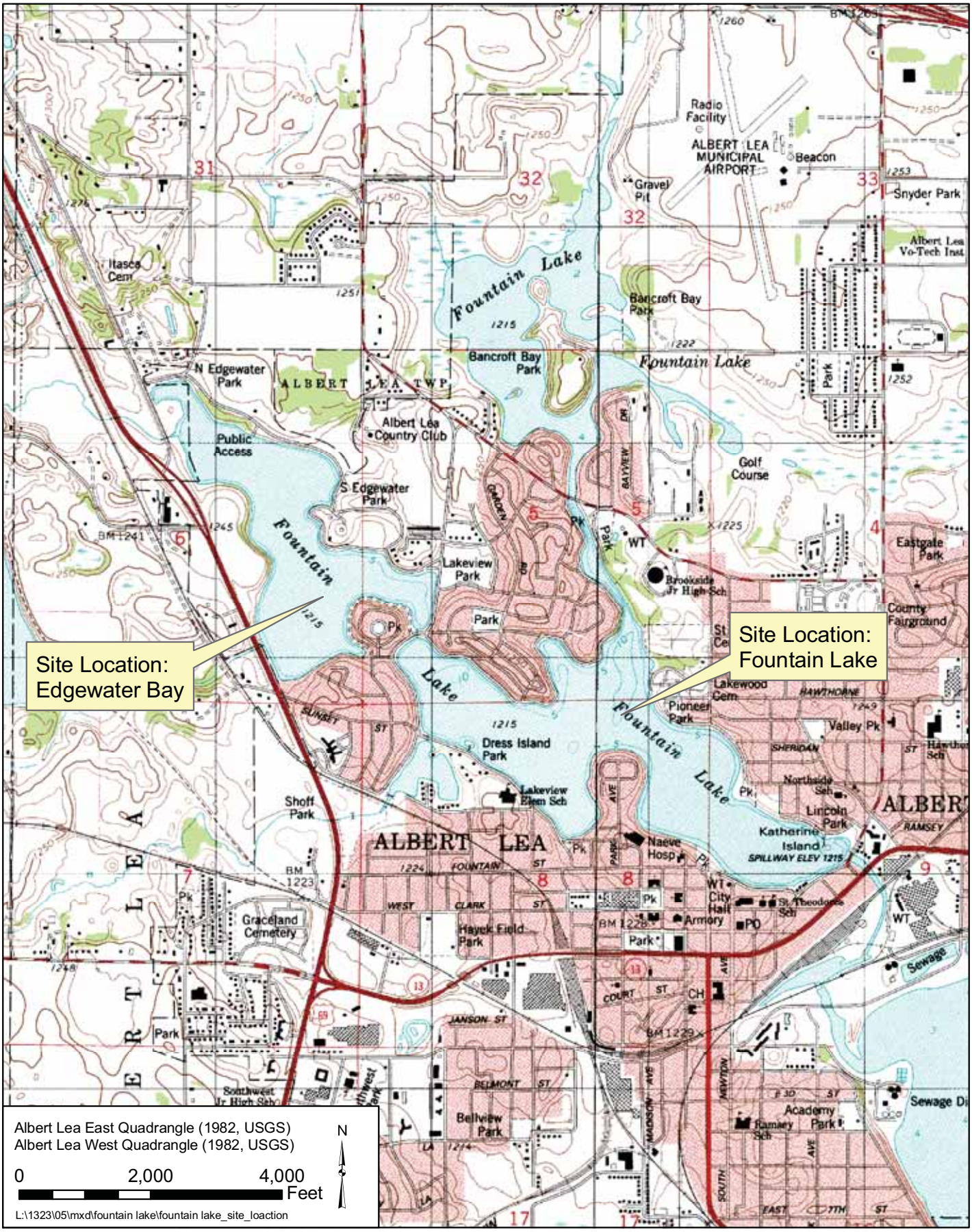
The 2006 sediment investigation increased the level of accuracy for sediment depths and location in both Fountain Lake and Edgewater Bay. Overall, sediment depths were deeper in both the main basin of Fountain Lake with a six percent increase in average sediment depth and in Edgewater Bay with a 25 percent increase in sediment depth for 2006 sediment probes compared to 1973 sediment probes (Table 1). The 1973 *Study of Albert Lea Lake Watershed* estimated a total of 2,592,000 $yrds^3$ of sediment in Fountain Lake and 473,000 $yrds^3$ in Edgewater Bay. Based on the percent increase in average sediment depths from the 2006 field investigations, a

similar increase in total sediment volume would be expected in each lake, resulting in an estimate of 2,747,520 yrds^3 in Fountain Lake and 591,250 yrds^3 in Edgewater Bay.

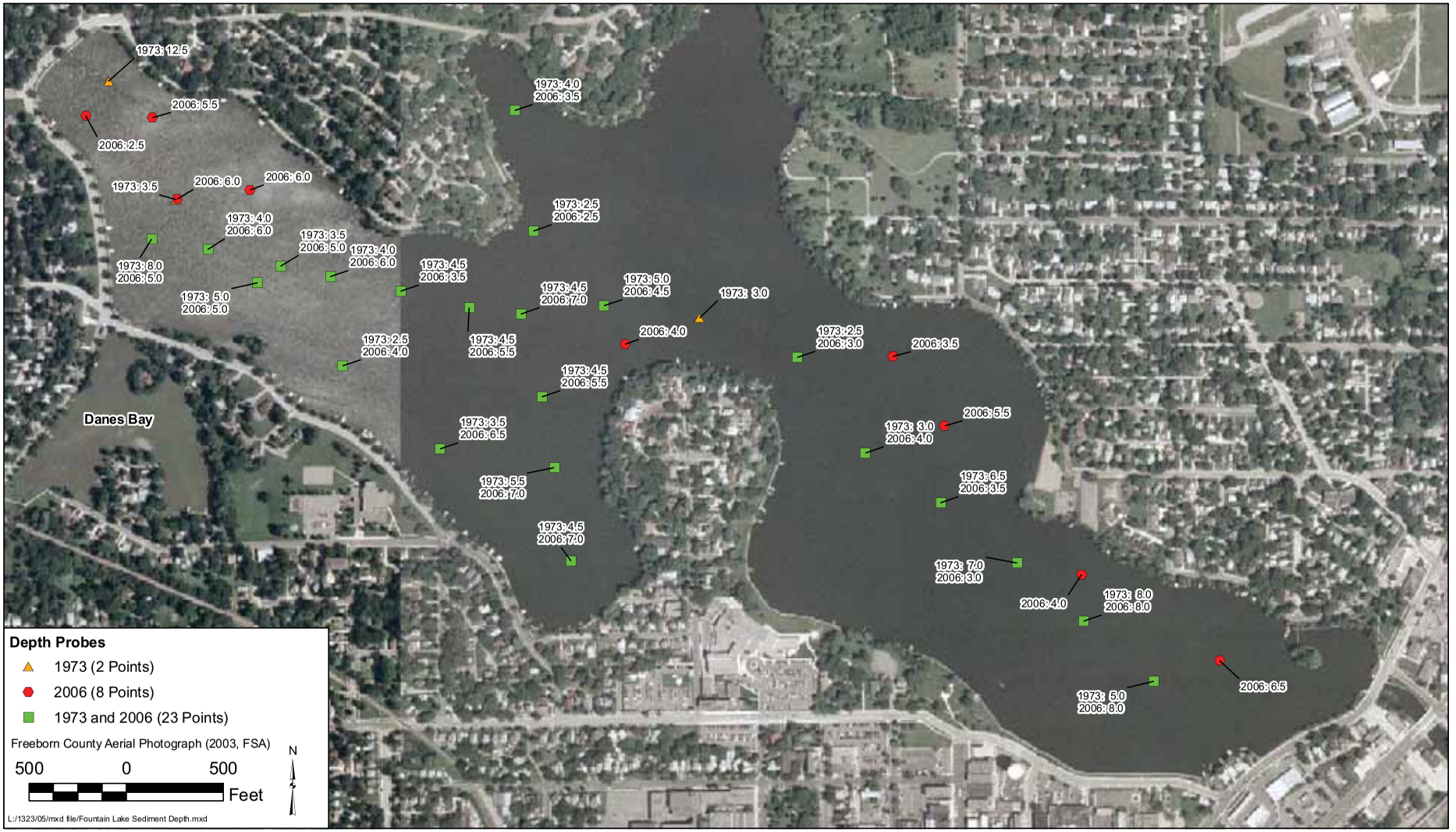
Table 1: Comparison of Observed Sediment depths in Fountain Lake and Edgewater Bay to other lakes sampled in the Shell Rock River Chain of Lakes.

	Number of Probes			Average Sediment Depth	
	1973	2006		1973	2006
Bancroft Bay	9	18		5.6 ft	6.5 ft
Edgewater Bay	5	16		3.8 ft	4.9 ft
Fountain Lake	25	31		4.8 ft	5.1 ft
West Basin Albert Lea Lake	21	40		8.4 ft	8.4 ft
Lake Chapeau	--	10		--	17.5

Figures



Shell Rock River Watershed District Site Location Map : Fountain Lake and Edgewater Bay	Wenck Associates, Inc. 1800 Pioneer Creek Center Environmental Engineers Maple Plain, MN 55359-0429	MAY 2006 Figure 1



SHELL ROCK RIVER WATERSHED DISTRICT

Comparison of Sediment Depths from 1973 and 2006 in Fountain Lake

Wenck

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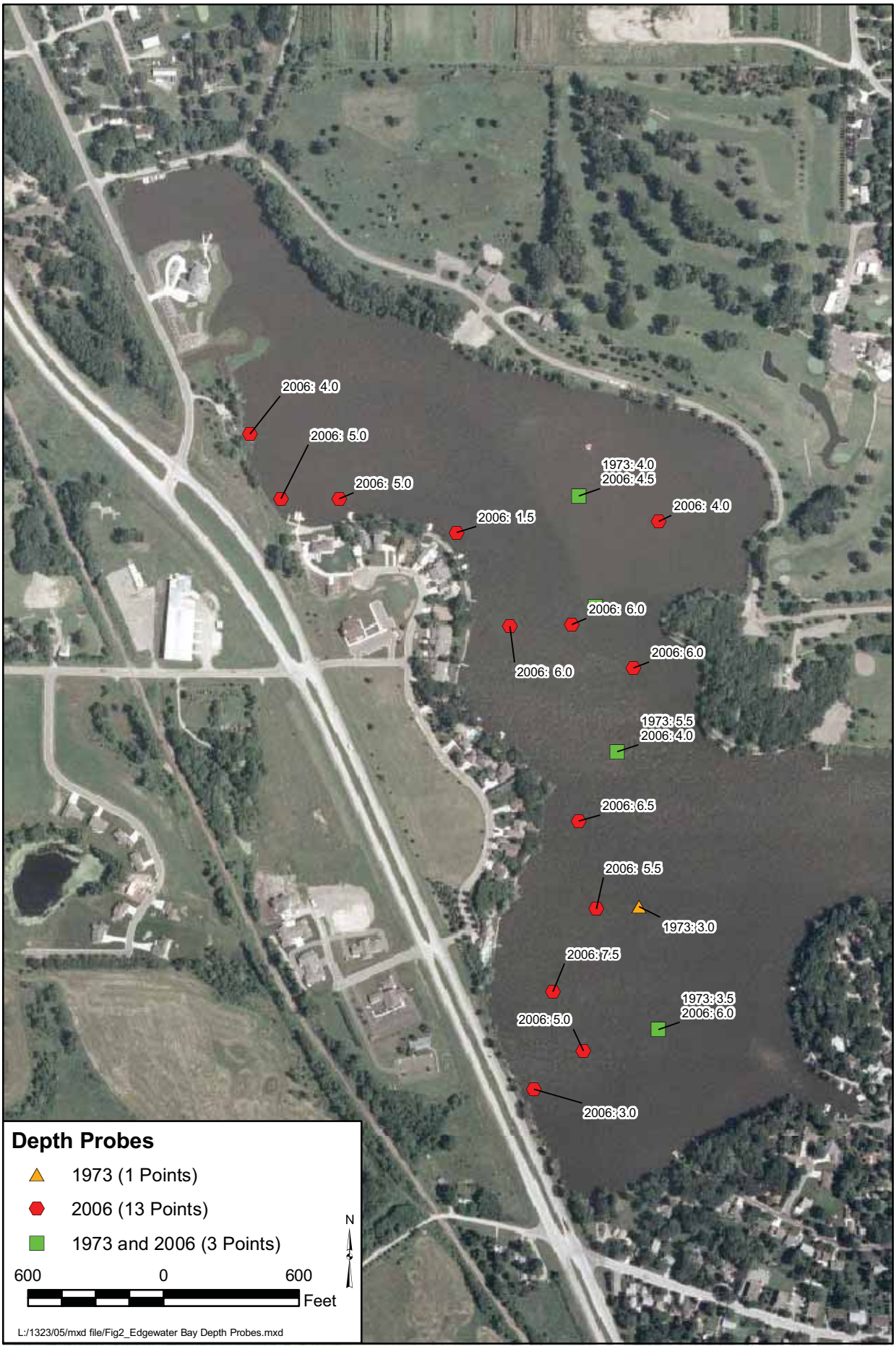
Environmental Engineers Maple Plain, MN 55359-0429

MAY 2006

Figure 2



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Comparison of Sediment Depths from 1973 and 2006 in Edgewater Bay

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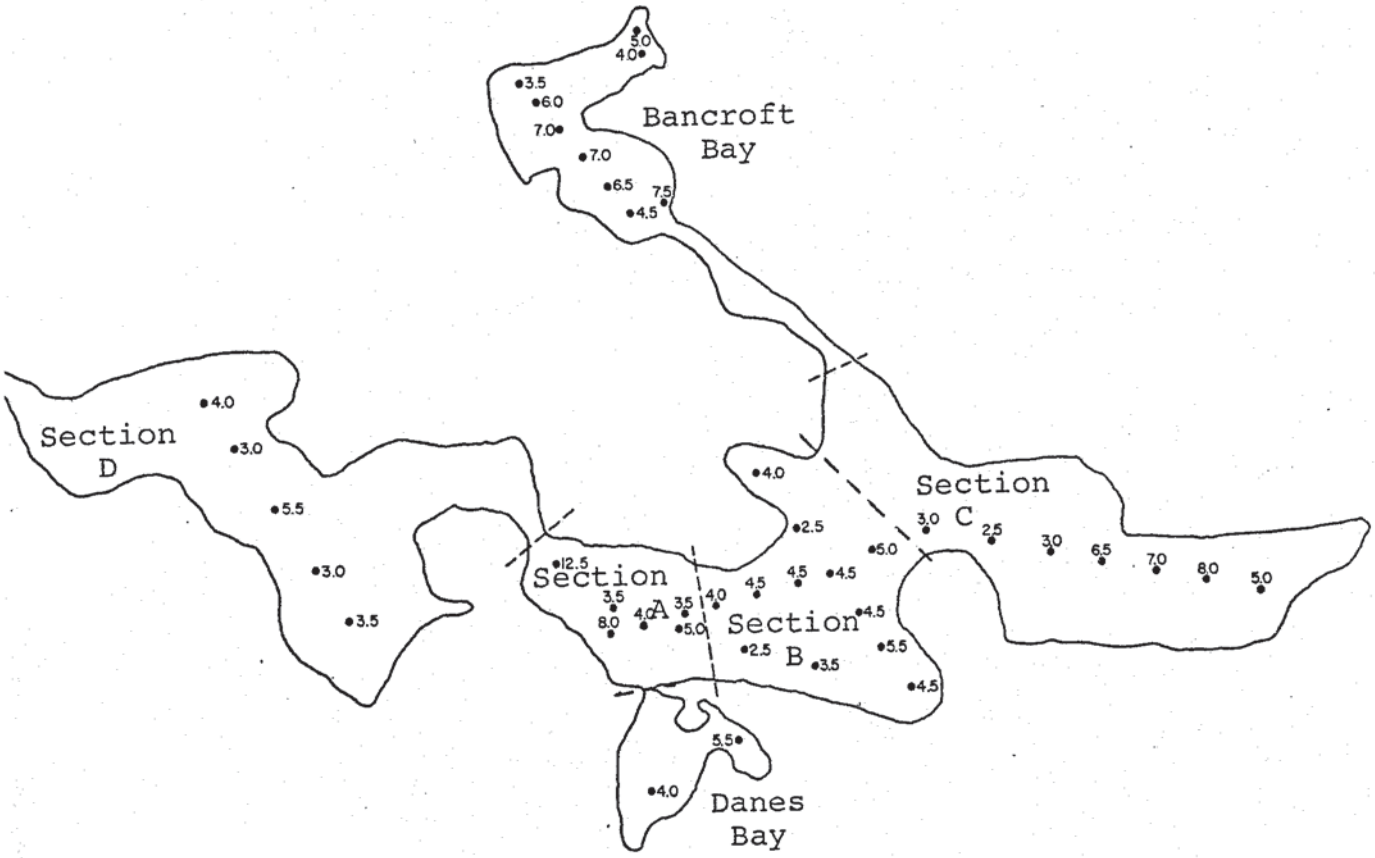
Figure 3

Appendix A

Exhibits from 1973
Study of Albert Lea Lake Watershed

DEPTH OF SEDIMENT IN FEET—AUGUST 6 & 7, 1973

FOUNTAIN LAKE



WATER = 555 ACRES

SEDIMENT = 2582 ACRE-FEET

SEDIMENT = 4,166,000 YARDS^3

Table 8

Fountain Lake

Sediment Calculations

Section	Area (Acres)	Average Sediment Thickness (Feet)	Sediment Volume (Acre Feet)	Sediment Volume (Cubic Yards)
A	48A	6.1	293	473,000
B	89A	4.1	365	589,000
C	129A	5.0	645	1,040,000
D	157A	3.8	597	963,000
Bancroft	121A	5.2	629	1,015,000
Dane's	11A	4.8	53	8,600
TOTAL			2,582	4,166,000

Albert Lea Lake

Sediment Calculations

Section	Area (Acres)	Average Sediment Depth (Feet)	Sediment Volume (Acre Feet)	Sediment Volume (Cubic Yards)
A	690.3	8.9	6,144	9,912,000
B	949.8	8.2	7,788	12,564,000
C	892.8	6.5	5,803	9,362,000
D	121.1	7.9	957	1,544,000
TOTAL			20,700	33,382,000

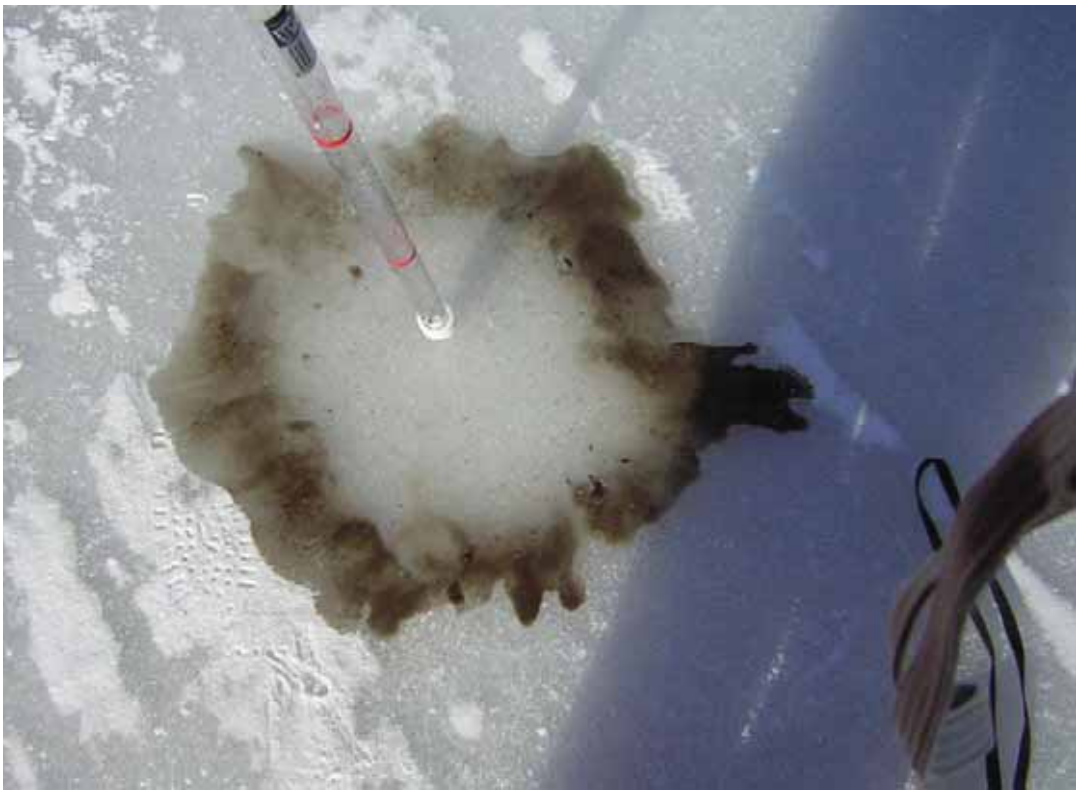
Appendix B

Field Photographs

Photograph 1: The 1973 historical sediment sampling points were located using a GPS.

Photograph 2: Aluminum rod was advanced into sediment until refusal. Water depth was measured using a survey rod. Sediment depth was calculated by subtracting the water depth and the amount of the exposed rod from the total rod length.

Photograph 3: Used tube with check-ball valve to measure water depth. Total depth at this location was four feet. The bottom one foot of the water column was very turbid with suspended sediments



Photograph 4: Water from tube ran out onto the ice, displaying that the dark area in the above picture was water with a high amount of suspended sediments.