

VOLUMETRIC SURVEY REPORT
OF
EUFAULA LAKE
JUNE 2004 SURVEY

Prepared by the:
TEXAS WATER DEVELOPMENT BOARD



April 2006

Texas Water Development Board

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Executive Summary

This report presents the results of a volumetric survey conducted by the Texas Water Development Board on Eufaula Lake, Oklahoma under contract with the U.S. Army Corps of Engineers, Tulsa District (Contract No. W44GQ41965861). The purpose of that survey was to collect hydrographic data when the reservoir was at or above power pool elevation (585.0 ft) and to provide updated elevation-area and elevation-volume tables up to power pool elevation. Analysis of the survey data indicates that Lake Eufaula contains a volume of 2,144,315 ac-ft at power pool elevation 585.5 ft and encompasses a surface area of 94,526 ac.

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Introduction

In June 2004, the Texas Water Development Board (TWDB) and the United States Army Corps of Engineers (USACE), Tulsa District, entered into a Memorandum of Agreement whereby the TWDB would perform a volumetric survey of Eufaula Lake. The purpose of that survey was to collect hydrographic data when the reservoir was at or above power pool elevation (585.0 ft) and to provide updated elevation-area and elevation-volume tables up to the power pool elevation. In addition, the TWDB survey team digitized and plotted historical (1964 and 1969) sedimentation ranges¹ against ranges interpolated from the current survey (TWDB 2004).

History and General Information

Eufaula Dam is located on the Canadian River, approximately 12 miles east of Eufaula in McIntosh County, Oklahoma (Figure 1). The lake is owned and operated by the U.S. Army Corp of Engineers, Tulsa District, and impounds the North Canadian River, Canadian River, Deep Fork of the Canadian River, Gaines Creek, and several smaller creeks. The lake provides flood control, water supply, hydroelectric power, fish and wildlife habitat, and recreation.²



Figure 1. Eufaula Lake is located in eastern central Oklahoma.

Construction on Eufaula Dam began in December 1956 and was completed for full flood control on February 10, 1964. Power generation began in July 1964 with the last of three generators coming online for commercial power in September of 1964. Elevations of pertinent features are presented below in Table 1.

Feature	Elevation (feet)
Top of Dam	612.0
Maximum Pool	604.5
Top of Gates and Flood Control	597.0
Flood Control Storage	585.0-597.0
Top of Power Pool (TOP)	585.0
Power Storage	565.0-585.0
Bottom of Power Pool and Spillway Crest	565.0

Table 1. Elevation of Pertinent Features for Eufaula Dam.

Results of the TWDB 2004 Survey

The current survey indicates that at the top of power pool elevation, 585.0 ft, Eufaula Lake contains a total volume of 2,144,315 ac-ft and a surface area of 94,526 ac. Table 2 presents the 2004 survey results and results from two previous USACE surveys in 1964 and 1969. Due to the different computational methods used in previous surveys direct comparisons are not recommended³ and are presented here solely for informational purposes.

Feature	TWDB 2004	USACE 1969	USACE 1964
Volume (TOP) 585.0 ft	2,144,315	2,330,000	2,378,000
Area (TOP) 585.0 ft	94,526	102,200	102,500
Power Storage (585ft-565ft)	1,346,325	1,465,200	1,481,000
Bottom of Power Pool 565ft	797,990	864,800	897,000

Table 2. Elevations, Areas, and Volumes from the TWDB 2004 survey and previous USACE surveys.

Methods

Pre-Survey Procedures

Survey team members defined preliminary reservoir and island boundaries from aerial photographs by digitizing the visible land-water interface. Sixty-two aerial photographs, obtained from USACE Tulsa District and GEO Information Systems⁴, were used in the digitization process. Once the boundary was established, the survey team designed a set of pre-planned navigation lines spaced 500 feet apart in a perpendicular fashion to the original streambed. During data collection, team members navigated from shore to shore along these lines (Figure 2).

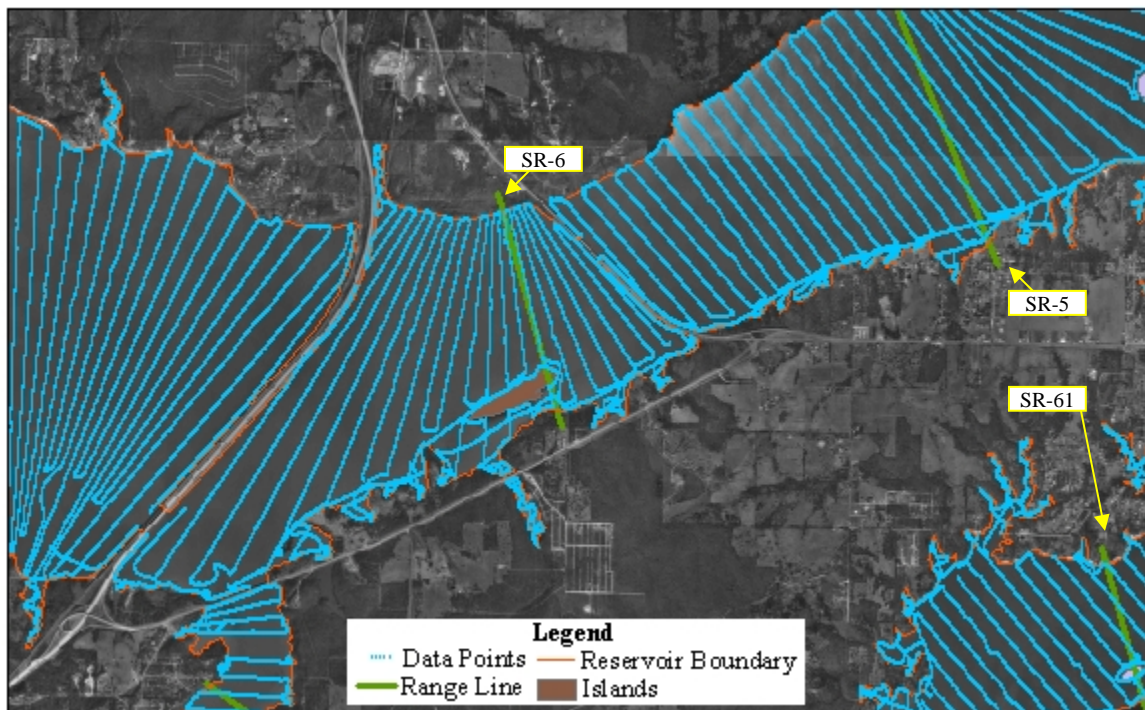


Figure 2. Data points superimposed on the 1995 aerial photographs illustrate the pattern of the pre-planned navigation lines. At the top of the picture, U.S. Highway 69 and State Highway 9 are visible entering the city of Eufaula from the south. Green lines are the approximate locations of USACE Sediment Range Lines established prior to 1964.

Hydrographic Survey

Bathymetric survey data was collected using integrated Differential Global Positioning System (DGPS) equipment and survey grade depth sounders. For this survey, three boats were equipped with similar systems providing an efficient and accurate method to collect data in varying conditions encountered throughout the reservoir.

Depth sounders were calibrated each day using velocity profilers to measure the average speed of sound through the water column. The speed of sound was entered into the depth sounder and depth readings were checked for accuracy with a weighted tape or stadia rod.

The survey team collected data on 38 days from July 22, 2004 to September 20, 2004, during that time the water surface elevation varied between 587.64 ft and 585.32 ft. The team navigated more than 2,300 miles while collecting over 1,152,000 data points. After post processing the data to remove anomalies, the water surface elevation for each day was used to correct all data and all files were combined into a single (MASS Points) file to be used in the GIS processing.

GIS Processing

Datum

The vertical datum used for this survey is referenced to the USACE Gauge⁵ EUFO2. In order to monitor any variations in water surface elevation during the survey, four pressure transducers were placed on bridge pilings throughout the reservoir. Analysis of the pressure transducer data indicates that the water surface elevation was consistent throughout the reservoir during the survey. Therefore, the measurements at the gauge (EUFO2) were used to adjust the depth readings for the complete survey data set. A complete description of the process used in the analysis of the pressure transducer data is provided in Appendix A. The horizontal datum used in this report is Oklahoma State Plane NAD 1983.

Model Boundary

As discussed earlier, a preliminary reservoir boundary was digitized from aerial photographs. However, the water surface elevation varies from photograph to photograph

because the images were photographed on five separate occasions between February and April of 1995. The reservoir's elevation for each of the photographs was determined using data from the USACE Gauge EFUO2, and is summarized in Table 3. Five line segments were digitized around Eufaula Lake and assigned an elevation corresponding to the appropriate elevation of the land-water interface in each photograph. To simplify the final processing, the five elevations listed in Table 3 were rounded to three elevations, 585.0 ft, 585.3 ft, and 586.8 ft. and the line segments were combined accordingly.

The Triangular Irregular Network (TIN) Model⁶ routine used to make volume and area calculations requires the boundary to be a closed polygon with a unique water surface elevation. Since the aerial photography provided us with three line segments with varying elevations, another boundary was created. To accomplish this, a boundary using the 180-meter (590.6 ft) contour, from the 1:24,000 scale hypsography⁷, was created to encompass the three line segments digitized from the aerial photographs. The aerial photography has a scale of 1:12,000, while the hypsography has a scale of 1:24,000. Due to the scale differential between these two GIS layers, estimation of the true position of elevation 590.6 ft was necessary therefore, elevation-volume and elevation-area calculations above 585.0 ft are not included in this report.

Table 3. Aerial Photographs Dates and Corresponding Reservoir Elevation

Number of Photographs	Date of Photographs	Reservoir Elevation (ft)
13	2/24/1995	584.99
14	3/9/1995	585.33
17	3/10/1995	585.29
14	3/21/1995	586.78
4	4/01/1995	585.07

TIN

The data points (MASS Points file), line segments defining the land-water interface, and the outer boundary polygon, were input into the TIN routine to model the reservoir's bathymetry. Using this model, volumes and areas were calculated at one-tenth foot intervals from the minimum depth recorded during the survey, 491.8 ft; to the power pool elevation of 585.0 ft. Elevation volume and elevation area tables and graphs are presented in Appendix B through E. In addition, the TIN model was averaged into 50-foot

grids to create an Elevation Relief Map (Figure 4), Depth Range Map (Figure 5) and a 4-foot interval contour map (Figure 6).

Historical Sediment Range Lines

Historical Sediment Range Line locations were selected from a 1969 intermediate-scale map (approximately 1:120,000) entitled “SILT RANGES”. The map was scanned and geo-referenced using the 1995 aerial photographs. Range line endpoint coordinates were then estimated from the map; however, horizontal positional inaccuracies are present due to the scale differential and the condition of the paper map. These positional inaccuracies are evident in the cross-sectional comparisons between the 1969 range lines and the interpolated ranges of 2004, presented in Appendix F. This report assumes that the vertical datum at gauge EUFO2 is the same as that used to establish the range lines. Figure 3 details a portion of the 1969 map overlain with the boundary segments to show the horizontal inaccuracies.

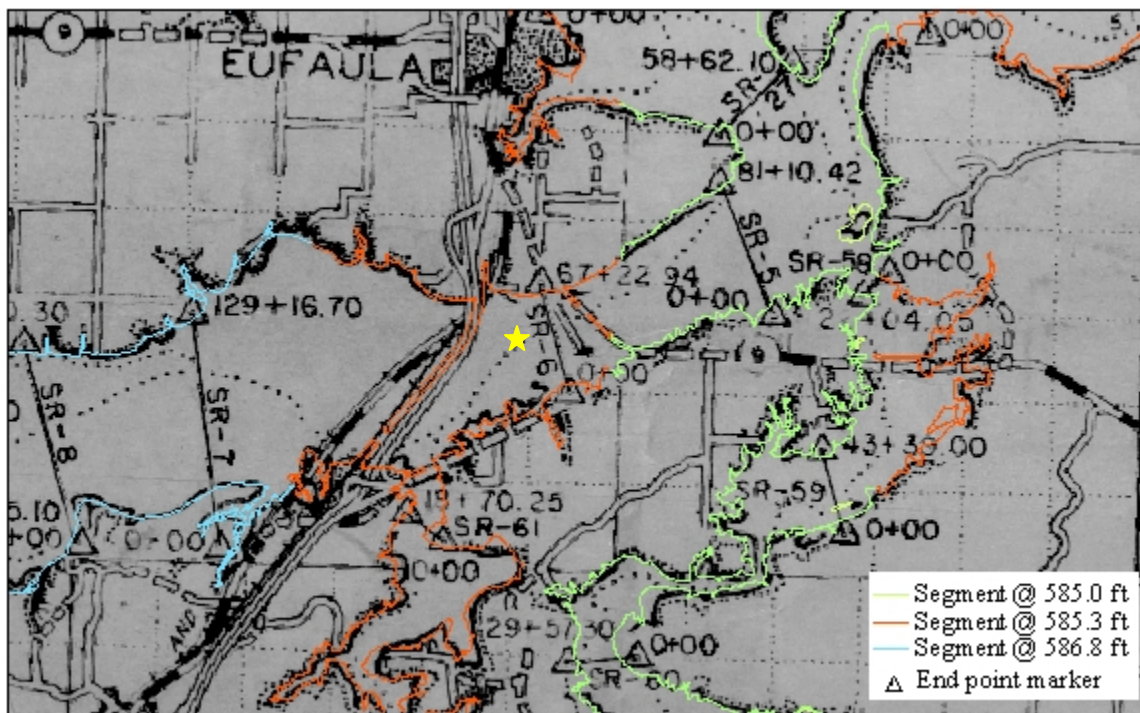


Figure 3. A portion of the 1969 map after geo-referencing, with the line segments digitized from the aerial photography. Notice the proposed roads near SR-6, (★) near the center. Variations in the cross-sections in these areas are most likely due to road and bridge construction since 1969.

References

- 1) Eufaula Lake, Report on June 1969 Resurvey of Sedimentation and Degradation Lines, Department of the Army, Tulsa District Corps of Engineers, Oklahoma, May 1977.
- 2) United States Army Corps of Engineers, Tulsa District, Reservoir Control Office, May 7, 1997,
<<http://www.swt.usace.army.mil/projects/pertdata/eufaula/eufaula.htm>>, August 2005.
- 3) Blanton III, James O. Bureau of Reclamation. 1982. "Procedures for Monitoring Reservoir Sedimentation."
- 4) Geo Information Systems, a department of the University of Oklahoma, 2020 Industrial Boulevard, Second Floor, Norman Oklahoma. 73069-8512
- 5) United States Army Corps of Engineers, Tulsa District, Reservoir Control Office. August 2005 <<http://www.swt-wc.usace.army.mil/webdata/gagedata/EUFO2.current.html>>. August 2005.
- 6) ESRI, Environmental Systems Research Institute, 1995. ARC/INFO Surface Modeling and Display, TIN Users Guide.
- 7) United States Geological Survey. 1:24,000 DLG Hypsography.
<http://edc.usgs.gov/geodata/dlg_large/states/OK.html> September 2005

Appendix A

Hydrographic Survey of Eufaula Lake, OK

GPS Measurement Report

Prepared by Jordan Furnans
Texas Water Development Board
February 25, 2005

Purpose of Measurements:

As part of its hydrographic survey of Eufaula Lake, the Texas Water Development Board was required to produce a bathymetry dataset containing the elevation above mean sea level for all points within the lake. To create this dataset, water depths were measured with boat-mounted sonar equipment, and lake bottom elevation is calculated by subtracting the water depth from the water surface elevation measured with the Eufaula Lake dam gauge. The elevation at the top of Eufaula Dam was determined to be 612 ft, and (at time of publication) no records are available that describe the procedures used to determine this elevation. It is also unclear as to the values of the gauge datum, or exactly where the water level measurements are made. There is a type of staff gauge built into the side of the dam, where the elevation markings are fixed in the dam concrete.

GPS equipment and surveying techniques were used to verify the elevation of the dam, of the water surface near the dam, and of the water surfaces at 4 locations within the lake. These locations were near where pressure transducers (PTs) were installed to record water level changes during the period of the hydrographic survey. The GPS measurements were tied-in to the local National Geodetic Survey benchmark system by referencing the known elevations at two benchmarks along Highway I-40.

This document serves as notice for how the GPS measurements were made, how the data was processed, and how the final dam and water surface elevation values were obtained.

Surveyor in charge: Jordan Furnans, Texas Water Development Board

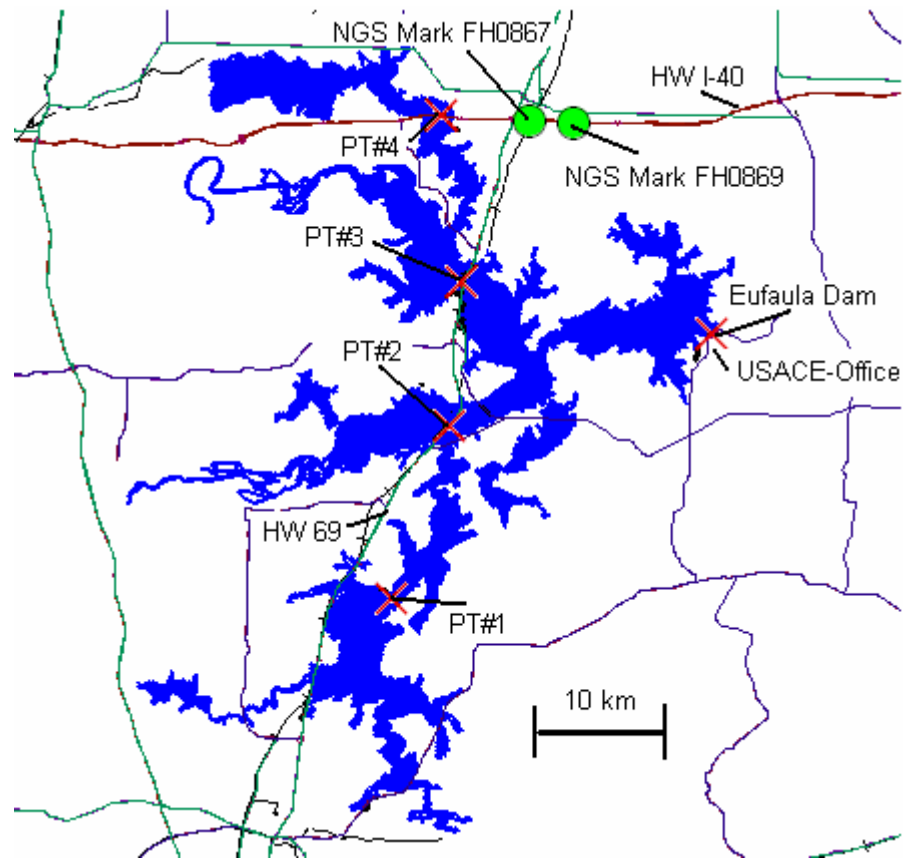


Figure 1 – Map of Eufaula Lake showing locations of benchmarks (Green Circles), locations of water level measurements (Red X's), and USACE Office.

GPS measurements were made according to the plan presented on the following page. A full GPS loop was created by setting the base station near FH0867 on 7/20/04, taking rover shots including one at the temporary mark at the USACE Office, setting the base station at the temporary mark at the USACE Office on 7/21/04, and taking rover shots including one at the location near FH0867 where the base station was located on the previous day. It was not possible to set the base station at FH0867 because the mark is immediately next to a wooden utility pole that could block some satellite signals. A level and stadia rod was used to determine the elevation difference between FH0867 and the location at which the GPS measurements were made near that mark. On 7/23/04, GPS measurements were made in order to determine the water surface elevation near PT#2. This measurement was not made on 7/21/04 because the batteries supplying power to the base station had drained before the rover shot was taken at PT#2. This prevented making simultaneous measurements with the base and rover when at PT#2 on 7/21/04.

Completed GPS Measurement Plan:

7/20/04

- Locate suitable NGS Benchmarks – Found FH0867, FH0869
- Set Up Base Station (Trimble 5700) near FH0867, use level to determine elevation at base station location (FH0867 was near a large wooden pole that could impede the GPS measurement; Randy Burns of TWDB held the stadia rod during the level shot)
- Take GPS Measurements with Rover (Trimble 5800) at point FH0869, at USACE benchmark “Eufaula Res. G3 -1988” on Eufaula Dam, and at temporary location on grounds of USACE office. Temporary location = center of manhole near front gate of USACE Eufaula Lake office. Exact position marked with an “X” on the manhole, using a pocketknife.
- Retrieve all Equipment

7/21/04

- Set Up Base Station (Trimble 5700) at temporary location on grounds of USACE office, at the manhole cover on the “X”.
- Take GPS Measurements with Rover (Trimble 5800) at USACE benchmark “Eufaula Res. G3 -1988” on Eufaula Dam, at the water surface in the vicinity of the dam, at FH0869, at point of previous base setup near FH0867, at water surfaces near PT#1, PT#2, PT#3, PT#4
- Retrieve all Equipment

7/23/04

- Set Up Base Station (Trimble 5700) at temporary location on grounds of USACE office, at the manhole cover on the “X”.
- Take GPS Measurements with Rover (Trimble 5800) at water surface near PT#2
- Retrieve all Equipment

7/27/04

- Process GPS measurement data using Trimble Geomatics Office Software, upon returning to TWDB office in Austin, TX.

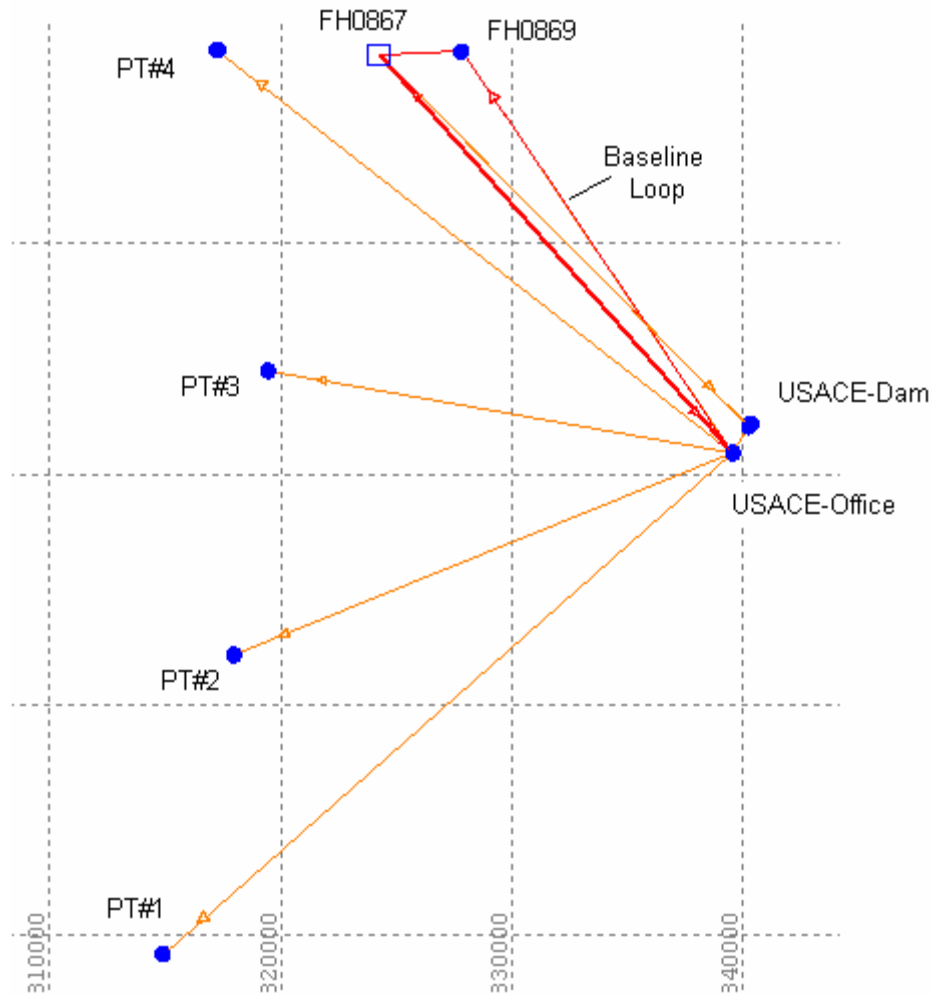


Figure 2 – Screen Capture from Trimble Geomatics Office Software – Processing GPS data. Complete Baseline Loop was formed between USACE-Office, FH0867, and FH0869. Elevation was fixed at FH0867 and used to determine elevations at each of the other measurement locations.

Table 1 – Elevations Derived from GPS Measurements

GPS Point	GPS Height (m)	Geoid (m)	Elevation (m)	Elevation (ft)
USACE-office	193.357	30.3	223.65±0.03	733.78±0.10
FH0869	155.736	29.84	185.57±0.04	608.84±0.12
FH0867	168.843	29.80	198.65±0.00	651.74±0.00
USACE-dam	156.499	30.28	186.78±0.03	612.80±0.10
dam-wse	148.877	30.28	179.15±0.04	587.78±0.12
PT1	148.867	30.18	179.05±0.09	587.44±0.30
PT2	149.021	30.11	179.13±0.10	587.70±0.33
PT3	149.197	29.96	179.16±0.07	587.79±0.24
PT4	149.416	29.73	179.15±0.06	587.77±0.18

*** At time of dam-wse measurement, dam gauge recorded 578.70 ft, within the error limits of this GPS survey.

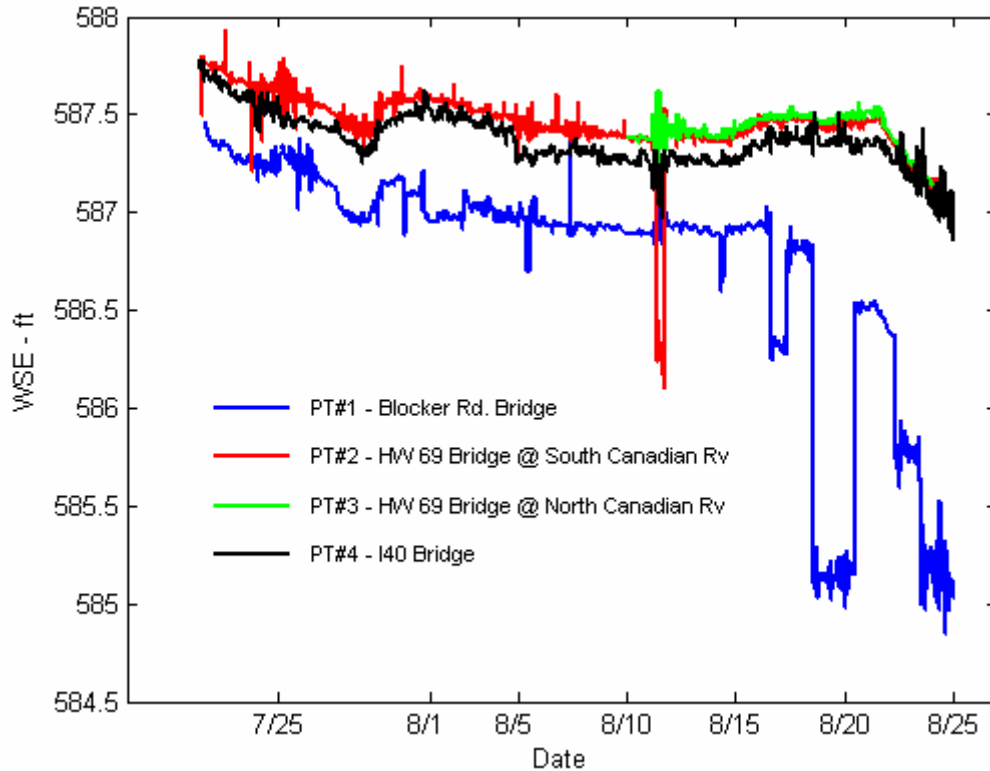


Figure 3- Water Surface Elevations (WSEs) measured with the PTs.

Water surface elevations were calculated by adding the depths measured by the PTs to the known elevations of the PTs. The PT elevations were calculated by subtracting the measured depth to the PT at the time of the GPS measurements of the water surface elevations. The time-histories of water surface elevations (Figure 3) exhibit similar trends among the four locations. PT #1 was disturbed after 8/15, causing the 2-ft drop in WSE recorded. PT#3 did not record valid data until 8/10. Given the error in the GPS recorded PT elevations (Table 1), WSE elevation differences cannot be discerned amongst the 4 PT locations.

Conclusion: the water surface elevation of Lake Eufaula changed uniformly during the hydrographic survey data collection, and that the gauge at the dam is sufficient for determining lake surface elevations throughout the lake.

Appendix B
Eufaula Lake
RESERVOIR VOLUME TABLE

TEXAS WATER DEVELOPMENT BOARD

SEPTEMBER 2004 SURVEY
 Power Pool Elevation 585.0 ft

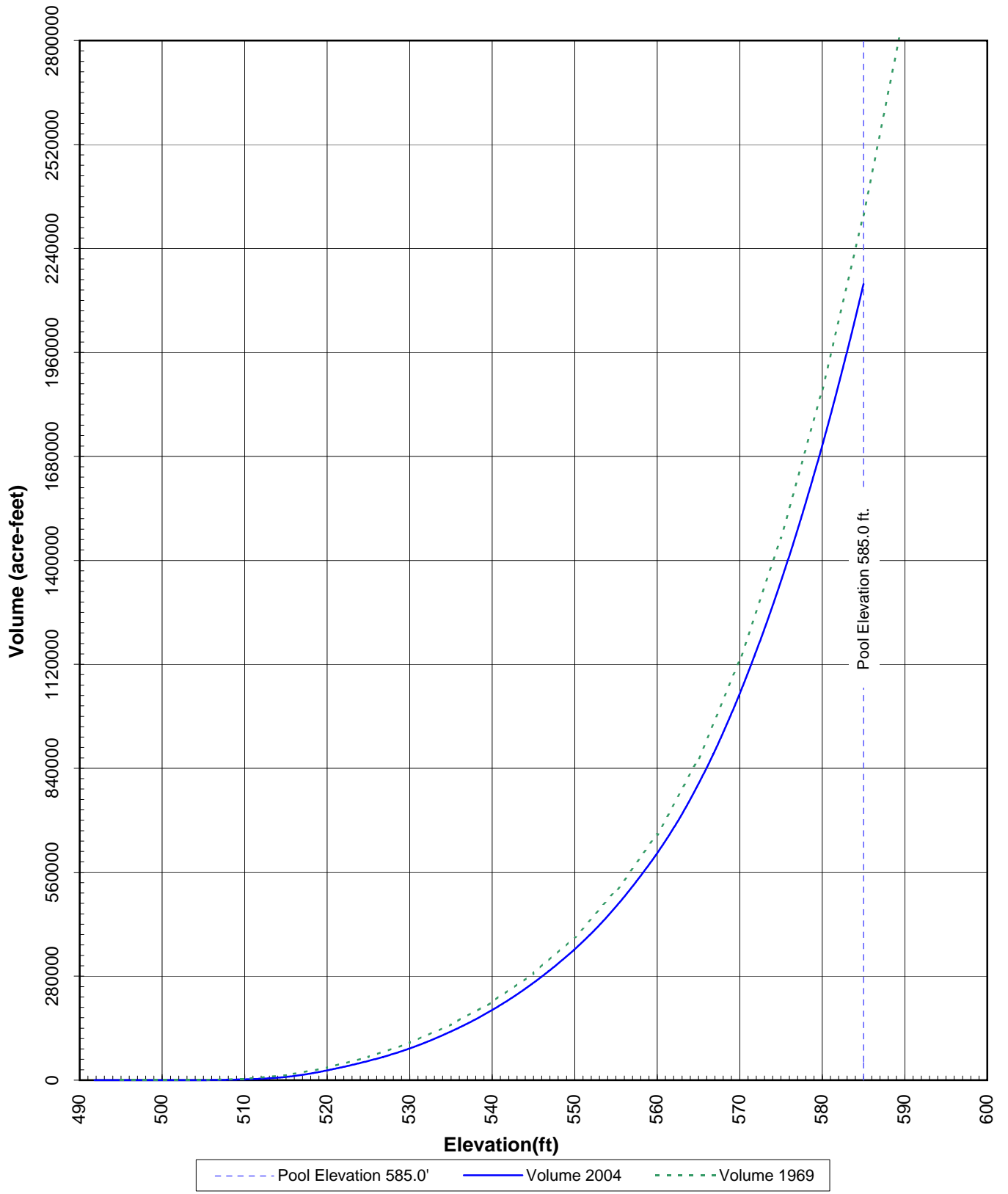
ELEVATION in Feet	VOLUME IN ACRE-FEET									
	0.0	0.1	0.2	0.3	0.4	0.5	0.6	0.7	0.8	0.9
491									0	0
492	0	0	0	0	0	0	0	0	0	0
493	0	0	0	0	0	0	0	0	0	0
494	0	0	0	0	0	0	0	0	0	0
495	0	0	0	0	0	0	1	1	1	1
496	1	1	1	1	1	1	1	2	2	2
497	2	2	2	2	3	3	3	3	3	4
498	4	4	4	5	5	5	6	6	6	7
499	7	8	8	8	9	9	10	10	11	12
500	12	13	14	14	15	16	17	17	18	19
501	20	21	22	23	24	26	27	28	30	31
502	33	35	37	39	42	45	48	51	55	59
503	63	68	73	79	84	91	97	104	112	120
504	128	137	146	156	166	177	189	201	214	228
505	242	257	272	288	305	323	341	360	380	401
506	423	446	469	494	519	546	574	602	632	662
507	694	726	760	794	830	866	904	943	983	1,024
508	1,065	1,108	1,152	1,197	1,244	1,291	1,339	1,388	1,438	1,490
509	1,542	1,596	1,651	1,708	1,765	1,824	1,884	1,946	2,009	2,074
510	2,141	2,209	2,279	2,351	2,425	2,500	2,577	2,655	2,736	2,818
511	2,903	2,990	3,079	3,171	3,265	3,361	3,460	3,562	3,666	3,772
512	3,880	3,991	4,105	4,221	4,340	4,461	4,586	4,714	4,845	4,980
513	5,118	5,260	5,406	5,556	5,709	5,867	6,028	6,194	6,362	6,535
514	6,712	6,892	7,076	7,265	7,458	7,655	7,857	8,065	8,276	8,493
515	8,716	8,943	9,177	9,415	9,659	9,907	10,161	10,421	10,687	10,959
516	11,238	11,522	11,812	12,108	12,411	12,719	13,033	13,353	13,678	14,009
517	14,345	14,686	15,032	15,382	15,738	16,098	16,462	16,831	17,204	17,582
518	17,963	18,348	18,737	19,129	19,525	19,925	20,328	20,736	21,146	21,561
519	21,980	22,402	22,828	23,257	23,690	24,126	24,565	25,007	25,452	25,900
520	26,350	26,804	27,259	27,718	28,178	28,641	29,106	29,574	30,043	30,515
521	30,989	31,466	31,945	32,426	32,909	33,395	33,882	34,372	34,863	35,357
522	35,853	36,351	36,852	37,354	37,859	38,366	38,876	39,388	39,903	40,421
523	40,940	41,463	41,988	42,516	43,046	43,579	44,114	44,652	45,192	45,735
524	46,280	46,828	47,378	47,931	48,487	49,045	49,606	50,171	50,738	51,308
525	51,881	52,457	53,037	53,619	54,204	54,793	55,385	55,980	56,578	57,180
526	57,785	58,393	59,006	59,622	60,242	60,867	61,495	62,127	62,763	63,402
527	64,046	64,693	65,344	65,998	66,657	67,320	67,986	68,657	69,332	70,012
528	70,696	71,385	72,079	72,777	73,481	74,189	74,902	75,621	76,345	77,076
529	77,811	78,552	79,299	80,050	80,808	81,570	82,338	83,112	83,891	84,675
530	85,464	86,258	87,058	87,862	88,673	89,487	90,307	91,132	91,962	92,797
531	93,637	94,481	95,331	96,186	97,045	97,909	98,777	99,651	100,530	101,415
532	102,304	103,199	104,100	105,005	105,917	106,833	107,753	108,679	109,608	110,542
533	111,481	112,424	113,372	114,324	115,281	116,242	117,206	118,175	119,148	120,126
534	121,106	122,091	123,081	124,074	125,072	126,073	127,078	128,087	129,100	130,117
535	131,138	132,162	133,191	134,223	135,260	136,300	137,345	138,395	139,449	140,509
536	141,573	142,641	143,715	144,794	145,878	146,967	148,062	149,162	150,268	151,380
537	152,498	153,621	154,752	155,888	157,031	158,180	159,335	160,498	161,667	162,843
538	164,024	165,212	166,408	167,609	168,817	170,032	171,252	172,479	173,712	174,950
539	176,193	177,441	178,696	179,955	181,221	182,492	183,767	185,050	186,337	187,630
540	188,930	190,235	191,548	192,867	194,193	195,526	196,865	198,212	199,565	200,926
541	202,292	203,666	205,047	206,433	207,827	209,226	210,631	212,043	213,459	214,883
542	216,311	217,746	219,188	220,634	222,089	223,548	225,013	226,485	227,962	229,446
543	230,935	232,430	233,931	235,439	236,953	238,474	240,002	241,539	243,082	244,633
544	246,191	247,756	249,330	250,910	252,498	254,092	255,695	257,306	258,924	260,550
545	262,182	263,821	265,467	267,120	268,780	270,445	272,118	273,798	275,483	277,176
546	278,874	280,579	282,292	284,010	285,735	287,466	289,204	290,949	292,700	294,459
547	296,223	297,994	299,774	301,560	303,356	305,158	306,969	308,788	310,614	312,449

Appendix C
Eufaula Lake
RESERVOIR AREA TABLE

TEXAS WATER DEVELOPMENT BOARD

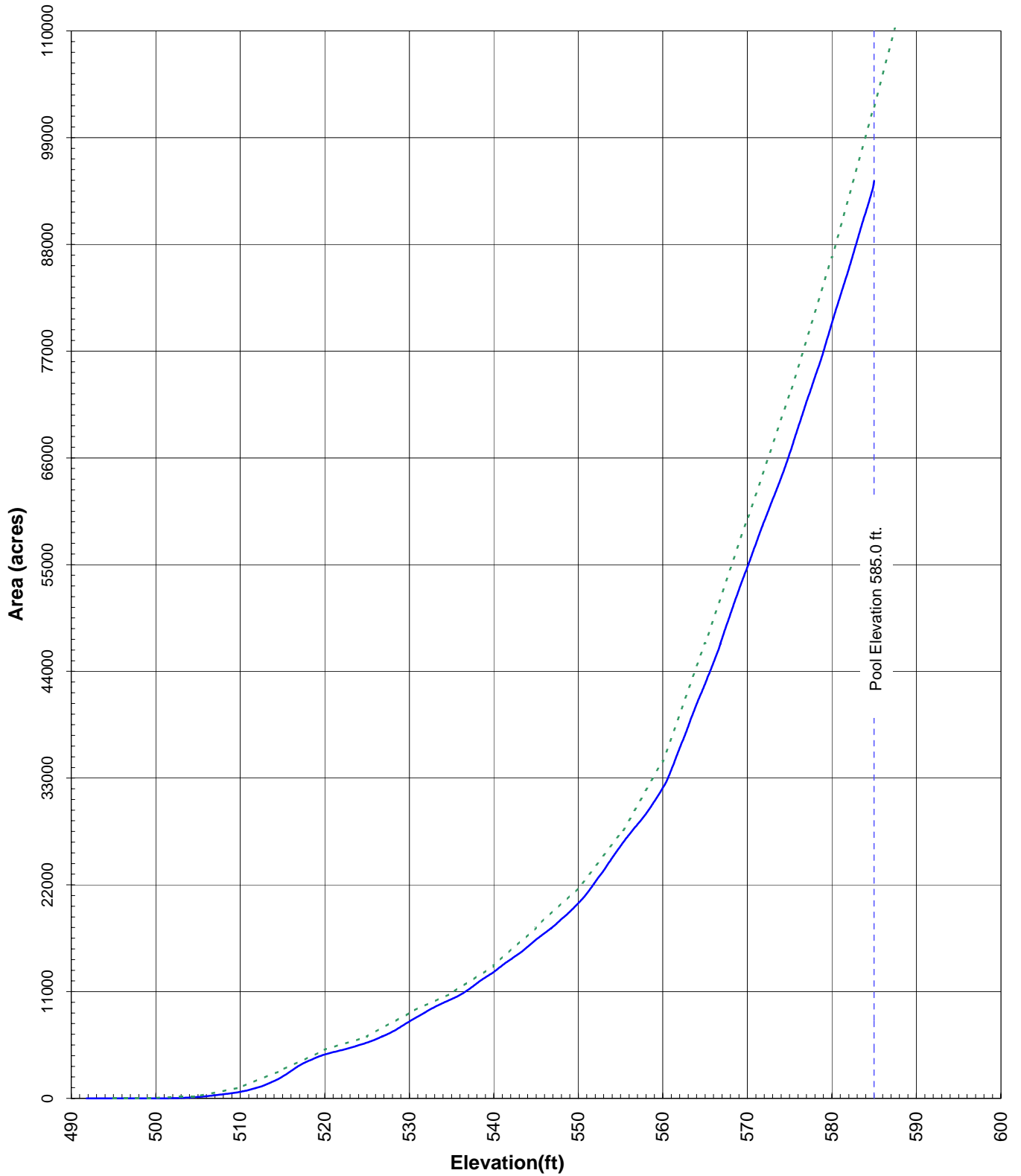
SEPTEMBER 2004 SURVEY
 Power Pool Elevation 585.0 ft

ELEVATION in Feet	AREA IN ACRES									
	0.0	0.1	0.2	0.3	0.4	0.5	0.6	0.7	0.8	0.9
491									0	0
492	0	0	0	0	0	0	0	0	0	0
493	0	0	0	0	0	0	0	0	0	0
494	0	0	0	0	0	0	0	0	0	0
495	0	0	0	0	0	1	1	1	1	1
496	1	1	1	1	1	1	1	1	1	1
497	1	2	2	2	2	2	2	2	2	2
498	3	3	3	3	3	3	3	4	4	4
499	4	4	4	5	5	5	5	6	6	6
500	6	7	7	7	8	8	8	9	9	9
501	10	10	11	11	12	12	13	14	15	16
502	18	20	22	25	27	30	33	36	39	42
503	45	49	52	56	60	63	68	73	77	82
504	86	90	95	101	107	113	119	126	132	138
505	145	151	158	164	172	180	187	196	204	214
506	224	233	242	251	260	270	281	290	300	310
507	320	330	340	350	361	372	383	393	403	413
508	424	434	446	456	467	477	487	497	508	519
509	532	545	557	570	583	596	610	625	641	658
510	675	692	710	727	744	760	777	795	815	836
511	859	881	904	928	953	977	1,002	1,026	1,050	1,074
512	1,097	1,121	1,148	1,175	1,202	1,231	1,262	1,295	1,329	1,365
513	1,402	1,440	1,477	1,518	1,557	1,595	1,633	1,671	1,708	1,746
514	1,783	1,822	1,863	1,908	1,952	1,999	2,047	2,094	2,144	2,196
515	2,250	2,305	2,359	2,409	2,459	2,512	2,570	2,628	2,691	2,753
516	2,813	2,873	2,933	2,992	3,050	3,110	3,170	3,227	3,282	3,336
517	3,386	3,434	3,483	3,530	3,576	3,623	3,668	3,711	3,753	3,794
518	3,833	3,869	3,905	3,941	3,978	4,015	4,053	4,090	4,128	4,166
519	4,203	4,239	4,275	4,310	4,343	4,376	4,407	4,437	4,465	4,493
520	4,520	4,545	4,570	4,593	4,617	4,640	4,663	4,685	4,708	4,731
521	4,754	4,777	4,800	4,822	4,844	4,865	4,885	4,906	4,927	4,949
522	4,971	4,993	5,015	5,037	5,061	5,085	5,110	5,134	5,160	5,186
523	5,211	5,238	5,265	5,290	5,315	5,341	5,366	5,391	5,415	5,440
524	5,465	5,491	5,517	5,543	5,570	5,598	5,627	5,656	5,686	5,716
525	5,747	5,777	5,808	5,839	5,870	5,902	5,934	5,966	6,000	6,033
526	6,068	6,104	6,142	6,183	6,224	6,264	6,302	6,339	6,376	6,414
527	6,452	6,490	6,529	6,567	6,607	6,646	6,687	6,729	6,773	6,818
528	6,867	6,915	6,961	7,008	7,057	7,107	7,160	7,216	7,274	7,329
529	7,383	7,437	7,490	7,544	7,600	7,655	7,709	7,761	7,813	7,865
530	7,917	7,970	8,022	8,073	8,125	8,175	8,224	8,274	8,323	8,374
531	8,424	8,473	8,520	8,567	8,615	8,663	8,712	8,762	8,816	8,869
532	8,923	8,979	9,033	9,087	9,137	9,183	9,228	9,272	9,318	9,364
533	9,411	9,456	9,501	9,545	9,587	9,627	9,668	9,710	9,750	9,790
534	9,831	9,873	9,915	9,955	9,994	10,032	10,070	10,110	10,148	10,187
535	10,226	10,265	10,304	10,344	10,386	10,429	10,474	10,520	10,568	10,616
536	10,663	10,712	10,763	10,814	10,866	10,920	10,974	11,030	11,089	11,147
537	11,208	11,269	11,331	11,395	11,460	11,527	11,592	11,657	11,722	11,785
538	11,851	11,916	11,982	12,048	12,113	12,177	12,239	12,297	12,352	12,407
539	12,461	12,515	12,569	12,624	12,679	12,735	12,790	12,844	12,902	12,964
540	13,029	13,092	13,158	13,224	13,291	13,361	13,432	13,501	13,567	13,635
541	13,702	13,770	13,837	13,901	13,962	14,024	14,084	14,142	14,200	14,260
542	14,319	14,379	14,441	14,505	14,566	14,626	14,685	14,744	14,803	14,862
543	14,922	14,982	15,044	15,109	15,176	15,248	15,324	15,398	15,471	15,544
544	15,617	15,693	15,766	15,840	15,913	15,988	16,067	16,143	16,218	16,291
545	16,359	16,427	16,494	16,561	16,627	16,696	16,761	16,825	16,890	16,955
546	17,020	17,086	17,152	17,217	17,281	17,348	17,414	17,479	17,545	17,611
547	17,680	17,754	17,830	17,909	17,989	18,069	18,148	18,228	18,306	18,385



Eufaula Lake
 September 2004
 Prepared by: TWDB

Appendix D Elevation vs. Volume

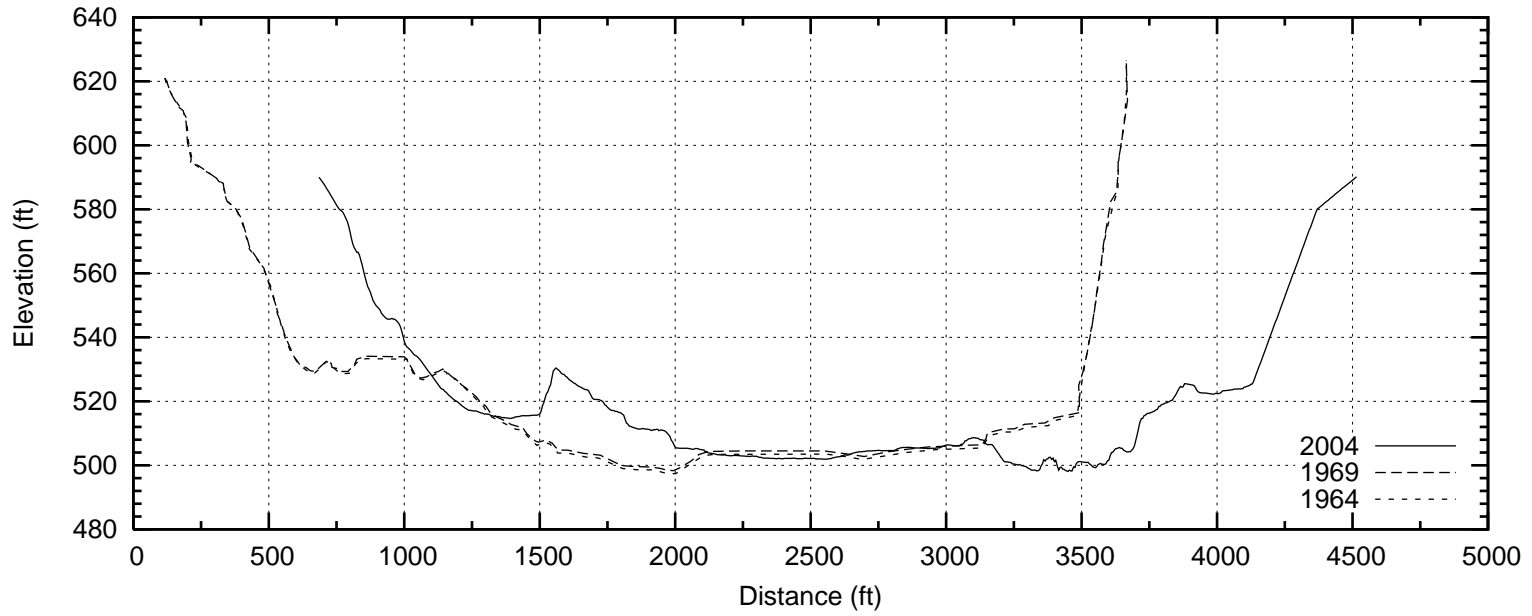


Pool Elevation 585.0'
Area 2004
Area 1969

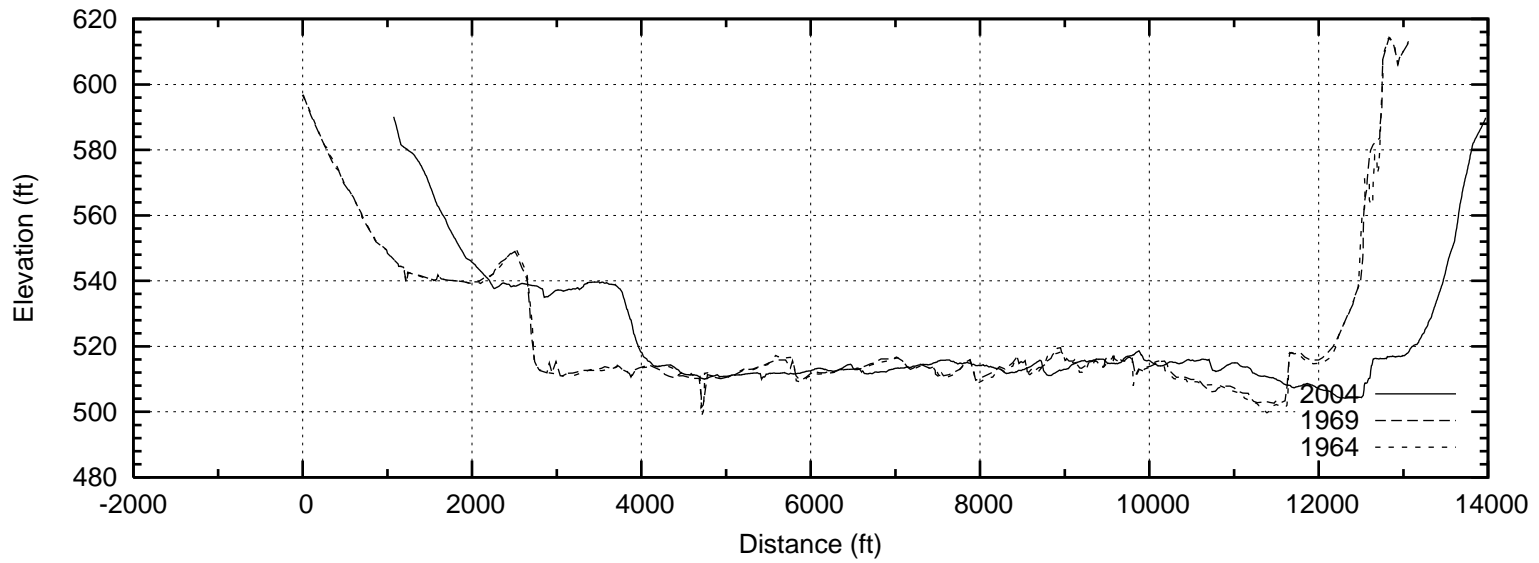
Eufaula Lake
 September 2004
 Prepared by: TWDB

Eufaula Lake

Range Line SR01

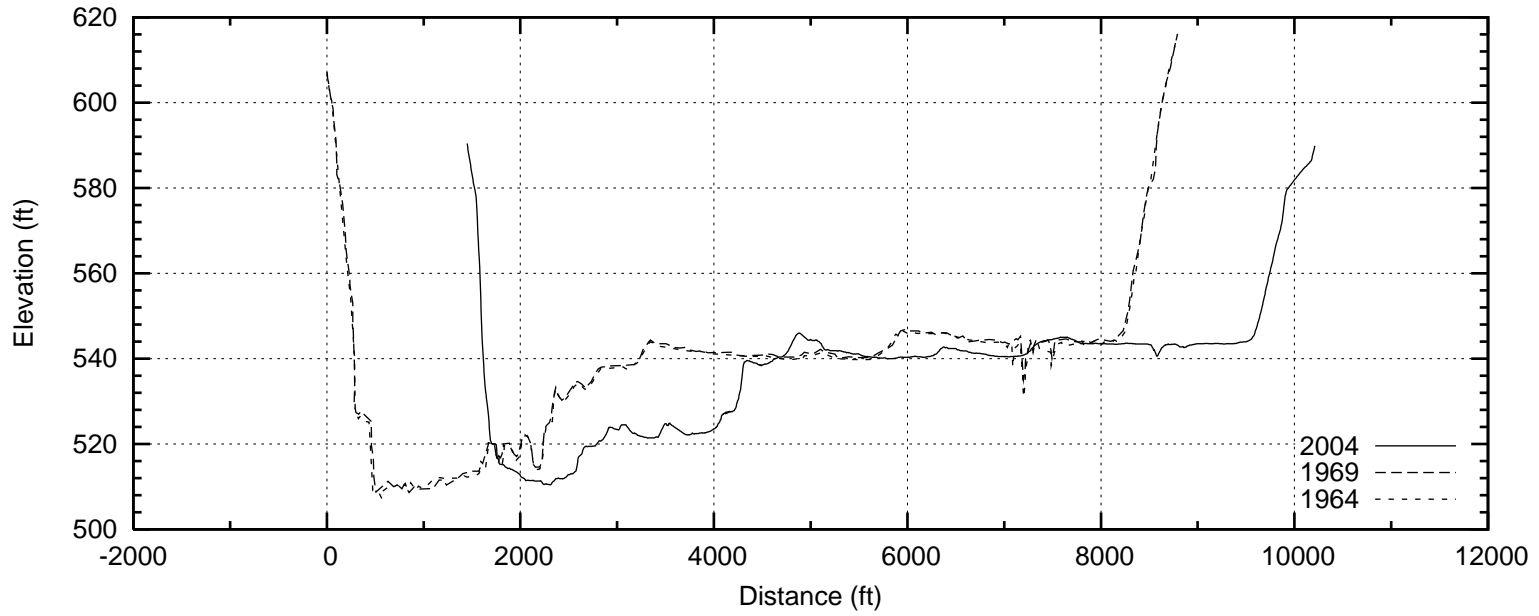


Range Line SR02

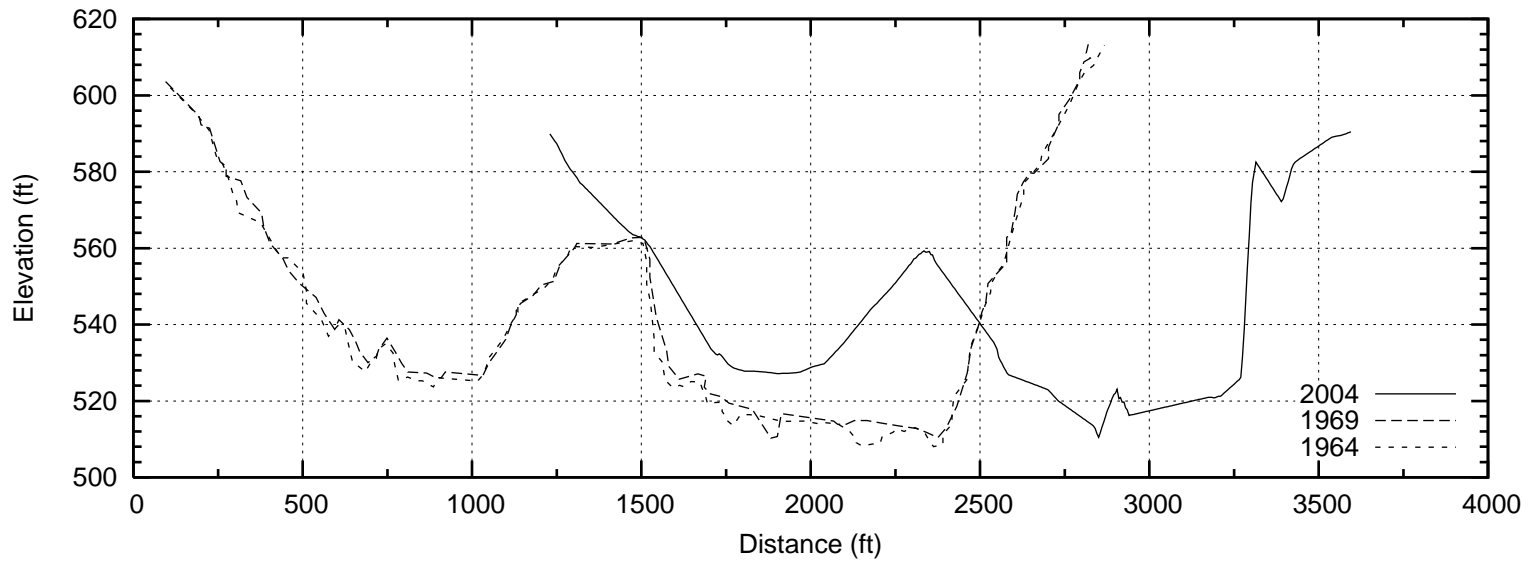


Eufaula Lake

Range Line SR03

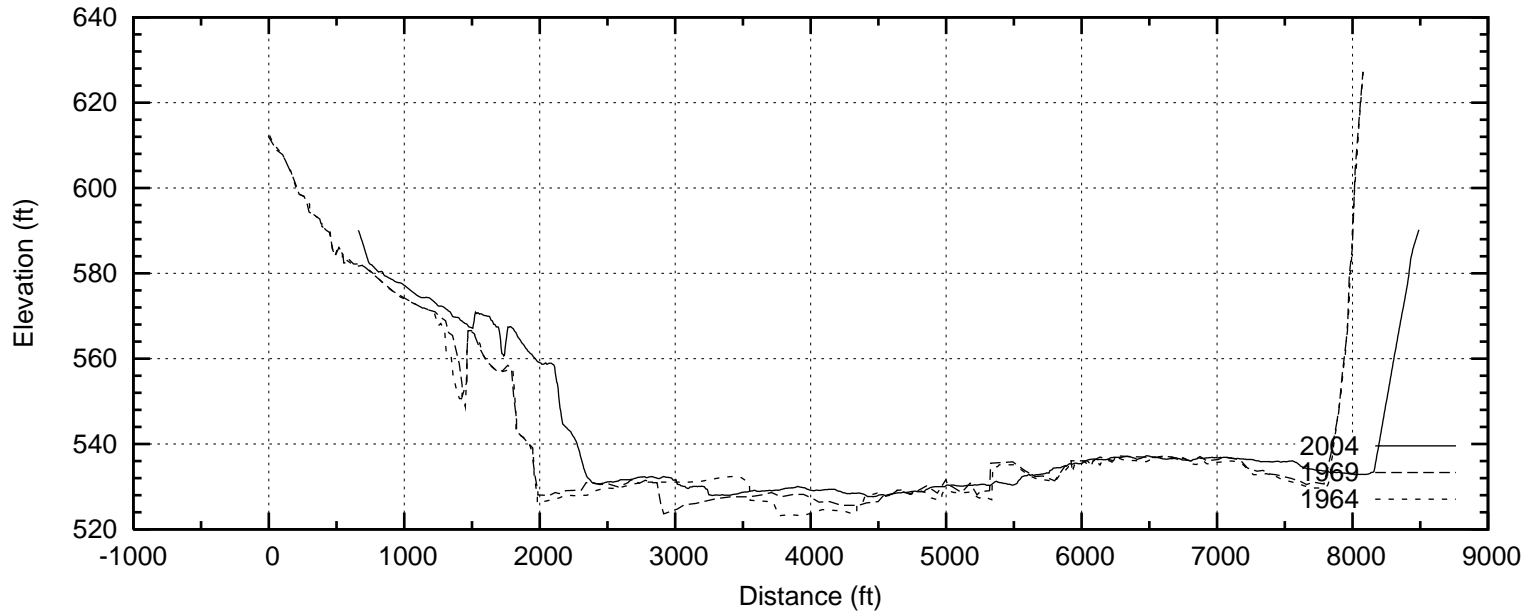


Range Line SR04

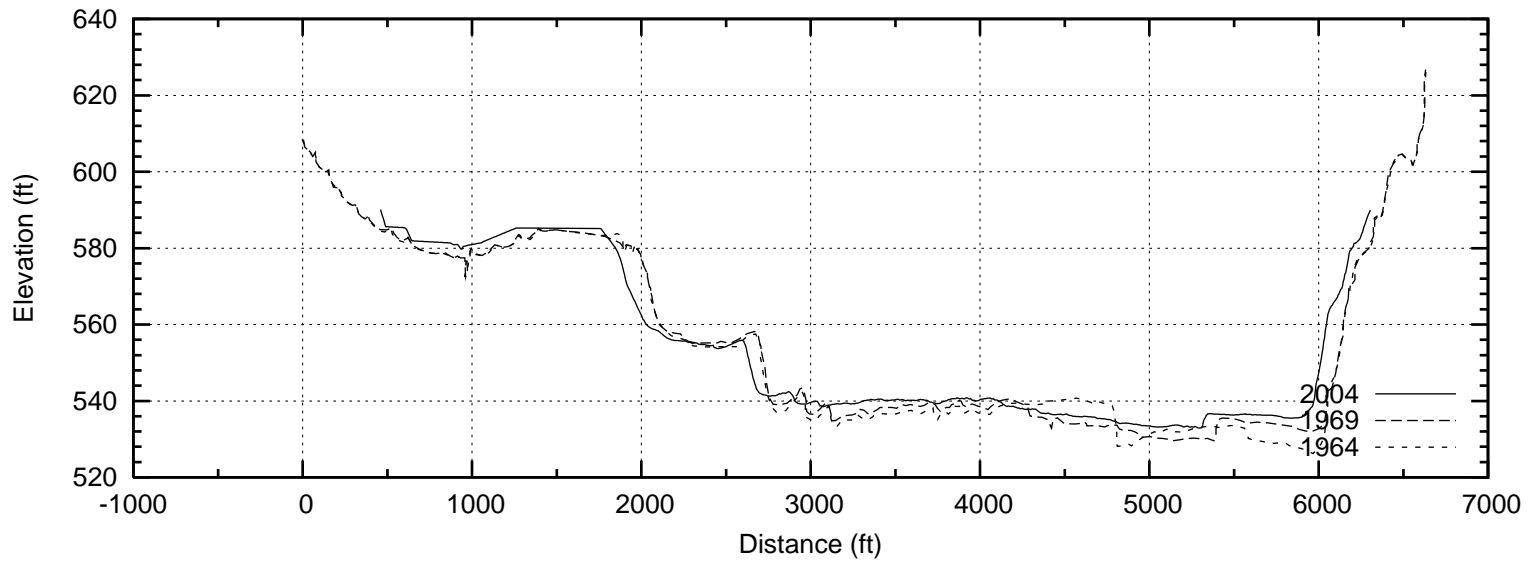


Eufaula Lake

Range Line SR05

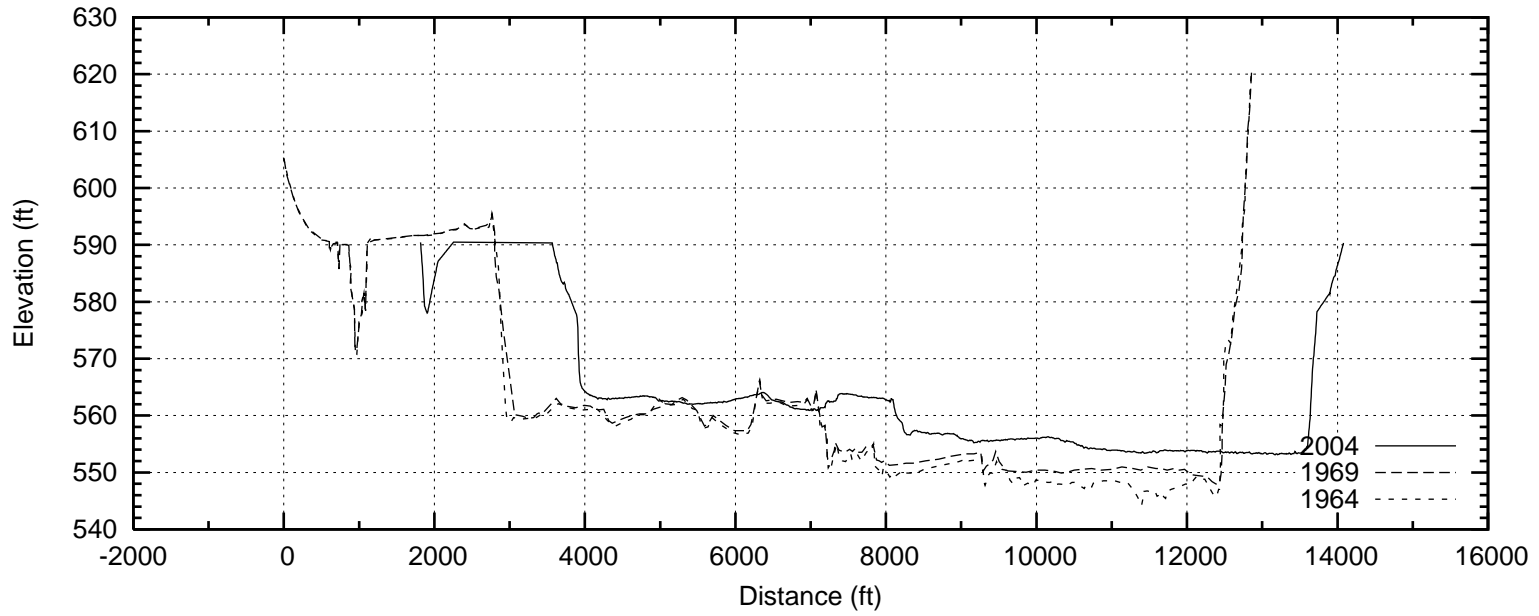


Range Line SR06

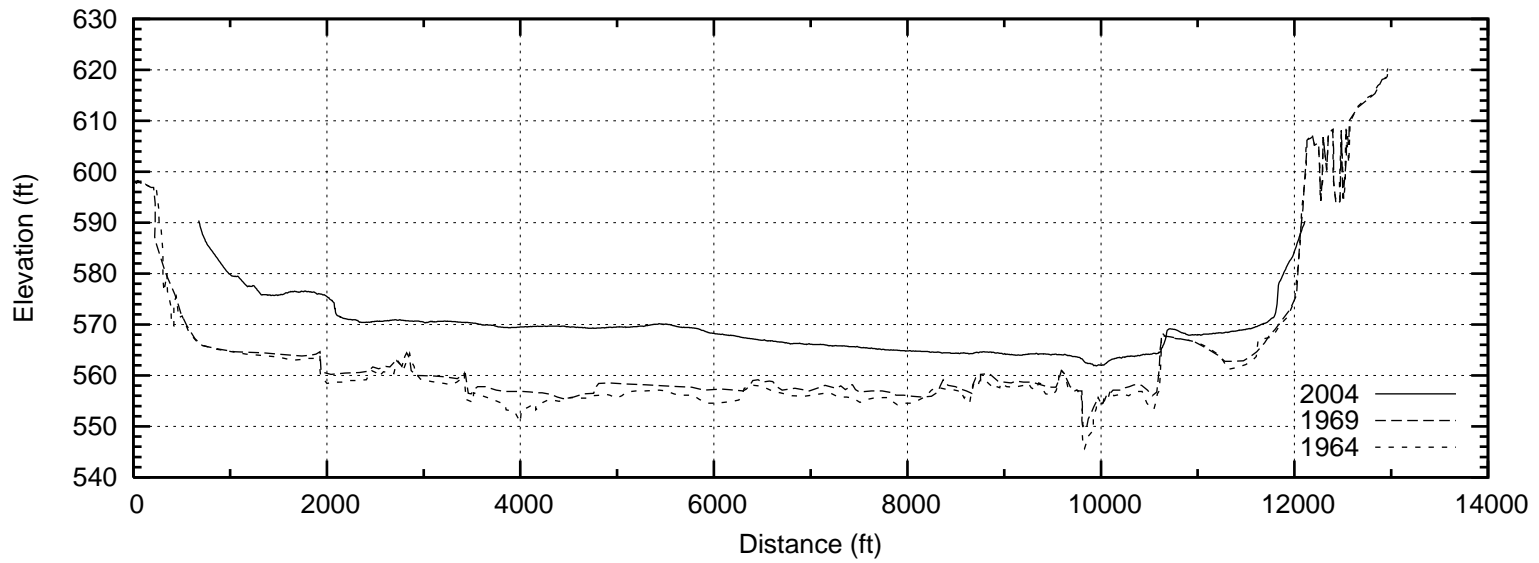


Eufaula Lake

Range Line SR07

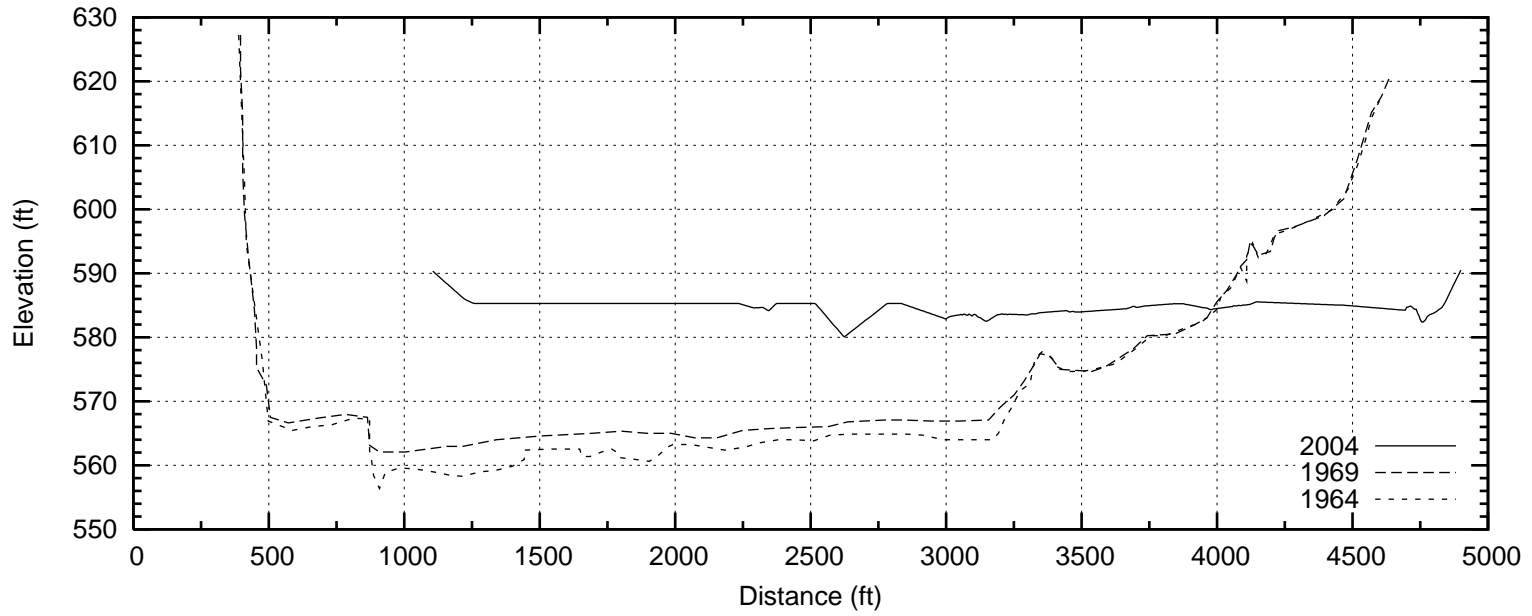


Range Line SR08

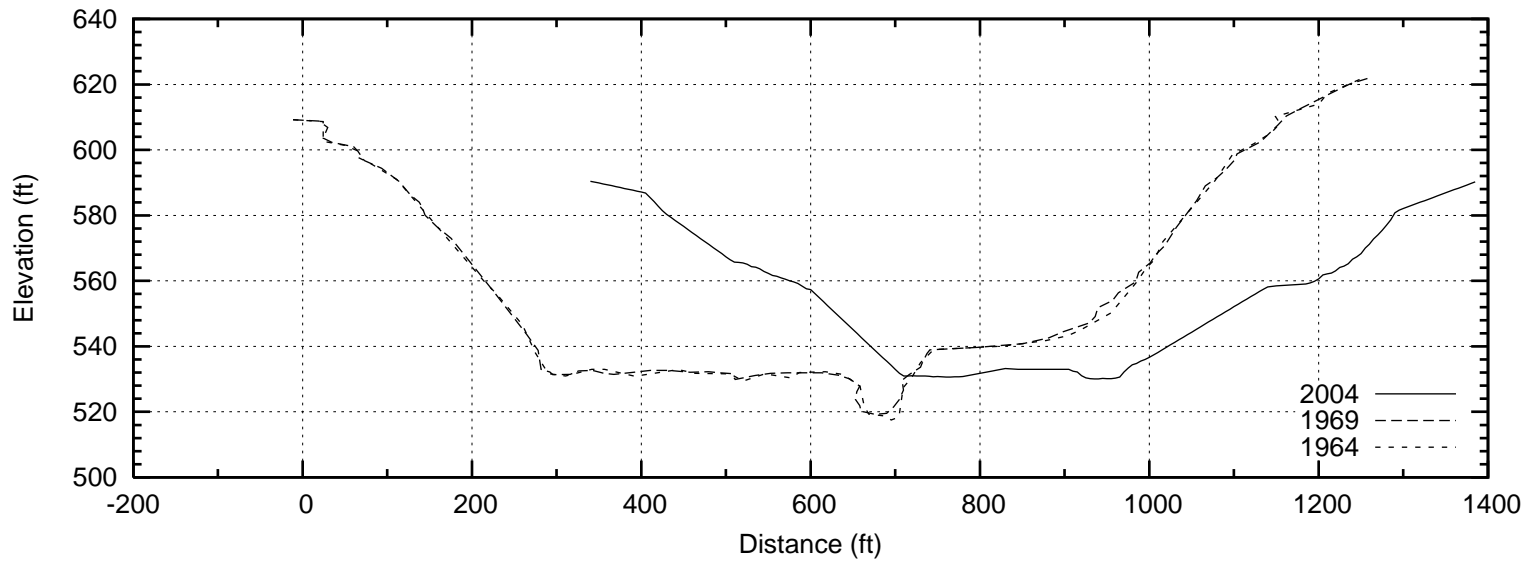


Eufaula Lake

Range Line SR09

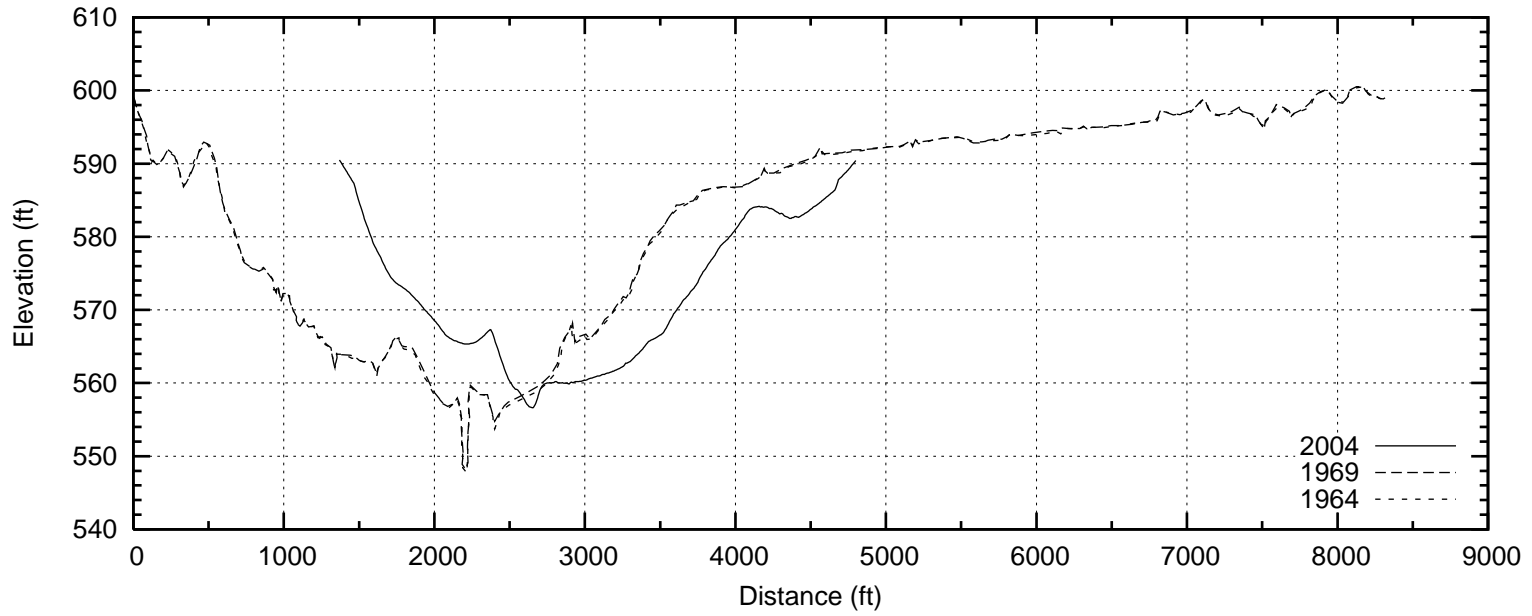


Range Line SR22

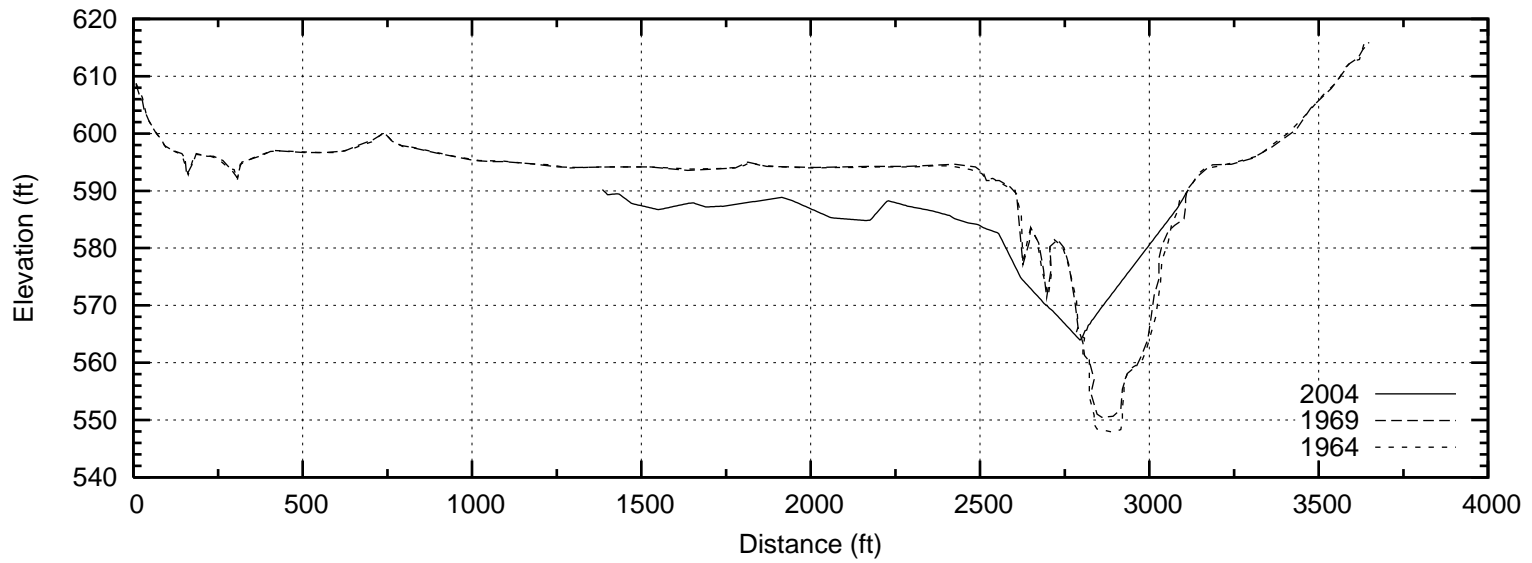


Eufaula Lake

Range Line SR23

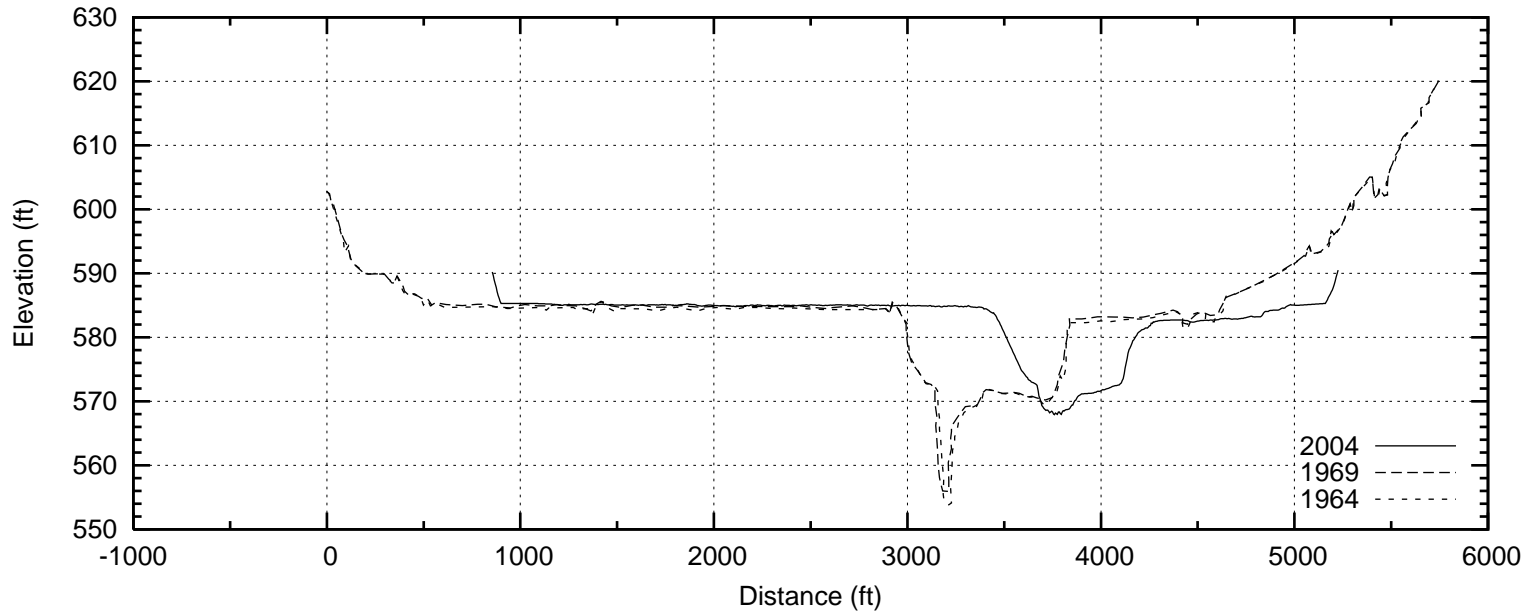


Range Line SR24

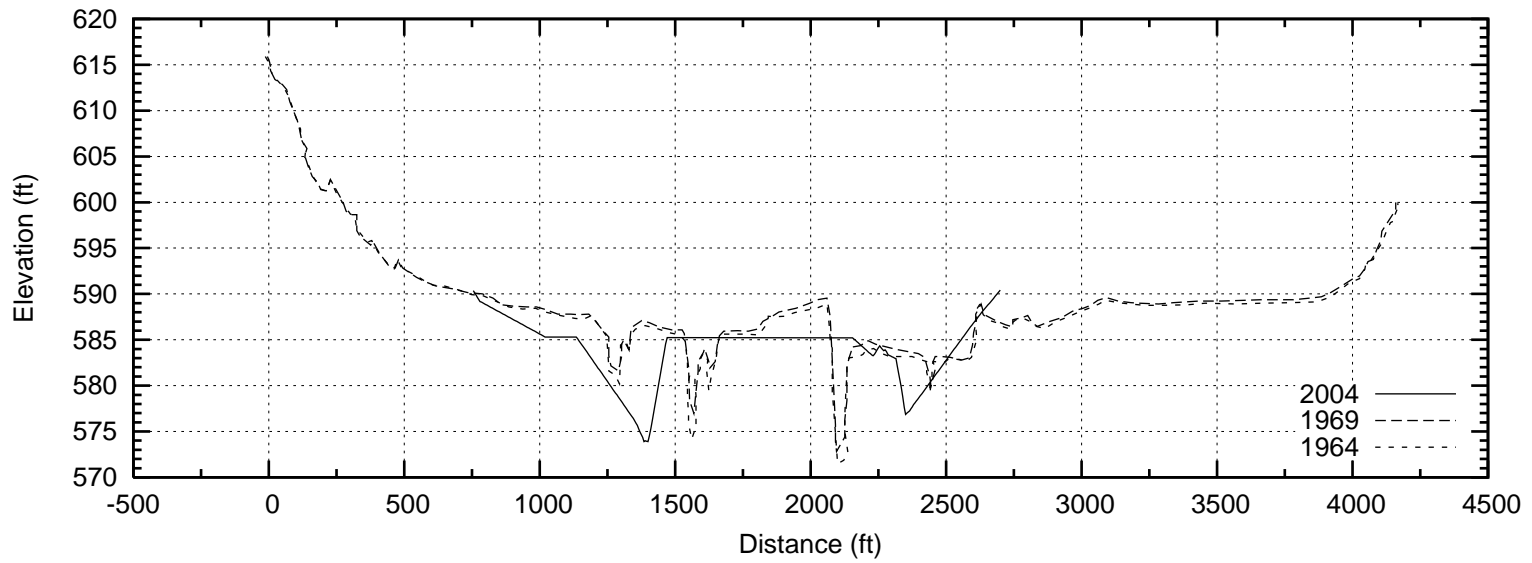


Eufaula Lake

Range Line SR25

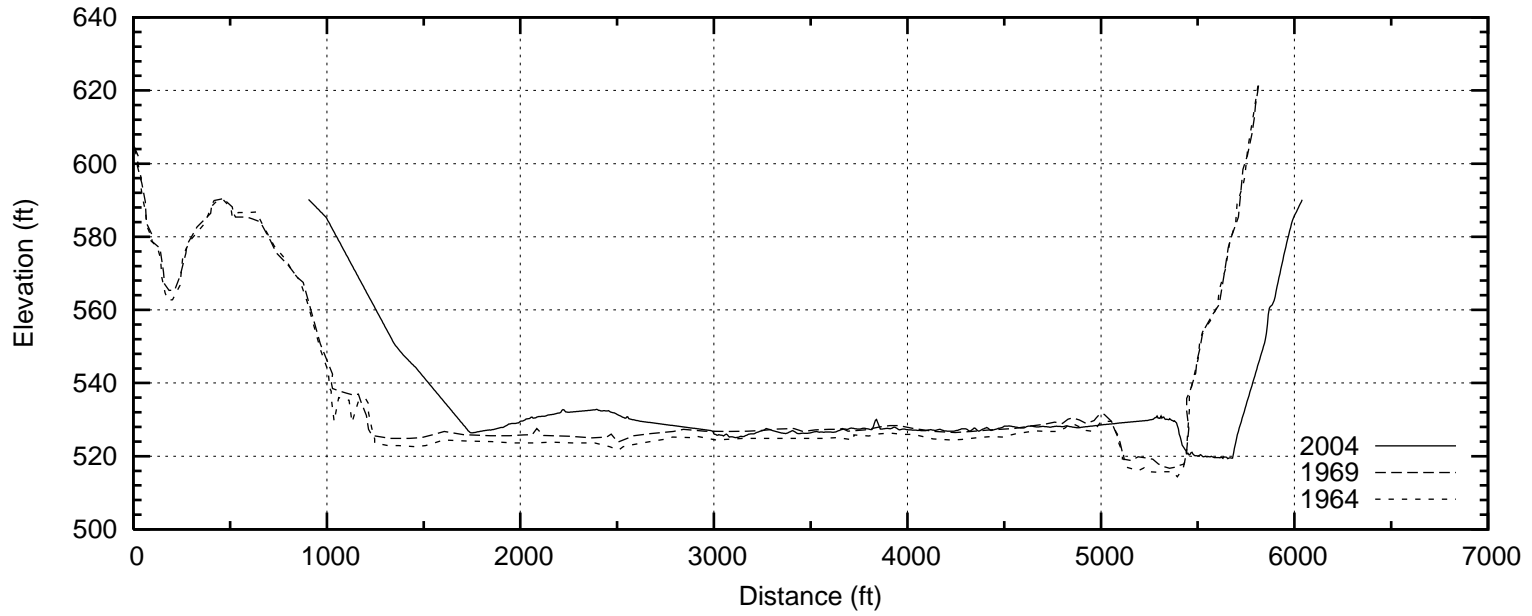


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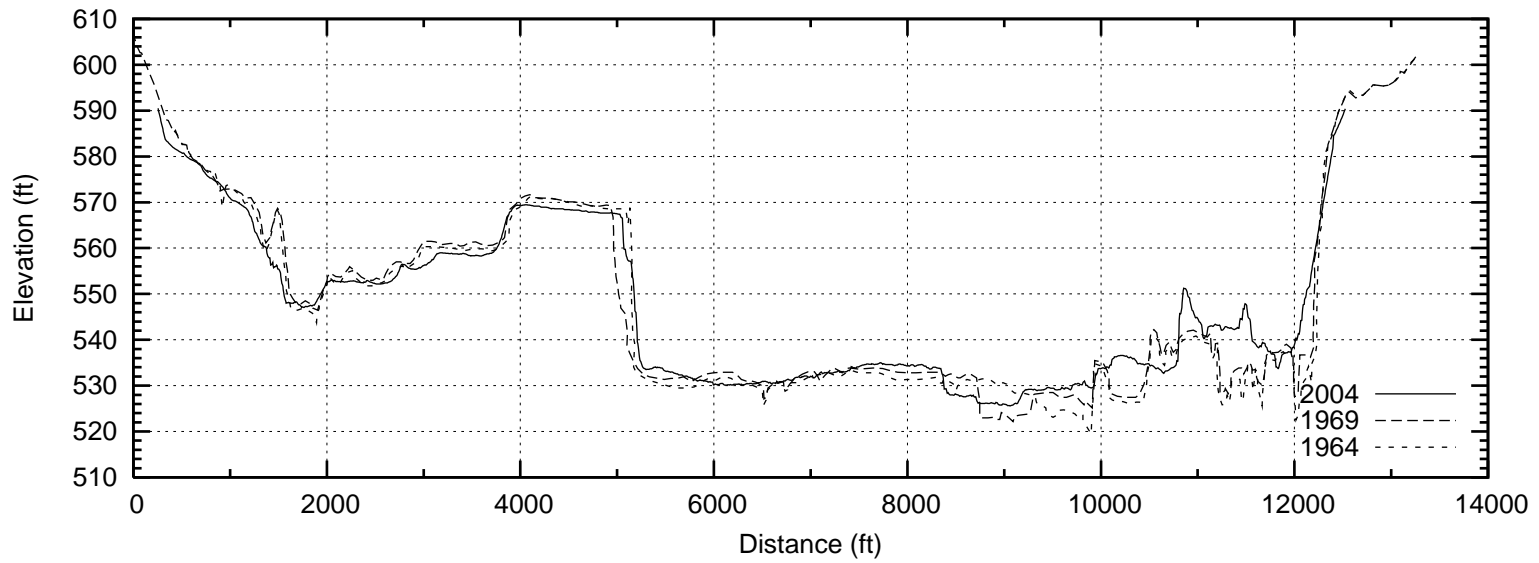


Eufaula Lake

Range Line SR27

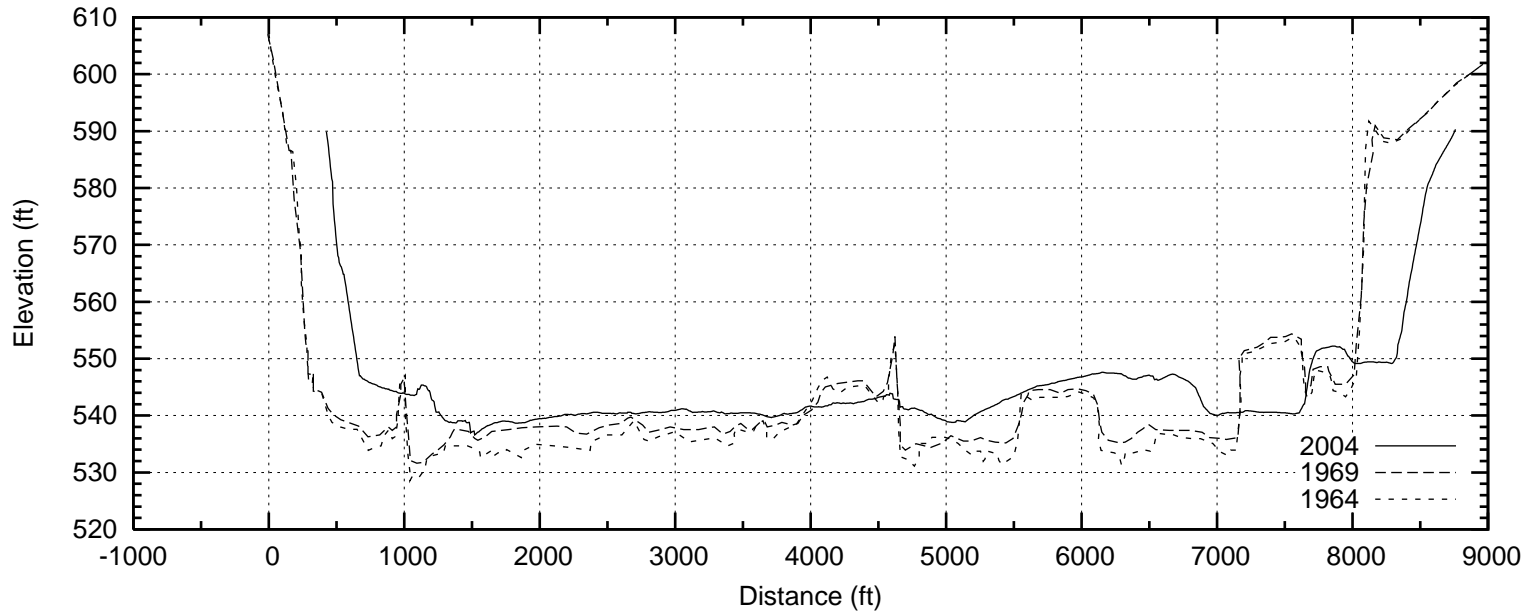


Range Line SR28

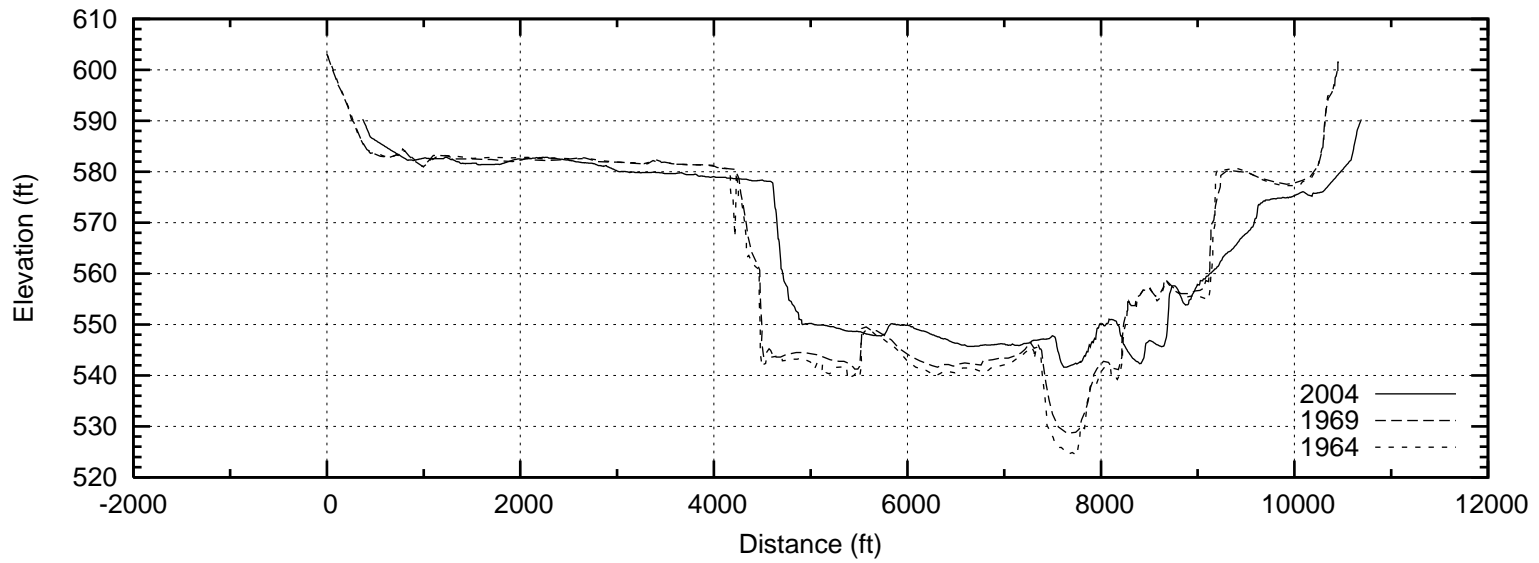


Eufaula Lake

Range Line SR29

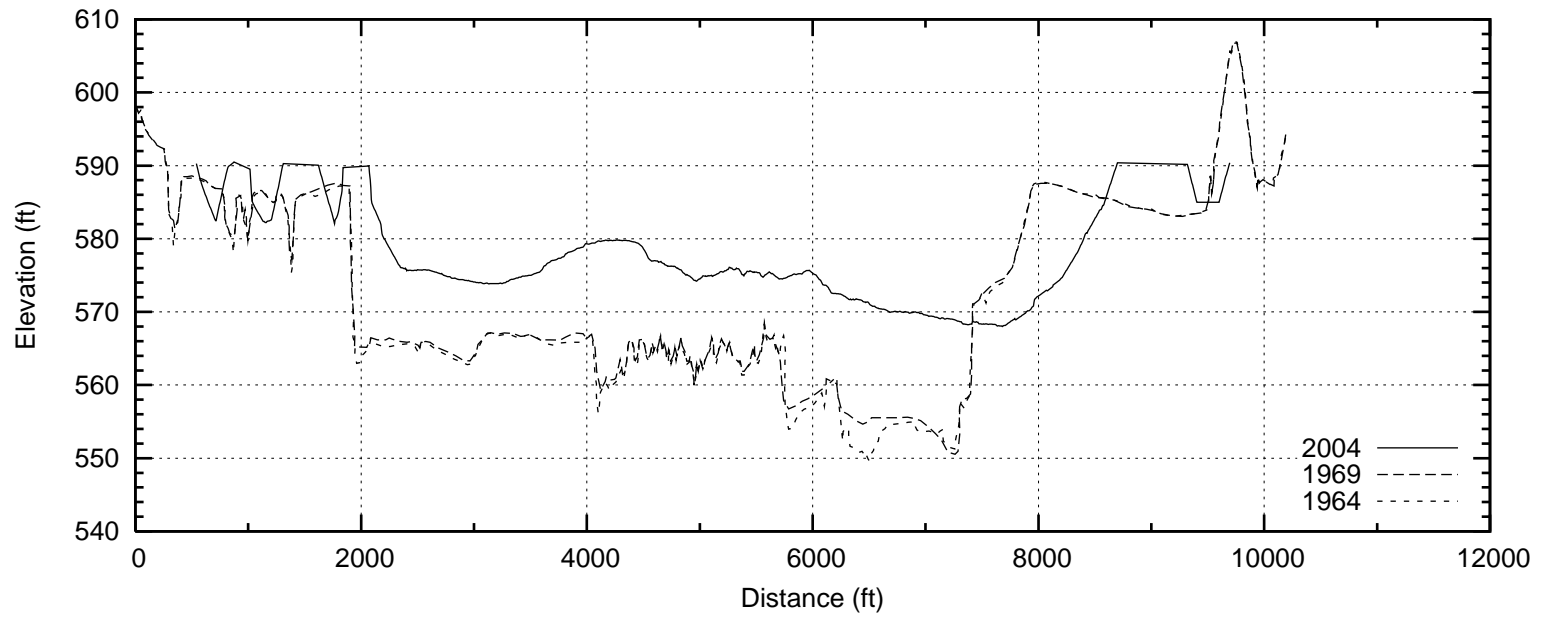


Range Line SR30

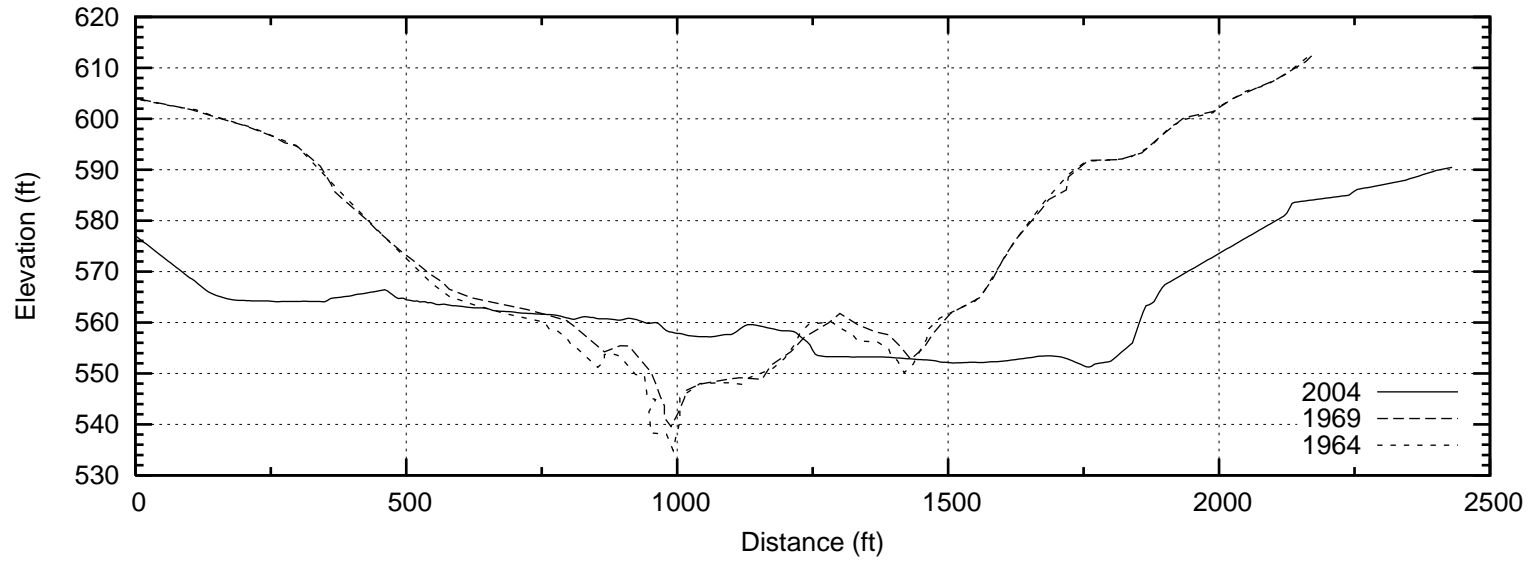


Eufaula Lake

Range Line SR31

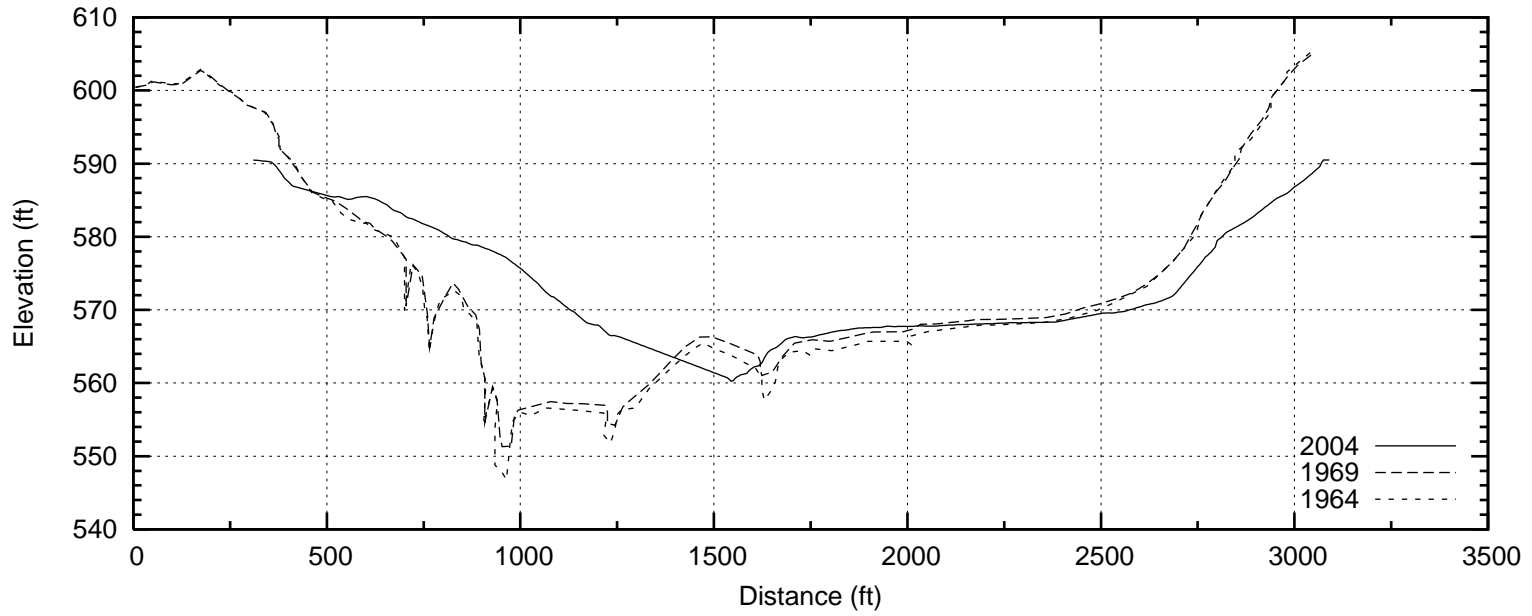


Range Line SR43

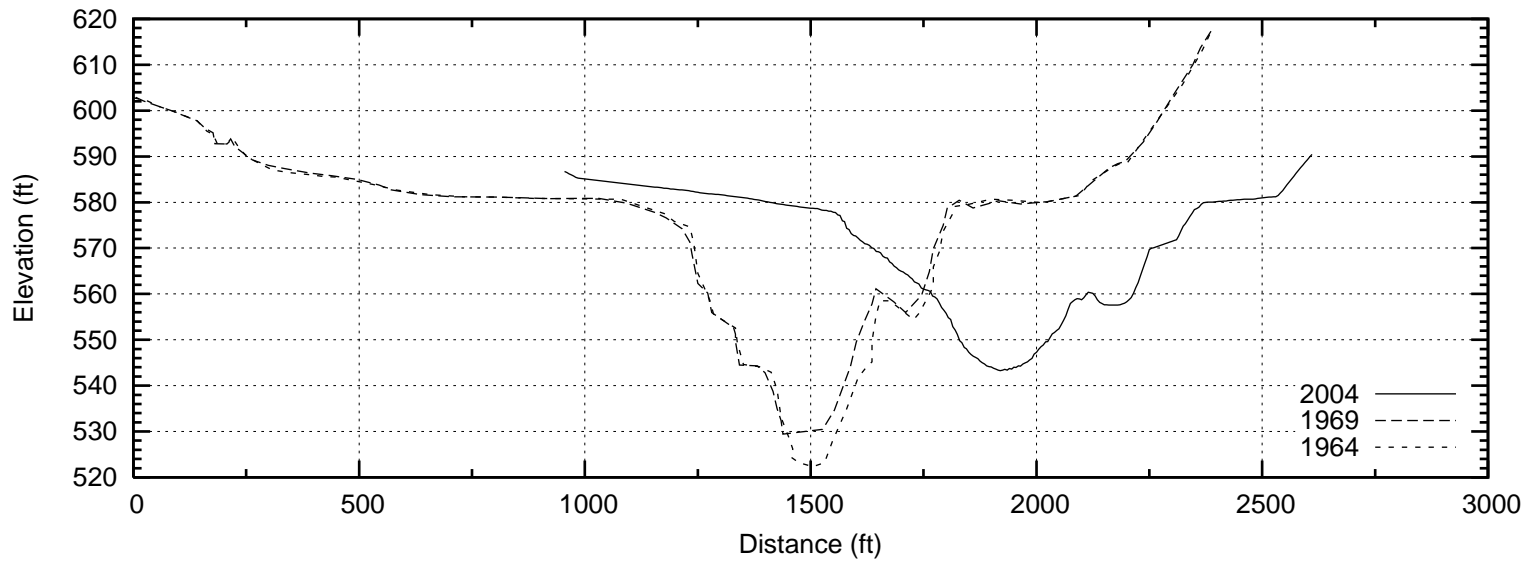


Eufaula Lake

Range Line SR44

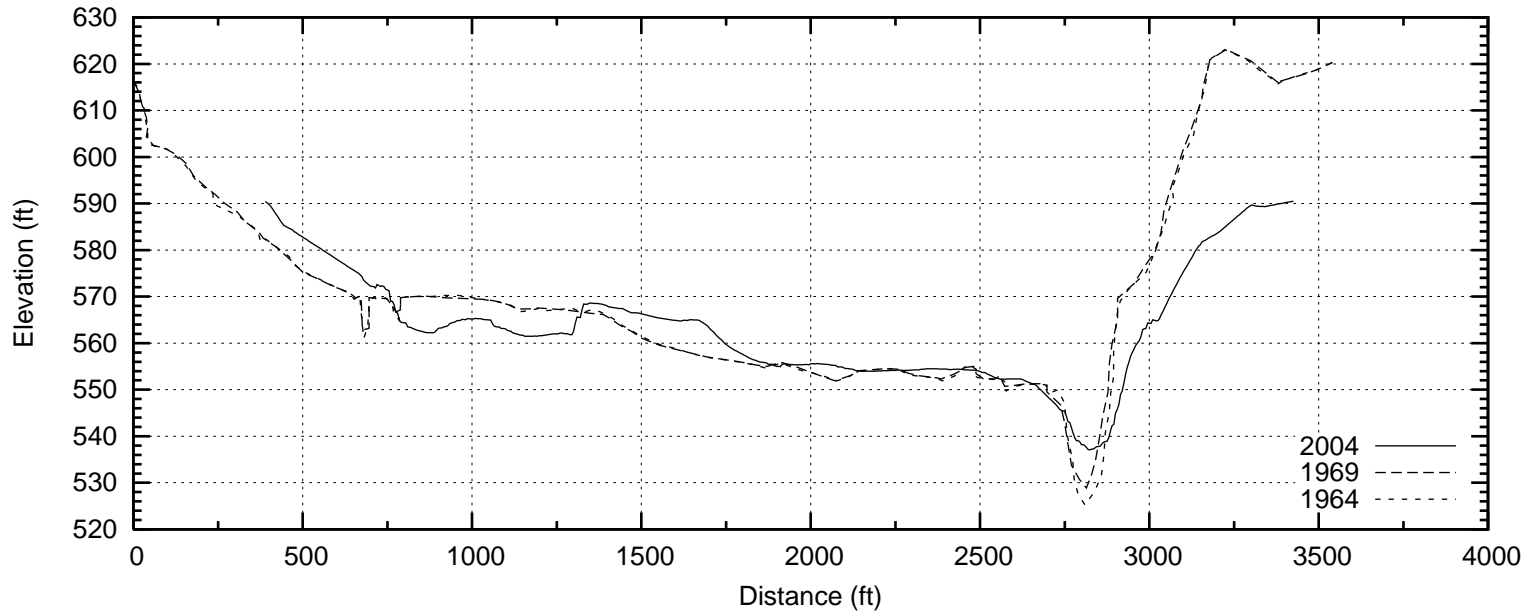


Range Line SR45

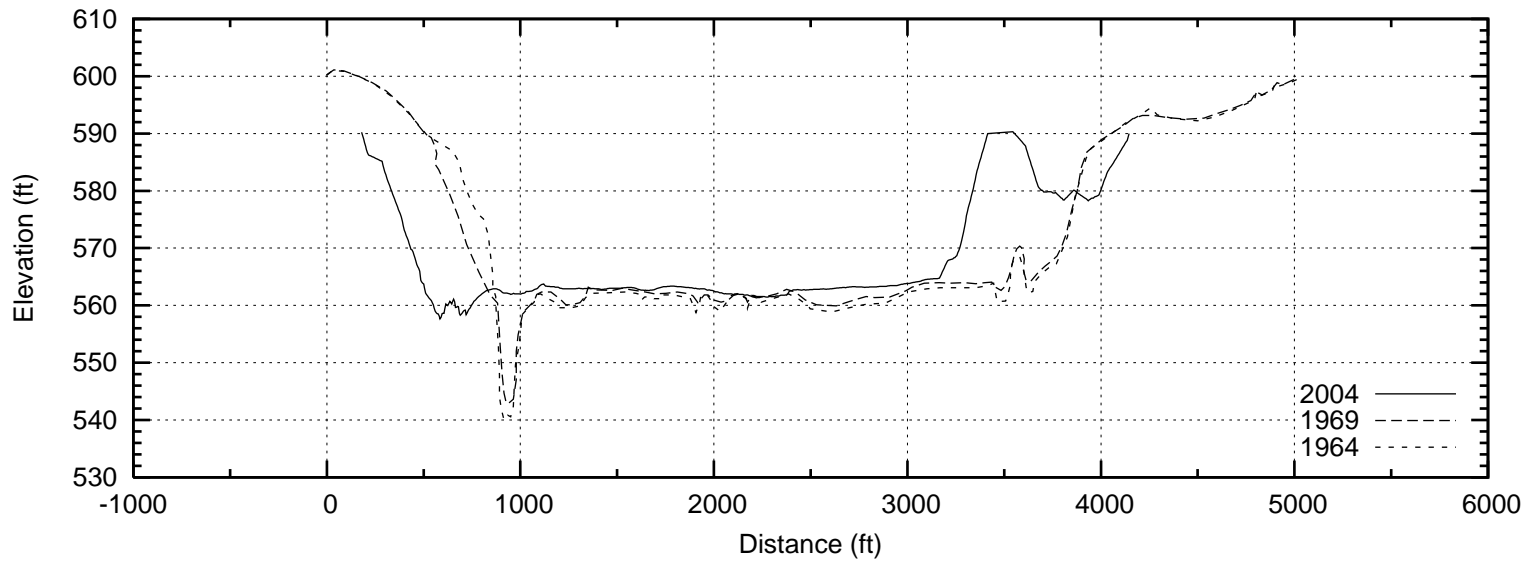


Eufaula Lake

Range Line SR46

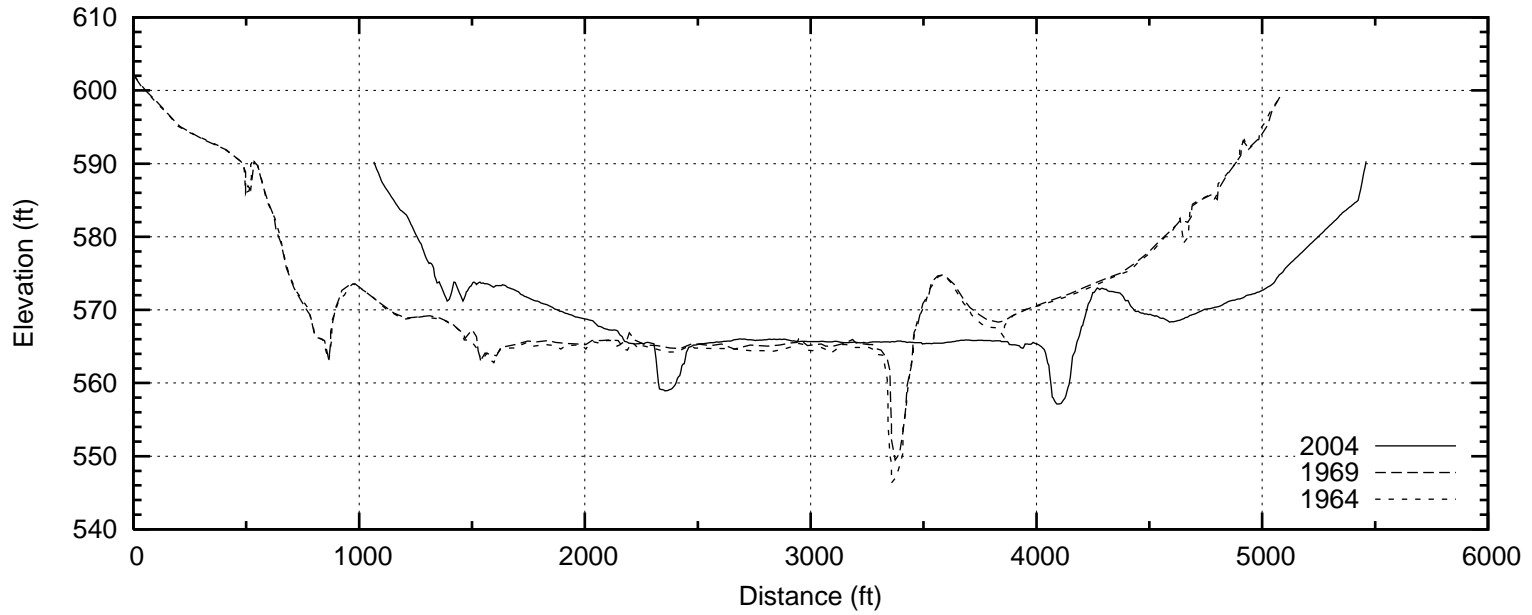


Range Line SR47

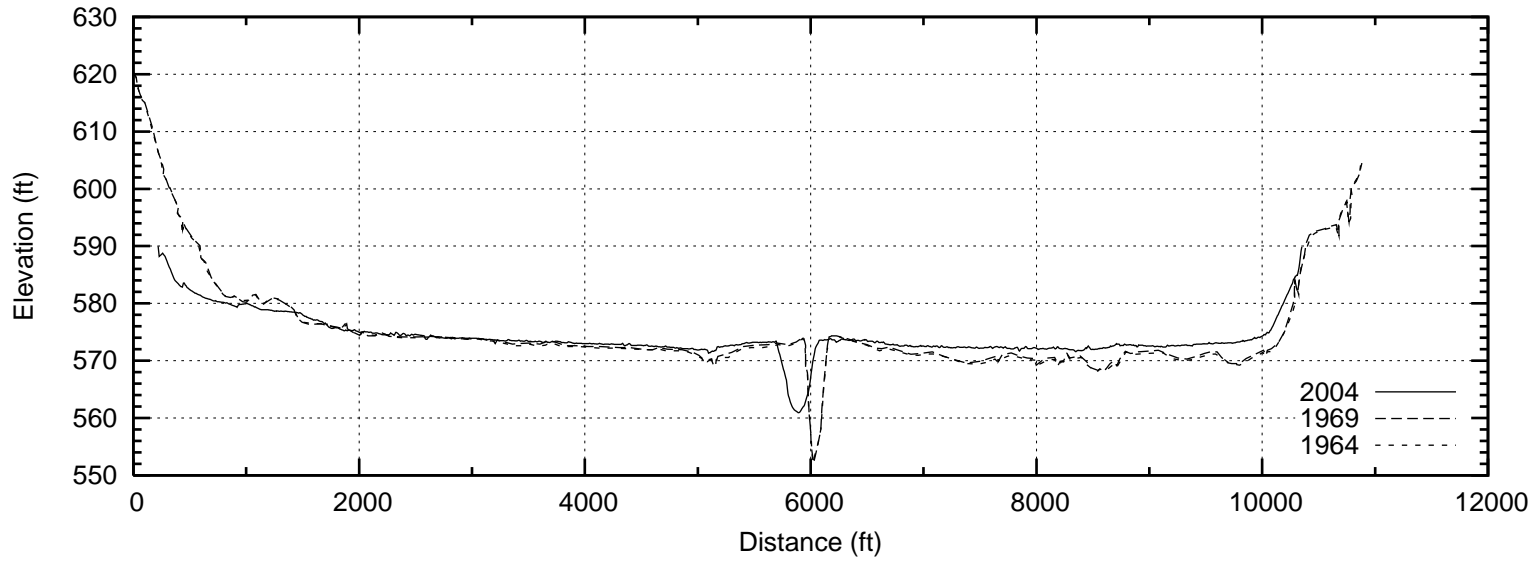


Eufaula Lake

Range Line SR48

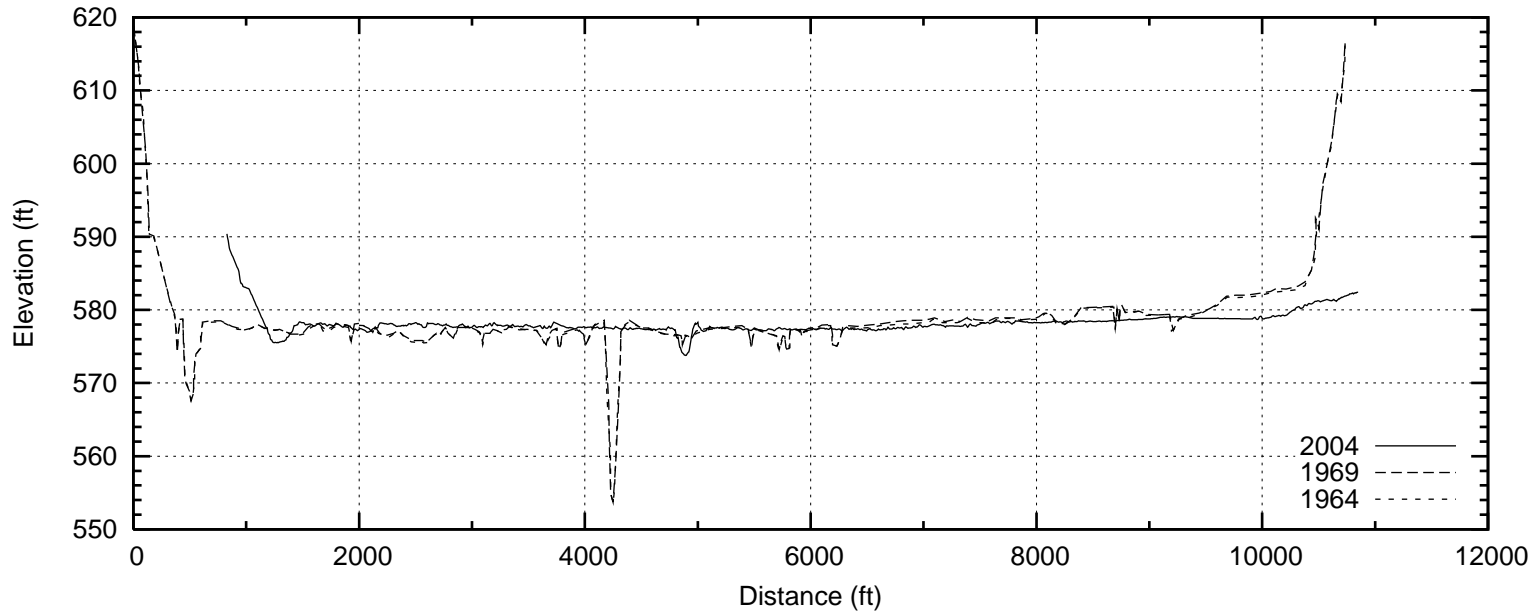


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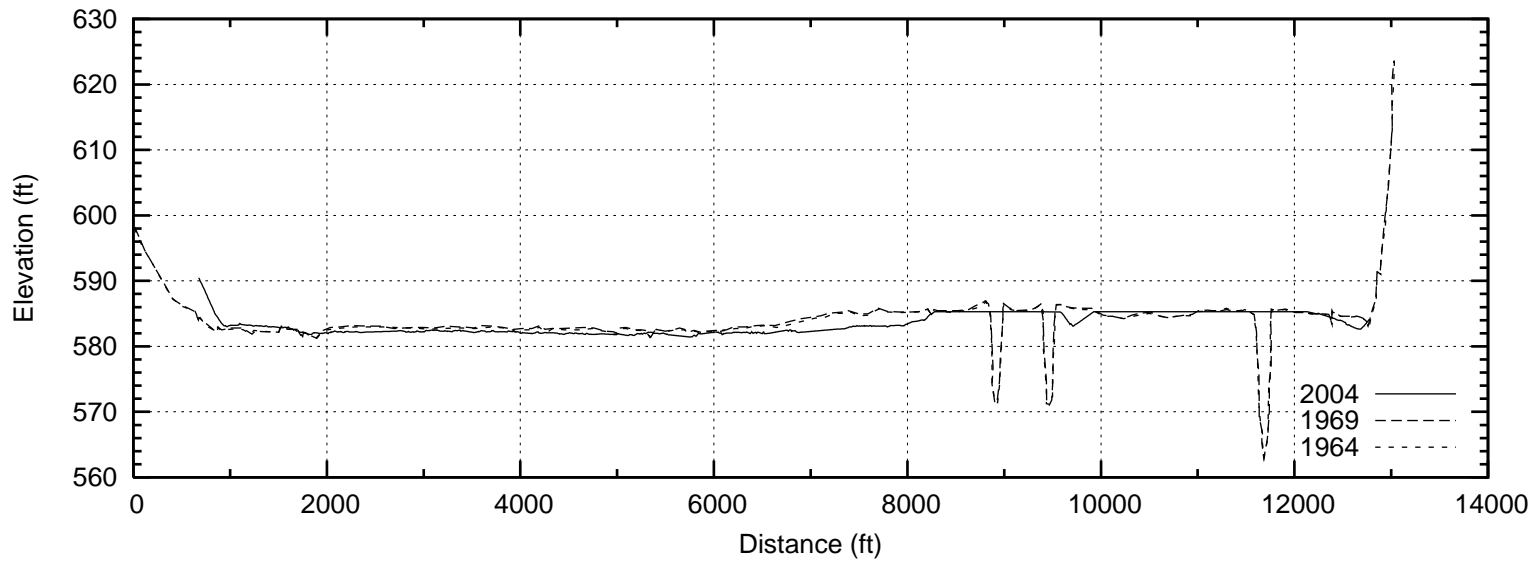


Eufaula Lake

Range Line SR50

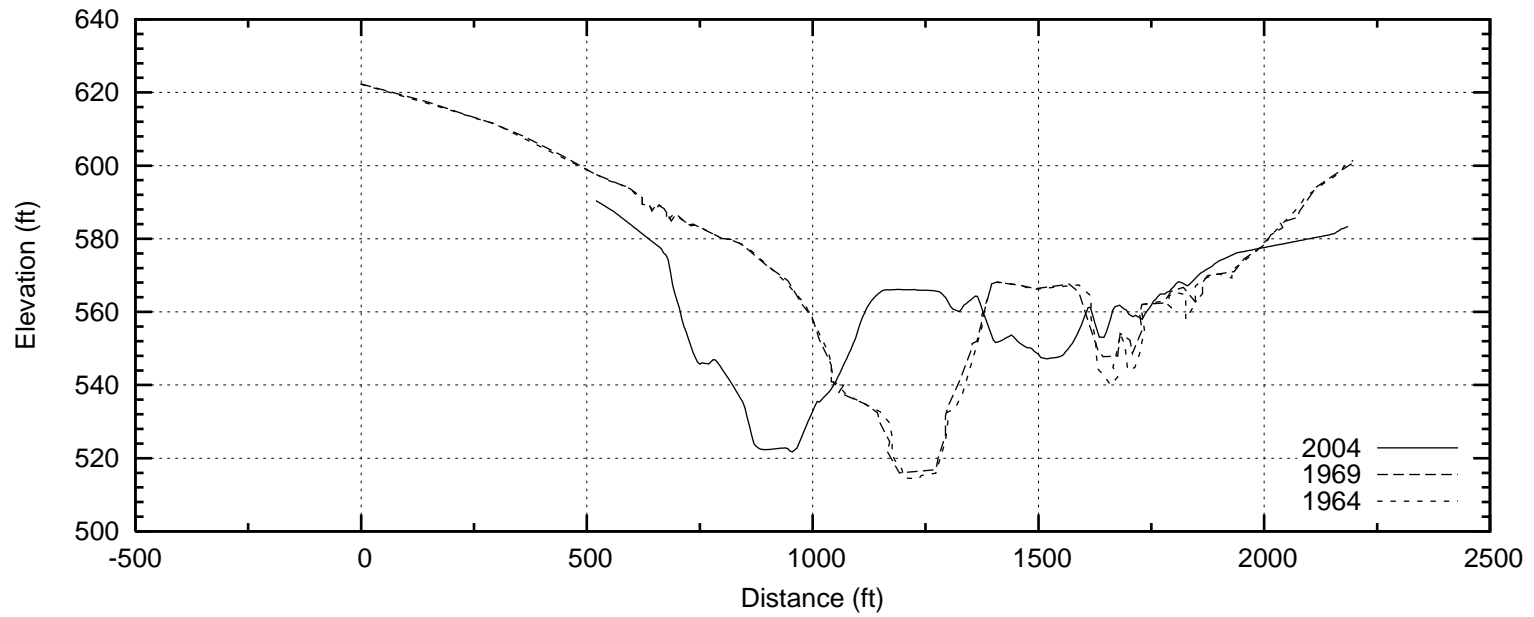


Range Line SR51

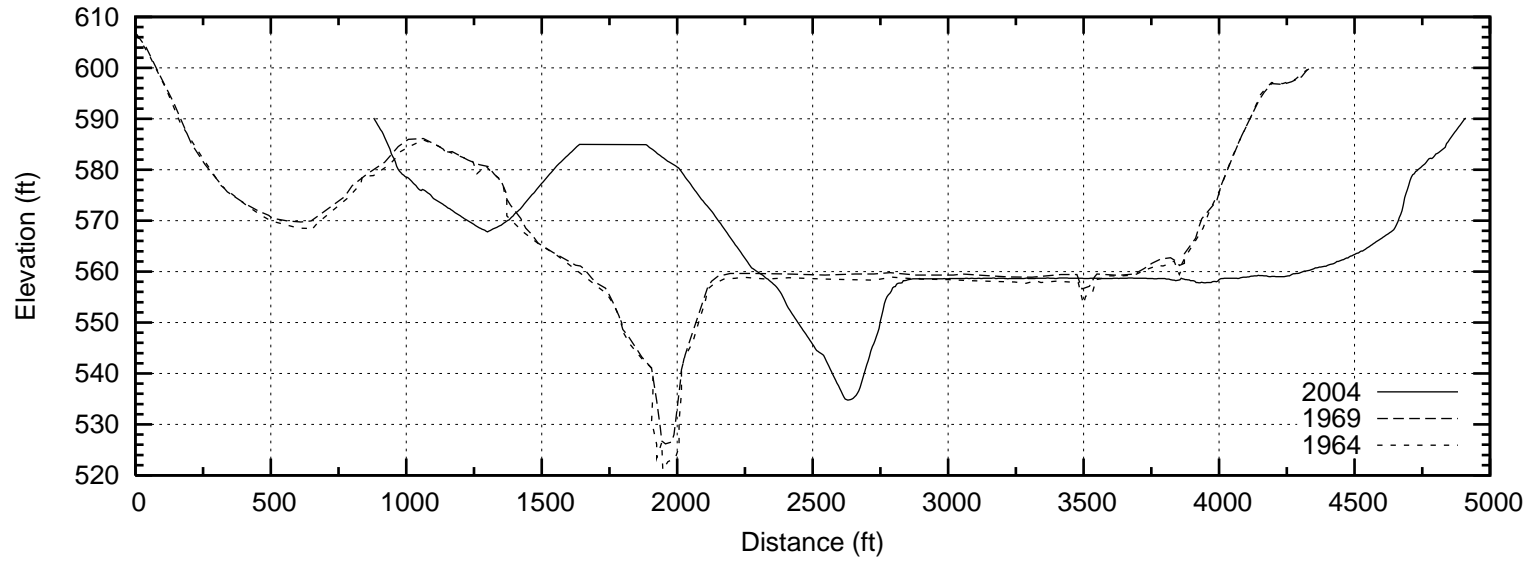


Eufaula Lake

Range Line SR58

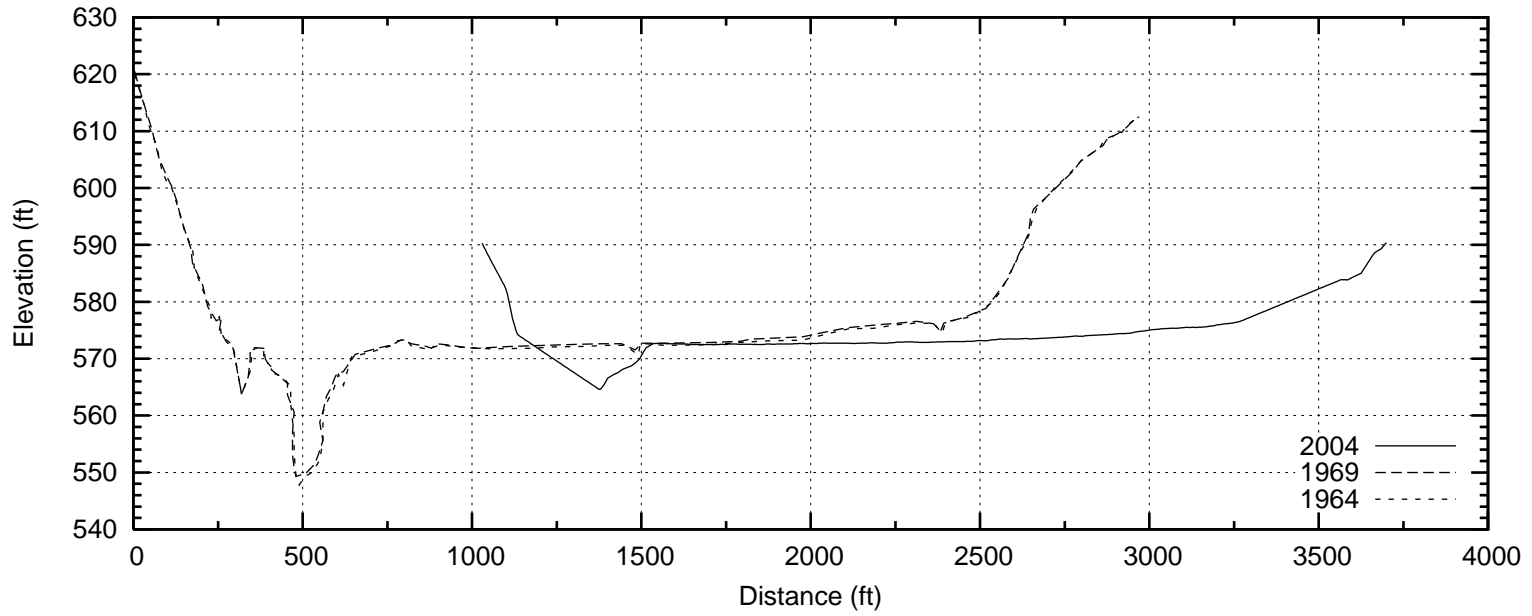


Range Line SR59

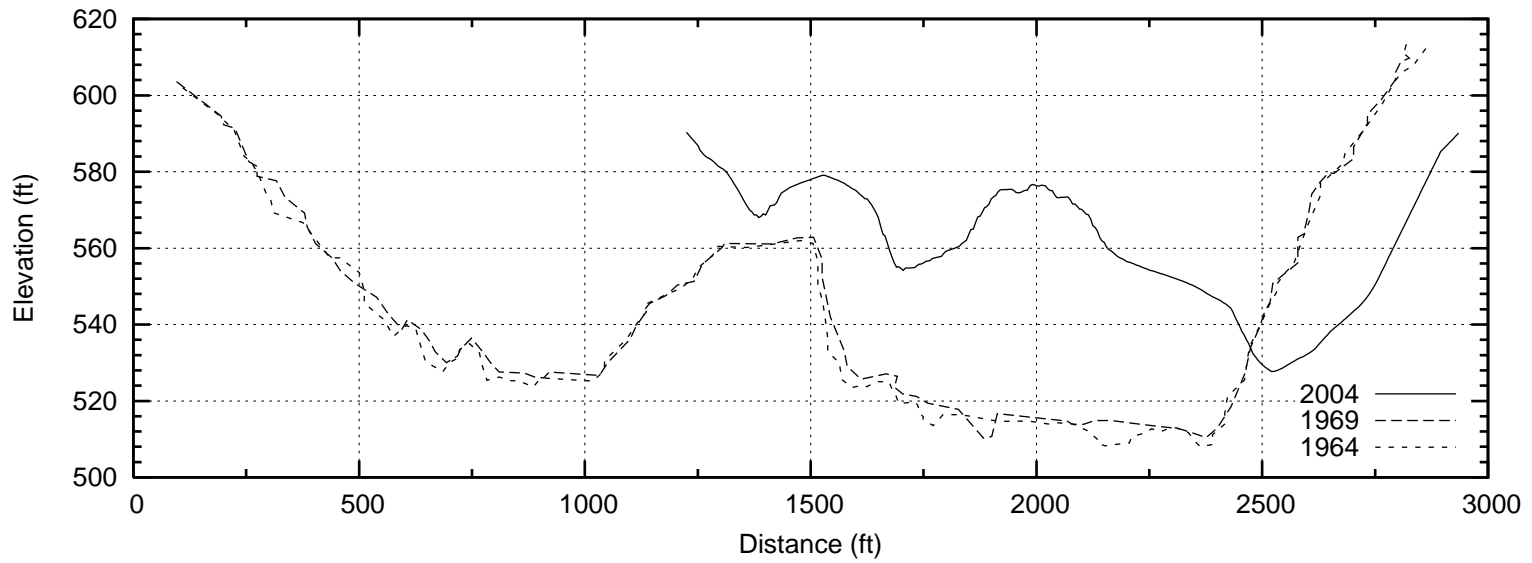


Eufaula Lake

Range Line SR60

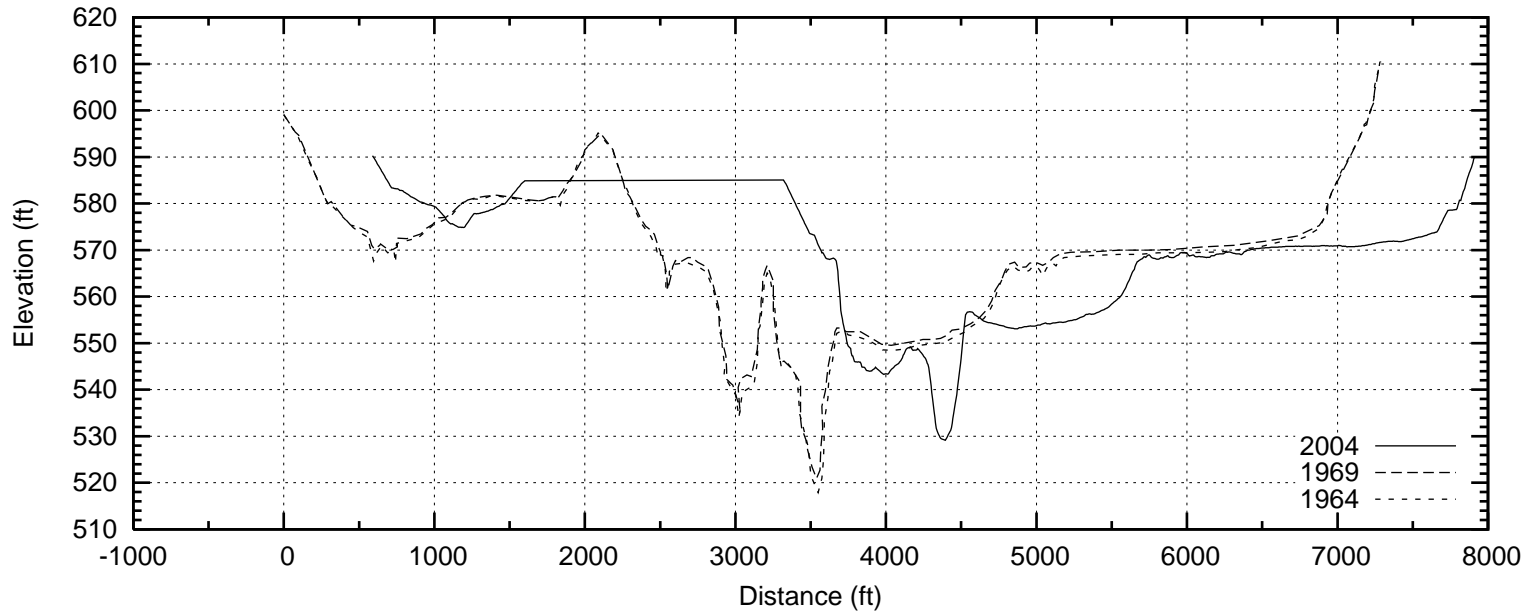


Range Line SR61

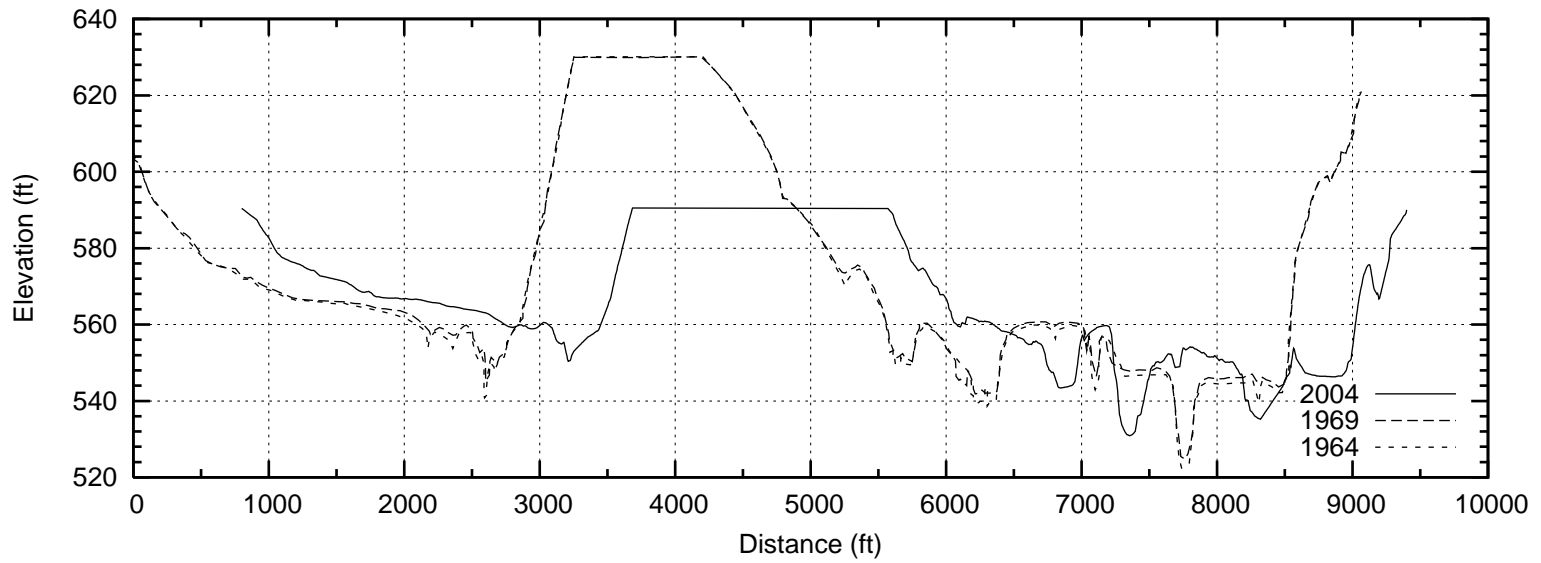


Eufaula Lake

Range Line SR62

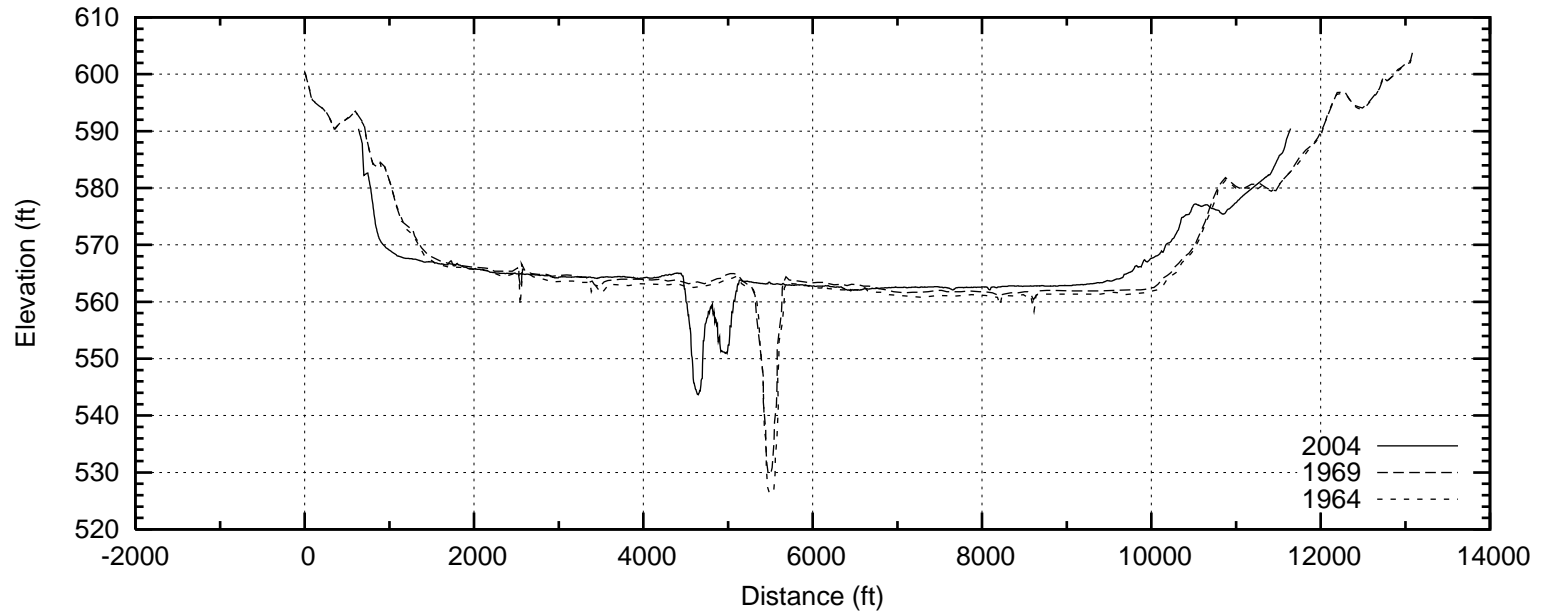


Range Line SR63

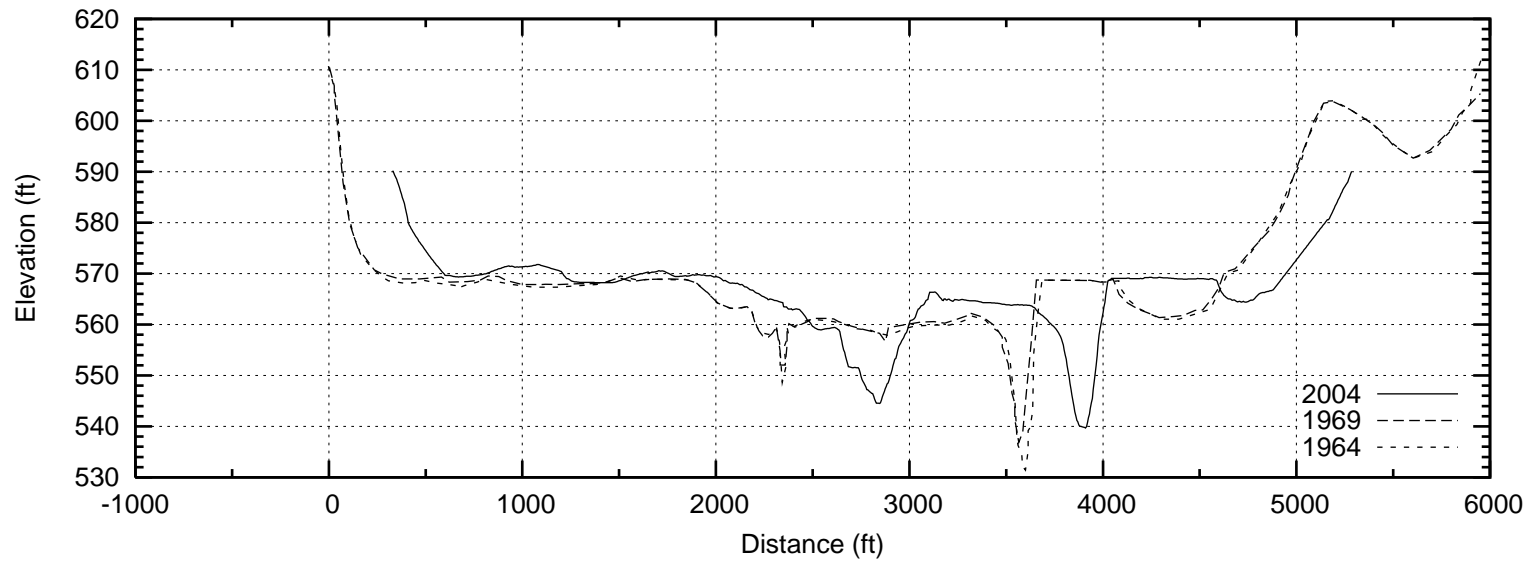


Eufaula Lake

Range Line SR64

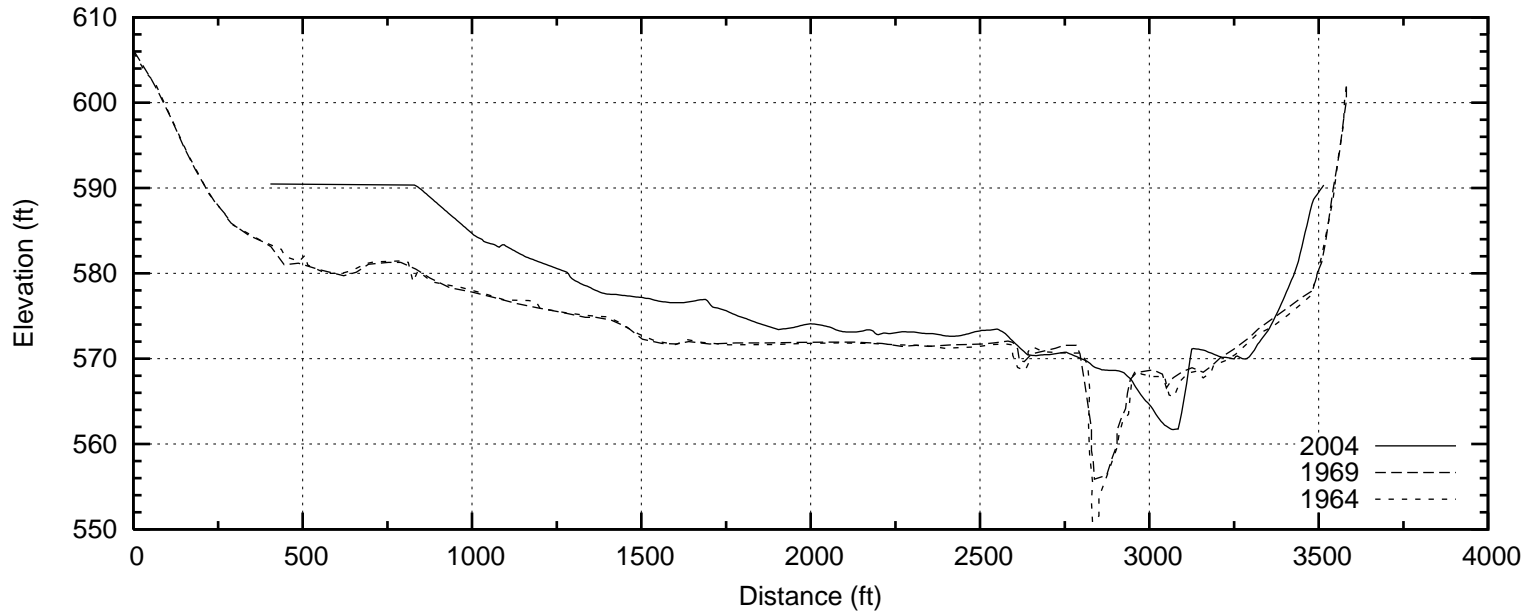


Range Line SR65

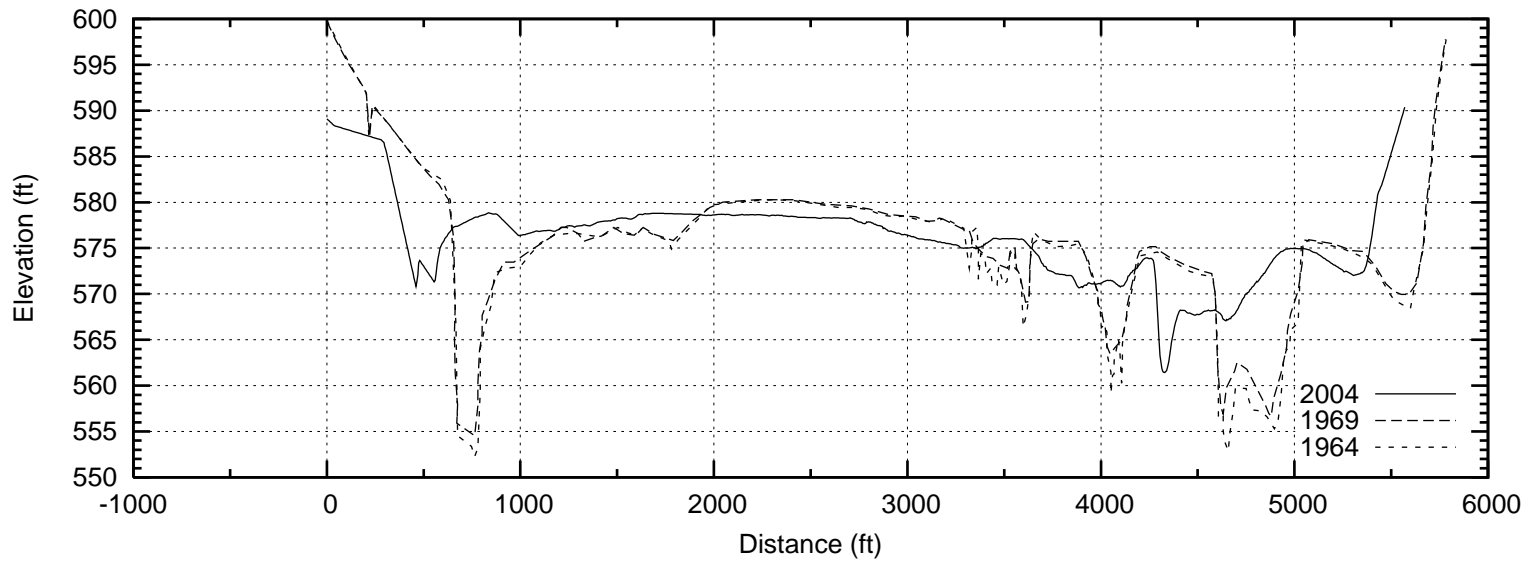


Eufaula Lake

Range Line SR66

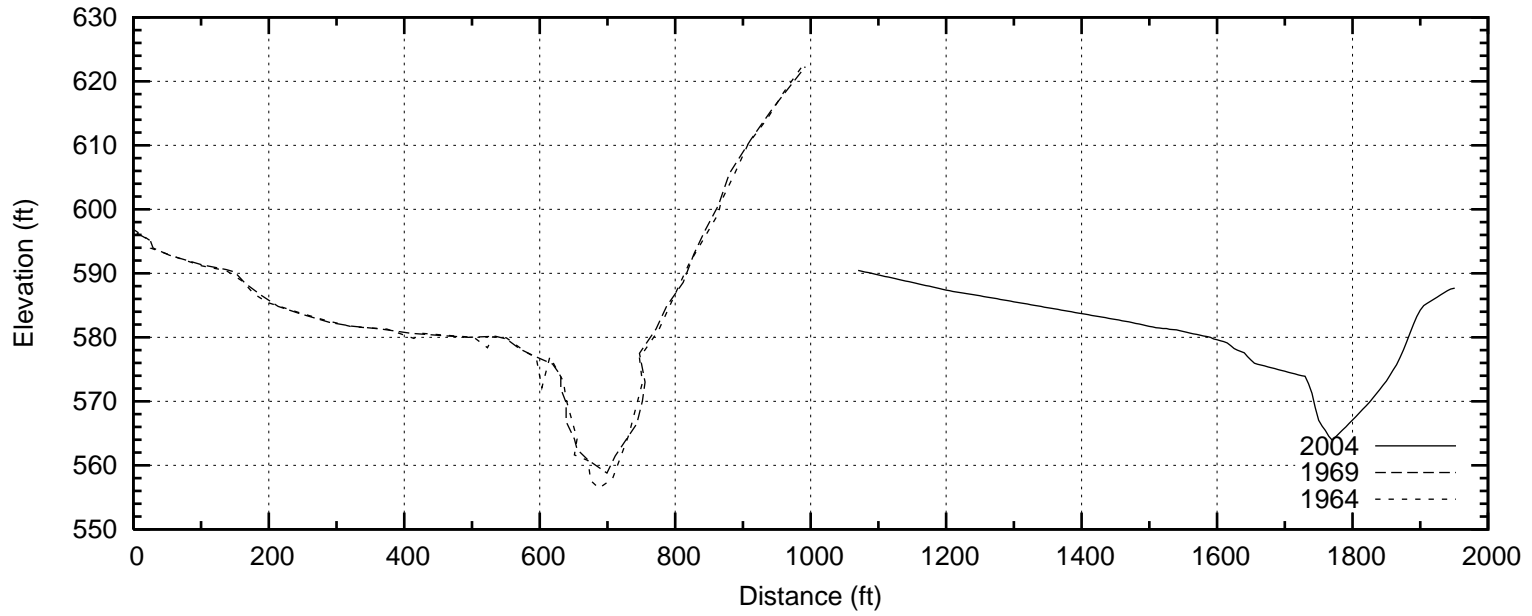


Range Line SR67

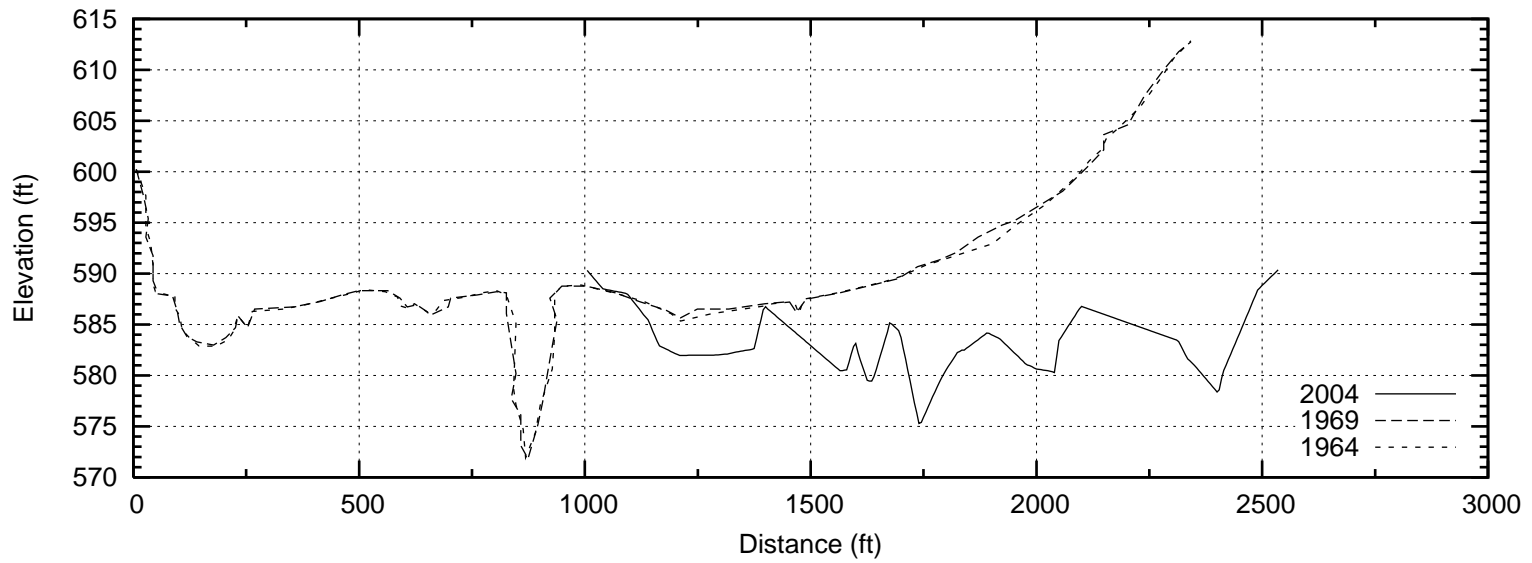


Eufaula Lake

Range Line SR68

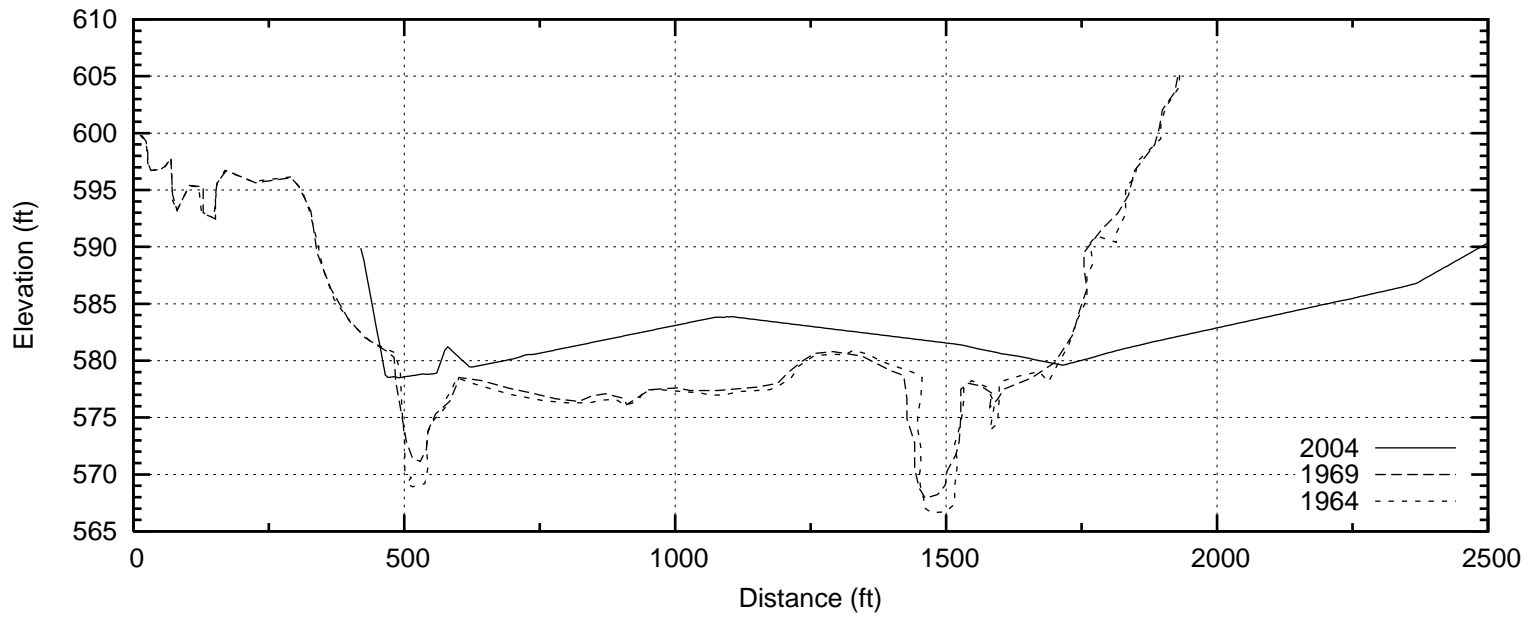


Range Line SR69

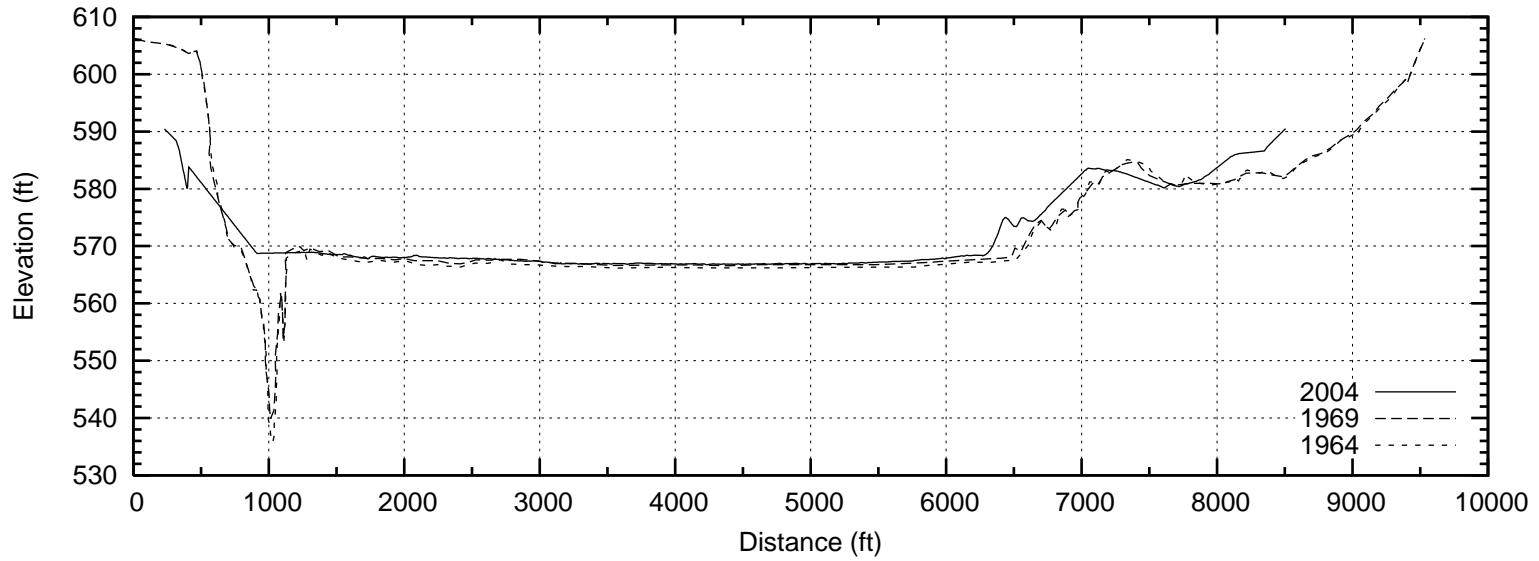


Eufaula Lake

Range Line SR71

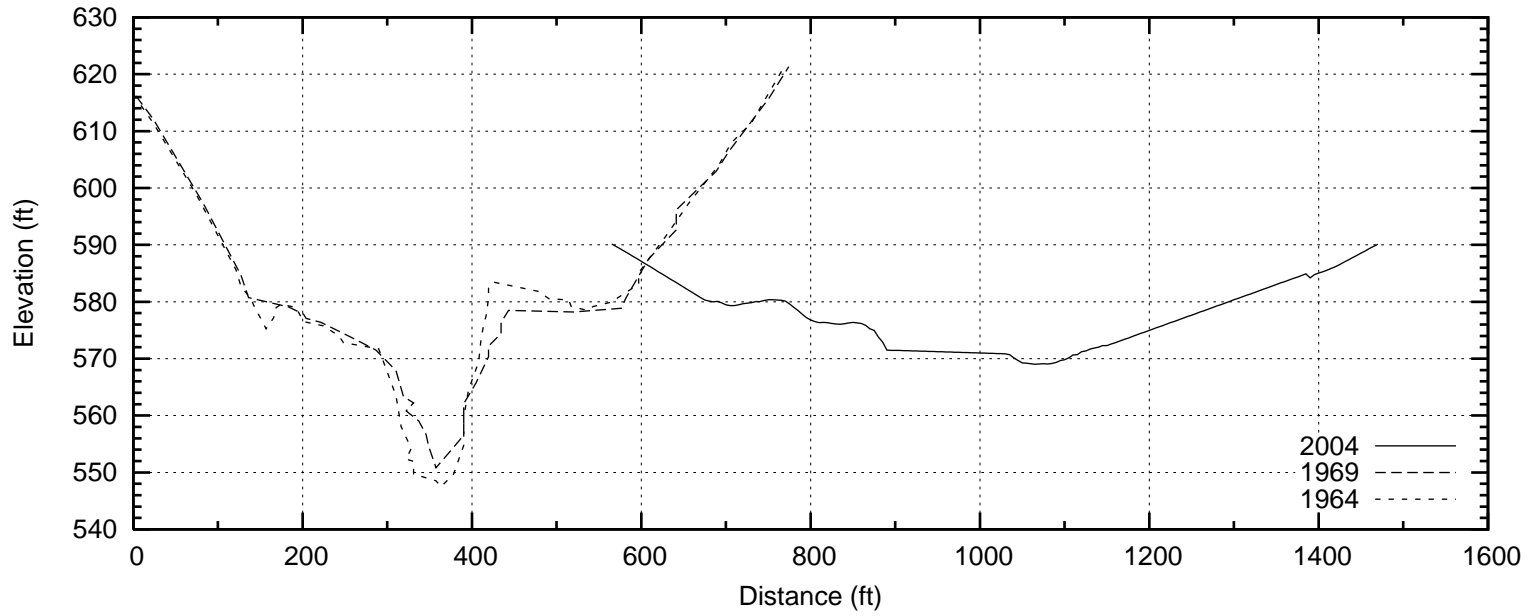


Range Line SR72



Eufaula Lake

Range Line SR73



Range Line SR74

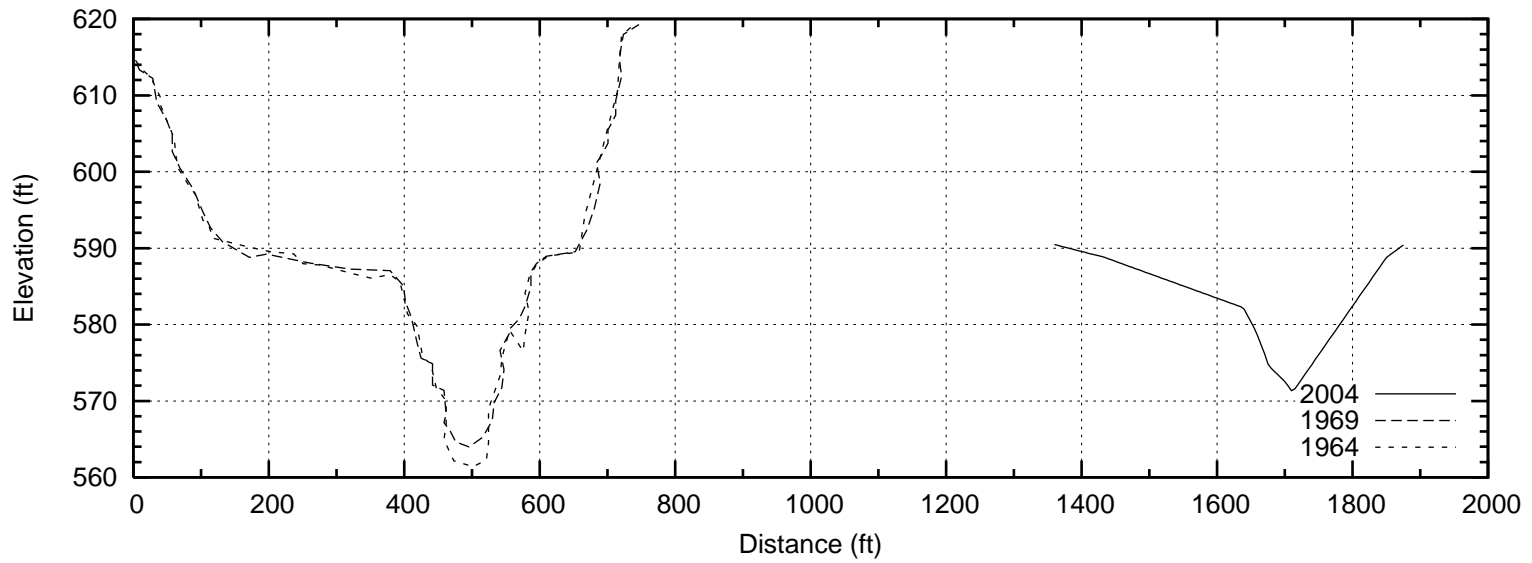


Figure 4
Eufaula Lake
Relief Map

Elevation (ft)

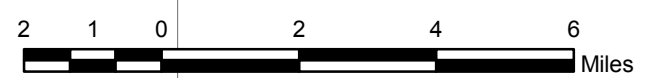
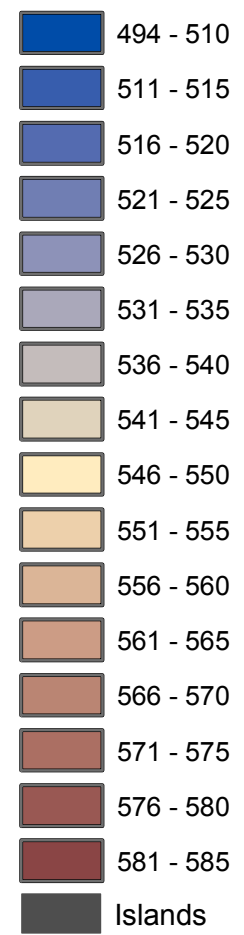













Figure 5
Eufaula Lake
Depth Range Map

Depth Ranges (ft)

-  > 90'
-  80 - 90'
-  70 - 80'
-  60 - 70'
-  50 - 60'
-  40 - 50'
-  30 - 40'
-  20 - 30'
-  10 - 20'
-  0 - 10'
-  Islands

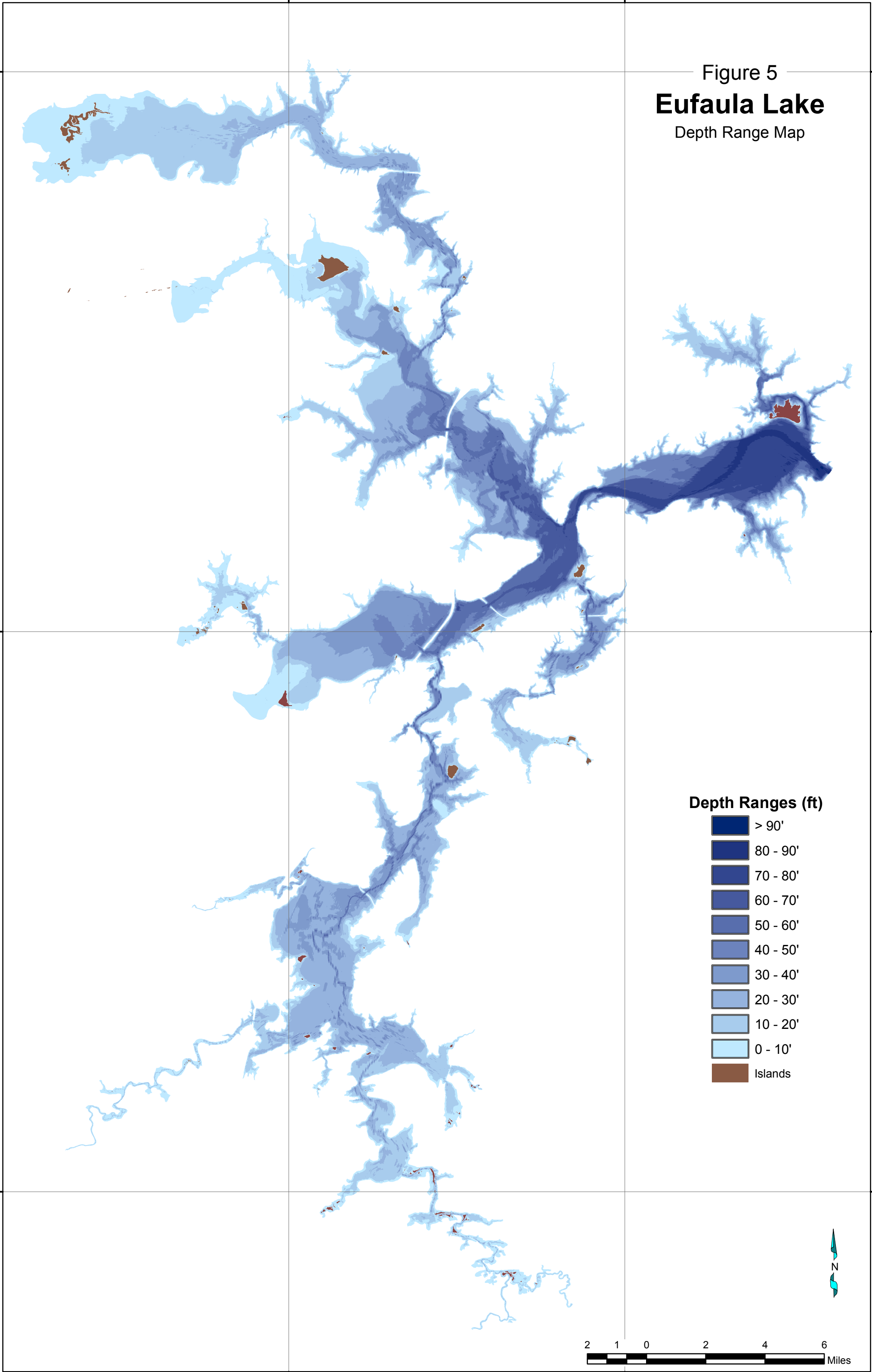
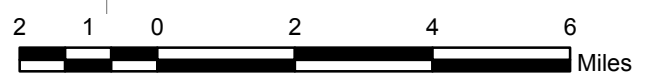
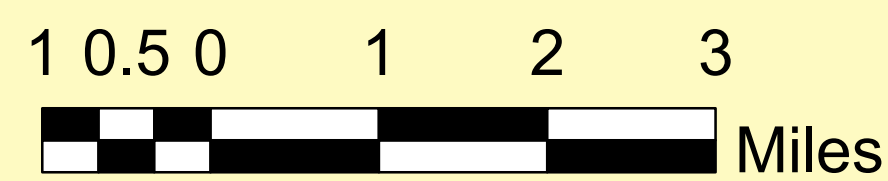


Figure 6 EUFAULA LAKE

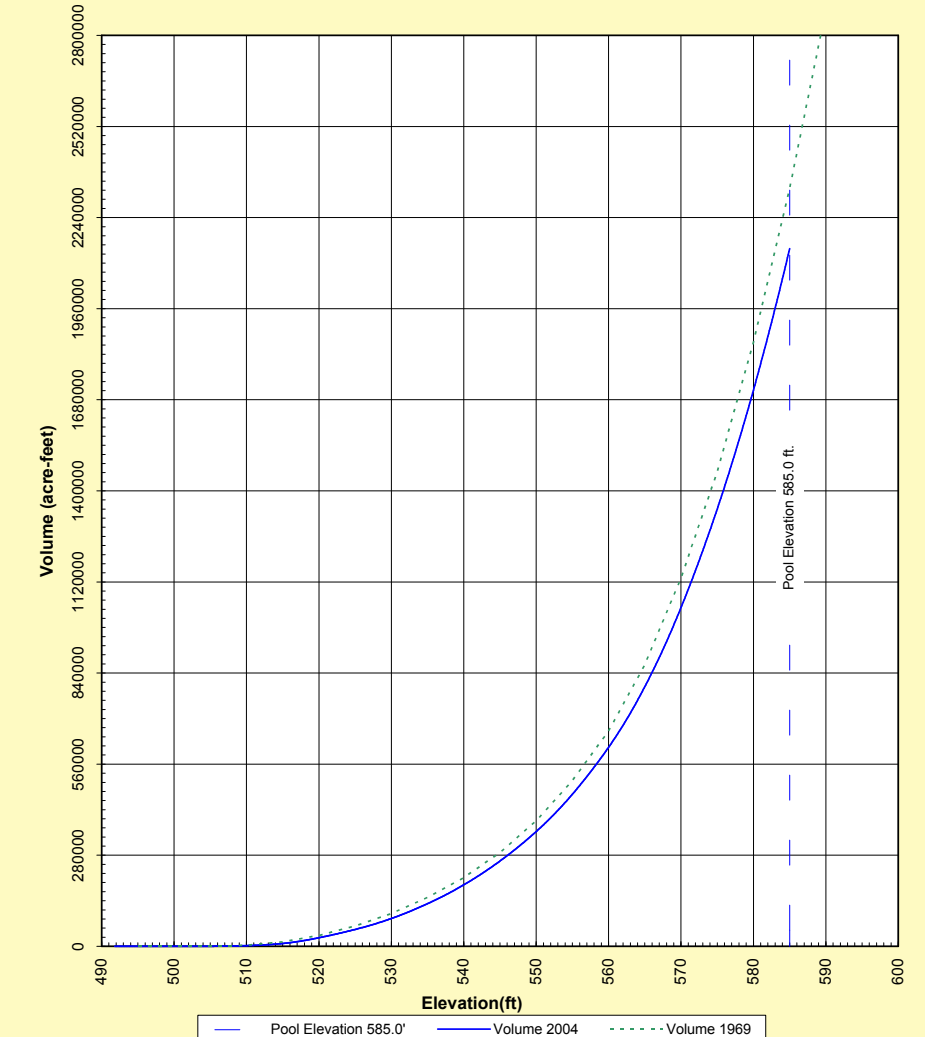
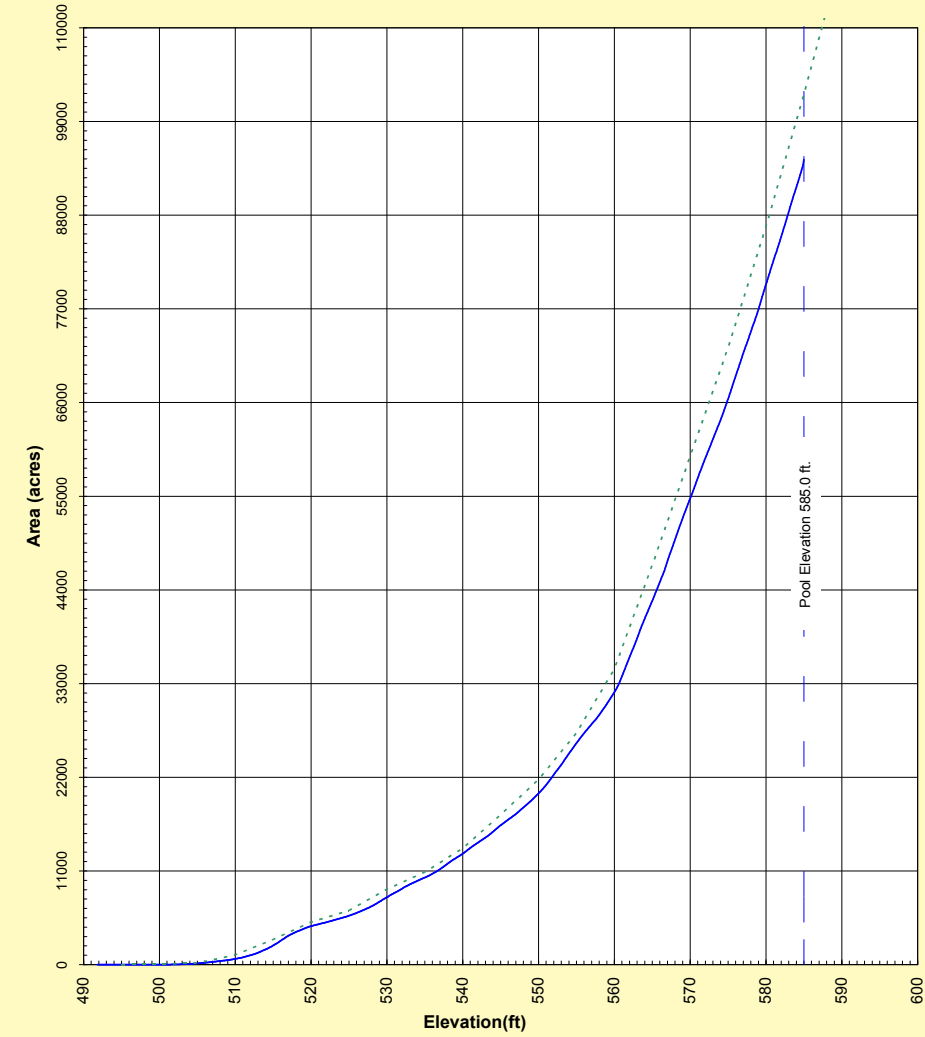
10' - Contour Map



-  Lake Boundary at Water Surface Elevation 590.6'
-  Islands
-  Historic Range Lines

Top of Power Pool
Elevation 585.0'

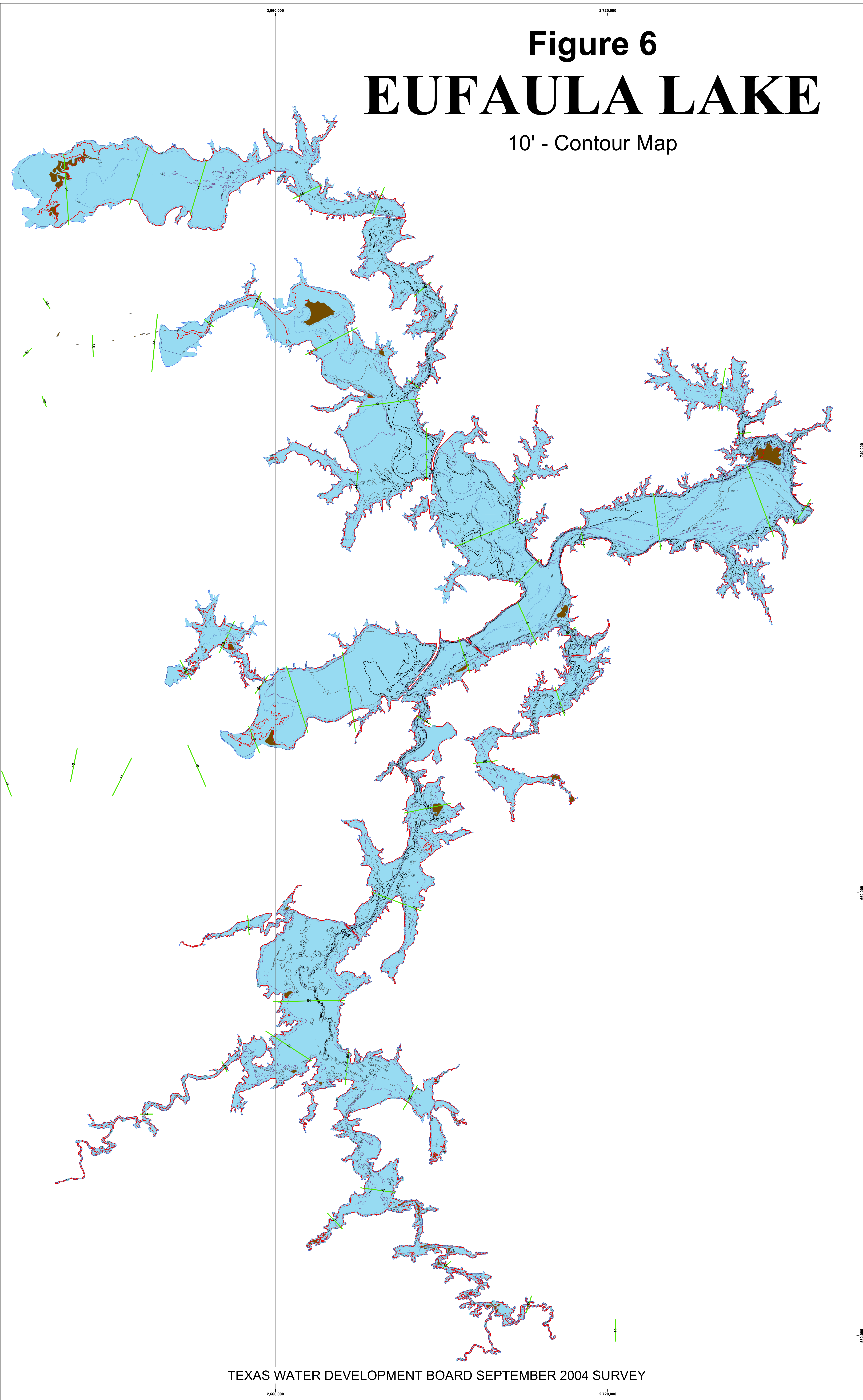
Contours



Grid: State Plane Oklahoma South
NAD 83
Projection



This map is the product of a survey conducted by the Texas Water Development Board's Hydrographic Survey Program to determine the capacity of Eufaula Lake. The Texas Water Development Board makes no representations nor assumes any liability.



TEXAS WATER DEVELOPMENT BOARD SEPTEMBER 2004 SURVEY