VOLUMETRIC SURVEY REPORT

OF

PROCTOR LAKE

JULY 2002 SURVEY

Prepared by the:

TEXAS WATER DEVELOPMENT BOARD

May 2003

Prepared for:

Brazos River Authority

In cooperation with the

United States Army Corps of Engineers

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Published and Distributed
by the
Texas Water Development Board
P.O. Box 13231
Austin, Texas 78711-3231

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ON PROCTOR LAKE
SURVEY OF JULY 2002

INTRODUCTION

Staff of the Surface Water Availability Section of the Texas Water Development Board (TWDB) conducted a volumetric survey of Proctor Lake during the period of June 22, 2002 through June 24, 2002. The primary purpose of the survey was to determine the current volume of the lake at conservation pool elevation (CPE). The results of the current survey will be compared to the baseline survey performed by TWDB in December of 1993. Results from a sediment survey will be presented in a later report. Survey results are presented in the following pages in both graphical and tabular form.

The vertical datum used during this survey is that used by the United States Geological Survey (USGS) for the lake elevation gage at Proctor Lake. The station number and name is 08099400 Proctor Lake near Proctor, TX. The datum for this gage is reported as sea level (USGS). Thus, elevations are reported here in feet (ft) sea level. Volume and area calculations in this report are referenced to water levels provided by the USGS gage.

Original design information for Proctor Lake was based on information furnished by U.S. Army Corps of Engineers, Fort Worth District. The equipment and methodology used in the current survey was similar to that used in the December 1993 survey. Please refer to the Volumetric Survey of Proctor Lake (TWDB March 30,1994) for more information.

PERTINENT DATA

Owner of Dam and Facilities:

U.S. Army Corps of Engineers

Operator of Dam and Facilities:

U.S. Army Corps of Engineers, Fort Worth District

Engineer and General Contractor:

U.S. Army Corps of Engineers

Armstrong and Ryan of Roswell, New Mexico (General Contractor)

Location:

Proctor Lake is located in Comanche County on the Leon River in the Brazos River Basin, approximately 8 miles northeast of Comanche, TX. (Figure 1).

Purpose:

Multi-purpose reservoir for flood control and water supply.

Authorization:

Federal: Federal Flood Control Act 1954, and the Public Works Appropriations Act of 1957.

State: Application No. 2292 was filed June 11, 1962, with the Texas Water Commission by the Brazos River Authority to construct a dam and reservoir on the Leon River and to impound a maximum of 64,100 ac-ft of water.

Permit No. 2107 was issued July 24, 1964. Authorization was given to impound 59,400 ac-ft of water. Maximum allocations were set as follows: 18,000 ac-ft for municipal purposes; 18,000 ac-ft for industrial purposes; and 18,000 ac-ft for irrigation purposes.

On September 13, 1979, Permit No. 2107 was amended to allow the Brazos River Authority the right to use the waters of Proctor Lake for recreational purposes. All other authorizations in the original permit remained enforced.

Permit No. 2107 was amended a second time on November 25, 1980. Basically all authorizations remained the same except for 200 ac-ft of the 18,000 ac-ft allocated for industrial purposes could be used for mining purposes.

Certificate of Adjudication 12-5159 was issued to the Brazos River Authority on December 14, 1987. The owner was authorized to maintain an existing dam and reservoir and impound a maximum of 59,400 ac-ft of water at elevation 1,162 ft above msl. The owner was authorized a priority right to divert and use not to exceed 19,658 ac-ft of water per annum from Proctor Lake for municipal, industrial, irrigational and mining purposes.

Certificate of Adjudication 12-5167 was also issued to the Brazos River Authority on December 14, 1987. The owner was authorized to divert and use not to exceed 30,000 ac-ft of water for municipal purposes and 170,000 ac-ft of water for industrial purposes in the San Jacinto-Brazos Coastal Basin. These waters were to be used from Proctor Lake and other reservoirs in the Brazos River Authority's system. Additional information on amendments to the Certificates of Adjudication and other matters relating to the water rights of Proctor Lake can be found at the Records Division of the Texas Commission on Environmental Quality.

Drainage area:

1,265 square miles

Dam:

Type	Rolled earth fill with concrete spillway in right abutment ridge
Length	13,460 ft (including spillway)
Maximum Height	86 ft (at streambed)
Top Width	30 ft

Spillway:

Crest Elevation	1,162.0 ft
Type	ogee
Control	11- 40-ft x 35-ft tainter gates
Length	440 ft at crest

Outlet works:

Type	2 gate-controlled conduits
Dimensions	3 ft diameter
Control	Two 3 ft x 3 ft slide gates
Invert elevations	1,128.0 ft

Reservoir Data:

FEATURE	ELEVATION (ft)	CAPACITY (ac-ft)	AREA (ac)
Top of Dam	1,206.0	-----	-----
Design Flood	1,201.0	433,000	15,410
Crest of Spillway	1,162.0	55,686	4,474
Top of Gates	1,197.0	374,200	14,010
Top of Conservation Storage Space	1,162.0	55,686	4,474
Usable Conservation Storage Space	1,162.0	55,686	4,474
Lowest Gated Outlet (invert)	1,128.0	0	0

1. Information at elevations above 1,162.0 ft provided by the U.S. Army Corp of Engineers.
2. Information at elevation 1,162.0 ft and below based on 1995 **revised** area and capacity data produced by the Texas Water Development Board and provided to the U.S. Army Corp of Engineers (See Appendices B & D).

VOLUMETRIC SURVEYING TECHNOLOGY

The equipment used to perform the latest volumetric survey consisted of a 23-foot aluminum tri-hull SeaArk craft with cabin, equipped with twin 90-Horsepower Honda outboard motors. (Reference to brand names throughout this report does not imply endorsement by TWDB). Installed within the enclosed cabin are a Coastal Oceanographics' Helmsman Display (for navigation), an Innerspace Technology Model 449 Depth Sounder and Model 443 Velocity Profiler, Trimble Navigation, Inc. AG132 GPS receiver with Omnistar differential GPS correction signal and a PC. A water-cooled 4.5 kW generator provides electrical power through an in-line uninterruptible power supply. In shallow areas and where navigational hazards such as stumps were present, a 20-foot aluminum shallow-draft flat bottom SeaArk craft with cabin and equipped with one 100-horsepower Yamaha outboard motor was used. The portable data collection equipment on-board the boat included a Knudsen 320 B/P Echosounder (depth sounder), a Trimble Navigation, Inc. AG132 GPS receiver with Omnistar differential GPS correction signal and a laptop computer.

The GPS equipment, survey vessel, and depth sounder in combination provide an efficient hydrographic survey system. As the boat travels across the pre-plotted transect lines, the depth sounder takes approximately ten readings of the lake bottom each second. The depth readings are stored on the computer along with the positional data generated by the boat's GPS receiver. The data files collected are downloaded and transferred to the office for editing after the survey is completed. During editing, poor-quality data is removed or corrected, multiple data points are averaged to one data point per second, and the average depths are converted to elevation readings based on the water-level elevation recorded on the day the survey was performed. Accurate estimates of the lake volume can then be determined by building a 3-D TIN model of the lake from the collected data.

PRESURVEY PROCEDURES

The lake's boundary was digitized using Environmental Systems Research Institute's (ESRI) ArcGIS from digital orthophoto quadrangles (DOQ's). VARGIS of Texas LLC produced the DOQ's for the TEXAS Orthoimagery Program (TOP). The DOQ products produced for the Department of Information Resources and the GIS Planning Council under the Texas Orthoimagery Program reside in the public domain. More information can be obtained on the Internet at http://www.tnris.state.tx.us/DigitalData/doqs.htm.

The lake elevations, at the time the DOQ's were photographed (January 9, 1995 January 23, 1995) were 1,162.22 ft and 1,162.29 ft respectively. The boundary was inspected against the collected data points and digitized versions of USGS 7.5 minute topographic maps (DRG's) and adjusted to include all the data points collected during the 2002 field survey. The lake and island boundaries were given an elevation of 1,162.3 ft and TWDB Staff utilized these updated boundary conditions in modeling Proctor Lake for this report. The lake elevations varied between elevation 1,162.6 ft and 1,162.4 ft during the field survey (July 22, 2002 – July 24, 2002).

The survey layout was designed by placing survey track lines at 500-foot intervals within the digitized lake boundary using the HYPACK software. The survey design required the use of approximately 140 survey lines placed perpendicular to the original river channel and tributaries along the length of the lake.

SURVEY PROCEDURES

The following procedures were followed during the volumetric survey of Proctor Lake performed by the TWDB. Information regarding equipment calibration and operation, the field survey, and data processing is presented.

Equipment Calibration and Operation

Prior to collecting data onboard the Hydro-survey boat, the depth sounder was calibrated with the Innerspace 443 Velocity Profiler, an instrument used to measure the variation in the speed of sound at different depths in the water column. The average speed of sound through the entire water column below the boat was determined by averaging local speed-of-sound measurements collected through the water column. The velocity profiler probe was first placed in the water to acclimate it. The probe was next raised to the water surface where the depth was considered zero. The probe was then gradually lowered on a cable to a depth just above the lake bottom, and then raised again to the surface. During this lowering and raising procedure, local speed-of-sound measurements were collected, from which the average speed was computed by the velocity profiler. This average speed of sound was entered into the ITI449 depth sounder, which then provided the depth of the lake bottom. The depth was then checked manually with a measuring tape to ensure that the depth sounder was properly calibrated and operating correctly.

While collecting data onboard the River Runner (shallow draft) boat, the Knudsen depth sounder was calibrated using the DIGIBAR-Pro Profiling Sound Velocimeter by Odem Hydrographic Systems. The steps to determine the speed of sound are similar to those used for the Innerspace 443 Velocity Profiler. The probe was first placed in the water to acclimate it, raised to the water surface where the depth was considered zero. The probe was then gradually lowered on a cable to a depth just above the lake bottom, and then raised again to the surface. During this lowering and raising procedure, local speed-of-sound measurements were collected, from which the average speed was computed by the velocimeter. The speed of sound was then entered into the bar check feature in the Knudsen software program. The depth was then checked manually with a stadia (survey) rod or weighted measuring tape to ensure that the depth sounder was properly calibrated and operating correctly.

The speed of sound in the water column ranged from 4,936 ft per second to 4,950 ft per second during the Proctor Lake survey. Based on the measured speed of sound for various depths and the average speed of sound calculated for the entire water column, the depth sounder is accurate to within $\pm$0.2 ft. An additional estimated error of $\pm$0.3 ft arises from variation in boat inclination. These two factors combine to give an overall accuracy of $\pm$0.5 ft for any instantaneous reading. These errors tend to be fairly minimal over the entire survey, since some errors are positive and some are negative, canceling each other out.

During the survey, the horizontal mask setting on the onboard GPS receiver was set to 10 degrees and the PDOP (Position Dilution of Precision) limit was set to seven to maximize the accuracy of the horizontal positioning. An internal alarm sounds if PDOP rises above seven to advise the field crew that the horizontal position has degraded to an unacceptable level. Further positional accuracy is obtained through differential corrections from the Omnistar receiver. The lake's initialization file used by the HYPACK data collection program was set up to convert the collected Differential GPS positions to, NAD 83, State Plane, Texas Central Zone coordinates on the fly.

Data Collection

TWDB staff collected data at Proctor Lake for approximately 3 days during the period of July 22nd through July 24th, 2002. The lake water level elevations remained constant at 1,162.3 ft during the survey, thus allowing the survey crew to collect data in most areas of the lake that would be inundated at conservation pool elevation 1,162.0 ft.

The design layout for collecting data at Proctor Lake required pre-plotting transects (range lines) that were perpendicular to the old river and creek channels. These

transects had an average spacing of 500 ft. While collecting data, the boat operator would steer the boat on course (with GPS navigation) starting from one shore and heading to the opposite shore. The data collector would monitor the data display and depth sounder to make sure the latitude; longitude and depth (x,y,z) values were being logged. Adjustments could be made if the instruments were receiving bad data at that time. The depth sounder and GPS equipment records 10 data points every second. These points are averaged to one data point per second for generating the model. The distance between data points depended on the speed of the boat. The maximum distance between data points on any one range line during the resurvey of Proctor Lake was approximately 30 ft.

Approximately 40,600 data points were collected over the 98.7 miles traveled during the data collection phase of Proctor Lake. The crews collected data on all 140 of the pre-plotted transects that were designed for the survey. These points were stored digitally on the boat's computer in 178 data files. Random data were collected in those areas where the crew was not able to stay on course due to obstructions. Data were not collected in areas with significant obstructions or where the water was too shallow. Figure 2 shows the actual location of all data points collected.

Data Processing

The collected data were downloaded from diskettes onto TWDB's network computers. Tape backups were made for future reference as needed. To process the data, the EDIT routine in the HYPACK Program was run on each raw data file. Data points such as depth spikes or data with missing depth or positional information were deleted from the files. A correction for the lake elevation at the time of data collection was also applied to each file during the EDIT routine. During the survey, the water level elevation remained constant at 1,162.3 ft (USGS gage #08099400) After all adjustments had been

made to the raw data files, the edited files were saved. The edited files were then combined into a single X, Y, Z data file, to be used with the GIS software to develop a model of the lake bottom elevation.

The resulting data file was imported into Environmental System Research Institute's (ESRI) Arc/Info Workstation GIS software. This software was used to convert the data to a MASS points file. The MASS points and the boundary file were then used to create a Digital Terrain Model (DTM) of the lake's bottom surface using Arc/Info's TIN software module. The module generates a triangulated irregular network (TIN) from the data points and the boundary file using a method known as Delauney's criteria for triangulation. A triangle is formed between three non-uniformly spaced points, including all points along the boundary. If there is another point within the triangle, additional triangles are created until all points lie on the vertex of a triangle. All of the data points are used in this method. The generated network of three-dimensional triangular planes represents the bottom surface. With this representation of the bottom, the software then calculates elevations along the triangle surface plane by determining the elevation along each leg of the triangle. The lake area and volume can be determined from the triangulated irregular network created using this method of interpolation.

Volumes and areas were calculated from the TIN for the entire lake at one-tenth of a foot interval from the lowest elevation to the contour used for the lake boundary during the current survey. The surface areas and volumes of the lake from elevation 1,129.3 ft to 1,162.0 ft, were computed using Arc/Info software. The computed lake volume table is presented in Appendix A and the area table in Appendix C for Proctor Lake. The 1993 lake volume and area tables were revised using the updated boundary conditions developed from 1995 photographs and are presented in Appendix B and Appendix D. An elevation-volume graph and an elevation-area graph are presented in Appendix E and Appendix F respectively.

Another product developed from the model includes a contour map. To develop this map, the TIN was converted to a lattice using the TINLATTICE command and then to a polygon coverage using the LATTICEPOLY command. Linear filtration algorithms were applied to the DTM to produce smooth cartographic contours. The resulting contour map of the bottom surface at 2-ft intervals is presented in Figure 3. Finally, endpoint coordinates for 17 range lines can be found in Appendix G. These range lines were used in comparing the current TWDB bathymetric TIN model (2002) and the TIN model based on the 1993 data using the current boundary conditions. Differences between cross-sections might be due to the fact that the 2002 range lines do not exactly match the range lines driven in the 1993 survey and in the methodology that Arc/Info uses to interpolate between points in developing the TIN model. The range line plots are presented in Appendix H.

RESULTS

Results from the 2002 TWDB resurvey indicate Proctor Lake encompasses 4,537 surface acres and contains a total volume of 55,457 ac-ft at the conservation pool an elevation of 1,162.0 ft. The length of the shoreline at the digitized elevation of 1,162.3 ft was calculated to be 62 miles. The deepest point physically measured during the survey was at elevation 1,129.3 ft corresponding to a depth of 32.7 ft below CPE and was located approximately 300 ft upstream of Proctor Dam.

SUMMARY AND COMPARISONS

Proctor Lake inundates the confluence of the Leon River and Rush Creek and other tributaries. There are two distinct arms to the lake with a small island located at the confluence. The lake is formed by a reinforced concrete gated structure and rolled earthfill dam. The lake was operated as a detention basin from January 30 to July 5, 1963. The gates were closed July 6, 1963 and the lake continued to be operated as a detention basin to elevation 1,156.0 ft until construction was completed. Deliberate impoundment began September 30, 1963. (USGS) The most recent survey report on Proctor Lake was published by the TWDB and based on a December 1993 volumetric survey. The results of that survey have been revised based on more accurate boundary information.

At conservation pool elevation 1,162.0 ft, the current TWDB survey measured 4,537 surface acres and reports a volume of 55,457 ac-ft of water. The capacity of the active pool (conservation storage) between elevations 1,128.0 ft and 1,162.0 ft is 55,457 ac-ft of water. There no longer appears to be an inactive pool below elevation 1,128.0 ft. The lowest elevation measured during the survey was 1,129.3 ft and corresponds to a depth of 32.7 ft below CPE.

The 1993 TWDB elevation-area-capacity table indicates that Proctor Lake had a volume of 55,588 ac-ft of water and a surface area of 4,761 ac at conservation pool elevation 1,162.0 ft. The 1993 results were recalculated using boundary estimates from the 1995 DOQ's and the 1993 TWDB survey data set. The 1993-revised elevation-area-capacity indicates that Proctor Lake had a volume of 55,686 ac-ft of water and a surface area of 4,474 ac at conservation pool elevation 1,162.0 ft. A comparative summary of the historical data and the results of the TWDB 2002 resurvey are presented in Table 2.

Comparisons between original survey data (1964) and the TWDB volumetric surveys are difficult and some apparent changes might simply be due to methodological differences. It is recommended that a similar survey be performed in five to ten years or after major flood events to monitor changes to the lake's capacity.

Table 2. Area and Volume Comparisons of Proctor Lake

	Original Design **1964**	TWDB Volumetric Survey **1993 revised**	TWDB Volumetric Survey **2002**
Area (ac)	4,610	4,474	4,537
Total Volume (ac-ft)	59,400	55,686	55,457
Conservation Pool storage capacity (ac-ft)	59,332	55,686	55,457
Dead Pool storage capacity (ac-ft)	68	0	0

Notes:
1. All results for conservation pool elevation 1,162.0 ft
2. Conservation Pool storage capacity is between elevations 1,162.0 and 1,128.0 ft
3. Dead Pool storage is that below elevation 1,1280.0 ft
4. 1993 TWDB volume and area revised with new boundary
5. All pre-1993 data provided by Texas Commission on Environmental Quality records.

REFERENCES

1. United States Geological Survey. 2001. Water Data Report TX-01-3. “Water Resources Data Texas Water Year 2001”

2. Texas Water Commission, 1964, Permit No. 2107

3. Texas Water Commission, 1979, Permit No. 2107A

4. Texas Water Commission, 1980, Permit No. 2107B

5. Texas Water Commission, 1987, Certificate of Adjudication 12-5159

6. Texas Water Development Board, 1994, “Volumetric Survey of Proctor Lake”

7. Texas Water Development Board. 1971. Report 126 Part II. “Engineering Data on Dams and Lakes in Texas”

Appendix A

Proctor Lake

RESERVOIR VOLUME TABLE

TEXAS WATER DEVELOPMENT BOARD **JULY 2002 SURVEY**

VOLUME IN ACRE-FEET ELEVATION INCREMENT IS ONE TENTH FOOT

ELEVATION in Feet	0.0	0.1	0.2	0.3	0.4	0.5	0.6	0.7	0.8	0.9
1129				0	0	0	0	0	0	0
1130	0	0	0	0	0	0	0	0	0	0
1131	0	0	0	0	0	0	0	0	0	0
1132	0	0	0	0	0	0	0	0	0	1
1133	1	3	5	8	11	15	20	26	34	42
1134	54	67	83	101	122	144	168	193	221	250
1135	281	315	350	387	425	464	506	549	595	641
1136	689	738	788	839	892	946	1001	1058	1116	1174
1137	1234	1294	1356	1418	1480	1544	1608	1673	1738	1804
1138	1871	1938	2006	2074	2144	2215	2287	2360	2435	2510
1139	2586	2663	2742	2821	2901	2983	3065	3149	3234	3320
1140	3408	3497	3587	3678	3770	3863	3956	4051	4147	4244
1141	4341	4440	4540	4640	4742	4844	4947	5050	5155	5260
1142	5366	5472	5579	5687	5796	5906	6016	6128	6241	6355
1143	6472	6592	6714	6837	6961	7087	7215	7343	7473	7604
1144	7737	7871	8007	8143	8281	8420	8559	8700	8842	8984
1145	9128	9272	9418	9565	9712	9861	10011	10161	10313	10466
1146	10619	10774	10930	11087	11245	11404	11564	11726	11889	12054
1147	12219	12385	12553	12722	12891	13062	13234	13406	13580	13754
1148	13929	14105	14282	14460	14638	14818	14998	15180	15363	15548
1149	15734	15922	16112	16304	16497	16691	16887	17084	17283	17482
1150	17683	17885	18088	18292	18497	18703	18909	19117	19326	19535
1151	19746	19957	20170	20383	20597	20813	21029	21246	21464	21683
1152	21904	22125	22347	22570	22795	23020	23246	23473	23701	23930
1153	24160	24391	24623	24856	25090	25324	25560	25797	26035	26274
1154	26515	26757	27000	27244	27490	27737	27986	28236	28488	28741
1155	28996	29252	29510	29776	30048	30326	30615	30910	31210	31514
1156	31823	32135	32451	32771	33095	33422	33753	34088	34428	34772
1157	35120	35470	35825	36183	36544	36907	37273	37641	38013	38386
1158	38761	39139	39519	39902	40286	40673	41063	41455	41849	42246
1159	42645	43046	43448	43853	44259	44667	45077	45489	45902	46318
1160	46735	47154	47575	47998	48422	48849	49277	49707	50139	50573
1161	51008	51445	51884	52325	52767	53211	53656	54104	54553	55004
1162	55457									

Appendix B

Proctor Lake

RESERVOIR VOLUME TABLE

TEXAS WATER DEVELOPMENT BOARD — December 1993 Survey

REVISED

VOLUME IN ACRE-FEET — ELEVATION INCREMENT IS ONE TENTH FOOT

ELEVATION in Feet	0.0	0.1	0.2	0.3	0.4	0.5	0.6	0.7	0.8	0.9
1127			0	0	0	0	0	0	0	0
1128	0	0	0	0	0	0	0	0	0	0
1129	0	0	0	0	0	0	0	0	0	0
1130	0	0	0	0	0	0	0	0	0	0
1131	0	0	0	0	0	0	0	0	0	1
1132	1	1	1	2	4	6	9	12	15	19
1133	25	31	38	47	57	68	81	96	113	131
1134	151	172	194	218	242	268	296	325	356	388
1135	421	456	493	532	572	613	656	700	746	793
1136	842	893	944	997	1051	1106	1162	1219	1278	1337
1137	1398	1459	1522	1585	1650	1715	1781	1848	1917	1987
1138	2058	2129	2202	2276	2351	2427	2504	2582	2661	2741
1139	2822	2904	2988	3073	3158	3245	3332	3421	3511	3602
1140	3694	3786	3880	3974	4069	4165	4262	4359	4457	4556
1141	4655	4756	4857	4958	5061	5164	5268	5372	5478	5584
1142	5690	5798	5906	6016	6127	6238	6351	6466	6583	6701
1143	6821	6943	7066	7190	7316	7443	7571	7699	7829	7960
1144	8092	8225	8359	8495	8632	8769	8908	9048	9189	9332
1145	9475	9620	9765	9912	10060	10209	10359	10510	10662	10815
1146	10969	11125	11281	11439	11597	11757	11917	12079	12242	12405
1147	12569	12734	12900	13067	13235	13404	13574	13745	13918	14091
1148	14266	14442	14618	14796	14975	15154	15335	15517	15700	15884
1149	16069	16255	16442	16631	16821	17012	17204	17397	17592	17788
1150	17985	18184	18384	18586	18788	18992	19198	19404	19612	19821
1151	20030	20241	20454	20667	20882	21097	21314	21532	21751	21971
1152	22192	22415	22639	22864	23090	23317	23545	23774	24004	24235
1153	24467	24700	24935	25170	25406	25644	25882	26122	26364	26607
1154	26852	27097	27344	27592	27842	28092	28344	28597	28852	29109
1155	29367	29628	29894	30164	30440	30724	31014	31310	31611	31915
1156	32224	32536	32853	33173	33497	33823	34153	34486	34823	35163
1157	35506	35853	36204	36558	36915	37275	37638	38003	38372	38742
1158	39115	39491	39869	40249	40632	41017	41405	41795	42187	42582
1159	42979	43379	43780	44184	44589	44996	45404	45815	46227	46640
1160	47055	47472	47890	48311	48732	49155	49579	50005	50433	50862
1161	51293	51725	52158	52594	53031	53470	53910	54351	54795	55240
1162	55686									

Appendix C

Proctor Lake

RESERVOIR AREA TABLE

TEXAS WATER DEVELOPMENT BOARD **JULY 2002 SURVEY**

AREA IN ACRES ELEVATION INCREMENT IS ONE TENTH FOOT

ELEVATION in Feet	0.0	0.1	0.2	0.3	0.4	0.5	0.6	0.7	0.8	0.9
1129				0	0	0	0	0	0	0
1130	0	0	0	0	0	0	0	0	0	0
1131	0	0	0	0	0	0	0	0	0	0
1132	0	0	0	0	0	0	0	1	2	5
1133	9	19	25	31	38	47	55	64	80	100
1134	122	150	172	194	214	230	246	264	284	302
1135	322	344	360	375	389	404	425	444	460	473
1136	483	493	505	519	534	547	560	572	583	592
1137	600	608	616	624	631	638	644	650	656	662
1138	668	675	683	692	704	715	725	737	748	758
1139	768	777	787	798	808	819	831	845	857	870
1140	884	895	905	915	924	933	942	951	964	974
1141	983	993	1001	1009	1018	1025	1033	1040	1047	1054
1142	1061	1068	1076	1083	1092	1102	1111	1122	1138	1157
1143	1182	1208	1224	1237	1254	1268	1280	1293	1305	1317
1144	1333	1350	1361	1372	1383	1392	1402	1412	1421	1431
1145	1440	1451	1461	1471	1482	1492	1501	1512	1522	1531
1146	1542	1552	1562	1574	1587	1599	1612	1625	1636	1647
1147	1659	1671	1681	1692	1704	1713	1722	1730	1738	1747
1148	1755	1764	1772	1781	1791	1800	1810	1824	1838	1854
1149	1872	1890	1907	1925	1939	1952	1965	1978	1990	2002
1150	2014	2024	2035	2045	2054	2063	2072	2082	2091	2100
1151	2110	2119	2128	2138	2148	2157	2167	2176	2187	2197
1152	2208	2218	2227	2237	2247	2257	2267	2277	2286	2296
1153	2305	2314	2323	2333	2342	2352	2363	2374	2386	2399
1154	2412	2424	2436	2450	2466	2481	2495	2510	2525	2540
1155	2554	2569	2620	2684	2750	2835	2923	2976	3019	3065
1156	3103	3140	3183	3219	3254	3292	3335	3375	3417	3458
1157	3493	3528	3563	3592	3619	3647	3674	3699	3722	3745
1158	3767	3789	3811	3835	3859	3884	3907	3932	3956	3978
1159	3999	4019	4037	4055	4072	4089	4107	4125	4144	4163
1160	4182	4200	4218	4236	4256	4275	4292	4310	4327	4345
1161	4362	4380	4397	4414	4431	4448	4466	4483	4501	4519
1162	4537									

Appendix D

Proctor Lake

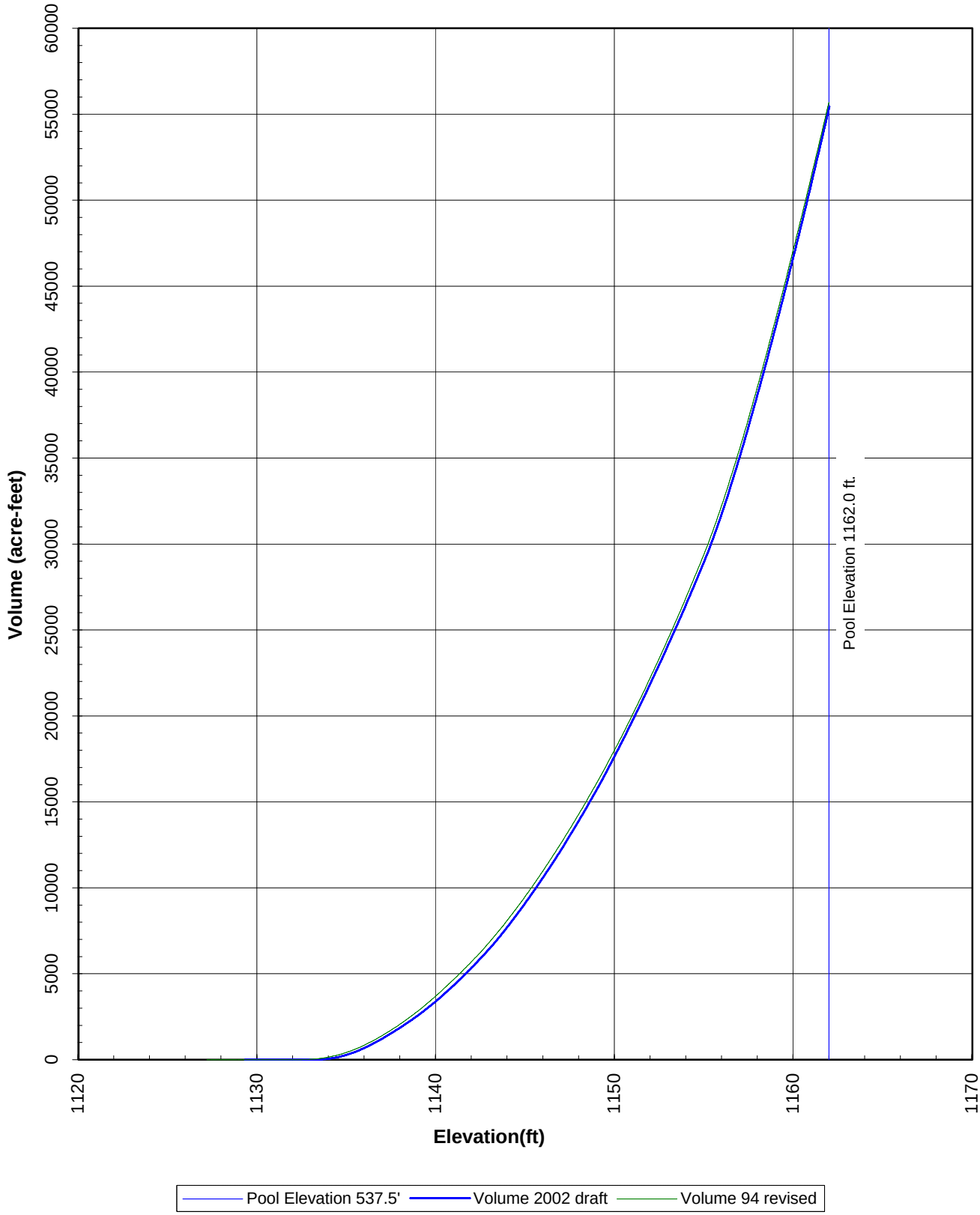
RESERVOIR AREA TABLE

TEXAS WATER DEVELOPMENT BOARD — December 1993 Survey

REVISED

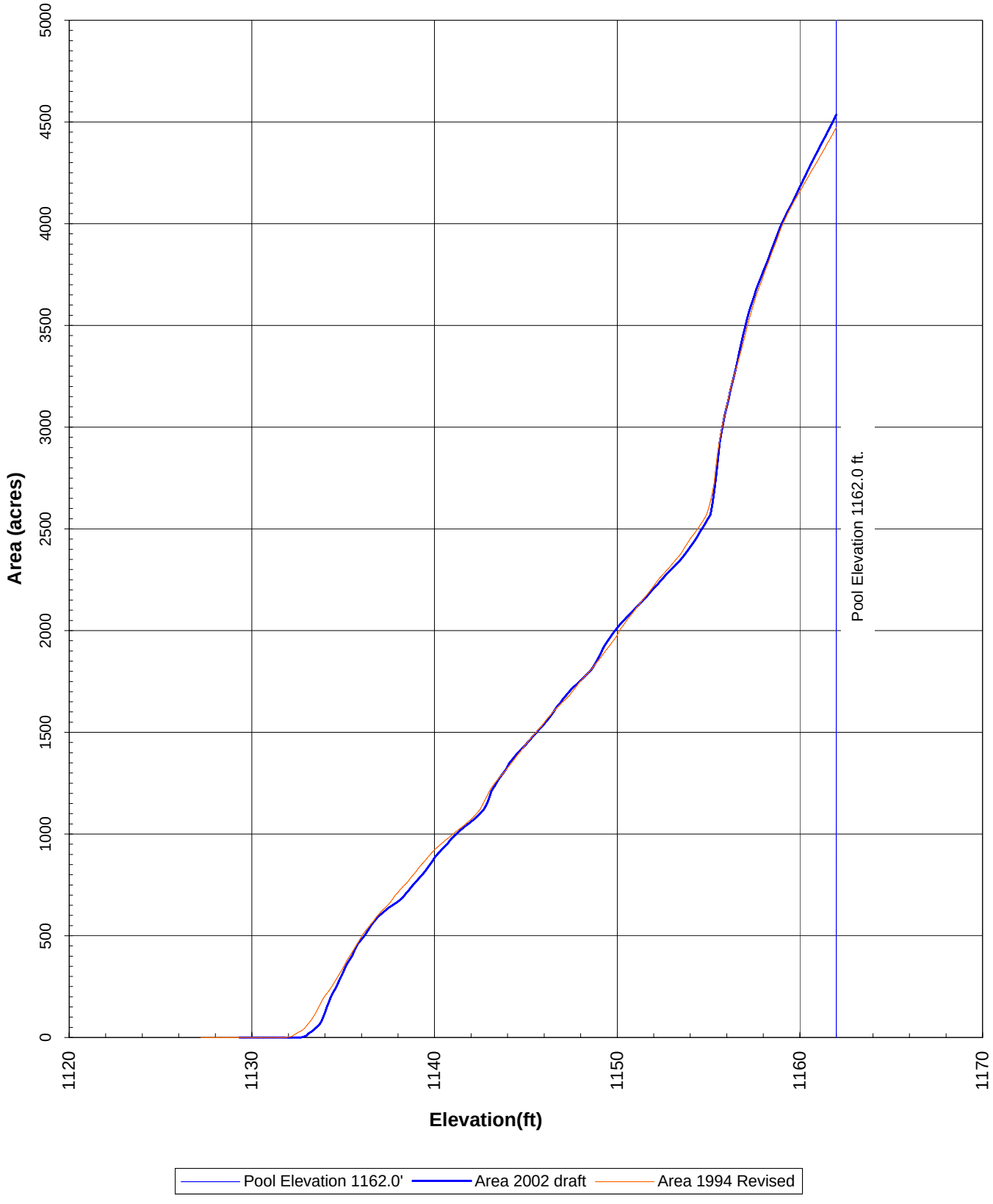
AREA IN ACRES — ELEVATION INCREMENT IS ONE TENTH FOOT

ELEVATION in Feet	0.0	0.1	0.2	0.3	0.4	0.5	0.6	0.7	0.8	0.9
1127			0	0	0	0	0	0	0	0
1128	0	0	0	0	0	0	0	0	0	0
1129	0	0	0	0	0	0	0	0	0	0
1130	0	0	0	0	0	0	0	0	0	0
1131	0	0	0	0	0	0	0	0	1	1
1132	2	3	6	12	18	24	28	33	39	48
1133	58	69	80	93	107	121	139	157	175	191
1134	205	217	227	240	253	269	284	298	313	328
1135	344	361	378	392	406	421	436	450	466	482
1136	497	510	522	534	544	555	566	578	591	601
1137	611	621	630	639	647	656	667	680	693	703
1138	714	725	735	744	753	763	773	785	796	806
1139	817	829	840	851	862	872	882	893	903	913
1140	923	931	939	947	955	962	970	977	984	992
1141	999	1006	1014	1020	1027	1035	1042	1049	1057	1065
1142	1072	1080	1090	1100	1111	1123	1139	1157	1175	1192
1143	1212	1225	1238	1251	1262	1273	1283	1294	1304	1315
1144	1326	1336	1349	1360	1371	1383	1395	1405	1417	1429
1145	1441	1453	1463	1474	1484	1495	1505	1515	1525	1536
1146	1547	1559	1570	1581	1591	1601	1611	1621	1630	1638
1147	1647	1656	1665	1674	1684	1695	1706	1718	1730	1742
1148	1752	1762	1772	1781	1791	1801	1811	1823	1834	1845
1149	1857	1868	1880	1893	1905	1917	1928	1940	1952	1964
1150	1978	1995	2010	2022	2034	2047	2059	2070	2082	2093
1151	2105	2117	2128	2139	2151	2162	2174	2184	2195	2207
1152	2219	2232	2244	2255	2266	2276	2286	2296	2305	2315
1153	2326	2337	2348	2358	2369	2380	2394	2408	2423	2437
1154	2450	2463	2475	2488	2500	2513	2526	2540	2555	2572
1155	2599	2634	2676	2726	2800	2876	2935	2983	3025	3064
1156	3105	3146	3186	3220	3253	3285	3315	3347	3381	3417
1157	3453	3487	3521	3554	3586	3616	3643	3669	3694	3718
1158	3743	3769	3793	3817	3840	3865	3888	3911	3936	3960
1159	3983	4006	4025	4043	4061	4078	4096	4112	4128	4143
1160	4159	4175	4191	4207	4222	4237	4253	4268	4283	4299
1161	4315	4330	4346	4362	4377	4393	4409	4425	4441	4457
1162	4474									



Proctor Lake
July 2002
Prepared by: TWDB

Appendix E Elevation vs. Volume



Proctor Lake
July 2002
Prepared by: TWDB

Appendix F Elevation vs. Area

Appendix G

Proctor Lake

TEXAS WATER DEVELOPMENT BOARD JULY 2002 SURVEY

Range Line Endpoints

State Plane NAD83 Units-feet

L-Left endpoint
R-right endpoint

Range Line	X	Y
Line 01-L	2874883.5	10685978.0
Line 01-R	2871011.0	10690550.0
Line 02-L	2875216.3	10691114.0
Line 02-R	2871391.3	10691315.0
Line 03-L	2872179.8	10694251.0
Line 03-R	2875707.5	10691551.0
Line 04-L	2869934.0	10692891.0
Line 04-R	2869704.5	10691002.0
Line 05-L	2868183.8	10694029.0
Line 05-R	2865340.5	10693053.0
Line 06-L	2870255.3	10698461.0
Line 06-R	2868736.5	10698831.0
Line 07-L	2867275.0	10701752.0
Line 07-R	2866173.8	10699518.0
Line 08-L	2865151.3	10704479.0
Line 08-R	2862303.3	10700525.0
Line 09-L	2860913.5	10707036.0
Line 09-R	2858630.5	10703985.0
Line 10-L	2857985.0	10709689.0
Line 10-R	2855680.0	10706723.0
Line 11-L	2870721.8	10689934.0
Line 11-R	2870982.3	10686086.0
Line 12-L	2866806.0	10687940.0
Line 12-R	2867027.8	10684149.0
Line-13-L	2864392.8	10688898.0
Line-13-R	2864454.3	10684560.0
Line 14-L	2859888.5	10687916.0
Line 14-R	2859936.0	10685790.0
Line 15-L	2857255.0	10688582.0
Line 15-R	2855755.3	10686189.0

Appendix G (Continued)

Proctor Lake

TEXAS WATER DEVELOPMENT BOARD JULY 2002 SURVEY

Range Line Endpoints

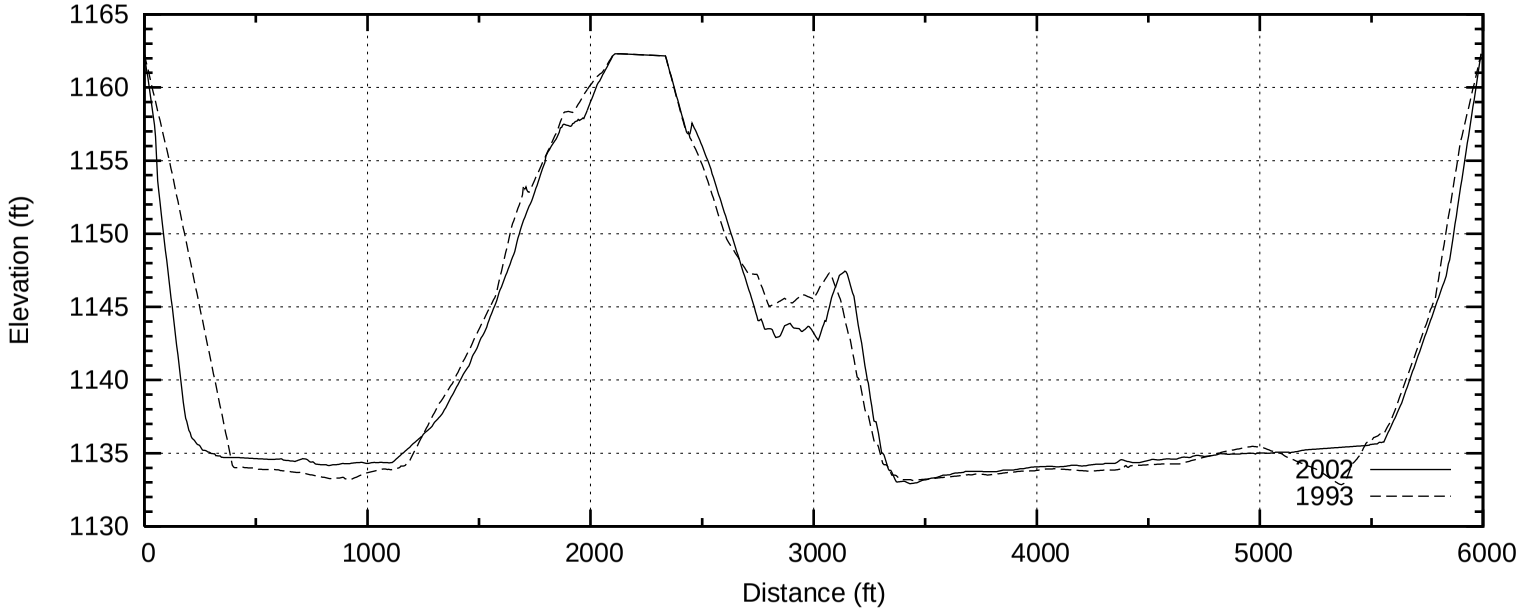
State Plane NAD83 Units-feet

L-Left endpoint
R-right endpoint

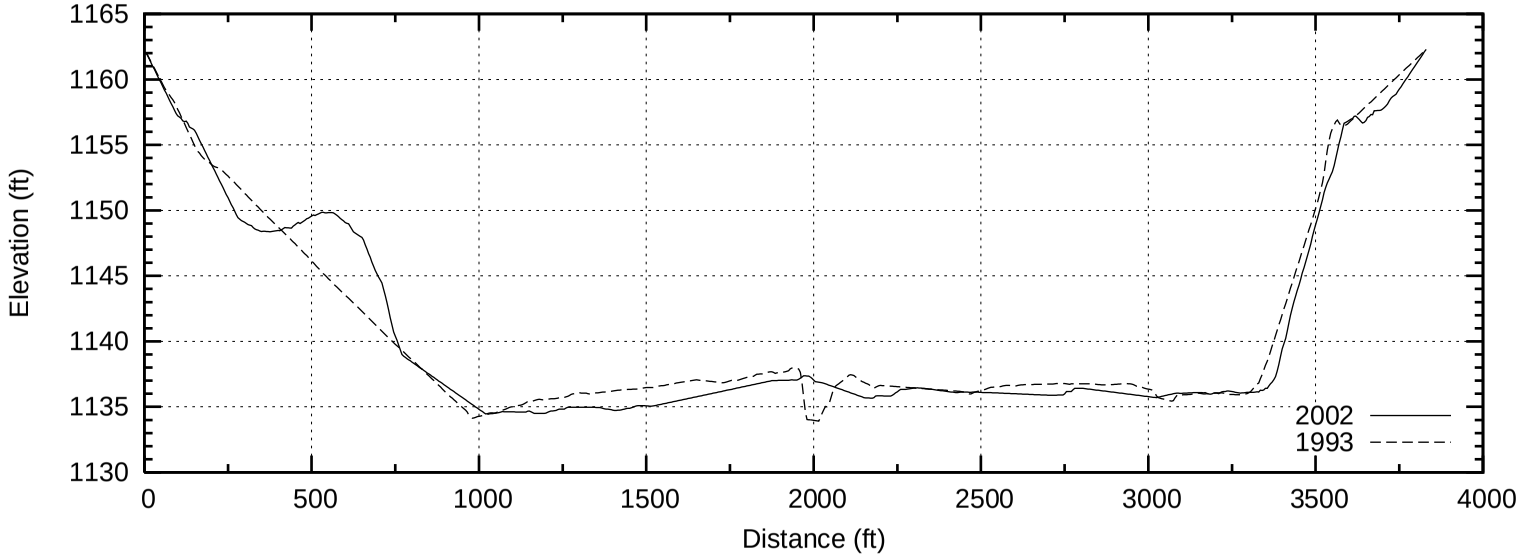
Range Line	X	Y
Line 16-L	2855462.5	10690056.0
Line 16-R	2853457.3	10687369.0
Line 17-L	2853572.3	10687007.0
Line 17-R	2854322.3	10686241.0

Proctor Lake

Rangeline SR01

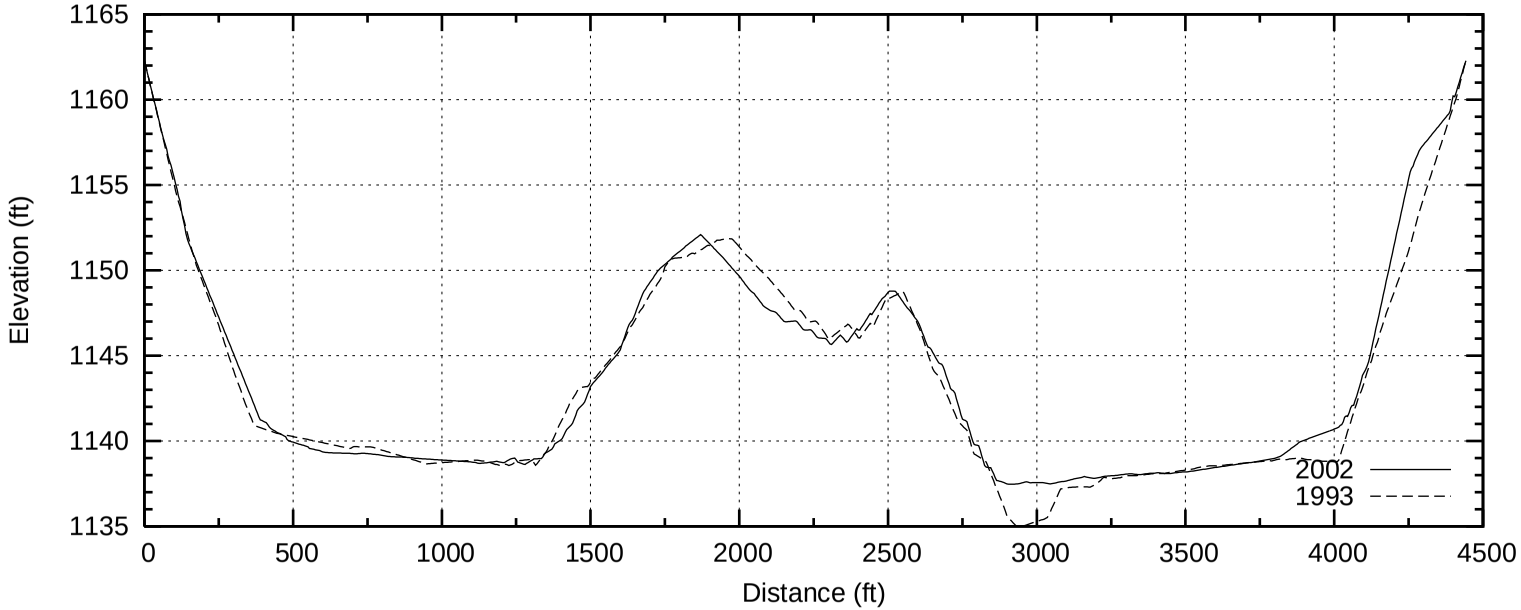


Rangeline SR02

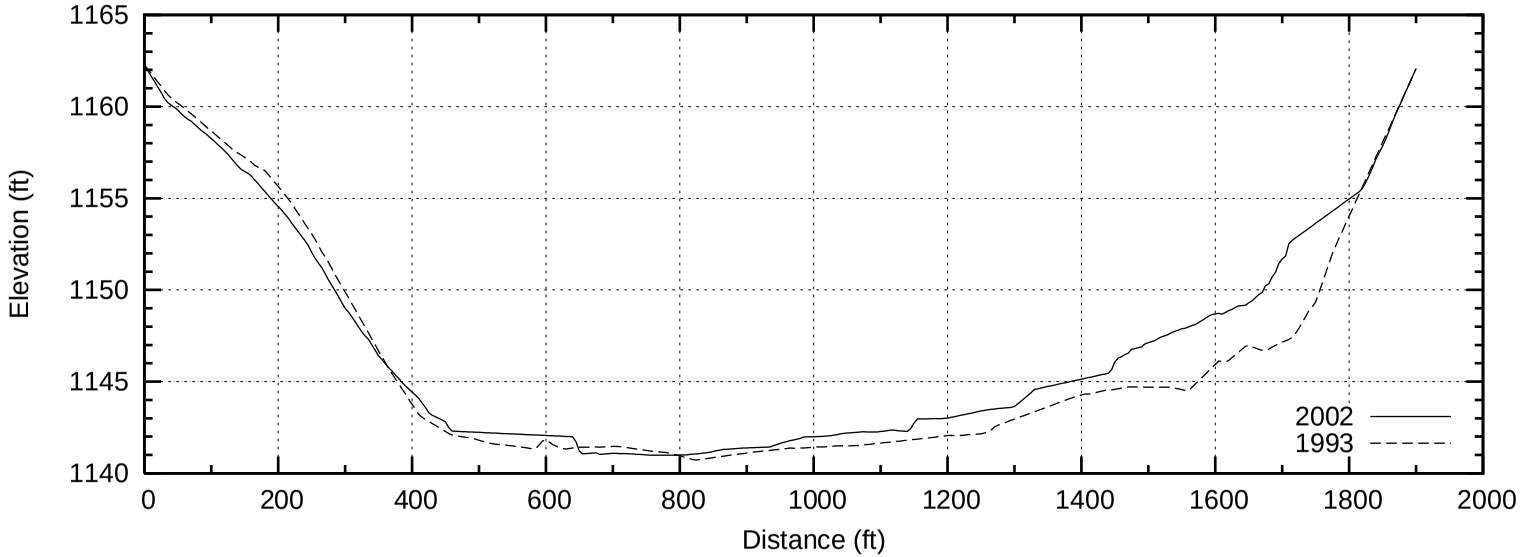


Proctor Lake

Rangeline SR03

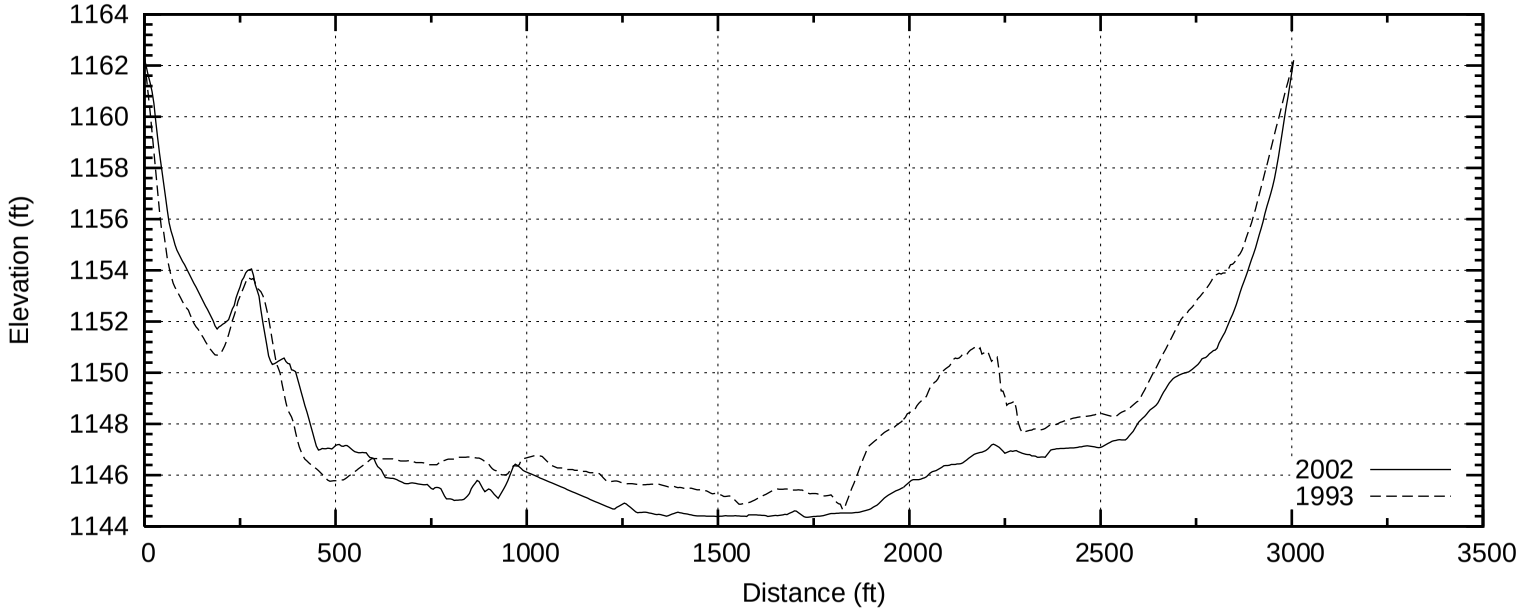


Rangeline SR04

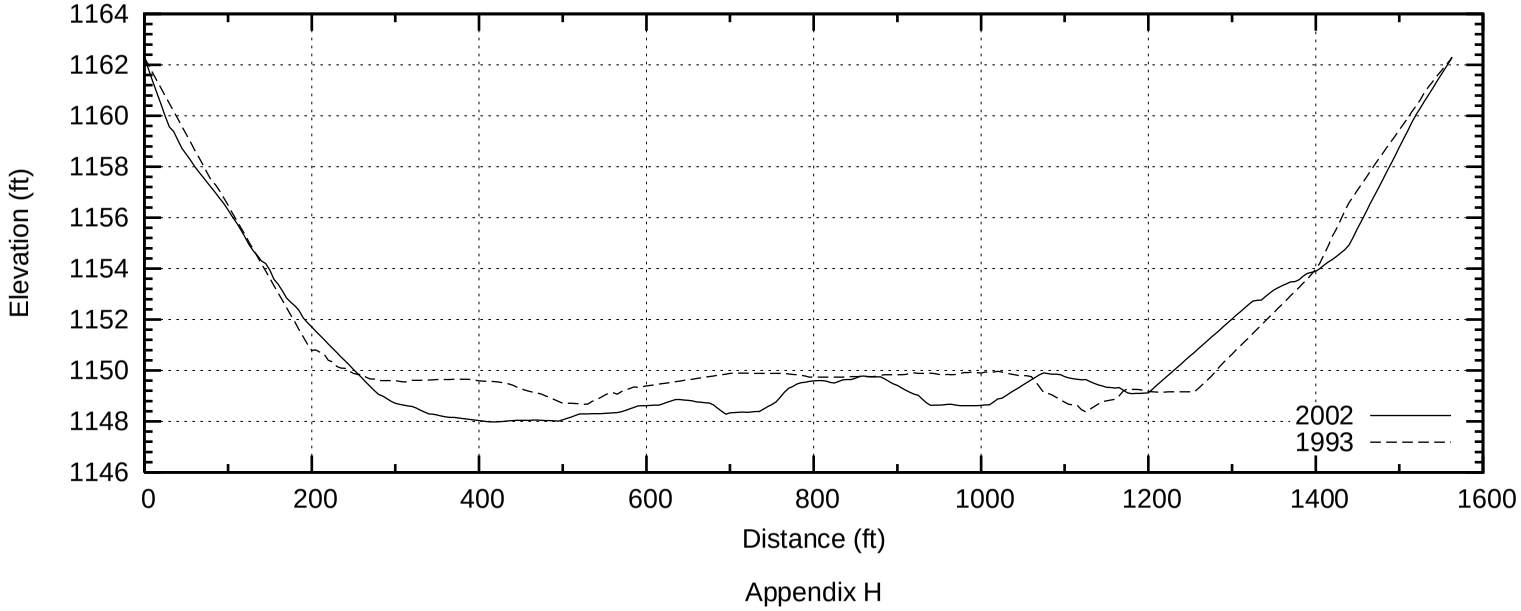


Proctor Lake

Rangeline SR05

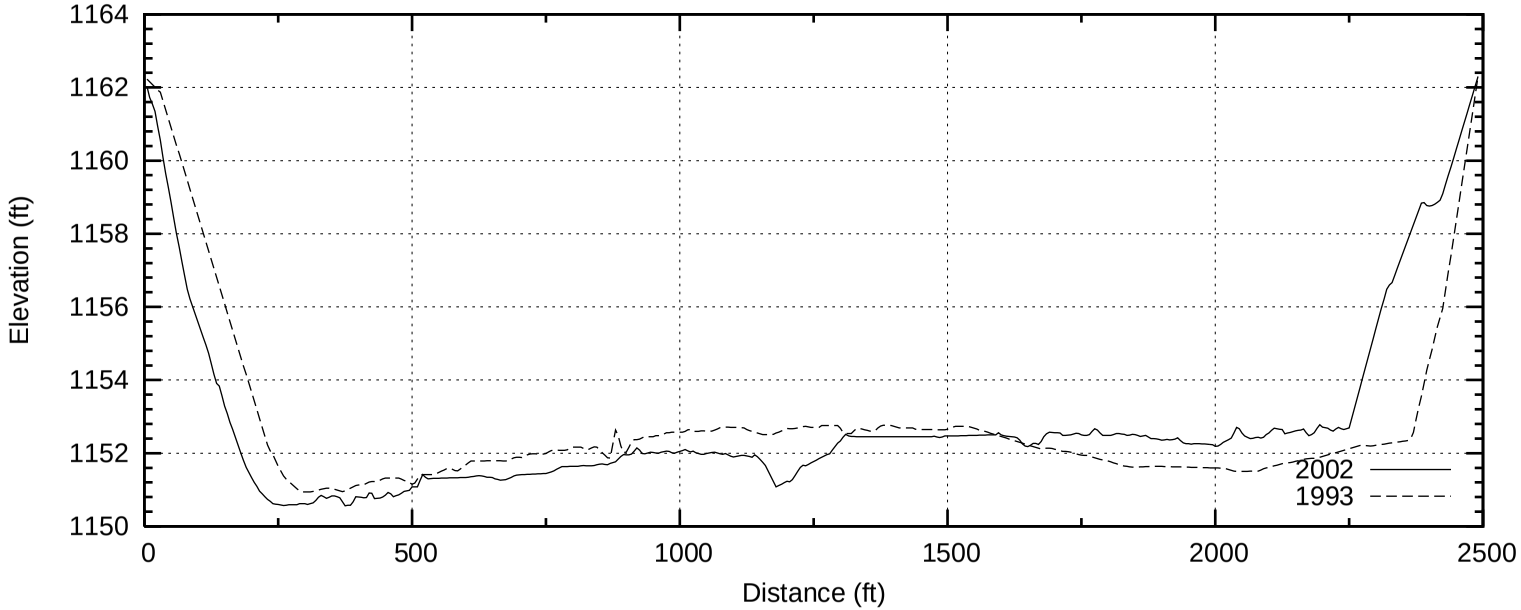


Rangeline SR06

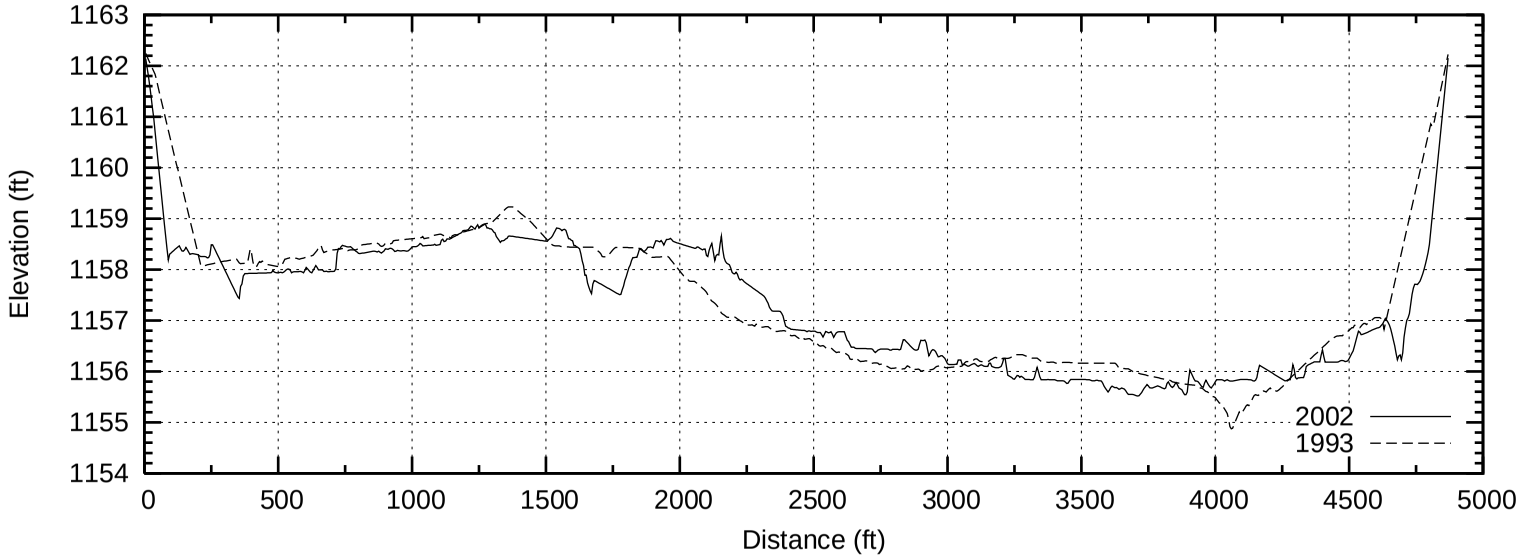


Proctor Lake

Rangeline SR07

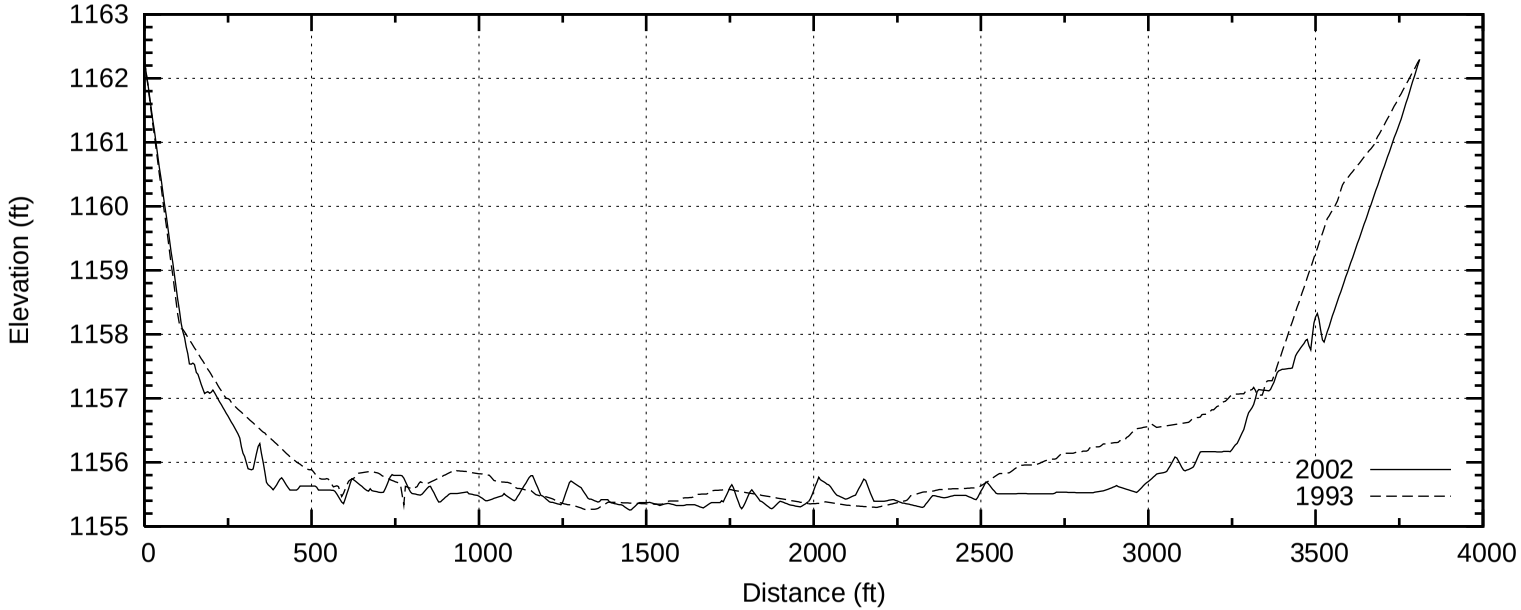


Rangeline SR08

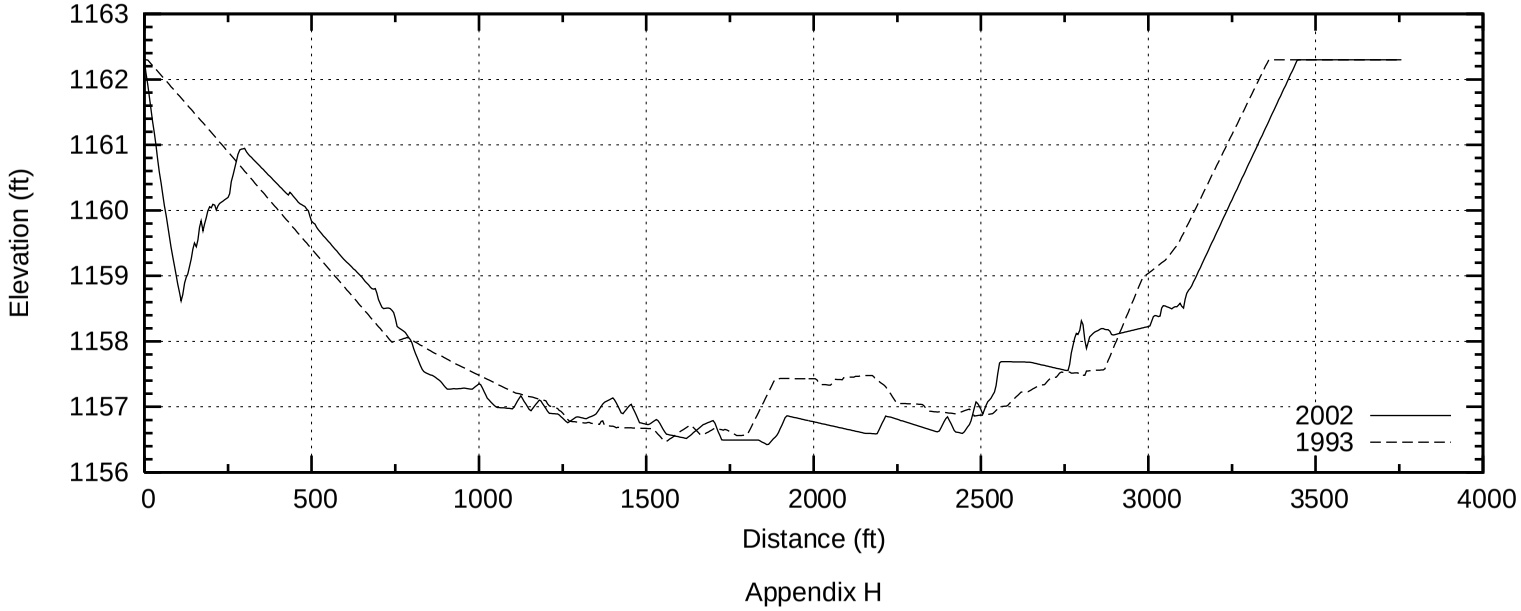


Proctor Lake

Rangeline SR09

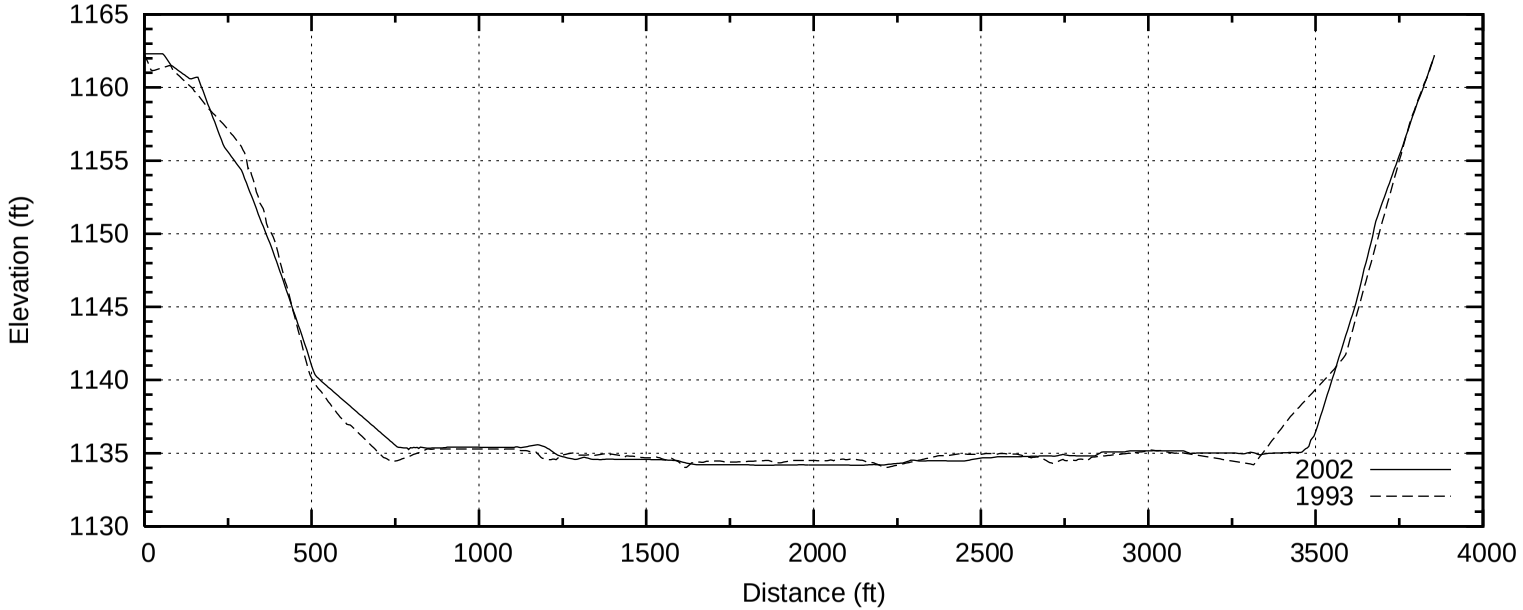


Rangeline SR10

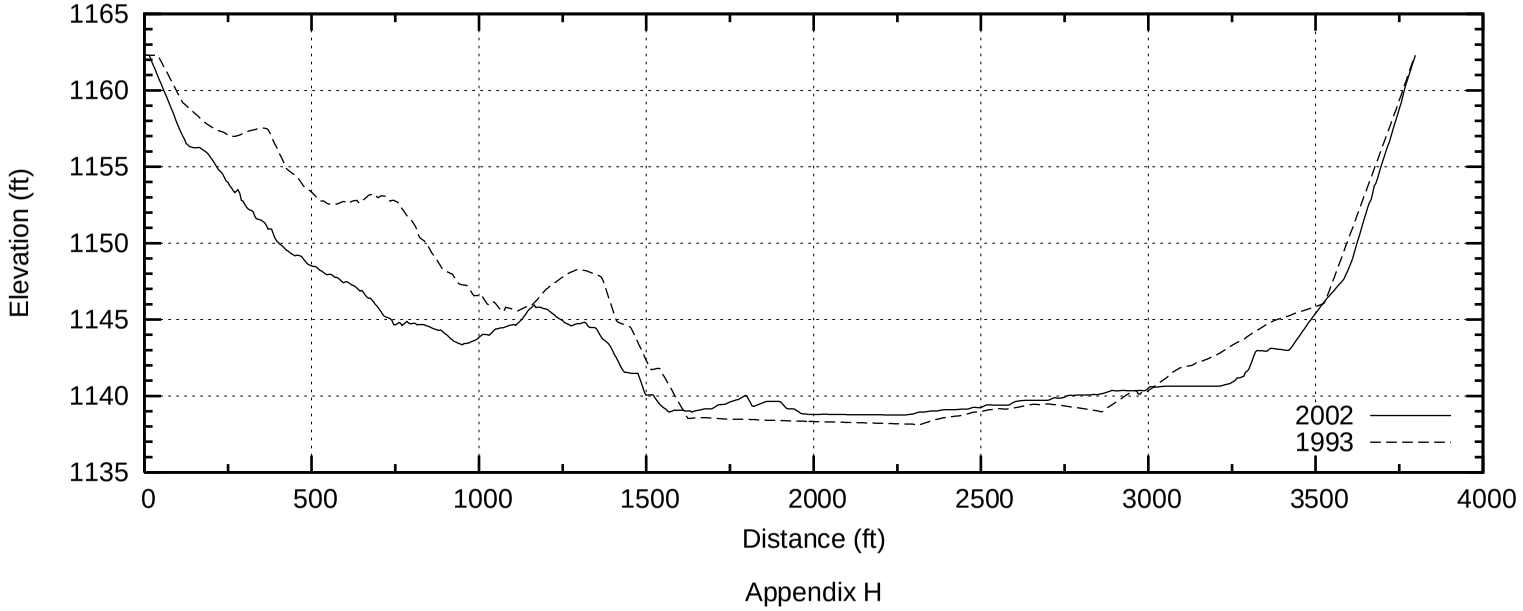


Proctor Lake

Rangeline SR11

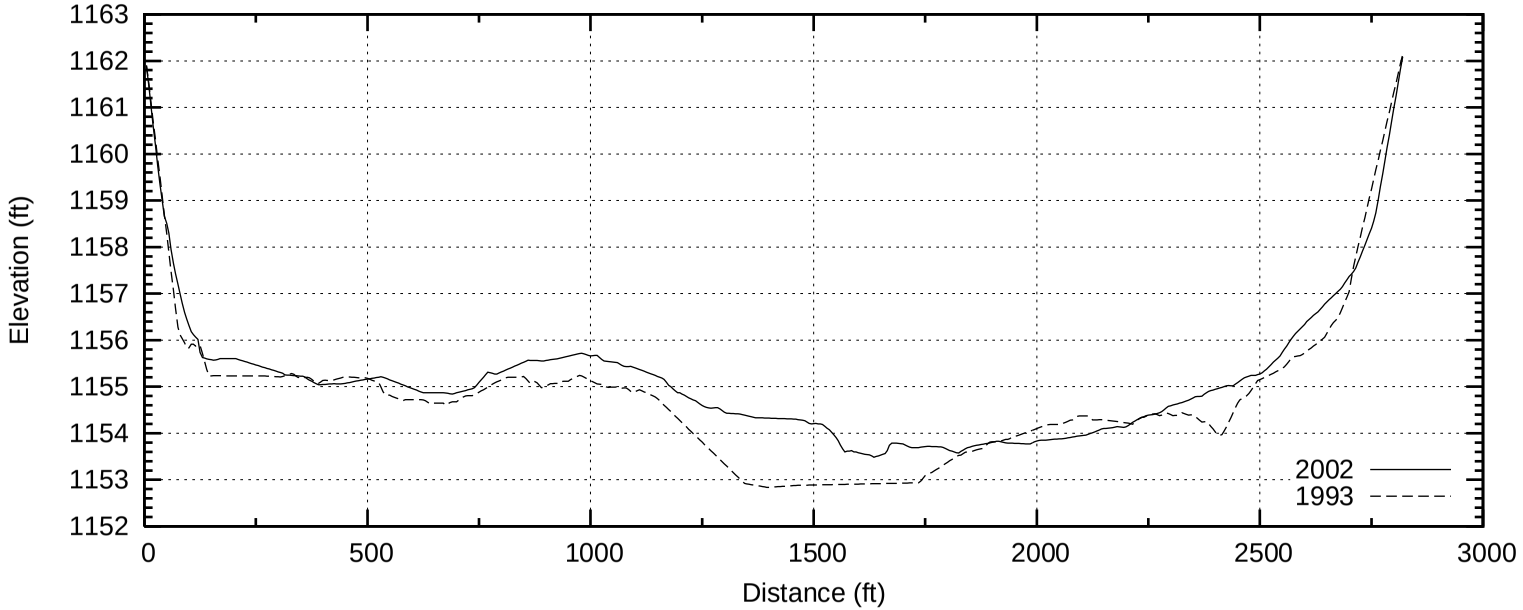


Rangeline SR12

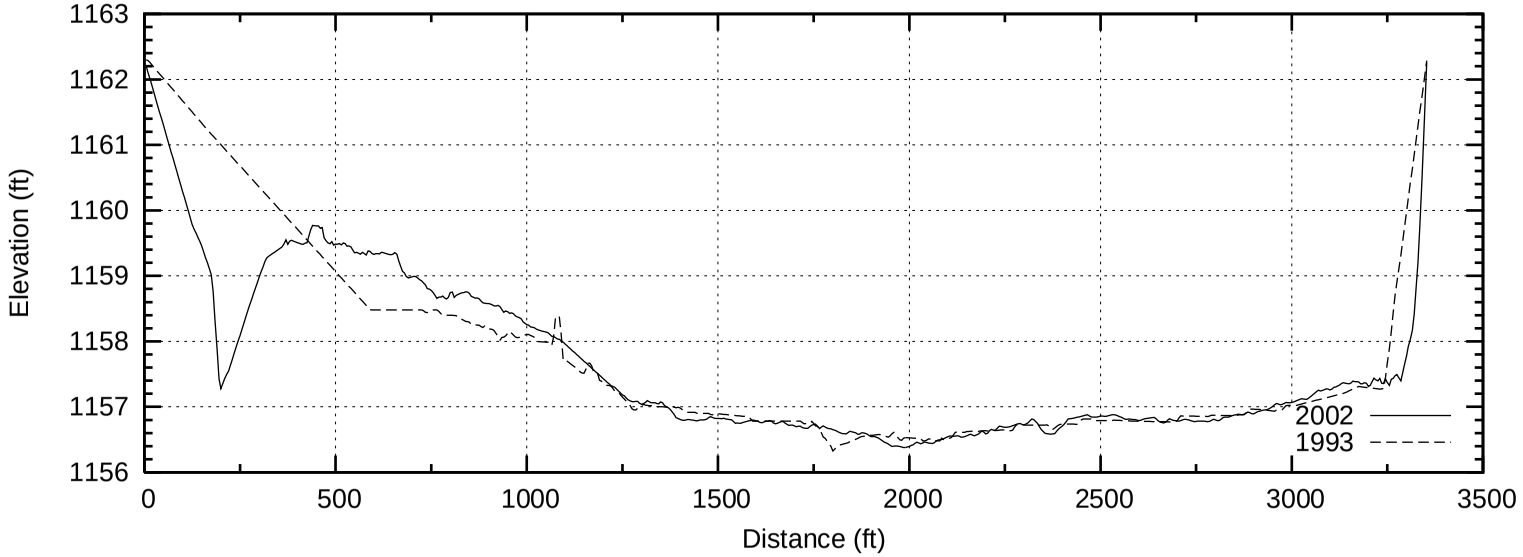


Proctor Lake

Rangeline SR15



Rangeline SR16



Proctor Lake

Rangeline SR17

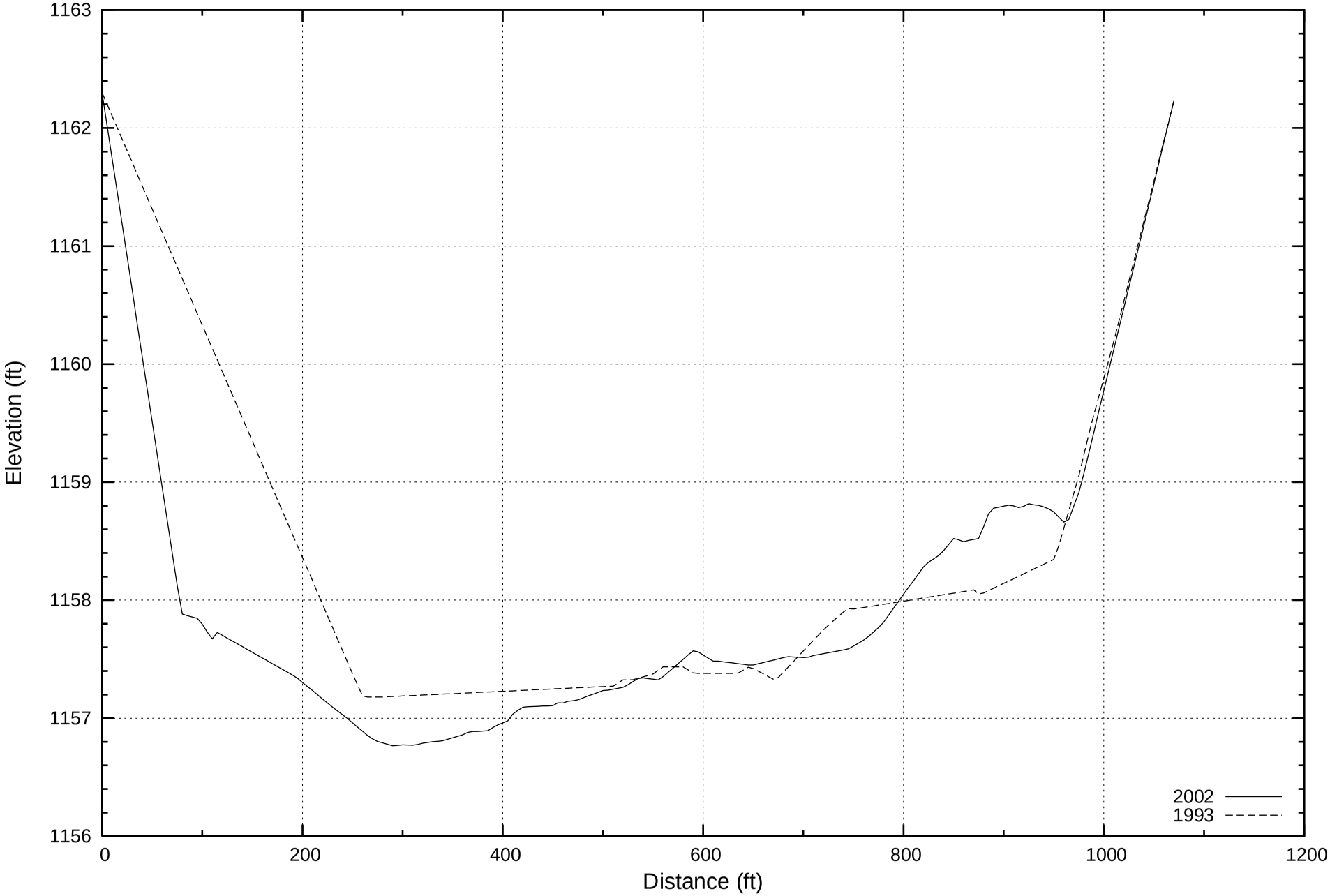
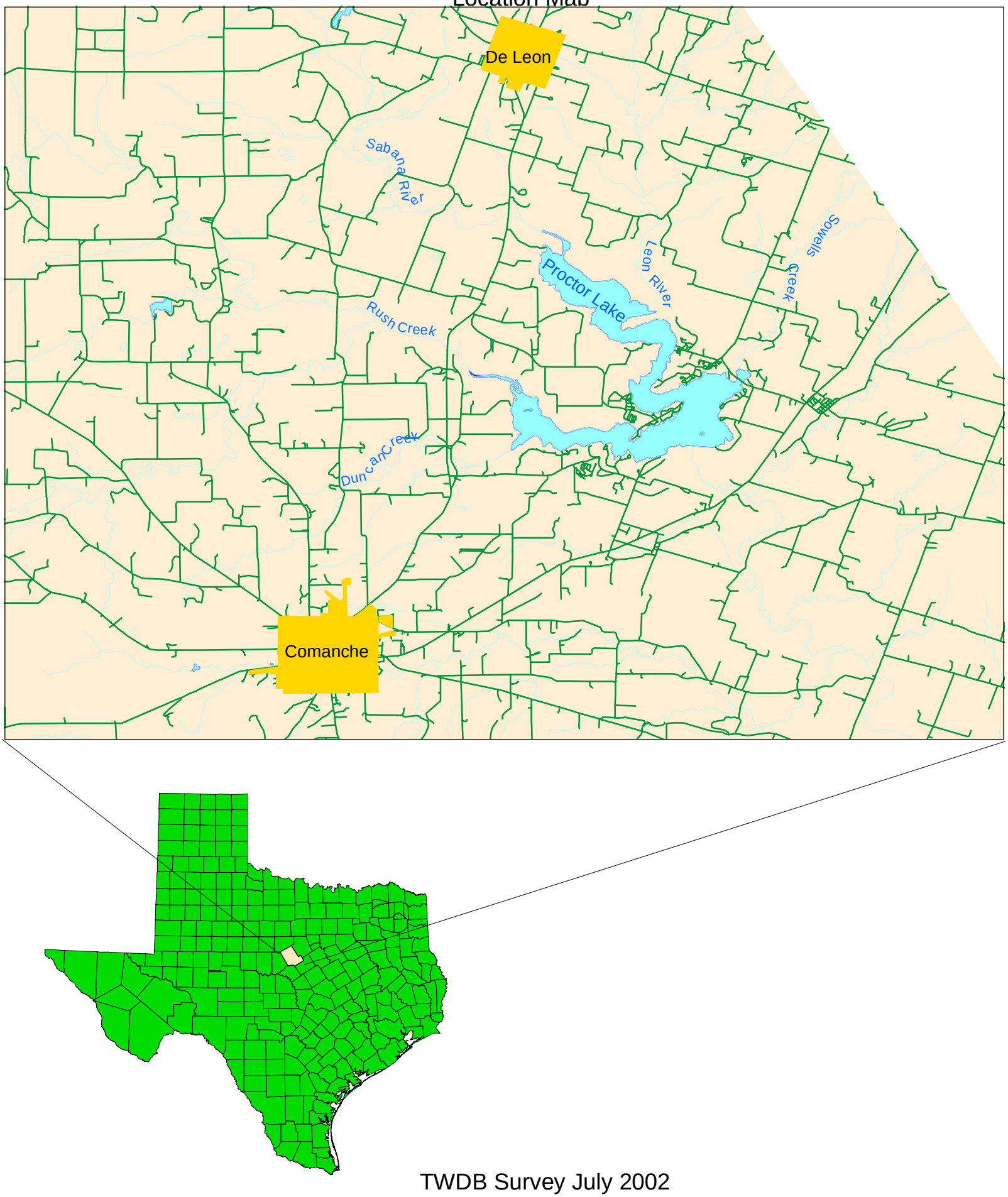


Figure 1

PROCTOR LAKE

Location Map

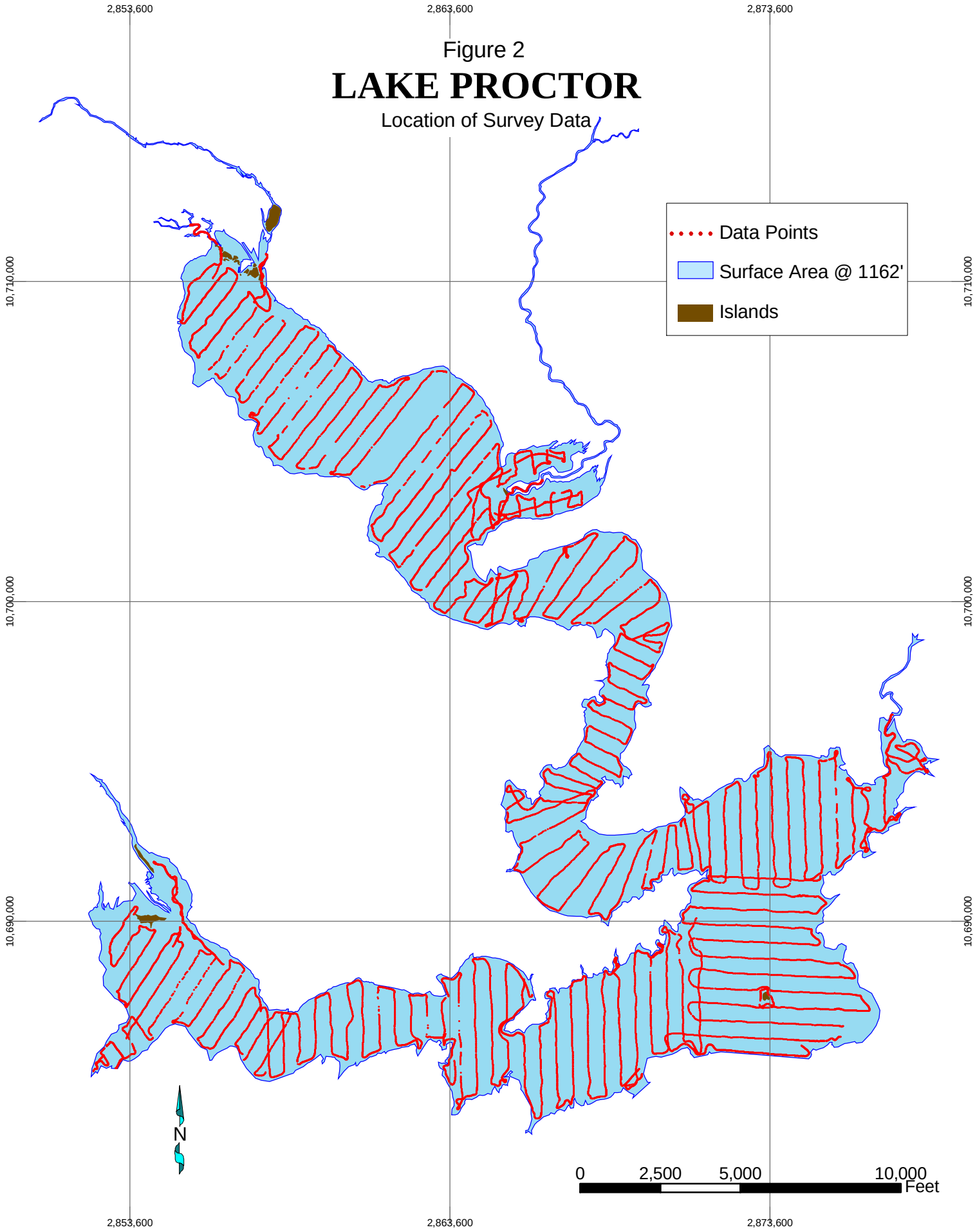


TWDB Survey July 2002

Figure 2

LAKE PROCTOR

Location of Survey Data



TWDB Survey June 2002

Figure 3

2' - Contour Map

PROCTOR LAKE

1,000 500 0 1,000 2,000 Feet

N

Water Surface @ 1162.3'

Islands

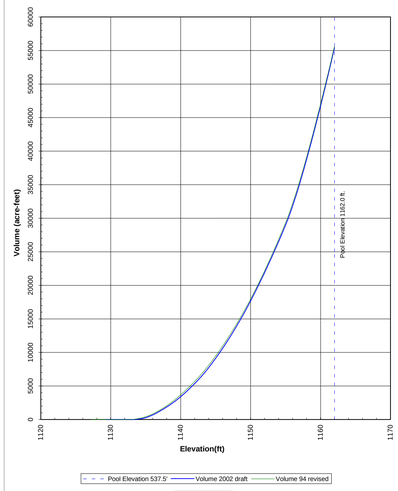
Elevation 1162.3'

Cross Sections

Contours

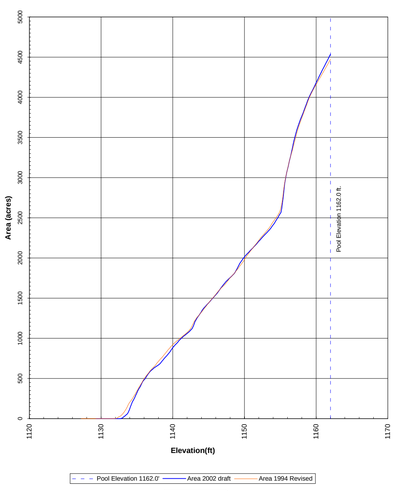
1134
1136
1138
1140
1142
1144
1146
1148
1150
1152
1154
1156
1158
1160

SR10-L
SR10-R
SR09-L
SR09-R
SR08-L
SR08-R
SR07-L
SR07-R
SR06-R
SR06-L
SR05-L
SR05-R
SR04-L
SR04-R
SR03-L
SR03-R
SR02-R
SR02-L
SR01-R
SR01-L
SR11-L
SR11-R
SR12-L
SR12-R
SR13-L
SR13-R
SR14-L
SR14-R
SR15-L
SR15-R
SR16-L
SR16-R
SR17-L
SR17-R



Proctor Lake
July 2002
Prepared by: TWDB

Appendix E Elevation vs. Volume



Proctor Lake
July 2002
Prepared by: TWDB

Appendix F Elevation vs. Area

NAD_1983_StatePlane_Texas_Central_FIPS_4203_Feet
Lambert_Conformal_Conic
False_Easting: 2296583.333333
False_Northing: 9842500.000000
Central_Meridian: -100.333333
Standard_Parallel_1: 30.116667
Standard_Parallel_2: 31.883333
Latitude_Of_Origin: 29.666667

GCS_North_American_1983

TEXAS WATER DEVELOPMENT BOARD

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

2860000
2870000
10752000
10742000
10732000
10722000

TEXAS WATER DEVELOPMENT BOARD JULY 2002 SURVEY