Volumetric and Sedimentation Survey of LAKE MARBLE FALLS

April 2007 Survey

Prepared by:

The Texas Water Development Board

December 2007

Texas Water Development Board

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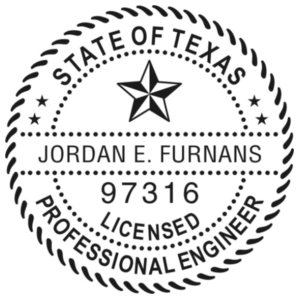

Executive Summary

In March of 2007, the Texas Water Development Board entered into agreement with the Lower Colorado River Authority, Austin, Texas, for the purpose of performing a volumetric and sediment survey of Lake Marble Falls. These surveys were performed simultaneously using a multi-frequency (200 kHz, 50 kHz, and 24 kHz) sub-bottom profiling depth sounder. The 200 kHz return measures the current bathymetric surface, while the combination of the three frequency returns is analyzed for evidence of sediment accumulation throughout the reservoir. In addition, sediment core samples were collected in selected locations and are used both in interpreting the signal returns from the multi-frequency depth sounder and for validation of the sediment accumulation estimates.

Starke Dam and Lake Marble Falls are located on the Colorado River in Burnet County near Marble Falls, Texas. While Lake Marble Falls is considered full at elevation 738.0 feet (NGVD29) above mean sea level, the standard operating level is 736.2 to 737.0 feet above mean sea level (NGVD29). TWDB conducted the Lake Marble Falls survey on April 11th and 12th of 2007, while the water surface elevation measured 737.23 and 737.30 feet above mean sea level (NGVD29), respectively. TWDB returned to the lake to collect data in shallow upstream areas near Wirtz Dam on June 12, 2007 while the water surface elevation measured between 737.05 and 737.08 feet above mean sea level (NGVD29).

To augment the survey data collected by TWDB, the Lower Colorado River Authority provided high-resolution LiDAR data, collected on January 2, 2007 when the water surface elevation in Lake Marble Falls was 737.09 feet above mean sea level (NGVD29). Reservoir capacities were computed based on a combination of the TWDB survey data, TWDB interpolated data, and LiDAR data.

The results of the TWDB 2007 Volumetric Survey indicate Lake Marble Falls has a total reservoir capacity of 7,486 acre-feet and encompasses 608 acres at conservation pool elevation (738 feet above mean sea level, NGVD29).

The results of the TWDB 2007 Sediment Survey indicate Lake Marble Falls has accumulated a negligible amount of sediment since impoundment. Sediment may be accumulating on the edges of the reservoir where it is too shallow for TWDB survey equipment to effectively measure. The expected source of this sediment includes bank erosion and construction runoff.

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Lake Marble Falls General Information

With recurring drought and devastating flooding, early-day residents of Central Texas recognized the value of building dams on the Colorado River. Through the passage of the LCRA Act by the Texas Legislature in 1934, the Lower Colorado River Authority (LCRA) was established as a "conservation and reclamation district" responsible for harnessing the Colorado River and its tributaries and making them productive for the people within its water service area. By 1951, the Lower Colorado River Authority had completed six dams on the Colorado River. The string of lakes is known as the Highland Lakes, and includes (from upstream to downstream) Lake Buchanan, Inks Lake, Lake Lyndon Baines Johnson (LBJ), Lake Marble Falls, Lake Travis, and Lake Austin. All these lakes are owned and operated by the LCRA with the exception of Lake Austin, which is owned by the City of Austin but operated by the Lower Colorado River Authority.[1] The Lower Colorado River Authority's service area originally consisted of the ten counties that comprise the watershed of the lower Colorado River: Blanco, Burnet, Fayette, Colorado, Llano, Travis, Bastrop, Wharton, San Saba, and Matagorda. Several amendments to the LCRA Act expanded the service area to its current extent (Figure 1).

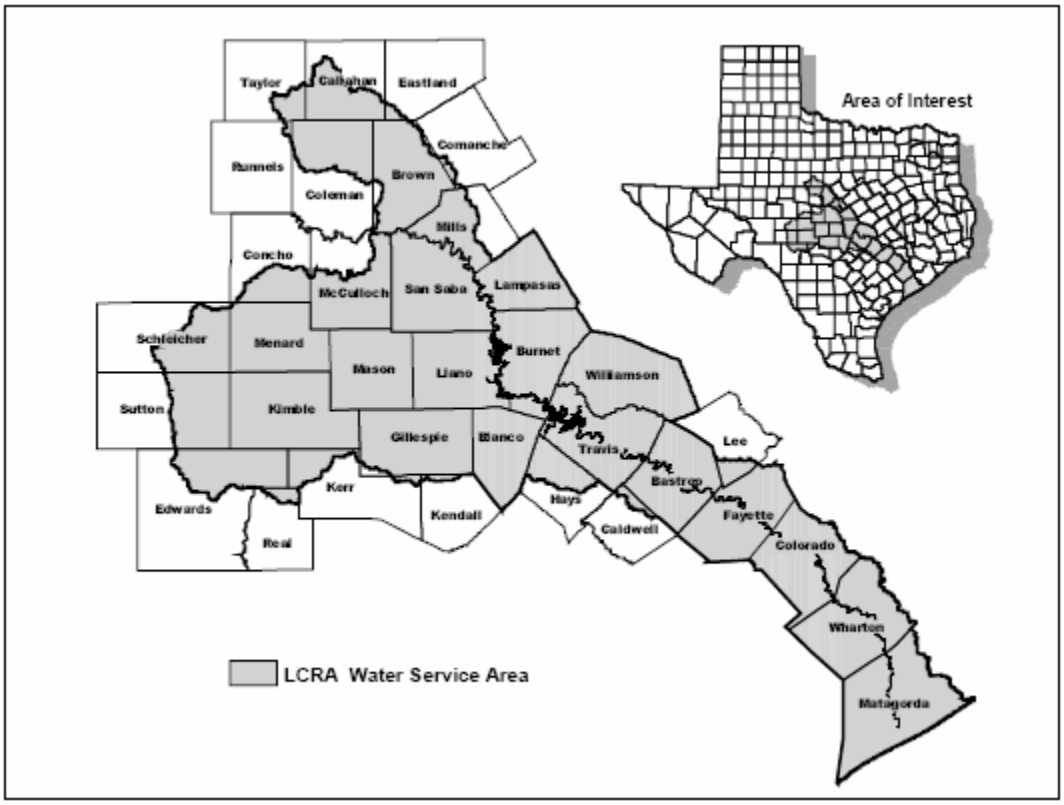


Figure 1. Lower Colorado River Authority Water Service Areas as of January 1, 2003.
Source: Lower Colorado River Authority Water Management Plan 2003.

The Lower Colorado River Authority operates the Highland Lakes as a system. Lakes Buchanan and Travis are water storage reservoirs, while Inks Lake, Lake LBJ, Lake Marble Falls, and Lake Austin are pass-through reservoirs. Lake Travis is the only lake in the system truly designed for flood control purposes. The Lower Colorado River Authority maintains a Water Management Plan as a blueprint for how it will operate the Highland Lakes System. Water availability is based on the Combined Firm Yield of Lakes Buchanan and Travis. The Combined Firm Yield is the annual dependable water supply that can be supplied from Lakes Buchanan and Travis during a repetition of the drought of record. Any water available for use in excess of the combined firm yield is considered interruptible water, used mainly for irrigation, and is sold on an interruptible basis subject to annual availability. Availability of interruptible water is projected by the Lower Colorado River Authority each November. The projected supply depends on the amount of expected combined water storage in Lakes Buchanan and Travis on January 1, anticipated inflows for the subsequent months through the irrigation season, and the current demands for firm water.[2]

The Water Management Plan and a system-operation approach to their water rights and reservoirs allows the Lower Colorado River Authority to optimize and conserve available water to meet existing and future water needs while being a steward of the water and land of the lower Colorado River.[3] The complete Lower Colorado River Authority Water Management Plan is available through the Lower Colorado River Authority website at http://www.lcra.org/water/wmp.html.

Starke Dam and Lake Marble Falls are located on the Colorado River in Burnet County near Marble Falls, Texas.[4] (See Figure 2). Construction on Starke Dam began on November 6, 1949 with deliberate impoundment beginning in July of 1951 and power generation commencing on September 25, 1951. Originally named "Marble Falls Dam" the Starke Dam was renamed in 1962 for Max Starke, LCRA's second general manager.[5] The dam was constructed primarily for the production of hydroelectricity and is not designed to store flood water. The City of Marble Falls and other local communities use Lake Marble Falls as a water supply source.[6] Lake Marble Falls is considered full at elevation 738.0 feet above mean sea level (NGVD29), however, the normal operating level is between 736.2 and 737 feet above mean sea level (NGVD29).[5]

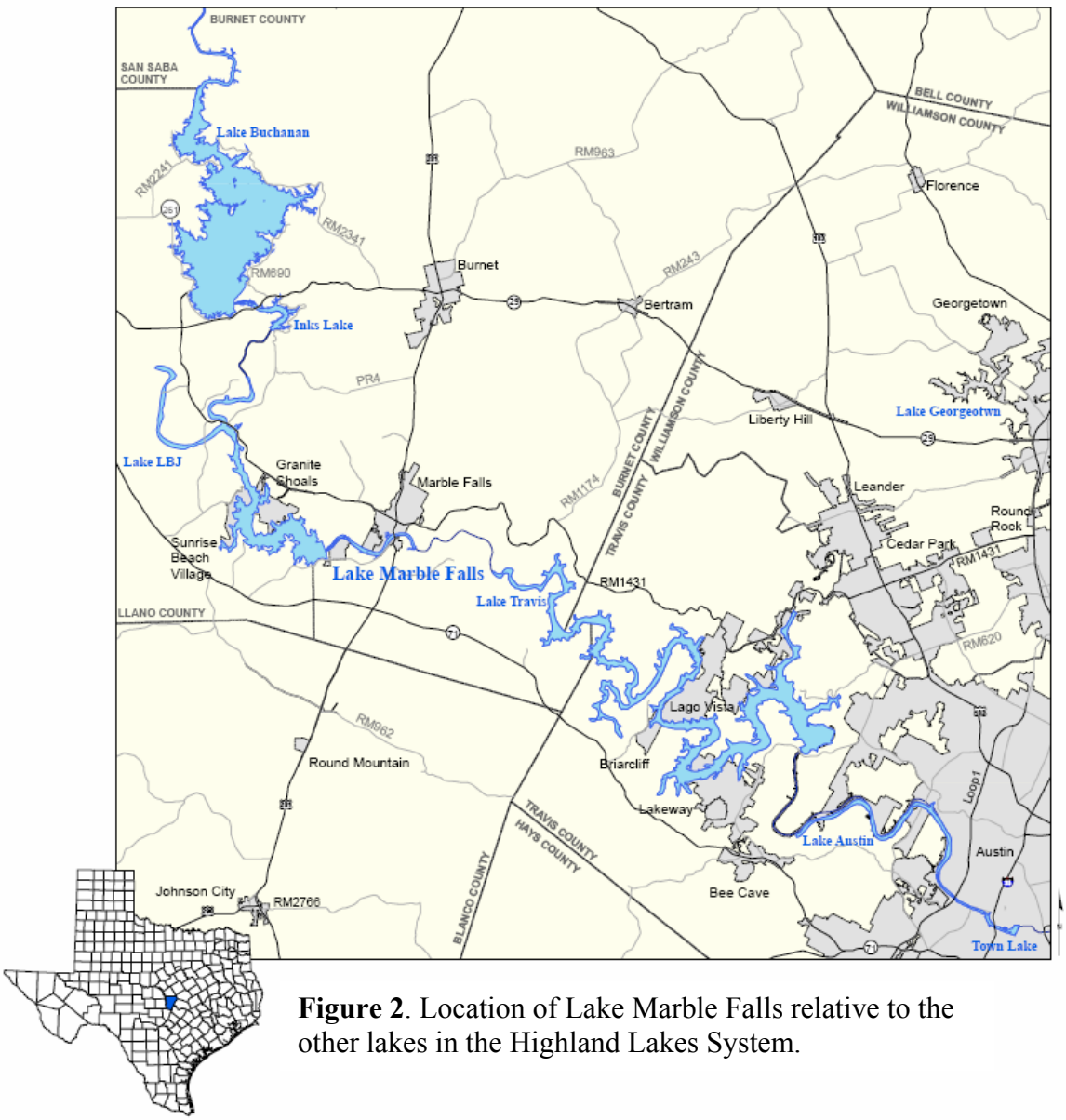


Figure 2. Location of Lake Marble Falls relative to the other lakes in the Highland Lakes System.

Water Rights

The Lower Colorado River Authority was granted the following water right for Lake Marble Falls:

Certificate of Adjudication: 14-2632 - Priority Date: March 29, 1926

This water right authorizes the Lower Colorado River Authority to maintain an existing dam and reservoir on the Colorado River (Starcke Dam and Lake Marble Falls) and impound therein not to exceed 8,760 acre-feet of water. The Lower Colorado River Authority is authorized to divert and use water through Starcke Dam for the purpose of hydroelectric power generation. However, the water cannot be released solely for the

purpose of hydroelectric generation, except during emergency shortages of electricity and during times that such releases will not impair Lower Colorado River Authority's ability to satisfy all existing and projected demands for water from Lakes Travis and Buchanan pursuant to all firm, uninterruptible and all non-firm, interruptible commitments. The right to release water solely for the purpose of hydroelectric generation is specifically subordinated, as to priority, to all present and future upstream rights to use the waters of the Colorado River and its tributaries for municipal, domestic, industrial, irrigation and/or mining purposes, except during emergency shortages of electricity or when the holder of any upstream right agrees otherwise. The maximum rate for diversion for hydroelectric power generation is 8,200 cubic feet per second.

The following table is a list of pertinent data about Starke Dam and Lake Marble Falls.[4,5]

Table 1: Pertinent Data for Starke Dam and Lake Marble Falls

Owner: Lower Colorado River Authority
Engineer: (Design): Fargo Engineering Company
Location: On the Colorado River in Burnet County, near Marble Falls, TX, 382 river miles from the Gulf of Mexico.
Drainage Area: 36,325 square miles of 11,900 square miles is probably noncontributing. River flow is regulated by upstream storage and powerplant operation.
Dam:

Type	Concrete with roof-weir gates
Length	859.5 feet including the powerhouse
Height	98.8 feet to top of the control piers
Top Width	13 feet
Base Width	56.83 feet

Spillway:

Type	Ogee section
Length (net)	608.3 feet
Crest Elevation	725.0 feet above msl
Control	10 floodgates, each 60 feet wide by 15 feet tall*
Discharge Capacity	10 floodgates @ 10,400 cubic feet per second each
	2 turbines @ 4,100 cubic feet per second each
Total discharge capacity	112,200 cubic feet per second

Outlet Works: None. Water releases made through turbine operation.
Power Features: Two turbines with a total generating capacity of 36.4 megawatts.

* LCRA replaced all 10 floodgates in 2003, originally there were 10 roof-weir gates, each 60.83 feet wide by 13 feet tall. The new gate design and automated controls improve response time and reliability, as well as worker safety. The old gates totaled 80,000 pounds versus the 60,000 pounds that the new gates weigh. The new gates also increased the discharge capacity by approximately 200 cubic feet per second per floodgate. [5,7]

Volumetric and Sediment Survey of Lake Marble Falls

Introduction

The Texas Water Development Board's (TWDB) Hydrographic Survey Program was authorized by the state legislature in 1991. The Texas Water Code authorizes TWDB to perform surveys to determine reservoir storage capacity, sedimentation levels, rates of sedimentation, and projected water supply availability.

In March of 2007, TWDB entered into agreement with the LCRA for the purpose of performing volumetric and sediment surveys of Lake Marble Falls. These surveys were performed simultaneously using a single-beam multi-frequency (200 kHz, 50 kHz, and 24 kHz) sub-bottom profiling depth sounder. The 200 kHz return measures the current bathymetric surface, while the combination of the three frequencies, along with core samples for correlating the pre-impoundment surface with the signal return, is analyzed for evidence of sediment accumulation throughout the reservoir.

To augment the survey data collected by TWDB, the LCRA provided high-resolution LiDAR data, collected on January 2, 2007 when the water surface elevation in Lake Marble Falls was 737.09 feet above mean sea level (NGVD29). Reservoir capacities were computed based on a combination of the TWDB survey data, TWDB interpolated points, and LiDAR data.

Datum

All elevations reported throughout this report are referenced to the NGVD29 datum. Per instructions provided by the LCRA, water levels measured at Starcke Dam and reported through the LCRA's River Operations Center Hydromet system were referenced to the NGVD29 datum by adding 0.50 feet.[8,9] At the request of the LCRA, area and volume tables were created using elevations based on the NGVD29 datum and based on the NAVD88 datum. Per LCRA instructions water levels at Starke Dam available on the Hydromet system were converted to the NAVD88 datum by adding 0.69 feet. This conversion is only valid for the area about Starke Dam and should not be used for other locations. Volume and area tables computed from each vertical datum are included in Appendix A and B, respectively. The horizontal datum used for this report is North

American Datum of 1983 (NAD83) State Plane Texas Central Zone (feet). Unless otherwise noted, all elevations provided herein are referenced to the NGVD29 datum.

TWDB Bathymetric Data Collection

Bathymetric data collection for Lake Marble Falls occurred on April 11th and April 12th of 2007, while the water surface elevation averaged 737.23 feet and 737.30 feet above mean sea level (NGVD29), respectively. TWDB returned to the lake to collect data in the shallow areas downstream from Wirtz Dam on June 12, 2007 while the water surface elevation averaged between 737.05 and 737.08 feet above mean sea level. For data collection on April 11th and April 12th of 2007, TWDB used a Specialty Devices, Inc., multi-frequency (200 kHz, 50 kHz, and 24 kHz) sub-bottom profiling depth sounder integrated with Differential Global Positioning System (DGPS) equipment. Data collection occurred while navigating along pre-planned range lines oriented perpendicular to the assumed location of the original river channels and spaced approximately 500 feet apart. For data collection on June 12th 2007, a TWDB used a Knudsen Engineering Ltd. single-frequency (200 kHz) depth sounder integrated with DGPS equipment. Data was collected in-between rock outcrops where boat passage was permissible. For all data collection efforts, the depth sounder was calibrated daily using a velocity profiler to measure the speed of sound in the water column and a weighted tape or stadia rod for depth reading verification. The average speed of sound through the water column measured 4,852 feet per second on April 11th and 4,856 feet per second on April 12th. During the 2007 survey, team members collected 25,147 data points over cross-sections totaling nearly 19 miles in length. Figure 3 shows where data points were collected during the TWDB 2007 survey.

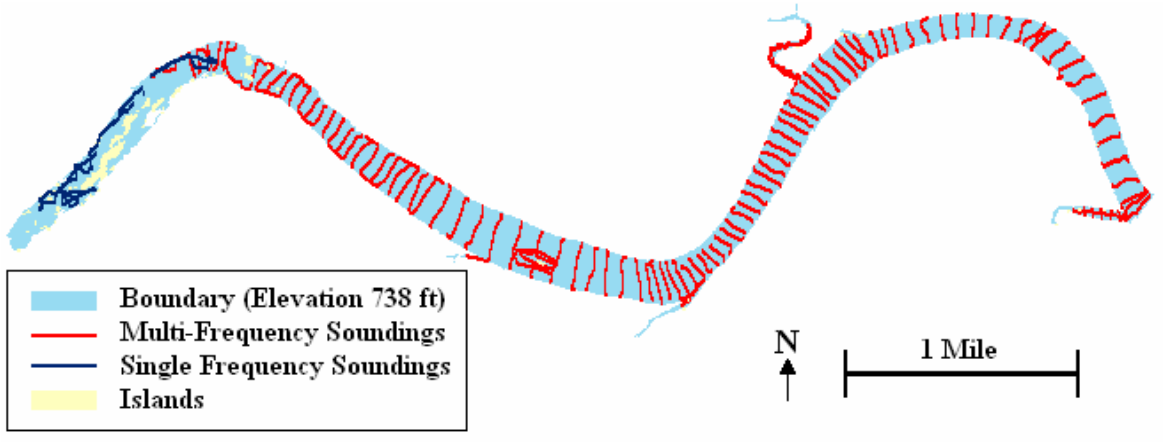


Figure 3 TWDB 2007 survey data points for Lake Marble Falls

Data Processing

Model Boundaries

At the request of the Lower Colorado River Authority, surface areas and capacities were calculated to elevation 845 feet, or 107 feet above conservation pool elevation. The model boundary at elevation 845 feet was developed from a combination of the 860-foot contour from the digital hypsography (1:24,000 scale)[10] and LCRA-provided LiDAR data (See Appendix F). For modeling purposes only, the 860-foot contour was closed across the tops of both Starke and Wirtz dam, and therefore does not reflect the true elevations near the either dam crest. Upon analysis of the land surface suggested by the LiDAR data, areas outside of Lake Marble Falls but with elevations less than the 738-foot conservation pool elevation were identified. As such areas should not be included when assessing the area and volume of Lake Marble Falls, a second model boundary was developed at the 738-foot contour, including only the areas within the lake. This boundary was developed from a combination of the LiDAR and aerial photography. The aerial photographs, or digital orthophoto quarter-quadrangle images[11] (DOQQs) used for Lake Marble Falls were entitled Marble Falls NW, Marble Falls NE, Marble Falls SW, and Marble Falls SE. These images were photographed on September 3, 2005, during which time the water surface elevation at Lake Marble Falls measured 737.15 feet. A complete description of the methods used in creating each of the model boundaries used herein is provided in Appendix F.

Triangulated Irregular Network (TIN) Model

Upon completion of data collection, the raw data files collected by TWDB were edited using DepthPic and HydroEdit to remove any data anomalies. DepthPic is used to display, interpret, and edit the multi-frequency data, while HydroEdit is used to edit the single-frequency data collected in the shallower upper reaches of the reservoir. The water surface elevations at the times of each sounding are used to convert sounding depths to corresponding bathymetric elevations. For processing outside of DepthPic and HydroEdit, the sounding coordinates (X,Y,Z) are exported as a MASS points file. A similar MASS points file was created from the LCRA-provided LiDAR data (Appendix F). TWDB also created a MASS points file of interpolated data located in-between surveyed cross sections. This points file is described in the section entitled "Self-Similar Interpolation."

To create a surface representation of the Lake Marble Falls bathymetry, the 3D Analyst Extension of ArcGIS (ESRI, Inc.) is used. With this extension, a triangulated irregular network (TIN) model of the bathymetry is created following the Delaunay criteria, where each MASS point and boundary node becomes the vertex of a triangular portion of the reservoir bottom surface.[12] From the TIN model, reservoir capacities and areas are calculated at one-tenth of a foot (0.1 foot) intervals, from elevation 678 feet to elevation 845 feet. TWDB surveyed data and interpolated data were used in creating surfaces with elevations less than 737.5 feet, whereas LCRA-provided LiDAR data were used for areas with elevations greater than 737.5 feet. Due to the existence of low-elevation areas outside of the Lake Marble Falls boundary, two separate TIN models were created in order to properly compute areas and volumes. The first TIN model, named the "Bathymetry" TIN, describes the lake bathymetry up to elevation 738 feet. The second TIN model, named the "Terrain" TIN, describes the entire vicinity of Lake Marble Falls (including the bathymetry) up to elevation 860 feet. Figure 4 depicts the spatial extent of the various data sets used in creating the Lake Marble Falls TIN models. Due to presence of rock outcrops within the upper reaches of the lake, TWDB was unable to access and survey approximately 58 acres of the lake within 1 mile of Wirtz Dam. This unsurveyed area (See Appendix G) amounts to 10.5% of the lake area at conservation pool elevation. In creating the "Bathymetry" TIN and computing lake volumes (Appendix A), these unsurveyed areas were assumed to have elevations equal to 737.15 feet, equal to the water surface elevation at the time of the DOQQ photographs. A statistical analysis of the

possible volumes within this unsurveyed area (Appendix G) suggests that volumes within this area are likely to be less than 1.0% of the lake volume at conservation pool elevation.

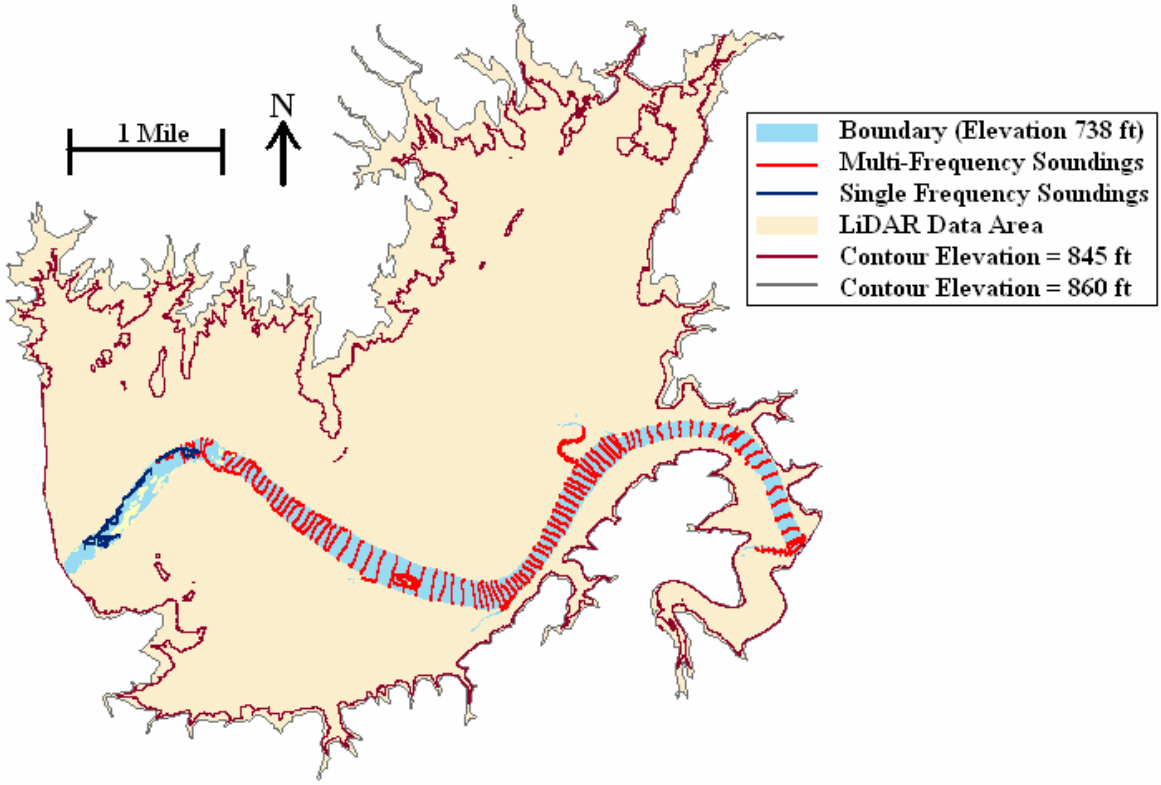


Figure 4 Spatial extent of data used in creating the Lake Marble Falls TIN models

The Elevation-Capacity and Elevation-Area Tables, updated for 2007, are presented in Appendices A and B, respectively. Tables are provided with elevations referenced to the NGVD29 and NAVD88 datums as requested by LCRA. For each datum, separate tables are provided for: 1) the Bathymetry TIN of Lake Marble Falls (up to elevation 738 feet), and 2) the Terrain TIN in and around the lake boundary (up to elevation 845 feet). Different areas and volumes are reported in each table at elevations ranging from 735.4 feet to 738.0 feet. TWDB recommends LCRA only refer to areas and volumes included in the Terrain tables when describing instances in which water levels in Lake Marble Falls exceed elevation 738 feet. Elevation-Capacity graphs and Elevation-Area graphs are presented in Appendices C and D, respectively.

The Bathymetry TIN model was interpolated and averaged using a cell size of 1 foot by 1 foot and converted to a raster. The raster was used to produce an Elevation Relief Map representing the topography of the reservoir bottom (Figure 5), a map showing shaded depth ranges for Lake Marble Falls (Figure 6), and a 5-ft contour map (Figure 7).

The reservoir extent depicted in these figures is that corresponding to the conservation-pool elevation (738 feet).

Self-Similar Interpolation

A limitation of the Delaunay method for triangulation when creating TIN models results in artificially-curved contour lines extending into the reservoir where the reservoir walls are steep and the reservoir is relatively narrow. These curved contours are likely a poor representation of the true reservoir bathymetry in these areas. Also, if the surveyed cross sections are not perpendicular to the centerline of submerged river channel (the location of which is often unknown until after the survey), then the TIN model is not likely to well-represent the true channel bathymetry.

To ameliorate these problems, a Self-Similar Interpolation routine (developed by TWDB) was used to interpolate the bathymetry in between many 500 foot-spaced survey lines. The Self-Similar Interpolation technique effectively increases the density of points input into the TIN model, and directs the TIN interpolation to better represent the reservoir topography.[13] In the case of Lake Marble Falls, the application of Self-Similar Interpolation helped represent the lake morphology near the banks and improved the representation of the submerged river channel, especially near Starke Dam where the lake sides are steep (Figure 8). In areas where obvious geomorphic features indicate a high-probability of cross-section shape changes (e.g. incoming tributaries, significant widening/narrowing of channel, etc.), the assumptions used in applying the Self-Similar Interpolation technique are not likely to be valid; therefore, self-similar interpolation was not used in areas of Lake Marble Falls where a high probability of change between cross-sections exists.[13] Figure 8 illustrates typical results of the application of the Self-Similar Interpolation routine in Lake Marble Falls, and the bathymetry shown in Figure 8C was used in computing reservoir capacity and area tables (Appendix A, B).

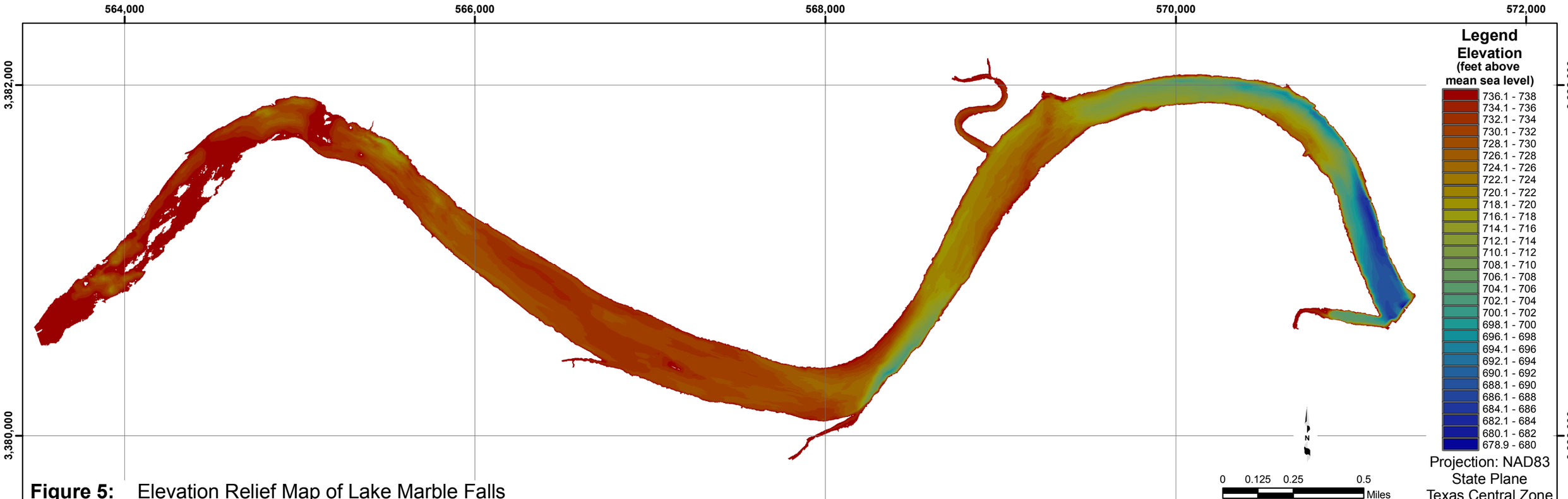


Figure 5: Elevation Relief Map of Lake Marble Falls

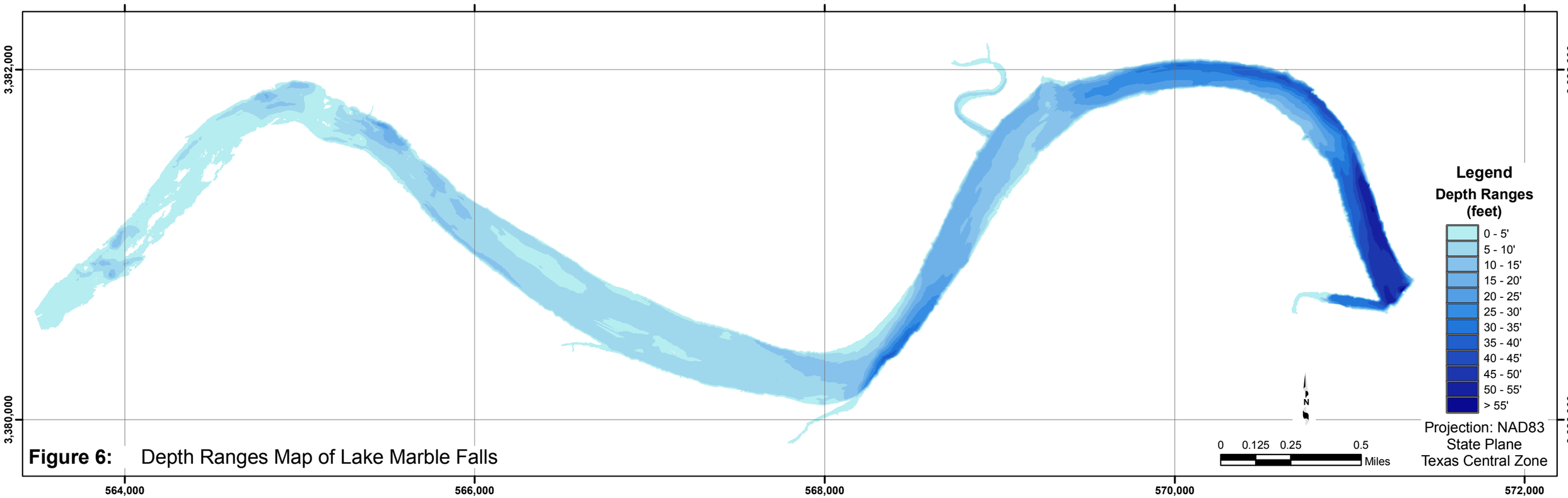


Figure 6: Depth Ranges Map of Lake Marble Falls

Figure 7

Legend

CONTOURS

- 680
- 685
- 690
- 695
- 700
- 705
- 710
- 715
- 720
- 725
- 730
- 735

Islands

Lake Marble Falls

Conservation Pool Elevation:
738 feet above mean sea level

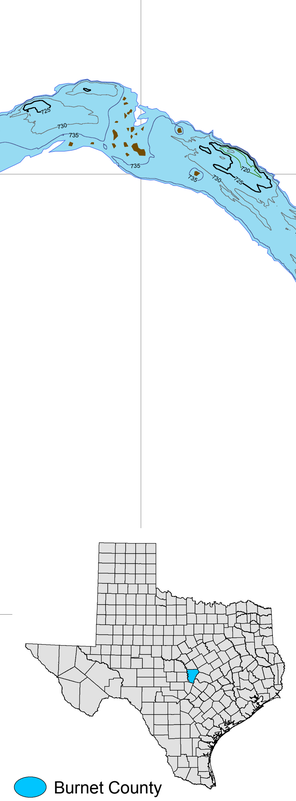
This map is the product of a survey conducted by the Texas Water Development Board's Hydrographic Survey Program to determine the capacity of Lake Marble Falls. The Texas Water Development Board makes no representation or assumes any liability.

Lake Marble Falls

5' - Contour Map

2,930,000 2,935,000 2,940,000 2,945,000 2,950,000

10,180,000 10,175,000 10,170,000



Prepared by: TEXAS WATER DEVELOPMENT BOARD April 2007 Survey

N

0 0.125 0.25 0.5 Miles

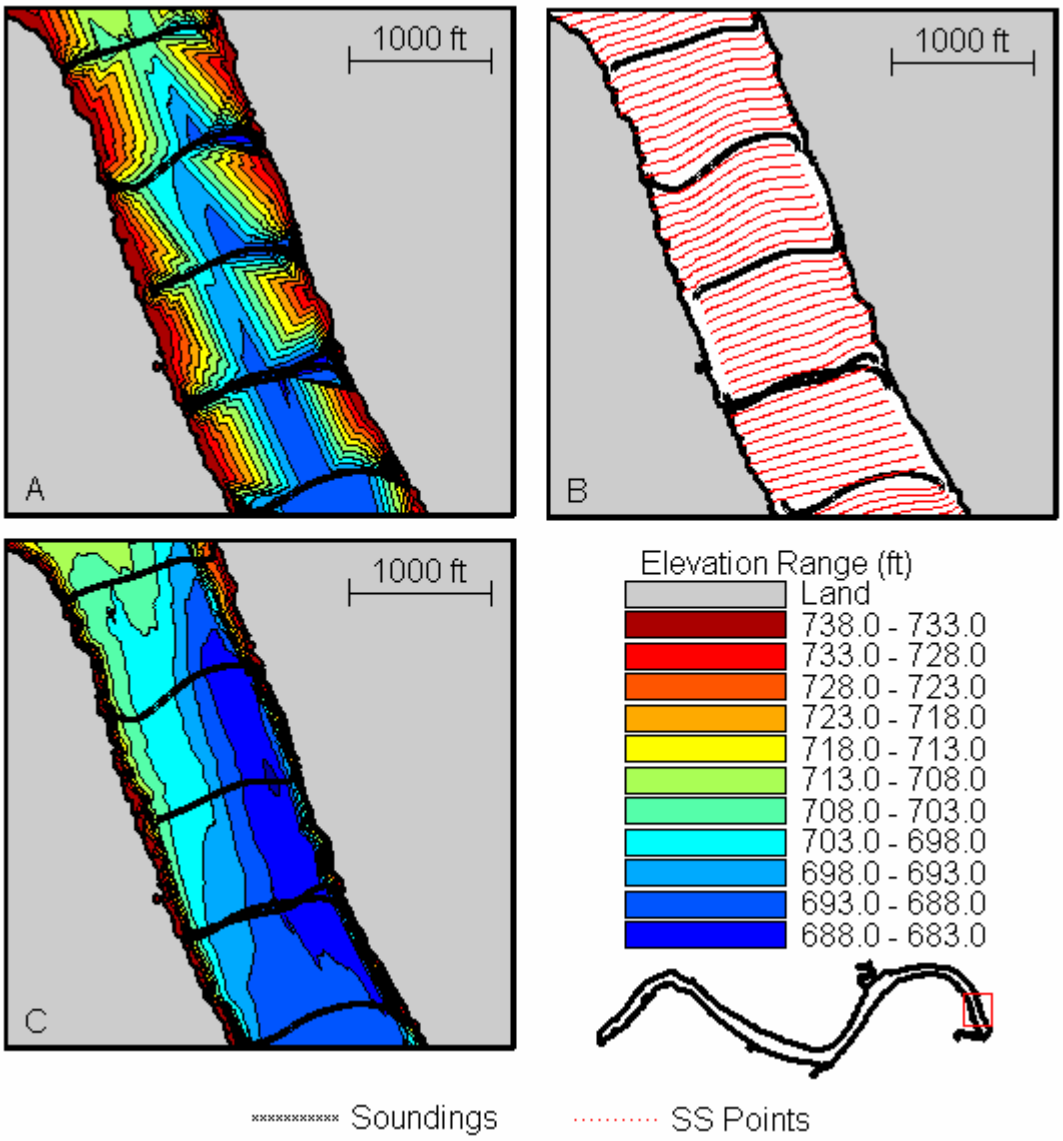


Figure 8 Application of the Self-Similar Interpolation technique to Lake Marble Falls sounding data – A) bathymetric contours without interpolated points, B) Sounding points (black) and interpolated points (red) with reservoir boundary shown at elevation 738.00 feet (black), C) bathymetric contours with the interpolated points. Note: In 8A the steep banks indicated by the surveyed cross sections are not represented for the areas in-between the cross sections. This is an artifact of the TIN generation routine when data points are too far apart. Inclusion of the interpolated points (8C) corrects this and smoothes the bathymetric contours.

Volumetric Survey Results

The results of the TWDB 2007 Volumetric Survey indicate Lake Marble Falls has a total reservoir capacity of 7,486 acre-feet and encompasses 608 acres at conservation pool elevation (738 feet above mean sea level, NGVD29).

The current area and volume tables used by LCRA for Lake Marble Falls were derived from survey data collected in 1995 and aerial photos taken in 1997 (LCRA-Melinda Luna, personal communication). Due to differences in survey methodologies used in previous surveys and this 2007 survey, comparisons of area and volume tables derived from each survey are not recommended.[14] The TWDB considers the methods used in the 2007 survey to be significantly improved in comparison with previous survey methods. TWDB recommends that a similar methodology be used to resurvey Lake Marble Falls in 10 to 20 years or after a major flood event.

Sediment Survey Results

The 200 kHz, 50 kHz, and 24 kHz frequency data were used to interpret sediment distribution and accumulation throughout Lake Marble Falls. To assist in the interpretation of post-impoundment sediment accumulation, ancillary data was collected in the form of seven core samples, one grab sample, and numerous spud bar measurements. John Dunbar Geophysical Consulting was contracted to collect and analyze the core samples.

The results of the TWDB 2007 Sediment Survey indicate Lake Marble Falls has accumulated a negligible amount of sediment since impoundment. Sediment may be accumulating on the edges of the reservoir where it is too shallow for TWDB survey equipment to effectively measure. The expected source of this sediment includes bank erosion and construction runoff. A complete description of the sediment measurement methodology and sample results is presented in Appendix E.

TWDB Contact Information

More information about the Hydrographic Survey Program can be found at:

http://www.twdb.state.tx.us/assistance/lakesurveys/volumetricindex.asp

Any questions regarding the TWDB Hydrographic Survey Program may be addressed to Barney Austin, Director of Surface Water Resources, at 512-463-8856, or by email at: Barney.Austin@twdb.state.tx.us.

References

1. Lower Colorado Regional Water Planning Group, Region K, 2006, LCWPG Water Plan, Chapter 3, http://www.twdb.state.tx.us/rwpg/2006_RWP/RegionK/Chapter%203.pdf

2. Lower Colorado River Authority, Water Management Plan for the Lower Colorado River Basin, Effective September 20, 1989 Including Amendments Through May 14, 2003, http://www.lcra.org/docs/water_RevisedWMP.pdf

3. Lower Colorado Regional Water Planning Group, Region K, 2006, LCWPG Water Plan, Chapter 4, http://www.twdb.state.tx.us/rwpg/2006_RWP/RegionK/Chapter%204.pdf

4. Texas Water Development Board, Report 126, Engineering Data on Dams and Reservoirs in Texas, Part III, February 1971.

5. Lower Colorado River Authority, Starcke Dam and Lake Marble Falls, viewed 29 October 2007, http://www.lcra.org/water/starcke.html

6. Lower Colorado River Authority, Starke Dam Floodgates, viewed 19 October 2007, http://www.lcra.org/newsstory/2003/lcra_gate_dedication.html

7. Lower Colorado River Authority, LCRA, local officials dedicate Starcke Dam's new floodgates, viewed 29 October 2007, http://www.lcra.org/newsstory/2003/dedication.html

8. LCRA, River Operations Center Hydrologic Data, viewed 26 October 2007, http://hydromet.lcra.org/index2.shtml

9. LCRA, Hydromet Historical Search, viewed 13 June 2007, http://hydromet.lcra.org/cgi-bin/hxsearch.pl

10. Texas Natural Resources Information System (TNRIS), viewed 31 October 2007, http://www.tnris.state.tx.us/

11. U.S Department of Agriculture, Farm Service Agency, Aerial Photography Field Office, National Agriculture Imagery Program, viewed February 10, 2006 http://www.apfo.usda.gov/NAIP.html

12. ESRI, Environmental Systems Research Institute. 1995. ARC/INFO Surface Modeling and Display, TIN Users Guide.

13. Furnans, Jordan. Texas Water Development Board. 2006. "HydroEdit User's Manual."

14. United States Department of Agriculture, Natural Resource Conservation Service, National Engineering Handbook, Section 3, Sedimentation, Chapter 7, Field Investigations and Surveys, December 1983.

Lake Marble Falls - BATHYMETRY

RESERVOIR VOLUME TABLE - NGVD29 DATUM

TEXAS WATER DEVELOPMENT BOARD — April 2007 SURVEY

Conservation Pool Elevation 738.00 ft

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
678	0	0	0	0	0	0	0	0	0	0
679	0	0	0	0	0	0	0	0	0	0
680	0	0	0	0	0	0	0	0	0	0
681	0	0	0	0	0	0	0	0	0	0
682	0	0	0	0	0	0	0	0	0	0
683	0	0	0	0	0	0	0	0	0	1
684	1	1	1	1	1	1	1	2	2	2
685	2	2	3	3	3	3	4	4	4	5
686	5	5	6	6	6	7	7	8	8	8
687	9	9	10	10	11	12	12	13	13	14
688	15	15	16	17	18	19	20	21	22	23
689	24	25	26	28	29	30	31	33	34	36
690	37	38	40	41	43	44	46	48	49	51
691	52	54	56	58	59	61	63	64	66	68
692	70	72	74	75	77	79	81	83	85	87
693	89	91	93	95	97	99	101	103	105	107
694	109	111	114	116	118	120	122	124	127	129
695	131	133	136	138	140	143	145	147	150	152
696	154	157	159	162	164	167	169	172	174	177
697	179	182	184	187	190	192	195	198	200	203
698	206	208	211	214	217	219	222	225	228	231
699	234	237	240	243	246	249	252	255	258	261
700	264	268	271	274	277	281	284	287	291	294
701	298	301	304	308	312	315	319	322	326	330
702	333	337	341	345	349	352	356	360	364	368
703	372	376	381	385	389	393	397	402	406	410
704	415	419	423	428	432	437	441	446	451	455
705	460	465	470	474	479	484	489	494	499	504
706	509	514	520	525	530	535	541	546	551	557
707	562	568	574	579	585	590	596	602	608	614
708	619	625	631	637	644	650	656	662	669	675
709	681	688	694	701	707	714	721	728	734	741
710	748	755	762	769	776	783	790	797	805	812
711	819	827	834	842	850	857	865	873	881	889
712	897	905	913	921	929	938	946	955	963	972
713	980	989	998	1,007	1,016	1,025	1,034	1,043	1,052	1,061
714	1,070	1,080	1,089	1,099	1,108	1,118	1,128	1,137	1,147	1,157
715	1,167	1,177	1,187	1,197	1,207	1,217	1,227	1,237	1,248	1,258
716	1,269	1,279	1,290	1,300	1,311	1,321	1,332	1,343	1,354	1,365
717	1,376	1,387	1,398	1,409	1,420	1,431	1,442	1,453	1,465	1,476
718	1,488	1,499	1,511	1,522	1,534	1,546	1,557	1,569	1,581	1,593
719	1,605	1,617	1,629	1,641	1,654	1,666	1,679	1,691	1,704	1,717
720	1,730	1,743	1,756	1,769	1,783	1,796	1,810	1,824	1,838	1,852
721	1,866	1,881	1,895	1,910	1,925	1,940	1,955	1,971	1,986	2,001
722	2,017	2,033	2,048	2,064	2,081	2,097	2,113	2,130	2,146	2,163
723	2,180	2,197	2,214	2,231	2,249	2,266	2,283	2,301	2,319	2,337
724	2,355	2,373	2,391	2,409	2,427	2,446	2,465	2,483	2,502	2,522
725	2,541	2,560	2,580	2,600	2,619	2,639	2,660	2,680	2,700	2,721
726	2,742	2,763	2,784	2,806	2,827	2,849	2,871	2,893	2,915	2,937
727	2,960	2,982	3,005	3,028	3,052	3,075	3,099	3,123	3,147	3,171
728	3,195	3,220	3,245	3,270	3,295	3,320	3,346	3,372	3,398	3,425
729	3,452	3,479	3,506	3,534	3,562	3,590	3,619	3,648	3,677	3,707
730	3,737	3,768	3,800	3,831	3,863	3,896	3,929	3,962	3,997	4,031
731	4,066	4,102	4,138	4,175	4,213	4,251	4,289	4,328	4,368	4,408
732	4,448	4,489	4,531	4,573	4,615	4,658	4,702	4,746	4,790	4,835
733	4,880	4,926	4,972	5,019	5,066	5,113	5,161	5,208	5,257	5,305

Lake Marble Falls - BATHYMETRY

RESERVOIR VOLUME TABLE - NGVD29 DATUM (Cont.)

TEXAS WATER DEVELOPMENT BOARD — April 2007 SURVEY

Conservation Pool Elevation 738.00 ft

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
734	5,354	5,403	5,452	5,501	5,551	5,601	5,650	5,701	5,751	5,801
735	5,852	5,903	5,954	6,005	6,056	6,108	6,159	6,211	6,263	6,315
736	6,367	6,420	6,473	6,526	6,579	6,632	6,685	6,739	6,793	6,847
737	6,901	6,956	7,011	7,069	7,127	7,186	7,245	7,305	7,365	7,425
738	7,486									

Lake Marble Falls - BATHYMETRY

RESERVOIR VOLUME TABLE - NAVD88 DATUM

TEXAS WATER DEVELOPMENT BOARD — April 2007 SURVEY

Conservation Pool Elevation 738.19 ft

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
678	0	0	0	0	0	0	0	0	0	0
679	0	0	0	0	0	0	0	0	0	0
680	0	0	0	0	0	0	0	0	0	0
681	0	0	0	0	0	0	0	0	0	0
682	0	0	0	0	0	0	0	0	0	0
683	0	0	0	0	0	0	0	0	0	0
684	1	1	1	1	1	1	1	1	2	2
685	2	2	2	2	3	3	3	3	4	4
686	4	5	5	5	6	6	6	7	7	8
687	8	9	9	10	10	11	11	12	12	13
688	14	14	15	16	16	17	18	19	20	21
689	22	23	24	25	26	28	29	30	32	33
690	34	36	37	39	40	42	43	45	46	48
691	49	51	53	54	56	58	59	61	63	65
692	66	68	70	72	74	76	77	79	81	83
693	85	87	89	91	93	95	97	99	101	103
694	105	107	109	112	114	116	118	120	122	125
695	127	129	131	134	136	138	141	143	145	148
696	150	152	155	157	160	162	164	167	169	172
697	174	177	179	182	185	187	190	192	195	198
698	200	203	206	209	211	214	217	220	223	225
699	228	231	234	237	240	243	246	249	252	255
700	258	262	265	268	271	274	278	281	284	288
701	291	294	298	301	305	308	312	315	319	323
702	326	330	334	338	341	345	349	353	357	361
703	365	369	373	377	381	385	389	393	398	402
704	406	411	415	419	424	428	433	437	442	446
705	451	456	460	465	470	475	480	485	490	495
706	500	505	510	515	520	525	531	536	541	547
707	552	557	563	569	574	580	585	591	597	603
708	608	614	620	626	632	638	644	650	657	663
709	669	676	682	688	695	702	708	715	721	728
710	735	742	749	756	763	770	777	784	791	798
711	805	813	820	828	835	843	850	858	866	874
712	882	890	898	906	914	922	930	939	947	955
713	964	973	981	990	999	1,008	1,017	1,026	1,035	1,044
714	1,053	1,062	1,071	1,081	1,090	1,100	1,109	1,119	1,129	1,138
715	1,148	1,158	1,168	1,178	1,188	1,198	1,208	1,218	1,228	1,238
716	1,249	1,259	1,270	1,280	1,291	1,301	1,312	1,322	1,333	1,344
717	1,355	1,366	1,377	1,388	1,399	1,410	1,421	1,432	1,443	1,455
718	1,466	1,477	1,489	1,500	1,512	1,523	1,535	1,547	1,558	1,570
719	1,582	1,594	1,606	1,618	1,630	1,643	1,655	1,667	1,680	1,692
720	1,705	1,718	1,731	1,744	1,757	1,771	1,784	1,798	1,811	1,825
721	1,839	1,853	1,868	1,882	1,897	1,912	1,927	1,942	1,957	1,972
722	1,988	2,003	2,019	2,034	2,050	2,066	2,082	2,098	2,115	2,131
723	2,148	2,165	2,182	2,199	2,216	2,233	2,250	2,268	2,285	2,303
724	2,321	2,338	2,356	2,374	2,393	2,411	2,429	2,448	2,466	2,485
725	2,504	2,523	2,543	2,562	2,582	2,602	2,621	2,641	2,662	2,682
726	2,702	2,723	2,744	2,765	2,786	2,808	2,829	2,851	2,873	2,895
727	2,917	2,940	2,962	2,985	3,008	3,031	3,054	3,077	3,101	3,125
728	3,149	3,173	3,198	3,222	3,247	3,272	3,298	3,323	3,349	3,375
729	3,401	3,427	3,454	3,481	3,509	3,536	3,564	3,593	3,622	3,651
730	3,680	3,710	3,741	3,771	3,803	3,834	3,867	3,899	3,932	3,966
731	4,000	4,035	4,070	4,106	4,142	4,179	4,216	4,254	4,293	4,332
732	4,372	4,412	4,452	4,493	4,535	4,577	4,619	4,663	4,706	4,750
733	4,795	4,840	4,885	4,931	4,977	5,024	5,071	5,118	5,165	5,213

Lake Marble Falls - BATHYMETRY

RESERVOIR VOLUME TABLE - NAVD88 DATUM (Cont.)

TEXAS WATER DEVELOPMENT BOARD — April 2007 SURVEY

Conservation Pool Elevation 738.19 ft

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
734	5,261	5,310	5,359	5,408	5,457	5,506	5,556	5,606	5,656	5,706
735	5,756	5,806	5,857	5,908	5,959	6,010	6,061	6,113	6,164	6,216
736	6,268	6,320	6,373	6,425	6,478	6,531	6,584	6,637	6,691	6,744
737	6,798	6,852	6,907	6,961	7,017	7,075	7,133	7,192	7,251	7,311
738	7,371	7,431	7,492							

Lake Marble Falls - TERRAIN

RESERVOIR VOLUME TABLE - NGVD29 DATUM

TEXAS WATER DEVELOPMENT BOARD — April 2007 SURVEY

Conservation Pool Elevation 738.00 ft

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
678	0	0	0	0	0	0	0	0	0	0
679	0	0	0	0	0	0	0	0	0	0
680	0	0	0	0	0	0	0	0	0	0
681	0	0	0	0	0	0	0	0	0	0
682	0	0	0	0	0	0	0	0	0	0
683	0	0	0	0	0	0	0	0	0	1
684	1	1	1	1	1	1	1	2	2	2
685	2	2	3	3	3	3	4	4	4	5
686	5	5	6	6	6	7	7	8	8	8
687	9	9	10	10	11	12	12	13	13	14
688	15	15	16	17	18	19	20	21	22	23
689	24	25	26	28	29	30	31	33	34	36
690	37	38	40	41	43	44	46	48	49	51
691	52	54	56	57	59	61	63	64	66	68
692	70	72	74	75	77	79	81	83	85	87
693	89	91	93	95	97	99	101	103	105	107
694	109	111	113	116	118	120	122	124	127	129
695	131	133	136	138	140	143	145	147	150	152
696	154	157	159	162	164	167	169	172	174	177
697	179	182	184	187	190	192	195	197	200	203
698	206	208	211	214	217	219	222	225	228	231
699	234	237	240	243	246	249	252	255	258	261
700	264	268	271	274	277	281	284	287	291	294
701	297	301	304	308	311	315	319	322	326	330
702	333	337	341	345	348	352	356	360	364	368
703	372	376	380	385	389	393	397	401	406	410
704	414	419	423	428	432	437	441	446	450	455
705	460	465	469	474	479	484	489	494	499	504
706	509	514	519	525	530	535	540	546	551	557
707	562	568	573	579	585	590	596	602	607	613
708	619	625	631	637	643	649	656	662	668	675
709	681	687	694	701	707	714	720	727	734	741
710	748	755	762	769	776	783	790	797	804	812
711	819	827	834	842	849	857	865	873	880	888
712	896	904	913	921	929	937	946	954	963	971
713	980	989	998	1,006	1,015	1,024	1,033	1,042	1,052	1,061
714	1,070	1,079	1,089	1,098	1,108	1,117	1,127	1,137	1,147	1,156
715	1,166	1,176	1,186	1,196	1,206	1,216	1,227	1,237	1,247	1,258
716	1,268	1,278	1,289	1,300	1,310	1,321	1,332	1,342	1,353	1,364
717	1,375	1,386	1,397	1,408	1,419	1,430	1,442	1,453	1,464	1,476
718	1,487	1,498	1,510	1,522	1,533	1,545	1,557	1,568	1,580	1,592
719	1,604	1,616	1,628	1,641	1,653	1,665	1,678	1,691	1,703	1,716
720	1,729	1,742	1,755	1,768	1,782	1,795	1,809	1,823	1,837	1,851
721	1,866	1,880	1,895	1,910	1,924	1,940	1,955	1,970	1,985	2,001
722	2,016	2,032	2,048	2,064	2,080	2,096	2,112	2,129	2,145	2,162
723	2,179	2,196	2,213	2,230	2,248	2,265	2,283	2,300	2,318	2,336
724	2,354	2,372	2,390	2,408	2,427	2,445	2,464	2,482	2,501	2,521
725	2,540	2,559	2,579	2,599	2,618	2,638	2,659	2,679	2,699	2,720
726	2,741	2,762	2,783	2,805	2,826	2,848	2,870	2,892	2,914	2,936
727	2,959	2,981	3,004	3,027	3,050	3,074	3,097	3,121	3,145	3,170
728	3,194	3,219	3,244	3,269	3,294	3,319	3,345	3,371	3,397	3,424
729	3,450	3,477	3,505	3,532	3,560	3,589	3,617	3,646	3,676	3,706
730	3,736	3,767	3,798	3,830	3,862	3,894	3,927	3,961	3,995	4,030
731	4,065	4,101	4,137	4,174	4,211	4,249	4,288	4,327	4,366	4,406
732	4,447	4,488	4,529	4,571	4,614	4,657	4,700	4,744	4,788	4,833
733	4,879	4,924	4,971	5,017	5,064	5,111	5,159	5,207	5,255	5,303

Lake Marble Falls - TERRAIN

RESERVOIR VOLUME TABLE - NGVD29 DATUM (Cont.)

TEXAS WATER DEVELOPMENT BOARD — April 2007 SURVEY

Conservation Pool Elevation 738.00 ft

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
734	5,352	5,401	5,450	5,499	5,549	5,599	5,649	5,699	5,749	5,799
735	5,850	5,901	5,952	6,003	6,054	6,106	6,157	6,209	6,261	6,313
736	6,365	6,418	6,471	6,524	6,578	6,633	6,687	6,742	6,798	6,853
737	6,909	6,966	7,023	7,082	7,142	7,203	7,264	7,325	7,387	7,449
738	7,511	7,574	7,637	7,700	7,763	7,827	7,890	7,954	8,018	8,082
739	8,146	8,210	8,275	8,339	8,404	8,469	8,534	8,599	8,664	8,730
740	8,796	8,861	8,927	8,994	9,060	9,127	9,193	9,260	9,327	9,395
741	9,462	9,530	9,598	9,666	9,734	9,803	9,871	9,940	10,009	10,078
742	10,148	10,217	10,287	10,357	10,427	10,497	10,568	10,639	10,710	10,781
743	10,853	10,924	10,996	11,069	11,141	11,214	11,287	11,360	11,433	11,507
744	11,580	11,654	11,729	11,803	11,878	11,952	12,027	12,103	12,178	12,254
745	12,329	12,405	12,482	12,558	12,635	12,711	12,788	12,866	12,943	13,021
746	13,099	13,177	13,255	13,333	13,412	13,491	13,570	13,650	13,729	13,809
747	13,889	13,969	14,050	14,130	14,211	14,292	14,373	14,455	14,537	14,618
748	14,701	14,783	14,865	14,948	15,031	15,114	15,197	15,280	15,364	15,448
749	15,532	15,616	15,700	15,785	15,870	15,954	16,040	16,125	16,210	16,296
750	16,382	16,468	16,554	16,641	16,728	16,814	16,902	16,989	17,076	17,164
751	17,252	17,340	17,429	17,518	17,607	17,696	17,785	17,875	17,965	18,055
752	18,145	18,236	18,327	18,418	18,510	18,602	18,694	18,786	18,879	18,971
753	19,065	19,158	19,252	19,346	19,441	19,536	19,631	19,726	19,822	19,918
754	20,015	20,111	20,209	20,306	20,404	20,502	20,601	20,700	20,799	20,899
755	20,999	21,099	21,200	21,301	21,403	21,505	21,607	21,710	21,813	21,916
756	22,020	22,124	22,229	22,334	22,439	22,544	22,650	22,757	22,864	22,971
757	23,078	23,186	23,295	23,404	23,513	23,623	23,733	23,843	23,954	24,065
758	24,177	24,289	24,402	24,515	24,629	24,743	24,858	24,974	25,089	25,206
759	25,322	25,439	25,557	25,675	25,794	25,913	26,032	26,152	26,273	26,394
760	26,515	26,637	26,760	26,883	27,007	27,131	27,257	27,383	27,510	27,637
761	27,766	27,895	28,025	28,155	28,287	28,419	28,552	28,686	28,820	28,956
762	29,092	29,228	29,365	29,503	29,642	29,781	29,921	30,061	30,202	30,344
763	30,486	30,629	30,773	30,917	31,062	31,208	31,354	31,500	31,648	31,795
764	31,944	32,093	32,242	32,392	32,543	32,694	32,846	32,998	33,151	33,304
765	33,458	33,613	33,768	33,923	34,080	34,236	34,393	34,551	34,710	34,868
766	35,028	35,188	35,348	35,510	35,671	35,834	35,996	36,160	36,324	36,489
767	36,654	36,820	36,987	37,154	37,322	37,491	37,660	37,830	38,000	38,172
768	38,343	38,515	38,688	38,862	39,036	39,210	39,385	39,561	39,737	39,914
769	40,092	40,270	40,448	40,627	40,807	40,987	41,168	41,349	41,531	41,713
770	41,896	42,079	42,264	42,448	42,634	42,820	43,007	43,194	43,382	43,570
771	43,760	43,949	44,140	44,331	44,523	44,715	44,909	45,103	45,297	45,492
772	45,688	45,885	46,083	46,281	46,480	46,679	46,880	47,081	47,282	47,485
773	47,688	47,891	48,095	48,300	48,506	48,712	48,919	49,126	49,334	49,542
774	49,751	49,961	50,171	50,382	50,594	50,805	51,018	51,231	51,445	51,659
775	51,874	52,090	52,306	52,523	52,740	52,958	53,177	53,396	53,616	53,837
776	54,058	54,280	54,502	54,725	54,949	55,173	55,398	55,623	55,849	56,076
777	56,303	56,531	56,760	56,989	57,219	57,449	57,680	57,912	58,144	58,377
778	58,610	58,844	59,079	59,314	59,550	59,786	60,023	60,261	60,500	60,739
779	60,978	61,219	61,460	61,701	61,944	62,187	62,430	62,674	62,919	63,165
780	63,411	63,658	63,905	64,153	64,402	64,651	64,901	65,152	65,404	65,656
781	65,908	66,162	66,416	66,670	66,926	67,182	67,438	67,696	67,954	68,213
782	68,472	68,732	68,993	69,254	69,516	69,779	70,042	70,306	70,571	70,837
783	71,103	71,370	71,638	71,906	72,175	72,445	72,716	72,987	73,259	73,532
784	73,805	74,079	74,354	74,629	74,906	75,182	75,460	75,738	76,017	76,296
785	76,577	76,858	77,139	77,422	77,705	77,988	78,273	78,558	78,843	79,130
786	79,417	79,705	79,993	80,282	80,572	80,863	81,154	81,446	81,739	82,032
787	82,326	82,621	82,917	83,213	83,510	83,807	84,106	84,405	84,705	85,006
788	85,307	85,609	85,912	86,215	86,519	86,824	87,130	87,436	87,743	88,051
789	88,360	88,669	88,979	89,290	89,601	89,913	90,226	90,540	90,854	91,169
790	91,484	91,800	92,118	92,435	92,754	93,073	93,392	93,713	94,034	94,356

Lake Marble Falls - TERRAIN

RESERVOIR VOLUME TABLE - NGVD29 DATUM (Cont.)

TEXAS WATER DEVELOPMENT BOARD — April 2007 SURVEY

Conservation Pool Elevation 738.00 ft

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
791	94,679	95,002	95,326	95,651	95,977	96,303	96,630	96,958	97,287	97,616
792	97,946	98,277	98,609	98,941	99,274	99,608	99,942	100,277	100,613	100,950
793	101,287	101,625	101,964	102,304	102,644	102,985	103,327	103,670	104,013	104,357
794	104,702	105,047	105,394	105,741	106,089	106,437	106,786	107,136	107,487	107,839
795	108,191	108,543	108,897	109,251	109,606	109,962	110,318	110,676	111,033	111,392
796	111,751	112,111	112,472	112,834	113,196	113,559	113,922	114,287	114,652	115,018
797	115,384	115,752	116,120	116,488	116,858	117,228	117,599	117,970	118,343	118,716
798	119,089	119,464	119,839	120,215	120,592	120,969	121,347	121,726	122,105	122,486
799	122,867	123,248	123,630	124,013	124,397	124,781	125,166	125,552	125,939	126,326
800	126,713	127,102	127,491	127,881	128,271	128,663	129,054	129,447	129,841	130,235
801	130,629	131,025	131,421	131,818	132,216	132,614	133,013	133,413	133,813	134,215
802	134,616	135,019	135,423	135,827	136,232	136,637	137,043	137,450	137,858	138,266
803	138,675	139,084	139,495	139,906	140,318	140,730	141,143	141,557	141,972	142,387
804	142,803	143,220	143,637	144,055	144,474	144,893	145,314	145,735	146,157	146,579
805	147,002	147,426	147,851	148,277	148,704	149,131	149,559	149,988	150,418	150,849
806	151,281	151,713	152,147	152,581	153,016	153,451	153,887	154,324	154,762	155,200
807	155,639	156,078	156,519	156,960	157,402	157,844	158,287	158,731	159,175	159,620
808	160,066	160,512	160,960	161,407	161,856	162,305	162,754	163,205	163,656	164,108
809	164,560	165,013	165,467	165,922	166,377	166,833	167,289	167,747	168,204	168,663
810	169,122	169,582	170,043	170,504	170,966	171,429	171,892	172,356	172,821	173,286
811	173,752	174,219	174,686	175,154	175,623	176,092	176,562	177,033	177,504	177,977
812	178,449	178,923	179,397	179,872	180,347	180,823	181,300	181,778	182,256	182,735
813	183,215	183,695	184,176	184,658	185,140	185,623	186,107	186,591	187,076	187,562
814	188,048	188,535	189,023	189,511	190,000	190,489	190,979	191,471	191,962	192,454
815	192,947	193,440	193,935	194,430	194,925	195,421	195,918	196,416	196,914	197,413
816	197,912	198,412	198,913	199,415	199,917	200,419	200,923	201,427	201,932	202,437
817	202,943	203,450	203,957	204,465	204,974	205,483	205,993	206,504	207,016	207,528
818	208,041	208,554	209,068	209,583	210,099	210,614	211,131	211,649	212,167	212,685
819	213,205	213,724	214,245	214,766	215,288	215,811	216,334	216,858	217,383	217,908
820	218,434	218,960	219,487	220,015	220,544	221,073	221,603	222,134	222,665	223,197
821	223,729	224,262	224,796	225,331	225,866	226,402	226,938	227,476	228,014	228,553
822	229,092	229,632	230,173	230,714	231,257	231,799	232,343	232,888	233,432	233,978
823	234,525	235,072	235,620	236,168	236,718	237,268	237,818	238,370	238,922	239,475
824	240,028	240,582	241,137	241,692	242,249	242,806	243,363	243,922	244,481	245,040
825	245,601	246,162	246,723	247,286	247,849	248,413	248,977	249,542	250,108	250,674
826	251,241	251,809	252,377	252,946	253,516	254,087	254,658	255,230	255,802	256,376
827	256,949	257,524	258,100	258,675	259,253	259,830	260,408	260,987	261,567	262,147
828	262,729	263,310	263,893	264,476	265,061	265,645	266,231	266,817	267,404	267,992
829	268,580	269,169	269,759	270,350	270,941	271,533	272,126	272,720	273,314	273,909
830	274,505	275,101	275,699	276,297	276,895	277,495	278,095	278,696	279,297	279,900
831	280,503	281,106	281,711	282,316	282,923	283,529	284,137	284,745	285,354	285,964
832	286,575	287,186	287,798	288,411	289,025	289,639	290,254	290,870	291,486	292,104
833	292,722	293,341	293,961	294,581	295,203	295,825	296,447	297,071	297,695	298,321
834	298,947	299,573	300,201	300,829	301,459	302,088	302,719	303,351	303,983	304,616
835	305,250	305,885	306,521	307,157	307,795	308,433	309,071	309,711	310,352	310,993
836	311,635	312,278	312,922	313,566	314,212	314,858	315,505	316,153	316,802	317,452
837	318,102	318,753	319,406	320,059	320,713	321,367	322,023	322,680	323,337	323,996
838	324,655	325,314	325,976	326,637	327,300	327,963	328,627	329,293	329,959	330,626
839	331,293	331,962	332,631	333,302	333,973	334,645	335,318	335,992	336,666	337,342
840	338,018	338,696	339,374	340,053	340,733	341,414	342,096	342,779	343,462	344,147
841	344,833	345,519	346,207	346,895	347,584	348,274	348,965	349,657	350,350	351,044
842	351,739	352,435	353,132	353,829	354,529	355,228	355,929	356,632	357,334	358,039
843	358,743	359,449	360,156	360,864	361,573	362,283	362,994	363,706	364,418	365,132
844	365,847	366,562	367,279	367,997	368,716	369,435	370,156	370,878	371,600	372,324
845	373,049									

Lake Marble Falls - TERRAIN

RESERVOIR VOLUME TABLE - NAVD88 DATUM

TEXAS WATER DEVELOPMENT BOARD — April 2007 SURVEY

Conservation Pool Elevation 738.19 ft

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
678	0	0	0	0	0	0	0	0	0	0
679	0	0	0	0	0	0	0	0	0	0
680	0	0	0	0	0	0	0	0	0	0
681	0	0	0	0	0	0	0	0	0	0
682	0	0	0	0	0	0	0	0	0	0
683	0	0	0	0	0	0	0	0	0	0
684	1	1	1	1	1	1	1	1	1	2
685	2	2	2	2	3	3	3	3	4	4
686	4	5	5	5	6	6	6	7	7	8
687	8	9	9	9	10	11	11	12	12	13
688	14	14	15	16	16	17	18	19	20	21
689	22	23	24	25	26	28	29	30	32	33
690	34	36	37	39	40	42	43	45	46	48
691	49	51	53	54	56	58	59	61	63	65
692	66	68	70	72	74	76	77	79	81	83
693	85	87	89	91	93	95	97	99	101	103
694	105	107	109	112	114	116	118	120	122	125
695	127	129	131	134	136	138	140	143	145	147
696	150	152	155	157	159	162	164	167	169	172
697	174	177	179	182	185	187	190	192	195	198
698	200	203	206	209	211	214	217	220	222	225
699	228	231	234	237	240	243	246	249	252	255
700	258	261	265	268	271	274	278	281	284	288
701	291	294	298	301	305	308	312	315	319	323
702	326	330	334	337	341	345	349	353	357	361
703	365	369	373	377	381	385	389	393	398	402
704	406	410	415	419	424	428	433	437	442	446
705	451	456	460	465	470	475	480	484	489	494
706	499	504	510	515	520	525	530	536	541	546
707	552	557	563	568	574	579	585	591	597	602
708	608	614	620	626	632	638	644	650	656	663
709	669	675	682	688	695	701	708	714	721	728
710	735	742	748	755	762	769	776	783	791	798
711	805	812	820	827	835	842	850	858	865	873
712	881	889	897	905	913	922	930	938	947	955
713	964	972	981	990	998	1,007	1,016	1,025	1,034	1,043
714	1,052	1,062	1,071	1,080	1,090	1,099	1,109	1,118	1,128	1,138
715	1,148	1,157	1,167	1,177	1,187	1,197	1,207	1,217	1,228	1,238
716	1,248	1,259	1,269	1,280	1,290	1,301	1,311	1,322	1,333	1,343
717	1,354	1,365	1,376	1,387	1,398	1,409	1,420	1,431	1,443	1,454
718	1,465	1,477	1,488	1,500	1,511	1,523	1,534	1,546	1,558	1,570
719	1,582	1,593	1,605	1,618	1,630	1,642	1,654	1,667	1,679	1,692
720	1,705	1,717	1,730	1,743	1,757	1,770	1,783	1,797	1,811	1,824
721	1,838	1,853	1,867	1,882	1,896	1,911	1,926	1,941	1,956	1,971
722	1,987	2,002	2,018	2,033	2,049	2,065	2,081	2,098	2,114	2,130
723	2,147	2,164	2,181	2,198	2,215	2,232	2,249	2,267	2,284	2,302
724	2,320	2,338	2,356	2,374	2,392	2,410	2,428	2,447	2,466	2,484
725	2,503	2,523	2,542	2,561	2,581	2,601	2,620	2,640	2,661	2,681
726	2,701	2,722	2,743	2,764	2,785	2,807	2,828	2,850	2,872	2,894
727	2,916	2,938	2,961	2,984	3,006	3,029	3,053	3,076	3,100	3,124
728	3,148	3,172	3,197	3,221	3,246	3,271	3,296	3,322	3,348	3,373
729	3,400	3,426	3,453	3,480	3,507	3,535	3,563	3,591	3,620	3,649
730	3,679	3,709	3,739	3,770	3,801	3,833	3,865	3,898	3,931	3,964
731	3,999	4,033	4,068	4,104	4,141	4,178	4,215	4,253	4,292	4,331
732	4,370	4,410	4,451	4,492	4,533	4,575	4,618	4,661	4,704	4,748
733	4,793	4,838	4,883	4,929	4,975	5,022	5,069	5,116	5,164	5,211

Lake Marble Falls - TERRAIN

RESERVOIR VOLUME TABLE - NAVD88 DATUM (Cont.)

TEXAS WATER DEVELOPMENT BOARD — April 2007 SURVEY

Conservation Pool Elevation 738.19 ft

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
734	5,260	5,308	5,357	5,406	5,455	5,504	5,554	5,604	5,654	5,704
735	5,754	5,804	5,855	5,906	5,957	6,008	6,059	6,111	6,162	6,214
736	6,266	6,318	6,371	6,423	6,476	6,530	6,584	6,638	6,693	6,748
737	6,803	6,859	6,915	6,971	7,029	7,088	7,148	7,209	7,270	7,331
738	7,393	7,455	7,518	7,580	7,643	7,706	7,770	7,833	7,896	7,960
739	8,024	8,088	8,152	8,217	8,281	8,346	8,410	8,475	8,540	8,606
740	8,671	8,737	8,802	8,868	8,934	9,000	9,067	9,133	9,200	9,267
741	9,334	9,402	9,469	9,537	9,605	9,673	9,741	9,810	9,878	9,947
742	10,016	10,085	10,155	10,224	10,294	10,364	10,434	10,505	10,575	10,646
743	10,717	10,788	10,860	10,932	11,004	11,076	11,148	11,221	11,294	11,367
744	11,440	11,514	11,588	11,662	11,736	11,810	11,885	11,960	12,035	12,110
745	12,186	12,261	12,337	12,413	12,489	12,566	12,642	12,719	12,796	12,873
746	12,951	13,029	13,106	13,185	13,263	13,341	13,420	13,499	13,578	13,658
747	13,737	13,817	13,897	13,977	14,058	14,138	14,219	14,300	14,381	14,463
748	14,545	14,627	14,709	14,791	14,874	14,956	15,039	15,122	15,205	15,289
749	15,372	15,456	15,540	15,624	15,709	15,793	15,878	15,963	16,048	16,133
750	16,219	16,305	16,391	16,477	16,563	16,649	16,736	16,823	16,910	16,998
751	17,085	17,173	17,261	17,349	17,438	17,527	17,615	17,705	17,794	17,884
752	17,974	18,064	18,154	18,245	18,336	18,427	18,519	18,611	18,703	18,795
753	18,888	18,981	19,074	19,168	19,262	19,356	19,450	19,545	19,640	19,736
754	19,832	19,928	20,024	20,121	20,218	20,316	20,414	20,512	20,611	20,710
755	20,809	20,909	21,009	21,110	21,210	21,312	21,413	21,515	21,617	21,720
756	21,823	21,927	22,030	22,135	22,239	22,344	22,449	22,555	22,661	22,768
757	22,874	22,982	23,089	23,197	23,306	23,415	23,524	23,634	23,744	23,854
758	23,965	24,076	24,188	24,300	24,413	24,527	24,641	24,755	24,870	24,985
759	25,101	25,217	25,334	25,451	25,569	25,687	25,806	25,925	26,044	26,164
760	26,285	26,406	26,527	26,649	26,772	26,895	27,019	27,144	27,269	27,396
761	27,522	27,650	27,779	27,908	28,038	28,168	28,300	28,432	28,565	28,699
762	28,834	28,969	29,105	29,242	29,379	29,517	29,656	29,795	29,935	30,075
763	30,216	30,358	30,501	30,644	30,787	30,932	31,077	31,222	31,368	31,515
764	31,662	31,810	31,959	32,108	32,257	32,407	32,558	32,709	32,861	33,013
765	33,166	33,320	33,474	33,628	33,783	33,939	34,095	34,252	34,409	34,567
766	34,725	34,884	35,044	35,204	35,365	35,526	35,687	35,850	36,013	36,176
767	36,341	36,506	36,671	36,837	37,004	37,171	37,339	37,508	37,677	37,847
768	38,018	38,189	38,360	38,533	38,706	38,879	39,053	39,228	39,403	39,579
769	39,755	39,932	40,110	40,287	40,466	40,645	40,825	41,005	41,186	41,367
770	41,549	41,731	41,914	42,098	42,282	42,467	42,652	42,839	43,025	43,213
771	43,401	43,589	43,779	43,968	44,159	44,350	44,542	44,735	44,928	45,122
772	45,317	45,512	45,708	45,905	46,103	46,301	46,500	46,699	46,900	47,101
773	47,303	47,505	47,708	47,912	48,116	48,321	48,526	48,733	48,939	49,147
774	49,355	49,563	49,772	49,982	50,192	50,403	50,615	50,827	51,039	51,253
775	51,466	51,681	51,896	52,111	52,328	52,545	52,762	52,980	53,199	53,418
776	53,638	53,859	54,080	54,302	54,524	54,747	54,971	55,195	55,420	55,646
777	55,872	56,099	56,326	56,554	56,783	57,012	57,242	57,472	57,703	57,935
778	58,167	58,400	58,633	58,867	59,102	59,337	59,573	59,810	60,047	60,285
779	60,523	60,763	61,002	61,243	61,484	61,726	61,968	62,211	62,454	62,699
780	62,944	63,189	63,435	63,682	63,930	64,178	64,427	64,676	64,926	65,177
781	65,429	65,681	65,934	66,187	66,441	66,696	66,951	67,207	67,464	67,722
782	67,980	68,239	68,498	68,758	69,019	69,280	69,542	69,805	70,069	70,333
783	70,598	70,863	71,130	71,397	71,665	71,933	72,202	72,472	72,743	73,014
784	73,286	73,559	73,833	74,107	74,382	74,657	74,933	75,210	75,488	75,766
785	76,045	76,324	76,605	76,886	77,168	77,450	77,733	78,017	78,301	78,586
786	78,872	79,159	79,446	79,733	80,022	80,311	80,601	80,892	81,183	81,475
787	81,768	82,061	82,356	82,650	82,946	83,243	83,540	83,837	84,136	84,435
788	84,735	85,036	85,337	85,639	85,942	86,246	86,550	86,855	87,161	87,467
789	87,774	88,082	88,391	88,700	89,010	89,321	89,633	89,945	90,257	90,571
790	90,885	91,200	91,516	91,832	92,149	92,467	92,785	93,105	93,424	93,745

Lake Marble Falls - TERRAIN

RESERVOIR VOLUME TABLE - NAVD88 DATUM (Cont.)

TEXAS WATER DEVELOPMENT BOARD — April 2007 SURVEY

Conservation Pool Elevation 738.19 ft

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
791	94,066	94,388	94,711	95,035	95,359	95,684	96,010	96,336	96,663	96,991
792	97,320	97,649	97,979	98,310	98,642	98,974	99,307	99,641	99,976	100,311
793	100,647	100,984	101,321	101,659	101,998	102,338	102,678	103,019	103,361	103,704
794	104,047	104,392	104,736	105,082	105,429	105,776	106,124	106,472	106,821	107,171
795	107,522	107,874	108,226	108,579	108,932	109,287	109,642	109,998	110,354	110,711
796	111,069	111,428	111,787	112,147	112,508	112,870	113,232	113,595	113,959	114,323
797	114,689	115,055	115,421	115,788	116,157	116,525	116,895	117,265	117,636	118,008
798	118,380	118,753	119,127	119,501	119,877	120,253	120,630	121,007	121,385	121,764
799	122,143	122,524	122,905	123,286	123,669	124,052	124,436	124,820	125,205	125,591
800	125,977	126,365	126,752	127,141	127,530	127,920	128,311	128,702	129,094	129,487
801	129,880	130,274	130,669	131,064	131,461	131,858	132,255	132,654	133,053	133,453
802	133,853	134,255	134,657	135,059	135,463	135,867	136,272	136,678	137,084	137,491
803	137,898	138,307	138,716	139,126	139,536	139,947	140,359	140,772	141,185	141,599
804	142,013	142,429	142,845	143,261	143,679	144,097	144,516	144,936	145,356	145,777
805	146,199	146,622	147,045	147,469	147,894	148,320	148,746	149,174	149,602	150,031
806	150,461	150,893	151,324	151,757	152,190	152,624	153,059	153,495	153,931	154,368
807	154,805	155,244	155,683	156,122	156,563	157,004	157,446	157,888	158,331	158,775
808	159,220	159,665	160,111	160,557	161,004	161,452	161,901	162,350	162,799	163,250
809	163,701	164,153	164,605	165,059	165,513	165,967	166,423	166,878	167,335	167,792
810	168,250	168,709	169,168	169,628	170,089	170,550	171,012	171,475	171,938	172,402
811	172,867	173,333	173,799	174,265	174,733	175,201	175,670	176,139	176,609	177,080
812	177,552	178,024	178,497	178,970	179,444	179,919	180,395	180,871	181,348	181,826
813	182,304	182,783	183,263	183,743	184,224	184,706	185,189	185,671	186,155	186,640
814	187,124	187,610	188,097	188,583	189,071	189,560	190,049	190,538	191,029	191,520
815	192,011	192,504	192,996	193,490	193,984	194,479	194,975	195,471	195,968	196,466
816	196,964	197,463	197,962	198,462	198,963	199,465	199,967	200,470	200,973	201,477
817	201,982	202,488	202,994	203,501	204,008	204,516	205,025	205,534	206,044	206,555
818	207,067	207,579	208,092	208,605	209,120	209,634	210,150	210,666	211,183	211,700
819	212,218	212,737	213,256	213,776	214,297	214,818	215,341	215,863	216,386	216,911
820	217,435	217,961	218,486	219,013	219,540	220,068	220,597	221,126	221,656	222,187
821	222,718	223,250	223,782	224,316	224,850	225,384	225,920	226,456	226,992	227,530
822	228,068	228,606	229,146	229,686	230,227	230,768	231,311	231,854	232,397	232,942
823	233,487	234,033	234,579	235,127	235,675	236,223	236,773	237,323	237,873	238,425
824	238,977	239,530	240,083	240,637	241,193	241,748	242,305	242,862	243,419	243,978
825	244,537	245,096	245,657	246,218	246,780	247,342	247,905	248,469	249,033	249,599
826	250,164	250,731	251,298	251,866	252,434	253,003	253,573	254,144	254,715	255,287
827	255,859	256,433	257,007	257,581	258,157	258,733	259,310	259,888	260,466	261,045
828	261,625	262,206	262,787	263,369	263,951	264,535	265,119	265,704	266,289	266,876
829	267,463	268,051	268,639	269,228	269,818	270,409	271,000	271,593	272,185	272,779
830	273,374	273,969	274,565	275,161	275,759	276,356	276,955	277,555	278,155	278,756
831	279,358	279,960	280,563	281,167	281,772	282,377	282,983	283,590	284,198	284,806
832	285,415	286,025	286,636	287,247	287,859	288,472	289,086	289,700	290,315	290,932
833	291,548	292,166	292,784	293,403	294,023	294,643	295,265	295,887	296,510	297,134
834	297,758	298,383	299,009	299,636	300,264	300,892	301,522	302,152	302,782	303,414
835	304,046	304,680	305,314	305,949	306,585	307,221	307,858	308,496	309,135	309,775
836	310,416	311,057	311,699	312,342	312,986	313,631	314,276	314,923	315,570	316,218
837	316,867	317,517	318,167	318,818	319,471	320,124	320,778	321,433	322,089	322,746
838	323,403	324,062	324,721	325,381	326,042	326,703	327,366	328,030	328,694	329,359
839	330,025	330,693	331,360	332,029	332,698	333,369	334,040	334,712	335,385	336,059
840	336,734	337,410	338,086	338,764	339,442	340,121	340,802	341,482	342,164	342,847
841	343,531	344,216	344,901	345,588	346,275	346,964	347,653	348,343	349,034	349,726
842	350,419	351,114	351,808	352,504	353,201	353,899	354,599	355,299	355,999	356,702
843	357,405	358,109	358,814	359,520	360,227	360,935	361,644	362,354	363,065	363,777
844	364,490	365,204	365,918	366,634	367,351	368,069	368,788	369,507	370,228	370,950
845	371,673									

Lake Marble Falls - BATHYMETRY

RESERVOIR AREA TABLE - NGVD29 DATUM

TEXAS WATER DEVELOPMENT BOARD — April 2007 SURVEY

Conservation Pool Elevation 738.00 ft

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
678	0	0	0	0	0	0	0	0	0	0
679	0	0	0	0	0	0	0	0	0	0
680	0	0	0	0	0	0	0	0	0	0
681	0	0	0	0	0	0	0	0	0	0
682	0	0	0	0	0	0	0	0	0	0
683	0	0	0	0	0	1	1	1	1	1
684	1	1	1	1	1	2	2	2	2	2
685	2	2	2	2	3	3	3	3	3	3
686	3	3	4	4	4	4	4	4	4	5
687	5	5	5	5	6	6	6	6	6	7
688	7	7	8	8	9	9	10	10	11	11
689	12	12	12	13	13	13	13	14	14	14
690	14	15	15	15	15	15	16	16	16	16
691	16	17	17	17	17	17	18	18	18	18
692	18	18	19	19	19	19	19	19	19	20
693	20	20	20	20	20	20	21	21	21	21
694	21	21	21	22	22	22	22	22	22	22
695	23	23	23	23	23	23	23	24	24	24
696	24	24	24	24	25	25	25	25	25	25
697	26	26	26	26	26	26	27	27	27	27
698	27	27	28	28	28	28	28	29	29	29
699	29	30	30	30	30	31	31	31	31	32
700	32	32	32	33	33	33	33	34	34	34
701	34	35	35	35	36	36	36	36	37	37
702	37	38	38	38	39	39	39	40	40	40
703	41	41	41	42	42	42	43	43	43	43
704	44	44	44	45	45	45	46	46	47	47
705	47	48	48	48	49	49	50	50	50	51
706	51	52	52	52	53	53	54	54	54	55
707	55	55	56	56	57	57	57	58	58	59
708	59	60	60	61	61	62	62	63	63	64
709	64	65	65	66	66	67	67	68	68	68
710	69	69	70	70	71	71	72	72	73	74
711	74	75	75	76	77	77	78	79	79	80
712	80	81	82	82	83	84	84	85	86	86
713	87	88	88	89	89	90	91	91	92	93
714	93	94	94	95	96	96	97	97	98	99
715	99	100	100	101	101	102	102	103	103	104
716	104	105	106	106	107	107	108	108	109	109
717	109	110	110	111	111	112	112	113	114	114
718	115	115	116	116	117	117	118	118	119	120
719	120	121	122	123	124	125	126	127	128	129
720	130	131	132	134	135	136	138	139	141	143
721	144	146	147	149	150	151	152	153	154	155
722	156	157	159	160	162	163	165	166	167	168
723	169	170	171	173	174	175	176	177	178	179
724	180	181	182	183	184	186	187	189	191	192
725	194	195	196	198	199	201	202	204	206	208
726	209	211	213	215	217	218	220	221	222	224
727	226	227	229	231	233	236	238	240	242	244
728	245	247	249	251	253	256	258	261	263	266
729	269	272	275	278	282	285	289	293	297	301
730	306	310	314	319	323	328	333	338	344	349
731	355	360	366	371	377	382	388	393	398	403
732	407	412	417	422	428	433	438	442	447	451
733	456	460	464	467	471	474	477	480	483	485

Lake Marble Falls - BATHYMETRY

RESERVOIR AREA TABLE - NGVD29 DATUM (Cont.)

TEXAS WATER DEVELOPMENT BOARD — April 2007 SURVEY

Conservation Pool Elevation 738.00 ft

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
734	488	490	493	495	497	499	501	502	504	505
735	507	509	510	512	514	515	517	519	520	522
736	524	526	528	530	532	534	536	538	540	542
737	544	546	570	578	585	591	596	599	602	604
738	608									

Lake Marble Falls - BATHYMETRY

RESERVOIR AREA TABLE - NAVD88 DATUM

TEXAS WATER DEVELOPMENT BOARD — April 2007 SURVEY

Conservation Pool Elevation 738.19 ft

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
678	0	0	0	0	0	0	0	0	0	0
679	0	0	0	0	0	0	0	0	0	0
680	0	0	0	0	0	0	0	0	0	0
681	0	0	0	0	0	0	0	0	0	0
682	0	0	0	0	0	0	0	0	0	0
683	0	0	0	0	0	0	0	1	1	1
684	1	1	1	1	1	1	1	2	2	2
685	2	2	2	2	2	2	3	3	3	3
686	3	3	3	3	4	4	4	4	4	4
687	4	5	5	5	5	5	6	6	6	6
688	6	7	7	7	8	8	9	9	10	10
689	11	11	12	12	12	13	13	13	13	14
690	14	14	14	15	15	15	15	15	16	16
691	16	16	17	17	17	17	17	17	18	18
692	18	18	18	18	19	19	19	19	19	19
693	19	20	20	20	20	20	20	20	21	21
694	21	21	21	21	21	22	22	22	22	22
695	22	22	23	23	23	23	23	23	23	24
696	24	24	24	24	24	25	25	25	25	25
697	25	25	26	26	26	26	26	26	27	27
698	27	27	27	27	28	28	28	28	28	29
699	29	29	29	30	30	30	30	31	31	31
700	31	32	32	32	32	33	33	33	33	34
701	34	34	34	35	35	35	36	36	36	36
702	37	37	37	38	38	38	39	39	39	40
703	40	40	41	41	41	42	42	42	43	43
704	43	43	44	44	44	45	45	45	46	46
705	47	47	47	48	48	48	49	49	50	50
706	51	51	51	52	52	52	53	53	54	54
707	54	55	55	56	56	56	57	57	57	58
708	58	59	59	60	60	61	61	62	63	63
709	64	64	64	65	65	66	66	67	67	68
710	68	69	69	69	70	70	71	71	72	72
711	73	74	74	75	75	76	77	77	78	79
712	79	80	80	81	82	82	83	84	84	85
713	86	86	87	88	88	89	90	90	91	91
714	92	93	93	94	95	95	96	96	97	98
715	98	99	99	100	100	101	101	102	102	103
716	103	104	105	105	106	106	107	107	108	108
717	109	109	110	110	111	111	111	112	113	113
718	114	114	115	115	116	116	117	117	118	119
719	119	120	120	121	122	123	124	125	126	127
720	128	129	130	131	132	134	135	136	138	139
721	141	143	145	146	148	149	150	151	152	153
722	154	155	156	158	159	160	162	163	165	166
723	167	168	169	170	172	173	174	175	176	177
724	178	179	180	181	182	183	184	186	188	189
725	191	193	194	195	197	198	199	201	202	204
726	206	208	210	212	213	215	217	218	220	221
727	223	224	226	228	229	231	234	236	238	240
728	242	244	246	248	249	252	254	256	258	261
729	264	266	269	272	275	279	282	286	289	293
730	298	302	306	311	315	319	324	328	334	339
731	344	350	355	361	366	372	377	383	388	393
732	398	403	408	413	418	423	428	433	438	443
733	447	452	456	460	464	468	471	474	477	480

Lake Marble Falls - BATHYMETRY

RESERVOIR AREA TABLE - NAVD88 DATUM (Cont.)

TEXAS WATER DEVELOPMENT BOARD — April 2007 SURVEY

Conservation Pool Elevation 738.19 ft

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
734	483	486	488	491	493	495	497	499	501	502
735	504	506	507	509	511	512	514	516	517	519
736	521	522	524	526	528	530	532	534	536	538
737	540	542	544	549	571	579	586	592	596	599
738	602	604	609							

Lake Marble Falls - TERRAIN

RESERVOIR AREA TABLE - NGVD29 DATUM

TEXAS WATER DEVELOPMENT BOARD — April 2007 SURVEY

Conservation Pool Elevation 738.00 ft

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
678	0	0	0	0	0	0	0	0	0	0
679	0	0	0	0	0	0	0	0	0	0
680	0	0	0	0	0	0	0	0	0	0
681	0	0	0	0	0	0	0	0	0	0
682	0	0	0	0	0	0	0	0	0	0
683	0	0	0	0	0	1	1	1	1	1
684	1	1	1	1	1	2	2	2	2	2
685	2	2	2	2	3	3	3	3	3	3
686	3	3	4	4	4	4	4	4	4	5
687	5	5	5	5	6	6	6	6	6	7
688	7	7	8	8	9	9	10	10	11	11
689	12	12	12	13	13	13	13	14	14	14
690	14	15	15	15	15	15	16	16	16	16
691	16	17	17	17	17	17	18	18	18	18
692	18	18	19	19	19	19	19	19	19	20
693	20	20	20	20	20	20	21	21	21	21
694	21	21	21	22	22	22	22	22	22	22
695	23	23	23	23	23	23	23	24	24	24
696	24	24	24	24	25	25	25	25	25	25
697	26	26	26	26	26	26	27	27	27	27
698	27	27	28	28	28	28	28	29	29	29
699	29	30	30	30	30	31	31	31	31	32
700	32	32	32	33	33	33	33	34	34	34
701	34	35	35	35	36	36	36	36	37	37
702	37	38	38	38	39	39	39	40	40	40
703	41	41	41	42	42	42	42	43	43	43
704	44	44	44	45	45	45	46	46	46	47
705	47	48	48	48	49	49	50	50	50	51
706	51	52	52	52	53	53	54	54	54	55
707	55	55	56	56	57	57	57	58	58	59
708	59	60	60	61	61	62	62	63	63	64
709	64	65	65	66	66	67	67	68	68	68
710	69	69	70	70	71	71	72	72	73	74
711	74	75	75	76	77	77	78	79	79	80
712	80	81	82	82	83	84	84	85	86	86
713	87	88	88	89	89	90	91	91	92	92
714	93	94	94	95	96	96	97	97	98	99
715	99	100	100	101	101	102	102	103	103	104
716	104	105	106	106	107	107	107	108	108	109
717	109	110	110	111	111	112	112	113	113	114
718	115	115	116	116	117	117	118	118	119	120
719	120	121	122	123	124	124	126	127	128	129
720	130	131	132	133	135	136	138	139	141	143
721	144	146	147	149	150	151	152	153	154	155
722	156	157	159	160	161	163	164	166	167	168
723	169	170	171	173	174	175	176	177	178	179
724	180	181	182	183	184	186	187	189	191	192
725	194	195	196	198	199	201	202	204	206	208
726	209	211	213	215	216	218	219	221	222	224
727	226	227	229	231	233	236	238	240	242	244
728	245	247	249	251	253	256	258	261	263	266
729	269	272	275	278	281	285	289	293	297	301
730	306	310	314	319	323	328	333	338	343	349
731	355	360	366	371	377	382	388	393	398	403
732	407	412	417	422	427	433	437	442	447	451
733	456	460	464	467	470	474	477	480	483	485

Lake Marble Falls - TERRAIN

RESERVOIR AREA TABLE - NGVD29 DATUM (Cont.)

TEXAS WATER DEVELOPMENT BOARD — April 2007 SURVEY

Conservation Pool Elevation 738.00 ft

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
734	488	490	493	495	497	499	500	502	504	505
735	507	509	510	512	513	515	517	519	520	522
736	525	529	533	537	541	545	548	552	555	558
737	562	565	587	595	602	608	613	616	619	622
738	626	628	629	631	633	634	636	638	639	641
739	642	644	645	647	648	650	651	653	654	656
740	658	659	661	663	665	667	669	671	672	674
741	676	678	680	682	683	685	687	689	691	693
742	695	697	699	701	703	705	707	709	711	714
743	716	719	721	723	726	728	730	732	734	737
744	739	741	743	745	747	749	751	753	755	757
745	759	761	763	765	767	769	771	773	775	778
746	780	782	784	786	788	790	792	794	797	799
747	801	803	805	807	810	812	814	816	818	820
748	822	824	826	828	829	831	833	835	837	839
749	841	843	844	846	848	850	852	854	856	858
750	860	862	864	866	868	870	872	875	877	879
751	881	883	886	888	890	893	895	898	901	903
752	906	908	911	914	916	919	922	925	928	931
753	934	937	940	943	947	950	953	956	960	963
754	966	970	973	977	981	984	988	992	995	999
755	1,002	1,006	1,010	1,013	1,017	1,021	1,025	1,028	1,032	1,036
756	1,040	1,043	1,047	1,051	1,055	1,058	1,062	1,066	1,070	1,074
757	1,078	1,082	1,086	1,090	1,094	1,098	1,102	1,107	1,111	1,115
758	1,120	1,125	1,130	1,135	1,141	1,146	1,151	1,156	1,160	1,165
759	1,169	1,174	1,178	1,183	1,188	1,192	1,197	1,202	1,207	1,212
760	1,218	1,223	1,229	1,236	1,243	1,250	1,257	1,265	1,272	1,280
761	1,287	1,295	1,303	1,311	1,318	1,326	1,334	1,342	1,349	1,356
762	1,363	1,369	1,376	1,382	1,388	1,394	1,401	1,407	1,414	1,420
763	1,427	1,433	1,440	1,446	1,452	1,458	1,464	1,470	1,475	1,481
764	1,487	1,492	1,498	1,503	1,509	1,515	1,520	1,526	1,531	1,537
765	1,542	1,548	1,553	1,559	1,564	1,569	1,575	1,580	1,586	1,591
766	1,597	1,603	1,608	1,614	1,620	1,626	1,632	1,638	1,645	1,651
767	1,657	1,664	1,670	1,677	1,683	1,689	1,695	1,701	1,708	1,714
768	1,720	1,726	1,731	1,737	1,743	1,749	1,754	1,760	1,766	1,771
769	1,777	1,782	1,788	1,793	1,799	1,804	1,809	1,815	1,821	1,827
770	1,833	1,839	1,845	1,851	1,857	1,864	1,870	1,877	1,883	1,889
771	1,895	1,902	1,908	1,915	1,921	1,928	1,935	1,943	1,950	1,957
772	1,964	1,971	1,978	1,985	1,992	2,000	2,006	2,013	2,020	2,026
773	2,033	2,039	2,046	2,052	2,058	2,064	2,070	2,076	2,082	2,088
774	2,094	2,099	2,105	2,111	2,117	2,123	2,129	2,135	2,141	2,147
775	2,153	2,159	2,165	2,171	2,177	2,184	2,190	2,196	2,202	2,208
776	2,214	2,221	2,227	2,233	2,239	2,245	2,251	2,258	2,264	2,270
777	2,276	2,282	2,288	2,295	2,301	2,307	2,313	2,319	2,325	2,331
778	2,337	2,343	2,349	2,356	2,362	2,368	2,375	2,381	2,388	2,394
779	2,400	2,407	2,413	2,420	2,426	2,432	2,439	2,445	2,452	2,458
780	2,465	2,471	2,478	2,484	2,491	2,498	2,504	2,511	2,518	2,524
781	2,531	2,537	2,543	2,550	2,557	2,563	2,570	2,577	2,583	2,590
782	2,597	2,604	2,611	2,617	2,624	2,631	2,638	2,645	2,652	2,659
783	2,666	2,674	2,681	2,688	2,695	2,702	2,709	2,716	2,723	2,730
784	2,737	2,744	2,751	2,758	2,765	2,771	2,778	2,785	2,792	2,799
785	2,806	2,813	2,820	2,827	2,834	2,840	2,847	2,854	2,860	2,867
786	2,874	2,881	2,888	2,895	2,902	2,909	2,916	2,924	2,931	2,938
787	2,945	2,952	2,959	2,966	2,973	2,980	2,988	2,995	3,002	3,010
788	3,017	3,024	3,031	3,039	3,046	3,053	3,060	3,068	3,075	3,082
789	3,089	3,096	3,103	3,110	3,117	3,124	3,131	3,138	3,145	3,152
790	3,159	3,166	3,173	3,180	3,187	3,194	3,201	3,209	3,216	3,223

Lake Marble Falls - TERRAIN

RESERVOIR AREA TABLE - NGVD29 DATUM (Cont.)

TEXAS WATER DEVELOPMENT BOARD — April 2007 SURVEY

Conservation Pool Elevation 738.00 ft

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
791	3,231	3,238	3,245	3,253	3,260	3,268	3,275	3,282	3,290	3,297
792	3,304	3,312	3,319	3,326	3,333	3,341	3,348	3,355	3,363	3,370
793	3,378	3,385	3,392	3,400	3,407	3,415	3,422	3,429	3,437	3,444
794	3,452	3,459	3,467	3,474	3,482	3,489	3,496	3,503	3,510	3,518
795	3,525	3,532	3,539	3,546	3,554	3,561	3,568	3,575	3,582	3,590
796	3,597	3,604	3,611	3,619	3,626	3,633	3,641	3,648	3,655	3,662
797	3,669	3,676	3,683	3,691	3,698	3,705	3,712	3,719	3,727	3,734
798	3,741	3,748	3,756	3,763	3,770	3,777	3,784	3,791	3,798	3,805
799	3,812	3,819	3,826	3,833	3,840	3,847	3,854	3,861	3,867	3,874
800	3,881	3,888	3,895	3,902	3,909	3,916	3,923	3,930	3,937	3,944
801	3,951	3,958	3,965	3,972	3,980	3,987	3,994	4,002	4,009	4,016
802	4,023	4,030	4,037	4,044	4,051	4,058	4,065	4,073	4,080	4,086
803	4,093	4,100	4,107	4,114	4,121	4,128	4,135	4,142	4,149	4,156
804	4,163	4,170	4,177	4,185	4,192	4,199	4,207	4,214	4,222	4,229
805	4,237	4,244	4,252	4,261	4,270	4,279	4,287	4,296	4,304	4,313
806	4,321	4,329	4,337	4,344	4,351	4,358	4,365	4,372	4,379	4,386
807	4,393	4,400	4,407	4,414	4,421	4,427	4,434	4,441	4,448	4,454
808	4,461	4,467	4,474	4,480	4,487	4,494	4,501	4,507	4,514	4,521
809	4,528	4,535	4,542	4,549	4,556	4,562	4,569	4,576	4,582	4,589
810	4,596	4,602	4,609	4,616	4,623	4,630	4,637	4,643	4,650	4,657
811	4,664	4,670	4,677	4,684	4,690	4,697	4,704	4,711	4,718	4,724
812	4,731	4,738	4,745	4,752	4,759	4,766	4,773	4,780	4,787	4,793
813	4,800	4,807	4,813	4,820	4,826	4,833	4,839	4,846	4,853	4,860
814	4,866	4,873	4,880	4,886	4,893	4,899	4,906	4,912	4,919	4,925
815	4,932	4,939	4,945	4,952	4,959	4,965	4,972	4,978	4,985	4,992
816	4,998	5,005	5,011	5,018	5,024	5,031	5,037	5,044	5,051	5,057
817	5,064	5,071	5,077	5,084	5,090	5,097	5,104	5,111	5,118	5,125
818	5,131	5,138	5,145	5,151	5,158	5,164	5,170	5,177	5,183	5,190
819	5,196	5,203	5,209	5,216	5,223	5,229	5,236	5,242	5,249	5,256
820	5,262	5,269	5,275	5,282	5,289	5,295	5,302	5,309	5,316	5,322
821	5,329	5,336	5,342	5,349	5,356	5,362	5,369	5,376	5,383	5,390
822	5,397	5,404	5,412	5,419	5,426	5,433	5,440	5,447	5,454	5,461
823	5,468	5,475	5,482	5,489	5,496	5,503	5,510	5,517	5,524	5,531
824	5,539	5,546	5,552	5,559	5,566	5,573	5,580	5,586	5,593	5,600
825	5,607	5,614	5,620	5,627	5,634	5,641	5,647	5,654	5,661	5,667
826	5,674	5,681	5,687	5,694	5,701	5,708	5,715	5,722	5,729	5,736
827	5,743	5,750	5,758	5,765	5,772	5,779	5,786	5,793	5,801	5,808
828	5,816	5,823	5,830	5,837	5,844	5,852	5,859	5,866	5,873	5,880
829	5,888	5,895	5,903	5,910	5,918	5,925	5,932	5,940	5,947	5,954
830	5,962	5,969	5,976	5,983	5,990	5,998	6,005	6,012	6,020	6,027
831	6,035	6,042	6,050	6,057	6,064	6,072	6,079	6,087	6,094	6,102
832	6,109	6,117	6,125	6,132	6,140	6,147	6,155	6,163	6,170	6,178
833	6,186	6,193	6,201	6,209	6,217	6,225	6,232	6,240	6,248	6,256
834	6,264	6,272	6,280	6,287	6,295	6,303	6,312	6,320	6,328	6,336
835	6,344	6,352	6,360	6,369	6,377	6,385	6,393	6,401	6,409	6,417
836	6,425	6,433	6,442	6,450	6,458	6,467	6,475	6,484	6,492	6,501
837	6,509	6,518	6,527	6,536	6,544	6,553	6,561	6,570	6,579	6,587
838	6,596	6,604	6,613	6,621	6,630	6,639	6,647	6,656	6,664	6,673
839	6,682	6,690	6,699	6,707	6,716	6,725	6,734	6,743	6,752	6,760
840	6,769	6,778	6,787	6,796	6,805	6,814	6,823	6,832	6,841	6,850
841	6,860	6,869	6,878	6,887	6,897	6,906	6,915	6,925	6,934	6,944
842	6,954	6,964	6,974	6,984	6,995	7,005	7,015	7,025	7,035	7,045
843	7,055	7,065	7,074	7,084	7,094	7,104	7,113	7,123	7,133	7,142
844	7,152	7,162	7,172	7,182	7,192	7,202	7,212	7,222	7,232	7,242
845	7,251									

Lake Marble Falls - TERRAIN

RESERVOIR AREA TABLE - NAVD88 DATUM

TEXAS WATER DEVELOPMENT BOARD — April 2007 SURVEY

Conservation Pool Elevation 738.19 ft

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
678	0	0	0	0	0	0	0	0	0	0
679	0	0	0	0	0	0	0	0	0	0
680	0	0	0	0	0	0	0	0	0	0
681	0	0	0	0	0	0	0	0	0	0
682	0	0	0	0	0	0	0	0	0	0
683	0	0	0	0	0	0	0	1	1	1
684	1	1	1	1	1	1	1	2	2	2
685	2	2	2	2	2	2	3	3	3	3
686	3	3	3	3	4	4	4	4	4	4
687	4	5	5	5	5	5	6	6	6	6
688	6	7	7	7	8	8	9	9	10	10
689	11	11	12	12	12	13	13	13	13	14
690	14	14	14	15	15	15	15	15	16	16
691	16	16	16	17	17	17	17	17	18	18
692	18	18	18	18	19	19	19	19	19	19
693	19	20	20	20	20	20	20	20	21	21
694	21	21	21	21	21	22	22	22	22	22
695	22	22	23	23	23	23	23	23	23	24
696	24	24	24	24	24	24	25	25	25	25
697	25	25	26	26	26	26	26	26	27	27
698	27	27	27	27	28	28	28	28	28	29
699	29	29	29	30	30	30	30	31	31	31
700	31	32	32	32	32	33	33	33	33	34
701	34	34	34	35	35	35	36	36	36	36
702	37	37	37	38	38	38	39	39	39	40
703	40	40	41	41	41	42	42	42	43	43
704	43	43	44	44	44	45	45	45	46	46
705	47	47	47	48	48	48	49	49	50	50
706	50	51	51	52	52	52	53	53	54	54
707	54	55	55	55	56	56	57	57	57	58
708	58	59	59	60	60	61	61	62	62	63
709	64	64	64	65	65	66	66	67	67	68
710	68	69	69	69	70	70	71	71	72	72
711	73	74	74	75	75	76	77	77	78	79
712	79	80	80	81	82	82	83	84	84	85
713	86	86	87	88	88	89	89	90	91	91
714	92	93	93	94	94	95	96	96	97	97
715	98	99	99	100	100	101	101	102	102	103
716	103	104	104	105	106	106	107	107	108	108
717	109	109	110	110	110	111	111	112	112	113
718	114	114	115	115	116	116	117	117	118	119
719	119	120	120	121	122	123	124	125	126	127
720	128	129	130	131	132	134	135	136	138	139
721	141	143	145	146	148	149	150	151	152	153
722	154	155	156	158	159	160	162	163	165	166
723	167	168	169	170	172	173	174	175	176	177
724	178	179	180	181	182	183	184	186	187	189
725	191	193	194	195	197	198	199	201	202	204
726	206	208	210	211	213	215	217	218	220	221
727	223	224	226	227	229	231	234	236	238	240
728	242	244	246	247	249	251	254	256	258	261
729	264	266	269	272	275	278	282	285	289	293
730	297	302	306	310	315	319	324	328	334	339
731	344	350	355	361	366	372	377	383	388	393
732	398	403	408	413	418	423	428	433	438	443
733	447	452	456	460	464	467	471	474	477	480

Lake Marble Falls - TERRAIN

RESERVOIR AREA TABLE - NAVD88 DATUM (Cont.)

TEXAS WATER DEVELOPMENT BOARD — April 2007 SURVEY

Conservation Pool Elevation 738.19 ft

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
734	483	485	488	490	493	495	497	499	501	502
735	504	505	507	509	510	512	514	515	517	519
736	520	522	525	529	533	537	541	545	549	552
737	555	559	562	568	588	596	603	609	613	617
738	620	622	626	628	630	631	633	635	636	638
739	639	641	642	644	645	647	648	650	651	653
740	655	656	658	660	661	663	665	667	669	671
741	673	674	676	678	680	682	683	685	687	689
742	691	693	695	697	699	701	703	705	707	709
743	712	714	716	719	721	724	726	728	730	733
744	735	737	739	741	743	745	747	749	751	753
745	755	757	759	761	763	765	767	769	771	774
746	776	778	780	782	784	786	788	790	793	795
747	797	799	801	803	806	808	810	812	814	816
748	818	820	822	824	826	828	830	831	833	835
749	837	839	841	843	845	847	848	850	852	854
750	856	858	860	862	864	866	868	870	873	875
751	877	879	881	884	886	888	891	893	896	898
752	901	904	906	909	911	914	917	919	922	925
753	928	931	934	937	941	944	947	950	953	957
754	960	963	967	970	974	977	981	985	988	992
755	996	999	1,003	1,006	1,010	1,014	1,017	1,021	1,025	1,029
756	1,033	1,036	1,040	1,044	1,047	1,051	1,055	1,059	1,062	1,066
757	1,071	1,075	1,078	1,083	1,087	1,091	1,095	1,099	1,103	1,107
758	1,111	1,116	1,120	1,125	1,131	1,136	1,141	1,146	1,151	1,156
759	1,161	1,165	1,170	1,174	1,179	1,183	1,188	1,193	1,197	1,202
760	1,207	1,213	1,218	1,224	1,230	1,236	1,243	1,251	1,258	1,265
761	1,273	1,280	1,288	1,296	1,304	1,311	1,319	1,327	1,335	1,343
762	1,350	1,357	1,364	1,370	1,376	1,383	1,389	1,395	1,401	1,408
763	1,414	1,421	1,427	1,434	1,440	1,447	1,453	1,459	1,465	1,470
764	1,476	1,482	1,487	1,493	1,498	1,504	1,510	1,515	1,521	1,526
765	1,532	1,537	1,543	1,548	1,554	1,559	1,565	1,570	1,575	1,581
766	1,586	1,592	1,598	1,603	1,609	1,615	1,621	1,627	1,633	1,639
767	1,645	1,652	1,658	1,664	1,671	1,677	1,683	1,690	1,696	1,702
768	1,708	1,714	1,720	1,726	1,732	1,738	1,744	1,749	1,755	1,761
769	1,766	1,772	1,777	1,783	1,788	1,794	1,799	1,805	1,810	1,816
770	1,821	1,827	1,833	1,839	1,845	1,851	1,858	1,864	1,871	1,877
771	1,883	1,890	1,896	1,902	1,909	1,915	1,922	1,929	1,936	1,943
772	1,950	1,958	1,965	1,972	1,979	1,986	1,993	2,000	2,007	2,014
773	2,020	2,027	2,033	2,040	2,046	2,053	2,059	2,065	2,071	2,077
774	2,082	2,088	2,094	2,100	2,106	2,111	2,117	2,123	2,129	2,135
775	2,141	2,147	2,153	2,160	2,166	2,172	2,178	2,184	2,190	2,197
776	2,203	2,209	2,215	2,221	2,228	2,234	2,240	2,246	2,252	2,258
777	2,264	2,270	2,277	2,283	2,289	2,295	2,301	2,307	2,314	2,320
778	2,326	2,332	2,338	2,344	2,350	2,356	2,363	2,369	2,375	2,382
779	2,388	2,395	2,401	2,407	2,414	2,420	2,427	2,433	2,439	2,446
780	2,452	2,459	2,465	2,472	2,478	2,485	2,492	2,498	2,505	2,512
781	2,518	2,525	2,531	2,538	2,544	2,551	2,557	2,564	2,571	2,577
782	2,584	2,591	2,598	2,604	2,611	2,618	2,625	2,632	2,638	2,645
783	2,653	2,660	2,667	2,674	2,682	2,689	2,696	2,703	2,710	2,717
784	2,724	2,731	2,738	2,745	2,752	2,758	2,765	2,772	2,779	2,786
785	2,793	2,800	2,807	2,814	2,821	2,827	2,834	2,841	2,848	2,854
786	2,861	2,868	2,875	2,882	2,889	2,896	2,903	2,910	2,917	2,924
787	2,931	2,939	2,946	2,953	2,960	2,967	2,974	2,981	2,988	2,996
788	3,003	3,010	3,018	3,025	3,032	3,039	3,047	3,054	3,061	3,068
789	3,076	3,083	3,090	3,097	3,104	3,111	3,118	3,125	3,132	3,139
790	3,146	3,153	3,160	3,167	3,174	3,181	3,188	3,195	3,202	3,210

Lake Marble Falls - TERRAIN

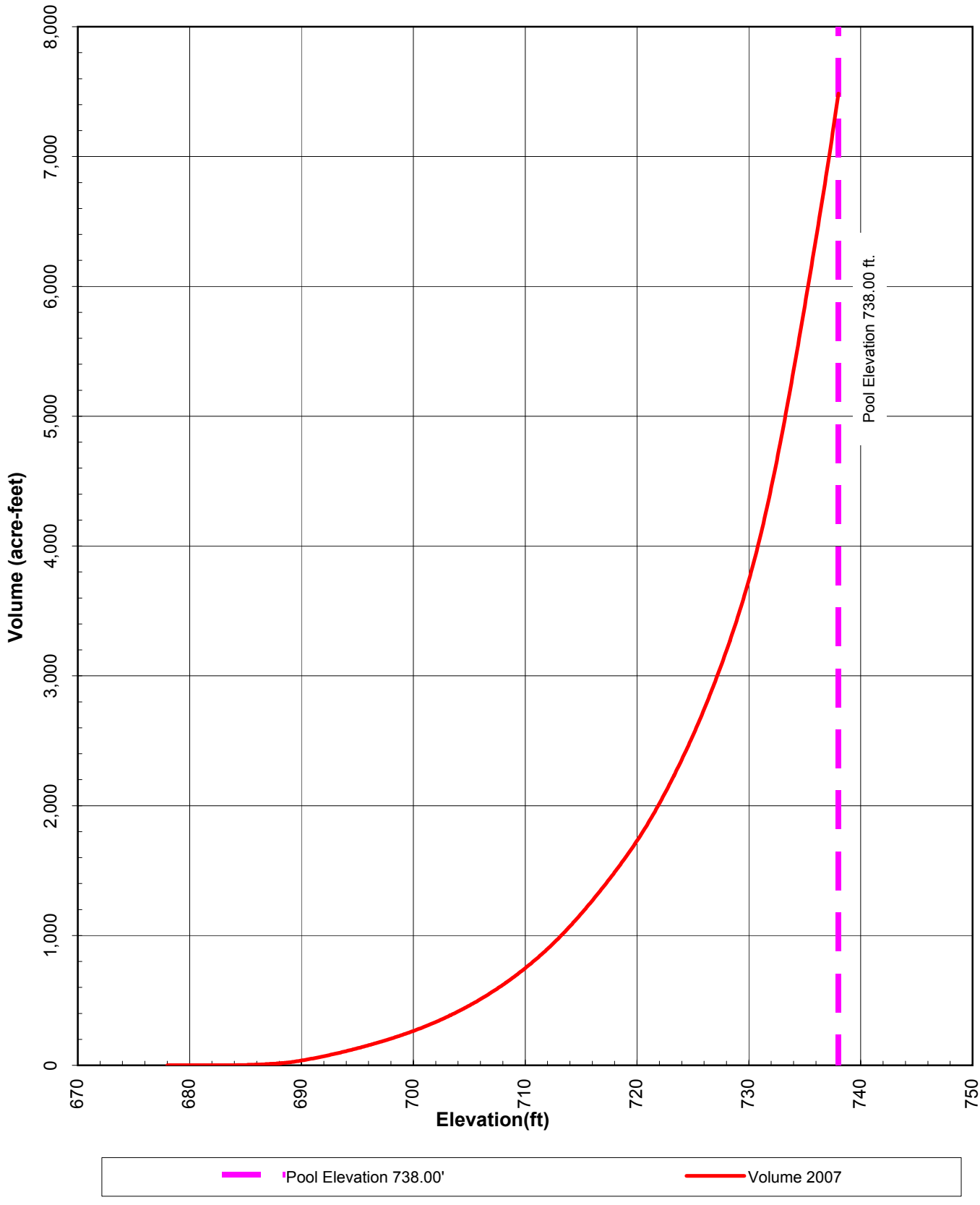
RESERVOIR AREA TABLE - NAVD88 DATUM (Cont.)

TEXAS WATER DEVELOPMENT BOARD — April 2007 SURVEY

Conservation Pool Elevation 738.19 ft

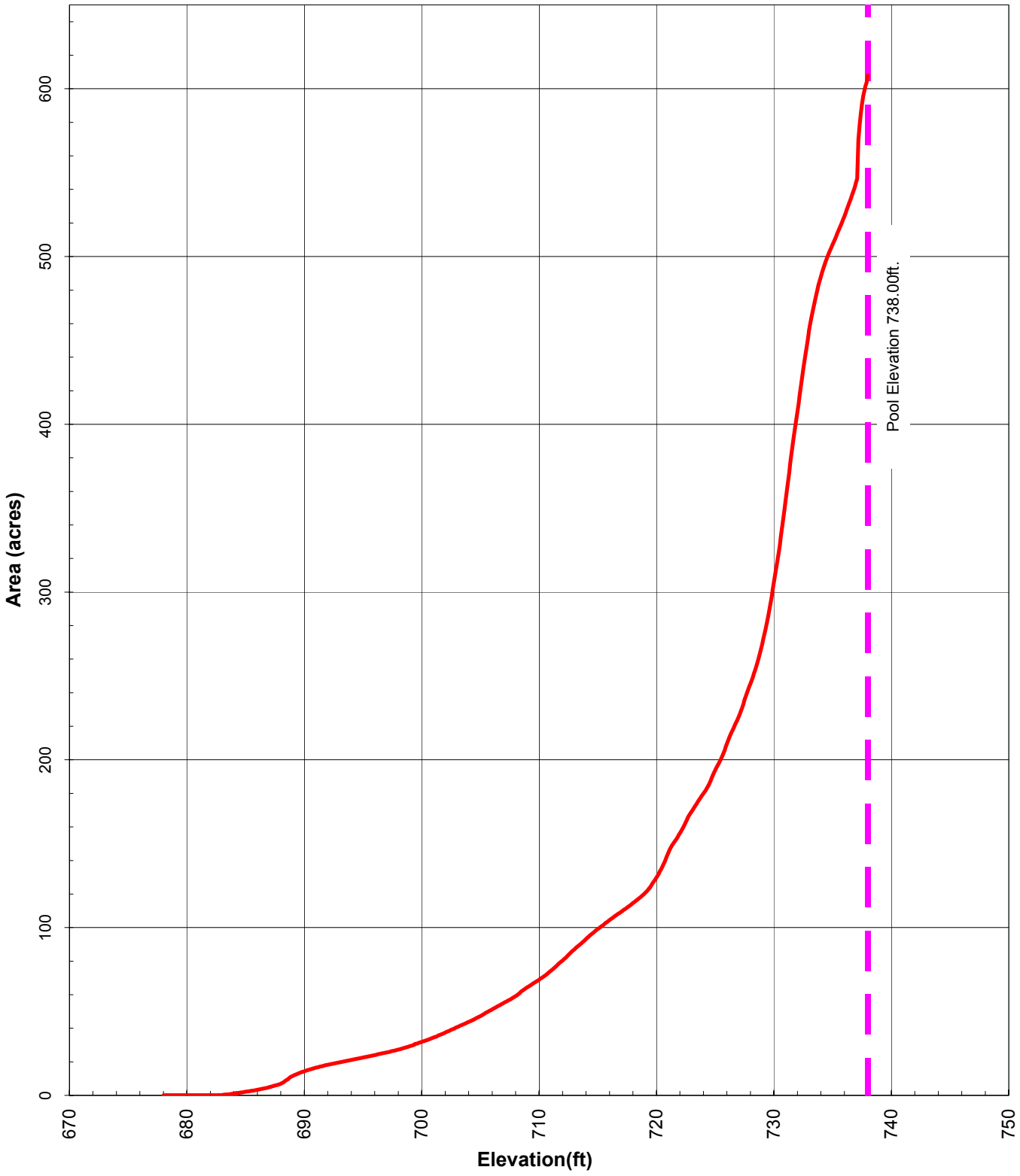
AREA IN ACRES — ELEVATION INCREMENT IS ONE TENTH FOOT

ELEVATION in Feet	0.0	0.1	0.2	0.3	0.4	0.5	0.6	0.7	0.8	0.9
791	3,217	3,224	3,232	3,239	3,246	3,254	3,261	3,268	3,276	3,283
792	3,290	3,298	3,305	3,312	3,320	3,327	3,334	3,341	3,349	3,356
793	3,364	3,371	3,378	3,386	3,393	3,401	3,408	3,415	3,423	3,430
794	3,438	3,445	3,453	3,460	3,468	3,475	3,482	3,490	3,497	3,504
795	3,511	3,518	3,526	3,533	3,540	3,547	3,554	3,561	3,569	3,576
796	3,583	3,590	3,598	3,605	3,612	3,619	3,627	3,634	3,641	3,648
797	3,656	3,663	3,670	3,677	3,684	3,691	3,699	3,706	3,713	3,720
798	3,727	3,735	3,742	3,749	3,756	3,764	3,771	3,778	3,785	3,792
799	3,799	3,806	3,813	3,820	3,827	3,834	3,841	3,848	3,855	3,861
800	3,868	3,875	3,882	3,889	3,895	3,902	3,910	3,917	3,924	3,931
801	3,938	3,945	3,952	3,959	3,966	3,973	3,980	3,988	3,995	4,002
802	4,010	4,017	4,024	4,031	4,038	4,045	4,052	4,059	4,066	4,073
803	4,080	4,087	4,094	4,101	4,108	4,115	4,122	4,129	4,136	4,143
804	4,150	4,157	4,164	4,171	4,178	4,185	4,193	4,200	4,208	4,215
805	4,222	4,230	4,237	4,245	4,253	4,262	4,270	4,279	4,288	4,297
806	4,305	4,313	4,322	4,330	4,337	4,345	4,352	4,359	4,366	4,373
807	4,380	4,387	4,394	4,401	4,408	4,414	4,421	4,428	4,435	4,442
808	4,448	4,455	4,461	4,468	4,474	4,481	4,488	4,494	4,501	4,508
809	4,515	4,522	4,529	4,536	4,543	4,549	4,556	4,563	4,570	4,576
810	4,583	4,590	4,596	4,603	4,610	4,617	4,624	4,630	4,637	4,644
811	4,651	4,658	4,664	4,671	4,678	4,684	4,691	4,698	4,705	4,711
812	4,718	4,725	4,732	4,739	4,745	4,752	4,759	4,766	4,774	4,781
813	4,787	4,794	4,801	4,807	4,814	4,820	4,827	4,833	4,840	4,847
814	4,853	4,860	4,867	4,874	4,880	4,887	4,893	4,900	4,906	4,913
815	4,920	4,926	4,933	4,939	4,946	4,953	4,959	4,966	4,973	4,979
816	4,986	4,992	4,999	5,005	5,012	5,018	5,025	5,032	5,038	5,045
817	5,051	5,058	5,065	5,071	5,078	5,085	5,091	5,098	5,105	5,112
818	5,118	5,125	5,132	5,139	5,145	5,152	5,158	5,165	5,171	5,177
819	5,184	5,190	5,197	5,203	5,210	5,217	5,223	5,230	5,236	5,243
820	5,250	5,256	5,263	5,269	5,276	5,283	5,289	5,296	5,303	5,309
821	5,316	5,323	5,330	5,336	5,343	5,350	5,356	5,363	5,370	5,377
822	5,384	5,391	5,398	5,405	5,412	5,420	5,427	5,434	5,441	5,448
823	5,455	5,462	5,469	5,476	5,483	5,490	5,497	5,504	5,511	5,518
824	5,525	5,532	5,539	5,546	5,553	5,560	5,567	5,574	5,580	5,587
825	5,594	5,601	5,607	5,614	5,621	5,628	5,635	5,641	5,648	5,655
826	5,661	5,668	5,675	5,681	5,688	5,695	5,702	5,709	5,716	5,723
827	5,730	5,737	5,744	5,751	5,758	5,765	5,773	5,780	5,787	5,794
828	5,802	5,809	5,816	5,824	5,831	5,838	5,845	5,852	5,859	5,866
829	5,874	5,881	5,888	5,896	5,903	5,911	5,918	5,926	5,933	5,941
830	5,948	5,955	5,962	5,969	5,977	5,984	5,991	5,998	6,006	6,013
831	6,021	6,028	6,035	6,043	6,050	6,058	6,065	6,072	6,080	6,087
832	6,095	6,103	6,110	6,118	6,125	6,133	6,140	6,148	6,156	6,163
833	6,171	6,179	6,186	6,194	6,202	6,210	6,218	6,225	6,233	6,241
834	6,249	6,257	6,265	6,273	6,280	6,288	6,296	6,304	6,312	6,321
835	6,329	6,337	6,345	6,353	6,361	6,369	6,377	6,385	6,393	6,401
836	6,409	6,418	6,426	6,434	6,442	6,451	6,459	6,468	6,476	6,485
837	6,493	6,502	6,510	6,519	6,528	6,536	6,545	6,554	6,562	6,571
838	6,579	6,588	6,596	6,605	6,614	6,622	6,631	6,640	6,648	6,657
839	6,665	6,674	6,682	6,691	6,700	6,708	6,717	6,726	6,735	6,744
840	6,752	6,761	6,770	6,779	6,788	6,797	6,806	6,815	6,824	6,833
841	6,842	6,851	6,861	6,870	6,879	6,888	6,898	6,907	6,916	6,926
842	6,935	6,945	6,955	6,965	6,975	6,985	6,996	7,006	7,016	7,026
843	7,036	7,046	7,056	7,066	7,075	7,085	7,095	7,105	7,114	7,124
844	7,134	7,143	7,153	7,163	7,173	7,183	7,193	7,203	7,213	7,223
845	7,233									



Lake Marble Falls
April 2007
Prepared by: TWDB

Appendix C Elevation vs. Volume



Lake Marble Falls
April 2007
Prepared by: TWDB

Appendix D Elevation vs. Area

Appendix E

Analysis of Sedimentation Data from Lake Marble Falls

Executive Summary

Based on multi-frequency depth sounder data collected by the Texas Water Development Board and data collected by John Dunbar Geophysical Consulting, Lake Marble Falls has accumulated a negligible amount of sediment since impoundment. To further assess sedimentation in Lake Marble Falls, a complete re-survey of the lake is suggested in 10-20 years or after 8 to 10 major flood events (similar to the flood events in the summer of 2007). Any re-survey should occur at a time when the water level is at or above the conservation pool elevation.

Introduction

This appendix includes the results of the sediment investigation using multi-frequency depth sounder data collected on April 11, 2007 and April 12, 2007 by the Texas Water Development Board (TWDB). Through careful analysis and interpretation of the multi-frequency signal returns, it is possible to discern the pre-impoundment bathymetric surface, as well as the current surface and sediment thickness. Such interpretations are aided and validated through comparisons with sediment core samples, grab samples, and/or spud-bar samples which provide independent measurements of sediment thickness. On July 25, 2007 John Dunbar Geophysical Consulting (JDGC), a subcontractor of TWDB, collected seven core samples and one grab-sample of the impoundment bottom throughout the reservoir. The remainder of this appendix presents a discussion of the results from and methodology used in the core sampling, grab sampling, and multi-frequency data collection efforts, followed by a composite analysis of the data collection efforts in Lake Marble Falls.

Data Collection & Processing Methodology

Bathymetric data collection assessing sedimentation in Lake Marble Falls occurred on April 11th and April 12th of 2007, while the water surface elevation measured 736.73 and 736.8 feet, respectively. For this data collection, TWDB used a Specialty Devices, Inc., multi-frequency (200 kHz, 50 kHz, and 24 kHz) sub-bottom profiling depth sounder integrated with Differential Global Positioning System (DGPS) equipment. Data collection occurred while navigating along pre-planned range lines oriented perpendicular to the assumed location of the original river channels and spaced approximately 500 feet apart. The depth sounders were calibrated each day using a velocity profiler to measure the speed of sound in the water column and a modified bar check using a weighted tape or stadia rod to verify the depth reading. During the 2007 survey, team members collected 25,147 data points over cross-sections totaling nearly 19 miles in length. Figure E1 shows where data points were collected during the TWDB 2007 survey.

Core samples and grab samples collected by John Dunbar Geophysical Consulting (JDGC) were collected at locations where sounding data had been previously collected (Figure E1). All cores were collected with a custom-coring boat and SDI Vibracorer system. Cores were analyzed by JDGC, who reported their observations of core contents and provided photos of core samples for further data verification. JDGC collected one grab sample (Site #2 on Figure E1) using a Ponar sampler.

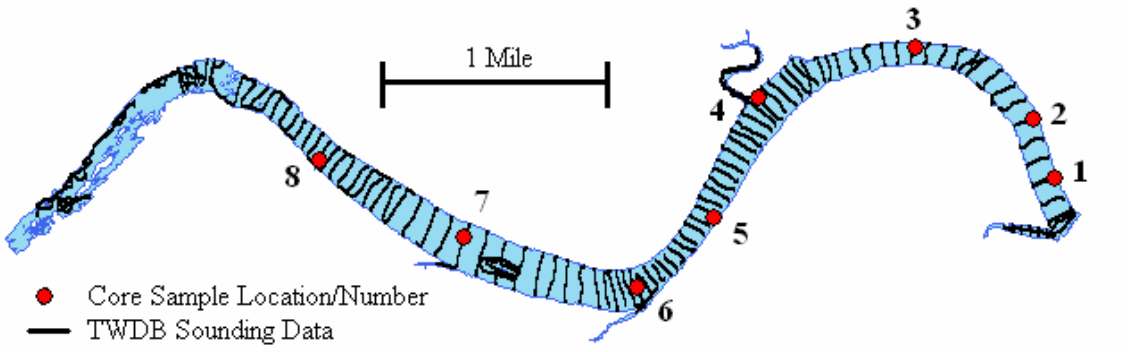


Figure E1 – Map of data collection effort for Lake Marble Falls

All sounding data is processed using the DepthPic software, within which both the pre-impoundment and current bathymetric surfaces may be visually identified and digitized manually. These surfaces are first identified along cross-sections for which core samples have been collected – thereby allowing the user to identify color bands in the DepthPic display that correspond to the sediment layer(s) observed in the core samples. This process is illustrated in Figure E2 where the core sample #3 is shown with its corresponding sounding data. As shown in Figure E2-A, core sample #3 was collected in nearly 32 feet of water near the deepest point of the measured cross-section. The bright yellow, pink, and red pixels underneath and around the yellow core sample symbol (Figure E2-B) are indicative of hard returns in the multi-frequency data, suggesting the bathymetric surface is devoid of soft sediment. Core sample #3 (Figure E2-C) contained 0.4 feet of coarse sand and pebbles, consistent with the interpretation of a hard bottom derived from the multi-frequency sounding data. The core sample was made up of quartz, calcite and granite. All clasts had been rounded by water transport and did not match the lithology of the reservoir banks. It was therefore concluded that these sands and pebbles were fluvial in origin and had been transported into Lake Marble Falls before the construction of Starke Dam.

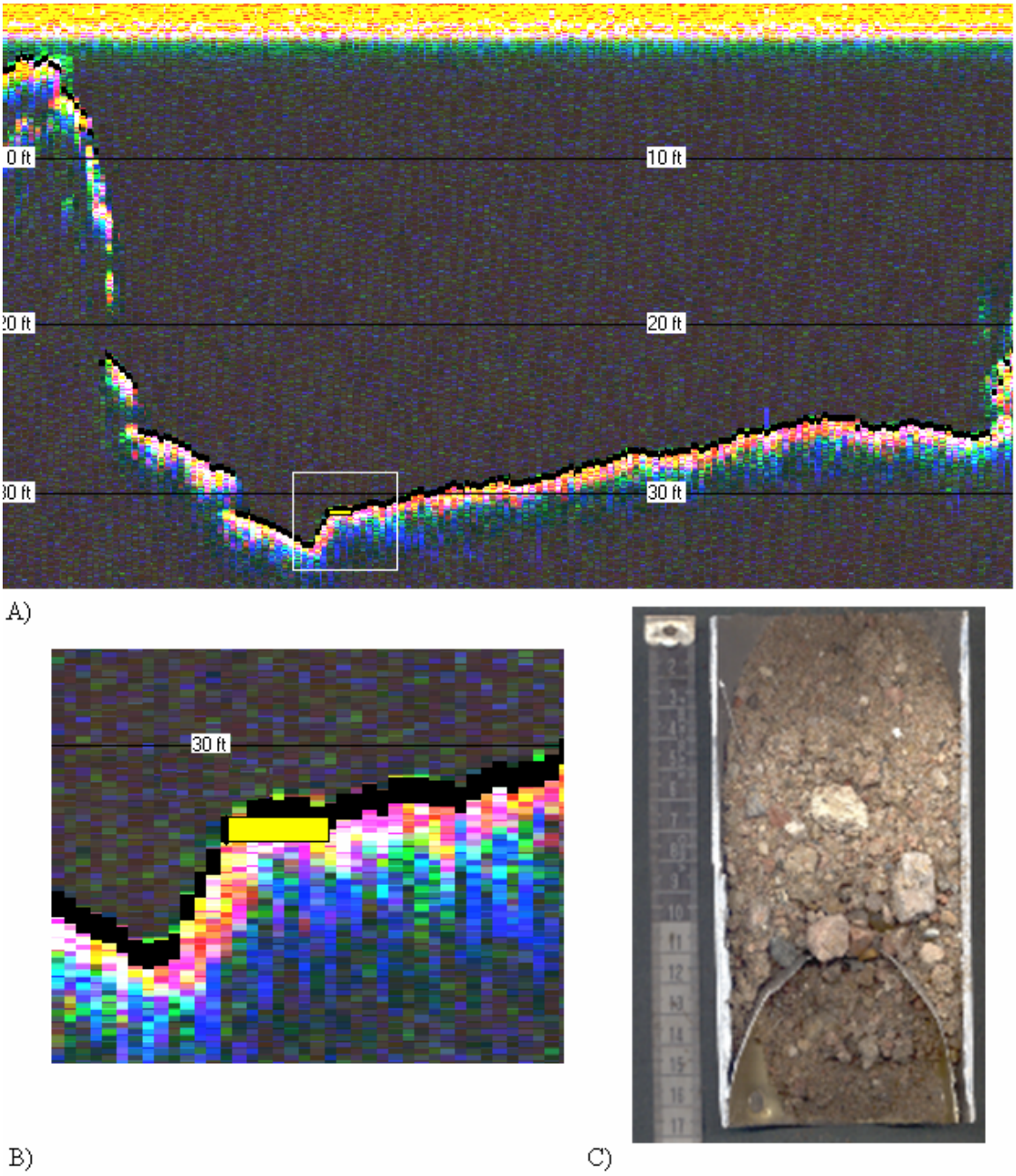


Figure E2 – Multifrequency data analysis and core sampling on Lake Marble Falls – A) DepthPic interpretations of data collected near core sample #3, B) close-up of the current bathymetric suface near the core sample, indicating a lack of benthic sediment, C) photograph of core sample #3 showing large rounded clasts indicating fluvial origin.

When viewed in DepthPic, each of the multi-frequency data files showed results similar to the data presented in Figure E2. Not a single file contained signal returns suggesting the accumulation of sediment, indicated as a darker color immediately underneath the

current bathymetric surface followed by a series of blue pixels indicating the sediment layer base. Such signal returns were observed within data collected from Inks Lake upstream of Lake Marble Falls, as indicated in Figure E3[1]. Core samples taken on Inks Lake also validated the acoustic signal interpretation (Figure E3). The lack of acoustic signals suggesting sediment accumulation within Lake Marble Falls, as compared to Inks Lake, is well supported by the lack of sediment present in the Lake Marble Falls core samples. Table E1 contains detailed descriptions of each of the core samples collected and interpreted by JDGC.

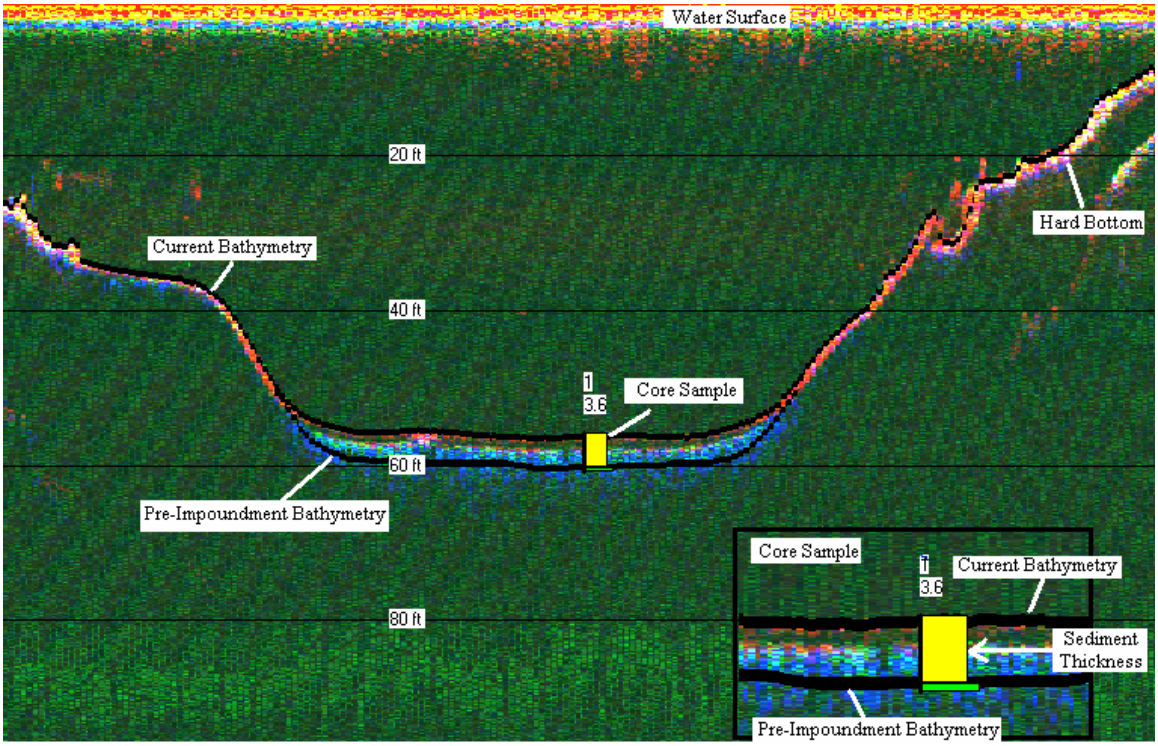


Figure E3 – DepthPic & core sample use in identifying the pre-impoundment bathymetry of Inks Lake.

Table E1 – Core Sample Locations & Descriptions

Sample	Easting**	Northing**	Description	Origin
1	2949806.0	10173439.0	40 cm of course sand over 19 cm of laminated clay & fine sand layers.	Fluvial
2 (Grab)	2949304.0	10174858.0	Sand, gravel and tree limb fragments	Fluvial
3	2946424.0	10176538.0	12 cm of coarse sand and rounded pebbles	Fluvial
4	2942650.0	10175289.0	10 cm of coarse sand over 15 cm of angular gravel	Fluvial, some bank material
5	2941625.0	10172418.0	20 cm of course sand and gravel, with few cobbles. All rounded by water transport	Fluvial
6	2939799.0	10171842.0	20 cm of course sand and gravel, with few cobbles. All rounded by water transport	Fluvial
7	2935605.0	10171842.0	12 cm of gavel and cobble	Fluvial
8	2932085.0	10173668.0	2 cm of coarse sand and pebbles	Fluvial

** Positions provided in the State Plane Texas Central (feet) coordinate system

Conclusions

The lack of sediment indicated by the multi-frequency acoustic signals, as well as the lack of sediment within all core samples, suggests that a negligible amount of sediment has accumulated in Lake Marble Falls since impoundment. The possibility exists that small pockets of sediment exist in areas between TWDB survey lines, however this is unlikely given the properties of the pebbles and rocks collected within the core samples. The core samples contained compositions varying from coarse sand to large gravel, with some clasts as large as 1 to 2 inches in diameter on the water bottom. The clasts were all partly rounded, indicating fluvial transport in the pre-impoundment Colorado River. Such large pebbles and cobbles could not be transported into the lake by water currents, thereby requiring that they were present on the river bottom before impoundment.

Based on the sedimentation analysis presented herein, runoff events within the reservoir's watershed have not been significant contributors of sediment to Lake Marble Falls. Sediment may be accumulating on the edges of the reservoir where it is too shallow

for TWDB survey equipment to effectively measure. The expected source of this sediment includes bank erosion and construction runoff. The other potential source of sediment to the lake (neglecting aerial deposition) is from the influx of water from Lake LBJ through Wirtz Dam. The existence of sizeable sediment deposits immediately upstream of Wirtz Dam within Lake LBJ (unpublished data collected by JDGC) therefore suggests that all of the sediment which passes into Lake Marble Falls is too fine to settle to the lake bottom before flowing downstream into Lake Travis. Given these characteristics, TWDB recommends repeating a sedimentation survey of Lake Marble Falls only after 10-20 years or extreme runoff events.

References

1. Volumetric and Sedimentation Survey of Inks Lake. 2007. Texas Water Development Board.

Appendix F

LiDAR Data Processing Methods

Summary

To supplement the data collected by TWDB during the 2007 volumetric and sedimentation survey of Lake Marble Falls, LCRA provided high-resolution LiDAR data for the land areas adjacent to each of the Highland Lakes. This appendix outlines how TWDB processed the LiDAR data provided by LCRA, and describes how this data was incorporated into the TIN models used in representing the bathymetric surface of Lake Marble Falls as well as its immediate surroundings.

The LCRA LiDAR data discussed herein was collected on January 2, 2007 when the approximate water surface elevation in Lake Marble Falls was 737.09 feet above mean sea level (NGVD29). LiDAR points were processed in a series of steps in order to reduce the number of points used in creating bathymetric TIN models. The processing steps used in dataset reduction were:

1. Excluding any point outside of the 820 foot elevation contour boundary about Lake Marble Falls, obtained from available hypsography datasets.
2. Separating all points within the boundary of Lake Marble Falls as derived from aerial photography (Elevation 737.15 feet).
3. Elminating any of the separated points with elevations greater than 737.15 feet which did not correspond to boulder outcrops visible on the aerial photographs.
4. Removing any wayward points located in the lake interior where elevations are known not to exceed 737.50 feet. Such points were often reflections off of boat docks or other man-made structures on the water surface as identified from aerial photos.
5. Adjusting the LiDAR point elevations by -0.19 feet to convert from the NAVD88 datum to the NGVD29 datum used by TWDB in this report. The conversion factor used herein was provided by LCRA and is only valid for use in the immediate vicinity of Lake Marble Falls.

The resulting LiDAR dataset contained 14,470,164 data points with elevations ranging from 735.48 feet (slightly below the Lake Marble Falls conservation pool elevation) to 901.5 feet.

Introduction

The LiDAR data provided by LCRA to TWDB were used in assessing the volume of Lake Marble Falls at elevations greater than 737.15 feet (the elevation of the lake boundary as discernible from aerial photography). The data were obtained in the form of LAS text files. Each file contained numerous lines of data, with each individual line containing an X coordinate, a Y coordinate, an elevation above mean sea level, and an unknown data value (This value was not

readily identifiable and LCRA did not provide metadata describing this value). The X- and Y-coordinates were in the UTM Zone 14N coordinate system, and the elevation value was given in feet above mean sea level referenced from the NAVD88 datum. TWDB was provided with 157 LAS files covering all of the Highland Lakes area (including the vicinity of Lakes Buchanan, Inks, LBJ, Marble Falls, and Travis), and consisting of 23.3 GB.

LiDAR Data Processing

To process the LAS text files, TWDB created the program "read_lidar.exe" using the FORTAN computer programming language and the Lahey Fujitsu Fortran (V5.6) compiler. This program performed the following operations:

1. Opened each individual LAS file and read the file contents
2. Removed any line of data that corresponded to a point outside the primary 860 foot contour line around Lake Marble Falls (as defined by the 860-foot contour about Lake Marble Falls from available hypsography datasets, artificially closed at the Starke and Wirtz Dam locations).
3. Output the data in CSV format, suitable for importation as a shapefile in the ArcGIS software system.

The output was then converted into ArcGIS shapefiles and manually reviewed to assure data quality. In this step, wayward points (i.e. those with incorrectly edited coordinates) were manually removed. Points within the boundary of Lake Marble Falls (as determined in ArcGIS using aerial photos) were reviewed and removed if determined to correspond with boat docks or other man-made structures on the lake surface. Points corresponding to visible rock outcrops were not removed. The spatial extent of the LiDAR data used in creating the Lake Marble Falls bathymetric and Terrain TIN models is shown in Figure F1. LiDAR data was used in representing 7,935 acres about Lake Marble Falls, with an average point density of 1 point per 25 square-ft. Due to the high resolution of the LiDAR data, small features such as road surfaces and stream channels become evident in the TIN model (Figure F2).

As shown in Figure F1, the terrain adjacent to Lake Marble Falls has numerous small areas with elevations less than elevation 738.0 feet (the conservation pool elevation of the lake). These depressions, if included in the lake bathymetric model, would yield incorrect assessments of lake volume and area at for elevations ranging from 735.48 feet to 738.0 feet, with the former elevation corresponding to the lowest elevation within the depressions. These exterior depressions would only contain water during and possibly after large flooding events, therefore their areas and capacities must not be included within the areas and capacities of the actual lake. In order to exclude the exterior depressions from the lake area and volume calculations, two separate TIN models were created. The first TIN model, "Bathymetry", corresponds to the area of the lake at and below conservation pool elevation (elevation 738.0 feet NGVD29), and excludes the exterior depressions. The second TIN model, "Terrain," corresponds to the entire area of LiDAR data shown in Figure F1, including the area of Lake Marble Falls. Volume and area tables derived from each of these TIN models are provided in Appendices A and B, respectively.

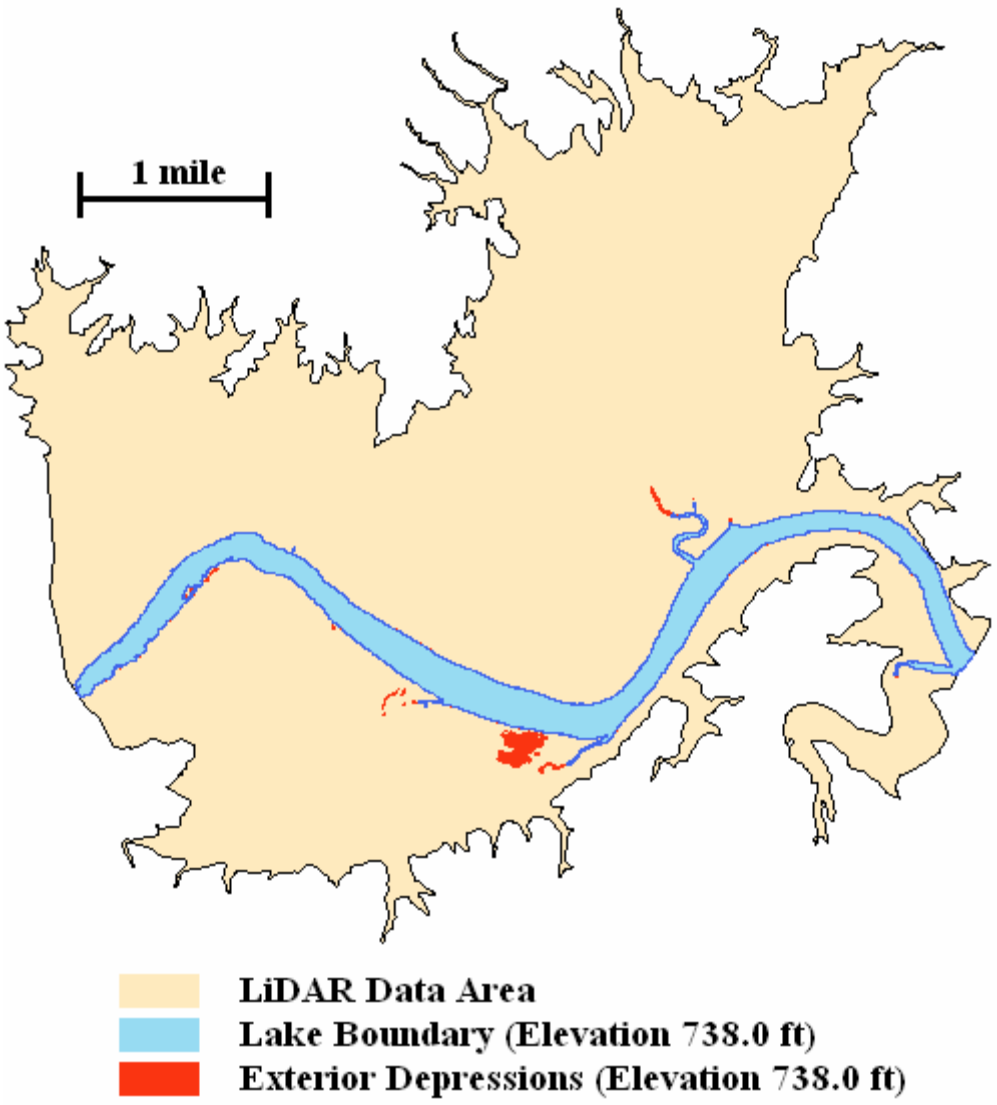


Figure F1 – Spatial extent of LiDAR data usage in describing the bathymetry of and terrain adjacent to Lake Marble Falls.

TIN Model Boundary Definition

In order to create the Bathymetry TIN model, a lake boundary at elevation 738.0 feet (NGVD29) had to be created. This was achieved through digitization of the lake boundary at elevation 737.15 feet (NGVD29) based on available aerial photos from 2005. The boundary at elevation 737.15 feet was then used as a hard line feature in a temporary TIN model derived from the entire LiDAR dataset following the removal of data points corresponding to the water surface. Using the ArcGIS 3D-Analyst Surface Contour function, a contour was derived at elevation 738.00 feet from the temporary TIN model. This contour was converted to a polygon and used as the lake boundary in creating the Bathymetry TIN model. A second temporary TIN model was then created in order to approximate the extent of the boulder outcrops present in the upper reach of Lake Marble Falls (Figure F3). These outcrops represent islands within the lake,

and need to be excluded from the TIN model when computing the lake bathymetry (however they are included in computing the Terrain TIN model). The second temporary TIN was derived using the lake boundary at elevation 738.0 feet as a soft clip feature, the boundary at elevation 737.15 feet as a hard line, TWDB sounding and interpolated points as mass points features, and any valid LiDAR data point inside the lake boundary as mass point features. Contours were then derived from this second temporary TIN model at elevation 738.0 feet, and island polygons were digitized from the contours.

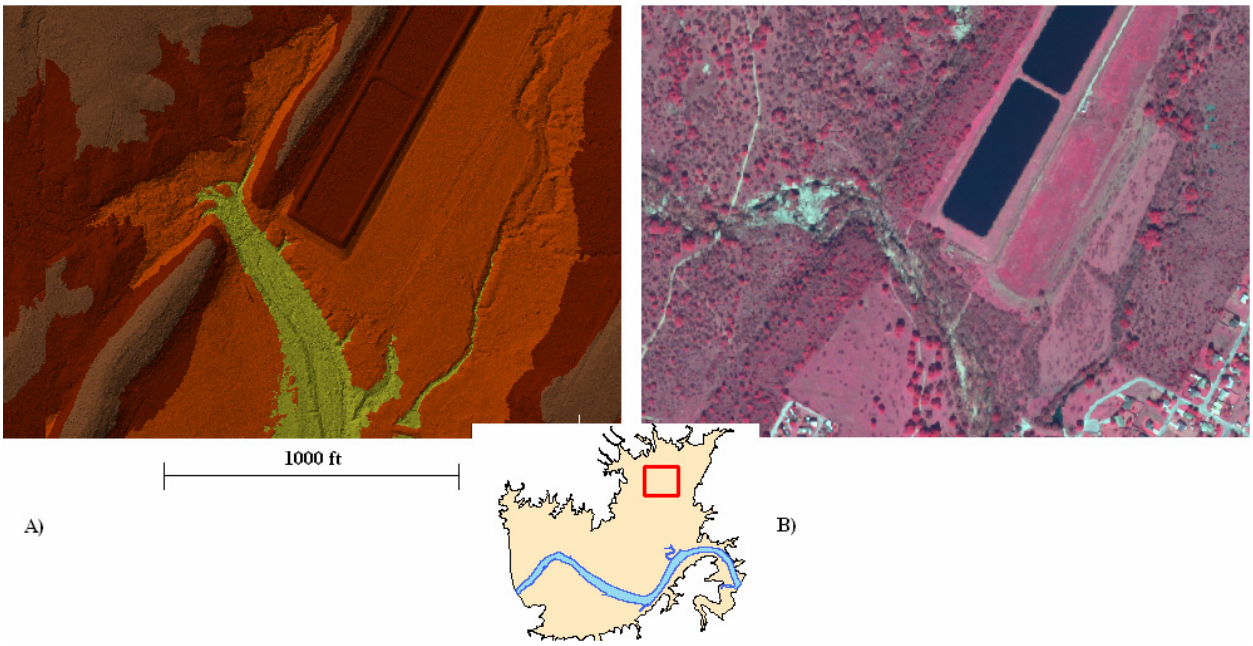


Figure F2 – TIN and aerial photo comparison – A) TIN model from LiDAR data, B) Aerial photo. The TIN model clearly shows the detention ponds and creeks evident in the aerial photo.

The Bathymetry TIN model was created using the following datasets and TIN creation options:

- Boundary at elevation 738.0 feet (soft clip)
- Boundary at elevation 737.15 feet (hard line)
- Islands at elevation 738.0 feet (hard erase)
- TWDB sounding and interpolated points (mass points)
- LiDAR points within the 738.0 ft contour (mass points)

To create the elevation relief (Figure 5), Depth Range (Figure 6), and 5-foot contour maps (Figure 7), the Lake Marble Falls Bathymetry TIN model was converted into a raster gird with elevations assigned at the centers of 1 foot x 1 foot grid cells.

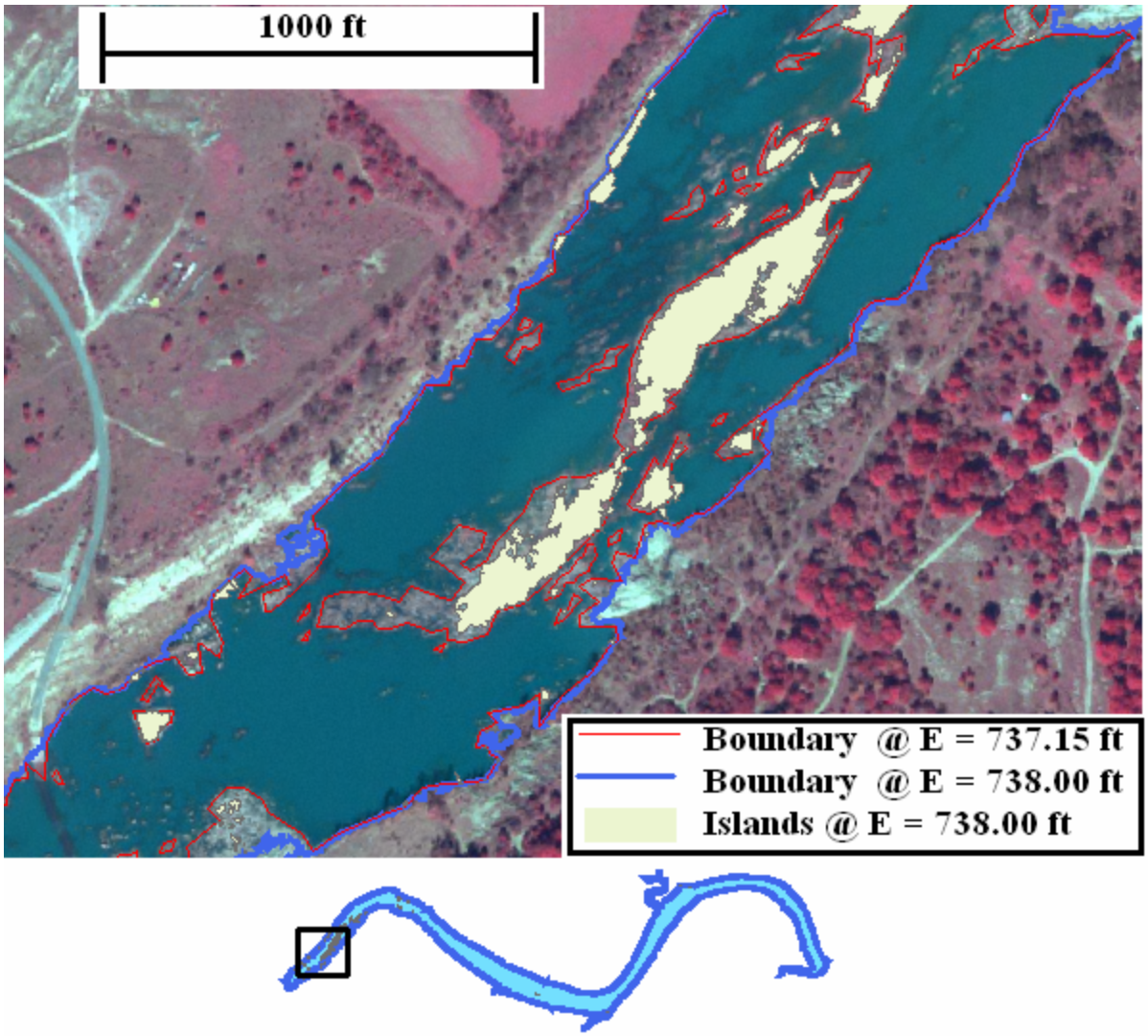


Figure F3 – Island definitions from LiDAR-derived contours, showing good agreement with islands identifiable in aerial photos from December 2004.

The Terrain TIN model was created using the following datasets and TIN creation options:

- Boundary at elevation 738.0 feet (hard line)
- Boundary at elevation 737.15 feet (hard line)
- Islands at elevation 738.0 feet (hard line)
- TWDB sounding and interpolated points (mass points)
- LiDAR points within the 738.0 feet contour (mass points)
- LiDAR points outside the 738.0 feet contour (mass points)
- Boundary at elevation 860 feet (soft clip).

Appendix G

Volume Estimates in Unsurveyable Areas

Summary

TWDB collected limited data in the shallow areas downstream from Wirtz Dam on June 12, 2007 while the water surface elevation measured between 736.55 and 736.58 feet above mean sea level. Data was collected in-between rock outcrops where boat passage was permissible. Data collection was either not possible within 1000 ft of Wirtz Dam and and limited near the south-east lake shore within 1 mile from Wirtz Dam. Visual assessment of the depths in these areas suggest the majority of the unsurveyable areas were shallow, however the possibility exists that regions of deeper water may have been missed by the data collection effort. To estimate possible water volumes in the unsurveyable areas, sets of bathymetric elevations were assigned at the centers of 5 meter x 5 meter grid cells throughout the areas. The assigned elevations were grouped into 3 sets of 6 random bathymetries, where the maximum depth allowed in each set was 3 feet, 5 feet, and 10 feet respectively. An additional set of uniform bathymetries was also created, with depths ranging from 1 to 5 feet. The resulting 23 groups of randomly and uniformly assumed elevations were combined with the TWDB surveyed and interpolated data points and were incorporated as MASS points into individual "approximated" TIN models of Lake Marble Falls. Comparisons between volumes computed at conservation pool elevation for each of these approximated TIN models with the "base" volume detailed in this report (Appendix A) suggest the missed volume in the unsurveyable areas likely represents less than 1% of the lake volume.

Introduction & Methods

Due to the numerous visible and slightly submerged rocky outcrops within 1 mile from Wirtz Dam, bathymetric data collection in the upper reaches of Lake Marble Falls was extremely difficult. Limited data was collected on June 12, 2007 (Figure G1) with the data collection concentrated along the North-Western shore of the lake and within a deep pool approximately 1600 feet upstream from Wirtz Dam. Data collection within 1000 feet of Wirtz Dam was

impossible as the survey boat was unable to pass over the surface of an old roadway. On June 12th, 2007 the roadway was submerged less than 6 inches.

In creating the Lake Marble Falls bathymetric and terrain TIN models described in this report, all unsurveyable areas within the upper reaches of the lake were assigned elevations using the Delaunay triangulation method. This method constructs triangles between sets of points of known elevations. As survey points were sparse in the upper reaches of Lake Marble Falls, the majority of the Delaunay triangles connected nodes of the contour line at elevation 737.15 feet NGVD29. These flat triangles therefore span areas submerged to depths of 0.85 ft from conservation pool elevation. This depth approximation was assumed by TWDB to be adequate for describing the averaged likely volume of water in the upper reaches of Lake Marble Falls.

To assess the validity of this depth/volume assumption, TWDB applied limited statistical tests to randomly generated "approximate" bathymetries for the upper reach of the lake, and compared the results to the "base" bathymetry discussed in this report. The approximate elevations were located at the centers of 5 meter x 5 meter grid cells where the corners of each grid cell are all at least 5 meters from a known elevation (i.e. a sounding point, contour line, lake boundary, or island). In total, 11,266 elevations were approximated, covering an area of approximately 58 surface acres of Lake Marble Falls (Figure G2). Twenty three (23) sets of elevations were assigned at each of the approximated locations and were separately added to the base TIN model to create approximated TIN models. The elevations were defined with water depths corresponding to the following:

- Random depths up to 3 feet (6 sets)
- Random depths up to 5 feet (6 sets)
- Random depths up to 10 feet (6 sets)
- Uniform 1-foot depths (1 set)
- Uniform 2-foot depths (1 set)
- Uniform 3-foot depths (1 set)
- Uniform 4-foot depths (1 set)
- Uniform 5-foot depths (1 set)

The random sets were each repeated six times in order to determine the resulting volume sensitivity to the randomness of the depth generation process. It was considered unlikely that uniform depths greater than five feet would be a reasonable approximation of the bathymetry in the upper reaches of Lake Marble Falls, therefore only uniform depths up to five feet were considered.

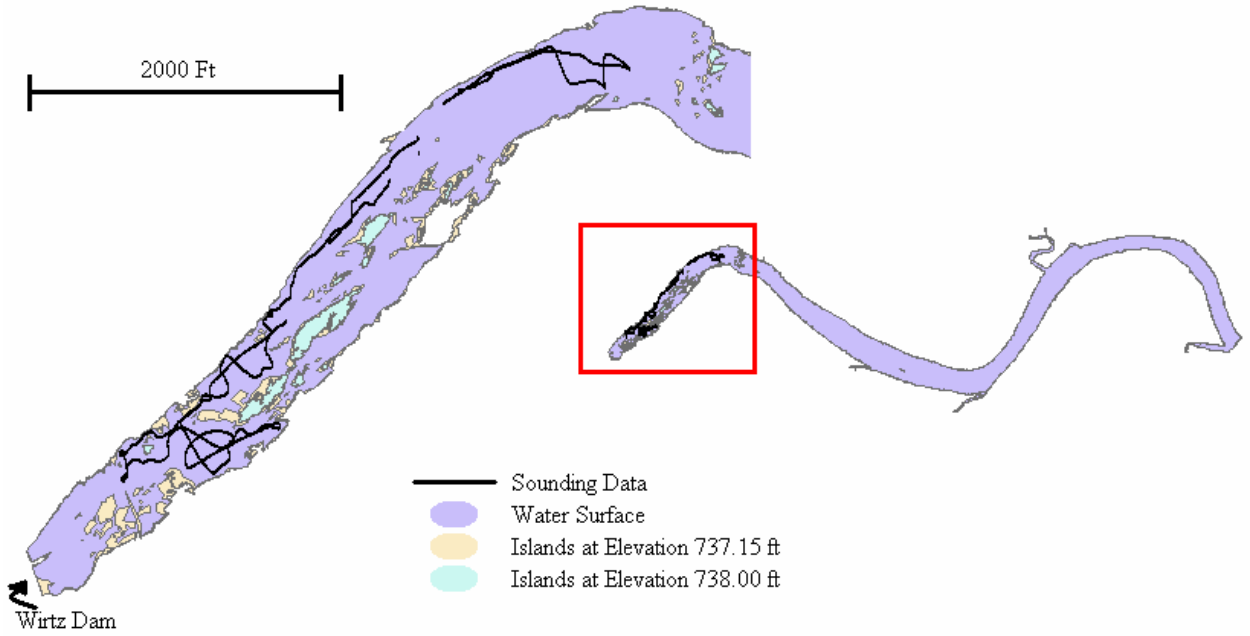


Figure G1 – Data collection in the upper reaches of Lake Marble Falls

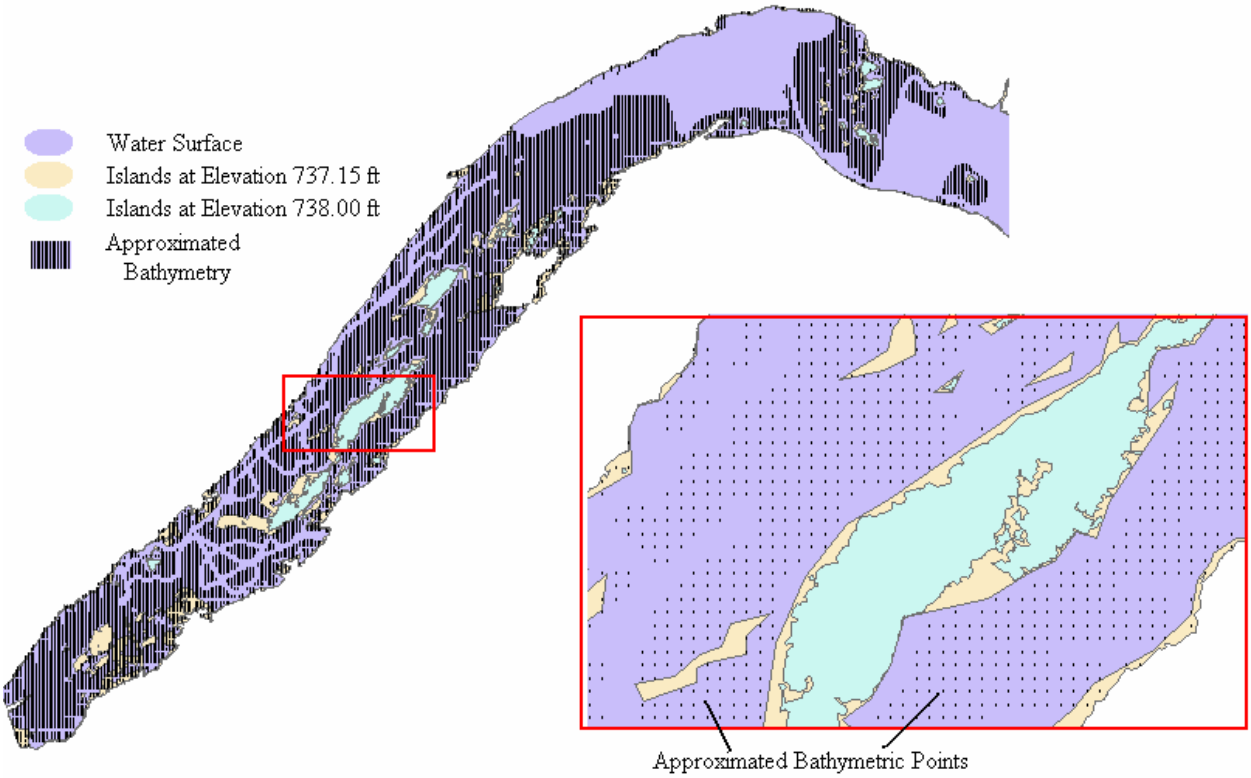


Figure G2 – Location of approximated bathymetry in Lake Marble Falls

Results & Conclusions

Table G1 presents a comparison of the base and approximated bathymetries generated in this analysis. Little statistical variation was achieved between each of the six random bathymetries of the same maximum depths. The negative volume differences shown in Table 1 suggest that the assumed depths (which were always greater that the depths resulting from the base TIN) located near the sounding data significantly altered the TIN models in such areas and resulted in an overall volume decrease. Based on TWDB observations while surveying, the scenarios most likely to be representative of the true Lake Marble Falls bathymetry are the Random, 5-foot maximum set and the Uniform 3-foot maximum set. Based on results from these scenarios, TWDB considered the volume derived from the base TIN to be within 1% of the true unknown total volume of Lake Marble Falls.

Table G1 – Volume comparisons between base and approximated TIN models

Approximated Depths	Volume Difference (acre-feet)	Volume Difference (%)
Random, 3 feet maximum	-105	-1.40% ± 0.01%
Random, 5 feet maximum	-37	-0.49% ± 0.02%
Random, 10 feet maximum	134	1.78 % ± 0.04%
Uniform 1-foot	-88	-1.17%
Uniform 2-foot	-20	-0.27%
Uniform 3-foot	48	0.64%
Uniform 4-foot	116	1.55%
Uniform 5-foot	184	2.46%

To further quantify the bathymetry within the upper reaches of Lake Marble Falls, TWDB recommends lowering the lake level to below 730 feet and surveying the areas with LiDAR and traditional land surveying equipment.