Volumetric and Sedimentation Survey of LAKE TEXANA

August 2020

Texas Water Development Board

August 2022

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Prepared for:

Lavaca-Navidad River Authority

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Executive summary

In April 2020, the Texas Water Development Board (TWDB) entered into an agreement with the Lavaca-Navidad River Authority (LNRA) to perform a volumetric and sedimentation survey of Lake Texana (Jackson County, Texas). Surveying was performed using a multi-frequency (208 kHz, 50 kHz, and 12 kHz), sub-bottom profiling depth sounder. Sediment core samples were collected and correlated with sub-bottom acoustic profiles to estimate sediment accumulation thicknesses and sedimentation rates.

Palmetto Bend Dam, impounding Lake Texana, is located on the Navidad River in Jackson County, approximately seven miles southeast of Edna, Texas. The conservation pool elevation of Lake Texana is 44.0 feet NGVD29. The TWDB collected bathymetric data for Lake Texana between July 31 and August 19, 2020, while daily average water surface elevations ranged between 43.52 and 44.10 feet NGVD29.

The 2020 TWDB volumetric survey indicates Lake Texana has a total reservoir capacity of 164,188 acre-feet and encompasses 10,312 acres at conservation pool elevation (44.0 feet NGVD29). Previous capacity estimates include a construction plan estimate of 170,310 acre-feet, a Bureau of Reclamation estimate of 165,918 acre-feet at the time of impoundment in 1980, a re-calculation of the original estimate by the Bureau of Reclamation in 1991 of 167,293 acre-feet, an estimate by the Bureau of Reclamation in 1991 of 163,506 acre-feet, a re-analysis of the 2000 TWDB volumetric survey data using current processing procedures that resulted in an updated capacity estimate of 162,416 acre-feet, and a re-calculated 2010 TWDB survey estimate of 160,944 acre-feet. Because of differences in past and present survey methodologies, direct comparison of volumetric surveys to others to estimate loss of area and capacity can be unreliable. Information from past surveys is presented here for informational purposes only.

The 2020 TWDB sedimentation survey measured 11,523 acre-feet of sediment. The sedimentation survey indicates sediment accumulation is greatest in the river channels with heavy accumulation in the submerged floodplains of the main channel and tributaries. The TWDB recommends that a similar methodology be used to resurvey Lake Texana in 10 years or after a major high flow event.

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Note: References to brand names throughout this report do not imply endorsement by the Texas Water Development Board

Introduction

The Hydrographic Survey Program of the Texas Water Development Board (TWDB) was authorized by the 72nd Texas State Legislature in 1991. Texas Water Code Section 15.804 authorizes the TWDB to perform surveys to determine reservoir storage capacity, sedimentation levels, rates of sedimentation, and projected water supply availability.

In April 2020, the TWDB entered into an agreement with the Lavaca-Navidad River Authority (LNRA), to perform a volumetric and sedimentation survey of Lake Texana (Jackson County, Texas) (Texas Water Development Board, 2021). This report provides an overview of the survey methods, analysis techniques, and associated results. Also included are the following contract deliverables: (1) an elevation-area-capacity table of the reservoir acceptable to the Texas Commission on Environmental Quality (Appendices E and F), (2) a bottom contour map (Figure 6), (3) a shaded relief plot of the reservoir bottom (Figure 4), and (4) an estimate of sediment accumulation and location (Figure 9).

Lake Texana general information

Palmetto Bend Dam, impounding Lake Texana, is located on the Navidad River in Jackson County, approximately seven miles southeast of Edna, Texas (Figure 1). Lake Texana is owned and operated by the Lavaca-Navidad River Authority. Construction of Palmetto Bend Dam and Lake Texana began in 1976, and the dam was completed in 1979. Deliberate impoundment of water began in May 1980 (Texas Water Development Board, 2010). The reservoir was built primarily for municipal and industrial water supply purposes within Jackson County and is also used for recreational purposes (Lavaca-Navidad River Authority, 2021). There was no provision for flood storage in the Palmetto Bend Dam design; therefore, waters from major high flow events are released downstream (Texas Water Development Board, 2000). Additional pertinent data about Palmetto Bend Dam and Lake Texana can be found in Table 1.

Water rights for Lake Texana have been appropriated to the LNRA through Certificate of Adjudication No. 16-2095 and Amendment to Certificate of Adjudication Nos. 16-2095A, 16-2095B, 16-2095C, 16-2095D, and 16-2095E (Texas Commission on Environmental Quality, 2021). The complete certificates are on file at the Texas Commission on Environmental Quality (TCEQ).

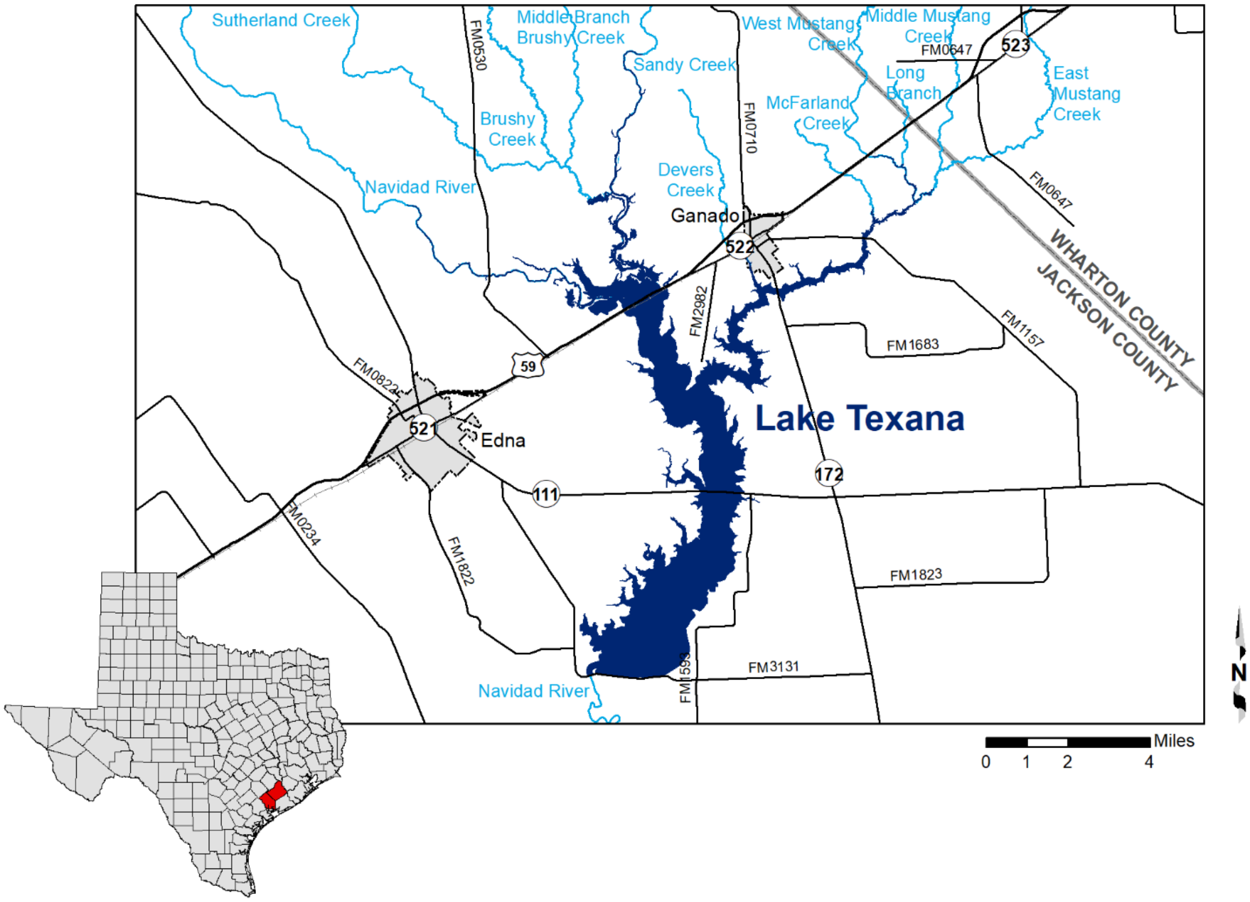


Figure 1. **Location map.**

Table 1. Pertinent Data for Palmetto Bend Dam and Lake Texana

Owner(s)	
Lavaca-Navidad River Authority (LNRA), Texas Water Development Board (TWDB), and United States Bureau of Reclamation (USBR)	
Engineer (Design)	
United States Bureau of Reclamation	
Construction Contractor	
Holloway Construction Company	
Location	
Navidad River in Jackson County, approximately seven miles southeast of Edna, Texas	
Drainage Area	
Total Drainage Area	1,404 square miles
Dam	
Type	Rolled earthfill embankment
Total Length (approximate)	8.0 miles
Dam	1.3 miles
Dike	6.7 miles
Maximum Height	58.0 feet
Top Width	42.0 feet
Top of Dam Elevation	55.0 feet mean sea level
Spillway	
Type	Gated concrete
Length	464 feet
Control	12 radial gates, each 35 feet by 22.61 feet
Top of Gate Elevation	45.0 feet mean sea level
Maximum discharge	190,000 cubic feet per second (cfs) of water at elevation 47.0 feet
Outlet Works	
Municipal and industrial intake structures	
Number and location	Two (2), located on each side of the service spillway
Design	Dual-level with two (2) gates, each 48 inches by 60 inches, a conduit, and a terminal structure
Concrete intake structure for downstream releases	
Number and location	One (1), located east of the service spillway along the dam
Design	Multi-level structure with one (1) 96 by 96-inch gate and two (2) 48 by 48-inch gates, an 8 by 8 foot upstream conduit, a gate structure with 96 by 96 inch gate, an 8 by 10 foot downstream conduit, and a stilling basin
Invert elevation	4.0 feet above mean sea level
Maximum release	1,800 cubic feet per second (cfs) of water

Reservoir Data (Based on 2020 TWDB survey)

Feature	**Elevation (feet above mean sea level[a])**	**Capacity (acre-feet)**	**Area (acres)**
Top of dam	55.0	346,944	26,970
Maximum design elevation	47.0	198,304	12,621
Top of spillway gates	45.0	174,868	10,902
Top of conservation pool	44.0	164,188	10,312
Dead pool elevation	14.0	5,213	1,431
Invert elevation	4.0	284	79
Conservation storage capacity[b]	—	158,975	—

Sources: Texas Water Development Board, 2011; Texas Water Development Board, 2001; U.S. Bureau of Reclamation, 2008, Freese and Nichols, Inc., 2008, S. Hartl, written commun(s)., 2022.

a. Mean sea level indicates a reference to USGS National Geodetic Vertical Datum 1929 (NGVD29).

b. Usable conservation storage equals total capacity at conservation pool elevation minus dead pool capacity. Dead pool refers to water that cannot be drained by gravity through the dam outlet works.

Volumetric and sedimentation survey of Lake Texana

Datum

The vertical datum used during this survey is the National Geodetic Vertical Datum 1929 (NGVD29). This datum is utilized by the United States Geological Survey (USGS) for the reservoir elevation gage *USGS 08164525 Lk Texana nr Edna, TX* (U.S. Geological Survey, 2021). Elevations herein are reported in feet relative to the NGVD29 datum. Volume and area calculations in this report are referenced to water levels reported by the USGS gage. The horizontal datum used for this report is North American Datum 1983 (NAD83), and the horizontal coordinate system is State Plane Texas South Central Zone (feet).

TWDB bathymetric and sedimentation data collection

The TWDB collected bathymetric data for Lake Texana between July 31 and August 19, 2020, while daily water surface elevations ranged from 43.52 and 44.10 feet NGVD29. For data collection, the TWDB used a Specialty Devices, Inc. (SDI), single-beam, multi-frequency (208 kHz, 50 kHz, and 12 kHz) sub-bottom profiling depth sounder integrated with differential global positioning system (DGPS) equipment. Data were collected along pre-planned survey lines oriented perpendicular to the assumed location of the original river channels and spaced approximately 500 feet apart. Many of the same survey lines also were used by the TWDB for the *Volumetric Survey of Lake Texana, August 2000 Survey* (Texas Water Development Board, 2001) and the *Volumetric and Sedimentation Survey of Lake Texana, January-March 2010 Survey* (Texas Water Development Board, 2011). 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. Each speed of sound profile, or velocity cast, is saved for further data processing. Figure 2 shows the data collection locations for the 2020 TWDB survey.

All sounding data were collected and reviewed before sediment core sampling sites were selected. Sediment core samples are collected throughout the reservoir to assist with interpretation of the sub-bottom acoustic profiles. After analyzing the sounding data, the TWDB selected 16 locations to collect sediment core samples (Figure 2). Sediment cores were collected on August 4-5, 2021, with a custom-coring boat and an SDI VibeCore system.

Sediment cores are collected in 3-inch diameter aluminum tubes. A sediment core extends from the current reservoir-bottom surface, through the accumulated sediment, and into the pre-impoundment surface. After the sample is retrieved, the core tube is cut to the level of the sediment core. The tube is capped, labeled, and transported to TWDB headquarters for further analysis.

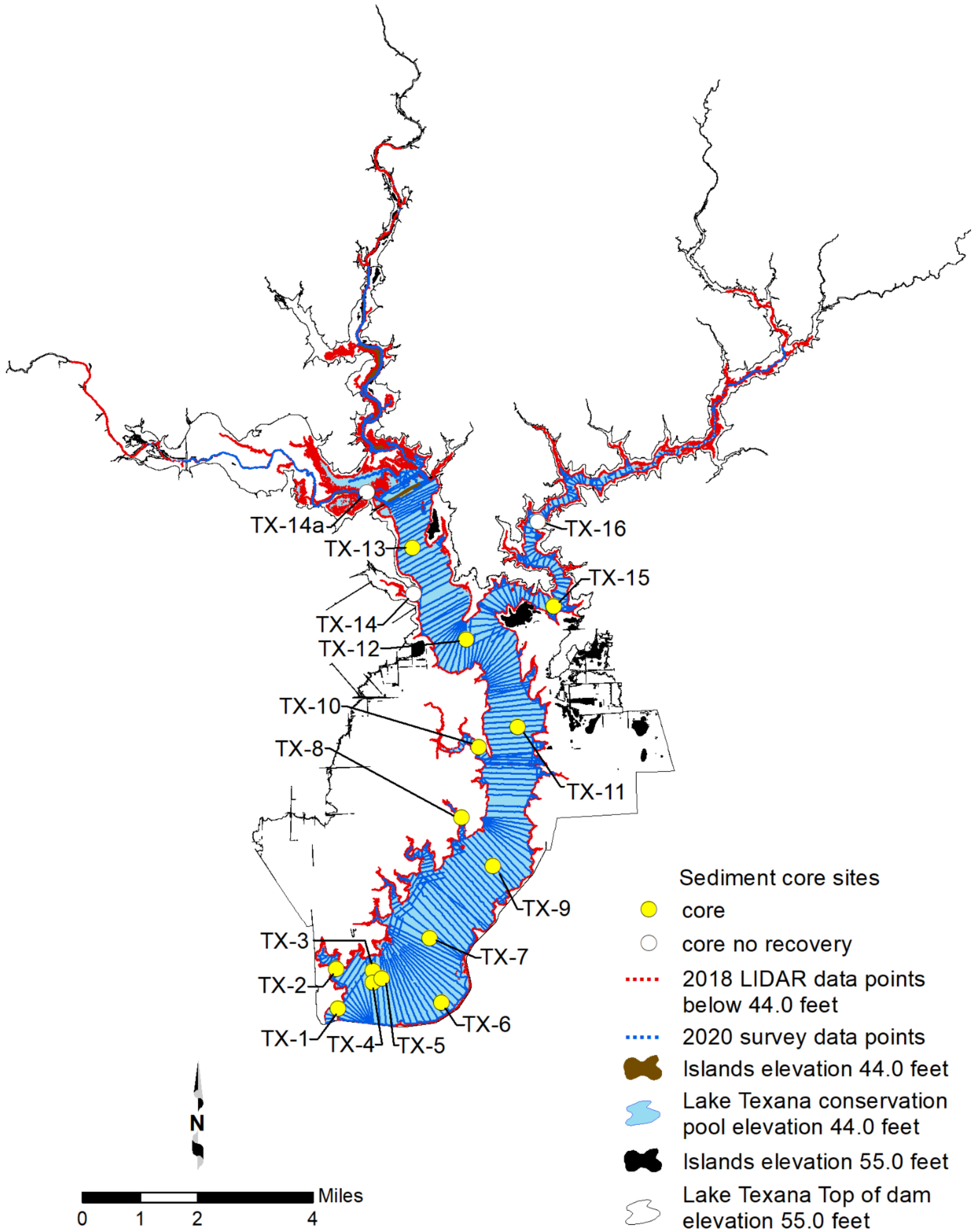


Figure 2. 2020 TWDB sounding data (*blue dots*), sediment coring locations (*yellow circles*), and 2018 LIDAR data for bathymetric model (*red dots*).

Data processing

Model boundary

The bathymetric and topographic model boundaries of the reservoir were generated with Light Detection and Ranging (LIDAR) Data available from the Texas Natural Resource Information System (TNRIS). LIDAR data for Jackson County were acquired between January 13 and March 12, 2018, while the daily average water surface elevation of the reservoir measured between 40.68 and 41.56 feet. LIDAR data for Wharton County were acquired between January 5 and January 15, 2018, while the daily average water surface elevation of the reservoir measured between 41.41 and 41.68 feet. The topographic model boundary of the reservoir was generated with Light Detection and Ranging (LIDAR) Data available from the Texas Natural Resource Information System (TNRIS) (Figure 2). All LIDAR data were imported into an Environmental Systems Research Institute's ArcGIS file geodatabase. The LIDAR data files (.las) were imported into an LAS Dataset and the dataset was converted to a raster using a cell size of 1.0 meters by 1.0 meters. The horizontal datum of the LIDAR data is North American Datum 1983 (NAD83; meters) and the projection is Universal Transverse Mercator (UTM) Zone 14. The vertical datum is North American Vertical Datum 1988 (NAVD88; meters). Contours representing the top of conservation pool elevation of 13.3902 meters NAVD88, equivalent to 44.0 feet NGVD29, and the top of dam elevation of 16.743 meters NAVD88, equivalent to 55.0 feet NGVD29, was extracted from the raster. The topographic model contour was edited to close the contour across the dam and remove other artifacts. Horizontal coordinate transformations to NAD83 State Plane Texas South Central Zone (feet) coordinates were applied using the ArcGIS Project tool.

LIDAR data points

To utilize the LIDAR data in the reservoir bathymetric and topographic models, the LIDAR data files (.las) were converted to a multipoint feature class in an Environmental Systems Research Institute's ArcGIS file geodatabase filtered to include only data classified as ground points. A topographical model of the data was generated. The ArcGIS tool Terrain to Points was used to extract points from the Terrain, or topographical model of the reservoir. The Terrain was created using the z-tolerance Pyramid Type. Points were extracted from the terrain at the z-tolerance level of 0.25 meters. New attribute fields were added to convert the elevations from meters NAVD88 to meters NGVD29, then feet NGVD29 for compatibility with the bathymetric survey data. LIDAR data outside of the 55.00-foot contour were deleted and the feature class projected to NAD83 State Plane Texas Central Zone (feet).

Triangulated Irregular Network model

Following completion of data collection, the raw data files collected by the TWDB were edited to remove data anomalies. The current bottom surface of the reservoir is automatically determined by the data acquisition software. Hydropick software, developed by TWDB staff, was used to display, interpret, and edit the multi-frequency data by manually removing data anomalies in the current bottom surface and to manually edit the pre-impoundment surfaces. The speed of sound profiles, also known as velocity casts, were used to further refine the measured depths. For each location velocity casts are collected, the harmonic mean sound speed of all the casts is calculated. From this, depths collected using one average speed of sound are corrected with an overall optimum speed of sound for each specific depth (Specialty Devices, Inc., 2018).

All data were exported into a single file, including the current reservoir bottom surface, pre-impoundment surface, and sediment thickness at each sounding location. The water surface elevation at the time of each sounding was used to convert each sounding depth to a corresponding reservoir-bottom elevation. This survey point dataset was then preconditioned by inserting a uniform grid of artificial survey points between the actual survey lines. Bathymetric elevations at these artificial points were determined using an anisotropic spatial interpolation algorithm described in the next section. This technique creates a high resolution, uniform grid of interpolated bathymetric elevation points throughout a majority of the reservoir (McEwen *et al.* 2011a). The resulting point file was used in conjunction with sounding and boundary data to create volumetric and sediment Triangulated Irregular Network (TIN) models utilizing the 3D Analyst Extension of ArcGIS. The 3D Analyst algorithm uses Delaunay's criteria for triangulation to create a grid composed of triangles from non-uniformly spaced points, including the boundary vertices (Environmental Systems Research Institute, 1995).

Spatial interpolation of reservoir bathymetry

Isotropic spatial interpolation techniques such as the Delaunay triangulation used by the 3D Analyst extension of ArcGIS are, in many instances, unable to suitably interpolate bathymetry between survey lines common to reservoir surveys. Reservoirs and stream channels are anisotropic morphological features where bathymetry at any particular location is more similar to upstream and downstream locations than to transverse locations. Interpolation schemes that do not consider this anisotropy lead to the creation of several types of artifacts in the final representation of the reservoir bottom surface and hence to errors in volume. These artifacts may include artificially curved contour lines extending into the reservoir where the reservoir walls are steep or the reservoir is relatively narrow, intermittent representation of submerged stream channel connectivity, and oscillations of contour lines in between survey lines. These artifacts reduce the accuracy of the resulting volumetric and sediment TIN models in areas between actual survey data.

To improve the accuracy of bathymetric representation between survey lines, the TWDB developed various anisotropic spatial interpolation techniques. Generally, the directionality of interpolation at different locations of a reservoir can be determined from external data sources. A basic assumption is that the reservoir profile in the vicinity of a particular location has upstream and downstream similarity. In addition, the sinuosity and directionality of submerged stream channels can be determined by directly examining the survey data, or more robustly by examining scanned USGS 7.5-minute quadrangle maps (DRGs), hypsography files (the vector format of USGS 7.5-minute quadrangle map contours), and historical aerial photographs, when available. Using the survey data, polygons are created to partition the reservoir into segments with centerlines defining the directionality of interpolation within each segment. Using the interpolation definition files and survey data, the current reservoir-bottom elevation, pre-impoundment elevation, and sediment thickness are calculated for each point in the high-resolution uniform grid of artificial survey points. The reservoir boundary, artificial survey points grid, and survey data points are used to create volumetric and sediment TIN models representing reservoir bathymetry and sediment accumulation throughout the reservoir. Specific details of this interpolation technique can be found in the HydroTools manual (McEwen and others, 2011a) and in McEwen and others (2011b).

In areas inaccessible to survey data collection, such as small coves and shallow upstream areas of the reservoir, linear interpolation is used for volumetric and sediment accumulation estimations (McEwen and others, 2011a). Although LIDAR was utilized, linear interpolation was necessary to accurately model features in the areas between survey data and LIDAR data. Linear interpolation results in improved elevation-capacity and elevation-area calculations.

Figure 3 illustrates typical results from application of the anisotropic interpolation as applied to Lake Texana. In Figure 3A, deeper channels and steep slopes indicated by surveyed cross-sections are not continuously represented in areas between survey cross-sections. This is an artifact of the TIN generation routine rather than an accurate representation of the physical bathymetric surface. Inclusion of interpolation points in creation of the volumetric TIN model, represented in Figure 3B, directs Delaunay triangulation to better represent the reservoir bathymetry between survey cross-sections. The bathymetry shown in Figure 3C was used in computing reservoir elevation-capacity (Appendix I, M) and elevation-area (Appendix J, N) tables.

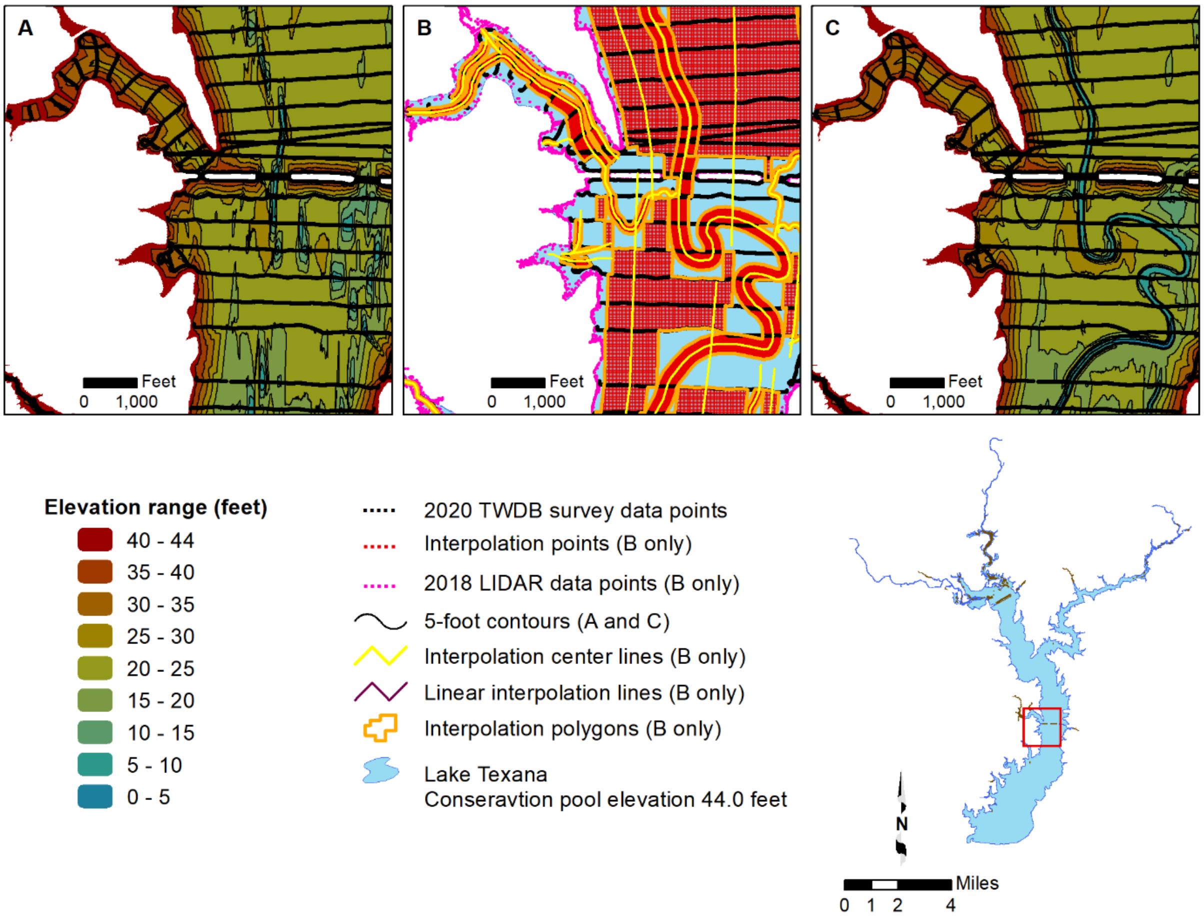


Figure 3. **Anisotropic spatial interpolation as applied to Lake Texana sounding data; A) bathymetric contours without interpolated points, B) sounding points (*black*) and interpolated points (*red*), C) bathymetric contours with interpolated points.**

To properly compare results from the 2000 TWDB survey of Lake Texana, the TWDB applied anisotropic spatial interpolation to the survey data collected in 2000. The 2000 survey boundary was digitized from DOQQs photographed on February 20, 1995, and January 24, 1996, while the daily average water surface elevation measured 43.78 and 43.43 feet NGVD29, respectively (Texas Water Development Board, 2000). While linear interpolation was used to estimate the topography in areas without data, flat triangles led to anomalous area and volume calculations at the boundary elevation of 44.00 feet. Therefore, areas between 40.50 feet and 44.00 feet were linearly interpolated between the computed values, and volumes above 40.50 feet were calculated based on the corrected areas (Texas Water Development Board, 2016). The

2000 re-calculated elevation-capacity table and elevation-area table are presented in Appendices A and B, respectively. The re-calculated capacity curve is presented in Appendix C, and the re-calculated area curve is presented in Appendix D.

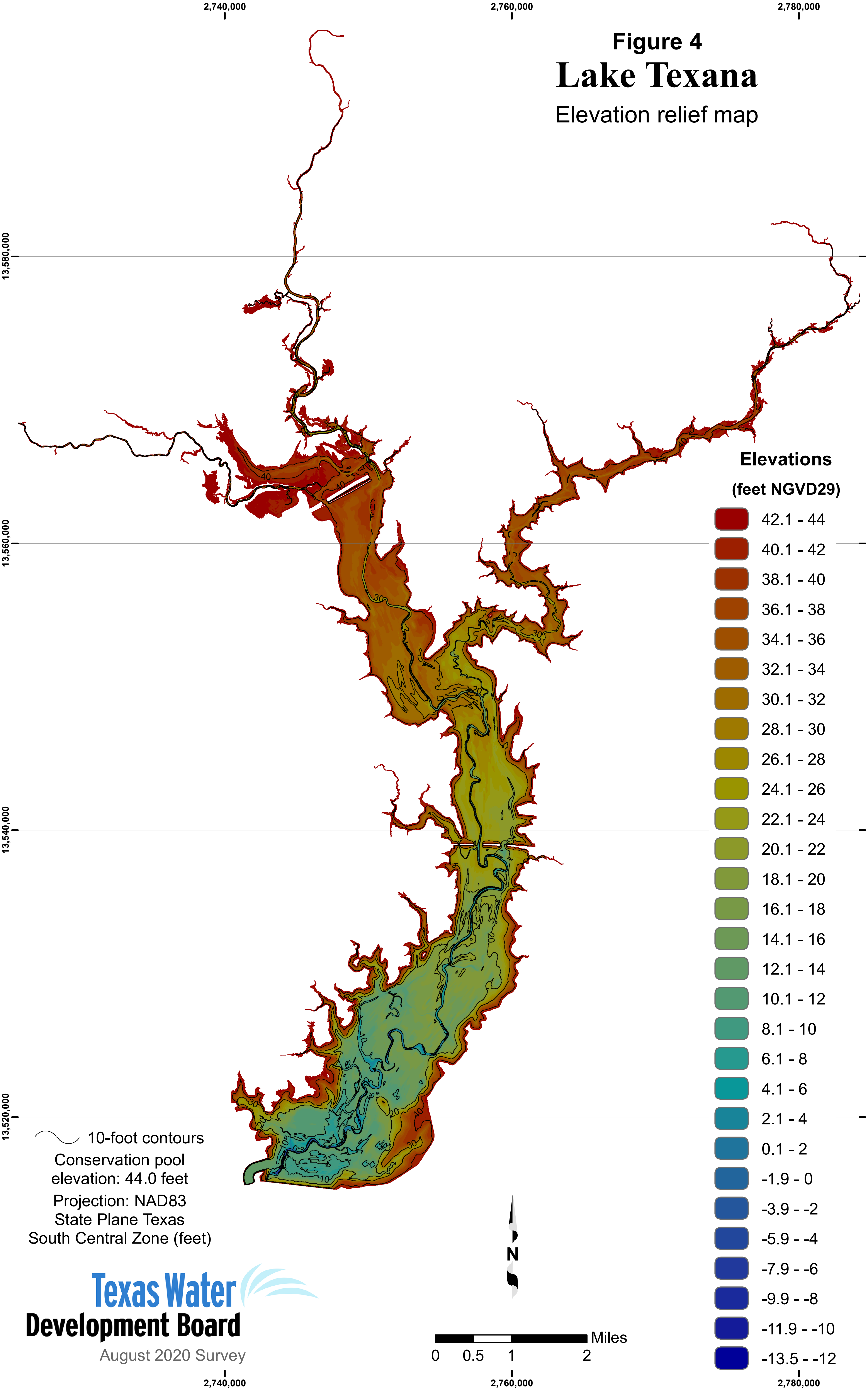
In 2016, the 2010 TWDB elevation-area-capacity tables were re-calculated to correct for flat triangles. Areas between 39.50 feet and 44.00 feet were linearly interpolated between the computed values, and volumes above 39.50 feet were calculated based on the corrected areas (Texas Water Development Board, 2016). The 2010 re-calculated elevation-capacity table and elevation-area table are presented in Appendices E and F, respectively. The re-calculated capacity curve is presented in Appendix G, and the re-calculated area curve is presented in Appendix H.

Area, volume, and contour calculation

Volumes and areas were computed for the entire reservoir at 0.1-foot intervals, from -13.5 to 44.0 feet for the bathymetric TIN model, and from -13.5 to 55.0 feet for the bathymetric and topographic TIN model. The bathymetric elevation-capacity table and bathymetric elevation-area table, based on the 2020 survey and analysis, are presented in Appendices I and J, respectively. The bathymetric capacity curve is presented in Appendix K, and the bathymetric area curve is presented in Appendix L. The topographic elevation-capacity table and topographic elevation-area table developed from the 2020 survey and analysis are presented in Appendices M and N, respectively. The topographic capacity curve is presented in Appendix O, and the topographic area curve is presented in Appendix P.

The bathymetric volumetric TIN model was converted to a raster representation using a cell size of 2 feet by 2 feet. The raster data then were used to produce three figures: (1) an elevation relief map representing the topography of the reservoir bottom (Figure 4); (2) a depth range map showing depth ranges for Lake Texana (Figure 5); and (3) a 5-foot contour map (Figure 6).

Figure 4
Lake Texana
Elevation relief map



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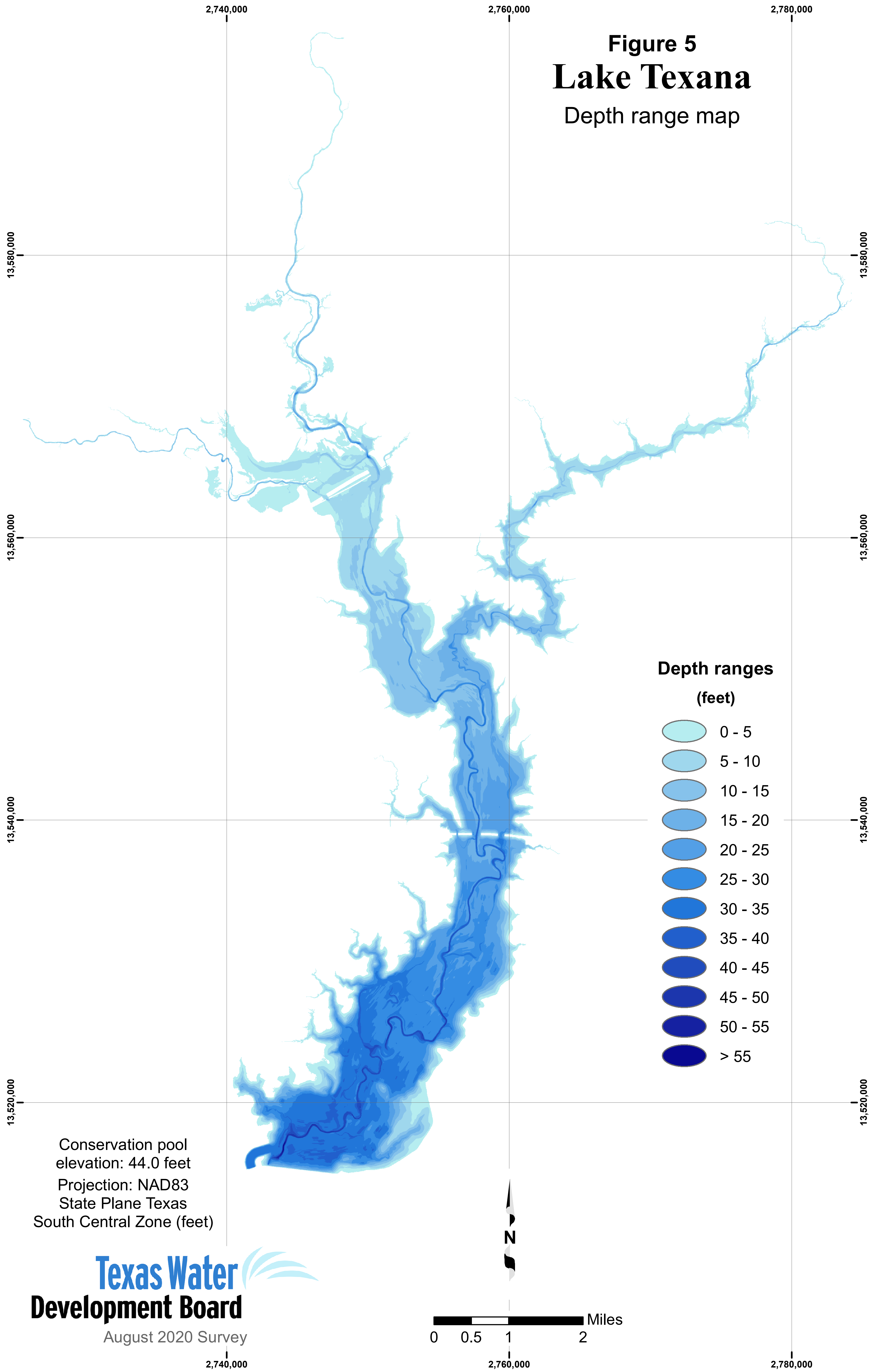

2,740,000
2,760,000
2,780,000
13,580,000
13,560,000
13,540,000
13,520,000
Figure 5
Lake Texana
Depth range map
Depth ranges
(feet)
0 - 5
5 - 10
10 - 15
15 - 20
20 - 25
25 - 30
30 - 35
35 - 40
40 - 45
45 - 50
50 - 55
> 55
Conservation pool
elevation: 44.0 feet
Projection: NAD83
State Plane Texas
South Central Zone (feet)
N
Miles
0
0.5
1
2
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Analysis of sediment data from Lake Texana

Sedimentation in Lake Texana was determined by analyzing the acoustic signal returns of all three depth sounder frequencies using customized software called Hydropick. While the 208 kHz signal is used to determine the current bathymetric surface, the 208 kHz, 50 kHz, and 12 kHz are analyzed to determine the reservoir bathymetric surface at the time of initial impoundment, *i.e.*, pre-impoundment surface. Sediment core samples collected in the reservoir are correlated with the acoustic signals in each frequency to assist in identifying the pre-impoundment surface. The difference between the current surface bathymetry and the pre-impoundment surface bathymetry yields a sediment thickness value at each sounding location.

Sediment cores were analyzed at TWDB headquarters in Austin. Each core was split longitudinally and analyzed to identify the location of the pre-impoundment surface. The pre-impoundment surface was identified within the sediment core using the following methods: (1) a visual examination of the sediment core for terrestrial materials, such as leaf litter, tree bark, twigs, intact roots, *etc.*, concentrations of which tend to occur on or just below the pre-impoundment surface; (2) recording changes in texture from well sorted, relatively fine-grained sediment to poorly sorted mixtures of coarse and fine-grained materials; and, (3) identifying variations in the physical properties of the sediment, particularly sediment water content and penetration resistance with depth (Van Metre and others, 2004). Total sediment core length, post impoundment sediment thickness, and pre-impoundment thickness were recorded. Physical characteristics of the sediment core, such as Munsell soil color, texture, relative water content, and presence of organic materials are presented in Table 2.

Table 2. Sediment core sample analysis data.

Sediment core sample	Easting[a] (feet)	Northing[a] (feet)	Total core sample / post-impoundment sediment length (inches)	Sediment core description[b]		Munsell soil color
TX-1	2742529.08	13516576.81	22.0 / 15.0	post-impoundment	0.0–7.0" high water content, silt, pudding like, smooth	10YR 4/2 dark grayish brown
					7.0–15.0" moderate water content, fine grain sand with silt, uniform size, mottled coloration	10YR 5/2 grayish brown 10YR 4/2 dark grayish brown
				pre-impoundment	15.0–22.0" low water content, fine grain sand, dense	10YR 5/4 yellowish brown
TX-2	2742348.67	13520194.83	20.0 / 16.0	post-impoundment	0.0–16.0" high to moderate water content, water content decreases with depth, silt, pudding like, uniform throughout, organic material present (bits of woody debris)	10YR 4/1 dark gray
				pre-impoundment	16.0–20.0" moderate water content, clay silt, peanut butter consistency, smooth	10YR 3/1 very dark gray
TX-3	2745690.78	13520018.68	33.0 / 26.0	post-impoundment	0.0–26.0" high to moderate water content, water content decreases with depth, silt, pudding like, smooth, uniform consistency throughout	10YR 4/1 dark gray
				pre-impoundment	26.0–33.0" low water content, clay silt, malleable, sticky, organic material present throughout (fibrous roots)	10YR 2/1 black
TX-4	2745701.56	13518946.69	46.0 / 32.0	post-impoundment	0.0–2.0" very high water content, silt, soupy smooth	10YR 4/1 dark gray
					2.0–32.0" high to moderate water content, water content decreases with depth, silt, pudding like, uniform consistency and texture throughout, density increases with depth, organic material present (large woody debris at 29-31 inches)	10YR 4/1 dark gray
				pre-impoundment	32.0–46.0" low water content, silty clay, malleable, dense, organic material present (fibrous and dendritic roots)	10YR 2/1 black
TX-5	2746514.33	13519324.02	27.0 / 22.0	post-impoundment	0.0–22.0" high to moderate water content, water content decreases with depth, silt, pudding like, smooth	10YR 4/1 dark gray
				pre-impoundment	22.0–27.0" low water content, silty clay, dense, malleable, uniform throughout, organic material present (fibrous roots)	10YR 2/1 black

[a] Coordinates are based on NAD83 State Plane Texas South Central System (feet).
[b] Sediment core samples are measured in inches with zero representing the current bottom surface.

Table 2 (continued). Sediment core sample analysis data.

Sediment core sample	Easting[a] (feet)	Northing[a] (feet)	Total core sample / post-impoundment sediment length (inches)	Sediment core description[b]		Munsell soil color
TX-6	2751992.40	13517143.10	22.0 / 14.0	post-impoundment	0.0–14.0" moderate water content, silt, smooth, density increases with depth	10YR 4/1 dark gray
				pre-impoundment	14.0–22.0" low water content, silty clay, malleable, dense, uniform, mottled coloration	10YR 4/2 dark grayish brown 10YR 2/1 black
TX-7	2750920.75	13523025.01	101.0 / 92.0	post-impoundment	0.0–58.0" high to moderate water content, water content decreases with depth, silt, smooth, pudding like, uniform consistency throughout, density increases with depth	10 YR 4/1 dark gray
					58.0–73.0" low water content, medium and fine grain sand, loosely packed	10YR 5/2 grayish brown
					73.0–80.0" low water content, medium grain sand with silt and clay mixed throughout	10YR 3/1 very dark gray
					80.0–92.0" low water content, medium to coarse grain sand, loosely packed, small bits of clay	10YR 4/1 dark gray
				pre-impoundment	92.0–101.0" low water content, medium to fine grain sand, more dense than previous layers	10YR 5/3 brown
TX-8	2753826.28	13534085.47	44.0 / 39.0	post-impoundment	0.0–3.0" high water content, silt with bits of clay, pudding like, uniform throughout	10YR 4/1 dark gray
					3.0–6.0" low water content, silty clay, sticky malleable, dense	10YR 3/1 very dark gray
					6.0–10.0" moderate water content, silt, smooth texture	10YR 4/1 dark gray
					10.0–39.0" low water content, silt with small bits of clay, peanut butter consistency, uniform consistency and texture throughout	10YR 3/1 very dark gray
				pre-impoundment	39.0–44.0" very low water content, clay, malleable, dense, uniform consistency and texture throughout, organic material present (woody debris)	10YR 3/1 very dark gray

[a.] Coordinates are based on NAD83 State Plane Texas South Central System (feet).
[b.] Sediment core samples are measured in inches with zero representing the current bottom surface.

Table 2 (continued). Sediment core sample analysis data.

Sediment core sample	Easting[a] (feet)	Northing[a] (feet)	Total core sample / post-impoundment sediment length (inches)	Sediment core description[b]		Munsell soil color
TX-9	2756689.02	13529651.59	27.0 / 19.0	post-impoundment	0.0–18.0” high to moderate water content, water content decreases with depth, silt, smooth, pudding like, uniform throughout	10YR 4/1 dark gray
					18.0–19.0” high water content, silt with bits of clay, soupy, organic material present (twig)	10YR 4/1 dark gray
				pre-impoundment	19.0–27.0” low water content, silty clay, loosely packed, malleable, uniform texture, organic material present (fibrous roots)	10YR 3/1 very dark gray
TX-10	2755403.37	13540516.05	71.0 / 67.0	post-impoundment	0.0–37.0” high to moderate water content, water content decreases with depth, silt, smooth, sticky, soupy at top and custard like with increasing depth	10YR 3/1 very dark gray
					37.0–48.0” moderate water content, sandy silt, uniform consistency and texture throughout, organic material present (fibrous roots)	10YR 4/1 dark gray
					48.0–67.0” low water content, sandy silt, uniform consistency and texture throughout, organic material present (fibrous roots and small twigs)	10YR 4/1 dark gray
				pre-impoundment	67.0–71.0” low water content, clay, smooth, malleable, dense, uniform texture throughout, organic material present throughout (fibrous roots)	10YR 2/1 black
TX-11	2759001.85	13542364.04	27.0 / 23.0	post-impoundment	0.0–23.0” high to moderate water content, water content decreases with depth, silt, smooth, pudding like, uniform consistency and texture throughout	10YR 4/2 dark gray
				pre-impoundment	23.0–27.0” low water content, clay, loosely packed, uniform consistency and texture throughout, organic material present (fibrous roots)	10YR 2/1 black
TX-12	2754268.88	13550401.95	12.0 / 7.0	post-impoundment	0.0–7.0” high to low water content, water content decreases with depth, silt with bits of clay, uniform color, consistency, and texture throughout	10YR 4/1 dark gray
				pre-impoundment	7.0–12.0” low water content, clay, dense, uniform consistency and texture throughout, organic material present (fibrous roots)	10YR 2/1 black

[a] Coordinates are based on NAD83 State Plane Texas South Central System (feet).

[b] Sediment core samples are measured in inches with zero representing the current bottom surface.

Table 2 (continued). Sediment core sample analysis data.

Sediment core sample	Easting[a] (feet)	Northing[a] (feet)	Total core sample / post-impoundment sediment length (inches)	Sediment core description[b]		Munsell soil color
TX-13	2749328.45	13558755.66	11.0 / 4.0	post-impoundment	0.0–4.0” high water content, silt with marble sized piece of clay, soupy	10YR 4/1 dark gray
				pre-impoundment	4.0–11.0” low water content, fine grain sand with bits of clay at the top, dense, organic material present (fibrous roots and twigs)	10YR 3/1 dark gray
TX-14	2749429.12	13554551.3	N/A	N/A	No recovery, obstructions	NA
TX-14a	2745138.72	13563868.90	N/A	N/A	No recovery, obstructions	NA
TX-15	2762259.91	13553409.99	103.0 / 84.0	post-impoundment	0.0–71.0” high to moderate water content, water content decreases with depth, silt, soup to peanut butter consistency, density increases with depth, uniform texture throughout	10YR 4/1 dark gray
					71.0–84.0” low water content, fine silty sand, uniform texture, organic material present (woody debris at 71-81 inches)	10YR 3/1 very dark gray
				pre-impoundment	84.0–92.0” low water content, sandy silt, malleable, dense, organic material present (fibrous roots and woody debris)	10YR 4/1 dark gray
					92.0–101.0” low water content, sandy clay, malleable, uniform consistency and texture throughout, organic material present (fibrous roots [sparse] and woody debris)	10YR 3/1 very dark gray
					101.0–103.0” low water content, sandy clay, dense, malleable, uniform consistency and texture throughout, organic material present (fibrous roots)	10YR 2/1 black
TX-16	2760814.02	13561186.2	N/A	N/A	No recovery, obstructions	N/A

[a.] Coordinates are based on NAD83 State Plane Texas South Central System (feet).

[b.] Sediment core samples are measured in inches with zero representing the current bottom surface.

A photograph of sediment core TX-5 (for location, refer to Figure 2) is shown in Figure 7. The base, or deepest part of the sample is denoted by the blue line. The pre-impoundment boundary (yellow line closest to the base) was evident within this sediment core sample at 22 inches and identified by the change in color, texture, moisture, porosity, and structure. Identification of the pre-impoundment surface for each sediment core followed a similar procedure.

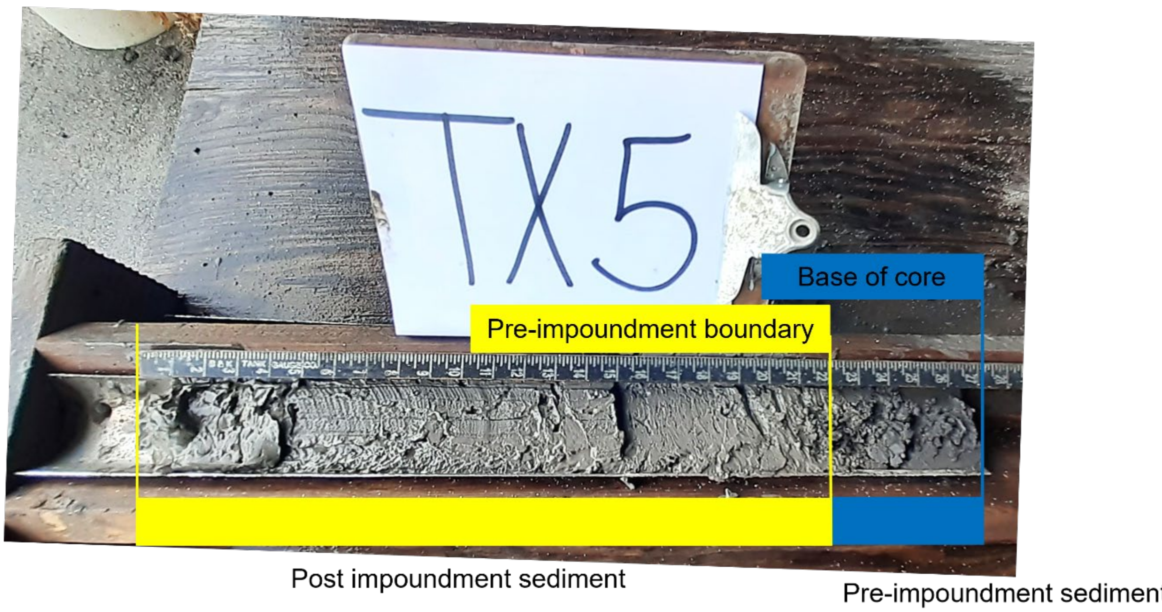

Figure 7. **Sediment core TX-5. Post-impoundment sediment layers occur in the top 22 inches of this sediment core (identified by the yellow box). Pre-impoundment sediment layers were identified and are defined by the blue box.**

Figure 8 illustrates the relationships between acoustic signal returns and the depositional layering seen in sediment cores. In this example, sediment core TX-5 is shown correlated with each frequency: 208 kHz, 50 kHz, and 12 kHz. The current bathymetric surface is determined based on signal returns from the 208 kHz transducer as represented by the top red line in Figure 8. The pre-impoundment surface is identified by comparing boundaries observed in the 208 kHz, 50 kHz, and 12 kHz signals to the location of the pre-impoundment surface of the sediment core sample. Many layers of sediment may be identified during analysis based on changes in observed characteristics such as water content, organic matter content, and sediment particle size, and each layer is classified as either post-impoundment or pre-impoundment. Yellow boxes represent post-impoundment sediments identified in the sediment core. Blue boxes indicate pre-impoundment sediments.

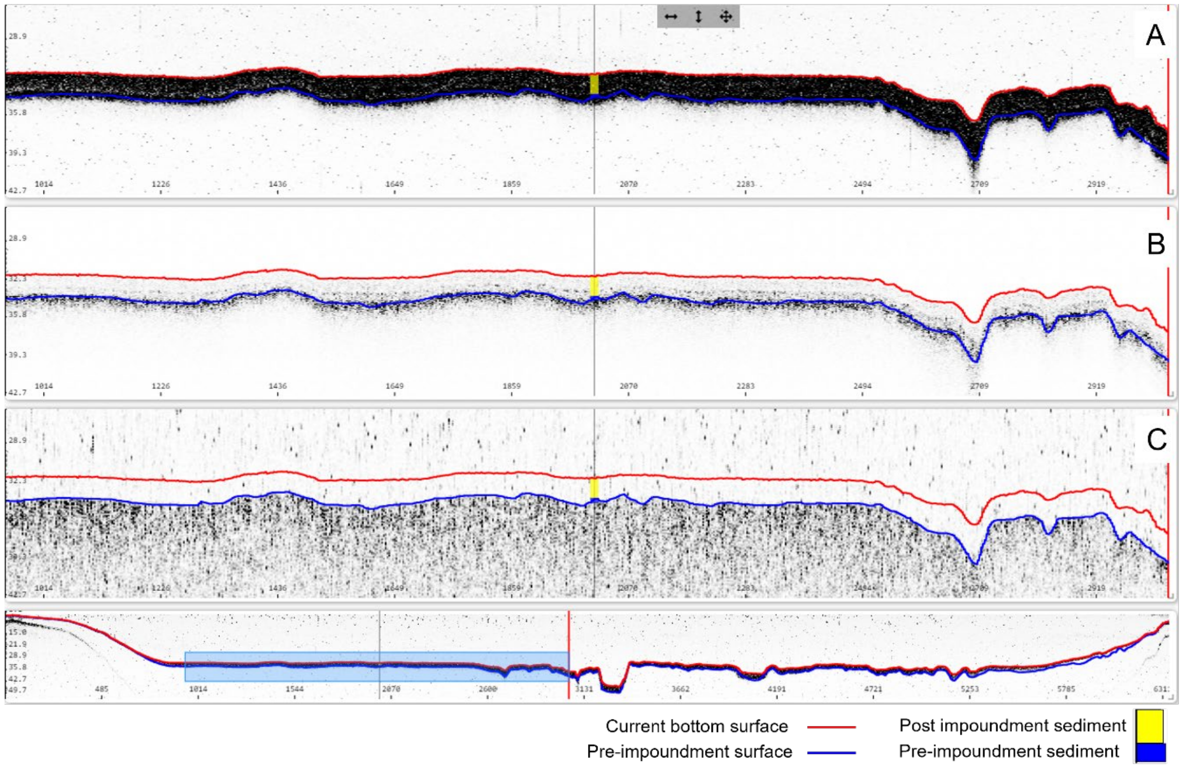

Figure 8. **Sediment core sample TX-5 compared with acoustic signal returns. A) 208 kHz frequency, B) 50 kHz frequency, and C) 12 kHz frequency.**

The pre-impoundment boundary in sediment core TX-5 most closely aligned with the different layers picked up by the 12 kHz acoustic returns (Figure 8). The pre-impoundment surface is first identified along cross-sections for which sediment core samples were collected. This information then is used as a guide for identifying the pre-impoundment surface along cross-sections where sediment core samples were not collected.

After the pre-impoundment surface for all cross-sections is identified, a pre-impoundment TIN model and a sediment thickness TIN model are created. Pre-impoundment elevations and sediment thicknesses are interpolated between surveyed cross-sections using HydroTools with the same interpolation definition file used for bathymetric interpolation. For the purposes of TIN model creation, the TWDB assumed the sediment thickness for each LIDAR point and the reservoir boundary was 0 feet (defined as the 44.0-foot elevation contour). The sediment thickness TIN model was converted to a raster representation using a cell size of 5 feet by 5 feet and was used to produce a sediment thickness map (Figure 9). Elevation-capacity and elevation-area tables were computed from the pre-impoundment TIN model for the purpose of calculating the total volume of accumulated sediment.

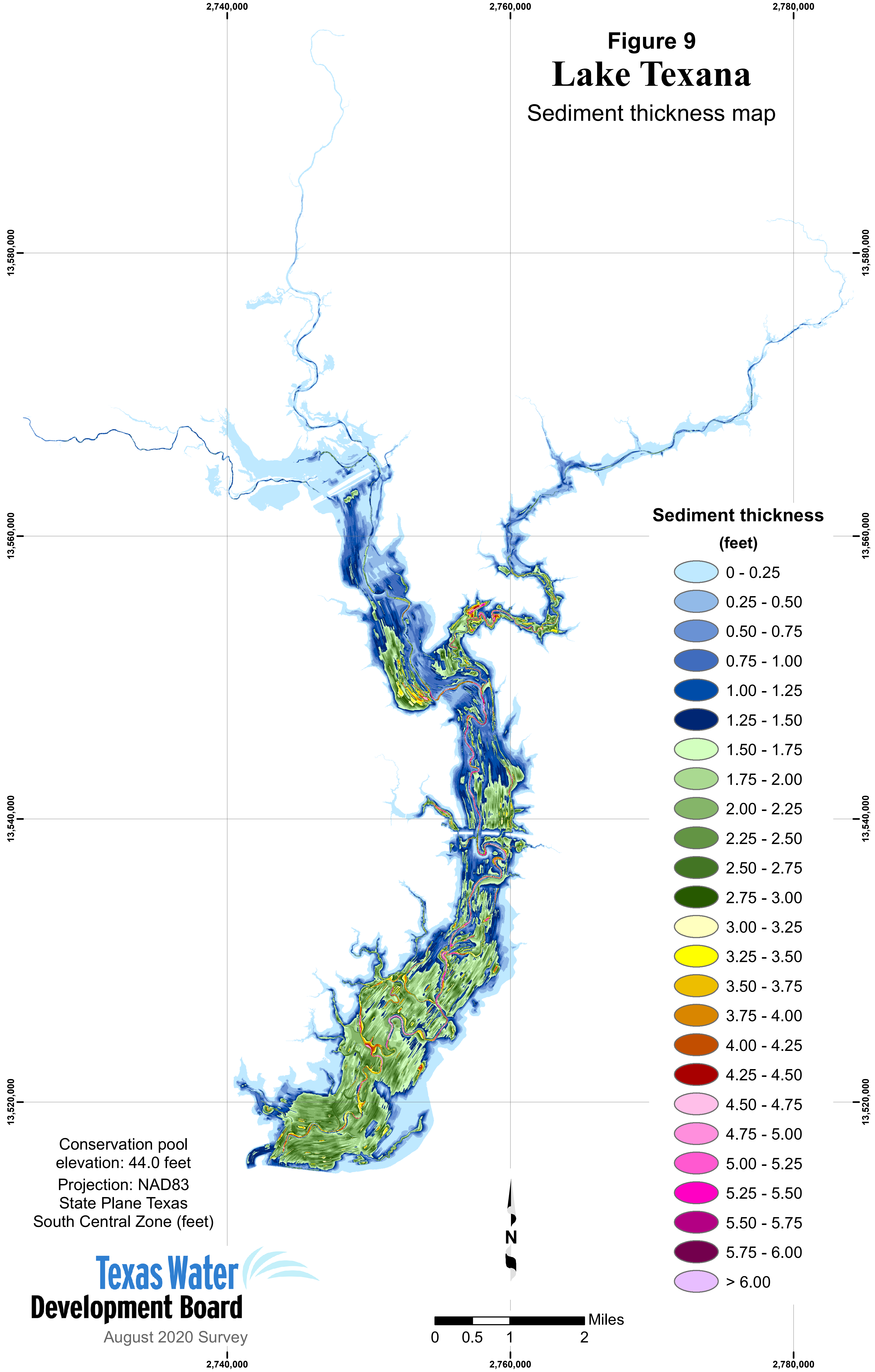

Figure 9
Lake Texana
Sediment thickness map
2,740,000
2,760,000
2,780,000
13,580,000
13,560,000
13,540,000
13,520,000
Sediment thickness (feet)
0 - 0.25
0.25 - 0.50
0.50 - 0.75
0.75 - 1.00
1.00 - 1.25
1.25 - 1.50
1.50 - 1.75
1.75 - 2.00
2.00 - 2.25
2.25 - 2.50
2.50 - 2.75
2.75 - 3.00
3.00 - 3.25
3.25 - 3.50
3.50 - 3.75
3.75 - 4.00
4.00 - 4.25
4.25 - 4.50
4.50 - 4.75
4.75 - 5.00
5.00 - 5.25
5.25 - 5.50
5.50 - 5.75
5.75 - 6.00
> 6.00
Conservation pool elevation: 44.0 feet
Projection: NAD83
State Plane Texas
South Central Zone (feet)
N
Miles
0 0.5 1 2
Texas Water Development Board
August 2020 Survey

Survey results

Volumetric survey

The 2020 TWDB volumetric survey indicates that Lake Texana has a total reservoir capacity of 164,188 acre-feet and encompasses 10,312 acres at conservation pool elevation (44.0 feet NGVD29). Current area and capacity estimates are compared to previous area and capacity estimates at different elevations in Table 3. Because of differences in past and present survey methodologies, direct comparison of volumetric surveys to others to estimate loss of area and capacity can be unreliable. The 2020 TWDB survey boundary was developed from LIDAR, while the previous TWDB survey boundaries were developed from aerial photography. Difficulty visually identifying the land water interface in the aerial photos may explain some of the area differences. The apparent increase in capacity over previous surveys is a result of increased data coverage of the lake in 2020, mostly attributable to the addition of LIDAR to the reservoir model.

Table 3. Surface area, total capacity, and conservation pool elevation.

Survey	Surface Area (acres)	Total Capacity (acre-feet)	Conservation Pool Elevation[a]	Source
Bureau of Reclamation 1963	10,370	170,310	44.00	Texas Water Development Board, 2022
Bureau of Reclamation 1980	9,934	165,918	44.00	Blanton and Ferrari, 1992
Bureau of Reclamation 1980 re-calculated	10,141	167,293	44.00	Blanton and Ferrari, 1992
Bureau of Reclamation 1991	10,134	163,506	44.00	Blanton and Ferrari, 1992
TWDB 2000	9,727	161,085	44.00	Texas Water Development Board, 2001
TWDB 2000 re-calculated	9,488	162,694	44.00	Texas Water Development Board, 2016
TWDB 2010	9,676	159,845	44.00	Texas Water Development Board, 2011
TWDB 2010 re-calculated	9,676	160,944	44.00	Texas Water Development Board, 2016
TWDB 2020	10,312	164,188	44.00	

a. Feet above mean sea level, National Geodetic Vertical Datum 1929 (NGVD29).

Sedimentation survey

The 2020 TWDB sedimentation survey measured 11,523 acre-feet of sediment. The sedimentation survey indicates that post-impoundment, sediment accumulation is greatest in the river channels and floodplains. The current capacity estimate determined by this survey (164,188 acre-feet) plus sediment volume (11,523 acre-feet) indicates a pre-impoundment capacity of 175,711 acre-feet. The 2020 TWDB sedimentation survey indicates that Lake Texana has lost capacity at an average of 288 acre-feet per year since impoundment due to sedimentation below conservation pool elevation (44.0 feet NGVD29) (Table 4). The estimated sediment volume is larger than previous surveys, though the results agree well with the 2010 TWDB sedimentation survey. In 2010, the TWDB measured 11,462 acre-feet of sediment, a 0.5 percent difference from 2020.

To quantify the accuracy of our surveys, in 2009, the TWDB partnered with Baylor University to study the accuracy of TWDB's volumetric and sedimentation surveys. Analysis by Baylor University shows acoustic profiling allows for point measurements of sediment thickness from acoustic returns to be identified within 10 percent of the actual sediment thickness identified in the sediment core samples (Dunbar and Estep, 2009). To identify the overall accuracy of the 2020 sedimentation survey, the average sediment thickness from all TWDB survey points and interpolated points was calculated. The average sediment thickness measured 1.457049 feet. Ten percent of the average sediment thickness multiplied across 10,312 surface acres, equates to ±1,503 acre-feet of sediment, or ±13 percent of the total sediment measured in the TWDB 2020 sedimentation survey. Adding and subtracting 1,503 from the 2020 pre-impoundment estimate results in a maximum sedimentation rate of 326 and a minimum sedimentation rate of 251 acre-feet of capacity lost per year since impoundment (Table 4).

Table 4. Average annual capacity loss comparisons.

Survey	Top of conservation pool elevation[a]		
TWDB pre-impoundment estimate based on 2020 survey	175,711	<>	<>
2020 pre-impoundment plus 1,503 acre-feet		177,214	
2020 pre-impoundment minus 1,503 acre-feet			174,208
TWDB 2020	164,188	164,188	164,188
Volume difference (acre-feet) Percent change	11,523 6.6	13,026 7.4	10,020 5.8
Number of years[b]	40	40	40
Capacity loss rate (acre-feet/year)	288	326	251
Capacity loss rate (acre-feet/square mile of drainage area of 1,404 square miles /year)	0.21	0.23	0.18

[a] Feet above mean sea level, National Geodetic Vertical Datum 1929 (NGVD29).

[b] Palmetto Bend Dam was completed, and deliberate impoundment began, in May 1980.

Identification of the pre-impoundment surface can be made more challenging by fluctuating water levels. Lake Texana has periodically experienced low water levels leading to the desiccation of any exposed sediment, for example, between August 15, 2011, and January 28, 2012, the water surface elevation of the reservoir measured below 35.0 feet NGVD29, reaching as low as 30.38 feet on January 9, 2012 (S. Hartl, written commun(s)., 2022). Upon inundation and re-saturation, exposed sediment will not return to its original high level of water content (Dunbar and Allen, 2003). Drying of sediment in exposed areas creates hard surfaces that cannot be penetrated with gravity coring techniques, and compressive stresses on the sediments may also increase sediment density, inhibiting the measurement of the original, pre-impoundment surface. Density stratification in the sediment layers can impair acoustic return signals of the multi-frequency depth sounder (U.S. Army Corps of Engineers, 2013).

Discussion

Any changes to the hydrologic system that contributes runoff to the reservoir, including changes in vegetative cover, land use, or frequency and intensity of rainfall events, can impact the local rate of sedimentation. Because methodological and technological changes from one survey to the next yield inconsistencies in capacity loss rates, long term capacity calculations, computed by plotting all capacity estimates and calculating a linear regression line, reduces the effect of individual survey error. In Figure 10, all previous volumetric surveys and pre-impoundment surveys are considered, resulting in an average loss of 201 acre-feet per year since impoundment due to sedimentation below conservation pool elevation (44.0 feet NGVD29).

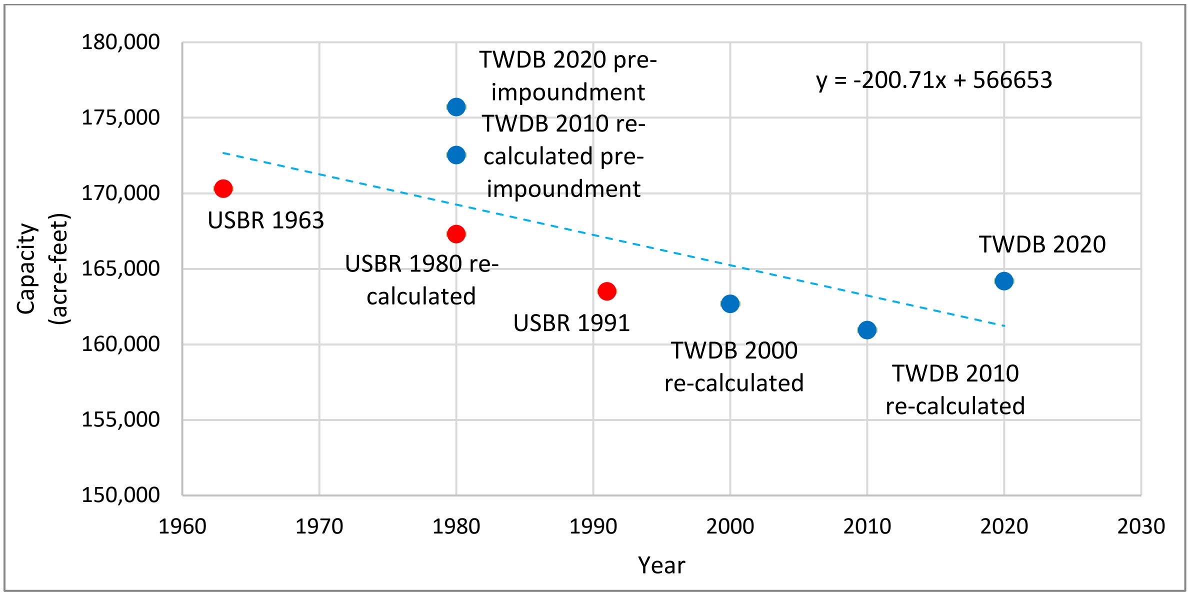

Figure 10. **Plot of current and previous capacity estimates (acre-feet). Capacity estimates for each TWDB survey plotted as blue dots and other surveys as red dots. The blue trend line illustrates the total average loss of capacity through 2020.**

The Lavaca-Navidad River Authority recognizes the 2010 TWDB volumetric capacity estimate may have underestimated total reservoir capacity at the time as a result of less data coverage in the upper reaches of the reservoir and does not use the 2010 results in their computations for capacity loss rates. However, the similarity in methodology and technology between the 2010 and 2020 surveys provides the best opportunity for insight into how the reservoir has changed in the last decade. Figure 11 illustrates how capacity has changed throughout the reservoir since 2010, with capacity losses occurring below elevation 33.6 feet due to sedimentation.

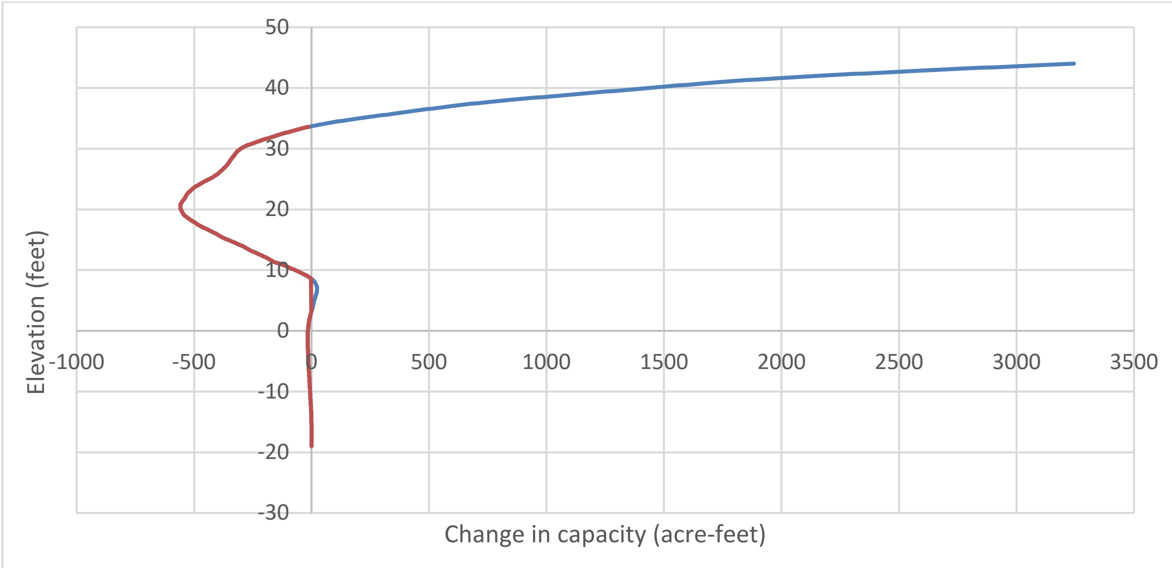

Figure 11. **Change in capacity of Lake Texana between TWDB 2020 and 2010 surveys. The red segments show elevations where capacity decreased since 2010. The blue segments show elevations where capacity increased since 2010. Capacity loss due to sedimentation is occurring below elevation 33.6 feet. Capacity gain above elevation 33.6 feet is largely a result of increased data coverage in the 2020 survey and LIDAR data coverage.**

Different methods of calculating capacity loss rates from the 2020 survey results yield a range of projected future capacity estimates. Table 5 shows projected capacity estimates based on capacity loss rates calculated from the 2020 sedimentation survey results (Table 4) and the long-term capacity loss rate from Figure 10. In the near term, 10 years, the upper and lower limits of the range vary by less than 1.0 percent. In the long term, 30 years, the upper and lower limits of the range vary by 2.4 percent (Figure 12).

Table 5. Projected capacity using various capacity loss rates

Loss rate	**Projected capacity (acre-feet) by year**		
	2030	**2040**	**2050**
325.65	160,932	157,675	154,419
288.07	161,307	158,427	155,546
250.50	161,683	159,178	156,673
200.71	162,181	160,174	158,167

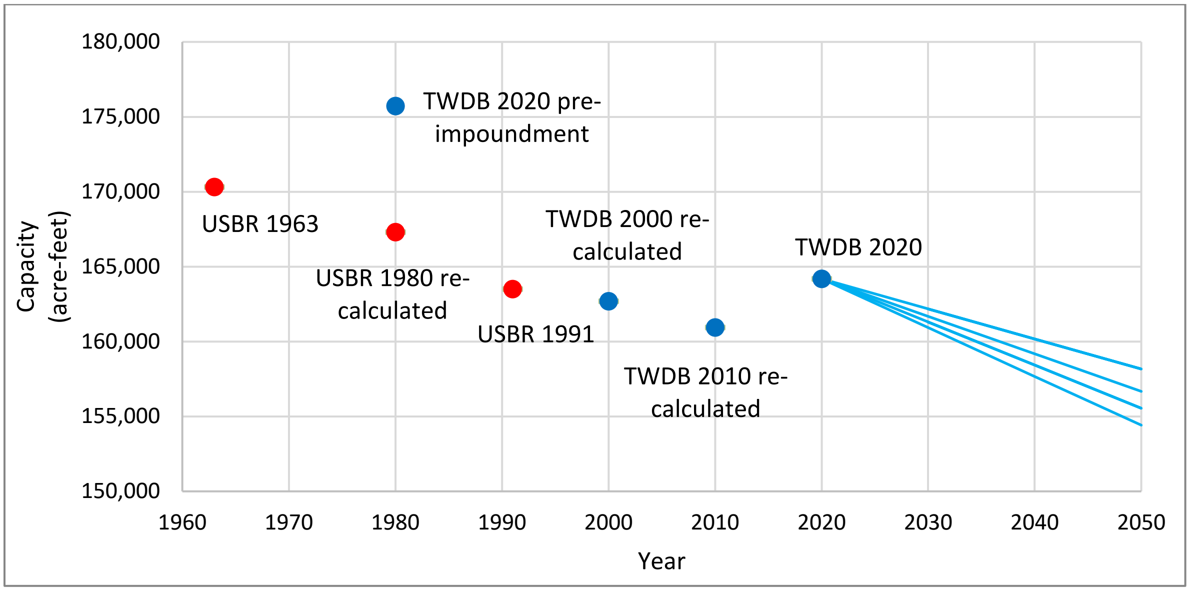

Figure 12. **Plot of current and previous capacity estimates (acre-feet) with projected future capacity trends. Capacity estimates for each TWDB survey plotted as blue dots and other surveys as red dots. Future capacity projections from Table 5 shown as light blue lines. The top light blue line represents capacity loss at 200.71 acre-feet per year, while the bottom light blue line represents capacity loss at 325.65 acre-feet per year.**

Sediment range lines

Sediment range lines for Lake Texana were established to measure sediment accumulation over time by the Bureau of Reclamation and originally surveyed between 1977 and 1980 (Ochs, 1982, Blanton and Ferrari, 1992). Plots of 24 cross-sections comparing the original survey prior to impoundment to USBR 1991 survey data are also available (Blanton and Ferrari, 1992). The TWDB digitized the USBR maps and the twenty-four range lines. The TWDB re-surveyed 20 of these lines. A map depicting these range lines can be found in Appendix Q. Table Q1 lists the endpoint coordinates for each range line. For comparison, the TWDB digitized the original design and 1991 transects plotted in the USBR 1991 survey report for comparison with the current bottom surface from each TWDB survey in 2000, 2010, and 2020 including both current and pre-impoundment surfaces (Appendix Q). Some differences in the cross-sections may be a result of difficulties interpreting the quadrangle map contours and inaccuracies in the quadrangle maps due to scale (Blanton and Ferrari, 1992) and distortions caused by digitizing the cross-sections from the USBR report. Additionally, some differences between the TWDB cross-sections may be a result of spatial interpolation and the interpolation routine of the TIN Model.

Recommendations

The TWDB recommends a detailed analysis of sediment deposits in the areas where exposure of the lake bottom may have led to identification of a false pre-impoundment using augured-coring techniques, as well as a volumetric and sedimentation survey in 10 years or after a major high flow event to further improve estimates of sediment accumulation rates. Continued monitoring of the reservoir's capacity will provide greater confidence in future planning efforts.

TWDB contact information

For more information about the TWDB Hydrographic Survey Program, visit www.twdb.texas.gov/surfacewater/surveys. Any questions regarding the TWDB Hydrographic Survey Program or this report may be addressed to: Hydrosurvey@twdb.texas.gov.

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Appendix A

Lake Texana

RESERVOIR CAPACITY TABLE

TEXAS WATER DEVELOPMENT BOARD
CAPACITY IN ACRE-FEET
ELEVATION INCREMENT IS ONE TENTH FOOT

August 2000 Survey re-calculated October 2016
Conservation Pool Elevation 44.0 feet NGVD29

ELEVATION (Feet)	-0.9	-0.8	-0.7	-0.6	-0.5	-0.4	-0.3	-0.2	-0.1	0.0
-19		0	0	0	0	0	0	0	0	0
-18	0	0	0	0	0	0	0	0	0	0
-17	0	0	0	0	0	0	0	0	0	0
-16	0	0	0	0	0	0	0	0	0	0
-15	0	0	0	0	0	0	0	0	0	0
-14	0	0	0	0	0	1	1	1	1	1
-13	1	1	1	1	1	1	1	1	1	1
-12	1	2	2	2	2	2	2	2	2	2
-11	3	3	3	3	3	3	4	4	4	4
-10	4	5	5	5	5	6	6	6	6	7
-9	7	7	7	8	8	8	9	9	9	9
-8	10	10	10	11	11	11	12	12	12	13
-7	13	13	14	14	14	15	15	16	16	16
-6	17	17	18	18	18	19	19	20	20	20
-5	21	21	22	22	23	23	24	24	25	25
-4	26	26	27	27	28	28	29	29	30	31
-3	31	32	33	33	34	35	36	36	37	38
-2	39	40	41	42	43	44	45	47	48	49
-1	51	52	53	55	57	58	60	62	63	65
0	67	69	72	74	76	79	81	84	86	89

ELEVATION (Feet)	0.0	0.1	0.2	0.3	0.4	0.5	0.6	0.7	0.8	0.9
0	89	92	95	98	101	104	107	110	113	117
1	120	124	127	131	135	139	143	147	152	156
2	160	165	170	175	179	184	189	195	200	205
3	211	217	223	229	235	241	248	254	261	268
4	275	282	289	297	305	313	321	329	337	346
5	355	364	373	383	393	403	413	424	434	446
6	457	469	481	494	507	521	534	549	564	579
7	596	612	630	648	667	687	708	730	754	778
8	803	830	858	888	919	951	986	1,022	1,060	1,100
9	1,142	1,185	1,231	1,278	1,328	1,380	1,434	1,490	1,548	1,609
10	1,671	1,736	1,803	1,872	1,944	2,018	2,095	2,175	2,257	2,342
11	2,430	2,520	2,613	2,708	2,806	2,906	3,008	3,113	3,220	3,330
12	3,442	3,557	3,674	3,793	3,915	4,040	4,167	4,296	4,428	4,561
13	4,698	4,836	4,977	5,120	5,266	5,415	5,567	5,721	5,878	6,038
14	6,200	6,366	6,533	6,704	6,876	7,051	7,229	7,409	7,592	7,778
15	7,966	8,157	8,350	8,545	8,743	8,944	9,147	9,353	9,561	9,772
16	9,985	10,201	10,420	10,641	10,864	11,090	11,318	11,549	11,782	12,018
17	12,256	12,496	12,739	12,984	13,232	13,482	13,734	13,989	14,246	14,506
18	14,769	15,033	15,301	15,570	15,842	16,116	16,392	16,670	16,950	17,233
19	17,518	17,805	18,094	18,386	18,679	18,975	19,273	19,573	19,875	20,179
20	20,485	20,794	21,104	21,416	21,731	22,047	22,366	22,687	23,010	23,335
21	23,662	23,991	24,321	24,654	24,988	25,323	25,661	26,000	26,341	26,684
22	27,028	27,375	27,723	28,074	28,426	28,780	29,136	29,494	29,854	30,216
23	30,580	30,946	31,314	31,684	32,057	32,432	32,809	33,189	33,570	33,954
24	34,341	34,729	35,120	35,513	35,909	36,306	36,707	37,109	37,514	37,921
25	38,331	38,742	39,156	39,572	39,991	40,411	40,833	41,258	41,685	42,114
26	42,544	42,977	43,411	43,848	44,286	44,727	45,169	45,614	46,060	46,508
27	46,958	47,410	47,864	48,319	48,777	49,237	49,698	50,161	50,626	51,093
28	51,563	52,034	52,507	52,983	53,461	53,941	54,424	54,909	55,396	55,886
29	56,379	56,874	57,371	57,871	58,374	58,879	59,386	59,897	60,410	60,925
30	61,443	61,964	62,488	63,013	63,541	64,072	64,605	65,140	65,678	66,219
31	66,762	67,307	67,855	68,406	68,960	69,515	70,073	70,634	71,197	71,762
32	72,329	72,899	73,471	74,046	74,623	75,202	75,784	76,368	76,954	77,543
33	78,134	78,727	79,323	79,922	80,522	81,126	81,731	82,340	82,952	83,568
34	84,187	84,809	85,435	86,063	86,696	87,331	87,970	88,612	89,258	89,907

Appendix A

Lake Texana

RESERVOIR CAPACITY TABLE (Continued)

TEXAS WATER DEVELOPMENT BOARD
CAPACITY IN ACRE-FEET
ELEVATION INCREMENT IS ONE TENTH FOOT

August 2000 Survey re-calculated October 2016
Conservation Pool Elevation 44.0 feet NGVD29

ELEVATION (Feet)	0.0	0.1	0.2	0.3	0.4	0.5	0.6	0.7	0.8	0.9
35	90,559	91,214	91,873	92,535	93,201	93,871	94,544	95,219	95,897	96,579
36	97,263	97,950	98,640	99,332	100,028	100,727	101,429	102,135	102,843	103,555
37	104,270	104,988	105,710	106,435	107,164	107,896	108,631	109,370	110,112	110,857
38	111,606	112,358	113,114	113,873	114,636	115,402	116,171	116,945	117,721	118,501
39	119,285	120,072	120,863	121,657	122,454	123,255	124,059	124,867	125,678	126,494
40	127,312	128,135	128,961	129,790	130,622	131,457	132,295	133,136	133,980	134,827
41	135,678	136,532	137,389	138,249	139,113	139,979	140,849	141,722	142,599	143,478
42	144,361	145,247	146,137	147,029	147,925	148,824	149,726	150,631	151,540	152,452
43	153,367	154,285	155,206	156,131	157,059	157,990	158,924	159,862	160,803	161,747
44	162,694									

Note: Capacities above elevation 40.5 feet calculated from interpolated areas

Appendix B

Lake Texana

RESERVOIR AREA TABLE

TEXAS WATER DEVELOPMENT BOARD
AREA IN ACRES
ELEVATION INCREMENT IS ONE TENTH FOOT

August 2000 Survey re-calculated October 2016
Conservation Pool Elevation 44.0 feet NGVD29

ELEVATION (Feet)	-0.9	-0.8	-0.7	-0.6	-0.5	-0.4	-0.3	-0.2	-0.1	0.0
-19		0	0	0	0	0	0	0	0	0
-18	0	0	0	0	0	0	0	0	0	0
-17	0	0	0	0	0	0	0	0	0	0
-16	0	0	0	0	0	0	0	0	0	0
-15	0	0	0	0	0	0	0	0	0	0
-14	0	0	0	0	0	0	0	0	0	0
-13	1	1	1	1	1	1	1	1	1	1
-12	1	1	1	1	1	1	1	1	1	1
-11	1	1	2	2	2	2	2	2	2	2
-10	2	2	2	2	2	2	3	3	3	3
-9	3	3	3	3	3	3	3	3	3	3
-8	3	3	3	3	3	3	3	3	3	3
-7	4	4	4	4	4	4	4	4	4	4
-6	4	4	4	4	4	4	4	4	4	4
-5	4	4	4	5	5	5	5	5	5	5
-4	5	5	5	5	5	6	6	6	6	6
-3	7	7	7	7	7	8	8	8	9	9
-2	9	10	10	11	11	12	12	12	13	13
-1	14	14	15	15	16	17	17	18	19	20
0	20	21	22	23	24	24	25	26	27	27

ELEVATION (Feet)	0.0	0.1	0.2	0.3	0.4	0.5	0.6	0.7	0.8	0.9
0	27	28	29	30	31	31	32	33	34	34
1	35	36	37	38	39	40	41	42	43	44
2	45	46	47	48	49	50	51	53	54	55
3	57	58	59	61	62	64	65	67	68	70
4	71	73	74	76	78	80	82	84	86	88
5	90	92	94	97	99	102	105	108	111	114
6	117	121	124	128	132	137	142	147	153	159
7	165	172	179	187	195	205	215	226	237	248
8	261	274	288	303	318	335	353	372	390	407
9	426	445	466	486	507	529	550	571	594	617
10	637	658	681	704	729	756	783	810	837	865
11	890	914	939	965	989	1,013	1,037	1,060	1,084	1,108
12	1,133	1,158	1,182	1,208	1,233	1,258	1,282	1,305	1,327	1,350
13	1,372	1,395	1,420	1,448	1,475	1,502	1,530	1,557	1,584	1,612
14	1,639	1,665	1,690	1,714	1,739	1,764	1,789	1,816	1,843	1,869
15	1,894	1,919	1,944	1,968	1,993	2,019	2,045	2,071	2,096	2,121
16	2,146	2,173	2,197	2,222	2,246	2,271	2,295	2,320	2,344	2,367
17	2,390	2,415	2,440	2,464	2,489	2,513	2,537	2,561	2,586	2,611
18	2,636	2,660	2,683	2,706	2,728	2,749	2,770	2,792	2,815	2,837
19	2,860	2,882	2,905	2,926	2,948	2,969	2,990	3,011	3,031	3,051
20	3,071	3,092	3,113	3,134	3,155	3,176	3,198	3,220	3,241	3,261
21	3,279	3,297	3,314	3,331	3,349	3,366	3,384	3,400	3,418	3,437
22	3,455	3,474	3,494	3,514	3,533	3,552	3,570	3,589	3,609	3,628
23	3,649	3,671	3,693	3,716	3,738	3,761	3,783	3,806	3,829	3,852
24	3,875	3,897	3,920	3,943	3,965	3,988	4,013	4,037	4,061	4,084
25	4,106	4,128	4,150	4,171	4,193	4,215	4,236	4,257	4,277	4,297
26	4,317	4,336	4,356	4,375	4,394	4,414	4,434	4,453	4,472	4,491
27	4,510	4,529	4,548	4,567	4,585	4,604	4,622	4,642	4,662	4,682
28	4,702	4,723	4,744	4,767	4,791	4,815	4,839	4,863	4,888	4,913
29	4,938	4,963	4,987	5,012	5,037	5,063	5,090	5,116	5,142	5,169
30	5,195	5,221	5,246	5,270	5,293	5,317	5,341	5,366	5,391	5,418
31	5,444	5,469	5,495	5,521	5,545	5,569	5,593	5,616	5,639	5,663
32	5,686	5,709	5,733	5,757	5,781	5,805	5,829	5,852	5,876	5,899
33	5,923	5,948	5,972	5,995	6,019	6,045	6,073	6,104	6,138	6,172
34	6,206	6,239	6,271	6,304	6,339	6,373	6,406	6,438	6,471	6,504

Appendix B

Lake Texana

RESERVOIR AREA TABLE (Continued)

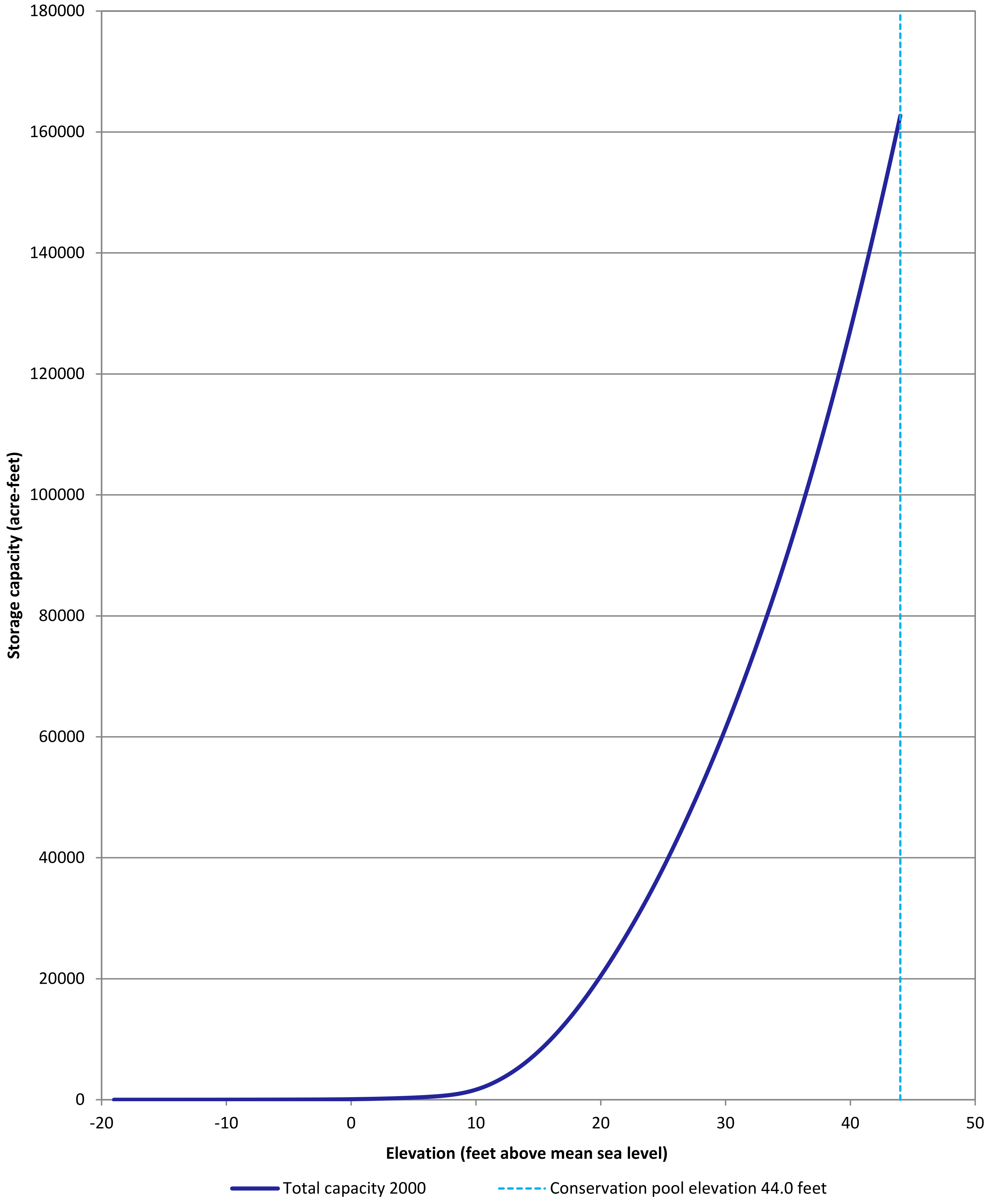
TEXAS WATER DEVELOPMENT BOARD — August 2000 Survey re-calculated October 2016

AREA IN ACRES — Conservation Pool Elevation 44.0 feet NGVD29

ELEVATION INCREMENT IS ONE TENTH FOOT

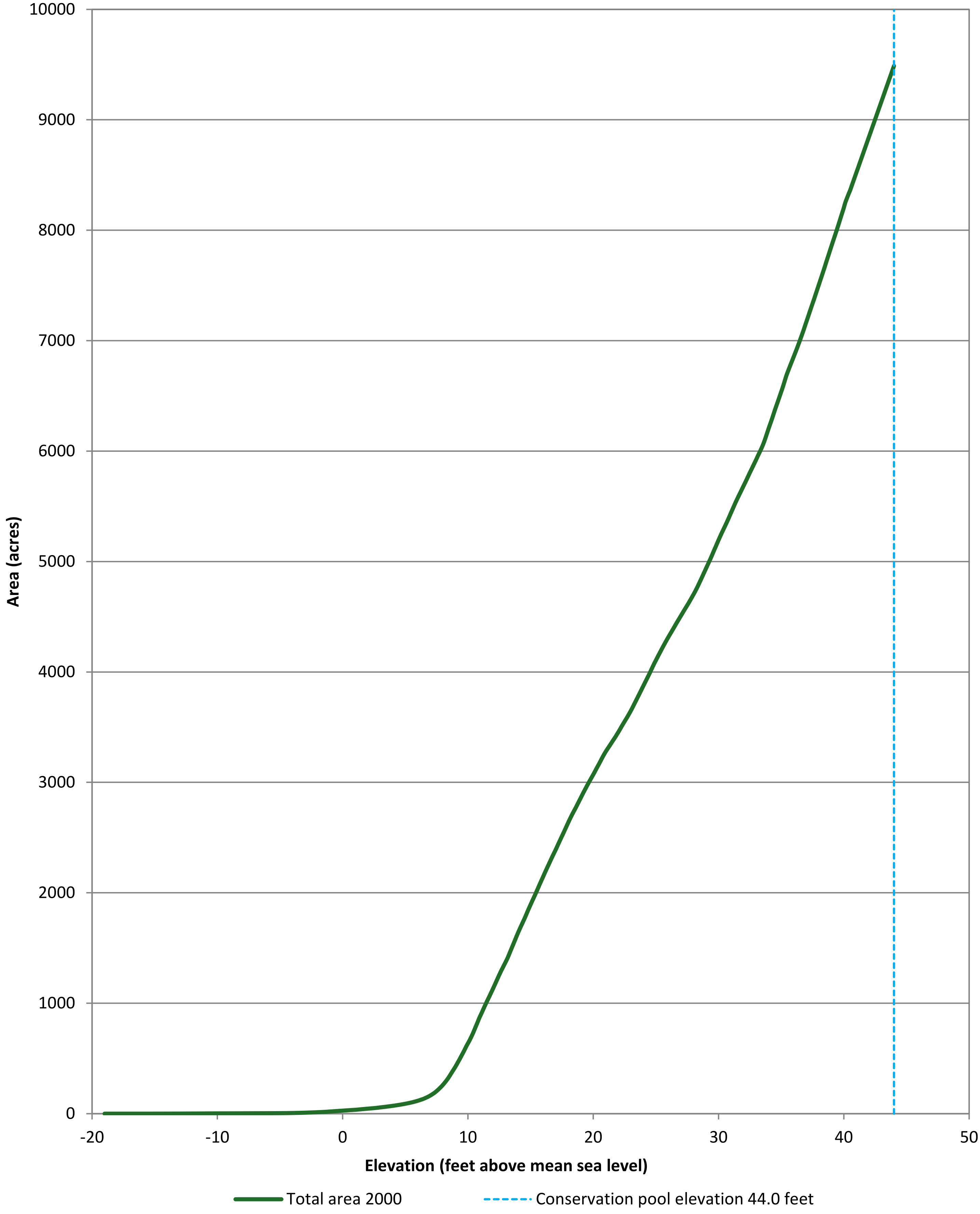
ELEVATION (Feet)	0.0	0.1	0.2	0.3	0.4	0.5	0.6	0.7	0.8	0.9
35	6,537	6,570	6,606	6,643	6,679	6,711	6,740	6,769	6,798	6,827
36	6,856	6,884	6,914	6,944	6,974	7,005	7,036	7,068	7,100	7,135
37	7,168	7,201	7,235	7,270	7,303	7,336	7,369	7,403	7,437	7,471
38	7,506	7,540	7,574	7,608	7,643	7,678	7,714	7,749	7,784	7,819
39	7,854	7,888	7,922	7,956	7,990	8,026	8,061	8,097	8,133	8,169
40	8,205	8,245	8,277	8,306	8,334	8,361	8,394	8,426	8,458	8,490
41	8,522	8,555	8,587	8,619	8,651	8,683	8,716	8,748	8,780	8,812
42	8,844	8,877	8,909	8,941	8,973	9,005	9,038	9,070	9,102	9,134
43	9,166	9,199	9,231	9,263	9,295	9,327	9,359	9,392	9,424	9,456
44	9,488									

Note: Areas between elevations 40.5 and 44.0 feet linearly interpolated



Lake Texana
August 2000 Survey
re-calculated October 2016
Prepared by: TWDB

Appendix C: 2000 re-calculated capacity curve



Lake Texana
August 2000 Survey
re-calculated October 2016
Prepared by: TWDB

Appendix D: 2000 re-calculated area curve

Appendix E

Lake Texana

RESERVOIR CAPACITY TABLE

TEXAS WATER DEVELOPMENT BOARD — January - March 2010 Survey re-calculated October 2016

CAPACITY IN ACRE-FEET — Conservation Pool Elevation 44.0 feet NGVD29

ELEVATION INCREMENT IS ONE TENTH FOOT

ELEVATION (Feet)	-0.9	-0.8	-0.7	-0.6	-0.5	-0.4	-0.3	-0.2	-0.1	0.0
-18		0	0	0	0	0	0	0	0	0
-17	0	0	0	0	0	0	0	0	0	0
-16	0	0	0	0	0	0	0	0	0	0
-15	0	0	0	0	0	0	0	0	0	0
-14	0	0	0	0	1	1	1	1	1	1
-13	1	1	1	1	1	1	2	2	2	2
-12	2	2	2	3	3	3	3	3	3	4
-11	4	4	4	4	4	5	5	5	5	5
-10	6	6	6	6	7	7	7	7	8	8
-9	8	8	9	9	9	10	10	10	10	11
-8	11	11	12	12	12	13	13	13	14	14
-7	14	15	15	15	16	16	17	17	17	18
-6	18	19	19	19	20	20	21	21	22	22
-5	22	23	23	24	24	25	25	26	26	27
-4	27	28	29	29	30	30	31	32	32	33
-3	33	34	35	36	36	37	38	39	40	41
-2	42	43	44	45	46	47	48	50	51	52
-1	54	55	57	58	60	62	63	65	67	69
0	71	73	75	77	79	82	84	87	89	92

ELEVATION (Feet)	0.0	0.1	0.2	0.3	0.4	0.5	0.6	0.7	0.8	0.9
0	92	95	98	100	103	107	110	113	116	120
1	123	127	130	134	138	142	146	150	154	159
2	163	168	172	177	182	187	192	198	203	209
3	214	220	226	232	238	245	251	258	265	272
4	279	286	294	301	309	317	325	334	342	351
5	360	369	378	387	397	407	417	427	438	449
6	460	471	482	494	506	519	532	545	559	573
7	588	603	619	635	652	670	688	707	727	747
8	769	791	815	839	865	892	920	950	981	1,013
9	1,047	1,083	1,121	1,160	1,201	1,244	1,289	1,336	1,384	1,435
10	1,487	1,541	1,598	1,656	1,716	1,779	1,844	1,911	1,981	2,053
11	2,129	2,207	2,288	2,371	2,456	2,544	2,634	2,727	2,821	2,919
12	3,019	3,121	3,225	3,332	3,441	3,552	3,666	3,782	3,901	4,022
13	4,145	4,271	4,400	4,531	4,664	4,799	4,936	5,076	5,218	5,363
14	5,510	5,660	5,812	5,967	6,124	6,284	6,447	6,612	6,780	6,950
15	7,122	7,297	7,475	7,655	7,838	8,023	8,210	8,400	8,592	8,787
16	8,984	9,184	9,387	9,592	9,800	10,010	10,223	10,438	10,657	10,877
17	11,100	11,326	11,554	11,785	12,018	12,253	12,491	12,731	12,973	13,218
18	13,466	13,716	13,968	14,223	14,481	14,740	15,003	15,267	15,534	15,803
19	16,074	16,348	16,623	16,901	17,181	17,464	17,749	18,035	18,325	18,616
20	18,910	19,205	19,503	19,803	20,104	20,408	20,714	21,022	21,332	21,644
21	21,957	22,273	22,591	22,910	23,232	23,556	23,883	24,211	24,541	24,874
22	25,208	25,544	25,882	26,222	26,563	26,906	27,251	27,598	27,947	28,298
23	28,651	29,006	29,364	29,723	30,084	30,447	30,812	31,179	31,549	31,920
24	32,294	32,669	33,047	33,428	33,810	34,195	34,583	34,972	35,364	35,758
25	36,154	36,552	36,953	37,356	37,762	38,170	38,580	38,994	39,409	39,828
26	40,248	40,672	41,097	41,525	41,956	42,389	42,825	43,262	43,703	44,145
27	44,590	45,036	45,486	45,937	46,390	46,845	47,303	47,763	48,224	48,688
28	49,153	49,621	50,090	50,562	51,035	51,510	51,988	52,467	52,949	53,433
29	53,919	54,408	54,898	55,392	55,887	56,385	56,885	57,388	57,893	58,401
30	58,911	59,423	59,939	60,457	60,978	61,502	62,028	62,558	63,090	63,625
31	64,162	64,702	65,245	65,790	66,338	66,889	67,442	67,998	68,556	69,118
32	69,682	70,249	70,818	71,390	71,965	72,542	73,122	73,705	74,291	74,879
33	75,470	76,064	76,661	77,260	77,862	78,466	79,073	79,684	80,297	80,914
34	81,534	82,159	82,786	83,418	84,052	84,691	85,333	85,978	86,627	87,280

Appendix E

Lake Texana

RESERVOIR CAPACITY TABLE (Continued)

TEXAS WATER DEVELOPMENT BOARD
CAPACITY IN ACRE-FEET
ELEVATION INCREMENT IS ONE TENTH FOOT

January - March 2010 Survey re-calculated October 2016
Conservation Pool Elevation 44.0 feet NGVD29

ELEVATION (Feet)	0.0	0.1	0.2	0.3	0.4	0.5	0.6	0.7	0.8	0.9
35	87,935	88,594	89,256	89,922	90,592	91,265	91,942	92,622	93,306	93,993
36	94,684	95,378	96,075	96,775	97,479	98,186	98,897	99,611	100,328	101,048
37	101,772	102,499	103,229	103,962	104,698	105,437	106,179	106,925	107,673	108,425
38	109,180	109,938	110,700	111,465	112,234	113,006	113,782	114,562	115,345	116,132
39	116,923	117,719	118,518	119,320	120,126	120,935	121,747	122,563	123,383	124,205
40	125,032	125,861	126,695	127,532	128,372	129,216	130,063	130,913	131,768	132,625
41	133,487	134,351	135,219	136,091	136,966	137,845	138,727	139,612	140,501	141,394
42	142,290	143,190	144,093	144,999	145,909	146,823	147,740	148,660	149,584	150,512
43	151,442	152,377	153,315	154,256	155,201	156,149	157,101	158,057	159,015	159,978
44	160,944									

Note: Capacities above elevation 39.5 feet calculated from interpolated areas

Appendix F

Lake Texana

RESERVOIR AREA TABLE

TEXAS WATER DEVELOPMENT BOARD — January - March 2010 Survey re-calculated October 2016

AREA IN ACRES — Conservation Pool Elevation 44.0 feet NGVD29

ELEVATION INCREMENT IS ONE TENTH FOOT

ELEVATION (Feet)	-0.9	-0.8	-0.7	-0.6	-0.5	-0.4	-0.3	-0.2	-0.1	0.0
-18		0	0	0	0	0	0	0	0	0
-17	0	0	0	0	0	0	0	0	0	0
-16	0	0	0	0	0	0	0	0	0	0
-15	0	0	0	0	0	0	0	0	0	0
-14	0	0	0	0	1	1	1	1	1	1
-13	1	1	1	1	1	1	1	1	1	1
-12	1	1	1	1	2	2	2	2	2	2
-11	2	2	2	2	2	2	2	2	2	2
-10	2	2	2	2	2	2	2	3	3	3
-9	3	3	3	3	3	3	3	3	3	3
-8	3	3	3	3	3	3	3	3	3	4
-7	4	4	4	4	4	4	4	4	4	4
-6	4	4	4	4	4	4	4	4	4	5
-5	5	5	5	5	5	5	5	5	5	5
-4	5	6	6	6	6	6	6	6	7	7
-3	7	7	7	8	8	8	9	9	9	10
-2	10	10	11	11	12	12	12	13	13	14
-1	14	15	15	16	16	17	17	18	19	19
0	20	21	22	22	23	24	25	26	26	27

ELEVATION (Feet)	0.0	0.1	0.2	0.3	0.4	0.5	0.6	0.7	0.8	0.9
0	27	28	29	29	30	31	32	33	34	34
1	35	36	37	38	39	40	41	42	43	44
2	45	46	47	49	50	51	52	54	55	56
3	57	59	60	62	63	65	66	68	69	71
4	72	74	75	77	79	80	82	84	86	88
5	89	91	93	96	98	100	102	104	107	109
6	111	114	117	120	124	127	131	135	140	144
7	149	155	160	166	173	180	187	194	202	210
8	219	229	240	251	263	276	289	303	318	334
9	351	368	385	402	419	438	457	476	495	514
10	533	553	573	593	614	636	661	686	713	741
11	769	794	819	844	866	889	912	936	961	985
12	1,010	1,033	1,056	1,079	1,102	1,125	1,149	1,173	1,198	1,223
13	1,248	1,273	1,296	1,319	1,341	1,363	1,386	1,409	1,434	1,459
14	1,485	1,510	1,536	1,562	1,588	1,613	1,638	1,663	1,688	1,713
15	1,739	1,765	1,789	1,813	1,838	1,861	1,885	1,910	1,935	1,961
16	1,987	2,013	2,038	2,064	2,090	2,116	2,143	2,169	2,194	2,219
17	2,244	2,269	2,294	2,319	2,342	2,365	2,388	2,412	2,437	2,462
18	2,487	2,512	2,537	2,562	2,585	2,609	2,633	2,657	2,680	2,702
19	2,723	2,745	2,768	2,790	2,813	2,836	2,858	2,881	2,903	2,925
20	2,946	2,967	2,987	3,007	3,028	3,049	3,069	3,089	3,108	3,128
21	3,147	3,166	3,187	3,208	3,230	3,252	3,273	3,293	3,314	3,333
22	3,352	3,370	3,388	3,406	3,423	3,442	3,461	3,480	3,499	3,519
23	3,540	3,562	3,582	3,601	3,620	3,640	3,662	3,683	3,704	3,726
24	3,747	3,769	3,792	3,815	3,838	3,860	3,883	3,905	3,928	3,950
25	3,972	3,996	4,020	4,045	4,069	4,093	4,118	4,144	4,170	4,196
26	4,220	4,245	4,269	4,294	4,318	4,342	4,367	4,391	4,413	4,435
27	4,457	4,479	4,501	4,522	4,544	4,565	4,586	4,606	4,626	4,646
28	4,665	4,684	4,704	4,724	4,744	4,764	4,785	4,806	4,828	4,850
29	4,873	4,896	4,920	4,943	4,966	4,990	5,014	5,040	5,064	5,089
30	5,114	5,139	5,168	5,196	5,225	5,252	5,280	5,308	5,335	5,361
31	5,387	5,414	5,440	5,467	5,492	5,518	5,545	5,572	5,600	5,627
32	5,655	5,681	5,707	5,733	5,760	5,787	5,815	5,844	5,871	5,898
33	5,925	5,952	5,978	6,004	6,031	6,058	6,088	6,120	6,152	6,186
34	6,222	6,259	6,295	6,331	6,366	6,401	6,438	6,473	6,507	6,539

Appendix F

Lake Texana

RESERVOIR AREA TABLE (Continued)

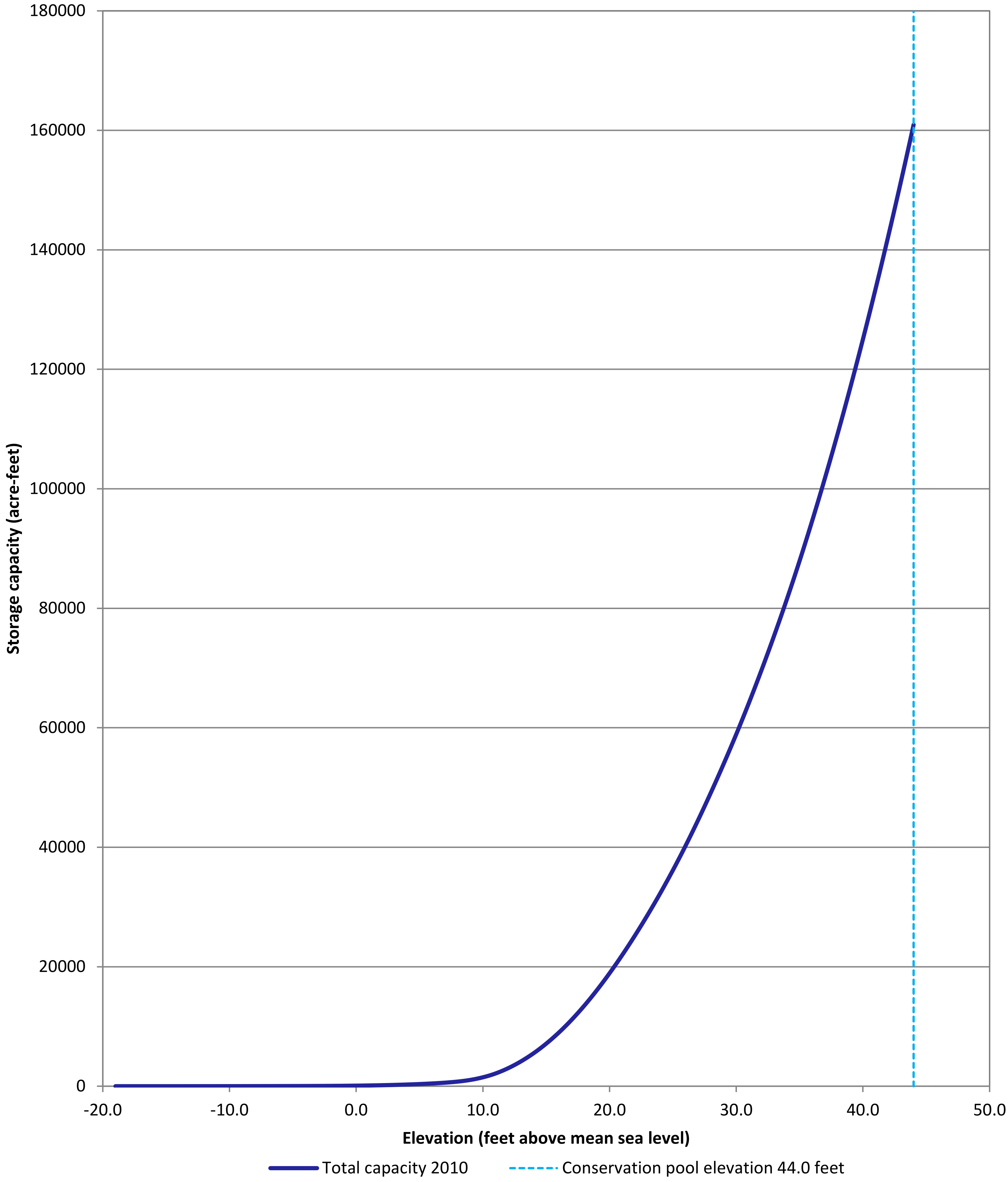
TEXAS WATER DEVELOPMENT BOARD — January - March 2010 Survey re-calculated October 2016

AREA IN ACRES — Conservation Pool Elevation 44.0 feet NGVD29

ELEVATION INCREMENT IS ONE TENTH FOOT

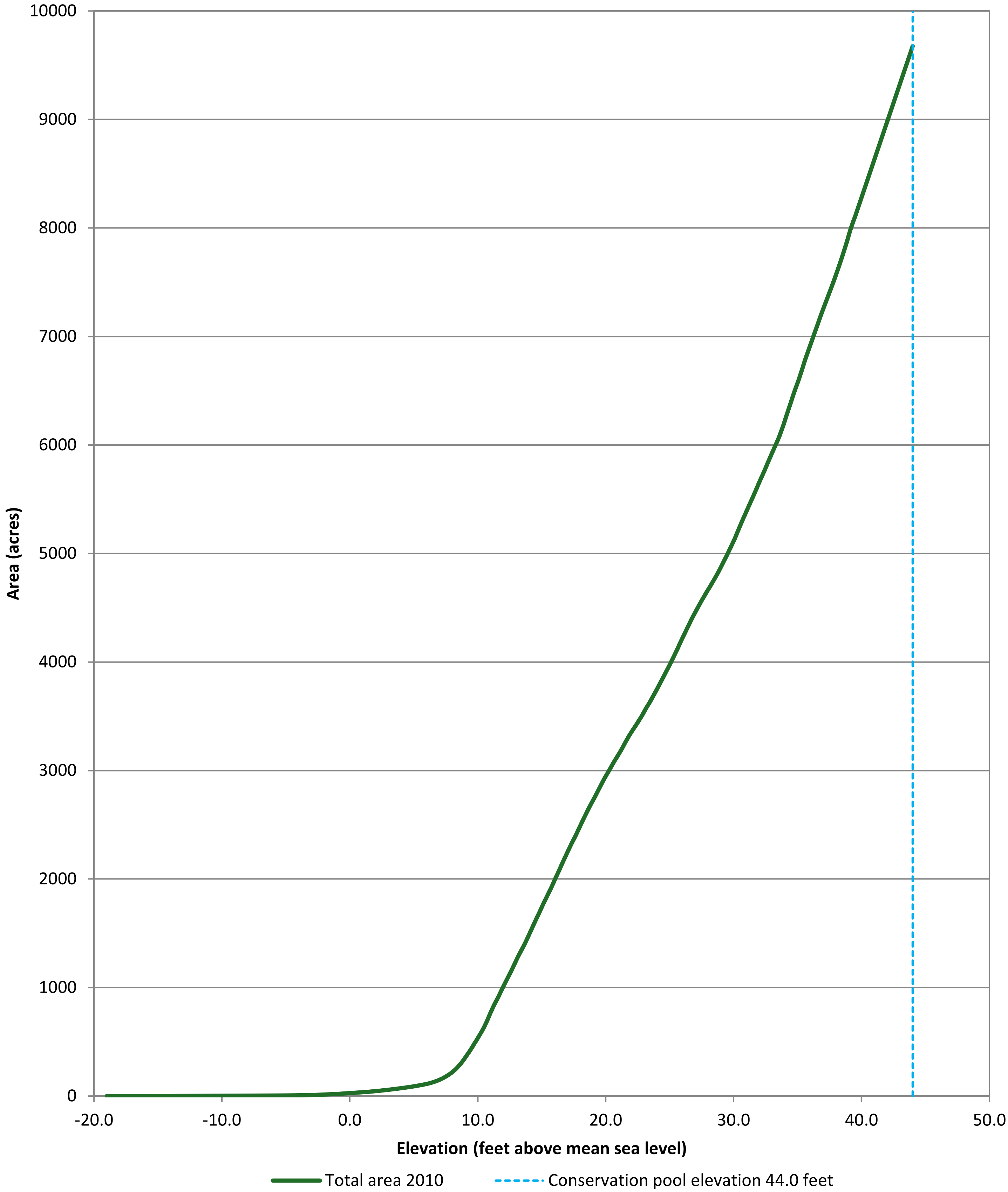
ELEVATION (Feet)	0.0	0.1	0.2	0.3	0.4	0.5	0.6	0.7	0.8	0.9
35	6,572	6,605	6,641	6,677	6,713	6,752	6,788	6,822	6,855	6,888
36	6,922	6,955	6,989	7,022	7,055	7,088	7,121	7,155	7,188	7,221
37	7,252	7,283	7,314	7,345	7,376	7,407	7,438	7,470	7,501	7,534
38	7,567	7,601	7,635	7,670	7,705	7,741	7,777	7,814	7,852	7,890
39	7,932	7,972	8,008	8,042	8,075	8,106	8,141	8,176	8,211	8,246
40	8,280	8,315	8,350	8,385	8,420	8,455	8,490	8,525	8,559	8,594
41	8,629	8,664	8,699	8,734	8,769	8,804	8,838	8,873	8,908	8,943
42	8,978	9,013	9,048	9,083	9,117	9,152	9,187	9,222	9,257	9,292
43	9,327	9,362	9,396	9,431	9,466	9,501	9,536	9,571	9,606	9,641
44	9,676									

Note: Areas between elevations 39.5 and 44.0 feet linearly inteprolated



Lake Texana
January - March 2010 Survey
re-calculated October 2016
Prepared by: TWDB

Appendix G: 2010 re-calculated capacity curve



Lake Texana
January - March 2010 Survey
re-calculated October 2016
Prepared by: TWDB

Appendix H: 2010 re-calculated area curve

Appendix I

Lake Texana

RESERVOIR BATHYMETRIC CAPACITY TABLE

TEXAS WATER DEVELOPMENT BOARD — August 2020 Survey

CAPACITY IN ACRE-FEET — Conservation pool elevation 44.0 feet NGVD29

ELEVATION INCREMENT IS ONE TENTH FOOT

ELEVATION (Feet)	-0.9	-0.8	-0.7	-0.6	-0.5	-0.4	-0.3	-0.2	-0.1	0.0
-13					0	0	0	0	0	0
-12	0	0	0	0	0	0	0	0	0	0
-11	0	0	0	0	0	0	1	1	1	1
-10	1	1	1	1	1	1	1	1	2	2
-9	2	2	2	2	2	2	2	3	3	3
-8	3	3	3	4	4	4	4	4	5	5
-7	5	5	5	6	6	6	6	7	7	7
-6	7	8	8	8	9	9	9	9	10	10
-5	10	11	11	11	12	12	12	13	13	14
-4	14	15	15	15	16	16	17	17	18	19
-3	19	20	20	21	22	22	23	24	25	26
-2	26	27	28	29	31	32	33	34	35	37
-1	38	39	41	43	44	46	48	49	51	53
0	55	57	60	62	64	66	69	71	74	77

ELEVATION (Feet)	0.0	0.1	0.2	0.3	0.4	0.5	0.6	0.7	0.8	0.9
0	77	80	83	86	89	92	96	99	103	107
1	110	114	118	123	127	131	136	140	145	150
2	155	160	166	171	177	182	188	194	200	206
3	213	219	226	233	240	247	254	261	269	276
4	284	292	300	309	317	326	334	343	352	362
5	371	381	391	401	412	422	433	444	456	467
6	479	491	503	516	529	542	555	569	582	597
7	611	626	642	658	674	691	708	726	744	763
8	783	803	824	847	869	893	918	944	972	1,000
9	1,030	1,062	1,095	1,129	1,165	1,203	1,242	1,283	1,326	1,370
10	1,417	1,465	1,516	1,568	1,623	1,679	1,738	1,799	1,862	1,928
11	1,996	2,066	2,140	2,216	2,295	2,378	2,463	2,550	2,641	2,733
12	2,828	2,926	3,025	3,126	3,230	3,335	3,443	3,553	3,666	3,781
13	3,899	4,020	4,143	4,268	4,396	4,527	4,660	4,795	4,932	5,071
14	5,213	5,358	5,504	5,653	5,805	5,959	6,115	6,274	6,435	6,599
15	6,766	6,935	7,106	7,281	7,458	7,638	7,821	8,006	8,194	8,384
16	8,577	8,773	8,970	9,170	9,373	9,578	9,785	9,995	10,208	10,423
17	10,641	10,862	11,085	11,310	11,539	11,770	12,003	12,240	12,478	12,719
18	12,963	13,209	13,457	13,708	13,961	14,217	14,475	14,736	14,999	15,265
19	15,534	15,805	16,079	16,355	16,633	16,914	17,197	17,483	17,771	18,061
20	18,354	18,648	18,946	19,245	19,546	19,850	20,156	20,464	20,775	21,087
21	21,402	21,720	22,039	22,361	22,684	23,010	23,339	23,669	24,001	24,335
22	24,671	25,008	25,348	25,689	26,032	26,377	26,724	27,073	27,425	27,778
23	28,134	28,492	28,852	29,214	29,578	29,944	30,313	30,684	31,057	31,433
24	31,811	32,191	32,574	32,959	33,346	33,736	34,128	34,522	34,918	35,317
25	35,719	36,122	36,528	36,936	37,346	37,758	38,173	38,589	39,008	39,430
26	39,854	40,280	40,708	41,140	41,573	42,009	42,447	42,888	43,330	43,775
27	44,223	44,672	45,124	45,577	46,033	46,490	46,950	47,411	47,874	48,339
28	48,806	49,276	49,747	50,221	50,696	51,173	51,653	52,135	52,618	53,104
29	53,592	54,082	54,575	55,070	55,568	56,068	56,571	57,076	57,585	58,095
30	58,609	59,126	59,647	60,170	60,696	61,226	61,759	62,295	62,834	63,376
31	63,921	64,469	65,019	65,572	66,128	66,686	67,247	67,811	68,378	68,947
32	69,520	70,095	70,672	71,253	71,837	72,423	73,012	73,604	74,199	74,797
33	75,397	76,001	76,607	77,216	77,828	78,444	79,062	79,684	80,311	80,941
34	81,575	82,214	82,856	83,502	84,153	84,807	85,465	86,127	86,794	87,464
35	88,138	88,816	89,498	90,183	90,872	91,565	92,260	92,959	93,662	94,369
36	95,079	95,792	96,508	97,228	97,952	98,679	99,410	100,144	100,881	101,622
37	102,367	103,115	103,866	104,622	105,381	106,143	106,910	107,681	108,456	109,234
38	110,017	110,804	111,594	112,389	113,188	113,990	114,796	115,606	116,420	117,237

Appendix I

Lake Texana

RESERVOIR BATHYMETRIC CAPACITY TABLE (Continued)

TEXAS WATER DEVELOPMENT BOARD

CAPACITY IN ACRE-FEET

ELEVATION INCREMENT IS ONE TENTH FOOT

August 2020 Survey

Conservation pool elevation 44.0 feet NGVD29

ELEVATION (Feet)	0.0	0.1	0.2	0.3	0.4	0.5	0.6	0.7	0.8	0.9
39	118,058	118,883	119,712	120,545	121,381	122,221	123,064	123,911	124,761	125,614
40	126,471	127,331	128,195	129,061	129,932	130,806	131,683	132,565	133,451	134,341
41	135,237	136,136	137,040	137,950	138,864	139,783	140,707	141,636	142,570	143,508
42	144,451	145,399	146,351	147,307	148,268	149,232	150,201	151,174	152,150	153,131
43	154,117	155,106	156,100	157,097	158,099	159,104	160,113	161,126	162,142	163,162
44	164,188									

Appendix J

Lake Texana

RESERVOIR BATHYMETRIC AREA TABLE

TEXAS WATER DEVELOPMENT BOARD | August 2020 Survey
AREA IN ACRES | Conservation pool elevation 44.0 feet NGVD29
ELEVATION INCREMENT IS ONE TENTH FOOT

ELEVATION (Feet)	-0.9	-0.8	-0.7	-0.6	-0.5	-0.4	-0.3	-0.2	-0.1	0.0
-13					0	0	0	0	0	0
-12	0	0	0	0	0	0	0	0	0	0
-11	0	0	0	0	1	1	1	1	1	1
-10	1	1	1	1	1	1	1	1	1	1
-9	1	1	1	1	1	1	1	1	2	2
-8	2	2	2	2	2	2	2	2	2	2
-7	2	2	2	2	2	2	2	3	3	3
-6	3	3	3	3	3	3	3	3	3	3
-5	3	3	3	4	4	4	4	4	4	4
-4	4	4	5	5	5	5	5	5	5	6
-3	6	6	6	7	7	7	8	8	8	9
-2	9	10	10	11	11	11	12	12	13	14
-1	14	15	15	16	17	17	18	19	19	20
0	20	21	22	22	23	24	25	26	27	28

ELEVATION (Feet)	0.0	0.1	0.2	0.3	0.4	0.5	0.6	0.7	0.8	0.9
0	28	29	31	32	33	34	35	36	37	38
1	39	40	41	42	43	44	45	47	49	50
2	51	53	54	55	56	57	58	60	62	63
3	65	66	68	69	70	72	73	75	76	77
4	79	81	82	84	85	87	88	90	92	94
5	97	99	101	103	105	108	110	112	114	117
6	119	122	124	126	129	132	135	138	141	144
7	148	152	156	160	165	170	175	181	187	193
8	201	208	216	225	234	244	256	267	279	293
9	307	322	337	352	368	384	400	417	435	455
10	474	495	515	536	557	578	599	620	642	667
11	693	720	749	778	810	837	863	889	915	939
12	962	983	1,004	1,024	1,045	1,066	1,089	1,114	1,140	1,167
13	1,192	1,218	1,243	1,268	1,293	1,317	1,339	1,361	1,383	1,407
14	1,431	1,455	1,479	1,503	1,527	1,551	1,575	1,600	1,626	1,652
15	1,678	1,705	1,732	1,758	1,786	1,813	1,840	1,866	1,892	1,916
16	1,942	1,965	1,989	2,013	2,037	2,062	2,087	2,114	2,140	2,166
17	2,192	2,218	2,244	2,270	2,296	2,323	2,350	2,375	2,400	2,424
18	2,448	2,472	2,495	2,520	2,544	2,570	2,596	2,620	2,647	2,673
19	2,699	2,725	2,749	2,773	2,796	2,820	2,844	2,867	2,891	2,915
20	2,937	2,959	2,982	3,004	3,026	3,048	3,071	3,093	3,116	3,139
21	3,161	3,183	3,205	3,227	3,249	3,271	3,292	3,311	3,330	3,349
22	3,367	3,385	3,402	3,420	3,440	3,460	3,482	3,504	3,527	3,548
23	3,567	3,587	3,609	3,630	3,652	3,675	3,698	3,722	3,745	3,769
24	3,793	3,816	3,838	3,861	3,884	3,907	3,930	3,953	3,977	4,002
25	4,026	4,048	4,069	4,089	4,110	4,132	4,155	4,179	4,203	4,226
26	4,250	4,274	4,300	4,324	4,347	4,370	4,393	4,416	4,439	4,462
27	4,483	4,505	4,525	4,545	4,565	4,585	4,604	4,623	4,642	4,662
28	4,682	4,703	4,724	4,744	4,765	4,785	4,806	4,826	4,847	4,868
29	4,891	4,914	4,940	4,965	4,991	5,016	5,041	5,067	5,095	5,124
30	5,154	5,185	5,217	5,249	5,281	5,313	5,346	5,378	5,406	5,434
31	5,462	5,489	5,516	5,543	5,570	5,598	5,626	5,654	5,681	5,708
32	5,736	5,764	5,792	5,821	5,848	5,877	5,906	5,935	5,963	5,991
33	6,019	6,048	6,077	6,107	6,137	6,168	6,203	6,243	6,282	6,322
34	6,365	6,405	6,444	6,484	6,523	6,562	6,601	6,643	6,683	6,722
35	6,761	6,799	6,836	6,871	6,906	6,940	6,974	7,010	7,047	7,082
36	7,115	7,149	7,183	7,218	7,253	7,288	7,323	7,358	7,393	7,428
37	7,464	7,498	7,533	7,570	7,608	7,648	7,688	7,727	7,767	7,808
38	7,847	7,887	7,927	7,967	8,005	8,043	8,081	8,118	8,156	8,192

Appendix J

Lake Texana

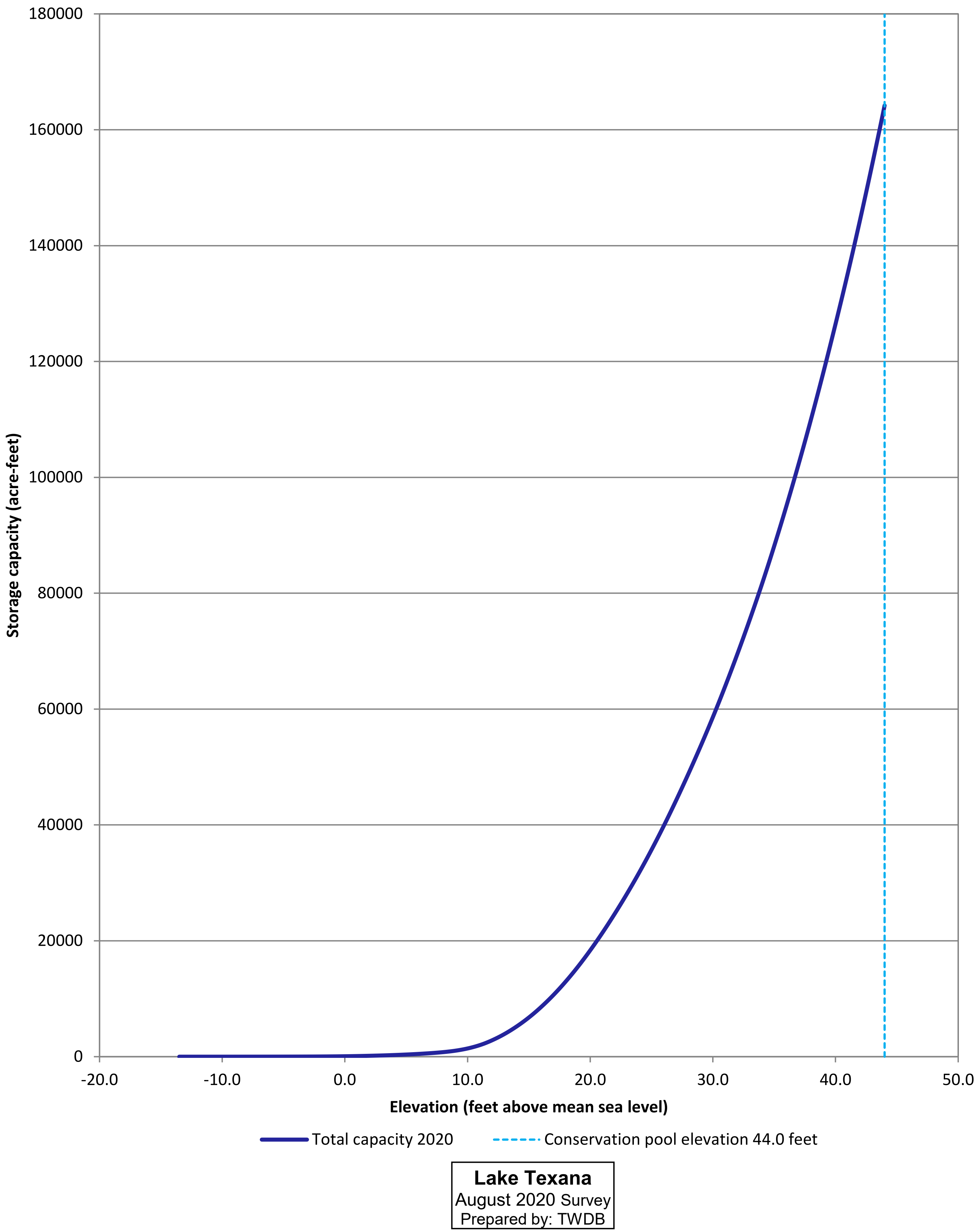
RESERVOIR BATHYMETIRC AREA TABLE (Continued)

TEXAS WATER DEVELOPMENT BOARD | August 2020 Survey

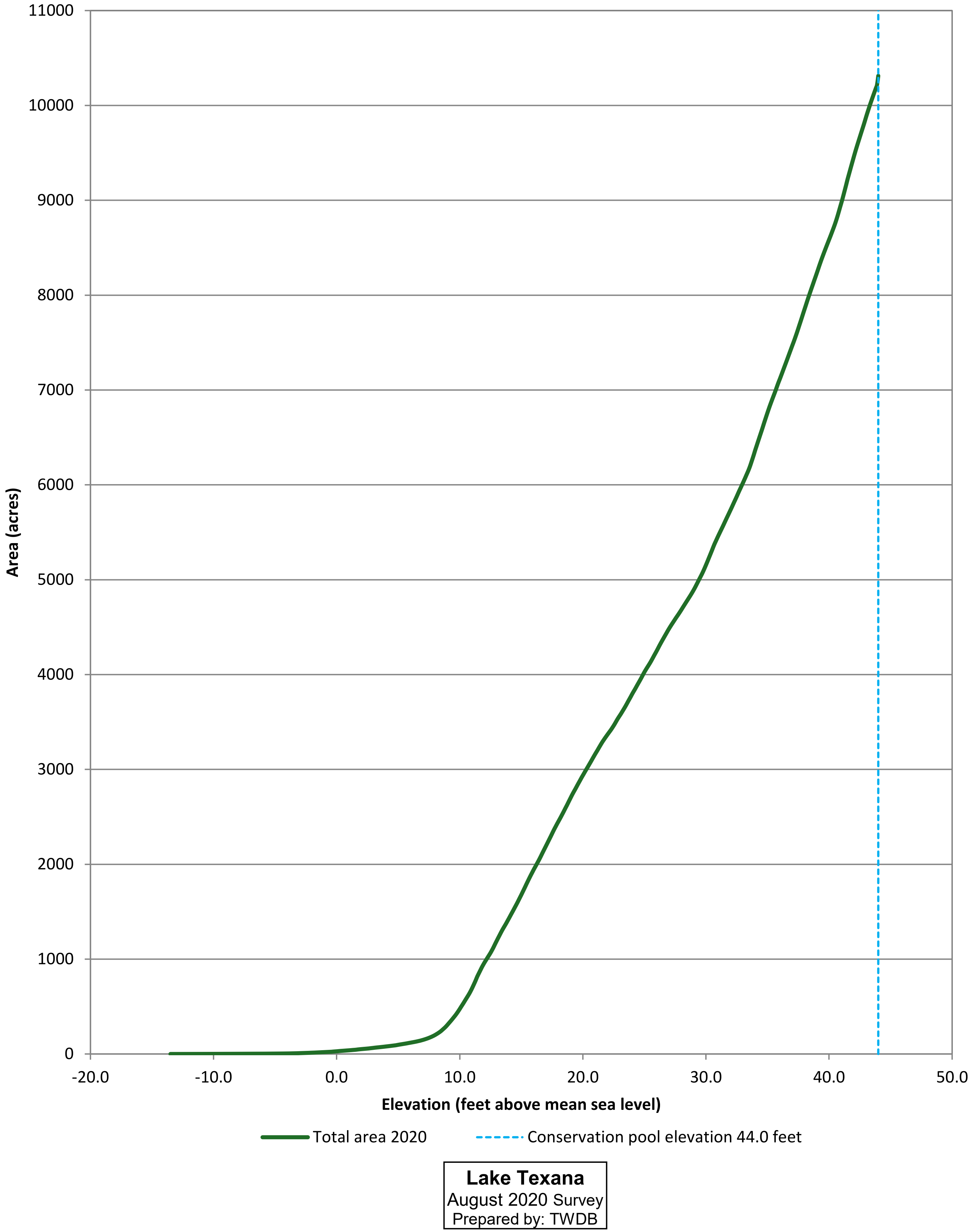
AREA IN ACRES | Conservation pool elevation 44.0 feet NGVD29

ELEVATION INCREMENT IS ONE TENTH FOOT

ELEVATION (Feet)	0.0	0.1	0.2	0.3	0.4	0.5	0.6	0.7	0.8	0.9
39	8,230	8,268	8,307	8,344	8,381	8,416	8,451	8,485	8,518	8,551
40	8,584	8,617	8,651	8,685	8,720	8,757	8,796	8,838	8,883	8,928
41	8,973	9,019	9,068	9,117	9,167	9,219	9,266	9,313	9,360	9,406
42	9,452	9,498	9,542	9,584	9,625	9,666	9,708	9,748	9,789	9,831
43	9,874	9,916	9,956	9,996	10,034	10,071	10,108	10,144	10,180	10,217
44	10,312									



Appendix K: 2020 Bathymetric capacity curve



Appendix L: 2020 Bathymetric area curve

Appendix M

Lake Texana

RESERVOIR BATHYMETRIC AND TOPOGRAPHIC CAPACITY TABLE

TEXAS WATER DEVELOPMENT BOARD
CAPACITY IN ACRE-FEET
ELEVATION INCREMENT IS ONE TENTH FOOT

August 2020 Survey
Conservation pool elevation 44.0 feet NGVD29
Top of dam elevation 55.0 feet NGVD29

ELEVATION (Feet)	-0.9	-0.8	-0.7	-0.6	-0.5	-0.4	-0.3	-0.2	-0.1	0.0
-13					0	0	0	0	0	0
-12	0	0	0	0	0	0	0	0	0	0
-11	0	0	0	0	0	0	1	1	1	1
-10	1	1	1	1	1	1	1	1	2	2
-9	2	2	2	2	2	2	2	3	3	3
-8	3	3	3	4	4	4	4	4	5	5
-7	5	5	5	6	6	6	6	7	7	7
-6	7	8	8	8	9	9	9	9	10	10
-5	10	11	11	11	12	12	12	13	13	14
-4	14	15	15	15	16	16	17	17	18	19
-3	19	20	20	21	22	22	23	24	25	26
-2	26	27	28	29	31	32	33	34	35	37
-1	38	39	41	43	44	46	48	49	51	53
0	55	57	60	62	64	66	69	71	74	77

ELEVATION (Feet)	0.0	0.1	0.2	0.3	0.4	0.5	0.6	0.7	0.8	0.9
0	77	80	83	86	89	92	96	99	103	107
1	110	114	118	123	127	131	136	140	145	150
2	155	160	166	171	177	182	188	194	200	206
3	213	219	226	233	240	247	254	261	269	276
4	284	292	300	309	317	326	334	343	352	362
5	371	381	391	401	412	422	433	444	456	467
6	479	491	503	516	529	542	555	569	582	597
7	611	626	642	658	674	691	708	726	744	763
8	783	803	824	847	869	893	918	944	972	1,000
9	1,030	1,062	1,095	1,129	1,165	1,203	1,242	1,283	1,326	1,370
10	1,417	1,465	1,516	1,568	1,623	1,679	1,738	1,799	1,862	1,928
11	1,996	2,066	2,140	2,216	2,295	2,378	2,463	2,550	2,641	2,733
12	2,828	2,926	3,025	3,126	3,230	3,335	3,443	3,553	3,666	3,781
13	3,899	4,020	4,143	4,268	4,396	4,527	4,660	4,795	4,932	5,072
14	5,213	5,358	5,504	5,654	5,805	5,959	6,115	6,274	6,435	6,599
15	6,766	6,935	7,107	7,281	7,458	7,638	7,821	8,006	8,194	8,385
16	8,578	8,773	8,971	9,171	9,373	9,578	9,786	9,996	10,209	10,424
17	10,642	10,862	11,086	11,311	11,540	11,771	12,004	12,241	12,479	12,721
18	12,964	13,210	13,459	13,709	13,963	14,218	14,477	14,738	15,001	15,267
19	15,536	15,807	16,081	16,357	16,635	16,916	17,199	17,485	17,773	18,063
20	18,356	18,651	18,948	19,247	19,549	19,853	20,159	20,467	20,777	21,090
21	21,405	21,723	22,042	22,364	22,688	23,014	23,342	23,672	24,004	24,338
22	24,674	25,012	25,351	25,693	26,036	26,381	26,728	27,077	27,429	27,783
23	28,139	28,496	28,856	29,218	29,583	29,949	30,318	30,689	31,062	31,438
24	31,816	32,197	32,579	32,964	33,352	33,741	34,133	34,527	34,924	35,323
25	35,725	36,128	36,534	36,942	37,352	37,765	38,179	38,596	39,015	39,436
26	39,860	40,287	40,715	41,147	41,580	42,016	42,454	42,895	43,338	43,783
27	44,230	44,680	45,131	45,585	46,040	46,498	46,957	47,419	47,882	48,348
28	48,815	49,284	49,756	50,229	50,705	51,182	51,662	52,144	52,627	53,113
29	53,601	54,092	54,584	55,080	55,578	56,078	56,581	57,086	57,595	58,106
30	58,620	59,137	59,657	60,180	60,707	61,237	61,770	62,306	62,846	63,388
31	63,933	64,480	65,031	65,584	66,140	66,698	67,260	67,824	68,391	68,960
32	69,533	70,108	70,686	71,267	71,850	72,437	73,026	73,618	74,214	74,811
33	75,412	76,016	76,622	77,232	77,844	78,459	79,078	79,701	80,327	80,958
34	81,592	82,231	82,874	83,520	84,171	84,825	85,484	86,146	86,813	87,483
35	88,158	88,836	89,518	90,204	90,893	91,586	92,282	92,981	93,685	94,391
36	95,102	95,815	96,532	97,252	97,976	98,704	99,435	100,169	100,907	101,649
37	102,394	103,142	103,894	104,650	105,409	106,172	106,939	107,711	108,486	109,265
38	110,048	110,835	111,626	112,422	113,221	114,024	114,830	115,641	116,455	117,273

Appendix N

Lake Texana

RESERVOIR BATHYMETRIC AND TOPOGRAPHIC AREA TABLE (Continued)

TEXAS WATER DEVELOPMENT BOARD
CAPACITY IN ACRE-FEET
ELEVATION INCREMENT IS ONE TENTH FOOT

August 2020 Survey
Conservation pool elevation 44.0 feet NGVD29
Top of dam elevation 55.0 feet NGVD29

ELEVATION (Feet)	0.0	0.1	0.2	0.3	0.4	0.5	0.6	0.7	0.8	0.9
39	118,094	118,920	119,749	120,582	121,418	122,259	123,102	123,949	124,800	125,654
40	126,511	127,371	128,234	129,101	129,972	130,846	131,723	132,605	133,491	134,382
41	135,277	136,177	137,081	137,991	138,905	139,825	140,749	141,679	142,613	143,552
42	144,495	145,443	146,396	147,354	148,315	149,281	150,251	151,225	152,204	153,187
43	154,174	155,165	156,161	157,162	158,166	159,174	160,186	161,202	162,223	163,248
44	164,277	165,311	166,350	167,394	168,443	169,498	170,560	171,627	172,701	173,781
45	174,868	175,962	177,063	178,171	179,286	180,410	181,542	182,682	183,830	184,986
46	186,152	187,325	188,508	189,700	190,902	192,112	193,331	194,560	195,798	197,046
47	198,304	199,570	200,847	202,133	203,430	204,736	206,053	207,381	208,719	210,068
48	211,428	212,800	214,184	215,581	216,991	218,415	219,851	221,301	222,765	224,241
49	225,731	227,233	228,748	230,274	231,812	233,361	234,921	236,493	238,076	239,672
50	241,280	242,902	244,538	246,190	247,857	249,541	251,243	252,963	254,702	256,460
51	258,237	260,033	261,848	263,682	265,534	267,405	269,297	271,208	273,138	275,088
52	277,059	279,052	281,067	283,105	285,167	287,256	289,372	291,513	293,679	295,868
53	298,082	300,320	302,582	304,869	307,179	309,512	311,868	314,247	316,648	319,068
54	321,508	323,965	326,441	328,934	331,446	333,976	336,525	339,093	341,680	344,287
55	346,944									

Appendix N

Lake Texana

RESERVOIR BATHYMETRIC AND TOPOGRAPHIC AREA TABLE

TEXAS WATER DEVELOPMENT BOARD — August 2020 Survey

AREA IN ACRES — Conservation pool elevation 44.0 feet NGVD29

ELEVATION INCREMENT IS ONE TENTH FOOT — Top of dam elevation 55.0 feet NGVD29

ELEVATION (Feet)	-0.9	-0.8	-0.7	-0.6	-0.5	-0.4	-0.3	-0.2	-0.1	0.0
-13					0	0	0	0	0	0
-12	0	0	0	0	0	0	0	0	0	0
-11	0	0	0	0	1	1	1	1	1	1
-10	1	1	1	1	1	1	1	1	1	1
-9	1	1	1	1	1	1	1	1	2	2
-8	2	2	2	2	2	2	2	2	2	2
-7	2	2	2	2	2	2	2	3	3	3
-6	3	3	3	3	3	3	3	3	3	3
-5	3	3	3	4	4	4	4	4	4	4
-4	4	4	5	5	5	5	5	5	5	6
-3	6	6	6	7	7	7	8	8	8	9
-2	9	10	10	11	11	11	12	12	13	14
-1	14	15	15	16	17	17	18	19	19	20
0	20	21	22	22	23	24	25	26	27	28

ELEVATION (Feet)	0.0	0.1	0.2	0.3	0.4	0.5	0.6	0.7	0.8	0.9
0	28	29	31	32	33	34	35	36	37	38
1	39	40	41	42	43	44	45	47	49	50
2	51	53	54	55	56	57	58	60	62	63
3	65	66	68	69	70	72	73	75	76	77
4	79	81	82	84	85	87	88	90	92	94
5	97	99	101	103	105	108	110	112	114	117
6	119	122	124	126	129	132	135	138	141	144
7	148	152	156	160	165	170	175	181	187	193
8	201	208	216	225	234	244	256	267	279	293
9	307	322	337	352	368	384	400	417	435	455
10	474	495	515	536	557	578	599	620	642	667
11	693	720	749	778	810	837	863	889	915	939
12	962	983	1,004	1,024	1,045	1,066	1,089	1,114	1,140	1,167
13	1,192	1,218	1,243	1,268	1,293	1,317	1,339	1,361	1,384	1,407
14	1,431	1,455	1,479	1,503	1,527	1,551	1,575	1,600	1,626	1,652
15	1,678	1,705	1,732	1,758	1,786	1,813	1,840	1,866	1,892	1,917
16	1,942	1,966	1,989	2,013	2,037	2,062	2,088	2,115	2,141	2,166
17	2,192	2,218	2,244	2,270	2,296	2,323	2,350	2,376	2,400	2,425
18	2,448	2,472	2,496	2,520	2,545	2,570	2,596	2,621	2,647	2,673
19	2,699	2,725	2,750	2,773	2,796	2,820	2,845	2,868	2,891	2,915
20	2,937	2,960	2,983	3,005	3,027	3,049	3,071	3,094	3,117	3,140
21	3,162	3,184	3,205	3,228	3,250	3,272	3,293	3,312	3,331	3,350
22	3,368	3,386	3,403	3,421	3,441	3,461	3,482	3,505	3,528	3,548
23	3,568	3,588	3,610	3,631	3,653	3,675	3,699	3,723	3,746	3,769
24	3,794	3,817	3,839	3,861	3,885	3,908	3,931	3,954	3,978	4,003
25	4,026	4,049	4,070	4,090	4,111	4,133	4,156	4,180	4,204	4,227
26	4,251	4,275	4,300	4,325	4,348	4,371	4,394	4,417	4,439	4,462
27	4,484	4,505	4,526	4,546	4,565	4,585	4,605	4,624	4,643	4,663
28	4,683	4,704	4,725	4,745	4,766	4,786	4,806	4,827	4,848	4,869
29	4,892	4,915	4,941	4,966	4,992	5,017	5,042	5,068	5,096	5,125
30	5,156	5,187	5,218	5,250	5,282	5,314	5,347	5,379	5,407	5,436
31	5,464	5,491	5,518	5,545	5,572	5,600	5,628	5,655	5,682	5,710
32	5,737	5,765	5,794	5,822	5,850	5,879	5,908	5,937	5,965	5,993
33	6,021	6,050	6,079	6,109	6,139	6,171	6,206	6,245	6,284	6,325
34	6,368	6,407	6,447	6,486	6,526	6,565	6,604	6,645	6,685	6,725
35	6,764	6,802	6,839	6,874	6,909	6,944	6,977	7,013	7,050	7,085
36	7,118	7,152	7,187	7,222	7,257	7,291	7,326	7,362	7,397	7,432
37	7,468	7,502	7,538	7,575	7,612	7,652	7,692	7,731	7,772	7,812
38	7,852	7,892	7,932	7,972	8,010	8,048	8,085	8,122	8,160	8,197

Appendix N

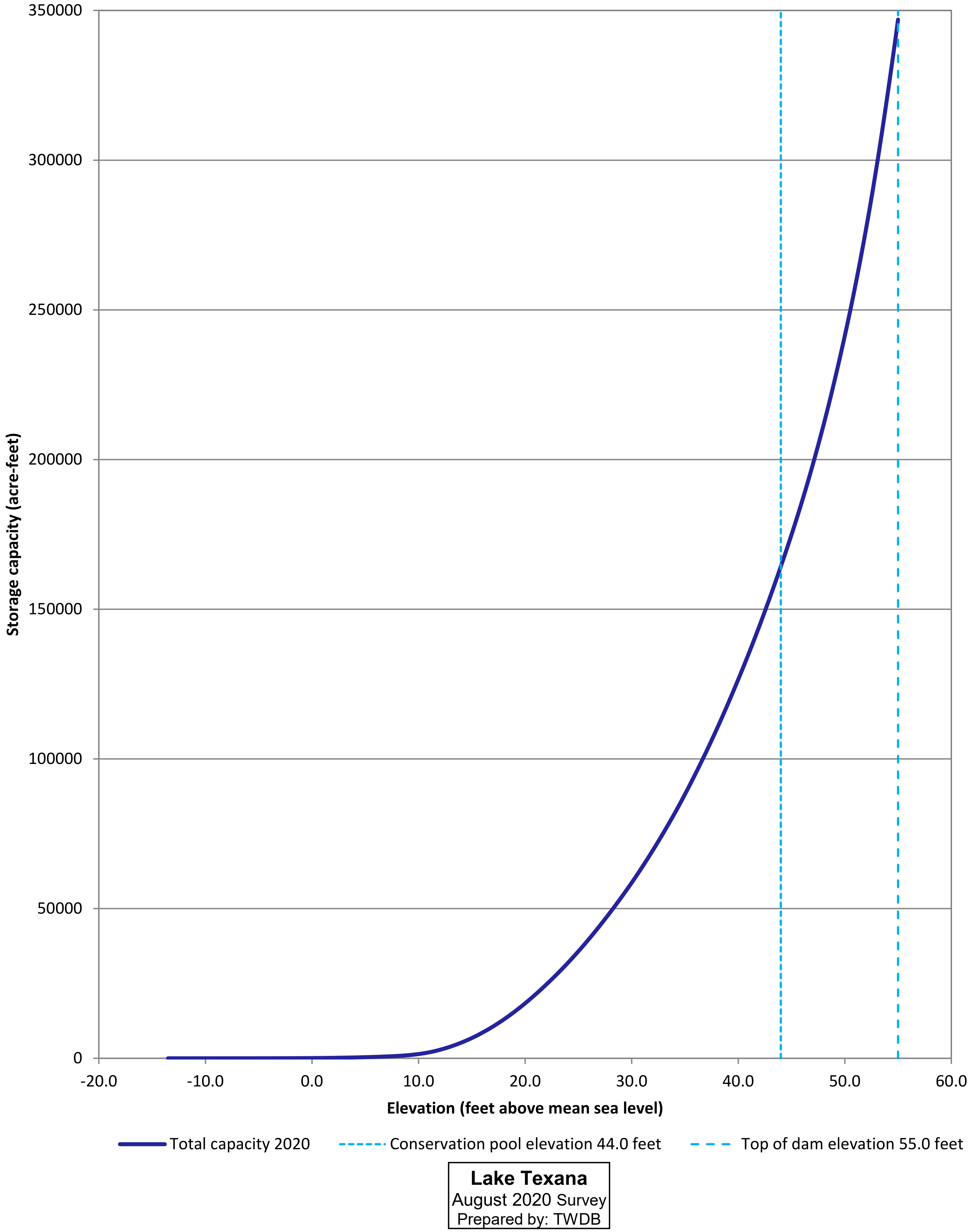
Lake Texana

RESERVOIR BATHYMETRIC AND TOPOGRAPHIC AREA TABLE (Continued)

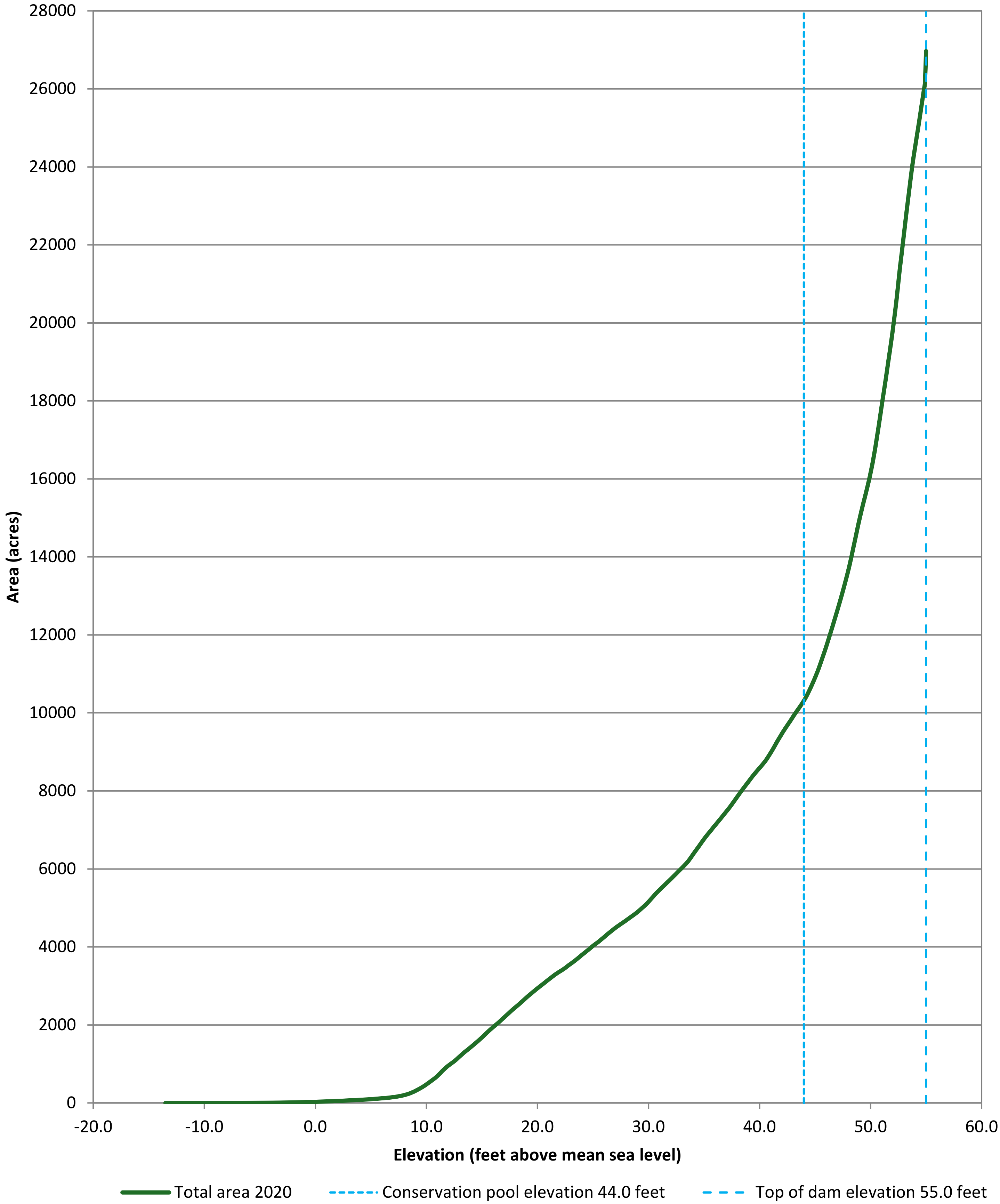
TEXAS WATER DEVELOPMENT BOARD
AREA IN ACRES
ELEVATION INCREMENT IS ONE TENTH FOOT

August 2020 Survey
Conservation pool elevation 44.0 feet NGVD29
Top of dam elevation 55.0 feet NGVD29

ELEVATION (Feet)	0.0	0.1	0.2	0.3	0.4	0.5	0.6	0.7	0.8	0.9
39	8,234	8,272	8,311	8,348	8,385	8,419	8,454	8,488	8,521	8,554
40	8,587	8,619	8,653	8,687	8,721	8,758	8,797	8,839	8,884	8,929
41	8,974	9,020	9,069	9,119	9,169	9,222	9,270	9,317	9,365	9,412
42	9,460	9,506	9,551	9,595	9,637	9,679	9,722	9,764	9,806	9,850
43	9,895	9,938	9,980	10,022	10,062	10,102	10,142	10,184	10,226	10,270
44	10,315	10,363	10,413	10,467	10,524	10,583	10,644	10,706	10,770	10,836
45	10,902	10,972	11,043	11,116	11,196	11,277	11,359	11,442	11,524	11,607
46	11,694	11,784	11,875	11,966	12,057	12,148	12,241	12,336	12,430	12,526
47	12,621	12,717	12,815	12,914	13,015	13,117	13,221	13,328	13,436	13,546
48	13,659	13,778	13,904	14,032	14,169	14,301	14,432	14,566	14,703	14,834
49	14,961	15,084	15,203	15,321	15,434	15,544	15,659	15,776	15,895	16,019
50	16,152	16,290	16,433	16,593	16,754	16,931	17,112	17,293	17,481	17,673
51	17,867	18,059	18,241	18,428	18,617	18,815	19,013	19,207	19,403	19,605
52	19,813	20,036	20,264	20,498	20,755	21,022	21,293	21,537	21,771	22,015
53	22,258	22,502	22,748	22,984	23,215	23,445	23,676	23,900	24,110	24,302
54	24,483	24,665	24,847	25,025	25,208	25,396	25,587	25,775	25,966	26,165
55	26,970									



Appendix O: 2020 Bathymetric and topographic capacity curve



Lake Texana
August 2020 Survey
Prepared by: TWDB

Appendix P: 2020 Bathymetric and topographic area curve

Appendix Q

Lake Texana

Sediment range lines

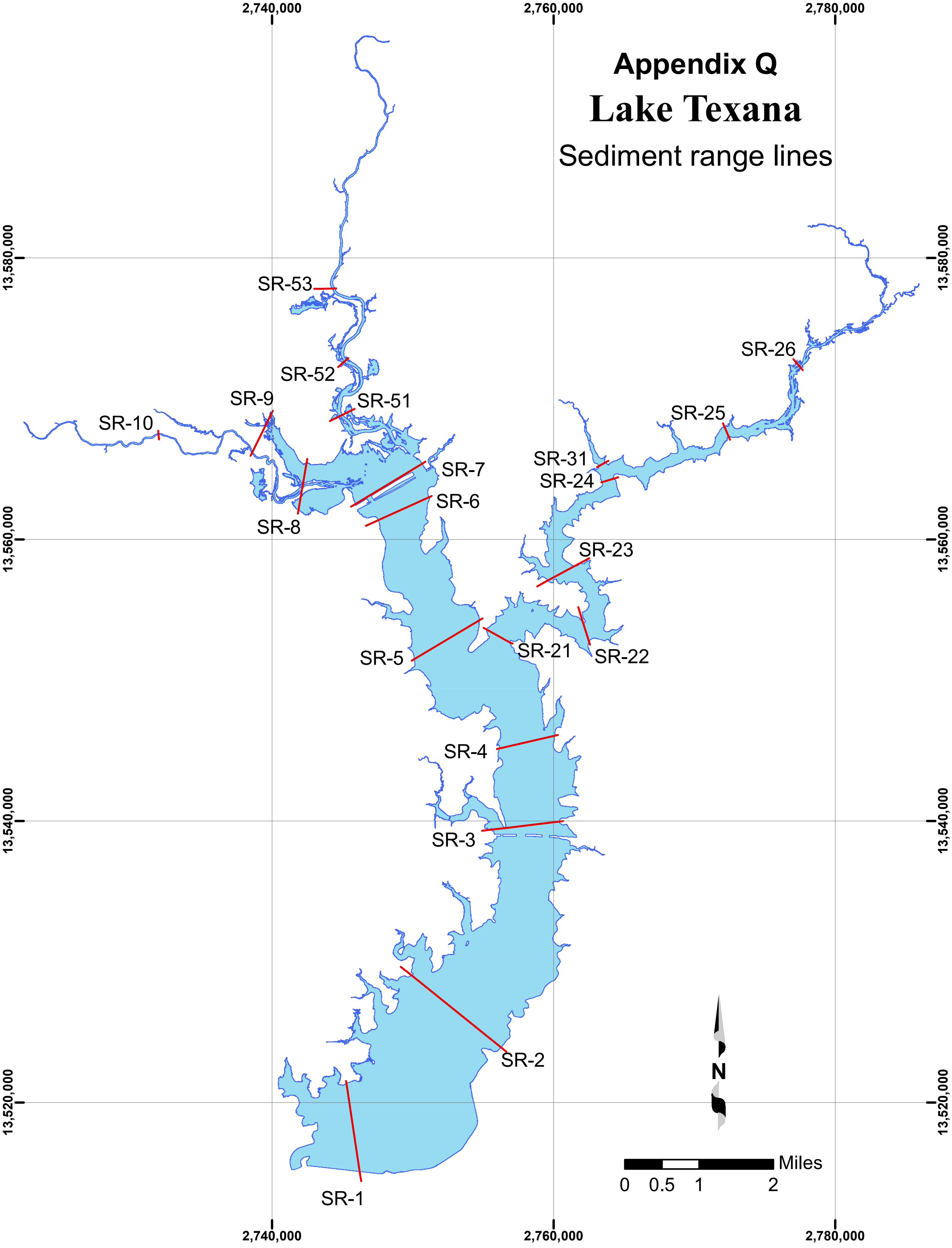


Table Q1. Sediment range line endpoint coordinates

Sediment range line	X	Y
SR-1-L	2,746,313.92	13,514,435.18
SR-1-L P.O.T	2,746,215.83	13,515,082.88
SR-1-R P.O.T	2,745,252.75	13,521,442.80
SR-1-R	2,745,237.75	13,521,541.71
SR-2-L	2,756,631.34	13,523,626.73
SR-2-L P.O.T	2,756,320.40	13,523,876.71
SR-2-R P.O.T	2,749,723.29	13,529,180.47
SR-2-R	2,749,129.56	13,529,657.81
SR-3-L	2,760,656.65	13,540,007.38
SR-3-L P.O.T	2,760,458.11	13,539,983.35
SR-3-R P.O.T	2,756,566.20	13,539,512.05
SR-3-R P.O.T	2,755,538.26	13,539,387.58
SR-3-R	2,754,899.48	13,539,310.22
SR-4-L	2,760,296.60	13,546,121.14
SR-4-R P.O.T	2,756,074.48	13,545,141.72
SR-4-R	2,755,967.33	13,545,116.88
SR-5-L	2,754,929.59	13,554,412.12
SR-5-R	2,749,901.01	13,551,404.16
SR-6-L	2,751,328.63	13,563,091.82
SR-6-R	2,746,662.02	13,560,976.93
SR-7-L	2,750,876.06	13,565,538.61
SR-7-L P.O.T	2,750,704.93	13,565,435.12
SR-7-R P.O.T	2,745,794.53	13,562,465.29
SR-7-R	2,745,599.97	13,562,347.62
SR-8-L	2,742,485.33	13,565,724.00
SR-8-R	2,741,823.70	13,561,843.13
SR-9-L	2,740,030.49	13,569,150.34
SR-9-R	2,738,450.12	13,565,948.85

Source: (Ochs, 1982, Blanton and Ferrari, 1992)

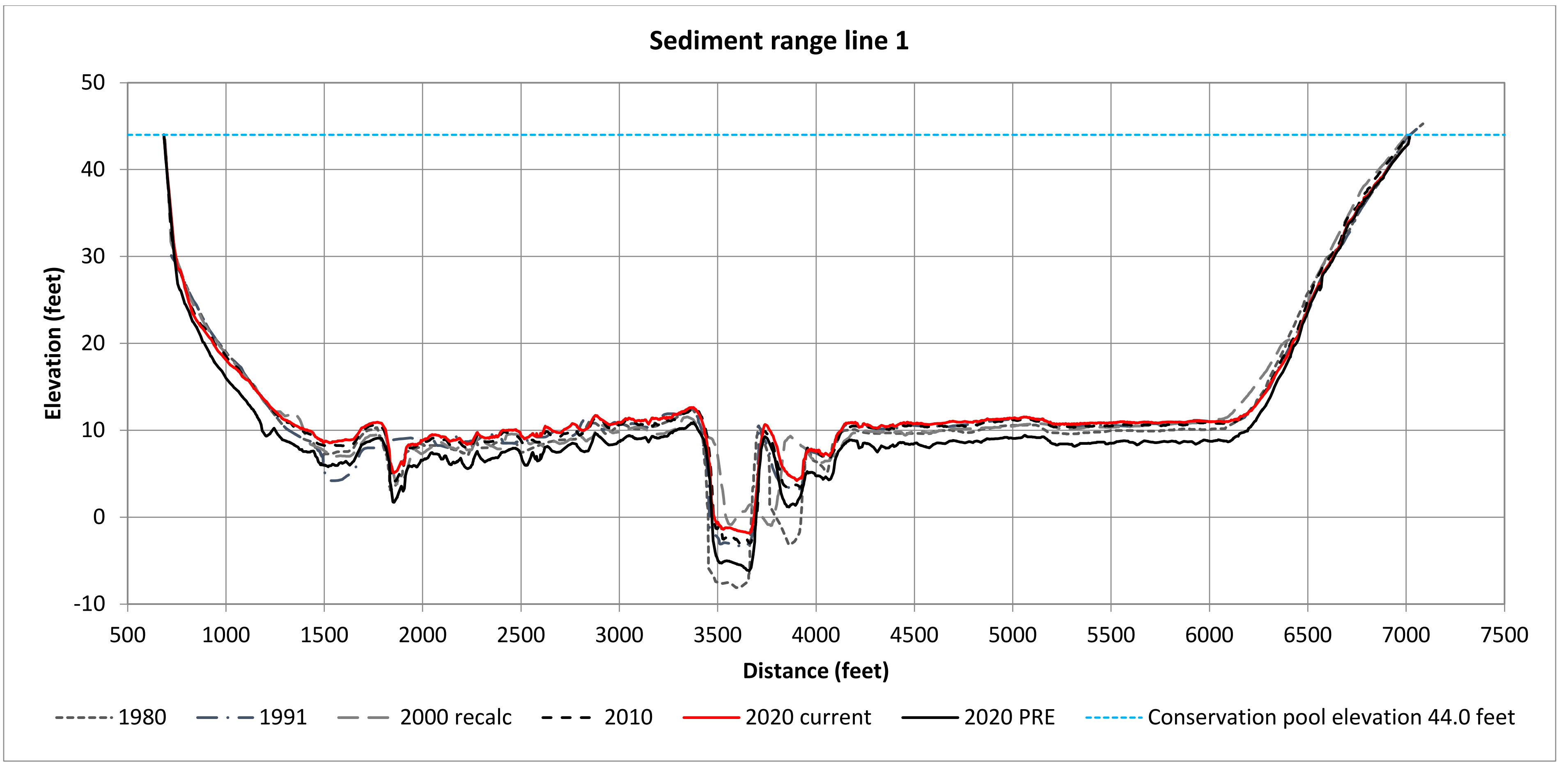
Coordinates reported in NAD83 State Plane Texas South Central Zone (feet)

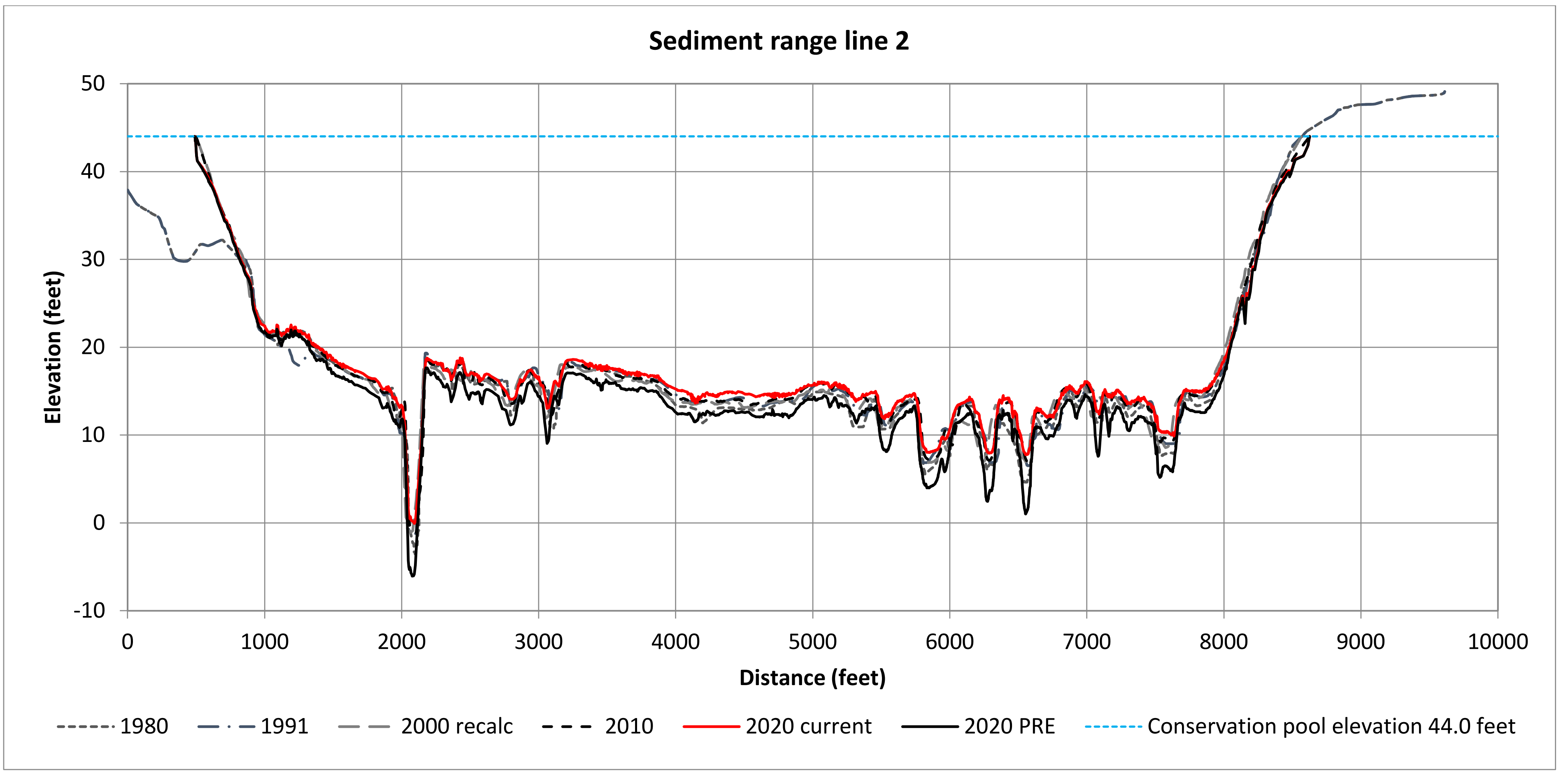
Table Q1. Sediment range line endpoint coordinates (continued)

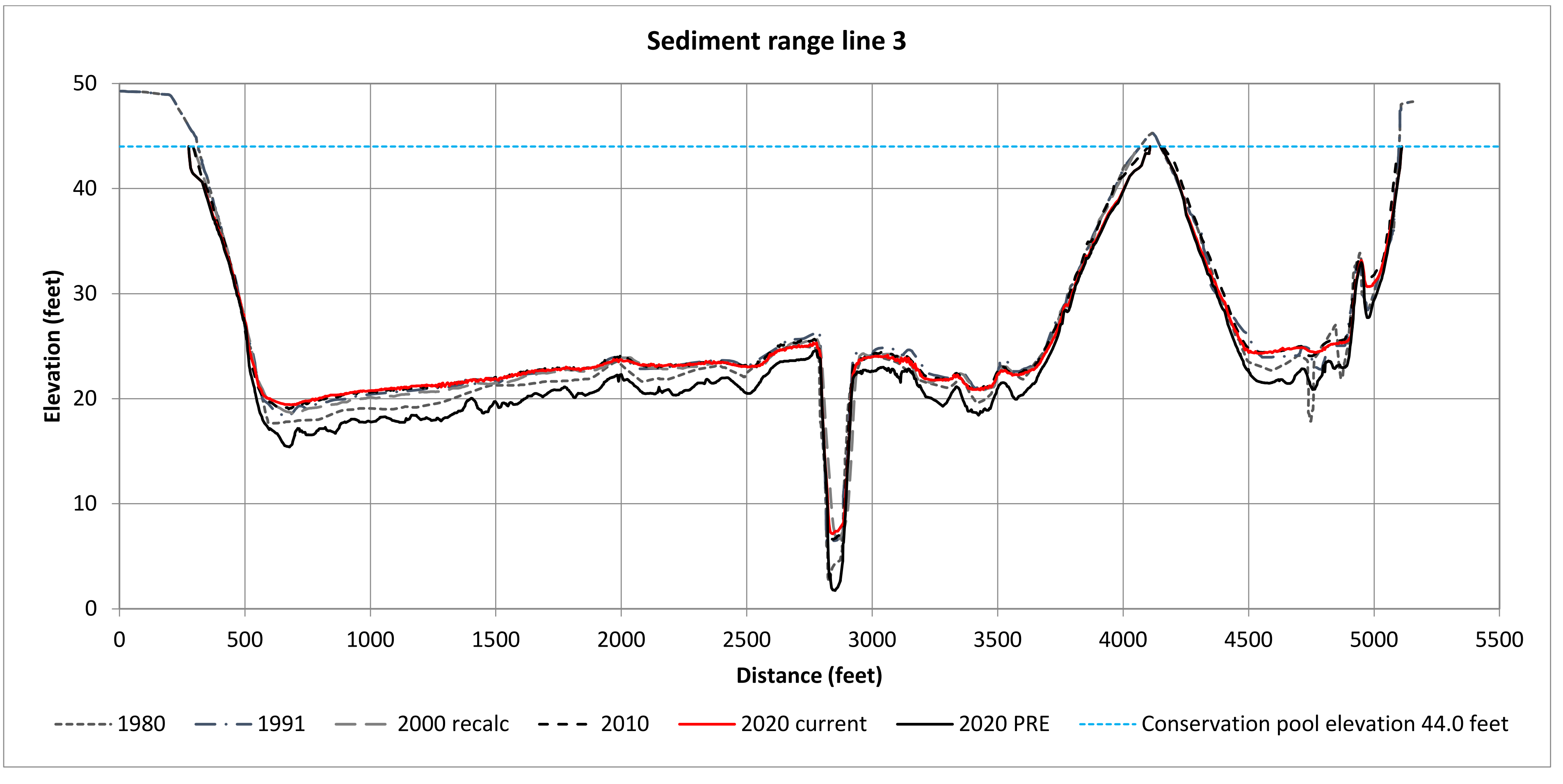
Sediment range line	X	Y
SR-10-L	2,731,896.73	13,567,731.41
SR-10-R P.O.T	2,731,933.43	13,567,330.41
SR-10-R	2,731,951.27	13,567,135.39
SR-21-L	2,757,060.22	13,552,613.16
SR-21-L P.O.T	2,756,972.24	13,552,661.34
SR-21-R	2,755,014.69	13,553,728.23
SR-22-L	2,762,581.46	13,552,537.66
SR-22-R P.O.T	2,761,998.20	13,554,365.98
SR-22-R	2,761,732.54	13,555,198.71
SR-23-L	2,762,526.36	13,558,687.96
SR-23-R P.O.T	2,759,461.73	13,557,029.63
SR-23-R	2,758,832.11	13,556,691.93
SR-24-L	2,764,571.34	13,564,438.34
SR-24-R	2,763,365.68	13,564,081.40
SR-25-L	2,772,501.47	13,567,105.08
SR-25-R	2,772,006.79	13,568,258.48
SR-26-L	2,777,668.45	13,572,051.95
SR-26-R	2,777,015.20	13,572,829.01
SR-31-L	2,763,861.99	13,565,598.46
SR-31-L	2,763,766.05	13,565,542.65
SR-31-R	2,763,079.55	13,565,142.02
SR-51-L	2,745,838.08	13,569,289.73
SR-51-R	2,744,096.06	13,568,436.11
SR-52-L	2,745,393.66	13,572,909.27
SR-52-R	2,744,669.10	13,572,268.89
SR-53-L	2,744,553.85	13,577,859.16
SR-53-R P.O.T	2,743,411.37	13,577,821.61
SR-53-R	2,742,999.88	13,577,808.09

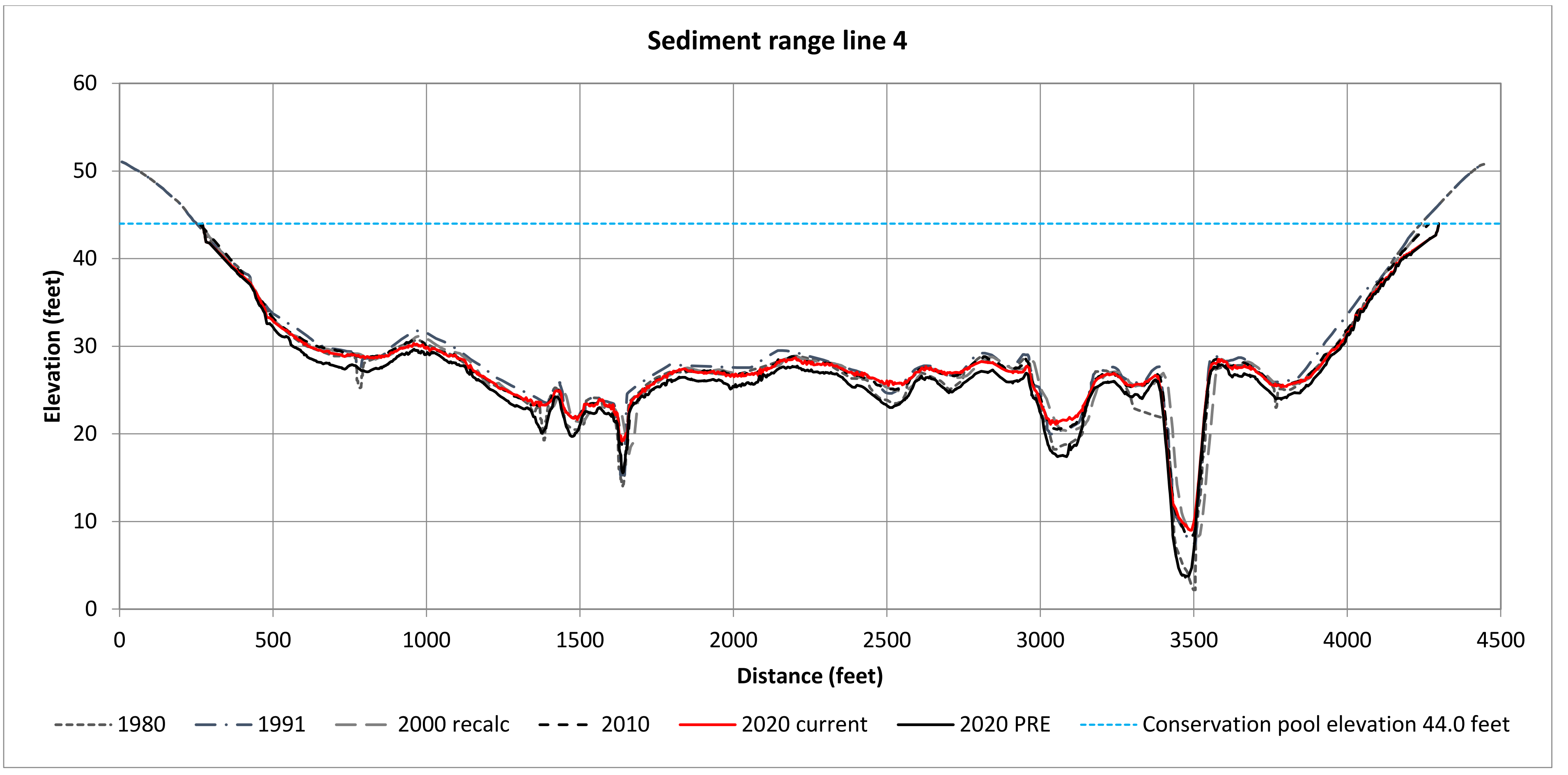
Source: (Ochs, 1982, Blanton and Ferrari, 1992)

Coordinates reported in NAD83 State Plane Texas South Central Zone (feet)

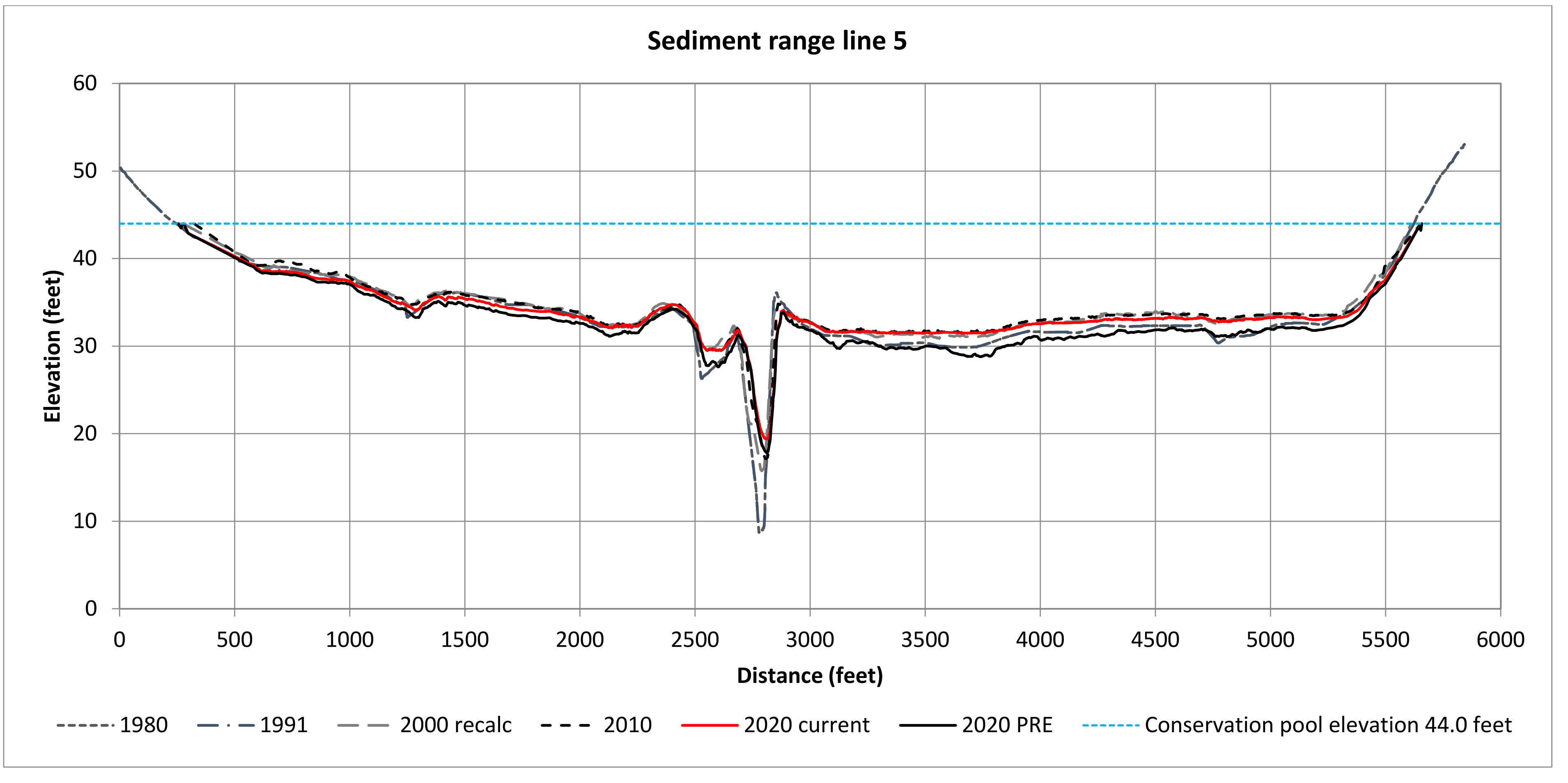

Sediment range line 1
Elevation (feet)
Distance (feet)
50
40
30
20
10
0
-10
500
1000
1500
2000
2500
3000
3500
4000
4500
5000
5500
6000
6500
7000
7500
1980
1991
2000 recalc
2010
2020 current
2020 PRE
Conservation pool elevation 44.0 feet


Sediment range line 2
Elevation (feet)
Distance (feet)
50
40
30
20
10
0
-10
0
1000
2000
3000
4000
5000
6000
7000
8000
9000
10000
1980
1991
2000 recalc
2010
2020 current
2020 PRE
Conservation pool elevation 44.0 feet

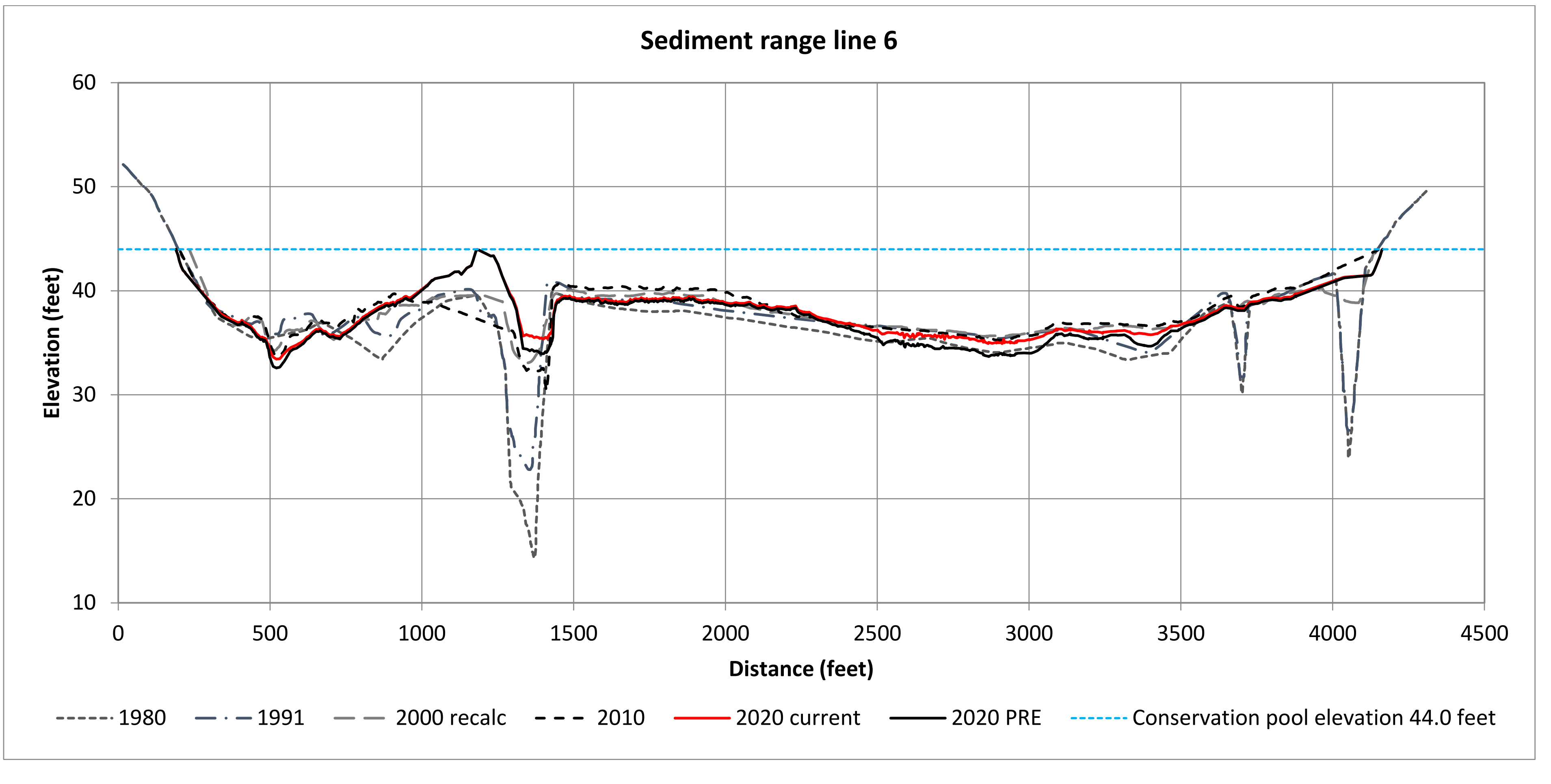

Sediment range line 3
Elevation (feet)
Distance (feet)
50
40
30
20
10
0
0
500
1000
1500
2000
2500
3000
3500
4000
4500
5000
5500
1980
1991
2000 recalc
2010
2020 current
2020 PRE
Conservation pool elevation 44.0 feet



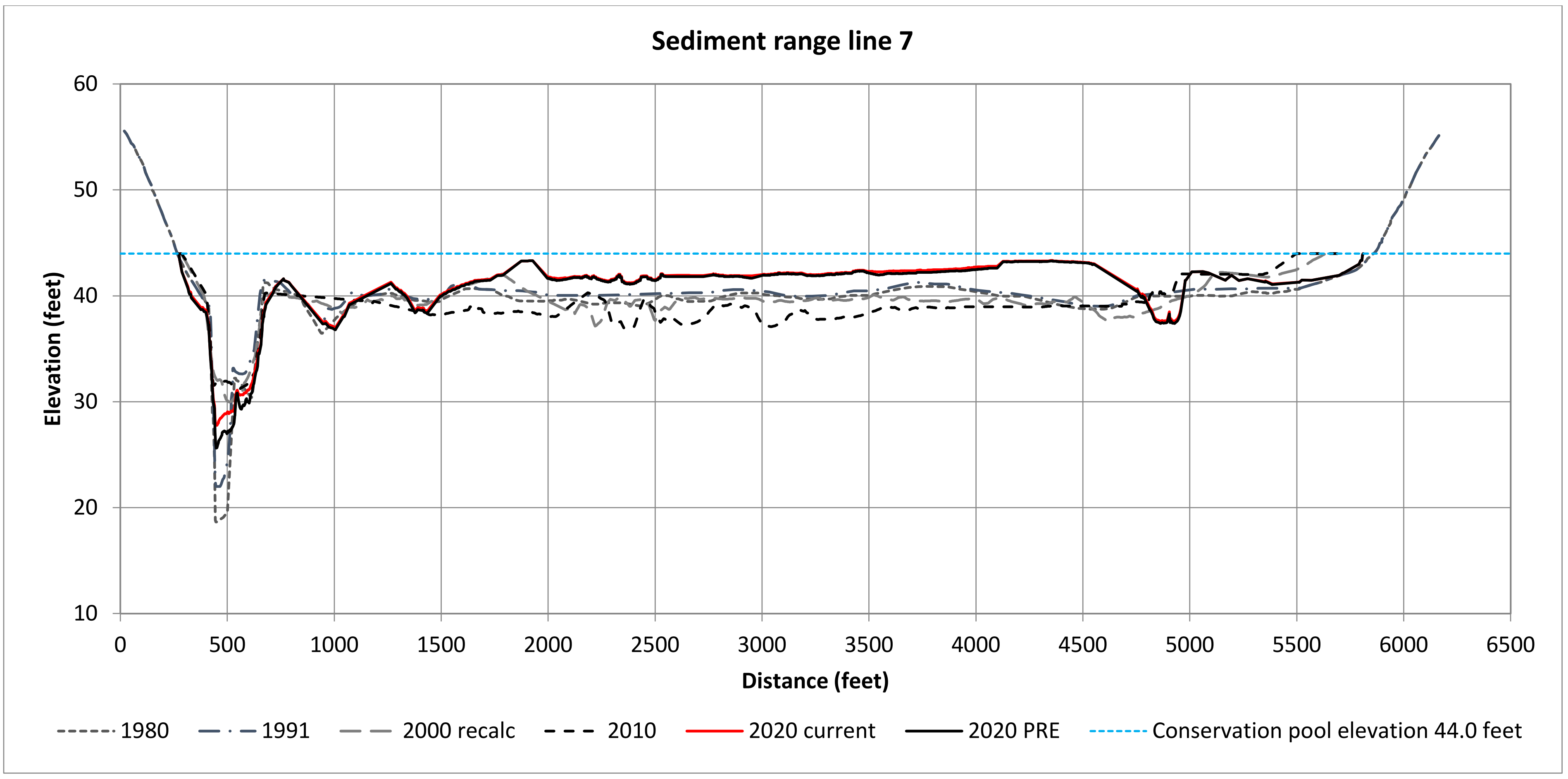
Sediment range line 4
Elevation (feet)
Distance (feet)
1980
1991
2000 recalc
2010
2020 current
2020 PRE
Conservation pool elevation 44.0 feet

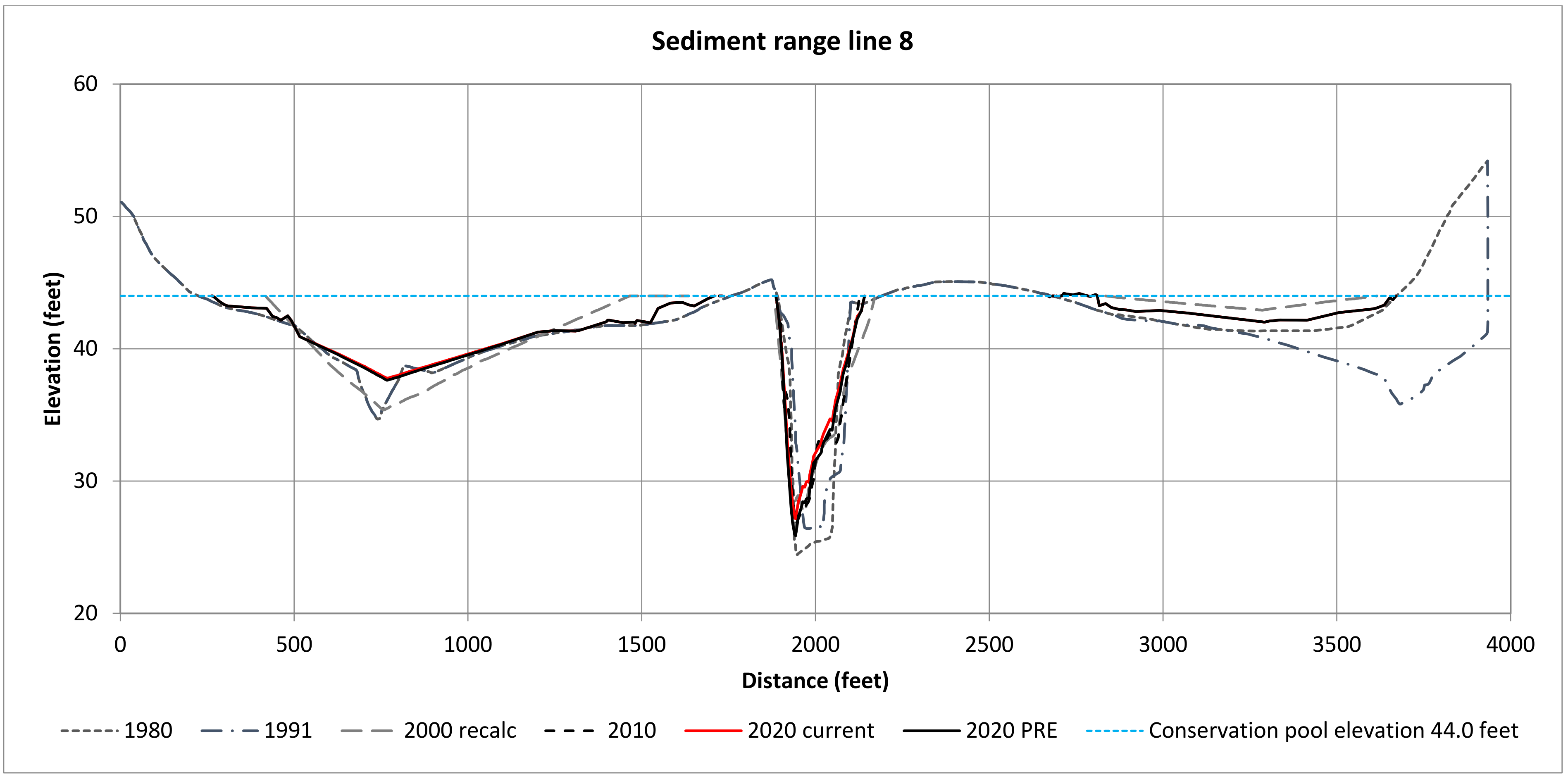


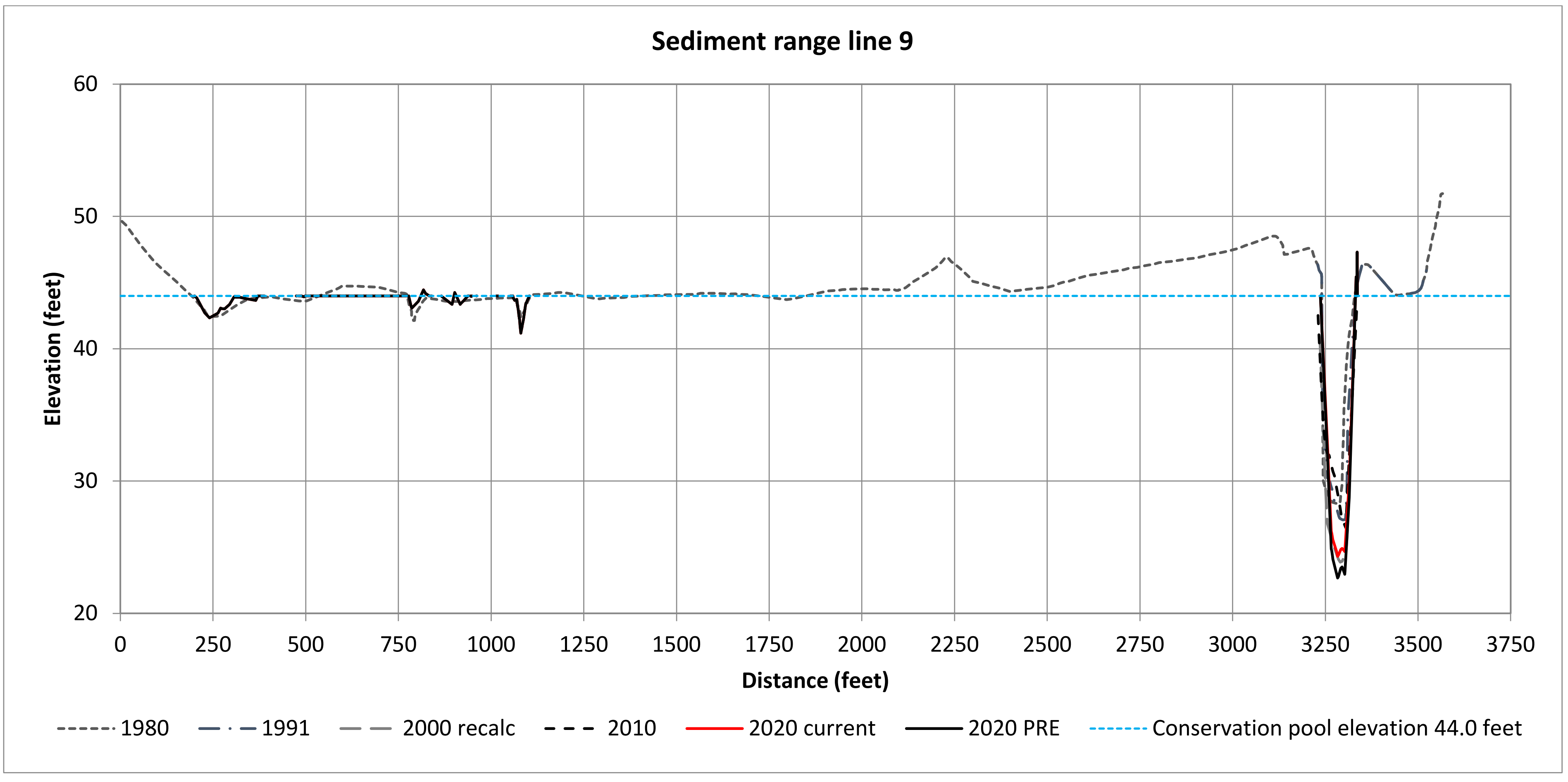
Sediment range line 5
Elevation (feet)
Distance (feet)
1980
1991
2000 recalc
2010
2020 current
2020 PRE
Conservation pool elevation 44.0 feet

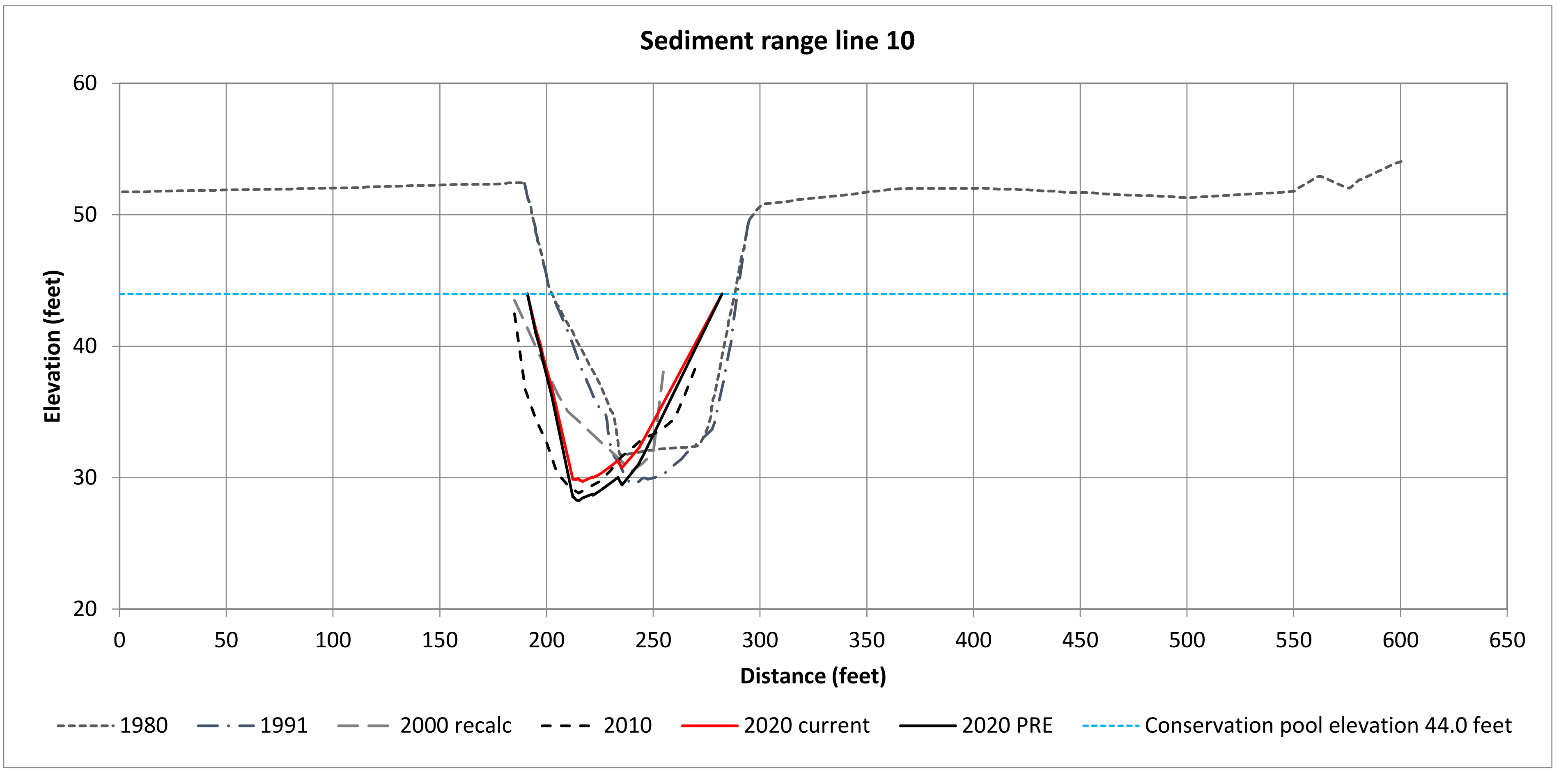


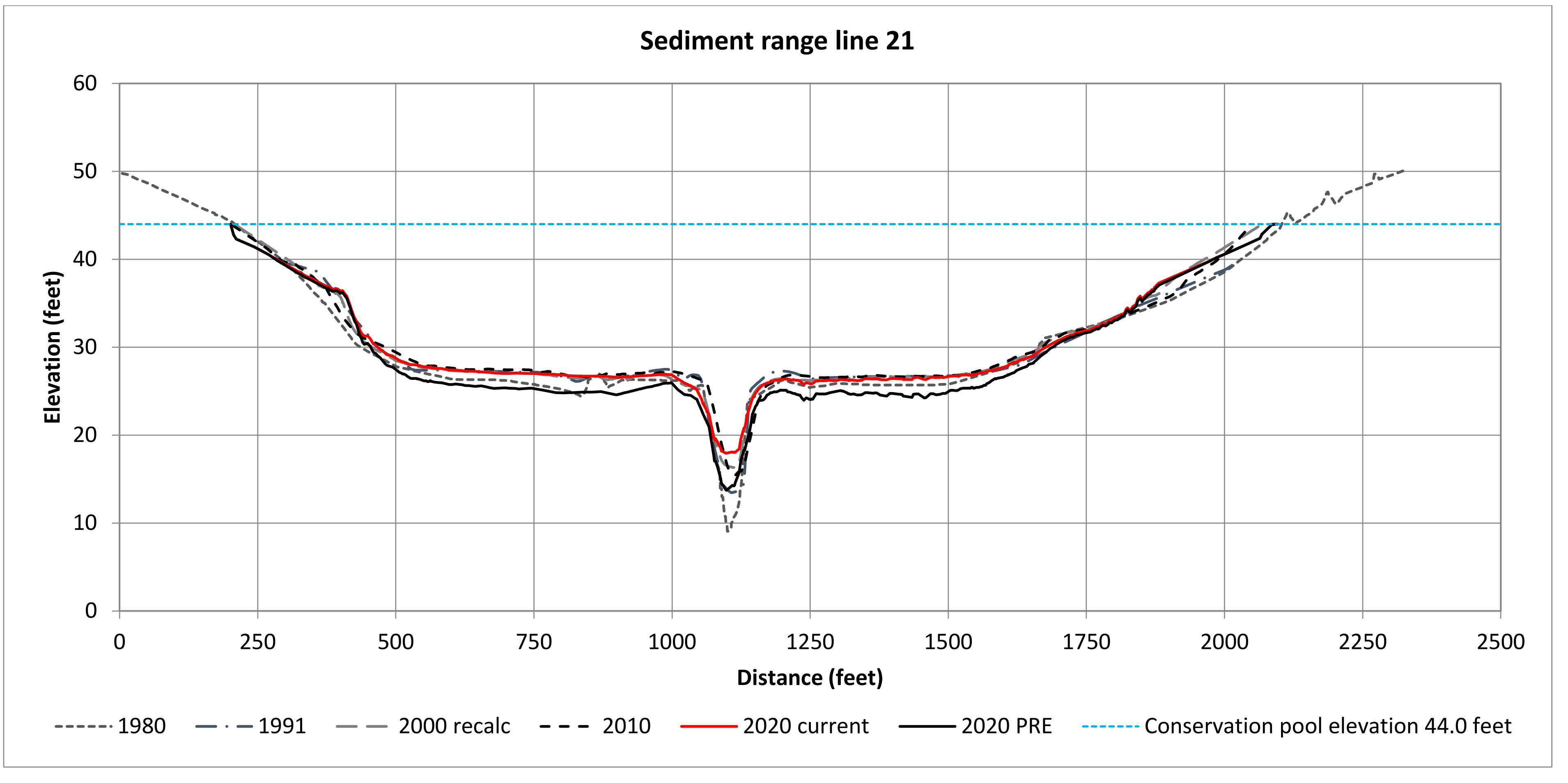
Sediment range line 6
Elevation (feet)
Distance (feet)
1980
1991
2000 recalc
2010
2020 current
2020 PRE
Conservation pool elevation 44.0 feet

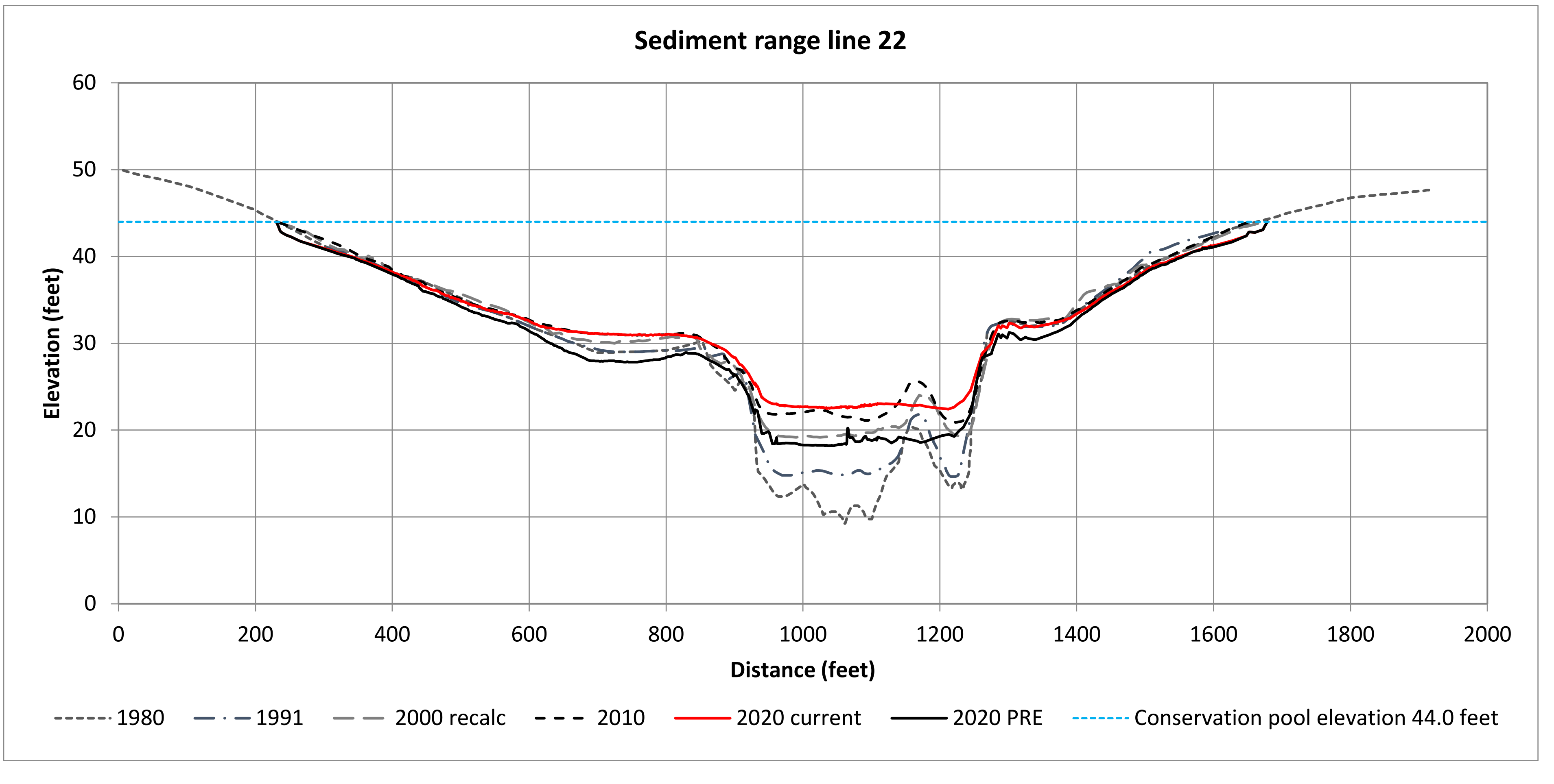

Sediment range line 7
Elevation (feet)
Distance (feet)
60
50
40
30
20
10
0
500
1000
1500
2000
2500
3000
3500
4000
4500
5000
5500
6000
6500
1980
1991
2000 recalc
2010
2020 current
2020 PRE
Conservation pool elevation 44.0 feet

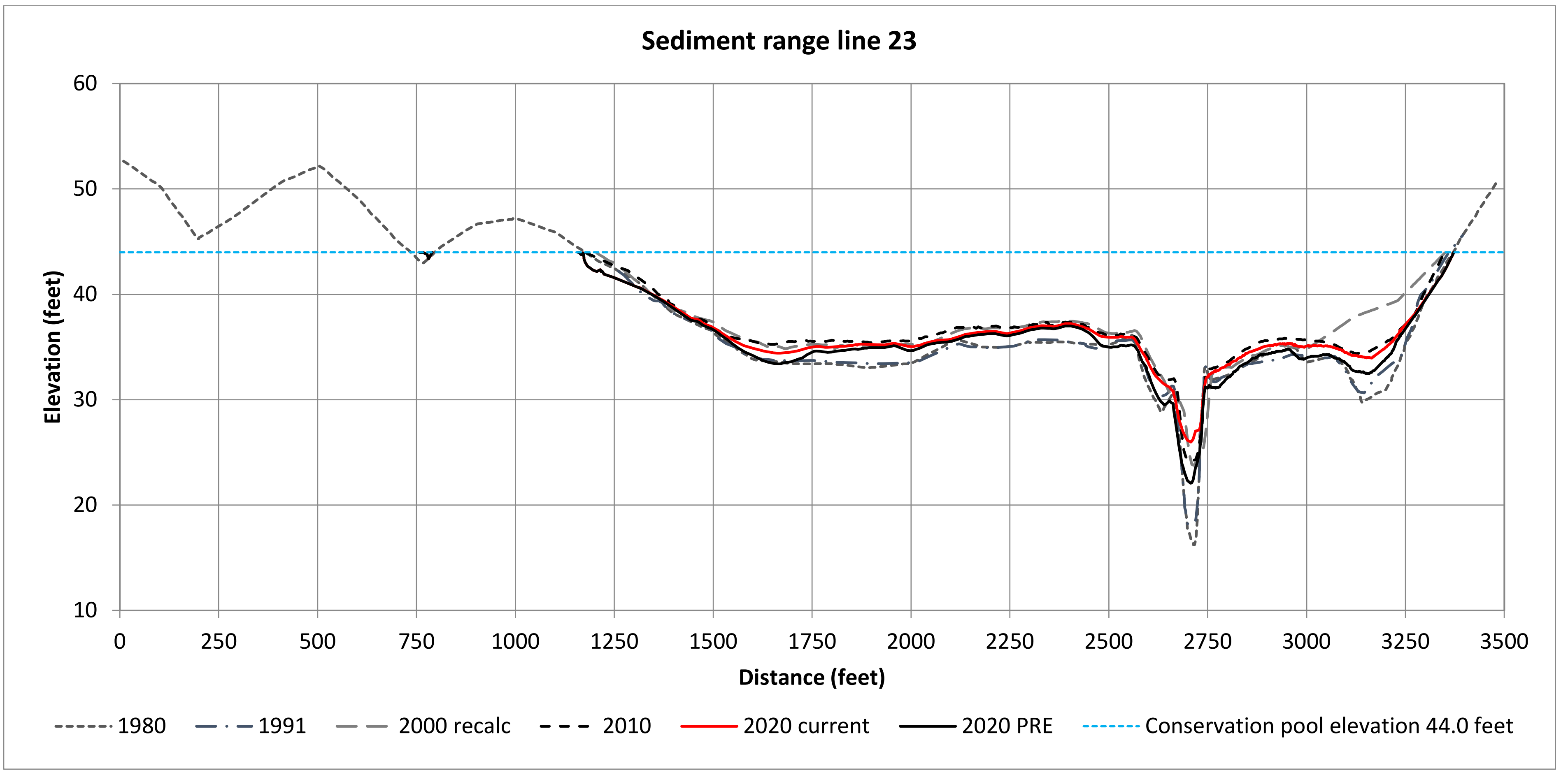

Sediment range line 8
Elevation (feet)
Distance (feet)
60
50
40
30
20
0
500
1000
1500
2000
2500
3000
3500
4000
1980
1991
2000 recalc
2010
2020 current
2020 PRE
Conservation pool elevation 44.0 feet


Sediment range line 9
Elevation (feet)
Distance (feet)
60
50
40
30
20
0
250
500
750
1000
1250
1500
1750
2000
2250
2500
2750
3000
3250
3500
3750
1980
1991
2000 recalc
2010
2020 current
2020 PRE
Conservation pool elevation 44.0 feet

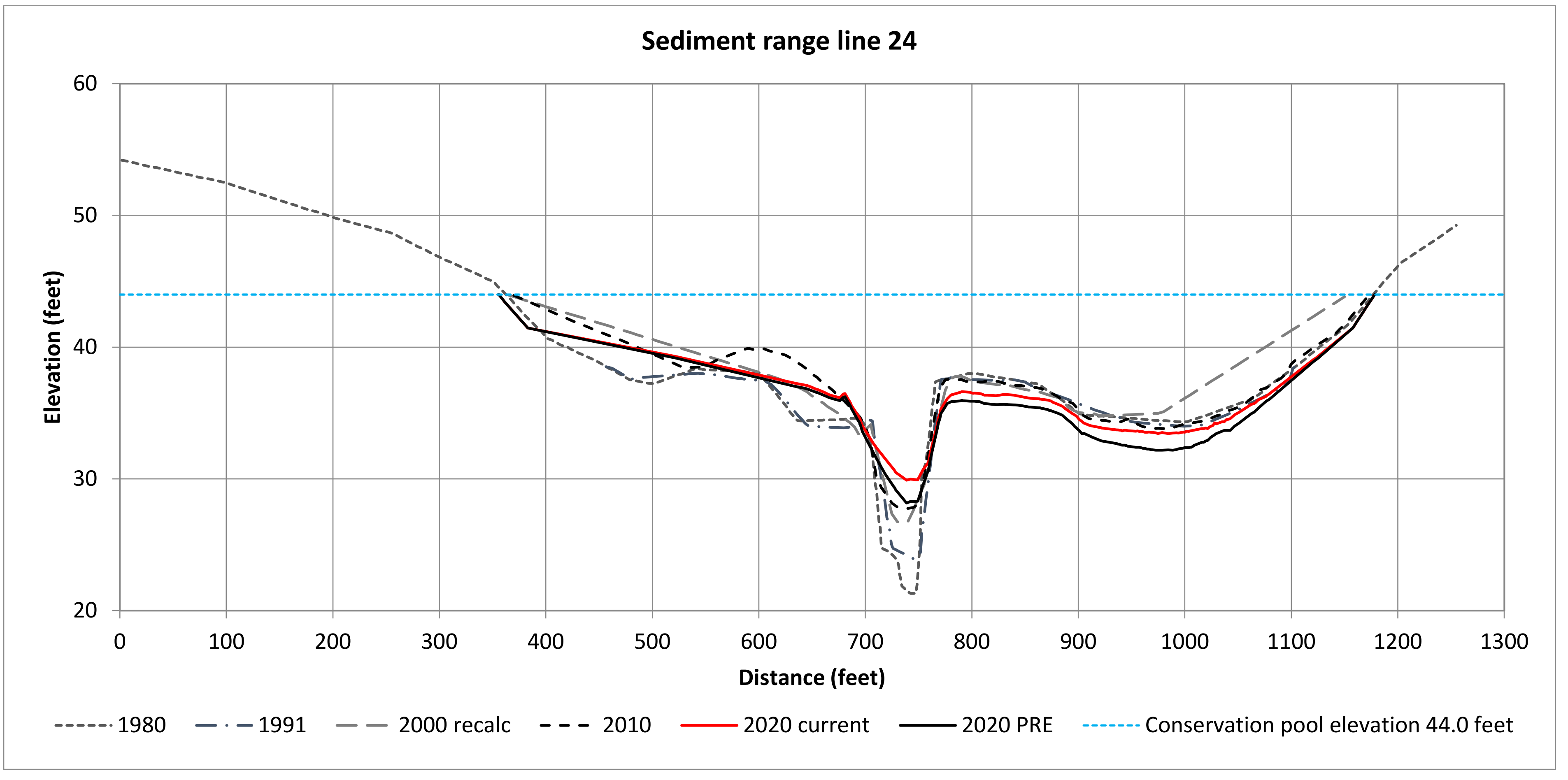

Sediment range line 10
Elevation (feet)
60
50
40
30
20
0
50
100
150
200
250
300
350
400
450
500
550
600
650
Distance (feet)
1980
1991
2000 recalc
2010
2020 current
2020 PRE
Conservation pool elevation 44.0 feet


Sediment range line 21
Elevation (feet)
60
50
40
30
20
10
0
0
250
500
750
1000
1250
1500
1750
2000
2250
2500
Distance (feet)
1980
1991
2000 recalc
2010
2020 current
2020 PRE
Conservation pool elevation 44.0 feet

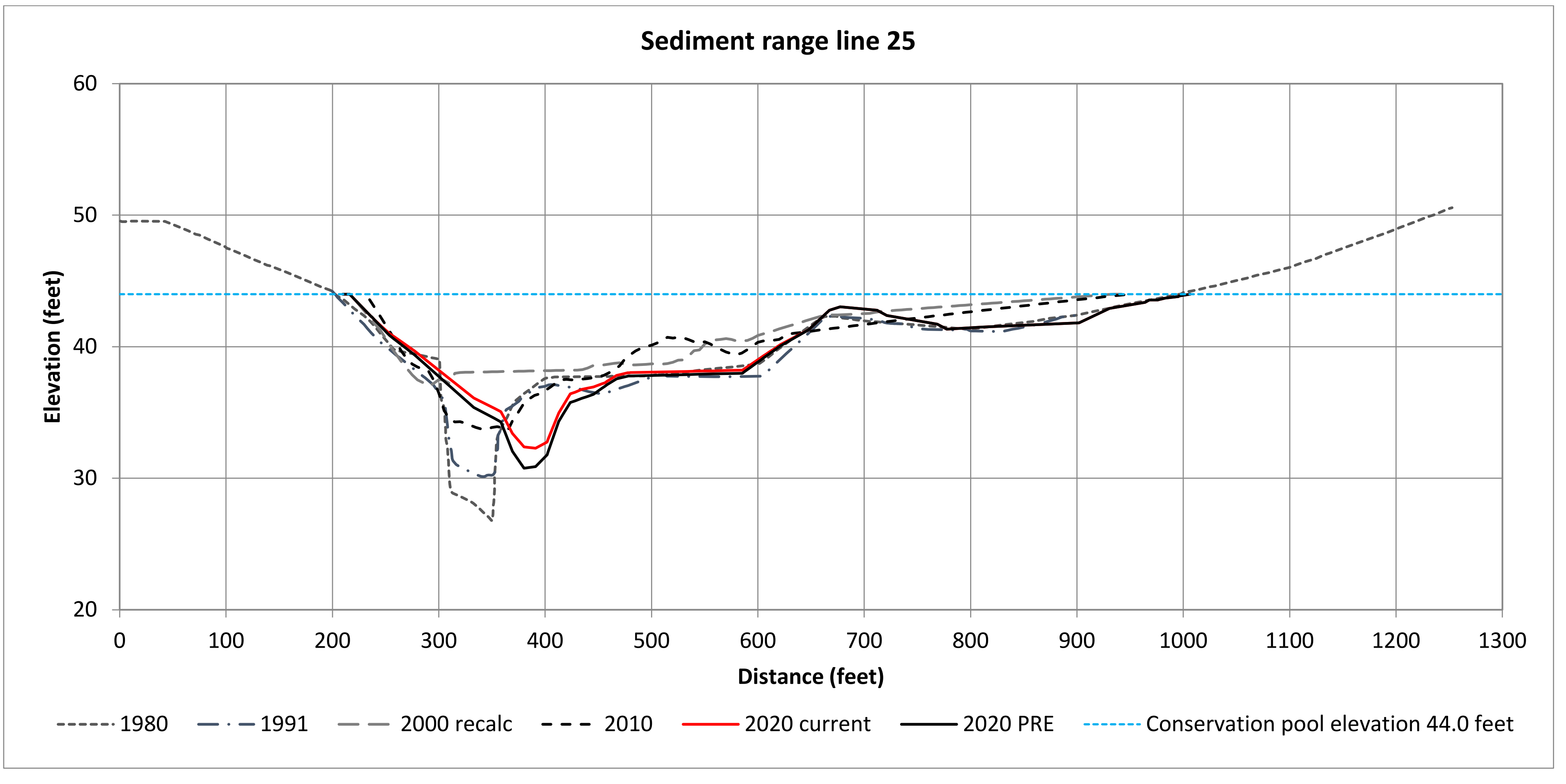

Sediment range line 22
Elevation (feet)
60
50
40
30
20
10
0
0
200
400
600
800
1000
1200
1400
1600
1800
2000
Distance (feet)
1980
1991
2000 recalc
2010
2020 current
2020 PRE
Conservation pool elevation 44.0 feet



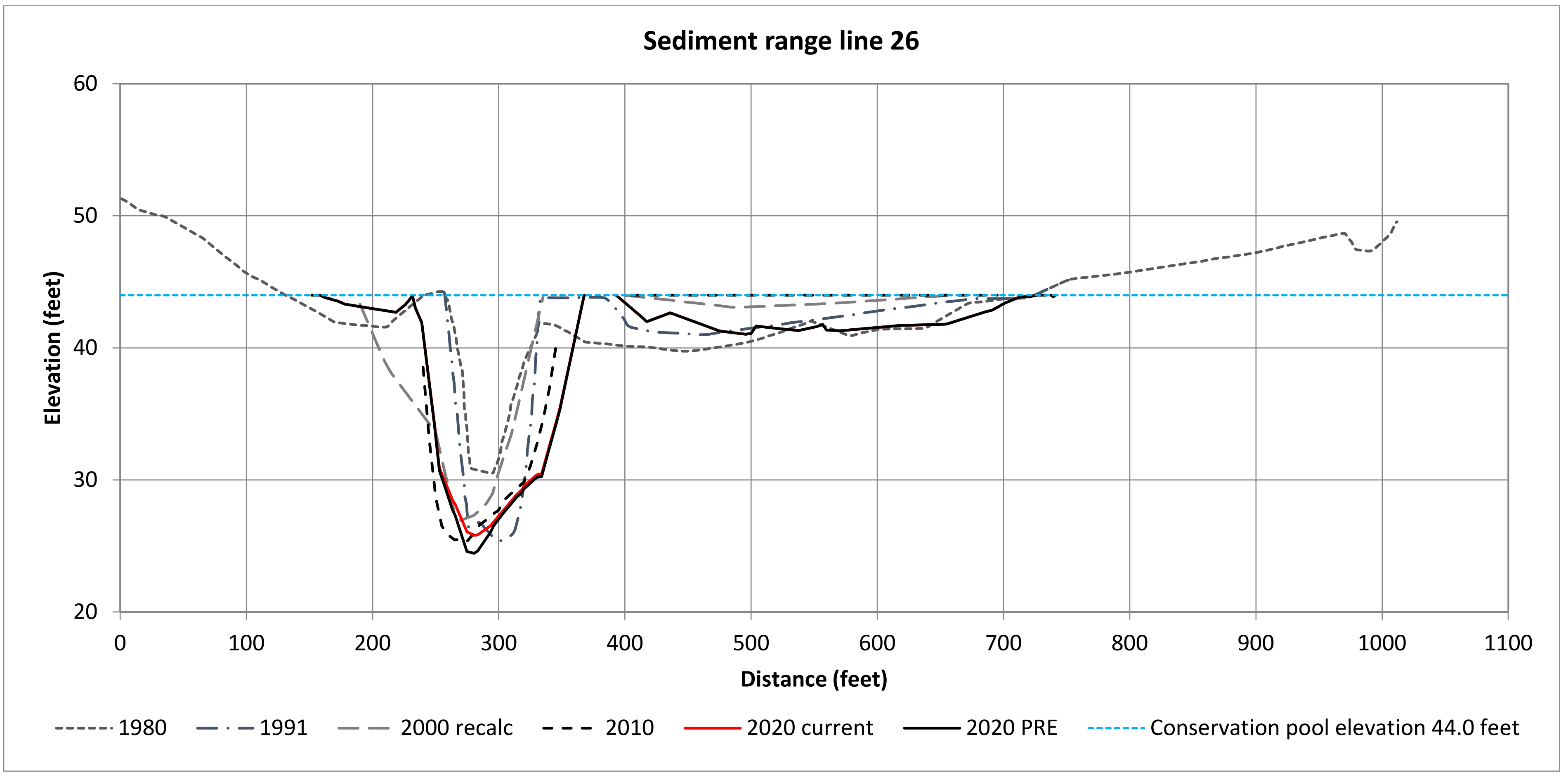
Sediment range line 23
Elevation (feet)
60
50
40
30
20
10
0
250
500
750
1000
1250
1500
1750
2000
2250
2500
2750
3000
3250
3500
Distance (feet)
1980
1991
2000 recalc
2010
2020 current
2020 PRE
Conservation pool elevation 44.0 feet

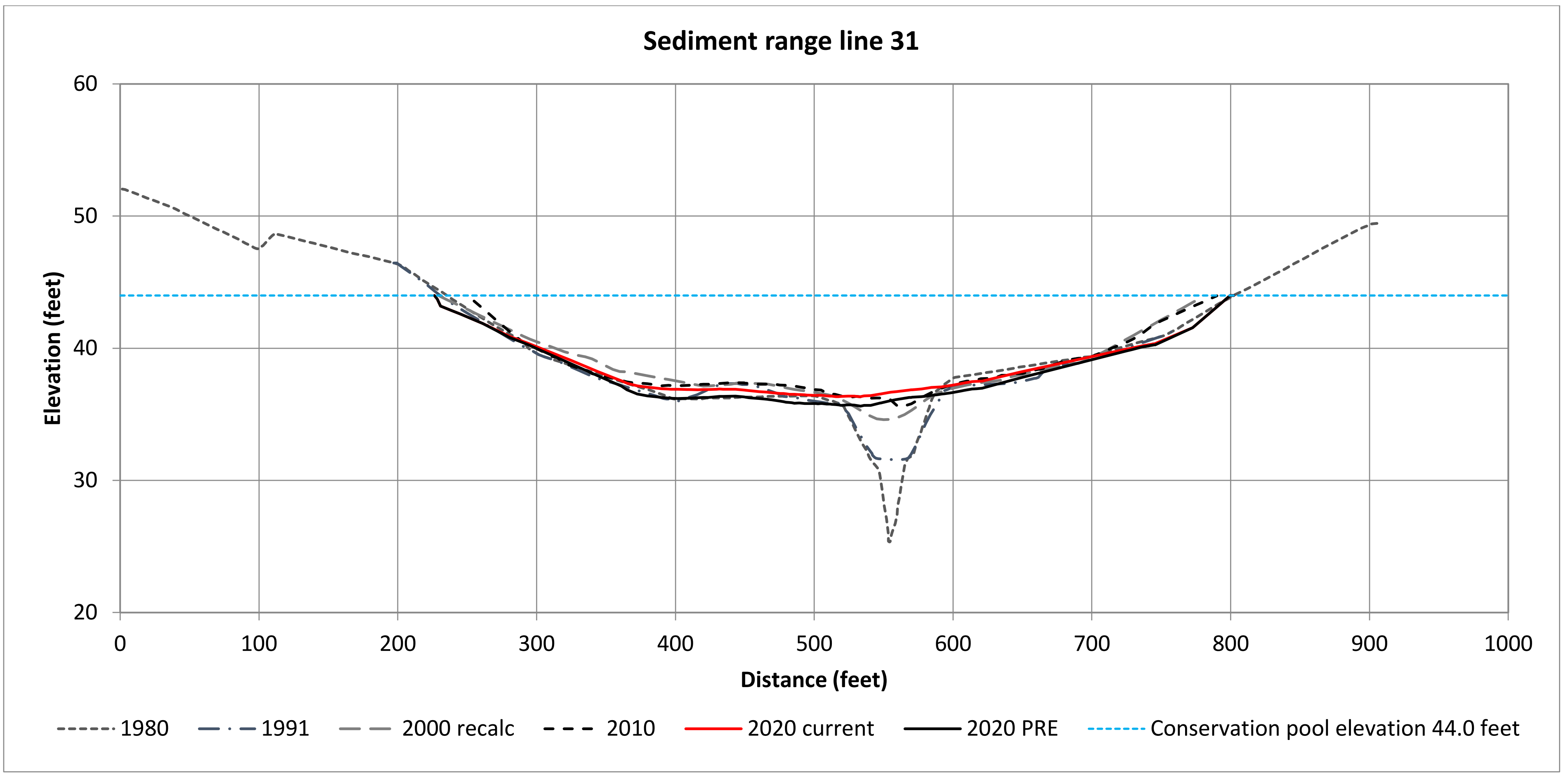


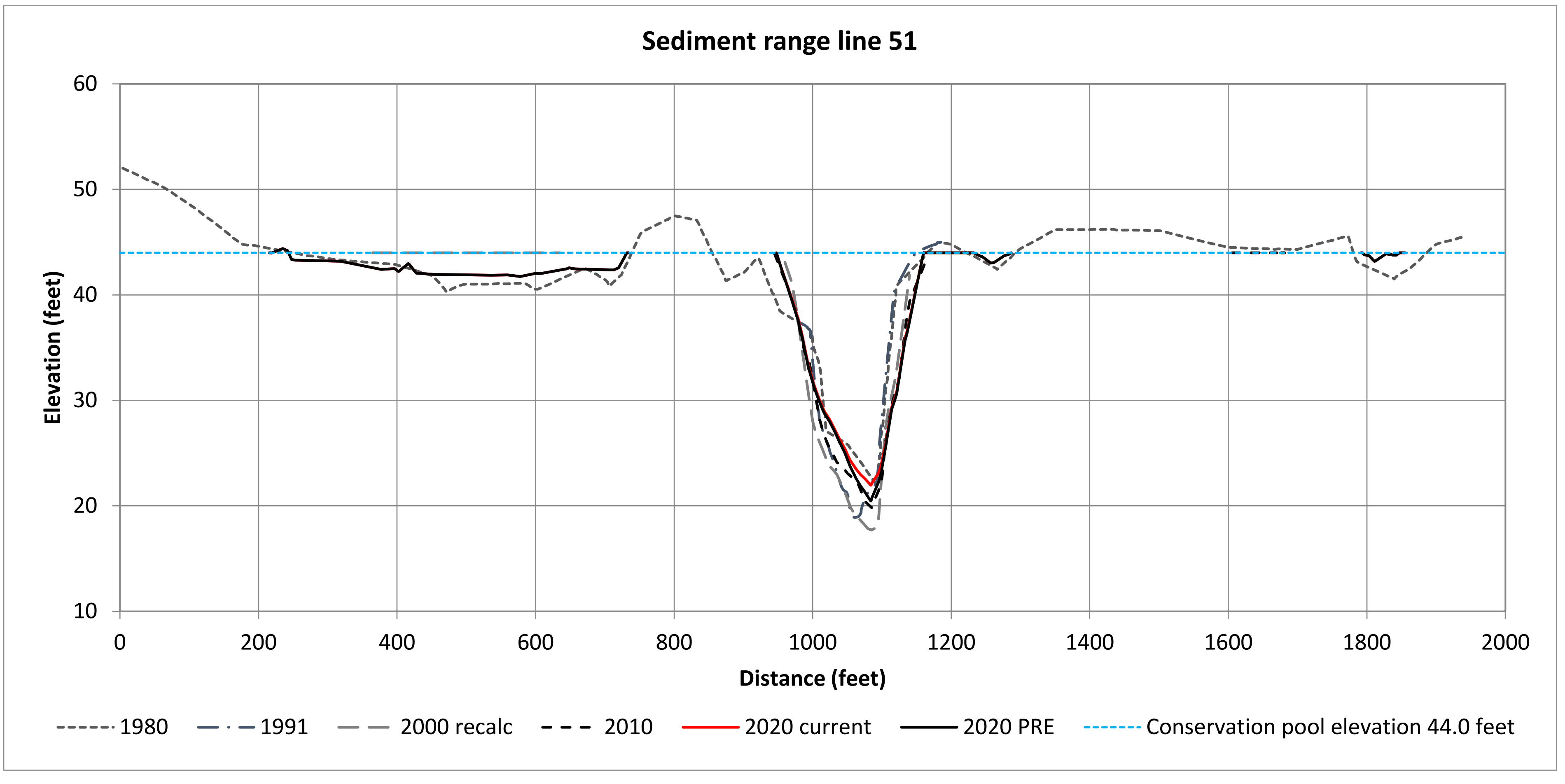
Sediment range line 24
Elevation (feet)
60
50
40
30
20
0
100
200
300
400
500
600
700
800
900
1000
1100
1200
1300
Distance (feet)
1980
1991
2000 recalc
2010
2020 current
2020 PRE
Conservation pool elevation 44.0 feet

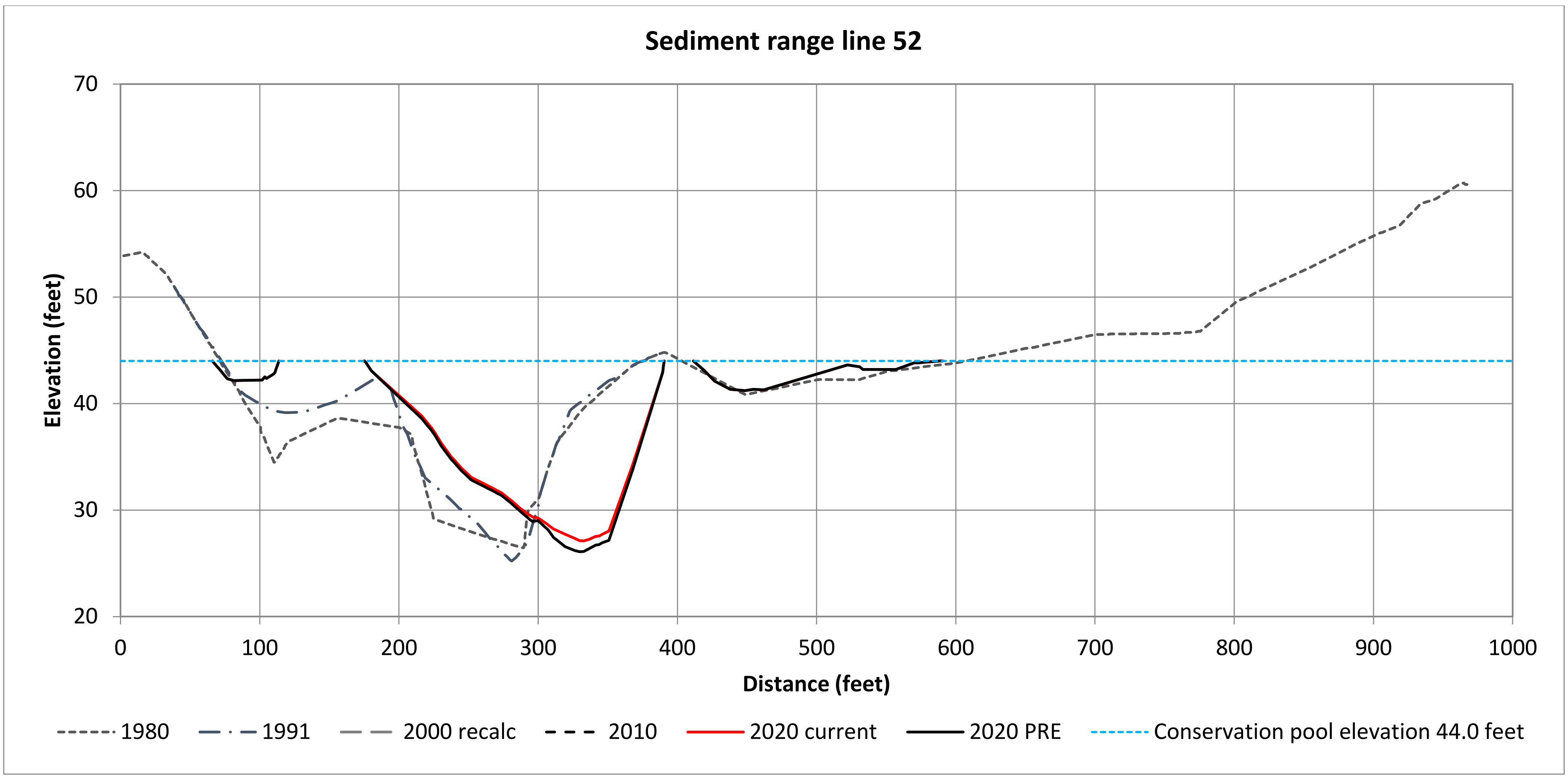


Sediment range line 25
Elevation (feet)
60
50
40
30
20
0
100
200
300
400
500
600
700
800
900
1000
1100
1200
1300
Distance (feet)
1980
1991
2000 recalc
2010
2020 current
2020 PRE
Conservation pool elevation 44.0 feet

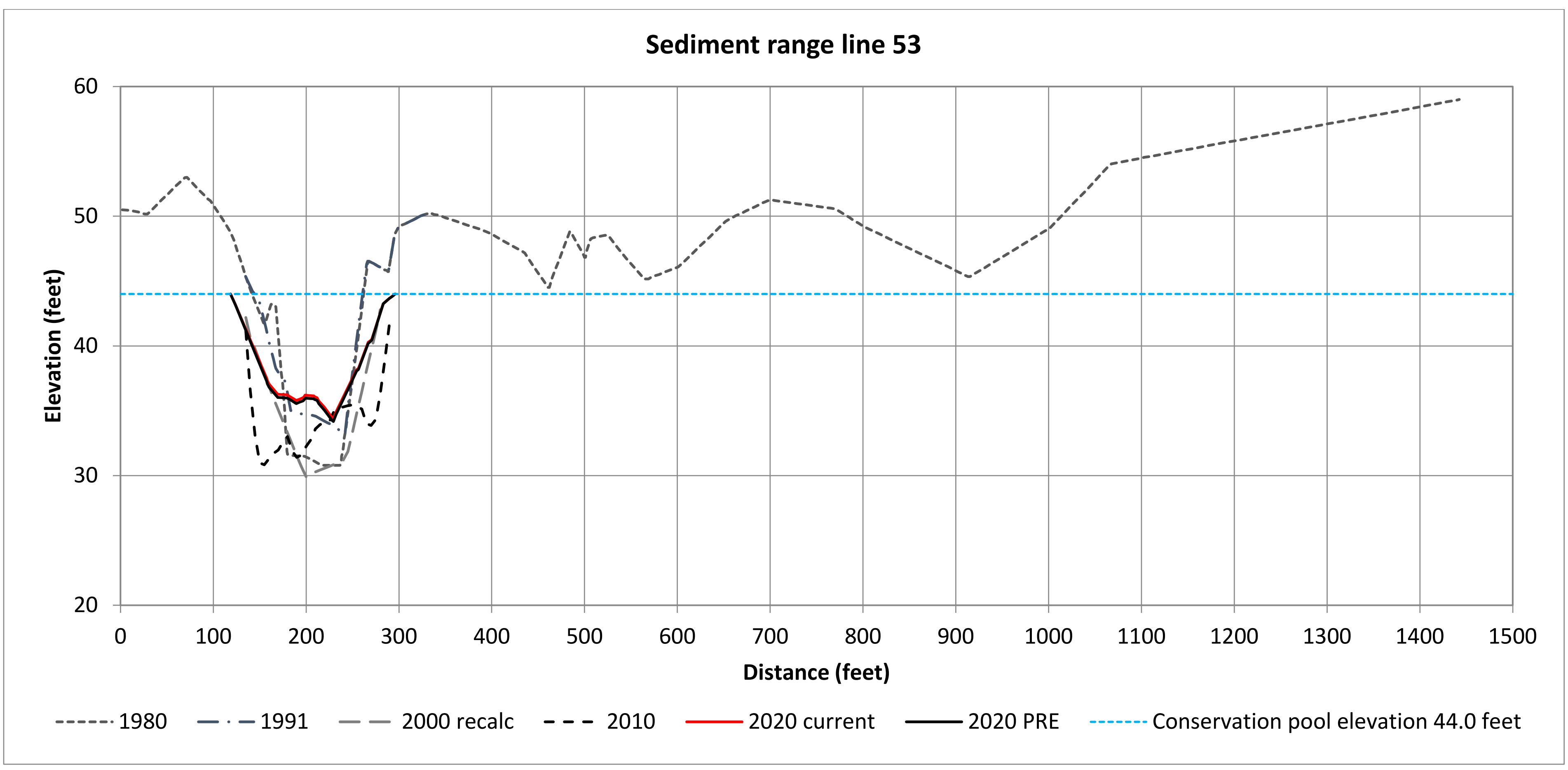

Sediment range line 26
Elevation (feet)
Distance (feet)
60
50
40
30
20
0
100
200
300
400
500
600
700
800
900
1000
1100
1980
1991
2000 recalc
2010
2020 current
2020 PRE
Conservation pool elevation 44.0 feet


Sediment range line 31
Elevation (feet)
Distance (feet)
60
50
40
30
20
0
100
200
300
400
500
600
700
800
900
1000
1980
1991
2000 recalc
2010
2020 current
2020 PRE
Conservation pool elevation 44.0 feet


Sediment range line 51
Elevation (feet)
Distance (feet)
60
50
40
30
20
10
0
200
400
600
800
1000
1200
1400
1600
1800
2000
1980
1991
2000 recalc
2010
2020 current
2020 PRE
Conservation pool elevation 44.0 feet



Sediment range line 52
Elevation (feet)
70
60
50
40
30
20
0
100
200
300
400
500
600
700
800
900
1000
Distance (feet)
1980
1991
2000 recalc
2010
2020 current
2020 PRE
Conservation pool elevation 44.0 feet



Sediment range line 53
Elevation (feet)
60
50
40
30
20
0
100
200
300
400
500
600
700
800
900
1000
1100
1200
1300
1400
1500
Distance (feet)
1980
1991
2000 recalc
2010
2020 current
2020 PRE
Conservation pool elevation 44.0 feet

Figure 6

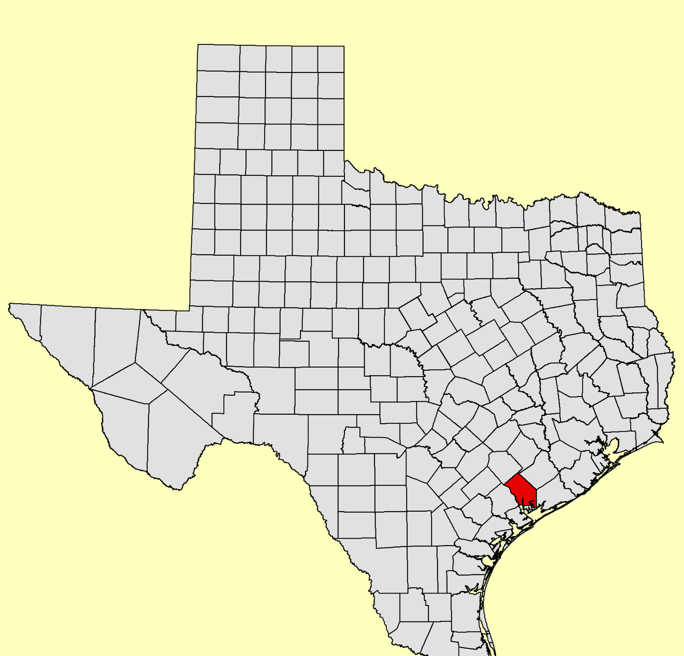
Contours
feet NGVD29

- 40
- 35
- 30
- 25
- 20
- 15
- 10
- 5
- 0
- -5
- -10

Lake Texana Conservation pool elevation 44.0 feet NGVD29

Islands

Projection: NAD83
State Plane Texas
South Central Zone (feet)



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 Texana. The Texas Water Development Board makes no representations nor assumes any liability.