Volumetric and Sedimentation Survey of LAKE CHEROKEE

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Texas Water Development Board

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Prepared for:

Cherokee Water Company

This report was prepared by staff of the Surface Water Division:

Mindy Conyers, Ph.D., Manager
Holly Holmquist
Khan Iqbal
Josh Duty
Dane McCollum

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P.O. Box 13231, 1700 N. Congress Ave.
Austin, TX 78711-3231, www.twdb.texas.gov
Phone (512) 463-7847, Fax (512) 475-2053

Executive summary

In November 2022, at the request of the City of Longview, the Texas Water Development Board (TWDB) entered into an agreement with the Cherokee Water Company to perform a volumetric and sedimentation survey of Lake Cherokee (Gregg and Rusk counties, Texas). Surveying was performed using a multi-frequency (200 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.

Cherokee Dam, impounding Lake Cherokee, is located on Cherokee Bayou, approximately 12 miles southeast of Longview, in southeastern Gregg and northeastern Rusk Counties, Texas. The conservation pool elevation of Lake Cherokee is 280.0 feet above mean sea level (NGVD29). The TWDB collected bathymetric data for Lake Cherokee between January 25 through January 27, 2023, while daily average water surface elevations measured 280.54, 280.60, and 280.58 feet NGVD29, respectively. Additional data was collected on July 11, 2023, while the daily average water surface elevation measured 280.01 feet NGVD29.

The 2023 TWDB volumetric survey indicates Lake Cherokee has a total reservoir capacity of 42,791 acre-feet and encompasses 3,464 acres at conservation pool elevation (280.0 feet NGVD29). Previous capacity estimates at elevation 280.0 feet include a re-calculated original design estimate of 49,295 acre-feet and a 1960 estimate of 46,705 acre-feet by the U.S. Soil Conservation Service, and three prior TWDB survey estimates in 1996, 2003, and 2015, of 42,314 acre-feet, 44,440 acre-feet, and 44,475 acre-feet, respectively. Differences in reservoir conditions as well as differences in the methodologies used among surveys can affect area and volume calculations. For this reason, the TWDB does not recommend comparing between volumetric surveys to determine loss of area or capacity. Information from past surveys is thus presented for informational purposes only, and the results of the current study should be considered as the best available science.

The 2023 TWDB sedimentation survey measured 2,921 acre-feet of sediment. The sedimentation survey indicates sediment accumulation is greatest upstream of the highway FM 2011 Silvey Bridge and in the Mud Creek and Lee Creek tributaries. The TWDB recommends that reservoirs be resurveyed approximately every 10 years or following a major event that results in increased sedimentation or scouring within the reservoir.

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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 November 2022, at the request of the City of Longview, the TWDB entered into an agreement with the Cherokee Water Company, to perform a volumetric and sedimentation survey of Lake Cherokee (Gregg and Rusk counties, Texas) (Texas Water Development Board, 2022). 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 A, B, 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 Cherokee general information

Cherokee Dam, impounding Lake Cherokee, is located on Cherokee Bayou, a tributary of the Sabine River, approximately 12 miles southeast of Longview, in southeastern Gregg and northeastern Rusk Counties, Texas (Figure 1). Cherokee Dam and Lake Cherokee are owned and operated by the Cherokee Water Company. Construction of Cherokee Dam began on February 26, 1948, and deliberate impoundment of water began on October 1, 1948. Cherokee Dam was completed on November 19, 1948 (TWDB, 1974). The reservoir was built primarily for municipal water supply storage for the City of Longview and is used for cooling at the Knox Lee Power plant operated by Southwestern Electric Power Company (SWEPCO) an American Electric Power (AEP) Company (Texas Water Development Board, 2016; Southwestern Electric Power Company, 2023). Additional pertinent data about Cherokee Dam and Lake Cherokee can be found in Table 1.

Water rights for Lake Cherokee have been appropriated to the City of Longview through Certificate of Adjudication No. 05-4642 (Texas Commission on Environmental Quality, 2023). The complete certificate is on file at the Texas Commission on Environmental Quality (TCEQ).

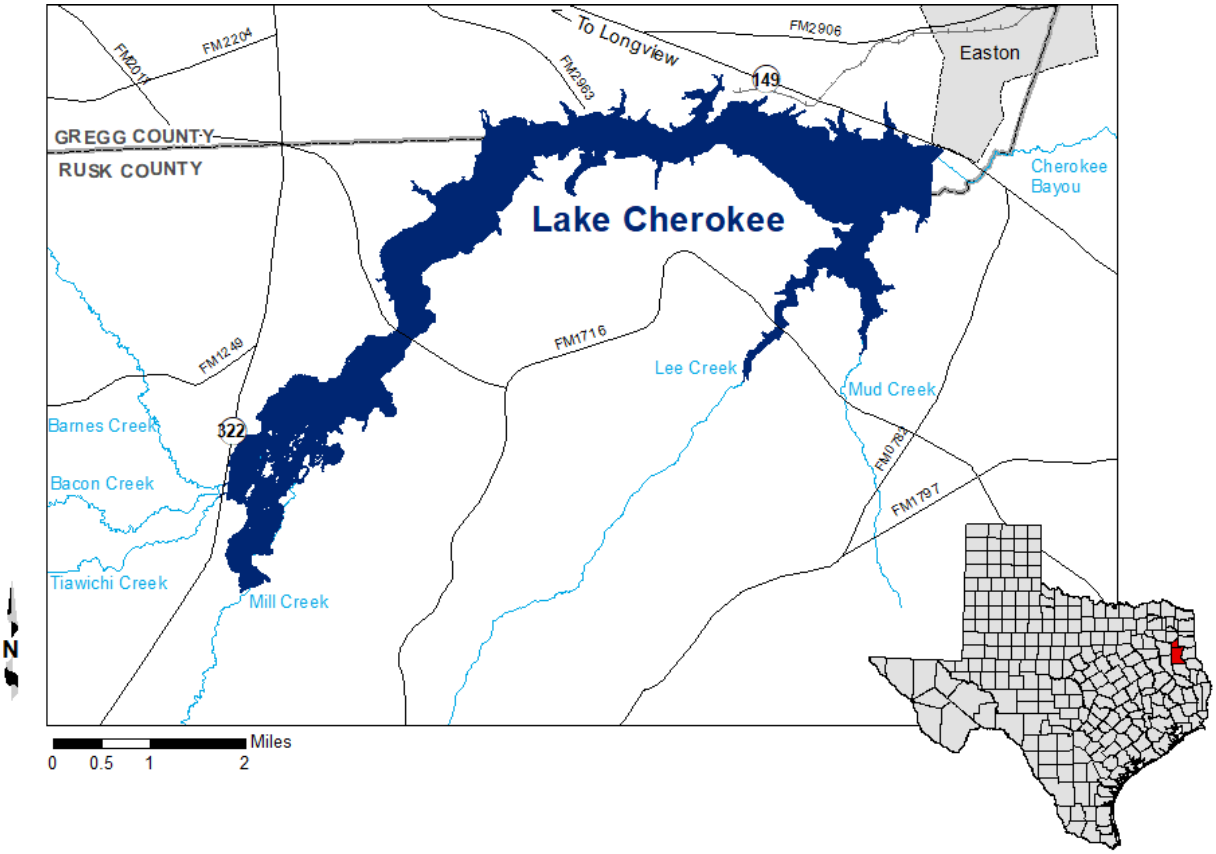

Figure 1. Location map.

Table 1. Pertinent Data for Cherokee Dam and Lake Cherokee

Owner(s)	
Cherokee Water Company	
Engineer	
Powell and Powell	
Location	
On Cherokee Bayou approximately 8 miles upstream from the confluence with the Sabine River, located in Gregg and Rusk counties, 12 miles southeast of Longview, Texas	
Purpose	
Municipal water supply storage and cooling operations for the Knox Lee Power Plant	
Drainage Area	
Total Drainage Area	158 square miles
Dam	
Type	Earthfill
Total Length (including spillway)	4,000 feet
Maximum Height	45 feet
Top Width	20.0 feet
Spillway (emergency)	
Location	near right end of dam
Type	Cut in natural ground
Crest Elevation	287.7 feet above mean sea level
Length	160.0 feet net at crest
Spillway (service)	
Location	Left end of dam
Type	Uncontrolled concrete structure
Crest Elevation	280.0 feet above mean sea level
Length	828± feet
Outlet Works	
Type	Concrete pipe, 18-inch diameter
Invert elevation	260.0 feet above mean sea level
Control	Gate valve operated from tower

Reservoir Data (Based on 2023 TWDB survey)

Feature	**Elevation (feet above mean sea level[a])**	**Capacity (acre-feet)**	**Area (acres)**
Top of dam	295.0	119,198	6,729
Top of design flood pool	291.0	94,148	5,789
Emergency spillway crest	287.7	76,361	5,039
Service spillway crest/ Conservation pool elevation	280.0	42,791	3,464
Outlet works invert elevation	260.0	4,206	823
Conservation storage capacity[b]	—	38,585	—

Sources: Texas Water Development Board, 1974.

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 Cherokee

Datum

The vertical datum used during this survey is the National Geodetic Vertical Datum 1929 (NGVD29). This datum was converted from the North American Vertical Datum 1988 that is utilized by the United States Geological Survey (USGS) for the reservoir elevation gage *USGS 08021400 Lk Cherokee nr Tatum, TX* (U.S. Geological Survey, 2023). 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 adjusted to the NGVD29 datum. Conversion from NAVD88 to NGVD29 was made by adding 0.108 feet from values provided by the USGS gage. This vertical datum transformation offset for the conversion from NAVD88 to NGVD29 was determined by applying the National Oceanic and Atmospheric Administration National Geodetic Survey's Coordinate Conversion and Transformation Tool (NCAT) (National Geodetic Survey, 2023) to a single reference point in the vicinity of the survey, the reservoir elevation gage *USGS 08021400 Lk Cherokee nr Tatum, TX Latitude 32°22'09.10" N, Longitude 94°40'06.83" W NAD83.* The horizontal datum used for this report is North American Datum 1983 (NAD83), and the horizontal coordinate system is State Plane Texas North Central Zone (feet).

TWDB bathymetric and sedimentation data collection

The TWDB collected bathymetric data for Lake Cherokee between January 25 through January 27, 2023, while daily average water surface elevations measured 280.54, 280.60, and 280.58 feet NGVD29, respectively. Additional data was collected on July 11, 2023, while the daily average water surface elevation measured 280.01 feet NGVD29. For data collection, the TWDB used a Specialty Devices, Inc. (SDI), single-beam, multi-frequency (200 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 lines also were used by the TWDB for the *Volumetric and Sedimentation Survey of Lake Cherokee, April 2015 Survey* (Texas Water Development Board, 2016a). 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 2023 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 July 31 through August 3, 2023, 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.

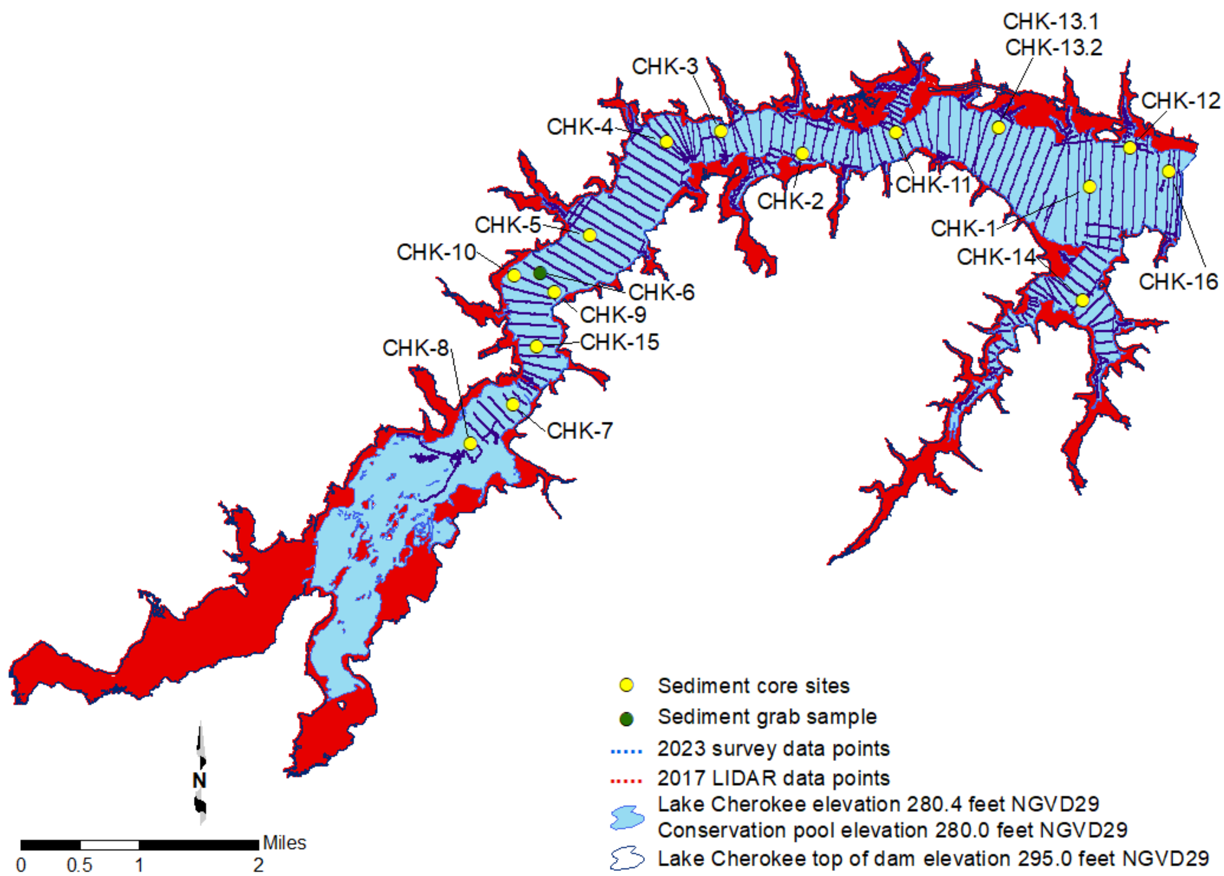

Figure 2. **2023 TWDB sounding data (*blue dots*), sediment coring locations (*yellow and green circles*), and 2017 LIDAR data for bathymetric model (*red dots*).**

Data processing

Model boundary

The topographic model boundary of the reservoir was generated with Light Detection and Ranging (LIDAR) data available from the Texas Geographic Information Office (TxGIO), formerly known as the Texas Natural Resource Information System (TNRIS). These data were collected on February 24 -25, 2017, while the daily average water surface elevation of the reservoir measured 280.50 and 280.44 feet NGVD29, respectively. 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 meter by 1.0 meter. 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). A contour representing the top of the dam elevation of 89.883997 meters NAVD88, equivalent to 295.0 feet NGVD29 was extracted from the raster. The vertical datum transformation offset of 0.032 meters, was used to convert from meters NAVD88 to meters NGVD29 before converting to feet NGVD29. The vertical datum transformation offset for the conversion from NAVD88 to NGVD29 was determined by applying the National Oceanic and Atmospheric Administration National Geodetic Survey's Coordinate Conversion and Transformation Tool (NCAT) (National Geodetic Survey, 2023) to a single reference point in the vicinity of the survey, the reservoir elevation gage *USGS 08021400 Lk Cherokee nr Tatum, TX Latitude 32°22'09.10" N, Longitude 94°40'06.83" W NAD83.* The topographic model contour was edited to close the contour across the dam and remove other artifacts.

The bathymetric model boundary of the reservoir was digitized by referencing aerial photographs, also known as digital orthophoto quarter-quadrangle images (DOQQs), obtained through the Texas Imagery Service. The Texas Geographic Information Office (TxGIO) formerly the Texas Natural Resources Information System (TNRIS) manages the Texas Imagery Service, allowing public organizations in the State of Texas to access high resolution imagery as a service using Environmental Systems Research Institute's ArcGIS software (Texas Geographic Information Office, 2023). DOQQs photographed on April 6, 2017, while the daily average water surface elevation measured 280.44 feet NGVD29, were used to digitize a model boundary at the land-water interface. For modeling purposes, the boundary was assigned an elevation of 280.4 feet. Some inaccuracies may exist in the digitized boundary due to significant vegetative growth throughout Lake Cherokee, especially upstream of the Highway FM 2011 Silvey Bridge, making it difficult to identify the land-water interface in the photographs.

LIDAR data points

To utilize the LIDAR data in the reservoir topographic model, 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 0.1 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 295.0-foot contour were deleted and the feature class projected to NAD83 State Plane Texas North Central Zone (feet). LIDAR data points inside the bathymetric model boundary were verified against the survey data and the aerial photographs and found to be representative of vegetation misclassified as ground. Therefore, all LIDAR points within the bathymetric model boundary were deleted.

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 Cherokee. 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 (Appendices A and E) and elevation-area (Appendices B and F) tables.

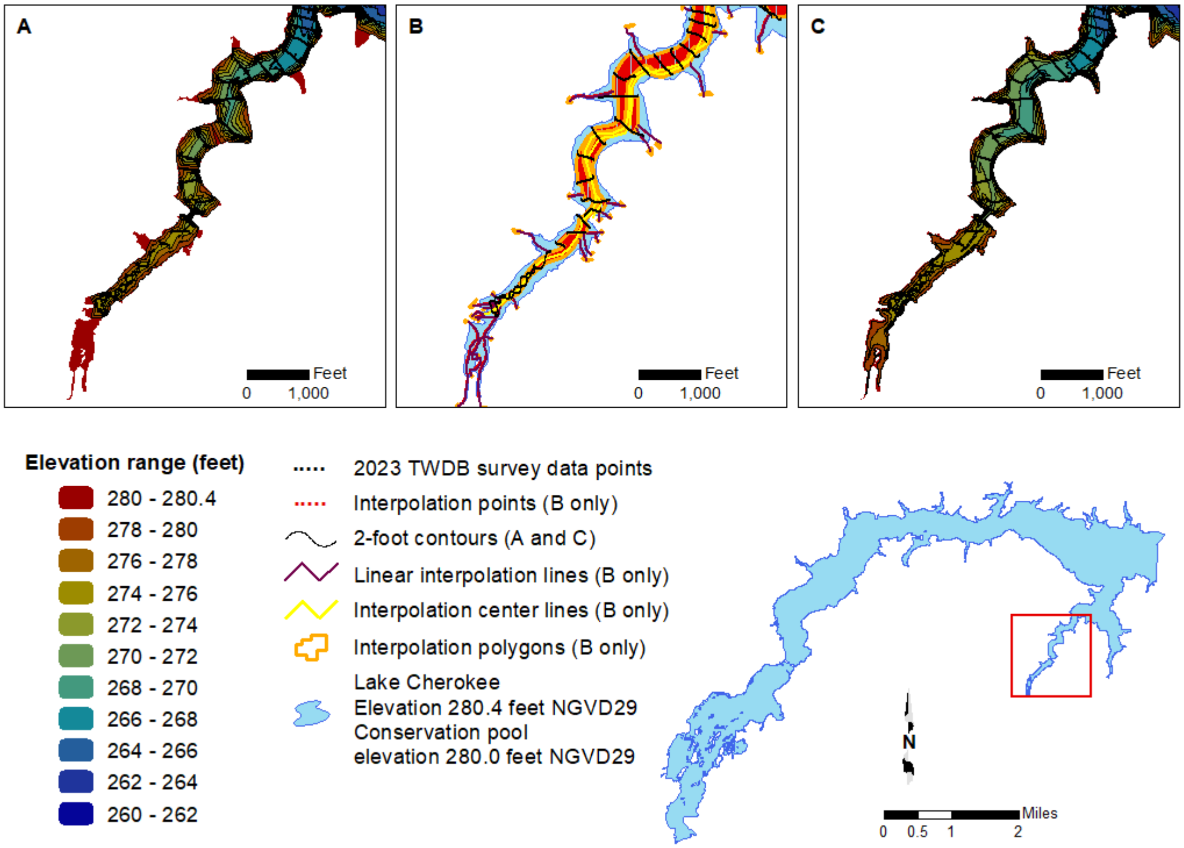

Figure 3. **Anisotropic spatial interpolation as applied to Lake Cherokee sounding data: A) bathymetric contours without interpolated points; B) sounding points (*black*) and interpolated points (*red*); C) bathymetric contours with interpolated points.**

Area, volume, and contour calculation

Volumes and areas were computed for the entire reservoir at 0.1-foot intervals, from 246.9 to 280.4 feet for the bathymetric TIN model, and from 246.9 to 295.0 feet for the bathymetric and topographic TIN model. The bathymetric elevation-capacity table and bathymetric elevation-area table, based on the 2023 survey and analysis, are presented in Appendices A and B, respectively. The bathymetric capacity curve is presented in Appendix C, and the bathymetric area curve is presented in Appendix D. The topographic elevation-capacity table and topographic elevation-area table developed from the 2023 survey and analysis are presented in Appendices E and F, respectively. The topographic capacity curve is presented in Appendix G, and the topographic area curve is presented in Appendix H.

The topographic and bathymetric volumetric TIN models were converted to a raster representation using a cell size of 1 foot by 1 foot. 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 Cherokee (Figure 5); and (3) a 2-foot contour map (Figure 6).

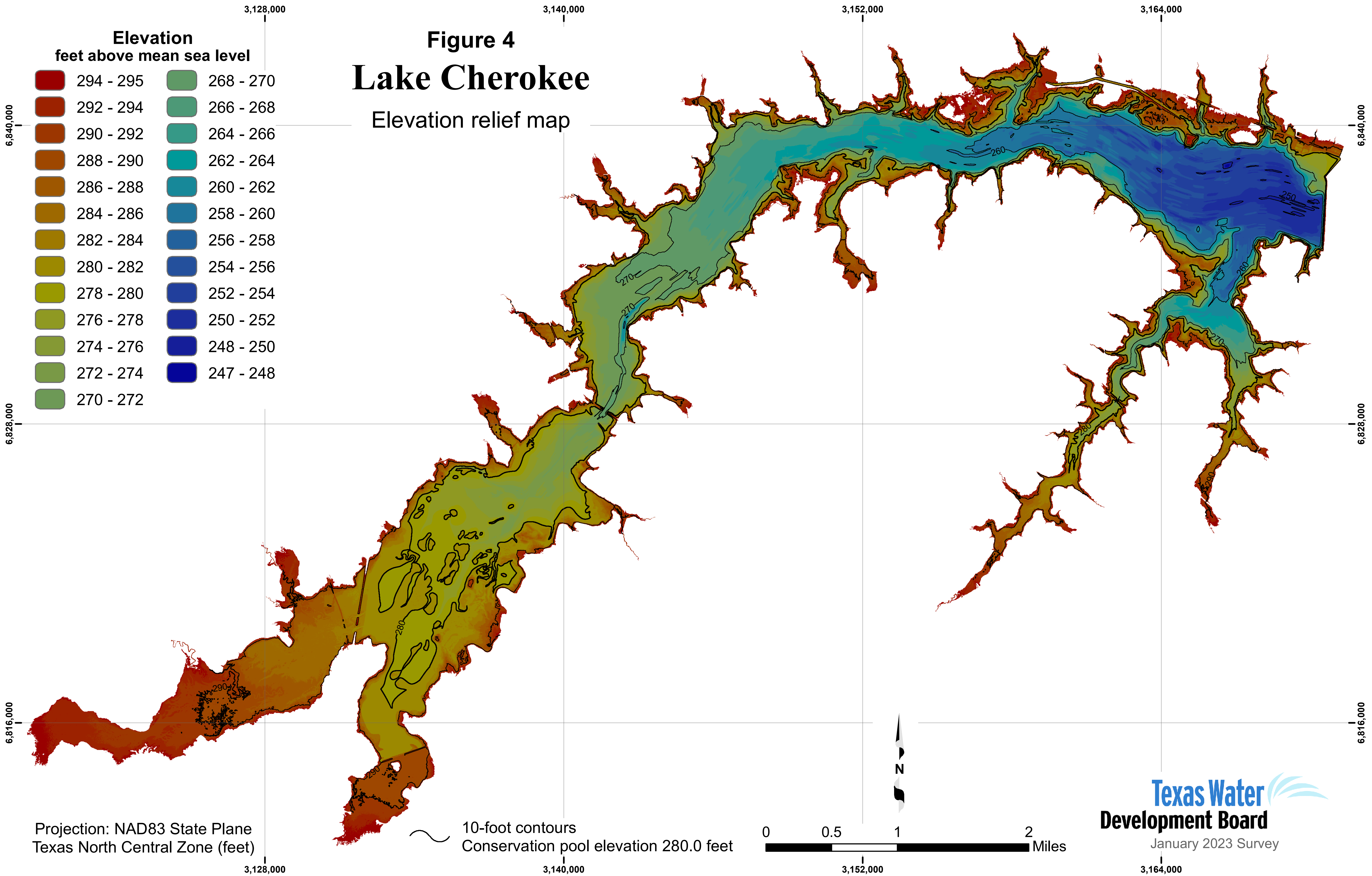

Figure 4

Lake Cherokee

Elevation relief map

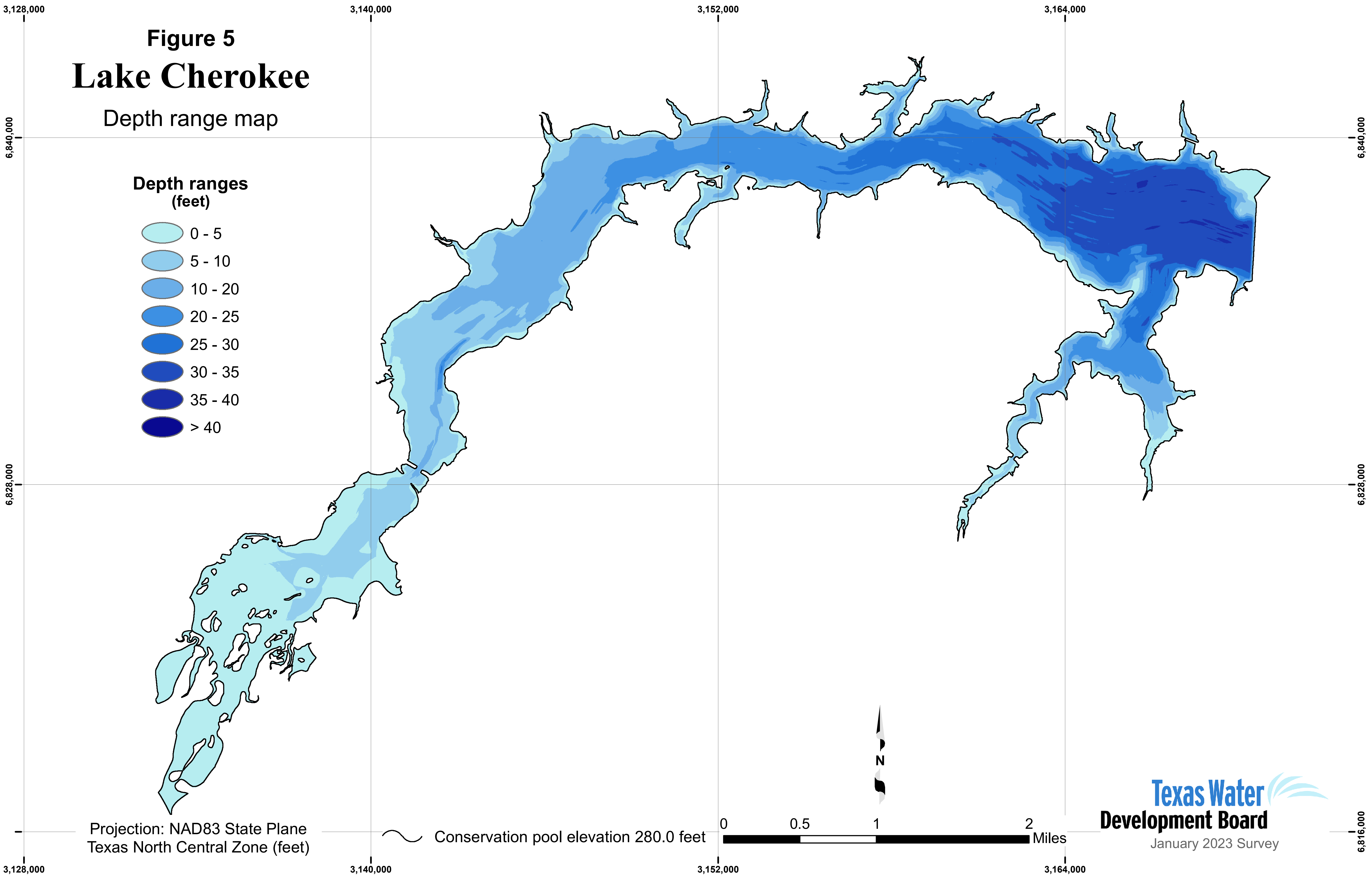

Figure 5

Lake Cherokee

Depth range map

Analysis of sediment data from Lake Cherokee

Sedimentation in Lake Cherokee was determined by analyzing the acoustic signal returns of all three depth sounder frequencies using customized software called Hydropick. While the 200 kHz signal is used to determine the current bathymetric surface, the 200 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 (2018) 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
CHK-1	3166530.68	6837240.33	33.0 / 5.5	post-impoundment	0.0−4.0″ high water content, silt, soupy, smooth, minimal grit, uniform consistency and texture throughout	GLEY1 2.5/10Y greenish black
				pre-impoundment	4.0–5.5″ moderate water content, all organic material throughout (detritus, leaves, sticks, fibrous roots)	10YR 2/1 black
					5.5–20.0″ moderate to low water content, water content decreases with depth, clay loam with a small amount of sand present, malleable, holds shape, peanut butter like, gritty throughout, uniform consistency and texture throughout, organic material present throughout (fibrous roots)	2.5Y 4/2 dark grayish brown
					20.0–33.0″ low water content, clay loam with a small amount of sand present, dense, easily fractures by hand, uniform consistency and texture throughout, mottled coloration, organic material present throughout (leaves, dendritic and fibrous roots)	2.5Y 4/2 dark grayish brown 10YR 4/4 dark yellow brown
CHK-2	3153772.63	6838730.97	38.0 / 21.0	post-impoundment	0.0−4.0″ high water content, silt, smooth, pudding like, uniform consistency and texture throughout	5Y 3/2 dark olive gray
					4.0–16.0″ moderate to low water content, water content decreases with depth, fine sand, tightly packed, thin layer of silty sand at top of layer, dense, uniform consistency and texture throughout	2.5Y 4/3 olive brown
					16.0–21.0″ low water content, sandy clay, mottled coloration	2.5Y 4/1 dark gray 2.5Y 4/3 olive brown
				pre-impoundment	21.0–38.0″ low water content, clay, malleable, dense, easily fractures by hand, organic material present (dendritic and fibrous roots)	2.5Y 4/1 dark gray
CHK-3	3150167.09	6839702.41	55.0 / 18.0	post-impoundment	0.0–18.0″ high water content, silt, smooth, pudding like, uniform consistency and texture throughout	5Y 3/2 dark olive gray
				pre-impoundment	18.0−41.0″ moderate water content, water content decreases with depth, sandy clay loam, sticky, peanut butter like, organic material present (fibrous roots, charred woody debris, twigs, and stems)	5Y 4/1 dark gray

[a.] Coordinates are based on NAD83 State Plane Texas North 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
CHK-3 (cont.)	3150167.09	6839702.41	55.0 / 18.0	pre-impoundment	41.0–55.0″ low water content, sandy clay, malleable, dense, sticky, mottled coloration, organic material present throughout (fibrous roots)	5Y 4/1 dark gray 10YR 4/4 dark yellowish brown
CHK-4	3147711.08	6839233.94	57.0 / 8.0	post-impoundment	0.0–8.0″ very high water content, silt, smooth, soupy, pudding like, organic material present (fine to very coarse sized bits of charcoal)	5Y 3/2 dark olive gray
				pre-impoundment	8.0–44.0″ high to moderate water content, water content decreases with depth, silty clay, smooth, sticky, peanut butter like, uniform consistency and texture throughout, organic material present throughout (fibrous and dendritic roots)	2.5Y 3/1 very dark gray
					44.0–57.0″ low water content, clay, sticky, density increases with depth, holds shape well, streaked coloration	2.5Y 3/1 very dark gray 10YR 5/4 yellowish brown 2.5YR 3/4 dark reddish brown
CHK-5	3144291.63	6835096.52	66.0 / 2.0	post-impoundment	0.0–2.0″ moderate water content, silty sand, gritty, loosely packed	2.5Y 3/3 dark olive brown
				pre-impoundment	2.0–22.0″ moderate to low water content, water content decreases with depth, sandy clay, malleable, sticky, uniform consistency and texture throughout, mottled coloration, organic material present (fibrous roots)	2.5Y 4/2 dark grayish brown 2.5Y 4/1 dark gray
					22.0–52.0″ moderate to low water content, water content decreases with depth, sandy clay, malleable, mottled coloration	2.5Y 4/2 dark grayish brown 2.5Y 4/1 dark gray
					52.0–66.0″ low water content, sandy clay, higher clay content and lower water content than previous layer, dense, density increases with depth, malleable, mottled coloration	2.5Y 4/2 dark grayish brown 2.5Y 4/1 dark gray
CHK-6	3142116.6	6833437.57	grab[c]	post-impoundment	silty clay with a fine layer of silt on top, small to medium sized bits of clay throughout, organic material present (woody debris, twigs, bark)	5Y 2.5/1 black

a. Coordinates are based on NAD83 State Plane Texas North Central System (feet).
b. Sediment core samples are measured in inches with zero representing the current bottom surface.
c. Grab samples were collected using a Ponar dredge sampler.

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
CHK-7	3140885.25	6827600.55	18.0 / 12.0	post-impoundment	0.0–12.0″ high water content, silt, soupy, smooth with a small amount of grit, uniform consistency and texture throughout	2.5Y 2.5/1 black
				pre-impoundment	12.0−18.0″ moderate water content, silty clay, sticky, pea to grape sized bits of clay, organic material present throughout (woody debris, leaf litter, rocks, fibrous roots)	2.5Y 3/1 very dark gray
CHK-8	3139018.46	6825873.77	25.0 / 9.0	post-impoundment	0.0–9.0″ high water content, silt, smooth, organic material throughout (leaf litter)	2.5Y 2.5/1 black
				pre-impoundment	9.0–15.0″ high to moderate water content, water content decreases with depth, silty clay, sticky malleable holds shape, density increases with depth, loosely packed at top, medium sized clay bits found at top of layer, organic material present throughout (fibrous and dendritic roots, twigs)	5Y 2.5/1 black
					15.0–25.0″ moderate to low water content, water content decreases with depth, clay malleable, easily fractures by hand, uniform consistency and texture throughout, streaked coloration, organic material present (fibrous roots)	5Y 4/1 dark gray 10YR 5/4 yellowish brown
CHK-9	3142748.67	6832579.59	42.0 / 34.0	post-impoundment	0.0–34.0″ high water content, silt, pudding like, density increases with depth, uniform consistency and texture throughout	5Y 2.5/1 black
				pre-impoundment	34.0–38.0″ high water content, silt clay with a few very coarse sized bits of clay, smooth, organic material present throughout (fibrous roots and leaf litter)	5Y 3/1 very dark gray
					38.0–42.0″ low water content, coarse grain sand mixed with small rock and small bits of clay	5Y 4/3 olive
CHK-10	3140940.70	6833332.67	50.0 / 10.0	post-impoundment	0.0–10.0″ high water content, silt, smooth, pudding like, uniform consistency and texture throughout	5Y 3/2 dark olive gray
				pre-impoundment	10.0–26.0″ high to low water content, water content decreases with depth, silty clay, malleable, smooth, easily fractures by hand but sticky, organic material present throughout (fibrous roots)	5Y 4/1 dark gray

[a] Coordinates are based on NAD83 State Plane Texas North 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
CHK-10 (cont.)	3140940.70	6833332.67	50.0 / 10.0	pre-impoundment (cont.)	26.0–50.0″ low water content, clay, malleable, density increases with depth, uniform consistency and texture throughout, mottled coloration, organic material present (fibrous roots)	10YR 5/4 yellowish brown 5Y 4/1 dark gray
CHK-11	3157901.33	6839668.59	104.0 / 50.0	post-impoundment	0.0–34.0″ high water content, silt, soupy at top of layer to pudding like as depth increases	2.5Y 2.5/1 black
					34.0–50.0″ high to moderate water content, silty clay smooth, peanut butter like, color consistent throughout, organic material present throughout (fibrous and dendritic roots, woody debris)	2.5Y 4/1 dark gray
				pre-impoundment	50.0–55.0″ moderate water content, sandy loam, copious amounts of organic material between 50 and 51 inches, organic material present throughout (fibrous roots, woody debris)	5Y 3/2 dark olive gray
					55.0–76.0″ moderate water content, fine sand, easily crumbles, density increases with depth, mottled and streaked coloration, organic material present throughout (fibrous roots)	GLEY1 4/10 GY dark greenish gray 5Y 5/3 Olive
					76.0–96.0″ low water content, fine and course grain sand, very dense, coarse and very coarse sized flat rocks, mottled coloration, organic material present (fibrous roots)	5Y 2.5/2 black 5Y 4/2 olive gray
					96.0–104.0″ low water content, rock with fine and coarse grain sand mixed throughout	10YR 3/3 dark brown
CHK-12	3168316.49	6838971.78	59.0 / 15.0	post-impoundment	0.0–15.0″ high water content, silt, smooth, soupy to pudding like consistency with increases in depth	2.5Y 2.5/1 black
				pre-impoundment	15.0–32.0″ high to low water content, sandy loam, density increases with depth, malleable holds shape, easily fractures by hand, copious amounts of organic material between 15 and 16 inches, organic material present (fibrous and dendritic roots)	5Y 3/1 very dark gray
					32.0–49.0″ low water content, fine sand, very dense but easily fractures	5Y 5/1 gray

a. Coordinates are based on NAD83 State Plane Texas North 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
CHK-12 (cont.)	3168316.49	6838971.78	59.0 / 15.0	pre-impoundment (cont.)	49.0–59.0″ low water content, sandy loam with small amount of clay, very dense, easily crumbles, mottled coloration	5Y 5/1 gray GLEY1 4/10 GY dark greenish gray
CHK-13.1	3162481.32	6839901.11	41.0 / 3.0	post-impoundment	0.0–3.0″ high water content, silt, pudding like, organic material present throughout (stems and twigs)	5Y 2.5/2 black
				pre-impoundment	3.0–30.0″ high to moderate water content, water content decreases with depth, sandy loam with some grit, loosely packed, density and clay content increase with depth, organic material present throughout (fibrous roots)	2.5Y 3/2 very dark grayish brown
					30.0–41.0″ moderate to low water content, sandy clay, dense, malleable, clay content increases with depth, organic material present (fibrous roots)	10YR 5/4 yellowish brown
CHK-13.2	3162481.32	6839901.11	22.0 / 10.0	post-impoundment	0.0–8.0″ high water content, silt, soupy, leaf litter and twigs present	2.5Y 2.5/1 black
					8.0–10.0″ high water content, silt, high amount of organics present, leaves, woody debris, stems, sticks	2.5Y 2.5/1 black
				pre-impoundment	10.0–20.0″ moderate to low water content, water content decreases with depth, sandy loam, density increases with depth, malleable, crumbles then holds shape with depth, fibrous roots presents throughout	2.5Y 4/2 dark grayish brown
					20.0–22.0″ low water content, sandy clay loam, easily fractures, more grit than previous layer	2.5Y 5/3 light olive brown
CHK-14	3166208.77	6832230.62	120.0 / 75.0	post-impoundment	0.0–8.0″ high water content, silt, pudding like, uniform consistency throughout	5Y 2.5/2 black
					8.0–57.0″ high to moderate water content, water content decreases with depth, silty clay, peanut butter like, density increases with depth, uniform consistency and texture throughout	5Y 3/2 dark olive gray
					57.0–59.0″ void in sediment	N/A
					59.0–62.0″ moderate water content, silty clay, peanut butter like, density increases with depth, uniform consistency and texture throughout	5Y 3/2 dark olive gray

a. Coordinates are based on NAD83 State Plane Texas North 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
CHK-14 (cont.)	3166208.77	6832230.62	120.0 / 75.0	post-impoundment (cont.)	62.0–63.0″ void in sediment	N/A
					63.0–68.0″ moderate water content, silty clay, peanut butter like, density increases with depth, uniform consistency and texture throughout	5Y 3/2 dark olive gray
					68.0–69.0″ void in sediment	N/A
					69.0–75.0″ moderate water content, silty clay, peanut butter like, density increases with depth, uniform consistency and texture throughout	5Y 3/2 dark olive gray
				pre-impoundment	75.0–91.0″ low water content, fine sand, very dense, mottled coloration, organic material present throughout (fibrous and dendritic roots, woody debris)	2.5Y 5/2 grayish brown 2.5Y 3/1 very dark gray
					91.0–102.0″ void in sediment	N/A
					102.0–120.0″ low water content, sandy loam, easily fractures, organic material present throughout (fibrous roots, leaf litter, woody debris)	2.5Y 5/2 grayish brown
CHK-15	3141964.13	6830172.23	23.0 / 16.0	post-impoundment	0.0–16.0″ high to moderate water content, water content decreases with depth, silt, smooth, peanut butter like	2.5Y 2.5/1 black
				pre-impoundment	16.0–23.0″ moderate water content, clay, malleable but too wet to make ribbons, loosely packed, organic material present throughout (fibrous roots, leaf litter, woody debris)	5Y 4/1 dark gray
CHK-16	3170063.90	6837917.79	9.0 / 1.0	post-impoundment	0.0–1.0″ high water content, sandy silt, pudding like, gritty, uniform consistency and texture throughout	5Y 3/2 dark olive gray
				pre-impoundment	1.0–9.0″ low water content, clay, dense, malleable, easily forms soil ribbons, mottled coloration	7.5Y 5/4 brown 2.5Y ¾ dark reddish brown GLEY1 6N gray

a. Coordinates are based on NAD83 State Plane Texas North Central System (feet).

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

Several criteria determine sediment core locations. Locations are dispersed throughout the reservoir, are selected to represent the various acoustic signatures seen in the data and are chosen to represent various depths and topographical features such as the submerged river channels, floodplains, shallow slopes, and deep basins. The pre-impoundment surface is identified by matching each sediment core with the acoustic signal returns. This information then serves as a guide for identifying the pre-impoundment surface along cross-sections where sediment core samples were not collected.

A photograph of sediment core CHK-15 (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 16 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.

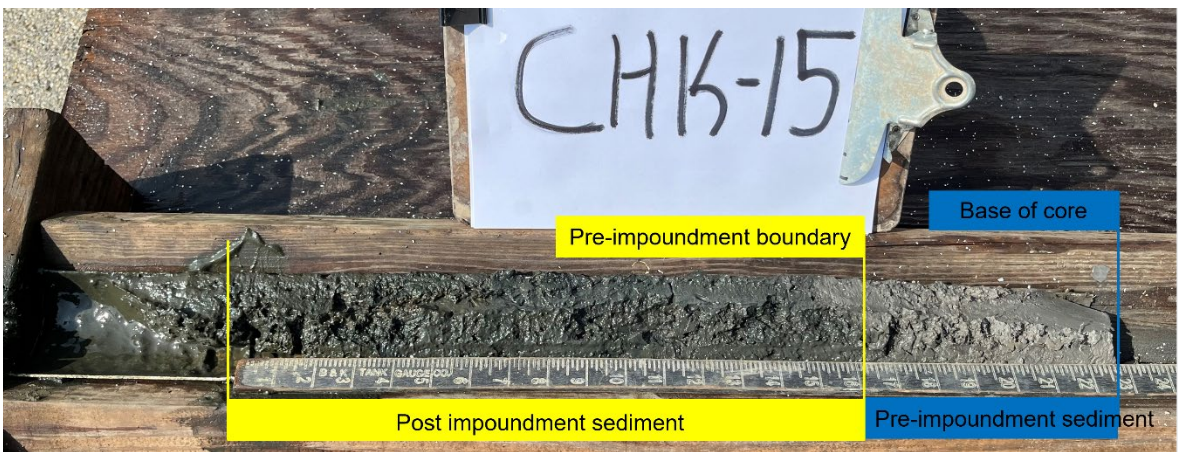

Figure 7. Sediment core CHK-15. Post-impoundment sediment layers occur in the top 16 inches of this sediment core (identified by the yellow box). Pre-impoundment sediment layers were identified and are defined by the blue box.

Figure 8 illustrates the relationships between acoustic signal returns and the depositional layering seen in sediment cores. In this example, sediment core CHK-15 is shown correlated with each frequency: 200 kHz, 50 kHz, and 12 kHz. The current bathymetric surface is determined based on signal returns from the 200 kHz transducer as represented by the top red line in Figure 8. The pre-impoundment surface is identified by comparing boundaries observed in the 200 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. In this example, the pre-impoundment boundary in sediment core CHK-15 most closely aligned with the different layers picked up by the 50 kHz acoustic returns (Figure 8 B).

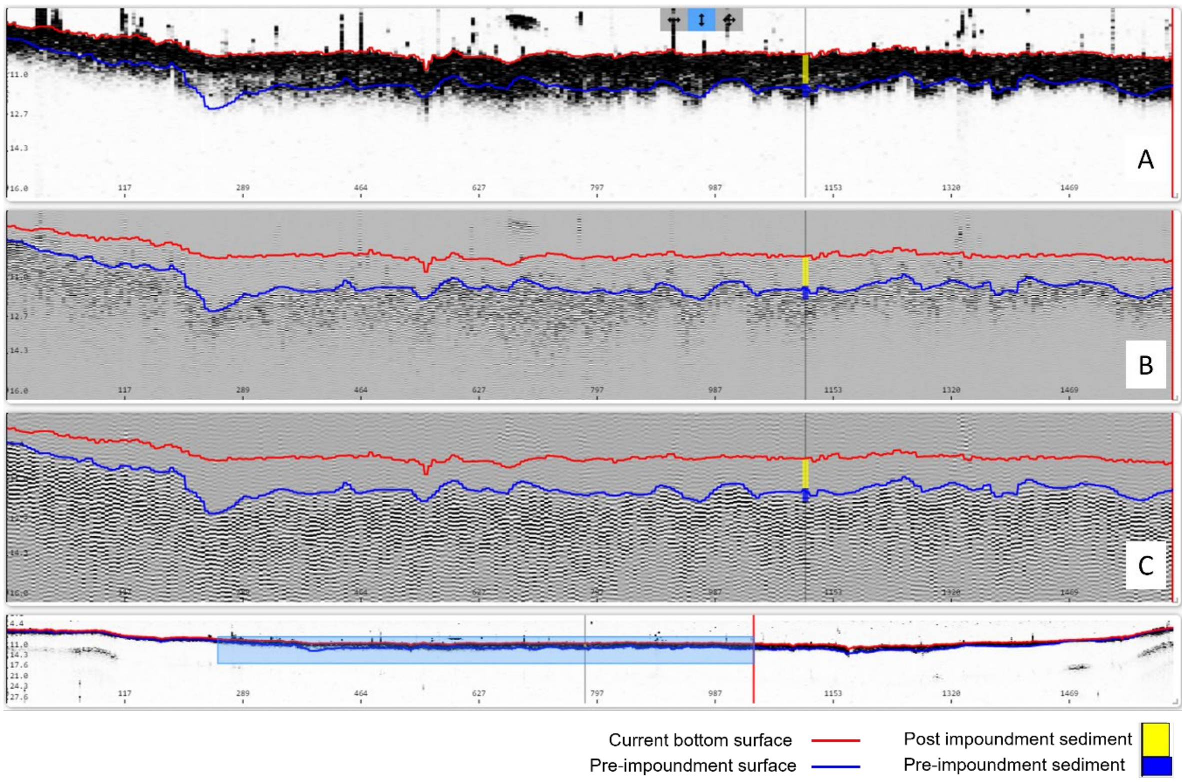

Figure 8. **Sediment core sample CHK-15 compared with acoustic signal returns: A) 200 kHz frequency, B) 50 kHz frequency, and C) 12 kHz frequency.**

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 of the reservoir boundary was zero feet (defined as the 280.4-foot elevation contour). The sediment thickness TIN model was converted to a raster representation using a cell size of 1 foot by 1 foot 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.

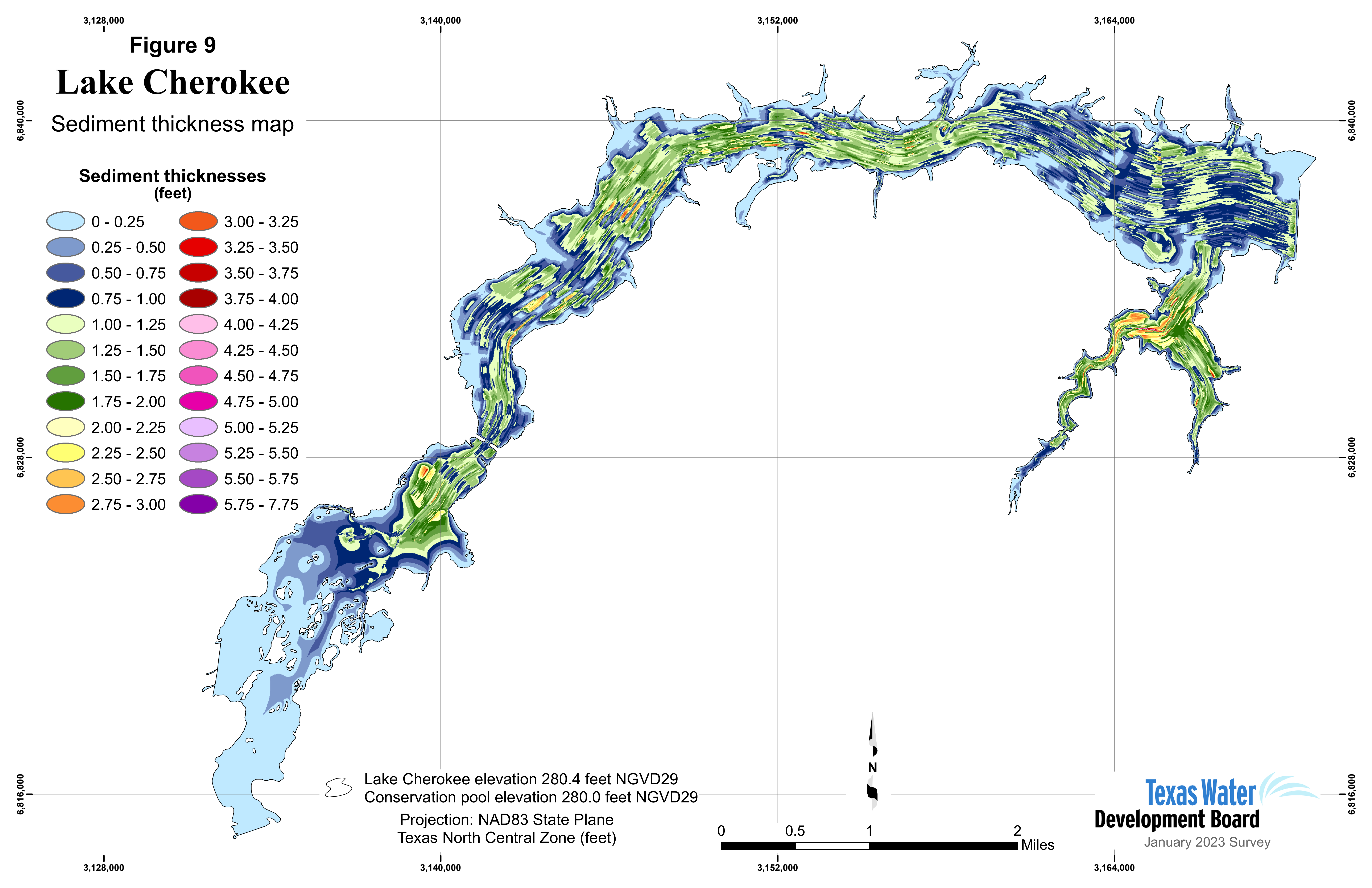

Figure 9

Lake Cherokee

Sediment thickness map

Survey results

Volumetric survey

The 2023 TWDB volumetric survey indicates that Lake Cherokee has a total reservoir capacity of 42,791 acre-feet and encompasses 3,464 acres at conservation pool elevation (280.0 feet NGVD29). Current area and capacity estimates are presented along with previous estimates of area and capacity at conservation pool elevation in Table 3. Because differences in reservoir conditions as well as differences in the methodologies used among surveys can affect area and volume calculations, the TWDB does not recommend comparing between volumetric surveys to determine loss of area or capacity. Information from past surveys is thus presented for informational purposes only, and the results of the current study should be considered as the best available science.

Table 3. Current and previous survey capacity and surface area estimates.

Survey	Surface Area (acres)	Total Capacity (acre-feet)	Conservation Pool Elevation[a]	Source
Original Design	3,479	62,400	280.0	U.S. Soil Conservation Service, 1960[b]
Original Design (re-calculated)	3,987	49,295	280.0	U.S. Soil Conservation Service, 1960
U.S. Soil Conservation Service 1960	3,987	46,705	280.0	U.S Soil Conservation Service, 1960
TWDB 1996 (re-calculated)	3,083	42,314	280.0	Texas Water Development Board, 2016b
TWDB 2003 (re-calculated)	3,493	44,440	280.0	Texas Water Development Board, 2016b
TWDB 2015	3,749	44,475	280.0	Texas Water Development Board, 2016a
TWDB 2023	3,464	42,791	280.0	

a. Feet above mean sea level, National Geodetic Vertical Datum 1929 (NGVD29).
b. U.S. Department of Agriculture (USDA) Natural Resources Conservation Service (NRCS).

Sedimentation survey

The 2023 TWDB sedimentation survey measured 2,921 acre-feet of sediment. The sedimentation survey indicates sediment accumulation is greatest upstream of the highway FM 2011 Silvey Bridge and in Mud Creek and Lee Creek tributaries. Average annual sediment rates of Lake Cherokee are provided in Table 4 for informational purposes. The 2023 sediment estimate may be an underestimate of total sediment accumulation particularly in the river channels and shallow upstream areas. Density stratification in the sediment layers can scatter and attenuate acoustic return signals of the multi-frequency depth sounder (U.S. Army Corps of Engineers, 2013). The 2023 TWDB sedimentation survey indicates Lake Cherokee has lost capacity at an average of 39 acre-feet per year since impoundment due to sedimentation below conservation pool elevation (280.0 feet NGVD29). 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 estimates of 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. As illustrated in Figure 10, long-term trends indicate Lake Cherokee loses capacity at an average of 41 acre-feet per year since impoundment due to sedimentation below conservation pool elevation (280.0 feet NGVD29).

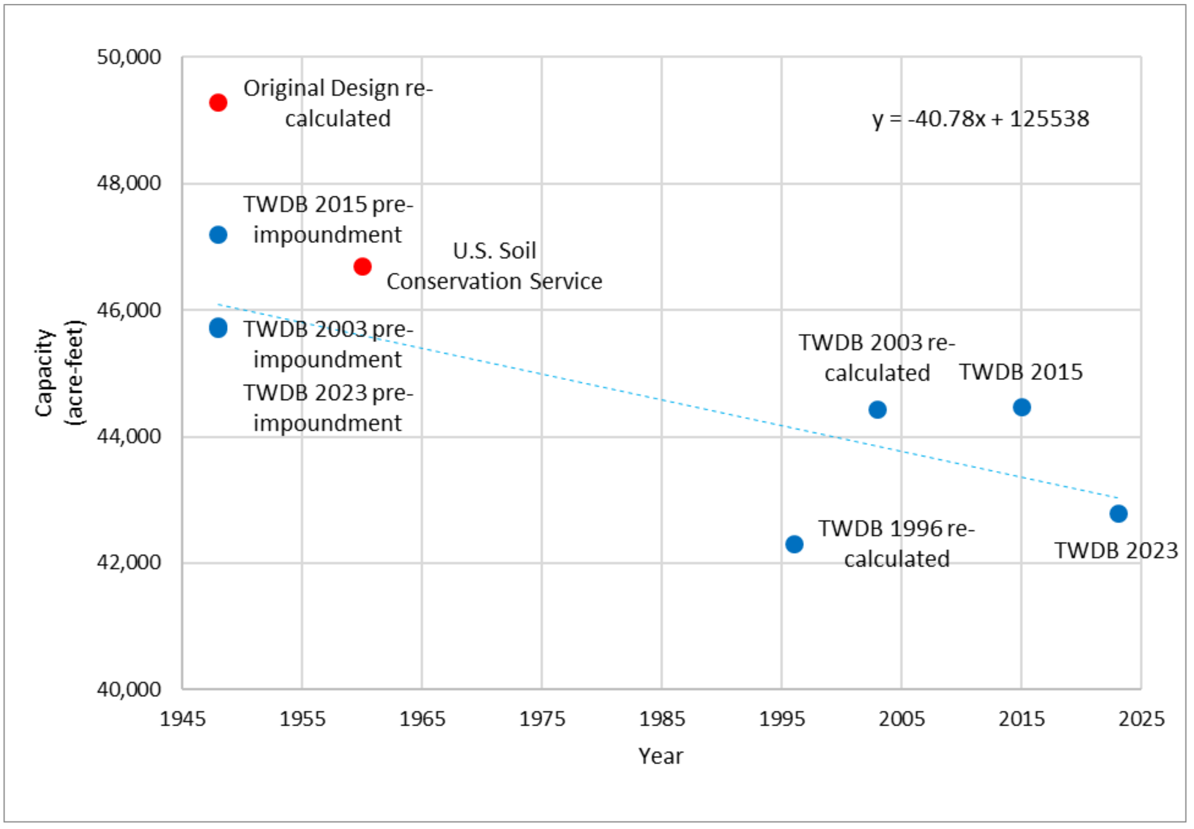

Figure 10. **Plot of current and previous capacity estimates (acre-feet). Capacity estimates for each TWDB survey plotted as blue dots and other surveys as red dots. The blue trend line illustrates the total average loss of capacity through 2023.**

Table 4. Average annual capacity loss.

Previous surveys	U.S. Soil Conservation Service re-calculated original design[b]	U.S. Soil Conservation Service 1960	TWDB 1996 (re-calculated)	TWDB 2003 (re-calculated)	TWDB 2015	TWDB pre-impoundment estimate based on 2023 survey
Total capacity (acre-feet) at top of conservation pool elevation 280.0 feet NGVD29[a]	49,295	46,705	42,314	44,440	44,475	45,712
	versus 42,791 acre-feet (TWDB 2023)					
Volume difference (acre-feet)	6,504	3,914	-477	1,649	1,684	2,921
Percent change	13.2	8.4	-1.1	3.7	3.8	6.4
Number of years	75	63	27	20	8	75
Capacity loss rate (acre-feet/year)	87	62	-18	82	211	39
Capacity loss rate (acre-feet/square mile of drainage area of 158 square miles/year	0.55	0.39	-0.11	0.52	1.33	0.25

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

[b] Source: U.S. Soil Conservation Service, 1960; Deliberate impoundment of Lake Cherokee began in October 1948. Lake Cherokee Dam was completed in November 1948.

Recommendations

Sedimentation processes tend to be slow, with changes accumulating over the time frame of years—unless in the event of a major flood, for example. For these reasons, we recommend that reservoir sedimentation surveys be conducted every 10 years or after a major event. Closely monitoring changes in the reservoir provides information needed to plan for a secure water supply for the future.

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 Cherokee

RESERVOIR BATHYMETRIC CAPACITY TABLE

TEXAS WATER DEVELOPMENT BOARD — January 2023 Survey

CAPACITY IN ACRE-FEET — Conservation pool elevation 280.0 feet NGVD29

ELEVATION INCREMENT IS ONE TENTH FOOT

ELEVATION (Feet NGVD29)	0.0	0.1	0.2	0.3	0.4	0.5	0.6	0.7	0.8	0.9
246	0	0	0	0	0	0	0	0	0	0
247	0	0	0	0	0	0	0	0	0	0
248	0	0	0	0	0	1	1	1	1	1
249	1	2	2	2	3	4	4	5	6	7
250	8	10	12	14	16	19	23	27	31	37
251	43	49	57	65	73	83	94	105	117	130
252	144	159	174	191	208	226	245	266	288	311
253	336	362	388	417	446	476	507	539	572	607
254	642	678	715	753	793	834	875	917	961	1,005
255	1,049	1,095	1,141	1,188	1,236	1,284	1,333	1,382	1,432	1,483
256	1,534	1,586	1,638	1,691	1,744	1,798	1,853	1,909	1,965	2,022
257	2,080	2,139	2,200	2,260	2,322	2,385	2,448	2,512	2,577	2,643
258	2,709	2,777	2,845	2,913	2,983	3,053	3,124	3,196	3,269	3,343
259	3,417	3,493	3,569	3,646	3,724	3,803	3,882	3,962	4,042	4,124
260	4,206	4,288	4,371	4,455	4,540	4,625	4,710	4,797	4,884	4,971
261	5,060	5,149	5,239	5,329	5,420	5,513	5,606	5,700	5,795	5,891
262	5,988	6,085	6,184	6,283	6,384	6,485	6,588	6,691	6,795	6,900
263	7,006	7,113	7,221	7,330	7,439	7,550	7,662	7,774	7,888	8,003
264	8,119	8,236	8,354	8,473	8,593	8,715	8,837	8,960	9,084	9,209
265	9,335	9,462	9,590	9,718	9,848	9,979	10,112	10,246	10,381	10,517
266	10,654	10,792	10,931	11,072	11,213	11,356	11,499	11,644	11,790	11,937
267	12,085	12,234	12,385	12,536	12,689	12,843	12,999	13,155	13,313	13,471
268	13,631	13,792	13,954	14,117	14,281	14,446	14,612	14,780	14,948	15,117
269	15,288	15,460	15,633	15,808	15,984	16,162	16,341	16,522	16,705	16,889
270	17,076	17,264	17,454	17,645	17,838	18,032	18,228	18,426	18,625	18,825
271	19,027	19,231	19,436	19,642	19,850	20,059	20,269	20,481	20,694	20,908
272	21,124	21,341	21,559	21,779	22,001	22,224	22,448	22,673	22,899	23,127
273	23,356	23,586	23,817	24,050	24,284	24,519	24,755	24,992	25,231	25,471
274	25,713	25,955	26,199	26,445	26,691	26,939	27,189	27,439	27,691	27,944
275	28,198	28,454	28,711	28,969	29,229	29,490	29,752	30,015	30,280	30,546
276	30,813	31,082	31,352	31,623	31,896	32,170	32,446	32,723	33,001	33,281
277	33,563	33,845	34,130	34,415	34,703	34,991	35,281	35,573	35,866	36,160
278	36,456	36,753	37,052	37,353	37,655	37,959	38,265	38,573	38,883	39,195
279	39,509	39,825	40,143	40,464	40,787	41,113	41,442	41,773	42,108	42,447
280	42,791	43,140	43,496	43,858	44,230					

Appendix B

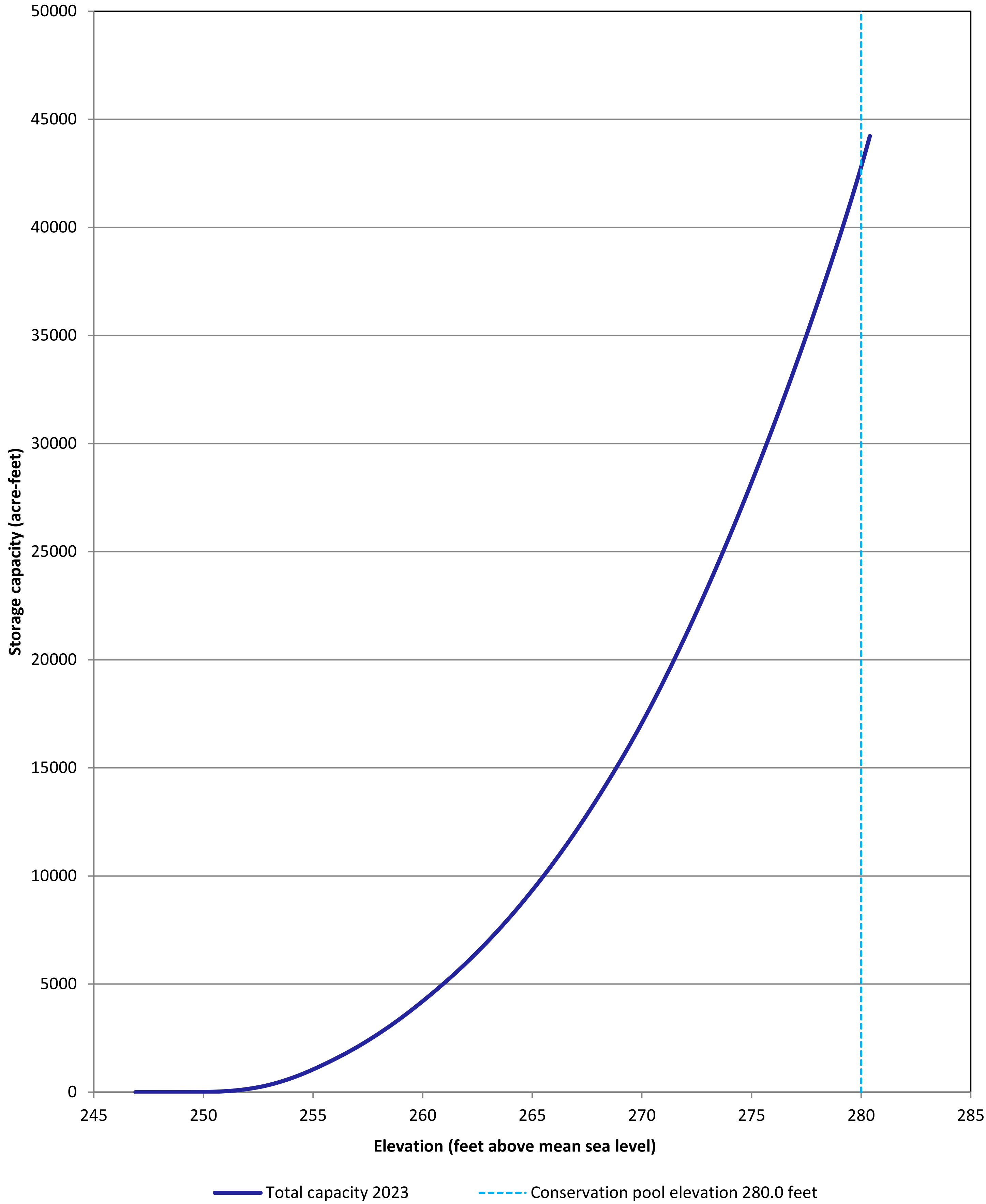
Lake Cherokee

RESERVOIR BATHYMETRIC AREA TABLE

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

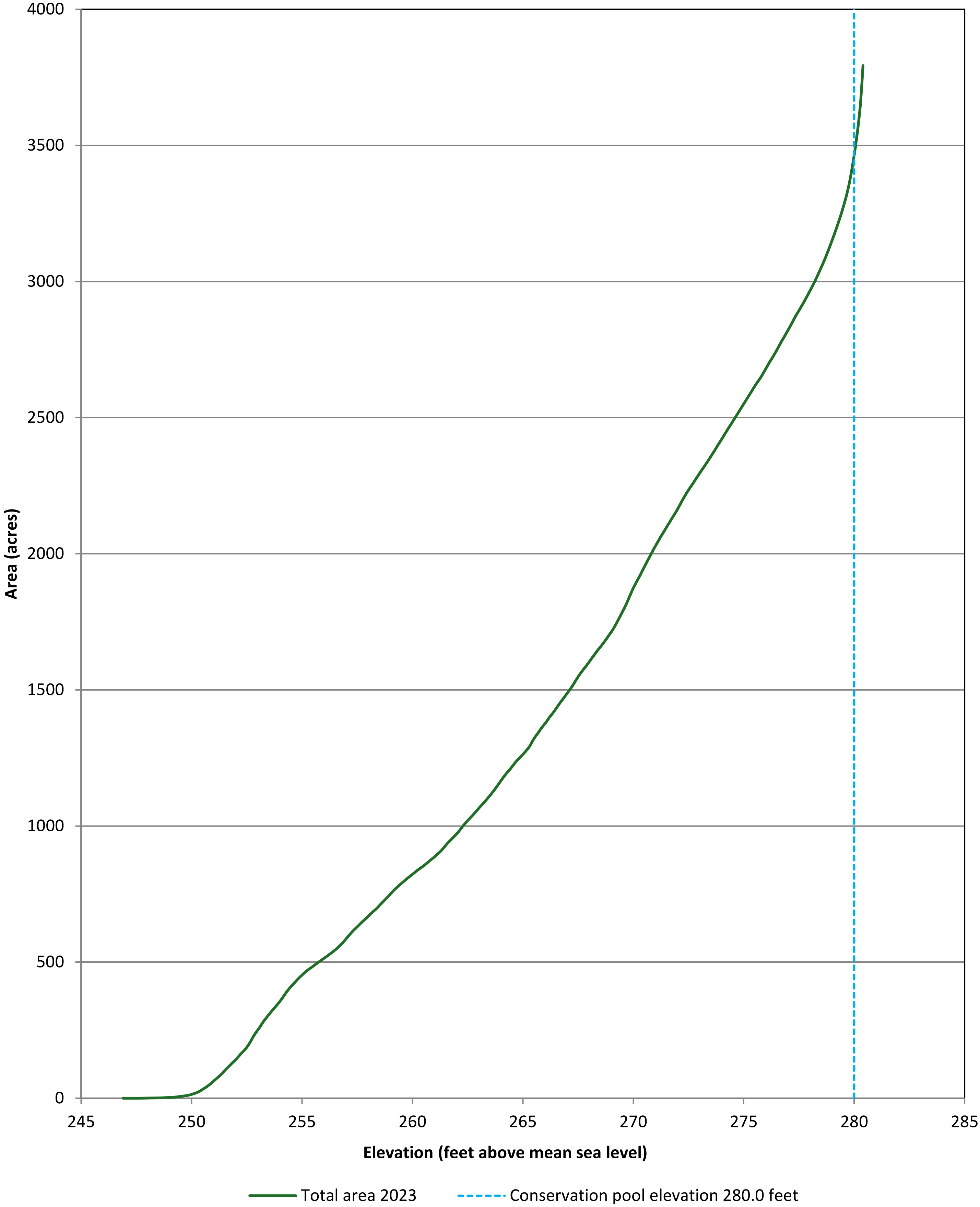
January 2023 Survey
Conservation pool elevation 280.0 feet NGVD29

ELEVATION (Feet NGVD29)	0.0	0.1	0.2	0.3	0.4	0.5	0.6	0.7	0.8	0.9
246	0	0	0	0	0	0	0	0	0	0
247	0	0	0	0	0	0	0	0	0	0
248	0	1	1	1	1	1	1	2	2	2
249	3	3	4	5	5	6	8	9	10	12
250	14	17	20	23	27	32	38	43	49	56
251	63	70	77	84	92	102	110	118	126	134
252	142	151	160	168	177	187	199	212	227	240
253	251	262	275	287	297	307	317	327	336	346
254	356	367	378	390	401	410	419	428	436	445
255	452	460	467	473	479	485	491	497	503	508
256	514	520	526	532	538	545	552	559	568	576
257	586	596	605	614	622	630	638	646	653	661
258	668	676	684	691	699	707	716	724	732	741
259	750	759	767	775	782	789	796	803	809	816
260	823	829	836	841	847	853	860	866	873	880
261	887	894	901	909	919	928	937	946	954	962
262	971	980	990	1,001	1,011	1,020	1,029	1,037	1,046	1,055
263	1,065	1,074	1,083	1,092	1,101	1,111	1,121	1,132	1,143	1,154
264	1,165	1,177	1,187	1,197	1,206	1,217	1,227	1,237	1,246	1,255
265	1,263	1,272	1,281	1,292	1,307	1,320	1,332	1,343	1,355	1,366
266	1,376	1,387	1,399	1,409	1,419	1,431	1,443	1,454	1,465	1,476
267	1,487	1,498	1,509	1,522	1,535	1,548	1,560	1,571	1,581	1,591
268	1,603	1,614	1,625	1,636	1,647	1,657	1,667	1,678	1,689	1,701
269	1,712	1,725	1,739	1,754	1,769	1,786	1,801	1,818	1,837	1,856
270	1,874	1,890	1,905	1,919	1,936	1,952	1,968	1,983	1,998	2,013
271	2,028	2,042	2,057	2,070	2,083	2,097	2,110	2,123	2,137	2,149
272	2,163	2,178	2,193	2,208	2,221	2,234	2,246	2,258	2,271	2,283
273	2,295	2,307	2,319	2,331	2,343	2,356	2,369	2,382	2,395	2,408
274	2,421	2,434	2,447	2,460	2,473	2,486	2,498	2,511	2,524	2,537
275	2,551	2,563	2,576	2,589	2,603	2,615	2,628	2,640	2,652	2,666
276	2,680	2,694	2,708	2,721	2,734	2,749	2,763	2,778	2,792	2,806
277	2,821	2,835	2,850	2,866	2,880	2,893	2,907	2,921	2,936	2,951
278	2,966	2,981	2,998	3,015	3,032	3,050	3,069	3,088	3,108	3,129
279	3,151	3,173	3,196	3,220	3,245	3,272	3,300	3,332	3,369	3,414
280	3,464	3,520	3,585	3,668	3,793					



Lake Cherokee
January 2023 Survey
Prepared by: TWDB

Appendix C: Bathymetric capacity curve



Lake Cherokee
January 2023 Survey
Prepared by: TWDB

Appendix D: Bathymetric area curve

Appendix E

Lake Cherokee

RESERVOIR BATHYMETRIC AND TOPOGRAPHIC CAPACITY TABLE

TEXAS WATER DEVELOPMENT BOARD | January 2023 Survey

CAPACITY IN ACRE-FEET | Conservation pool elevation 280.0 feet NGVD29

ELEVATION INCREMENT IS ONE TENTH FOOT | Top of Dam elevation 295.0 feet NGVD29

ELEVATION (Feet NGVD29)	0.0	0.1	0.2	0.3	0.4	0.5	0.6	0.7	0.8	0.9
246	0	0	0	0	0	0	0	0	0	0
247	0	0	0	0	0	0	0	0	0	0
248	0	0	0	0	0	1	1	1	1	1
249	1	2	2	2	3	4	4	5	6	7
250	8	10	12	14	16	19	23	27	31	37
251	43	49	57	65	73	83	94	105	117	130
252	144	159	174	191	208	226	245	266	288	311
253	336	362	388	417	446	476	507	539	572	607
254	642	678	715	753	793	834	875	917	961	1,005
255	1,049	1,095	1,141	1,188	1,236	1,284	1,333	1,382	1,432	1,483
256	1,534	1,586	1,638	1,691	1,744	1,798	1,853	1,909	1,965	2,022
257	2,080	2,139	2,200	2,260	2,322	2,385	2,448	2,512	2,577	2,643
258	2,709	2,777	2,845	2,913	2,983	3,053	3,124	3,196	3,269	3,343
259	3,417	3,493	3,569	3,646	3,724	3,803	3,882	3,962	4,042	4,124
260	4,206	4,288	4,371	4,455	4,540	4,625	4,710	4,797	4,884	4,971
261	5,060	5,149	5,239	5,329	5,420	5,513	5,606	5,700	5,795	5,891
262	5,988	6,085	6,184	6,283	6,384	6,485	6,588	6,691	6,795	6,900
263	7,006	7,113	7,221	7,330	7,439	7,550	7,662	7,774	7,888	8,003
264	8,119	8,236	8,354	8,473	8,593	8,715	8,837	8,960	9,084	9,209
265	9,335	9,462	9,590	9,718	9,848	9,979	10,112	10,246	10,381	10,517
266	10,654	10,792	10,931	11,072	11,213	11,356	11,499	11,644	11,790	11,937
267	12,085	12,234	12,385	12,536	12,689	12,843	12,999	13,155	13,313	13,471
268	13,631	13,792	13,954	14,117	14,281	14,446	14,612	14,780	14,948	15,117
269	15,288	15,460	15,633	15,808	15,984	16,162	16,341	16,522	16,705	16,889
270	17,076	17,264	17,454	17,645	17,838	18,032	18,228	18,426	18,625	18,825
271	19,027	19,231	19,436	19,642	19,850	20,059	20,269	20,481	20,694	20,908
272	21,124	21,341	21,559	21,779	22,001	22,224	22,448	22,673	22,899	23,127
273	23,356	23,586	23,817	24,050	24,284	24,519	24,755	24,992	25,231	25,471
274	25,713	25,955	26,199	26,445	26,692	26,939	27,189	27,439	27,691	27,944
275	28,198	28,454	28,711	28,969	29,229	29,490	29,752	30,015	30,280	30,546
276	30,813	31,082	31,352	31,623	31,896	32,170	32,446	32,723	33,001	33,281
277	33,563	33,846	34,130	34,416	34,703	34,992	35,282	35,573	35,866	36,160
278	36,456	36,753	37,052	37,353	37,655	37,960	38,265	38,573	38,883	39,195
279	39,509	39,825	40,144	40,465	40,788	41,114	41,442	41,774	42,109	42,448
280	42,792	43,141	43,496	43,859	44,231	44,611	44,991	45,373	45,756	46,141
281	46,528	46,916	47,307	47,699	48,093	48,490	48,888	49,287	49,689	50,092
282	50,497	50,903	51,311	51,721	52,132	52,545	52,959	53,375	53,793	54,212
283	54,632	55,054	55,478	55,903	56,330	56,758	57,188	57,619	58,052	58,486
284	58,922	59,360	59,799	60,241	60,684	61,130	61,577	62,027	62,478	62,931
285	63,386	63,843	64,302	64,763	65,225	65,689	66,156	66,624	67,094	67,565
286	68,039	68,514	68,992	69,471	69,952	70,434	70,919	71,405	71,893	72,383
287	72,874	73,367	73,862	74,358	74,856	75,356	75,858	76,361	76,866	77,372
288	77,880	78,389	78,901	79,414	79,929	80,446	80,966	81,487	82,011	82,537
289	83,066	83,596	84,129	84,664	85,202	85,742	86,285	86,830	87,378	87,928
290	88,481	89,036	89,594	90,154	90,717	91,282	91,851	92,421	92,994	93,570
291	94,148	94,728	95,310	95,894	96,481	97,070	97,661	98,255	98,851	99,450
292	100,051	100,654	101,260	101,868	102,479	103,092	103,708	104,326	104,946	105,569
293	106,194	106,822	107,452	108,084	108,719	109,357	109,997	110,639	111,284	111,931
294	112,580	113,231	113,885	114,541	115,200	115,860	116,523	117,189	117,856	118,526
295	119,198									

Appendix F

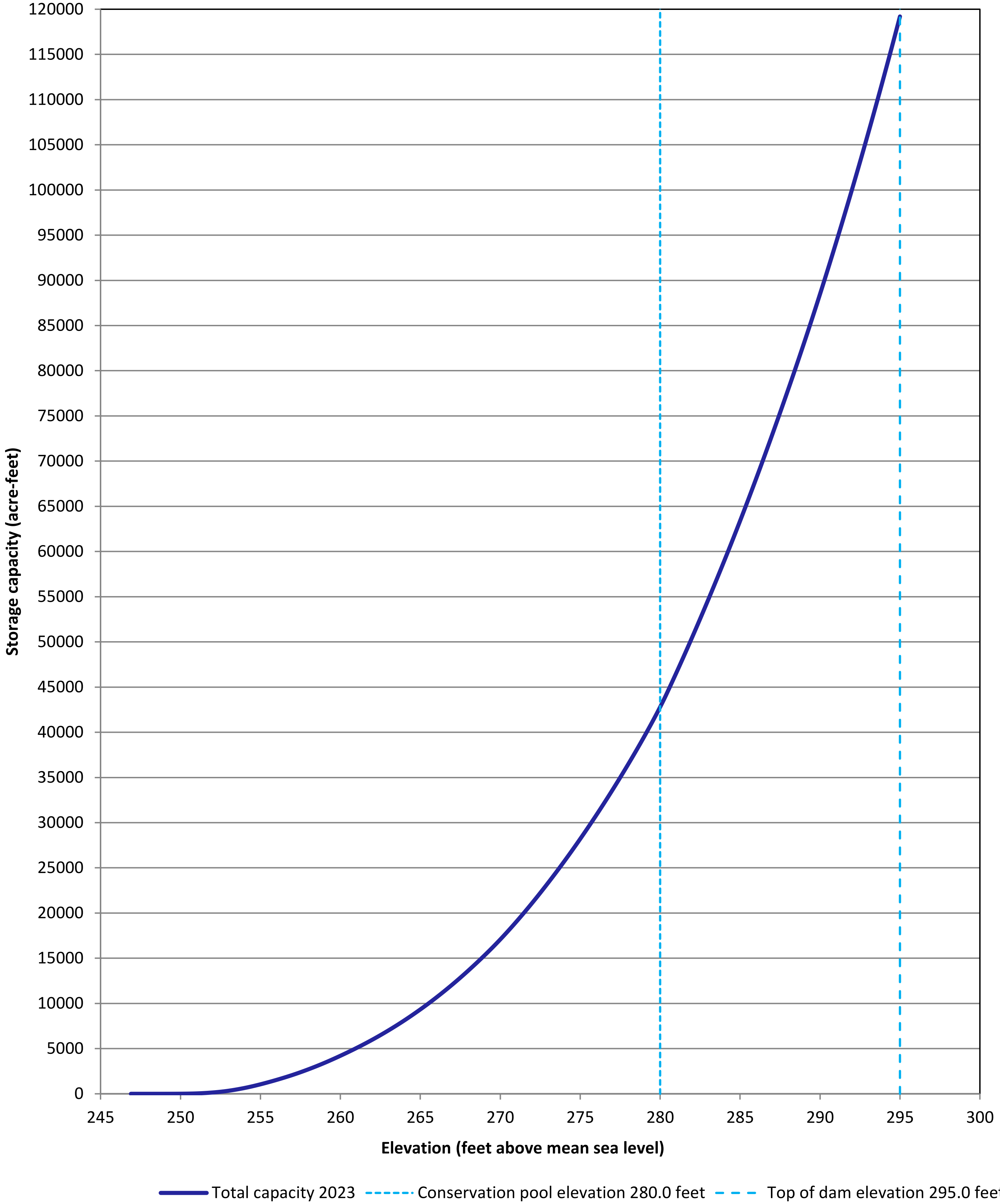
Lake Cherokee

RESERVOIR BATHYMETRIC AND TOPOGRAPHIC AREA TABLE

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

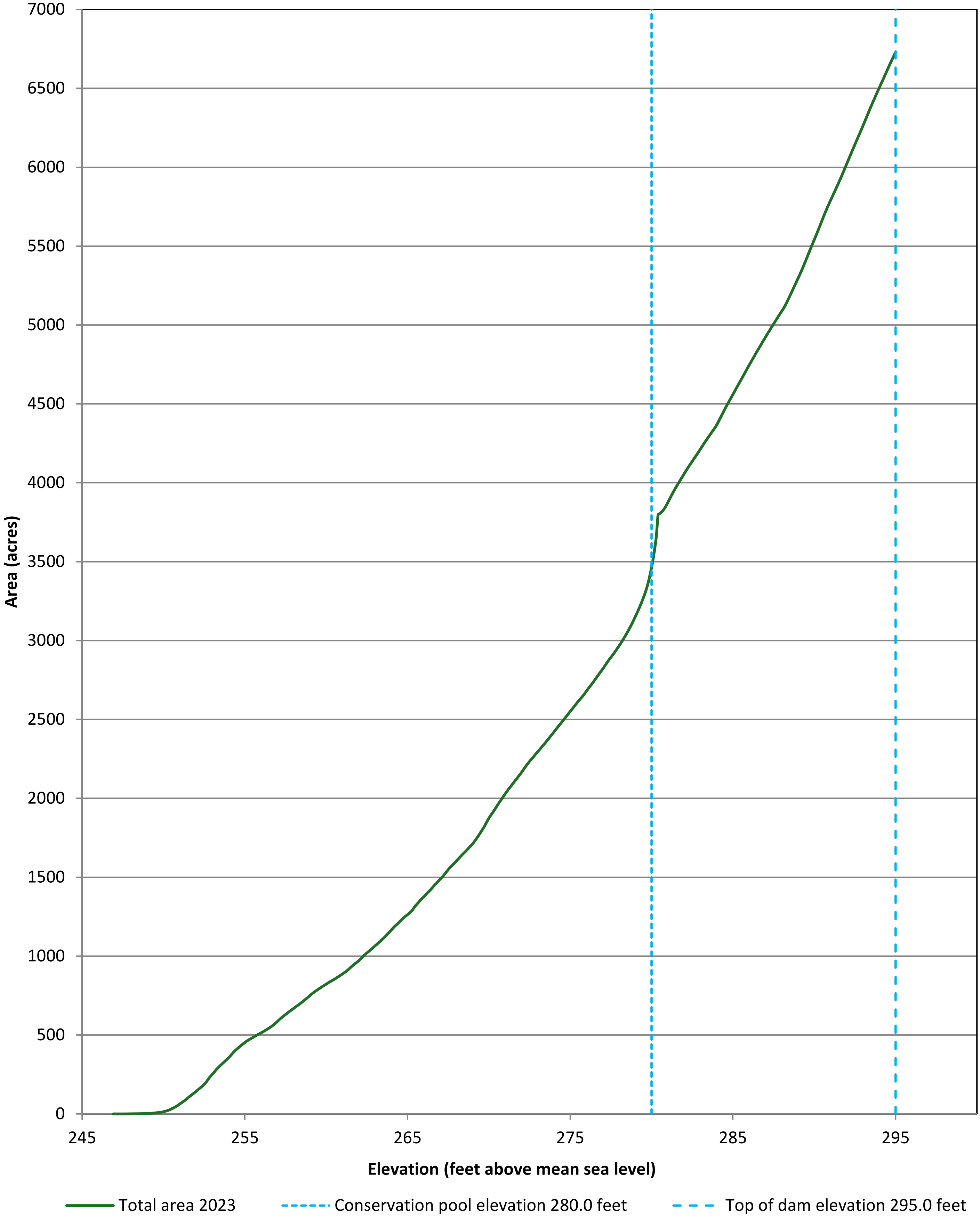
January 2023 Survey
Conservation pool elevation 280.0 feet NGVD29
Top of Dam elevation 295.0 feet NGVD29

ELEVATION (Feet NGVD29)	0.0	0.1	0.2	0.3	0.4	0.5	0.6	0.7	0.8	0.9
246	0	0	0	0	0	0	0	0	0	0
247	0	0	0	0	0	0	0	0	0	0
248	0	1	1	1	1	1	1	2	2	2
249	3	3	4	5	5	6	8	9	10	12
250	14	17	20	23	27	32	38	43	49	56
251	63	70	77	84	92	102	110	118	126	134
252	142	151	160	168	177	187	199	212	227	240
253	251	262	275	287	297	307	317	327	336	346
254	356	367	378	390	401	410	419	428	436	445
255	452	460	467	473	479	485	491	497	503	508
256	514	520	526	532	538	545	552	559	568	576
257	586	596	605	614	622	630	638	646	653	661
258	668	676	684	691	699	707	716	724	732	741
259	750	759	767	775	782	789	796	803	809	816
260	823	829	836	841	847	853	860	866	873	880
261	887	894	901	909	919	928	937	946	954	962
262	971	980	990	1,001	1,011	1,020	1,029	1,037	1,046	1,055
263	1,065	1,074	1,083	1,092	1,101	1,111	1,121	1,132	1,143	1,154
264	1,165	1,177	1,187	1,197	1,206	1,217	1,227	1,237	1,246	1,255
265	1,263	1,272	1,281	1,292	1,307	1,320	1,332	1,343	1,355	1,366
266	1,376	1,387	1,399	1,409	1,419	1,431	1,443	1,454	1,465	1,476
267	1,487	1,498	1,509	1,522	1,535	1,548	1,560	1,571	1,581	1,591
268	1,603	1,614	1,625	1,636	1,647	1,657	1,667	1,678	1,689	1,701
269	1,712	1,725	1,739	1,754	1,769	1,786	1,801	1,818	1,837	1,856
270	1,874	1,890	1,905	1,919	1,936	1,952	1,968	1,983	1,998	2,013
271	2,028	2,042	2,057	2,070	2,083	2,097	2,110	2,123	2,137	2,149
272	2,163	2,178	2,193	2,208	2,221	2,234	2,246	2,258	2,271	2,283
273	2,295	2,307	2,319	2,331	2,343	2,356	2,369	2,382	2,395	2,408
274	2,421	2,434	2,447	2,460	2,473	2,486	2,498	2,511	2,524	2,537
275	2,551	2,563	2,576	2,589	2,603	2,616	2,628	2,640	2,652	2,666
276	2,680	2,694	2,708	2,721	2,734	2,749	2,763	2,778	2,792	2,806
277	2,821	2,835	2,850	2,866	2,880	2,893	2,907	2,921	2,936	2,951
278	2,966	2,982	2,998	3,015	3,032	3,050	3,069	3,088	3,108	3,129
279	3,151	3,174	3,196	3,220	3,245	3,272	3,301	3,332	3,369	3,414
280	3,464	3,520	3,586	3,669	3,796	3,804	3,813	3,824	3,838	3,856
281	3,875	3,895	3,915	3,935	3,953	3,971	3,988	4,005	4,022	4,039
282	4,057	4,073	4,089	4,105	4,121	4,136	4,151	4,166	4,182	4,197
283	4,213	4,229	4,245	4,260	4,275	4,290	4,305	4,320	4,335	4,349
284	4,366	4,385	4,405	4,426	4,446	4,466	4,485	4,504	4,523	4,541
285	4,560	4,578	4,597	4,615	4,634	4,653	4,671	4,690	4,709	4,727
286	4,746	4,764	4,782	4,800	4,818	4,835	4,853	4,870	4,888	4,905
287	4,923	4,940	4,956	4,973	4,990	5,006	5,023	5,039	5,055	5,071
288	5,087	5,103	5,121	5,141	5,162	5,184	5,206	5,228	5,250	5,272
289	5,294	5,317	5,340	5,364	5,389	5,414	5,440	5,465	5,491	5,515
290	5,540	5,565	5,590	5,616	5,642	5,668	5,694	5,719	5,743	5,766
291	5,789	5,812	5,834	5,856	5,879	5,901	5,924	5,948	5,973	5,997
292	6,022	6,047	6,071	6,095	6,120	6,144	6,168	6,192	6,215	6,239
293	6,264	6,288	6,313	6,338	6,363	6,388	6,411	6,435	6,458	6,481
294	6,504	6,527	6,549	6,572	6,595	6,618	6,641	6,664	6,686	6,707
295	6,729									



Lake Cherokee
January 2023 Survey
Prepared by: TWDB

Appendix G: Bathymetric and topographic capacity curve



Lake Cherokee
January 2023 Survey
Prepared by: TWDB

Appendix H: Bathymetric and topographic area curve

Figure 6

Islands elevation
280.4 feet NGVD29

Lake Cherokee
at elevation280.4 feet NGVD29

Conservation pool elevation
280.0 feet NGVD29

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

CONTOURS
(feet above mean sea level)

280
278
276
274
272
270
268
266
264
262
260
258
256
254
252
250
248

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