Volumetric Survey
of
DARCO LAKE

April 2018 Survey

Texas Water Development Board

September 2018

Texas Water Development Board

Prepared for:

Railroad Commission of Texas

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Executive summary

In March 2018, the Texas Water Development Board (TWDB) entered into an agreement with the Railroad Commission of Texas, to perform volumetric surveys Darco Lake and two additional ponds on the Darco Mine site (Harrison County, Texas). The reservoirs are referred to as Darco Lake, Darco Pond 1 (Pond 1), and Darco Pond 2 (Pond 2). Surveying of Darco Lake and Pond 1 was performed using a multi-frequency (208 kHz, 50 kHz, and 24 kHz), sub-bottom profiling depth sounder; although only data collected at the 208 kHz frequency was analyzed for this report. Additional surveying of Darco Lake and Pond 2 was performed using a Trimble® R8-Model 4 Global Navigation Satellite System (GNSS) survey system. The GNSS system is a Real Time Kinematic with differential GPS (RTK-GPS) system that utilizes a base station with multiple rovers to collect data as either singular GPS points or as continuous bathymetric points by pairing the R8-Model 4 rover with a boat mounted SonarMite-MIL Spec^{tm} single beam echosounder.

The Darco Mine reservoirs are located just west of Highway 43, approximately 12 miles southwest of Marshall, in Harrison County, Texas. The TWDB collected bathymetric data for Darco Lake on April 17, 2018, while the water surface elevation measured 252.34 feet (NAVD88). The TWDB collected bathymetric data on Pond 1 on April 18, 2018, while the water surface elevation measured 254.16 feet (NAVD88). The TWDB collected bathymetric data for Pond 2 on April 18, 2018, while the water surface elevation measured 246.39 feet (NAVD88).

The 2018 TWDB volumetric survey indicates Darco Lake has a total reservoir capacity of 530 acre-feet and encompasses 51 acres at the modeled elevation (255.0 feet NAVD88). The 2018 TWDB volumetric survey indicates Pond 1 has a total reservoir capacity of 21 acre-feet and encompasses 4 acres at the modeled elevation (255.0 feet NAVD88). The 2018 TWDB volumetric survey indicates Pond 2 has a total reservoir capacity of 9 acre-feet and encompasses 2 acres at the modeled elevation (248.0 feet NAVD88).

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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 March 2018, the TWDB entered into an agreement with the Railroad Commission of Texas, to perform volumetric surveys of Darco Lake and two additional ponds on the Darco Mine site. (Harrison County, Texas) (Texas Water Development Board, 2018). The reservoirs are hereafter referred to as Darco Lake, Darco Pond 1 (Pond 1), and Darco Pond 2 (Pond 2). This report provides an overview of the survey methods, analysis techniques, and associated results. Also included are the following contract deliverables: (1) a shaded relief plot of each reservoir bottom (Figures 4 and 5), (2) a bottom contour map for each reservoir (Figures 8 and 9), and (3) an elevation-area-capacity table for each reservoir acceptable to the Texas Commission on Environmental Quality (Appendices A through L).

Darco Lake general information

The Darco Mine reservoirs were formerly runoff collection basins for the lignite coal mining activity of the Darco Mine. The mining area was bounded by Brandy Branch on the west, Sandy Creek on the east, and the Sabine River on the south, within the Sabine River Basin (Railroad Commission of Texas, 1992). The Darco Mine reservoirs are just west of Highway 43, approximately 12 miles southwest of Marshall, in Harrison County, Texas (Figure 1).

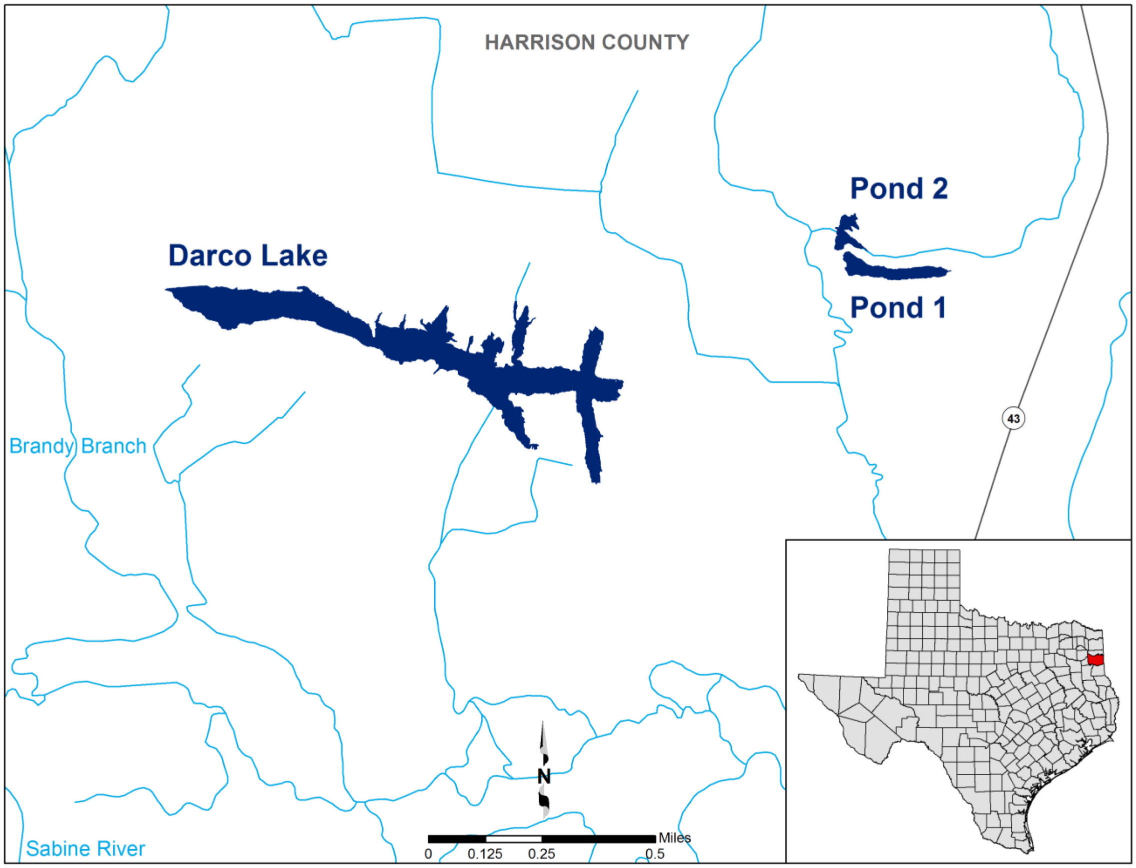


Figure 1. Location map of the Darco Mine reservoirs.

Volumetric survey of Darco Lake

Datum

The vertical datum used during this survey is the North American Vertical Datum 1988 (NAVD88). Elevations herein are reported in feet relative to the NAVD88 datum. Volume and area calculations in this report are referenced to water levels the TWDB measured while in the field. 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 data collection

The TWDB collected bathymetric data for Darco Lake on April 17, 2018, while the water surface elevation measured 252.34 feet (NAVD88). The TWDB collected bathymetric data on Pond 1 on April 18, 2018, while the water surface elevation measured 254.16 feet (NAVD88). The TWDB collected bathymetric data for Pond 2 on April 18, 2018, while the water surface elevation measured 246.39 feet (NAVD88). For data collection on Darco Lake and Pond 1, the TWDB used a Specialty Devices, Inc. (SDI), single-beam, multi-frequency (208 kHz, 50 kHz, and 24 kHz) sub-bottom profiling depth sounder integrated with differential global positioning system (DGPS) equipment; although only data collected at the 208 kHz frequency was analyzed. Data was collected along pre-planned survey lines oriented perpendicular to the assumed location of the original river channels and spaced approximately 75 feet apart on Darco Lake and 50 feet apart on Pond 1. The depth sounder was calibrated daily using a velocity profiler to measure the speed of sound in the water column and a weighted tape or stadia rod for depth reading verification. The TWDB collected additional data for Darco Lake and Pond 2 using a Trimble® R8-Model 4 Global Navigation Satellite System (GNSS) survey system. The GNSS system is a Real Time Kinematic with differential GPS (RTK-GPS) system that utilizes a base station with multiple rovers to collect data as either singular GPS points or as continuous bathymetric points by pairing the R8-Model 4 rover with a boat mounted SonarMite-MIL Spec™ single beam echosounder. Figure 2 shows the data collection locations for the 2018 TWDB survey.

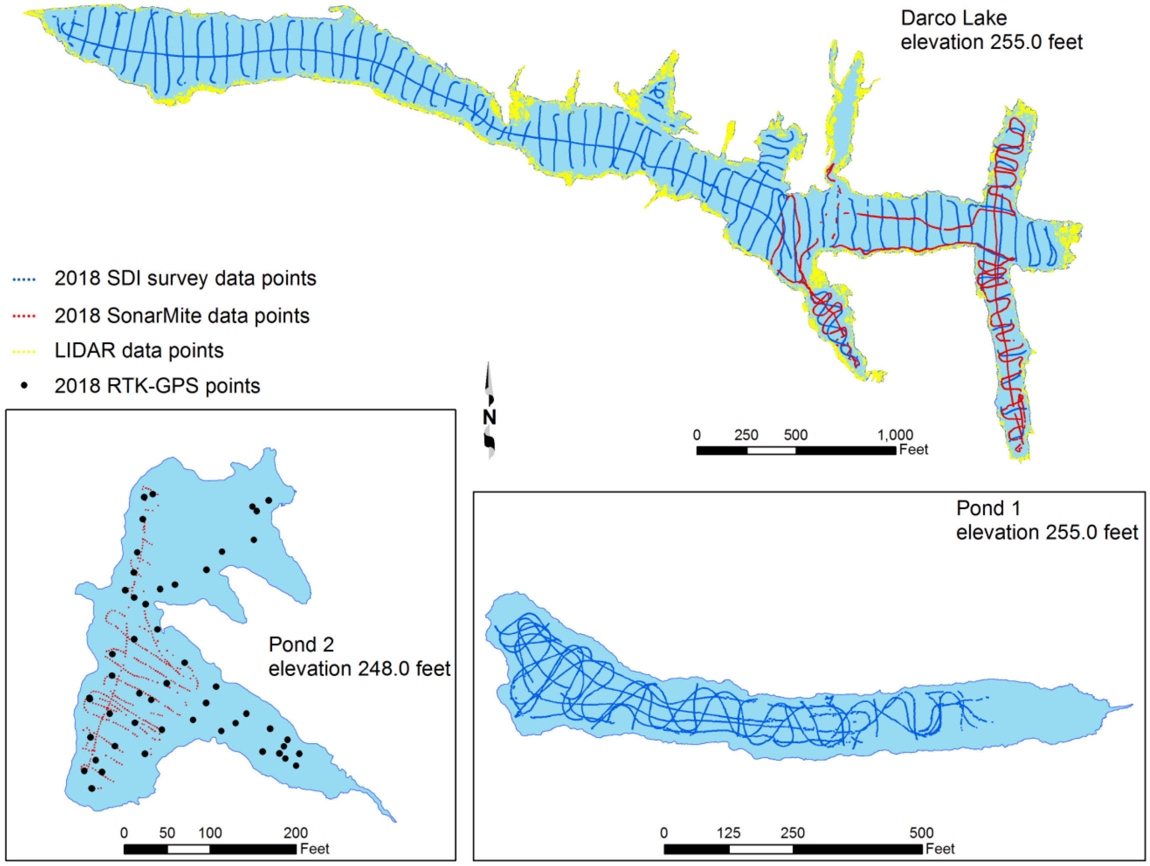


Figure 2. **2018 TWDB Darco reservoirs SDI survey data (*blue dots*), SonarMite data (*red dots*), singular RTK-GPS points (*black dots*), and LIDAR data points (*yellow dots*).**

Data processing

Model boundary

The reservoir's model boundaries were generated from Light Detection and Ranging (LIDAR) data provided to the TWDB by the Railroad Commission of Texas. The LIDAR data was collected on October 21, 2016, covering approximately 1,874 acres, 11 miles southwest of Marshall, Texas, to support the Texas Abandoned Mine Land Program for reclamation design, calculation of earthwork volumes associated with abandoned open pit surface mines, and vegetation biomass calculation. According to the associated metadata, the classified point cloud was produced to meet a horizontal positional accuracy of 0.2 meters. For vertical accuracy, the data set meets ASPRS Positional Accuracy Standards for Digital Geospatial Data (2014) for a 5cm RMSEz Vertical Accuracy Class equating to NVA = +/- 9.8cm at 95% confidence level and VVA =+/- 14.7cm at the 95th percentile.

To generate a boundary utilizing the LIDAR data, LIDAR data with a classification equal to 2, or ground, was imported into an Environmental Systems Research Institute's ArcGIS file geodatabase from .las files. A topographical model of the data was generated and converted to a raster using a cell size of 1.0 foot by 1.0 foot. The horizontal datum used for this data is North American Datum 1983 (NAD83), and the horizontal coordinate system is State Plane Texas North Central Zone (feet). Elevations are in the North American Vertical Datum of 1988. The LIDAR data and the TWDB survey data horizontal datum and vertical datum are the same requiring no additional conversion for compatibility. Contours at 1-foot intervals were generated from the raster. From these contours an appropriate contour was extracted and converted to a polygon for use as a model boundary for each reservoir. If necessary the contour was edited to fit the extent of bathymetric data collection.

LIDAR data points

For Darco Lake, LIDAR data points between the model boundary elevation 255.0 feet and LIDAR contour elevation 252.0 feet were added to the TIN model (Figure 2). The .las files were converted to text files with x, y, and z values keeping only those points classified as ground and then converted to a shapefile and clipped to the desired coverage area. In areas where survey data could not be collected and water was present at the time of LIDAR collection, linear interpolation of the data was necessary to provide a better estimate of true bathymetry.

RTK-GPS post-processing

Data collected using the Trimble® GPS system was downloaded from each rover's data controller and post-processed using the Trimble® Business Center (Version 4.0) software. Post-processing entails confirming project settings (e.g. vertical and horizontal datum, horizontal coordinate system) and tying the base station coordinates to Continuously Operating Reference Stations (CORS) sites to improve the precision of the project data from each rover. CORS sites are maintained by the National Geodetic Survey (NGS), an office of the National Oceanographic and Atmospheric Administration's (NOAA) National Ocean Service (National Geodetic Survey, 2014).

Triangulated Irregular Network model

Following completion of data collection using the SDI depth sounder, the raw data files collected by the TWDB were edited to remove data anomalies. The reservoir's current bottom surface is automatically determined by the data acquisition software. DepthPic© software, developed by SDI, Inc., was used to display, interpret, and edit the multi-frequency data by manually removing data anomalies in the current bottom surface. For further analysis, HydroTools, software developed by TWDB staff, was used to merge all the data into a single file. 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 and others, 2011a). Finally, the point file resulting from spatial interpolation is used in conjunction with sounding and boundary data to create a volumetric Triangulated Irregular Network (TIN) model 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 to errors in volume. These 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 TIN model 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 (known as digital raster graphics), 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 directionality of interpolation within each segment. For surveys with similar spatial coverage, these interpolation definition files are, in principle, independent of the survey data and could be applied to past and future survey data of the same reservoir. In practice, however, minor revisions of the interpolation definition files may be needed to account for differences in spatial coverage and boundary conditions between surveys. Using the interpolation definition files and survey data, the current reservoir-bottom elevation is calculated for each point in the high resolution uniform grid of artificial survey points. The reservoir boundary, artificial survey points grid, survey data points, and LIDAR points are used to create the TIN model representing reservoir bathymetry. 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 bathymetric and volumetric estimations. Linear interpolation follows a line linking the survey points file to the reservoir boundary file (McEwen and others, 2011a).

Figure 3 illustrates typical results from application of the anisotropic interpolation and linear interpolation techniques to Darco Lake. 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 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 A) and elevation-area (Appendix B) tables.

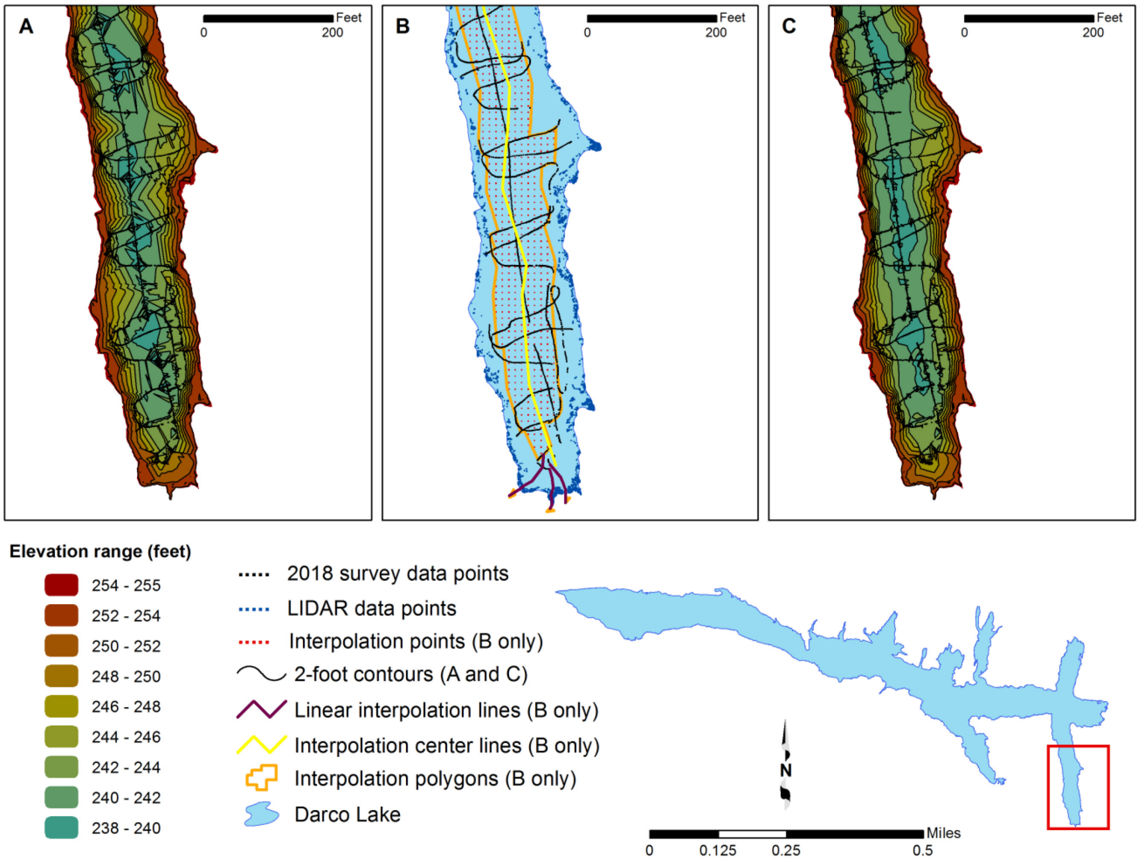


Figure 3. **Anisotropic spatial interpolation and linear interpolation of Darco Lake sounding data; A) bathymetric contours without interpolated points, B) sounding points (*black*), LIDAR points (*blue*), and interpolated points (*red*), C) bathymetric contours with interpolated points.**

Area, volume, and contour calculation

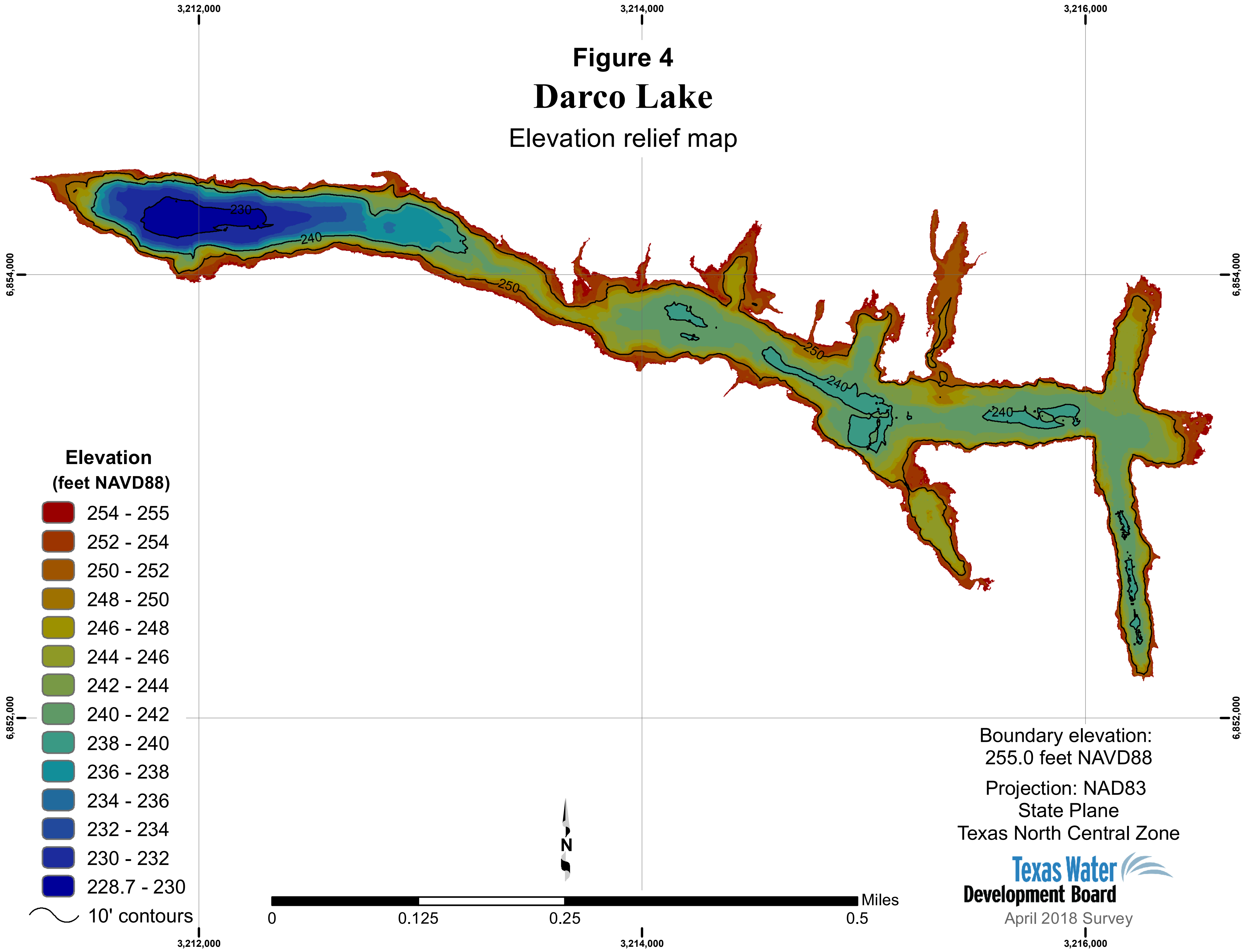
Using ArcInfo software and the TIN model, volumes and areas for Darco Lake were computed for the entire reservoir at 0.1-foot intervals, from 228.6 to 255.0 feet. The elevation-capacity table and elevation-area table, based on the 2018 survey and analysis, are presented in Appendices A and B, respectively. The capacity curve is presented in Appendix C, and the area curve is presented in Appendix D. Volumes and areas for Pond 1 were computed for the entire reservoir at 0.1-foot intervals, from 238.9 to 255.0 feet. The elevation-capacity table and elevation-area table, based on the 2018 survey and analysis, are presented in Appendices E and F, respectively. The capacity curve is presented in Appendix G, and the area curve is presented in Appendix H. Volumes and areas for Pond 2 were computed for the entire reservoir at 0.1-foot intervals, from 236.9 to 248.0 feet. The elevation-capacity table and elevation-area table, based on the 2018 survey and analysis, are presented in Appendices I and J, respectively. The capacity curve is presented in Appendix K, and the area curve is presented in Appendix L.

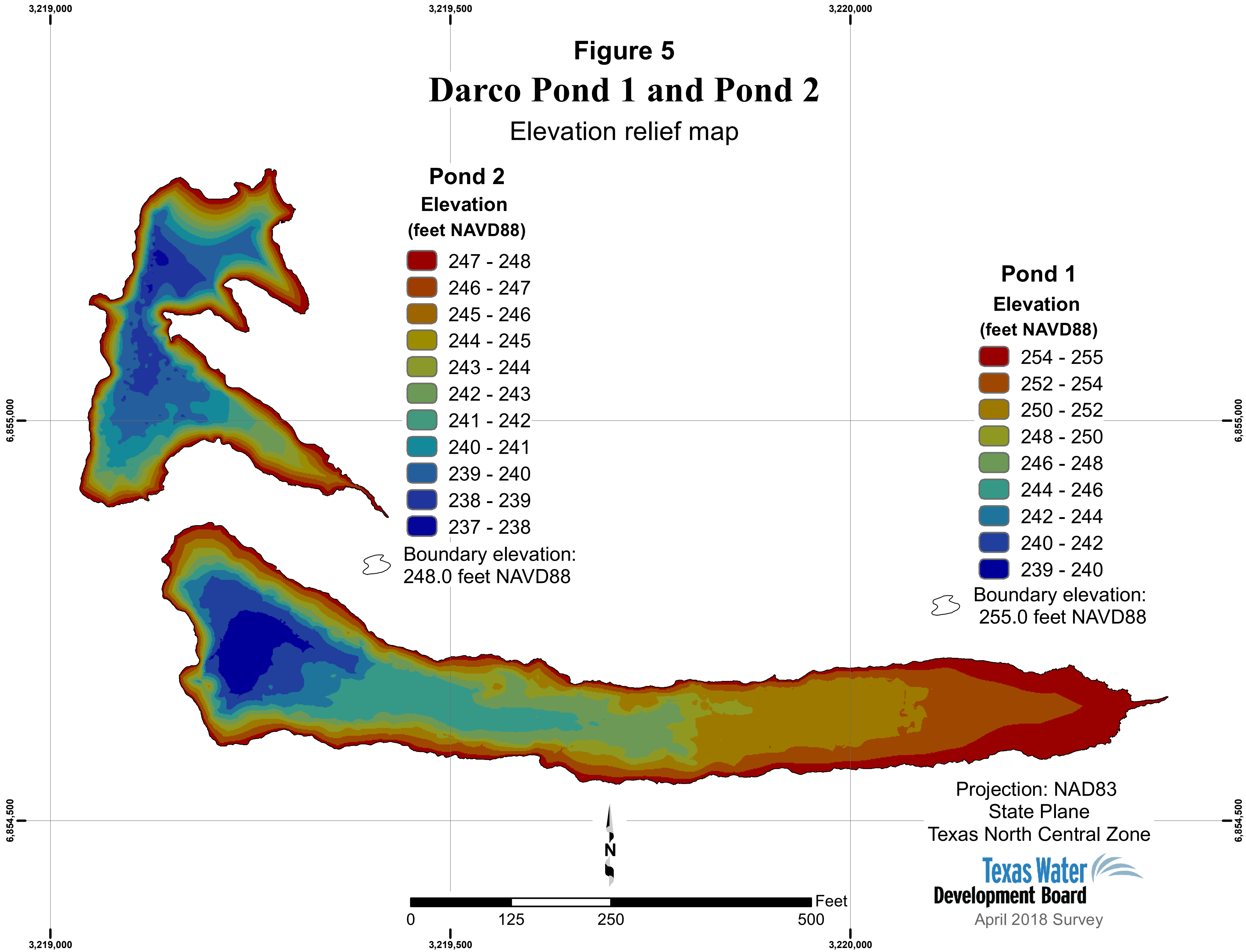
The TIN models were converted to a raster representation using a cell size of 1-foot by 1-foot. The raster data then was used to produce three figures: (1) an elevation relief map representing the topography of each reservoir bottom (Figures 4 and 5); (2) a depth range map showing shaded depth ranges for each reservoir (Figures 6 and 7); and, (3) a 2-foot contour map of each reservoir (Figures 8 and 9).

Figure 4

Darco Lake

Elevation relief map




3,219,000
3,219,500
3,220,000
Figure 5
Darco Pond 1 and Pond 2
Elevation relief map
Pond 2
Elevation
(feet NAVD88)
247 - 248
246 - 247
245 - 246
244 - 245
243 - 244
242 - 243
241 - 242
240 - 241
239 - 240
238 - 239
237 - 238
Boundary elevation:
248.0 feet NAVD88
Pond 1
Elevation
(feet NAVD88)
254 - 255
252 - 254
250 - 252
248 - 250
246 - 248
244 - 246
242 - 244
240 - 242
239 - 240
Boundary elevation:
255.0 feet NAVD88
6,855,000
6,854,500
Projection: NAD83
State Plane
Texas North Central Zone
N
Feet
0
125
250
500
Texas Water
Development Board
April 2018 Survey

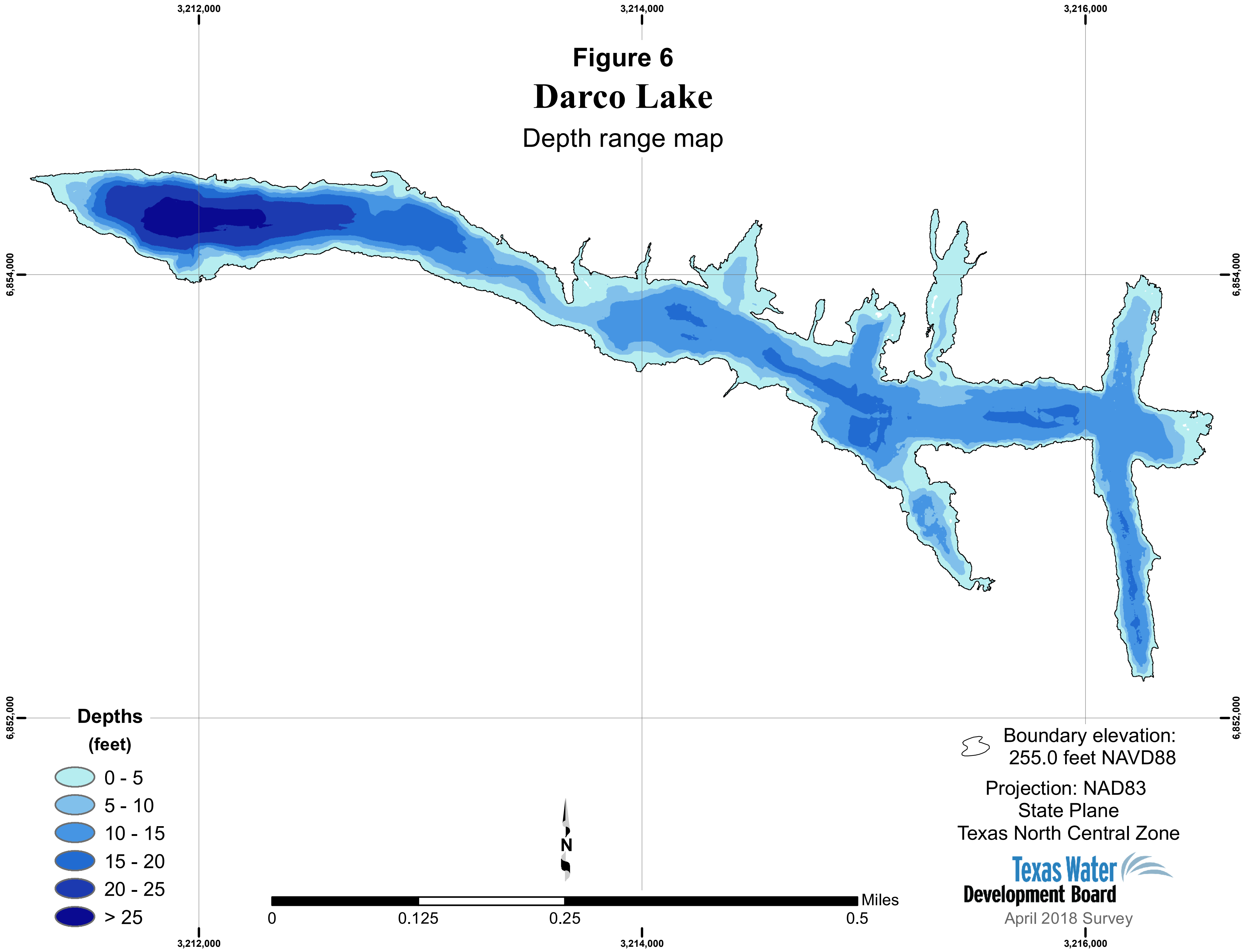


Figure 6

Darco Lake

Depth range map

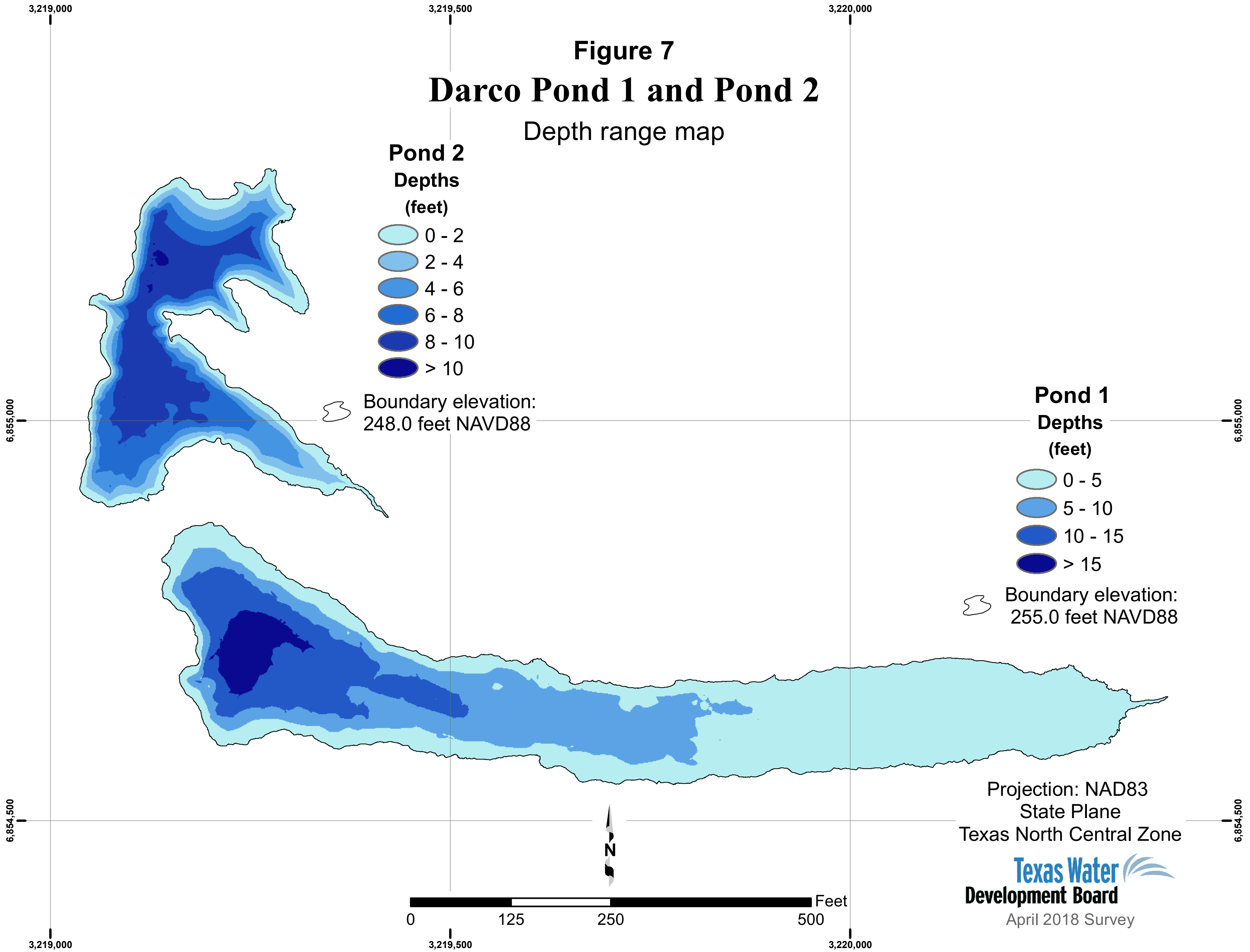
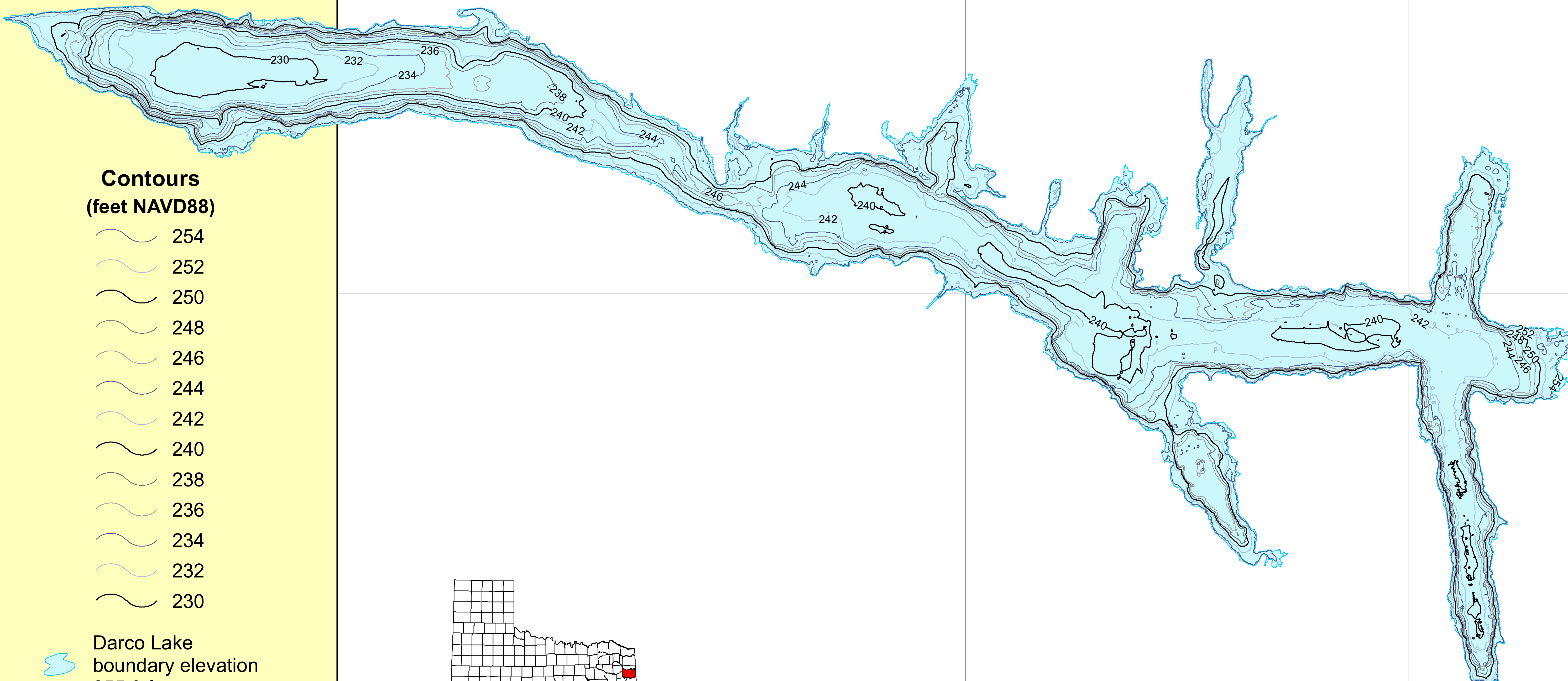


Figure 7
Darco Pond 1 and Pond 2
Depth range map
Pond 2
Depths
(feet)
0 - 2
2 - 4
4 - 6
6 - 8
8 - 10
> 10
Boundary elevation:
248.0 feet NAVD88
Pond 1
Depths
(feet)
0 - 5
5 - 10
10 - 15
> 15
Boundary elevation:
255.0 feet NAVD88
Projection: NAD83
State Plane
Texas North Central Zone
Texas Water
Development Board
April 2018 Survey
N
0
125
250
500
Feet
3,219,000
3,219,500
3,220,000
6,855,000
6,854,500

Figure 8

Darco Lake

2' - contour map



Contours
(feet NAVD88)

- 254
- 252
- 250
- 248
- 246
- 244
- 242
- 240
- 238
- 236
- 234
- 232
- 230

Darco Lake boundary elevation 255.0 feet

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

Harrison County

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

Texas Water Development Board

April 2018 Survey

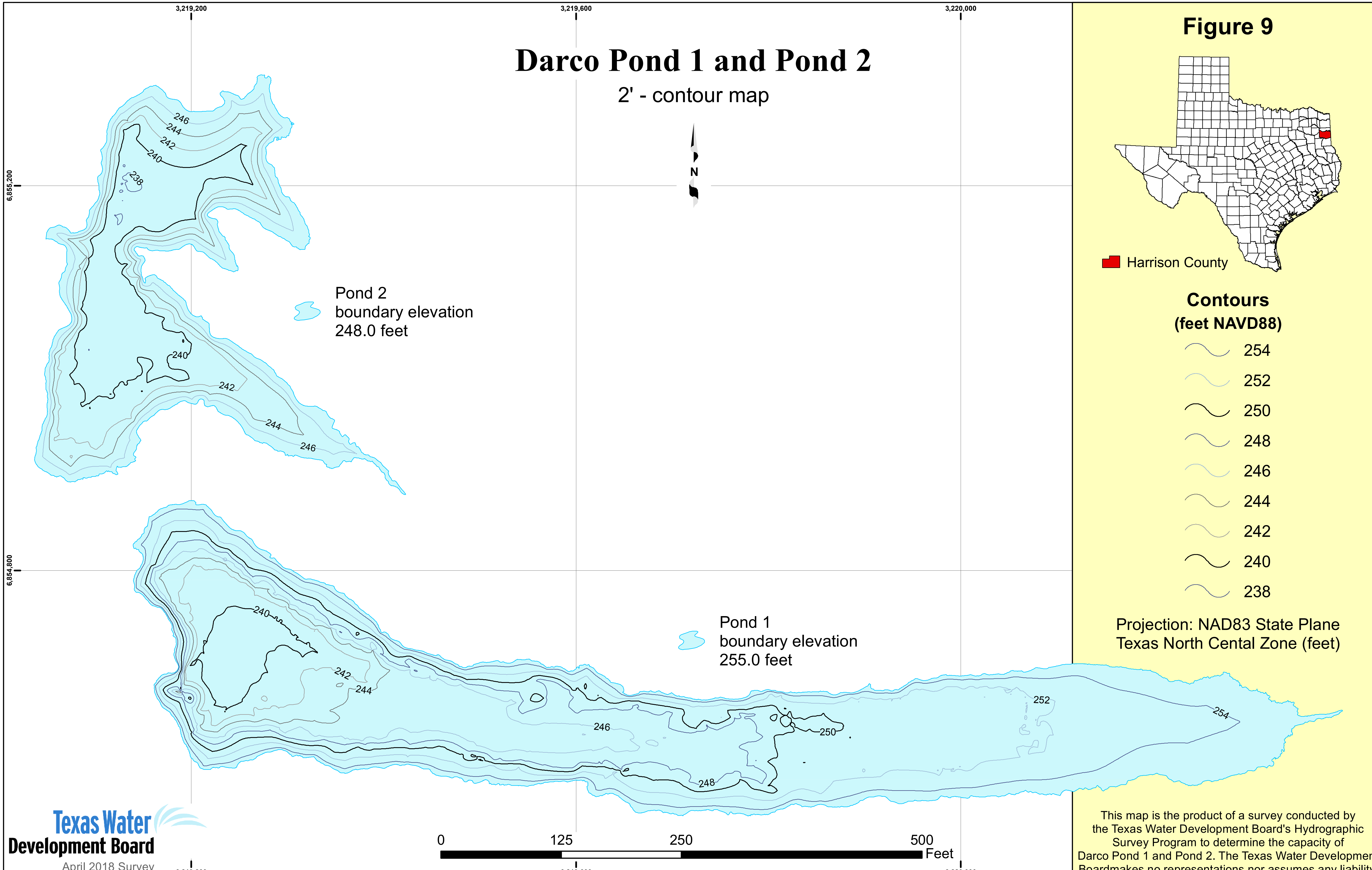


Figure 9
Darco Pond 1 and Pond 2
2' - contour map
N
Pond 2
boundary elevation
248.0 feet
Pond 1
boundary elevation
255.0 feet
Harrison County
Contours
(feet NAVD88)
254
252
250
248
246
244
242
240
238
Projection: NAD83 State Plane
Texas North Cental Zone (feet)
This map is the product of a survey conducted by
the Texas Water Development Board's Hydrographic
Survey Program to determine the capacity of
Darco Pond 1 and Pond 2. The Texas Water Development
Boardmakes no representations nor assumes any liability.
Texas Water
Development Board
April 2018 Survey
0
125
250
500
Feet
3,219,200
3,219,600
3,220,000
6,855,200
6,854,800

Survey results

Volumetric survey

The 2018 TWDB volumetric survey indicates that Darco Lake has a total reservoir capacity of 530 acre-feet and encompasses 51 acres at the modeled elevation (255.0 feet NAVD88). The 2018 TWDB volumetric survey indicates that Pond 1 has a total reservoir capacity of 21 acre-feet and encompasses 4 acres at the modeled elevation (255.0 feet NAVD88). The 2018 TWDB volumetric survey indicates that Pond 2 has a total reservoir capacity of 9 acre-feet and encompasses 2 acres at the modeled elevation (248.0 feet NAVD88).

TWDB contact information

More information about the Hydrographic Survey Program can be found at:
http://www.twdb.texas.gov/surfacewater/surveys/index.asp
Any questions regarding the TWDB Hydrographic Survey Program may be addressed to:
Hydrosurvey@twdb.texas.gov

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Texas Water Development Board, 2018, Contract No. 1848012186 with the Railroad Commission of Texas, Austin, Texas.

Appendix A

Darco Lake

RESERVOIR CAPACITY TABLE

TEXAS WATER DEVELOPMENT BOARD

CAPACITY IN ACRE-FEET

ELEVATION INCREMENT IS ONE TENTH FOOT

April 2018 Survey

Model boundary elevation 255.0 feet

ELEVATION in Feet	0.0	0.1	0.2	0.3	0.4	0.5	0.6	0.7	0.8	0.9
228	0	0	0	0	0	0	0	0	0	0
229	0	0	0	0	0	0	0	0	0	1
230	1	1	1	1	1	2	2	2	2	3
231	3	3	3	4	4	4	4	5	5	5
232	6	6	6	7	7	7	8	8	9	9
233	9	10	10	11	11	11	12	12	13	13
234	14	14	14	15	15	16	16	17	17	18
235	18	19	19	20	20	21	21	22	22	23
236	23	24	24	25	26	26	27	27	28	29
237	29	30	30	31	32	32	33	34	34	35
238	36	37	37	38	39	39	40	41	42	42
239	43	44	45	46	47	47	48	49	50	51
240	52	53	54	56	57	58	59	61	62	63
241	65	66	68	69	71	73	74	76	78	80
242	82	84	86	88	90	92	94	96	98	100
243	103	105	107	109	112	114	117	119	121	124
244	126	129	132	134	137	139	142	145	147	150
245	153	155	158	161	164	167	170	172	175	178
246	181	184	187	190	193	196	199	202	206	209
247	212	215	218	221	224	228	231	234	237	241
248	244	247	251	254	257	261	264	267	271	274
249	278	281	285	288	292	295	299	303	306	310
250	313	317	321	325	328	332	336	340	343	347
251	351	355	359	363	367	371	375	379	383	387
252	391	395	399	404	408	412	417	421	425	430
253	434	439	443	448	453	457	462	467	471	476
254	481	486	491	495	500	505	510	515	520	525
255	530									

Appendix B

Darco Lake

RESERVOIR AREA TABLE

TEXAS WATER DEVELOPMENT BOARD

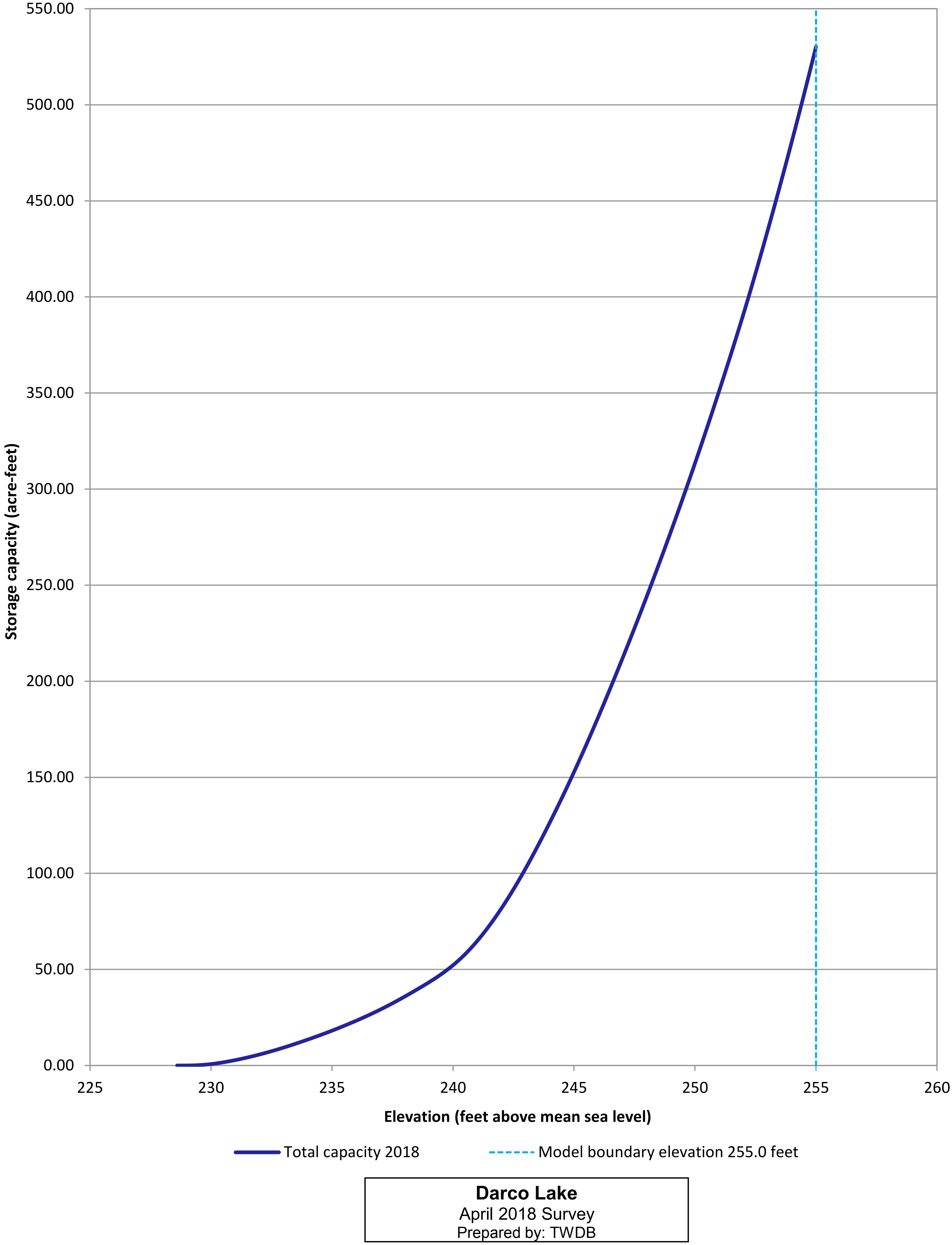
AREA IN ACRES

ELEVATION INCREMENT IS ONE TENTH FOOT

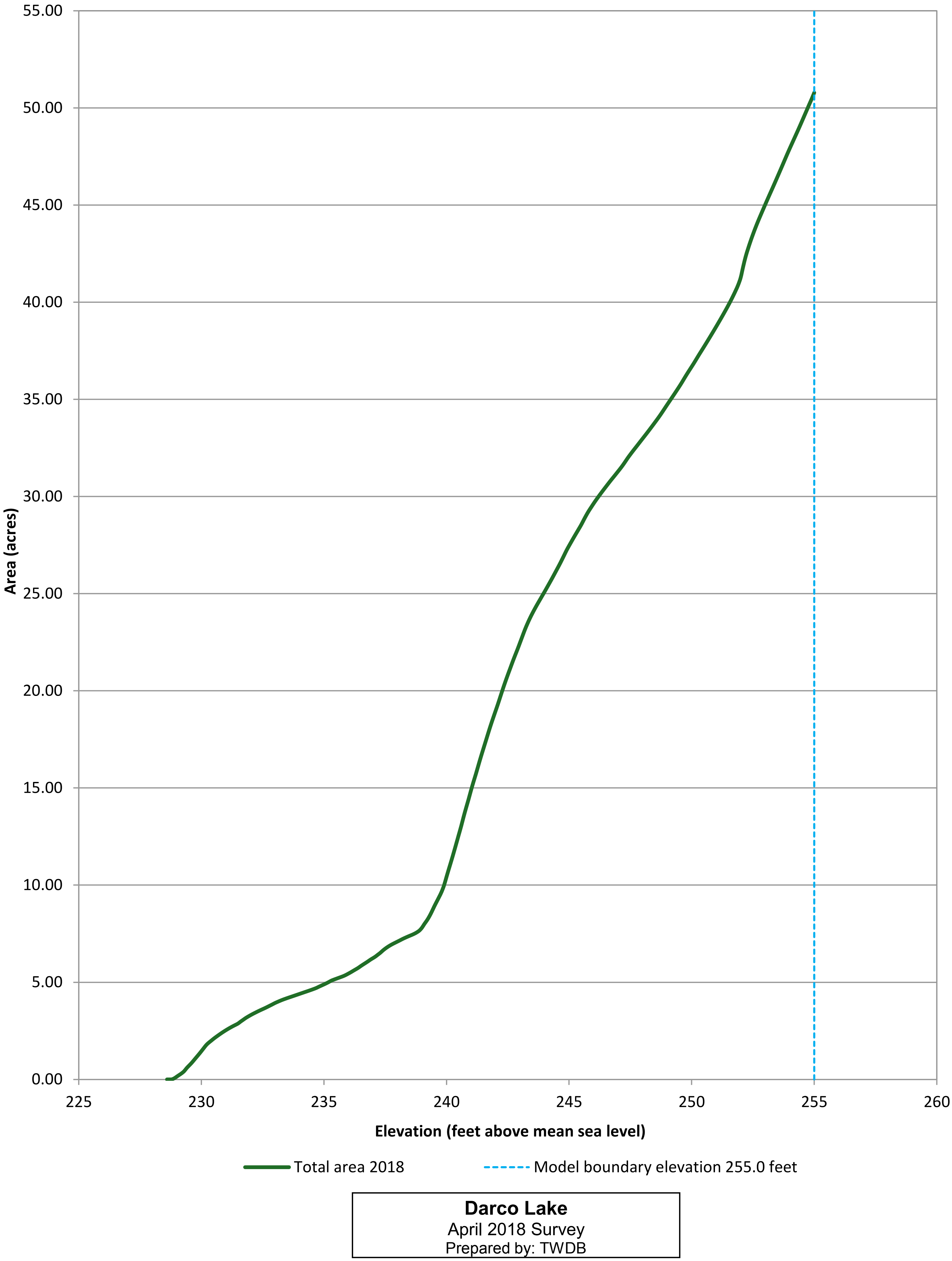
April 2018 Survey

Model boundary elevation 255.0 feet

ELEVATION in Feet	0.0	0.1	0.2	0.3	0.4	0.5	0.6	0.7	0.8	0.9
228	0	0	0	0	0	0	0	0	0	0
229	0	0	0	0	1	1	1	1	1	1
230	1	2	2	2	2	2	2	2	2	2
231	3	3	3	3	3	3	3	3	3	3
232	3	3	3	3	4	4	4	4	4	4
233	4	4	4	4	4	4	4	4	4	4
234	4	4	4	5	5	5	5	5	5	5
235	5	5	5	5	5	5	5	5	5	5
236	5	6	6	6	6	6	6	6	6	6
237	6	6	6	7	7	7	7	7	7	7
238	7	7	7	7	7	7	7	8	8	8
239	8	8	8	8	9	9	9	9	10	10
240	10	11	11	12	12	13	13	14	14	14
241	15	15	16	16	17	17	17	18	18	19
242	19	19	20	20	20	21	21	22	22	22
243	22	23	23	23	24	24	24	24	25	25
244	25	25	26	26	26	26	26	27	27	27
245	27	28	28	28	28	29	29	29	29	29
246	30	30	30	30	30	31	31	31	31	31
247	31	31	32	32	32	32	32	32	33	33
248	33	33	33	33	34	34	34	34	34	35
249	35	35	35	35	35	36	36	36	36	36
250	37	37	37	37	37	38	38	38	38	39
251	39	39	39	39	40	40	40	40	41	41
252	41	42	42	43	43	43	44	44	44	45
253	45	45	46	46	46	46	47	47	47	48
254	48	48	48	49	49	49	50	50	50	50
255	51									



Appendix C: Capacity curve



Appendix D: Area curve

Appendix E

Darco Pond 1

RESERVOIR CAPACITY TABLE

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

April 2018 Survey
Model boundary elevation 255.0 feet

ELEVATION in Feet	0.0	0.1	0.2	0.3	0.4	0.5	0.6	0.7	0.8	0.9
238	0	0	0	0	0	0	0	0	0	0
239	0	0	0	0	0	0	0	0	0	0
240	0	0	0	0	0	0	0	0	0	0
241	0	0	0	0	0	0	0	1	1	1
242	1	1	1	1	1	1	1	1	1	1
243	1	1	1	1	1	1	1	1	1	1
244	2	2	2	2	2	2	2	2	2	2
245	2	2	2	2	2	3	3	3	3	3
246	3	3	3	3	3	3	4	4	4	4
247	4	4	4	4	5	5	5	5	5	5
248	5	5	6	6	6	6	6	6	6	7
249	7	7	7	7	7	7	8	8	8	8
250	8	8	9	9	9	9	9	9	10	10
251	10	10	10	11	11	11	11	11	12	12
252	12	12	13	13	13	13	14	14	14	14
253	15	15	15	16	16	16	16	17	17	17
254	18	18	18	19	19	19	20	20	20	21
255	21									

Appendix F

Darco Pond 1

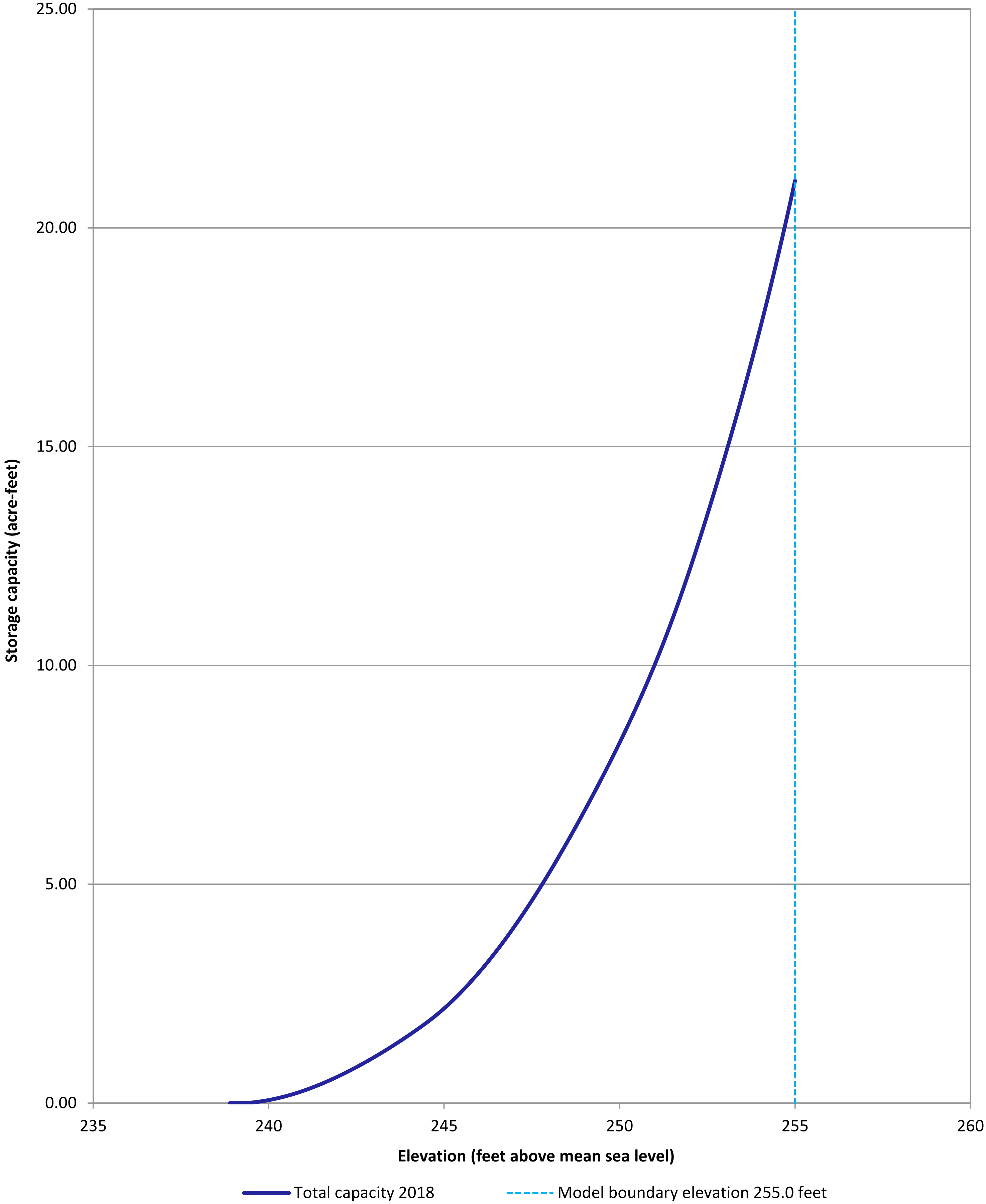
RESERVOIR AREA TABLE

TEXAS WATER DEVELOPMENT BOARD — April 2018 Survey

AREA IN ACRES — Model boundary elevation 255.0 feet

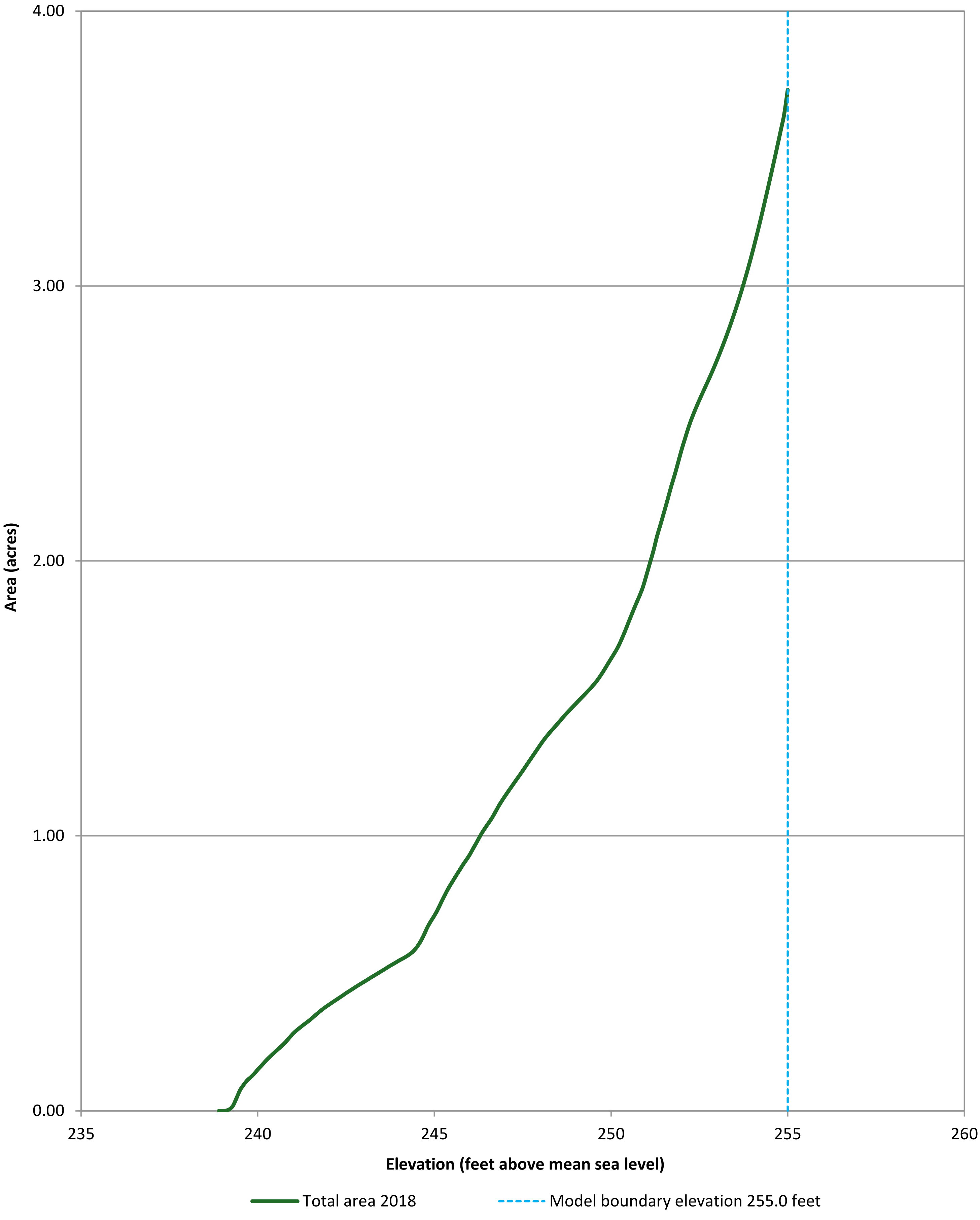
ELEVATION INCREMENT IS ONE TENTH FOOT

ELEVATION in Feet	0.0	0.1	0.2	0.3	0.4	0.5	0.6	0.7	0.8	0.9
238	0	0	0	0	0	0	0	0	0	0
239	0	0	0	0	0	0	0	0	0	0
240	0	0	0	0	0	0	0	0	0	0
241	0	0	0	0	0	0	0	0	0	0
242	0	0	0	0	0	0	0	0	0	0
243	0	0	0	0	1	1	1	1	1	1
244	1	1	1	1	1	1	1	1	1	1
245	1	1	1	1	1	1	1	1	1	1
246	1	1	1	1	1	1	1	1	1	1
247	1	1	1	1	1	1	1	1	1	1
248	1	1	1	1	1	1	1	1	1	1
249	1	1	2	2	2	2	2	2	2	2
250	2	2	2	2	2	2	2	2	2	2
251	2	2	2	2	2	2	2	2	2	2
252	2	2	2	3	3	3	3	3	3	3
253	3	3	3	3	3	3	3	3	3	3
254	3	3	3	3	3	3	3	4	4	4
255	4									



Darco Pond 1
April 2018 Survey
Prepared by: TWDB

Appendix G: Capacity curve



Darco Pond 1
April 2018 Survey
Prepared by: TWDB

Appendix H: Area curve

Appendix I

Darco Pond 2

RESERVOIR CAPACITY TABLE

TEXAS WATER DEVELOPMENT BOARD | April 2018 Survey
CAPACITY IN ACRE-FEET | Model boundary elevation 248.0 feet
ELEVATION INCREMENT IS ONE TENTH FOOT

ELEVATION in Feet	0.0	0.1	0.2	0.3	0.4	0.5	0.6	0.7	0.8	0.9
236	0	0	0	0	0	0	0	0	0	0
237	0	0	0	0	0	0	0	0	0	0
238	0	0	0	0	0	0	0	0	0	0
239	0	0	0	0	0	0	0	0	0	0
240	0	0	0	1	1	1	1	1	1	1
241	1	1	1	1	1	1	1	1	1	2
242	2	2	2	2	2	2	2	2	2	2
243	2	3	3	3	3	3	3	3	3	3
244	3	4	4	4	4	4	4	4	4	4
245	4	5	5	5	5	5	5	5	5	6
246	6	6	6	6	6	6	6	7	7	7
247	7	7	7	7	8	8	8	8	8	8
248	9									

Appendix J

Darco Pond 2

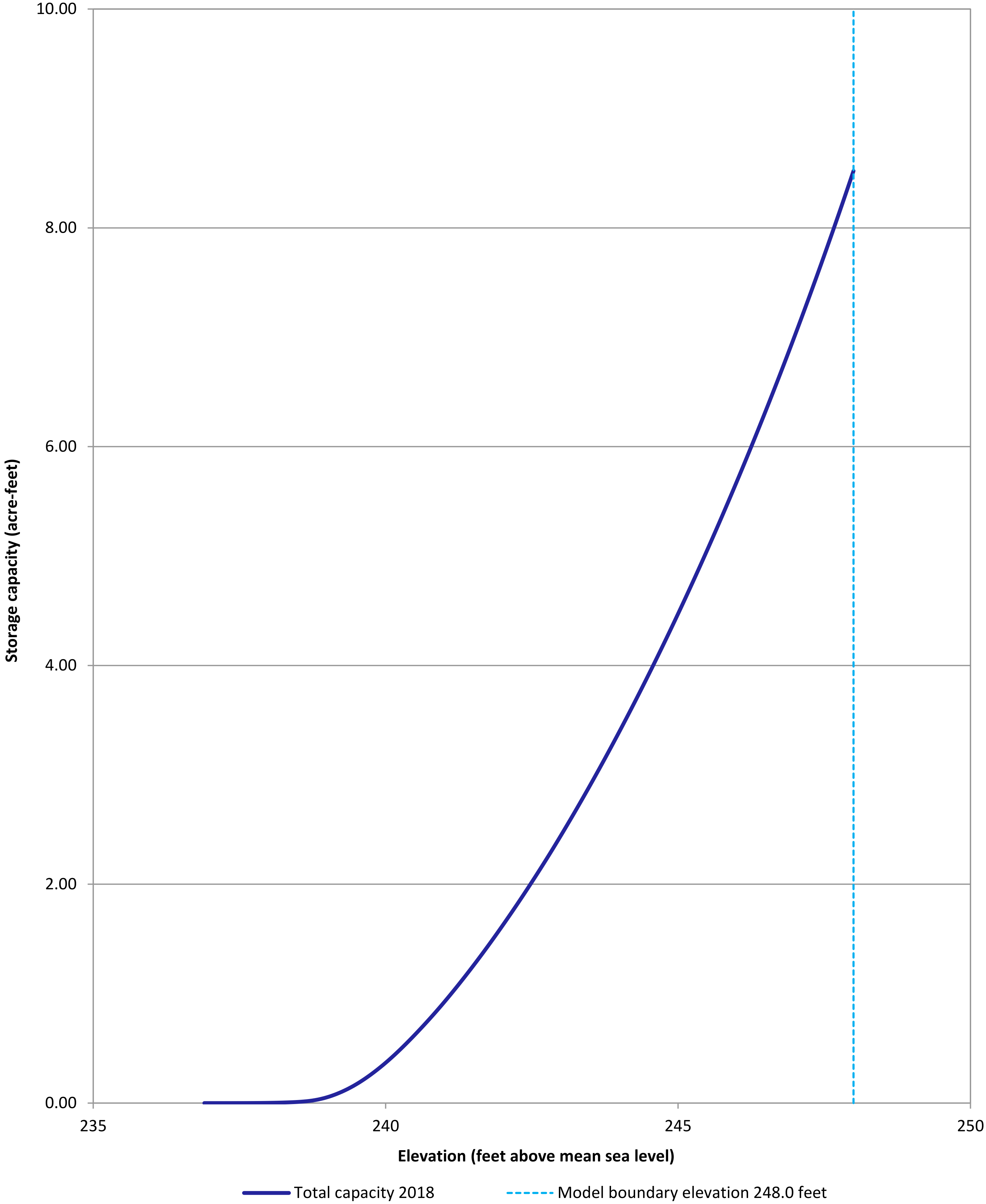
RESERVOIR AREA TABLE

TEXAS WATER DEVELOPMENT BOARD — April 2018 Survey

AREA IN ACRES — Model boundary elevation 248.0 feet

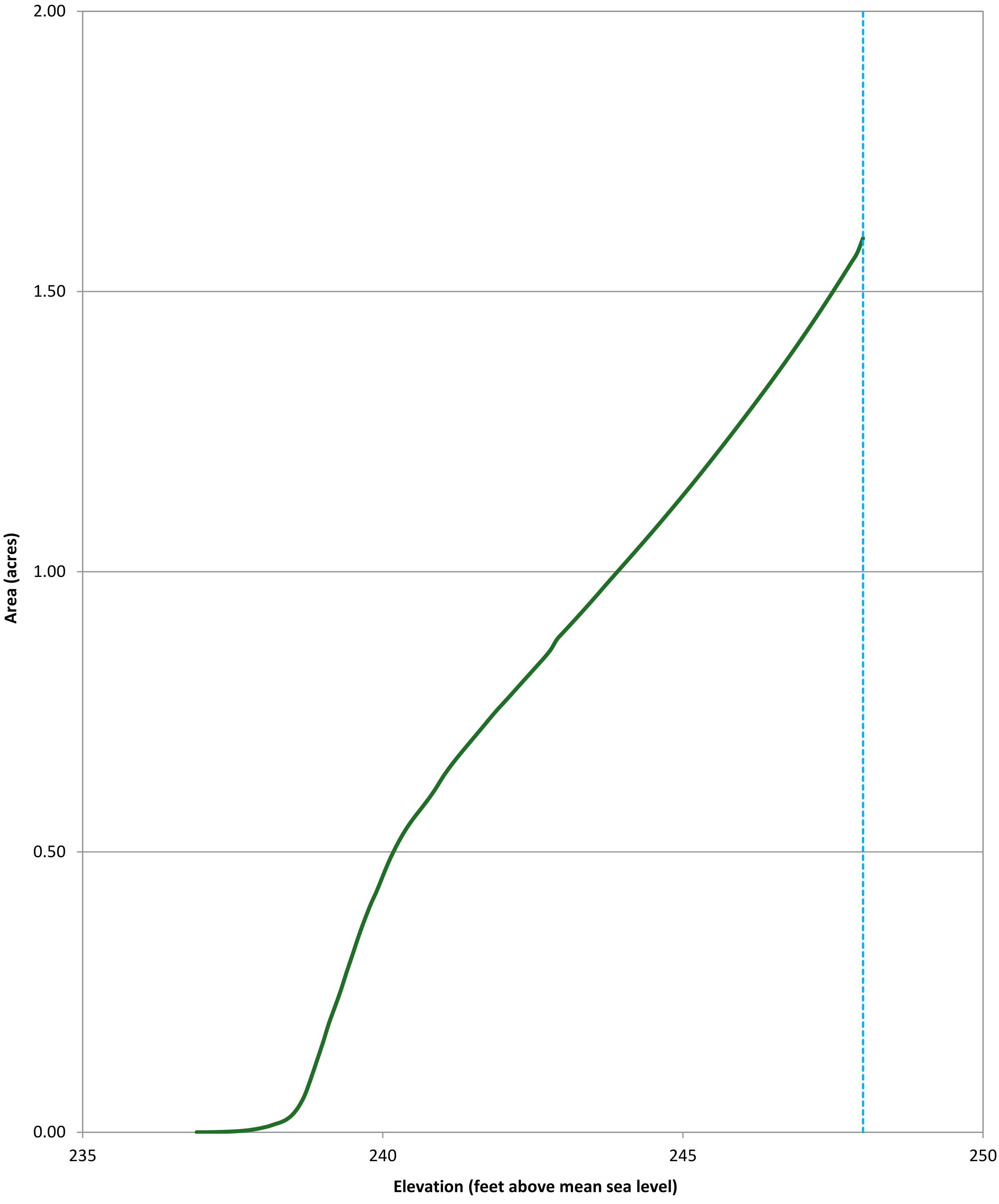
ELEVATION INCREMENT IS ONE TENTH FOOT

ELEVATION in Feet	0.0	0.1	0.2	0.3	0.4	0.5	0.6	0.7	0.8	0.9
236	0	0	0	0	0	0	0	0	0	0
237	0	0	0	0	0	0	0	0	0	0
238	0	0	0	0	0	0	0	0	0	0
239	0	0	0	0	0	0	0	0	0	0
240	0	0	1	1	1	1	1	1	1	1
241	1	1	1	1	1	1	1	1	1	1
242	1	1	1	1	1	1	1	1	1	1
243	1	1	1	1	1	1	1	1	1	1
244	1	1	1	1	1	1	1	1	1	1
245	1	1	1	1	1	1	1	1	1	1
246	1	1	1	1	1	1	1	1	1	1
247	1	1	1	1	1	2	2	2	2	2
248	2									



Darco Pond 2
April 2018 Survey
Prepared by: TWDB

Appendix K: Capacity curve



Darco Pond 2
April 2018 Survey
Prepared by: TWDB

Appendix L: Area curve