

June 2019

## RAINFALL

Rainfall observations from the National Oceanic and Atmospheric Administration – National Weather Service (NOAA-NWS) indicate that total rainfall for June [Figure 1(a)] over the Lower Valley, East Texas, South Central, southwestern Edwards Plateau, Upper Coast, southern Trans Pecos, central Low Rolling Plains, and northern Plains climate divisions was above-average compared to historical data from 1981–2010. Rainfall exceeded 20” in portions of the East Texas and Upper Coast climate divisions. Rainfall in the southern High Plains, western and northern Trans Pecos, and the Southern climate divisions was below-average [Figure 1(b)].

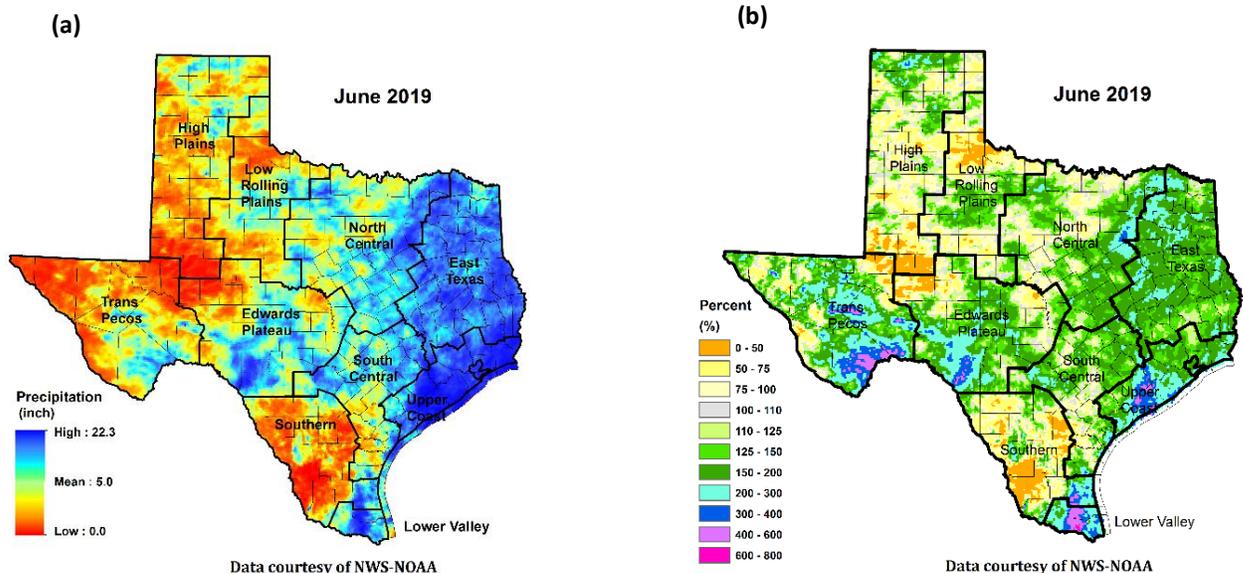
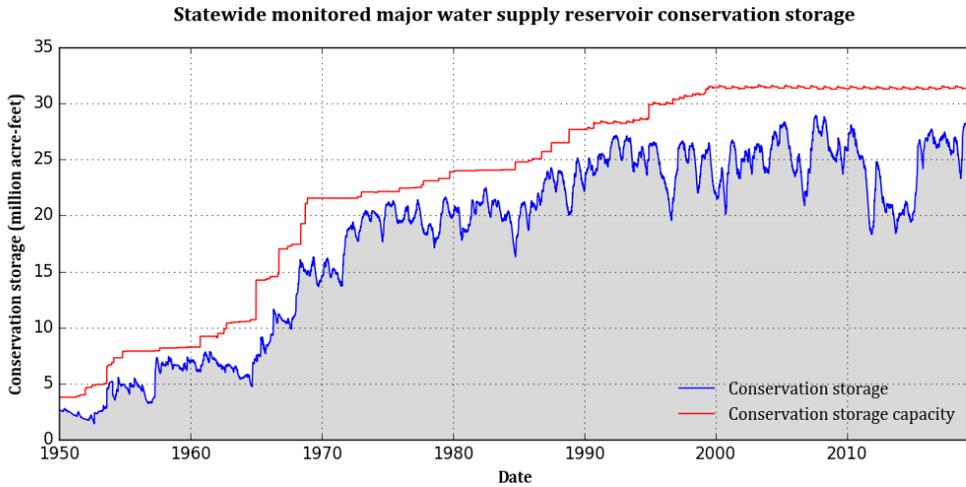


Figure 1: (a) Monthly accumulated rainfall, and (b) Percent of normal rainfall for June 2019

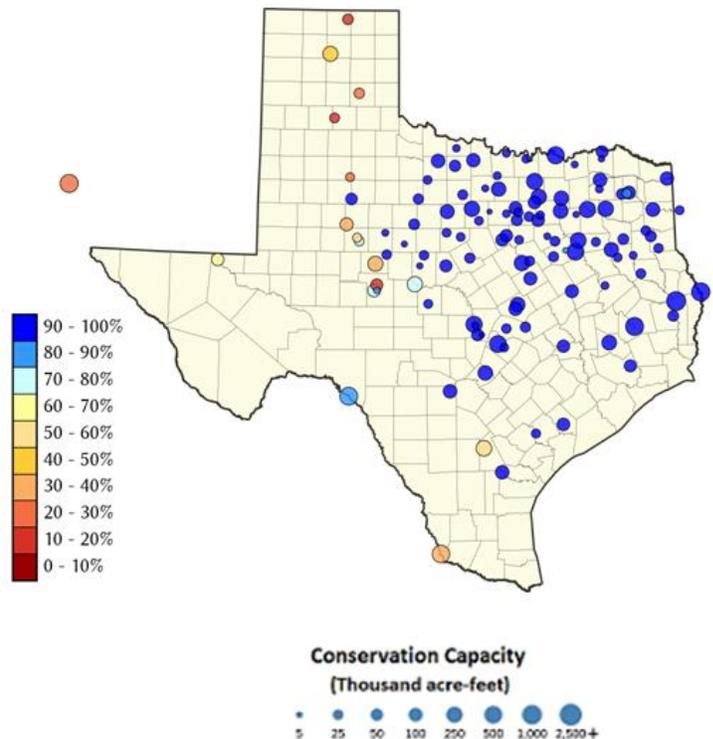
## **RESERVOIR STORAGE**

At the end of June 2019, total conservation storage\* in 118 of the state’s major water supply reservoirs plus Elephant Butte Reservoir in New Mexico was 28.6 million acre-feet or 89 percent of total conservation storage capacity (Figure 2). This is approximately 0.09 million acre-feet less than a month ago and 3.3 million acre-feet more than end-May 2018.



**Figure 2:** Statewide reservoir conservation storage

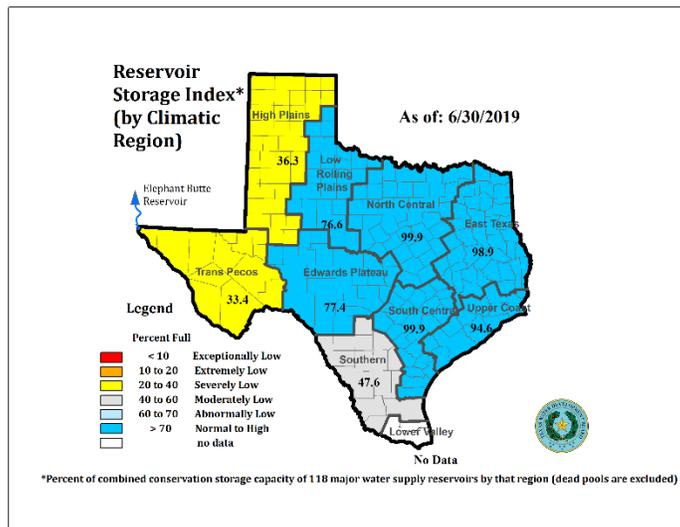
Out of 118 reservoirs in the state, 75 reservoirs held 100 percent of conservation storage capacity (Figure 3). Additionally, 24 were above 90 percent full. Five reservoirs [Palo Duro Reservoir (13 percent full), Mackenzie (12 percent full), O. C. Fisher (14 percent full), White River (25 percent full) and Greenbelt (22 percent full) remained below 30 percent full. Elephant Butte Reservoir (located in New Mexico) was at 28 percent full, which is an improvement of 3 percentage points from the end of May 2019.



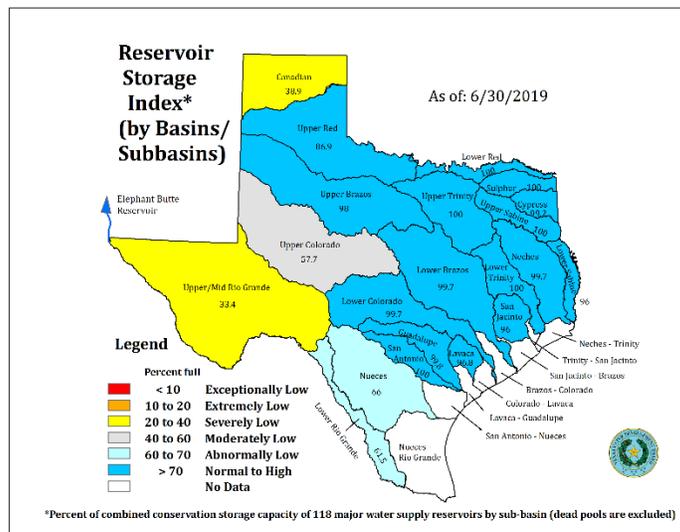
**Figure 3:** Reservoir conservation storage at end-June expressed as percent full (%)

\*Storage is based on end of the month data in 118 major reservoirs that represent 96 percent of the total conservation storage capacity of 188 major water supply reservoirs in Texas plus Elephant Butte Reservoir in New Mexico. Major reservoirs are defined as having a conservation storage capacity of 5,000 acre-feet or greater. Only the Texas share of storage in border reservoirs is counted.

Total regionally-combined conservation storage was at or above-normal (storage  $\geq 70$  percent full) in the Upper Coast (94.6 percent full), East Texas (98.9 percent full), North Central (99.9 percent full), South Central (99.9 percent full), Edwards Plateau (77.4), and Low Rolling Plains (76.6 percent full) climate divisions (Figure 3). Storage in the Southern climate division was moderately low (47.6 percent full). Storage was severely low in the Trans Pecos (33.4 percent full) and High Plains (36.3 percent full) climate divisions. Combined conservation storage by river basin or sub-basin depicts a similar picture (Figure 4). Storage in basins/sub-basins in the North Central, Eastern, and South-Central regions of the state was normal to high ( $>70$  percent full). The Upper/Mid Rio Grande and the Canadian River Basin had severely low storage, the Upper Colorado had moderately low storage, and the Lower Rio Grande and the Nueces had abnormally low storage.



**Figure 3: Reservoir Storage Index\* by climate division at 6/30/2019**



**Figure 4: Reservoir Storage Index by river basin/sub-basin at 6/30/2019**

\*Reservoir Storage Index is defined as the percent full of conservation storage capacity.

**CONSERVATION STORAGE DATA FOR SELECTED MAJOR TEXAS RESERVOIRS**

Name of lake or reservoir	Storage capacity	Storage at end-June		Storage change from end-May 2019		Storage change from end-June 2018	
	(acre-feet)	(acre-feet)	(%)	(acre-feet)	(%)	(acre-feet)**	(%)
Abilene, Lake	7,900	7,900	100	0	0	4,640	59
Alan Henry Reservoir	96,207	93,142	97	759	1	14,500	15
*Amistad Reservoir (Texas & Mexico)	1,840,849	1,517,368	82	51,068	3	280,698	15
*Amistad Reservoir (Texas)	3,275,532	1,708,770	52	88,123	3	91,463	3
Amon G Carter, Lake	19,266	19,266	100	0	0	493	3
Aquilla Lake	43,243	43,243	100	0	0	3,057	7
Arlington, Lake	40,188	39,001	97	-229	-1	2,233	6
Arrowhead, Lake	230,359	228,190	99	-2,169	-1	31,424	14
Athens, Lake	29,503	29,503	100	0	0	587	2
*Austin, Lake	23,972	23,112	96	247	1	340	1
B A Steinhagen Lake	66,961	55,984	84	-6,102	-9	-4,383	-7
Bardwell Lake	46,122	46,122	100	0	0	2,113	5
Belton Lake	435,225	435,225	100	0	0	35,785	8
Benbrook Lake	85,648	85,648	100	0	0	17,507	20
Bob Sandlin, Lake	192,417	192,417	100	0	0	3,540	2
Bonham, Lake	11,027	11,027	100	0	0	918	8
Brady Creek Reservoir	28,808	28,776	100	-32	0	13,982	49
Bridgeport, Lake	366,236	366,236	100	0	0	27,340	7
*Brownwood, Lake	128,839	128,839	100	0	0	33,290	26
Buchanan, Lake	860,607	816,904	100	216	0	81,838	10
Caddo, Lake	29,898	29,898	100	0	0	0	0
Canyon Lake	378,781	378,781	100	0	0	39,042	10
Cedar Creek Reservoir in Trinity	644,686	644,686	100	0	0	27,395	4
Champion Creek Reservoir	41,580	30,178	73	-337	-1	8,850	21
Cherokee, Lake	40,094	40,094	100	0	0	3,013	8
Choke Canyon Reservoir	662,820	351,528	53	-10,333	-2	178,796	27
*Cisco, Lake	29,003	28,510	98	513	2	6,105	21
Coleman, Lake	38,075	37,877	99	-198	-1	6,699	18
Colorado City, Lake	31,040	30,219	97	-821	-3	4,816	16
*Coleta Creek Reservoir	30,758	16,394	53	456	1	6,087	20
Conroe, Lake	410,988	399,939	97	6,023	1	-8,176	-2
Corpus Christi, Lake	256,062	254,681	99	-788	0	54,836	21
Crook, Lake	9,195	9,185	100	-10	0	407	4
Cypress Springs, Lake	66,756	66,756	100	0	0	1,735	3
E. V. Spence Reservoir	517,272	163,021	32	12,591	2	106,052	21
Eagle Mountain Lake	179,880	179,880	100	0	0	21,656	12
Elephant Butte Reservoir (Texas)	852,491	237,459	28	27,778	3	138,339	16
Elephant Butte Reservoir (Total Storage)	1,973,358	549,673	28	64,300	3	320,229	16
*Falcon Reservoir (Texas & Mexico)	1,551,007	568,544	37	-55,810	-4	90,286	6
*Falcon Reservoir (Texas)	2,646,817	784,719	30	-90,190	-3	184,766	7
Fork Reservoir, Lake	605,061	605,061	100	0	0	34,103	6
Fort Phantom Hill, Lake	70,030	70,030	100	0	0	12,299	18
Georgetown, Lake	36,823	36,823	100	0	0	12,798	35
Graham, Lake	45,288	45,288	100	0	0	5,232	12
Granbury, Lake	132,949	131,971	99	-896	-1	8,256	6

**CONSERVATION STORAGE DATA FOR SELECTED MAJOR TEXAS RESERVOIRS**

Name of lake or reservoir	Storage capacity	Storage at end-June		Storage change from end-May 2019		Storage change from end-June 2018		
	(acre-feet)	(acre-feet)	(%)	(acre-feet)	(%)	(acre-feet)**	(%)	
<i>Continued</i>								
Granger Lake	51,822	51,822	100	0	0	123	0	
Grapevine Lake	164,703	164,703	100	0	0	7,636	5	
Greenbelt Lake	59,968	13,204	22	-154	0	-549	-1	
*Halbert, Lake	6,033	5,373	89	39	1	316	5	
Hords Creek Lake	8,443	8,100	96	860	10	3,342	40	
Houston County Lake	17,113	17,113	100	0	0	615	4	
Houston, Lake	130,147	119,558	92	107	0	-7,451	-6	
Hubbard Creek Reservoir	313,298	313,298	100	0	0	68,979	22	
Hubert H Moss Lake	24,058	23,831	99	-183	-1	630	3	
Inks, Lake	13,962	12,945	93	53	0	45	0	
J. B. Thomas, Lake	199,931	64,773	32	-2,846	-1	-14,309	-7	
Jacksonville, Lake	25,670	25,670	100	0	0	656	3	
Jim Chapman Lake (Cooper)	260,332	260,332	100	0	0	27,279	10	
Joe Pool Lake	175,358	175,358	100	0	0	7,159	4	
Kemp, Lake	245,307	245,307	100	0	0	48,193	20	
Kickapoo, Lake	86,345	86,345	100	0	0	19,334	22	
Lavon Lake	406,388	406,388	100	0	0	31,916	8	
Leon, Lake	27,762	27,604	99	-158	-1	6,868	25	
Lewisville Lake	563,228	563,228	100	0	0	43,662	8	
Limestone, Lake	203,780	203,780	100	0	0	27,700	14	
*Livingston, Lake	1,785,348	1,785,348	100	0	0	2,158	0	
*Lost Creek Reservoir	11,950	11,912	100	-38	0	444	4	
Lyndon B Johnson, Lake	115,249	110,270	96	-489	0	0	0	
Mackenzie Reservoir	46,450	5,802	12	29	0	-500	-1	
Marble Falls, Lake	6,901	6,890	100	32	0	119	2	
Martin, Lake	75,726	75,726	100	642	1	6,569	9	
Medina Lake	254,823	254,823	100	545	0	121,334	48	
Meredith, Lake	500,000	210,090	42	5,716	1	15,515	3	
Millers Creek Reservoir	26,768	26,768	100	0	0	5,981	22	
*Mineral Wells, Lake	5,273	5,273	100	0	0	614	12	
Monticello, Lake	34,740	30,246	87	-852	-2	1,313	4	
Mountain Creek, Lake	22,850	22,850	100	0	0	480	2	
Murvaul, Lake	38,285	38,285	100	0	0	2,842	7	
Nacogdoches, Lake	39,522	38,827	98	-498	-1	2,804	7	
Nasworthy	9,615	8,393	87	-25	0	708	7	
Navarro Mills Lake	49,827	49,827	100	0	0	2,833	6	
New Terrell City Lake	8,583	8,583	100	0	0	471	5	
Nocona, Lake (Farmers Crk)	21,444	21,444	100	0	0	1,074	5	
North Fork Buffalo Creek Reservoir	15,400	15,299	99	-101	-1	3,902	25	
O' the Pines, Lake	241,363	268,566	100	0	0	29,314	11	
O. C. Fisher Lake	119,445	16,848	14	-176	0	6,508	5	
*O. H. Ivie Reservoir	554,340	428,533	77	46,023	8	342,133	62	
Oak Creek Reservoir	39,210	39,210	100	0	0	22,331	57	

CONSERVATION STORAGE DATA FOR SELECTED MAJOR TEXAS RESERVOIRS							
Name of lake or reservoir	Storage capacity	Storage at end-June		Storage change from end-May 2019		Storage change from end-June 2018	
	(acre-feet)	(acre-feet)	(%)	(acre-feet)	(%)	(acre-feet)**	(%)
<b>Continued</b>							
Palestine, Lake	367,303	367,303	100	0	0	19,545	5
Palo Duro Reservoir	61,066	8,076	13	-2,574	-4	7,252	12
Palo Pinto, Lake	26,766	26,614	99	-152	-1	6,206	23
Pat Cleburne, Lake	26,008	26,008	100	0	0	2,131	8
*Pat Mayse Lake	113,683	113,683	100	0	0	1,854	2
Possum Kingdom Lake	538,139	538,139	100	11,017	2	35,082	7
Proctor Lake	54,762	54,762	100	0	0	18,505	34
Ray Hubbard, Lake	439,559	439,559	100	1,253	0	31,134	7
Ray Roberts, Lake	788,167	788,167	100	0	0	18,857	2
Red Bluff Reservoir	151,110	98,152	65	1,406	1	7,702	5
Richland-Chambers Reservoir	1,087,839	1,087,839	100	0	0	28,501	3
Sam Rayburn Reservoir	2,857,077	2,857,077	100	0	0	227,525	8
Somerville Lake	147,104	147,104	100	0	0	7,079	5
Squaw Creek, Lake	151,250	151,250	100	0	0	0	0
Stamford, Lake	51,570	51,570	100	0	0	12,153	24
Stillhouse Hollow Lake	227,771	227,771	100	0	0	34,978	15
Striker, Lake	16,934	16,934	100	0	0	933	6
Sweetwater, Lake	12,267	12,267	100	0	0	10,337	84
*Sulphur Springs, Lake	17,747	17,747	100	0	0	2,587	15
Tawakoni, Lake	871,685	871,685	100	0	0	35,727	4
Texana, Lake	159,566	154,459	97	-4,647	-3	-4,280	-3
Texoma, Lake (Texas & Oklahoma)	1,258,113	1,258,113	100	0	0	0	0
Texoma, Lake (Texas)	2,525,281	3,035,031	100	-458,114	-18	436,469	17
Toledo Bend Reservoir (Texas & Louisiana)	2,236,450	2,147,378	96	-89,072	-4	130,634	6
Toledo Bend Reservoir (Texas)	4,472,900	4,298,856	96	-232,816	-5	261,269	6
Travis, Lake	1,113,348	1,113,348	100	0	0	334,896	30
Twin Buttes Reservoir	182,454	137,499	75	2,008	1	128,120	70
Tyler, Lake	72,073	72,073	100	0	0	3,427	5
Waco, Lake	189,418	189,418	100	0	0	14,282	8
Waxahachie, Lake	10,780	10,780	100	0	0	1,010	9
Weatherford, Lake	17,812	17,736	100	-76	0	2,108	12
White River Lake	29,880	7,547	25	308	1	2,933	10
Whitney, Lake	553,344	547,449	99	-5,895	-1	52,837	10
Worth, Lake	33,495	33,221	99	-274	-1	3,424	10
Wright Patman Lake	310,382	231,496	100	-78,886	-34	0	0
<b>STATEWIDE TOTAL</b>							
<b>STATEWIDE TOTAL</b>	<b>32,300,210</b>	<b>28,615,475</b>	<b>89</b>	<b>-95,132</b>	<b>0</b>	<b>3,327,098</b>	<b>10</b>

\* Total volume below elevation of conservation pool top is used as conservation storage capacity, because the dead pool storage is unknown.

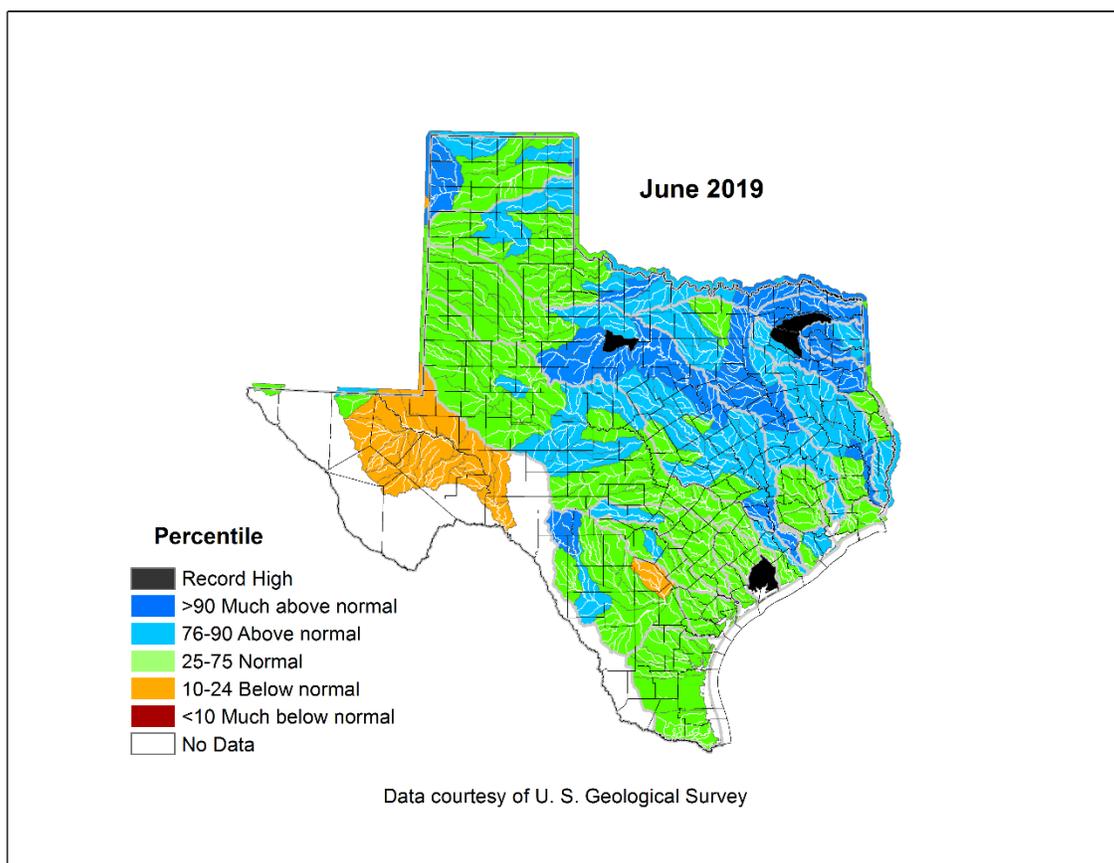
\*\*Monthly and yearly changes do not include reservoirs that did not have data in the last month or last year.

**Note:**

Conservation storage capacity is the space available to store water above the lowest outlet and below the top of the conservation pool (some may have seasonal variations), or normal maximum operating level. Conservation storage refers to the volume of water held within the conservation storage space. Not included is any water in flood control storage (above the top of the conservation pool or normal maximum operating level) or any water in the dead pool storage. Conservation storage percentage is based on the conservation storage capacity of the reservoir and the conservation storage in the reservoir on date shown. Percent change is given by  $100 * (\text{current conservation storage} - \text{past conservation storage}) / \text{conservation storage capacity}$ .

## ***STREAMFLOW CONDITIONS***

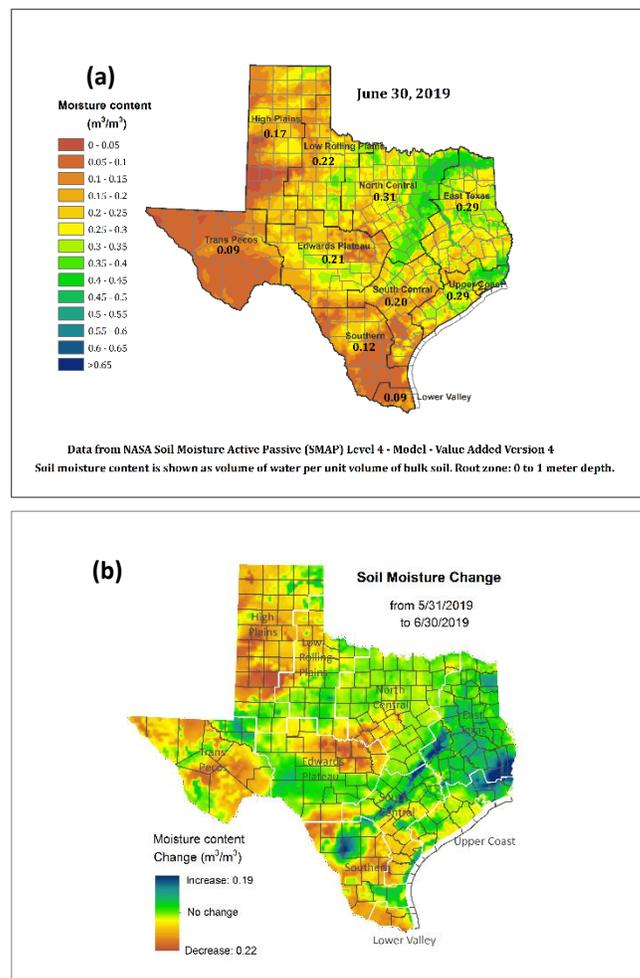
Computed runoff by hydrologic unit codes for June 2019 show that much of the state had above normal (76–90<sup>th</sup> percentile, light blue shading in Figure 6) or near normal (25–75<sup>th</sup> percentile, green shading in Figure 6) streamflow. A couple of sub-basins in the Lower Red, Sulphur, Sabine, Neches, Trinity, Brazos, and Lower Colorado river basins had much above normal (> 90<sup>th</sup> percentile, dark blue shading in Figure 6) streamflow. A few sub-basins located in the Sabine, the Upper Brazos, and lower reaches of the Lower Colorado river basins had record high (black shading in the Figure 6) streamflow. Some sub-basins in the Upper Rio Grande and the Nueces had below normal (10–24<sup>th</sup> percentile, light brown shading in Figure 6) streamflow.



**Figure 6:** Runoff percentiles by the U.S. Geological Survey's Hydrologic Unit Codes

## **SOIL MOISTURE CONDITIONS**

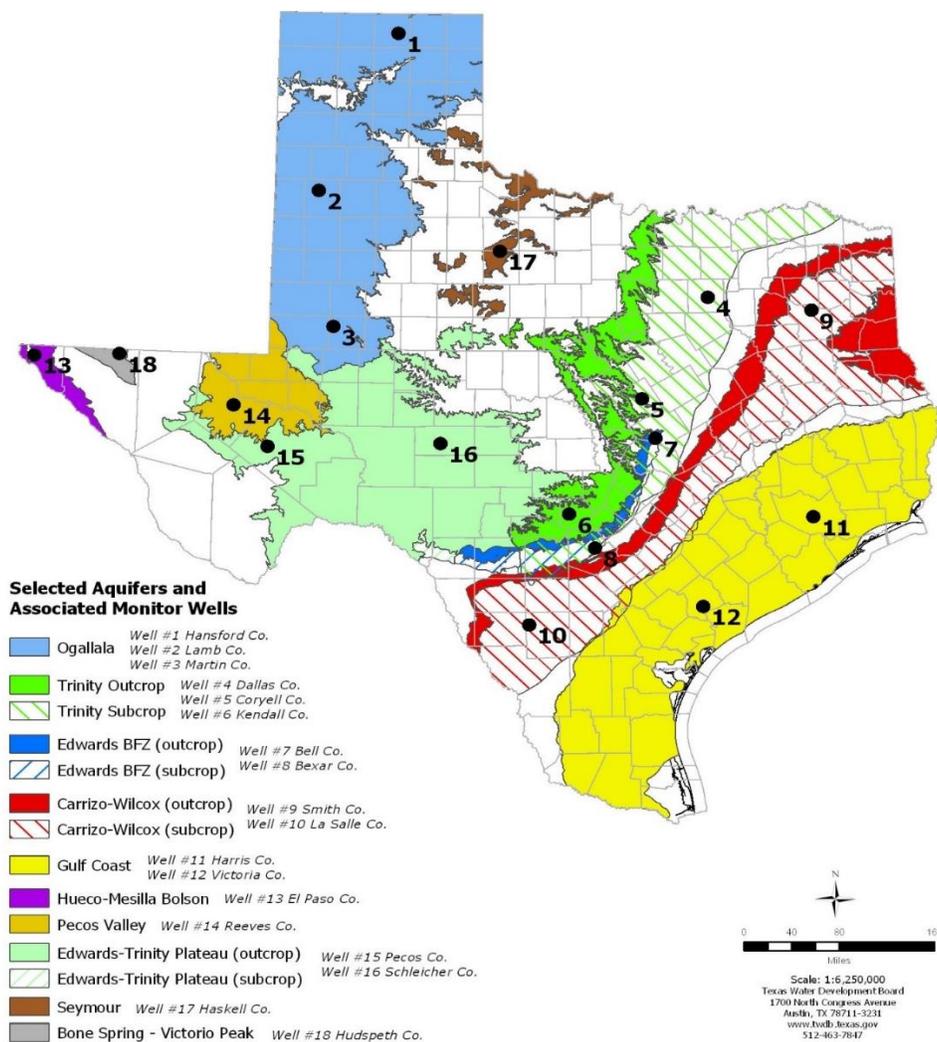
Soil moisture at the end of June 2019 [Figure 7(a)] was moderate [ $> 0.20$  cubic meters of water per bulk cubic meter soil ( $m^3/m^3$ )] in the High Plains, Trans Pecos, Southern, and Lower Valley climate divisions where the area averaged soil moisture was 0.17, 0.09, 0.12, and 0.09  $m^3/m^3$ , respectively. On a regional basis, and compared to conditions at the end of May 2019, soil moisture content increased [green to blue shading in Figure 7(b)] in the southern High Plains, East Texas, central Edwards Plateau, eastern Trans Pecos, northern South Central, East Texas, and in northern regions of the Southern climate division. Soil moisture content decreased [brown and yellow shading in Figure 7(b)] in the central Southern, southern South Central, southern and western Trans Pecos, southern Upper Coast, and the central High Plains climate division.



**Figure 7:** Root zone soil moisture conditions on June 30, 2019 (a) and the difference in root zone soil moisture from end-May 2019 and end-June 2019 (b)

## June 2019 GROUNDWATER LEVELS IN OBSERVATION WELLS

Water-level measurements were available for all 18 key monitoring wells in the state. Water levels rose in 7 monitoring wells since the beginning of June, ranging from an increase of 0.01 feet in the Bell County Edwards (Balcones Fault Zone) Aquifer well (#7 on map) to 3.00 feet in the Edwards (Balcones Fault Zone) Aquifer well (#8 on map). Water levels declined in 11 monitoring wells, ranging from a decline of -0.03 feet in the Lamb County Ogallala Aquifer well (#2 on map) to -7.95 feet in the La Salle County Carrizo-Wilcox Aquifer well (#10 on map). The J-17 well (#8 on map) in San Antonio recorded a water level of 48.00 feet below land surface or 682.6 feet above mean sea level. Water levels are 23 feet above the Stage 1 critical management level for the San Antonio portion of the Edwards (Balcones Fault Zone) Aquifer.

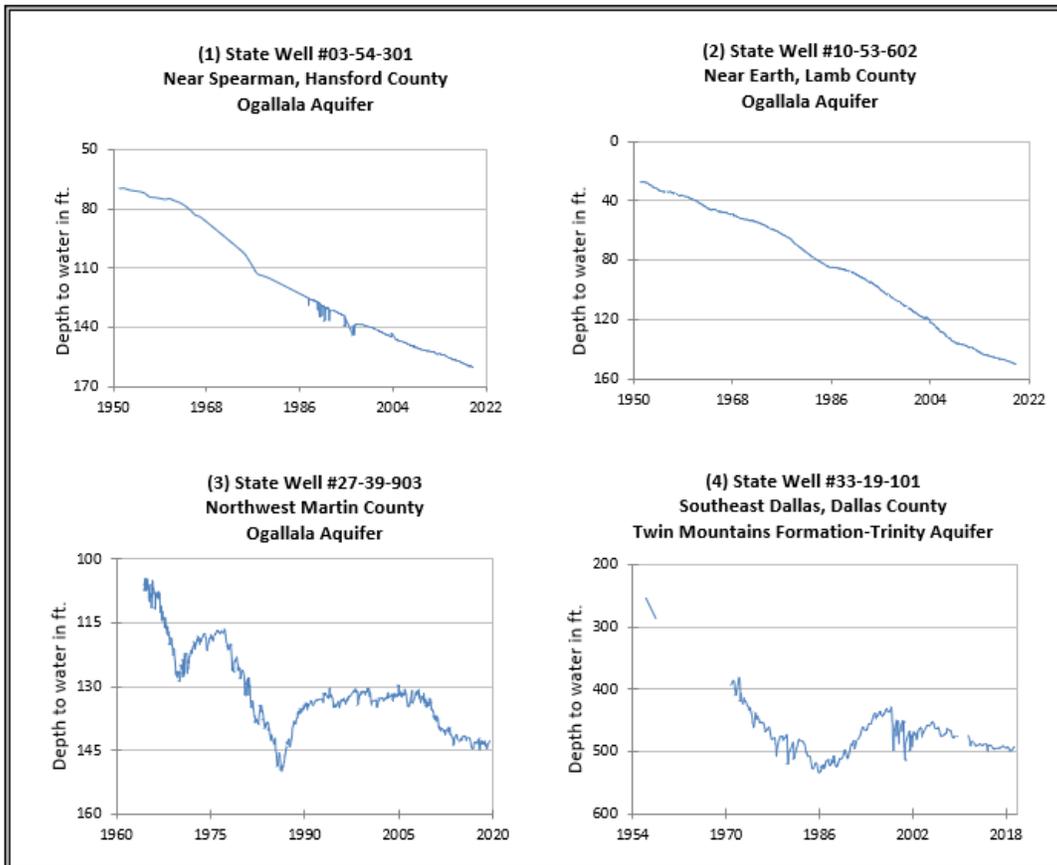


**\*Well numbers used in this publication on the aquifer map to indicate the monitoring well location (numbers 1–18) are different to the TWDB's seven-digit state well number.**

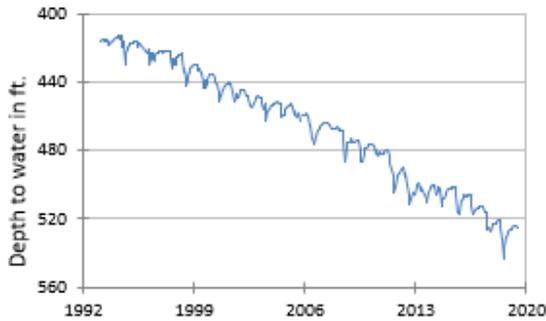
Monitoring Well	June	May	Month Change	Year Change	Historical Change	First Measured
(1) Hansford 0354301	160.32	160.34	0.02	-0.97	-90.20	1951
(2) Lamb 1053602	150.21	150.18	-0.03	-1.57	-122.04	1951
(3) Martin 2739903	142.99	143.17	0.18	0.88	-38.10	1964
(4) Dallas 3319101	493.28	493.79	0.51	0.56	-271.28	1954
(5) Coryell 4035404	524.92	524.04	-0.88	6.54	-232.92	1955
(6) Kendall 6802609	117.47	116.71	-0.76	35.41	-57.47	1975
(7) Bell 5804816	118.05	118.06	0.01	8.64	5.46	2008
(8) Bexar 6837203	48.00	51.00	3.00	40.11	-1.36	1932
(9) Smith 3430907	432.91	433.06	0.15	2.06	-132.91	1977
(10) La Salle 7738103	499.75	491.80	-7.95	20.99	-246.68	2003
(11) Harris 6514409	191.60	190.63	-0.97	0.95	-56.10*	1947**
(12) Victoria 8017502	33.98	33.62	-0.36	-0.10	0.02	1958
(13) El Paso 4913301	298.21	298.16	-0.05	-3.94	-66.31	1964
(14) Reeves 4644501	167.12	165.66	-1.46	3.39	-75.03	1952
(15) Pecos 5216802	198.23	196.82	-1.41	25.69	48.65	1976
(16) Schleicher 5512134	273.80	271.57	-2.23	43.94	28.10	2003
(17) Haskell 2135748	44.70	44.93	0.23	1.89	-1.70	2002
(18) Hudspeth 4807516	154.26	152.38	-1.88	1.72	-50.34	1966

\*Change since the original measurement of 135.5 feet below land surface in 1947 (\*\*measurement not shown on the hydrograph)

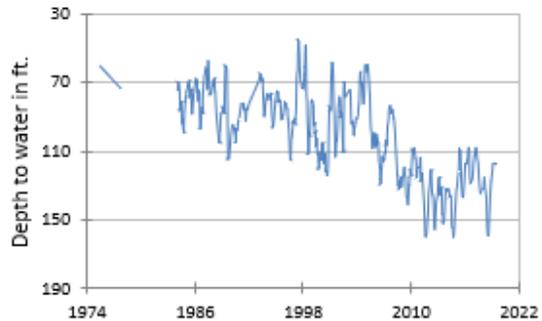
### June 2019 OBSERVATION WELL HYDROGRAPHS



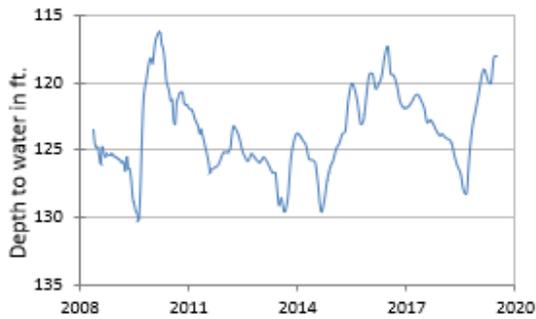
(5) State Well #40-35-404  
Gatesville, Coryell County  
Hosston Formation-Trinity Aquifer



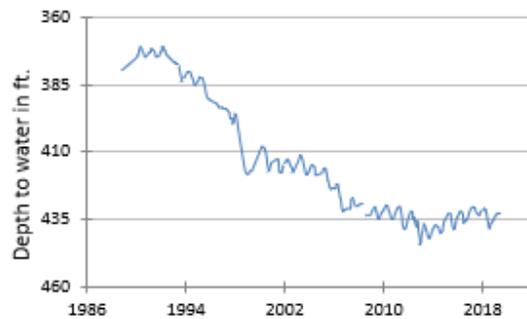
(6) State Well #68-02-609  
Waring, Kendall County  
Cow Creek Formation-Trinity Aquifer



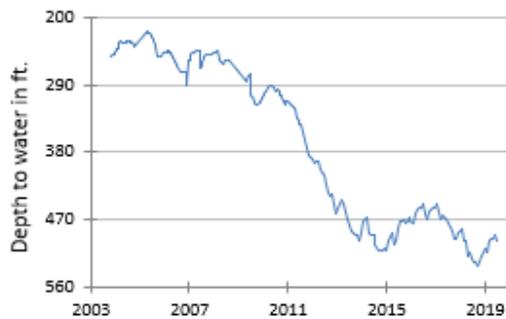
(7) State Well #58-04-816  
Near Salado, Bell County  
Edwards (Balcones Fault Zone) Aquifer



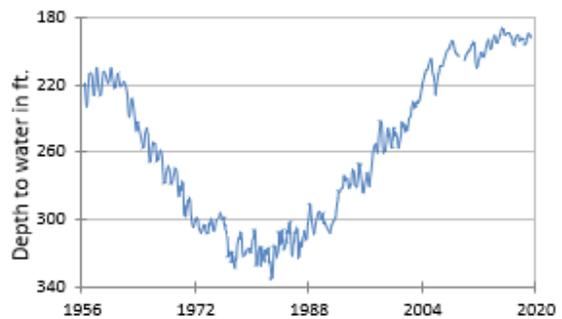
(9) State Well #34-30-907  
Red Springs, Smith County  
Carrizo-Wilcox Aquifer



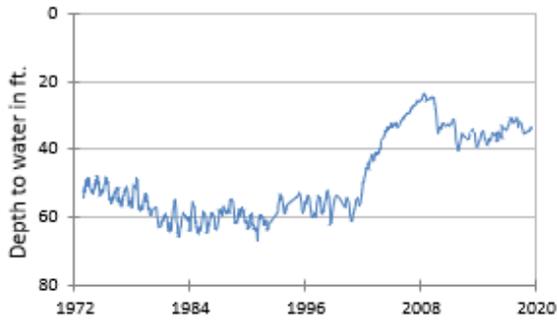
(10) State Well #77-38-103  
Near Cotulla, La Salle County  
Carrizo-Wilcox Aquifer



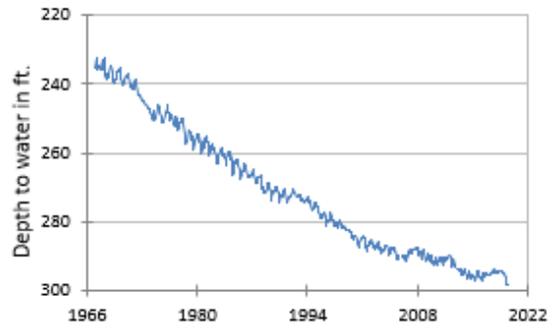
(11) State Well #65-14-409  
Alief, Harris County  
Evangeline Formation-Gulf Coast Aquifer



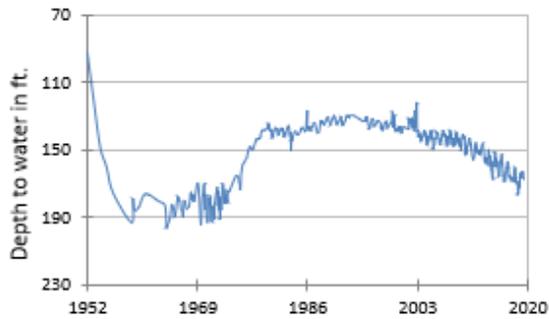
(12) State Well #80-17-502  
Near Bloomington, Victoria County  
Lissie Formation-Gulf Coast Aquifer



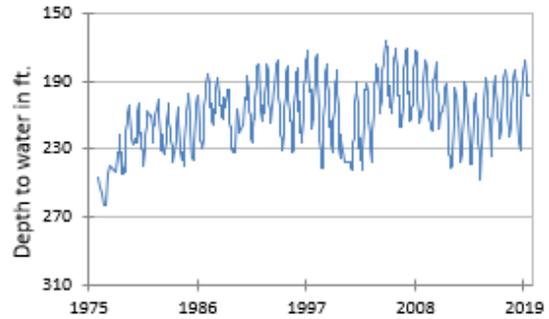
(13) State Well #49-13-301  
El Paso, El Paso County  
Hueco-Mesilla Bolson Aquifer



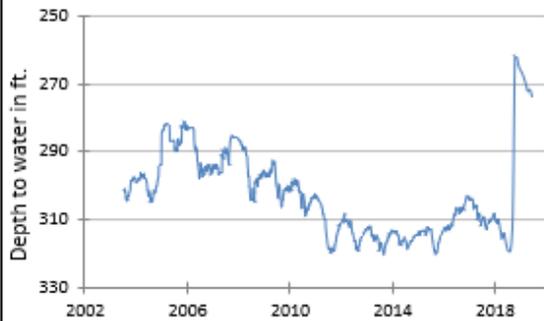
(14) State Well #46-44-501  
Near Pecos, Reeves County  
Pecos Valley Aquifer



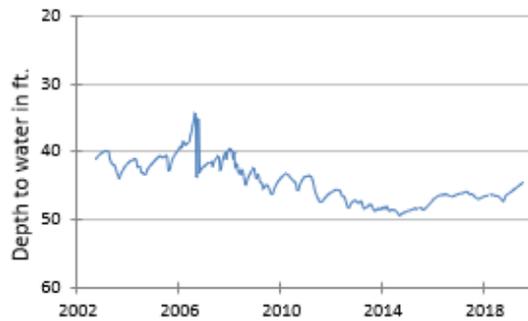
(15) State Well #52-16-802  
Fort Stockton, Pecos County  
Edwards-Trinity (Plateau) Aquifer



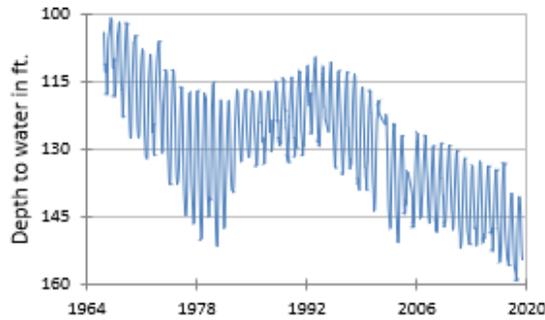
(16) State Well #55-12-134  
Eldorado, Schleicher County  
Trinity Aquifer



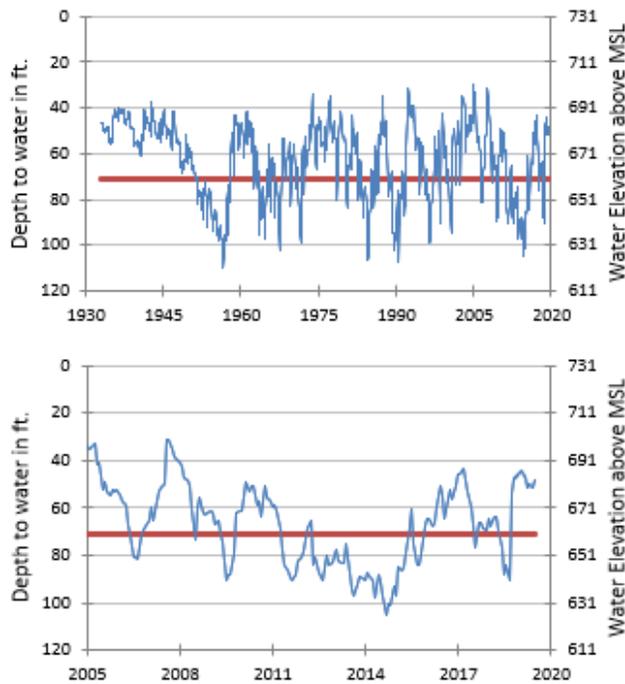
(17) State Well #21-35-748  
Near O'Brien, Haskell County  
Seymour Aquifer



(18) State Well #48-07-516  
 Dell City, Hudspeth County  
 Bone Spring - Victorio Peak Aquifer



(8) State Well #68-37-203 (J-17)  
 San Antonio, Bexar County  
 Edwards (Balcones Fault Zone) Aquifer



The late June water-level measurement in this Edwards (Balcones Fault Zone) Aquifer well, elevation 731 feet above mean sea level, was 48.00 feet below land surface, or 682.6 feet above mean sea level. This was 3.00 feet above last month's measurement, 40.11 feet above last year's measurement and 1.36 feet below the initial measurement recorded in 1932.

Water levels below the red line indicate periods in which Edwards Aquifer Authority Stage 1 drought restrictions are in effect.



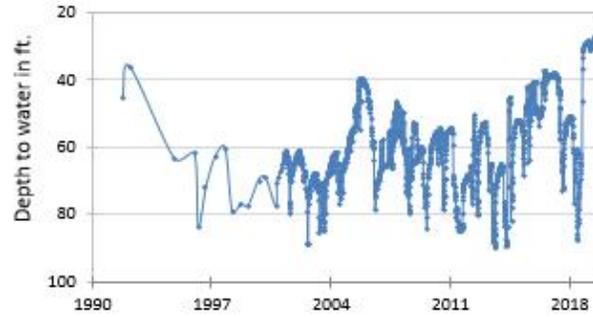
## HYDROGRAPH OF THE MONTH

Each month this space features a new hydrograph (marked with the • symbol on the map) depicting different aquifers and their conditions in Texas.

The Lipan Aquifer is a minor aquifer found in parts of Coke, Concho, Glasscock, Irion, Runnels, Schleicher, Sterling, and Tom Green counties located in west-central Texas. The aquifer includes water-bearing alluvium and the updip portions of older, underlying strata. The alluvium includes as much as 125 feet of saturated sediments of the Quaternary Leona formation. The underlying strata include the San Angelo Sandstone of the Pease River Group and the Choza Formation, Bullwagon Dolomite, Vale Formation, Standpipe Limestone, and Arroyo Formation of the Clear Fork Group. These units are predominantly limestones and shales. Groundwater in the alluvial deposits and the upper parts of the older rocks is hydraulically connected, and most wells in the area are completed in both units. Groundwater in the alluvium ranges from fresh to slightly saline, containing between 350 and 3,000 milligrams per liter of total dissolved solids, and is very hard. The aquifer is primarily used for irrigation, but also supports livestock and municipal, domestic, and manufacturing uses.

### Lipan Aquifer

Well #43-45-306, 155 feet deep  
unused, Tom Green County



The initial measurement of 45 feet below land surface was recorded by the Texas Water Development Board October of 1991. A Groundwater Conservation District then took measurements in the unused well until May of 2001 when the TWDB installed an automatic water-level recorder which then took hourly measurements (displayed online) and near-weekly measurements (in the groundwater database). The period of record reveals seasonal fluctuations in water level that are likely a result of nearby pumping of water for irrigation. Currently, the water level is at a historic high of 27.26 feet below land surface.



Far away (left), and close-up (right) images of well #43-45-306.