

<b>NWS FORM E-5</b> (11-88) (PRES. by NWS Instruction 10-924)	<b>U.S. DEPARTMENT OF COMMERCE</b> NATIONAL OCEANIC AND ATMOSPHERIC ADMINISTRATION NATIONAL WEATHER SERVICE	HYDROLOGIC SERVICE AREA (HSA)	
		<b>Tulsa, Oklahoma (TSA)</b>	
<b>MONTHLY REPORT OF RIVER AND FLOOD CONDITIONS</b>		REPORT FOR:	
		MONTH <b>June</b>	YEAR <b>2020</b>
TO: Hydrometeorological Information Center, W/OH2 NOAA / National Weather Service 1325 East West Highway, Room 7230 Silver Spring, MD 20910-3283		SIGNATURE <b>Steven F. Piltz</b> (Meteorologist-in-Charge)	
		DATE <b>July 2, 2020</b>	

When no flooding occurs, include miscellaneous river conditions, such as significant rises, record low stages, ice conditions, snow cover, droughts, and hydrologic products issued (NWS Instruction 10-924)

An "X" in the box indicates no flood stages were reached in this Hydrologic Service Area (HSA) during the month above.

For the first time since July 2018, no rivers were above flood stage in the NWS Tulsa HSA, breaking the 22-month streak of flooding. Tulsa recorded its driest June since records began in 1888, with below normal rainfall across the entire HSA this month, as a flash drought developed. Normal rainfall in the month of June ranges from 3.9 inches in McIntosh County to 5.9 inches in Wagoner County. The Ozark region of northwest Arkansas averages 5.1 inches for the month. This report, past E-5 reports, and monthly hydrology and climatology summaries can be found at <http://www.weather.gov/tsa/hydro-monthly-summary>.

### Monthly Summary

Using the radar-derived estimated observed precipitation from the RFCs (Fig. 1a), rainfall totals for June 2020 ranged from around 0.10" to near 6" across eastern OK and northwest AR, with most of the area receiving only 0.50"-2". These rainfall totals correspond to near 75% to less than 5% of the normal June rainfall for eastern OK and northwest Arkansas, with the greatest deficits across northeast OK (Fig. 1b).

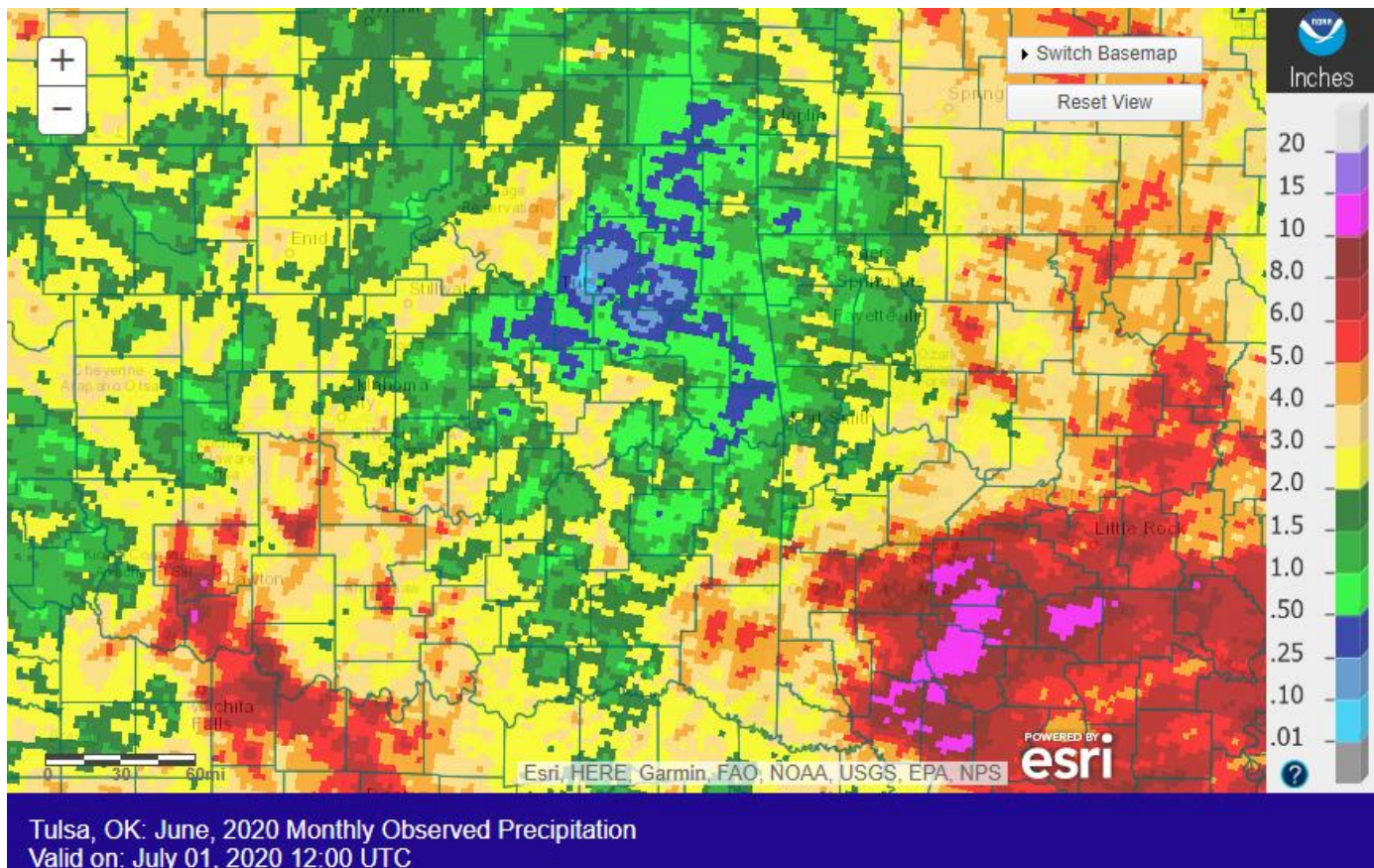
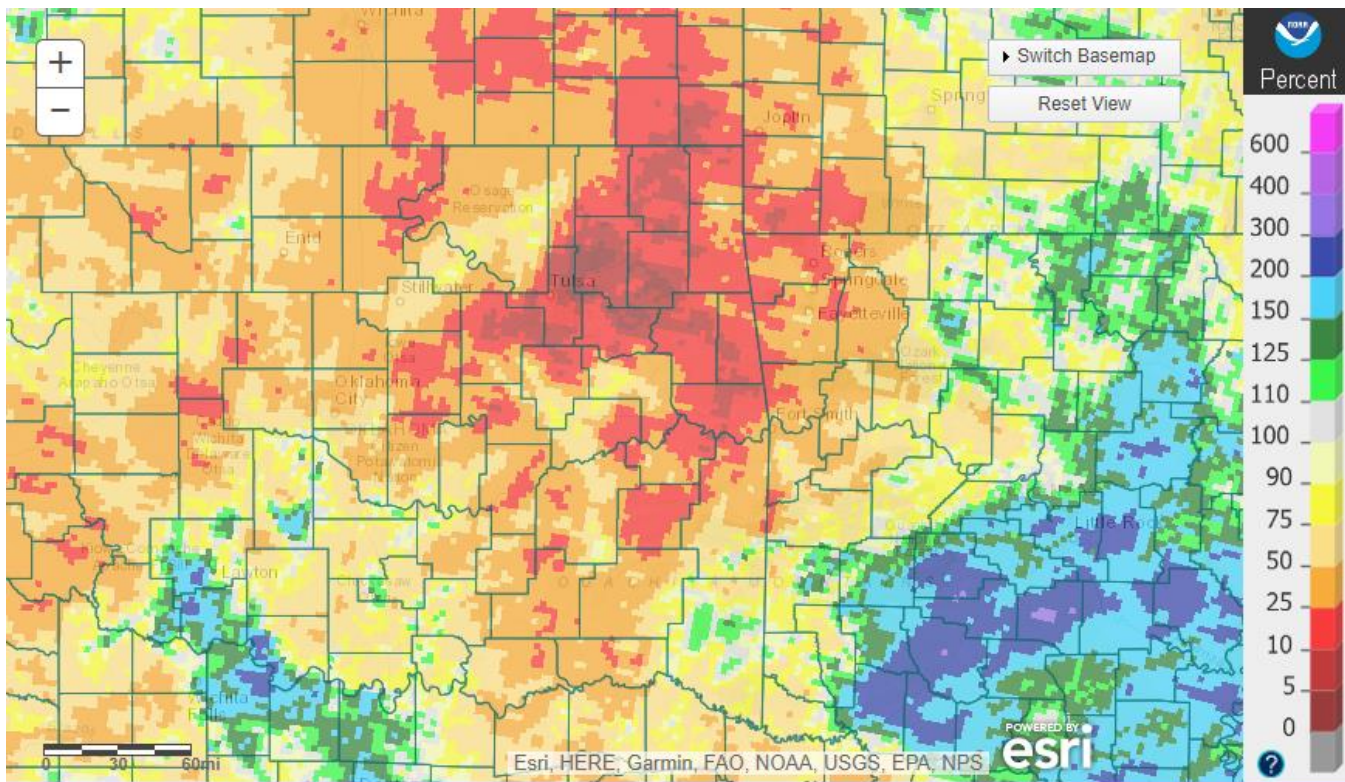


Fig. 1a. Estimated Observed Rainfall for June 2020



Tulsa, OK: June, 2020 Monthly Percent of Normal Precipitation  
Valid on: July 01, 2020 12:00 UTC

Fig. 1b. Estimated % of Normal Rainfall for June 2020

In Tulsa, OK, June 2020 ranked as the 17<sup>th</sup> warmest June (81.2°F; since records began in 1905) and the Record driest June (0.11", previous record 0.27" in 1933; since records began in 1905). Fort Smith, AR had the 28<sup>th</sup> warmest June (79.8°F, tied 1988; since records began in 1882) and the 11<sup>th</sup> driest June (0.75"; since records began in 1882). Fayetteville, AR had the 18<sup>th</sup> warmest (75.6°F) and the 15<sup>th</sup> driest (2.44") June since records began in 1950.

Some of the larger precipitation reports (in inches) for June 2020 included:

Hindsville 10NNE, AR (coop)	6.39	Ochelata 5.6N, OK (coco)	4.84	Wynona, OK (meso)	3.77
Pawnee, OK (coop)	3.22	Cloudy, OK (meso)	2.99	Bartlesville, OK (ASOS)	2.93
Sperry 6.7WNW, OK (coco)	2.81	Pawnee, OK (meso)	2.62	Winslow 7NE, AR (coop)	2.62

Some of the lowest precipitation reports (in inches) for June 2020 included:

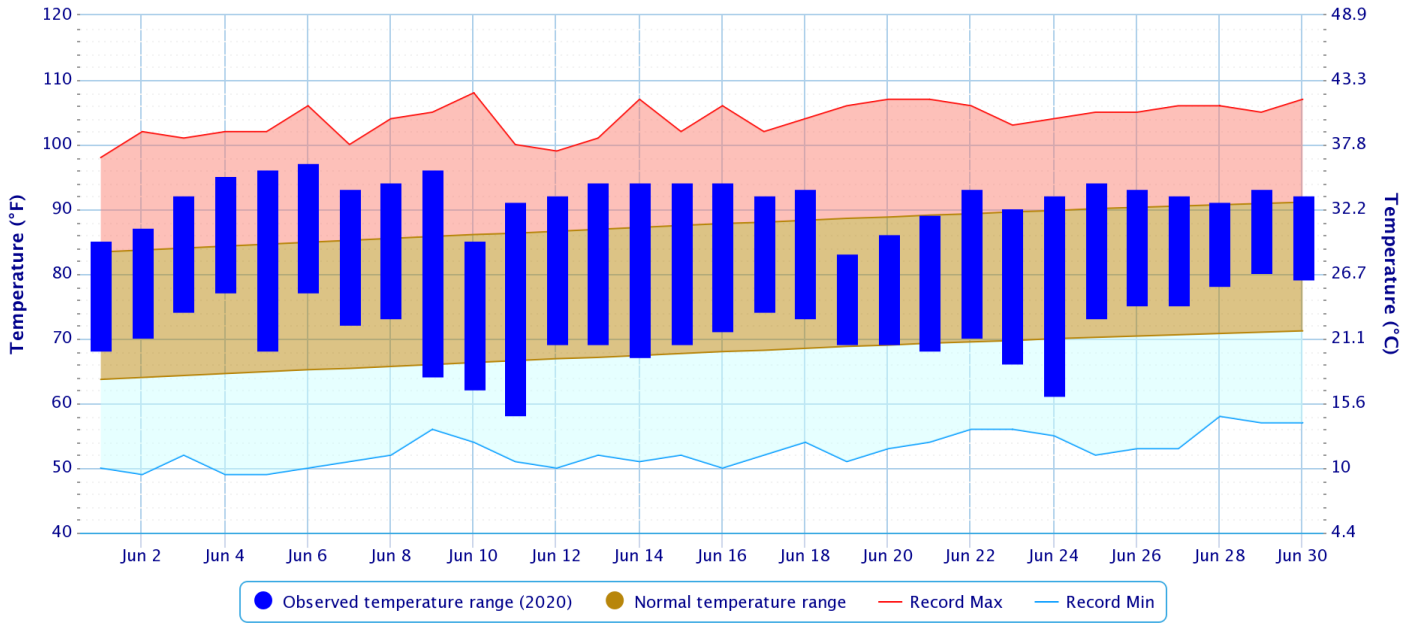
Tulsa, OK (ASOS)	0.11	Tahlequah, OK (meso)	0.13	Hectorville, OK (meso)	0.27
Sallisaw, OK (meso)	0.31	Porter, OK (meso)	0.34	Spavinaw, OK (coop)	0.39
Talala, OK (meso)	0.46	Inola, OK (meso)	0.46	Vinita, OK (meso)	0.48

According to statistics from the [Oklahoma Climatological Survey](#) (OCS) Mesonet:

Rank since 1921	June 2020	Last 60 Days (May 2 – Jun 30)	Warm Growing Season 2020 (Mar 1 – Jun 30)	Year-to-Date (Jan 1 – Jun 30)	Last 90 Days (Apr 2 – Jun 30)	Water Year-to-Date (Oct 1 – Jun 30)	Last 365 Days (Jul 2, 2019 – Jun 30, 2020)
Northeast OK	<b>3<sup>rd</sup> driest</b>	30 <sup>th</sup> driest	32 <sup>nd</sup> wettest	20 <sup>th</sup> wettest	29 <sup>th</sup> driest	15 <sup>th</sup> wettest	<b>9<sup>th</sup> wettest</b>
East Central OK	<b>5<sup>th</sup> driest</b>	46 <sup>th</sup> driest	25 <sup>th</sup> wettest	12 <sup>th</sup> wettest	48 <sup>th</sup> driest	<b>5<sup>th</sup> wettest</b>	<b>4<sup>th</sup> wettest</b>
Southeast OK	21 <sup>st</sup> driest	28 <sup>th</sup> wettest	<b>10<sup>th</sup> wettest</b>	<b>10<sup>th</sup> wettest</b>	23 <sup>rd</sup> wettest	11 <sup>th</sup> wettest	<b>9<sup>th</sup> wettest</b>
Statewide	11 <sup>th</sup> driest	26 <sup>th</sup> driest	49 <sup>th</sup> driest	35 <sup>th</sup> wettest	23 <sup>rd</sup> driest	29 <sup>th</sup> wettest	24 <sup>th</sup> wettest

### Daily Temperature Data – Tulsa Area, OK (ThreadEx)

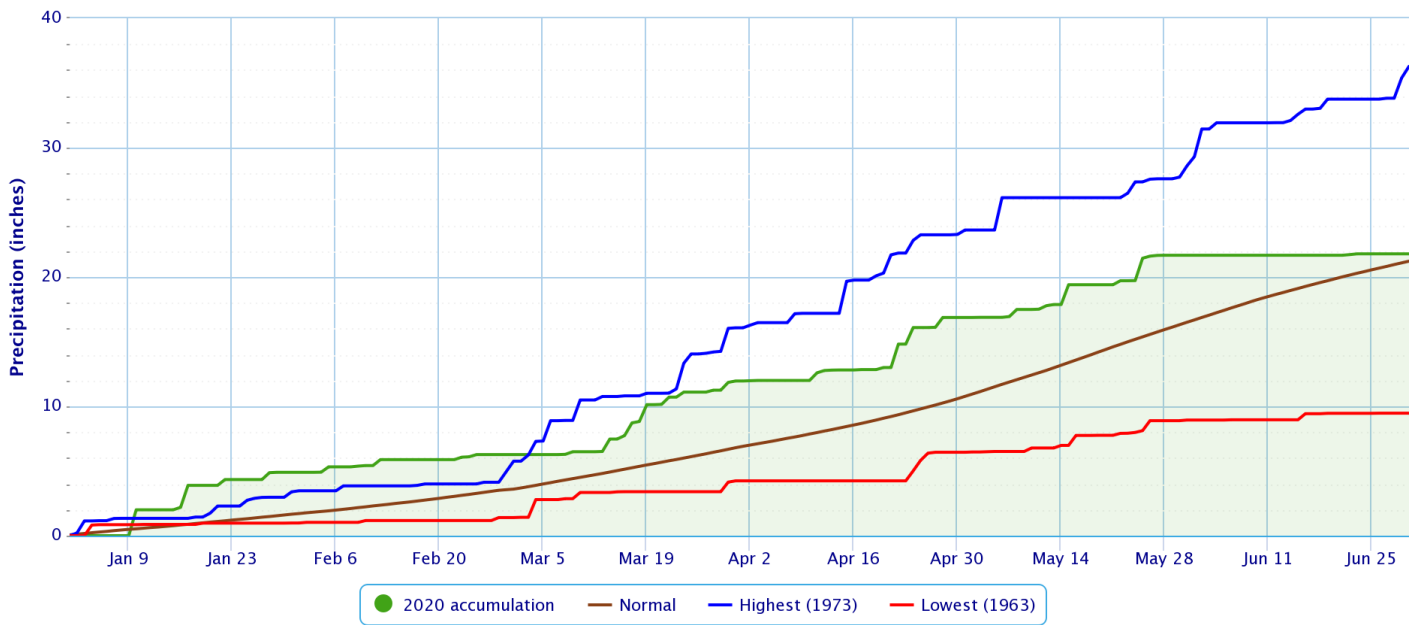
Period of Record – 1905-01-06 to 2020-06-30. Normals period: 1981-2010. Click and drag to zoom chart.



Powered by ACIS

### Accumulated Precipitation – Tulsa Area, OK (ThreadEx)

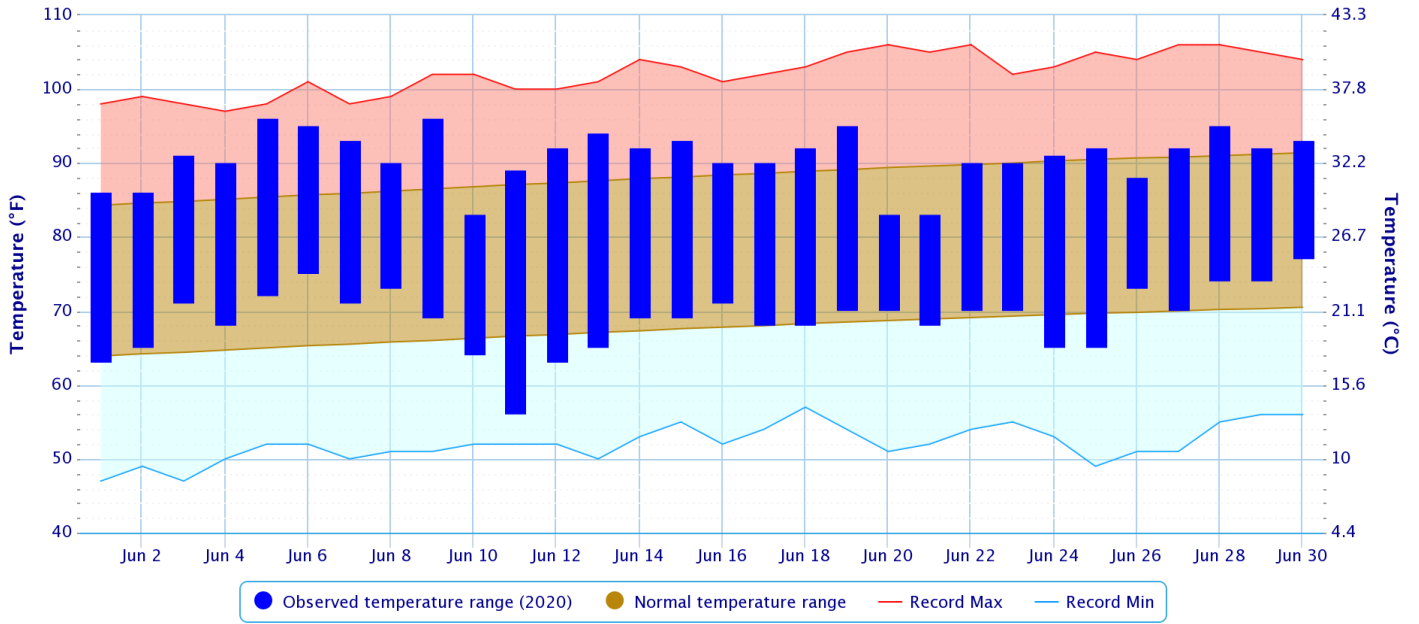
Click and drag to zoom to a shorter time interval; green/black diamonds represent subsequent/missing values



Powered by ACIS

### Daily Temperature Data – Fort Smith Area, AR (ThreadEx)

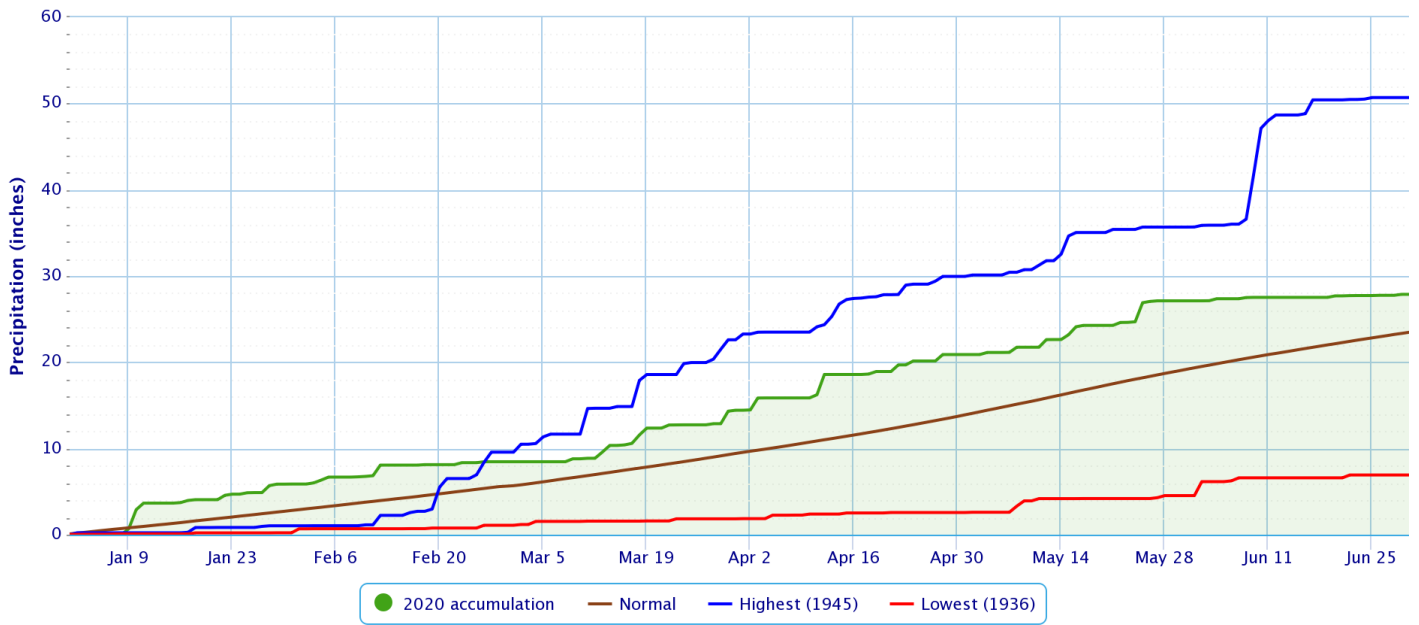
Period of Record – 1882-06-01 to 2020-06-30. Normals period: 1981-2010. Click and drag to zoom chart.



Powered by ACIS

### Accumulated Precipitation – Fort Smith Area, AR (ThreadEx)

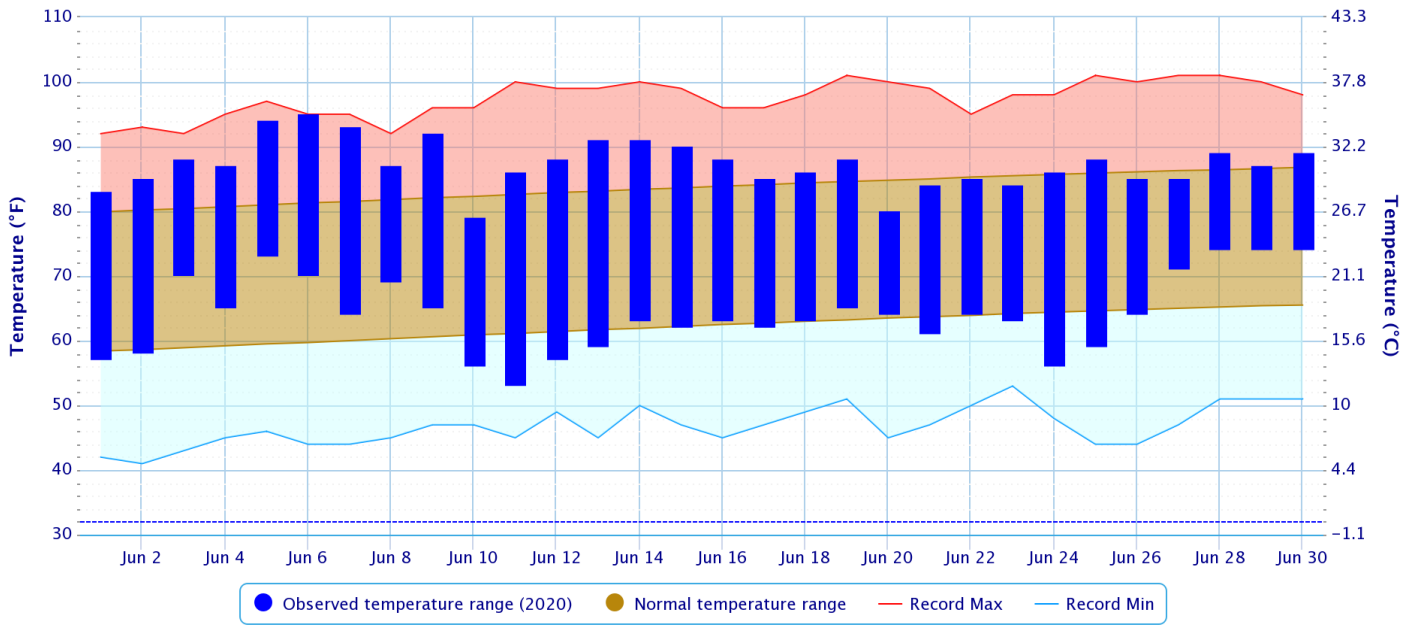
Click and drag to zoom to a shorter time interval; green/black diamonds represent subsequent/missing values



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### Daily Temperature Data – FAYETTEVILLE DRAKE FIELD, AR

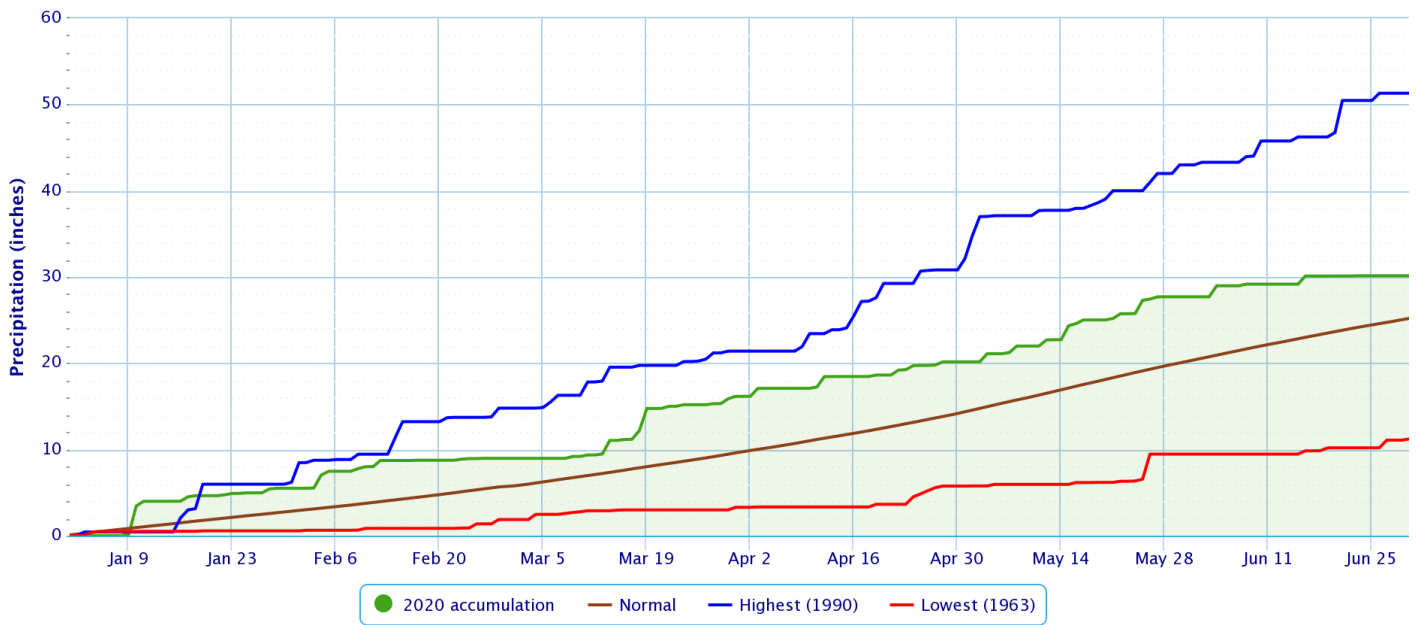
Period of Record – 1949-07-14 to 2020-06-30. Normals period: 1981-2010. Click and drag to zoom chart.



Powered by ACIS

### Accumulated Precipitation – FAYETTEVILLE DRAKE FIELD, AR

Click and drag to zoom to a shorter time interval; green/black diamonds represent subsequent/missing values

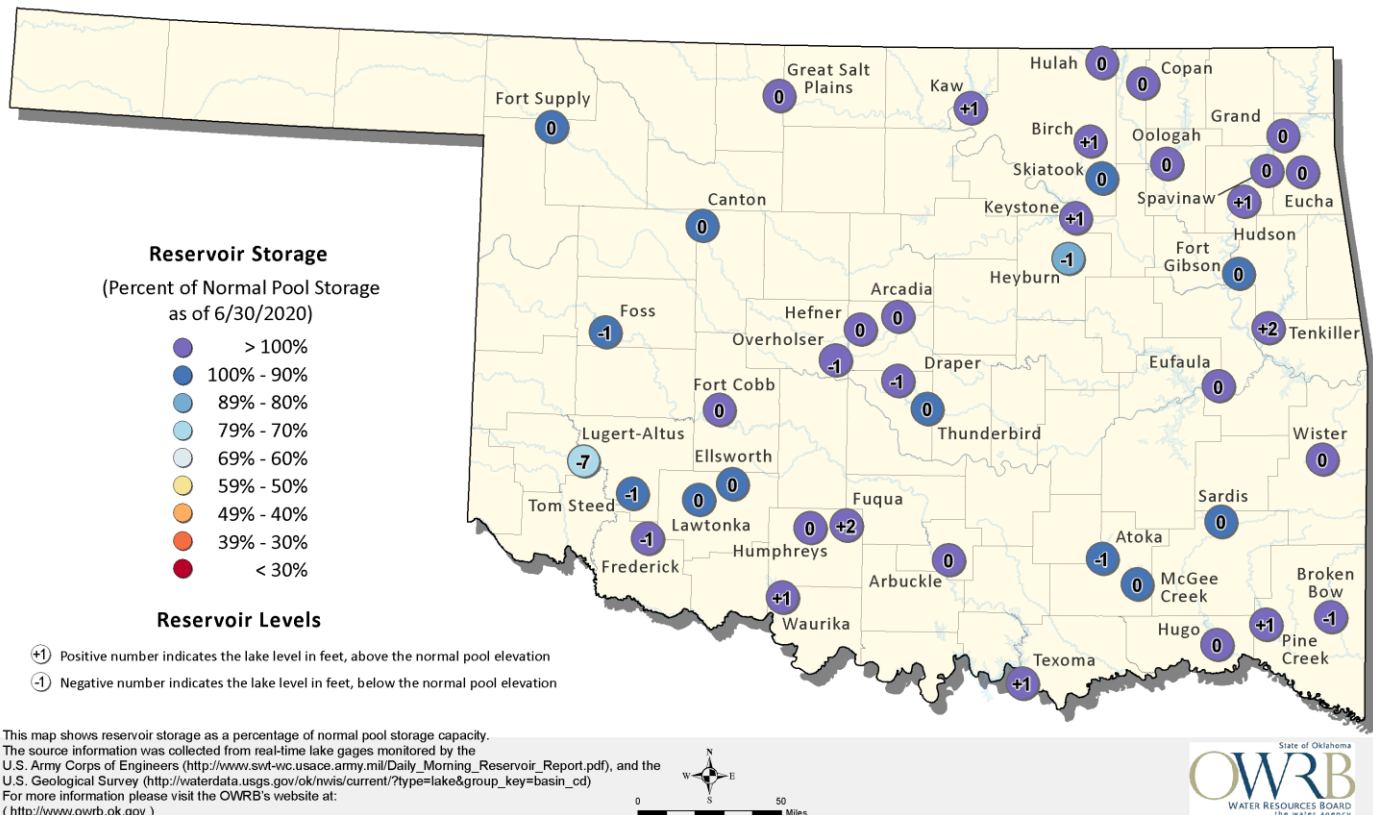


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## Reservoirs

# Oklahoma Surface Water Resources

## Reservoir Levels and Storage as of 6/30/2020



According to the USACE, most of the lakes in the HSA were within  $\pm 3\%$  of top of their conservation pools as of 6/30/2020. However, two lakes were still using a higher percentage of their flood control pools: Beaver Lake 71% and Tenkiller Lake 4%.

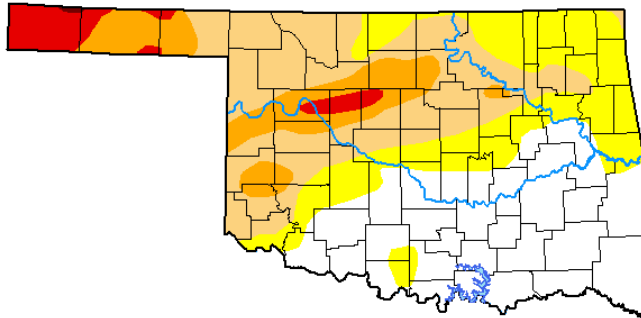
## Drought

A flash drought was developing across northeast OK during June 2020. According to the [U.S. Drought Monitor](#) (USDM) from June 30, 2020 (Figs. 2, 3), drought conditions were occurring across portions of eastern OK and northwest AR. Severe (D2) Drought was affecting a small portion of far western Tulsa, far northern Creek, and far southeastern Pawnee Counties in northeast OK. Moderate (D1) Drought was present across portions of eastern Kay, Osage, Pawnee, Creek, Tulsa, Rogers, Mayes, Wagoner, and Ottawa Counties in northeast OK. Abnormally Dry (D0), but not in drought, conditions were occurring across portions eastern Kay, Osage, Tulsa, Creek, Okfuskee, Okmulgee, Washington, Nowata, Rogers, Wagoner, Craig, Mayes, Ottawa, Delaware, Cherokee, Adair, Sequoyah, Haskell, and Le Flore Counties in northeast OK and Benton, Carroll, Washington, Madison, Crawford, Sebastian, and Franklin Counties in northwest AR.

Prior to June 2020, the last time drought conditions were present in eastern OK and northwest AR was on October 22, 2019, when D1 conditions were present in southern Choctaw County in southeast OK.

# U.S. Drought Monitor Oklahoma

**June 30, 2020**  
(Released Thursday, Jul. 2, 2020)  
Valid 8 a.m. EDT



Drought Conditions (Percent Area)

	None	D0-D4	D1-D4	D2-D4	D3-D4	D4
<b>Current</b>	34.87	65.13	43.03	15.39	4.46	0.10
<b>Last Week</b> 06-23-2020	43.25	56.75	34.75	13.95	4.26	0.00
<b>3 Months Ago</b> 03-31-2020	95.89	4.11	2.52	0.84	0.00	0.00
<b>Start of Calendar Year</b> 12-31-2019	76.45	23.55	10.47	3.64	0.00	0.00
<b>Start of Water Year</b> 10-01-2019	71.94	28.06	11.08	1.01	0.00	0.00
<b>One Year Ago</b> 07-02-2019	99.98	0.02	0.00	0.00	0.00	0.00

**Intensity:**  
 None (white)      D2 Severe Drought (orange)  
 D0 Abnormally Dry (yellow)      D3 Extreme Drought (red)  
 D1 Moderate Drought (light orange)      D4 Exceptional Drought (dark red)

The Drought Monitor focuses on broad-scale conditions. Local conditions may vary. For more information on the Drought Monitor, go to <https://droughtmonitor.unl.edu/About.aspx>

**Author:**  
Adam Hartman  
NOAA/NWS/NCEP/CPC

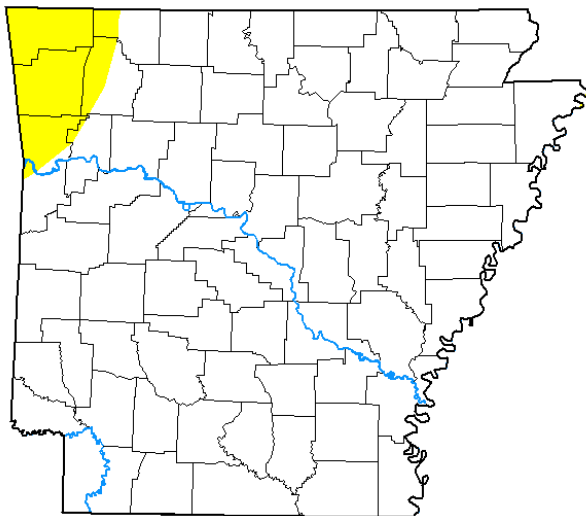


[droughtmonitor.unl.edu](https://droughtmonitor.unl.edu)

Fig. 2. Drought Monitor for Oklahoma

# U.S. Drought Monitor Arkansas

**June 30, 2020**  
(Released Thursday, Jul. 2, 2020)  
Valid 8 a.m. EDT



Drought Conditions (Percent Area)

	None	D0-D4	D1-D4	D2-D4	D3-D4	D4
<b>Current</b>	94.43	5.57	0.00	0.00	0.00	0.00
<b>Last Week</b> 06-23-2020	97.69	2.31	0.00	0.00	0.00	0.00
<b>3 Months Ago</b> 03-31-2020	100.00	0.00	0.00	0.00	0.00	0.00
<b>Start of Calendar Year</b> 12-31-2019	86.68	13.32	4.35	0.31	0.00	0.00
<b>Start of Water Year</b> 10-01-2019	54.35	45.65	11.77	5.79	0.00	0.00
<b>One Year Ago</b> 07-02-2019	100.00	0.00	0.00	0.00	0.00	0.00

**Intensity:**  
 None (white)      D2 Severe Drought (orange)  
 D0 Abnormally Dry (yellow)      D3 Extreme Drought (red)  
 D1 Moderate Drought (light orange)      D4 Exceptional Drought (dark red)

The Drought Monitor focuses on broad-scale conditions. Local conditions may vary. For more information on the Drought Monitor, go to <https://droughtmonitor.unl.edu/About.aspx>

**Author:**  
Adam Hartman  
NOAA/NWS/NCEP/CPC



[droughtmonitor.unl.edu](https://droughtmonitor.unl.edu)

Fig. 3. Drought Monitor for Arkansas

## **Outlooks**

The [Climate Prediction Center](#) (CPC) outlook for July 2020 (issued June 30, 2020) indicates a greatly enhanced chance for above normal temperatures and an enhanced chance for below median precipitation across eastern OK and northwest AR. This outlook takes into account dynamical model guidance, the weeks 3-4 outlook, and current soil moisture.

For the 3-month period July-August-September 2020, CPC is forecasting an equal chance for above, near, and below normal temperatures across northeast OK and northwest AR and an enhanced chance for above normal temperatures from north central into southeast OK. This outlook also indicates an enhanced chance for above median precipitation across all of northeast OK and northwest AR (outlook issued June 18, 2020). This outlook is based on both statistical and dynamical forecast tools, current soil moisture, and decadal timescale climate trends. According to CPC, the combined effect of the ocean-atmosphere system is consistent with ENSO neutral conditions. The forecast is for ENSO neutral conditions to continue through Summer (60%) 2020 and then the chance decreases into Autumn 2020. By Autumn, there is a 40%-50% chance of ENSO neutral and a 40%-50% chance of La Nina conditions.

**Summary of Heavy Precipitation Events** Daily quality-controlled rainfall maps can be found at: [http://water.weather.gov/precip/index.php?location\\_type=wfo&location\\_name=tsa](http://water.weather.gov/precip/index.php?location_type=wfo&location_name=tsa)

A complex of thunderstorms moved south out of southwest MO and into northwest AR around sunrise on the 4<sup>th</sup>. These storms continued to move south through west central AR and just across the state line into far eastern OK, before exiting the area by noon. Rainfall totals in the affected area were generally around 0.50" to around 2" (Fig. 4).

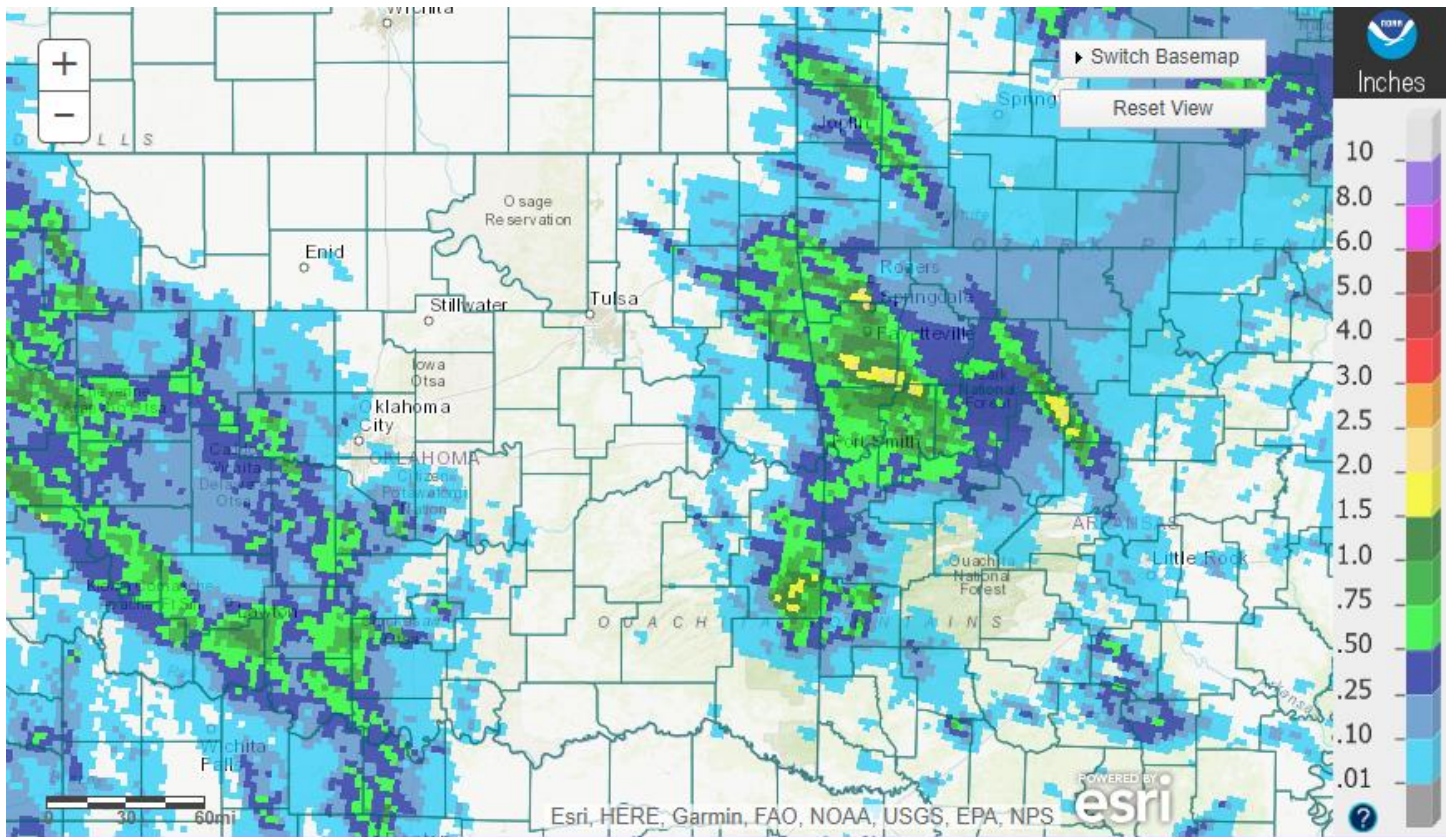
During the early morning hours of the 19<sup>th</sup>, a mesoscale convective complex (MCS) moved south out of KS and into north central/northeast OK. This activity remained nearly stationary north of I-44 and west of Highway 75 through the remainder of the morning hours as the low-level jet continued to interact with the complex's cold pool. Scattered thunderstorms were able to develop a little further east along an outflow boundary, mainly along and northwest of I-44 in northeast OK, during the afternoon hours. While most of this activity dissipated by late afternoon, showers and isolated thunderstorms lingered across Creek, Pawnee, Tulsa, Okfuskee, and Okmulgee Counties during the evening hours. A few short-lived isolated storms also occurred over other parts of east central OK during the evening. The extended period of rainfall during the morning brought widespread 1.5"-4" of rain to Pawnee, Osage, and Washington (OK) Counties (Figs. 5, 6). This area had been experiencing abnormally dry conditions prior to this rainfall, so there was no significant hydrologic response. Elsewhere, rainfall totals ranged from around 0.10" to 1.5" (Fig. 6).

Showers and thunderstorms moved northeast across southeast/east central OK and into west central/northwest AR on the 20<sup>th</sup> as an upper-level wave traversed the area. This activity pushed east of the area by mid-evening. Most affected locations received around 0.10" to around 0.50", though isolated totals of 0.75" to around 2" occurred in Le Flore, Haskell, Pittsburg, and Sebastian Counties (Fig. 7).

Elevated thunderstorms over south central OK spread east into southeast OK during the morning of the 21<sup>st</sup> within an area of warm air advection. This activity slowly moved east during the afternoon, with additional thunderstorms developing over west central and northwest AR in response to a residual mesoscale convective vortex (MCV) and afternoon surface heating. This activity came to an end by early evening. A second round of thunderstorms then began to impact eastern OK around midnight as a stronger MCS moved southeast across OK. These storms affected most of eastern OK during the overnight through early morning hours before shifting south of the area soon after sunrise on the 22<sup>nd</sup>. The highest rainfall totals were generally along and southwest of a line from Bristow to Muskogee to Poteau, where 0.50" to 3" of rain fell (Figs. 8, 9). Carroll, far eastern Benton, and far northern Madison Counties also received 0.50" to 1" of rain.

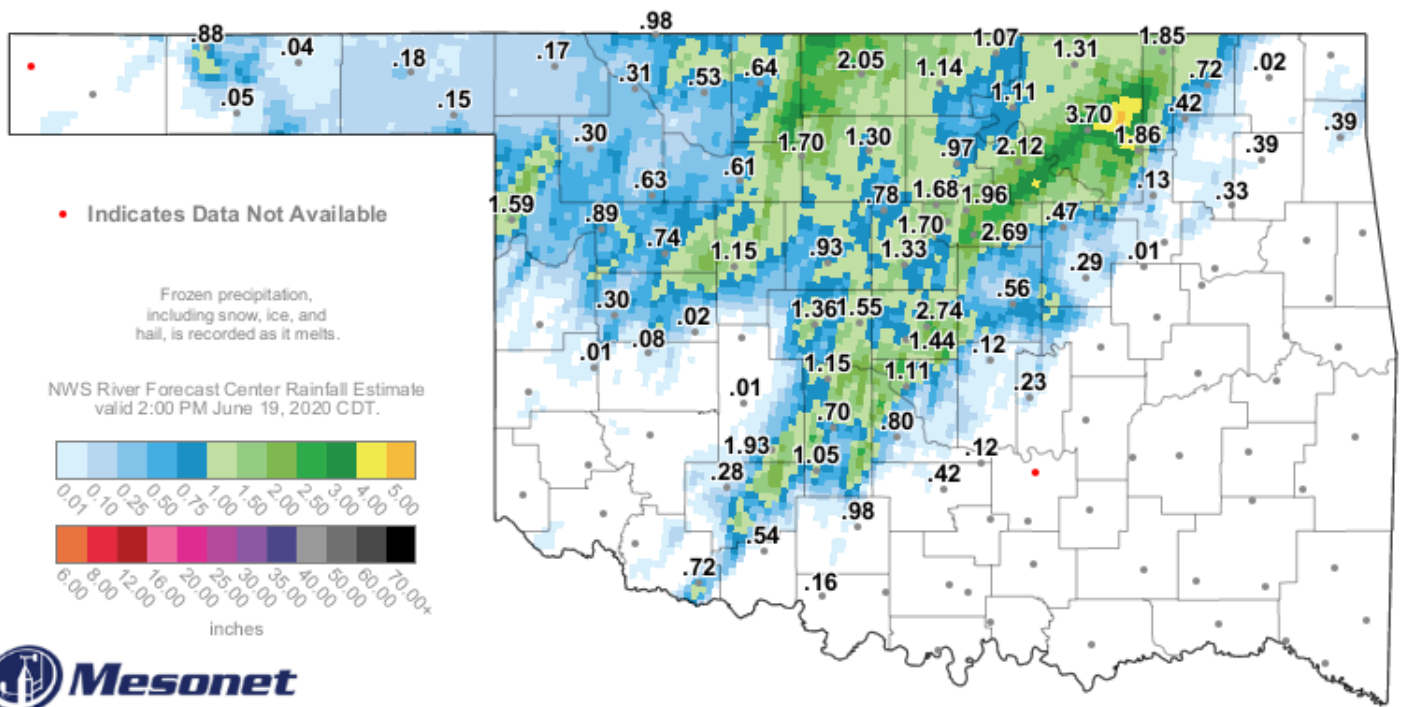
Shortly before midnight on the 23<sup>rd</sup>, a small area of thunderstorms developed over northeast OK within an instability axis. This activity propagated south across eastern OK and west central AR during the overnight through mid-morning hours. Meanwhile, an MCS was tracking eastward across northern TX. Storms along its northern periphery crossed the Red River by mid-morning and impacted southeast OK through around noon. Rainfall from these storms ranged from a few hundredths of an inch to around 2" (Figs. 10-12).





Tulsa, OK: June 05, 2020 1-Day Observed Precipitation  
Valid on: June 05, 2020 12:00 UTC

Fig. 4. 24-hour Estimated Observed Rainfall ending at 7am CDT 6/05/2020.

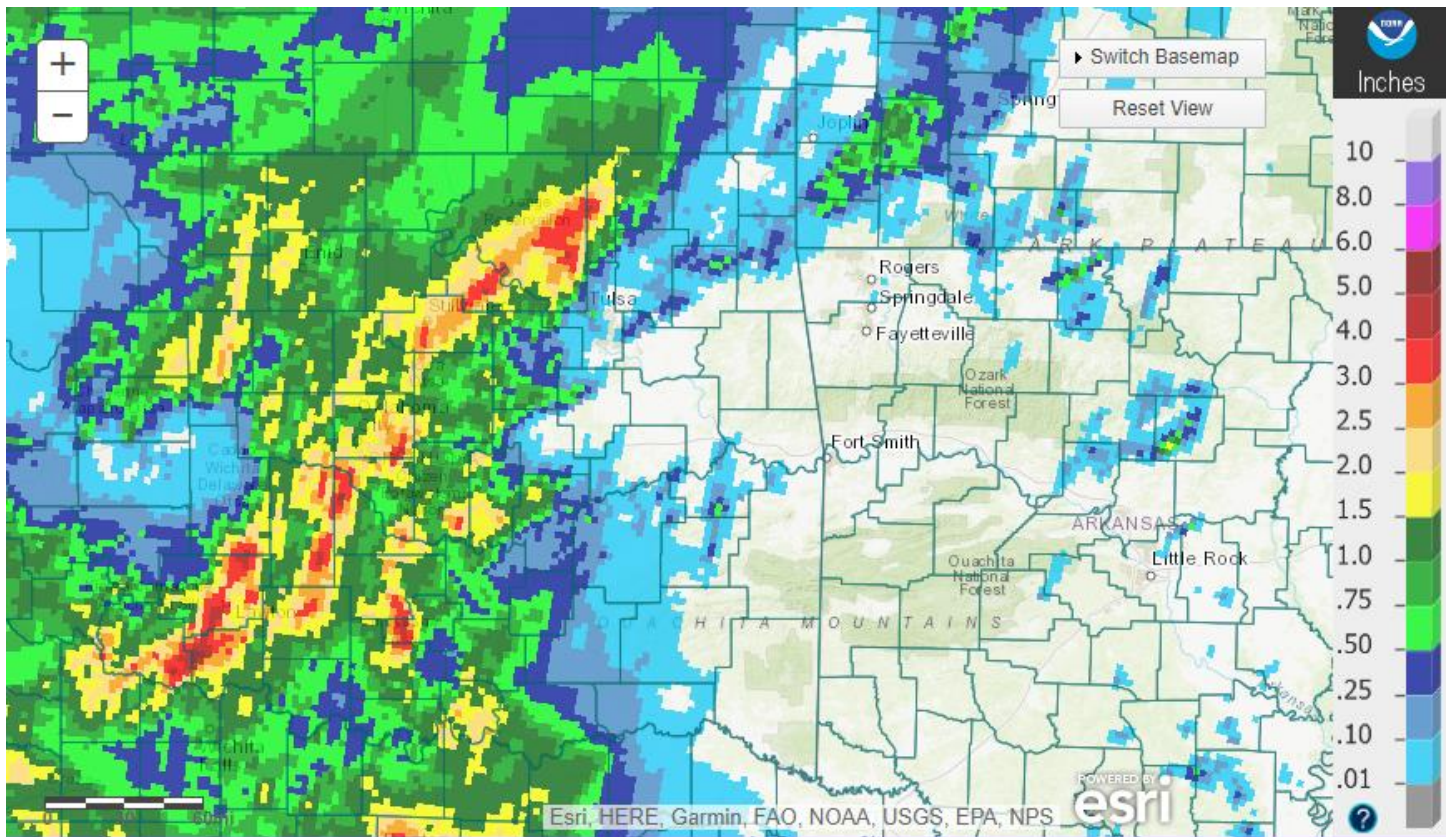


**12-Hour Rainfall Accumulation (inches)**

3:25 PM June 19, 2020 CDT

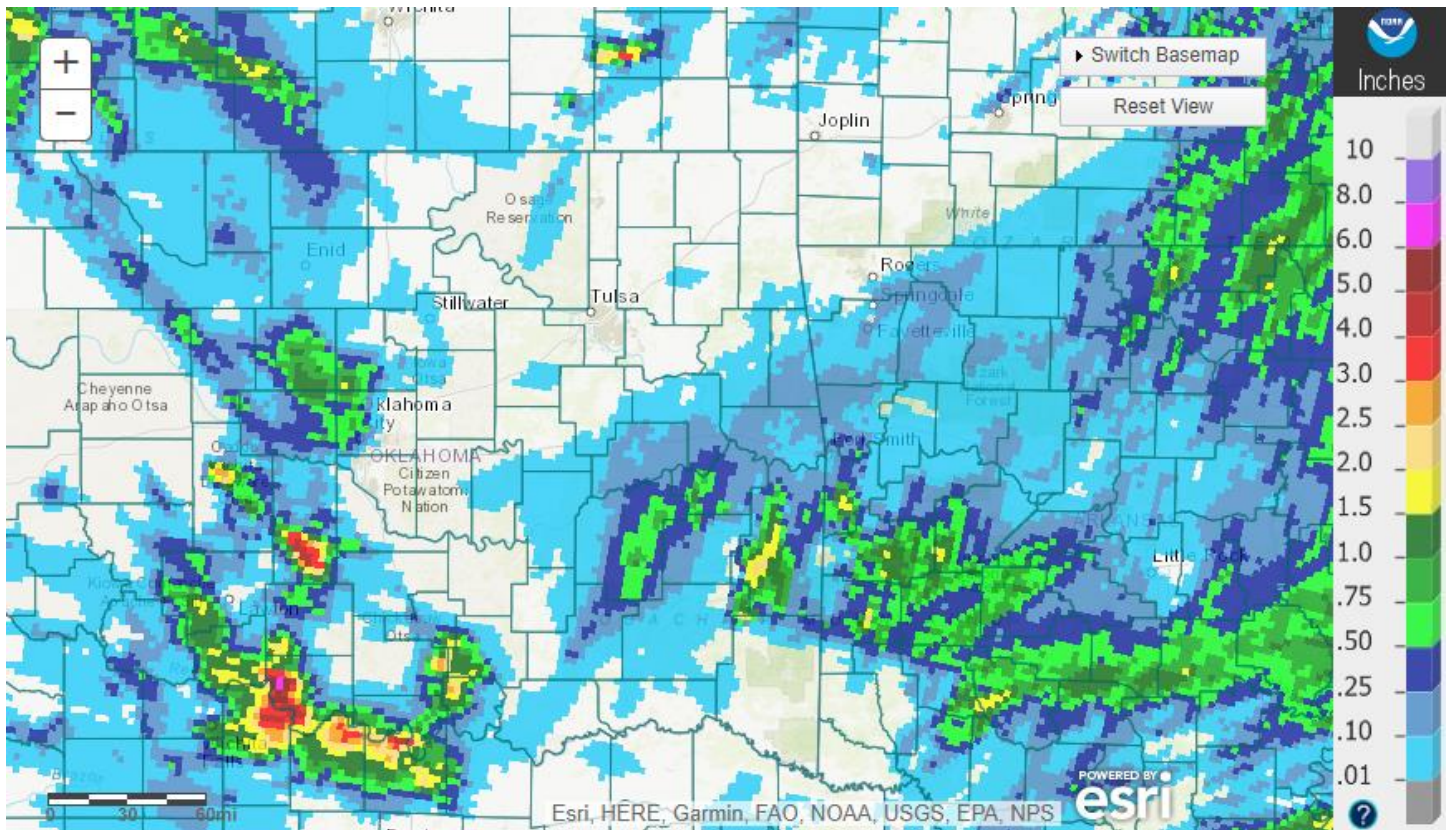
Created 3:30:49 PM June 19, 2020 CDT. © Copyright 2020

Fig. 5. OK Mesonet (values) and NWS RFC rainfall estimate (image) 12-hour rainfall ending at 3:25 pm CDT 6/19/2020.



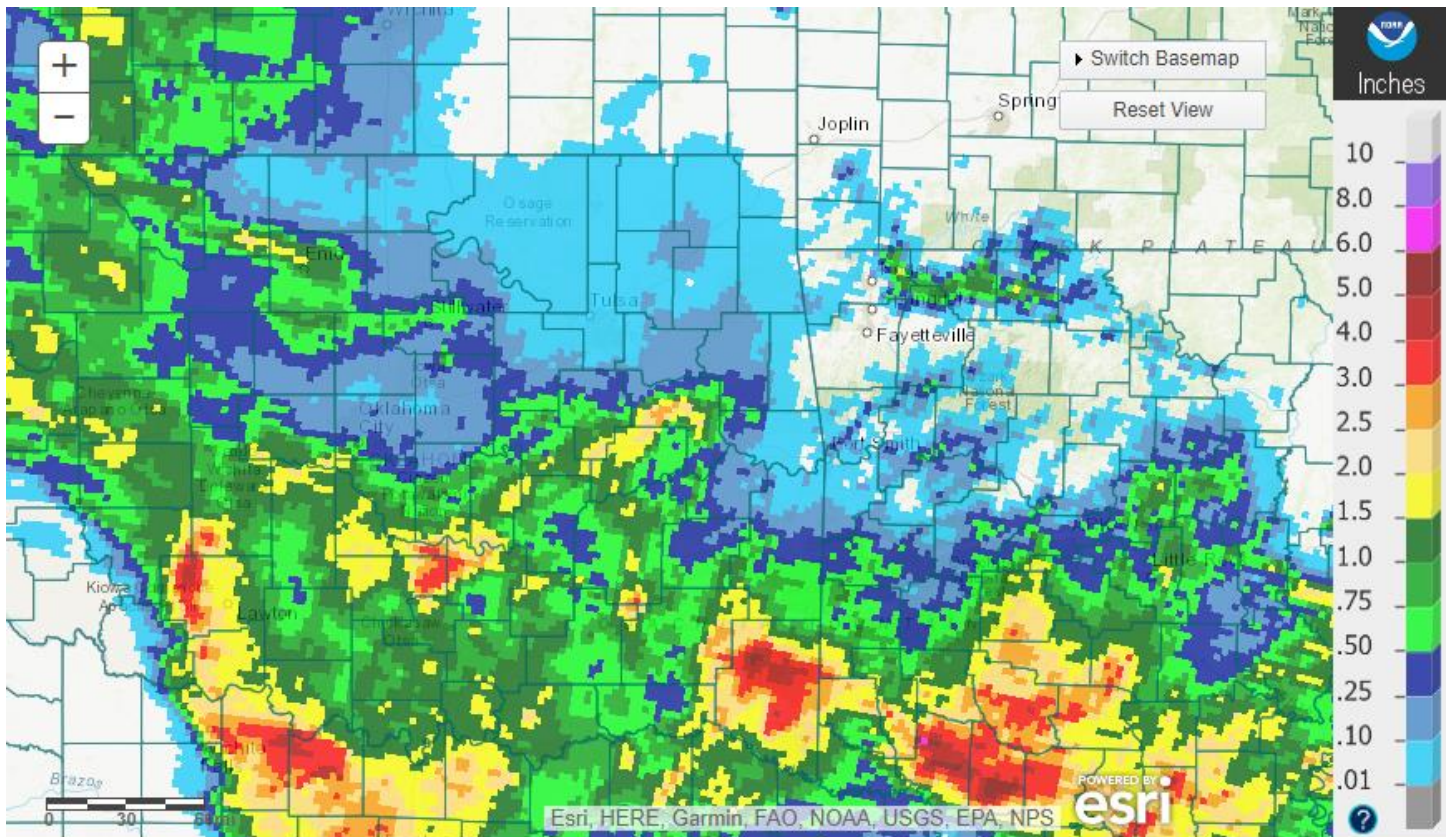
Tulsa, OK: June 20, 2020 1-Day Observed Precipitation  
Valid on: June 20, 2020 12:00 UTC

Fig. 6. 24-hour Estimated Observed Rainfall ending at 7am CDT 6/20/2020.



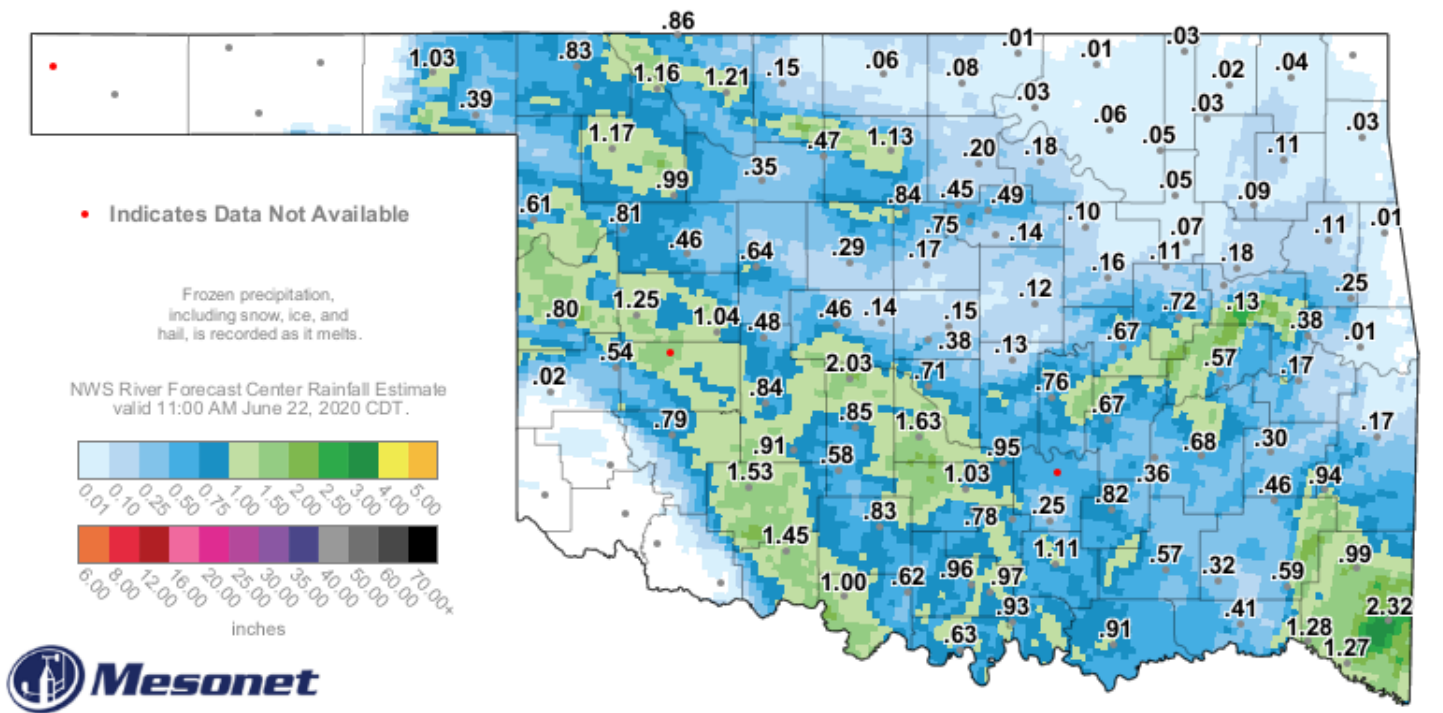
Tulsa, OK: June 21, 2020 1-Day Observed Precipitation  
Valid on: June 21, 2020 12:00 UTC

Fig. 7. 24-hour Estimated Observed Rainfall ending at 7am CDT 6/21/2020.



Tulsa, OK: June 22, 2020 1-Day Observed Precipitation  
Valid on: June 22, 2020 12:00 UTC

Fig. 8. 24-hour Estimated Observed Rainfall ending at 7am CDT 6/22/2020.

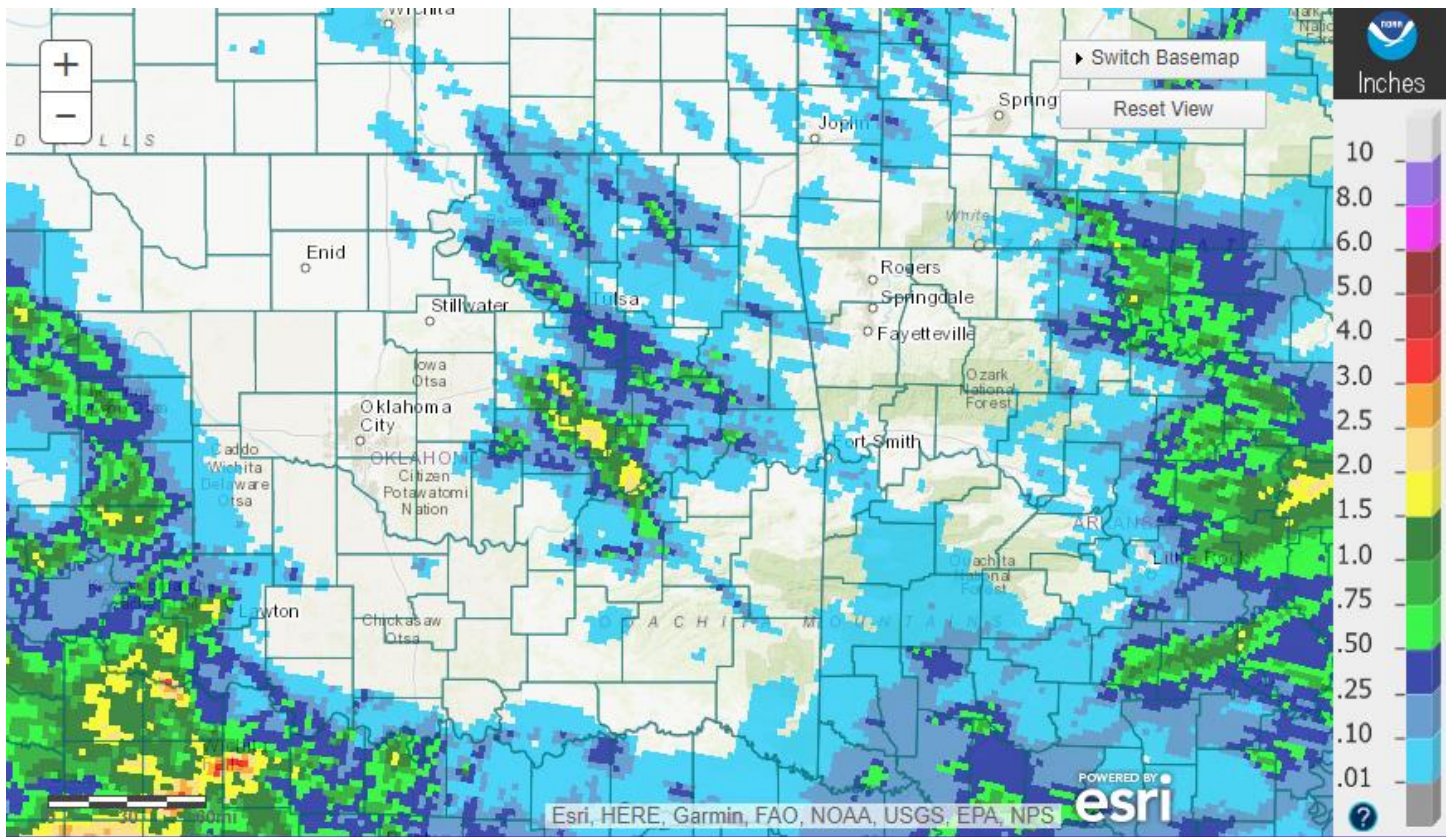


**Mesonet**  
24-Hour Rainfall Accumulation (inches)

11:50 AM June 22, 2020 CDT

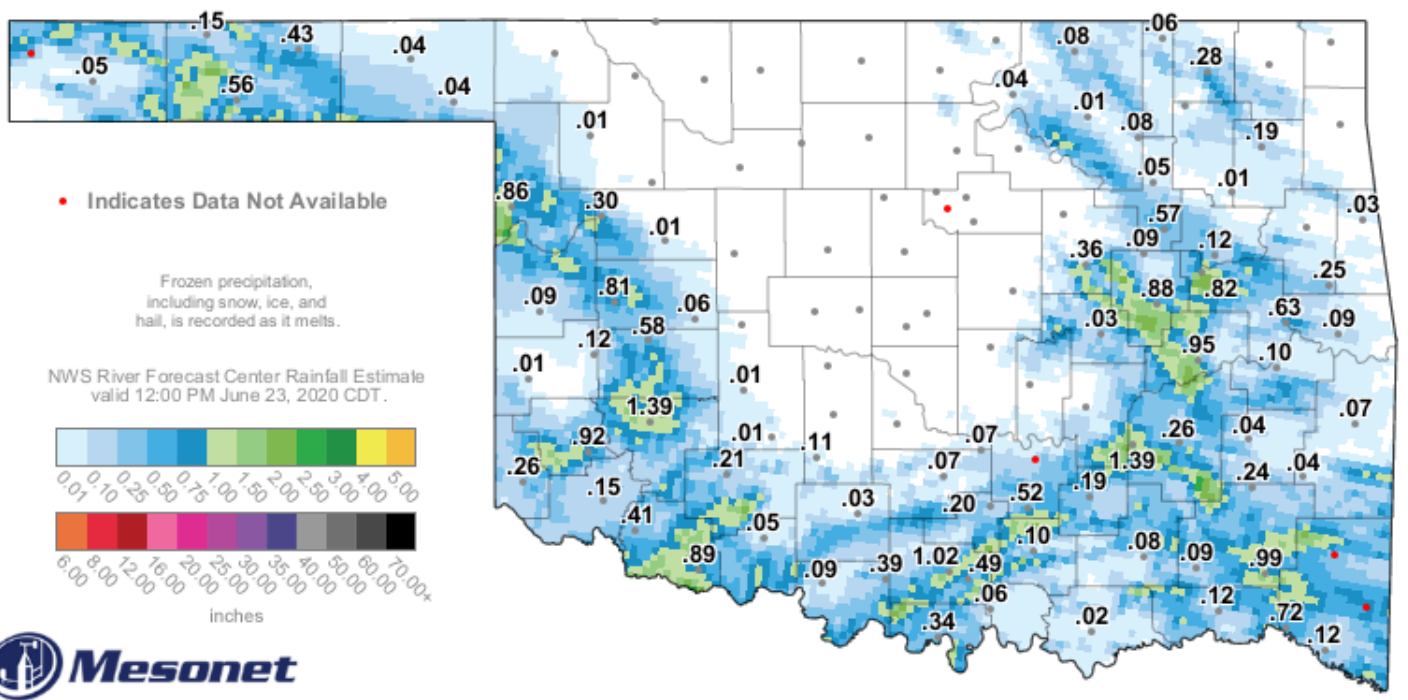
Created 11:55:48 AM June 22, 2020 CDT. © Copyright 2020

Fig. 9. OK Mesonet (values) and NWS RFC rainfall estimate (image) 24-hour rainfall ending at 11:50 am CDT 6/22/2020.



Tulsa, OK: June 23, 2020 1-Day Observed Precipitation  
Valid on: June 23, 2020 12:00 UTC

Fig. 10. 24-hour Estimated Observed Rainfall ending at 7am CDT 6/23/2020.

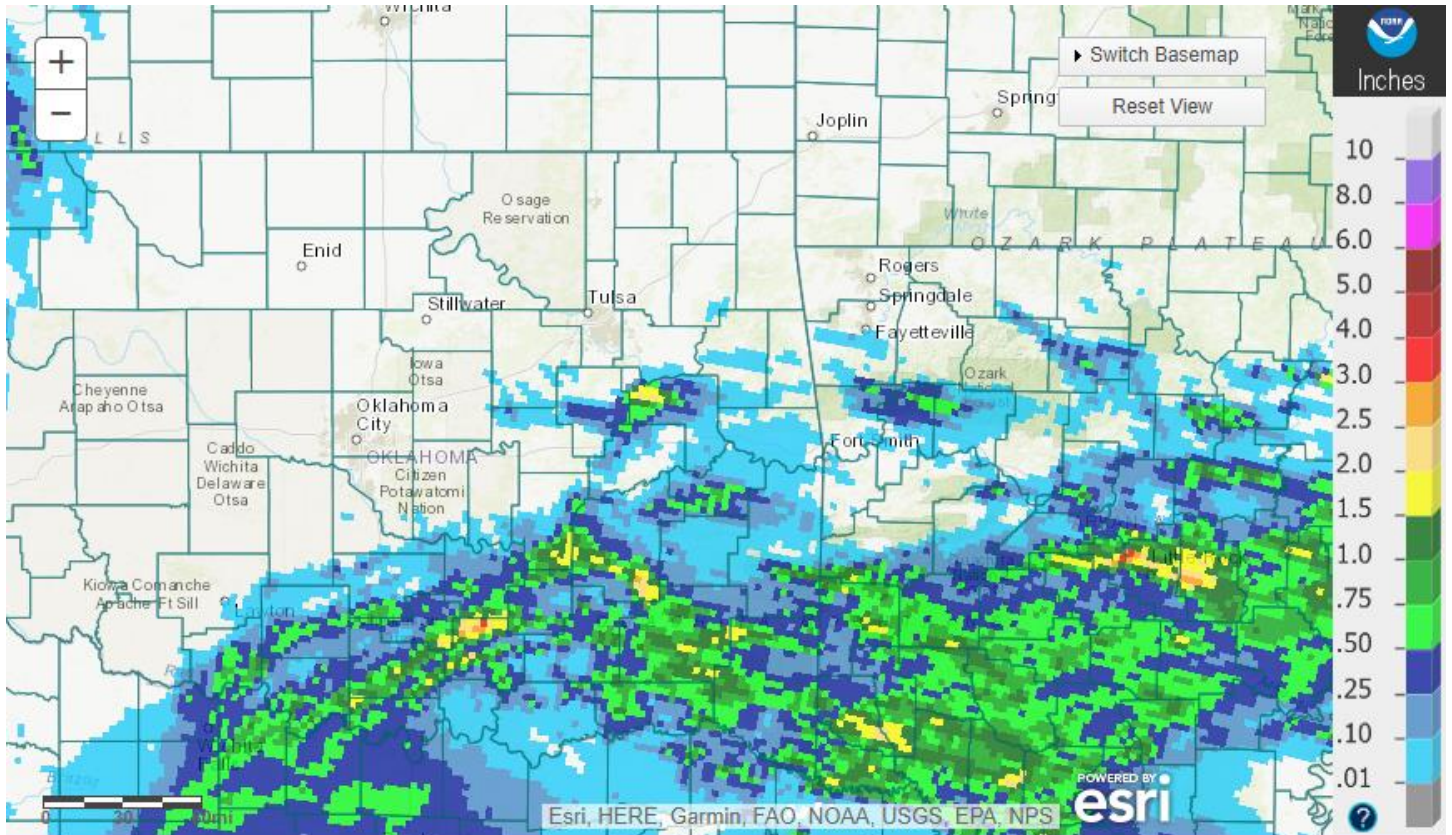


**24-Hour Rainfall Accumulation (inches)**

1:10 PM June 23, 2020 CDT

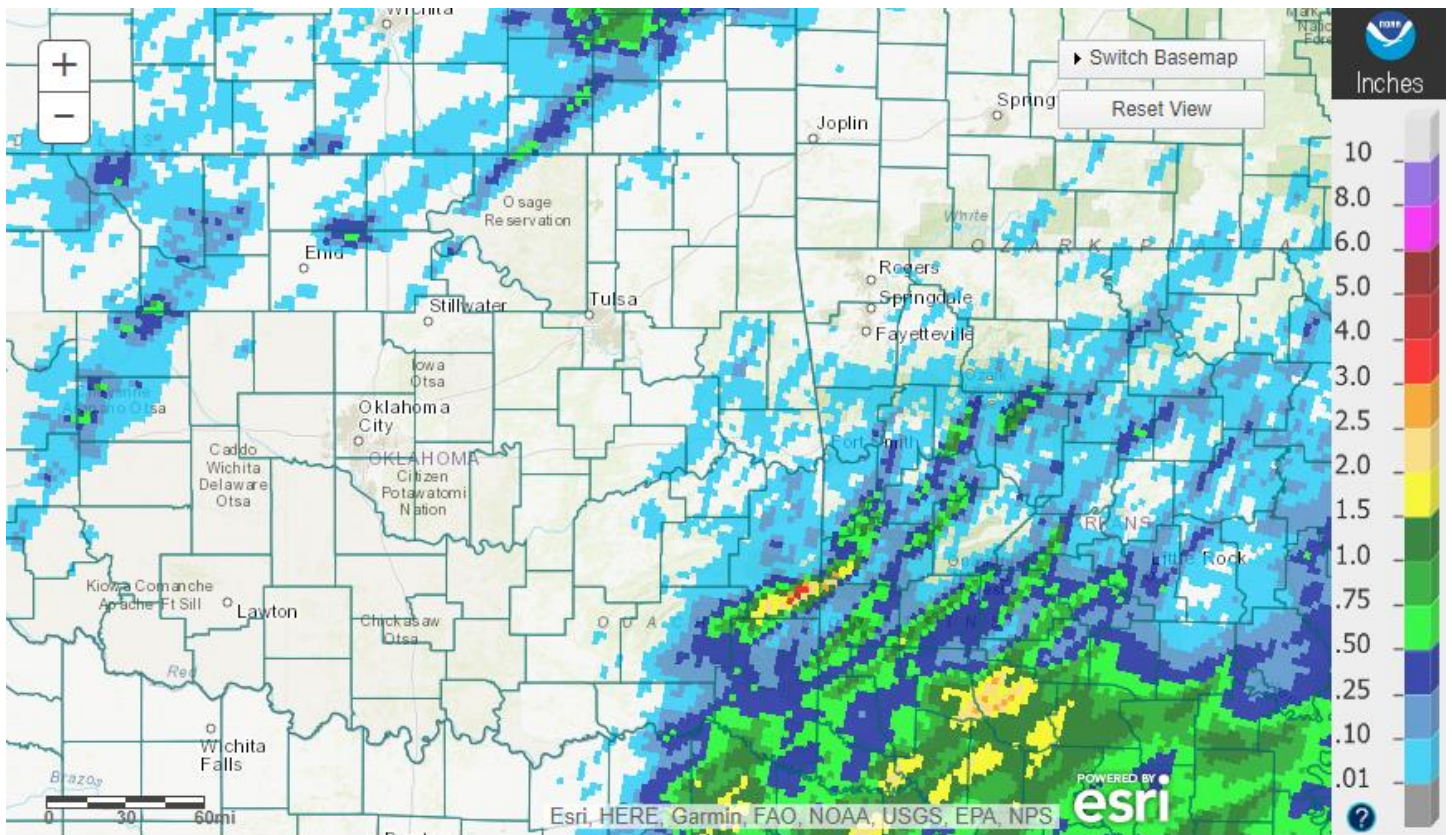
Created 1:15:54 PM June 23, 2020 CDT. © Copyright 2020

Fig. 11. OK Mesonet (values) and NWS RFC rainfall estimate (image) 24-hour rainfall ending at 1:10 pm CDT 6/23/2020.



Tulsa, OK: June 24, 2020 1-Day Observed Precipitation  
Valid on: June 24, 2020 12:00 UTC

Fig. 12. 24-hour Estimated Observed Rainfall ending at 7am CDT 6/24/2020.



Tulsa, OK: June 27, 2020 1-Day Observed Precipitation  
Valid on: June 27, 2020 12:00 UTC

Fig. 13. 24-hour Estimated Observed Rainfall ending at 7am CDT 6/27/2020.

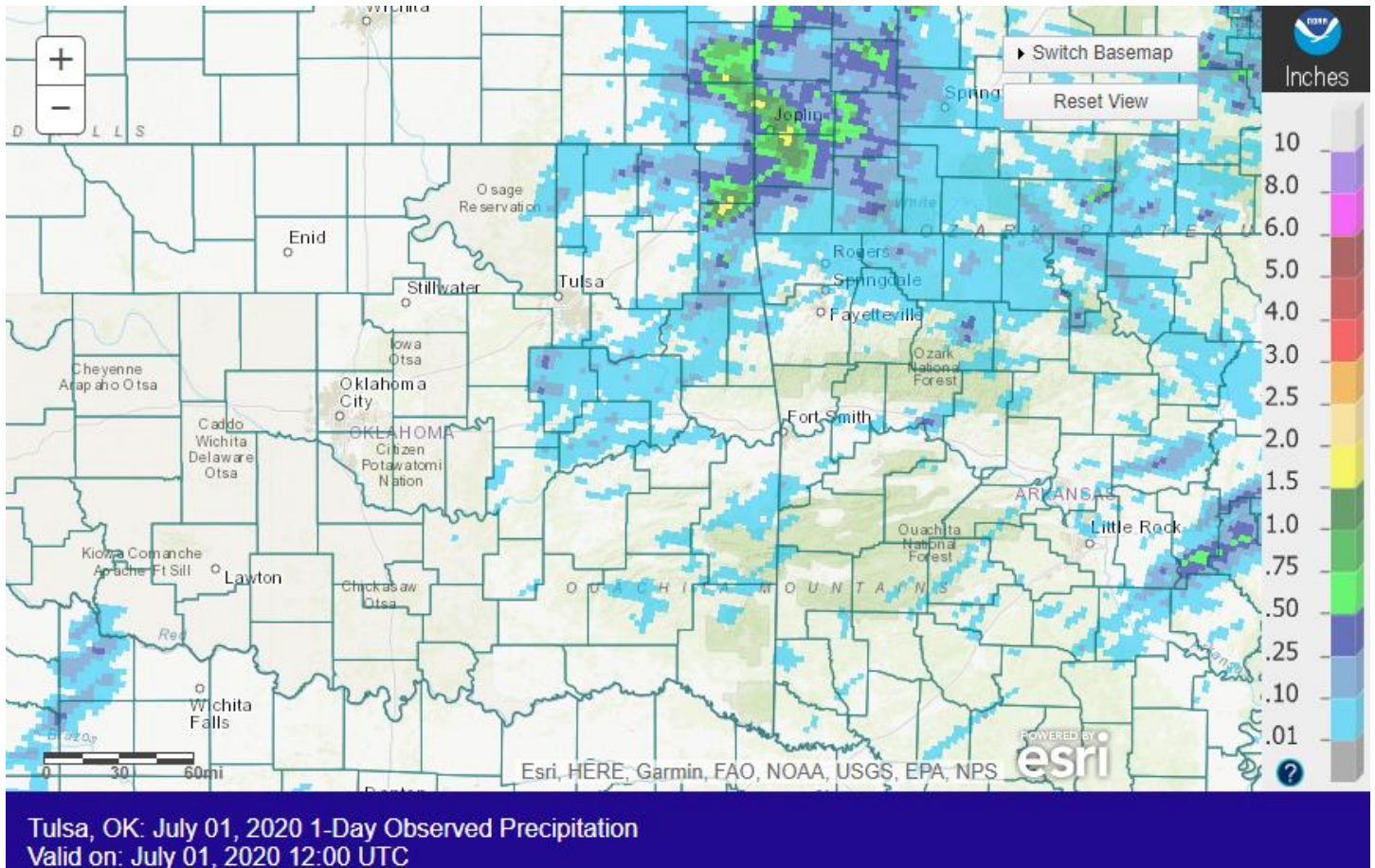


Fig. 14. 24-hour Estimated Observed Rainfall ending at 7am CDT 7/01/2020.

On the 26<sup>th</sup>, a weak vorticity max lifted northeast out of northeast TX into southern AR and interacted with a plume of Gulf moisture lifting into the region within the southerly low-level flow. In response, scattered showers and thunderstorms developed across southeast OK into west central AR during the afternoon hours. This activity then ended by evening as the backside of the vorticity max exited the region. Rainfall was overall light, however, 1.5” to 4” fell across southern Le Flore County (Fig. 13).

Showers and thunderstorms developed primarily over far northeast OK during the morning of the 30<sup>th</sup>, enhanced by isentropic lift as a weak mid-level shortwave passed by. Isolated showers and thunderstorms occurred elsewhere during the morning and afternoon hours. Rainfall totals were generally around 0.25” or less from this activity, though totals of 0.50” to around 1.5” occurred over Ottawa and Delaware Counties in northeast OK (Fig. 14).

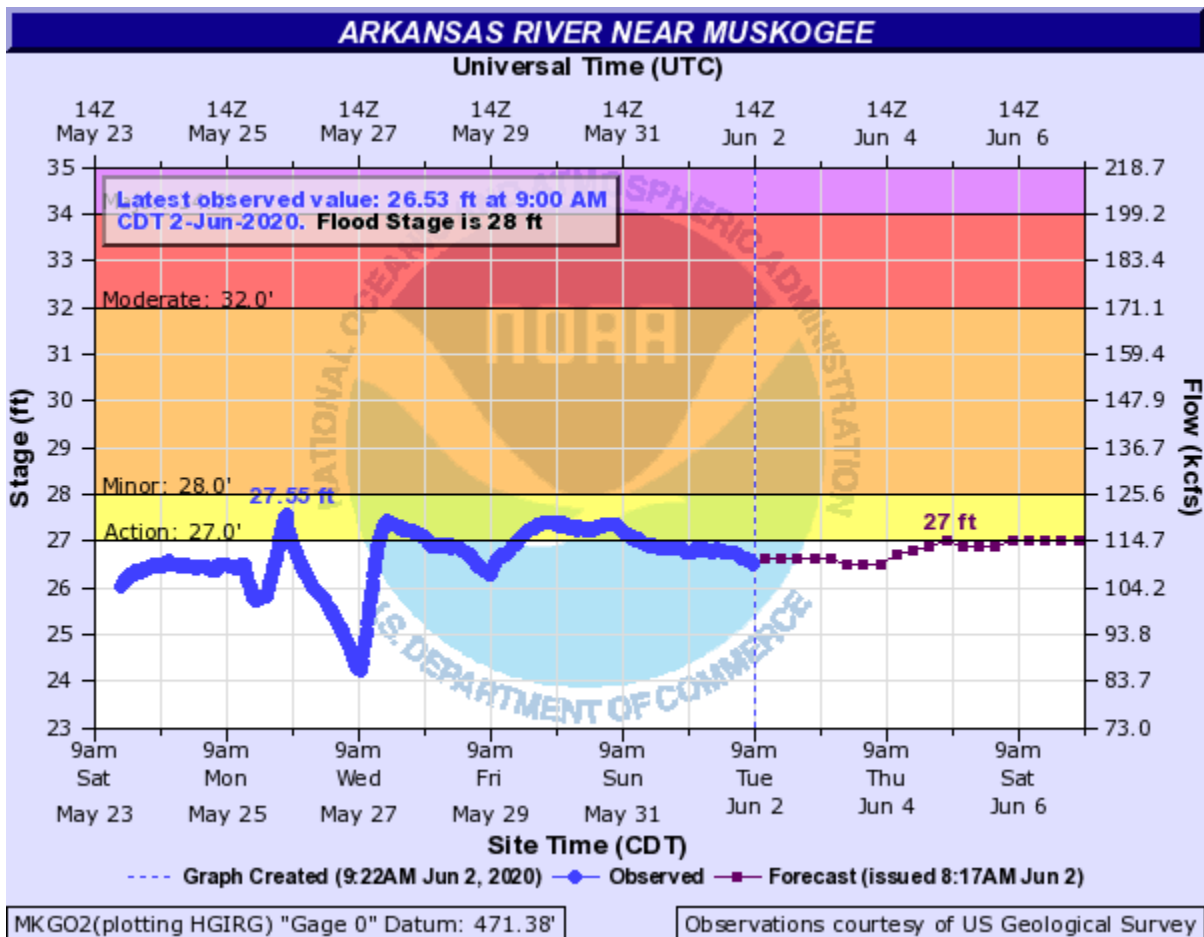
Written by:  
 Nicole McGavock  
 Service Hydrologist  
 WFO Tulsa

**Products issued in June 2020:**

- \*CWYO2 became a daily river forecast point September 7, 2016
- \*MLBA4 and OZGA4 transferred to NWS Tulsa HSA February 5, 2014
- \*Mixed case River Flood products began July 31, 2013

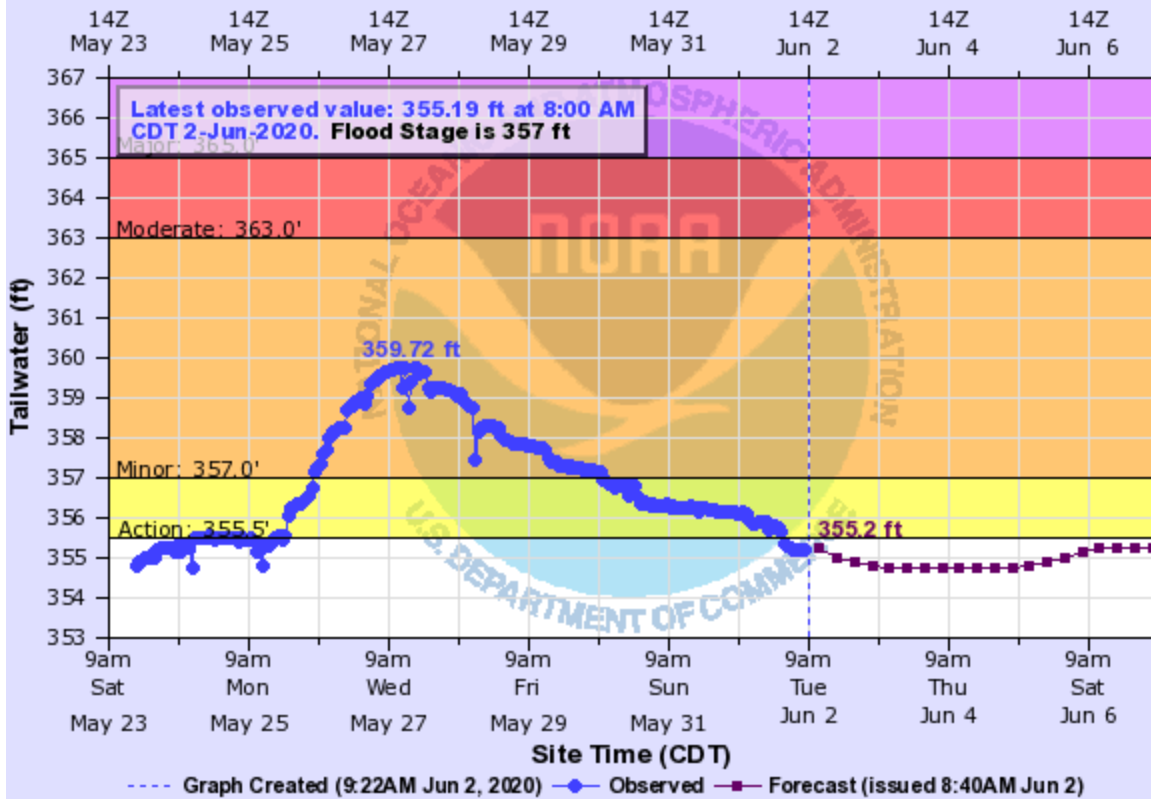
- 0 Flash Flood Warnings (FFW)
- 0 Flash Flood Statements (FFS)
- 1 Flash/Areal Flood Watches (FFA) (6 Watch FFA CON/EXT/EXA/EXB/CAN)
- 3 Urban and Small Stream Advisories (FLS)
- 0 Areal Flood Warnings (FLW)
- 0 Areal Flood Statements (FLS)
- 0 River Flood Warnings (FLW) (includes category increases)
- 0 River Flood Statements (FLS)
- 0 River Flood Advisories (FLS) (8 Advisory FLS CON/EXT/CAN)
- 0 River Flood Watches (FFA) (0 Watch FFA CON/EXT/CAN)
- 0 River Statements (RVS)
- 0 Hydrologic Outlooks (ESF)
- 0 Drought Information Statements (DGT)

**Preliminary Hydrographs:**



# ARKANSAS RIVER AT OZARK L/D TAILWATER

Universal Time (UTC)



OZGA4(plotting HTIRG) "Gage 0" Datum: 0'

Observations courtesy of US Army Corps of Engineers - LRD