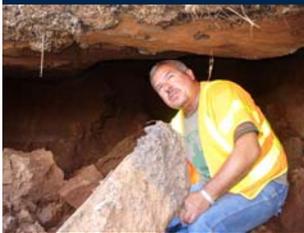


# Mother Nature's Fury on Oklahoma's Roads & Bridges 2007

Presented by : Leslie Lewis, PE, CFM  
Hydraulic Engineer, Bridge Division  
Oklahoma Department of Transportation



**THANK YOU** to over 1000 ODOT maintenance workers;  
who worked many hours, in horrible conditions, through every summer holiday;  
keeping the traveling public safe.



## Background and Technical Terms

- **FLOODPLAIN** -The land area that borders a stream and is covered by its waters in time of flood.
- **FLOOD FREQUENCY** or **STORM** - An expression or measure of how often a hydrologic event of given size or magnitude should, on an average, be...exceeded. For example a 50-year frequency flood or storm should be...exceeded in size, on the average, only once in 50 years.
- **SCOUR** - The result of the erosive action of running water that excavates and carries away material from a channel bed.
- **RIPRAP**- Stones and/or rock placed in a loose assemblage along the banks and around the bridge to inhibit erosion and scour.

## Mother Nature's Fury on Oklahoma's Roads & Bridges 2007

### DATA DISCLAIMER

- **Data shown is informational.**
- **The accuracy of the data is not guaranteed.**
- **The data information and related graphics are not legal documents and are not intended to be used as such.**

# Mother Nature's Fury on Oklahoma's Roads & Bridges 2007

- Background and definition of technical terms used in presentation
- This presentation will go through the flooding events since March in chronological order.
- For each event, the period of the event, event storm descriptions, geographic locations affected, photos of locations affected, and overall affects of the event on the roads and/ or bridges
- Focus will be given to the magnitude and extreme affects of the Tropical Storm in August
- Overall impact on Oklahoma Department of Transportation resources
- Compare to other historic events
- How will we use the data and lessons learned
- Conclusion
- Thanks again to all of our Maintenance workers!

## Background and Technical Terms

- **SLOUGHING** - Shallow, transverse movement of a soil mass down a stream bank as the result of an instability condition at or near the surface
- **SEDIMENT** or **LOAD** - sand, gravel, and eroded material transported, suspended or deposited by water
- **FLOOD STAGE**- The gage elevation of the lowest bank of the reach in which the gage is situated or above bank full stage
- **BANKFULL DISCHARGE**. Discharge that, on the average, fills a channel to the point of overflowing. Commonly considered as the mean annual discharge ( $Q_{2.33}$ ) or two- to three-year discharge ( $Q_2$ ,  $Q_3$ ) in a channel that has been relatively stable for a number of years without the occurrence of a large, bank-destroying flood.

## Background and Technical Terms

- Most roadway profiles and bridges are designed for a design discharge that does not overtop the road (usually 25-50 yr flood).
- Typically the roadway will have an overtopping location away from the bridge so that the slower moving, shallower floodplain water overtops the roadway first.
- If the flooding does result in failure, it is faster and less expensive to replace roadway fill than it is to replace a bridge

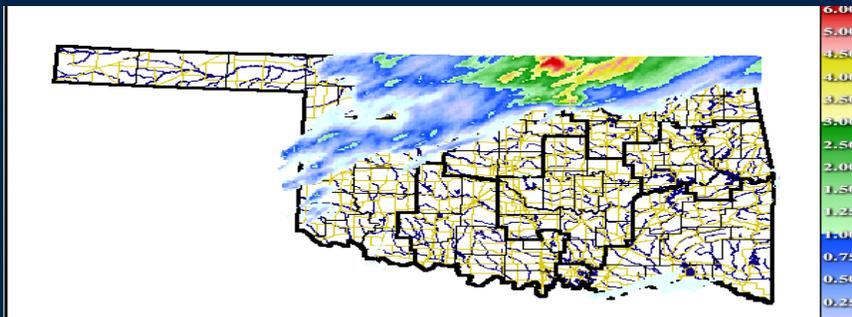
## Period of Event

March 20, 2007

# Event Storm Description

March 20, 2007

March 20, 2007

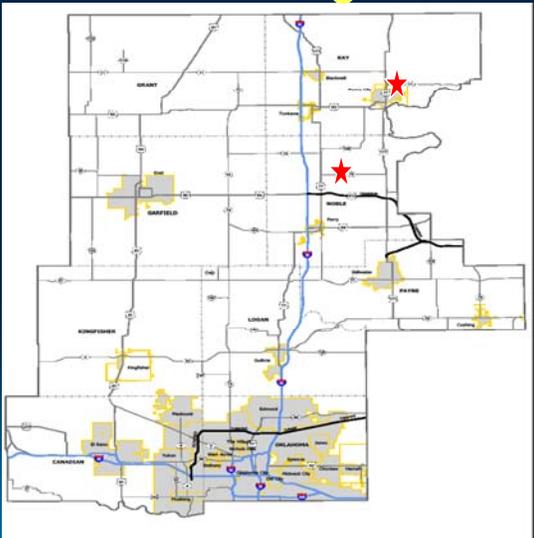


- Rainfall totals of 2 to 4 inches over central Noble County generated flash flooding in the area. At 0120 CST, a law enforcement official reported that flash flooding had covered and closed SH 15 one mile west of Red Rock. The floodwaters reached were 2 to 3 feet deep over the highway.
- Heavy rainfall totals of 3 to 7 inches over northern Kay Co during the morning hours of March 20 produced flash flooding in the area. At 1200 CST, the Kay County emergency manager reported that flash flooding from along Turkey Creek had covered and closed SH 11; 4 miles northeast of Ponca City and one miles east of the intersection with U.S. Highway 77. The powerful forces of the floodwaters damaged a temporary low water crossing on OK SH 11, tearing a 10-foot-wide section from the highway and damaging culverts under the highway.

# Geographic Locations Affected

March 20, 2007

## March 20, 2007 Flooding locations



Kay Co  
SH 11 and Turkey Creek

Noble County  
SH 15 1 mile west of Red  
Rock.

# Photos of Locations Affected

March 20, 2007

## Kay Co SH 11 Detour over Turkey Creek



# Kay Co SH 11 Detour over Turkey Creek



# Kay Co SH 11 Detour over Turkey Creek



# Kay Co SH 11 Detour over Turkey Creek

NEXT TIME YOU THINK YOU CAN  
MAKE IT ACROSS .....



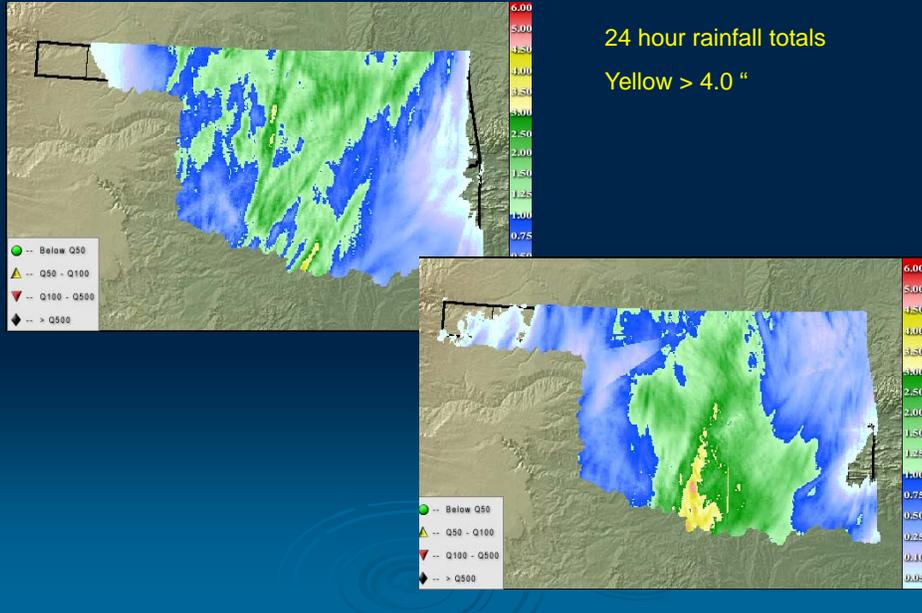
THINK AGAIN!!!!



## Event Storm Description

March 29 – 31, 2007

# March 29th and 30th



# Geographic Locations Affected

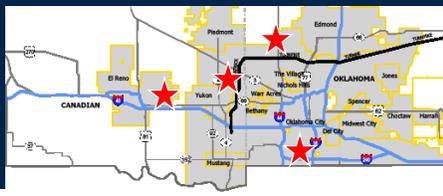
March 29 – 31, 2007

## March 29<sup>th</sup> and 30<sup>th</sup>



**Blaine County** A F1 tornado was reported near Okeene and moved northeast.

**Canadian County** The F2 tornado in El Reno and in western Oklahoma City injured 5 people and caused an estimated half of a million dollars in damage.



**Oklahoma County** sets precipitation record for highest one day total for March at 3.50"



**Murray County** Rainfall totals of 2 to 3 inches over Murray County during the afternoon of March 30 produced flash flooding in the area

**Stephens County** Rainfall totals of 3 to 6 inches fell over south central Oklahoma during the morning and afternoon of March 30 and generated flash flooding across the region.

## Photos of Locations Affected

March 29 – 31, 2007

# Driving away the drought

## Top rainfall totals

- Comanche 4.71
- Will Rogers World Airport, Oklahoma City 3.50
- Chickasha 3.34
- Wauwata 2.65
- Perry 2.48
- Buffalo 2.30
- Billings 1.95
- Shawnee 1.94

Source: National Weather Service

■ Oklahoma City sets precipitation record.



A winding tree-lined creek snakes through flooded fields Saturday near Bryant Road, about two miles north of Seward Road and south of Guthrie. Widespread rainfall was both good news and bad news for the state, easing drought fears but causing localized flooding.



A pickup splashes through flood waters near Highway 74 and Coffee Creek Road west of Edmond on Saturday. Record rainfall amounts in portions of Oklahoma caused localized flooding.

## March 29<sup>th</sup> and 30<sup>th</sup>



S. Penn March 30th



NW 150<sup>th</sup> between Council & County Line Rd



Reno and Portland

## March 29<sup>th</sup> and 30<sup>th</sup>



Hobbie Benson, 16, waits for help after getting his car stuck in high water Friday on Pennsylvania Avenue just south of Memorial Road in Oklahoma City.



BERRY YARBROUGH, NEWSOK CONTRIBUTOR  
"Overturned semi-trailer Thursday on Kilpatrick Turnpike just north of Britton Road." **Berry J. Yarbrough**

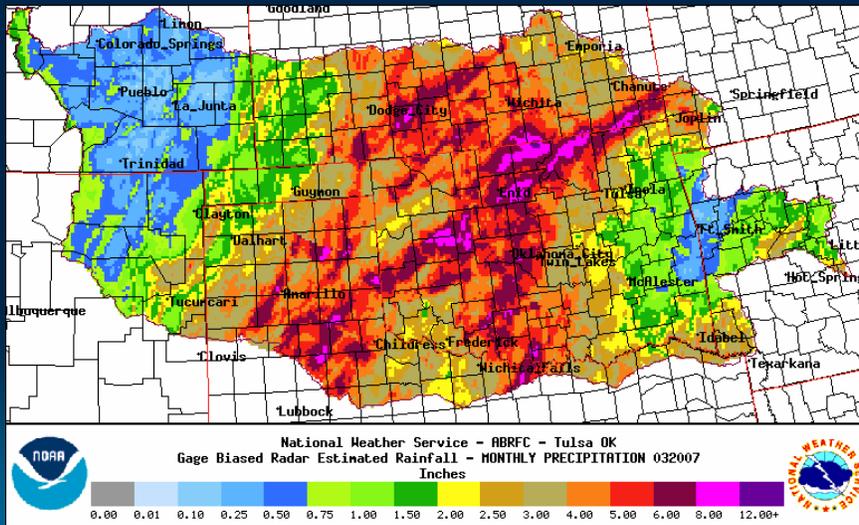


Friends of the family look over what remains of Vance and Barbra Woodbury's house Thursday afternoon in Beaver County. The couple were killed when a tornado struck the house Wednesday night.

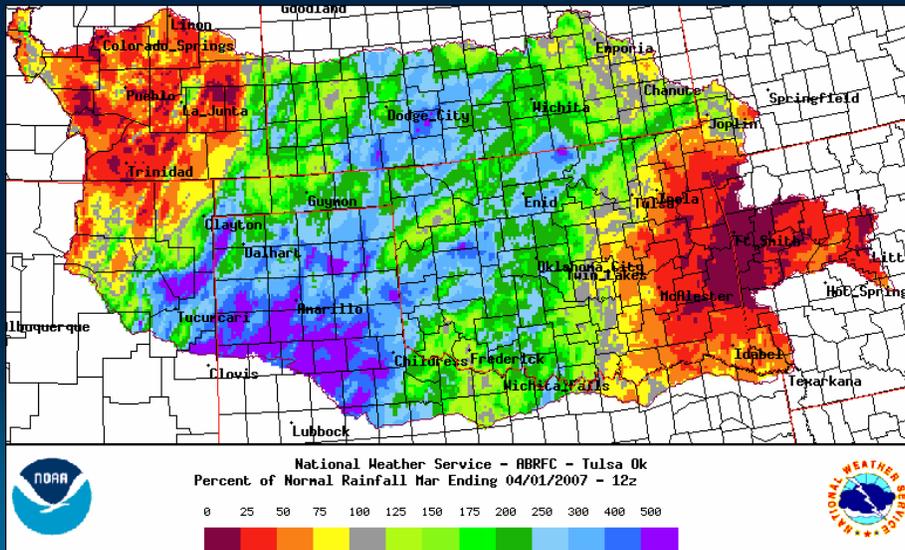
## Overall Affects of the Event on Roads and Bridges

March 29 – 31, 2007

# March Precipitation totals



# March - Percent of Normal



# Period of Event

April 2007

# Event Storm Description

April 2007

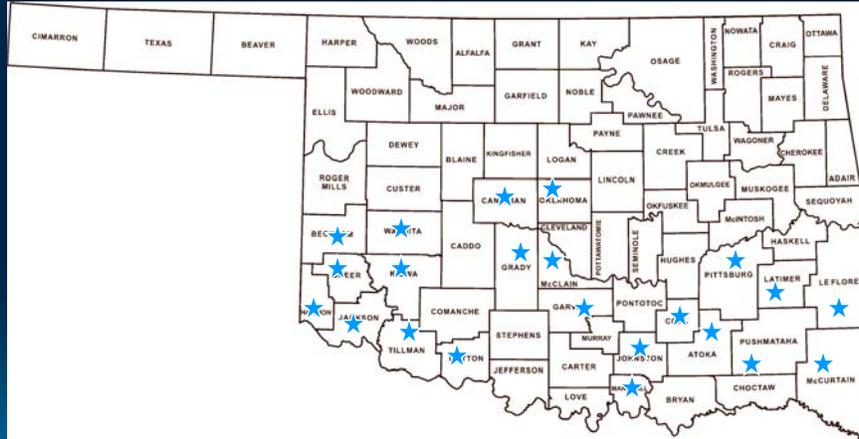
## April 2007

- A warm front lifted north out of the northern Texas during the afternoon hours of the 10th. Also, an upper level disturbance moved out of the Rocky and moved over Oklahoma and a dry line approached from the Texas panhandle. Scattered strong to severe thunderstorms developed over central and south central Oklahoma and moved east during the late afternoon and early evening hours. A strong super cell thunderstorm moved over southern Grady county and moved east. Another super cell developed farther north over McClain county, also moving east. Both of these thunderstorms had large hail to the size of golf balls, and wind gusts near 60 mph.
- An early morning non-severe thunderstorm caused two fires at the Wynnewood Refinery. The first fire occurred in a tank housing naphtha, a gasoline component. This fire was thought to be contained, before another fire began that evening in a tank containing diesel fuel. Approximately 70,000 barrels of naphtha and diesel were lost in the two day fire. Roads surrounding the refinery were closed due to the massive amounts of smoke coming from the refinery. No injuries were reported with the explosions. The fire burned for at least 2 days before finally extinguishing
- Strong thunderstorm wind, associated with a mesocyclone, destroyed two mobile homes and several storage buildings. The wind also damaged a number of homes. Numerous trees and power poles were also snapped, uprooted, or blown down. An NWS storm survey indicated an estimated maximum wind speed of 85 to 95 mph.

## Geographic Locations Affected

April 2007

April 2007



## Photos of Locations Affected

April 2007

April 2007



## Overall Affects of the Event on Roads and Bridges

April 2007



# Period of Event

May 4 – 11, 2007

# Event Storm Description

May 4 – 11, 2007

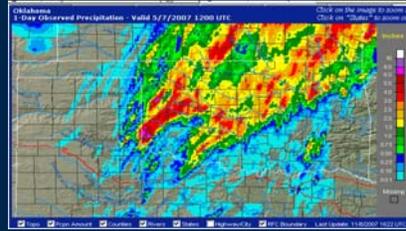
# Event Storm Description May 4 – 11, 2007

May 4, 2007

May 7, 2007



KONAWA 4ESE	OK	1.74
SKIATOOK 4W	OK	1.44
COMMERCE 5W	OK	1.17
TULSA 5SSW	OK	1.1
SKIATOOK 4W - DAM	OK	1.09
NOWATA 3NNE (MESO)	OK	1.03
BARTLESVILLE 2W	OK	1



CARL 8NNW	OK	6.09
SAYRE 1NE	OK	4.8
SAYRE 2SE	OK	4.57
ELK CITY 2S	OK	4.26
BIXBY 2ENE (MESO)	OK	3.93
TULSA 9SE (HLC)	OK	3.87
ERICK 4ESE (MESO)	OK	3.65

# Event Storm Description May 4 – 11, 2007

May 8, 2007

May 9, 2007



LANE 1WNW (MESO)	OK	5.23
FARRIS 3WNW	OK	4.38
EUFAULA 5W (MESO)	OK	3.85
WETUMKA 3NE	OK	3.74
BLUE 1W - HWY 70 BR	OK	3.55
FARRIS 3N	OK	3.44
TROUSDALE 7S	OK	3.2



INDIAHOMA 10N	OK	5.05
LAWTON 13NW (MESO)	OK	3.84
FORT COBB 4NNW (MES)	OK	3.83
EL RENO 9W (MESO)	OK	3.27
SEDAN	OK	3.26
BLACKWELL 4SSE (MES)	OK	2.57
APACHE (MESO)	OK	2.51

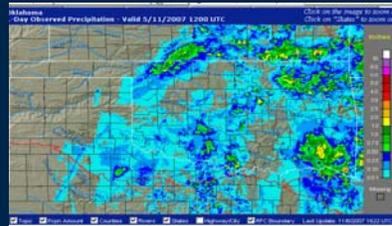
# Event Storm Description May 4 – 11, 2007

May 10, 2007



PAULS VALLEY 3SSW (	OK	1.82
WALTERS 1ENE	OK	1.73
SULPHUR 4NNE (MESO)	OK	1.69
PAULS VALLEY 4WSW	OK	1.6
ELK CITY 2S	OK	1.37
ENID 3SSW (VANCE AF	OK	1.35
PAULS VALLEY 2WNW	OK	1.35

May 11, 2007

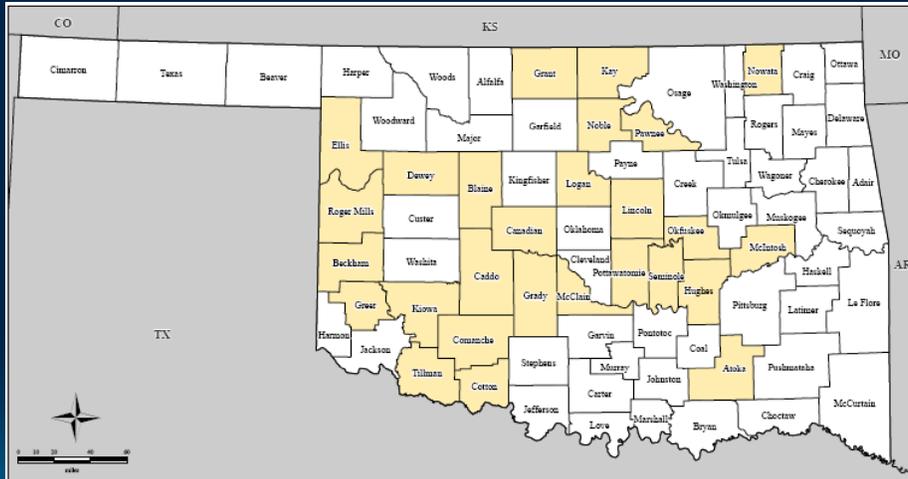


SKIATOOK 4W - DAM	OK	1.77
SHERWOOD 4SW (MESO)	OK	1.66
LOCUST GROVE 5S	OK	1.58
INGALLS	OK	1.48
JAY 4N (MESO)	OK	1.36
IDABEL 5NE	OK	1.3
HEALDTON 2S	OK	1.28

## Geographic Locations Affected

May 4 – 11, 2007

May 4 – 11, 2007



## Photos of Locations Affected

May 4 – 11, 2007

# May 8, 2007



A couple stand on one side of SE 17 between Central and Robinson and look at a gap between the road surface and a bridge that was created when roadbed was washed away by rushing waters of Lightning Creek.



CLEANUP is under way today after a thunderstorm ripped through Oklahoma City early Monday. The storm flooded many areas, damaged buildings, left a bridge impassable and knocked out power to thousands.

**Death:** A Canute man died after his car was swept away by high water in Washita County.

**Electricity:** More than 11,000 Oklahoma Gas and Electric Co. customers lacked power Monday morning. That had improved by 9 p.m., when the Oklahoma Corporation Commission reported about 1,800 power outages across the state. OG&E had 600 customers and PSO had 1,162 customers without power statewide.

**Flooding:** Powerful floodwaters forced closure of some streets, including a 200-foot section of SW 59 near Santa Fe Avenue; SE 17, near Central Avenue; and a portion of SE 15 near Hiwassee.

**Record:** The rainfall total Monday of 2.33 inches at Will Rogers World Airport broke a record for the maximum rainfall recorded for the city, the National Weather Service said. The old record was 2.27 inches in 1892.

**Fires:** A lightning-sparked blaze caused \$40,000 in damage to a home in Moore. Oklahoma City fire calls were slightly above average.

**What's ahead:** KWTW NEWS9 meteorologist Gary England's seven-day forecast calls for more rain this week. There is a 60 percent chance of rain in the forecast for today and Wednesday.

See Page 3A for full coverage

# May 9

## How much fell?

Oklahoma Climatological Survey rainfall totals in inches from 1 a.m. to 5 p.m. Monday.

- El Reno: 3.17
- Norman: 2.42
- E Oklahoma City: 2.5
- N Oklahoma City: 2.3
- W Oklahoma City: 2.14
- Shawnee: 2.15
- Spencer: 2.78



A driver tries to plow through high water Tuesday on SW 29, between Sara Road and Mustang Road in Oklahoma City.

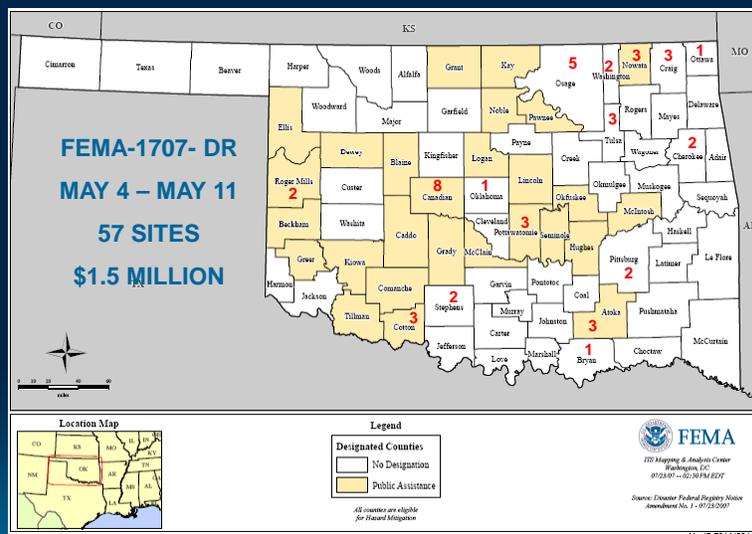
This car was washed off the road Tuesday on SW 44, east of Mustang Road in Oklahoma City.



BY PAUL HELLSTERN, THE OKLAHOMAN

# Overall Affects of the Event on Roads and Bridges

May 4 – 11, 2007



# Period of Event

May 24 – June 1, 2007

# Event Storm Description

May 24 – June 1, 2007

## May 24 – June 1, 2007

- Torrential rainfall early Monday County across central and southern Oklahoma. Flash flood warnings were issued Monday for Atoka, Bryan, Coal, Pottawatomie, Seminole, Pontotoc and Johnston counties in southeastern Oklahoma. As much as 4 to 5 inches of rain was possible for some areas.
- Different parts of Duncan received 4.5 and 6.5 inches of rain in about a 3-hour time span.

## May 24 – June 1, 2007

May 27, 2007

May 28, 2007



MARLOW 1WSW	OK	4.16
DUNCAN 11E (MESO)	OK	3.23
HEALDTON 2S	OK	3.01
COX CITY 2NE	OK	2.8
DAVIS 5SSW	OK	2.37
PAULS VALLEY 4WSW	OK	2.26
LINDSAY 2W	OK	2.04

LOCO	OK	5.45
INGALLS	OK	3.5
MADILL 10WSW (MESO)	OK	3.49
MADILL	OK	3.2
SEWARD	OK	2.59
PAWNEE	OK	2.53
RIPLEY	OK	2.45

# Geographic Locations Affected

May 24 – June 1, 2007

May 24 – June 1, 2007



# Photos of Locations Affected

May 24 – June 1, 2007

May 24 – June 1, 2007



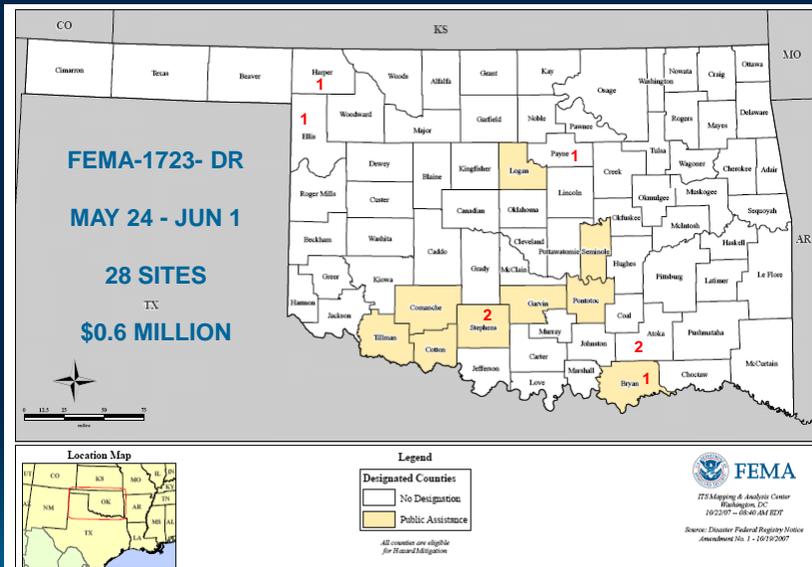
May 24 – June 1, 2007



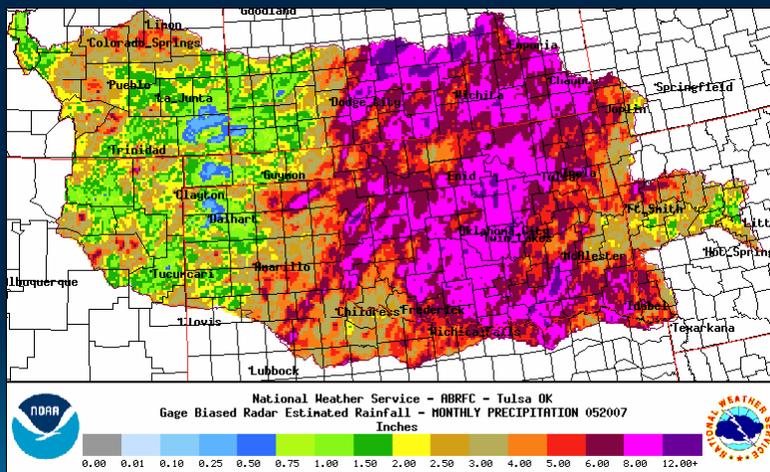
## Overall Affects of the Event on Roads and Bridges

May 24 – June 1, 2007

May 24 – June 1, 2007



# May Precipitation totals





# Event Storm Description

June 10 – July 25, 2007

## June 10 – July 25, 2007

- First week Creek, Kiowa, Logan, Major, Nowata and Washington counties were hit hard by the severe storms and received 4 to 8 inches of rain causing flash flooding.
- Excessive rainfall across the state. Atoka, Bryant, Coal, Johnston and Pontotoc counties have been hit hard and remain under a flash flood warning. Some areas have seen as much as 4 to 6 inches of rainfall.
- June 20- Thunderstorms developed near Enid. These storms moved south and southeast into central and western Oklahoma. Initial activity produced giant size hail in northwest Oklahoma while overnight the primary impact was widespread damaging winds. In Major County, winds topping 80 mph were reported and in Alfalfa County softball size hail was reported.
- July 2 - Oklahoma City metro area has seen its twentieth (20) consecutive day of rainfall.
- July 10 -Severe thunderstorms developed across Oklahoma, producing excessive rainfall, strong winds and large hail. Hardest hit areas include Atoka, Cleveland, Creek, Grady, McCurtain, Muskogee, Oklahoma and Pottawatomie counties. Rainfall totals of three to six inches were common.

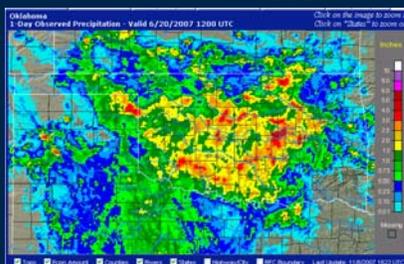
# June 10 – July 25, 2007

June 11<sup>th</sup>



COPAN DAM	OK	6.26
HULAH 2W - DAM	OK	5.55
LENAPAH	OK	4.7
WANN 1NE	OK	4.67
WANN 1NE	OK	4.08
CHILDERS 2SSE	OK	3.7
COMMERCE 5W	OK	3.51

June 20<sup>th</sup>



SEMINOLE	OK	3.75
FORAKER BESE (MESO)	OK	3.51
INDIAHOMA 10N	OK	3.48
FORT SILL AWS	OK	3.15
PRAGUE 3W	OK	3.14
SEMINOLE 4SSE (MESO)	OK	3.1
STROUD 3N	OK	3.08

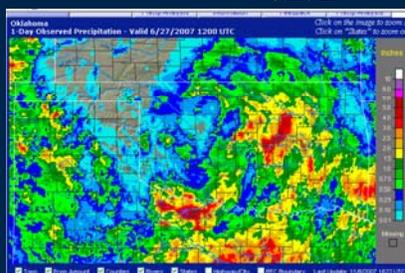
# June 10 – July 25, 2007

June 26<sup>th</sup>



WALTERS 1ENE	OK	5
RANDLETT 9E	OK	4.8
WALTERS 1NW (MESO)	OK	4.44
CHATTANOOGA 3NE	OK	3.49
DUNCAN 9W	OK	3.48
MINCO 3SSW (MESO)	OK	3.22
WAURIKA 6N - DAM	OK	3.2

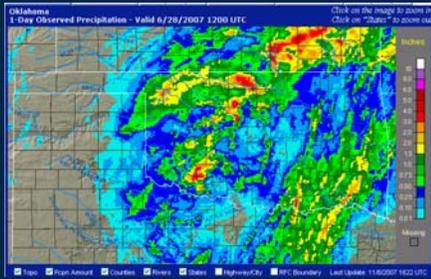
June 27<sup>th</sup>



SHAWNEE 2NE	OK	5.19
DRUMRIGHT 7ENE (MES)	OK	4.85
MEEKER 5W	OK	4.78
SHAWNEE 3NNW (MESO)	OK	4.74
PRAGUE 3W	OK	4.73
MANNFORD 6NW	OK	3.78
BRISTOW 4SSE (MESO)	OK	3.42

# June 10 – July 25, 2007

June 29th



KINGFISHER 2NE (MES)	OK	4.84
INDIAHOMA 10N	OK	3.64
MEDFORD 2SW (MESO)	OK	3.48
MEDFORD	OK	3.35
JEFFERSON	OK	3.23
LAMONT	OK	3.14
FORT SUPPLY 3SE	OK	3.02

July 10<sup>th</sup>

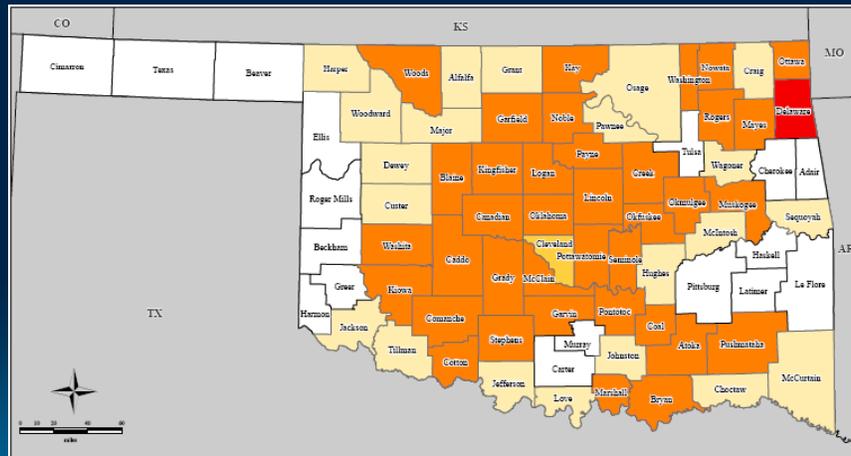


PURCELL 10WSW (MESO)	OK	5.23
TISHIMINGO 11NNE	OK	5.02
BLANCHARD 2SSW	OK	4.88
COLEMAN 1SE	OK	4.75
BATTIEST 1SSW	OK	4.59
TISHOMINGO 7NNW	OK	4.46
WAPANUCKA 8SW	OK	4.43

## Geographic Locations Affected

June 10 – July 25, 2007

June 10 – July 25, 2007



## Photos of Locations Affected

June 10 – July 25, 2007

## June 10 – July 25, 2007



## June 10 – July 25, 2007



## June 10 – July 25, 2007



## June 10 – July 25, 2007



## June 10 – July 25, 2007



## June 10 – July 25, 2007



## June 10 – July 25, 2007



## June 10 – July 25, 2007

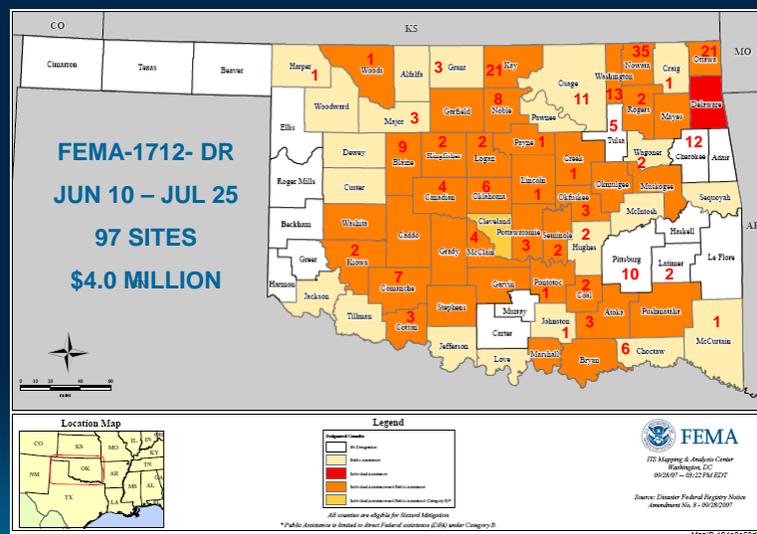


Miami, OK after Neosho  
crested at 29.5 feet  
July 4th

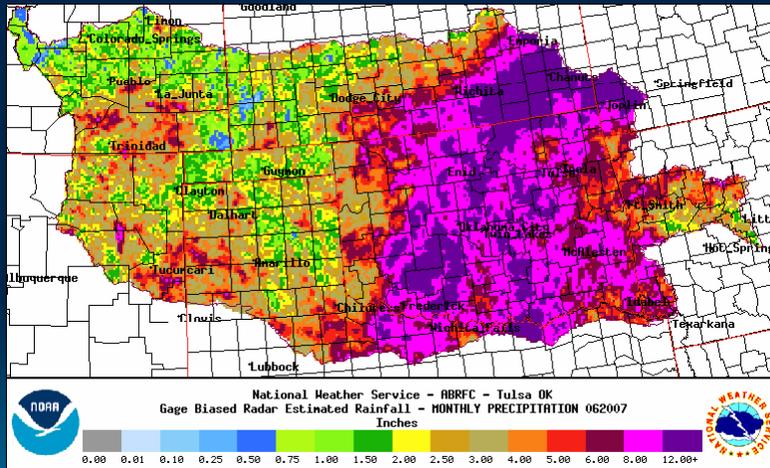


# Overall Affects of the Event on Roads and Bridges

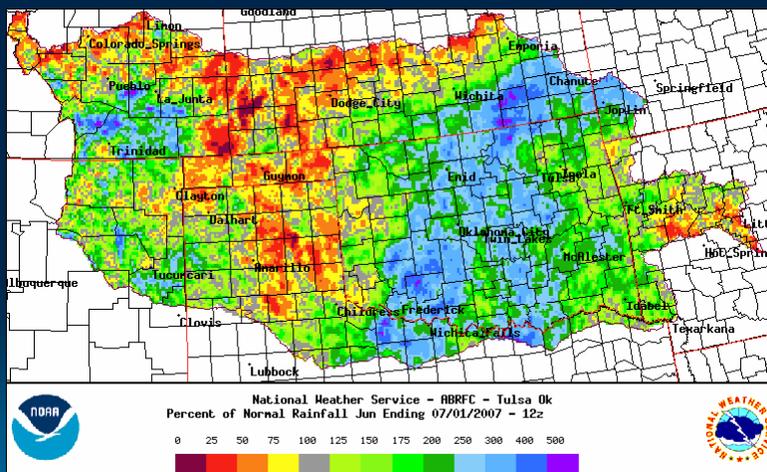
June 10 – July 25, 2007



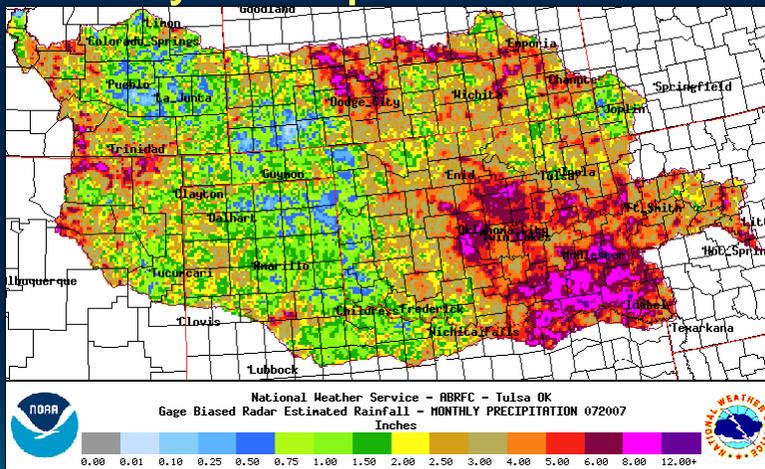
# June Precipitation totals



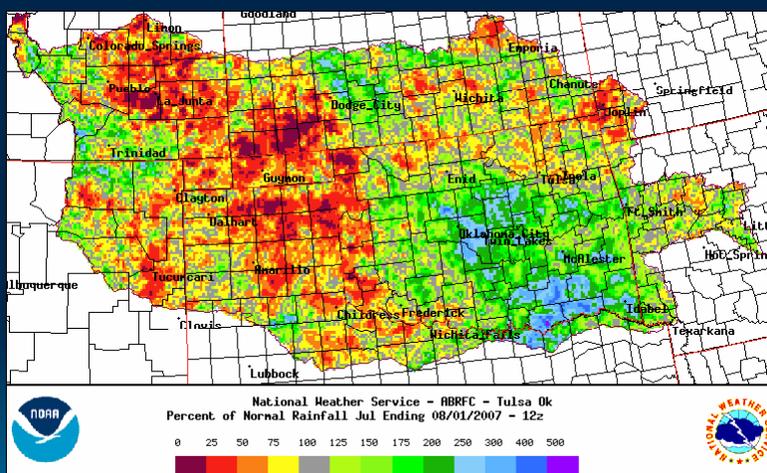
# June - Percent of Normal



# July Precipitation totals



# July - Percent of Normal



# July 31, 2007



Under an overpass on State Highway 33, Shawn Kincheloe, an employee of the Kingfisher street department, wades in water as he and other crews try to unplug pumps after heavy rainfall.

**Flash  
flooding  
brings  
surprises**

**Top rainfall**  
In inches, from  
Oklahoma Mesonet:

Kingfisher, 3.47
Hugo, 2.95
Norman, 1.90
Sallisaw, 1.66
Byars, 1.64
Durant, 1.36
Jay, 1.36
Okemah, 1.17
Camargo, 1.01

In Kingfisher, a storm dumped about 3½ inches of rain during a three-hour period ending at 5:10 p.m., according to the Oklahoma Mesonet.

# Period of Event

Aug 18 – Sep 12, 2007



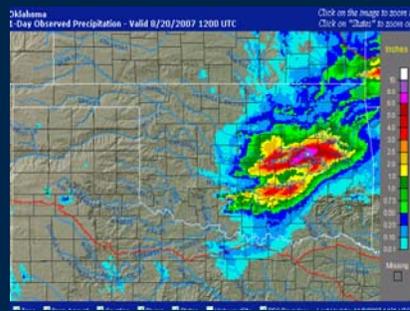
On August 18, 2007, a Tropical Depression entered Oklahoma in the southwest part of the state . Shortly after 12:00 am on August 19, 2007, Tropical Storm Erin strengthened and reformed over the mid west and central parts of the state. By 8:00 am Erin had pounded the state with record rainfalls and sustained winds of over 50 mph, leaving 7 people dead and \$ millions in damages in her path.



## Aug 18 – Sep 12, 2007

Aug 19, 2007

Aug 20, 2007



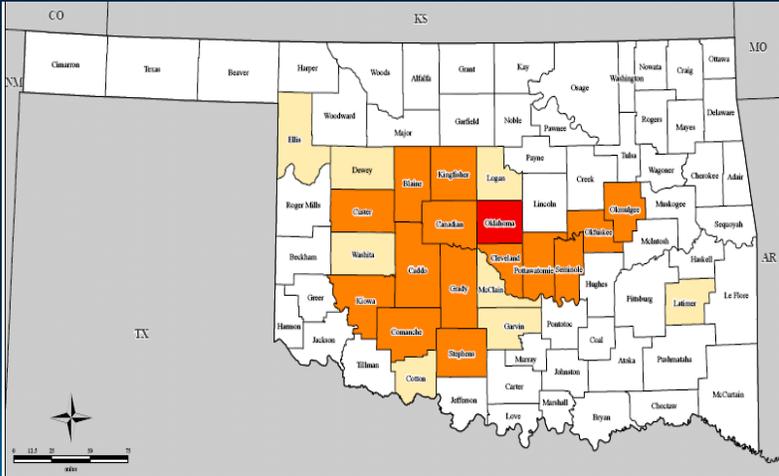
CARNEGIE	9.54
ANADARKO	9.47
FORT COBB	9.23
WATONGA	9.07

OKMULGEE	8.33
OKEMAH	7.33
TECUMSEH	5.52

# Geographic Locations Affected

Aug 18 – Sep 12, 2007

Aug 18 – Sep 12, 2007



# Photos of Locations Affected

Aug 18 – Sep 12, 2007

Aug 18 – Sep 12, 2007



100\_1859.mov



Aug 18 – Sep 12, 2007



SH 33 east of Watonga



## SH 33 east of Watonga

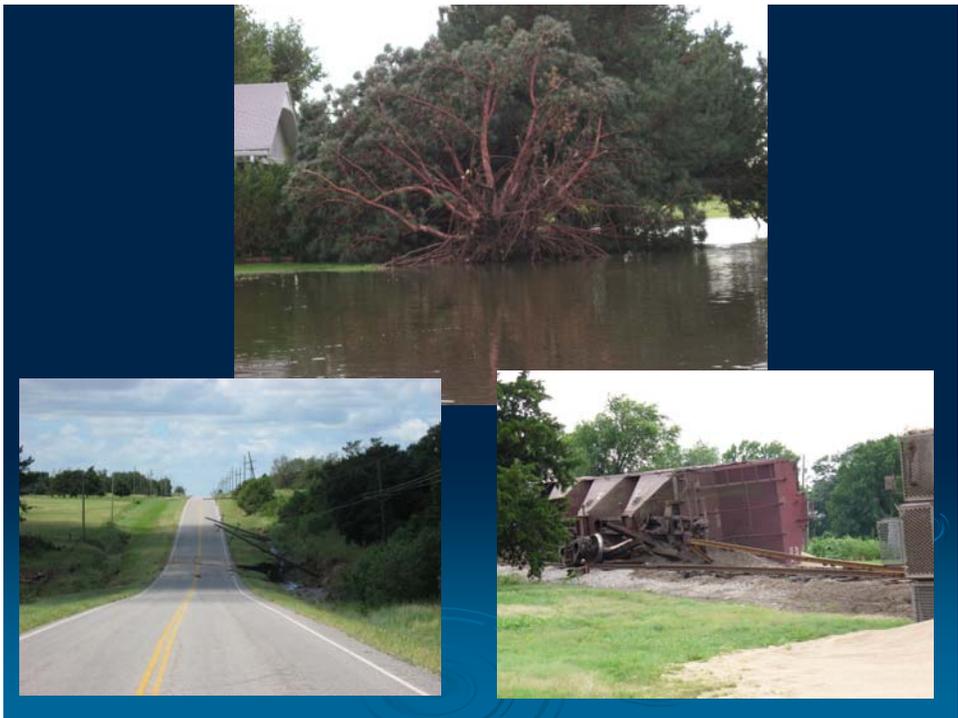


## SH 33 east of Watonga



Debris - showing how deep the water was when it went through our bridge













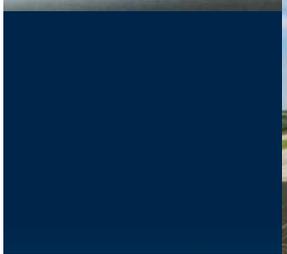


















UPSTREAM BEFORE TROPICAL STORM ERIN

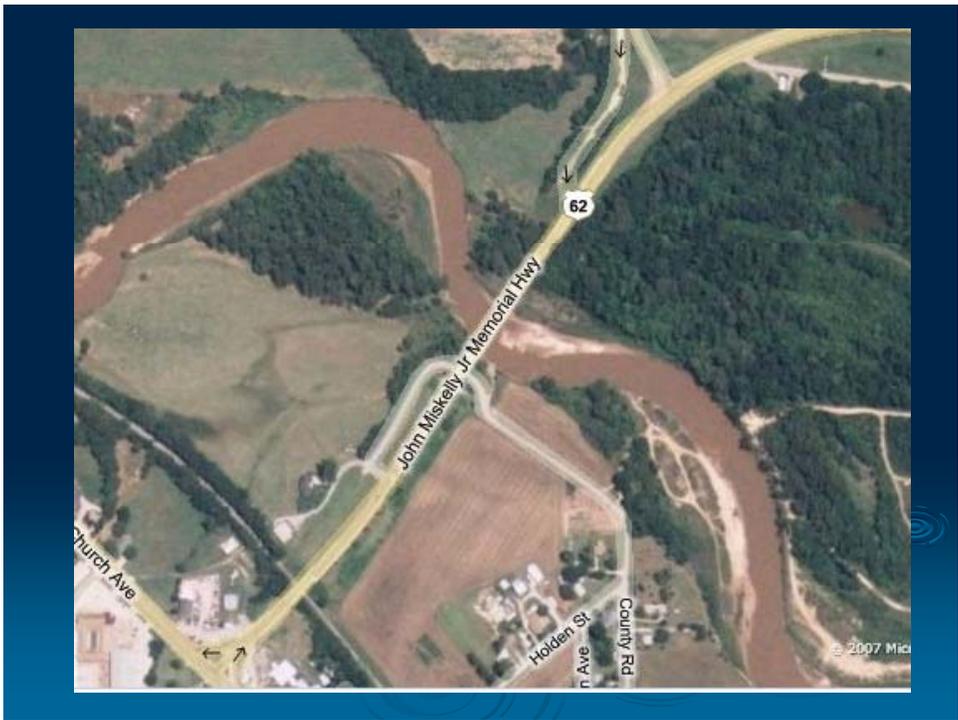


UPSTREAM AFTER TROPICAL STORM ERIN

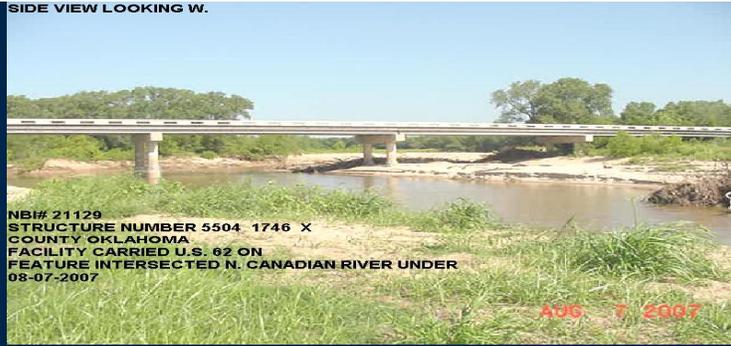
UPSTREAM AFTER TROPICAL STORM ERIN







SIDE VIEW LOOKING W.



NBI# 21129  
STRUCTURE NUMBER 5504 1746 X  
COUNTY OKLAHOMA  
FACILITY CARRIED U.S. 62 ON  
FEATURE INTERSECTED N. CANADIAN RIVER UNDER  
08-07-2007

AUG 7 2007



21129  
5504 1746 X  
OKLAHOMA CO.  
US 62  
N. CANADIAN RIVER

BENT #1 PIERS

LOCAL  
ROADWAY

TOE OF RIVER BANK

AUG 7 2007



Upstream

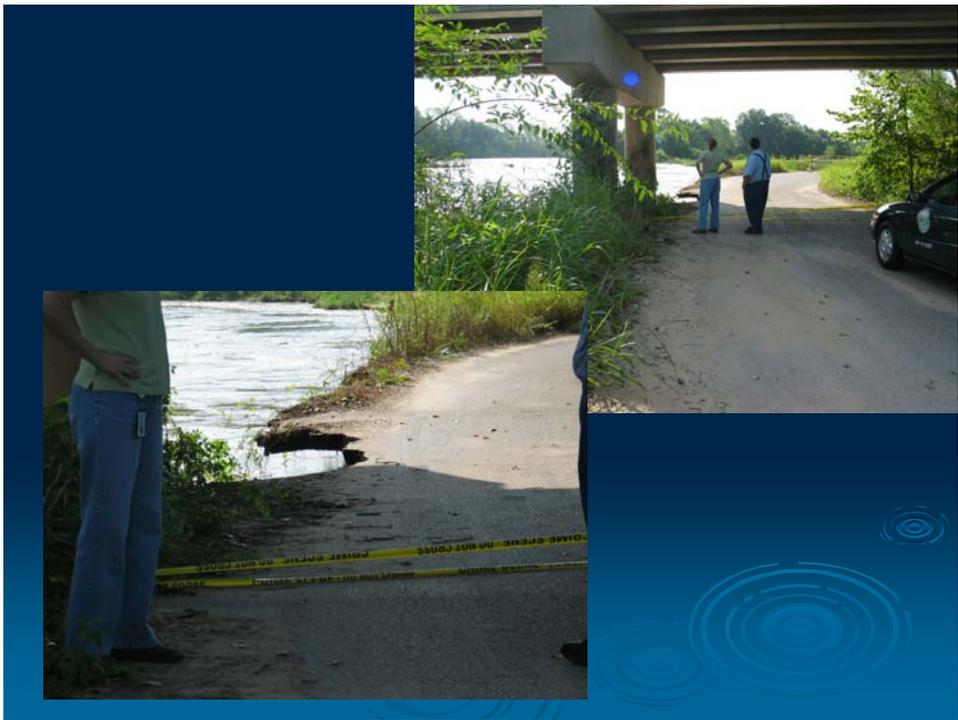


North Canadian near Harrah



Downstream





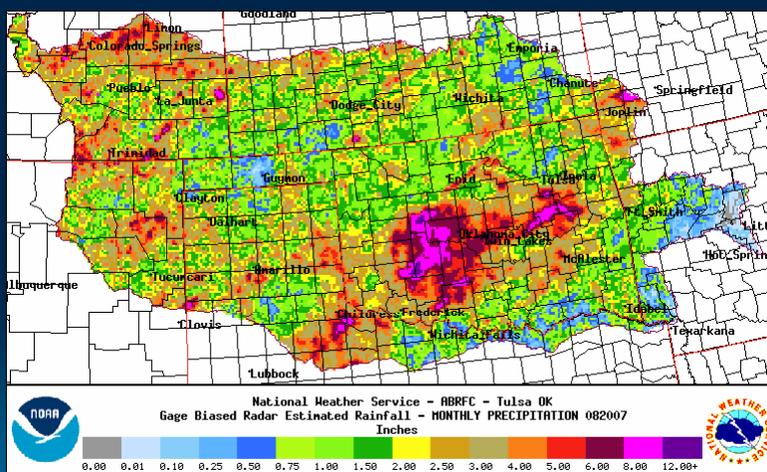


August 22, 2007 6:45pm  
North Canadian R. under SH-62 in Harrah  
road eroding

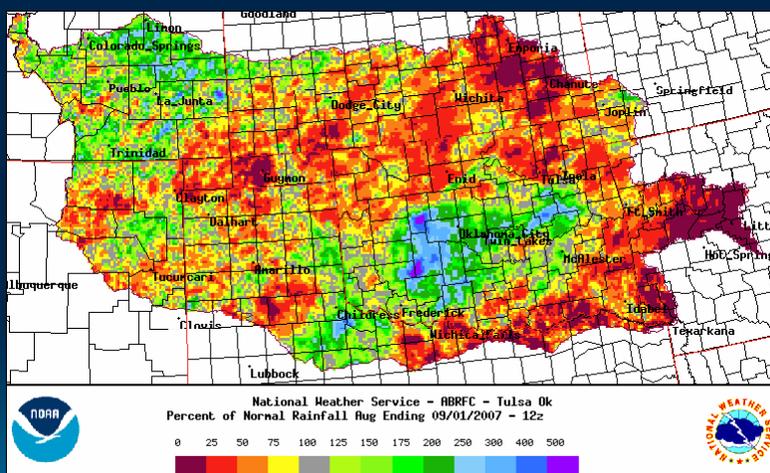




# Aug Precipitation totals



# Aug - Percent of Normal



# ROUGH ROAD AHEAD



## Overall impact on ODOT resources

- All 77 counties were declared to be under a state of emergency under the Governor's Proclamation
- 4 Federal Disasters declared with FEMA for both public and individual assistance
- To date ODOT has **259** county sites and **28** state highway sites for a total of **307** sites requesting assistance for ER projects to repair bridges and roadways
- The total requested for ER projects for county sites is **\$10.7 million**
- The total requested for ER projects for state sites is **\$13.8 million**
- Total for state is **\$24.5 million**

## Compare to other historic events

- On April 3-4, 1934, heavy rains just across the Texas border helped swell the Washita from its banks and sweep 17 Oklahomans to their death. This event was the most prominent of several that led to a new method of flood control on the prairie. Instead of taming the Washita with one large dam, state officials and some federal engineers convinced the USDA to try using dozens of smaller dams to control its tributaries
- **SPRING (MAM) Year Statistics**
  - Warmest Spring 2006 62.8°F
  - Coldest Spring 1931 54.3°F
  - Wettest Spring 1957 22.74 in.
  - Driest Spring \*1971 5.24 in.
  - **Year Statistics**
    - Warmest March 1910 57.9°F
    - Coldest March 1915 37.6°F
    - Wettest March 1973 7.46 in.
    - Driest March 1971 0.38 in.
    - **Year Statistics**
      - Warmest April 2006 65.5°F
      - Coldest April 1983 53.2°F
      - Wettest April 1942 8.50 in.
      - Driest April 1989 0.58 in.
      - **Year Statistics**
        - Warmest May \*1962 73.8°F
        - Coldest May \*1917 62.1°F
        - Wettest May 1957 10.68 in.
        - Driest May 1988 1.30 in.
- On June 1, 1917, much of Coalgate was destroyed by a tornado that claimed 14 lives. June 12, 1942, brought a violent tornado (later estimated to be F4 strength) through southwest Oklahoma City, killing 35. May 3, 1999, 22 tornadoes spawned in nine short hours
- June has twice delivered calamity to urban Oklahoma City in the form of a swollen North Canadian River, first in 1915 and again in 1923. Engorged by more than a foot of rainfall, the Canadian rose out of its banks near Hydro on June 23-24, 1948, killing 11 along a stretch of U.S. Highway 66.
- **Summer (JJA) Year Statistics**
  - Warmest 1934 85.2°F
  - Coolest 1915 74.9°F
  - Wettest 1950 17.25 in.
  - Driest 1936 2.79 in.
  - **June Year Statistics**
    - Warmest 1953 84.6°F
    - Coolest 1982\* 72.6°F
    - Wettest 1908 8.73 in.
    - Driest 1933 0.46 in.
    - **July Year Statistics**
      - Warmest 1954 88.1°F
      - Coolest 1950\* 76.2°F
      - Wettest 1950 9.26 in.
      - Driest 1980 0.41 in.
      - **August Year Statistics**
        - Warmest 1936 87.2°F
        - Coolest 1915 73.2°F
        - Wettest 1915\* 6.39 in.
        - Driest 2000 0.14 in.

## How will we use the data and lessons learned

- High-water marks have been surveyed and will be used to calibrate hydraulic models for bridge design.
- Use data to calibrate on going research with OU and USGS.
- Debris removal is ESSENTIAL!
- Poison ivy can withstand the forces of any flood.
- Our maintenance crews are the best!

# Use data to calibrate on going research with OU and USGS.



# Debris removal is ESSENTIAL!



# Debris removal is ESSENTIAL!



THANK YOU to over 1000 ODOT maintenance workers;  
 who worked many hours, in horrible conditions, through every summer holiday;  
 keeping the traveling public safe.

ROBERTA BENSASSI  
 JOHN HOLLAND  
 RANDALL SHARP  
 HERMAN CAPPS JR.  
 JEREMY BARNES  
 CHARLES GARRETT  
 KENNETH BAUGHMAN II  
 RALPH CARTER  
 JOSE LUIS LOPEZ  
 STEVEN GUSSERT  
 CHARLES PURDOM  
 KENNETH JONES  
 RONALD PEARCE  
 DARELL OHNSON  
 SAMMY WALLIS  
 EARNEST FORD JR  
 PHILLIP NOFIRE  
 JEFFERY PERRY  
 ROBERT DONATELLI JR  
 RUSSELL LAMONS  
 JACKIE DRAIN  
 BRADLEY COX  
 BEAU BALLARD  
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 EDWARD DECKARD JR  
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 LARRY WILSON  
 JIMMY JONES  
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 TROY MAYS  
 GARY DRAIN  
 BROOKS BILLINGS  
 DALE GLASS  
 BILLY JACOBS  
 ARCHIE RISENHOOVER  
 DONALD SMITHSON  
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ROBERT WINKLE  
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 GARRY BROWN  
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 STEVEN PITTMAN  
 SAMMY DUVALL  
 DUANE MARTINDALE  
 CRAIG ENGLAND  
 GORDON REAL  
 DANE BASHTA  
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 MARK PHILLIPS  
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 JERRY BROCK  
 HEATH RICHEY  
 BILLY WALTON  
 PHILLIP HARRIS  
 JAMES SUMMERS  
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 JASON HAAS  
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 DUSTY GEORGE  
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 DWAYNE BURRIS  
 JIMMY JOHNSON  
 CHARLEY FEGETT  
 KENNETH HELMS  
 RICHARD BAYLISS  
 JAMES MIRON  
 KIRK KING  
 ROGER CHAPMAN  
 MICHAEL PREGROVE  
 DESIREE KEASLER

JIMMY KINSLow  
 WALTER MCLEMORE  
 ANDY ROBINSON  
 JOSEPH SPRINGFIELD  
 SEAN CLUCK  
 JOSHUA JONES  
 WILLIAM HUFFMAN  
 BRIAN MUNCRIEF  
 CHRISTOPHER BRIDENSTINE  
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 JAMIE BISHOP  
 RICKY KERNS  
 DONALD QUINLAN  
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 BRYAN CROW  
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 MONTE WILLIAMS  
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