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The Year Streamflow Records Fell—The 2007 Floods in Kansas

In Recognition of the Hard-Working, Dedicated Streamgagers Who Documented the Floods—A Job Well Done

Summary of Floods

Floods in Kansas between May and July 2007 shattered previous streamflow records at 16 long-term streamgages in Kansas. Two large rain events in May caused flooding in the eastern half of Kansas. The National Weather Service (NWS) reported that monthly precipitation in May in central Kansas was between 200 and 500 percent of normal. The June 27 to July 2 storm and resulting flood in southeast Kansas caused widespread damage across 20 counties. Rainfall totals for June in southeast Kansas ranged from 8 to 20 inches.

Preparing for flood measurement at Smoky Hill River at Ellsworth. Highest flow since 1993

(photo by Nathan Sullivan)

The May 5-7 storm (fig. 1) caused 50 streamgages to surge above NWS flood stage between May 7 and May 8 (fig. 2). Six streamgages reached record water levels. Dragoon Creek near Burlingame recorded a peak stage of 23.32 feet on May 7, the highest river stage since continuous discharge records began in 1961. On May 8, the Arkansas River near Hutchinson, in operation since 1960, peaked at 13.08 feet topping the previous record river stage set in 1973 by 0.13 foot.

The second May flood occurred May 23-25 (fig. 3) and resulted in 22 streamgages topping the NWS flood stage between May 24 and May 25 (fig. 4). Three long-term gages (over 30 years of record) and one crest-stage gage reached historic water levels. Chapman Creek near Chapman (54 years of record) recorded the highest stage since 1951 on May 24. On May 25, the Smoky Hill River at New Cambria rose to 31.42 feet, just 0.3 foot below the 1993 stage.

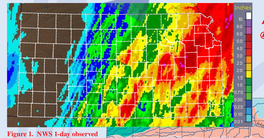


Figure 1. NWS 1-day observed precipitation for *May 7, 2007*. Source: *http://water.weather.gov*.

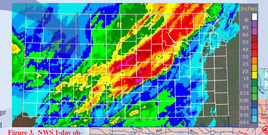


Figure 3. NWS 1-day observed precipitation for *May 24, 2007*. Source: *http://water.weather.gov*.

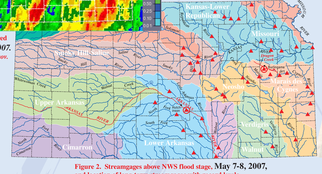
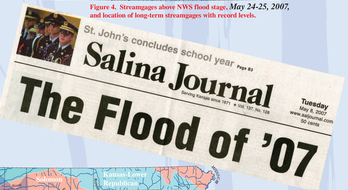


Figure 2. Streamgages above NWS flood stage, May 7-8, 2007, and location of long-term streamgages with record levels.

Figure 4. Streamgages above NWS flood stage, *May 24-25, 2007*, and location of long-term streamgages with record levels.



The June 27 to July 2 flood generally affected southeast Kansas and was the result of steady rain over this several-day period (fig. 5). Because of the rain pattern, no record flows were reached at crest-stage gages located on small streams. Record or near-record flood levels were reached at 5 long-term streamgages and 3 streamgages with less than 30 years of record.

The most severe flooding occurred in Independence and Coffeyville on the Verdigris River and Fall River. NWS rainfall 24-hour precipitation reports near Fredonia were near 12 inches. The Verdigris River at Independence peaked at 52.40 feet on July 1, shattering the previous peak stage recorded in 1945 by more than 5 feet. Fall River at Fredonia rose to 41.12 feet on June 30, nearly 5 feet higher than the previous record stage recorded in 1945. Because of the large amount of rain, the streamgages at Independence and Coffeyville remained above NWS flood stage for 9 days. Damaging high water also occurred on the Marais des Cygnes River. The Marais des Cygnes River near the Kansas- Missouri Stateline topped 40 feet stage on July 2, the highest water level since record collection began in 1959. The Neosho River near Parsons rose to 35.05 feet on July 2, the highest stage since 1951.

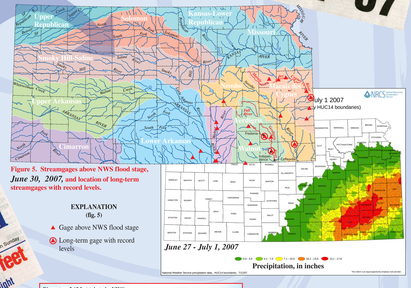
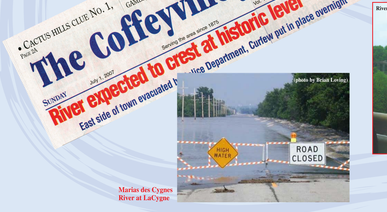


Figure 5. Streamgages above NWS flood stage, *June 30, 2007*, and location of long-term streamgages with record levels.



(photo by Brian Loving)

Marais des Cygnes River at LaCygne

River stage 2.65 feet (photo by NWS).

Verdigris River at Independence looking toward old H ighway 96 bridge

July 1, 2007. River stage 52.27 feet. Streamflow is 145,900 cubic feet per second (photo by NWS).

Data-Collection Activities

Kansas streamgagers made more than 100 direct discharge measurements between May 1 and July 2 to document the historic floods of 2007. Several critical gage repairs were made. The streamflow data collected provided valuable flood-forecast information to the NWS and emergency management personnel.

Many measurements were the highest ever made (tables 1, 2) or highest since 1951. Most measurements were made using acoustic Doppler current profilers (ADCP), and many were made from boats. Advances in measuring equipment such as the ADCP resulted in measurements being made much quicker than in the past, allowing streamgagers to make more measurements and cover a larger area than in past floods. Also, advances in information on the Web such as real-time streamflow data, NWS flood forecasts, and Kansas Department of Transportation State road closures improved flood coordination.

Table 1. Record flood measurements made May through July 2007 at streamgages with greater than 30 years of record

Measurement made by	Date	Stream Name	Years of operation	Measured streamflow (ft^3/s)	Comment
Jeff Barnard/Scott Morgan	5/7/2007	Salt Creek at Lyndon, KS (formerly near Lyndon)	67	14,600	Highest measured discharge since 1951
Mike Holt/Robert Swanson	5/8/2007	Arkansas River near Hutchinson, KS	47	20,100	Highest measured discharge
Brian Loving/Dirk Hargadine	5/24/2007	Mulberry Creek near Salina, KS	44	29,100	Highest measured discharge
Brian Loving/Dirk Hargadine	5/24/2007	Chapman Creek near Chapman, KS	54	13,500	Highest measured discharge
Brian Loving/Dirk Hargadine	5/24/2007	Mud Creek near Abilene (CSI), KS	36	20,400	Highest measured discharge
Pat Rasmussen/Brian Loving/Dirk Hargadine	5/25/2007	Smoky Hill River at New Cambria, KS	44	31,700	Highest measured discharge
Mike Holt/Chris Moehring	6/11/2007	Caney River near Elgin, KS	68	51,000	Highest measured discharge since 1961
Brian Loving/Dirk Hargadine	6/30/2007	Fall River at Fredonia, KS	72	69,700	Highest measured discharge
Mike Holt	6/30/2007	Elk Creek at Elk Falls, KS	39	41,500	Highest measured discharge
Brian Loving	6/30/2007	Neosho River near Iola, KS	100	40,700	Highest measured discharge since 1951
Brian Loving/Dirk Hargadine	6/30/2007	Verdigris River near Altoona, KS	68	51,200	Highest measured discharge
Jeff Barnard/Mark Lynaught	6/30/2007	Marmaton River near Marmaton, KS	35	35,800	Highest measured discharge
Jeff/Barnard/Andrew Clark	7/1/2007	Verdigris River at Independence, KS	92	145,900	Highest measured discharge
Craig Dare/Dirk Hargadine/Mark Lynaught	7/1/2007	Marais des Cygnes River near Ottawa, KS	99	50,000	Highest measured discharge
Brian Loving/Jeff Barnard/Andrew Clark	7/2/2007	Marais des Cygnes River near KS-MO Stateline, KS	48	131,000	Highest measured discharge
Dirk Hargadine/Mark Lynaught/Craig Dare	7/2/2007	Pottwatomie Creek near Scipio (formerly at Garnett), KS	69	22,000	Highest measured discharge since 1967
Dirk Hargadine/Craig Dare	7/2/2007	Neosho River near Parsons	85	148,000	Highest measured discharge since 1951

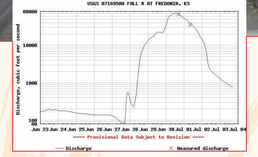
Table 2. Record flood measurements made May through July 2007 at streamgages with less than 30 years of record.

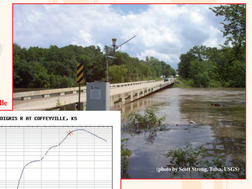
Measurement made by	Date	Stream Name	Years of operation	Measured streamflow (ft^3/s)	Comment
Nathan Sullivan/Brian Loving/Dirk Hargadine/Craig Dare	5/7/2007	Walnut Creek blw. Cheyenne Bottoms Div. nr. Great Bend, KS	11	1,200	Highest measured discharge
Jeff Barnard	5/7/2007	Wakarusa River near Richland, KS	4	18,100	Highest measured discharge
Mike Holt/Robert Swanson	5/9/2007	Arkansas River near Nickerson, KS	10	5,770	Highest measured discharge
Mike Holt/Trudy Bennett	5/25/2007	Little Arkansas River at HWY 50 near Halstead, KS	11	10,500	Highest measured discharge
Jeff Barnard/Mark Lynaught	6/30/2007	Marmaton River near Uniontown, KS	6	16,200	Highest measured discharge
Jim Wellman/Scott Strong (USGS, Tulsa, OK)	7/2/2007	Verdigris River at Coffeyville, KS	5	142,000	Highest measured discharge
Brian Loving/Jeff Barnard	7/2/2007	Marais des Cygnes River at La Cygne, KS	22	116,000	Highest measured discharge

Fall River at Fredonia

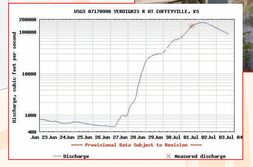
(photo by NWS. River stage 2.65 feet.)

(photo by Brian Loving. River stage 41.12 feet.)




(photo by Scott Strong, Tulsa, USGS)

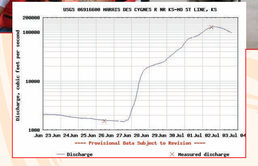
Verdigris River at Coffeyville



(photo by Brian Loving)

Marais des Cygnes River near KS-MO Stateline

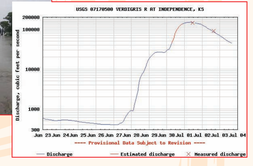
(photo by Brian Loving)



(photo by Jeff Barnard)

(photo by Jeff Barnard)

Verdigris River at Independence

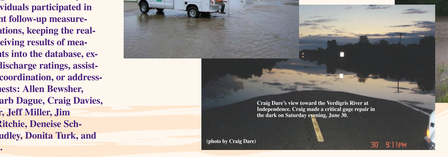


Documenting the 2007 floods was a concerted effort by many individuals including the streamgagers that collected the high-flow streamflow measurements listed in tables 1 and 2. A USGS crew from Tulsa was called in to help with the Verdigris River at Coffeyville measurement on July 2. Other individuals participated in flood activities by making important follow-up measurements to verify stage-discharge relations, keeping the real-time computer system working, receiving results of measurements and getting measurements into the database, extending stage-discharge ratings, assisting with flood coordination, or addressing media requests: Allen Bewsher, Steve Brady, Barb Dague, Craig Davies, Lori Marintzer, Jeff Miller, Jim Putnam, Bea Ritchie, Deneise Schneider, Seth Studley, Donita Turk, and Duane Wilmes.

(photo by S. Strong, Tulsa, USGS)

Old-styled acoustic Doppler current profiler used by Jim Wellman and Scott Strong (USGS, Tulsa) at Coffeyville measurement on July 2

Dirk Hargadine measuring overflow at Smoky Hill River at New Cambria, May 25, 2007.


Craig Dare's view toward the Verdigris River at Independence. Craig made a critical gage repair in the dark on Saturday evening, June 30.

(photo by Craig Dare)

Craig Dare preparing acoustic Doppler current profiler for measurement of Neosho River near Parsons, July 2, 2007

(photo by Dirk Hargadine)

Results of Floods

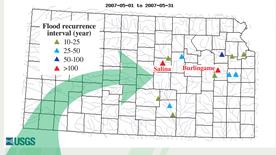
The 2007 floods in Kansas resulted in millions of dollars of damage to property, roads, bridges, and structures. One death in Coffeyville was attributed to the flood.

Streamflow data collected during the floods will be used to provide additional high-flow data to improve NWS flood-forecasting models, to update FEMA 100-year flood maps, to design or update future bridges, for flood mitigation purposes, and to improve future flood-frequency analysis.

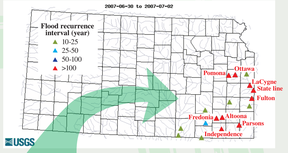
(photograph by Brian Loving)

Marias des Cygnes at River LaCygne, July 2, 2007

Flood Recurrence Intervals for Long-Term Streamgages during May Floods



Flood Recurrence Intervals for Long-Term Streamgages during the June 27 to July 2 Flood



June 27 to July 2 Flood

- Flooding affected 20 counties in southeast and east-central Kansas
- Preliminary estimates by FEMA indicated 3,150 homes and businesses destroyed or sustained major damage in just 5 counties in Kansas
- 71,000 gallons of crude oil spilled into the Verdigris River when the levees surrounding the Coffeyville Resources Refinery were topped by flood waters
- Neosho River topped levees near Erie
- Cities of Altoona, Fredonia, Elk City, and Independence were without drinking water because of flood-damaged treatment plants or no electricity
- Numerous road closures and road damage, and many bridges washed out or damaged
- One death in Coffeyville attributed to flood
- Thousands of acres of cropland damaged

May Flooding

- 239 structures along the Smoky Hill River damaged
- 80% of Saline county roads damaged and 3 bridges closed
- Numerous road closures
- Breached levees on the Arkansas River at 5 separate locations between Yoder and the Sedgwick County line
- Reports of many cattle lost in the Arkansas River near Haven
- $5 million damage to property, roads, and bridges in Salina from the May 5-7 flood
- During May 24-25 flood on Smoky Hill River, evacuation of property owners in New Cambria was needed and by May 24, all roads into New Cambria were closed
- Many homes and businesses in the city of Ellsworth and in Lyons and Ellsworth counties were damaged
- Many evacuations in parts of Salina during May 24 flood

(photograph by Brian Loving)

East of Independence at the Highway 160 bridge over the Verdigris River, July 1, 2007

(photography by the NWS)

After the flood, broken levee along the Neosho River near Erie

Neosho River spilling over Highway 59, 2 miles south of Erie

(photograph by the NWS)

(photograph by Brian Loving)

Bridge damage at Fall River near Fredonia

Near Fredonia

(photograph by Dirk Hargadine)

(photograph by Brian Loving)

Flooded farm near Parsons

References

The following data sources were used to summarize the 2007 floods.

National Weather Service, Wichita, 2007, Monthly report of river and flood conditions May 2007, August 6, 2007

National Weather Service, Wichita, 2007, Monthly report of river and flood conditions June 2007, August 28, 2007

National Weather Service, Wichita, 2007, Record flooding on the Verdigris and Neosho Rivers: Information available on World Wide Web, accessed August 20, 2007, at *http://www.crh.noaa.gov/ict/scripts/viewstory.php?STORY_NUMBER=200707062I*.

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Natural Resources Conservation Service, 2007, Cumulative average precipitation by HUC 14 for June 27 to July 1

October 2007