

Floods in Southwest-Central Florida from Hurricane Frances, September 2004

Hurricane Frances brought heavy rainfall and widespread flooding to southwest-central Florida September 4-14, 2004. The center of Hurricane Frances made landfall on the east coast of Florida on September 5 as a category 2 hurricane on the Saffir-Simpson scale, then moved west-northwestward through central Florida before exiting Pasco County into the Gulf of Mexico on September 6 (fig. 1; National Weather Service, 2004). The hurricane moved across the Florida Peninsula generating 5 to 11 inches of rain over already saturated ground (table 1). Record flooding occurred in parts of Hardee, Hillsborough, Pasco, and Polk Counties (fig. 1). The hurricane and resulting floods caused an estimated \$4-5 billion in damage to public and private property (Harrington, 2004), and 23 deaths were attributed to Hurricane Frances (National Weather Service, 2004).

Several watersheds drain counties in southwest-central Florida that were affected by Hurricane Frances. De Soto, Hardee, and Polk Counties generally are drained by the Peace River system, which flows southwestward to Charlotte Harbor and the Gulf of Mexico. Hillsborough and Pasco Counties generally are drained by the Alafia, Hillsborough, Anclote, and Pithlachascotee River systems. Water in the Hillsborough and Alafia River watersheds flows west to Tampa Bay and water in the Anclote and Pithlachascotee River watersheds flows west to the Gulf of Mexico. (fig. 1).

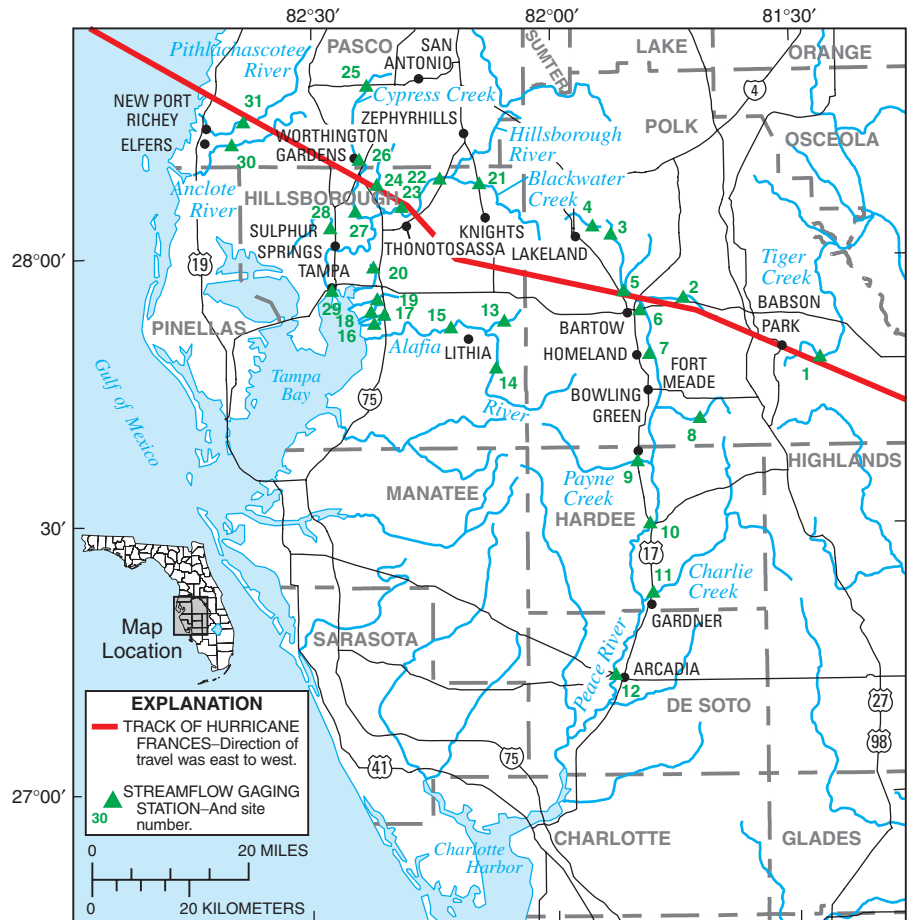


Figure 1. Geographic and hydrologic features and track of hurricane in southwest-central Florida.

Data Collection

The U.S. Geological Survey (USGS) operates a network of streamflow-gaging stations in southwest-central Florida in cooperation with Federal, State, and local agencies. Data from these stations are crucial for water-supply planning, flood monitoring, emergency response, dam and reservoir-system operation, engineering and maintenance of bridges, roads, and other structures, and are also used to delineate flood-hazard zones. Most of these stations provide real-time data through satellite relay or radio telemetry. Real-time data from these stations are used by the National Weather Service, the Southwest Florida Water Management District, and other agencies and are available on the Internet at <http://waterdata.usgs.gov/>.

USGS field crews obtained some of the highest discharge (flow) measurements ever recorded at several gaging stations during this flood. These data contribute to understanding flood behavior, enhancing efforts to minimize destruction caused by floods, and providing information for planning.

Flood of September 6-14, 2004

Information on peak discharges for selected gaging stations in southwest-central Florida is shown in table 1. The data include peak discharge, peak stage, recurrence interval, rainfall totals, gaging-station period of record, and date and magnitude of the largest historical peak discharge recorded prior to September 2004.

Table 1. Peak discharges and rainfall at selected sites in southwest-central Florida.

[Data were compiled from Kane (2005) and from unpublished data on file at the U.S. Geological Survey office in Tampa, Florida; stage in feet above gage datum; ft³/s, cubic feet per second; >, greater than; <, less than; --, not determined]

Site number (fig. 1)	Station number	Streamflow-gaging station	Peak discharge, September 6-14, 2004			Rainfall ² total Sept. 4-7, 2004 (inches)	Period of record through 2004	Largest historical peak discharge recorded prior to September 6, 2004	
			Peak discharge (ft ³ /s)	Peak stage (feet)	Recurrence interval ¹ (years)			Date	Magnitude (ft ³ /s)
1	02268390	Tiger Creek near Babson Park	188	47.09	--	--	1991-2004	Mar. 22, 1998	188
2	02293987	Peace Creek Drainage Canal near Wahnetta	1,020	45.34	--	--	1991-2004	Sept. 27, 1994	739
3	02294217	Saddle Creek at State Highway 542 near Lakeland	795	17.33	--	8.68	1987-1988, 1996-2004	Sept. 1, 2003	744
4	02294260	Lake Parker Outlet at Lakeland	247	5.67	--	6.95	1956-1959 1967,1969, 1997-2004	Dec. 13, 2002	192
5	02294491	Saddle Creek at Structure P-11 near Bartow	1,640	17.63	--	--	1963-2004	Jan. 4, 2003	937
6	02294650	Peace River at Bartow	4,710	11.12	>100	5.98	1939-2004	Sept. 24, 1947	4,141
7	02294898	Peace River at Ft. Meade	2,450	80.85	--	6.03	1964-1969 1972-2004	Feb. 23, 1998	2,250
8	02295013	Bowlegs Creek near Ft. Meade	1,450	--	50	--	1964-1968 1991-2004	Sept. 21, 1994	742
9	02295420	Payne Creek near Bowling Green	3,230	18.13	> 10	6.20	1963-1969 1979-2004	Sept. 14, 2001	3,220
10	02295637	Peace River at Zolfo Springs	8,470	22.39	< 10	--	1933-2004	Sept. 6, 1933	26,300
11	02296500	Charlie Creek near Gardner	5,460	17.27	> 10	5.15	1950-2004	Aug. 1, 1960	8,160
12	02296750	Peace River at Arcadia	14,600	17.22	< 10	--	1931-2004	Sept. 9, 1933	36,200
13	02301000	North Prong Alafia River at Keysville	9,550	15.18	>100	--	1950-2004	Sept. 11, 1960	9,570
14	02301300	South Prong Alafia River near Lithia	2,630	17.81	> 25	--	1992-2004	Aug. 14, 1967	2,600
15	02301500	Alafia River at Lithia	10,300	22.08	> 10	6.77	1932-2004	Sept. 7, 1933	45,900
16	02301738	Archie Creek at 78th St. near Tampa	138	24.46	--	--	1999-2004	Jan. 1, 2003	133
17	02301740	North Archie Creek at Progress Bl. near Tampa	353	19.62	--	7.95	1999-2004	Jan. 1, 2003	328
18	02301745	Delaney Popoff Canal near Tampa	399	12.19	--	7.01	1999-2004	Sept. 14, 2001	359
19	02301750	Delaney Creek near Tampa	721	6.45	> 10	8.80	1984-2004	Sept. 27, 1997	633
20	02301793	East Lake Outfall at East Chelsea St. near Tampa	127	25.15	--	--	1999-2004	Sept. 15, 2001	56
21	02302500	Blackwater Creek near Knights	3,140	81.40	> 25	--	1951-2004	Mar. 18, 1960	5,400
22	02303000	Hillsborough River near Zephyrhills	6,410	13.93	> 10	--	1939-2004	Mar. 18, 1960	12,600
23	02303330	Hillsborough River at Morris Bridge near Thonotosassa	5,910	34.35	--	11.07	1964-2004	Dec. 15, 1997	5,200
24	02303350	Trout Creek near Sulphur Springs	1,830	43.15	> 25	--	1962-2004	June 28, 1974	1,540
25	02303400	Cypress Creek near San Antonio	923	75.89	> 10	--	1962-2004	Mar. 31, 1987	1,100
26	02303420	Cypress Creek at Worthington Gardens	1,800	13.78	> 25	--	1964-2004	April 3, 1987	1,450
27	02303800	Cypress Creek near Sulphur Springs	1,820	31.36	> 10	--	1956-2004	Aug. 1, 1960	2,160
28	02305851	Curiosity Creek at 122nd Avenue near Sulphur Springs	205	35.15	--	--	1999-2004	Aug. 3, 2003	150
29	02306028	Hillsborough River at Platt Street at Tampa	--	15.83	--	--	1997, 2001-2004	--	--
30	02310000	Anclote River near Elfers	2,680	24.44	> 25	--	1946-2004	July 30, 1960	3,890
31	02310300	Pithlachascotee River near New Port Richey	945	23.81	> 10	--	1963-2004	Sept. 9, 1988	1,480

¹From Kathleen Hammett, U.S. Geological Survey, written commun., 2004.

²Collection, computation, and publication of rainfall data do not necessarily conform to standards used by the National Weather Service. Rainfall data could be subject to error because of high winds.

The flooding caused by widespread rainfall and runoff as a result of Hurricane Frances was most severe in the Peace River Basin. Peak discharges for the period of record were recorded at several gaging stations in the upper Peace River Basin (sites 1-9, fig. 1, table 1; Tiger Creek near Babson Park, Peace Creek Drainage Canal near Wahneta, Saddle Creek at State Highway 542 near Lakeland, Lake Parker Outlet at Lakeland, Saddle Creek at Structure P-11 near Bartow, Peace River at Bartow, Peace River at Ft. Meade, Bowlegs Creek near Ft. Meade, and Payne Creek near Bowling Green). At Peace River at Bartow (site 6), the recurrence interval for the discharge of 4,710 cubic feet per second (ft^3/s) was determined to be greater than 100 years (Kathleen Hammett, U.S. Geological Survey, written commun., 2004). At the Saddle Creek at Structure P-11 near Bartow station (site 5), USGS field crews measured 1,550 ft^3/s of discharge 2 days after the peak flow. This measurement was used to refine the rating curve that determined the peak flow to be 1,640 ft^3/s . The gage height at this site was observed to be approximately 9 feet (ft) higher than base flow conditions (fig. 2). The flooding continued downstream to Peace River at Zolfo Springs (site 10) where the discharge of 8,470 ft^3/s was computed. This discharge was the



Figure 3. U.S. Geological Survey field crew making flow measurement at Alafia River at Lithia (site 15) using current meter, bridge crane, and 100-pound weight at discharge of 10,000 cubic feet per second at gage height 21.86 feet on September 8, 2004. Photograph taken by M. Dickman, U.S. Geological Survey.

highest since flooding associated with rainfall from the 1997-1998 El Niño. At the Charlie Creek near Gardner station (site 11), a tributary to the Peace River, the discharge was 5,460 ft^3/s , and the highest since flooding caused by Tropical Storm Gabrielle in 2001. Discharge at the Peace River at Arcadia station, the farthest downstream discharge site, peaked at 14,600 ft^3/s (site 12). This discharge was also the highest since flooding caused by Tropical Storm Gabrielle.

Flooding also occurred in the Alafia, Hillsborough, Anclote, and Pithlachascotee River watersheds. A peak discharge of 9,550 ft^3/s was recorded at the North Prong of the Alafia River at Keysville (site 13). This discharge was the highest since Hurricane Donna in 1960, and second highest for the period of record dating back to 1950. At the South Prong of the Alafia River near Lithia the computed discharge was 2,630 ft^3/s (site 14), which was the highest for the period of record, which began in 1967. A peak discharge of 10,300 ft^3/s was recorded for the Alafia River at Lithia (site 15). This was the second highest flow since Hurricane Donna in 1960. Figure 3 shows a USGS field crew using a bridge crane and Price AA meter to measure the flow at the Alafia River at Lithia station.

In the Hillsborough River watershed (sites 17-20, and 23), peak flows for periods of record were recorded at Archie Creek, North Archie Creek, Delaney Popoff Canal, Delaney Creek, East Lake Outfall at East Chelsea Street, and at Hillsborough River at Morris Bridge Road. At Blackwater Creek near Knights (site 21) a peak discharge of 3,140 ft^3/s was the highest recorded since the 1997-1998 El Niño. A peak discharge of 6,410 ft^3/s at Hillsborough River near Zephyrhills (site 22) was the third highest for the period of record since 1939. The highest discharge for the period of record also was recorded at Trout Creek near Sulphur Springs (1,830 ft^3/s , site 24). USGS field crews observed Trout Creek overflowing the road at State Highway 581 (fig. 4). At Cypress Creek near San Antonio, a discharge of 923 ft^3/s was recorded (site 25), the highest since 1987 and the second highest for the period of record. Farther downstream at Cypress Creek at Worthington Gardens, a record discharge of 1,800 ft^3/s



Figure 2. Views of Saddle Creek below Structure P-11 (site 5) near Bartow looking downstream. Top—view when creek was at 0.02 ft^3/s on December 1, 2003. Bottom—view of boat measurement at discharge of 1,550 ft^3/s on September 13, 2004. Photographs taken by J. Newby and J. Regar, U.S. Geological Survey.



Figure 4. Views of Trout Creek near Sulphur Springs (site 24) on downstream side of bridge. Top—view when creek was at gage height of 37.01 ft and flow of 25 ft³/s on October 2, 2003. Middle—view during flood on September 7, 2004, at stage 6 ft higher and flow of 1,610 ft³/s. Bottom—view of west bound traffic lane (State Highway 581) overflow discharge on September 7, 2004. Photographs taken by R. Carson and G. Baraket, U.S. Geological Survey.

was recorded (site 26). A peak discharge of 1,820 ft³/s was computed at Cypress Creek near Sulphur Springs (site 27), which was the highest since 1960 and second highest for the period of record. A period of record discharge of 205 ft³/s also occurred at Curiosity Creek at 122nd Avenue near Sulphur Springs (site 28). Downtown Tampa also experienced flooding from the Hillsborough River and storm surge from Tampa Bay (fig. 5). The Hillsborough River at Platt Street (site 29) near the mouth of Hillsborough River at Tampa Bay experienced a storm surge nearly 4 ft above the normal high tide gage reading of 11.94 ft. The peak recorded gage height of 15.83 ft was the highest for the period of record (fig. 6).



Figure 5. View of flooding in downtown Tampa on September 6, 2004, from storm surge and flooding near the mouth of the Hillsborough River. Photograph provided by National Weather Service.

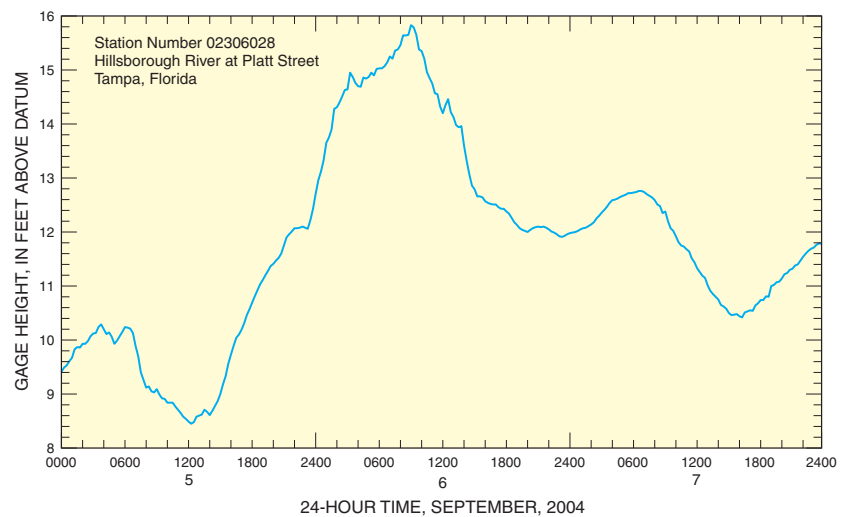


Figure 6. Gage height fluctuation with time at Hillsborough River at Platt Street at Tampa during September 5-7, 2004 (site 29). Computed gage height, in feet, at datum 10 feet below National Geodetic Vertical Datum of 1929. These data are provisional and subject to revision.

Streams in other watersheds also had peak flows. At Anclote River near Elfers (site 30), a peak discharge of 2,680 ft³/s was the second highest computed since the period of record peak in 1960. A peak discharge of 945 ft³/s at Pithlachascotee River near New Port Richey (site 31), was the highest since the 1997-1998 El Niño.

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