FloridaClimateCenter
Office of the State Climatologist

# Post-Storm Summary Report on Hurricane Milton

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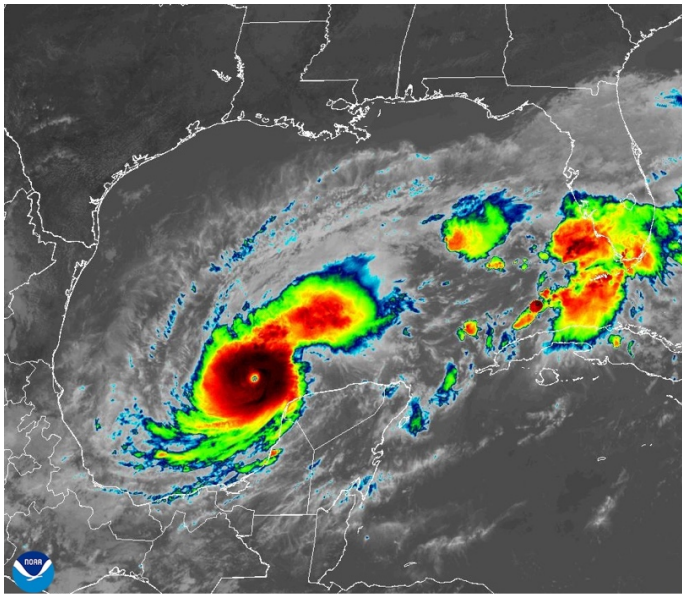
*October 31, 2024*

## Synoptic Overview

Hurricane Milton made landfall in Siesta Key, Florida in Sarasota County on the evening of October 9, 2024 as a major Category 3 hurricane with maximum sustained winds of 120 mph. Milton became the ninth hurricane and the second Category 5 hurricane, after Hurricane Beryl, of the 2024 Atlantic hurricane season. It was one of the most intense hurricanes on record in the Atlantic basin overall.

Milton formed as a tropical depression in the southwestern Gulf of Mexico on Saturday, October 5 and became a tropical storm that same day. It intensified into a hurricane on October 6. It reached its maximum intensity on Monday, October 7, as a Category 5 hurricane with maximum sustained winds of 180 mph and a central pressure of 897 millibars, ranking fifth most intense hurricane overall in the Atlantic basin based on pressure.



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Milton underwent explosive intensification in the Gulf of Mexico and was one of the fastest rapidly intensifying storms on record in the Atlantic Basin. Over a 24-hour period from Sunday, October 6 to Monday, October 7, the storm's wind speeds increased by 95 mph. In addition, the storm intensified from a Category 1 hurricane in the early morning of October 7 into a major Category 4 hurricane by noon with maximum sustained winds of 155 mph, which represented an increase in wind speeds of approximately 65 mph and a drop in pressure of 46 mb in under 24 hours.

The storm's intensity varied as the storm went through an eyewall replacement cycle in the western Gulf of Mexico. After passing by the Yucatan Peninsula, it turned northeastward towards Florida and entered more inhospitable conditions with increasing wind shear. The storm lost some strength and made landfall as a category 3 hurricane in Sarasota County. While the Tampa area was spared from devastating storm surge, the heaviest rainfall and highest winds occurred around and just north of the eyewall in the Tampa Bay and Sarasota areas. Areas to the south of where the storm made landfall experienced the worst storm surge. The storm's impacts extended well inland as it spawned a record number of tornadoes and led to widespread wind and flooding damage as it tracked across the Peninsula. After crossing the state, Milton entered the Atlantic Ocean where it became extratropical and eventually dissipated on October 12.

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Milton is responsible for at least 24 fatalities in Florida. The storm caused devastating flooding, including from storm surge, flash flooding from heavy rainfall, and riverine flooding following the storm. As of midday October 10, approximately 3.38 million customers were without power in the state, with the highest outages in Sarasota, Manatee, Pinellas, Hillsborough, Hardee, and Highlands Counties. Milton came on the heels of Hurricane Helene, which made landfall as a Category 4 hurricane on September 26 further up the coast in Florida's Big Bend region. The back-to-back major hurricanes broke the record for number of days between two major hurricane landfalls in Florida and compounded impacts and recovery efforts.

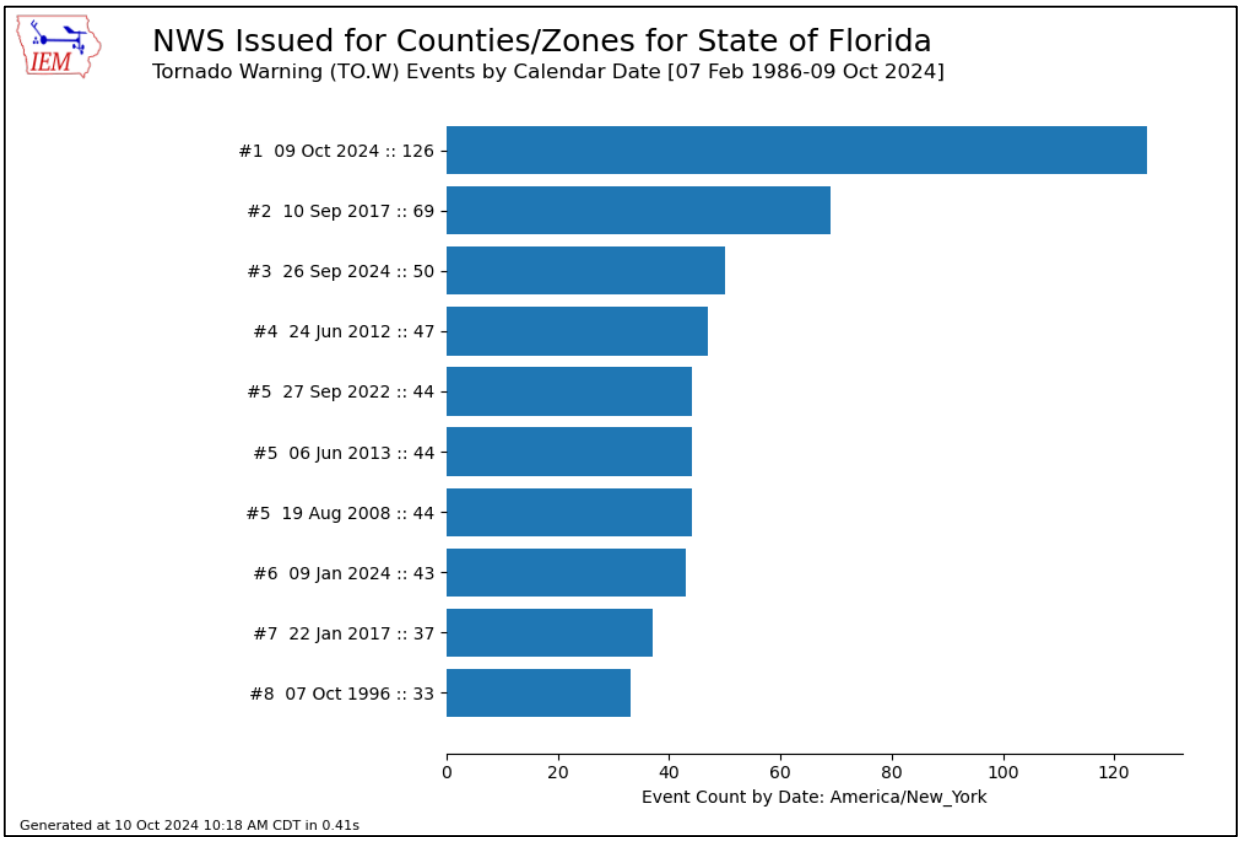
## Milton Led to Record Tornado Outbreak

Hurricane Milton led to a total of 47 confirmed tornadoes in Florida on October 9. This was the strongest tornado outbreak in a single day in Florida, and the strongest tornado outbreak from a tropical cyclone in Florida. (Hurricane Ivan holds the record of 120 confirmed tornadoes from a tropical cyclone.) The table below shows a breakdown of the tornadoes by intensity and region. There were 7 deaths and 14 injuries attributed to the tornadoes. In all, these tornadoes covered a total of 271.3 miles.

*Table of the total tornado counts by intensity and region in Florida during Hurricane Milton on October 9, 2024.*

| Region (NWS Office) | EF-0 | EF-1 | EF-2 | EF-3 | EF-U (unknown) | Total |
|---|---|---|---|---|---|---|
| West Central (TBW) | 4 | 6 | 2 | 0 | 0 | **12** |
| East Central (MLB) | 2 | 11 | 4 | 1 | 1 | **19** |
| South Florida (MIA) | 3 | 6 | 0 | 2 | 4 | **15** |
| The Keys (KEY) | 0 | 1 | 0 | 0 | 0 | **1** |
| **Total:** | **9** | **24** | **6** | **3** | **5** | **47** |

In addition, there were a record number of tornado warnings issued in Florida on October 9, with 126 tornado warnings issued by the NWS offices serving Florida. This is a new state record for total number of tornado warnings issued in a single day, and it far surpasses the previous records set during Hurricane Irma on September 10, 2017 with 69 tornado warnings (#2) and Hurricane Helene with 50 tornado warnings issued on September 26, 2024 (#3). This many tornado warnings issued in a day also ranks second overall for any state, only surpassed by a tornado outbreak that occurred in Alabama on April 27, 2011, with 134 tornado warnings. The figure below shows the top 8 tornado warning events in Florida, dating back to 1986.




*Top eight tornado warning events in a single day in the state of Florida from 1986 to present, from the Iowa Environmental Mesonet (IEM).*

While tornadoes often occur during tropical cyclones, severe tornadoes, ranked EF3 or higher, are relatively rare in Florida. As Milton nudged closer to the state, moist tropical air from the southwest collided with drier air inland. This, combined with daytime heating and increasing wind shear conditions, helped produced conditions supportive to tornadic development.

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The tornadoes impacted highly developed and populated areas of the state. Some impacted areas included Wellington, Miami, Clewiston, Ft. Myers, Vero Beach, Stuart, North Palm Beach, Ft. Pierce, Loxahatchee, and I-95 in Port St. Lucie. An EF-3 tornado that moved through Ft. Pierce, Spanish Lakes, and the Vero Beach area traveled on the ground for 21 miles and led to 6 fatalities, while an EF-2 tornado in Stuart resulted in one fatality. Another EF-3 tornado moved through the Sarasota Colony and

Fishermans Lane neighborhoods in Glades County where it severely damaged homes and led to 3 injuries. Another long-track EF-3 caused major damage in the Palm Beach Gardens and Avenir neighborhoods and led to 7 injuries. An EF-2 tornado was reported to have damaged the Lake Placid Solar Power Plant in Highlands County, FL, which supplies electricity to power more than 12,000 homes at peak capacity.

## Peak Wind Gusts

Hurricane Milton had maximum sustained wind speeds of 120 mph as it made landfall in Sarasota County. Peak wind gusts were observed in the Sarasota to St. Petersburg areas around the center of the storm. The table below provides select peak wind gusts that were recorded on October 9-10 from various station networks. Note that some of these wind gusts were the result of a tornado near the station and not from Milton directly.

*Select peak wind gusts observed during Hurricane Milton on October 9, 2024.*

| Station | County | Peak Wind Gusts (mph) |
|---|---|---|
| Tampa Skyway Fishing Pier | Pinellas/Manatee | 103 |
| Sarasota-Bradenton International Airport | Manatee | 102 |
| St. Petersburg Albert Whitted Airport | Pinellas | 101 |
| KF45 North Palm Beach County General | Palm Beach | 92 |
| Tampa International Airport | Hillsborough | 91 |
| Tower 714 at Kennedy Space Center | Brevard | 92 |
| Orlando International Airport | Orange | 86 |
| KSC20 tower | Brevard | 81 |
| Daytona Beach International Airport | Volusia | 87 |
| Winter Haven Gilbert Airport | Polk | 87 |
| Vero Beach Regional Airport | Indian River | 84 |
| Orlando International Airport | Orange | 86 |
| New Smyrna Beach Mesonet | Volusia | 86 |
| Punta Gorda | Charlotte | 81 |
| Sanibel Island | Lee | 78 |
| Venice CMAN | Sarasota | 97 |
| Clearwater Beach | Pinellas | 79 |
| St. Pete Clearwater International | Pinellas | 83 |

## Heavy Rainfall

Milton was a fast-moving storm and this helped to reduce total storm rainfall amounts; however, Milton produced extreme rainfall rates of several inches or more per hour in areas along and north of the storm's track. As a result, flash and riverine flooding were major hazards that affected coastal and inland areas.

Milton's heaviest rainfall generally fell to the north of the eyewall as it moved inland. Select high rainfall amounts are provided in the table below. Heavy rainfall and flash flooding caused damages across a wide area of the Florida Peninsula, from flooded roadways in Hillsborough County to damaged roadways and infrastructure in Volusia County. The highest daily rainfall totals were observed in Pinellas County, in the Clearwater Beach and St. Petersburg areas with nearly 20 inches of rainfall. The St. Petersburg Albert Whitted Airport recorded a one-day rainfall total of 18.54 inches; the normal monthly October rainfall is 2.16 inches at this station. St. Petersburg recorded 5.09 inches in one hour and 9.04 inches in a 3-hour period on October 9, which was more than a 1-in-1,000 year event.

*Select 24-hour rainfall totals during Hurricane Milton on October 9, 2024, recorded from various station networks.*

| Station | Station Type | 1-Day Rainfall Total (inches) |
|---|---|---|
| St. Petersburg Albert Whitted AP | WBAN | 18.54 |
| Gibsonia 7.6 N | CoCoRaHS | 18.75 |
| McKay Creek at Largo | USGS | 16.87 |
| Ormond Beach 4.1 ESE | CoCoRaHS | 14.05 |
| Daytona Beach Shores 1.8 SSE | CoCoRaHS | 15.80 |
| Lake Helen 0.9 S | CoCoRaHS | 15.37 |
| Mount Plymouth 0.2 WSW | CoCoRaHS | 15.01 |
| Port Orange 0.2 NNW | CoCoRaHS | 14.86 |
| De Bary 1.7 NE | CoCoRaHS | 14.73 |
| Ormond Beach 4.1 ESE | CoCoRaHS | 14.05 |
| Tampa 5.1 S | CoCoRaHS | 13.97 |
| Tampa Intl AP | COOP | 11.43 |
| Daytona Beach Intl AP | COOP | 9.14 |
| Sarasota Bradenton Intl AP | WBAN | 7.57 |

A map of the estimated storm total rainfall amounts for central Florida is provided below, courtesy of National Weather Service Melbourne Office. You can also view an interactive map of storm rainfall totals recorded by Community Collaborative Rain, Hail and Snow Network (CoCoRaHS) observers during the storm. Many CoCoRaHS observers also submit comments with their rainfall observations during storms. Here are some of the comments about the storm submitted by Florida CoCoRaHS observers:

1. Gibsonia 7.6 N, Polk County (PK-93) – 18.75 inches:
   "104 mph gust with eyewall."

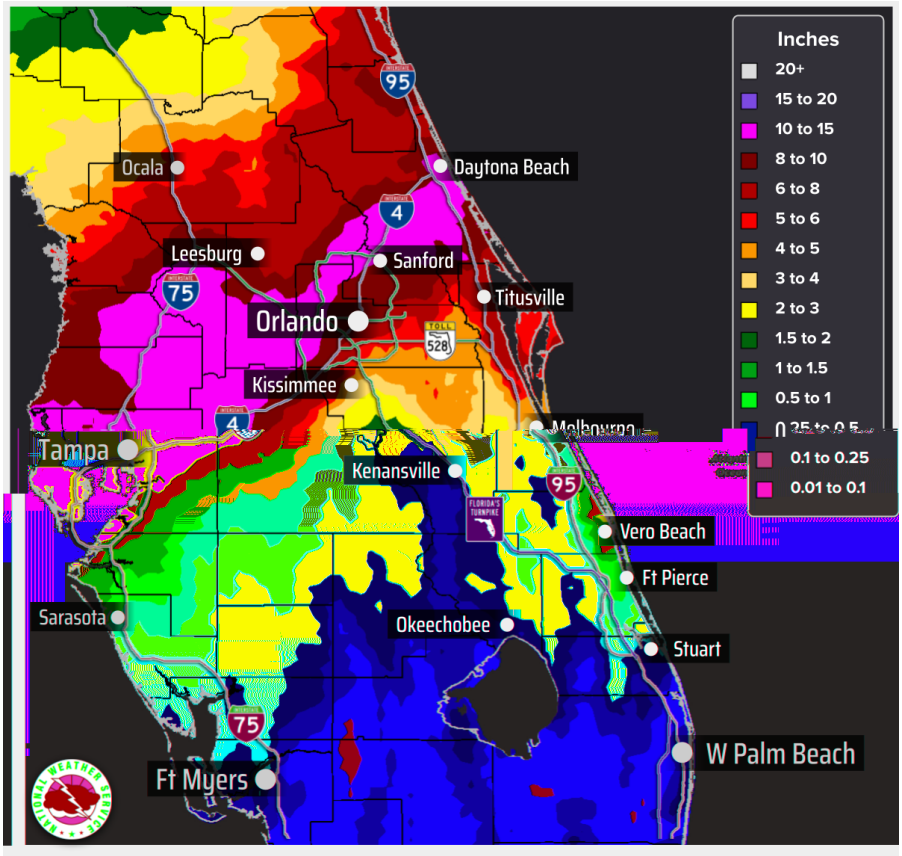
2. Lake Helen 0.9 S, Volusia County (VL-90) – 15.37 inches:

"*Hurricane Milton - 4.28" between 7 am and 7:30 pm on 10/9/2024, plus 11.07 between 7:30 pm and 7 am on 10/10/2024. Rain gauge possibly overflowed this morning. We only had power fluctuations and lots of tree limbs down. Some roads are flooded due to lakes overflowing their banks.*"

3. Ormond Beach 3.5 SE, Volusia County (VL-5) – 9.87 inches:
"*During the day 3.79" fell (should be accurate). During the night the rain gauge caught 6.08" (probably under actual amount because rain was coming down horizontally due to wind gust to almost 90 mph)... Total for 24 hrs ending 0700 10/10/2024, 9.87". Very little flooding in my immediate area but elsewhere it's pretty serious. Worst storm here since Matthew in 2016.*"

4. Bradenton 11.0 E, Manatee County (MA-18) – 5.72 inches:
"*Hurricane Milton. Major tree damage. No home damage.*"

5. Rockledge 1.6 NNE, Brevard County (BV-149) – 4.14 inches:
"*Post Milton. Some minor ponding in this location. Branches down. Debris in streets. No power. Winds subsiding.*"



**Hurricane Milton Total Rainfall**

*Estimated storm total rainfall amounts from Hurricane Milton, observed from 8:00am October 9 to 8:00am October 11 (source: NWS Melbourne Office).*

## Storm Surge and Riverine Flooding

Storm surge flooding devasted coastal communities in areas near and south of where Milton made landfall. Strong winds and high surge levels pushed an enormous amount of sand inland, adding to the sand that was displaced from Hurricane Helene. The back-to-back storms also compounded riverine flooding in central Florida.

Along the southwest Florida coast, storm surge did not reach levels seen during Hurricane Ian two years ago, but some places experienced higher storm surge from Milton than seen during Helene, including in Naples and Ft. Myers. The NOAA tide gage stations at Ft. Myers and Naples Bay North recorded preliminary peak water levels of 5.27 feet and 5.08 feet above MHHW (mean higher high water), respectively. This storm surge at Fort Myers was the 2nd-highest storm surge on record. The top 3 surge levels recorded at Fort Myers have all occurred in the past 2 years, according to NOAA Tides and Currents, which are: 1) 7.26 feet (Hurricane Ian), 2) 5.27 feet (Hurricane Milton), and 3) 5.12 feet (Hurricane Helene). A USGS gauge at Venice recorded a similar peak water level of 5.3 feet above MHHW on October 9.

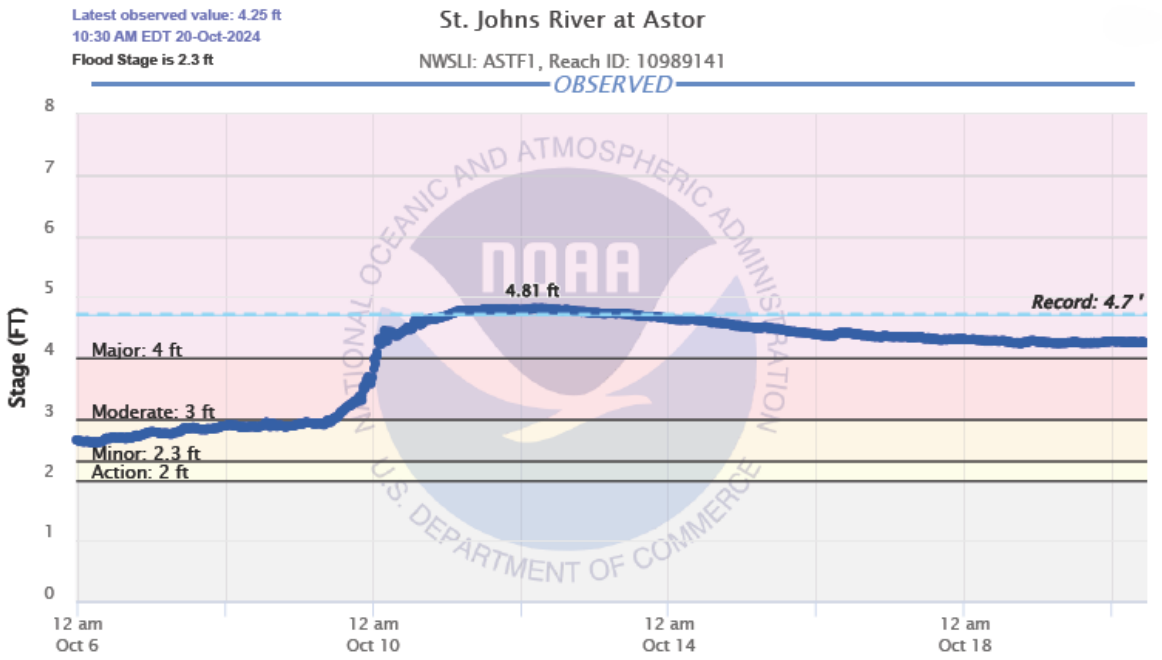
*High water rescues in Deland, FL on October 10 following Hurricane Milton (credit: City of Deland).*

Enormous amounts of sand were displaced along Florida's west-central coast following Hurricanes Helene and Milton, which eroded beaches and undid previous beach renourishment projects. Sand piles were an issue in Manasota Key, Venice, and surrounding areas as the surge carried sand from renourished beaches inland, burying cars, roadways, and entering people's homes. Cleanup efforts continue and are expected to take weeks or months to collect, clean, and redistribute the sand.

Heavy rainfall from Milton caused some rivers and tributaries to reach major flood stages in the days and weeks following the storm. In some places, rivers crested to levels higher than seen during Hurricanes Ian in 2022 and Irma in 2017. Select hydrographs along rivers reaching major flood stage during and following Milton are provided below.

## East Central Florida

Heavy rain from Milton caused parts of the St. Johns River in St. Johns County to reach record levels on October 10. Extensive flooding occurred throughout the southern part of St. Johns County and western Flagler County. The two hydrographs below show the peak river level along St. Johns River at Astor, which reached a record 4.81 feet and surpassed Hurricane Ian levels in 2022, and at Haw Creek in Flagler County, which set a new record of 9.23 feet, surpassing the previous record of 8.67 feet also set in the aftermath of Hurricane Ian.

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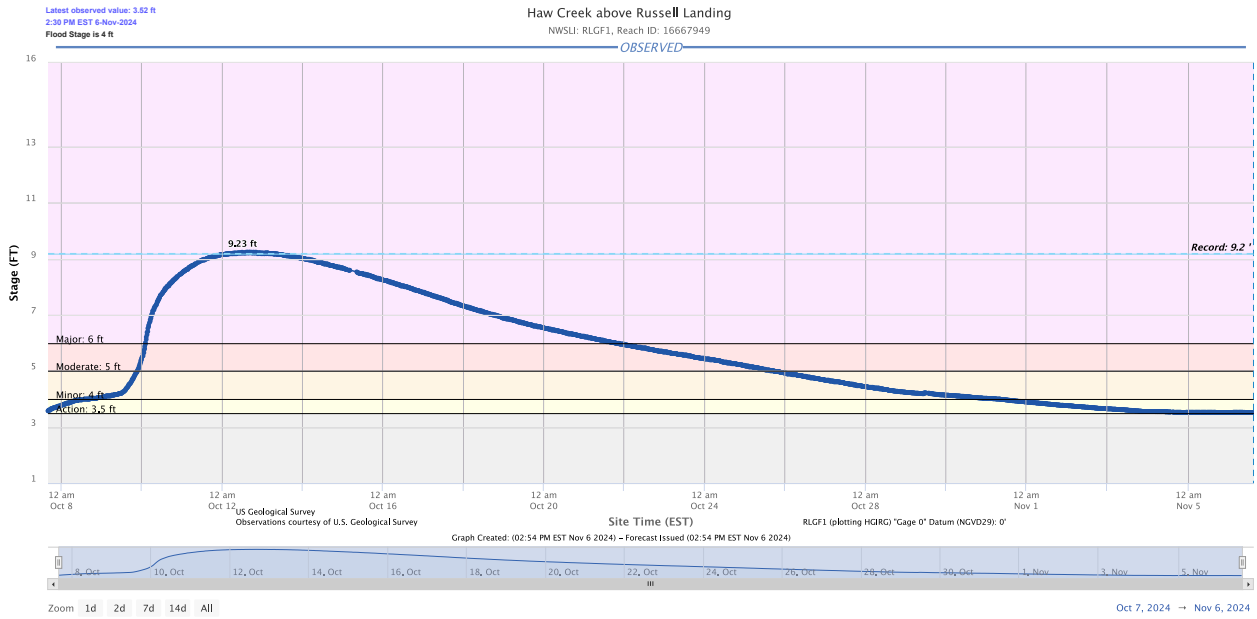


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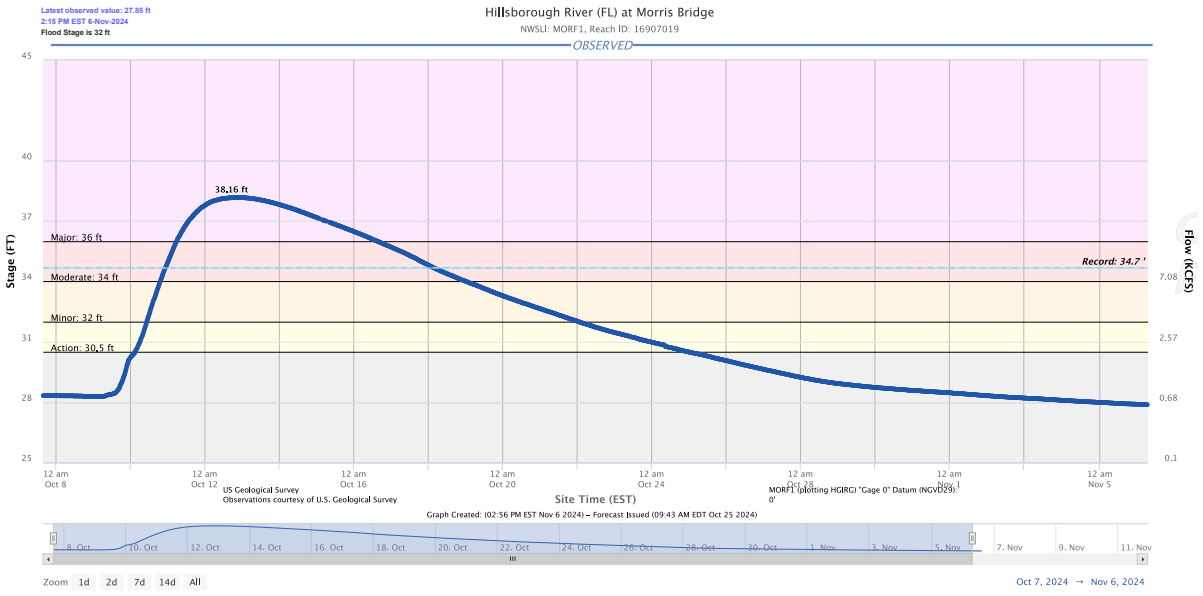
## West Central Florida

Record-high river levels were observed along the Hillsborough River. A crest of 38.16 feet was recorded at Morris Bridge on October 12, which surpassed the previous record of 34.66 feet set on September 14, 2017 following Hurricane Irma. A new record crest of 17.14 feet was observed near Zephyrhills at Hillsborough River State Park on October 10, where flooding of that scale had not been observed in a long time since 1960 when it crested to 15.33 feet.

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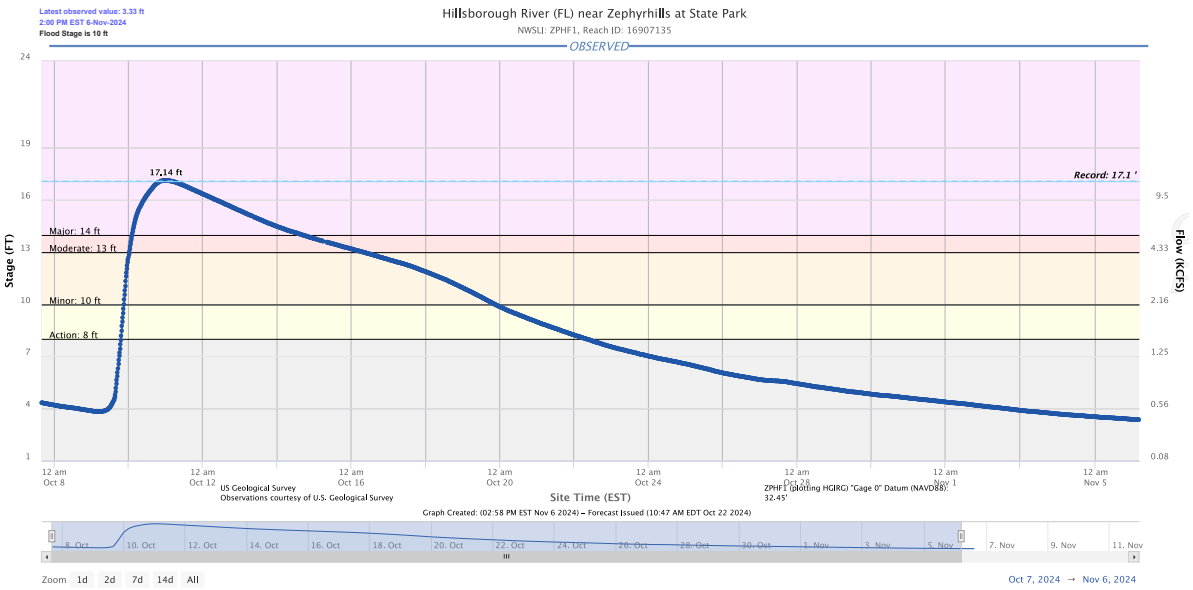


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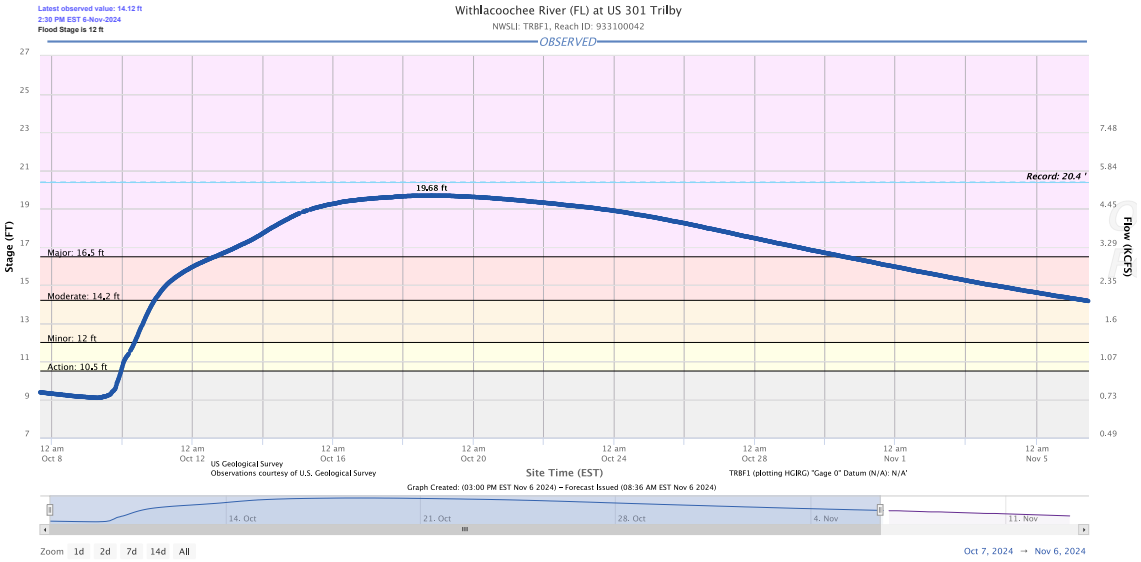
The Withlacoochee River reached major flood stage following Milton, cresting at near record levels at 19.68 feet. While some rivers crested immediately following the storm, downstream sections of the Withlacoochee River were still rising weeks following Milton. Residents in impacted areas were warned to evacuate due to the higher water levels still to come. As the river remained in flood stage for weeks, homes and roadways were left inaccessible for an extended period of time, producing what residents called a "worst case scenario." That level of flooding had not been observed since the 1930s; the all-time record flood level of 20.38 feet was set in 1934 and the 2nd-highest flood level of 20.06 feet was set in 1933.

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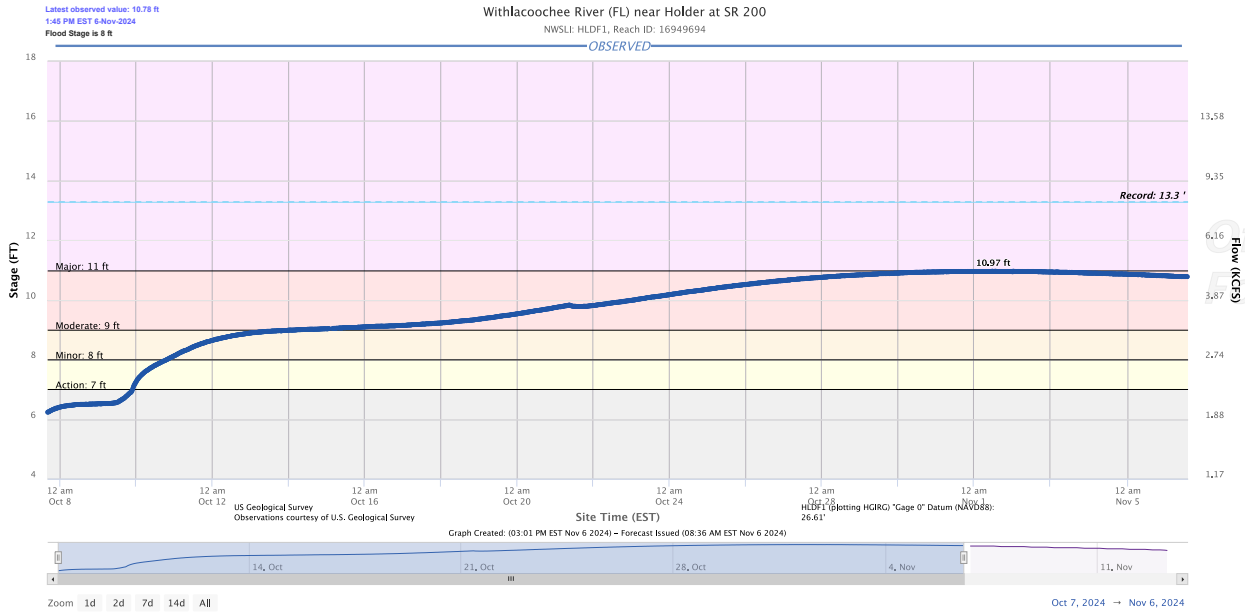


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## Additional Resources

- Coastal Data Information Program's Wave Observations during Milton - http://blog.cdipucsd.org/content/images/size/w2000/2024/10/2024-10_Milton.png
- NOAA Hurricane Milton Page - https://www.noaa.gov/milton
- NOAA Hurricane Milton Aerial Imagery of damages - https://storms.ngs.noaa.gov/storms/milton/index.html#7.2/27.799/-82.319