



The National Weather Service

Automated Flood Warning Systems (AFWS)

Version 1.0



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Background

The concept of the Integrated Flood Observing and Warning Systems (IFLOWS) has been developed extensively since the creation of the National Flash Flood Program Development Plan in 1978. The goals of the IFLOWS Program are to substantially reduce the annual loss of life from flash floods, reduce property damage, and reduce disruption of commerce and human activities. To develop the IFLOWS concept, the National Weather Service (NWS) began a joint effort with selected states in the Appalachian Region of the United States to undertake the establishment and development of a flash flood warning system to improve flood-warning capabilities in that Region.

In 1979 the NWS first began development of a prototype IFLOWS system to use as a model for expansion into other areas. A 3-state, 12-county area along the borders of Virginia, West Virginia, and Kentucky was selected for the prototype because of its susceptibility to flooding and its lack of existing flood warning systems and available communications circuits to tie this 3-state area together. The NWS completed the prototype IFLOWS system in 1981, and work began on expanding the system in the three original states and on developing IFLOWS in Pennsylvania and Tennessee. The expansion program was targeted to implement IFLOWS equipment in approximately 120 counties of the multistate area.

In 1985, Congress approved an amendment to a continuing resolution, which earmarked additional funds specifically for expansion of IFLOWS in the areas hardest hit by the devastating floods of November 4–5, 1985. This area encompassed 29 new counties in West Virginia and numerous counties in Virginia and Pennsylvania, which were declared disaster areas. It was also expanded to include counties in North Carolina and New York with a history of serious flooding problems in the past.

While resource limitations have restricted additional expansion of direct NWS support for new IFLOWS installations, IFLOWS technology has now spread well beyond the seven original states. Numerous communities, state and federal agencies are now linked in a wide area communications network using this technology. This Automated Flood Warning Systems (AFWS) network connects numerous local flood-warning systems, and integrates and shares information from 1900 sensors in 12 states.



Web Browser Requirements

The NWS AFWS Web interface does not utilize any special scripting or protocols to display its information. Any major web browser that is currently available on any OS platform should be sufficient to view all information within this interface.

The Interface

The NWS AFWS Interface consists of 4 main areas:

- **The Blue Left-hand Navigation Area**
- **The AFWS Tabular Navigation Bar**
- **The Map and Legend Area**
- **The Additional Resources Area**

National Weather Service
Automated Flood Warning Systems

Home News Organization Search for: [] NWS All NOAA Go

Home > Water

Automated Flood Warning Systems (AFWS)

Precipitation Observations River Observations Precipitation QPE Other Information

All Locations [] Click The Map To Zoom In.

1748 Total Gauges
View Locations at or Above 70% FFG

- 1664 Gauges: Observations older than 24 hours
- 0 Gauges: Out of Service
- 3 Gauges: \geq 90% Flash Flood Guidance
- 4 Gauges: \geq 70% Flash Flood Guidance
- 56 Gauges: < 70% Flash Flood Guidance
- 21 No Flash Flood Guidance available for Location

Last map update: Sun, Sep. 20, 2009 at 07:45:09 EDT.

Hydrologic Resources

- ▶ Text Products
- ▶ River Forecast Centers
- ▶ About AFWS
- ▶ AFWS Partners
- ▶ AFWS State Summary
- ▶ AFWS RSS **RSS**
- ▶ AFWS Feedback

Additional Resources

- ▶ National Significant River Flood Outlook
- ▶ U.S. Geological Survey Streamflow Information
- ▶ Snow Information

US Dept of Commerce
National Oceanic and Atmospheric Administration
National Weather Service
1325 East West Highway
Silver Spring, MD 20910
Page Author: NWS AFWS Internet Services Team

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Figure 1: The Interface



Blue Left-hand Navigation Area

The Blue Left-hand Navigation Area is found throughout all NWS web pages and is utilized to present informational links to other resources and information within NWS. Here users can find historical information about the AFWS/IFLOWS program or download the AFWS User Guide PDF. Additionally, users can also select to visit websites of AFWS/IFLOWS Project Partners or choose to visit the US Government's Official Web Portal.

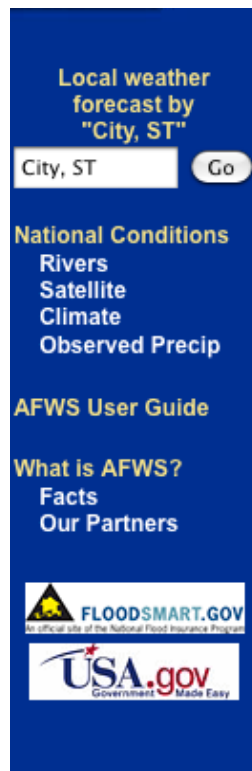


Figure 2: Blue Left-hand Navigation Area



AFWS Tabular Navigation Bar

The AFWS Tabular Navigation Bar is where users can select to view different types of information as it relates to the AFWS website. By default users are directed to the Precipitation Observations Tab. To view the additional areas located within the AFWS website, users need simply to click on the desired tab to navigate to that area. Available options are:

- **Precipitation Observations (default)**
- **River Observations**
- **Precipitation QPE**
- **Other Information**



Figure 3: AFWS Tabular Navigation Bar

Each area will be covered in more detail later in the guide, in the order presented above, once the interface has been fully introduced.

The Map and Legend Area

The Map and Legend Area is designed to display observed precipitation and stage information in a graphical format. Depending on what information is being viewed within the mapping interface, different colors are utilized to represent the different levels of data.

Users also have the ability click the mapping interface in selected geographical area(s) to view the information on a more localized level. Once the user clicks the desired area on the National map, they will be directed to the Weather Forecast Office (WFO) AFWS page that resides in that area of responsibility. Once on the WFO AFWS page, the user has the ability to make the data even more localized by clicking on the map in a specific county.

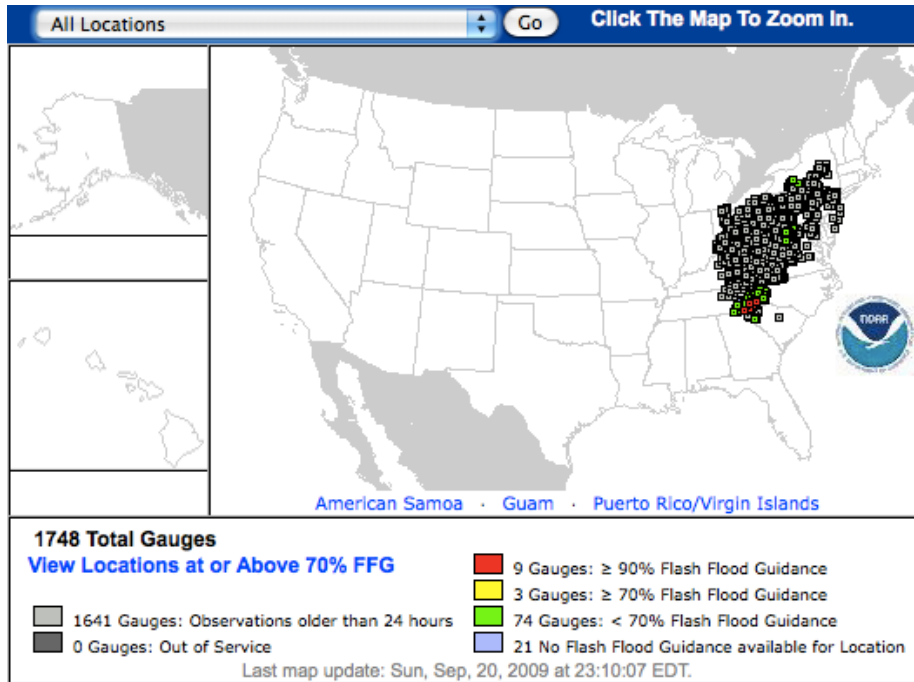


Figure 4: The National Map and Legend Area

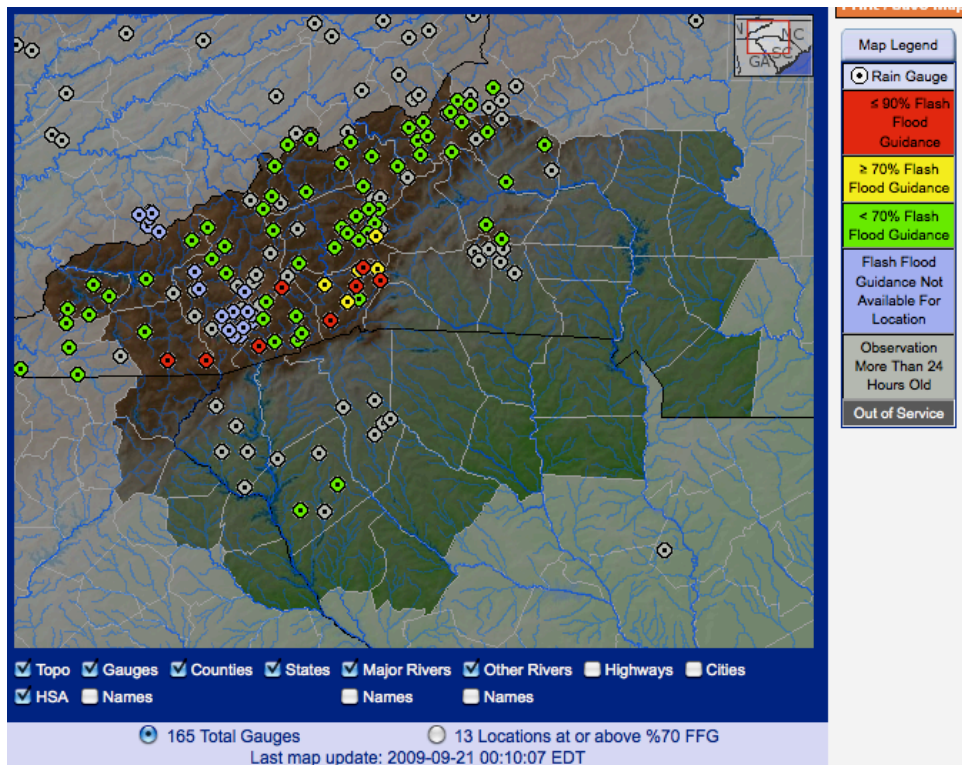


Figure 5: WFO AFWS Map and Legend



The Additional Resources Area

The Additional Resources Area is where users can acquire information that pertains to the AFWS network and NWS offices/divisions that provide relational information to the content presented within the interface. These links were designed to be a quick and easy way for the general public to obtain the most information as possible about the AFWS program, supplemental data, and its project partners.

Hydrologic Resources	Additional Resources
<ul style="list-style-type: none">▶ Text Products▶ River Forecast Centers▶ About AFWS▶ AFWS Partners▶ AFWS State Summary▶ AFWS RSS RSS▶ AFWS Feedback	<ul style="list-style-type: none">▶ National Significant River Flood Outlook▶ U.S. Geological Survey Streamflow Information▶ Snow Information

Figure 6: AFWS Additional Resources Area



Precipitation Observations

National Level

When a user first arrives at the AFWS website, the first glimpse of information they can preview is observed precipitation observations on a national scale. These observations are recorded events from the network of automated rain gauge sensors located predominantly in the eastern U.S. When precipitation reports are received, they are processed and displayed in relation to percentages of Flash Flood Guidance (FFG).

FFG is a tool used by meteorologists to predict flash flooding of urban areas, creeks and streams. Soil type and moisture are used to predict how much rain is needed in a specified time period to produce flash flooding. These forecast guidance are produced by the River Forecast Centers, and they often model the output specific to the potential for flash flooding.

When there are multiple precipitation events ongoing within the AFWS network, users may want to view only certain levels of data instead of viewing the broad spectrum. To accommodate this need, the National Precipitation Observations Mapping Interface was designed to allow filtering of data content by means of a series of dropdown menus and clickable legend.

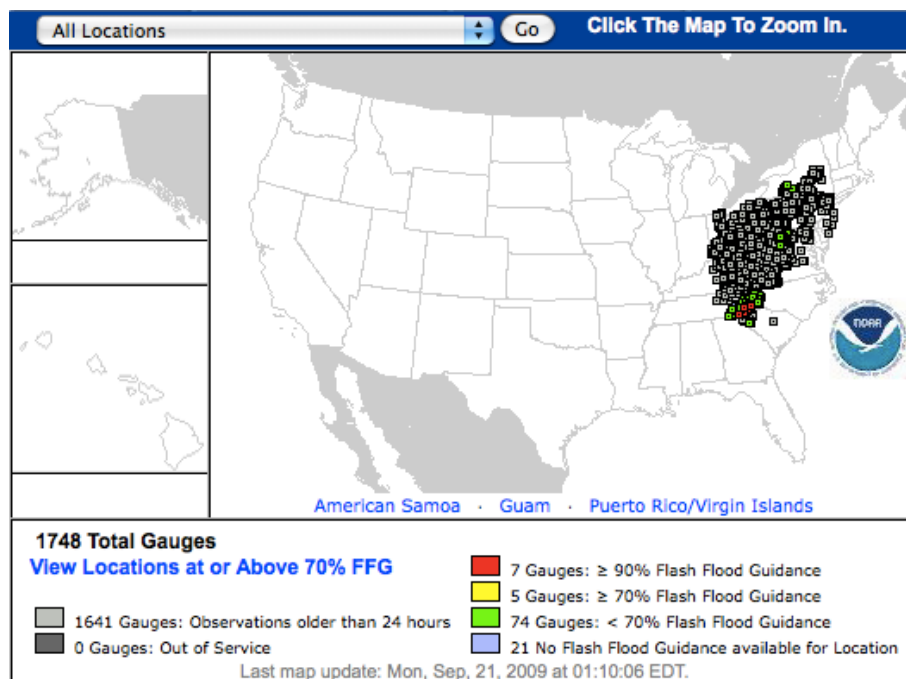


Figure 7: National Precipitation Observations

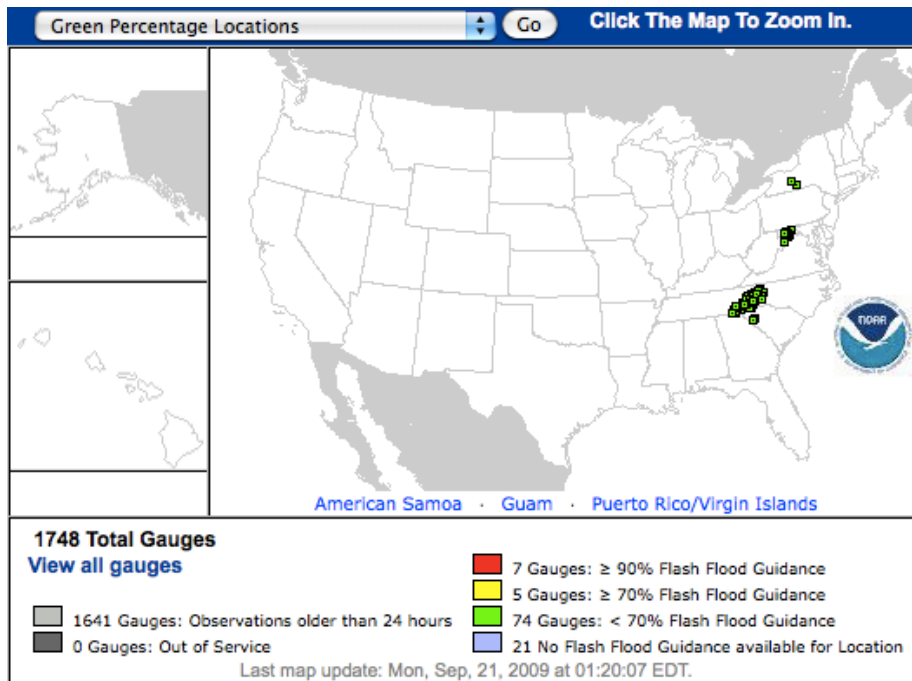


Figure 8: $<70\%$ FFG (Clicking Green Legend Item)

Users can quickly view all gauges that are at a level of $\geq 70\%$ Flash Flooding and above by clicking the link under the map [View Locations at or Above 70% FFG.](#) (see below)

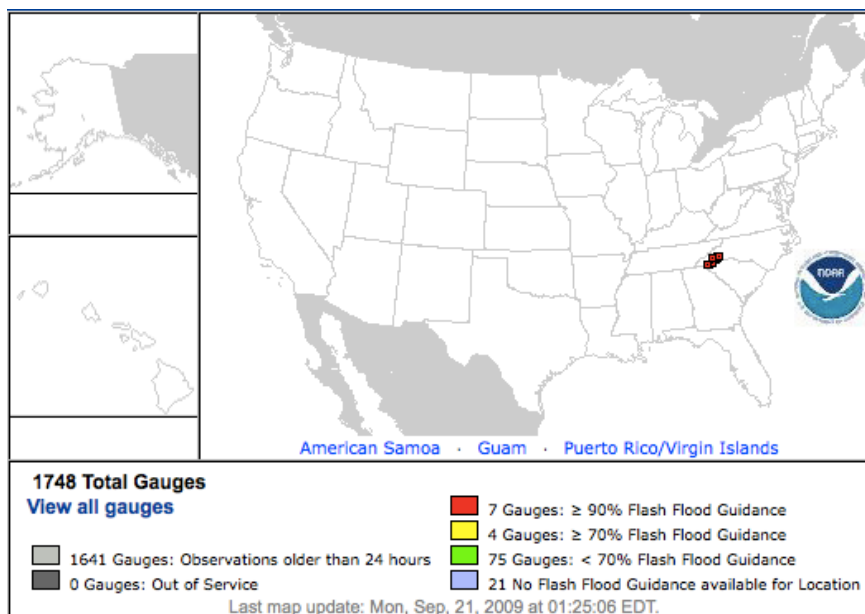


Figure 9: All locations $>70\%$ FFG



WFO LEVEL

As mentioned previously in the interface section of the guide, when a user clicks an area on the national map, they are directed to the WFO AFWS page for that area. When users arrive on this page, they are presented with a more detailed view of observed precipitation in relation to FFG. Just like the national map, users can choose to filter the information by usage of radio selection buttons located below the mapping interface. These radio buttons allow the user to either view “All Gauges” or “Gauges that are at a status of at or above 70% FFG”.

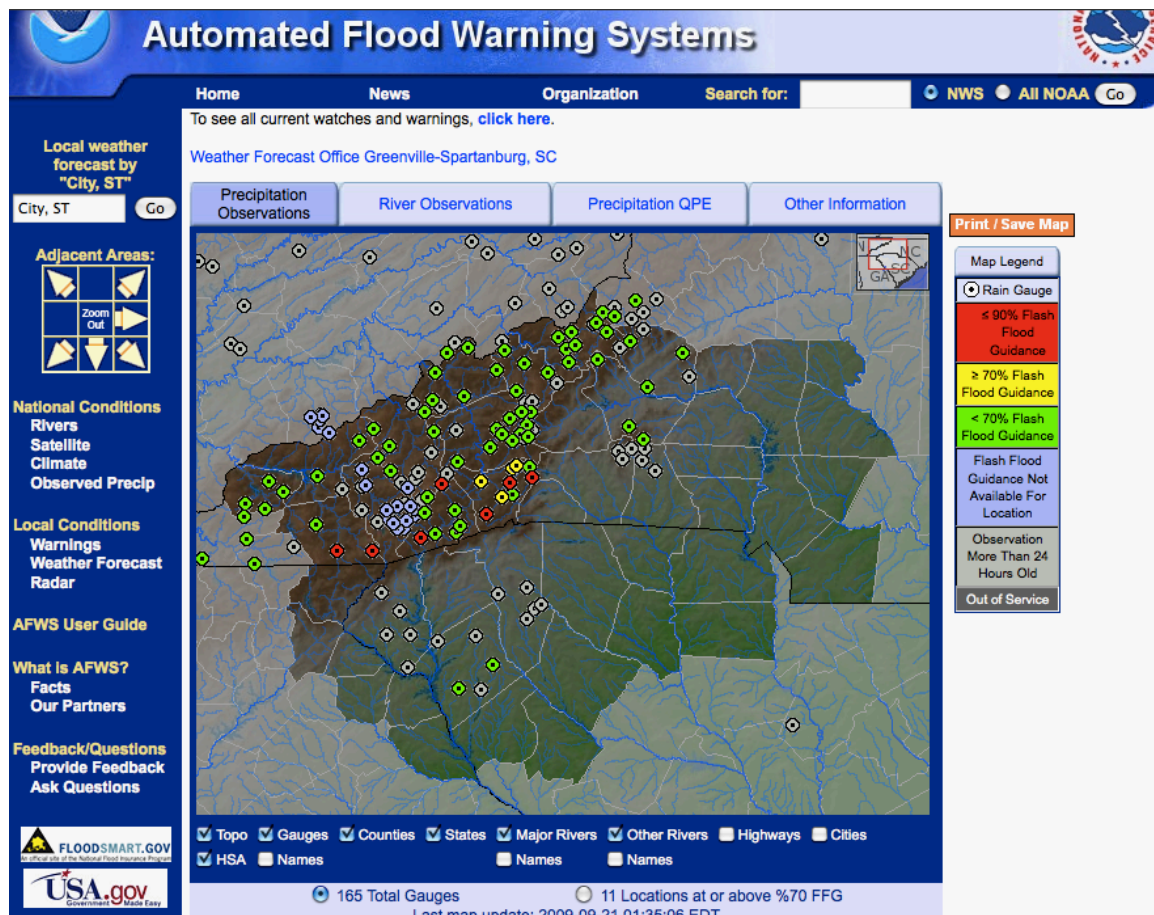


Figure 10: WFO Precipitation Observations

And with the “Locations that are at a status of at or above 70% FFG” seen below.

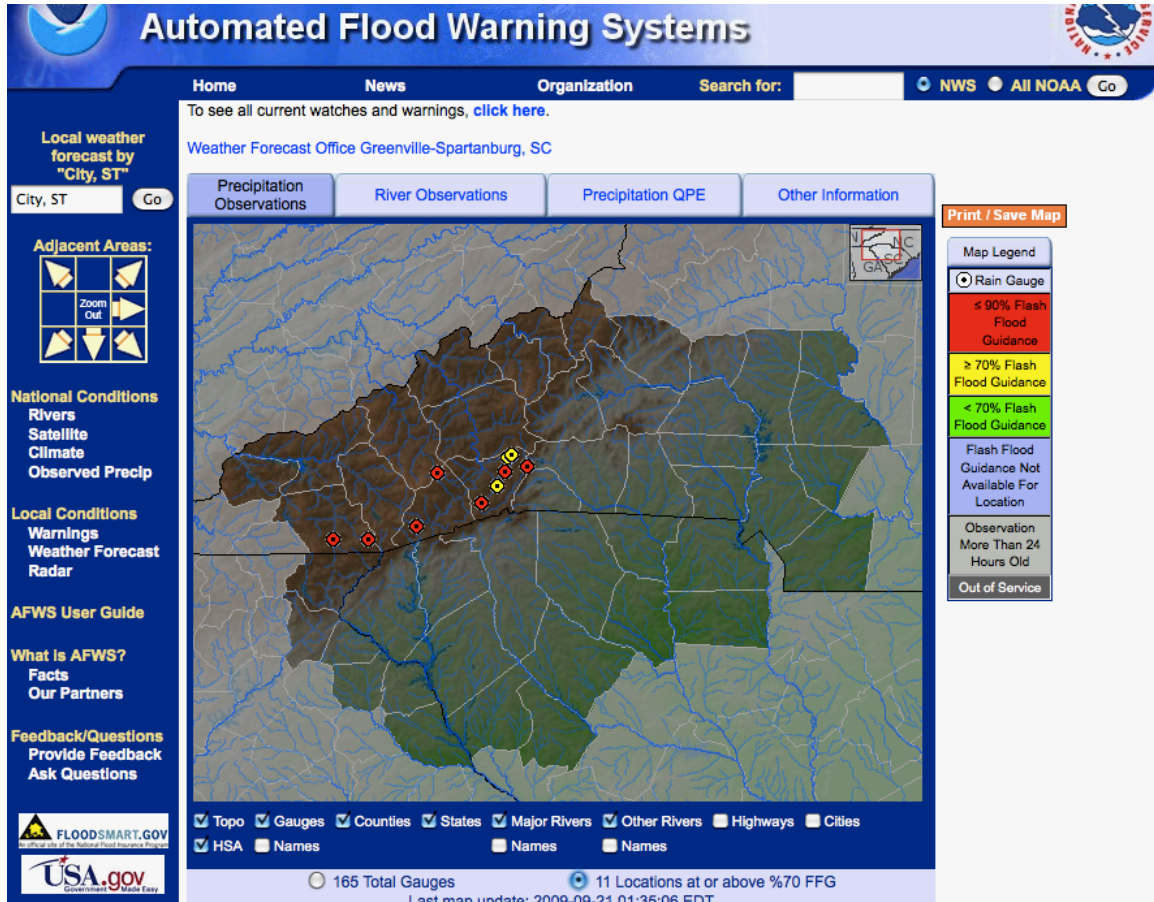


Figure 11: Locations status of at or above 70% FFG” selected

Once again users can choose to view the information at a more localized level by clicking within the mapping interface to view the data at the county level. Users can also select a specific county via a dropdown selection menu located just below the mapping interface.



County Level

When users arrive at the County Summary page they can view precipitation observation data specific to the actual gauge reported values. The data are displayed in intervals of 15 minute, 30 minute, 1 hour, 3 hour, 6 hour, 12 hour, and 24 hour in a table format. The data within the tables will populate dynamically as it is received in 5-minute intervals within the 24-hour sliding window that continually moves forward in time. The information will also automatically color in relation to the output FFG forecast as supplied by the RFC.

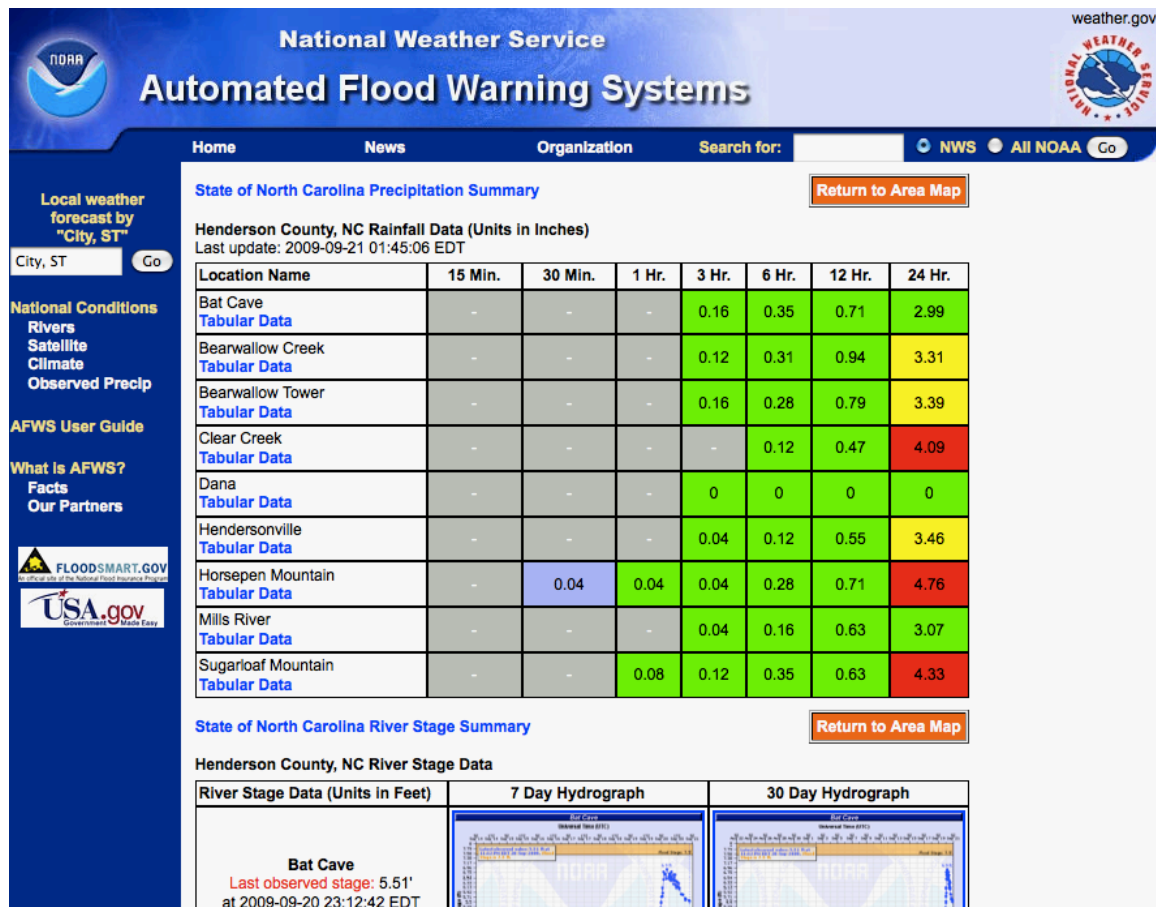


Figure 12: County Summary Page (Precipitation Observations)

Users can also choose to view the historical tabular data reports by click the **Tabular Data** link located under each gauge name. Along with the tabular data, users can select to view a precipitation summary for every county in the state by clicking **State of xxxxxx Precipitation Summary** located near the top of the page. (see below) To return back to the WFO page, users can either click "Return to Area Map" or use their back browser button.



Tabular Data for CCGN7

Gauge Type: Precipitation Gage

Observed Data:

<u>Date</u>	<u>Value</u>
2009-09-16 at 10:04:28 EDT	0.00
2009-09-16 at 10:59:50 EDT	0.04
2009-09-16 at 10:59:53 EDT	0.08
2009-09-16 at 19:44:06 EDT	0.00
2009-09-16 at 19:44:10 EDT	0.00
2009-09-17 at 03:27:52 EDT	0.04

Figure 13: Tabular Data Example (Precipitation Observation)

National Weather Service Automated Flood Warning Systems

Home News Organization Search for: NWS All NOAA Go

[Return to National Map](#)

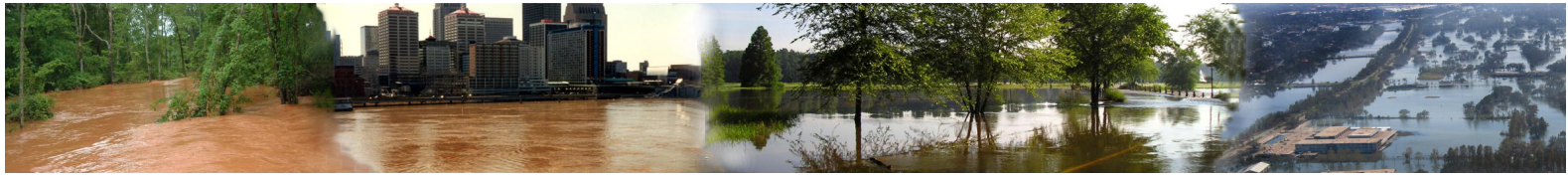
Avery County, NC Rainfall Data (Units in Inches)
Last update: 2009-09-21 02:05:06 EDT

Location Name	15 Min.	30 Min.	1 Hr.	3 Hr.	6 Hr.	12 Hr.	24 Hr.
Grandfather Meadows Tabular Data	-	-	0.04	0.24	0.59	0.87	2.28
Hickory Nut Gap Tabular Data	-	-	-	-	-	0.2	0.94
Roaring Creek Tabular Data	-	-	-	0	0	0	0
Newland	-	-	-	-	-	-	-
Bowers Gap Tabular Data	-	-	-	-	-	0	0
Spear Tabular Data	-	-	-	-	-	0	0.04

Buncombe County, NC Rainfall Data (Units in Inches)
Last update: 2009-09-21 02:05:06 EDT

Location Name	15 Min.	30 Min.	1 Hr.	3 Hr.	6 Hr.	12 Hr.	24 Hr.
Mt. Pisgah	-	-	-	-	-	-	-
Bee Tree Tabular Data	-	-	0.04	0.08	0.12	0.35	2.24
Riceville Tabular Data	-	-	-	0.04	0.04	0.28	2.36
Flat Top Tabular Data	-	-	0.04	0.04	0.04	0.04	0.04
Christmount Tabular Data	-	-	0.08	0.39	0.51	0.83	2.91
Ridgecrest	-	-	-	-	-	-	-
North Fork Tabular Data	-	0.04	0.04	0.12	0.2	0.35	2.6
Newfound Creek	-	-	-	-	-	-	-

Figure 14: Table Data State Precipitation Summary



River Observations

National Level

Selecting the River Observations Tab on the AFWS Tabular Navigation Bar will direct users to a page that will look similar in nature to the National Precipitation Observations page, with the exception being that these plotted data are from automated stream gauges within data cooperators' AFWS/IFLOWS networks. These gauges report stream/river levels when measured changes occur. This information is received and compared to levels set by local Service Hydrologists to categorize this information and display it in relation to certain levels of flooding or "Flood Categories". This information is unique to each sensor installation and/or waterbody. Not all locations may have this flood category information. These categories are used in AFWS much in the way that they are utilized in the NWS Advanced Hydrological Prediction Services (AHPS) program. These categories should not be confused with FFG.

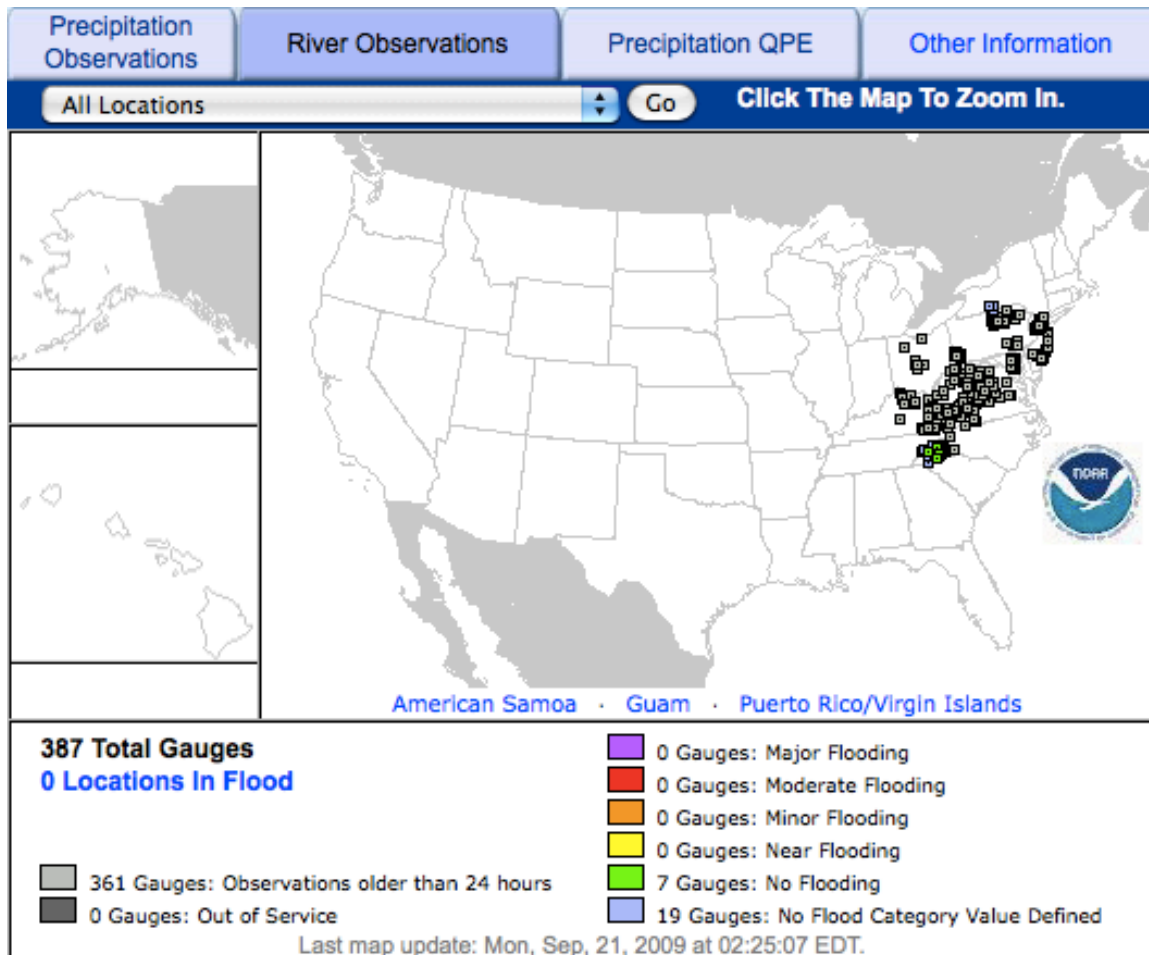


Figure 15: National River Observations



The National River Observations page functions much like the National Precipitation Observation page in that it has the same clickable legend, links, and mapping interface that allows users to view the information more localized.

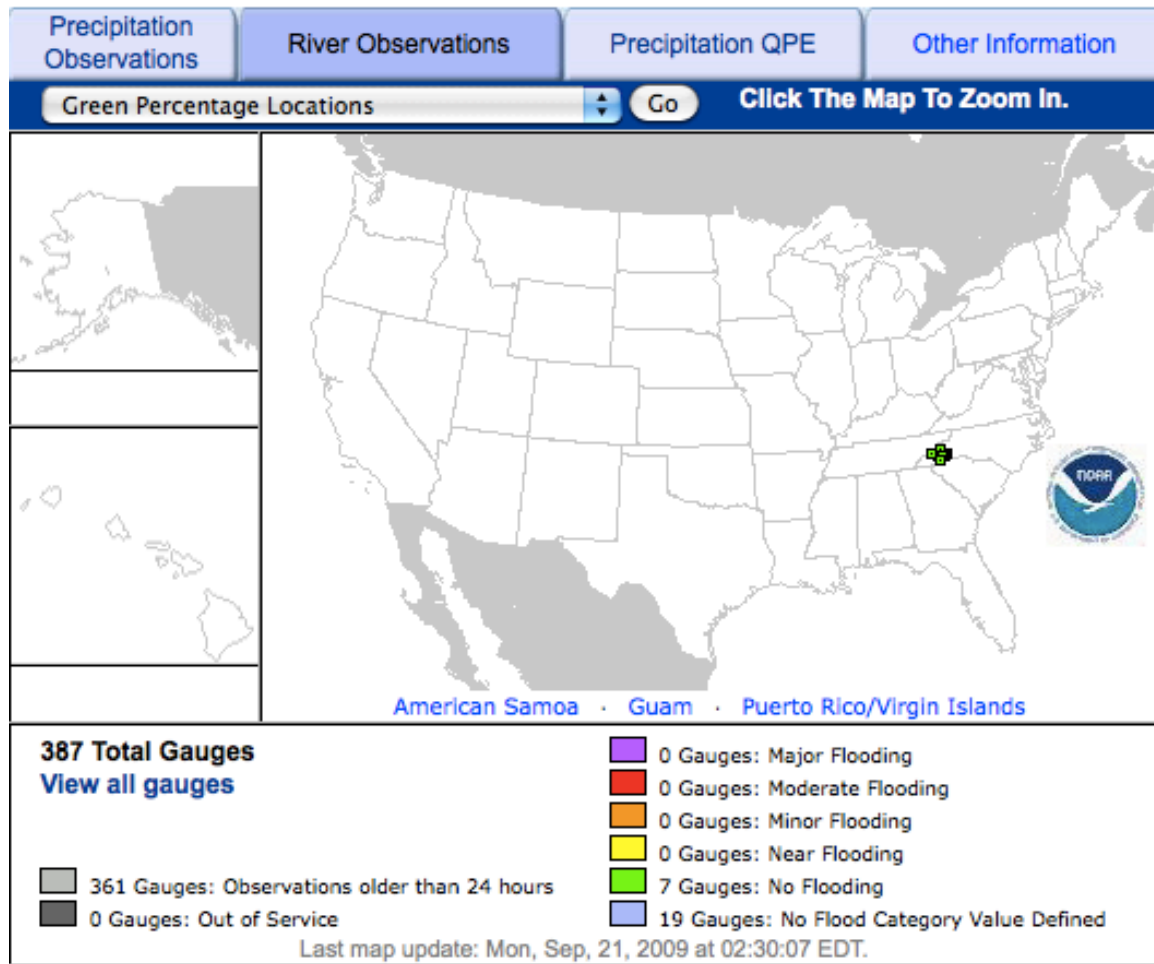


Figure 16: River Observation (Filtered for Sites not Flooding)

*Note - only when a site has been categorized in some manner will it go through the series of colors relating to the flooding category. If no flood categories are defined, the site will be either “Blue or Grey”. If a Location is defined only up to a category such as “Minor Flooding” and that location goes into a level of flood higher than that category, the plotted information will only reflect the highest level defined and will remain that color until the level has subsided to below that defining value.



WFO Level

By clicking the desired area on the national map, the user will be directed to the WFO AFWS River Observations Page. Just as with the WFO Precipitation Observations Page, the River Page has clickable radio buttons located below the mapping interface to filter the sensor information in relation to what is and is not flooding.

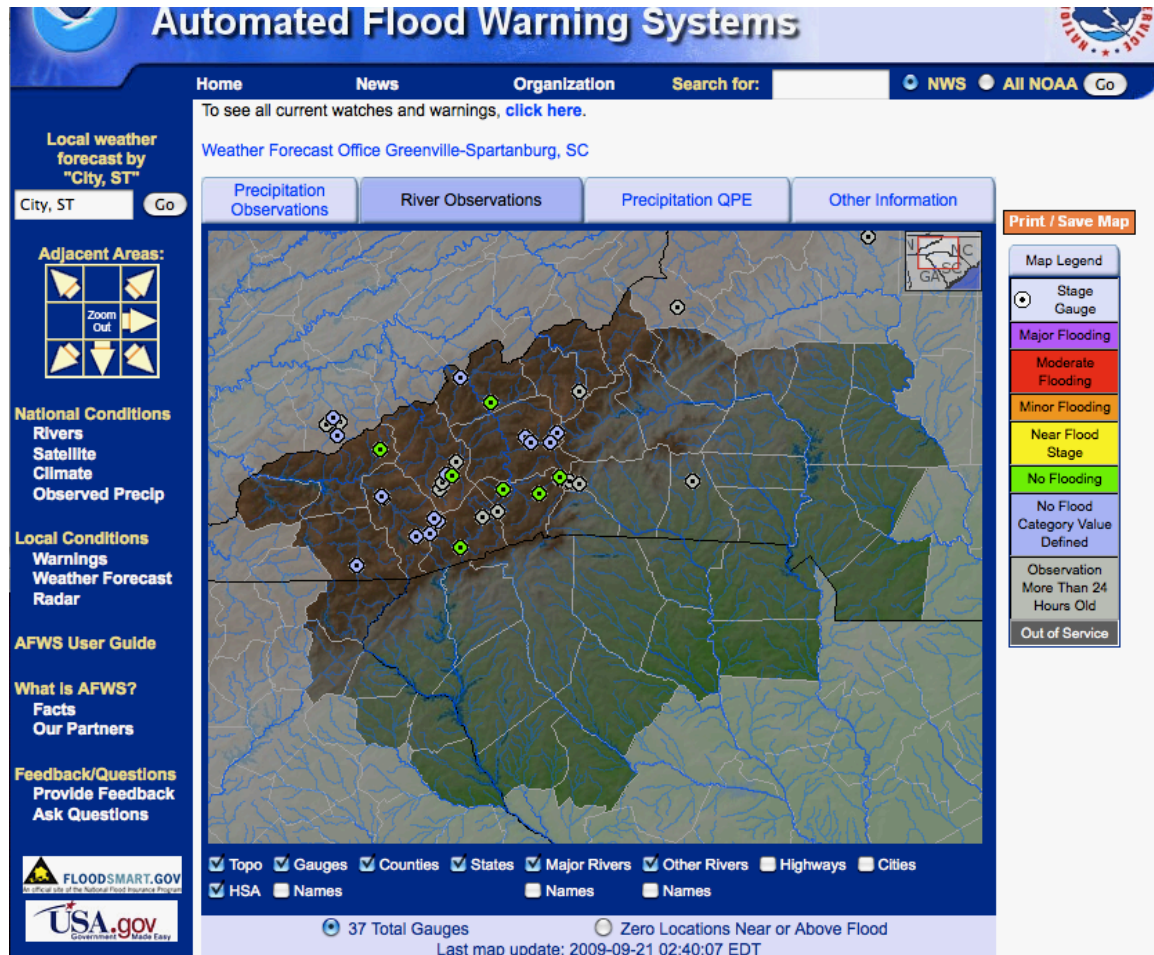


Figure 17: WFO River Observations Page

Just as with the Precipitation Observations WFO page, users can click the mapping interface or use the dropdown selection menu to view the County Summary page(s).



County Level

Once users have arrived at the County Summary page, they can view 7-day and 30-day hydrograph information related to stream/river sensors located in that county. To view a hydrograph more closely, users will simply point and click the desired hydrograph and it will display in a new window, enlarged so the data are more legible.

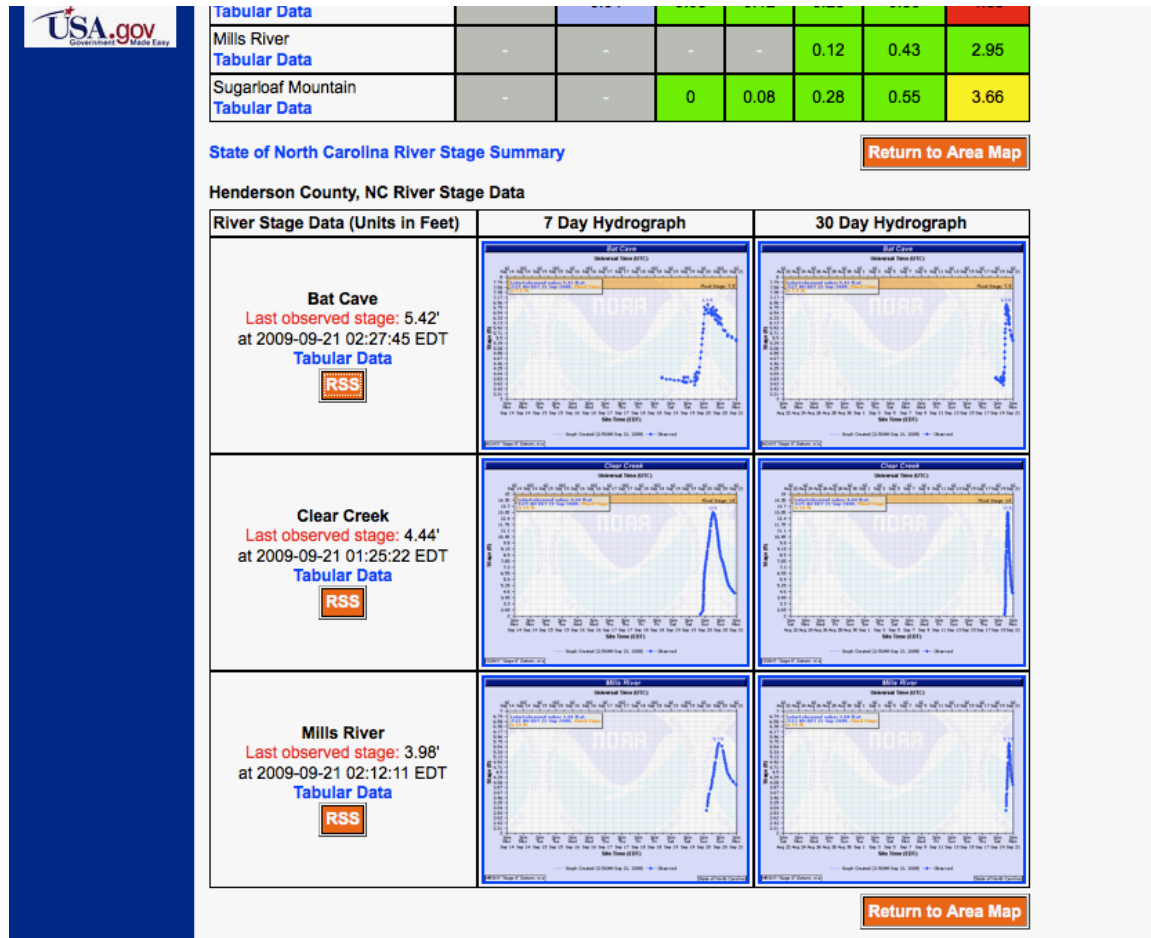


Figure 18: County Summary Page (Hydrograph Area)

To return to the WFO AFWS page, users will again simply click the “Return to Area Map” button located below and/or above the Hydrographs. Users can also choose to view historical sensor reports by clicking [Tabular Data](#) or they can subscribe to an RSS feed for the sensor information. Users can also view the State Summary page by clicking the link [State of xxxxx River Stage Summary](#).

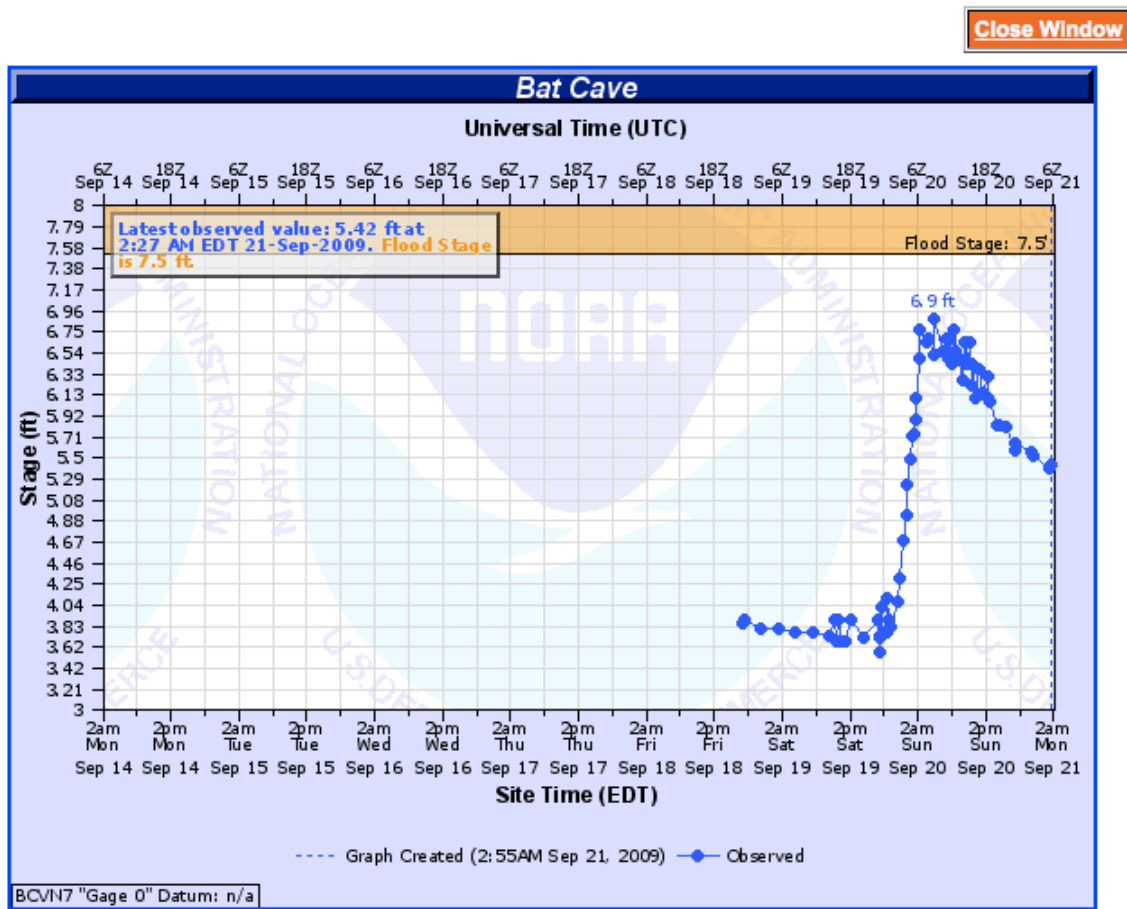


Figure 19: Example of 7-Day Hydrograph

Tabular Data for BCVN7

Gauge Type: Water Level PT

Observed Data:

Date	Value
2009-09-18 at 20:02:40 EDT	3.85
2009-09-18 at 20:17:43 EDT	3.89
2009-09-18 at 23:12:40 EDT	3.79
2009-09-19 at 02:12:40 EDT	3.79
2009-09-19 at 05:12:41 EDT	3.76
2009-09-19 at 05:12:44 EDT	3.76
2009-09-19 at 08:12:41 EDT	3.76

Figure 20: Example of Tabular River Observation Data



weather.gov

National Weather Service
Automated Flood Warning Systems

Home News Organization Search for: [NWS](#) [All NOAA](#) [Go](#)

[Return to National Map](#)

Buncombe County, NC River Stage Data

River Stage Data (Units in Feet)	Lastest Observed Stage	Date of Last Report
Riceville	1.15 Feet	2009-09-21 01:43:26 EDT
Montreat	1.48 Feet	2009-09-20 21:29:00 EDT
Black Mountain Park	2.08 Feet	2009-09-20 21:52:13 EDT
Warren Wilson	3.26 Feet	2009-09-21 02:48:55 EDT

Cleveland County, NC River Stage Data

River Stage Data (Units in Feet)	Lastest Observed Stage	Date of Last Report
Lawndale	-	Data Unavailable

Haywood County, NC River Stage Data

River Stage Data (Units in Feet)	Lastest Observed Stage	Date of Last Report
WF Hazelwood	-	Data Unavailable
Lake Logan Dam	-	Data Unavailable
E Pigeon Beth	2.66 Feet	2009-09-21 03:00:15 EDT
Pigeon Canton	-	Data Unavailable
W Pigeon Beth	1.59 Feet	2009-09-20 22:00:11 EDT
WF nr Retreat	-	Data Unavailable

Henderson County, NC River Stage Data

River Stage Data (Units in Feet)	Lastest Observed Stage	Date of Last Report
Mills River	3.98 Feet	2009-09-21 02:12:11 EDT
Clear Creek	4.44 Feet	2009-09-21 01:25:22 EDT
Bat Cave	5.42 Feet	2009-09-21 02:27:45 EDT

Jackson County, NC River Stage Data

River Stage Data (Units in Feet)	Lastest Observed Stage	Date of Last Report

Local weather forecast by "City, ST"

City, ST [Go](#)

National Conditions
Rivers
Satellite
Climate
Observed Precip

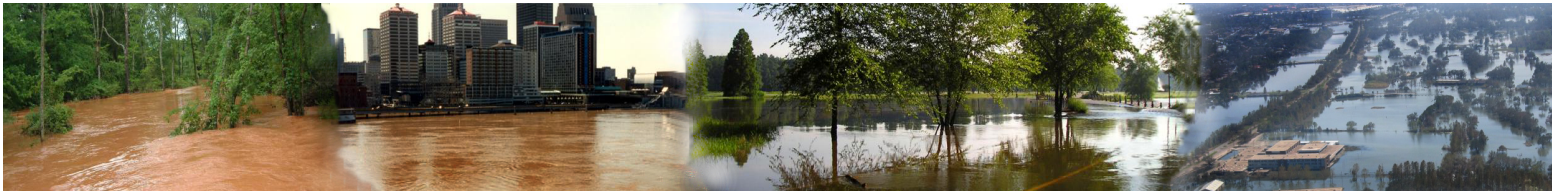
AFWS User Guide

What is AFWS?
Facts
Our Partners

FLOODSMART.GOV
Partners of the National Flood Insurance Program

USA.gov
Government Made Easy

Figure 21: State River Stage Summary Page



Precipitation QPE

When users select the Precipitation QPE tab located on the AFWS Tabular Navigation Bar, they are directed to the NWS AHPS Precipitation Analysis pages. Here users can observe precipitation amounts in graphical representation. Please reference the following link for more information concerning Precipitation QPE:

<http://water.weather.gov/about.php>

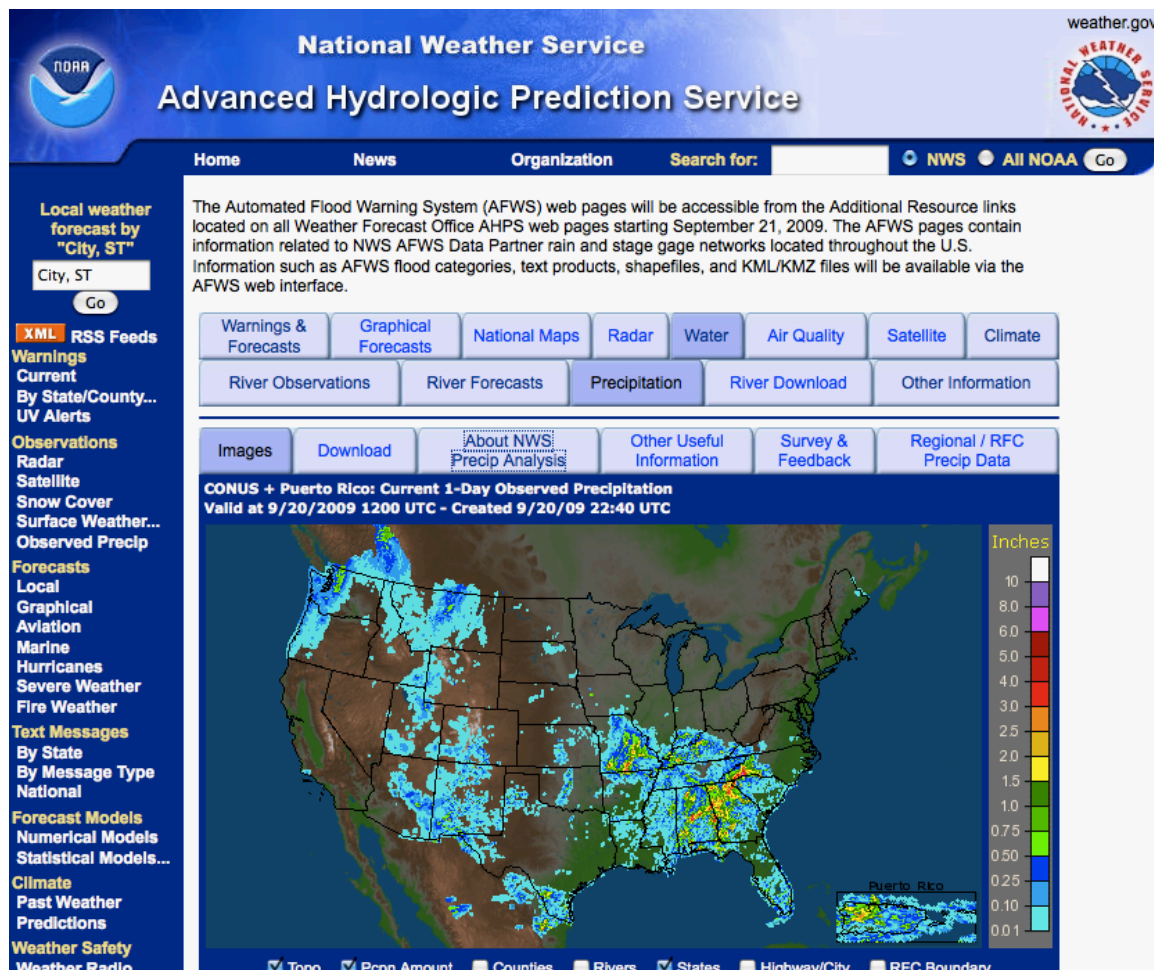


Figure 22: AHPS Precipitation Analysis Pages (QPE)



Other Information

The final tab to be covered on the AFWS Tabular Navigation Bar is the Other Information Tab. When users select this tab they will be directed to a page that contains various downloads and text products that users can utilize in other applications outside of the AFWS web suite. Some of the resources available on this page are KMZ/KML files for use in mapping applications such as Google Earth and NASA WorldWind; as well as FFG and Observed shapefile information for usage in GIS applications.

Precipitation Observations
River Observations
Precipitation QPE
Other Information

- ▶ [Flash Flood Guidance \(FFG\) data in Shapefile format](#)
- ▶ [Flash Flood Guidance \(FFG\) Text Products](#)

Flash Flood Guidance (FFG): Forecast guidance produced by the River Forecast Centers, often model output, specific to the potential for flash flooding (e.g., how much rainfall over a given area will be required to produce flash flooding).

- ▶ [National 1-Day Precipitation Analysis](#)
- ▶ [National Hourly Precipitation Analysis \(experimental\)](#)
- ▶ [NWS Watches, Warnings, and Advisories RSS Feeds](#)

Downloads

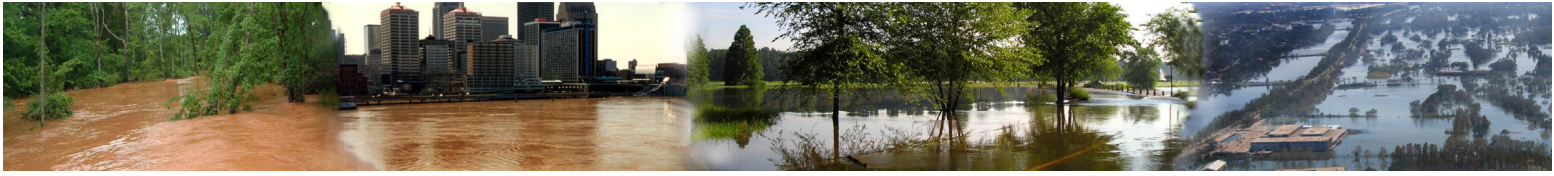
While the AFWS display allows for the use of interactive toggles with the image, AFWS data can also be utilized within GIS software. This page links to "Shapefiles" and "KMZ" files which are compressed "KML" files compatible with several GIS software applications. [A list of some of the software applications that support Shapefiles and KML can be found here.](#) Or, visit the [NWS website Standards Description Website](#) which explains KML in more detail.

Observed Shapefiles and KMZ Files

- [Shapefile \(Precipitation\)](#) (66k)
- [Shapefile \(Stage\)](#) (17k)
- [KMZ \(Precipitation\)](#) (99k)
- [KMZ \(Stage\)](#) (60k)

<h4>Hydrologic Resources</h4> <ul style="list-style-type: none"> ▶ Text Products ▶ River Forecast Centers ▶ About AFWS ▶ AFWS Partners ▶ AFWS State Summary ▶ AFWS RSS RSS ▶ AFWS Feedback 	<h4>Additional Resources</h4> <ul style="list-style-type: none"> ▶ National Significant River Flood Outlook ▶ U.S. Geological Survey Streamflow Information ▶ Snow Information
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Figure 23: Other Information Page



This concludes the AFWS End Users Guide. If you have any questions concerning the interface or any of the data within, please contact afswwebmaster@noaa.gov.