

## National Weather Service flood inundation mapping

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The National Weather Service (NWS) is responsible for issuing river and flood forecasts and warnings to mitigate the loss of life and property. Current NWS text-based products are utilized by emergency managers (EMs). One of the most often requested product from EMs is flood inundation mapping to show the areal extent of flooding. Flood inundation maps would translate the forecasted stages into inundation areas, making it easier for EMs to take action and alert the public. They would also prove invaluable to EMs in their outreach, mitigation, and educational efforts.

By partnering with the Federal Emergency Management Agency (FEMA) and local communities, the NWS is developing flood inundation maps for their forecast locations. When a community performs flood studies to update FEMA Flood Insurance Rate Maps (FIRMs), much of the necessary data are available to develop flood inundation maps. For a small incremental cost above the cost to develop FIRMs, flood inundation maps at various stages above the NWS-established flood stage are being developed. This collection of maps will form a flood inundation map library that can be served up to the public via the Internet.

The NWS has partnered with FEMA and developed flood inundation map libraries at about 15 locations across the country. Currently, work is ongoing to produce these maps for an additional 30 sites in the states that border the Gulf of Mexico. The NWS has established a web site and web structure to serve this data up to the public.

Keywords: Floods, Hydrology, Management and Planning, Models

### Introduction

The National Weather Service (NWS) is responsible for issuing river and flood forecasts and warnings to mitigate the loss of life and property. Current NWS text-based products are utilized by emergency managers (EMs) to determine areas to evacuate and the appropriate measures to take to mitigate the loss of life and property. Information in these text-based products are ideally suited for integrating with a geographic information system (GIS) to develop maps of inundation areas to show the areal extent of flooding based on projected river crest heights. These inundation maps provide EMs information in a form more easily understood. These inundation maps are the most often requested products when customers are surveyed. The NWS has developed prototype procedures to develop these inundation maps.

### Static and Dynamic Inundation Maps

After Hurricane Floyd caused widespread damages to homes and businesses in North Carolina, the NWS began

an initiative to develop flood inundation maps. The NWS has been experimenting with two approaches:

(1) Dynamically Generated Inundation Maps (Dynamic Inundation Maps) – To prepare dynamic inundation maps, the NWS runs a hydraulic model such as the Flood Wave Operational Model (FLDWAV). In these model runs, real-time model runs of FLDWAV compute the water surface profile by solving the St. Venant equation of momentum and energy. The resultant water surface profile is then merged with available digital elevation model (DEM) data to determine the areal extent of flooding and a graphical image is created for display on the Internet. Preparing inundation maps dynamically allows a user to generate inundation maps based on non-steady state hydraulic model runs.

(2) Statically Generated Inundation Maps (Static Inundation Maps) – To prepare static inundation maps,

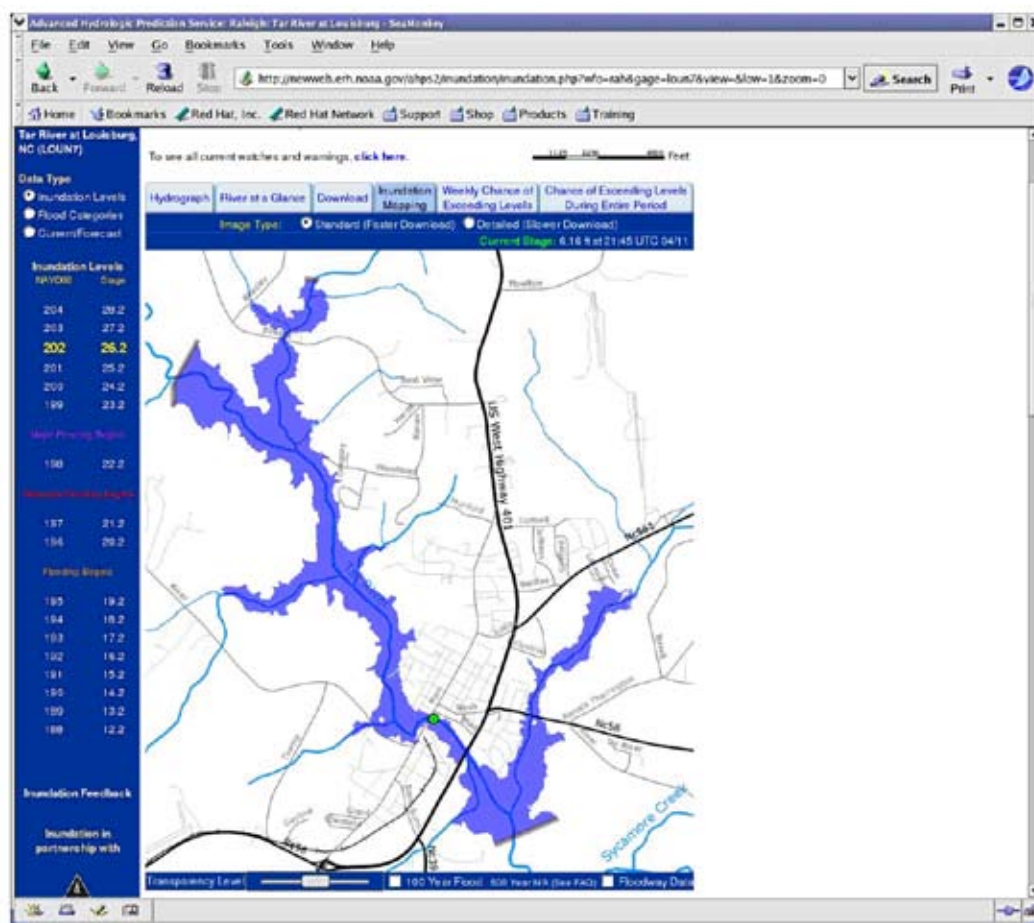
the NWS utilized the engineering expertise developed to prepare and update FEMA Flood Insurance Rate Map (FIRMs). In these analyses, the NWS had the contractor developing the new FIRMs run the Hydrologic Engineering Center- River Analysis System (HEC-RAS) hydraulic model in a steady state condition to simulate the water surface profile when the river was at flood stage. This water surface elevation was then combined with DEM data to produce a flood inundation map when the river level is at flood stage. A similar analysis is performed at 1 foot stage increments above flood stage until the flood of record is reached. These static inundation maps can be made available on the Internet for users to review and use in preparedness activities.

Over the past few years, the NWS has developed and continues to refine procedures to prepare both dynamic inundation maps and static inundation maps. Preparing dynamic inundation maps requires significant computer processing capabilities. These capabilities are usually

required when the computer processing requirements at NWS offices is at their highest and available resources will likely not be available. Because of this, the NWS is focusing most of its efforts in developing static inundation maps for their forecast locations.

### NWS Partnership Activities

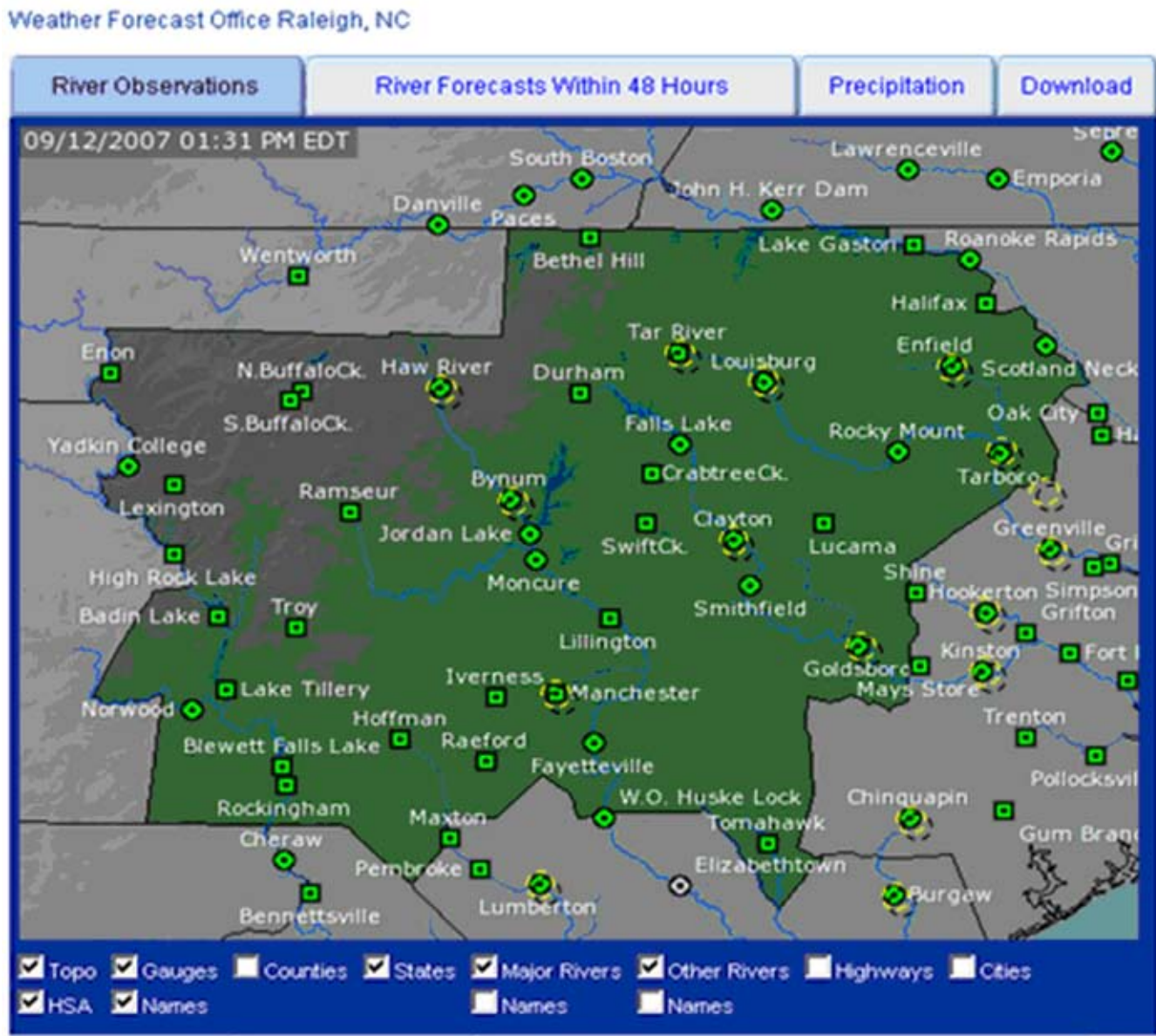
To make static flood inundation maps available at more locations, the NWS is partnering with FEMA and the local communities to develop these maps. When engineering consulting firms prepare FIRMs, the large majority of the engineering work needed to prepare static flood inundation maps has been completed. The HEC-RAS model has been developed. Because of the work already completed, the static inundation maps can be made for a small increase in the costs. The NWS is working to inform communities of the possibility of developing inundation maps for a small incremental cost in the hopes that the local community will be willing to bear these costs. A sample static inundation map presentation is shown in Figure 1.



**Figure 1** Sample static flood inundation map

The NWS has been working with its partners over the past

year to implement static inundation maps for 16 sites in North Carolina. Inundation maps at these sites represent a culmination of several years of effort and extensive coordination between the NWS, FEMA, the US Geological Survey, and the state of North Carolina. These inundation maps can be viewed at <http://www.weather.gov/ahps/inundation.php>. Figure 2 shows the current sites in North Carolina where static inundation maps are available.



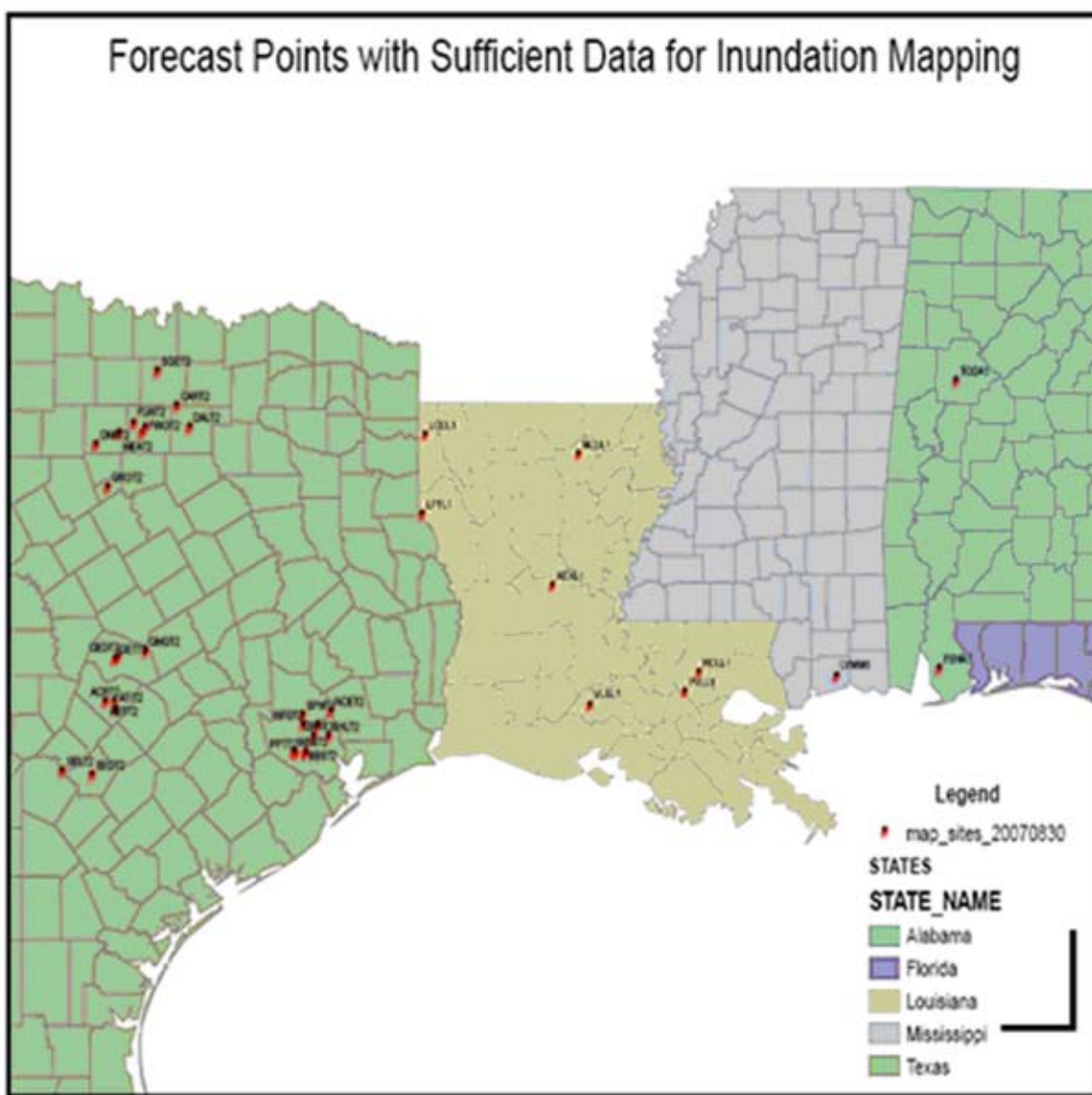
**Figure 2** Static flood inundation map locations in North Carolina



After Hurricane Katrina, the NWS was funded to provide inundation maps for sites in Texas, Louisiana, Mississippi, and Alabama as a demonstration. Work is currently underway to develop inundation maps at about 30 locations in these states. The projected locations for inundation mapping in Mississippi and Louisiana are shown in Figure 3. These inundation maps will likely be available by the end of calendar year 2008.

### Summary

Inundation maps provide valuable information to Emergency Managers and other interests along the major rivers of the US. The NWS is working to develop both dynamically generated inundation maps in real time and develop a library of inundation maps at various stages. The NWS hopes to partner with local communities to expand these products.



**Figure 3** Locations for flood inundation mapping in the Gulf Coast states.