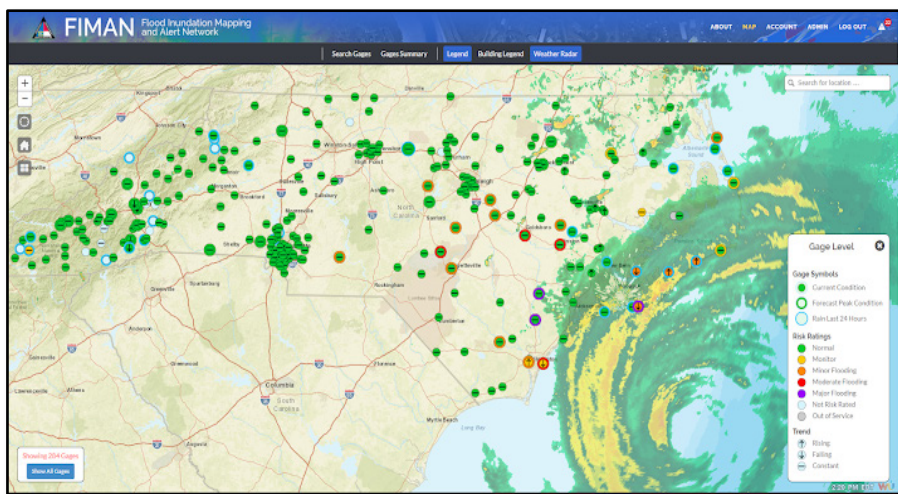


FIMAN & FIMAN-T

Innovations in Flood Warning and Emergency Response



Program: FIMAN is a sophisticated system of integrated technologies and datasets that effectively communicate flood information to emergency managers and the public. The goal of the FIMAN system is to reduce loss of life and flood-related property damage by providing emergency managers and the public with more timely, detailed, and accurate information. FIMAN integrates gages owned by the state, USGS, and other agencies to provide a network of over 550 gages. The FIMAN web application uses responsive design and modeling techniques to display real-time and forecasted flood information, accessible from any desktop, laptop, or mobile device.



FIMAN Homepage with Default Statewide Gage View

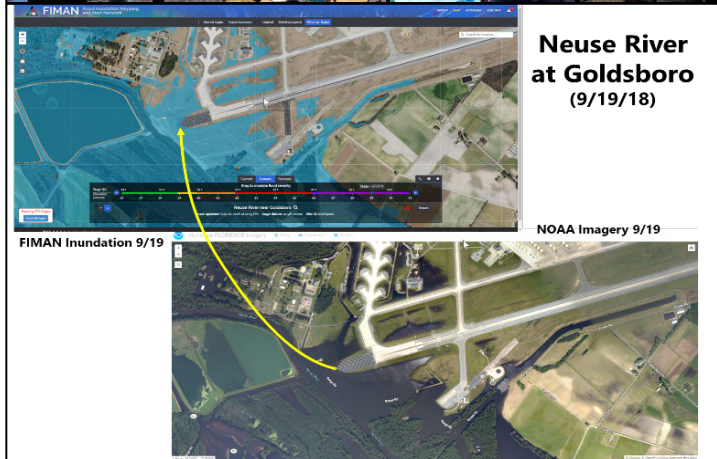
How It Works: One of the most powerful

aspects of FIMAN is its ability to not only measure and display current and forecasted stream gage information, but to **analyze, map, and communicate flood risks in real-time**. Every 15 minutes (or sooner), the application updates with data from over 500 sites across the state. Tools inside FIMAN overlay the flood inundation boundary with existing building information to quantify buildings impacted by flooding and provide exportable damage summary statistics. The FIMAN site also integrates available flood forecast information provided by the National Weather Service for sites across North Carolina. This forecast information is displayed to FIMAN users showing the forecasted flood extent, anticipated timeline, and estimated building-level impacts. FIMAN users and emergency managers can also sign up to receive alerts from FIMAN when flood levels at chosen areas rise to certain risk thresholds.



FIMAN in Action: The FIMAN application was put to the test during the weeks following Hurricanes Matthew and Florence in 2016 and 2018. FIMAN was used to provide real-time, situational awareness and planning for Emergency Managers and first responders. The FIMAN inundation mapping and real-time building damage estimates were used by NC Emergency Management to expedite the FEMA county disaster declarations in record time helping to reduce delays in initiating the recovery process.

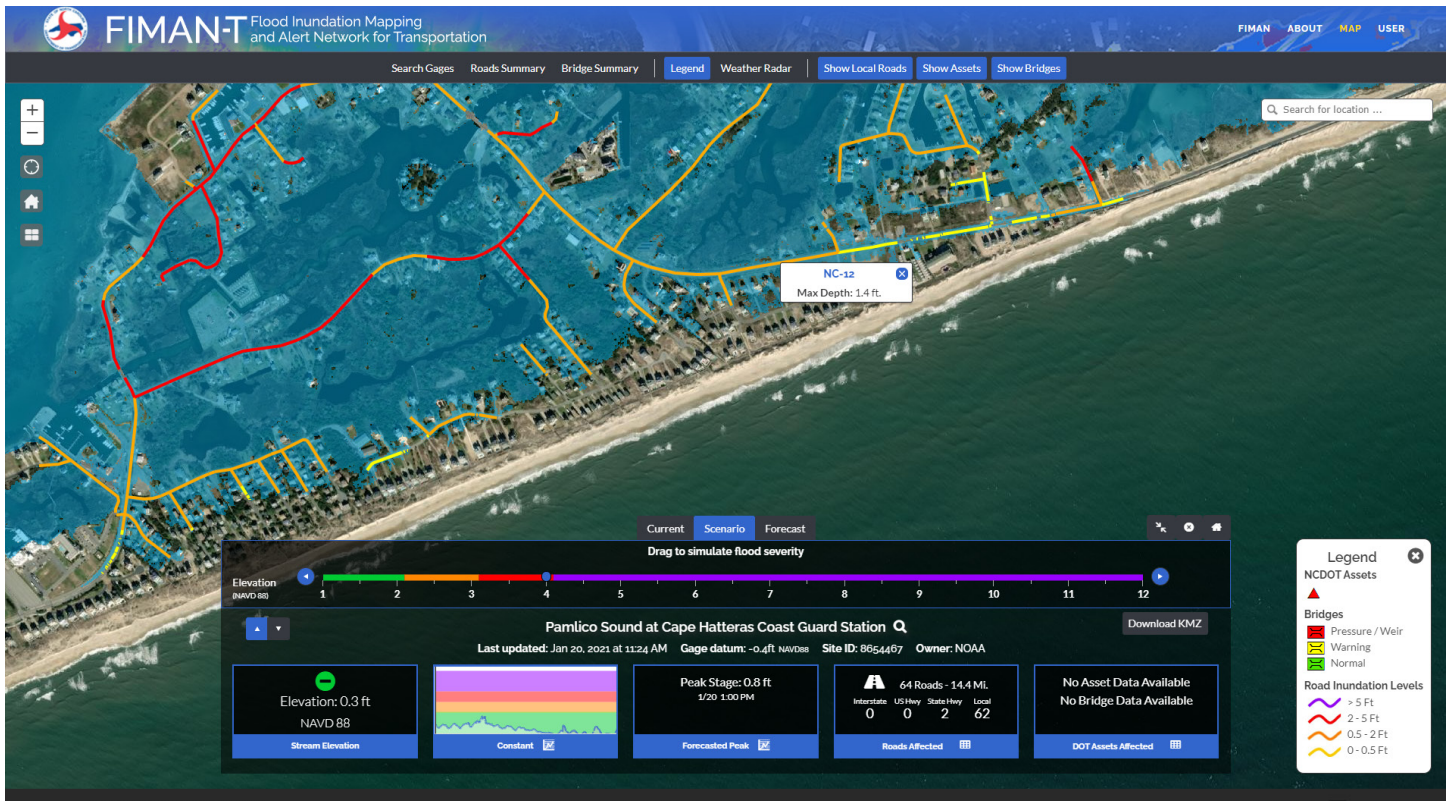
In addition, both hurricanes tested the application under extreme access loads. For example, during the two weeks of flooding resulting from Hurricane Florence, the application saw over 50 million hits and performed with no downtime or service interruption. This performance included national coverage including the NY Times and tweets from the Weather Channel's Jim Cantore. These events also offered chances to evaluate the accuracy and reliability of the FIMAN system – the graphic to the left shows a comparison of the FIMAN real-time inundation levels compared to the actual event flooding extents observed from NOAA aerial photography.



FIMAN-T

Enhanced Awareness of Flooded Roadways and Infrastructure

Expanding with FIMAN-T: In 2020, NCDOT and NCEM partnered to develop FIMAN for Transportation (FIMAN-T), a web-based tool used to provide NCDOT officials and emergency management stakeholders with real-time and forecasted flood inundation depths along roads, bridges, and other NCDOT assets in support of risk-based decision-making during flooding events. The goal of FIMAN-T is to provide visualization and metrics for roadway inundation, bridge hydraulic performance and identify potentially impacted NCDOT assets. This will enhance NCDOT's responsiveness during flooding events by generating data and reports for use in disaster response and planning. A pilot was completed for the Neuse River basin for use during the 2019 Hurricane season.



Example of FIMAN-T Road Flooding Predictions along NC 12 in Cape Hatteras

How FIMAN-T Works: FIMAN-T leverages the real time, 3D inundation mapping coupled with LIDAR derived roadway elevation layers to compute flooding depths over roadways for both current and forecasted conditions. The application features an interactive dashboard allowing users to navigate between current conditions, modeled scenarios, and forecasted conditions where available. The dashboard also features different "info-widgets" that provide detailed information including Stream Elevation, an interactive stage hydrograph, and Forecasted Peak. In addition, the Road Affected widget gives you the option to view a summary table of all impacted roads within the inundation extent of the selected gage, or a sortable and filterable table showing all impacted roadway segments (shown on the right). The system also leverages the DOT bridge database to provide real time bridge hydraulic performance dashboards during flooding events (shown on the left). The system reports critical emergency response information such as bridge freeboard (the distance between the water surface and the bridge's low chord elevation) and has the option to export this information to a PDF report.

What's Next for FIMAN-T: NCDOT and NC Emergency Management are working together to expand FIMAN-T sites include high risk transportation corridors such as I-40, I-95, NC24, US74 and other areas. In addition, new functionality is being added to FIMAN-T to include forecasted Hurricane and Tropical Storm surge inundation and roadway impacts for the entire NC Coastline allowing Emergency Managers and First Responders to have awareness of potential roadway and evacuation impacts from an approaching storm.

