



NORTH CAROLINA
Department of Transportation



Storm Operations: BridgeWatch and FIMAN-T

METTS West

April 7th, 2022

Matt Lauffer - Hydraulics



AGENDA:

1. BridgeWatch
2. FIMAN and FIMAN-T
3. Flood Warning Tool Team Site
4. Lessons Learned From TD Fred
5. Tools Under Development



Flood Awareness Products Will Be Available in the Future for Direct Use by Division Personnel

- 1) BridgeWatch
- 2) FIMAN-T





NCDOT BridgeWatch



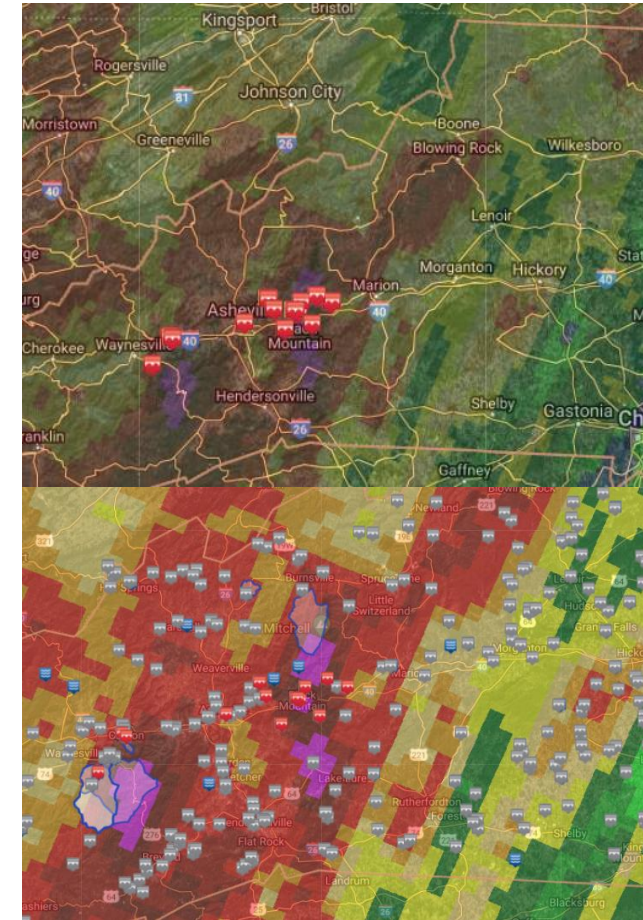
 **BridgeWatch**

What is BridgeWatch?

Real-time monitoring for structures over water.

Alerted immediately when levels exceed set threshold

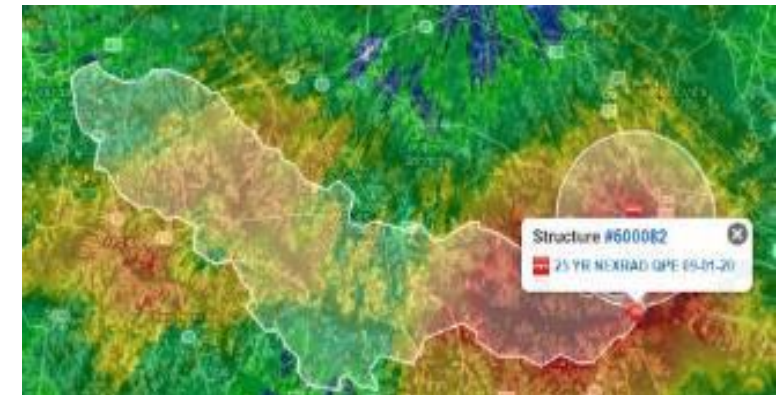
Alerts help identify flooded roadways and scour critical structures impacted by heavy rainfall



How BridgeWatch Works to Send Alerts



- 395 Gauged Bridges with Pre-Set Elevations Triggering:
 - Overtopping Alerts
 - Low Chord Alerts (Bottom of Girder)
 - Freeboard Alerts (2ft Below Girder)
- 15,700 Rainfall Alerts (25-year Storm and Greater) from Weather Radar



BridgeWatch Metrics

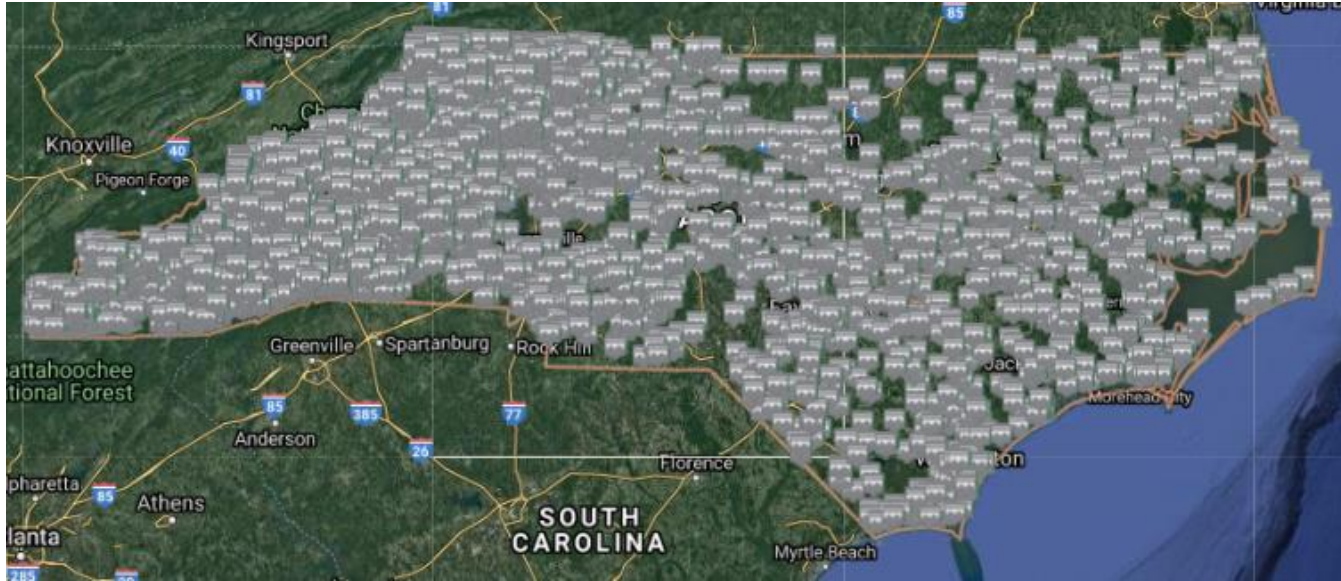
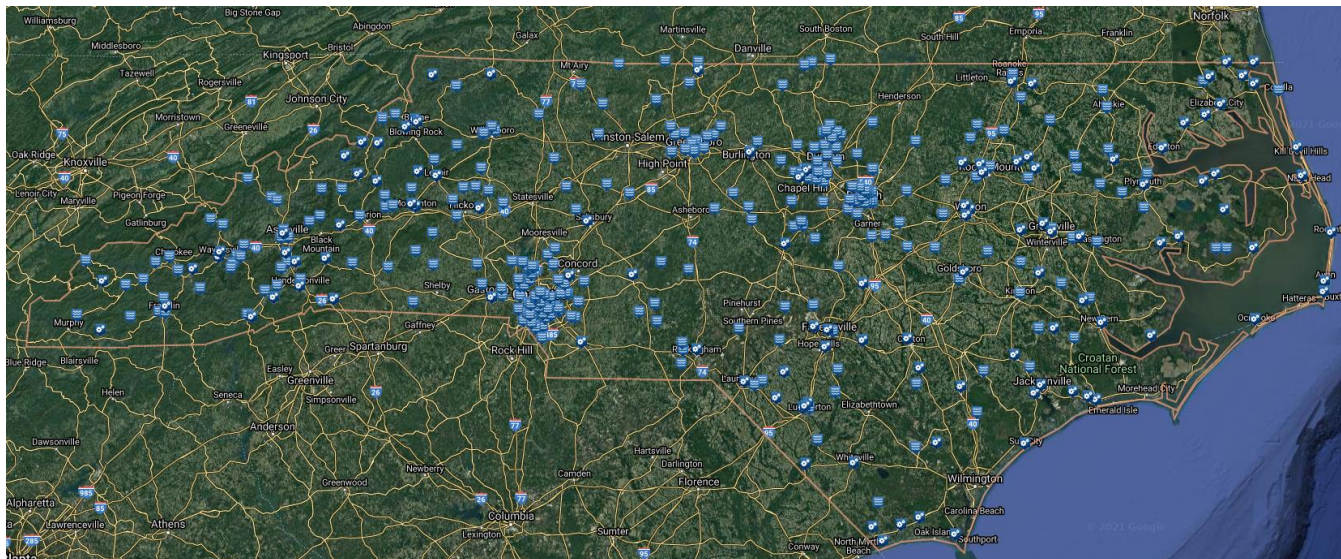


Figure of all gage locations

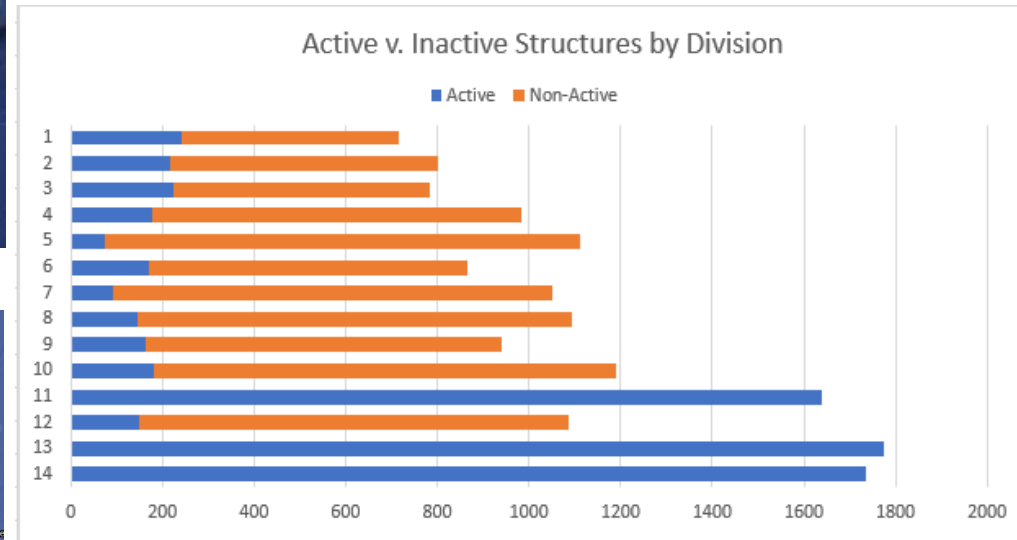


Structures

6978 Actively monitored

15767 Total in BridgeWatch

- 743 Active Evacuation Route Structures
- 5 Priority Structures Monitored (post-Fred)



Gages

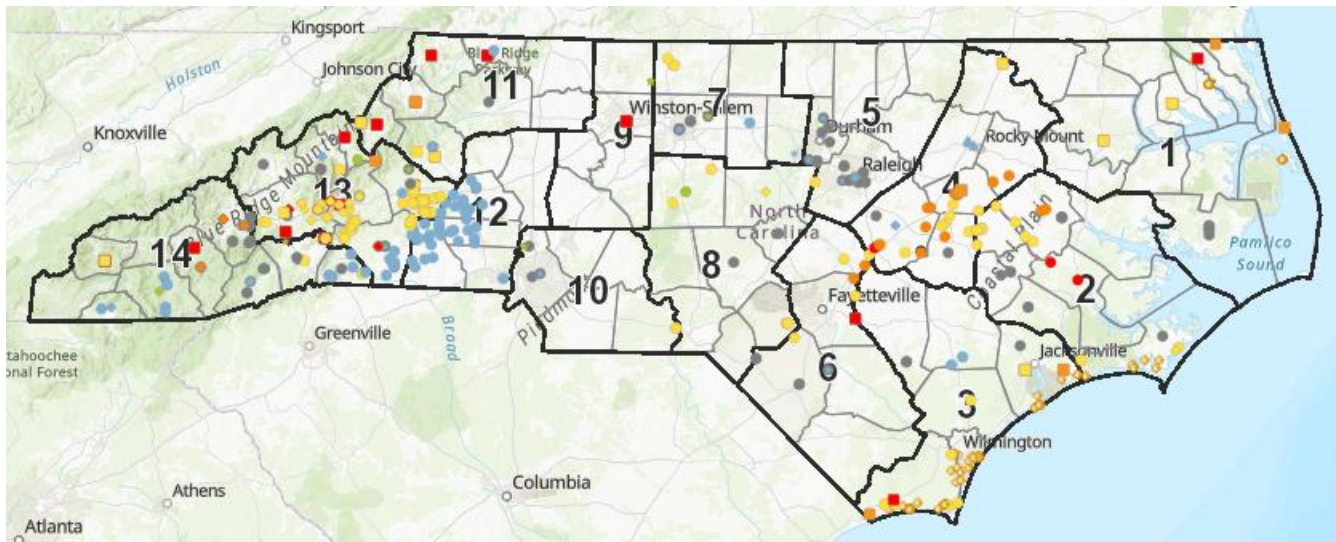
395 Gages Actively Monitored

USGS gages: 281

NCEM gages: 114/129

BridgeWatch Output

- 1) Flood Alerts Direct to Text or Email
- 2) Flood Alerts Displayed on Online Map
- 3) Summary of Alerts in Excel Format



[External] BridgeWatch - Device Alert

N
 NCBridgeWatch@ncdot.bridgewatch.us
 To ✔ Smith, Charles R

i You forwarded this message on 2/24/2022 7:14 AM.
 If there are problems with how this message is displayed, click here

CAUTION: External email. Do not click links or open attachments

Structure Overtopping bridges: 780045 (In Rockingham)

[NCEM Structure Overtopping](#)

Bridge: [780045](#)

County: Rockingham

Road: SR2282

Stream: DAN RIVER

Lat\Long: 36.485,-79.763

Gage: 30020

Time: 2022-02-24 06:16:01 UTC

Event Value: 49.02

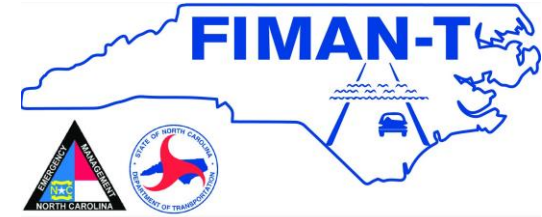
Threshold Exceeded: 45.4

Confirmation: Yes

(USGS Alert) USGS Structure
 Overtopping Br [990040](#) (Yancey)@
 NC197 & CANE RIVER Lat\long:
 35.830,-82.318 Time: 2021-12-03
 15:30:00.0 17.77 > 17.06

FIMAN-T and FIMAN

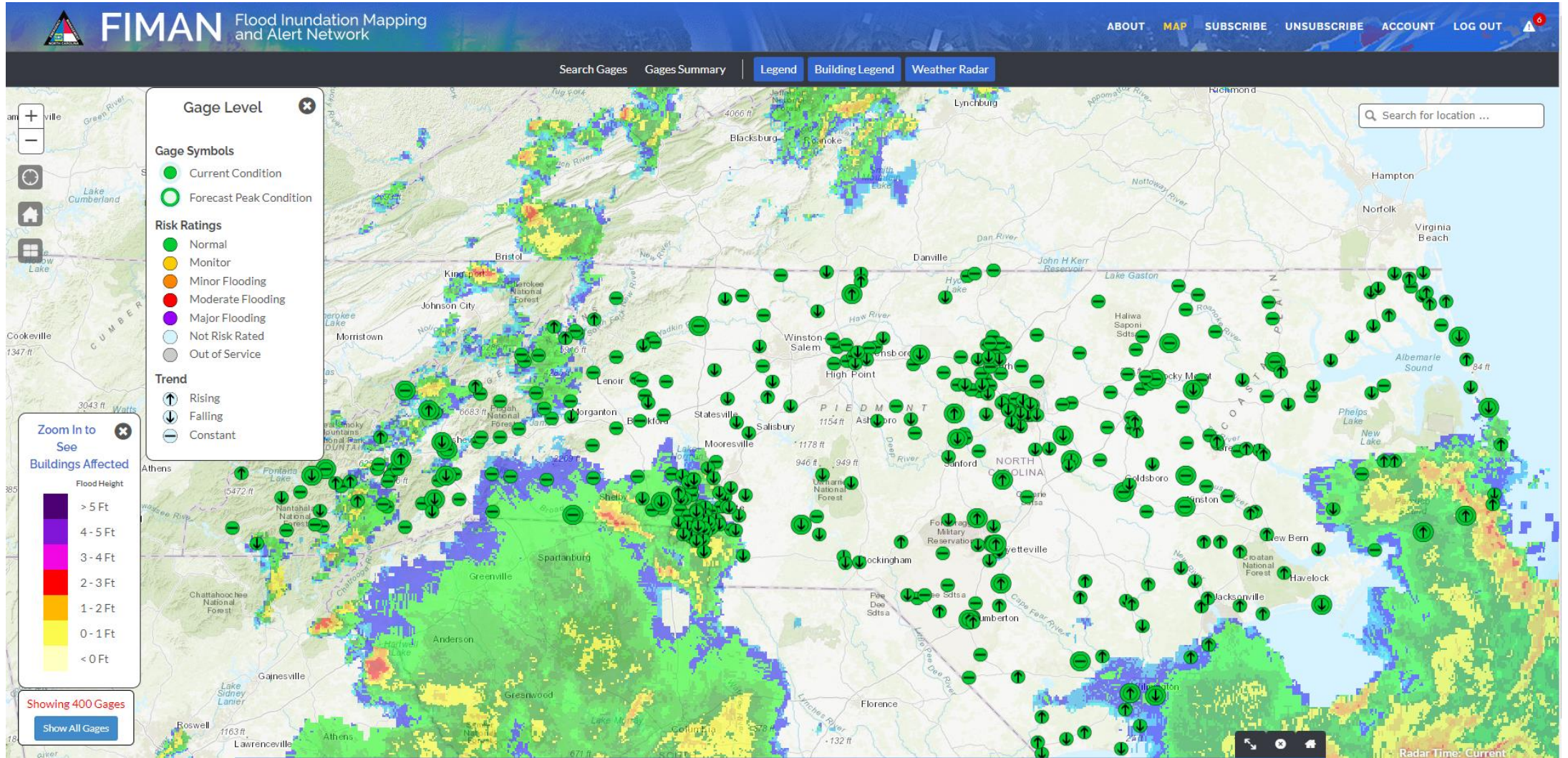
Flood Inundation Mapping and Alert Network for Transportation



Gauges and River Water Surface Models Are Used To Show Current and Forecasted Flooding from Rivers and Coastal Areas

Users will Investigate Roads of Interest, then Sign Up for Pre-Set and Custom Flooding Alerts by Text and Email, Using a Two-Step Process

(Also note that an Excel-based FIMAN-T summary is in development)



Subscribing to FIMAN Alerts

Step 1 - Start on FIMAN-T Website

The screenshot displays the FIMAN-T website interface. The top navigation bar includes the FIMAN-T logo and the text "Flood Inundation Mapping and Alert Network for Transportation". The main menu contains "FIMAN", "ABOUT", "MAP", and "USER". Below the menu, there are tabs for "Gage Based", "CERA Surge", "Search Gages", "Roads Summary", "Bridge Summary", "Legend", "Weather Radar", "Show Local Roads", "Show Assets", and "Show Bridges". The main content area shows a map of the Neuse River at Kinston with a flood inundation overlay. A slider at the bottom allows users to simulate flood severity by dragging a marker along a scale from 26 to 42. The current stage is 5.5 ft. The legend on the right side of the map shows various symbols for bridges, NCDOT assets, and road inundation levels. Three callout boxes with red arrows provide instructions: 1) Click on a Green Gauge Symbol and Select "Scenario"; 2) Move Slider Until Road is Highlighted. (See legend at lower right >>>); 3) Caswell Rd starts to flood at River Stage 26.5. Note this elevation for Step 2.

1) Click on a Green Gauge Symbol and Select "Scenario"

2) Move Slider Until Road is Highlighted. (See legend at lower right >>>)

3) Caswell Rd starts to flood at River Stage 26.5. Note this elevation for Step 2.

Legend

Bridges

- Pressure / Weir
- Warning
- Normal
- Not Reporting

NCDOT Assets

- Building
- Land

Road Inundation Levels

- > 5 Ft
- 2 - 5 Ft
- 0.5 - 2 Ft
- 0 - 0.5 Ft

Neuse River at Kinston

Last updated: Feb 25, 2022 at 11:00 AM Site ID: 02089500 Owner: USGS Gage datum: 9.8ft NAVD88
RFC Forecast Peak: No Forecast Available

Stage (ft): 5.5
Elevation (NAVD 88): 15.3 ft

Event: 09/22/1999 Hurricane Floyd Peak Stage: 27.71 ft

Roads Affected: [Grid Icon]

Bridges Affected: [Grid Icon]

Subscribing to FIMAN Alerts

Step 2 – Set Alerts on FIMAN Website

ALERT SETTINGS
Neuse River at Kinston

Alerts My Account

+ ADD NEW ALERT

| Stage | Alert Level | Action |
|----------|-------------------|--------|
| 21.0 ft. | Major Flooding | ✕ |
| 18.0 ft. | Moderate Flooding | ✕ |
| 14.0 ft. | Minor Flooding | ✕ |
| 13.0 ft. | Monitor | ✕ |

ALERTS WILL BE SENT WHEN THE FOLLOWING CONDITIONS ARE MET:
Click to Activate/Deactivate

Rises Above Falls Below Forecast to Rise

Forecast to Fall

Selected conditions will be applied to all gage alerts.

Unsubscribe

CANCEL SAVE

Gage Level

Gage Symbols

- Current Condition
- Forecast Peak Condition

Risk Ratings

- Normal
- Monitor
- Minor Flooding
- Moderate Flooding
- Major Flooding
- Not Risk Rated
- Out of Service

Trend

- ↑ Rising
- ↓ Falling
- Constant

Neuse River at Kinston

Last updated: Feb 28, 2022 at 8:15 AM Gage datum: 9.8ft NAVD88 Site ID: 02089500 Owner: USGS

Stage: 5.4 ft
15.1 ft NAVD88

1290 cfs

Peak Stage: 12.9 ft
1/23 1:00 AM
No Data Available

No Damages Assessed

Report

Showing 404 Gages
Show All Gages

Radar Time: 15 min. ago

2) Set a Custom Alert at the Road Flooding Elevation Found on FIMAN-T

1) Click on The Same Green Gauge Symbol and Select Red Triangle

SharePoint Search this site

NCDOT - Hydraulics Flood Warning Tools

Home + New Page details Analytics

Conversations Documents Notebook Pages Site contents Recycle bin Edit


BETA SITE UNDER DEVELOPMENT

BridgeWatch FIMAN-T & FIMAN FIMAN-T SURGE

BridgeWatch

Bridgewatch is a real-time bridge flooding warning system that relies on stream gauges and weather radar to indicate when bridges and culverts are near flooding, actively flooding, or weather conditions are favorable for flooding. Users can subscribe to text and/or email alerts, or view flooding statuses on a GIS map. Uses for Bridgewatch include: Closing and Reopening flooded roadways, compiling inspection list for flooded bridges, relief and resupply route finding.

Users wanting to monitor gauges of interest that are not currently triggering alerts should use [FIMAN](#).



BridgeWatch Alert Descriptions

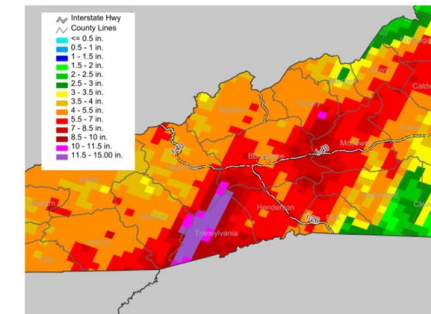
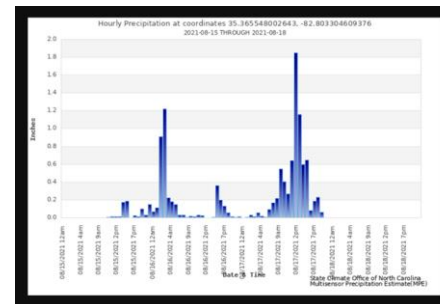
NON-GAUGE ALERTS: SLOSH, NEXRAD, & QPF

Forecast Coastal Storm Surge SLOSH (Watch-Yellow)

SLOSH ALERT IS ISSUED WHEN HURRICANE STORM SURGE HAS A 10% CHANCE OF EXCEEDING BRIDGE LOW CHORD ELEVATIONS. SLOSH ALERTS INDICATE FAVORABLE CONDITIONS FOR FLOODING - NOT THAT FLOODING IS IMMINENT OR OCCURING.

Lessons from TD Fred

- Use BridgeWatch to monitor temporary structures. Five in Division 14 and One in Division 13. Help provide more situational awareness in remote locations.
- Hydraulic coordinated with USGS to have a Rapid Deployment Gage placed on NC 197 at Bridge 990040 to provide Division 13 with real-time data on stream levels that will be provided through BridgeWatch. Installation completed on 8/31/21.
- All bridges for Divisions 11, 13 and 14 were activated in BridgeWatch for Tropical Depression IDA.
- Countywide rainfall awareness
- Land slide awareness



ncdot.bridgewatch.us/main/main-app.html#/structure

Google Bookmark ★ Bookmarks 2021_NCDOT_MP Storm_Event_Respo... Weather NCDOT -Resources OFFICE_365 Projects Family USCG Navy Landon_College GRACE Enrichment C-22 Faith Lily_Folder » | Other bookmarks

Structures Search

Quick Filter...

| Primary Identifier | Status | County | Division | Corridor | Latitude | Longitude | Stream Name | Road | Structure | River Basin |
|--------------------|--------|---------|----------|----------|----------|-----------|----------------------|--------|-----------|-------------|
| 430003 | Active | Haywood | 14 | Priority | 35.4178 | -82.8113 | E.FORK PIGEON RIV... | SR1887 | BRIDGE | CATA |
| 430005 | Active | Haywood | 14 | Priority | 35.4286 | -82.7986 | PISGAH CREEK | SR1888 | BRIDGE | CATA |
| 430026 | Active | Haywood | 14 | Priority | 35.5668 | -82.801 | UT TO N.HOMINY C... | SR1608 | BRIDGE | CATA |
| 430375 | Active | Haywood | 14 | Priority | 35.5173 | -82.8093 | DUTCH COVE CREEK | SR1856 | BRIDGE | CATA |
| 430382 | Active | Haywood | 14 | Priority | 35.5219 | -82.8145 | DUTCH COVE CREEK | SR1835 | BRIDGE | CATA |
| 990040 | Active | Yancey | 13 | Priority | 35.8297 | -82.3181 | CANE RIVER | NC197 | BRIDGE | CATA |

Hybrid Map

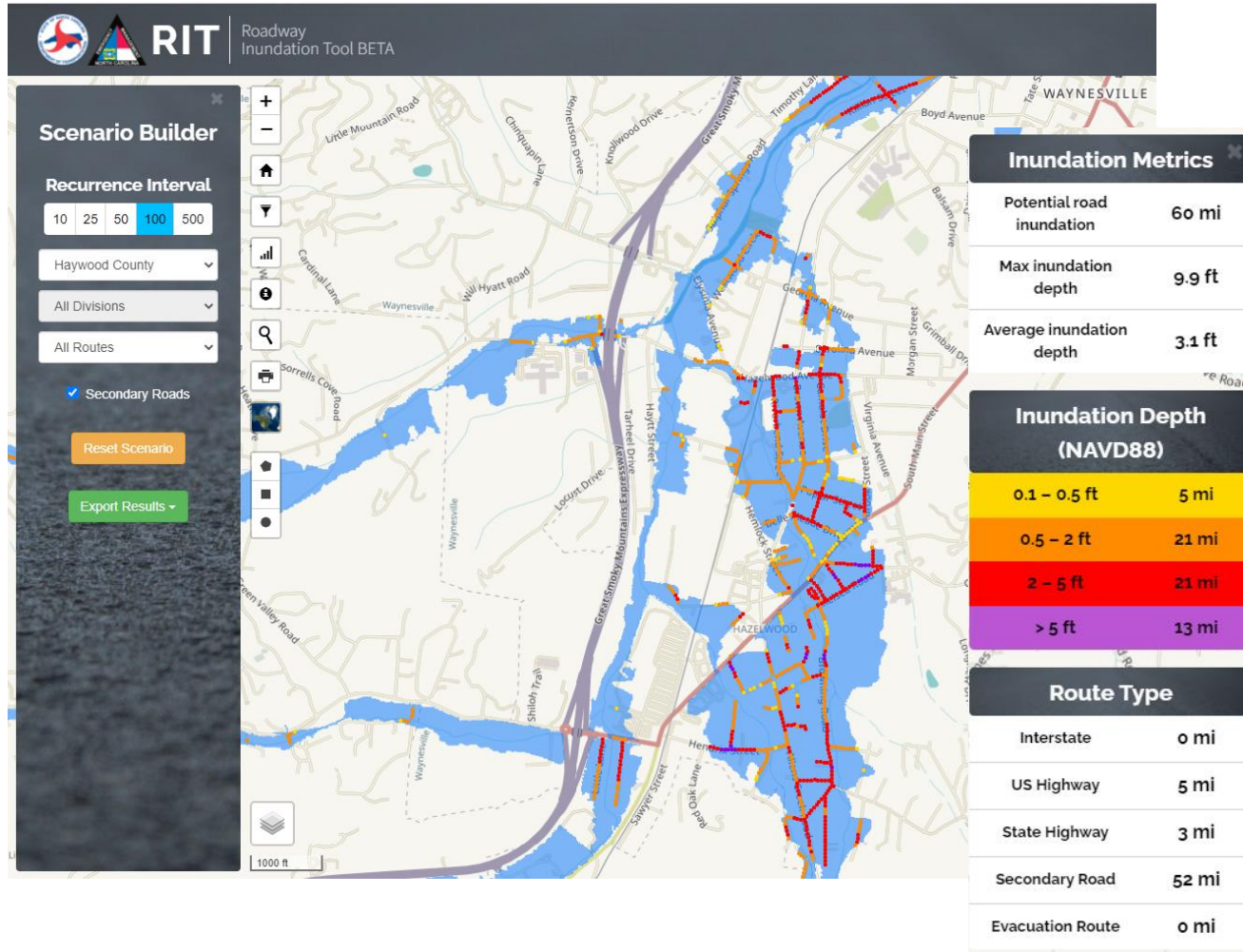
PRIORITY

2 Watchlist

Structures



Roadway Inundation Tool (RIT)



- Based on multi-frequency riverine flood studies
 - 10-, 25-, 50-, 100- and 500-year recurrence intervals
- Statewide coverage
- Primary and secondary roads



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<https://ncconnect.sharepoint.com/sites/HydroFloodWarningTools>

Additional training planned for June