



Maintaining Environmental Compliance during a Natural Disaster: CSX Transportation's Emergency Response to the Historic South Carolina Flooding



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The Event: A Perfect Storm

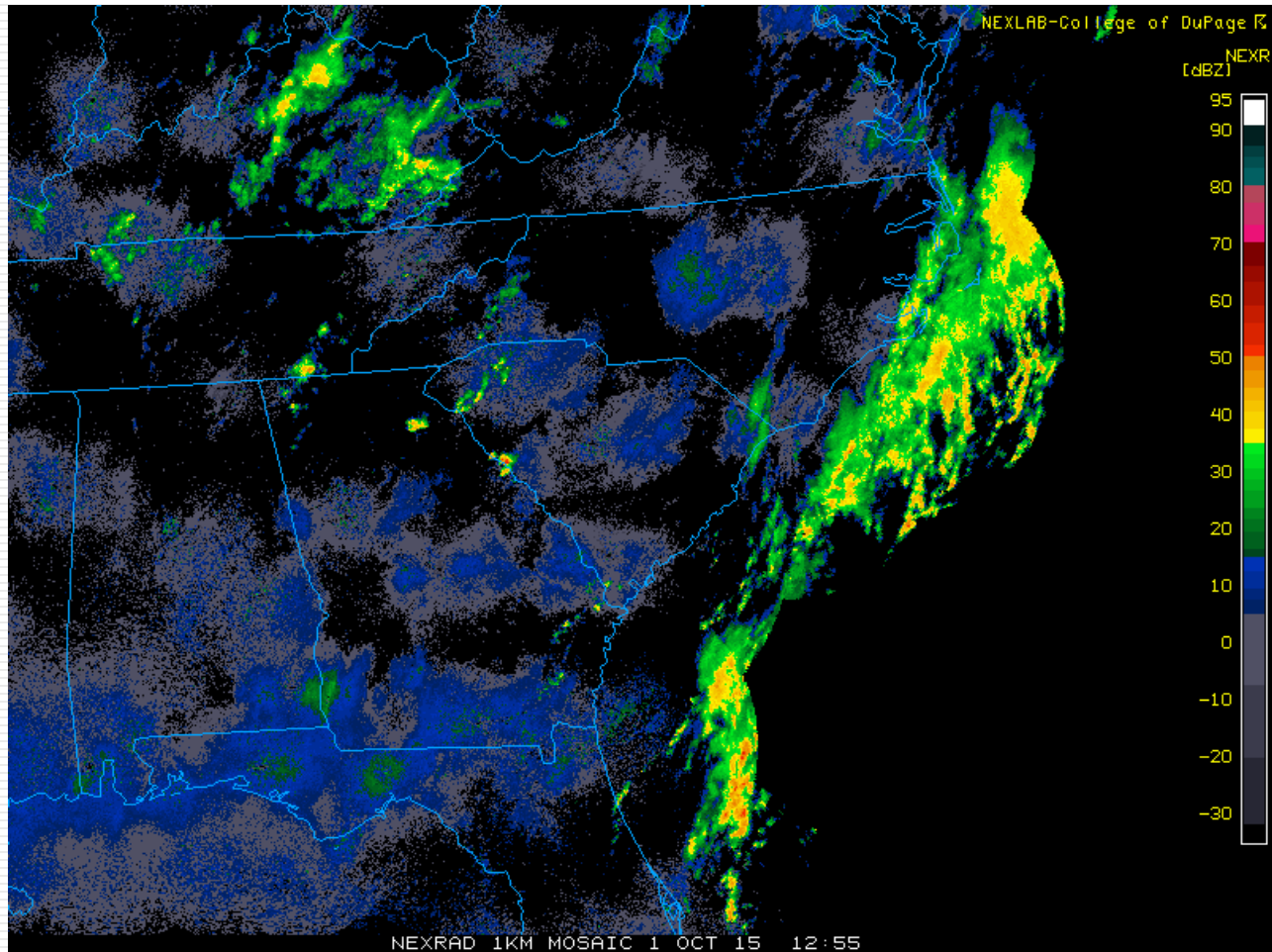
- A historic flooding event that affected the Carolinas from October 1-5, 2015.
- A stalled weather front offshore combined with deep tropical moisture streaming northwest into the area ahead of a strong upper level low pressure system to the west and Hurricane Joaquin to the east.
- This led to historic rainfall with widespread amounts of 15-20 inches and localized amounts over 25 inches.
- Flash flooding was prevalent and led to significant damage to numerous properties and roads and many people having to be rescued by emergency personnel.

The Event: A Perfect Storm

Additional Facts

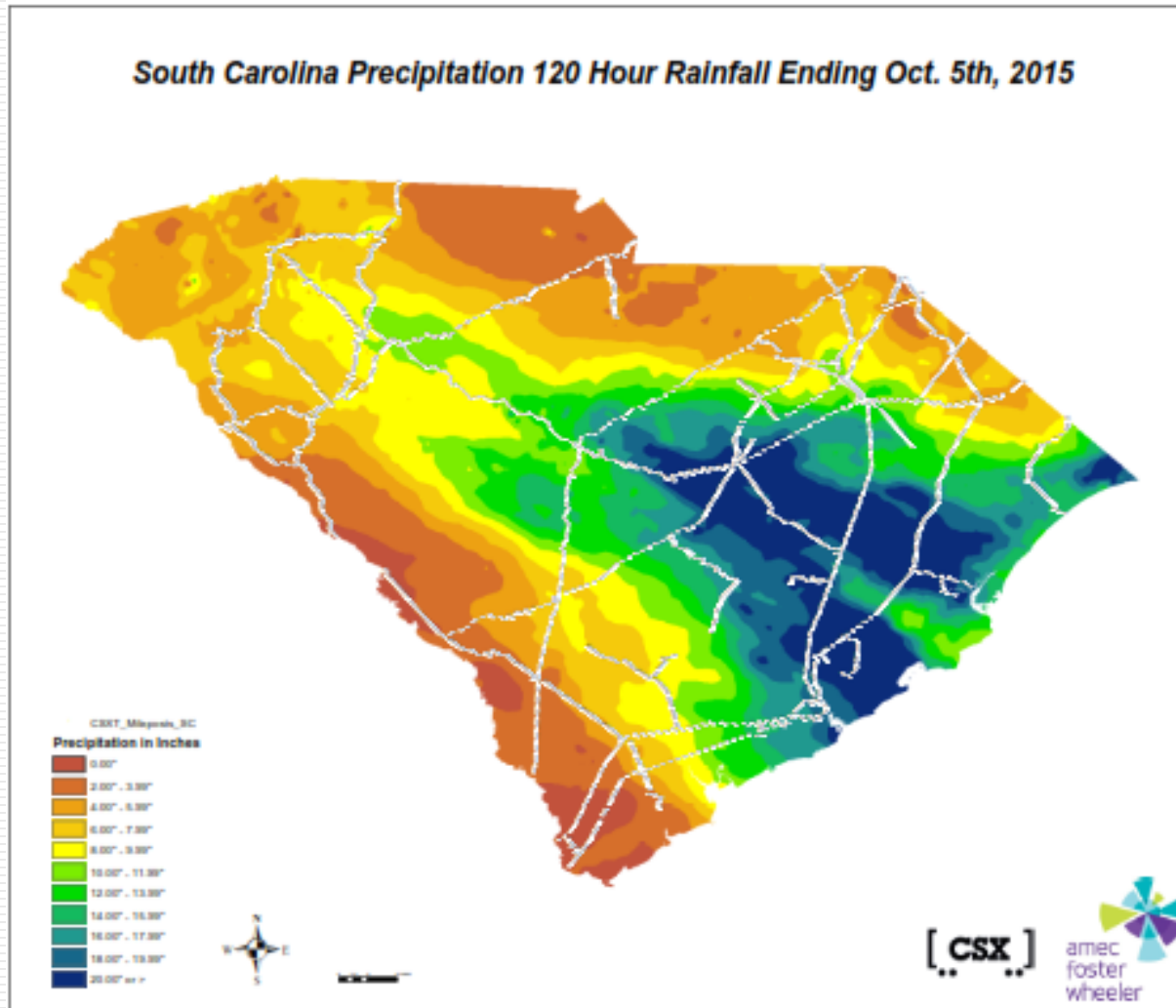
- The official statewide 24-hour rainfall record was exceeded in several locations.
- The unofficial state record for 5-day total rainfall, which had stood for 107 years, was surpassed at more than a dozen reporting sites.
- The rainfall exceeded that of any tropical system in South Carolina history.
- Seven sites with more than 50 years of data recorded their “wettest” October on record.

The Event: A Perfect Storm



Source:www.weather.com

The Event: A Perfect Storm



The Damage: Disaster in South Carolina

- 22 of the 46 counties in SC declared disaster areas.
- Over 50 dams severely damaged or breached.
- Over 160,000 homes received damage.
- Over \$12 Billion dollars in damage.
- Road and other infrastructure damage repairs still ongoing.



The Damage: CSX Infrastructure

- Over 100 damage locations to CSX's rail system identified on 8 subdivisions. Over 50% of these reporting severe damage.
- Damage varied from minor embankment washout to complete bridge collapse.
- Eastover Subdivision was worst hit.



The Damage: CSX Infrastructure



AKA 366.1 – 10' Brick Arch at Mill Creek

The Damage: CSX Infrastructure



AKA 360.3 – 12' Brick Arch at Cedar Creek

The Damage: CSX Infrastructure



AKA 356.6 – 90' Timber Bridge at Toms Creek

The Response: Where do we even begin?

- On Monday October 5th, CSX began helicopter reconnaissance to inventory and assess the damage to the infrastructure.
- Amec Foster Wheeler deployed multiple teams of engineers to access the damage.
- Amec Foster Wheeler engineers were teamed with CSX local bridge department employees to perform “boots on the ground” assessments.
- Amec Foster Wheeler engineers and scientists in multiple offices began performing watershed delineations and desktop environmental surveys to determine impacts.

The Response: CSX Transportation's commitment to Environmental Compliance

- Conversations with USACE and SCDHEC began immediately.
- Agencies were provided “up to date” repair lists to keep them informed of ongoing efforts.
- All work would be completed under USACE Nationwide Permit #3 or #14.
- Due to the damage to rail and other critical infrastructure, USACE and SCDHEC eventually released emergency repair procedures and removed Section 404 water quality conditions to NWP #14.

The Response: Putting it back and getting it right

- Amec Foster Wheeler engineers used information obtained from site visits, CSX valuation maps, and digital data to accurately determine the pre-storm structure and its capacity.
- Supplier inventories were obtained to determine available replacement sizes.
- Continuous coordination between CSX, Amec Foster Wheeler, and contractors performing work to ensure proper installation at each location.
- All locations sized to pass the FEMA 100 YR storm without impacts to upstream or downstream property owners.

The Response: Repairs Being Implemented



Pre-Storm – 10' Brick Arch
Post-Storm – 12' Multi-Plate Pipe

AKA 366.1 – Mill Creek



The Response: Repairs Being Implemented



AKA 360.3 – Cedar Creek

Pre-Storm – 12' Brick Arch
Post-Storm – 14' Multi-Plate Pipe



The Response: Repairs Being Implemented



AKA 356.6 – Toms Creek



Pre-Storm – 90' Timber Bridge
Post-Storm – (2) 7'6" x 12'11" Pipe Arches

The Response: CSX Transportation's commitment to its neighbors and customers

- By October 10th, seven of the eight subdivisions impacted by the storm were re-opened to train traffic.
- The Eastover Subdivision (most severely damaged) re-opened in early November 2015. Approximately one month after the storm.
- After replacement, CSX and Amec Foster Wheeler coordinated with the South Carolina Department of Transportation in their design of replacement downstream structures to ensure accurate capacity.
- After many long hours and challenging conditions, no injuries were reported by CSX and Amec Foster Wheeler staff.

How tomorrow moves

