



After the Flood:

Revitalization of DHEC's Dam Safety Program

South Carolina Department of Health and Environmental Control

Healthy People. **Healthy Communities.**

Dam Safety in South Carolina

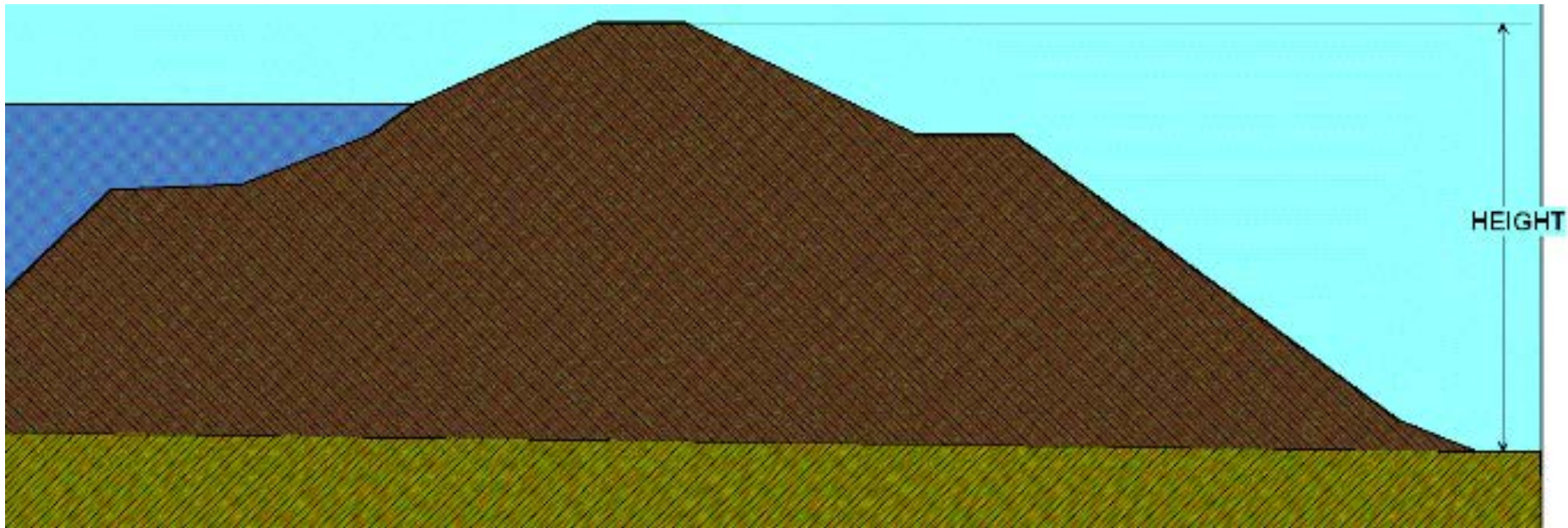
- S.C. Dams and Reservoir Safety Act enacted
- Regulations promulgated 1978
- Initially administered by South Carolina Land Resources Commission
- Mid 1990s – Program shifted to DHEC with state government restructuring

Criteria for Regulation

- Dams that meet any of the following three criteria:
 - 25' in height
 - Impounds 50 ac-ft or more
 - Potential failure may cause loss of human life



Measuring Height



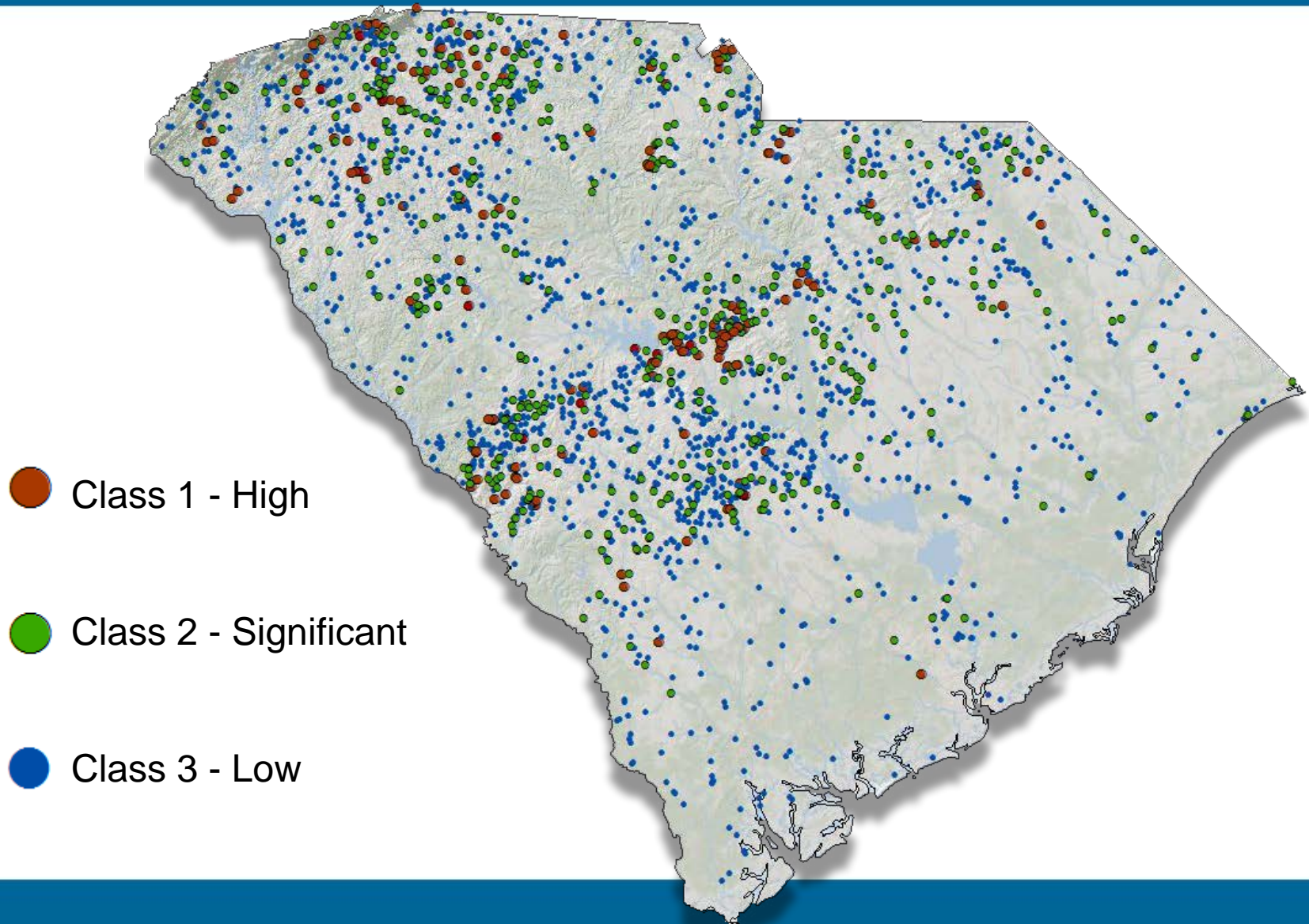
Hazard Classification

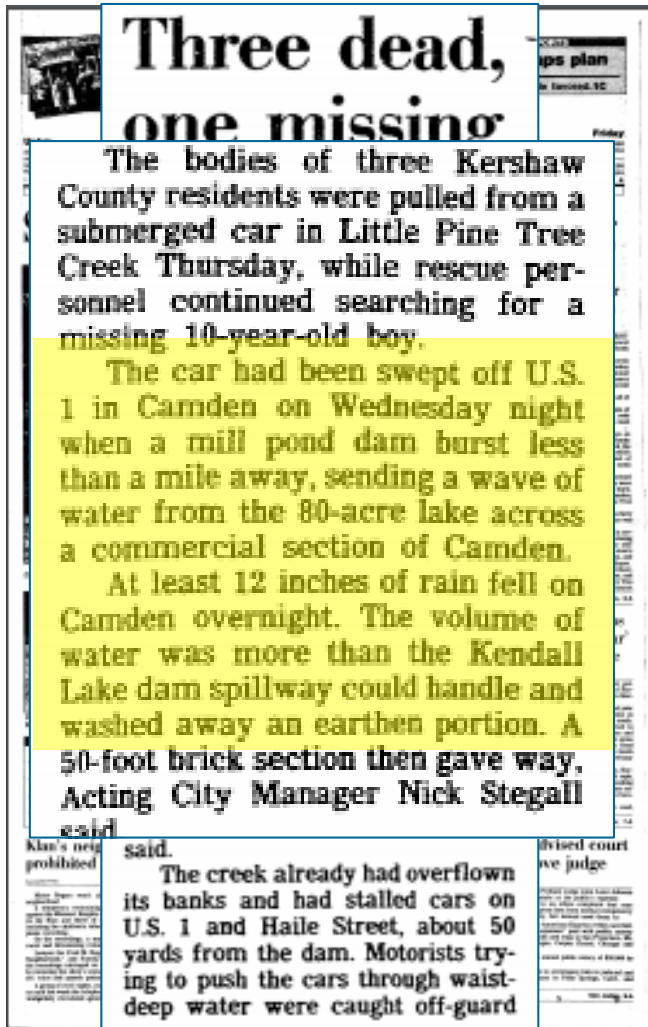
- Dams are classified based on the “hazard” they could bring in the event of failure.
- Hazards can be homes, roads, critical utilities (water, gas, sewer) that may be flooded in the event of dam failure.



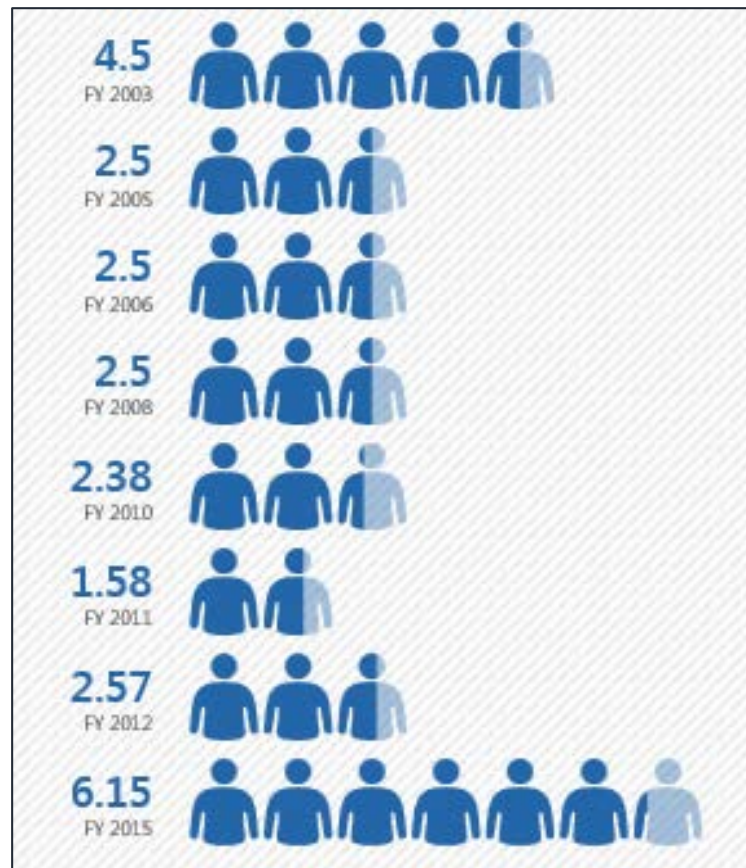
Classification of Regulated Dam s

Class 1	Class 2	Class 3
High Hazard	Significant Hazard	Low Hazard
Dam failure would likely result in loss of life or serious damage to homes, businesses, important public utilities, main highways or railroads	Dam failure wouldn't likely result in loss of life, but property, roads and other key infrastructure would be damaged	Dam failure might cause minimal property damage to others. Loss of life is not expected





Pre-Flood Program Staffing



October, 20 15



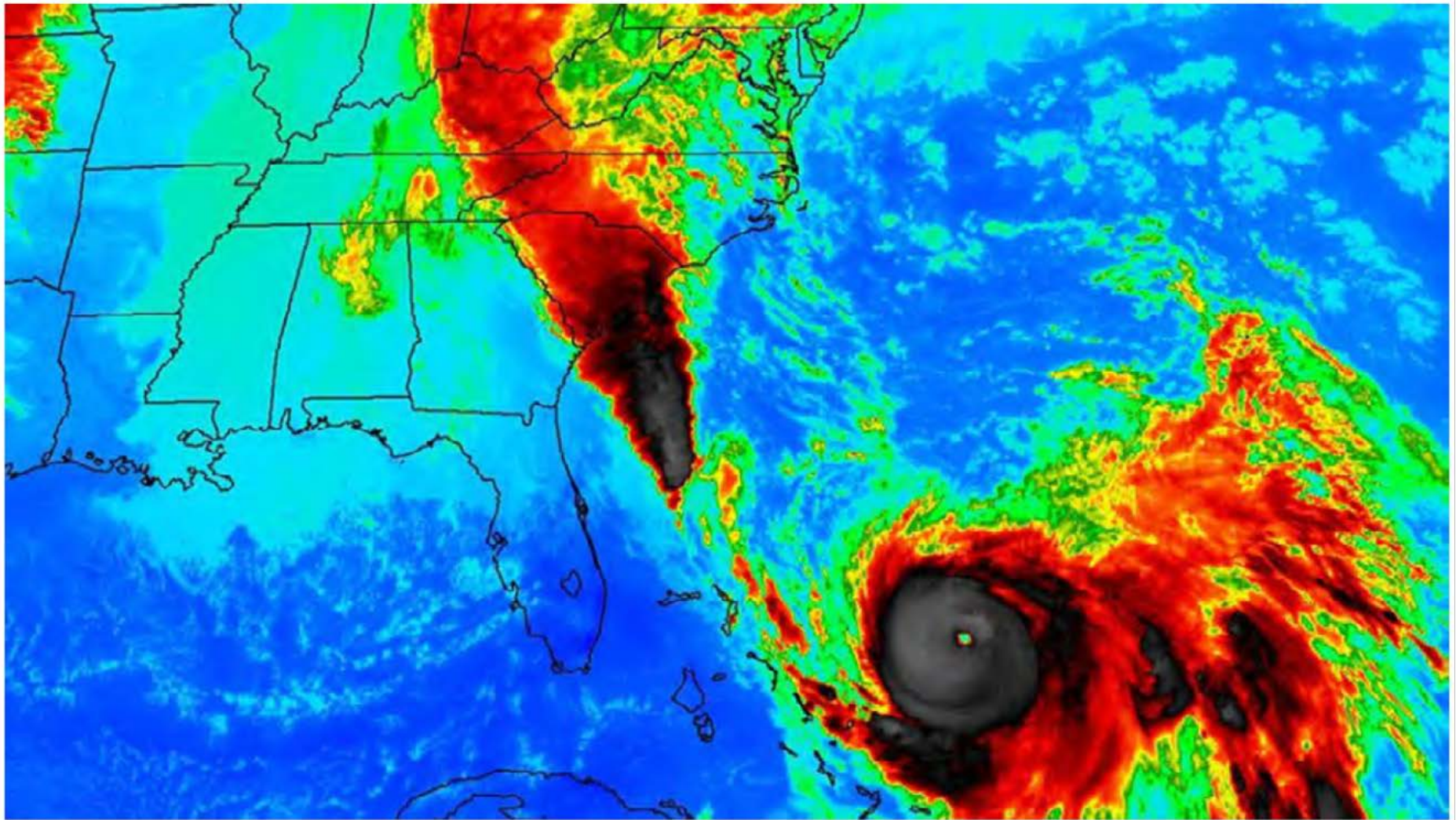


Figure 1. Infrared satellite image of the intense rainfall being funneled into South Carolina during the morning of October 3, 2015. (NASA)



















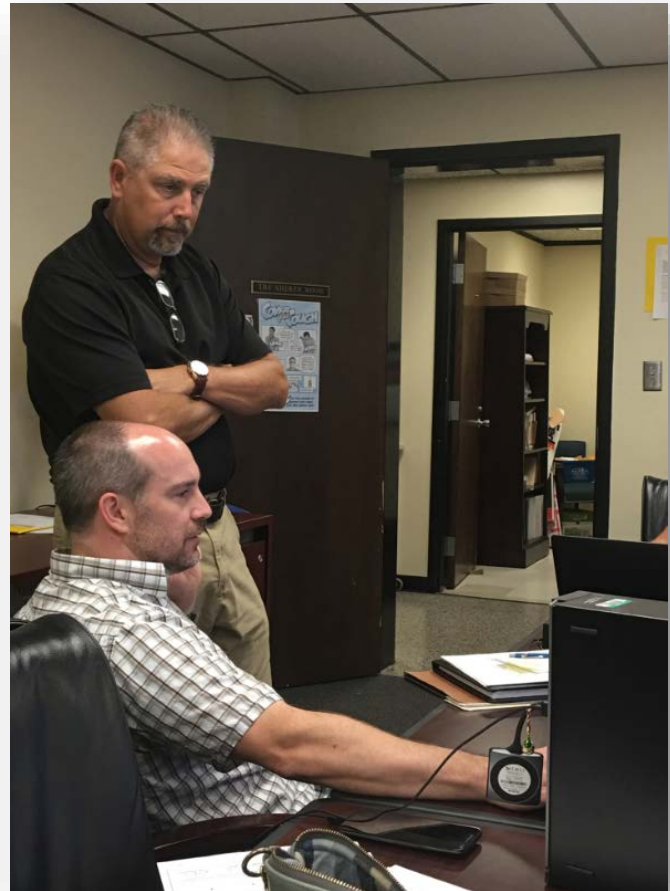




20 15 Flood Impacts

- 75 - Dams under Emergency Order
- 192 - Dams required to have engineering inspection (includes Low Hazard breached)
- 51+ Dams known to have breached
- 10 – Counties with breached dams

Immediate Program Response



Staffing in Immediate Aftermath

- Dam Safety Program brought under fully-dedicated manager.
- One of the Bureau of Water's Assistant Chiefs was fully detailed to the program
- Budget request for additional FTEs

Year	FTE
2015	6.15
2016	14.5

Flood Recovery

- DHEC – HDR Partnership
- Contract through SCEMD
- Assess the Dam Safety Program
- Monitoring of “Red/Orange” where owner has provided inadequate or no response
- Assessment of the Gills Creek Watershed in Richland County and Twelve Mile Creek Watershed in Lexington County
- Engineering support for plan review



Event Response Protocol

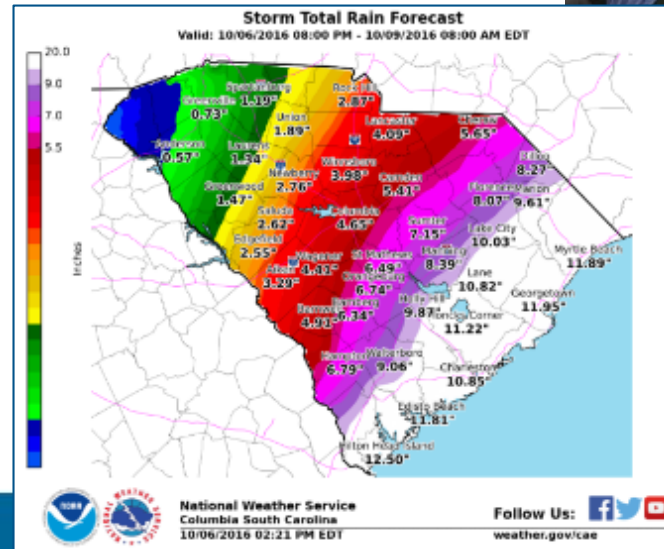
Preparation	Predicted Rainfall $\geq 6''$	Call owners of Emergency Order Dams to alert them of pending rainfall event and advise them to monitor the condition of their dam prior to, during, and after the rainfall event and review Emergency Action Plan.
		Call and email engineers for all permitted Emergency Order and Directive Letter Dams. Request assessment of the condition of the dams they have engineered if predicted rainfall occurs.
Preparation	Predicated Rainfall $\geq 7''$	Implement "Code Red" notification for all dams in the area forecast to receive 7" or more of rainfall. <i>See Code Red SOP.</i>
Response	Rainfall Accumulations $\geq 4''$ (per NWS estimates)	Assess condition of Emergency Order Dams in affected area within 48 hours.
Response	Rainfall Accumulations $\geq 7''$ (per NWS estimates)	Assess condition of High Hazard Dams in impacted area. Call owners in advance of site visit.
		Call owners of Significant Hazard Dams in impacted area and request that owner report back on condition of dam. If no report received within 24 hours of call, dispatch staff to assess dam.

Matthew



Storm Preparations

- Dam Safety Program staff began monitoring of potential impacts from Matthew 4 days before forecasted landfall



Communication of the Hazard



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LOCAL OCTOBER 5, 2016 7:59 PM

As Hurricane Matthew approaches, dam, reservoir owners urged to lower water levels



 **SC DHEC**
Wednesday at 8:12 PM · 🌐

Hurricane MatthewNEWS RELEASE #5
Dam, reservoir owners, operators should begin lowering water levels

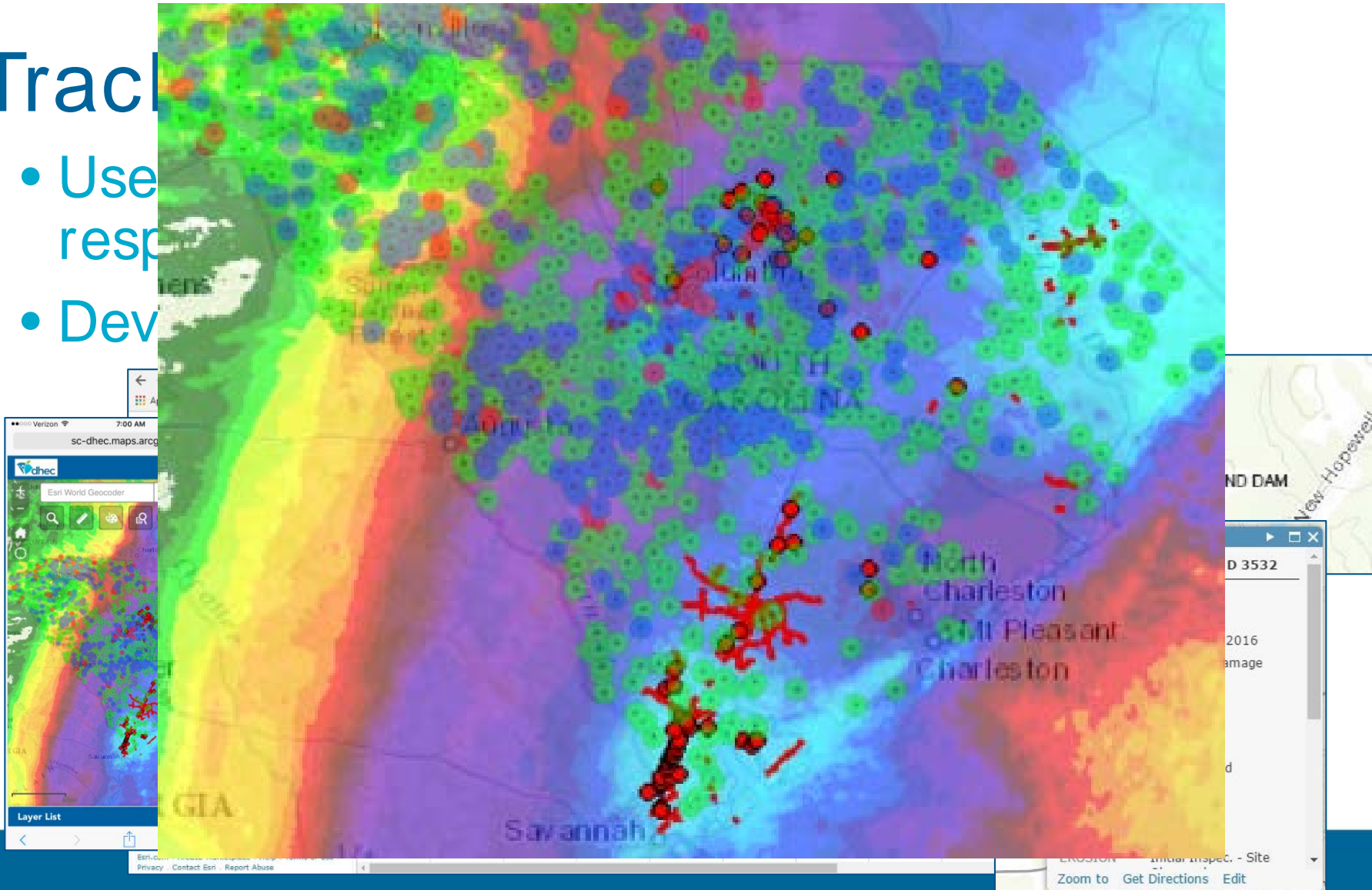
Owners and operators of reservoirs in areas potentially impacted by rain and winds from Hurricane Matthew should check their dams and take appropriate steps to safely lower the water levels today and through the next several days in preparation for the storm, according to the S.C. Department of Health and Environmental Control.
... See More

👤 Virginia Daguise and 3 others 6 Shares

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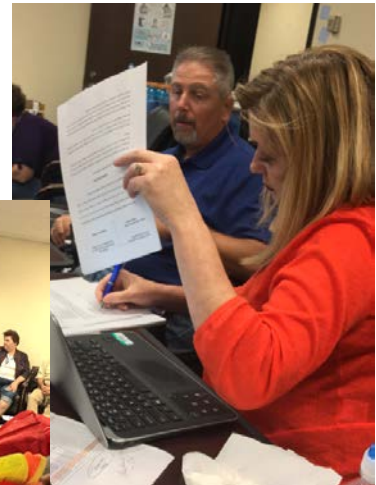
Track

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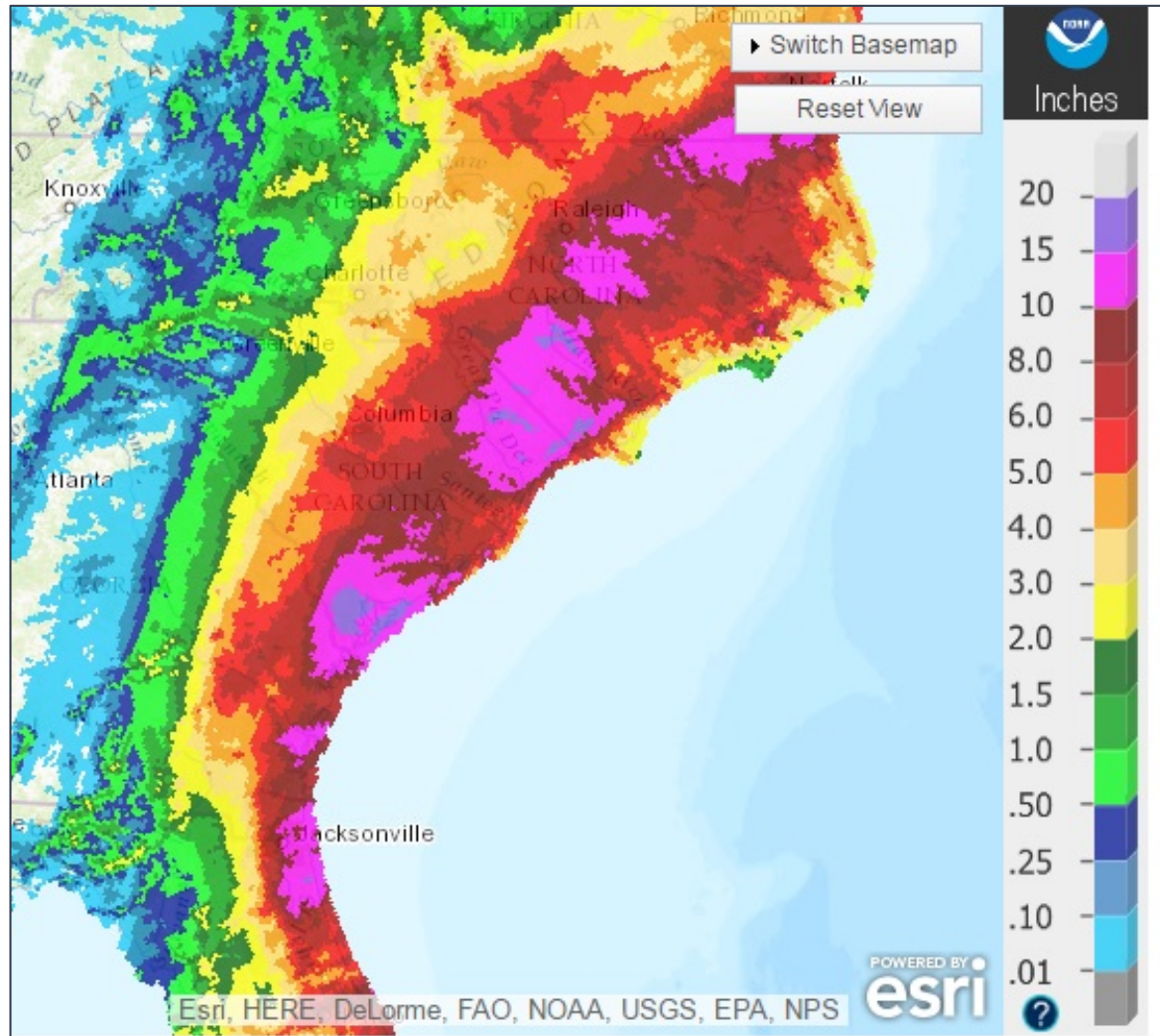
Team work

- Program response takes a multitude of resources including:
 - Upper Management
 - Staff Engineers
 - Non-Program Staff
 - Media Relations
 - Contract Support
 - GIS
 - Legal Staff



Hurricane Matthew



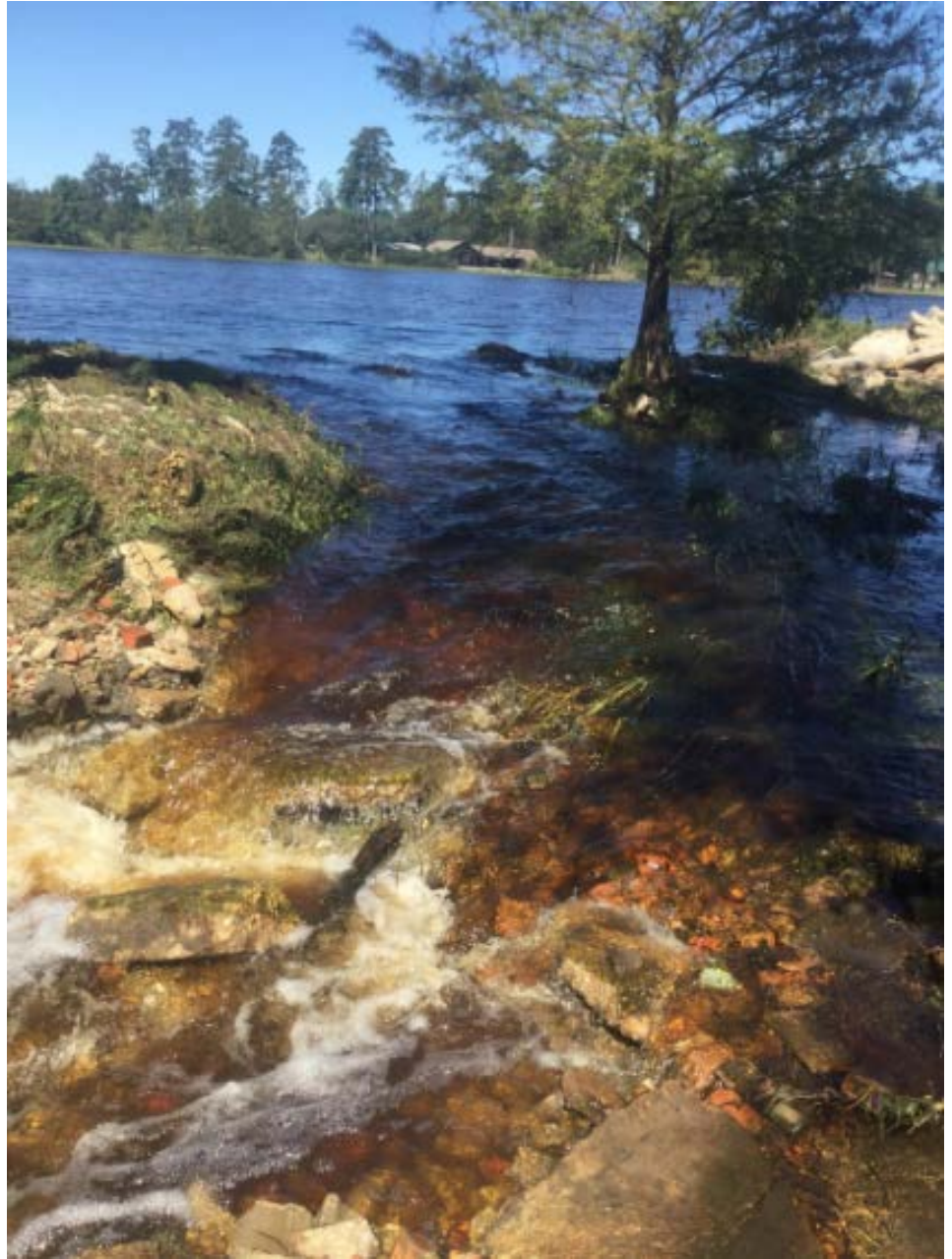














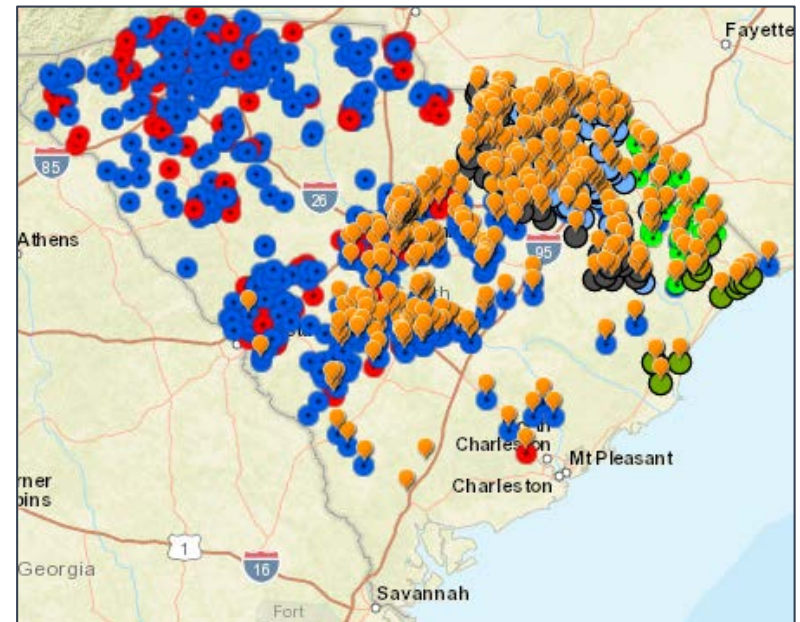






Hurricane Matthew Impacts

- 469 post-storm assessments
- Regulated Dams Breached – 20
- Unregulated Dams Breached - 5
- “Failure Imminent” – 2 (situation now stabilized)



Continued Program Development



Staffing

- Officially 14.5 Full FTE (Full Time Employees)
- Temporary Staff
 - Dam Owner Contact Research
 - File Management
 - Administrative Support
- Interns
 - EAP Development
 - 3-6 on a continuous basis

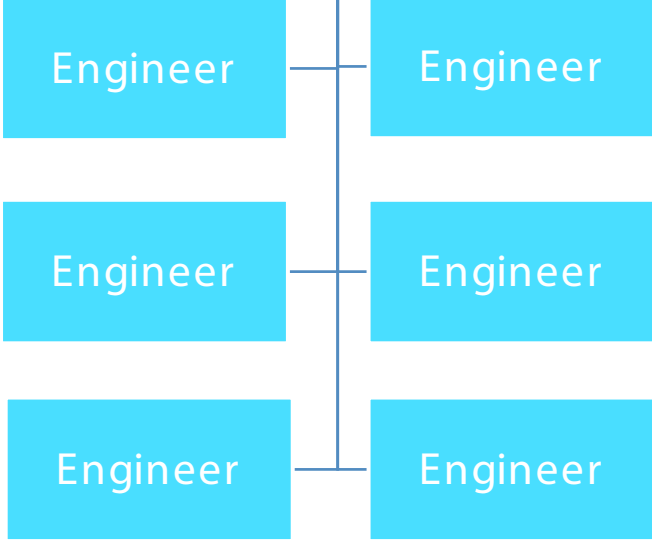
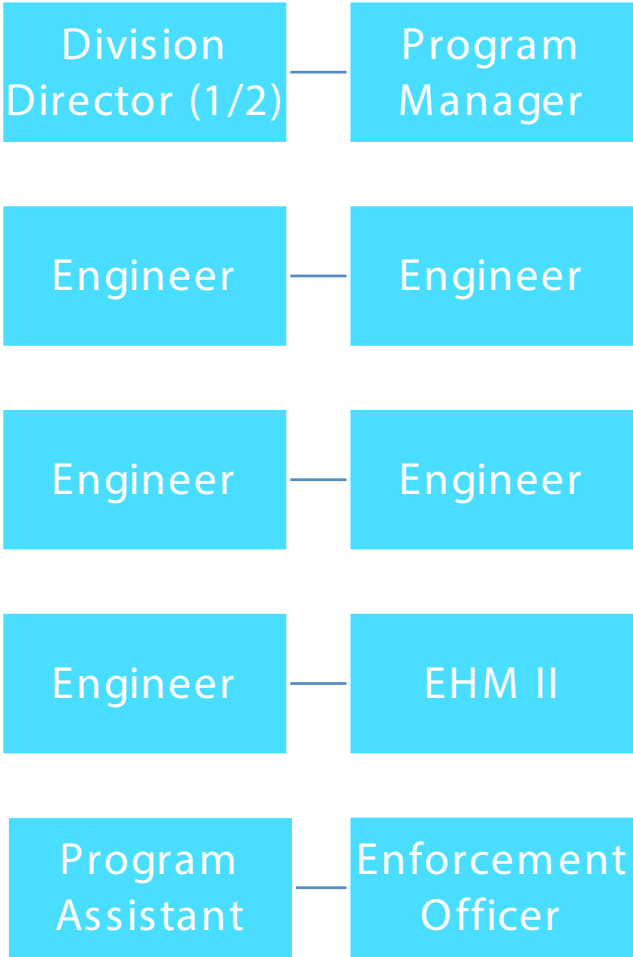


S.C. Department of Health and Environmental Control

Dam Safety Program

Bureau of Water

BEHS



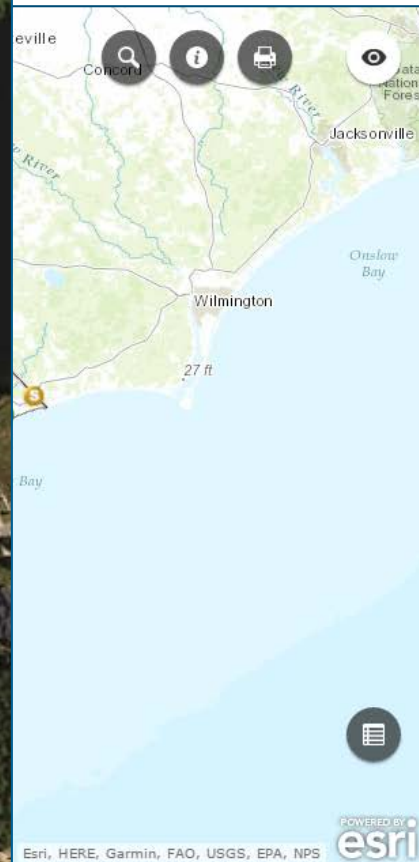
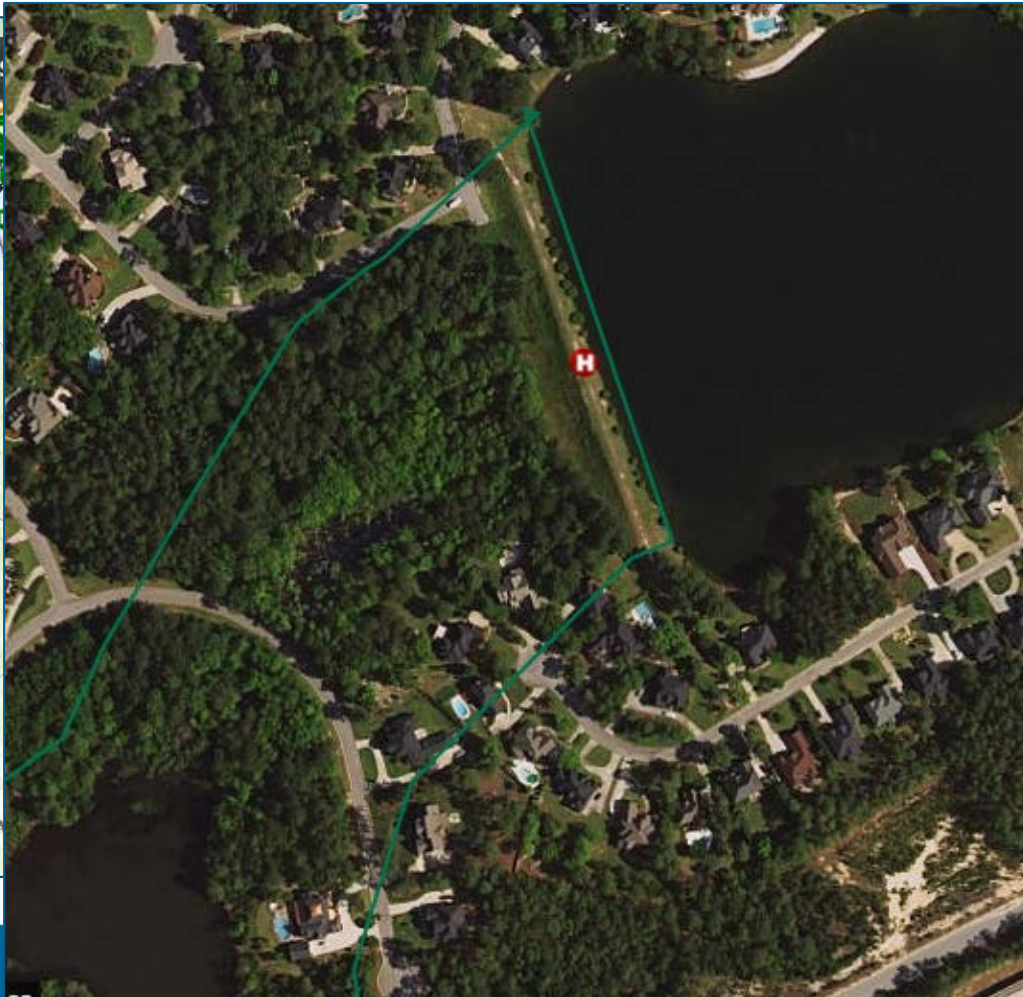
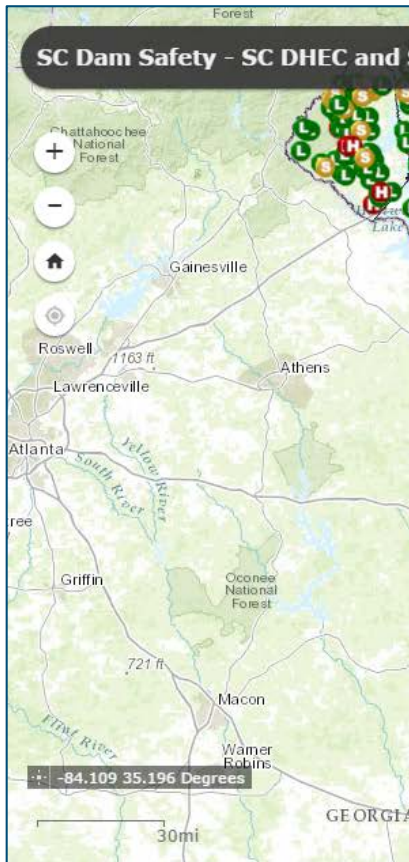
Inspection of Regulated Dam s

- DHEC Director Catherine Heigel directed Dam Safety Program Staff to inspect all regulated dams over 18 months
 - CDM has completed nearly 2000 inspections since March 2017

Inundation Mapping

- CDM was tasked to develop inundation maps for:
 - High and Significant hazard dams where DHEC did not have one available
 - Low hazard where reclassification is likely
- 500+
- “Enhanced SIMS”

Inundation Mapping



Inundation Mapping – the next wave

- DSS Wise Lite
 - Decision Support System for Water Infrastructural Security
 - Web-based Dam Breach Modeling
 - Hosted on servers at National Center for Computational Hydroscience and Engineering at the University of Mississippi
 - State Dam Safety Program Access currently supported by FEMA

Breach Hydrograph

Bridges

Cannon Campground

Bridges are optional.
Press the 'Create New' button to add one or more bridges.

Longitude Latitude

Center

Point in the center of the bridge opening

Name

Span Length

Create New

Next

Name: S-11-38 BR TO LITTLE THICKETTY

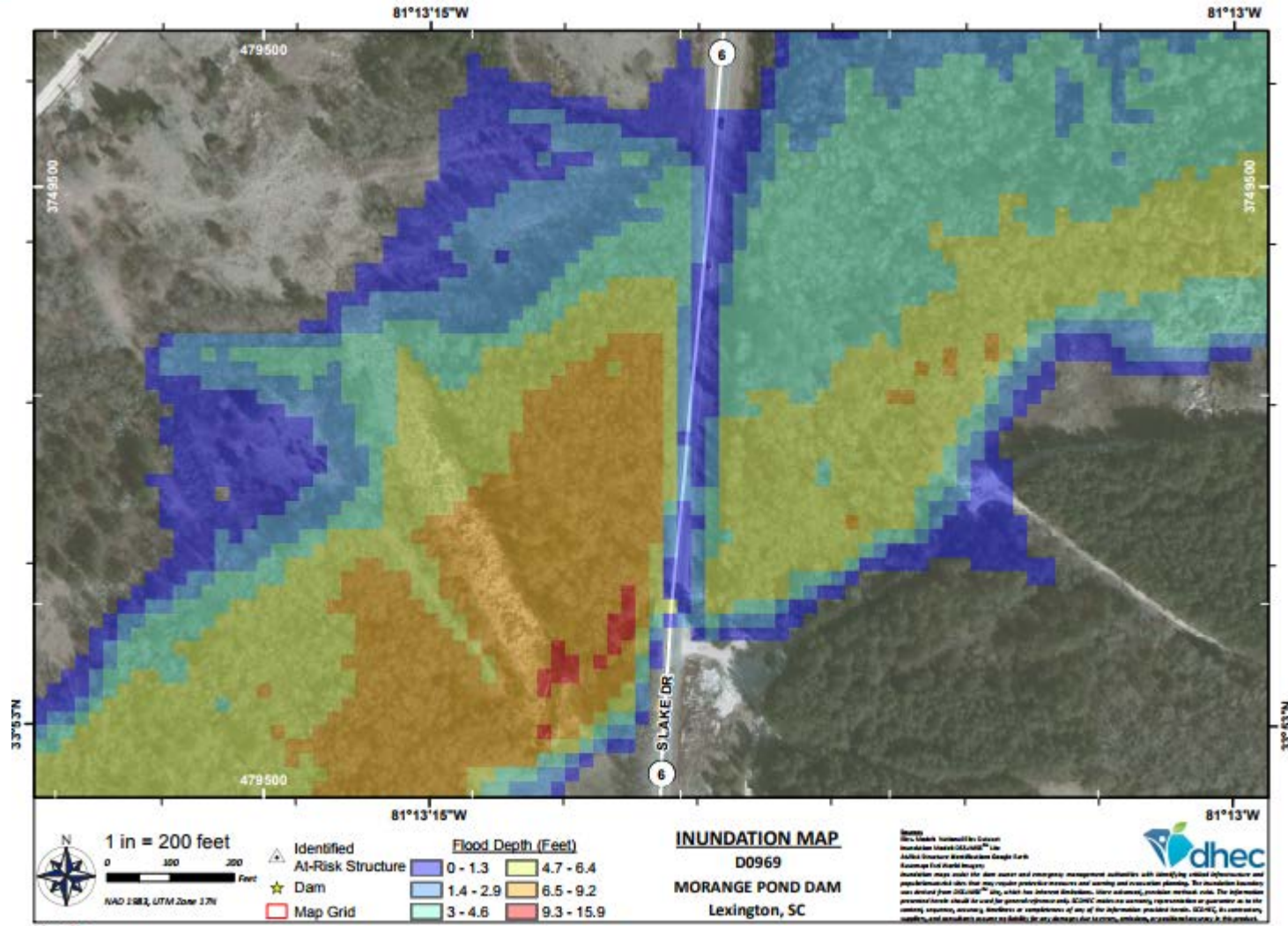
Span Length: 60 ft

S-11-38 & BR
TO LITTLE
THICKETTY

Lat: 35.0538, Lon: -81.8121

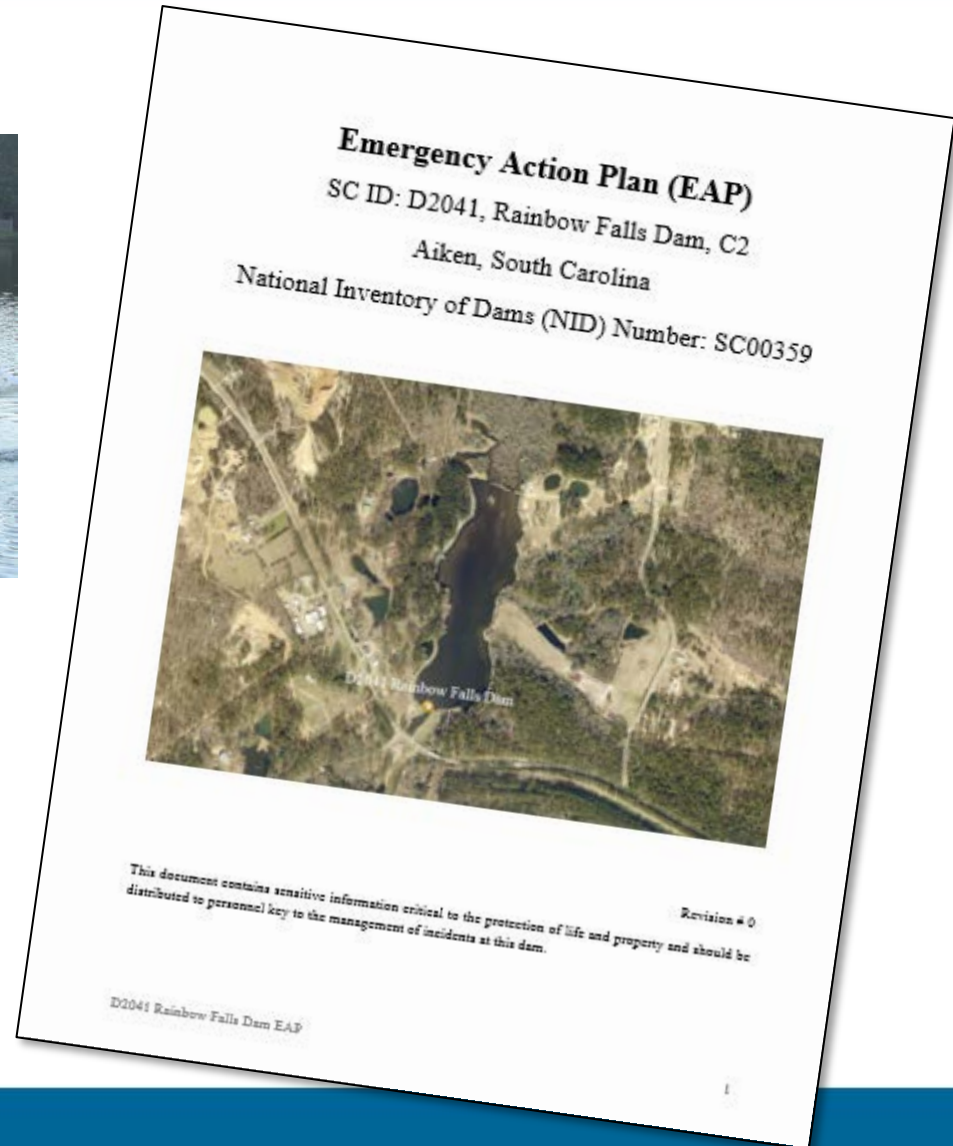
Next





Emergency Action Plans

- Each High and Significant Hazard Dam is required to develop and maintain an Emergency Action Plan (EAP)
- EAPs guide dam owners and first responders through managing a potential dam failure incident at their dam
- Previous EAP Template consisted of 5 pages
- Most didn't include maps



Hurricane Irma





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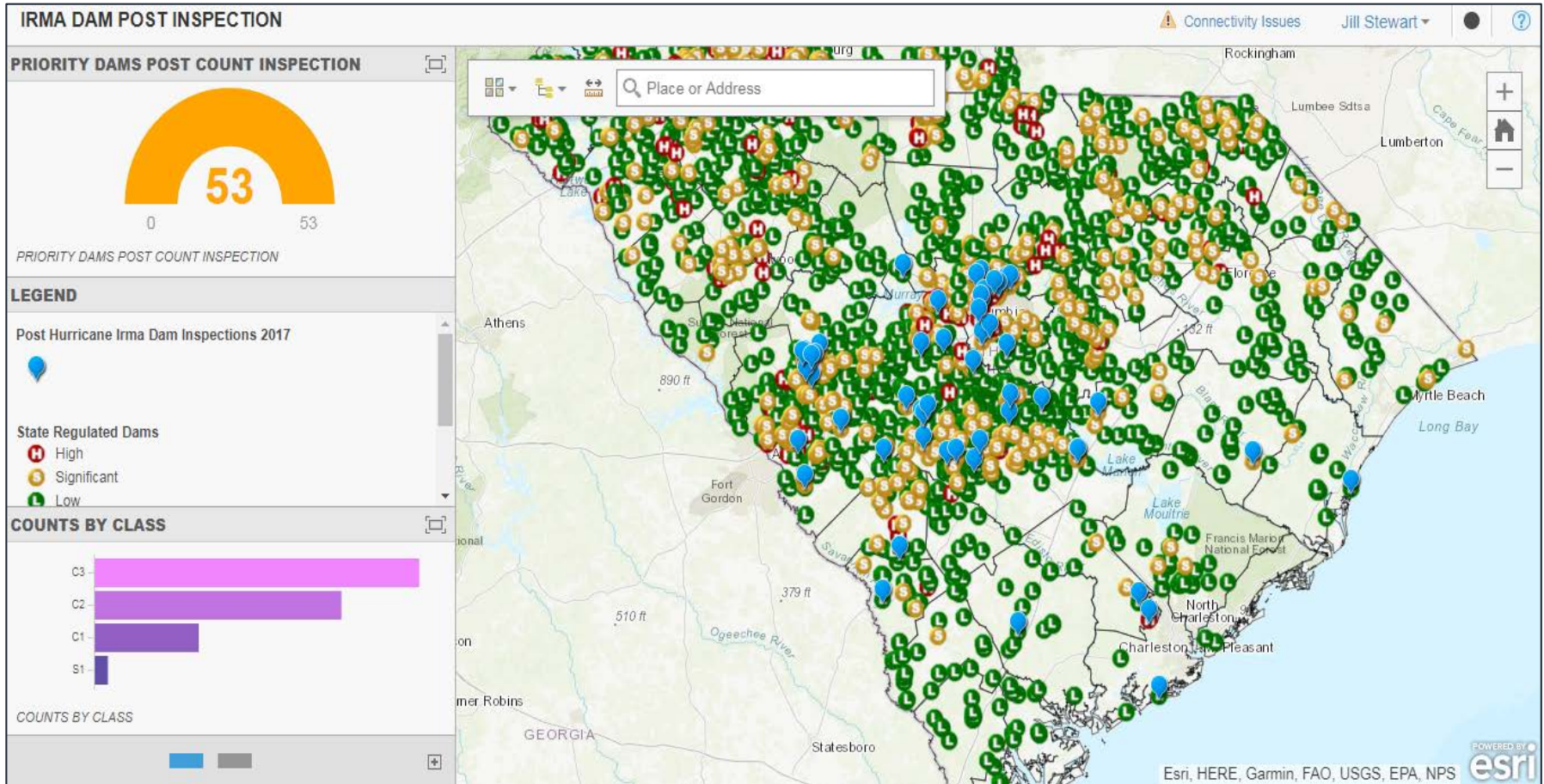
Storm Response

- Irma
 - Pre-storm assessment of flagged dams
 - Dams yet to be repaired from previous events
 - Dams under construction
 - Dams marked by CDM or Regional Engineers during Inspections

Storm Response

- Irma
 - Post-storm assessment prioritized based on pre-storm field visit
 - Post-storm assessment based on rainfall
 - Allowed staff to streamline efforts and reach critical dams more rapidly





Contact

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