SCEMD: Trying to Reason with Hurricane Season using Esri Technology

Charlie Kaufman – GIS Manager

ckaufman@emd.sc.gov

Melissa Potter – Chief of Operations Support
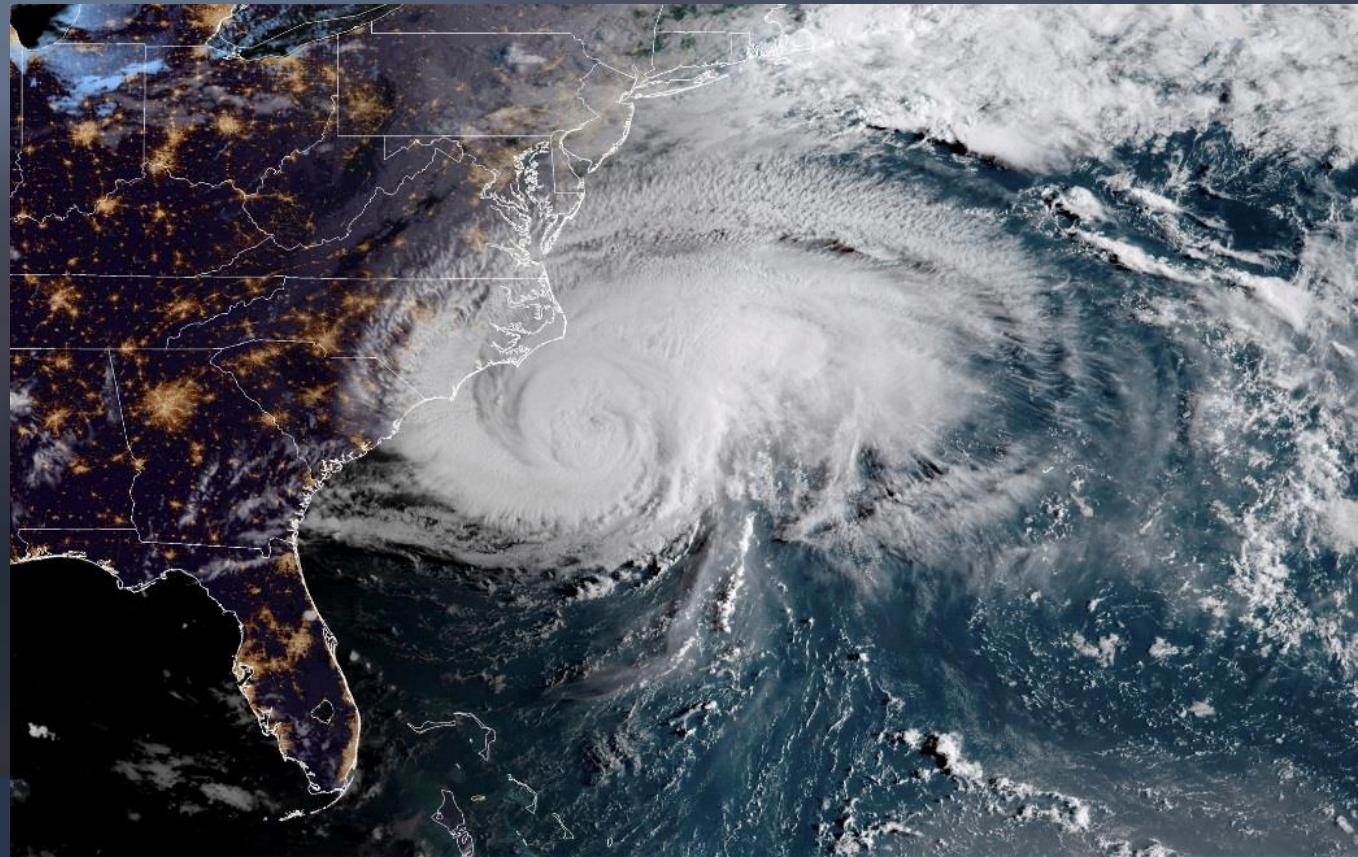
mpotter@emd.sc.gov

Introduction

- South Carolina Emergency Management Division (SCEMD) is the coordinating agency responsible for the statewide emergency management program, and is responsible for coordinating the preparation for, response to, and recovery from any major disaster in SC.

- The GIS Department falls under the Operations Support Section as it supplies GIS data and maps to all aspects of SCEMD operations.
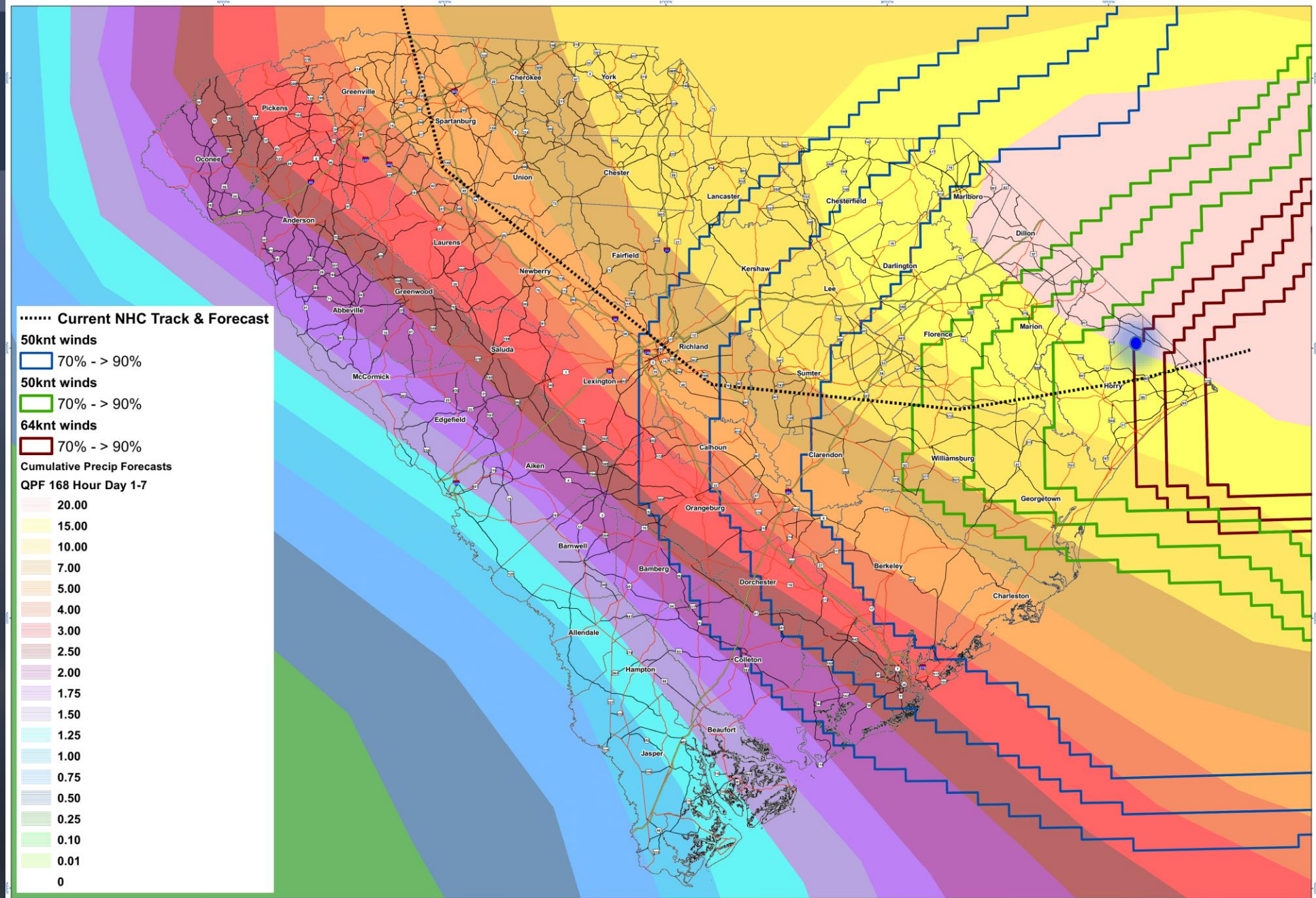
Hurricane Florence

- Hurricane Florence was a powerful hurricane that caused severe damage in the Carolinas in September 2018, primarily as a result of freshwater flooding.

- Florence rapidly intensified in September becoming a Cat 4 hurricane.

- Made landfall in NC as a Cat 1 storm on Sept 14th.

Current NHC Track & Forecast

50knt winds
70% - > 90%

50knt winds
70% - > 90%

64knt winds
70% - > 90%

Cumulative Precip Forecasts
QPF 168 Hour Day 1-7

	20.00
	15.00
	10.00
	7.00
	5.00
	4.00
	3.00
	2.50
	2.00
	1.75
	1.50
	1.25
	1.00
	0.75
	0.50
	0.25
	0.10
	0.01
	0

South Carolina: Hurricane Florence Wind and Rain Forecast Current Tract
9/14/2018

Disclaimer: This map is a graphic representation of data obtained from various sources. All efforts have been made to warrant the accuracy of this map. However, SC EMD disclaims all responsibility and liability for the use of this map.

0   25   50   100 Miles

N

SCEMD

Introduction

- When Hurricane Florence threatened and then impacted the Carolinas, SCEMD utilized Esri software in multiple ways.

  - Common Operating Picture - Palmetto
  - ArcMap / Static Mapping
  - Arc Online / Web Apps

Common Operating Picture Palmetto

SCEMD

- Palmetto: SC's Statewide COP.
  - Launched in June of 2017, Florence's activation saw the largest amount of simultaneous users ~ 1,500.
- Fully customizable application that utilizes Esri's Web App Builder.
  - Integrates all types of data feeds, and allows users situational awareness of an incident.
- "Mobile First" design allows users to share information on their mobile devices in the field.
- Available to all State, County , and Local emergency managers.

Ckaufman
SCEMD

- Call Center
- Chat
- Communication Check ○
- Damage Assessment
- DOT Video Wall
- › Executive Summary ●
- File Library
- Incidents
- Notifications ○
- Operational Rhythm
- Position Log ○
- Public Information
- Resource Request ○
- Shelters ○
- Significant Events ○
- Traffic Cameras ○

Resource Requests

	Track...	Resource Name	Requ...	Assig...	Status
⌄	0234	GIS Support Contract	SCEMD	ESF 7	Complete

GIS emergency support. Request Purchase Order for additional GIS support. SCEMD Finance please contact Charlie Kaufman. See attached cost estimate.

	Track...	Resource Name	Requ...	Assig...	Status
⌄	0834	plotter supplies	SCEMD	ESF 7	Complete

Need replacement Ink and Paper for GIS Plotter. Everything can be ordered from the same location Bluedogink.com Have attached sheet with part number. Need one of each ink cartridge and 2 rolls of paper.

	Track...	Resource Name	Requ...	Assig...	Status
⌄	0972	Maps	SCEMD	ESF 1	Complete

Request county road maps from SCDOT GIS. Need 10 hard copies of each of the affected Northern Conglomerate Counties. SCDOT county road maps printed on ARCH E (36x48). Delivered to SCEMD's GIS office.

3	0	0	3
TOTAL	SUBMITTED	CANCELLED	COMPL

Significant Events

Add Entry

Incident •
2019 SWP Daily Sitrep

Q Tsunami ✕ ⌄

Title
Tsunami Alert

Description
Test of system

LOCATION DETAILS

⊙ SELECT POINT ON MAP

◉ USE CURRENT LOCATION

● Autofill address

Address
415 Ben Sawyer Bikeway

Address 2	City
Address 2	Sullivan's Island

County	State
Charleston	SC

Zip code
29482

Latitude
32.76849184

Longitude
-79.8427834

CONTACT DETAILS

Primary name •	Primary phone •
Charlie Kaufman	+1 803-737-8588

- Base Layers ...
- e Layers ...
- Layers ...
- Base Layers ...
- erate Outlines ...
- erates ...
- e TCP ...
- rricane Special Medical Needs ...
- e Shelters ...
- on Fuel Stops ...
- lurricane Evacuation Routes ...
- at1 ...
- at2 ...
- at3 ...
- at4 ...
- at5 ...
- of Evacuation Zone ...
- on Zone Current Status ...
- Conglomerate Evacuation ...
- onglomerate Evacuation ...
- Conglomerate Evacuation ...

Palmetto

- Examples

Photo credit: SCEMD

Photo credit: https://www.thestate.com/news/state/south-carolina/article218528480.html

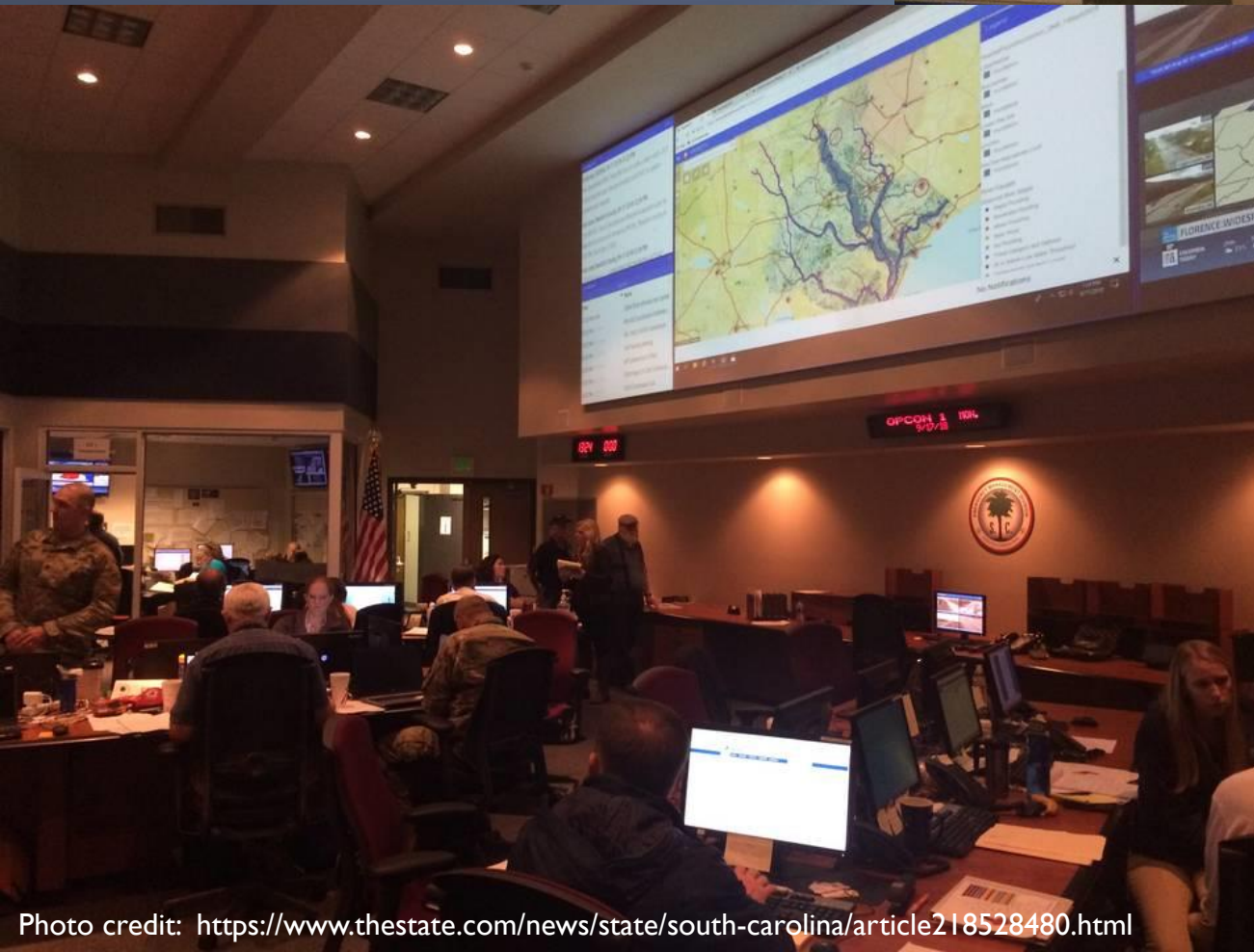# ArcMap

- SCEMD at the time had not moved to ArcPro – used Arc10.5.1.

- 36 different ArcMap files were created and updated.

- These files served as the templates for the final 66 GIS maps that were published.
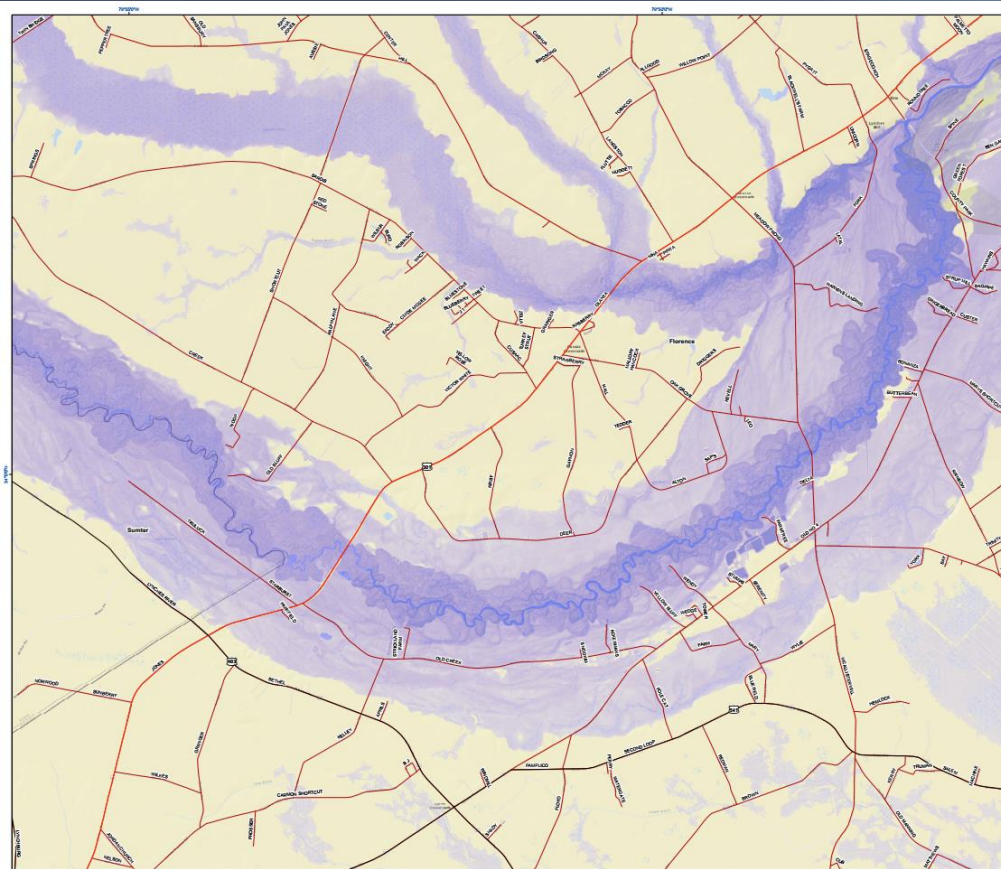
- 130 maps were printed from the plotter.

Organize ▾   Burn   New folder

Left window — maps

Name	Date modified	Type	Size
scenarios_florence962018.mxd	9/6/2018 12:39 PM	ArcGIS ArcMap D…	16,263 KB
scenarios_florence_9-7-2018.mxd	9/9/2018 1:49 PM	ArcGIS ArcMap D…	8,023 KB
slosh_nw_cat4_25hightide.mxd	9/9/2018 6:17 PM	ArcGIS ArcMap D…	16,394 KB
MEOW_hospitals.mxd	9/10/2018 11:12 AM	ArcGIS ArcMap D…	16,223 KB
MEOW_evac_zones.mxd	9/10/2018 12:40 PM	ArcGIS ArcMap D…	16,423 KB
hurricane_conglomerates_tv.mxd	9/10/2018 1:13 PM	ArcGIS ArcMap D…	9,305 KB
composite_MEOWs.mxd	9/10/2018 1:51 PM	ArcGIS ArcMap D…	760 KB
southern_recind_order.mxd	9/11/2018 11:00 AM	ArcGIS ArcMap D…	18,562 KB
DHEC_facilities.mxd	9/11/2018 1:59 PM	ArcGIS ArcMap D…	16,052 KB
nc_sc_map.mxd	9/12/2018 9:56 AM	ArcGIS ArcMap D…	16,088 KB
nichols_flood.mxd	9/12/2018 4:30 PM	ArcGIS ArcMap D…	655 KB
ESF9_SAR_grids.mxd	9/12/2018 6:36 PM	ArcGIS ArcMap D…	16,125 KB
scenarios_florence_2018.mxd	9/13/2018 8:33 AM	ArcGIS ArcMap D…	16,284 KB
rivers.mxd	9/13/2018 10:23 AM	ArcGIS ArcMap D…	16,161 KB
ESF9_SAR_Staging.mxd	9/13/2018 1:21 PM	ArcGIS ArcMap D…	16,740 KB
uscg_areal_comms.mxd	9/13/2018 2:11 PM	ArcGIS ArcMap D…	16,091 KB
scratch.mxd	9/13/2018 4:31 PM	ArcGIS ArcMap D…	16,050 KB
correctional_facilities.mxd	9/13/2018 6:22 PM	ArcGIS ArcMap D…	16,260 KB
crit_fac_targets.mxd	9/13/2018 6:54 PM	ArcGIS ArcMap D…	787 KB
horry_flood.mxd	9/14/2018 4:39 PM	ArcGIS ArcMap D…	16,257 KB
ESF9_SAR_divisions.mxd	9/15/2018 9:03 AM	ArcGIS ArcMap D…	16,071 KB
CoastGuard_FAA.mxd	9/16/2018 2:24 PM	ArcGIS ArcMap D…	16,207 KB
ESF9_flood_divisions.mxd	9/16/2018 3:27 PM	ArcGIS ArcMap D…	16,199 KB
ESF9_SAR_Planing.mxd	9/16/2018 4:52 PM	ArcGIS ArcMap D…	18,044 KB
dillion_rescue.mxd	9/16/2018 7:20 PM	ArcGIS ArcMap D…	16,235 KB
ESF9_SAR_Staging_large.mxd	9/19/2018 4:31 PM	ArcGIS ArcMap D…	16,305 KB
flood_depth.mxd	9/19/2018 6:20 PM	ArcGIS ArcMap D…	879 KB
horry_roadclosed.mxd	9/20/2018 2:44 PM	ArcGIS ArcMap D…	16,290 KB
Florence_county_evac.mxd	9/21/2018 1:30 PM	ArcGIS ArcMap D…	16,632 KB
georgetown_divisions.mxd	9/25/2018 3:02 PM	ArcGIS ArcMap D…	16,742 KB
registration_hotspots.mxd	9/28/2018 1:05 PM	ArcGIS ArcMap D…	1,032 KB
northern_pop_density.mxd	9/28/2018 5:29 PM	ArcGIS ArcMap D…	16,437 KB
florence_service.mxd	10/9/2018 5:06 PM	ArcGIS ArcMap D…	1,950 KB
redcross_damage_assessment.mxd	10/11/2018 4:52 PM	ArcGIS ArcMap D…	16,002 KB
viirs_imagery.mxd	10/22/2018 11:23 …	ArcGIS ArcMap D…	16,296 KB
florence_declarations.mxd	10/31/2018 3:50 PM	ArcGIS ArcMap D…	16,117 KB
county_ltrg.mxd	1/24/2019 4:29 PM	ArcGIS ArcMap D…	3,282 KB

Right window — outputs

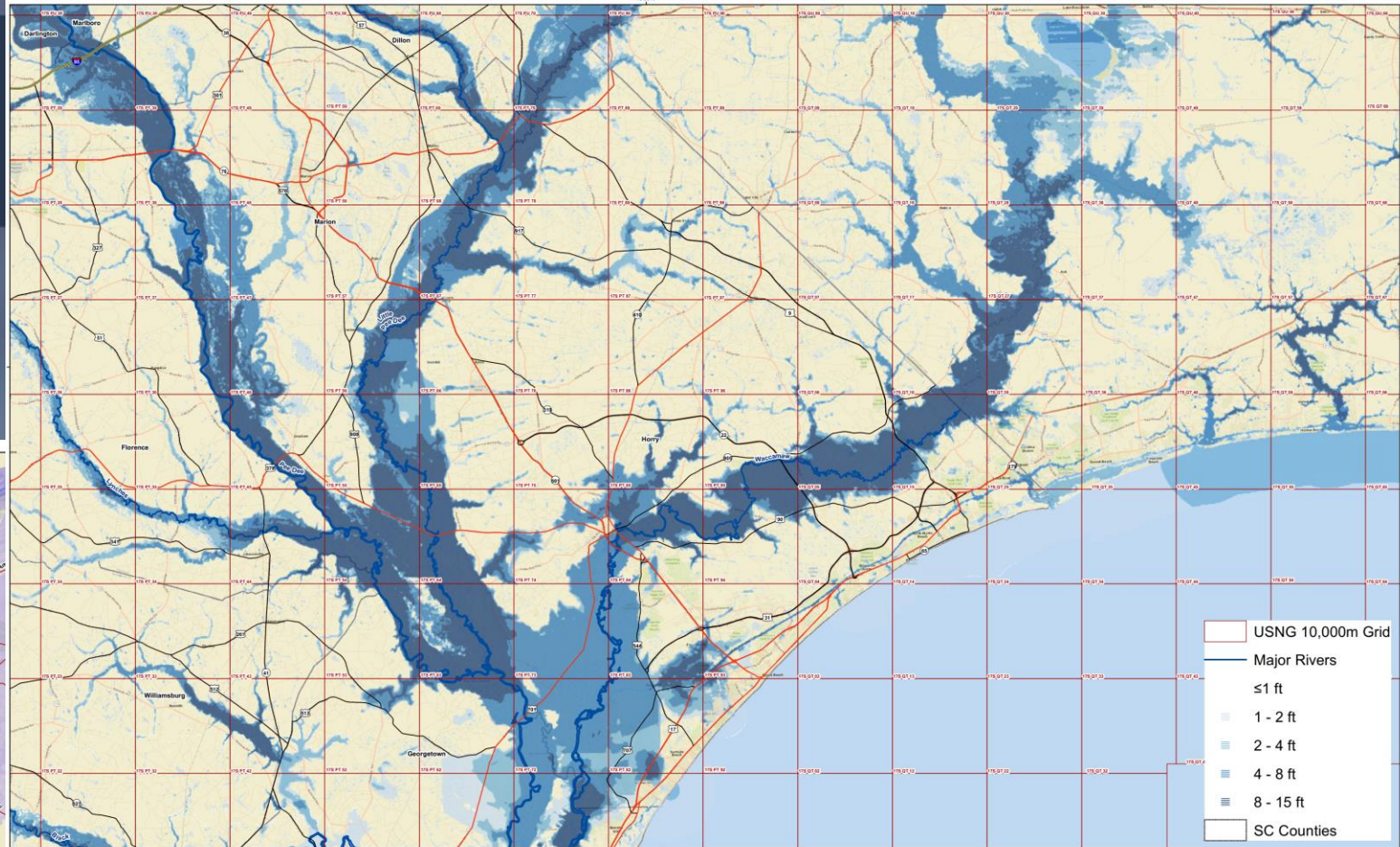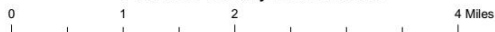| Name	Date modified	Type	Size
SouthCarolinaDams.pdf	9/14/2018 7:51 AM	Foxit Reader PDF …	4,155 KB
SouthCarolinaNuclearPlants.pdf	9/14/2018 7:52 AM	Foxit Reader PDF …	1,727 KB
StatewideTopo_HighFloodPotential.pdf	9/14/2018 7:52 AM	Foxit Reader PDF …	1,854 KB
StatewideTopo.pdf	9/14/2018 7:53 AM	Foxit Reader PDF …	1,927 KB
nc_sc_map1.pdf	9/14/2018 9:50 AM	Foxit Reader PDF …	240,229 KB
ESF9_SAR_Planing_9142018.pdf	9/14/2018 3:24 PM	Foxit Reader PDF …	2,424 KB
ESF9_SAR_Planing_9142018a.pdf	9/14/2018 3:31 PM	Foxit Reader PDF …	3,593 KB
horry_flood_cemetery.pdf	9/14/2018 4:02 PM	Foxit Reader PDF …	123,763 KB
horry_flood.pdf	9/14/2018 4:40 PM	Foxit Reader PDF …	1,288 KB
ESF9_SAR_Staging_large.pdf	9/14/2018 6:27 PM	Foxit Reader PDF …	2,737 KB
ESF9_SAR_divisions1.pdf	9/15/2018 8:42 AM	Foxit Reader PDF …	11,893 KB
ESF9_SAR_divisions3.pdf	9/15/2018 10:07 AM	Foxit Reader PDF …	12,015 KB
ESF9_SAR_divisions2.pdf	9/15/2018 10:13 AM	Foxit Reader PDF …	11,220 KB
ESF9_SAR_Planing_9152018.pdf	9/15/2018 4:39 PM	Foxit Reader PDF …	4,316 KB
ESF9_SAR_Planing_9152018a.pdf	9/15/2018 4:45 PM	Foxit Reader PDF …	5,857 KB
CoastGuard_FAA.pdf	9/16/2018 2:13 PM	Foxit Reader PDF …	122,405 KB
ESF9_flood_divisions.pdf	9/16/2018 3:29 PM	Foxit Reader PDF …	4,332 KB
ESF9_flood_chesterfield.pdf	9/16/2018 3:30 PM	Foxit Reader PDF …	2,921 KB
ESF9_flood_marlboro.pdf	9/16/2018 3:31 PM	Foxit Reader PDF …	2,981 KB
ESF9_flood_marion.pdf	9/16/2018 3:32 PM	Foxit Reader PDF …	3,121 KB
ESF9_flood_horry.pdf	9/16/2018 3:32 PM	Foxit Reader PDF …	3,125 KB
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dillion_rescue.pdf	9/16/2018 7:15 PM	Foxit Reader PDF …	123,037 KB
ESF9_SAR_Planing_9172018.pdf	9/17/2018 3:56 PM	Foxit Reader PDF …	4,547 KB
sc_roads.pdf	9/18/2018 3:00 PM	Foxit Reader PDF …	125,917 KB
ESF9_SAR_Staging_flood.pdf	9/19/2018 4:20 PM	Foxit Reader PDF …	124,839 KB
sc_usng_10000m.pdf	9/19/2018 4:35 PM	Foxit Reader PDF …	12,124 KB
horry_roadclosed.pdf	9/20/2018 2:05 PM	Foxit Reader PDF …	123,643 KB
Florence_county_evac.pdf	9/21/2018 10:08 AM	Foxit Reader PDF …	123,464 KB
florence_declarations_M_shelters.pdf	9/22/2018 1:40 PM	Foxit Reader PDF …	3,721 KB
florence_declarations_M.pdf	9/23/2018 9:53 AM	Foxit Reader PDF …	11,421 KB
georgetown_divisions.pdf	9/25/2018 2:44 PM	Foxit Reader PDF …	123,578 KB
northern_pop_density.pdf	9/28/2018 5:31 PM	Foxit Reader PDF …	122,353 KB
florence_declarations_M_IA.pdf	10/2/2018 3:29 PM	Foxit Reader PDF …	11,430 KB
redcross_damage_assessment.pdf	10/11/2018 4:53 PM	Foxit Reader PDF …	10,954 KB
florence_declarations_M_PA_status.pdf	10/11/2018 5:11 PM	Foxit Reader PDF …	12,231 KB
viirs_imagery.pdf	10/22/2018 11:24 …	Foxit Reader PDF …	123,524 KB
florence_declarations_M_PA.pdf	10/31/2018 3:50 PM	Foxit Reader PDF …	11,457 KB

ArcMap

- Examples

ESF 9: Potential Flooding Horry

0   5   10   20 Miles

USNG 10,000m Grid
Major Rivers
≤1 ft
1 - 2 ft
2 - 4 ft
4 - 8 ft
8 - 15 ft
SC Counties

Disclaimer: This map is a graphic representation of data obtained from various sources. All efforts have been made to warrant the accuracy of this map. However, SC EMD disclaims all responsibility and liability for the use of this map.
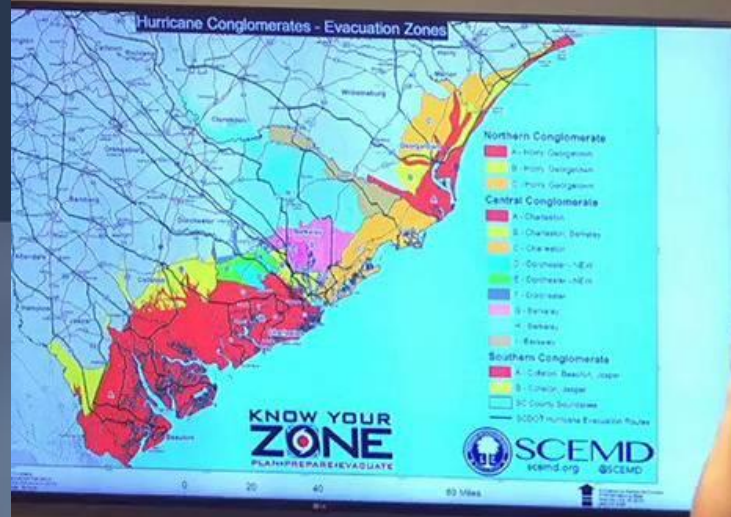
SC Emergency Management Division
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(803) 737-8588
E-mail: ckaufman@emd.sc.gov
SCEMD   Charlie Kaufman -- 9/16/2018

Florence County Evacuations

0   1   2   4 Miles

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SC Emergency Management Division
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West Columbia, SC 29172
(803) 737-8588
E-mail: ckaufman@emd.sc.gov
SCEMD   Charlie Kaufman -- 9/21/2018

ArcMap

- Examples
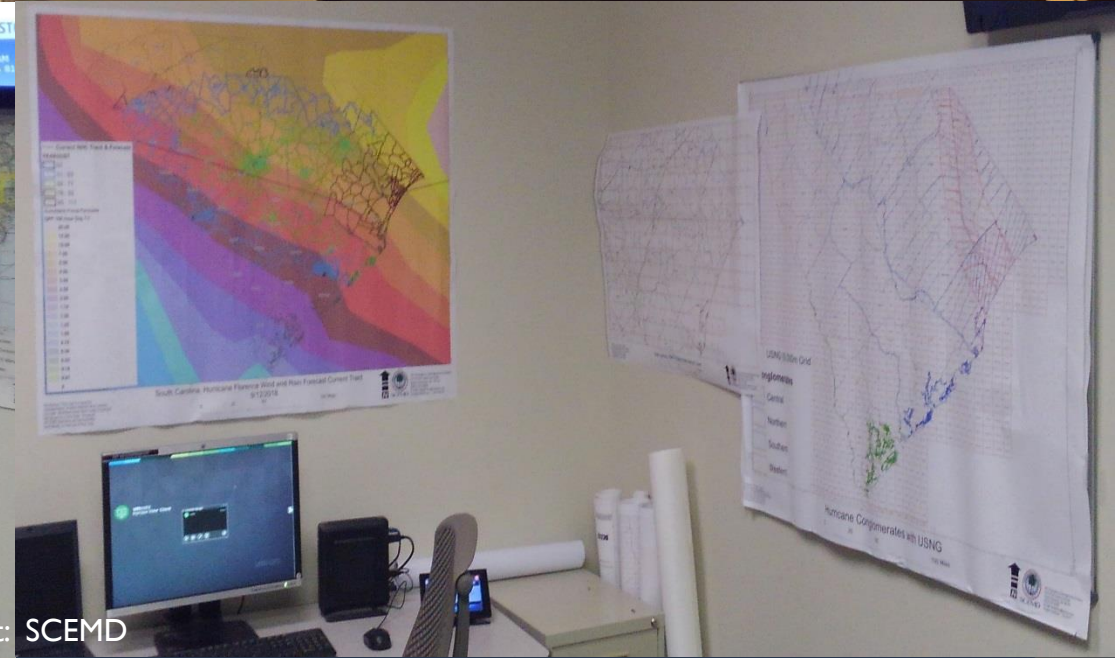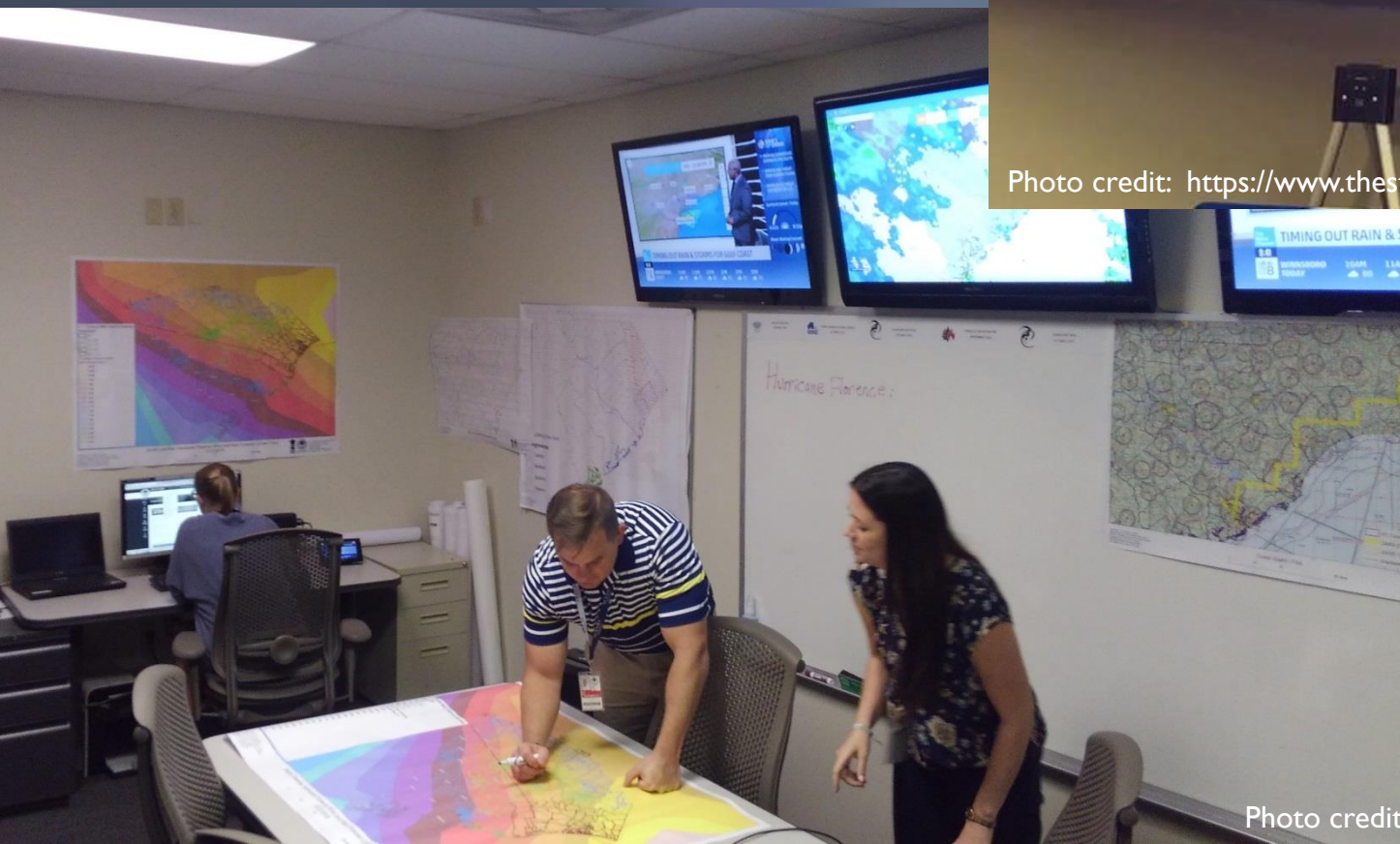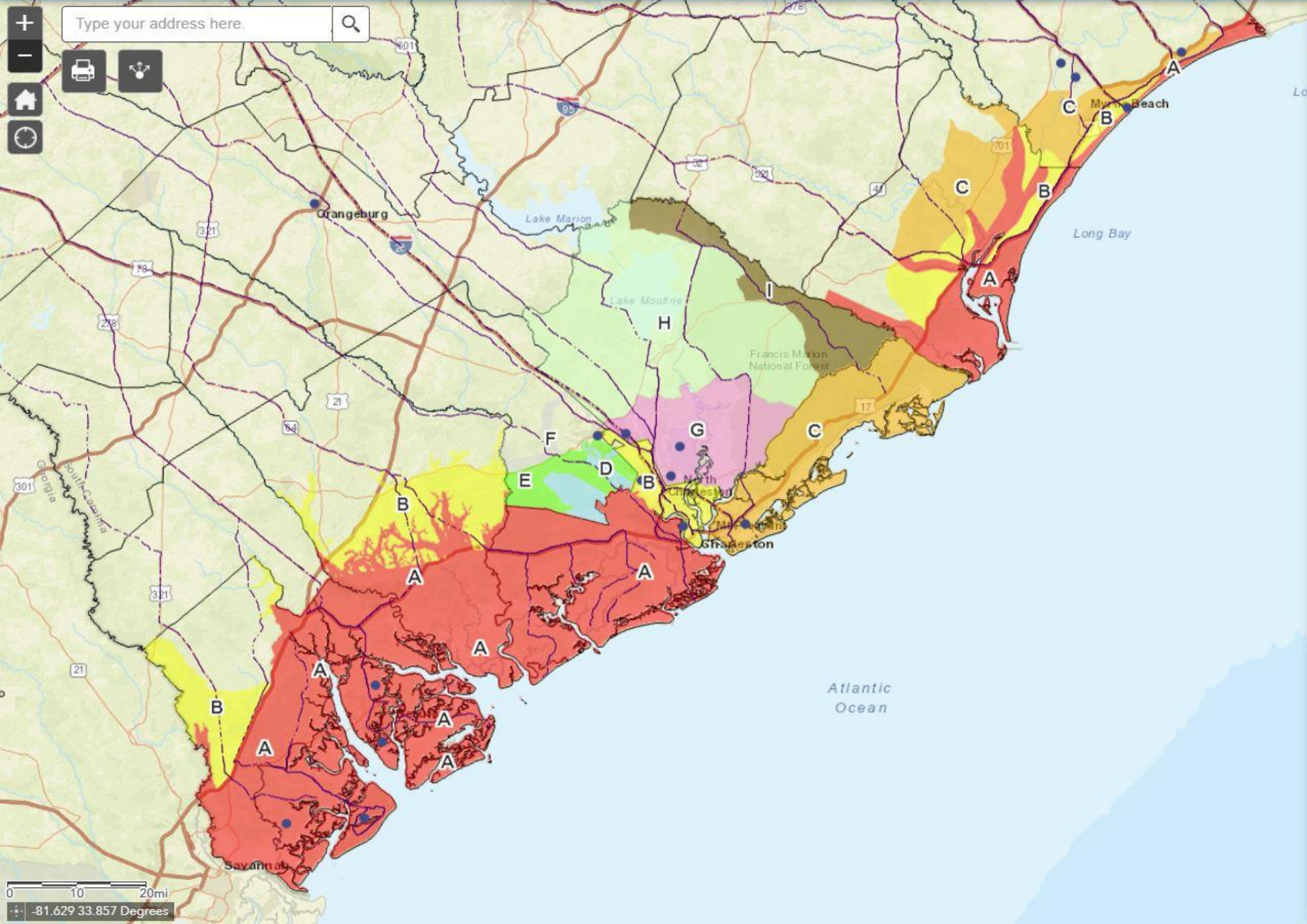
Arc Online

SCEMD

- SCEMD used Arc Online to create and host several web applications.

- Several of these apps were vital to SCEMD during the Hurricane Florence response and recovery.

    - Know Your Zone
    - Situation Report Dashboard
    - Search and Rescue Grid
    - Aerial Photo Viewer

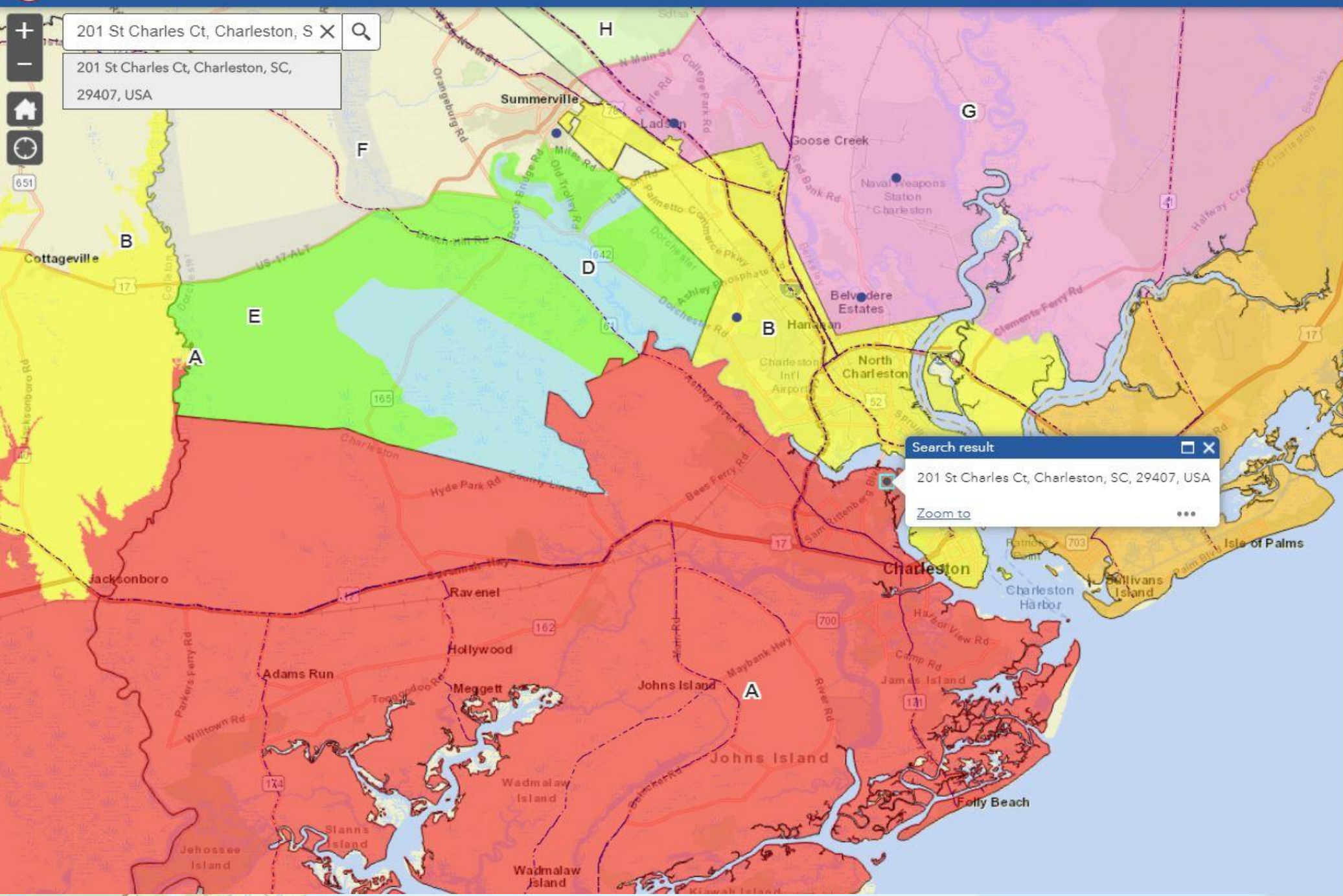Type your address here.

Map Legend

SC Cities

•

SCDOT Hurricane Evacuation Routes

Northern Evacuation Zones

A (Horry, Georgetown)

B (Horry, Georgetown)

C (Horry, Georgetown)

Central Evacuation Zones

A (Charleston)

B (Berkeley, Charleston) *New

C (Charleston)

D (Dorchester)

E (Dorchester)

F (Dorchester)

G (Berkeley)

H (Berkeley)

I (Berkeley)

Southern Evacuation Zones

A (Colleton, Beaufort, Jasper)

B (Beaufort, Jasper)

-81.629 33.857 Degrees

201 St Charles Ct, Charleston, S ✕ 🔍

201 St Charles Ct, Charleston, SC,
29407, USA

H

Summerville

Ladson

F

Goose Creek

G

Naval Weapons
Station
Charleston

B

Cottageville

D

Belvedere
Estates

E

B   Hanahan

A

Charleston
Int'l
Airport

North
Charleston

Search result ⬜ ✕

201 St Charles Ct, Charleston, SC, 29407, USA

Zoom to   • • •

Isle of Palms

Jacksonboro

Ravenel

Charleston

Charleston
Harbor

Sullivans
Island

Hollywood

Adams Run

Meggett

Johns Island

A

James Island

Johns Island

Wadmalaw
Island

Folly Beach

Jehossee
Island

Slann's
Island

Wadmalaw
Island

Kiawah Island

Map Legend

SC Cities

•

SCDOT Hurricane Evacuation Routes

Northern Evacuation Zones

▰ A (Horry, Georgetown)

▰ B (Horry, Georgetown)

▰ C (Horry, Georgetown)

Central Evacuation Zones

▰ A (Charleston)

▰ B (Berkeley, Charleston) *New

▰ C (Charleston)

▰ D (Dorchester)

▰ E (Dorchester)

▰ F (Dorchester)

▰ G (Berkeley)

▰ H (Berkeley)

▰ I (Berkeley)
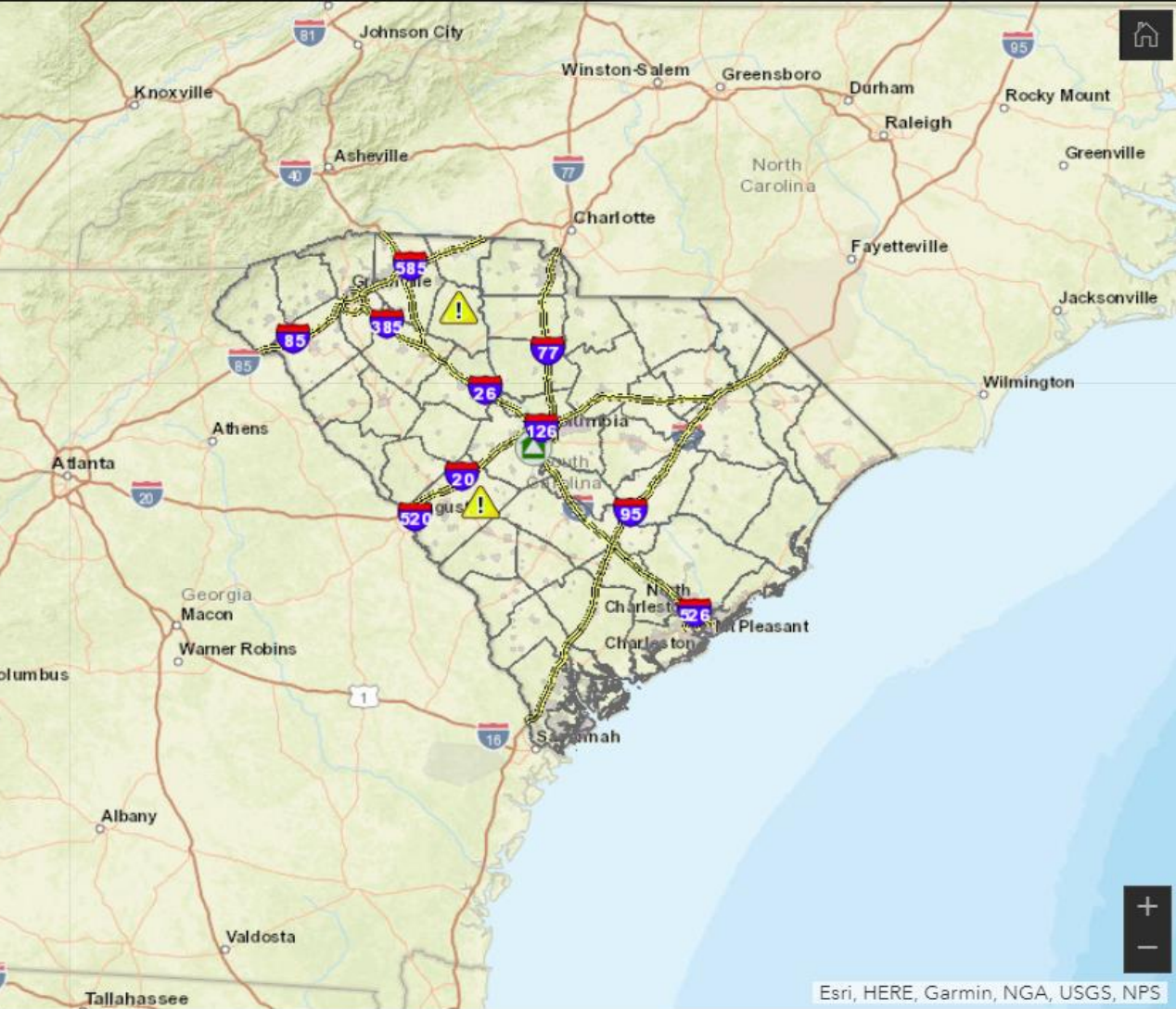
Southern Evacuation Zones

▰ A (Colleton, Beaufort, Jasper)
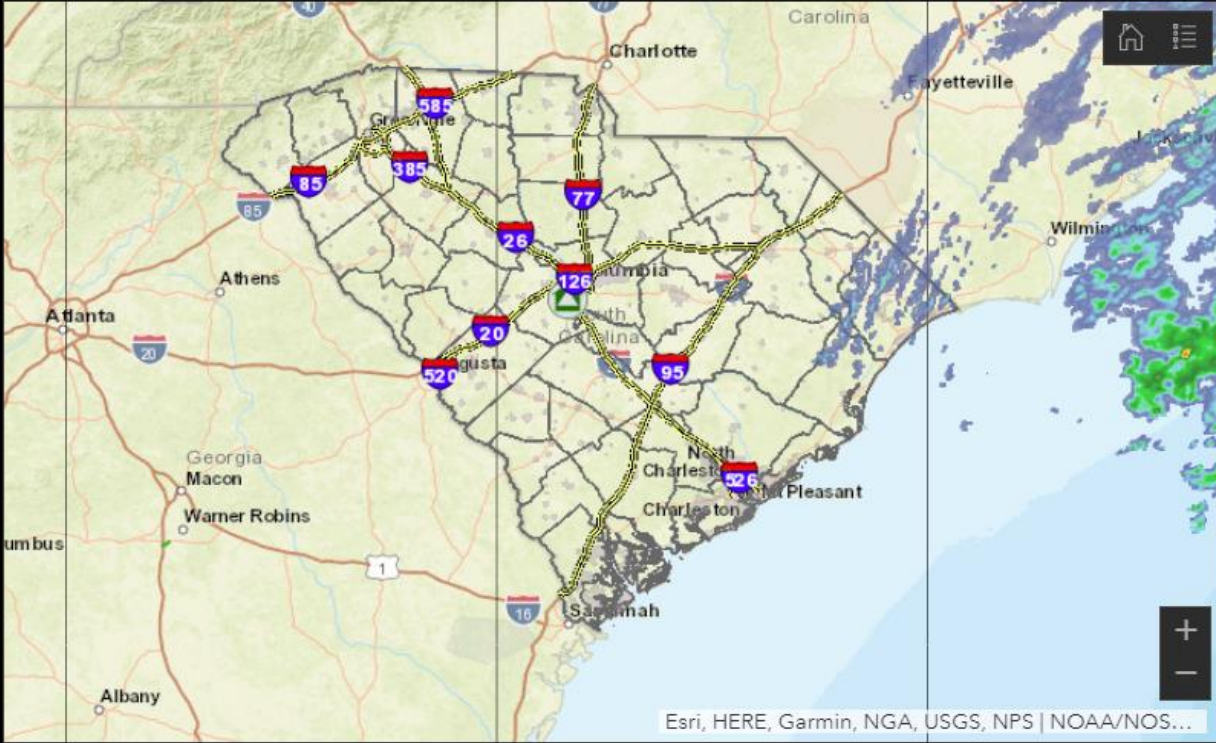
▰ B (Beaufort, Jasper)

For more detailed information please login to: http://palmettoeoc.com/

Reported Incidents & Damages Display

State Warning Point - Display

Esri, HERE, Garmin, NGA, USGS, NPS

Current Weather Conditions

Esri, HERE, Garmin, NGA, USGS, NPS | NOAA/NOS...

National Weather Service   **National Hurricane Center**

| Current Weather Conditions | NHC 5-day Outlook | Riverine Conditions | Wildfires |

Power Outages

Customers Affected

569 💡

(Refresh page for updated numbers)

| Total Outages | Outages by Provider |

Current Incident Situation Report

SCEMD

For more detailed information please login to: http://palmettoeoc.com/

Tue, September 18, 2018
10:41:31 EDT

County Closures

Dillon **Closed 9/17/2018, 12:22:54 PM**
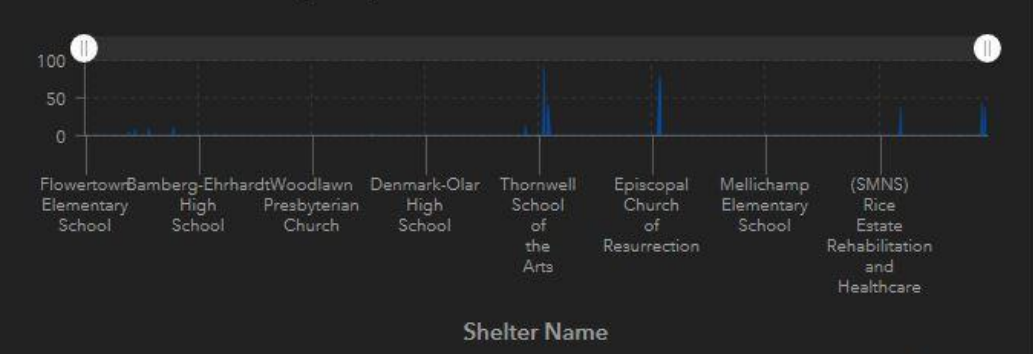
(Refresh page for updated closures)

Current Significant Events
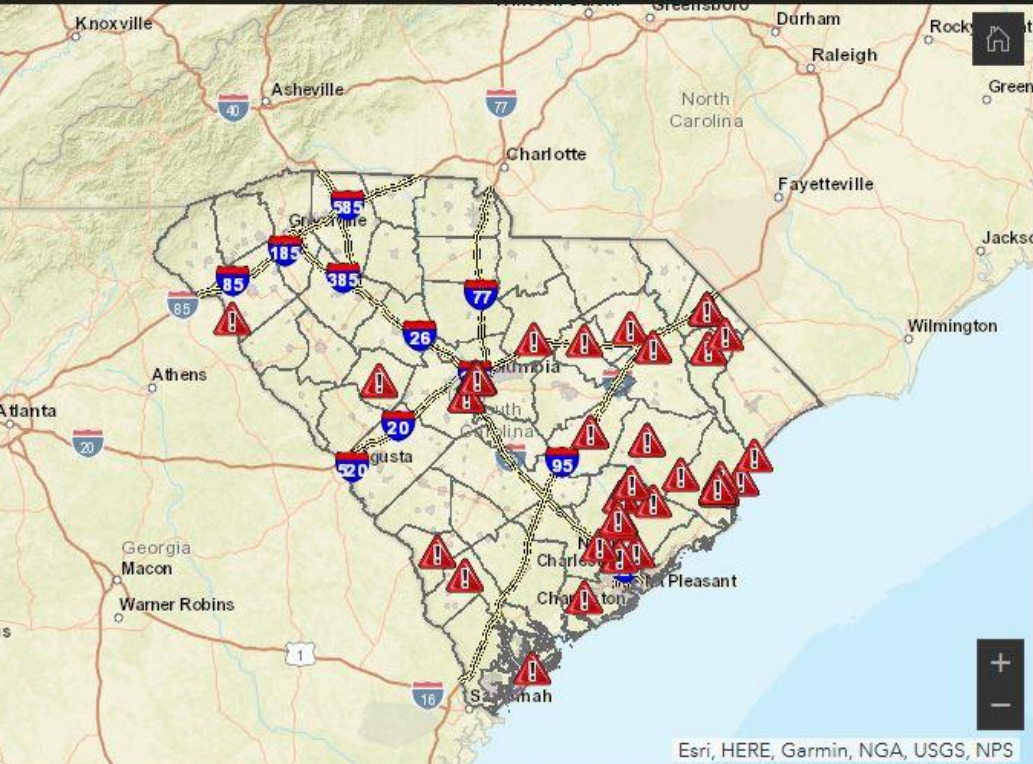
| Significant Events - Display | Significant Event - Entries | INTEL | NWS - ILM Office |

Esri, HERE, Garmin, NGA, USGS, NPS

Current Weather Conditions

Esri, HERE, Garmin, NGA, USGS, NPS | NOA...

National Weather Service   **National Hurricane Center**

| Current Weather Conditions | NHC 2-Day Outlook | Riverine Conditions |

DOT 511 Data

Current # of Traffic Incidents

41 ⬈

(Previous # 41)

http://www.511sc.org/

Last update: a few seconds ago

Current Shelter Occupancy

100
50
0

Flowertown Elementary School | Bamberg-Ehrhardt High School | Woodlawn Presbyterian Church | Denmark-Olar High School | Thornwell School of the Arts | Episcopal Church of Resurrection | Mellichamp Elementary School | (SMNS) Rice Estate Rehabilitation and Healthcare

Shelter Name

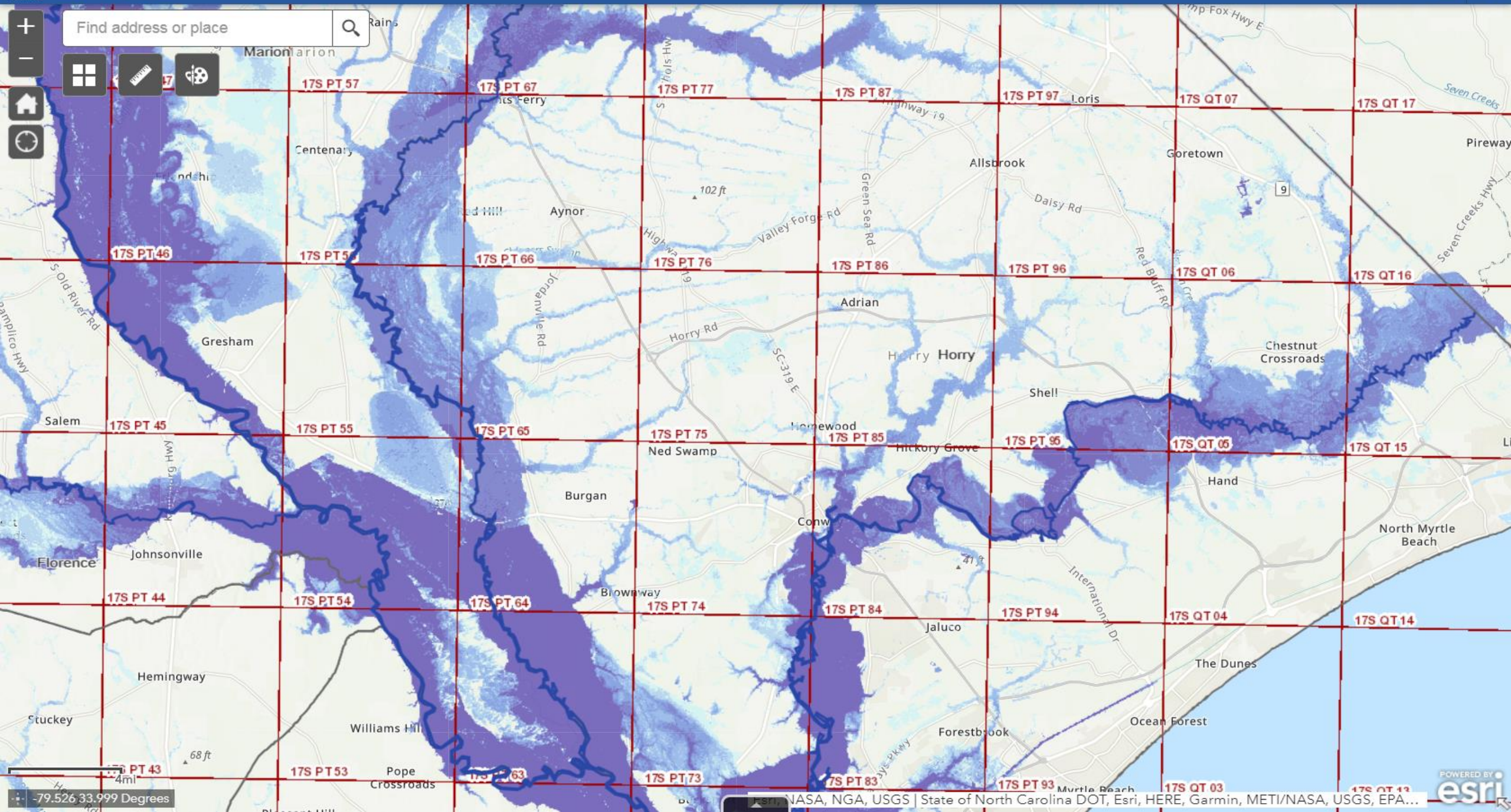Last update: a few seconds ago

Power Outages

Customers Affected

3,768 💡

(Previous # 3,768)

(Refresh page for updated numbers)

| Total Outages | Outages by Provider |

Imagery Obtained from multiple sources including NOAA, NASA, and Civil Air Patrol.

Find address or place
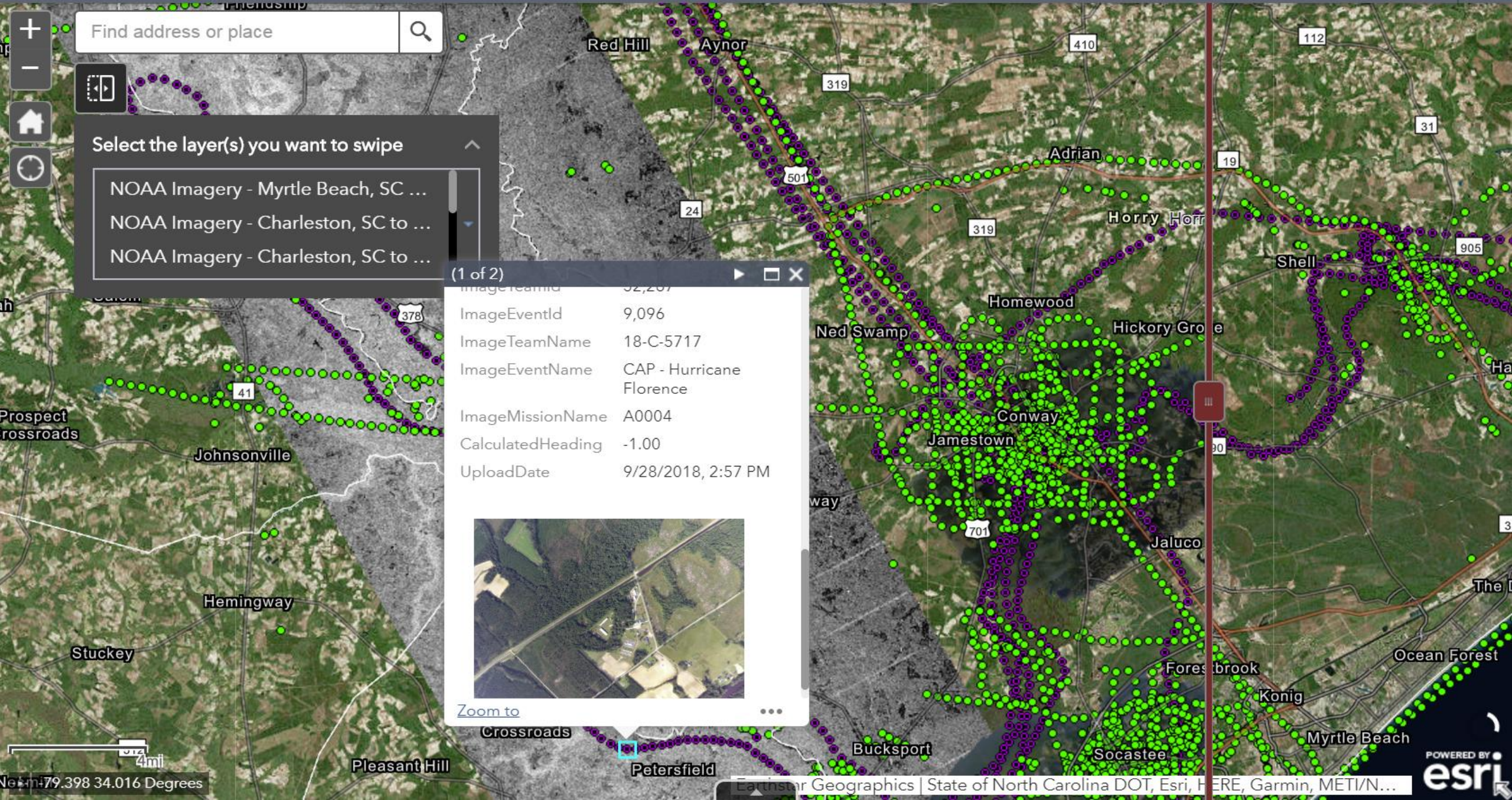
Select the layer(s) you want to swipe

NOAA Imagery - Myrtle Beach, SC ...
NOAA Imagery - Charleston, SC to ...
NOAA Imagery - Charleston, SC to ...

(1 of 2)

ImageTeamId	52,267
ImageEventId	9,096
ImageTeamName	18-C-5717
ImageEventName	CAP - Hurricane Florence
ImageMissionName	A0004
CalculatedHeading	-1.00
UploadDate	9/28/2018, 2:57 PM

Zoom to

Earthstar Geographics | State of North Carolina DOT, Esri, HERE, Garmin, METI/N...

POWERED BY esri

SC National Guard
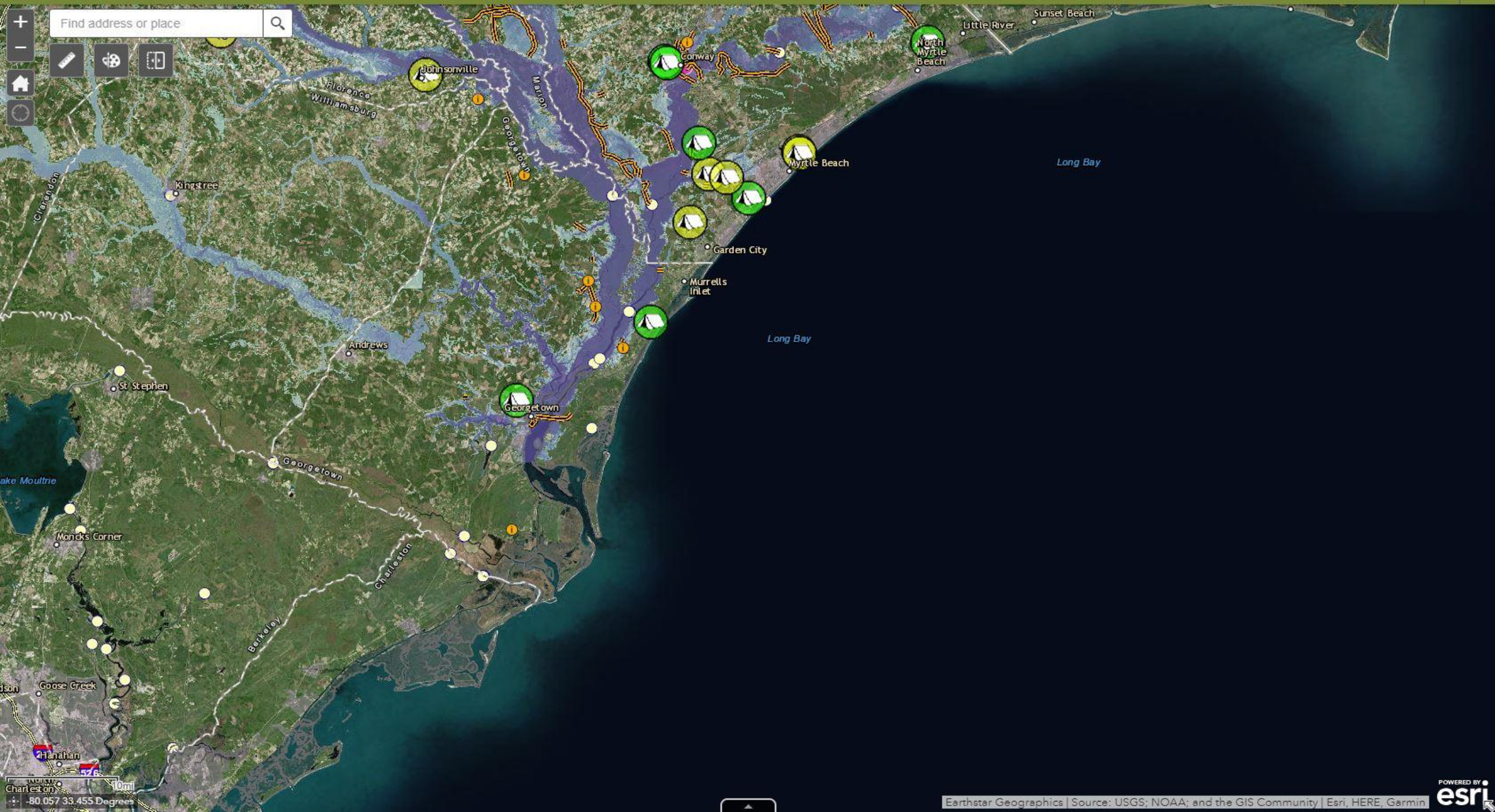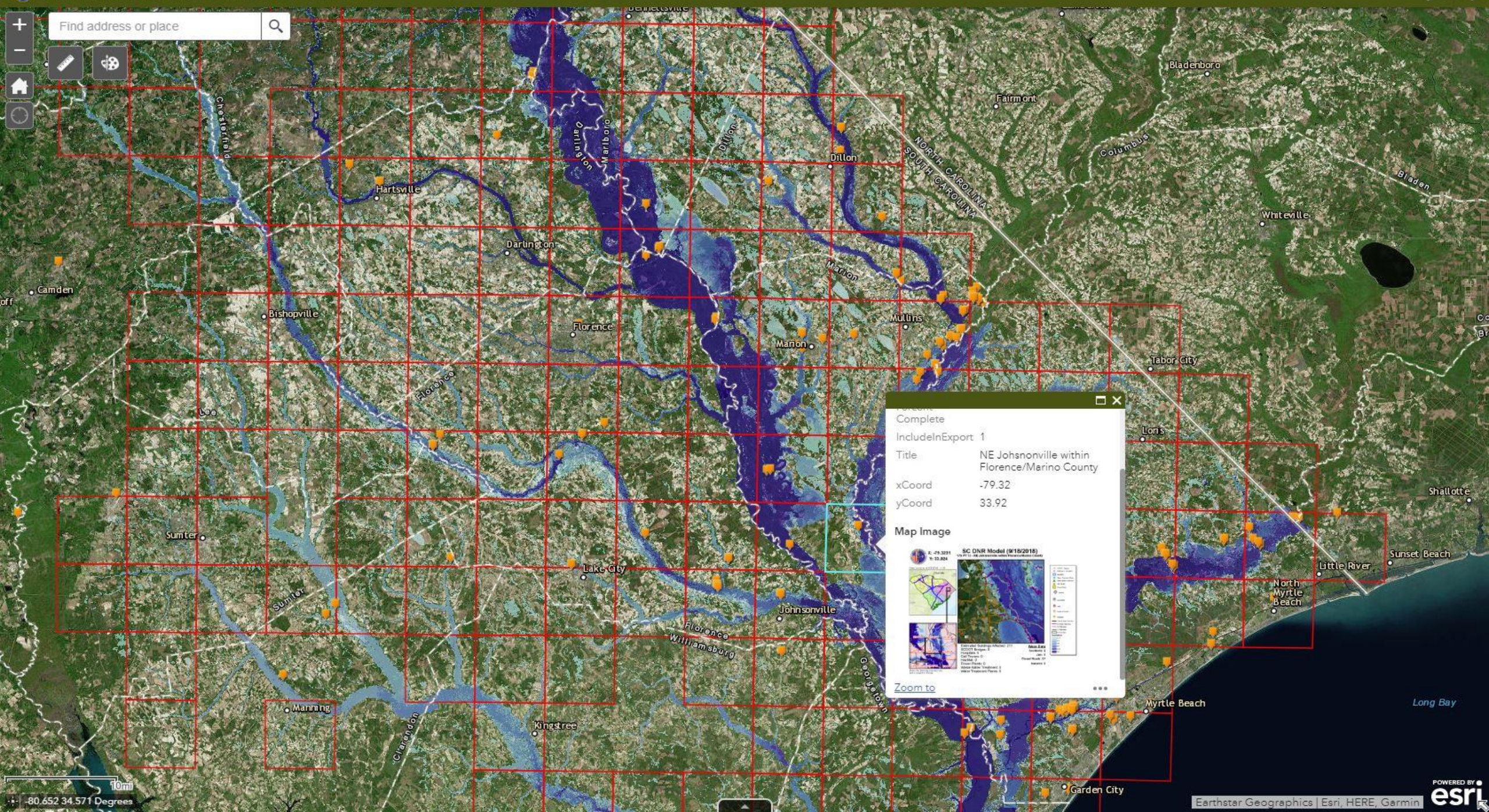
- The SC National Guard (SCNG) provided GIS support throughout the Hurricane Florence activation.

  - SCNG created briefing apps that our Plans section used to brief out on each day.

  - SCNG also created an advanced Search and Rescue Grid application to assist the National Guard with impacts and damage assessment.

Find address or place

Johnsonville

Conway

North Myrtle Beach

Little River

Sunset Beach

Long Bay

Myrtle Beach

Garden City

Murrells Inlet

Long Bay

Kingstree

Andrews

Georgetown

St Stephen

Georgetown

Lake Moultrie

Moncks Corner

Charleston

Goose Creek

Hanahan

-80.057 33.455 Degrees

10mi

Earthstar Geographics | Source: USGS; NOAA; and the GIS Community | Esri, HERE, Garmin

Find address or place

Percent
Complete
IncludeInExport   1
Title   NE Johsnonville within
                    Florence/Marino County
xCoord   -79.32
yCoord   33.92

Map Image

SC DNR Model (9/18/2018)

Zoom to

-80.652 34.571 Degrees

Earthstar Geographics | Esri, HERE, Garmin

POWERED BY
esri

We Had Help

- As with the past 3 years of natural disasters, Esri's Disaster Response Program (DRP) provided support.

  - Technical – both in house and online.
  - Project based – ingested outside agency flood models.
  - Kept me relatively sane!

- Renee Bernstein & Cameron Amrine came to SCEMD during the activation and were lifesavers!

  - THANK YOU!

Summary

SCEMD

- SCEMD was activated for a record 33 days, and GIS played a role in supporting all aspects of the activation.

- SCEMD's GIS department saw requests for all types of GIS outputs from interactive web applications to the more traditional static maps.

- The goal of the GIS department is to provide better data to the emergency managers and responders to help them make better plans and decisions.

Questions??