Unit 4:
Inland Hurricane Preparation in Practice

Unit 4 Objectives

At the end of this unit, you should be able to:

1. Compare the challenges of coastal and inland emergency managers.
2. Discuss the available planning resources to assist inland EMs in evacuation decision making.
3. Describe available flood inundation support tools.
4. Identify the purpose of the Hurricane Liaison Team.

Discussion 1: Evacuations

Activity Time: 10 minutes

Goal: Discuss the evacuation challenges that are:

- Unique to **coastal** EMs/decision-makers.
- Unique to **inland** EMs/decision-makers.

Directions:

- Pair up with a neighbor.
- Fill out the chart in the Unit 4 Discussion Handout.
- Prepare to share with class.

Coastal vs. Inland EM Challenges 1

Coastal EM Challenges/Advantages	Inland EM Challenges/Advantages
Advantage: Longer lead-time and there is enough forecast confidence to enable evacs far in advance of the storm.	Disadvantage: Flash Floods may provide little-to-no lead time. There is rarely enough confidence to enable evacs far in advance of the storm. Mainstem river flooding will have slightly more lead time, but still may prove difficult. Mainstem river forecasts will have greater confidence than flash flooding.
Advantage: Evacs occur prior to onset of hazards.	Disadvantage: Evacs could occur during hazardous weather, posing threats to both motorists and first responders. May be harder to communicate evac orders if communications infrastructure impacted.

Coastal vs. Inland EM Challenges 2

Coastal EM Challenges/Advantages	Inland EM Challenges/Advantages
Disadvantage: Larger-scale evacuations (100,000s, if not millions, of evacuees), who may need to travel significant distances to get to safety/comfort. “Shadow evacuees” will contribute significantly to the evacuating pop.	Advantage: Smaller-scale evacs (at least relative to coastal evacs), and evacuees may not need to travel far to get to safety/comfort. Few, if any, “shadow evacuees.”
Advantage: Predetermined surge evacuation zones, which can be communicated to the public during Blue Sky.	Disadvantage: Not many inland communities have pre-established evac zones beyond FEMA Flood Hazard Areas (which may not cover all of the flood-prone in an extreme flood event).

Coastal vs. Inland EM Challenges 3

Coastal EM Challenges/Advantages	Inland EM Challenges/Advantages
Advantage: Regularly updated Hurricane Evacuation Studies (HESs), including recalculated evac clearance times.	Disadvantage: There are HES-like studies for inland EMs, but they don't quite offer the same suite of tools.
Same: widespread severe impacts	Same: widespread severe impacts

Evacuations for Inland Communities

Basic Inland Evacuation Considerations:

- What areas are most susceptible to inland flooding?
- What structures will withstand the winds?
- Hide from the wind (mobile homes, if strong-enough winds extend far enough inland)?
- Community/neighborhood isolation (aka “evacuation islands”)?
- Resiliency of critical infrastructure?

Evacuations for Inland Communities 2

Inland Evacuation Timing Considerations

- Onset of hazards
- Time of day
- Ongoing Weather Hazards
- Response Time / Evacuation Departure Time (i.e. the amount of time it will take a household to respond to the evac order)
- Traffic management considerations

Evacuation Decision Considerations

Protective Action Decisions within a jurisdiction are frequently made by an elected official

- Define ultimate authority
- Consensus from other elected officials
- Verification by local ordinance or state code

Regional Considerations

Evacuation decisions by one jurisdiction **may** affect others

- Inland evacuations tend to be smaller-scale compared to coastal evacuations.
- Evacuees typically don't need to leave the town, county or state. But there are exceptions…

Will evacuees in your jurisdiction have to go to shelters in other jurisdictions?

What are the host jurisdiction considerations?

Blue Sky and Dark Sky coordination with those jurisdictions?

Important Inland Planning Factors

Widespread infrastructure impacts, that could be medium-to-long-term include:

- **Major and secondary roads** flooded, washed out and/or impacted by mudslides/debris. Seemingly unpredictable and random pattern to the impacts.
- **Key bridges** may be washed away by the floodwaters and/or debris.
- **Power outages** caused by flooding of grid facilities.
- **Water and sewer disruptions**, including for critical facilities (e.g., hospitals).

Important Inland Planning Factors (cont.)

- The importance of air operations given potential for severe disruption of roadway networks.
- Widespread HAZMAT threats.
- Major and potentially long-term impacts to agriculture.

Discussion 2: Vulnerable Facilities/Populations

Time: 10 minutes

Goal: Build a list of (1) vulnerable facilities and (2) populations that need to be accounted for when developing inland flooding plans.

Directions:

- Pair up with a neighbor.
- Fill out the chart in the Unit 4 Discussion Handout.
- Prepare to share with class.

Vulnerable Facilities

- Hospitals
- Assisted Living and Nursing Homes
- Critical Infrastructure
- Public Safety Facilities
- Industrial Facilities
- Tourist and Recreation Areas
- Mobile Homes

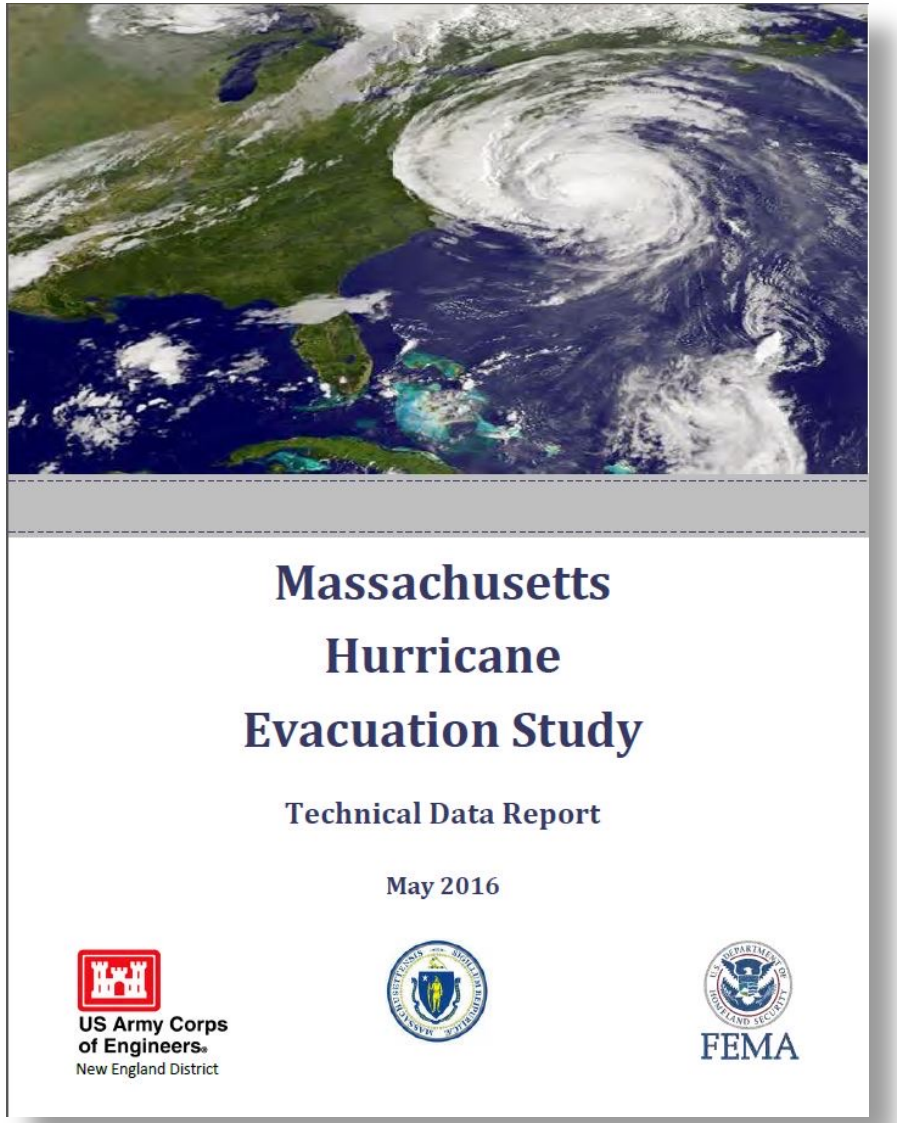
Vulnerable Populations

Socioeconomic Status	• Below Poverty • Unemployed • Income • No High School Diploma
Household Composition & Disability	• Aged 65 or Older • Aged 17 or Younger • Civilian with a Disability • Single-Parent Households
Minority Status & Language	• Minority • Speak English “Less than Well”
Housing & Transportation	• Multi-Unit Structures • Mobile Homes • Crowding • No Vehicle • Group Quarters

Hurricane Evacuation Study (HES)

- What will be wet and what stays dry?
- Who/what will be affected in your community?
- What is the Public thinking?
- What are your shelter needs?
- Where is traffic going to back up?
- Evacuations from storm surge risk
- Predominantly focused on storm surge & coastal areas, currently no inland flooding equivalent

Inland EMs have other resources at their disposal.



Discussion 3: Planning Resources

Time: 10 minutes

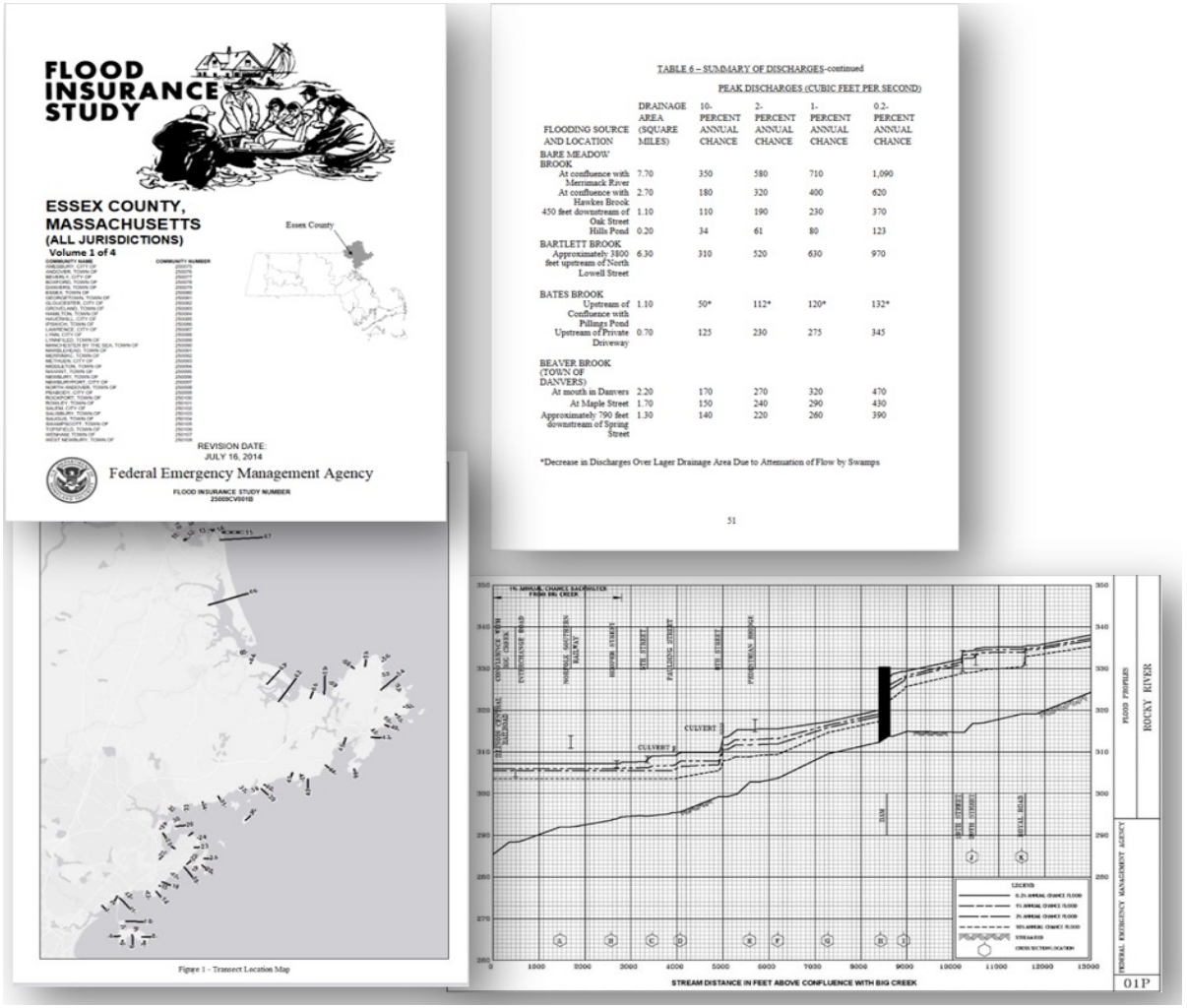
Goal: In the absence of an HES for inland EMs, what resources are you aware of in your jurisdiction/state that you can use to answer these same questions?

- Determine the extent, severity, location, and duration of hazards.
- Identify areas/neighborhoods that would need to evacuate in a given scenario.
- Identify vulnerable populations/facilities.
- Estimate shelter needs.
- Assess evacuation elements (routes, timing).

Directions:

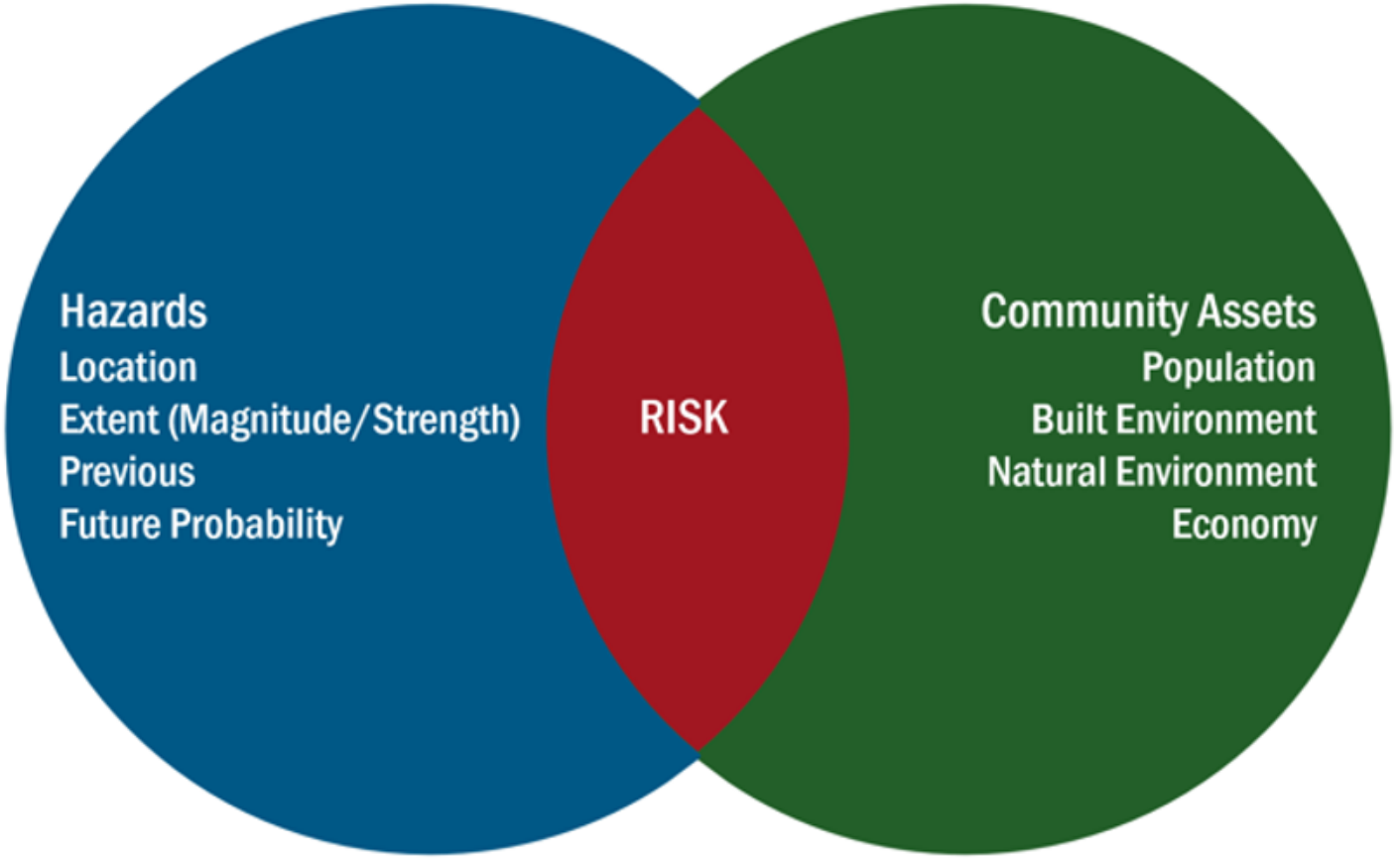
- Pair up with a neighbor.
- Fill out the chart in the Unit 4 Discussion Handout.
- Prepare to share with class.

Flood Insurance Studies (FIS)



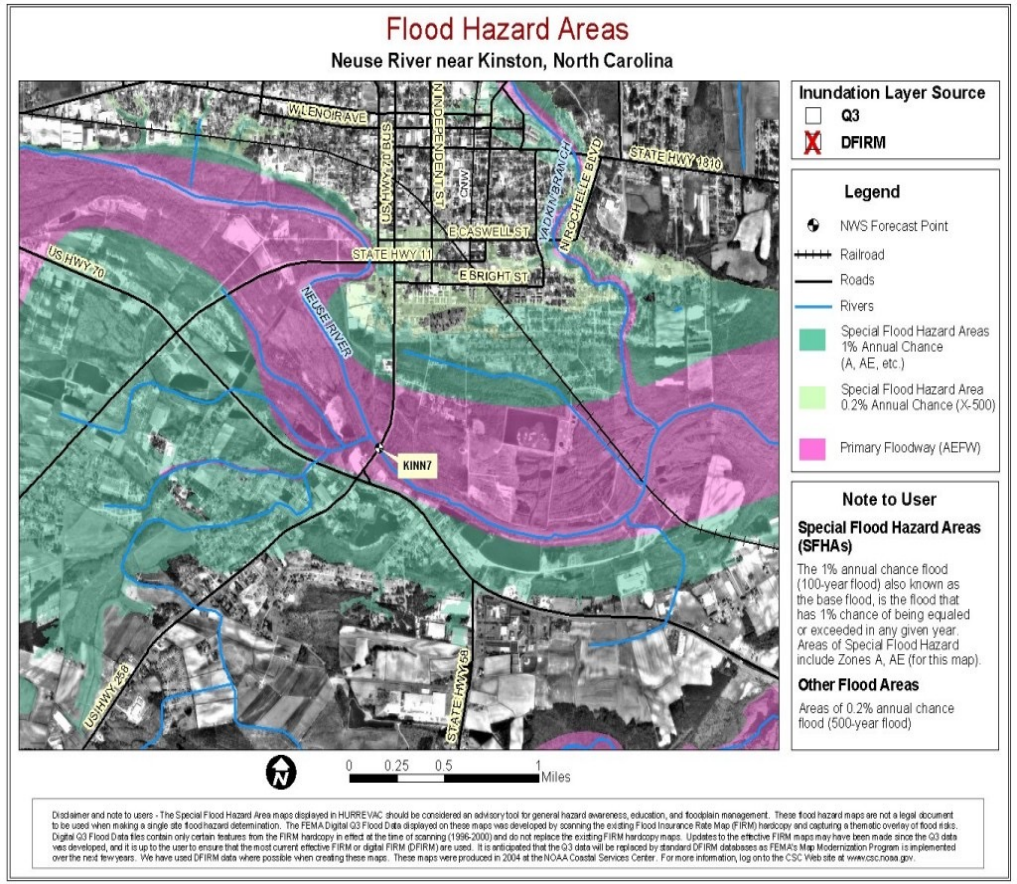
- A compilation and presentation of flood hazard areas along rivers, streams, coasts, and lakes within a community.
- A **Flood Insurance Study (FIS)** includes:
  - Cross sections
  - Coastal transects
  - Riverine flood profiles
  - H&H engineering
- The results of the FIS are shown on FEMA's flood maps called **Flood Insurance Rate Maps (FIRMs)**, and in the accompanying description of the study called an FIS report.

Hazard Mitigation Plans



- Hazard mitigation planning reduces loss of life and property by minimizing the impact of disasters.
- State, tribal and local governments identify natural disaster risks and vulnerabilities that are common in their area.
- Develop long-term strategies for protecting people and property from similar events.
- Mitigation plans are key to breaking the cycle of disaster damage and reconstruction.
- Updated every five years and required to receive hazard mitigation grant funding

FEMA Flood Hazard Area Mapping



Flood Hazard Areas

- Map shows special flood hazard areas
- Overlay of local features
- Can be applied for GIS use

Map Service Center

Access Products

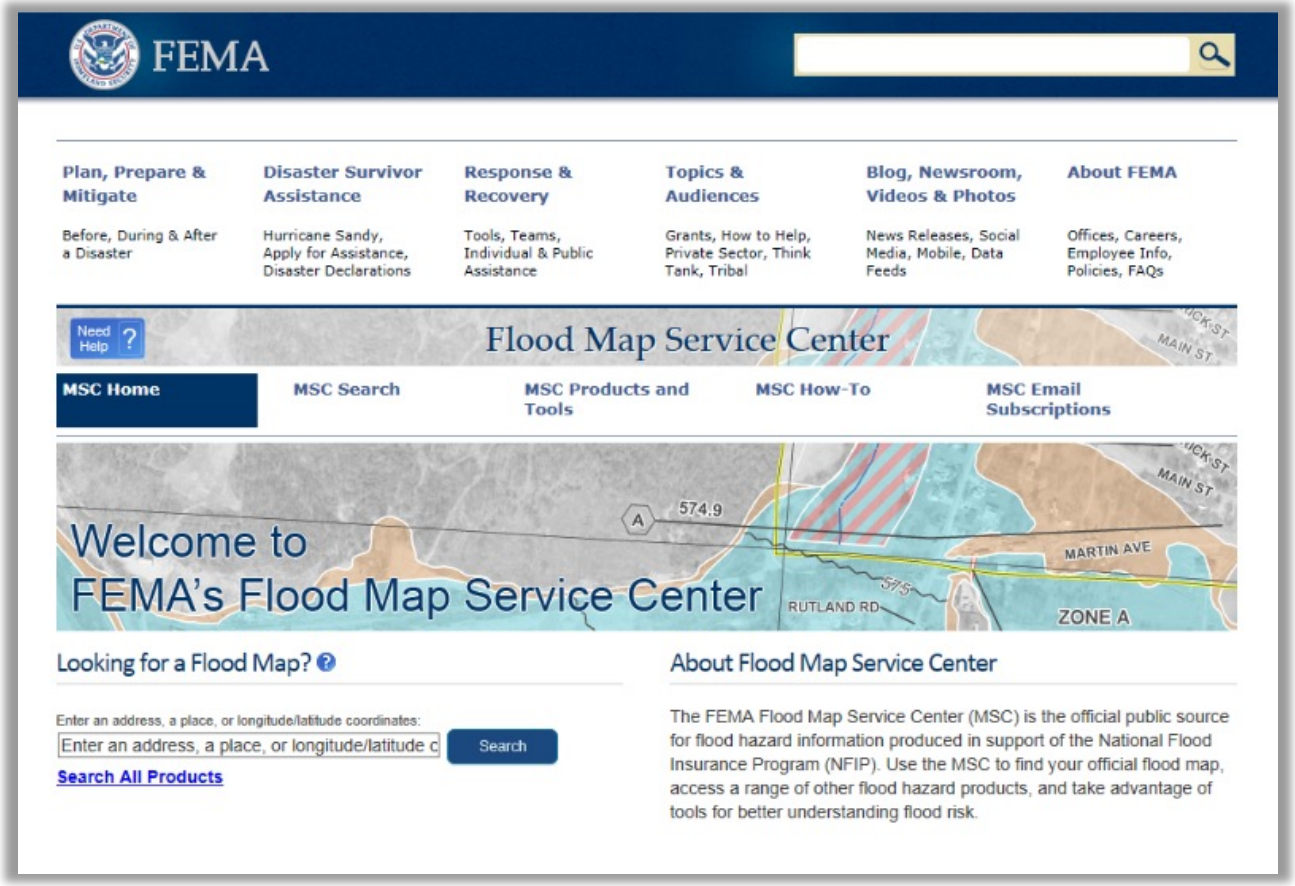
- FIRMs & FIS
- DFIRM Database
- LOMCs

Access Tools

- Make a FIRMette
- National Flood Hazard Layer (NFHL)

Resources

Live Mapping Support at the [Map Service Center]



https://msc.fema.gov/portal/home

Inundation Mapping Tool Demo

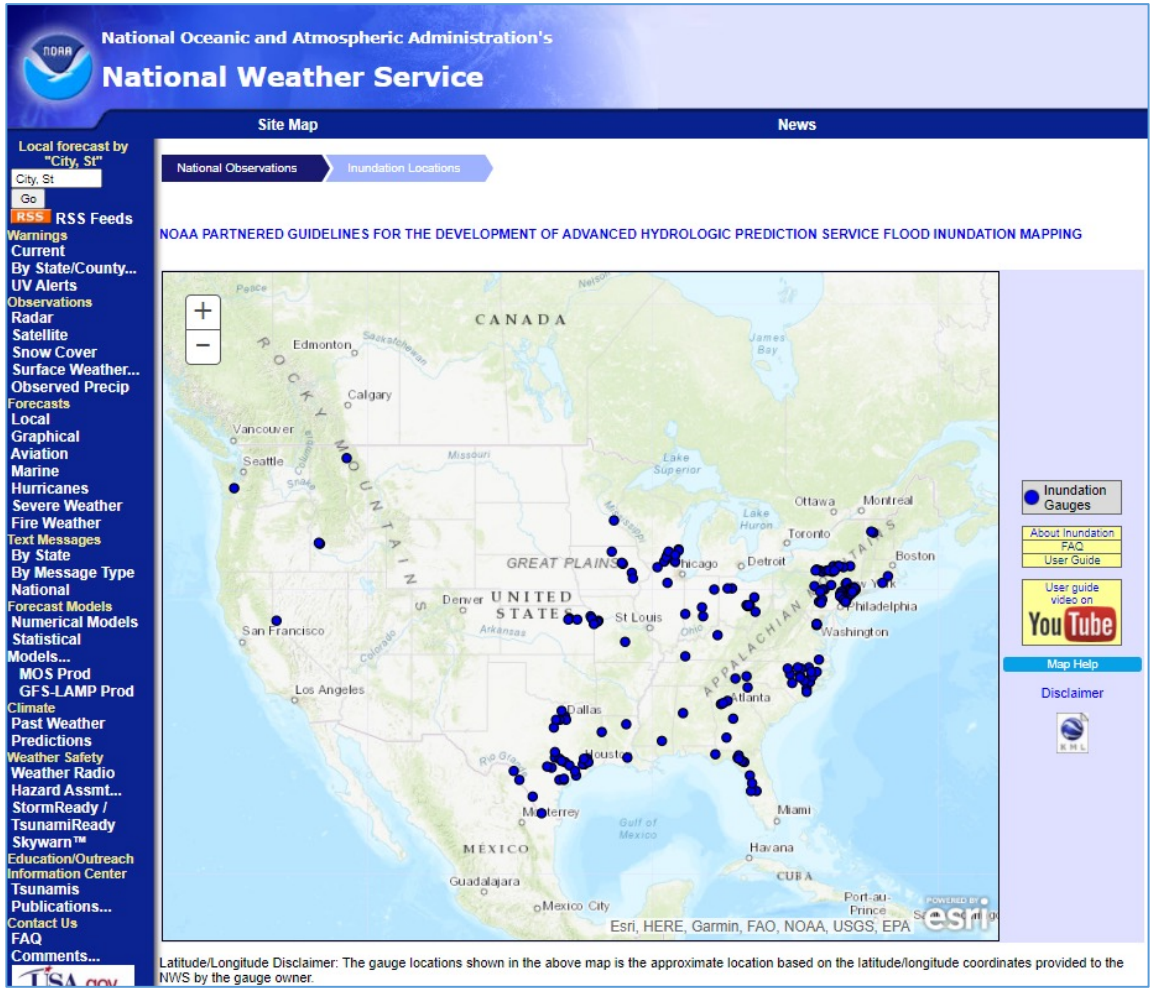
Instructor-Led Demonstration of Inundation Mapping Tool

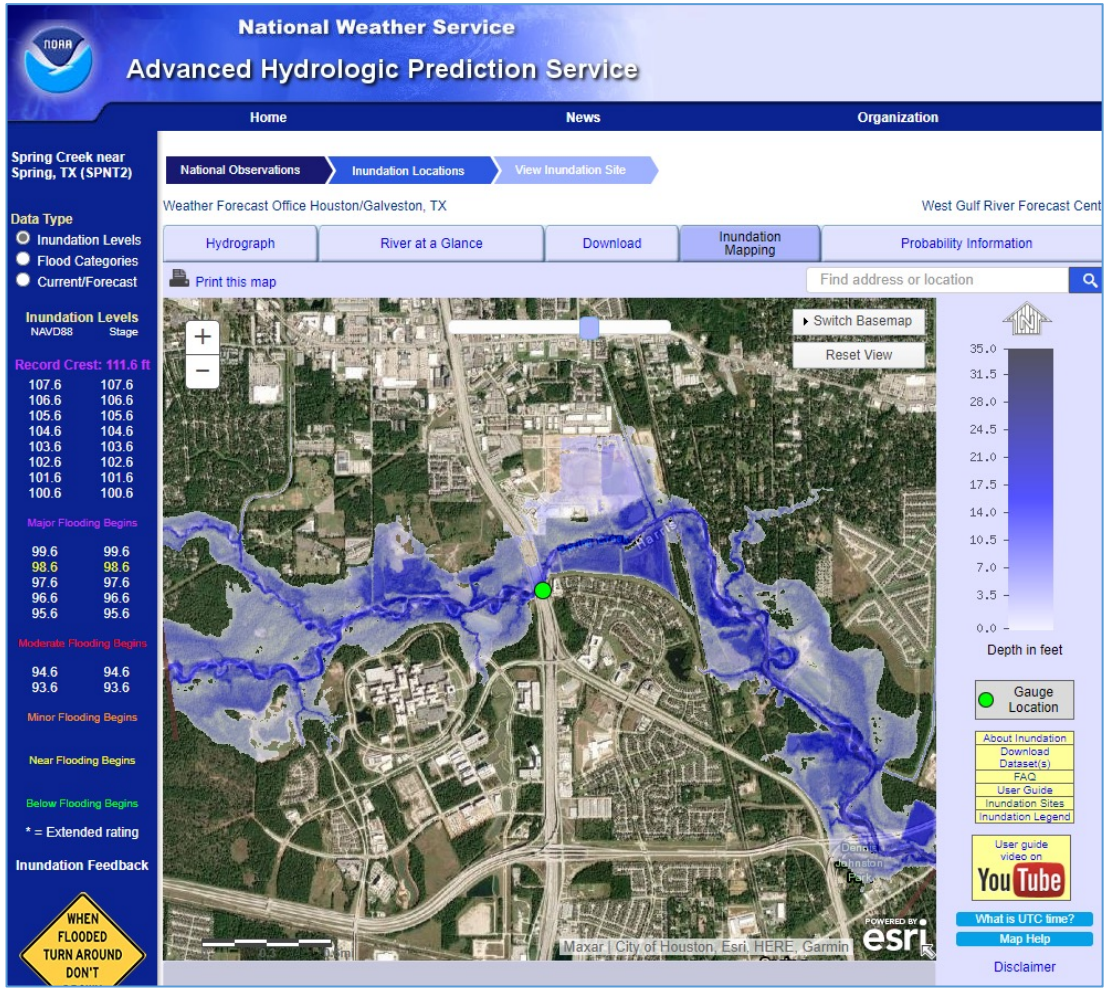
Activity Time: 5 minutes

Goal: Explore the Inundation Mapping Tool

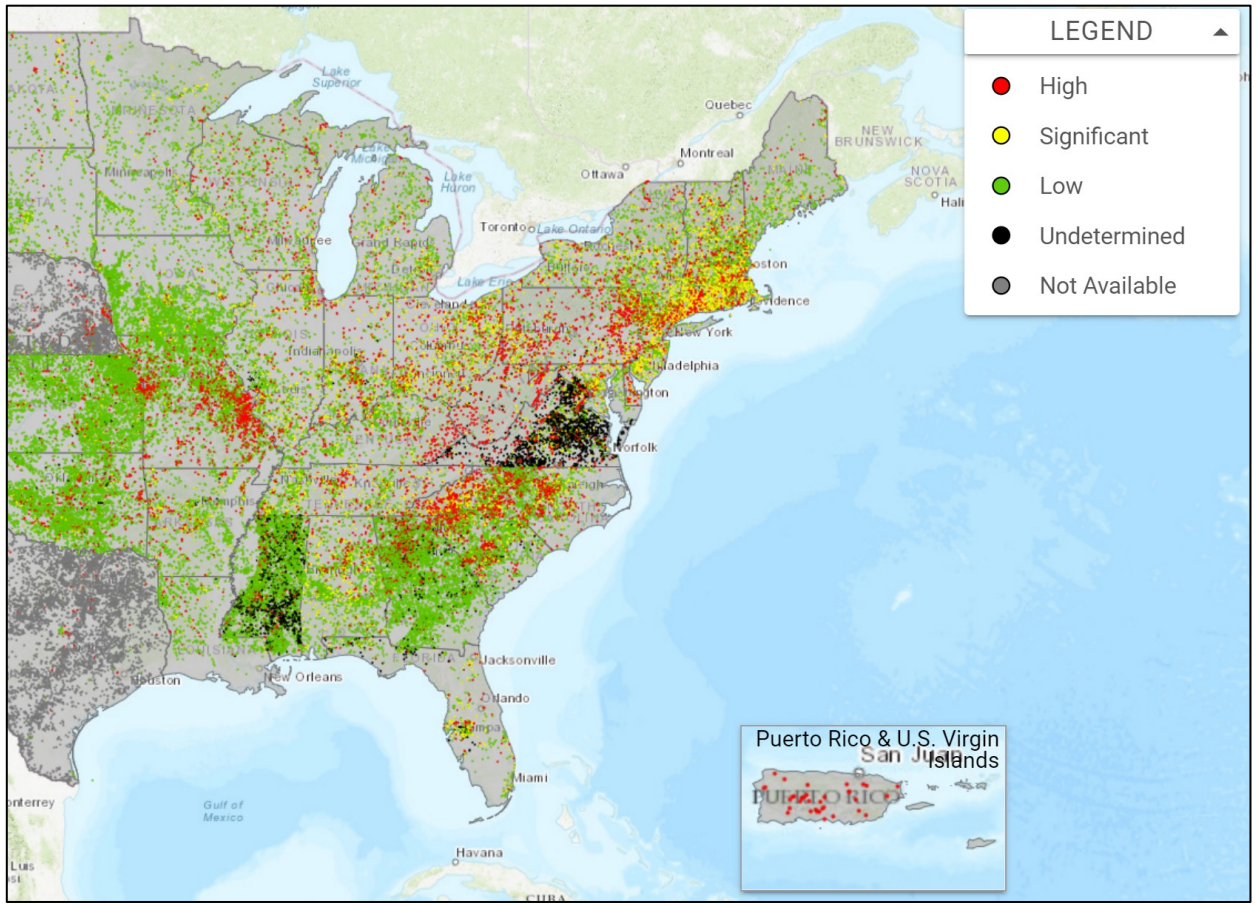
1. Layout of the interface
2. Locations of key information
3. How to set inundation levels/map features.

AHPS Flood Inundation Mapping Libraries





USACE National Inventory of Dams



Hazard Potential Classification	Loss of Human Life	Econ, Envi, Lifeline Losses
Low	None Expected	Low and generally limited to owner
Significant	None Expected	Yes
High	Probable. One or more expected	Yes (but not necessary for this classification)

Dam Hazards

Dam failure threat level terminology can vary between dam operators, which can easily cause confusion.

- Work with your dam operators in blue sky to understand their processes and language.

Dam inundation flood analysis (hasty analysis program used by some WFOs).

Exercises!

Operational Timeframe

- Understand pre-existing conditions, hazard related or infrastructure/facilities
- Ensure internal and external communication channels are open
- Realize the operational time frame
- Anticipate staffing issues/local issues that may impact the activation.

Execution Plan/Checklist/Timeline

Comprehensive guide to direct hurricane preparedness and decision-making for both pre-season and impending hazards.

Decisions and Actions are effective if they are based on:

- An understanding of tropical cyclones
- Hazards
- Community vulnerabilities
- Forecast products
- Good decision-making process

Public and private involvement is essential!

- Checklists are specific to each community

Importance of an Execution Checklist/Timeline

- Prompts for timely action
- Supports decision-making accountability
- Structures documentation
- Ensures coordination and communication

Hurricane Readiness Checklist

FEMA

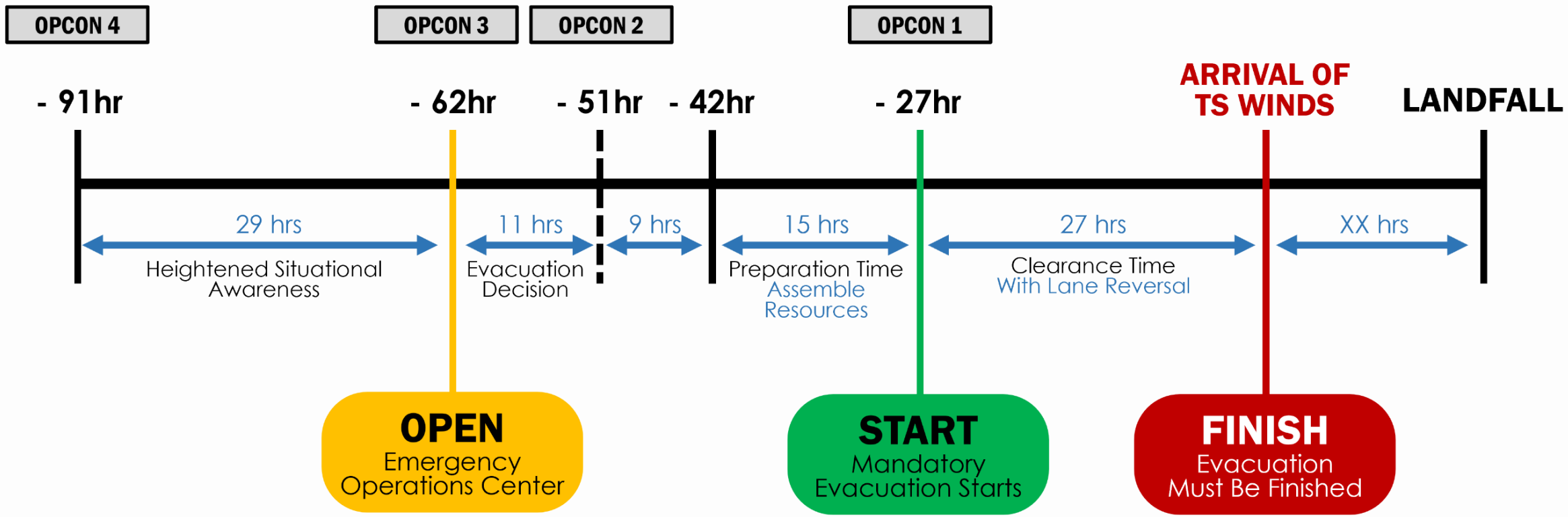
Hurricane Preparedness – prior to June 1	PRIORITY LEVEL	PERSONNEL RESPONSIBLE	STATUS OF TASK	DATE/TIME COMPLETED
Hurricane Planning				
• Update local hurricane operation, evacuation plans and resource files				
• Revise Standard Operating Procedures (SOPs)				
• Review local emergency management ordinances and update				
• Test HURREVAC and/or other hurricane tracking software				
• Review Stafford Act Policies with State Emergency Management				
• Determine evacuation decision making authority w/ line of succession				
Emergency Operations Center (EOC)				
• Replenish supplies and check equipment				
• Test communication lines				
• Update activation plans and train staff				
• Update HURREVAC to latest version				

Hurricane Readiness Checklist (cont.)

FEMA

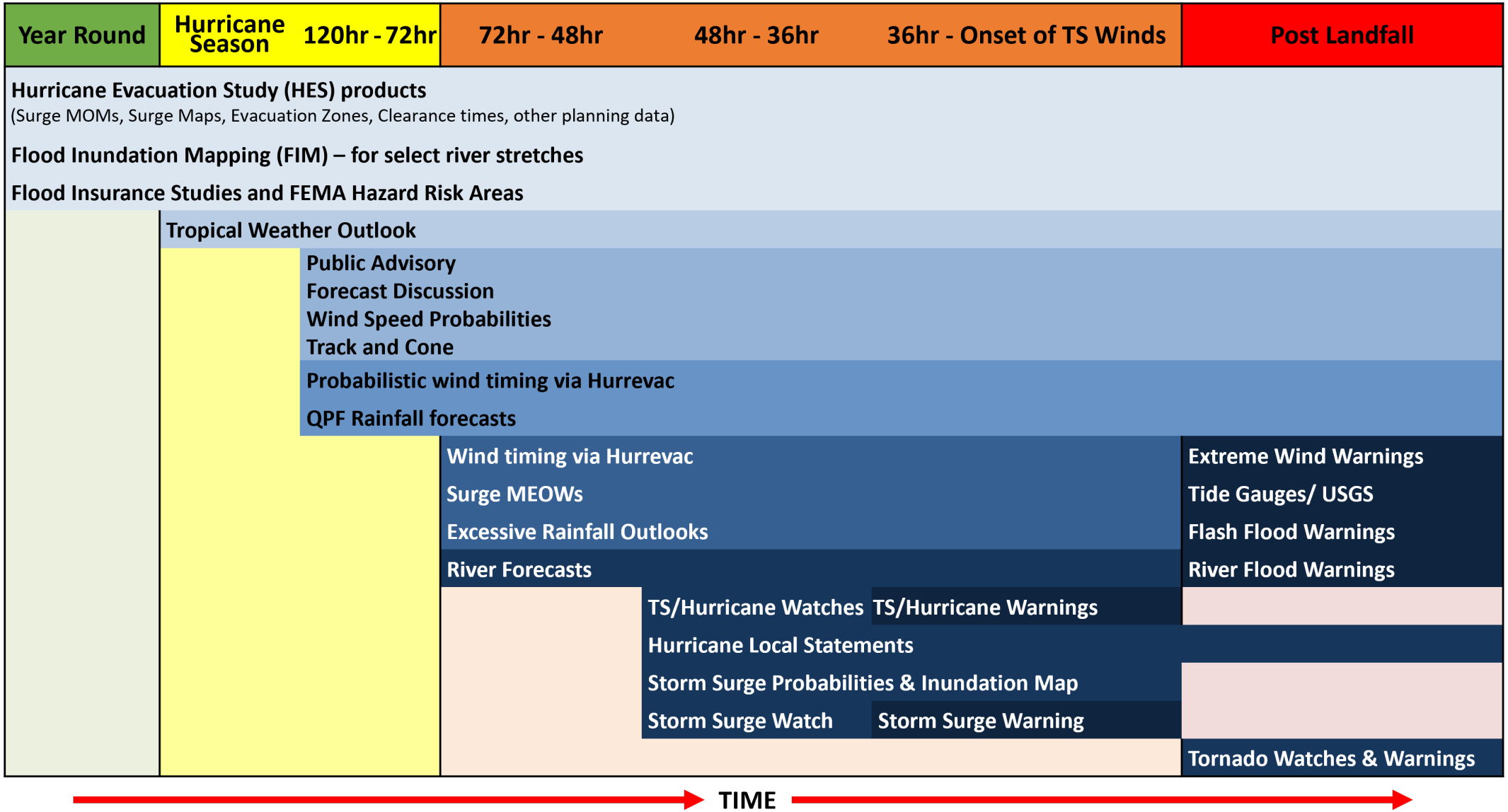
Storm Impacts Imminent (~36 hours) Hurricane Watches and Warnings Issued	PRIORITY LEVEL	PERSONNEL RESPONSIBLE	STATUS OF TASK	DATE/TIME COMPLETED
Storm Watch				
• Conference calls with NOAA local WFO/RFC/SPC				
• Continue to monitor HURREVAC and other systems				
• Monitor storm track and provide local government officials updates				
• Anticipate the possible arrival of rainfall and tornados				
• Monitor river stages and rainfall forecast				
Emergency Operations Center (EOC)				
• Activate EOC (partial or full based on clearance times and threat)				
• Request primary ESF support agencies provide EOC briefings				
• Complete and distribute EOC situation reports, as applicable				
• Prepare EOC facility- Mitigate for Winds, Water, etc.				

Timeline Example



Horry County Evacuation Timeline for ABC Scenario

Forecast Product Timeline



Resource Planning

Here are common items that are most likely to be needed during disasters:

- Shelf Stable Meals
- Bottled Water
- Cots
- Blankets
- Infant Toddler Kits
- Medical Equipment/Supply Kits
- Tarps
- Blue Sheeting
- Generators
- Fuel

Resource Planning (cont.)

Prior to the storm, have a plan on how you're going to acquire critical resources, and identify specific sources.

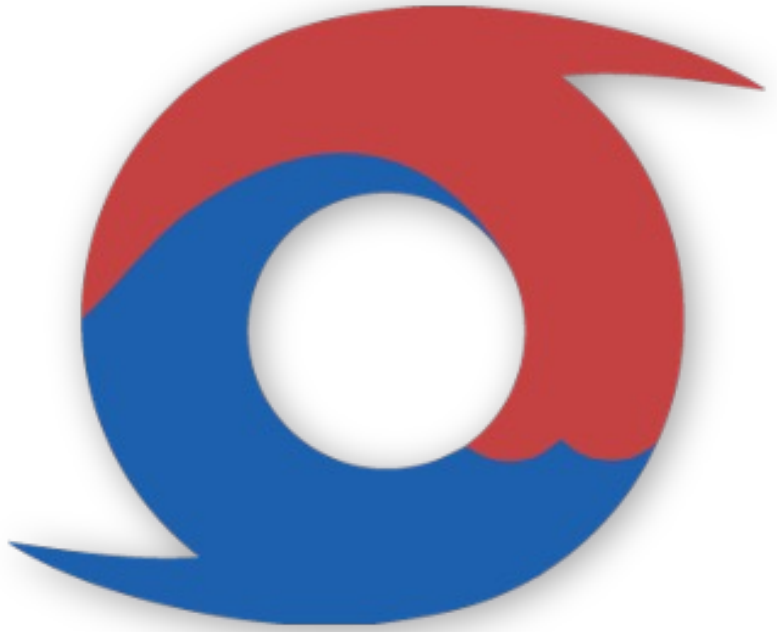
Communicate any remaining resource gaps to stakeholders.

There are several logistical planning resources for emergency managers.

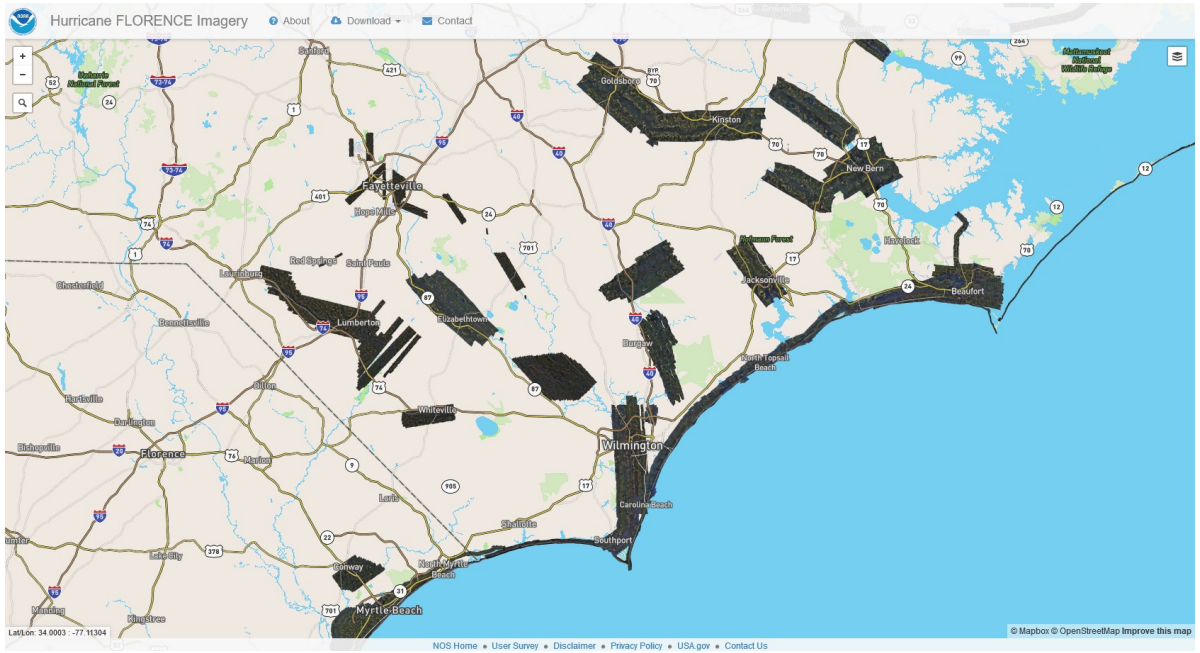
HURREVAC

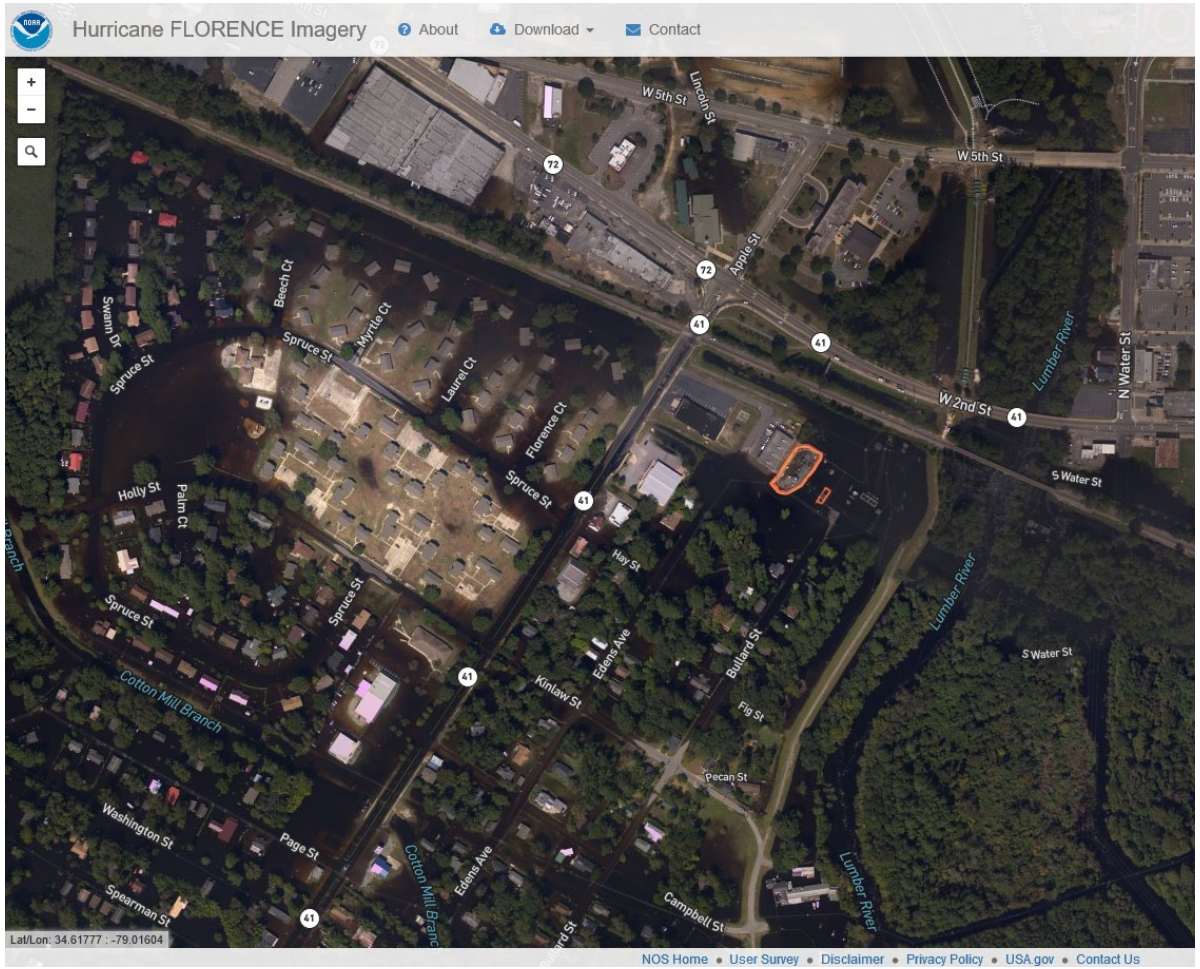
Hurricane tracking and decision support tool

- Tropical Weather Outlook
- Tropical Cyclone track and historical error cone
- Wind probabilities and deterministic wind fields
- Tropical Storm Wind Time of Arrival
- Rainfall Forecasts and Excessive Rainfall Outlooks
- Significant River Flooding Outlooks
- Observed and forecast flood stages along rivers (although less functionality and info than on AHPS website).



Post-Storm Aerial and Satellite Imagery





NWS IDSS & FEMA HLT

NWS IDSS & FEMA HLT address:

- Confidence? Contingencies?
- What is the forecast/evacuation timing?
- Can we get a briefing?

NWS Impact-Based Decision Support Services (IDSS)

IDSS connects NWS forecasts and warnings to decision makers on the local, state, and federal levels to save lives and property.

IDSS includes:

- Remote support with forecast advice through various means (such as phone calls, email or online webinars)
- On-site support at an emergency operations center
- On-site support at an incident or event (such as NWS deployment to a wildfire).

Hurricane Liaison Team (HLT) Background

- Initial idea arose in the early 1990s
- Proven during response to the 1995 Hurricane Season
  - Erin and Opal
- Formalized in 1996
  - Request from Governor of Florida to FEMA and NHC Director

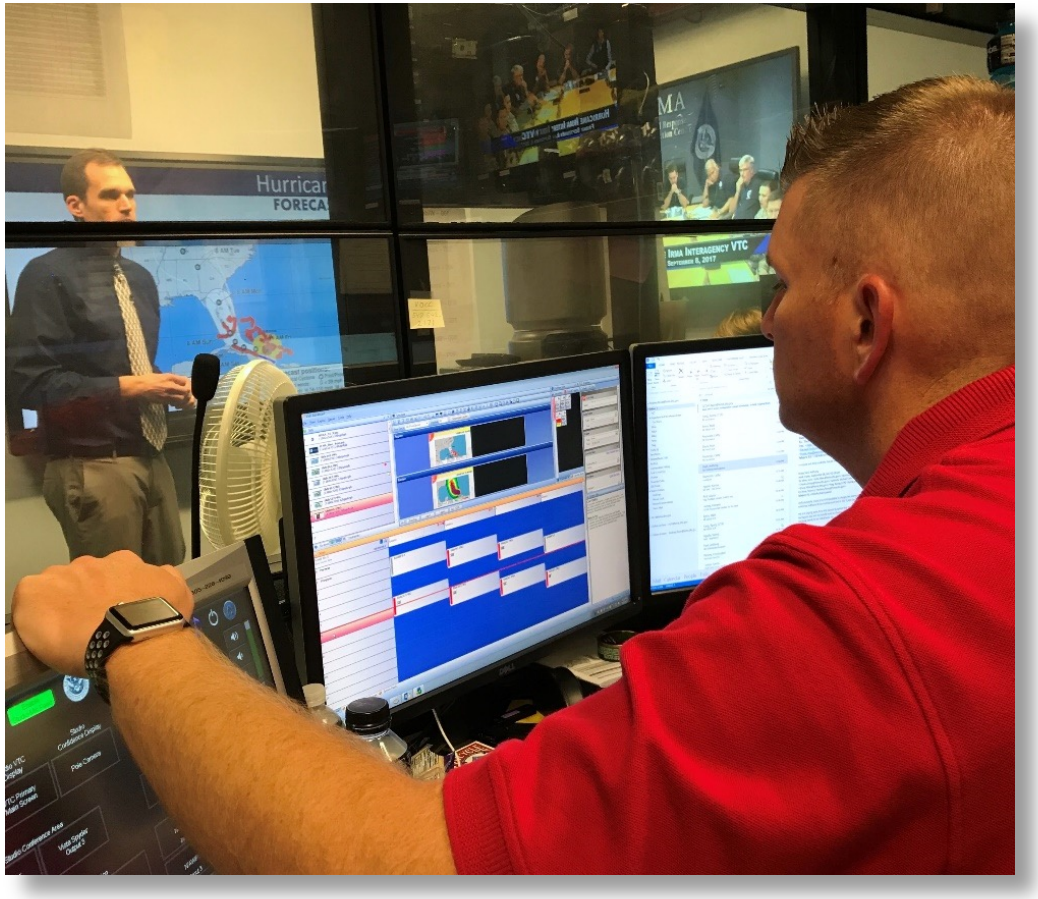
HLT Mission

The Hurricane Liaison Team's mission is to improve our Nation's capability to respond to hurricanes through the rapid exchange of critical information between the National Hurricane Center and Federal, State, Local, Tribal and Territorial emergency managers.

Rapid Communications

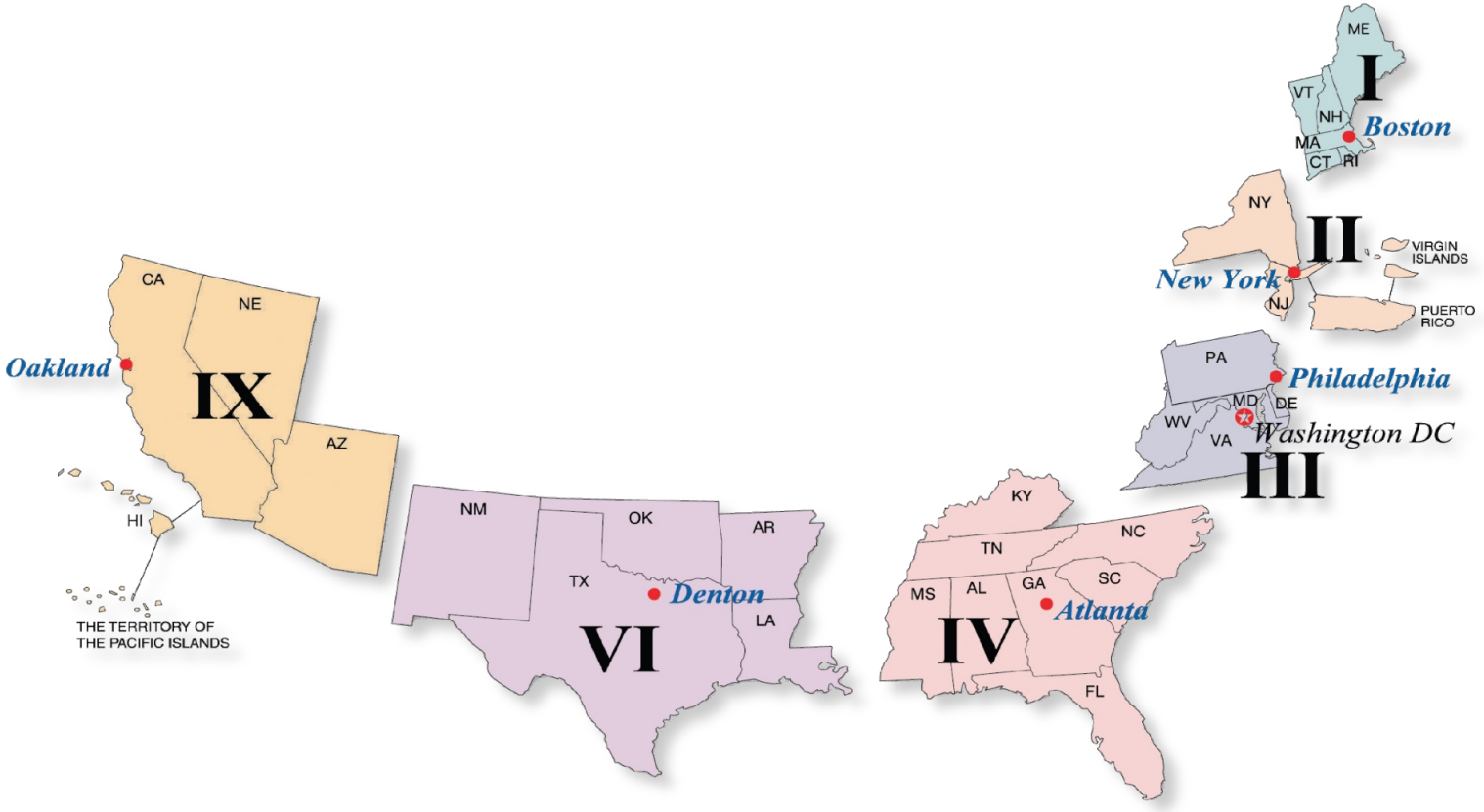
Partnership between the NWS and FEMA

- FEMA Hurricane Program Managers
- FEMA Reservists
- FEMA Liaison to NWS National Water Center
- NWS meteorologists and hydrologists



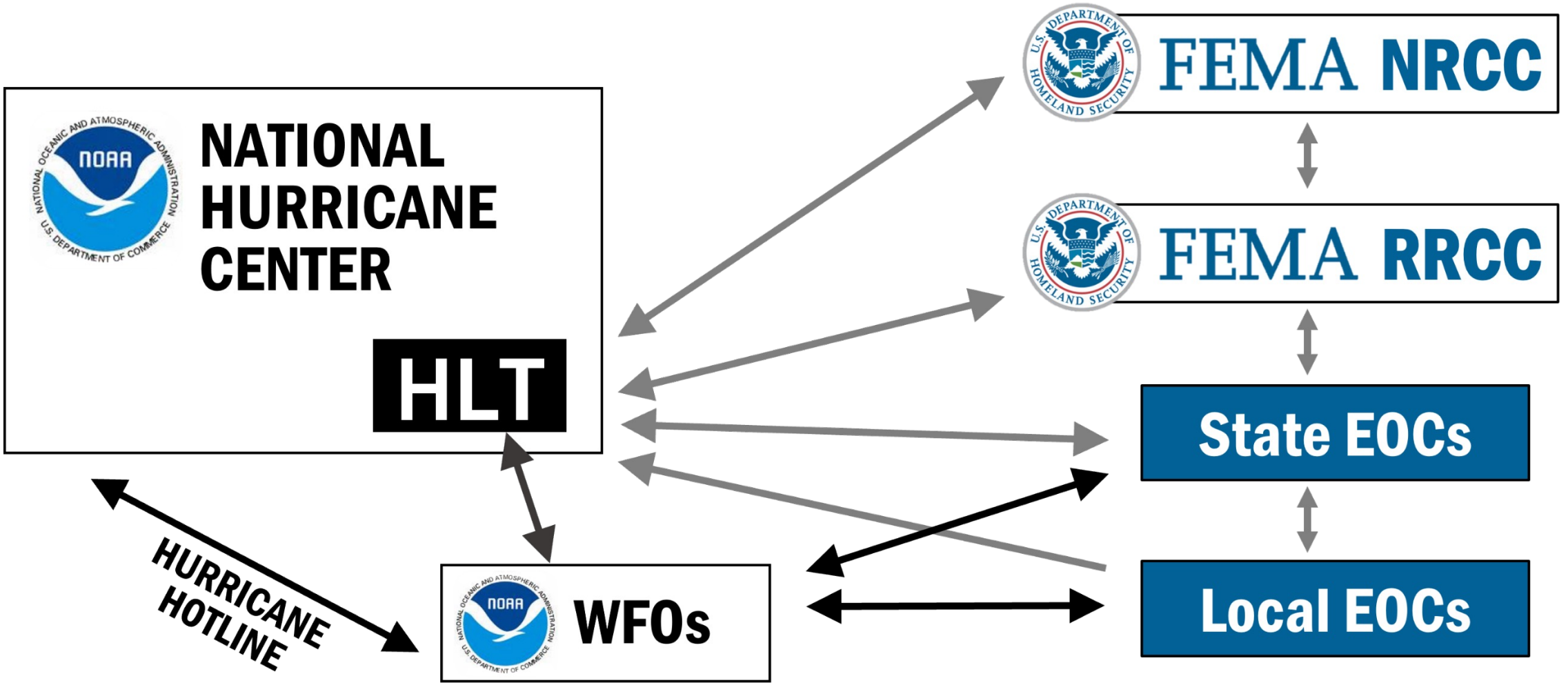
Regional Hurricane Program Manager (RHPMs)

- Technical Knowledge
- State/Local Relationships
- Deploy to NHC



Communication Flowchart

FEMA

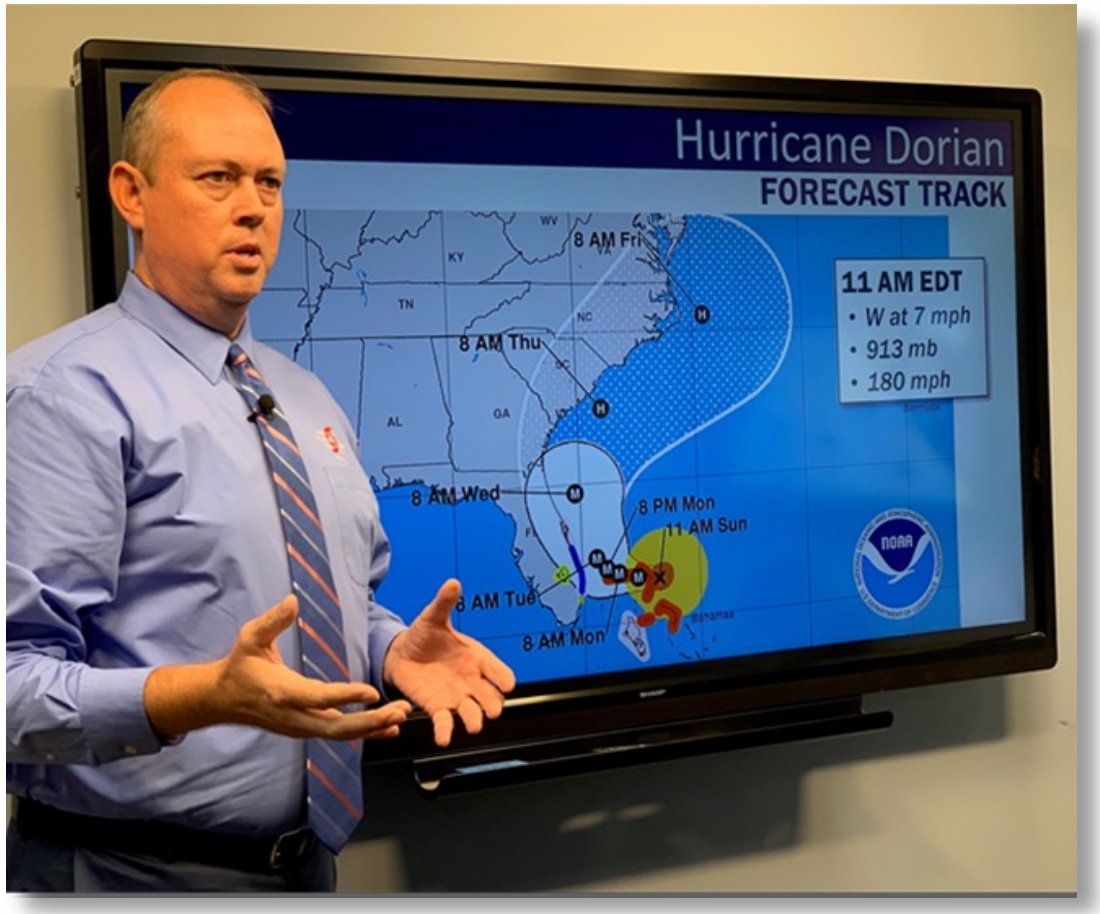


HLT Responsibilities

- Real-time interpretation, assessment and guidance;
  - Apply NHC forecasts with Regional, State and local response evacuation plans
- Forum for EMs to ask questions,
  - Reinforce decisions;
  - Assist with use of NHC forecasts and predictive modeling
- Provide NHC visibility on State and local protective actions
  - Improve messaging

HLT Responsibilities (cont.)

- **Facilitate two-way communications**
  - Between the NHC and EMs
  - Common forecast picture
  - Relay EM issues to improve NWS/NHC messaging
- **Video/Teleconferences**
  - NHC/NWS
  - FEMA and other Federal Agencies
  - Emergency Operations Centers (EOCs)



State Meteorologists & Hurricane Programs

- In addition to NWS and FEMA HLT, your state emergency management agency may also have a State Meteorologist or Climatologist, a State Hurricane Program Manager, or State Hurricane Lead.
- These individuals often work closely with NWS and FEMA.
- They are excellent resources for state-specific tropical threats and plans.

Questions/Comments

Final Examination

Time: 30 minutes

Activity: Complete final exam