



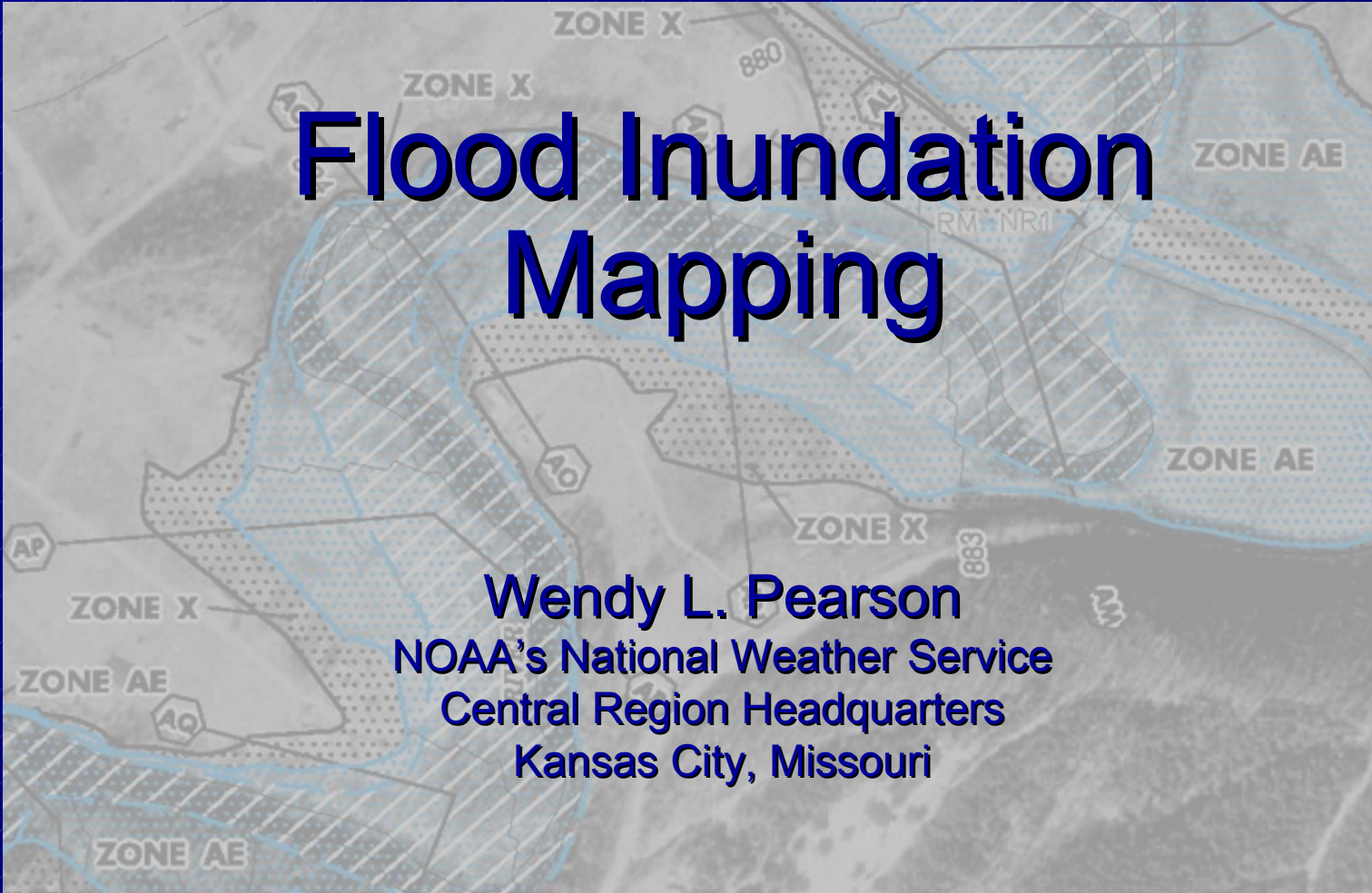
KU GIS Day 2009  
November 18, 2009

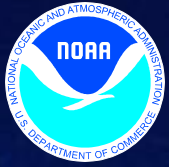


# Flood Inundation Mapping

Wendy L. Pearson

NOAA's National Weather Service  
Central Region Headquarters  
Kansas City, Missouri





# Flood Inundation Mapping

Objectives:

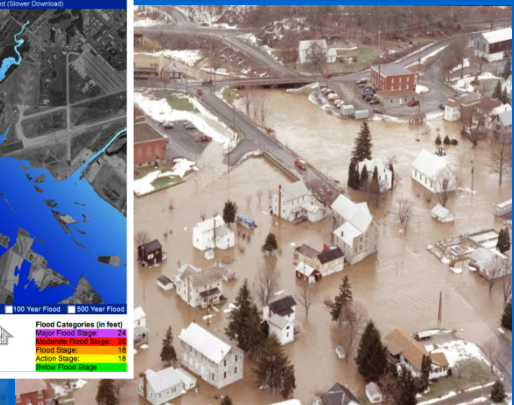
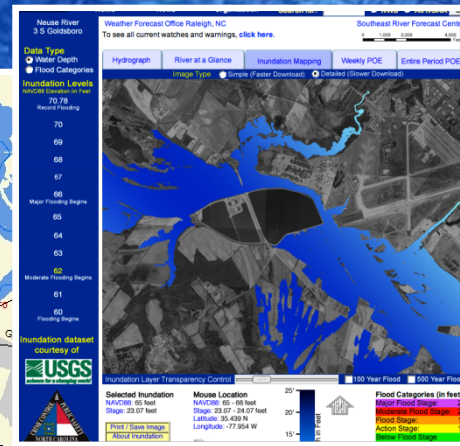
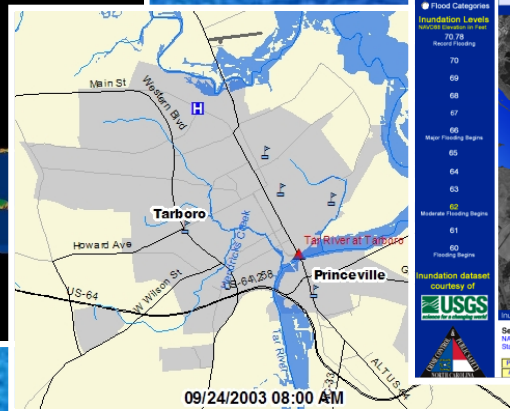
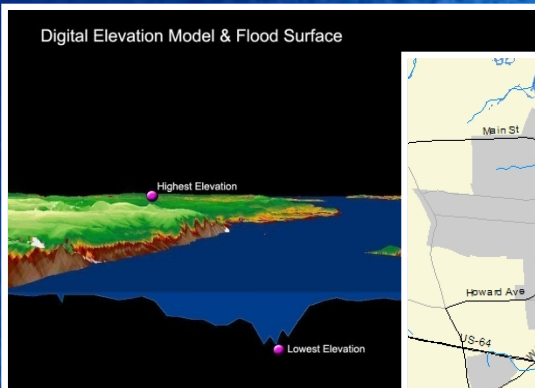
Overview of the technical aspects of the map development process

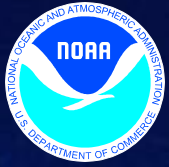
Web demonstration



# NOAA National Weather Service

- Flood Mapping depends on partnerships, diligence, dedication, and commitment to ensure consistency.*





# Flood Risk Communications

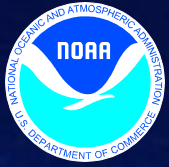
1. Map the Risk

2. Measure the Risk

3. Monitor the Risk

4. Manage the Risk

- \* Provide Decision Support Assistance to our key partners and the EM community
- \* Better quantify uncertainty and assessment of the risk.



# Web Demonstration

Neuse River  
3 S Goldsboro

Weather Forecast Office Raleigh, NC  
To see all current watches and warnings, [click here.](#)

Southeast River Forecast Center

0 1,000 2,000 4,000 Feet

Hydrograph River at a Glance **Inundation Mapping** Weekly POE Entire Period POE

Image Type  Simple (Faster Download)  Detailed (Slower Download)

Inundation Layer Transparency Control  100 Year Flood 500 Year Flood

**Data Type**  
 Water Depth  
 Flood Categories

**Inundation Levels**  
 NAVD88 Elevation in Feet

70.78  
Record Flooding

70

69

68

67

66  
Major Flooding Begins

65

64

63

62  
Moderate Flooding Begins

61

60  
Flooding Begins

Inundation dataset courtesy of

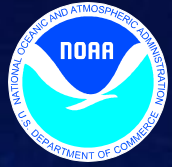
**Selected Inundation**  
 NAVD88: 65 feet  
 Stage: 23.07 feet

**Mouse Location**  
 NAVD88: 65 - 66 feet  
 Stage: 23.07 - 24.07 feet  
 Latitude: 35.439 N  
 Longitude: -77.954 W

[Print / Save Image](#)  
[About Inundation](#)

25'  
20'  
15'  
ft in Feet

**Flood Categories (in feet)**  
 Major Flood Stage: 24  
 Moderate Flood Stage: 20  
 Flood Stage: 18  
 Action Stage: 18  
 Below Flood Stage



# Four Phases of Flood Mapping

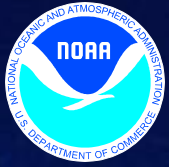
1. Planning (Scoping, Partnering)

2. Analyses

3. Implementation

4. Operations & Maintenance

There is a need to provide clarity, consistency, and oversight to all four phases so that AHPS Flood Mapping growth is enabled, sustained, and maintained.



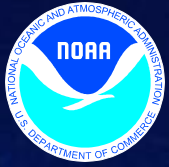
## 1. Planning (Scoping, Partnering)

### Partner with Detailed Flood Insurance Studies

- FEMA approved Hydraulic Models (1D, 2D, Steady vs Unsteady)
- 10M Digital Elevation Mapping
- Lidar 1.2 ft vertical accuracy (2 ft contour equiv)

### Partner without Detailed Flood Insurance Studies

- Find or create mapping and modeling data



## 1. Planning (Scoping, Partnering)

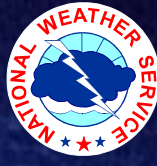
### Suitable Static Flood Mapping Candidates

- Hydraulic Models (1D)
- Steady Flow Upstream Boundary or Unsteady Flow Upstream Boundary with FEMA profiles
- Downstream Boundary with Good USGS ratings
- Water surface is level across each cross section
- Well defined channels
- Detail Cross Sections and Streambed



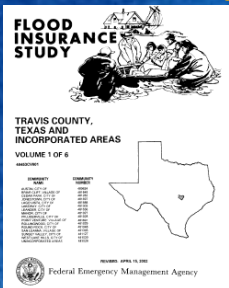
For more info, see **USGS Scientific Investigations Report 2007-5032**  
<http://pubs.usgs.gov/sir/2007/5032/pdf/SIR2007-5032.pdf>





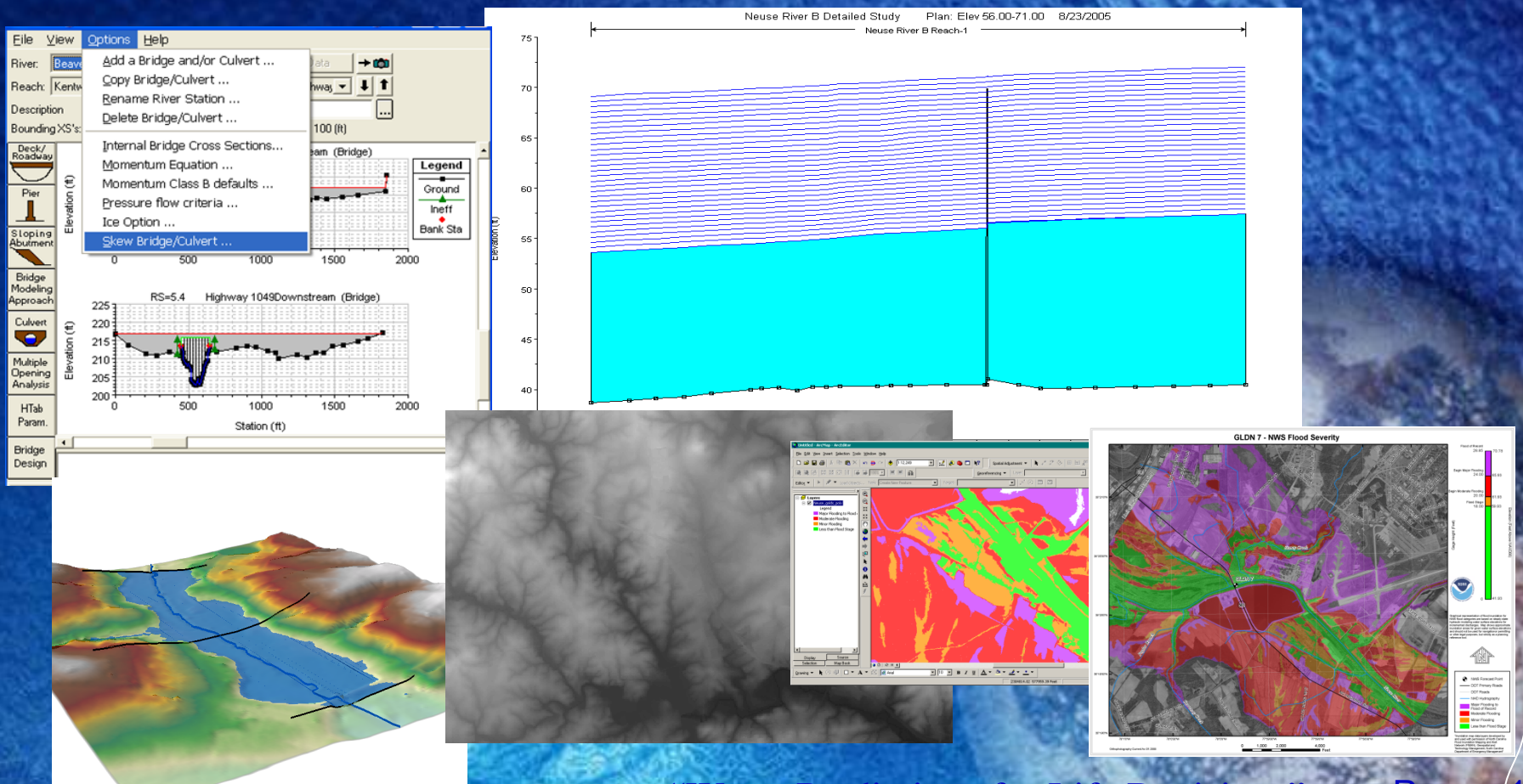
# 1. Planning (Scoping, Partnering)

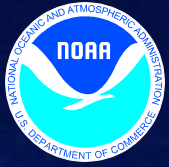
- **NWS verifies locations appropriate for Static Flood Inundation Mapping**
  - If dynamic effects (such as tides/significant backwater) are involved at a given forecast reach, static flood inundation mapping is not appropriate.
- **Discuss Data and Production Resources with Potential Partners**
- **NWS and partners investigate available high resolution topography (digital elevation models – DEM's and lidar data)**
  - NSGIC State Contacts (<http://www.gisinventory.net/summaries/>)
- **NWS and partners review FEMA Flood Insurance Studies, Flood Profiles, reanalysis of 100 yr, 500 yr levels.**
  - FEMA GIS and State Contacts (<https://hazards.fema.gov/contacts/statecontacts/contacts.asp?>)
  - Floodplain Managers (<http://www.floods.org/StatePOCs/map.asp>)



# 2. Analyses

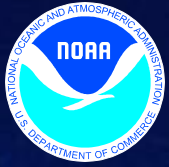
- Create water surface profiles that include the Flood Stage, minor, moderate, major flood levels. **Validate these with historic data.**





## 2. Analyses

- **GIS Work – Inundation Library Creation**
  - Use FEMA approved techniques to transform the hydraulic model water surface profiles into shapefiles representing inundation area and rasters representing depth of flow.
  - Edit to remove unconnected polygons (ponds).
  - Shapefiles need attributes for water surface elevations.
  - Levees and bridges represented to NWS standards
  - Collect metadata records for all GIS files.
- **Delivery supporting data**
  - DEM, hydraulic model, stream centerline, roads, aerial photo for each location, etc.
  - Required for long term maintenance by NWS.
  - Complete project summary report.

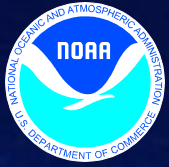


# Quality Assurance/Quality Control in the Flood Mapping Program

## Purpose:

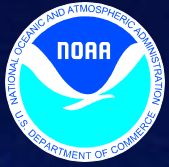
- Assure consistency of Flood Mapping.
- Assure Flood Mapping looks hydrologically and hydraulically reasonable.
- Minimize reprocessing

... increase trust, confidence, and reliability



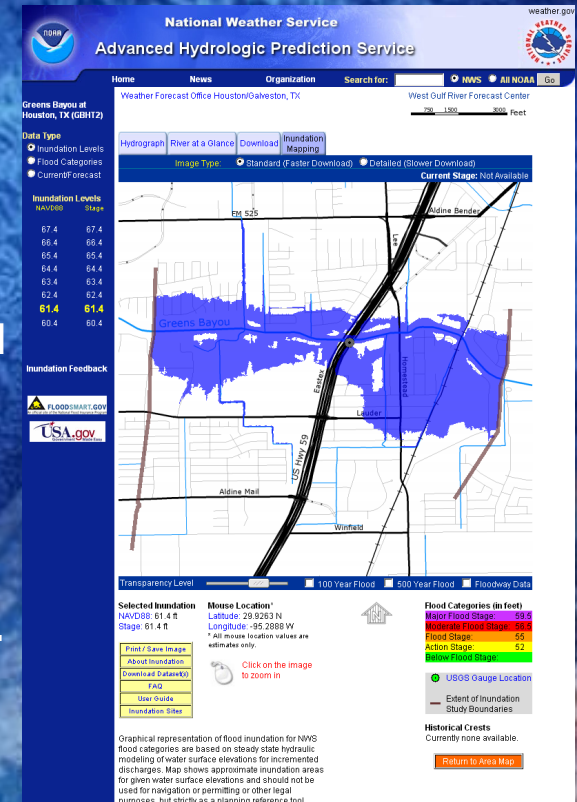
## 2. Analyses

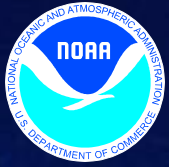
- Partner provides Shapefiles to a NWS Mapping Review Board
  - Board **loads** data for Review.
  - Board **coordinates** discussion on list of issues.
  - Deliverables are **approved** or **returned** for reprocessing.
  - Approved deliverables are issued to AHPS Web Contractor
  - Monthly Conference Calls.



### 3. Implementation

- **Web contractor receives Deliverables from Partner performing Modeling and Geospatial Analyses**
  - Shapefiles are processed to create the depth images.
  - All information is converted to pre-set transparent gifs/pngs so web images can be displayed quickly.
  - KMZ, shapefile formats are packaged for download tab.
  - Quick check to see if water surface/depths are reasonable.
  - Internal web site for QCing resultant web graphics.
  - Flood Inundation Maps are made available after loaded on NWS web farm.





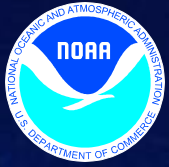
# Inundation Mapping Activities



## Iowa Flood Center

Partnership among NWS and the Iowa Flood Center to develop flood inundation maps at NWS Forecast locations.

- Iowa Flood Center will provide technical guidance and local hydrologic expertise to help set-up, run, and validate the models.



# Inundation Mapping Activities



## Central Indiana

Partnership among NOAA, USGS, Polis Center, and Indiana to develop near real-time inundation maps based on NWS Forecasts and show the infrastructure at risks for 20 forecast points.

- USGS will develop the models, provide stream gage observations, cross sections, and rating curves needed to calibrate models.
- The USGS Water Science Centers provided technical guidance and local hydrologic expertise to help validate the models.







# NOAA National Weather Service

- Flood Mapping depends on partnerships, diligence, dedication, and commitment to ensure consistency.***

