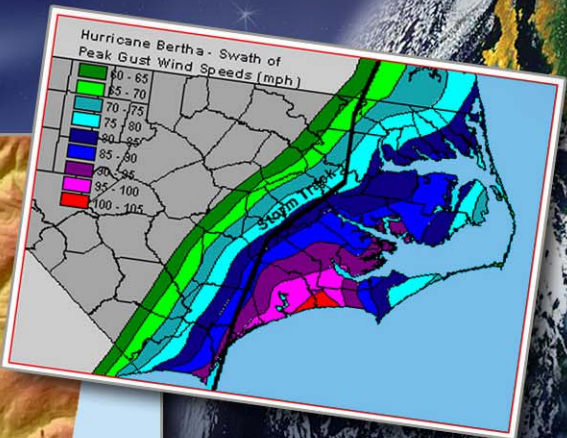
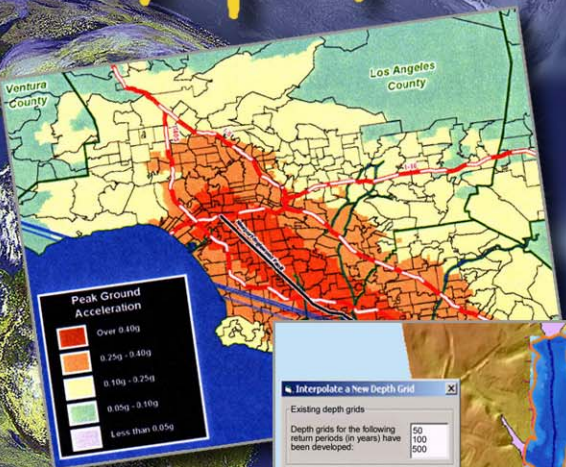


# HAZUS<sup>®</sup> MH

EARTHQUAKE • WIND • FLOOD

***FEMA's Software Program for Estimating Potential Losses from Disasters***



Interpolate a New Depth Grid

Existing depth grids

Depth grids for the following return periods (in years) have been developed:

50

100

500

New depth grid

Enter the return period of the new depth grid to interpolate:

OK Cancel



# FEMA

FEDERAL EMERGENCY MANAGEMENT AGENCY



# EMERGENCY MANAGEMENT HIGHER EDUCATION CONFERENCE

## HAZUS-MH Breakout Workshop Objectives

- Introduce HAZUS-MH and its applications
- Discuss opportunities for university support
  - Service learning opportunities
  - Resource for HAZUS-MH users
  - Student curriculum



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# HAZUS-MH Breakout Workshop Agenda

- HAZUS-MH Overview
- Software Demonstration
- University Roles in Supporting Implementation
- Education Opportunities



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# Earthquakes, Hurricanes, and Floods Will Continue to Occur...



**FEMA**

# Earthquakes, Hurricanes, and Floods Will Continue to Occur...

How can we *plan* to minimize damage and loss of life to prevent natural **hazards** from becoming natural **disasters**?

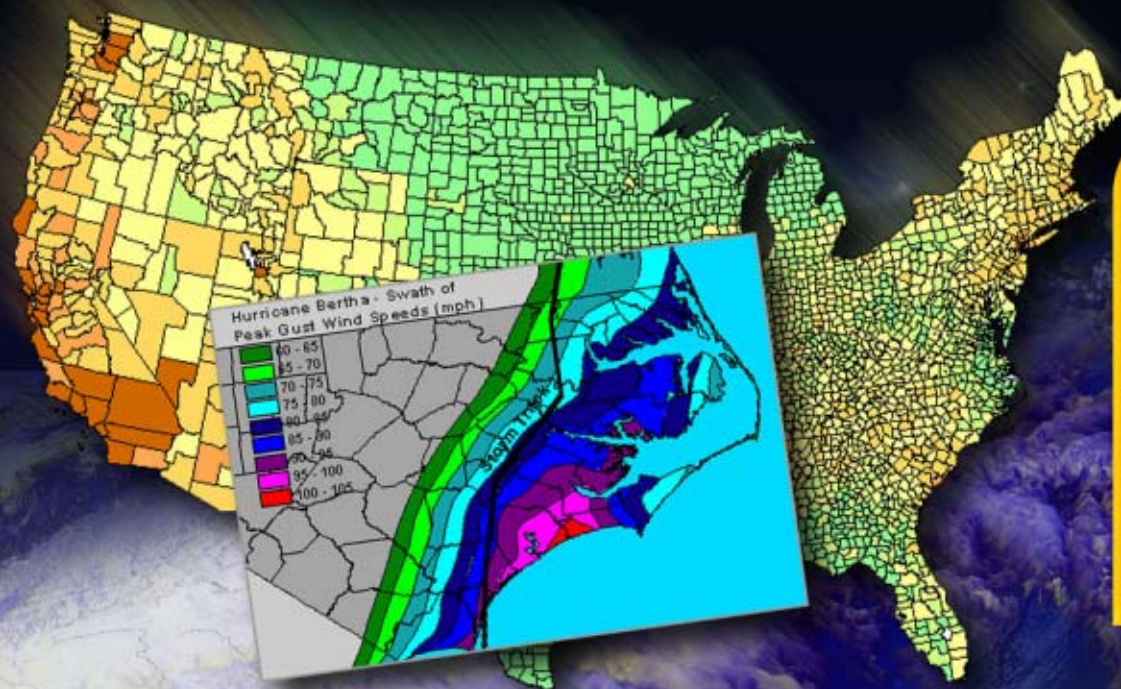
By understanding **potential losses** and **managing risks**



**FEMA**



# HAZUS-MH: Features



Physical  
Impacts

Economic  
Impacts

Social Impacts

- GIS Technology
- Nationwide Databases
- Nationally Standardized Loss Estimation and Risk Assessment Methodology



**FEMA**



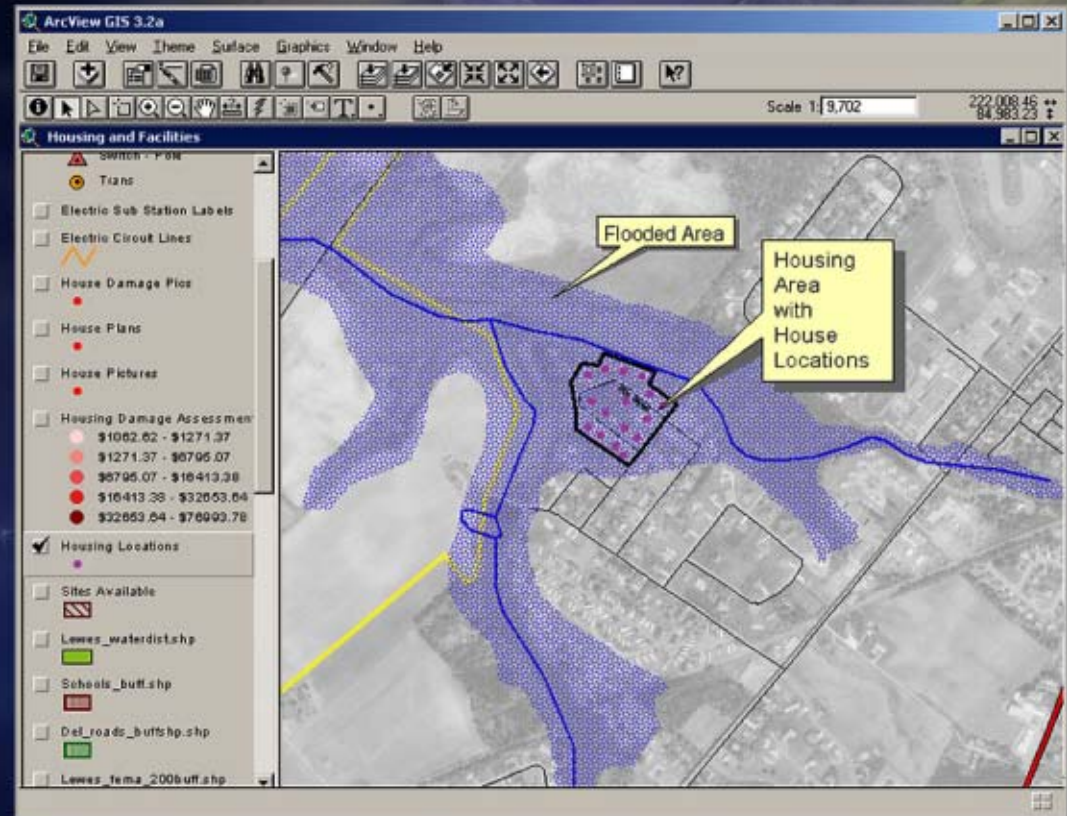
# GIS Technology

- Spatial Relationships

- Layers
- Computations

- Risk Communication

- Risks
- Solutions



# Nationwide Databases

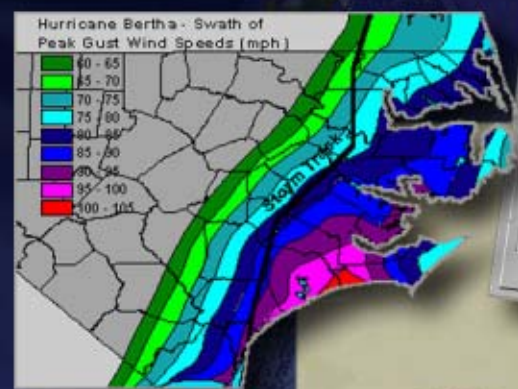
- **Demographics** – Population, Employment, Housing
- **Building Stock** – Residential, Commercial, Industrial
- **Essential Facilities** – Hospitals, Schools, Police Stations, Fire Stations
- **Transportation** – Highways, Bridges, Railways, Tunnels, Airports, Ports and Harbors, Ferry Facilities
- **Utilities** – Waste Water, Potable Water, Oil, Gas, Electric Power, Communication Facilities
- **High Potential Loss Facilities** – Dams and Levees, Nuclear Facilities, Hazardous Material Sites, Military Installations





# Nationally Standardized Loss Estimation and Risk Assessment Methodology

- Engineering Analysis
- Hazard-Specific Oversight Committees
  - Expert Practitioners
  - Academics
- Non-Proprietary
- Well Documented

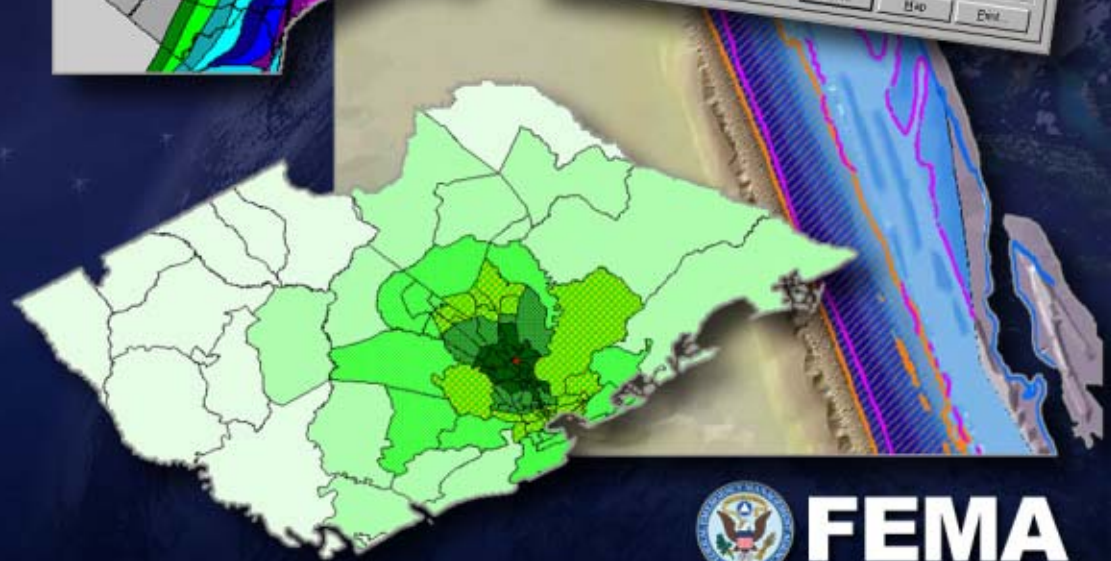


Building Count

By Occupancy | By Building Type

Table type: Number of buildings per specific occupancy

Census Tract	RES1	RES2
450190019002		
450190020002		
450190020004	859	0
450190020005	1,852	43
450190020006	1,021	2
450190020007	1,394	2
450190020008	1,467	5
450190021001	892	39
450190022000	1,582	0
450190024000	844	962
450190026000	1,111	223
450190028001	1,874	382
450190028002	2,027	1,059
450190028004	0	112
	1,011	0
		25





# HAZUS-MH: Models

**Earthquake**  
Ground Motion  
Ground Failure

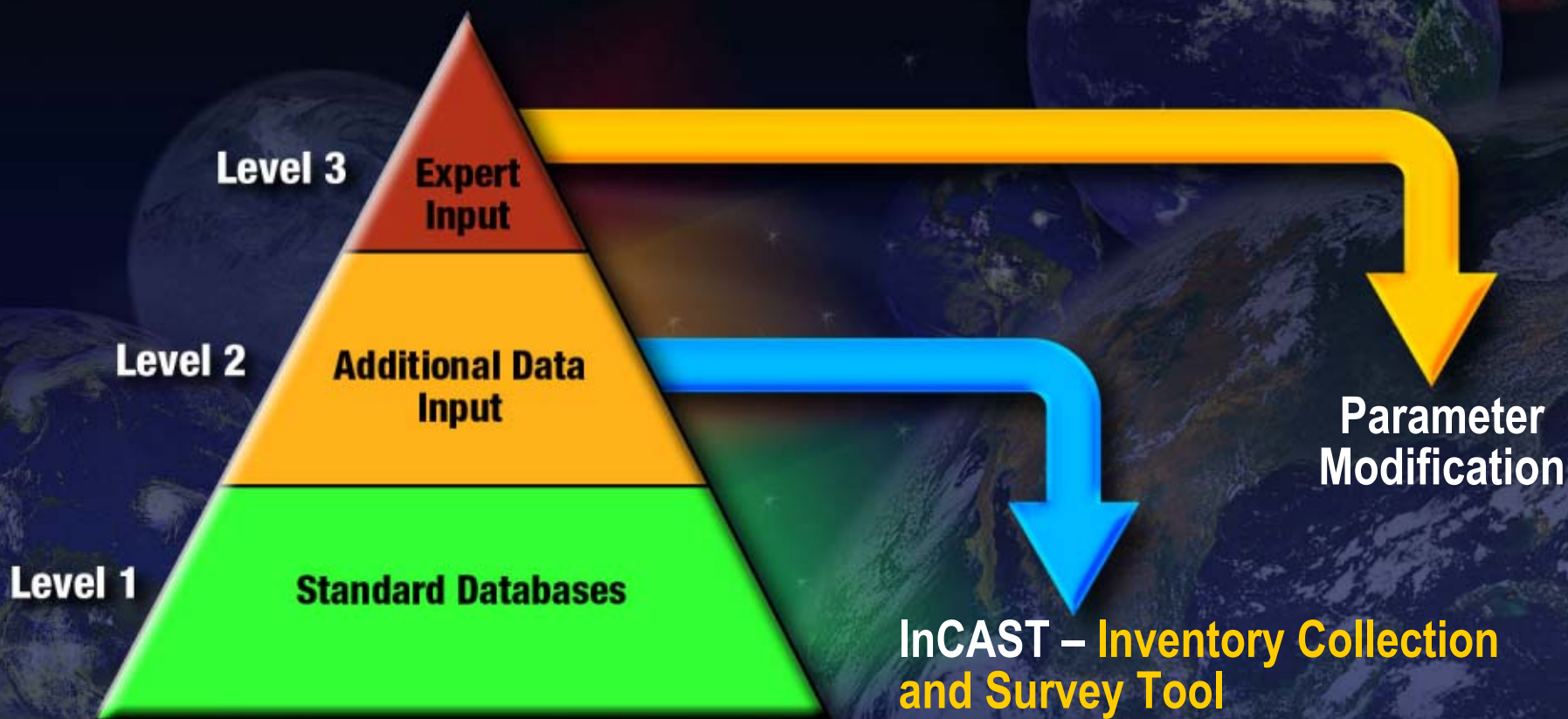
**Flood**  
Frequency Depth  
Discharge Velocity

**Hurricane**  
**Winds**  
Pressure | Missile | Rain

	Earthquake	Flood	Hurricane
<b>Direct Damage</b>			
General Building Stock	✓	✓	✓
Essential Facilities	✓	✓	✓
High Potential Loss Facilities	✓		✓
Transportation Facilities	✓	✓	
Lifelines	✓	✓	
<b>Induced Damage</b>			
Fire Following	✓		
Hazardous Materials Release	✓		✓
Debris Generation	✓	✓	✓
<b>Direct Losses</b>			
Cost of Repairs/Replacement	✓	✓	✓
Income Loss	✓	✓	
Crop Damage		✓	
Casualties	✓		
Shelter and Recovery Needs	✓	✓	✓
<b>Indirect Losses</b>			
Supply Shortages	✓	✓	
Sales Decline	✓	✓	
Opportunity Costs	✓	✓	
Economic Loss	✓	✓	



# HAZUS-MH: Analysis Levels



Level 1 and 2 analyses can usually be performed by emergency services or planning staff

Level 3 analysis typically requires specialized technical expertise

InCAST – Inventory Collection and Survey Tool

BIT – Building Input Tool

FIT – Flood Inventory Tool



# HAZUS-MH is for a study area of any size

- Region
- Community
- Neighborhood
- Individual Site



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# HAZUS-MH and Risk Management



**FEMA**



# Preparing for a Natural Hazard

What are our risks?

Where are the best locations for shelters and do we have enough space?

Where should we target outreach activities?



**FEMA**

# Mitigating the Effects of a Natural Hazard

Where should we put our resources to achieve maximum benefit?

How much will this mitigation strategy decrease our losses?

Where are we in our mitigation plan?

How have we progressed?



**FEMA**



# Responding to a Natural Hazard

How many injuries do we expect?



What are the best evacuation routes?

What hospitals were damaged and where should we take our injured?



**FEMA**

# Recovering from a Natural Hazard

What is the demand on recovery staff?

How much debris do we have to remove?

How much funding does the community need to request to recover?

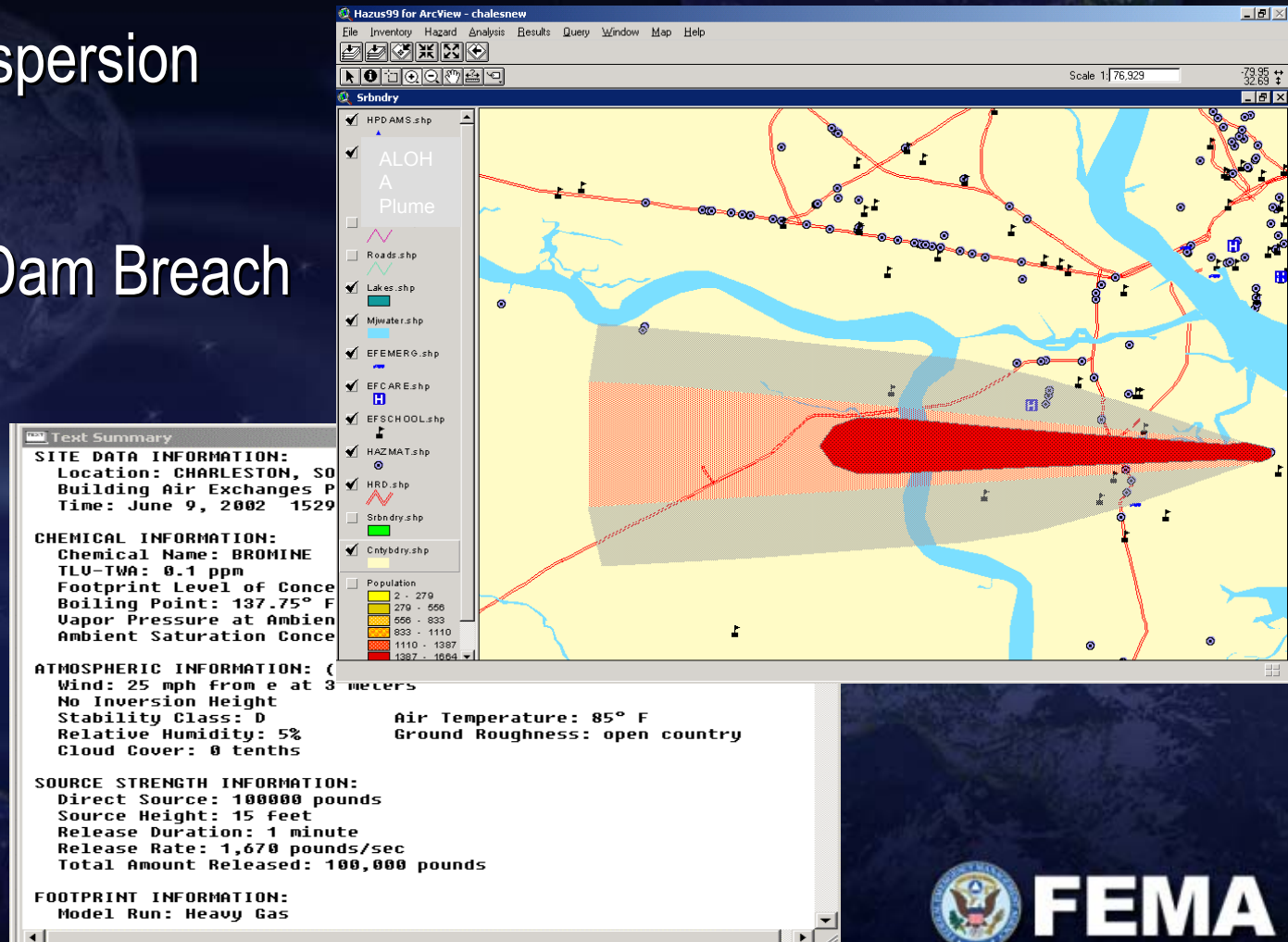


**FEMA**



# HAZUS MH Reaching Beyond Natural Disasters

- ALOHA Dispersion Modeling
- FLDWAV Dam Breach Modeling



# HAZUS-MH Breakout Workshop Agenda

- HAZUS-MH Overview
- **Software Demonstration**
- University Roles in Supporting Implementation
- Education Opportunities




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# Selecting a Hazard Model in the Start-up Wizard

**Create New Region** [X]

**Hazard Type**  
The hazard type controls the type and amount of data that will be aggregated.  
The hazard type selected affects the analysis options that will be available.



Your study region can include one or more of the following hazards. Check below the hazard(s) you are interested in.

Earthquake

Flood (selecting this option imposes a limit of 4 counties max. on the region size)

Hurricane

Notes:

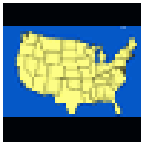
1. The list of hazards listed above depends upon the hazard modules installed.
2. Once a study region is built with a given hazard(s), it cannot be modified later on, in other words, you cannot add another hazard to it. Alternatively, you may re-create a similar region with different hazard(s).

< Back    Next >    Cancel

# Selecting Study Region County in the Start-up Wizard

**Create New Region** [X]

**County Selection**  
The county selection defines the county or counties within previously selected state(s), to include in the study region.



Please select the county or counties where your region is located.

States:  
North Carolina [NC]

Counties (1 selected):  
Alamance  
Alexander  
Alleghany  
Anson  
Ashe  
Avery  
Beaufort  
Bertie  
Bladen  
Brunswick  
Buncombe  
Burke

Total: 1

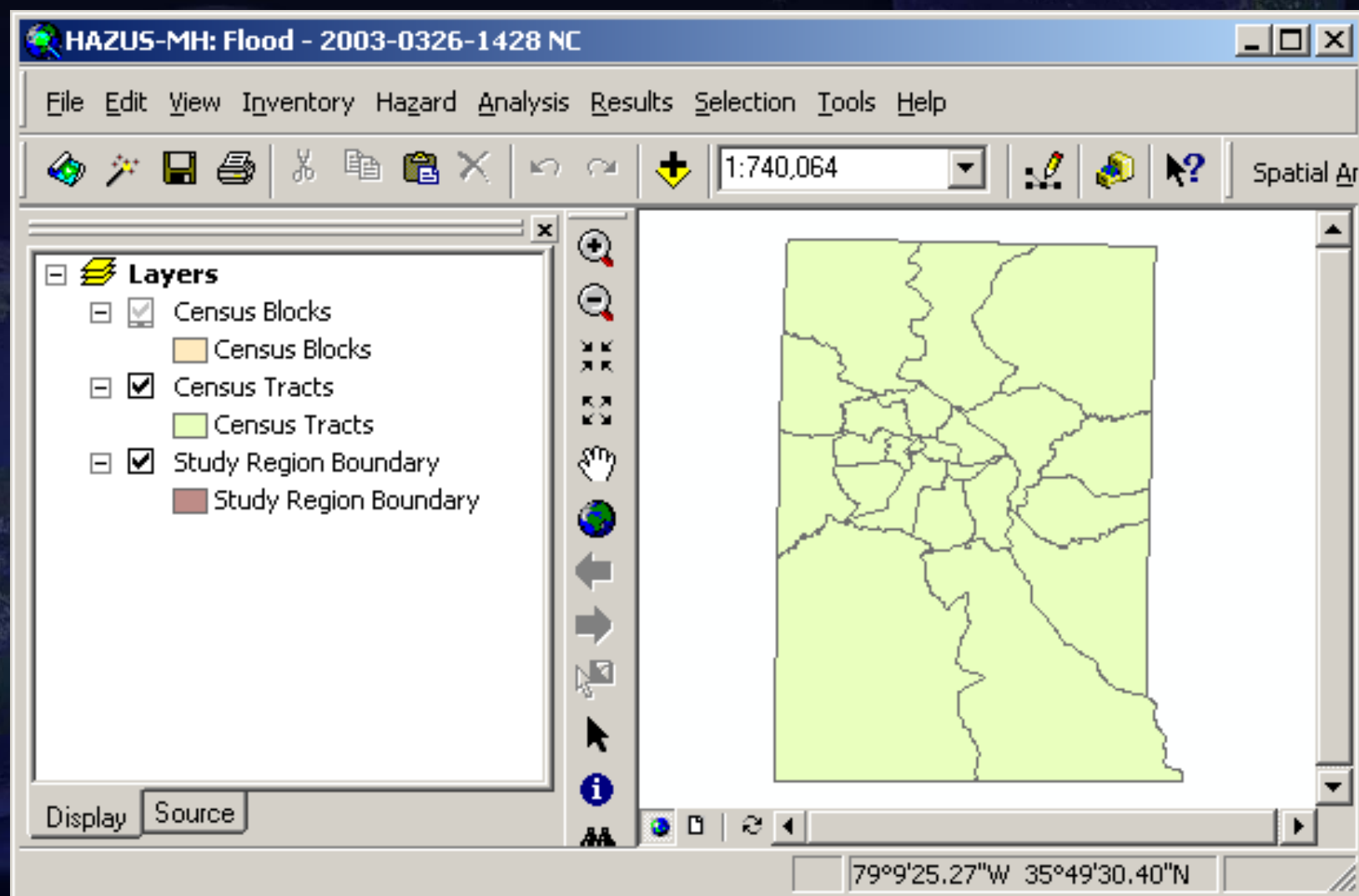
Auto select all

Select all counties  
Deselect all counties  
Show map

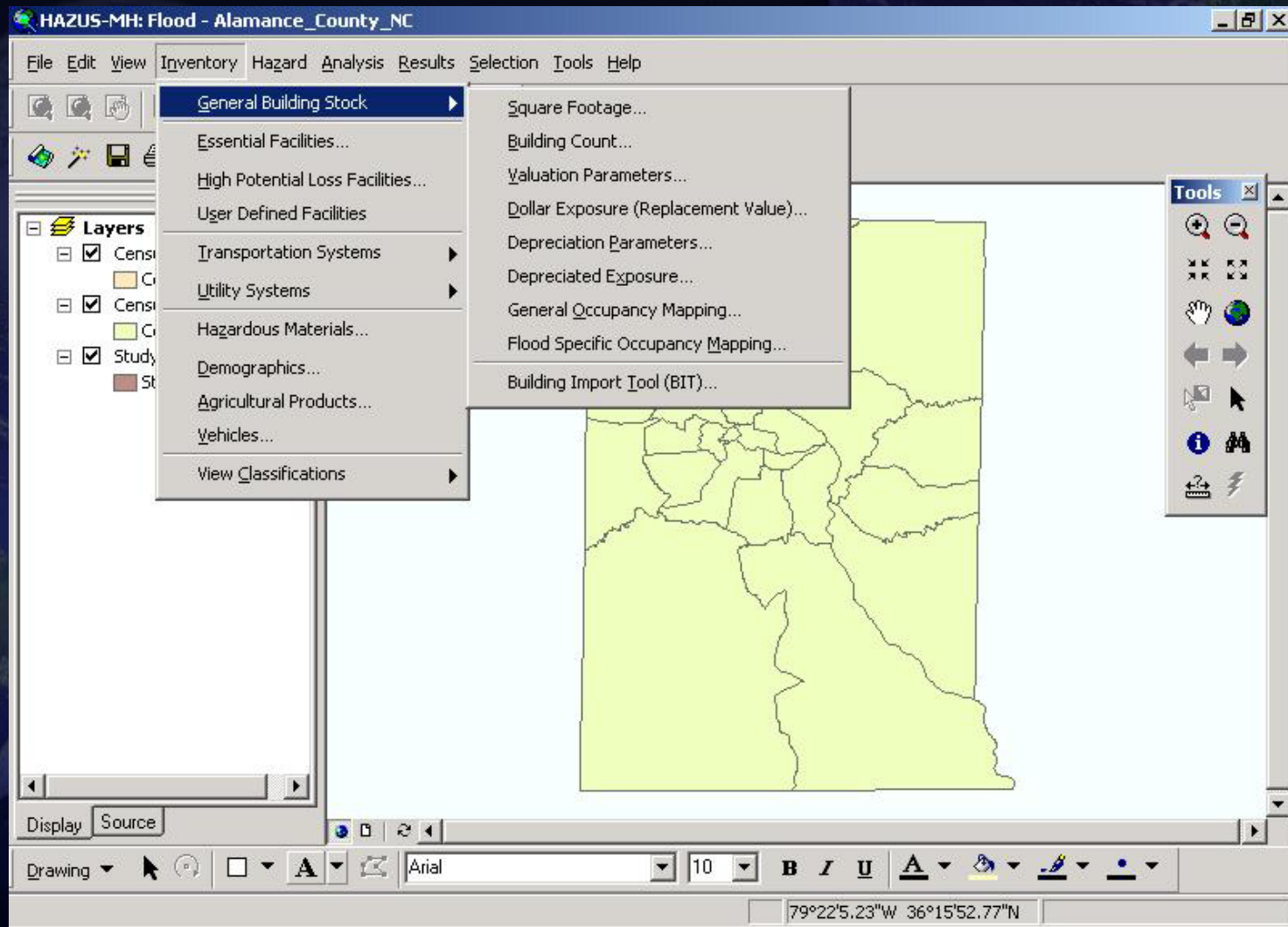
< Back   Next >   Cancel



# Alamance County as Seen in the Flood Model

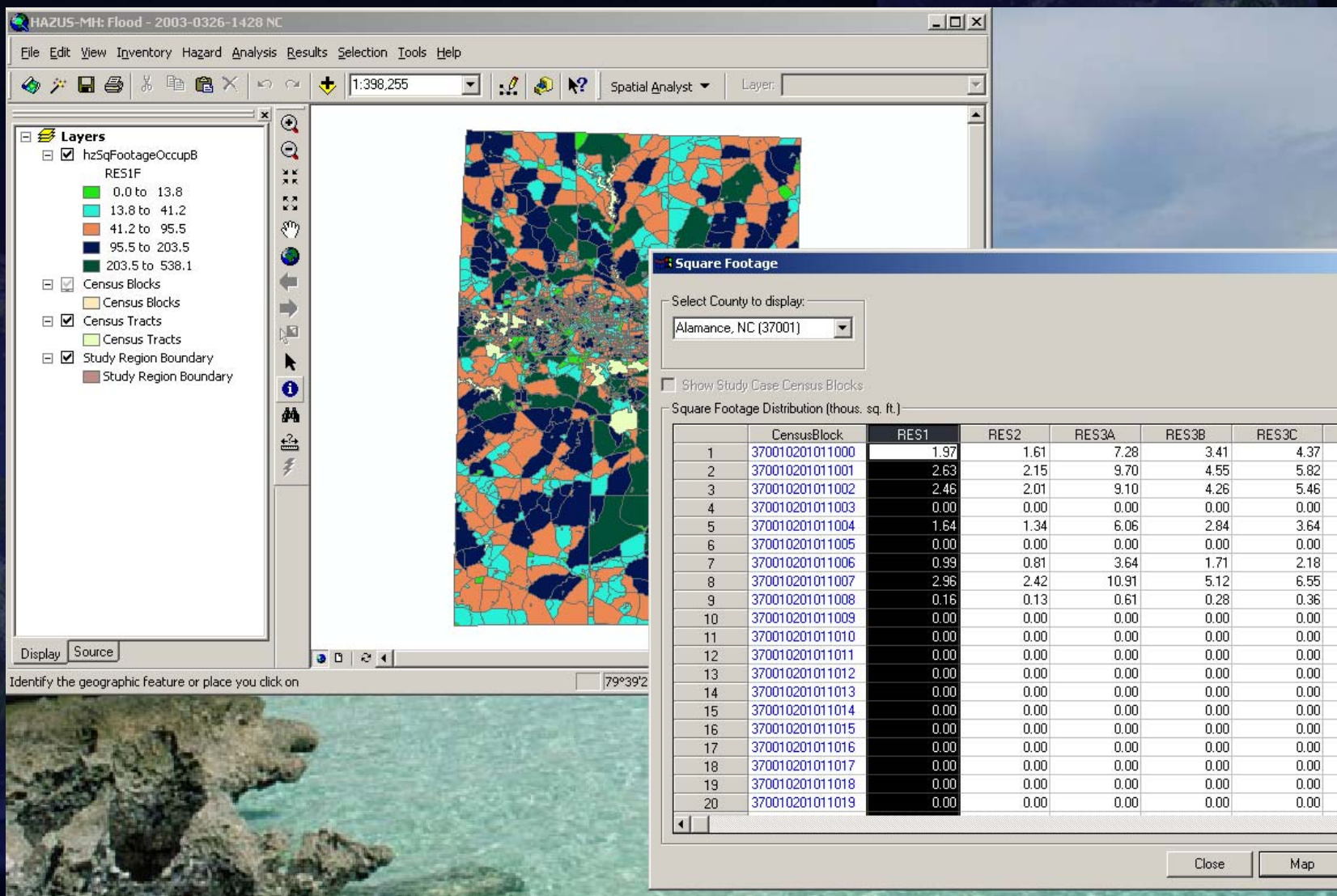


# Inventory and General Building Stock Menu Items





# RES1 Square Foot Occupancy Thematic Map



# Selecting Data to Map

**Building Count**

By Occupancy | By Building Type

Table Type:  Select County to display:

Show Study Case Census Blocks

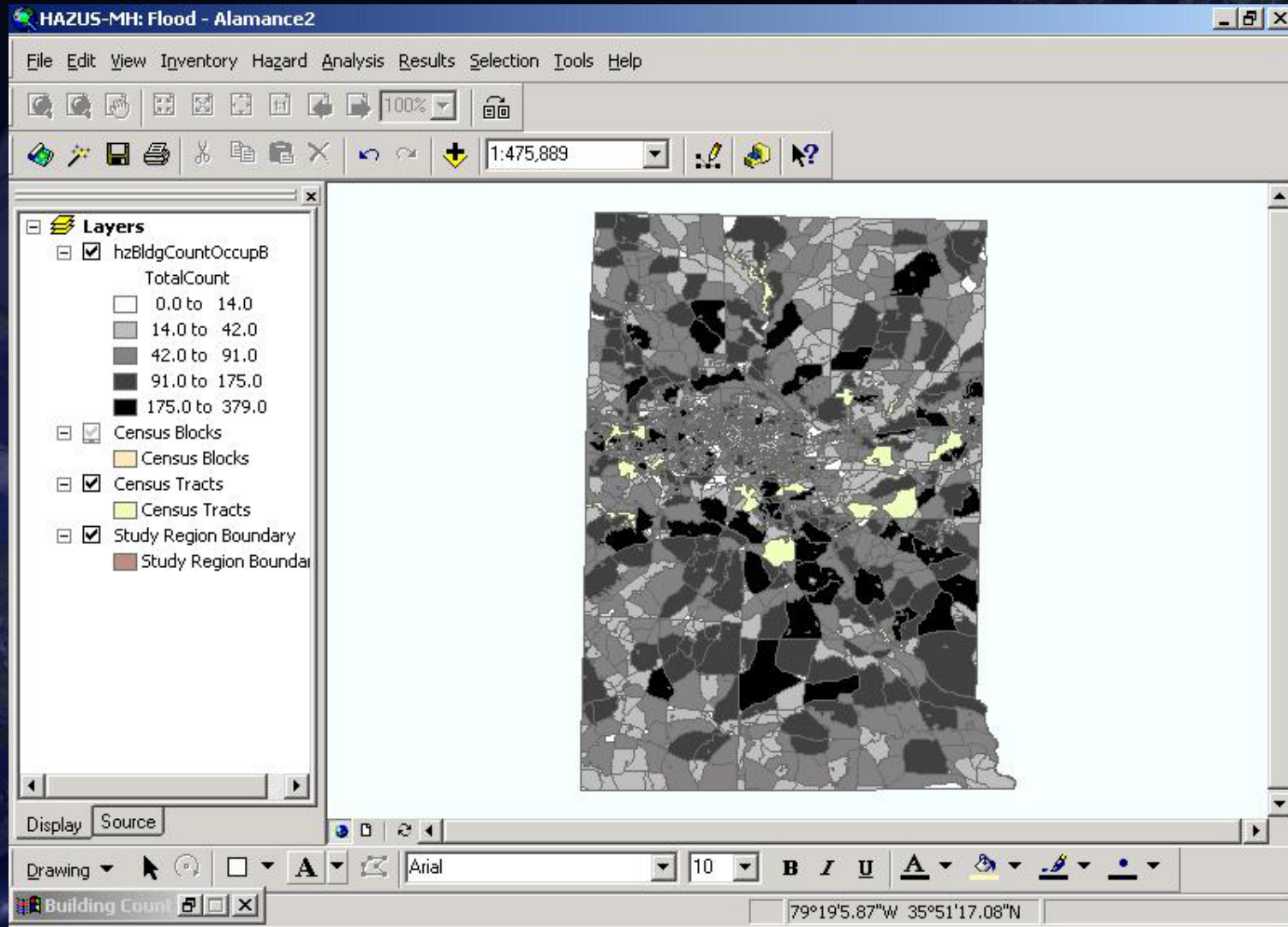
General Building Count By Occupancy

	CensusBlock	Total	Residential	Commercial	Industrial	Agriculture	Religi
1	370010201011000	8	7	1	0	0	
2	370010201011001	10	10	0	0	0	
3	370010201011002	9	9	0	0	0	
4	370010201011003	0	0	0	0	0	
5	370010201011004	5	5	0	0	0	
6	370010201011005	0	0	0	0	0	
7	370010201011006	4	4	0	0	0	
8	370010201011007	11	11	0	0	0	
9	370010201011008	0	0	0	0	0	
10	370010201011009	0	0	0	0	0	
11	370010201011010	0	0	0	0	0	
12	370010201011011	0	0	0	0	0	
13	370010201011012	0	0	0	0	0	
14	370010201011013	1	0	0	0	0	
15	370010201011014	2	1	1	0	0	
16	370010201011015	0	0	0	0	0	
17	370010201011016	0	0	0	0	0	
18	370010201011017	0	0	0	0	0	

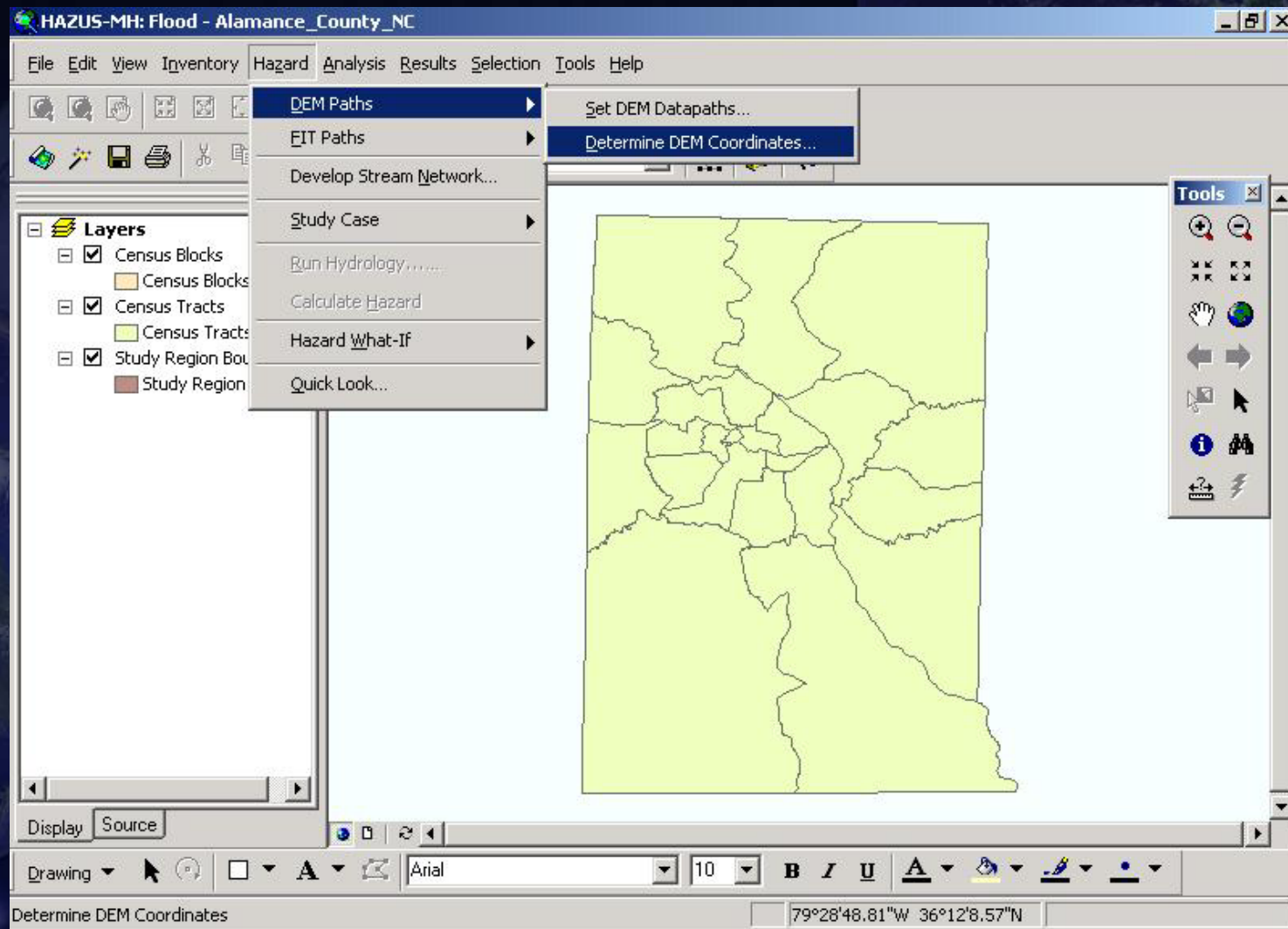
Sqft Factors | Close | Map | Print



# Mapped Data



# Hazard and DEM Paths Menus





# Coordinates for Downloading USGS DEM Files

**DEM Extent** [X]

Your analysis will require a DEM bounded by these coordinates in decimal degrees

Northmost Latitude  
 N

Westmost Longitude  W

Eastmost Longitude  W

Southmost Latitude  
 N

Point your browser to URL <http://seamless.usgs.gov/>  
Go to view and order datasets.  
Select Define Area by Coordinates.  
Change to decimal degrees.  
Paste in the 4 coordinates above.  
Download and unzip the resulting NED ArcGrid format files.



# USGS Web Page for Seamless Data Distribution System

The screenshot shows the USGS Seamless Data Distribution System - Enhanced web application. The browser window title is "Seamless Data Distribution System - Enhanced - Microsoft Internet Explorer". The page header includes the USGS logo and the title "Seamless Data Distribution System - Enhanced" with a "Help!" button. The main content area displays a map of the United States with a legend and various toolbars. The legend shows the "Current Active Layer" as "GNIS Names (text)". The "Download Layers" section includes checkboxes for "NED", "1/3\" NED", "NLCD", "SRTM", and "Hi-Res Ortho". The "View Layers" section includes checkboxes for "States 15M" and "Interstates". The "Tool selected" is "Zoom In". The footer contains the URL "http://seamless.usgs.gov/index.htm" and the date "Last Modified: Fri 30 Aug 2002".

Seamless Data Distribution System - Enhanced

USGS

Help!

Move

Zoom

Select

Misc

Download

Define Area By Coordinates

Tool selected = Zoom In

Welcome to the SDDS-Enhanced Raster Extraction Website

0 1150mi

Display Legend

Current Active Layer:  
GNIS Names (text)

Download Layers

- NED
- 1/3" NED
- NLCD
- SRTM
- Hi-Res Ortho

View Layers

Visible

- States 15M
- Interstates

U.S. Department of the Interior || U.S. Geological Survey || EROS Data Center  
URL: <http://seamless.usgs.gov/index.htm> || Maintainer: [webmapping@usgs.gov](mailto:webmapping@usgs.gov) || Last Modified: Fri 30 Aug 2002

Map: -171.08 , 29.07 -- Image: 37 , 202 -- ScaleFactor: 0.22727272727272726

Internet



# USGS Web Page Defining Geographic Area for DEM Data

Add Geographic Area - Microsoft Internet Explorer

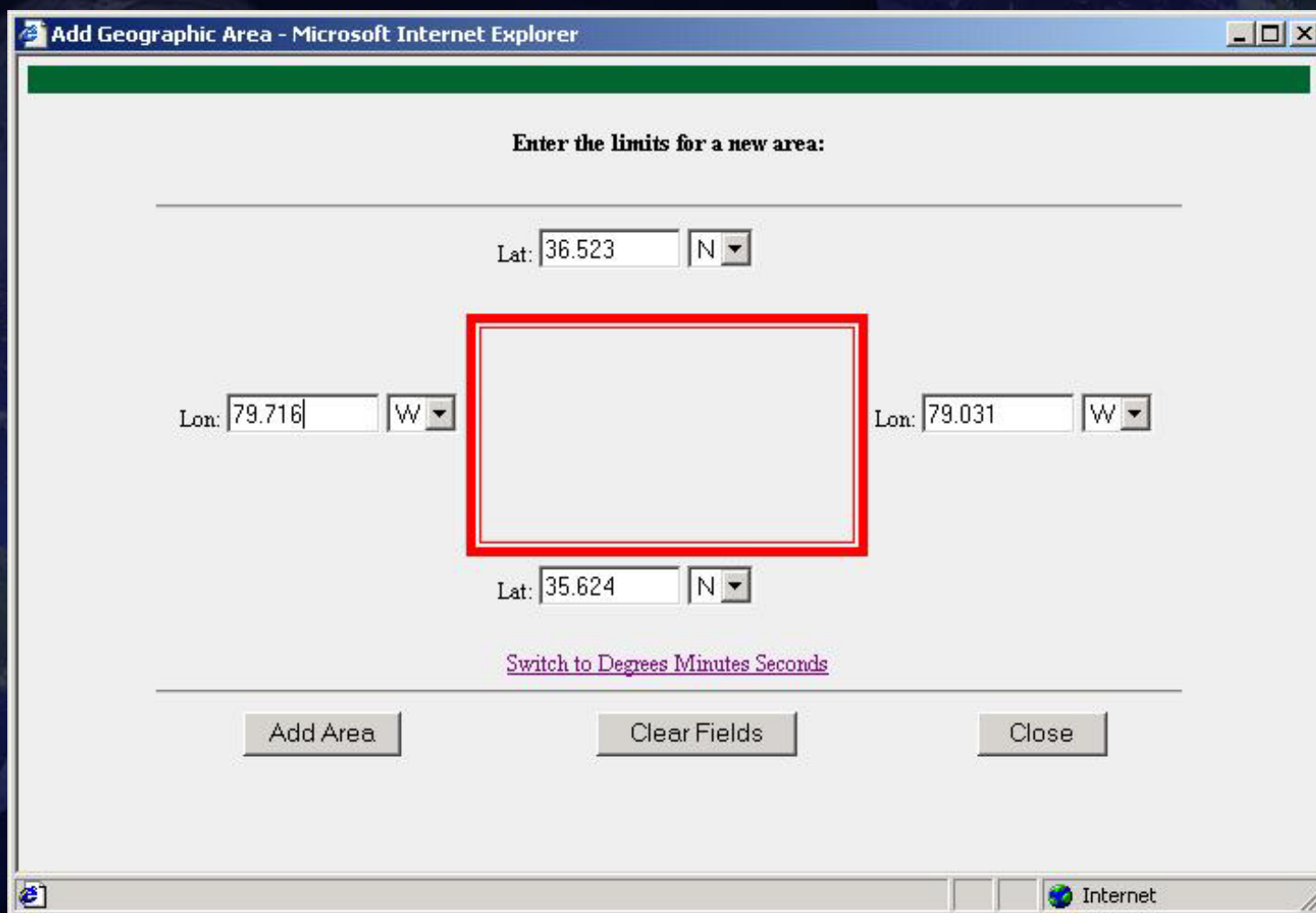
Enter the limits for a new area:

Lat:

Lon:

Lat:

[Switch to Degrees Minutes Seconds](#)



# Download Page for USGS DEM Data

USGS SDDS-E Raster Data Extraction Summary Page - Microsoft Internet Explorer

Address <http://edcw2ks36.cr.usgs.gov/Website/zipship/RequestSummary.jsp?areaList=36.523,35.624,-79.031,-79.716&prodList=NEDHR,NED> Go


**USGS**

## SDDS-Enhanced Request Summary Page Help!

Your data request consists of **1 product(s)**, broken into **1 individual piece(s)**. The data will be delivered through an **on-line download interface**. The 'Modify Data Request' button will allow you to specify different formats, products, or media. Clicking on the name of the Product will allow you to order the entire dataset from pre-mastered originals using the EROS Data Center Order pages. You may bookmark this page to return to this data request and download the same pieces.

[Modify Data Request](#)

**Data Extraction Request Pieces:**

Product	Southwest (Bottom Left) Corner	Northeast (Top Right) Corner	Size (MB)	Link
<a href="#">NED</a> - ArcGrid format				
	35.624000 N, 79.716000 W	36.523000 N, 79.031000 W	33	<a href="#">Download</a>

[U.S. Department of the Interior](#) || [U.S. Geological Survey](#) || [EROS Data Center](#)  
 URL: <http://edcw2ks36.cr.usgs.gov/Website/zipship/RequestSummary.jsp>  
 Maintainer: [webmapping@usgs.gov](mailto:webmapping@usgs.gov) || [Comments and Suggestions](#)  
 Last Modified: Wed 05 Feb 2003  
[Privacy Statement](#) || [Disclaimer](#) || [FOIA](#) || [Accessibility](#)

Done Internet



# Developing a Stream Network

## Develop Stream Network



Input a stream drainage area for the study region. When you select OK, the stream network will be created. This process may take some time.

Input stream drainage area  
(affects stream density)  
(1 - 400 sq mi)

1.8 Square miles

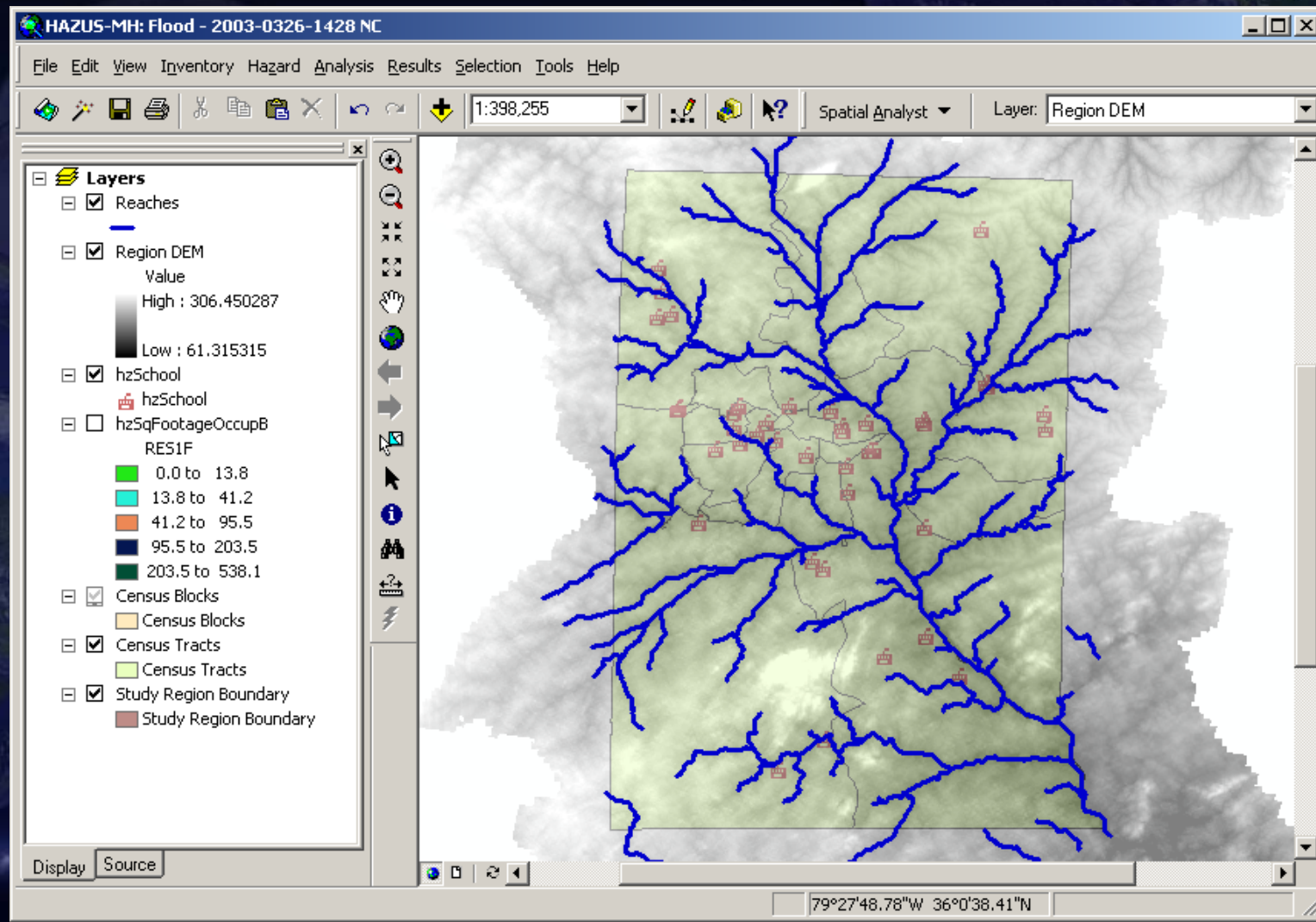
OK

Cancel



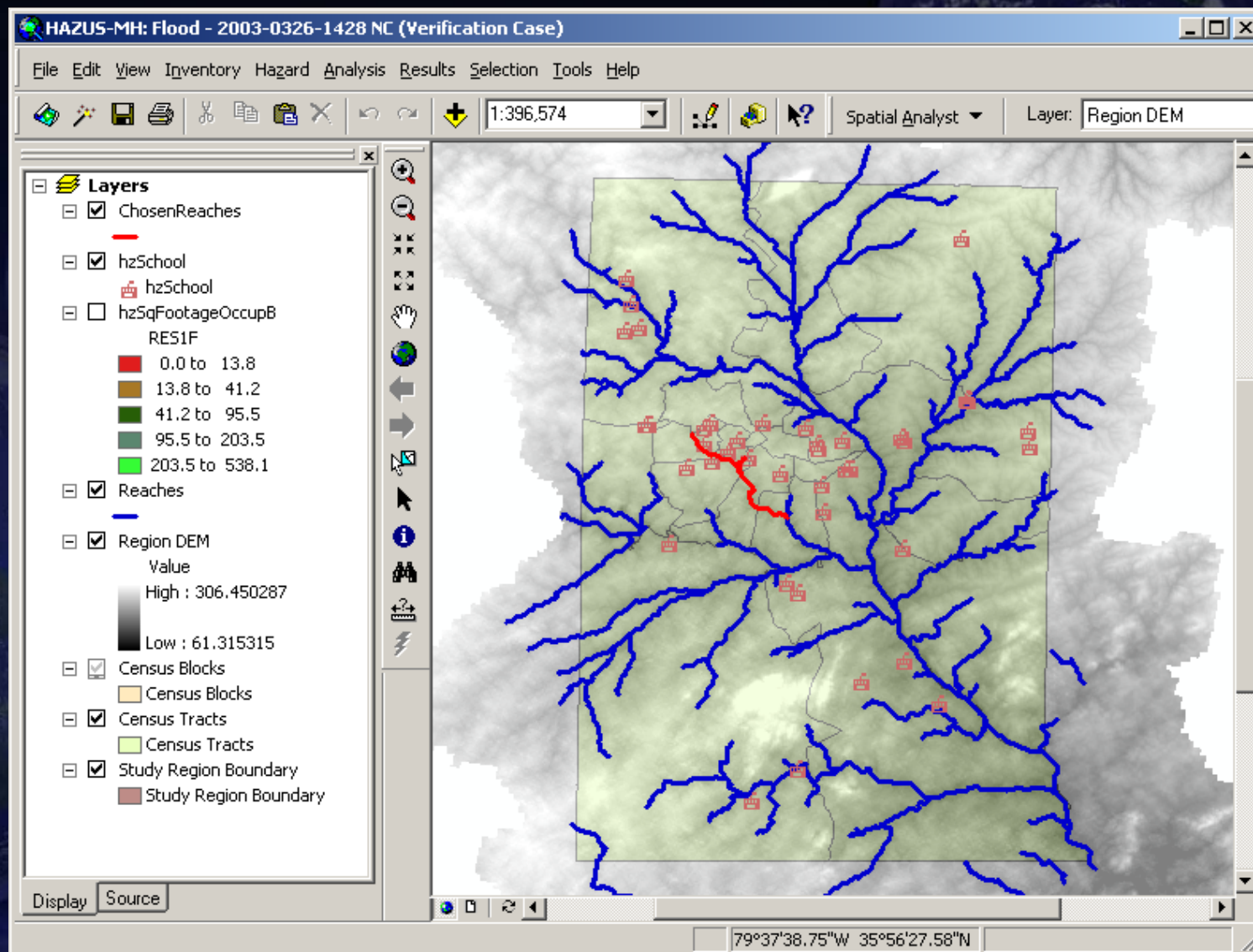
FEMA

# ArcMap Display of Completed Stream Network

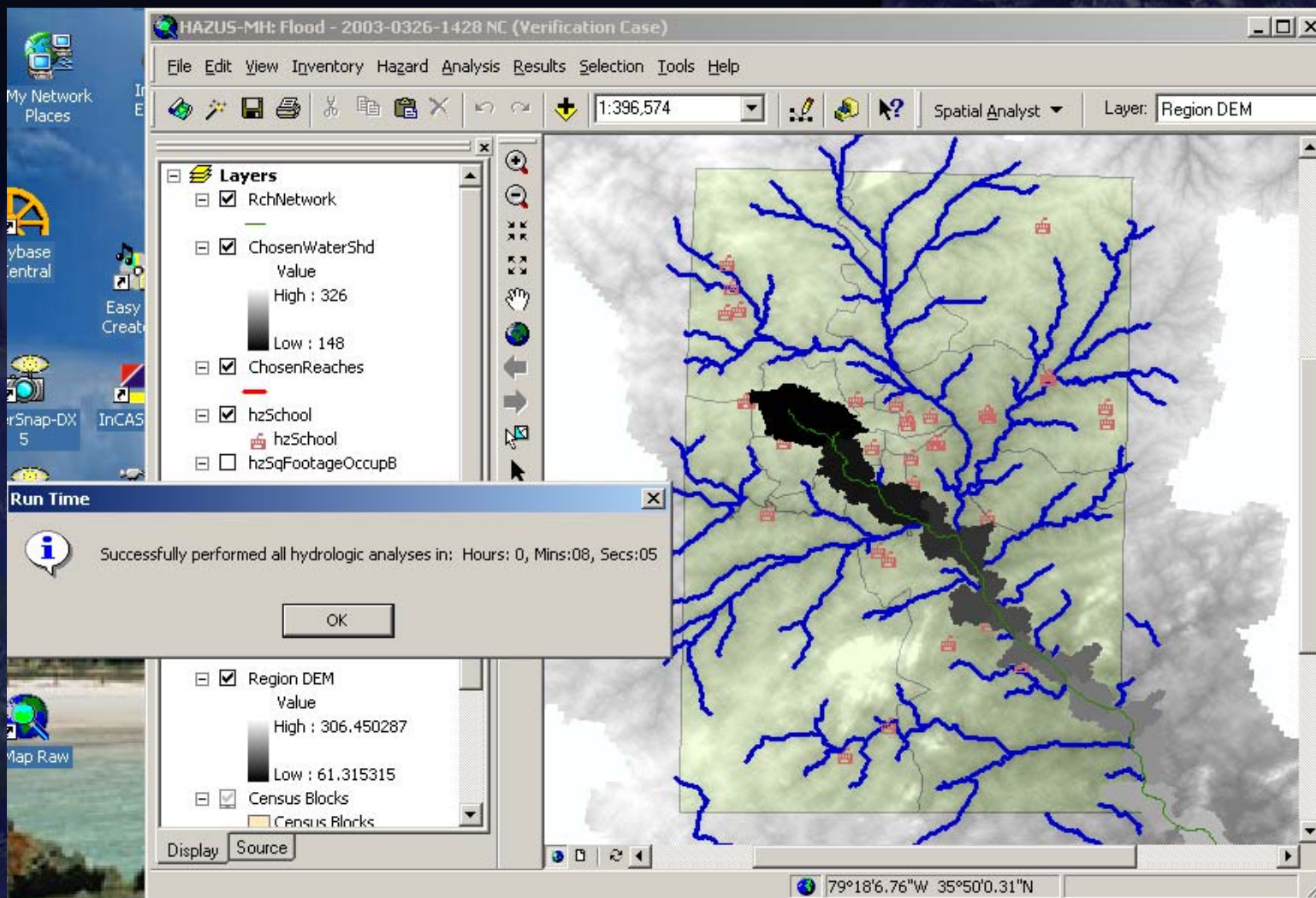




# Stream Network – Selected Reaches



# Hydrologic Analysis





# Calculate Hazard Window

**Riverine Hydraulics Analysis** [X]

Select analysis type: Return Periods 10, 50, 100, 200, 500

River reaches:

Reach ID	Return Periods
152	10, 50, 100, 200, 500
153	10, 50, 100, 200, 500
169	10, 50, 100, 200, 500
171	10, 50, 100, 200, 500
172	10, 50, 100, 200, 500
173	10, 50, 100, 200, 500
184	10, 50, 100, 200, 500

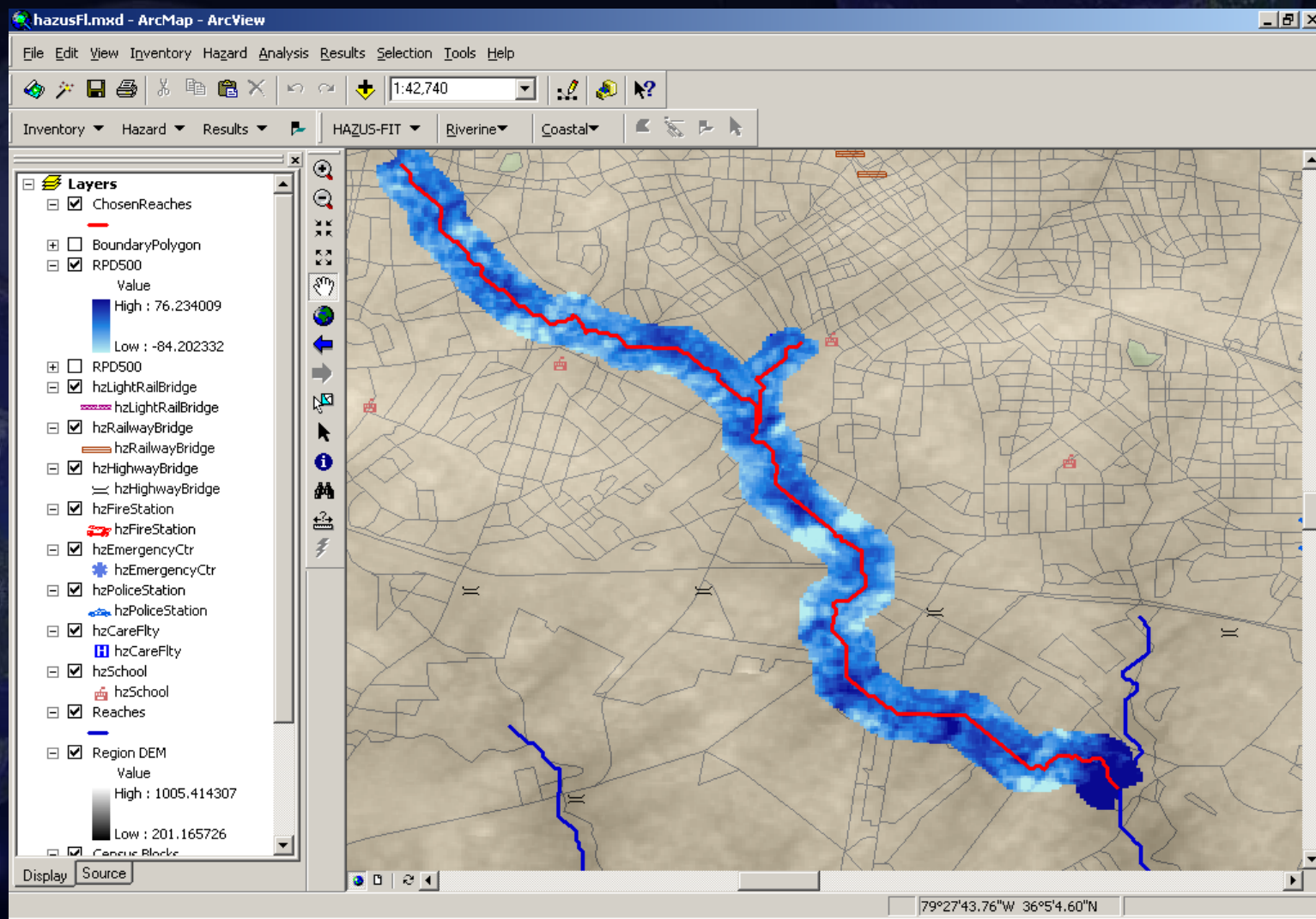
Specific Return Period  
Specific Discharge  
Annualized Loss

Apply

OK Cancel

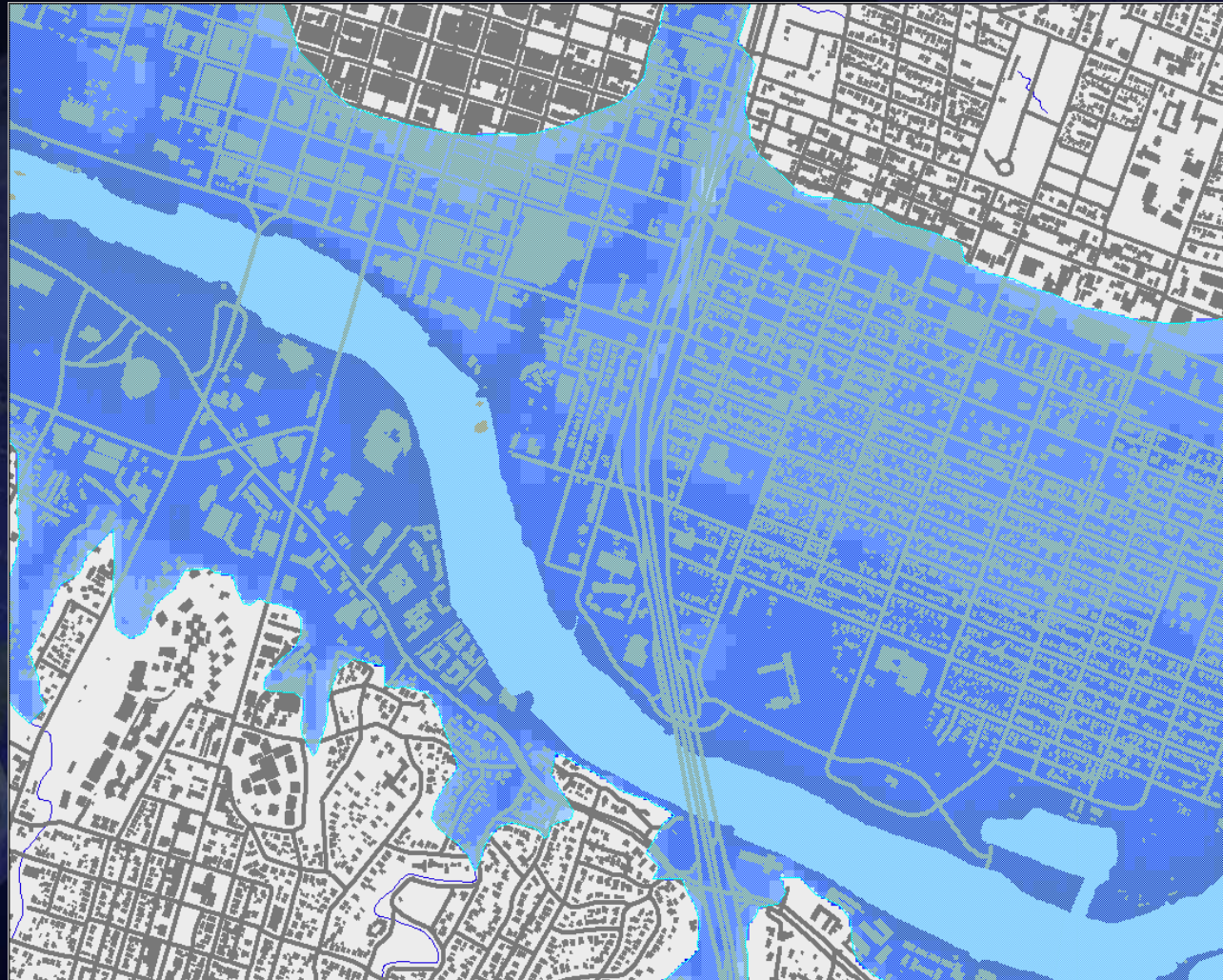
IA

# Flood Depth Grid For A 500-year Flood



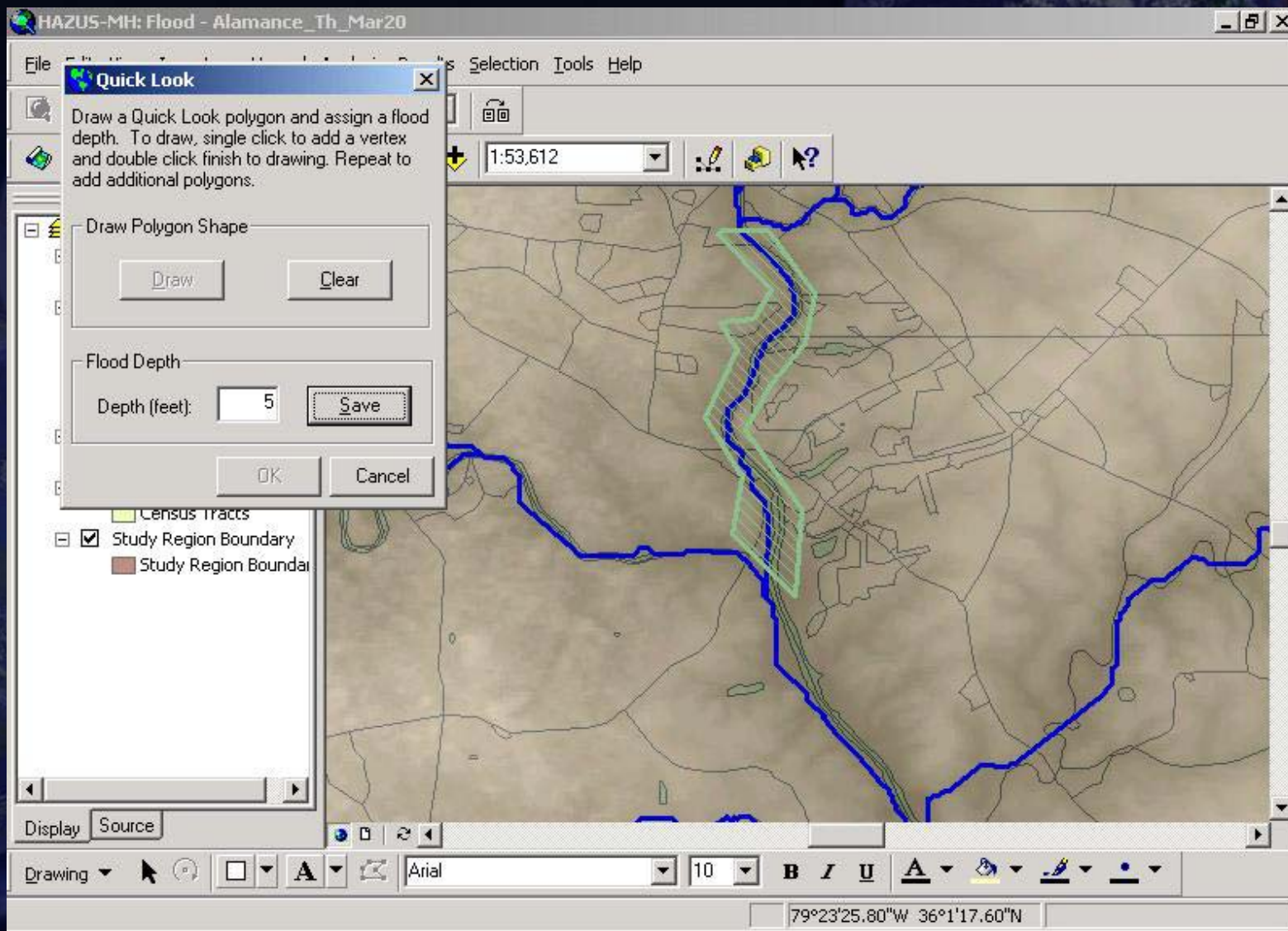


# Flood Inundation Output



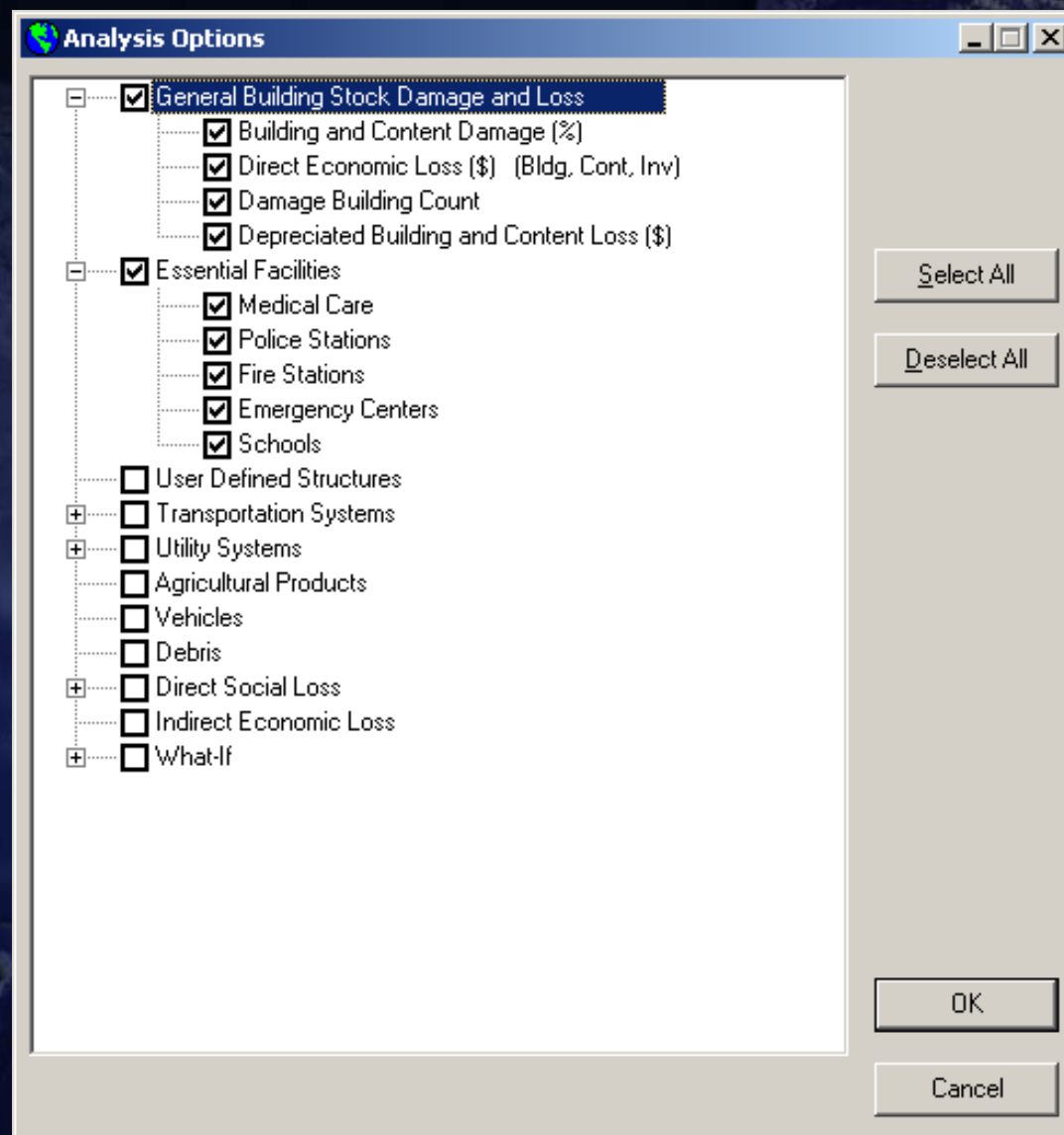


# Drawing a Polygon for Quick Look





# Available Loss Analysis Options



# Selecting Available Results to View

The screenshot displays the HAZUS-MH software interface for a flood analysis. The main window is titled "HAZUS-MH: Flood - Alamance (Test\_Case\_Study)". The menu bar includes File, Edit, View, Inventory, Hazard, Analysis, Results, Selection, Tools, and Help. The toolbar shows various icons for navigation and analysis, with a scale of 1:475,889. The Layers panel on the left lists several layers: ChosenReaches (checked), Census Blocks (checked), Census Tracts (checked), Study Region Boundary (checked), and Study Region Boundar (checked). The map area shows a light green flood zone with red lines indicating specific reaches. A "View Results by" dialog box is open, displaying the following information:

- Test\_Case\_Study
- Learning how to conduct a run with default data.
- Available results: 10, 100, 50, Annualized (selected)
- Buttons: OK, Cancel

The status bar at the bottom shows "Select Return Period to Report on" and coordinates: 79°22'29.69"W 36°13'26.02"N. A large white letter 'A' is visible in the bottom right corner of the image.

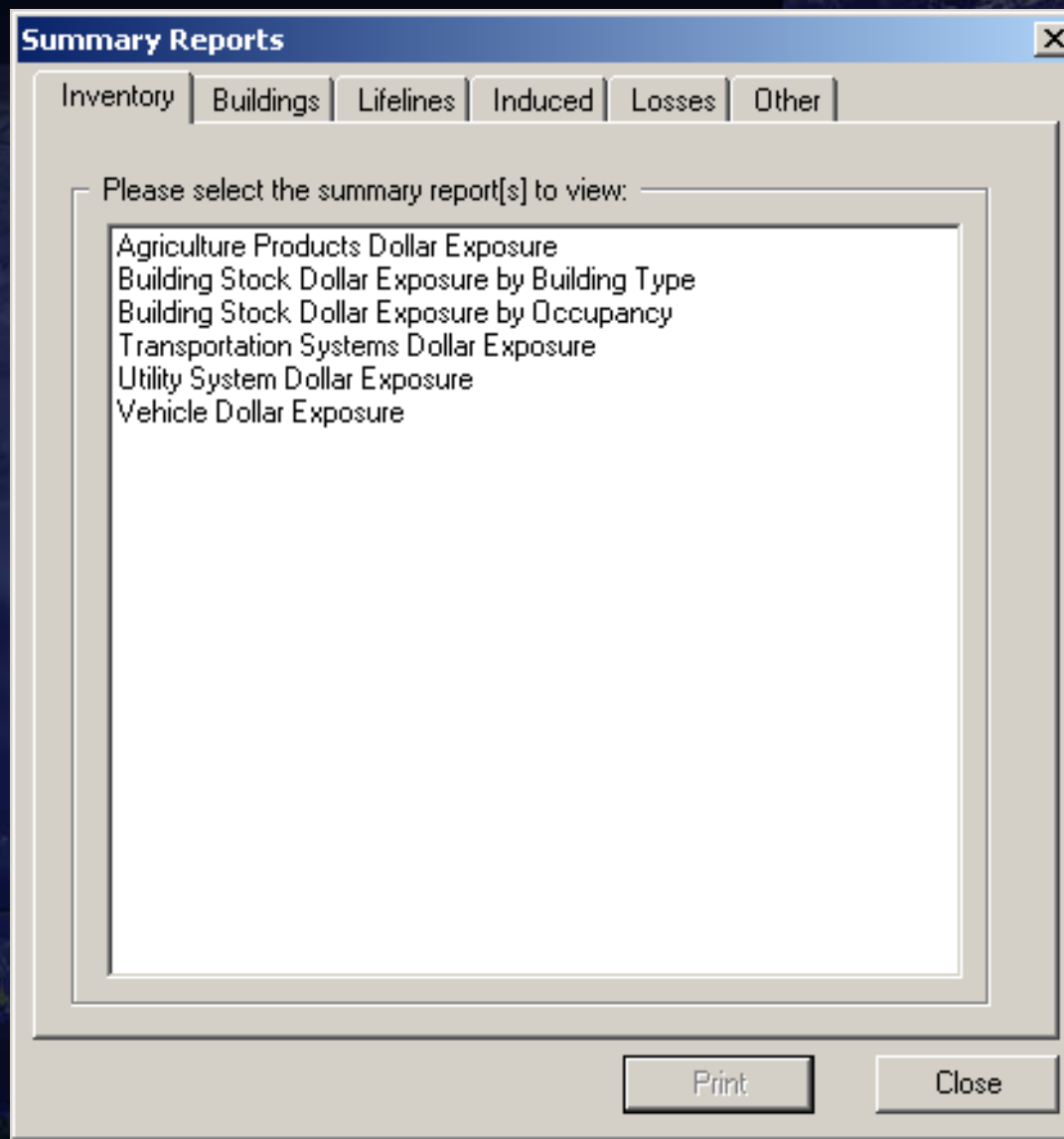


# Flood Hazard Risk Assessment Output

Flood Loss Estimates				
Occupancy Class	100 Year		500 Year	
	Count	Value	Count	Value
Residential	15942	616,619,008	19,583	808,068,992
Commercial	342	185,024,992	422	229,650,000
Government	36	3,957,430	44	6,353,330
Industrial	63	7,956,760	93	9,182,040
Utility	2	146,601	3	375,489
<b>Total</b>	<b>16,385</b>	<b>813,704,791</b>	<b>20,145</b>	<b>1,053,629,851</b>

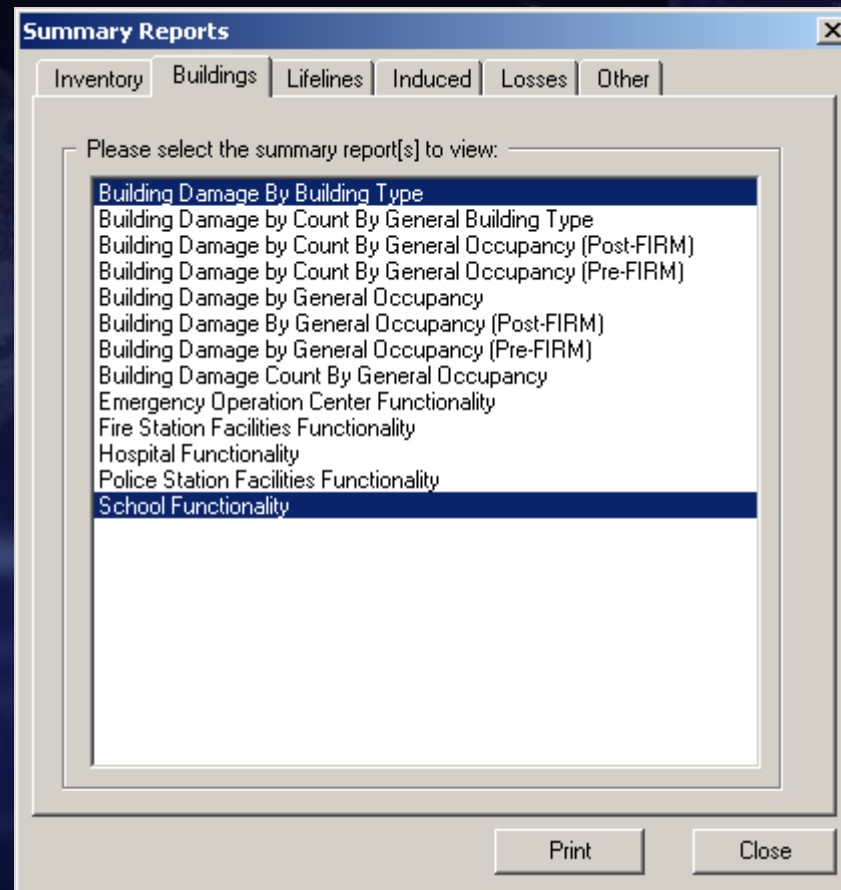


# Available Summary Reports





# Available Summary Reports (continued)



# HAZUS-MH Breakout Workshop Agenda

- HAZUS-MH Overview
- Software Demonstration
- **University Roles in Supporting Implementation**
- Education opportunities



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# Technical Support Opportunities

- Local and state mitigation planning support
- Resource center for HAZUS-MH users
- Technical advisory role for emergency management planning, GIS, engineering aspects

# State and Local Mitigation Plan Requirements

- Description of the planning process - HAZUS can support
- Risk assessment - HAZUS is tool
- Mitigation strategy - HAZUS is tool
- Coordination (state plan)
- Process for plan maintenance - HAZUS can support
- Process for plan adoption
- Assurances (state plan)



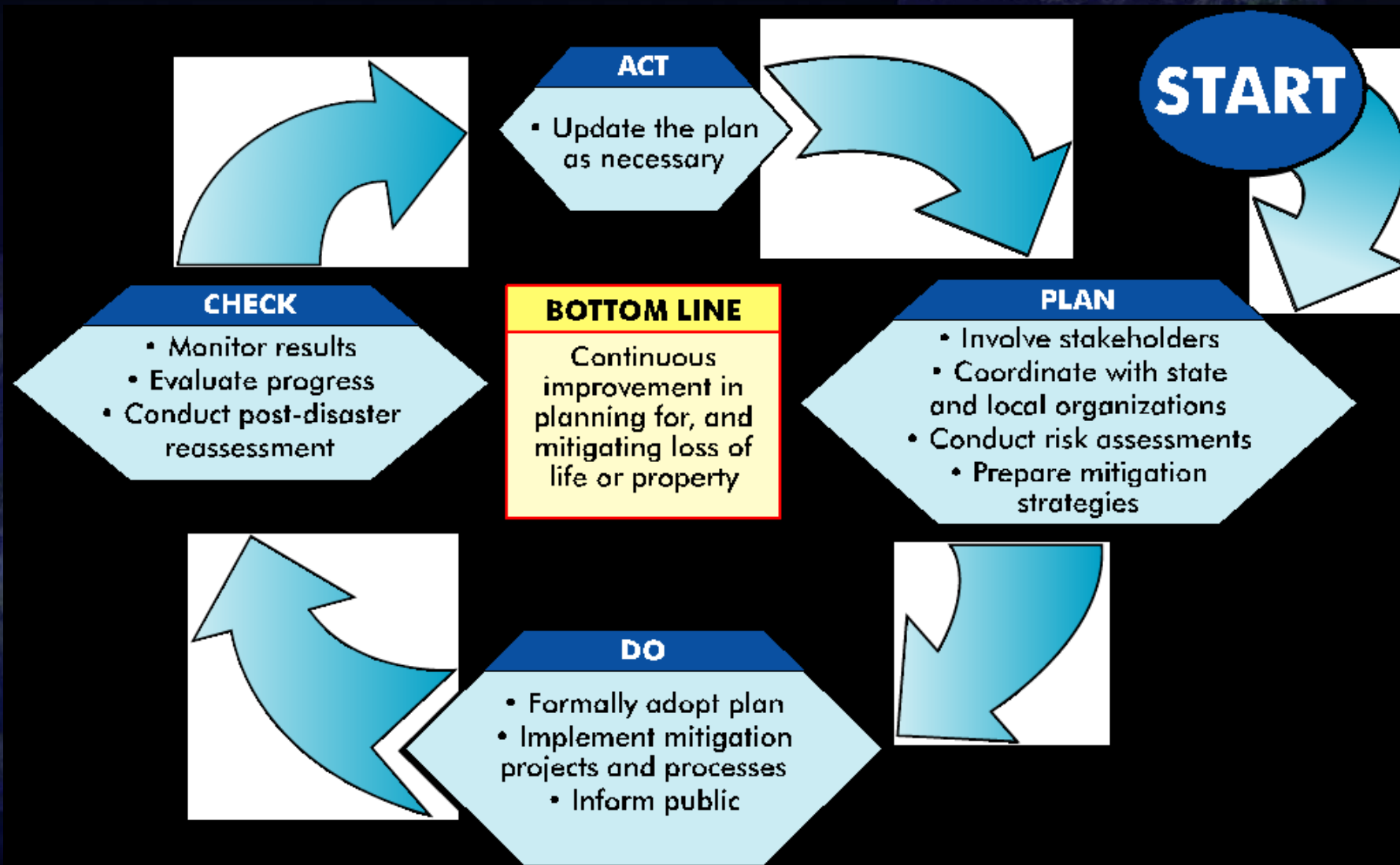
**FEMA**



# Service Learning Opportunities

- Support initial data collection for local inventory development
- Provide GIS support for risk assessment and mitigation planning
- Provide engineering and planning support for development of mitigation measures
- Technical support for level 2 and 3 risk and mitigation analysis

# Mitigation Planning is Continuous Process

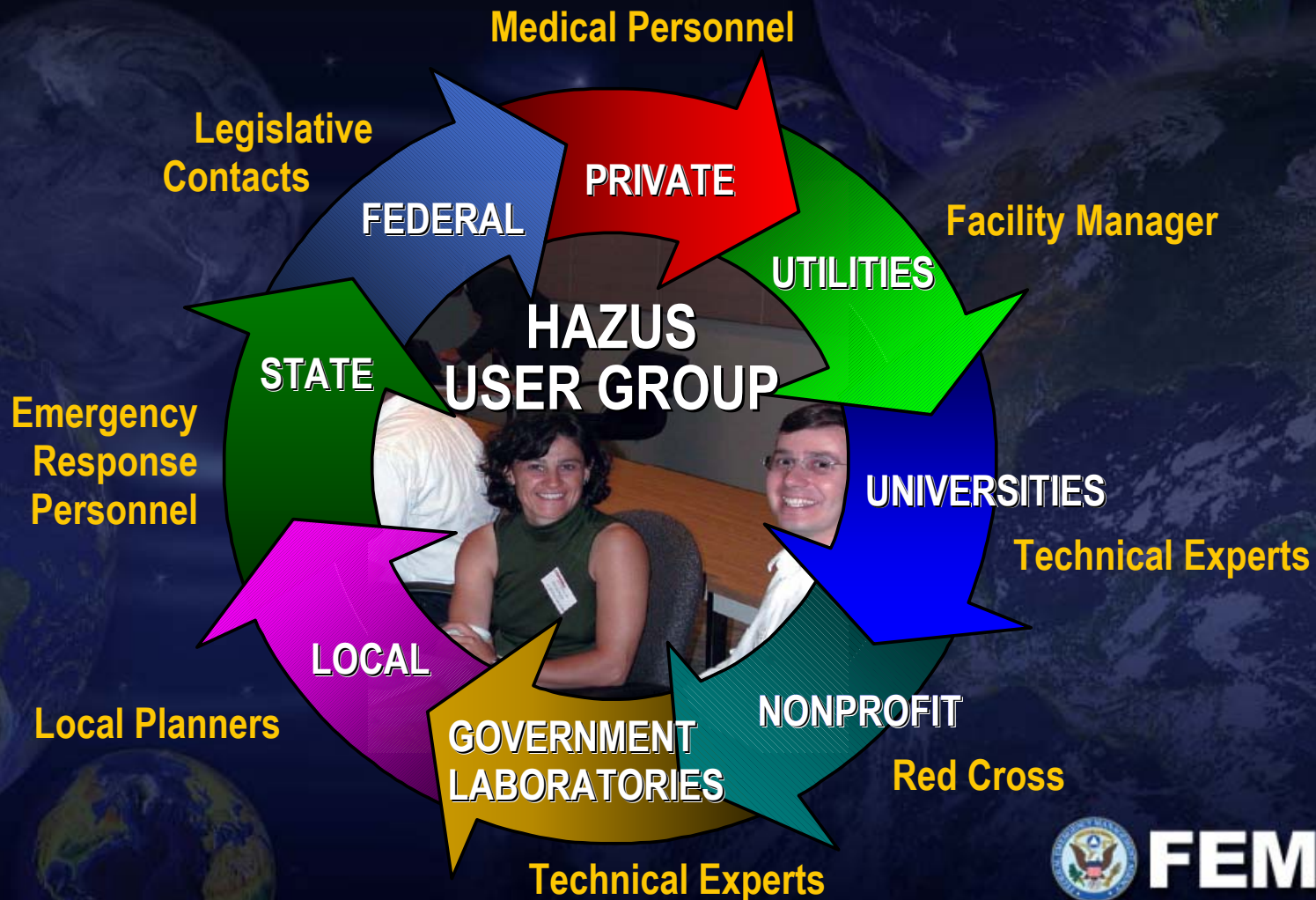




# Support to HAZUS MH Users

- Provide support to understanding hazards and their potential impact on the community
- Serve as data and mapping repository for HAZUS MH regional users
- Provide technical training support for HAZUS MH and its applications (e.g. mitigation planning, hazard risk assessment, GIS tools)
- Participation in Region HAZUS-MH User Groups

# Collaborative Support for HAZUS User Groups





# Higher Education/Government Collaborative Example

- Indiana State Emergency Management Agency (SEMA) recognizes need for providing HAZUS-MH support to communities
- SEMA/Polis Center at IUPUI Established Collaborative Program
- Polis Center provides GIS training and will support training for GIS uses of HAZUS-MH
- Disaster Mitigation Act (DMA 2000) funding to state will be source for IUPUI training support



# HAZUS-MH Breakout Workshop Agenda

- HAZUS-MH Overview
- Software Demonstration
- University roles in supporting implementation
- **Education opportunities**



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# Use of HAZUS-MH Tools and Techniques

- Graduate level applications
  - Emergency management – e.g. hazard profiling and risk assessment
  - Geography – e.g. mapping applications for emergency planning
  - Planning – e.g. zoning and building ordinances for hazard mitigation
  - Engineering – e.g. basic engineering analysis and modeling parameters
- Undergraduate level applications

# HAZUS-MH Summary

- Natural hazard risk assessment tool integrating
  - Standardized engineering analysis and loss estimation models
  - National databases and local data integration
  - GIS platform for data analysis and presentation
- Supports variety of emergency planning and management activities
  - Preparing for, and mitigating potential impacts of natural hazards
  - Planning for, and responding to, natural hazard events
  - Recovering from natural disasters



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# HAZUS-MH Summary (continued)

- Higher education institutions can play a key role
  - Providing service support to local and regional organizations
  - Resource center and repository
  - Integrating HAZUS-MH applications into curriculum
- Unique opportunities for multidisciplinary collaboration

# HAZUS-MH Information

Visit the HAZUS website:  
<http://www.fema.gov/hazus>

or email inquiries to:  
[hazus@fema.gov](mailto:hazus@fema.gov)



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