Applications of HAZUS-MH for Emergency Management

February 11, 2014

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Mitigation Branch
Ohio EMA

What is HAZUS-MH?

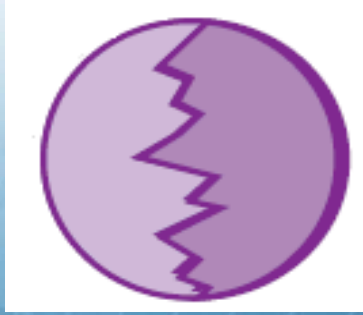
- Free ArcGIS extension
(http://www.fema.gov/hazus)
- Identifies and visually displays hazards and vulnerabilities
- Calculates scientifically-defensible damages, economic losses, and mitigation benefits
- Facilitates a risk-based approach to mitigation

Supported Hazards

- **Hurricanes**

- **Riverine and Coastal Floods**

- **Earthquakes**



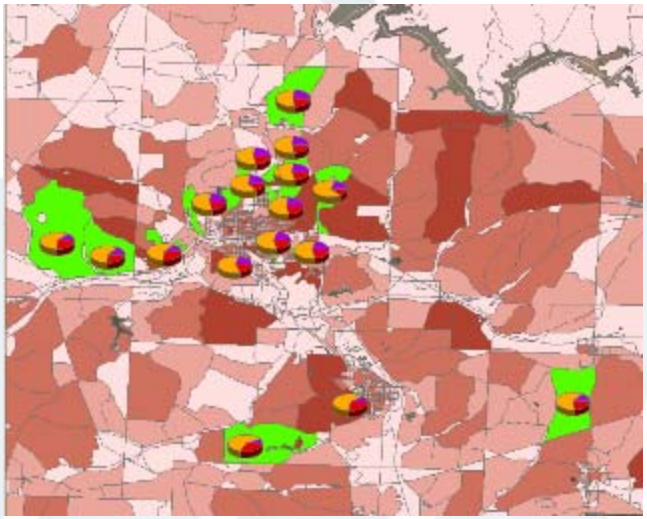
How HAZUS-MH Estimates Losses

- **Produces maps, tables, and reports**
- **Analyzes social and economic impacts**
- **Considers what is at risk**
- **Identifies hazard**
- **Analyzes physical landscape**

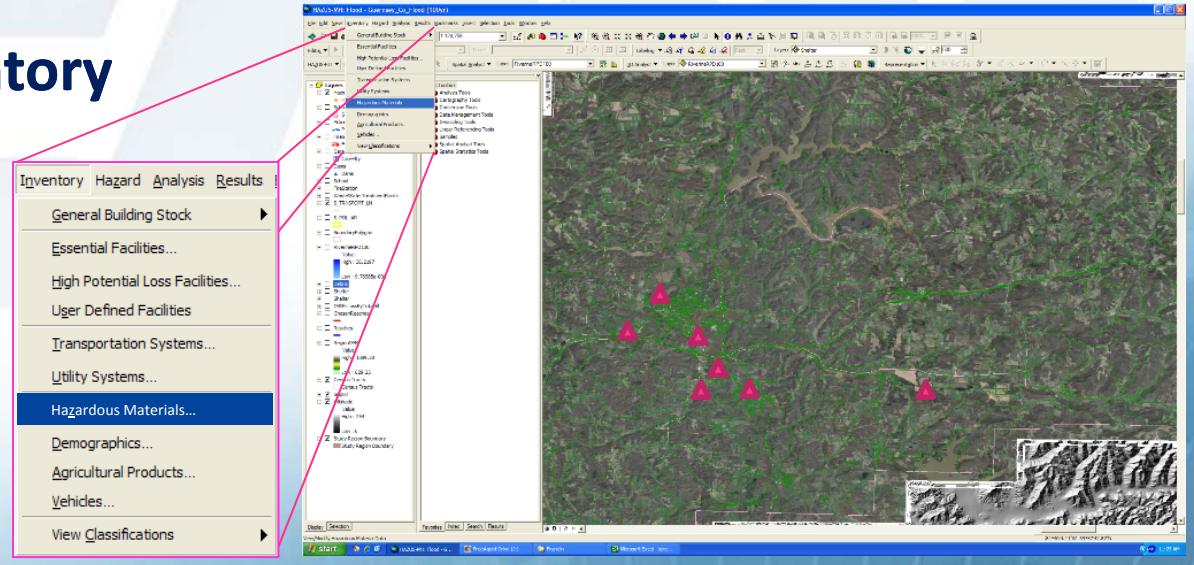
Inventory Components

Aggregate Inventory

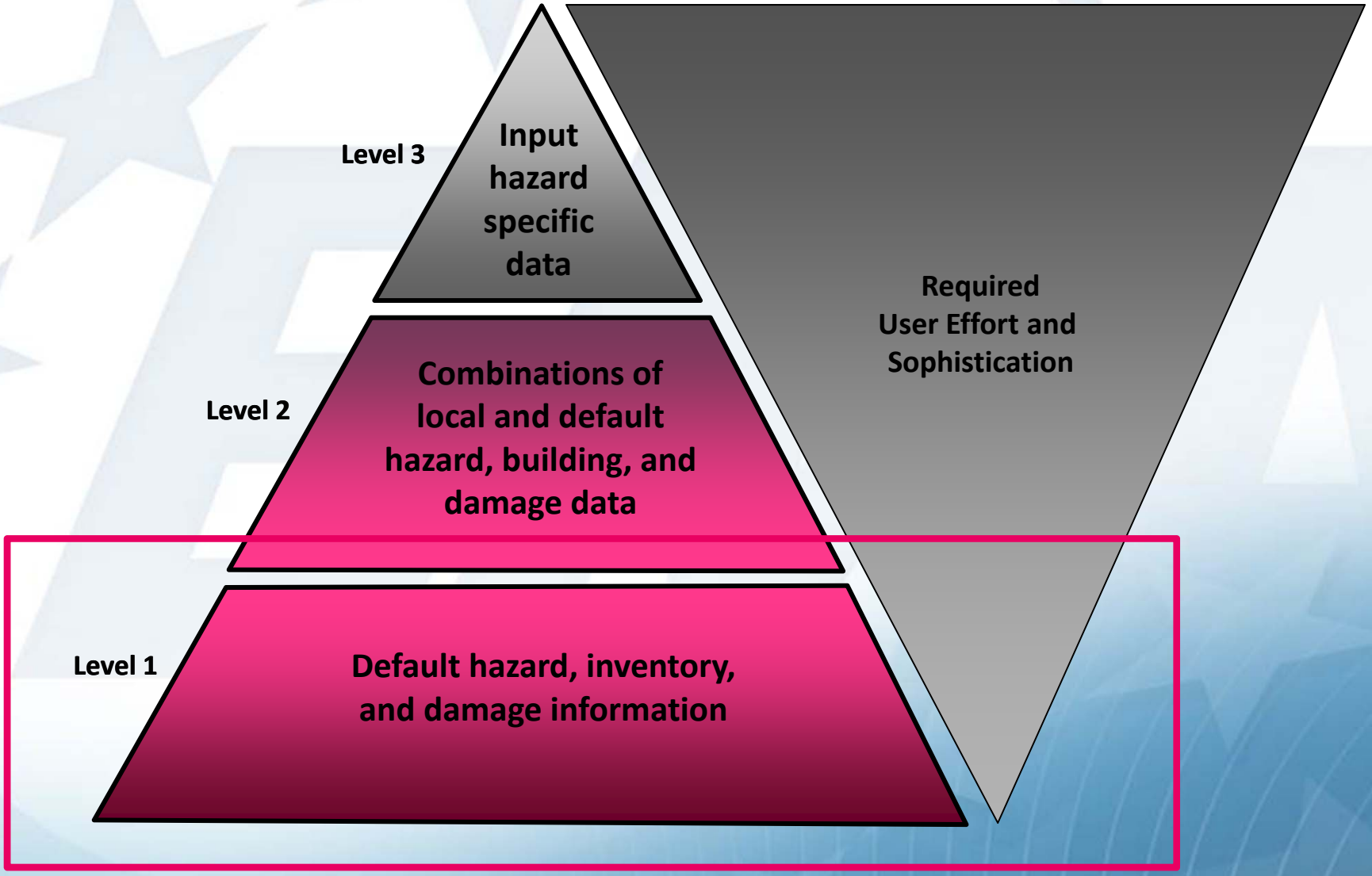
- Demographics
- General Building Stock broken down by type (how constructed) and occupancy (how used)



Site-Specific Inventory



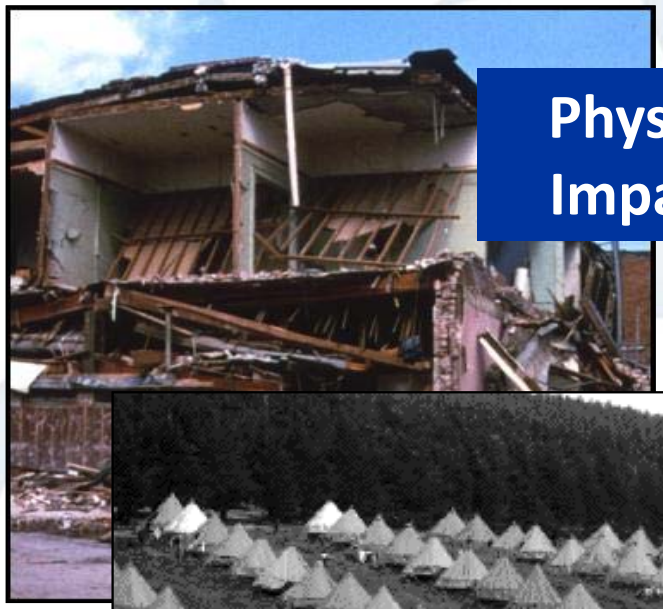
User Levels


Level 3
Input hazard specific data
Level 2
Combinations of local and default hazard, building, and damage data
Level 1
Default hazard, inventory, and damage information
Required User Effort and Sophistication

How do I integrate local data?

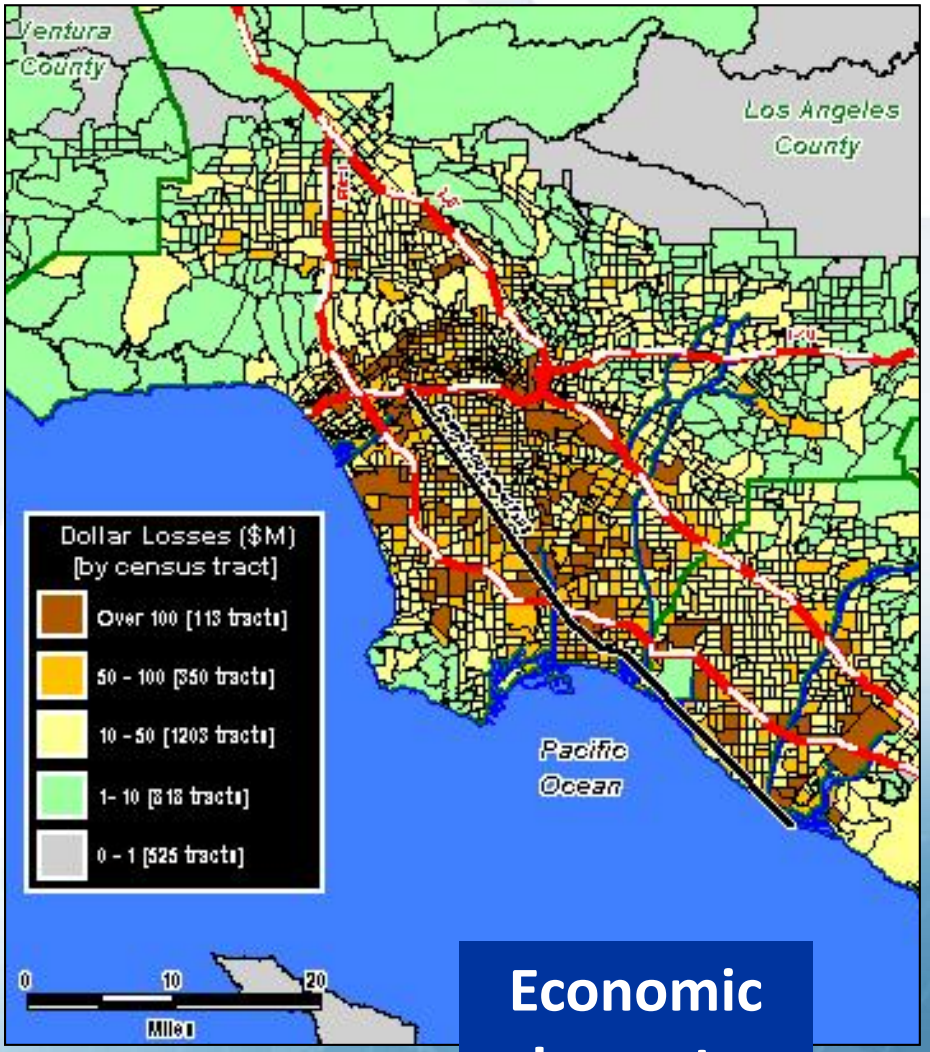
- Data integration tools:
  - Building Import Tool (BIT)
    - update GBS
  - Flood Information Tool (FIT)
    - incorporate flood studies
  - Comprehensive Data Management System
    - incorporate local, site specific data
    - Allow users to query and export inventory information
- Used to have linkage to third-party models
  - Areal Locations of Hazardous Atmospheres (ALOHA)
  - Flood Waves (FLDWAV) for dam breach analyses
  - HAZUS no longer supports these, but you can still use GIS for analyses by incorporating inventory from HAZUS

HAZUS-MH Output



Physical Impacts

Social Impacts

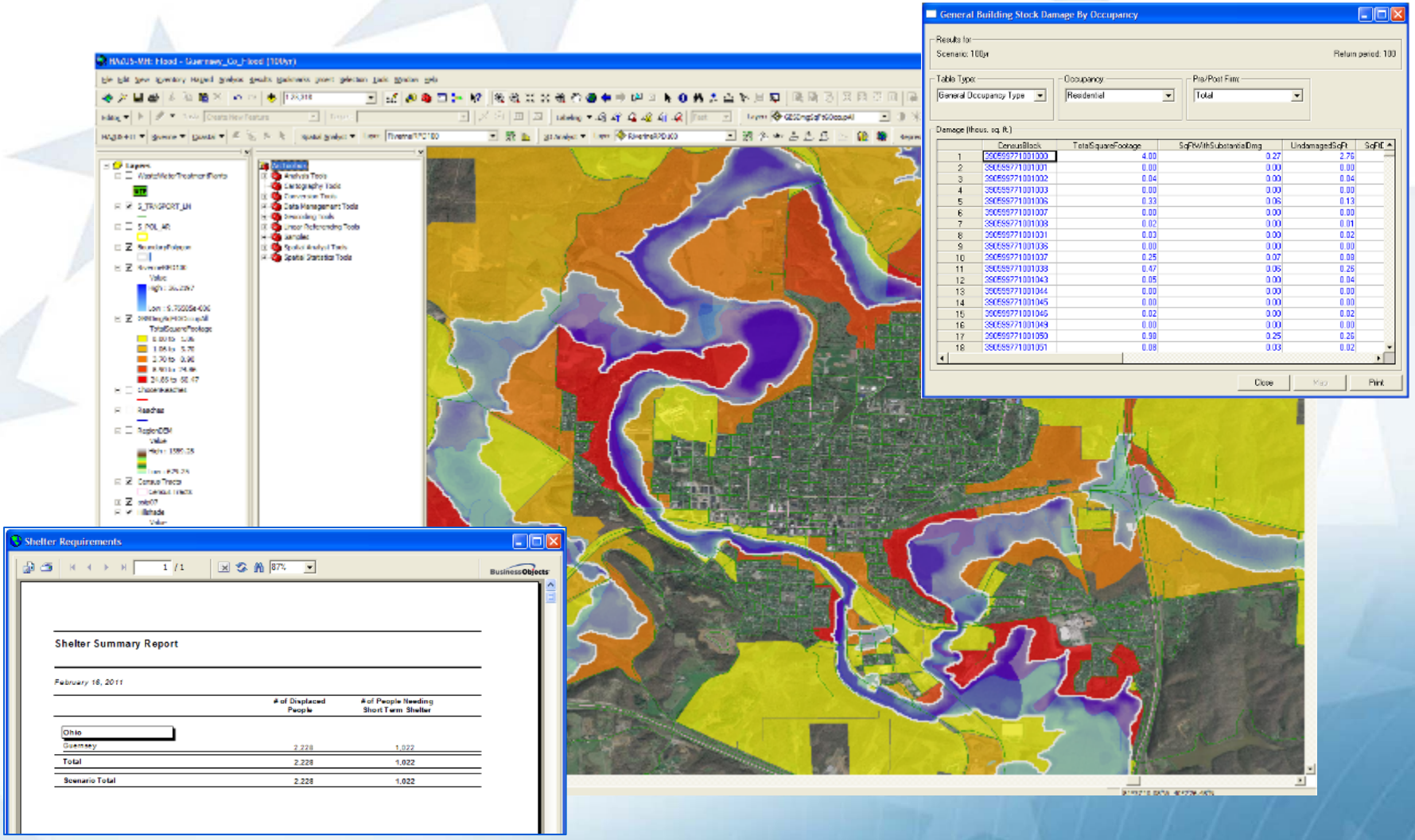


Economic Impacts

HAZUS-MH Output

	Earthquake Ground Shaking Ground Failure	Flood Frequency Depth Discharge Velocity	Hurricane Wind Pressure | Missile | Rain
Direct Damage			
General Building Stock	✓	✓	✓
Essential Facilities	✓	✓	✓
High Potential Loss Facilities	✓		
Transportation Systems	✓	✓	
Utility Systems	✓	✓	
Induced Damage			
Fire Following	✓		
Hazardous Materials Release			
Debris Generation	✓	✓	✓
Direct Losses			
Cost of Repair	✓	✓	✓
Income Loss	✓	✓	✓
Crop Damage		✓	
Casualties	✓	Generic Output	
Shelter Needs	✓	✓	✓
Indirect Losses			
Supply Shortages	✓	✓	
Sales Decline	✓	✓	
Opportunity Costs	✓	✓	
Economic Loss	✓	✓	

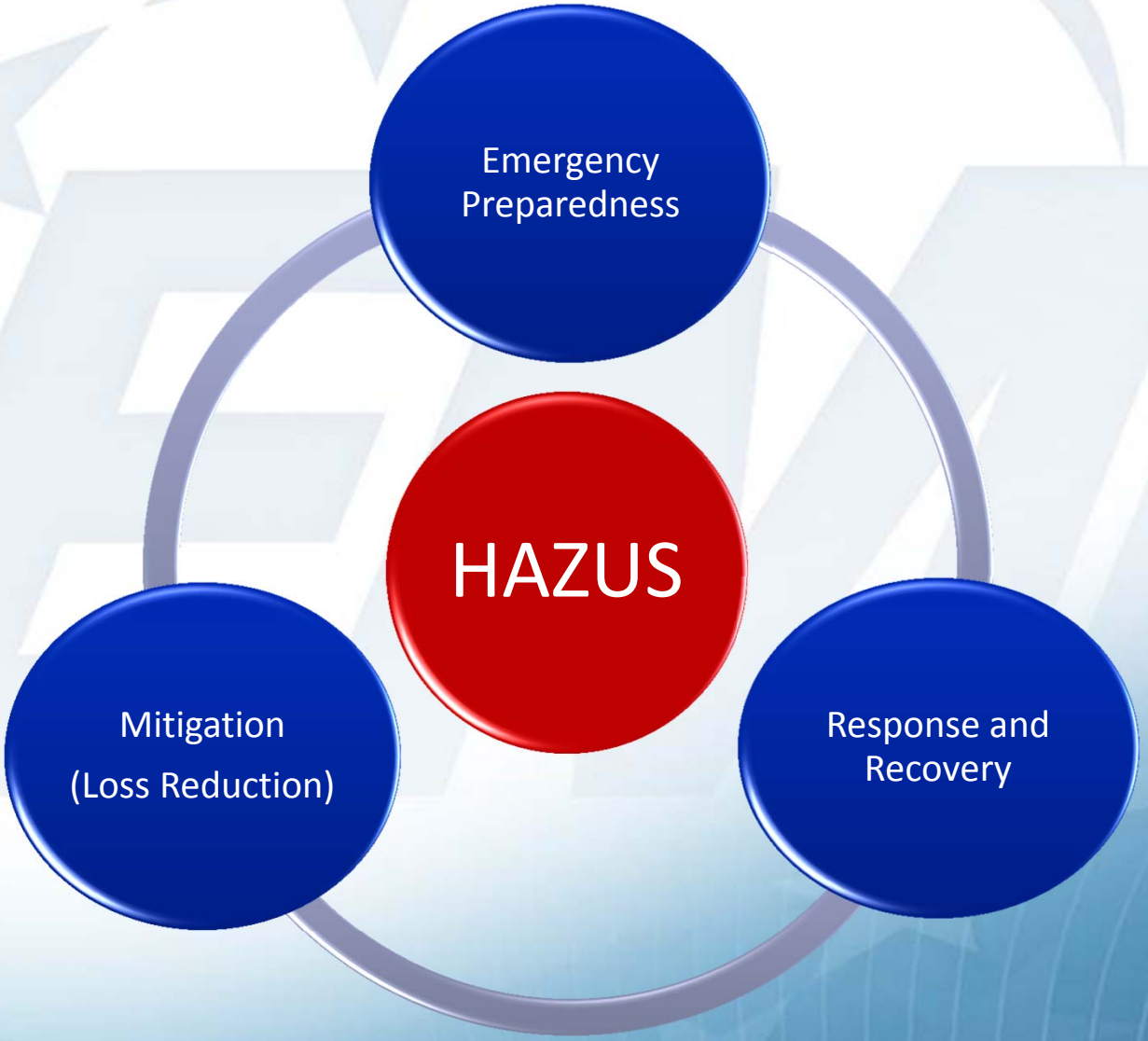
Results Formats



How does HAZUS-MH Support Emergency Management?

- **IDENTIFY** vulnerable areas
- **ASSESS** level of readiness and preparedness to deal with a disaster before disaster occurs
- **ESTIMATE** potential losses from specific hazard events
- **DECIDE** on how to allocate resources for most effective and efficient response and recovery
- **PRIORITIZE** mitigation measures that need to be implemented to reduce future losses (what if)

HAZUS in Emergency Management



Emergency Preparedness

- Develop emergency response plans
  - Evaluate temporary housing
  - Debris management/removal
  - Emergency power and water
  - Emergency medical services
  - Evacuation/emergency route clearance!!!
    - Who, where, etc.
- Organize response exercises

Response and Recovery

- Post-disaster damage assessment and ground-truthing
- Response planning for critical transportation outages
- Identify critical infrastructure
- Recovery action planning
- Long-term economic recovery planning

Who else uses this software?

- HAZUS has been used since 1997
  - Federal, state, and local government officials use HAZUS for pre-disaster preparedness and mitigation and post-disaster planning & response
  - Financial institutions such as banks and insurance companies use it to assess their exposure to the disasters (Schwabb, Wells Fargo, BofA, ISO, …)

Who else uses this software?

- HAZUS has been used since 1997
  - Universities (professors and graduate students) use it for advanced, applied research (MIT, GT, Univ of IL, Princeton Univ., Stanford, UC Berkeley, ...)
  - Transportation and utility agencies use it to assess the reliability of their systems (CalTran, LADWP, …)

SHARPP

- Mitigation assessment
  - Identify ‘at-risk’ communities
- Mitigation measures
  - Strengthen existing structures
  - Flood-proofing, Relocation, Elevation, Demolition
- Mitigation programs
  - Adopt and enforce hazard-resistant building codes
  - Land use planning

http://ohiosharpp.ema.state.oh.us/OhioSHARPP/Home.aspx

SHARPP

Ohio Disaster and Planning Maps

Click which type of map you would like to view. Disaster Maps display disaster and funding history by county. Planning Maps display the status of Mitigation Plans throughout Ohio.

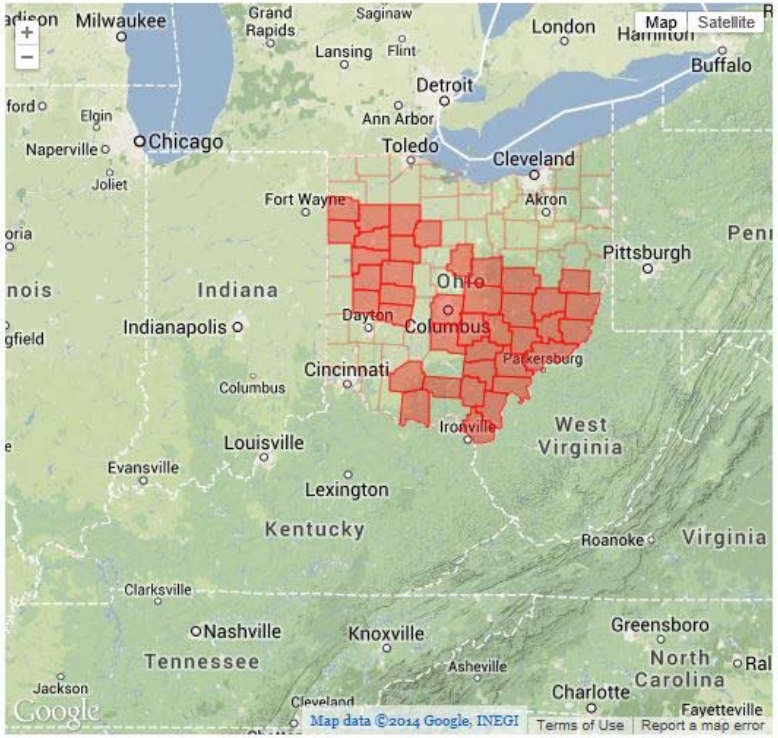
Disaster and Funding History Map | Status of Mitigation Plans Map

Disaster and Funding History

Click your county to see more detailed information about the disaster and funding history or select from below.

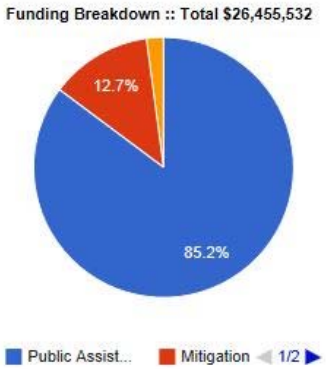
Select by Disaster Number	Select by Disaster Type	State Breakdown
DR-4077-OH	- Select -	- Select -

Clear Highlighted Counties



DR-4077-OH

Show as Pie Chart



Disaster Types Associated with this Declaration

Severe Summer Storm

Windstorm

Counties Associated with this Disaster Type

Adams, Allen, Athens, Auglaize, Belmont, Champaign, Clark, Coshocton, Fairfield, Franklin, Gallia, Guernsey, Hancock, Hardin, Harrison, Highland, Hocking, Jackson, Knox, Lawrence, Licking, Logan, Meigs, Miami, Monroe, Morgan, Morrow, Muskingum, Noble, Paulding, Perry, Pickaway, Pike, Putnam, Shelby, Van Wert, Vinton, Washington, Wyandot

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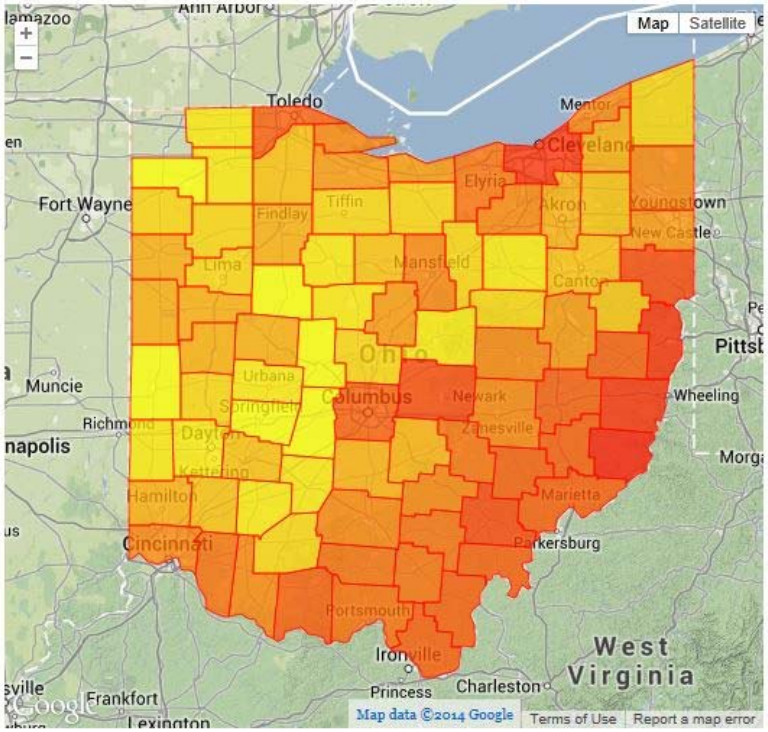

Severe Summer Storm

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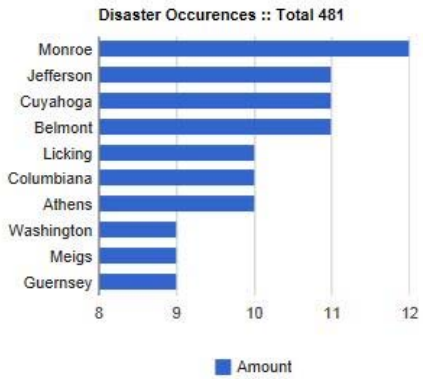


Disasters Associated with this Disaster Type

DR-1065-OH
DR-1097-OH
DR-1164-OH
DR-1227-OH
DR-1321-OH
DR-1339-OH

Counties Associated with this Disaster Type

Adams, Allen, Ashland, Ashtabula, Athens, Auglaize, Belmont, Brown, Butler, Carroll, Champaign, Clark, Clermont, Clinton, Columbiana, Coshocton, Crawford, Cuyahoga, Darke, Defiance, Delaware, Erie, Fairfield, Fayette, Franklin, Fulton, Gallia, Geauga, Greene

SHARPP

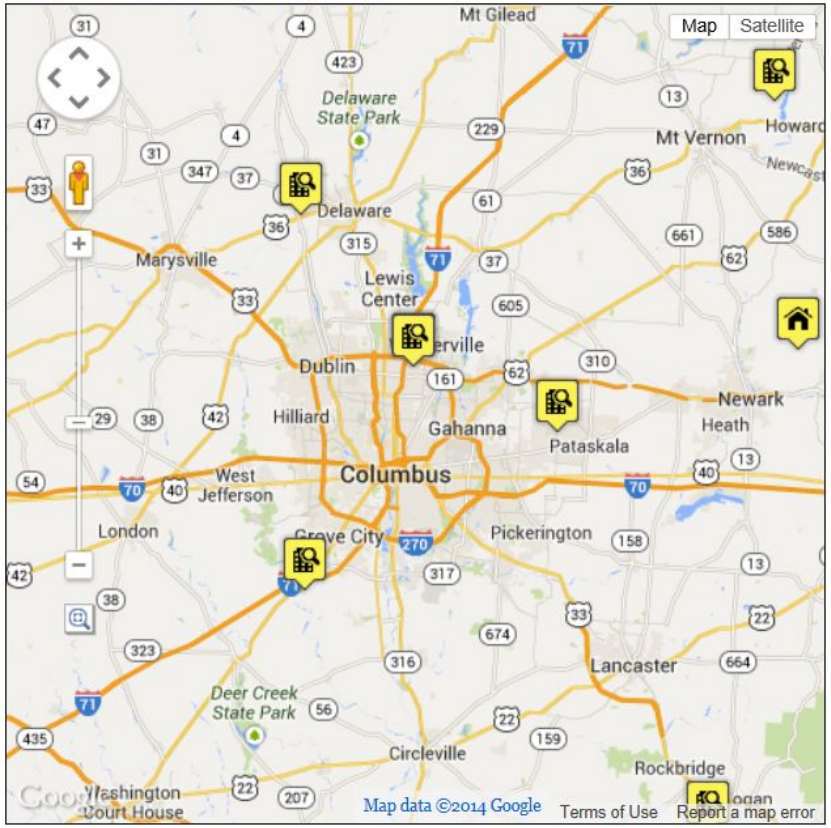
By County: Franklin Find

By Community: Bexley Find

By Property Address: Enter an address Find

By Lat/Long: Lat: Long: Find

Or click on a marker on the map below:



Projects and Structures In View

- **Project**: FY 11 RFC Scioto Township Mitigation Project
  Get More Info or Zoom To It
- **Project**: Columbus Acquisition
  Get More Info or Zoom To It
- **Project**: Knox County Acquisition
  Get More Info or Zoom To It

Map Legend

Hide Projects | Hide Structures

Project Types

Acquisition

Multipl

5% Initiative Icon

5% Initiative

Elevati

Storm Shelter

Stormw

Mitigation Home | Grants | Hazards | Planning | Mitigation Projects | Reports | FAQ's | Links
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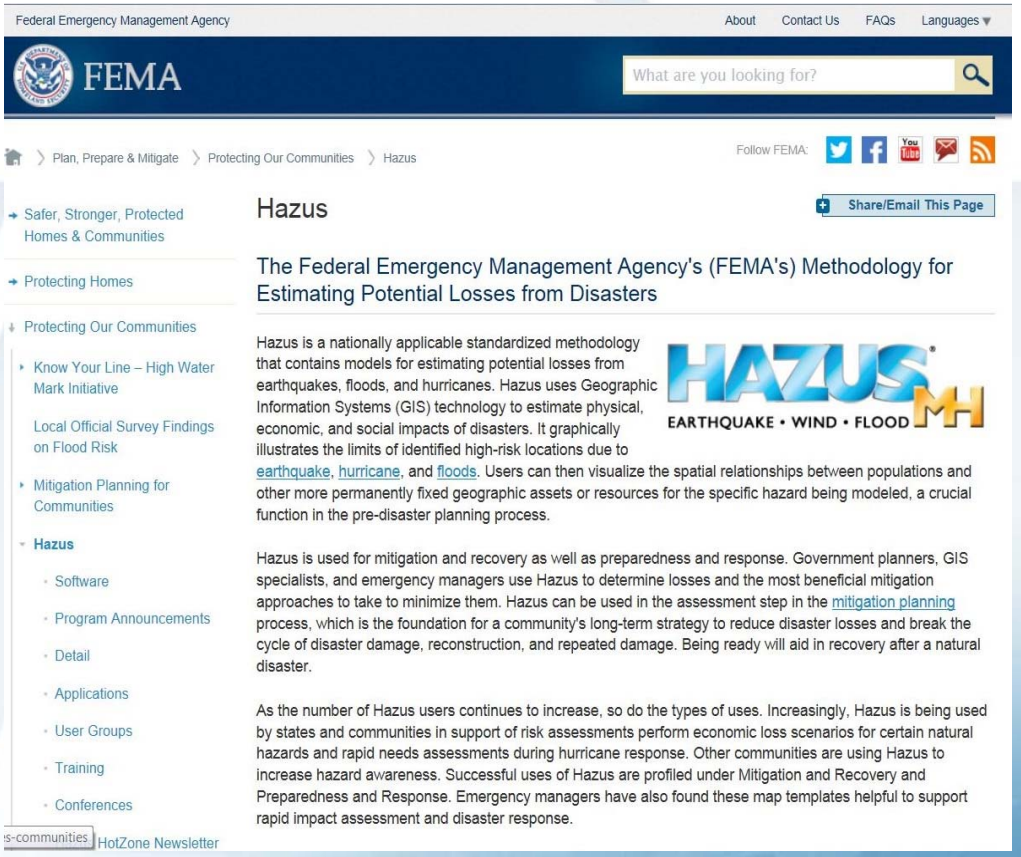
FEMA Resources

- HAZUS-MH Overview
- Software Order Forms
- Training / Conference Information
- FAQs



http://www.fema.gov/hazus

Training

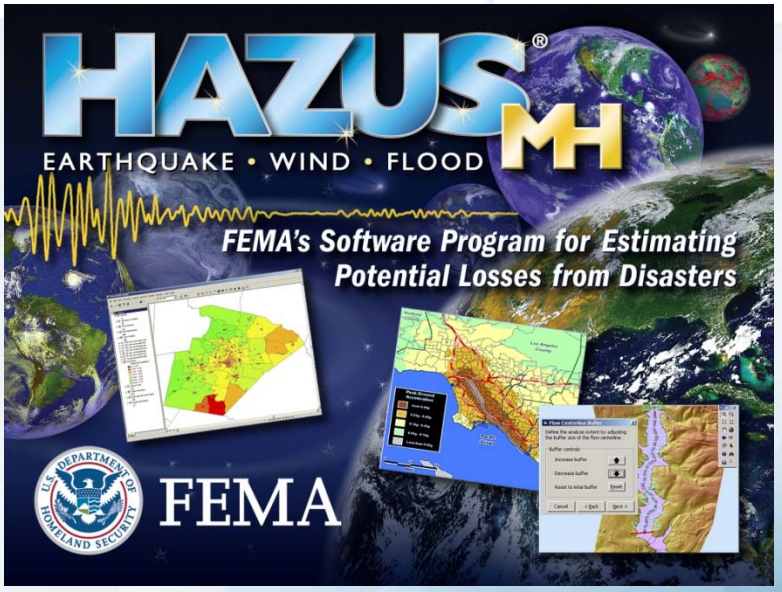
- Classroom Courses
  - ArcGIS for Emergency Managers
  - Basic HAZUS-MH
  - HAZUS-MH for Floods
  - HAZUS-MH for Earthquakes
  - HAZUS-MH for Hurricanes
  - Using HAZUS for Risk Assessment
  - Comprehensive Data Management for HAZUS-MH
  - HAZUS for Floodplain Managers
  - Using HAZUS for Disaster Operations
  - **http://www.fema.gov/hazus-training**

Training

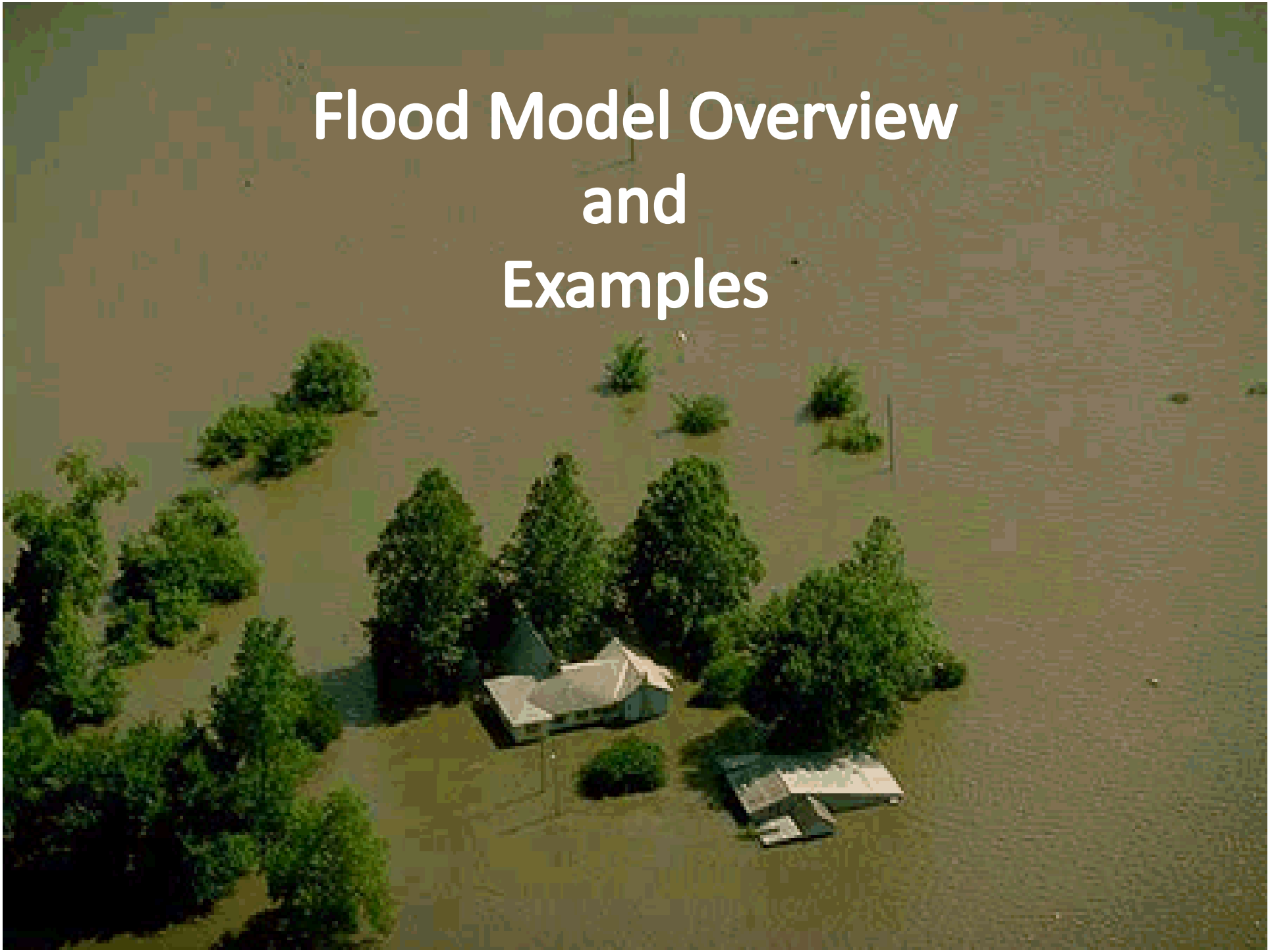
- Virtual Courses
  - Fourteen courses now available on the ESRI Virtual Campus
  - **http://www.fema.gov/hazus-training/new-virtual-courses-let-you-master-hazus-multi-hazard-your-timeline**

Last thoughts…

- HAZUS-MH is a "good" emergency management tool
  - How good depends on input data
- Local data can be incorporated in various ways
- Always need to remember that these results cannot be taken at face value
  - Needed to understand trends and relationships

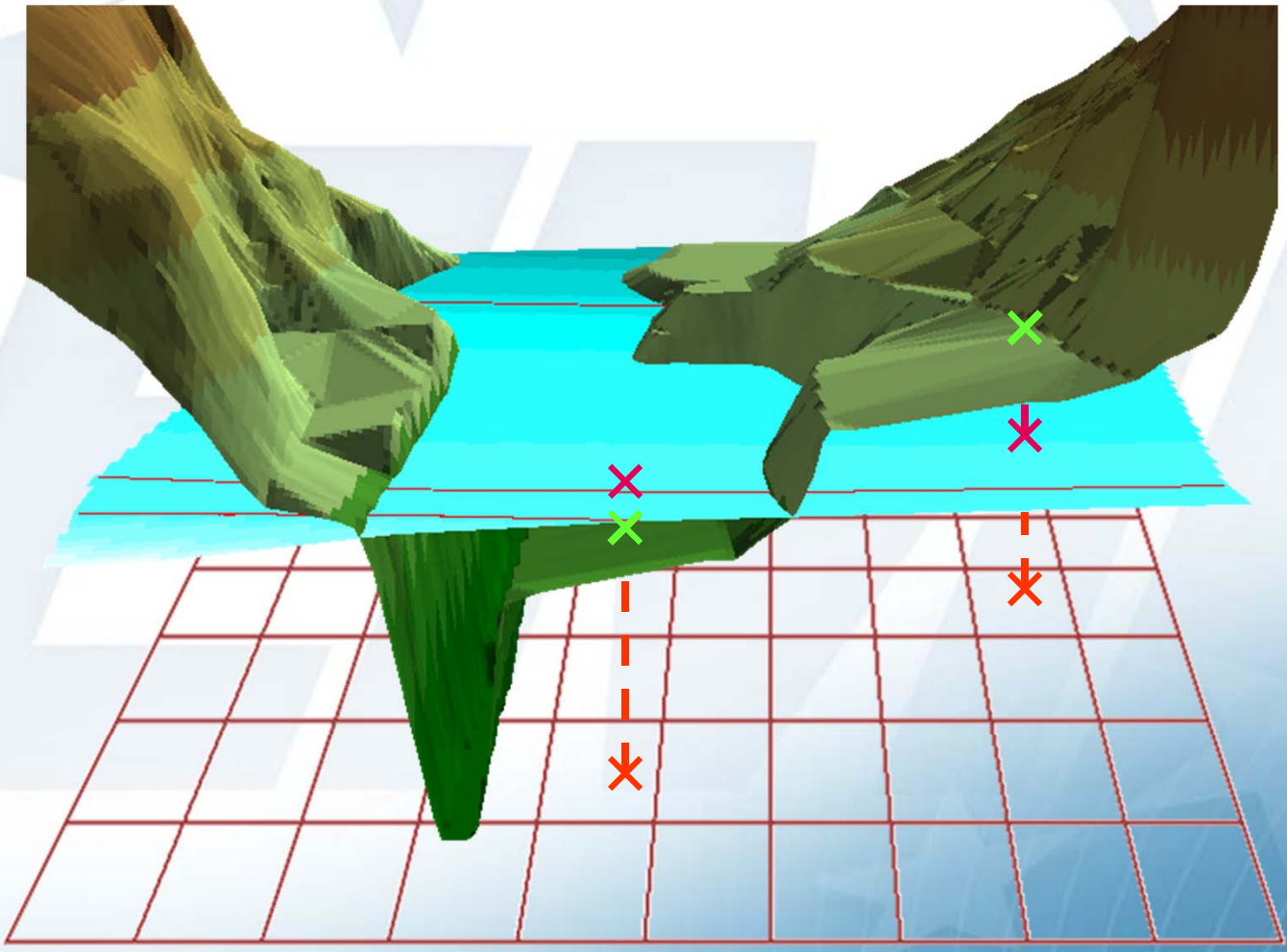


Flood Model Overview and Examples



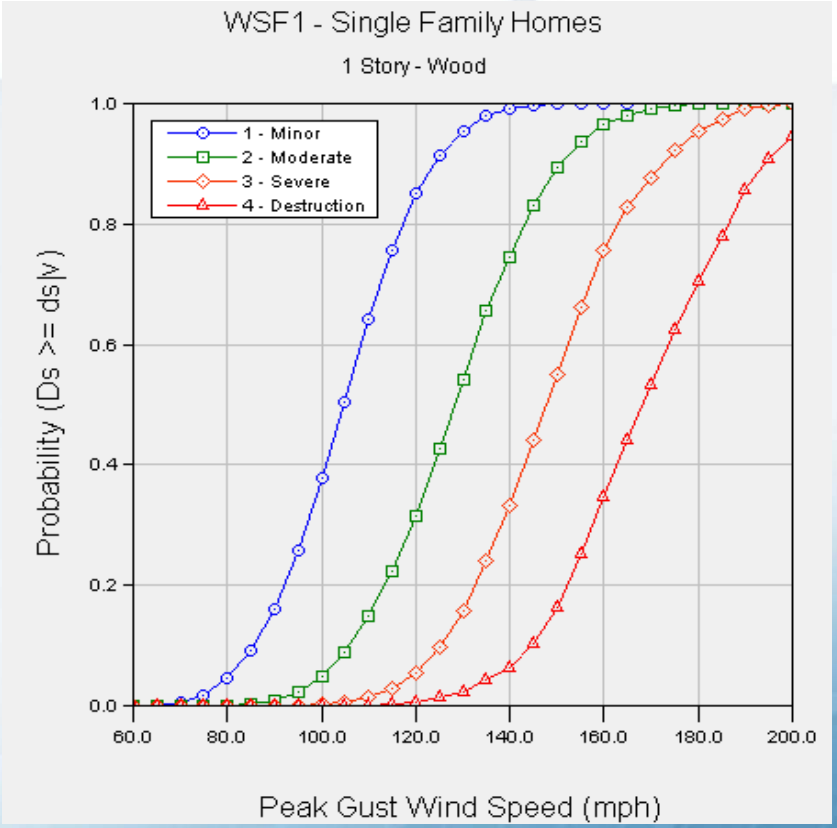
Flood Model Premise

Surfaces Used to Develop Depth Grid

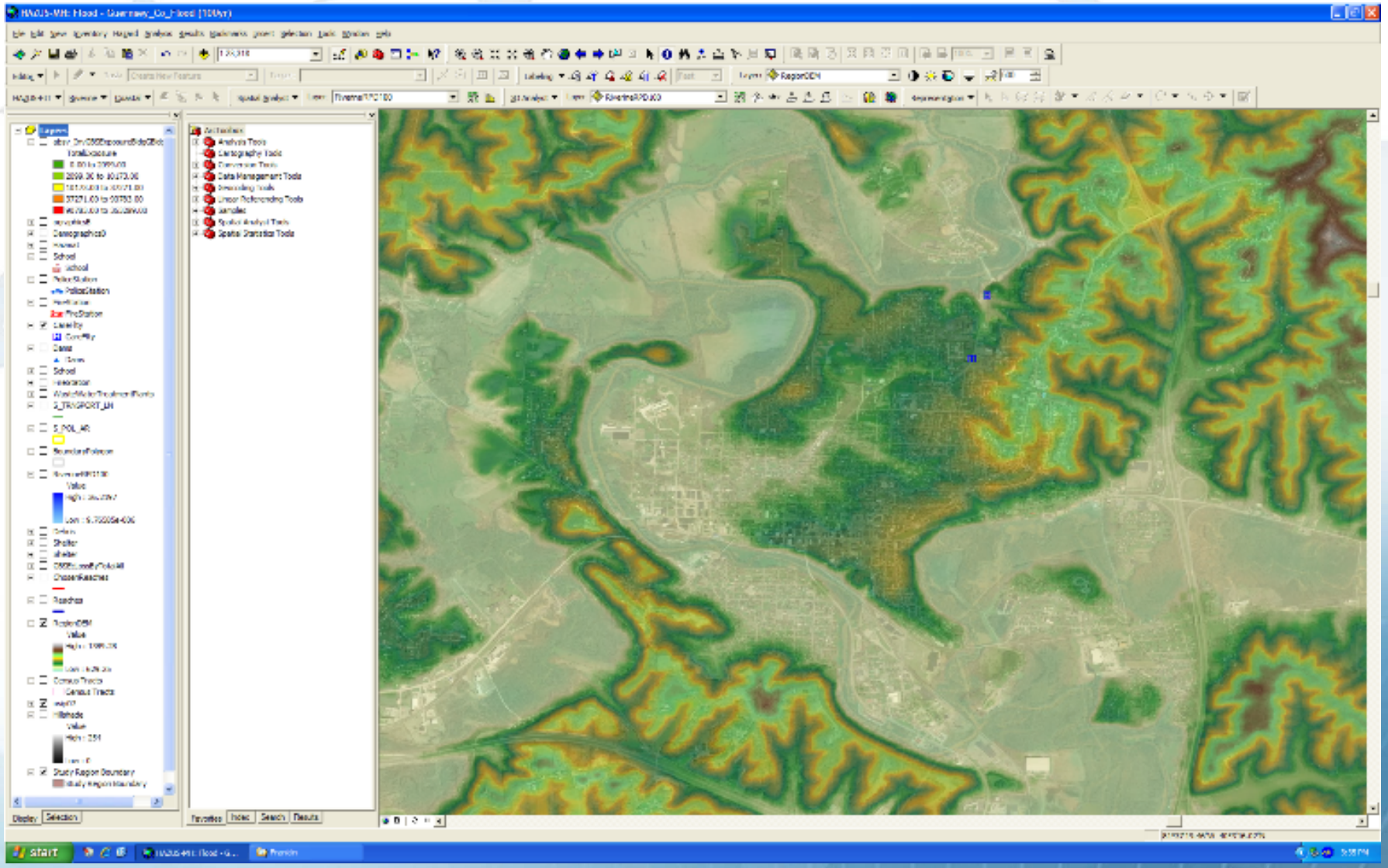


Damage/Loss Functions

- Assess damage and losses based on hazard conditions
- Example – Hurricane model has 4,818 unique building categories
  - 45 damage/loss functions for each building model
  - Total of 216,810 unique damage/loss curves



EXAMPLE: Guernsey County



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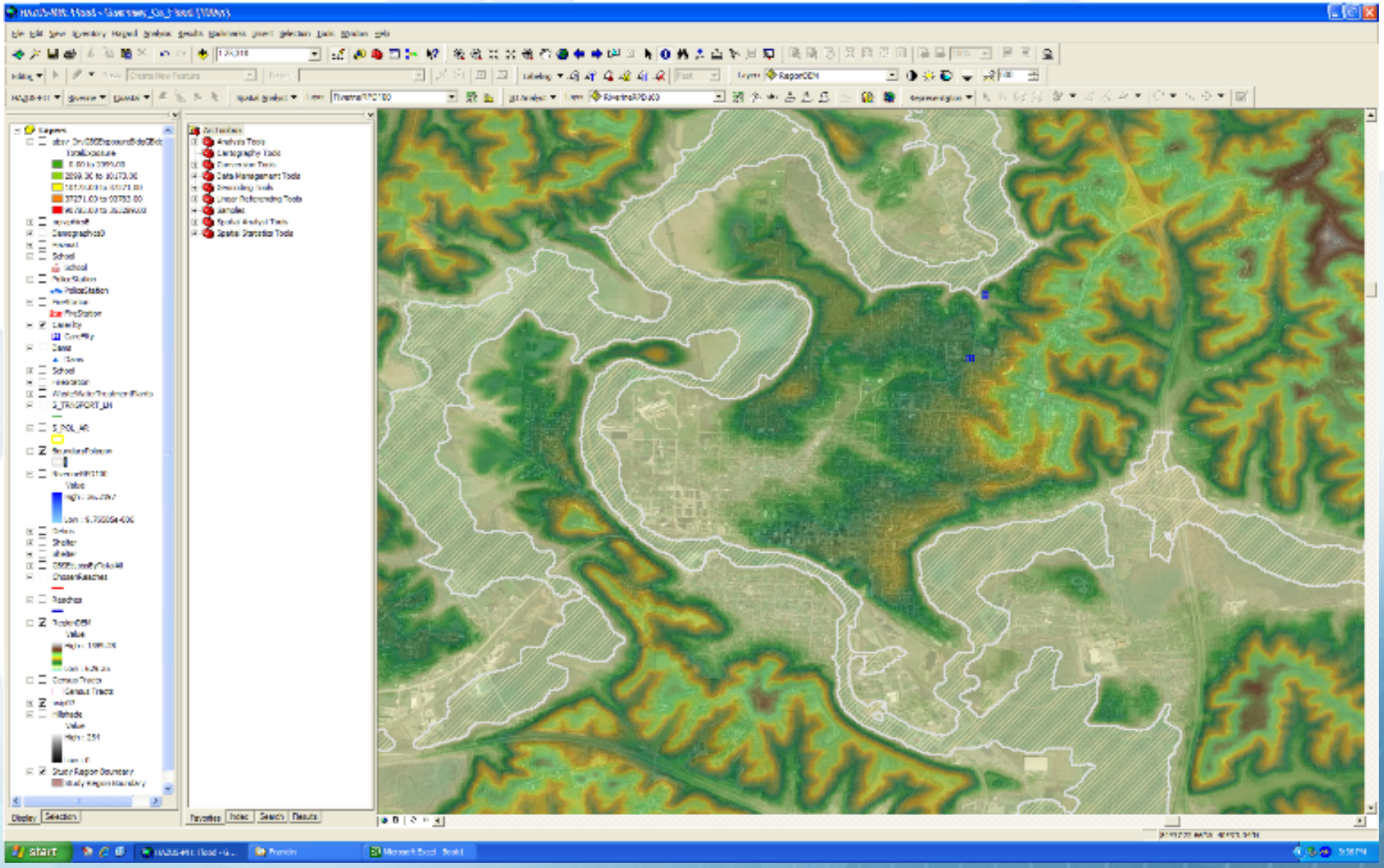

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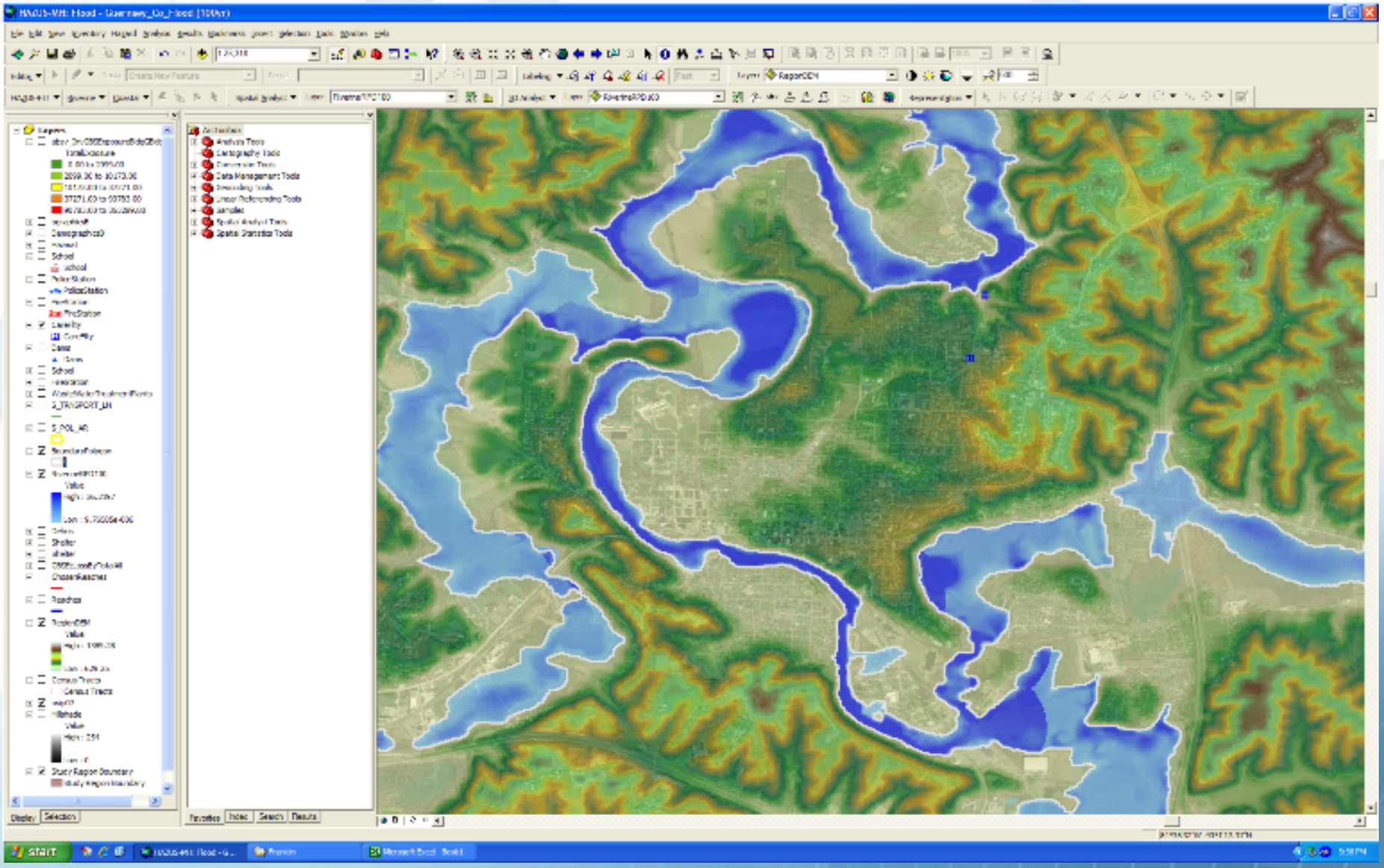

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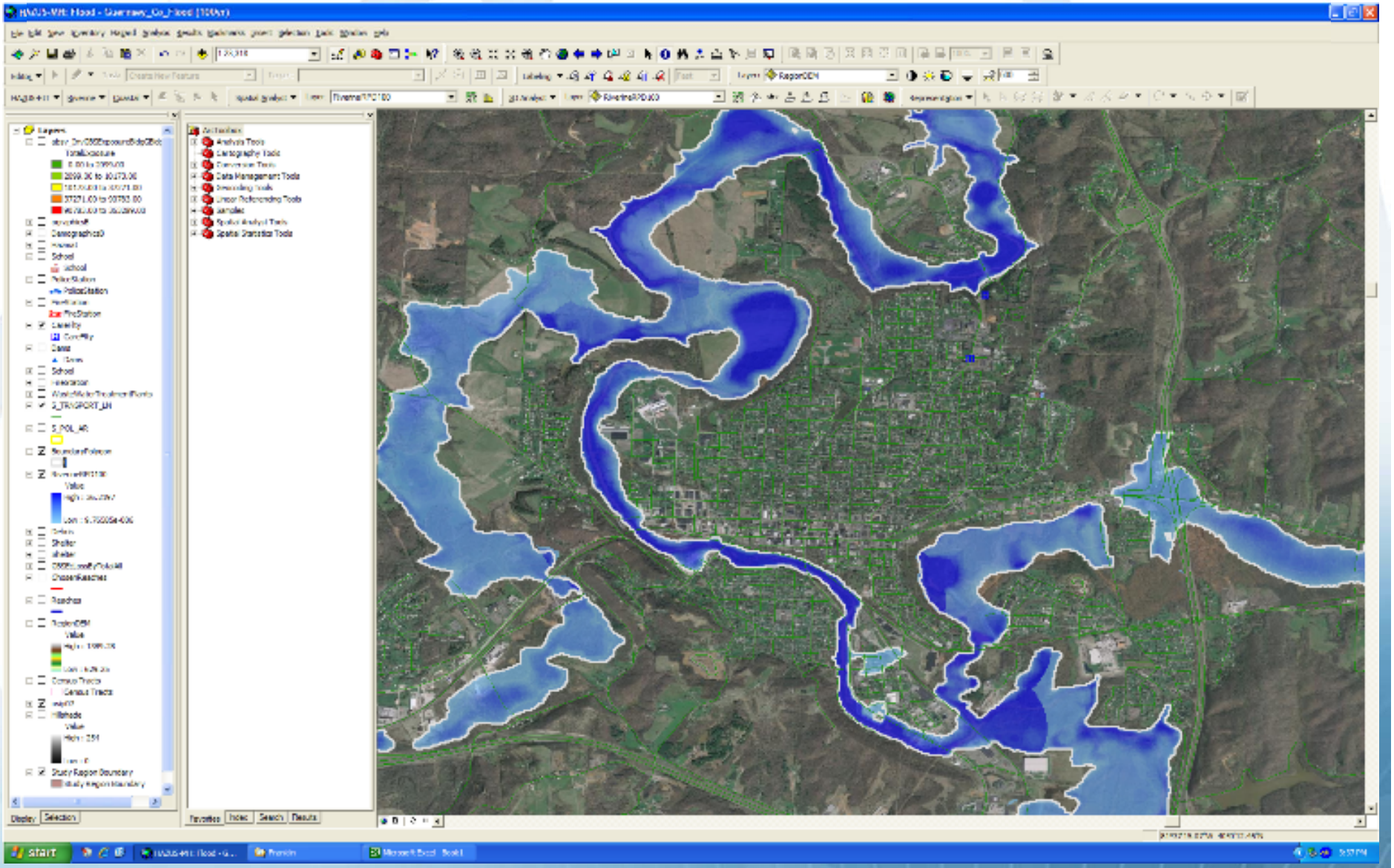
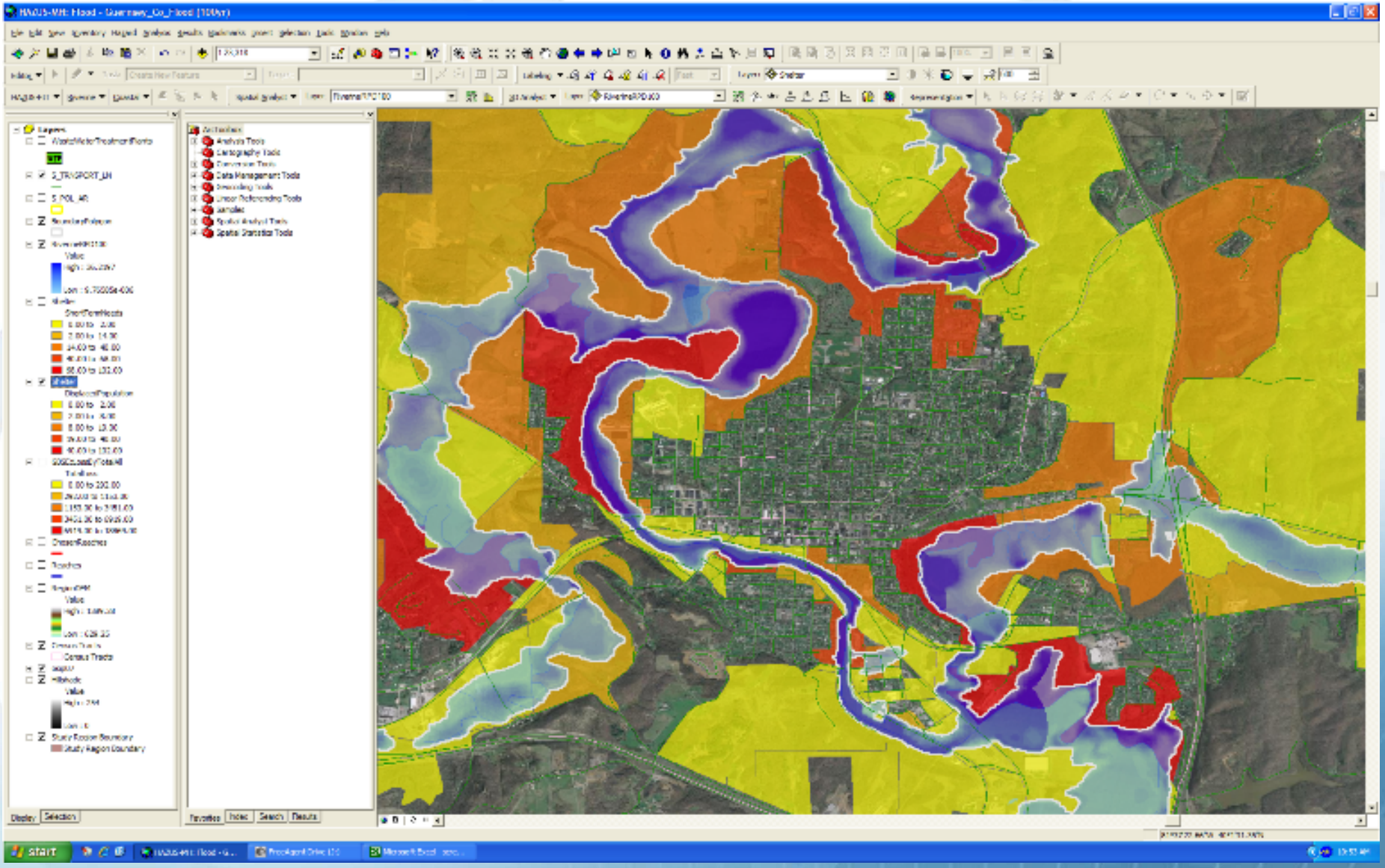
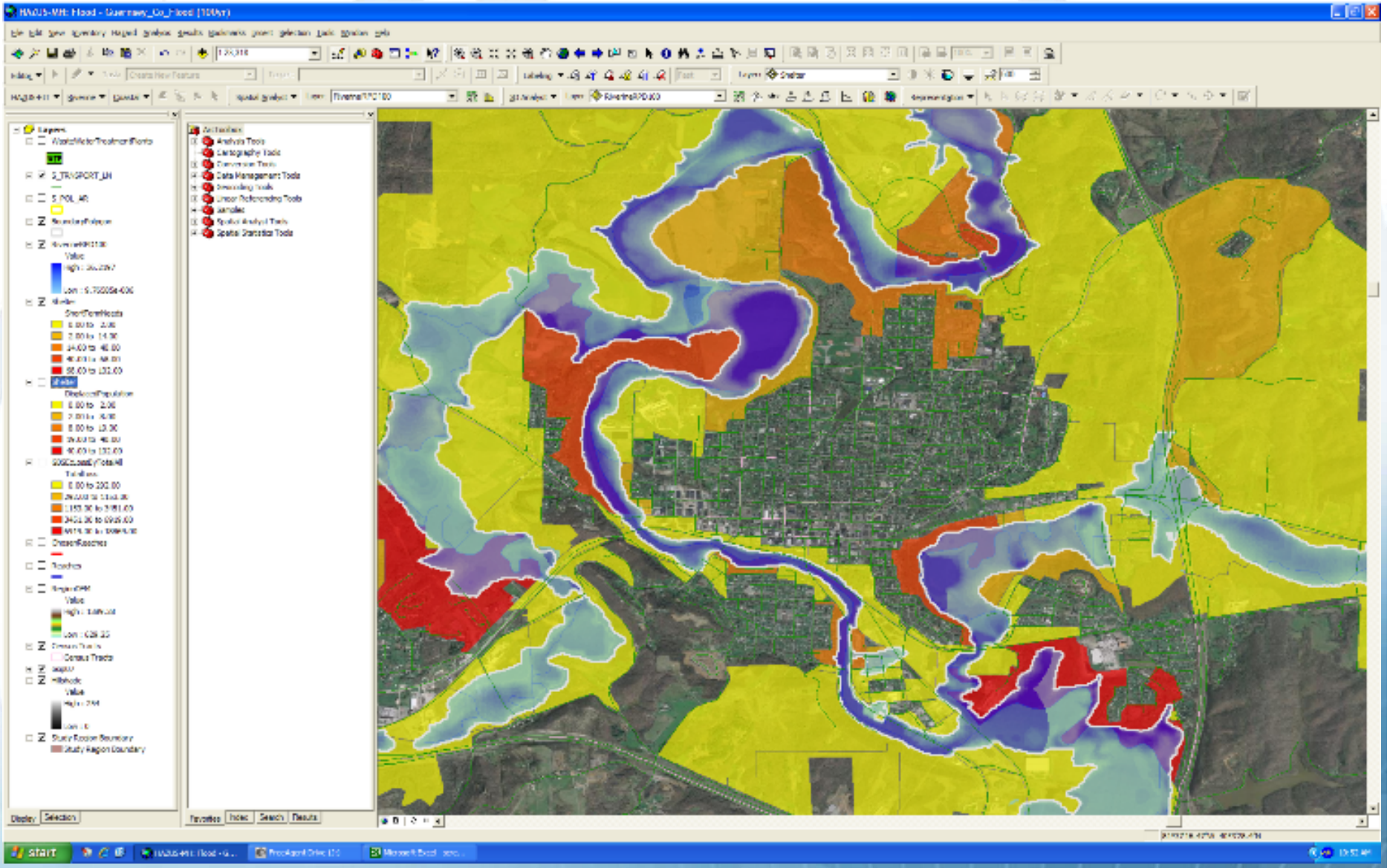


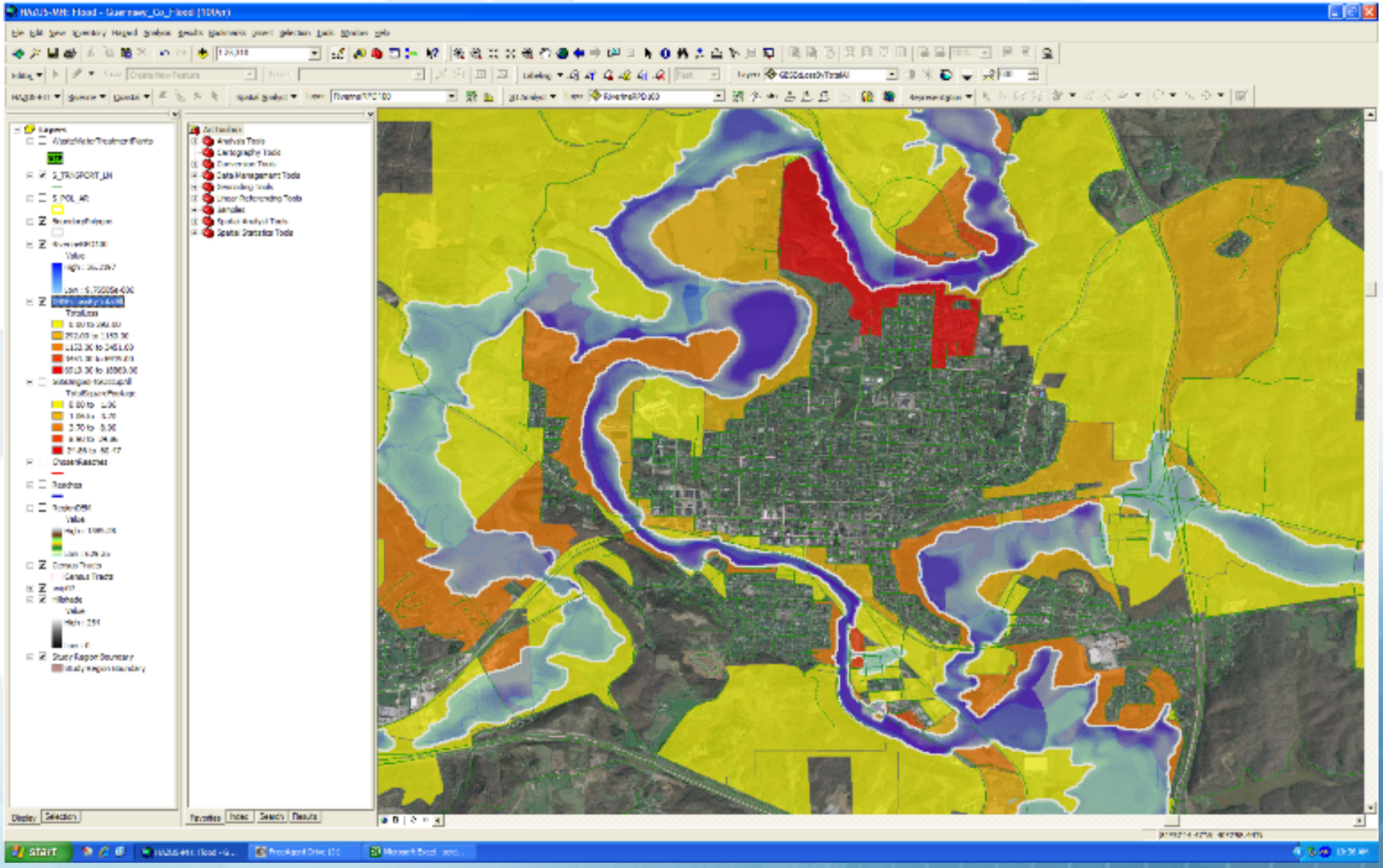
Guernsey County – Displaced Pop.



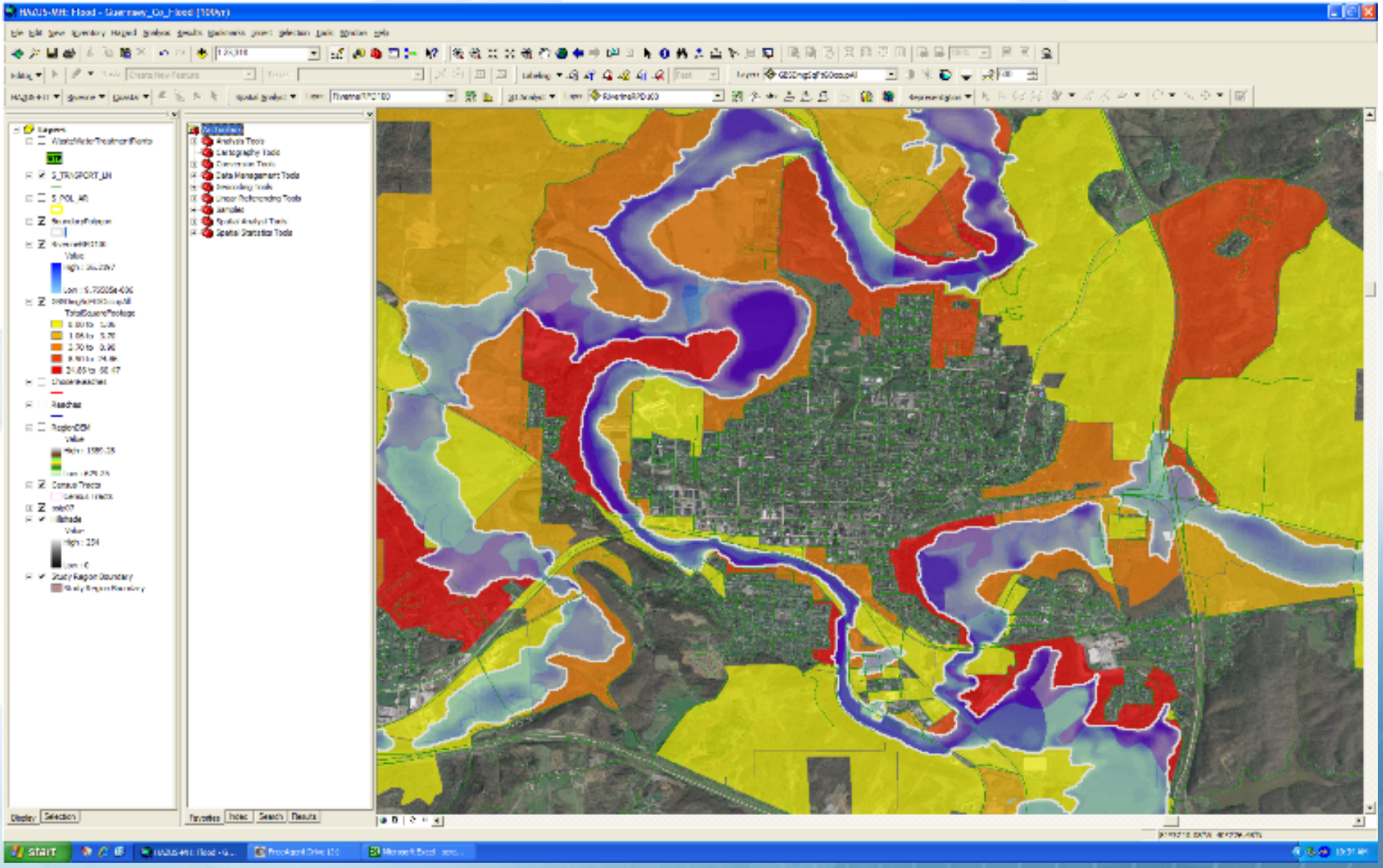
Guernsey County – Shelter Reqs.



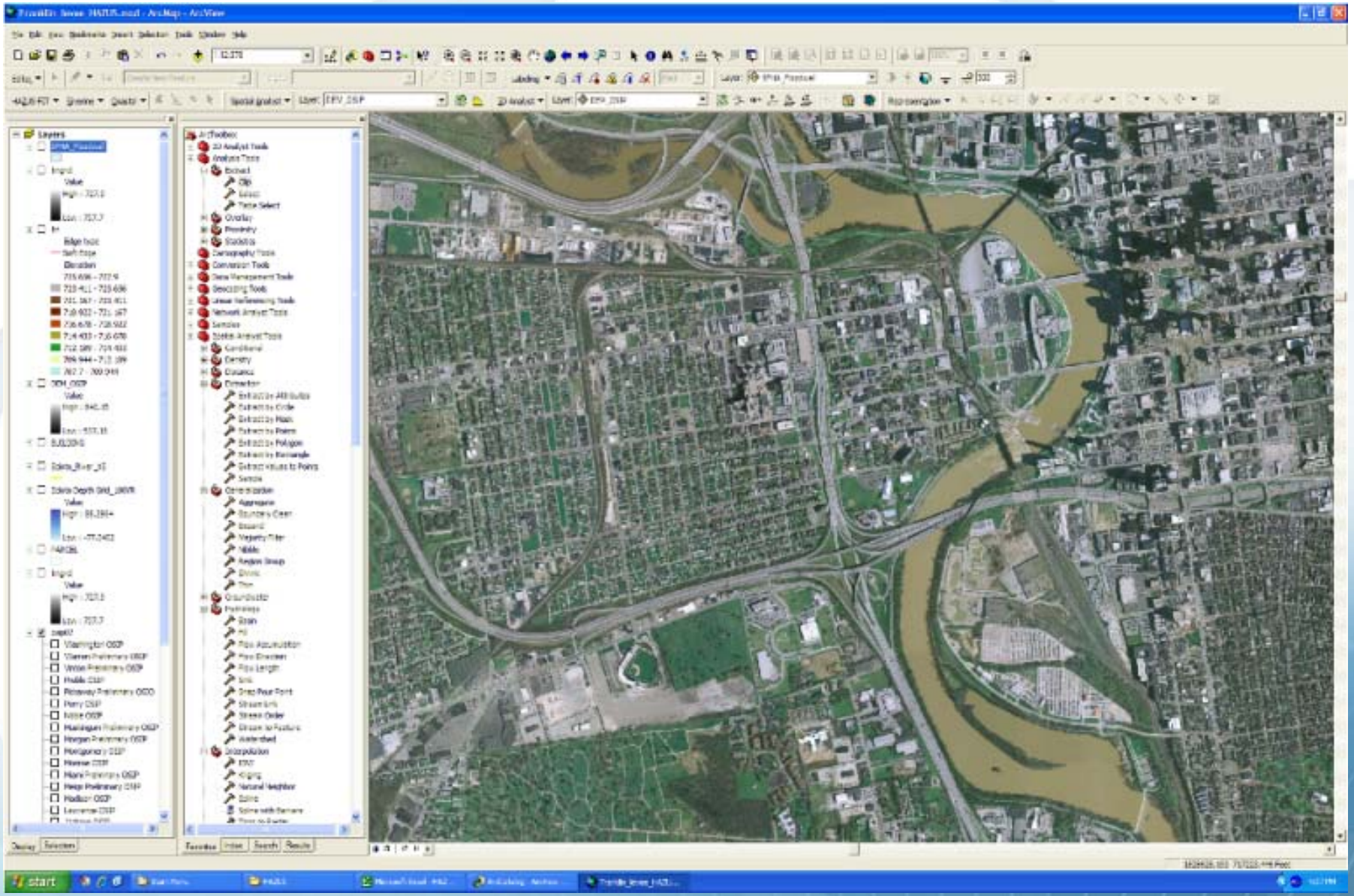
Guernsey County – Tot. Ec. Loss



Guernsey County – Building Damage



EXAMPLE: City of Columbus



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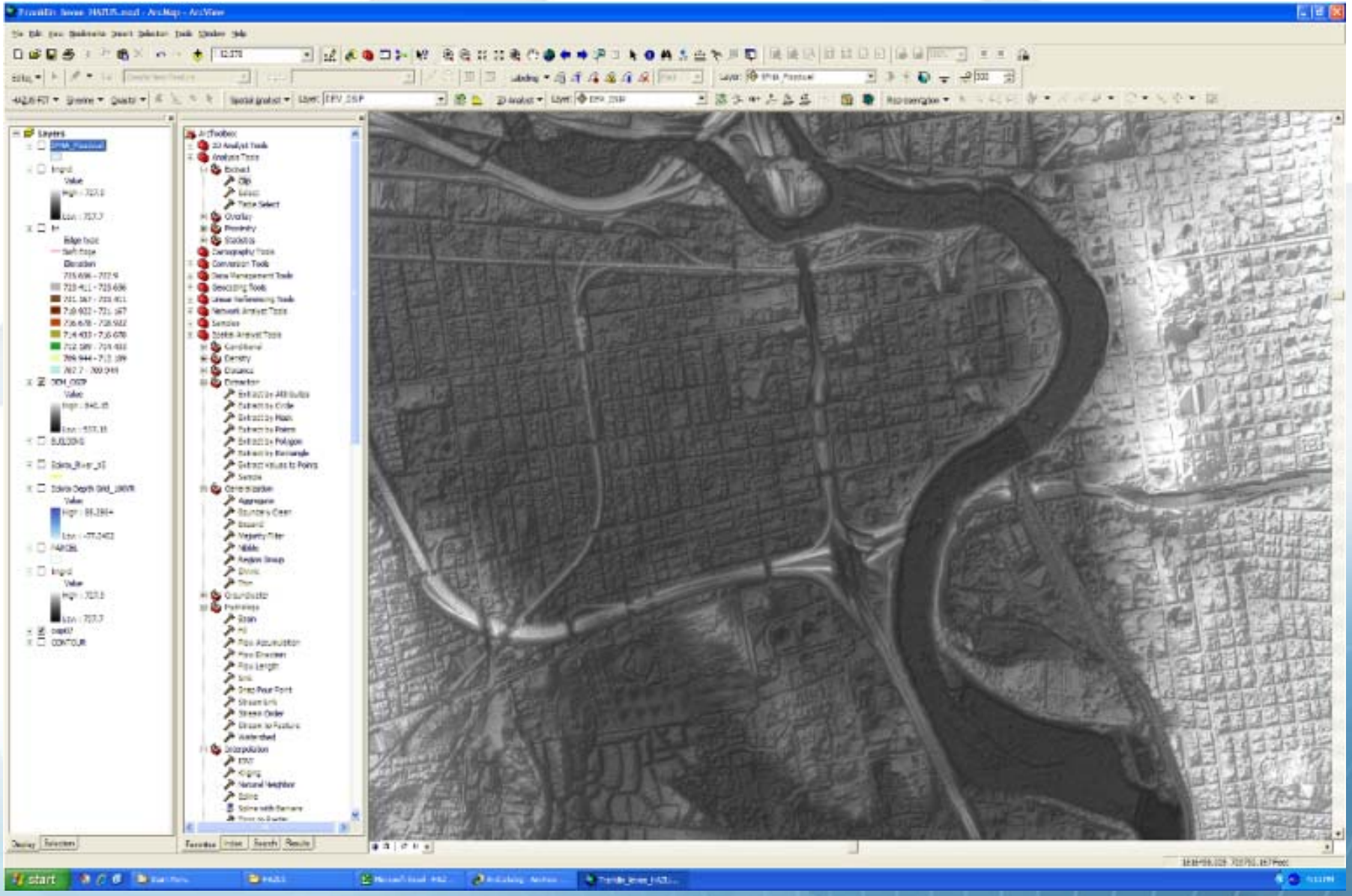

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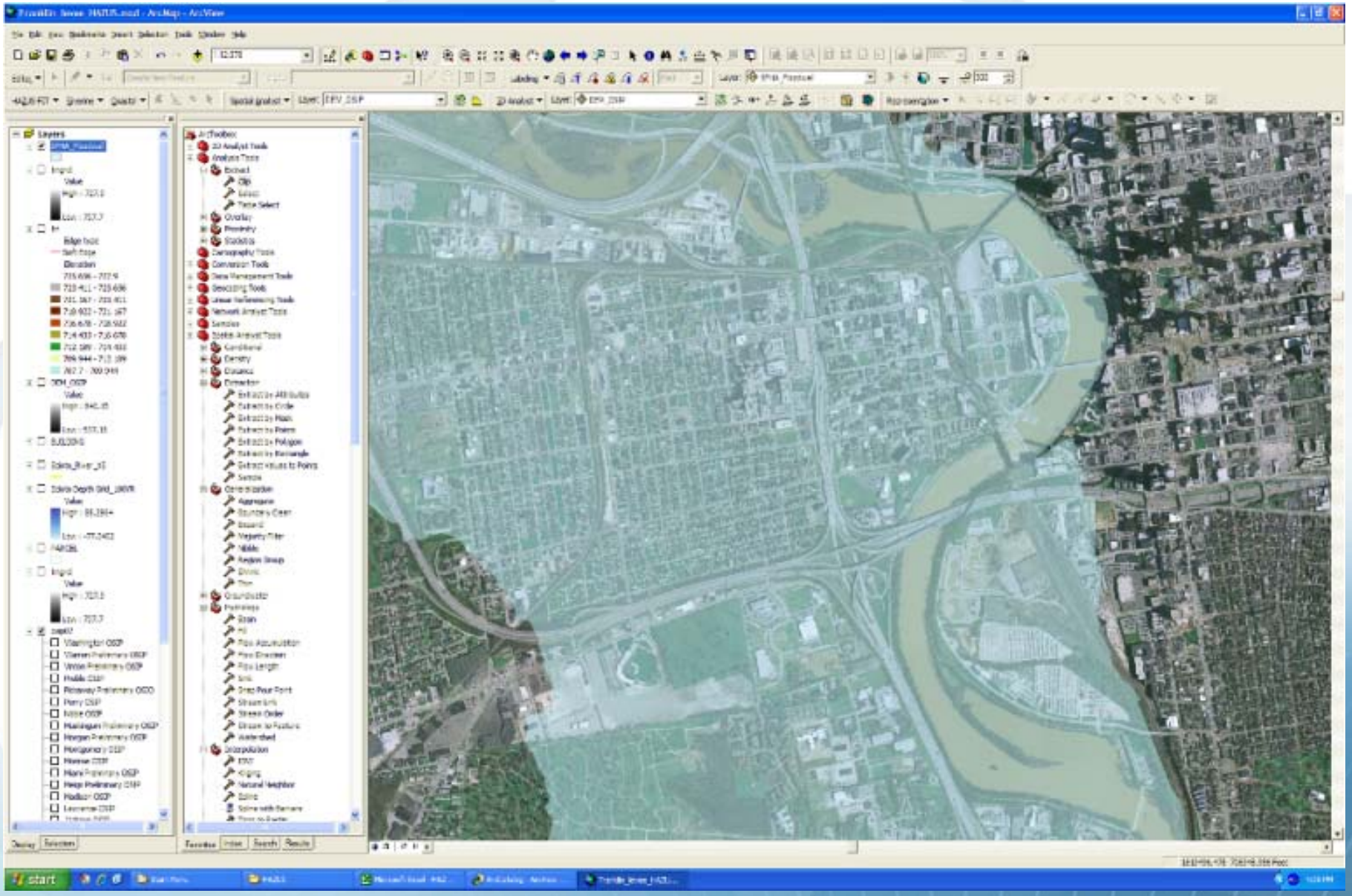

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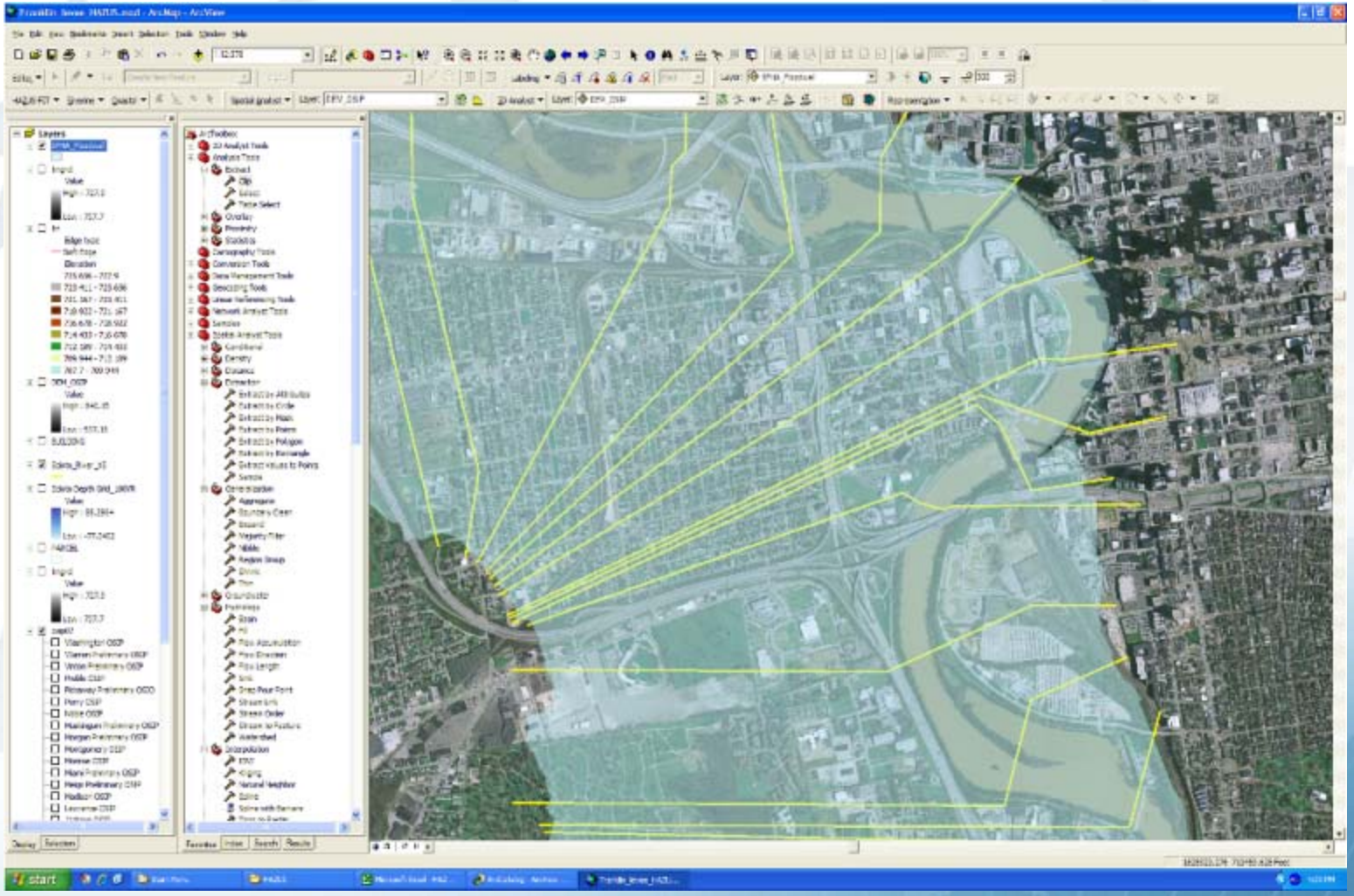

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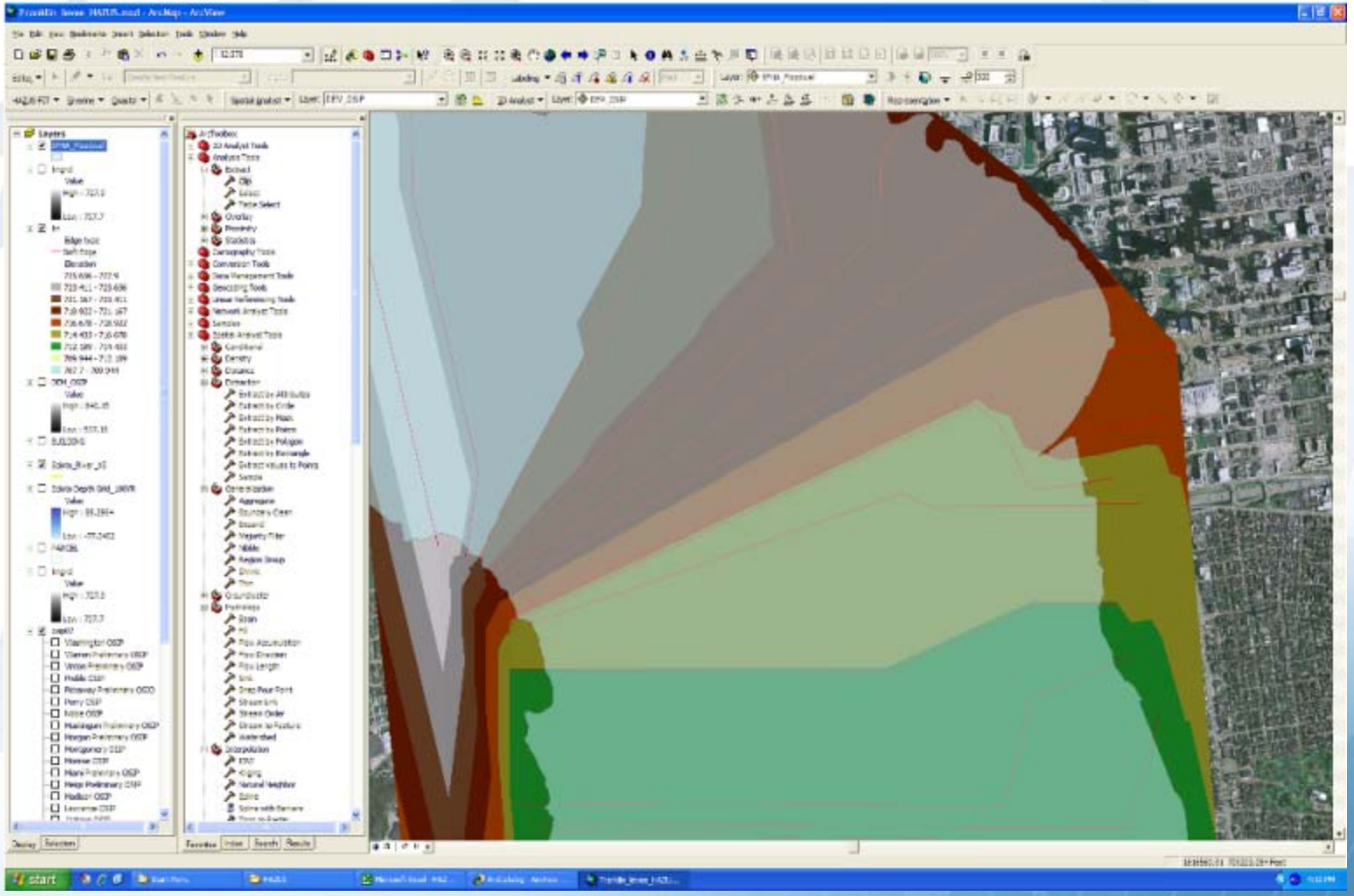
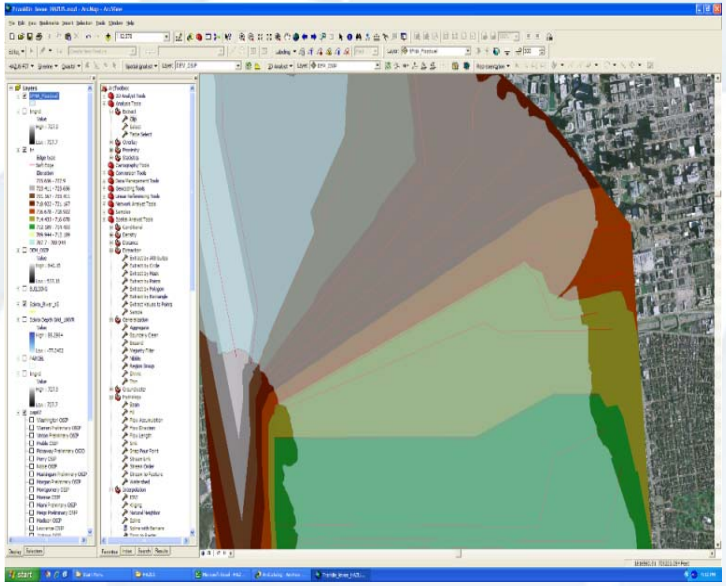


EXAMPLE: City of Columbus

Water Surface Elevations



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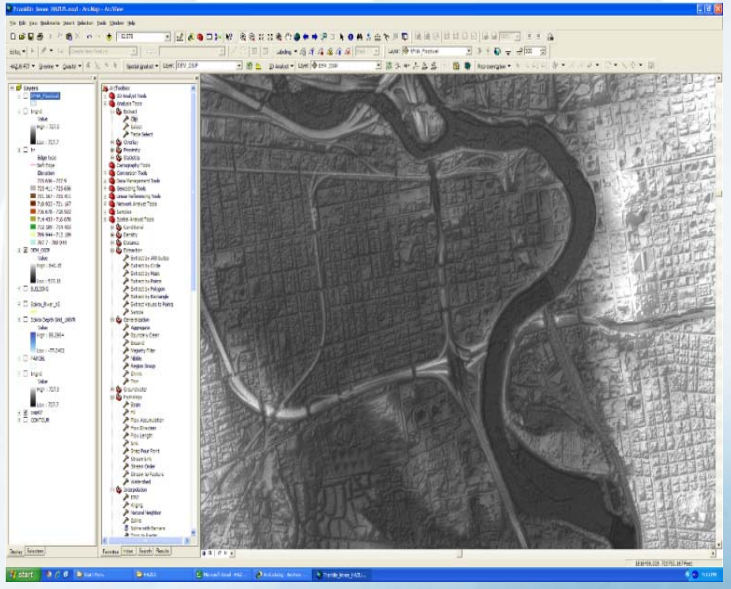
Ground Elevations



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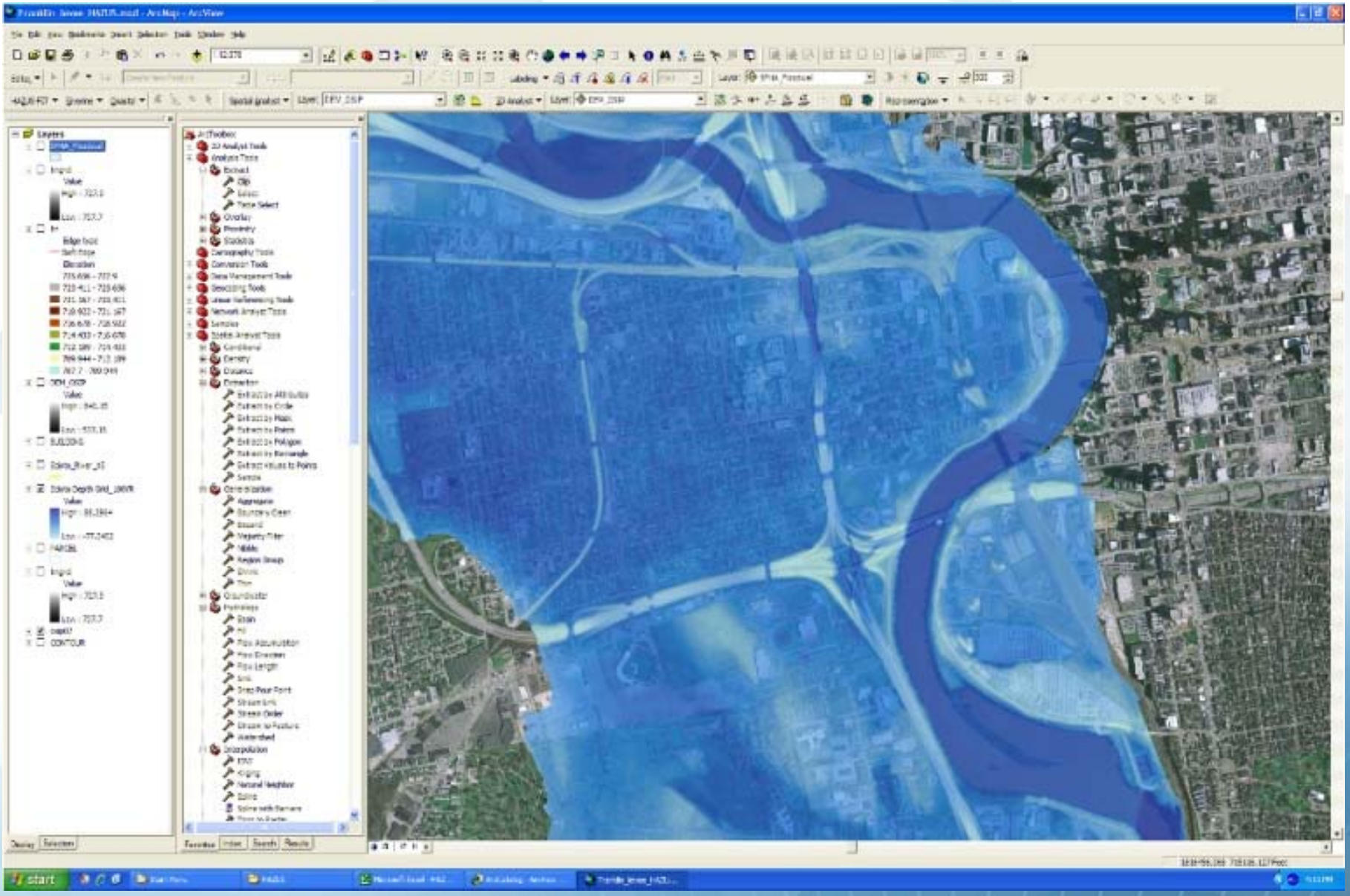
EXAMPLE: City of Columbus



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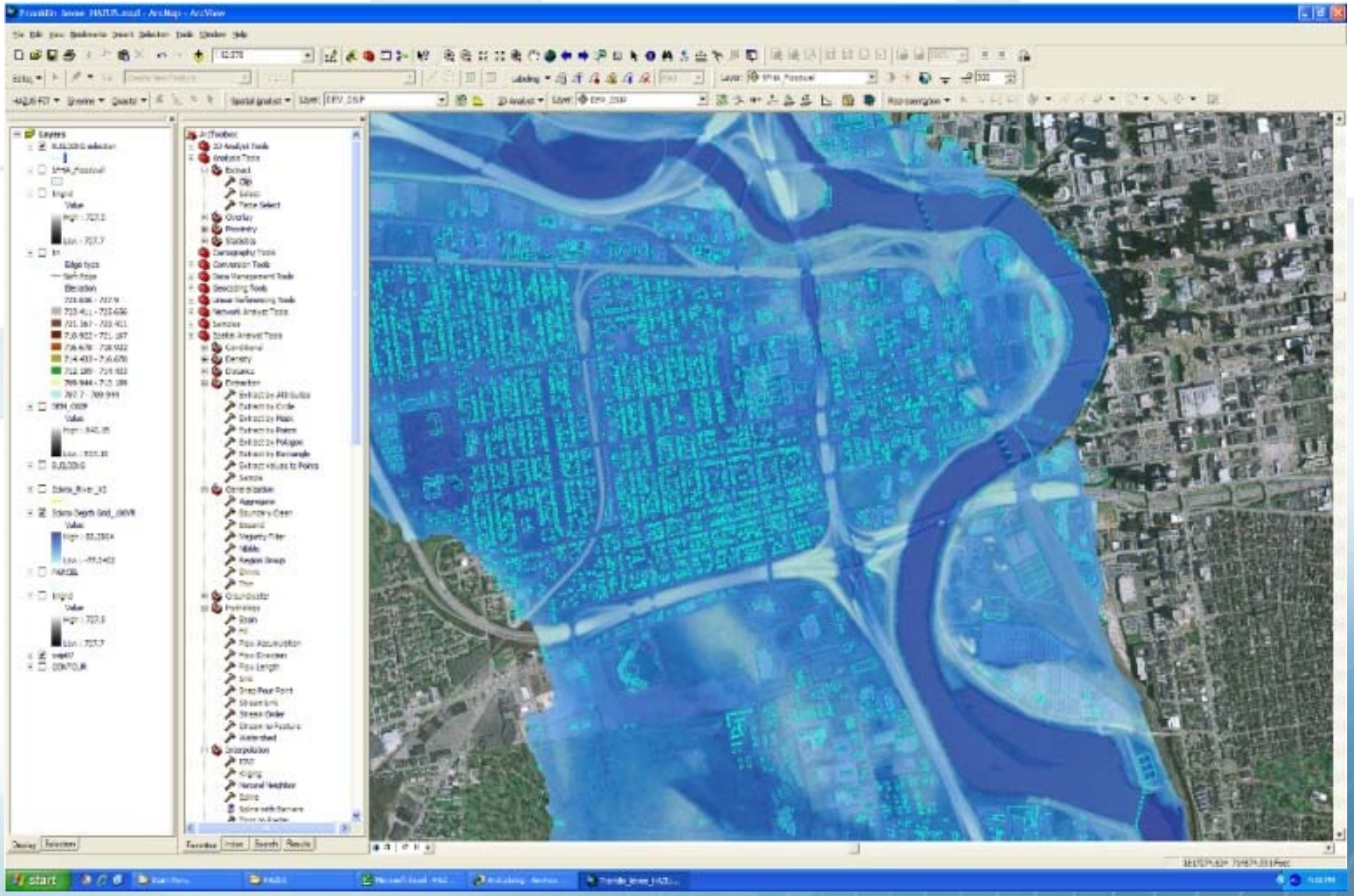

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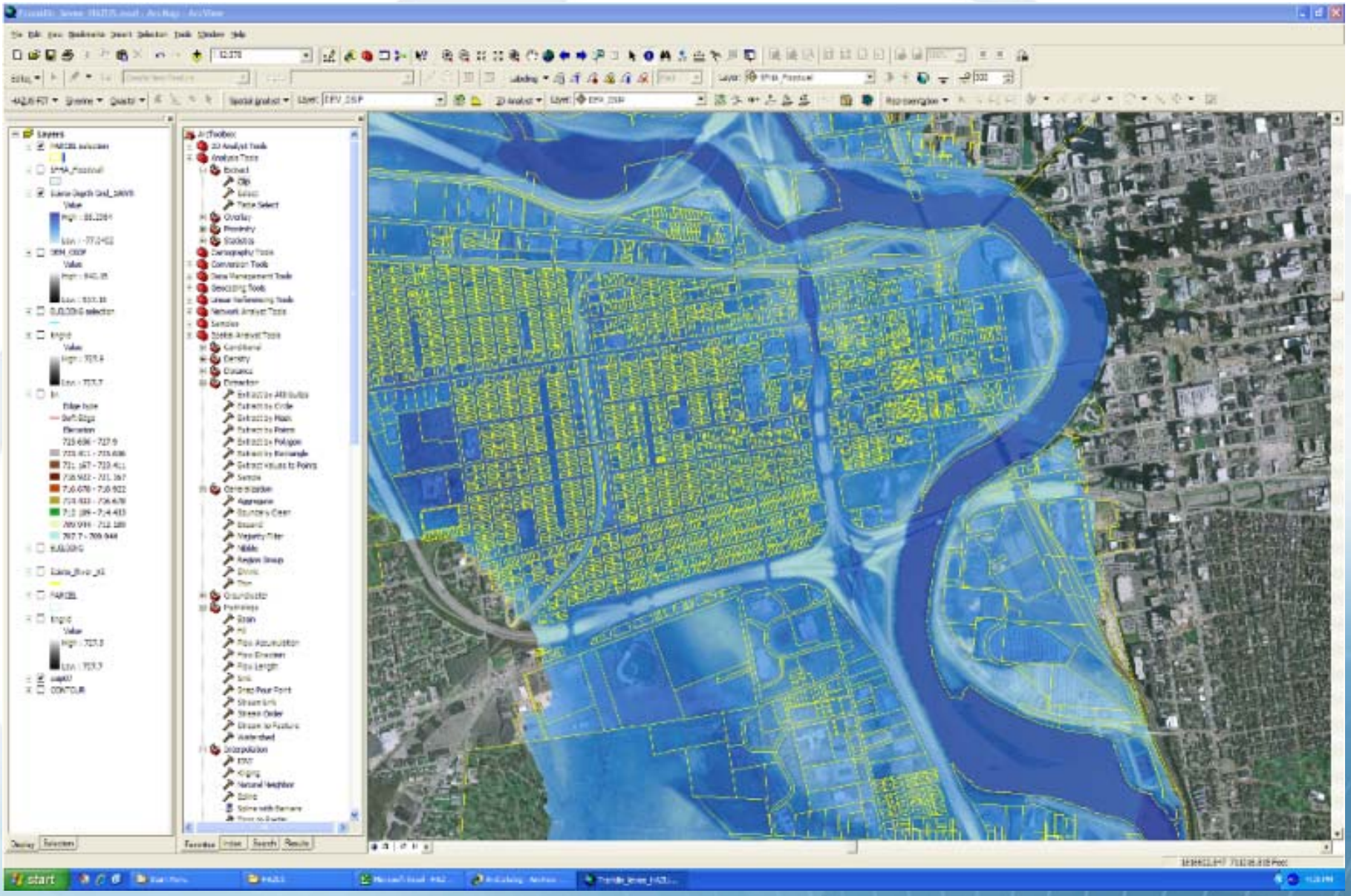

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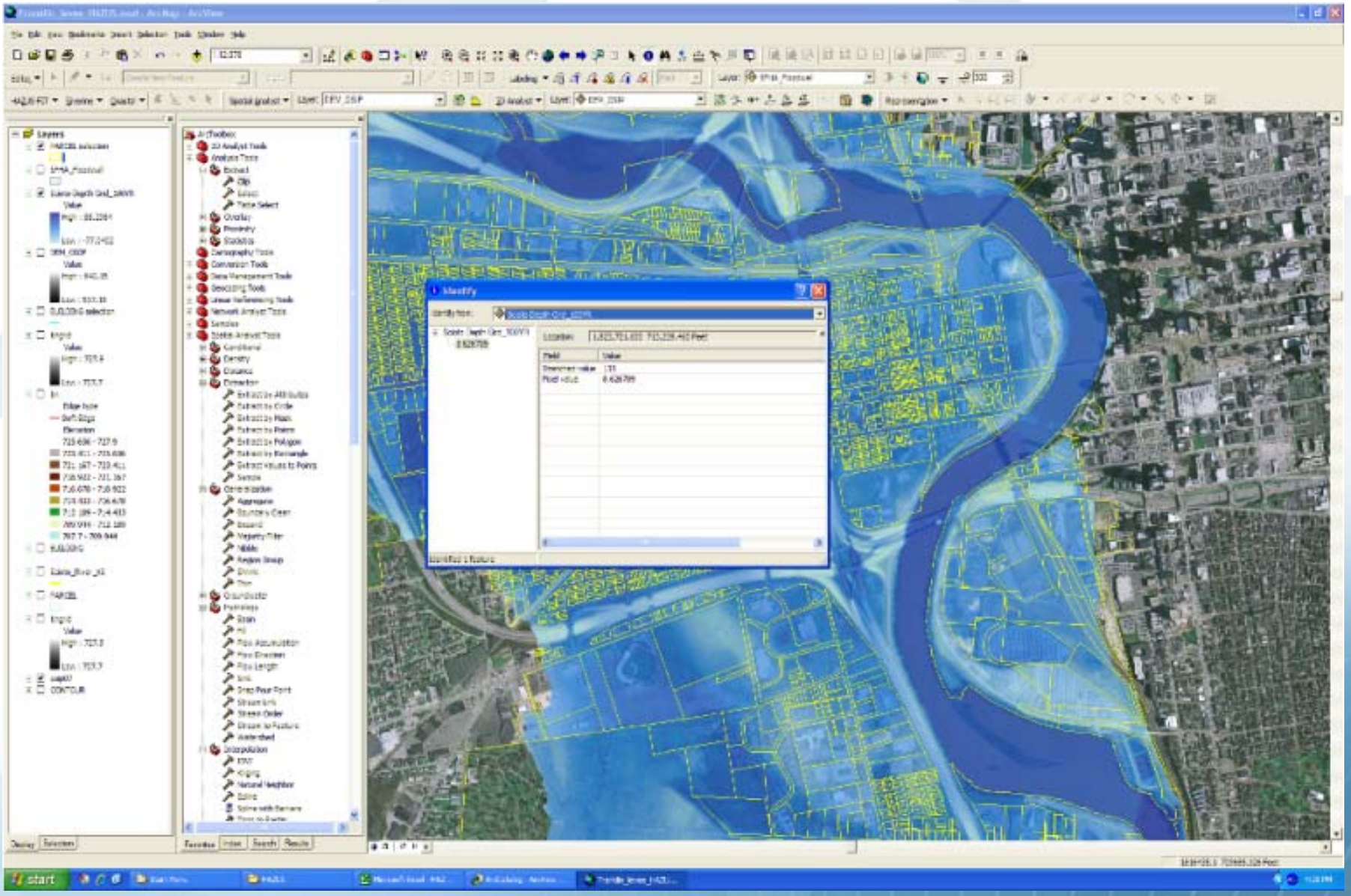

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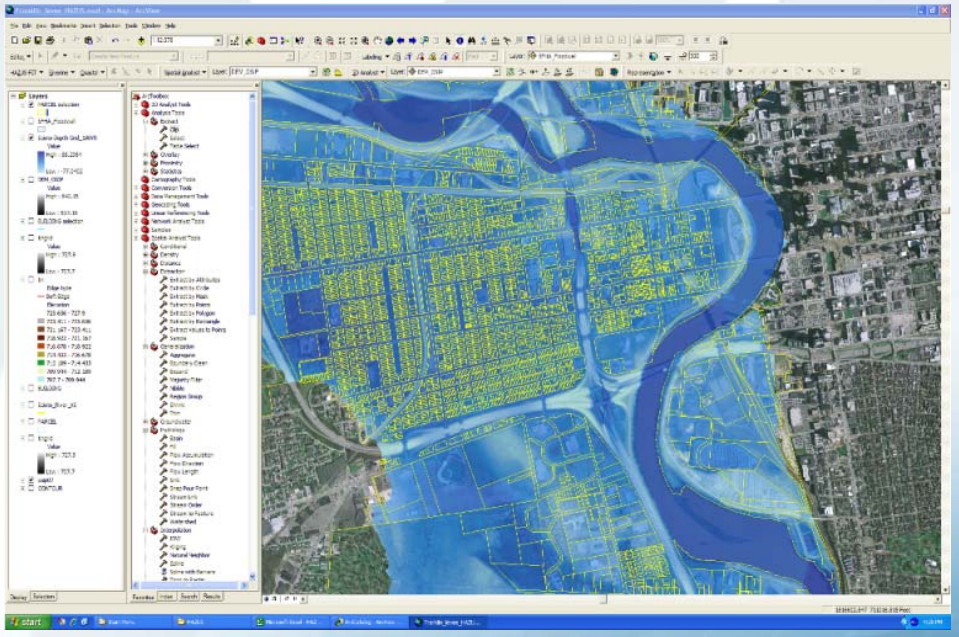
- Depth grid can be incorporated into HAZUS to see potential losses
- Can also incorporate local parcel data via the CDMS tool for more realistic/accurate results