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HAZUS-MH

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FEMA Region III

RiskMAP

Increasing Resilience Together



Presentation Summary

- HAZUS-MH Overview
- Applications of HAZUS-MH in Response, Recovery, Mitigation and Preparedness
- Applications of HAZUS-MH in FEMA Region III
- Get Connected to HAZUS



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HAZUS-MH Overview

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HAZUS-MH Technical Requirements

Software HAZUS-MH version 2.2

- Operates only with ArcView **10.2.2**, Service Pack 2 (SP2)
- **Spatial Analyst** required for Flood Model only
- Microsoft Windows XP SP3/Windows 7 or 8 Professional/Enterprise
- HAZUS-MH can be downloaded for free at the **FEMA Map Service Center**

Go to Product Catalog and HAZUS

Current modernization - 3 scheduled releases

1st release - Upgrade Hazus to be compatible with ArcGIS 10.2 and Windows 8 : January 2015

Next Release of HAZUS – Flood Model Enhancements:
Tentative Summer 2015



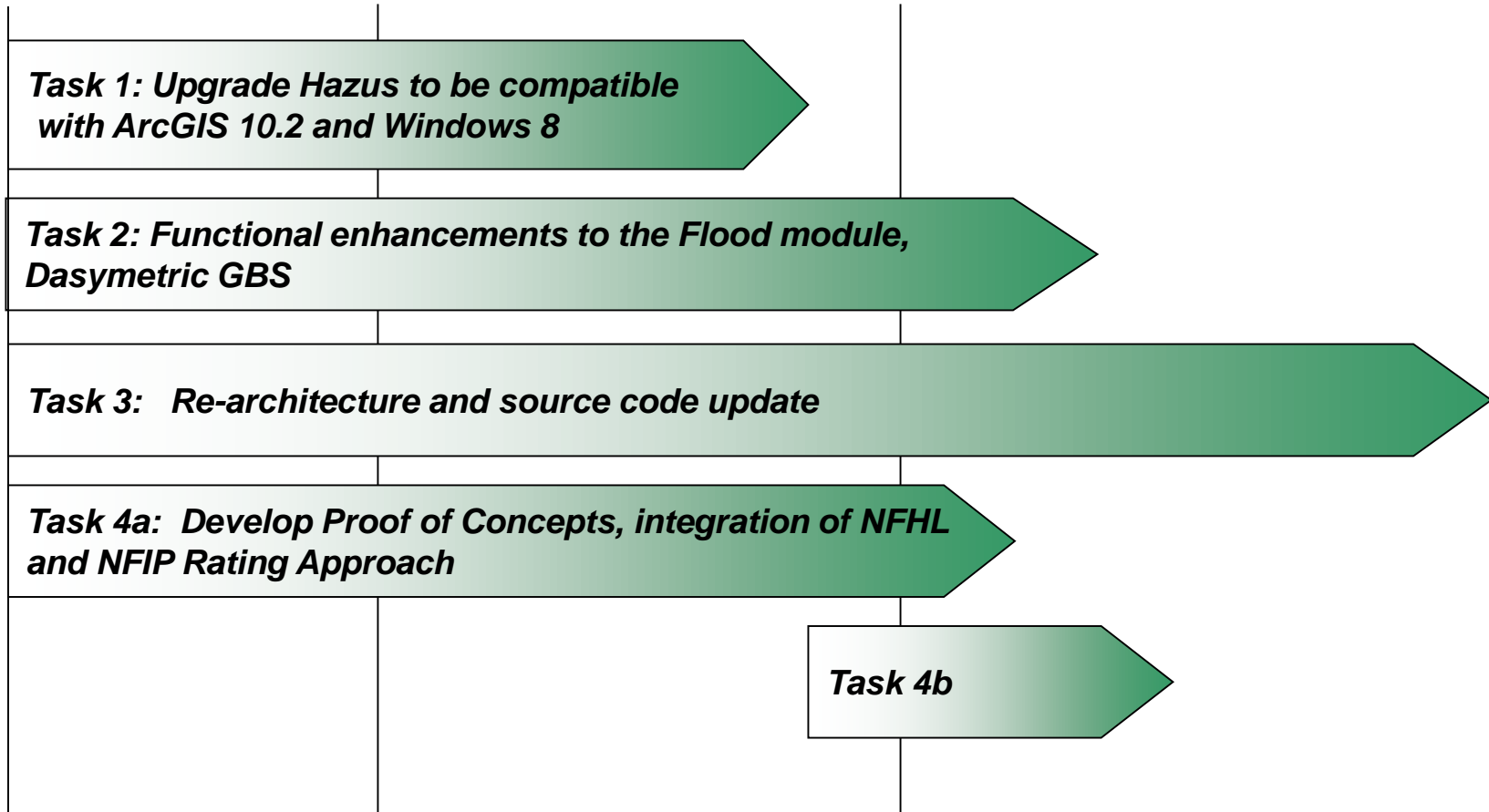
Project Timeline: Modernization

June 2014

August 2014

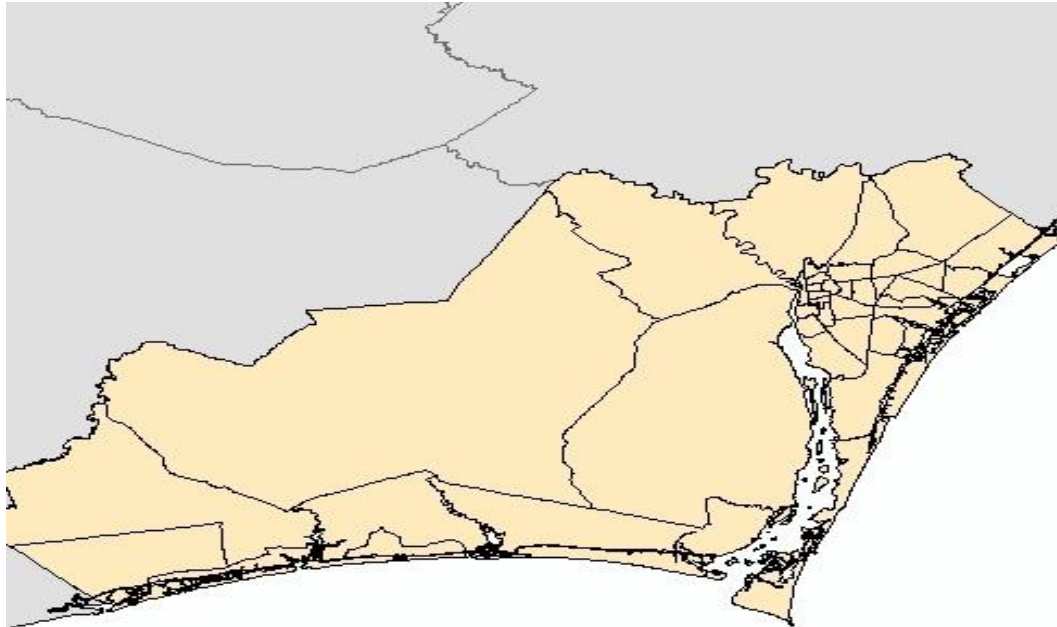
January 2015

August 2015

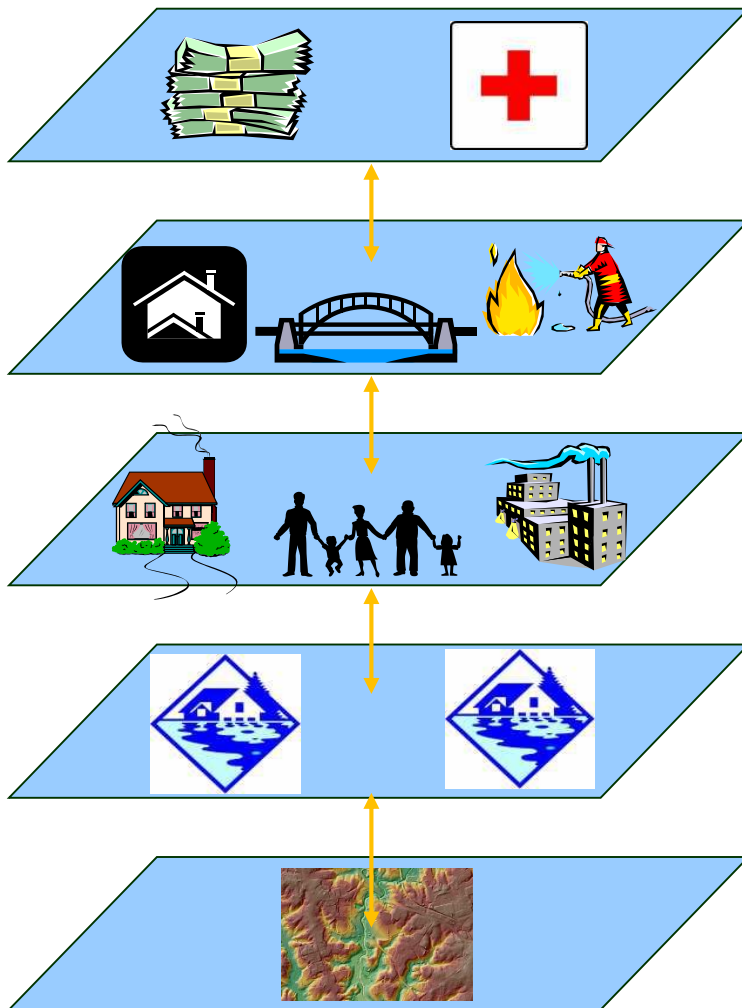


Study regions

- Population and inventory are defined for whole region
- Hazard may affect part of region, or whole region
- No damage assessment performed outside of study region

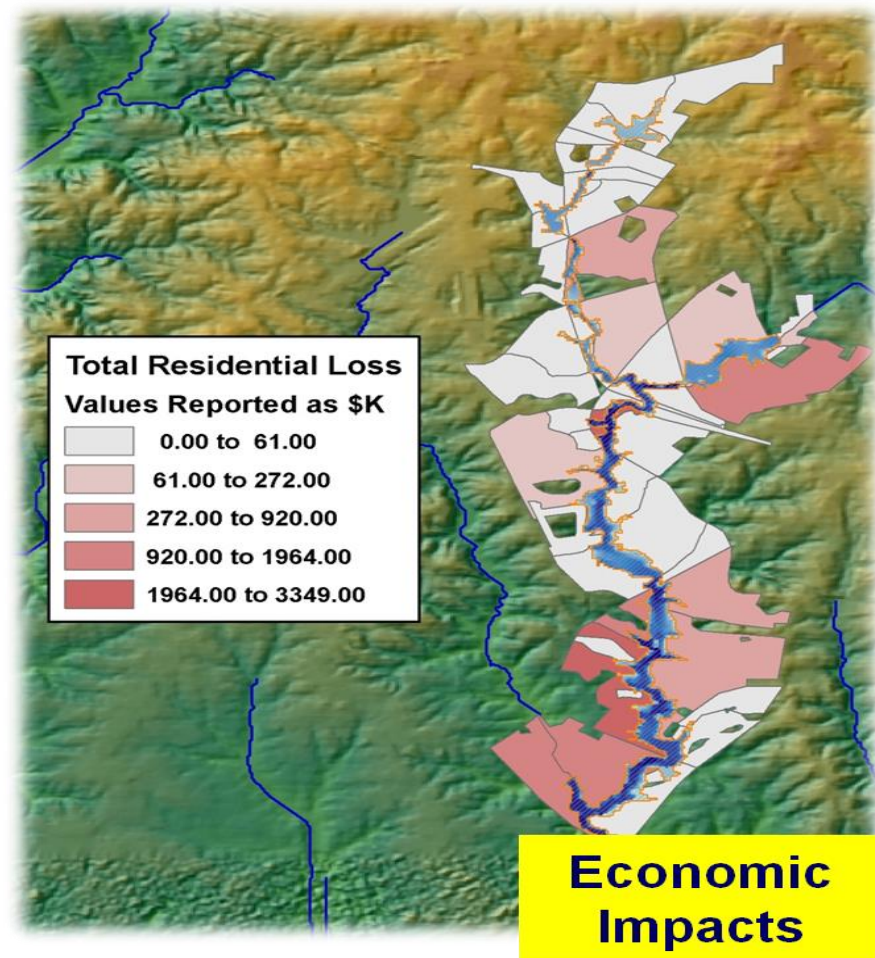


HAZUS-MH Methodology



1. **Define** the Geographic Area for Analysis
2. **Define** Hazard
Hurricane Wind, Flood, Earthquake
3. **Overlay** Inventory Data
4. **Loss Estimation** of Structural and Infrastructure Damage, and Functionality of critical facilities
5. **Estimate** Direct and Indirect Economic and Social Losses/Needs

Output

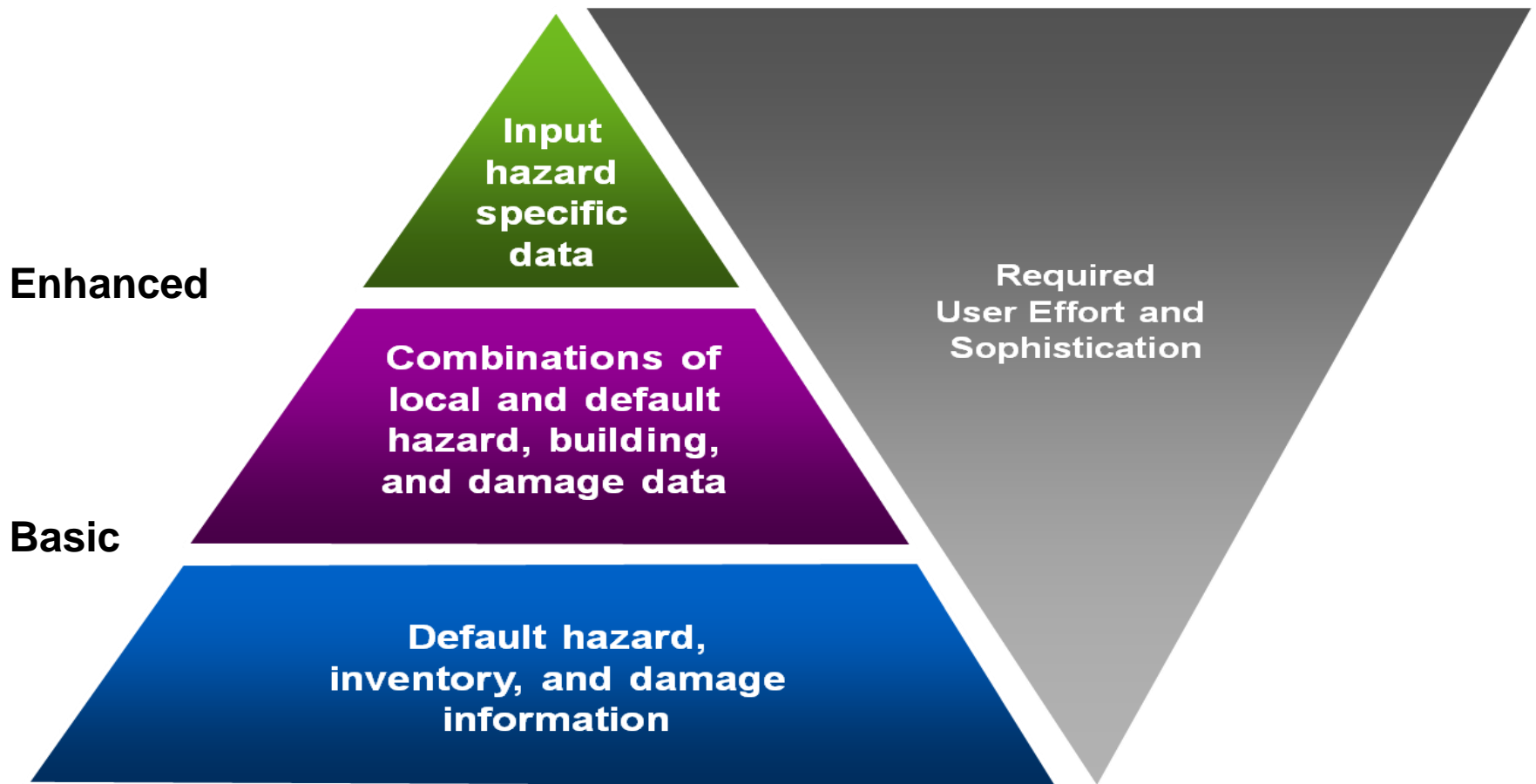


Loss Components

- **General Building Stock**
 - By Amount of Damage - occupancy, building type by count
 - By Dollar Losses - full and depreciated replacement for building, content and inventory
- **Essential facilities** – Number of facilities affected, and level of damage (Moderate, substantial, and loss of use)
- **Lifeline losses (for selected components)**
 - Damage and loss of functionality – Percent damaged & days out of use
- **Vehicle Losses** - Vehicles (Day and Night) (in \$1,000)
- **Agriculture Losses** – Dollar losses in \$1000
- **Shelter Requirements**
 - Households displaced and individuals seeking temporary shelter
- **Indirect Economic Losses**
 - Business Interruption (income, relocation, rental income and wages) – in \$Millions



User Level of Effort



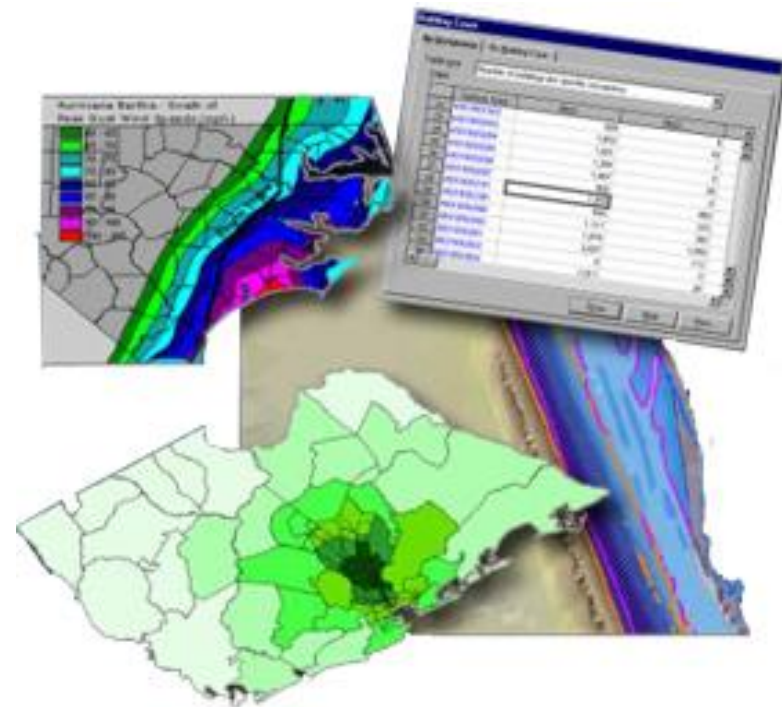
HAZUS-MH Base Data Inventory

Basic Analysis – No change to the base inventory

National Datasets (Collected in 2010)

- **Aggregated Data**
 - General Building Stock
 - Building Construction Type and Occupancy
 - Replacement Cost
 - Demographics

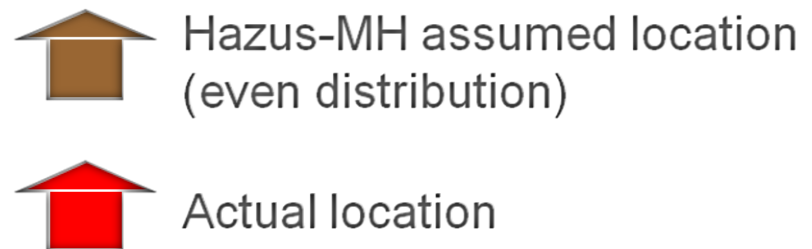
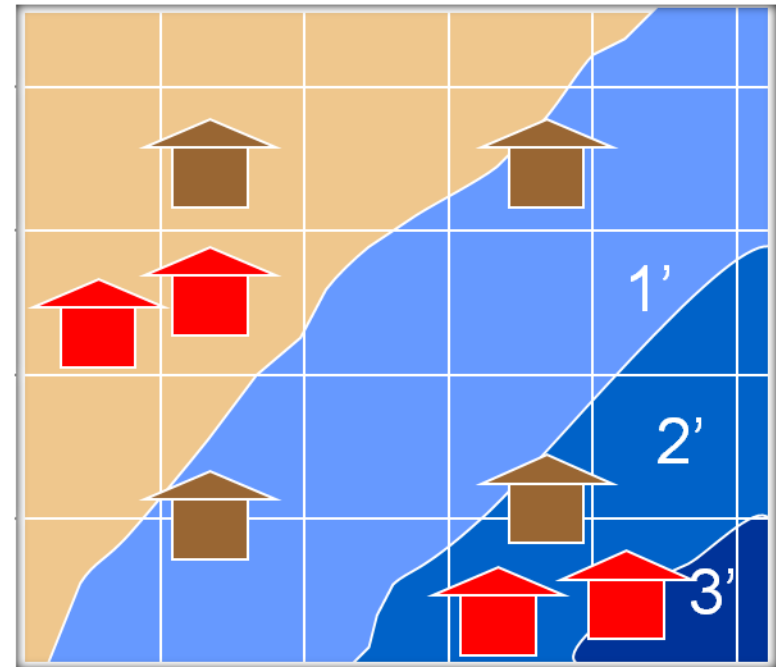
- **Site Specific Data**
 - Essential Facilities
 - Transit Infrastructure
 - Utilities



Inventory

GBS Loss Estimation Methodology

- Assumes that inventory is evenly distributed across each census block.
- Example: If 25% of the block has 2' of water, it is assumed that 25% of the 4 single-family dwellings in the block are in 2' of water.
- Losses are reported as totals for each occupancy and building type rather than for each building.



HAZUS-MH Local Data Integration

Enhanced Analysis – Integrate Local Data, modify damage functions

- HAZUS Inventory can be updated to reflect current conditions or illustrate proposed development and population growth
- More accurately reflect actual risk
- **Non Hazard Data Integration**
 - Comprehensive Data Management System (CDMS) enables integration of locally developed non-hazard data (Building stock, Demographics, Critical facility locations, High potential loss facilities, Transit Infrastructure, Utilities)
 - CDMS validates that user data are compliant with HAZUS requirements
- **Hazard Data Integration**
 - User-provided hazard maps (soils, elevation, user developed depthgrids, user defined facilities, etc.) can enhance the accuracy of loss estimations
- **User Defined Data**
 - HAZUS allows the user to input Arc GIS point shapefiles with necessary attributes to analyze potential losses for specific structures or facilities

What Impacts the HAZUS-MH Accuracy?

How well is what is at risk defined? (Inventory)



How accurate is the loss estimation methodology?



How well is the hazard defined?



The Reality of Data

- **In a perfect world, the data you need would already be collected and available, but the reality is far more complex.**
 - Some data owners charge a fee (less likely during disaster support)
 - An MOU may be required
 - Data stewards change from state to state and local jurisdiction to local jurisdiction (e.g. Assessor's Office vs. Auditor's Office)
 - The data may be incomplete or out of date
 - The data may not be geospatial, geocoded...or even digital!
 - The data you need may not exist
 - Each County/Municipality may collect the data in multiple formats.

- **Implementing inventory best practices can help address some of these issues**
 - **Tools and Workflows** created for transforming local assessor/parcel data to a Hazus compliant format



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Applications of HAZUS-MH

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Application of HAZUS-MH Emergency Preparedness

- **Develop emergency response plans**
 - Temporary housing
 - Debris removal
 - Emergency power and water
 - Emergency medical services
 - Evacuation/emergency route clearance
- **Organize response exercises**



Application of HAZUS-MH Emergency Response + 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



Disaster Operations

- **The utility of Hazus-MH for support disaster operations is largely due to the quality of the input data.**
- **Beware of using out-of-the box inventory and Hazus-MH generated hazard maps for disaster operations!**



Application of HAZUS-MH Mitigation Planning and Risk Reduction

- **Mitigation Assessment**
 - Identify 'at-risk' communities
- **Mitigation Measures**
 - Strengthen existing structures
 - Strengthen window/door openings and siding
- **Mitigation Programs**
 - Adopt and enforce hazard-resistant building codes
 - Land use planning





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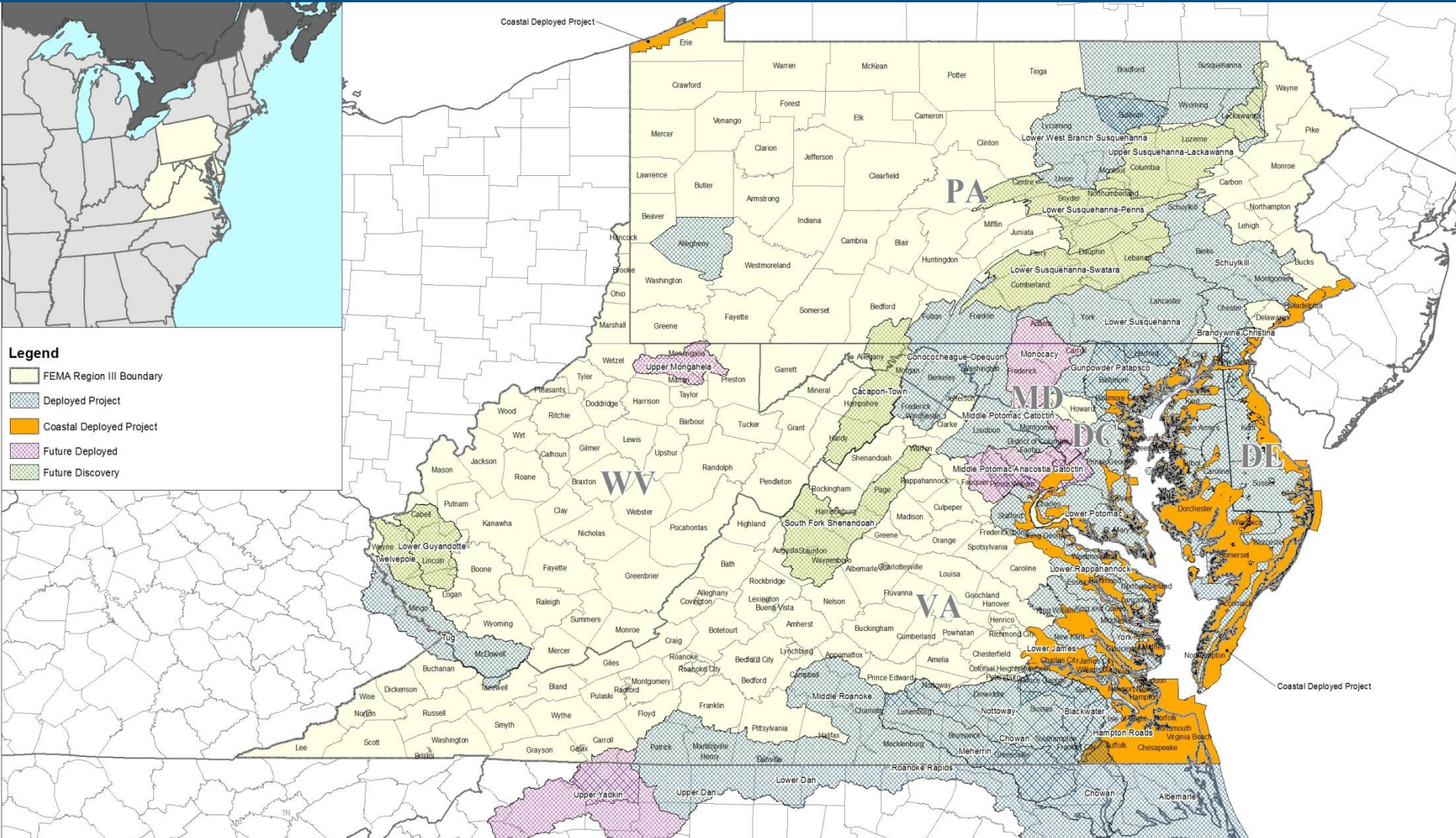
Applications of HAZUS-MH in FEMA Region III

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FEMA Risk MAP Deployment



Accessing HAZUS Products

- **Risk MAP HAZUS publically available assessments**
 - <http://www.pasda.psu.edu/uci/SearchResults.aspx?Keyword=hazus&Go=Go&searchType=keyword&condition=AND&sessionID=1772854402014520224251>
- **Risk MAP publically available depthgrids – HAZUS Input**
 - <http://www.pasda.psu.edu/uci/SearchResults.aspx?Keyword=fema&Go=Go&searchType=keyword&condition=AND&sessionID=1663035842014520224215>
- **Risk MAP Flood Information Portal**
 - <http://riskmap3.com/maps>
- **FEMA's AAL Viewer – Aims to depict national view of HAZUS projects**
 - Risk MAP, State and County Hazard Mitigation Plans, Other
 - <http://bit.ly/1knh5P3>
- **USGS Flood Inundation Mapper**
 - Series of sequential maps that help communicate where flooding may occur over a range of river levels.
 - Connected to real-time and forecasted river levels at USGS streamgages
 - <http://wim.usgs.gov/FIMI/>



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Measuring Historic and Probable Flood Losses

City of Baltimore, MARYLAND

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Project Rationale

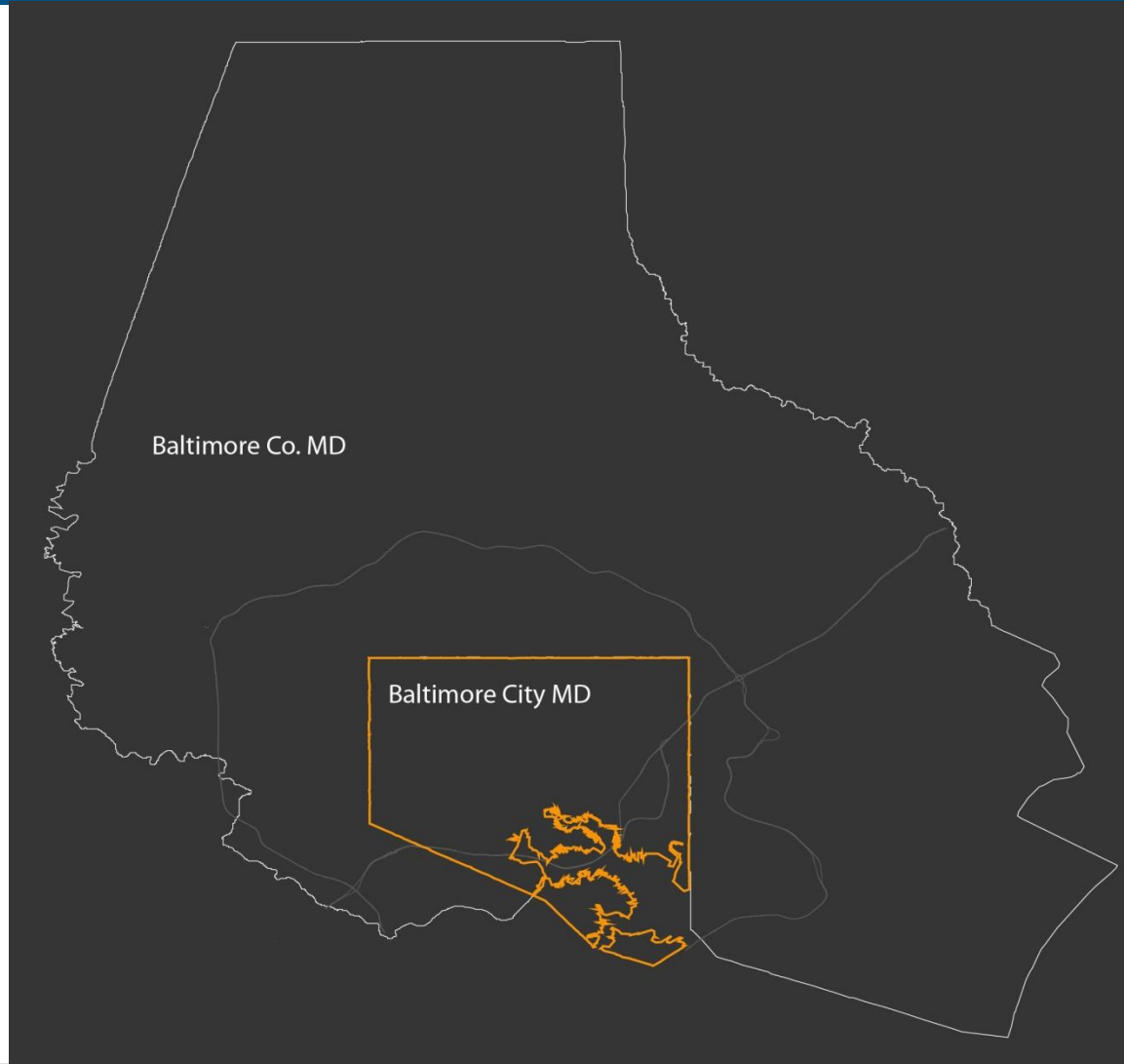
- **Updated Engineering Model – Coastal Flooding**
 - Reduced BFEs up to 4 ft. – Attributed to Storm surge study results
 - Preliminary Flood Insurance Rate Maps (FIRM) indicate change in flood zones
 - Decrease the number of households required to pay flood insurance
- **Improved Coastal Analysis is not reflective of historic flood risk**
 - False sense of safety
 - Advanced HAZUS Analysis will validate implementation of higher standards in the .2% chance flood zone



Refined Risk Assessment

Advanced HAZUS Analysis

- City of Baltimore - Coastal
- Hurricane Wind + Coastal Flood
- Completely updated Building + Demographic inventory
- Enhanced Depth grids
 - Illustrating new FIRM
 - Simulating SLR,
 - Illustrating historic storms
 - Simulating Forecasted storm extents
- Analyzed mitigation techniques



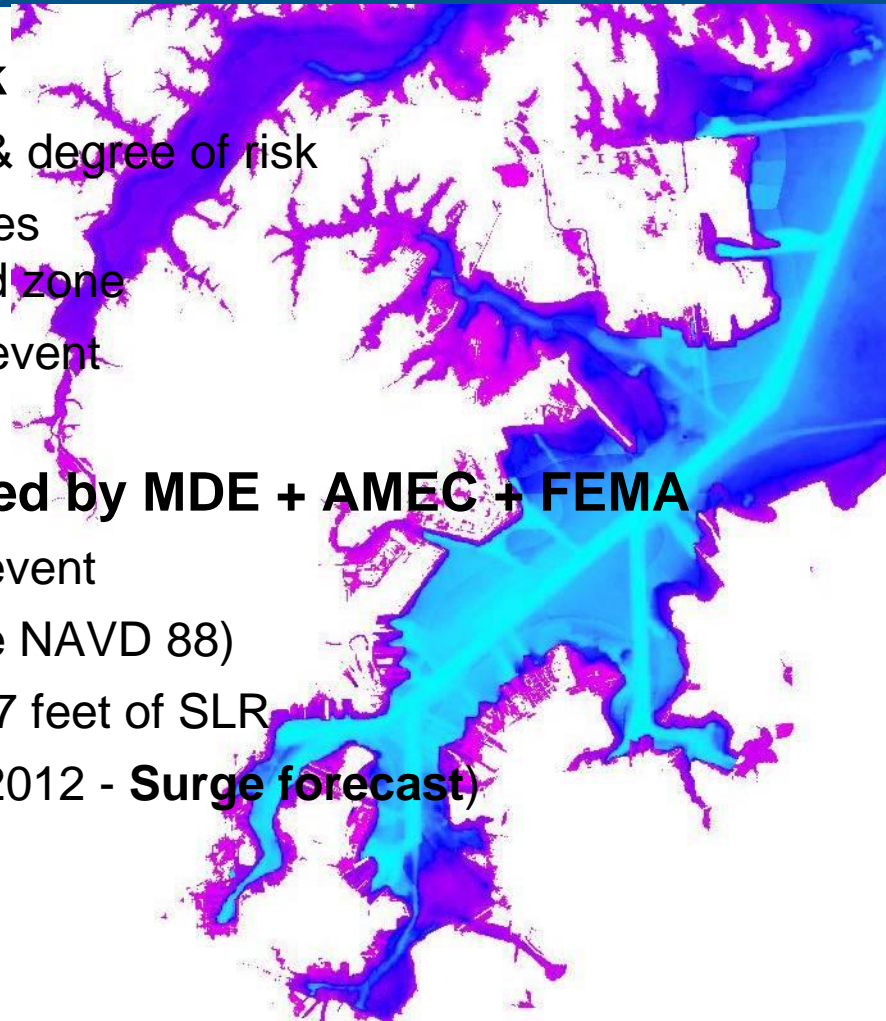
Data Inputs

- **Locally provided data**
 - Land-use, building counts, total built area, Replacement value, Age of structures
 - Essential Facilities ,Transit infrastructure, Utilities
 - 2010 Demographics, Population, Number of housing units, Age + race distribution
- **HAZUS Update - 2010 Census Data**
 - Age, Occupancy status, Average rent, Average home value (at Census Tract)
- **Enhanced Depth grids**



Data Inputs - Enhanced Depthgrids

- **Depth grids indicate degree of risk**
 - Each cell illustrates a depth of water & degree of risk
 - Can be utilized to calculate flood losses for structures which intersect the flood zone generated by that particular flooding event
- **Enhanced Depth grids – Developed by MDE + AMEC + FEMA**
 - Preliminary 1% annual chance flood event
 - Hurricane Isabel (7.5 feet storm surge NAVD 88)
 - Hurricane Isabel + 3 feet, 5 feet, and 7 feet of SLR
 - Tropical Storm Sandy (November 1, 2012 - **Surge forecast**)



Applications for Resilience & Mitigation – All-Hazard Mitigation Plan

- **Transportation**

- Integrate Climate change into transportation design, building and maintenance
- Alter transportation systems in flood-prone areas in order to effectively manage storm water

- **Waterfront**

- Enhance the resiliency of the City's waterfront to better adapt to impacts from hazard events and sea-level rise

- **Policy & Government Decision Making**

- Encourage the integration of climate change and natural hazards into private and State planning systems
- Develop City policy which requires new City government capital improvement projects to incorporate hazard mitigation principles

- **Buildings**

- Enhance building codes that regulate development within a floodplain or near a waterfront
- Update list of flood prone and repetitive loss buildings to consider for acquisition




Applications for Resilience & Mitigation – Continuity of Operations Planning

- **HAZUS analyses will define the potential impact from sea-level rise and inform:**
 - Public Outreach + Build Public Support
 - Communicate impacts of the preliminary Flood Insurance Rate Map (FIRM) and the economic impact to the business community
 - Apply for Community Rating System (CRS) Credit
 - 330 Outreach Projects – 350 Points
 - 410 Floodplain Mapping – 752 Points
 - 510 Floodplain Management Planning – 622 Points
 - Improve emergency planning with first responders
 - **Regulate to .2% Flood extent – Hurricane Isabel**
 - **More Restrictive Floodplain Regulations**
 - Update local floodplain ordinance beyond the NFIP requirements to capture potential impacts from sea-level rise
 - Put restrictions on Land Development Incentives in at risk areas - .2% flood extent

Minimum National Flood Insurance Program Regulatory Requirements

The National Flood Insurance Program (NFIP) is administered by the Federal Emergency Management Agency (FEMA). As a condition of making flood insurance available for their residents, communities that participate in the NFIP agree to regulate new construction in the area subject to inundation by the 100-year (base) flood. The floodplain subject to these requirements is shown as an A or V Zone on the Flood Insurance Rate Map (FIRM).

There are five major floodplain regulatory requirements. Additional floodplain regulatory requirements may be set by state and local law.

1. All development in the 100-year floodplain must have a permit from the community. The NFIP regulations define "development" as any manmade change to improved or unimproved real estate, including but not limited to buildings or other structures, mining, dredging, filling, grading, paving, excavation or drilling operations or storage of equipment or materials.
2. Development along a river or other channel cannot obstruct flows so as to cause an increase in flooding on other properties. An analysis must be conducted to demonstrate that the cumulative effect of the proposed development, when combined with all other existing and anticipated development, will not increase the water surface elevation of the base flood more than one foot at any point within the community.
3. New buildings may be built in the floodplain, but they must be protected from damage by the base flood. In riverine floodplains, the lowest floor of residential buildings must be elevated to or above the base flood elevation (BFE). Nonresidential buildings must be either elevated or floodproofed.
4. Development in the coastal high hazard area (shown as a V Zone on the FIRM) cannot obstruct the flow of waves, so the lower areas of an elevated building must remain open, as illustrated in the middle example to the right.
5. Under the NFIP, a "substantially improved" building is treated as a new building. The NFIP regulations define "substantial improvement" as any reconstruction, rehabilitation, addition, or other improvement of a structure, the cost of which equals or exceeds 50 percent of the market value of the structure before the start of construction of the improvement. This requirement also applies to buildings that are substantially damaged.

Communities are encouraged to adopt local ordinances that are more comprehensive or provide more protection than the Federal criteria. The NFIP's Community Rating System provides insurance premium credits to recognize the additional flood protection benefit of higher regulatory standards.



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Hazus-MH Training

- **The Emergency Management Institute (EMI) has the following HAZUS training course available:**
 - E0190 – ArcGIS for Emergency Managers
 - E0313 – Basic Hazus-MH
 - E0170 – Hazus-MH for Hurricanes
 - E0172 – Hazus-MH for Floods
 - E0174 – Hazus-MH for Earthquakes
 - E0317 – Comprehensive Data Management for Hazus-MH
 - E0176 – Hazus-MH for Floodplain Management
 - E0296 – Using Hazus-MH for Risk Management

To apply for a HAZUS training course, please visit: <http://training.fema.gov/Apply/>

To enroll, download the Admission Application or contact: Philip Moore at (301) 447-1248

For further information on registration, please visit www.training.fema.gov/emiweb

HAZUS User Groups

▪ User Group calls

- Monthly National Hazus User Groups calls as well as regional User Group calls.
- Visit <http://www.fema.gov/hazus-user-groups> or join the GovDelivery mailing list for more information.

▪ LinkedIn – Hazus Group

- The Hazus Group on LinkedIn is a great way to receive Hazus information, participate in discussions, and ask Hazus-related questions.
- To find out more about the Hazus group, go to <http://www.linkedin.com/groups/HAZUS-822417>

▪ National Capitol Region Hazus User Group Call

- Last Thursday of every month at 10AM EST
- Visit <http://www.usehazus.com/ncrhug/> and <https://www.linkedin.com/groups?home=&gid=4790251>



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