



# Risk MAP Exploratory Innovation Projects

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**RiskMAP**  
Increasing Resilience Together



# Project Themes and Focus



Explore



Build



Finish

# What are these Innovation Projects?

- A project (data analysis, research, pilot, etc.) whose objective is to explore efficiency, quality, or other program enhancements that could be initiated to help achieve Risk MAP goals, and to evaluate the feasibility in implementing them at a larger, program-wide scale

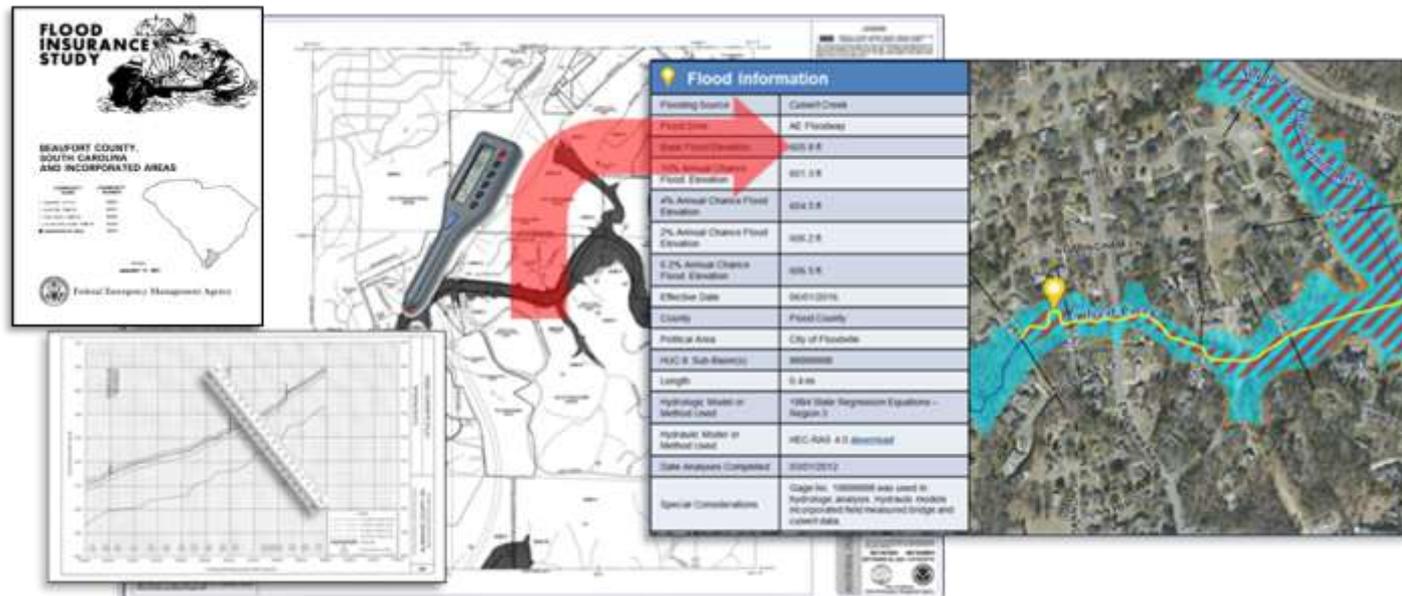
# Innovation Projects

- Database-Derived Digital Display Environment: Geodatabase Gap Analysis
- Regulatory-Quality WSEL Grids (“Point & Click BFEs”): Feasibility
- Structure-Level Risk: Data and Methodology Investigations
- 2D Modeling: Zone AE Model Upgrade and Floodway Best Practices
- Flood Hazard Modeling Parameters: Impact on BFEs and Top Width
- Mitigation Decision Support System (MDSS) Scenario Templates

# Database-Derived Digital Display: Geodatabase Gap Analysis

## ■ Innovation Purpose

- Identify gaps in the current FIRM Database that prevent the implementation of a database-driven solution for the communication of flood hazard and flood risk data on a seamless nationwide scale.
- Make implementation recommendations on actions and topics, in order to implement a database-driven solution.



# Database-Derived Digital Display: Geodatabase Gap Analysis

## ■ Key Findings

- FIRM Database lacks multiple structural and data elements needed to be able to drive the creation of regulatory products as currently formatted – especially the FIS Report
- “Back-population” of this information (or the effort to fully populate all necessary tables within the database schema for all of FEMA’s inventory) would be a large and lengthy effort
- Nationwide seamless implementation requires additional gaps to be addressed (e.g. FIRM panel scheme, water naming convention, engineering model storage/referencing, etc.)
- Database does not currently support the ability to retrieve BFE and other flood elevations in an on-demand fashion (other than at select locations)
- If engineering models and geospatial data were able to be retrieved in a more automated fashion through the digital display environment, many of the current tables in the FIS Report would likely become unnecessary (thus reducing back-population efforts)

# Database-Derived Digital Display: Geodatabase Gap Analysis

## ■ Potential Next Steps

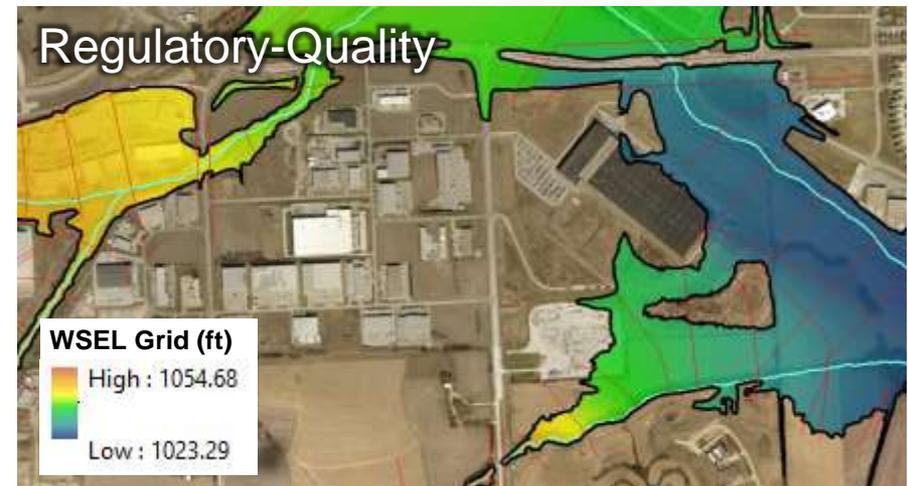
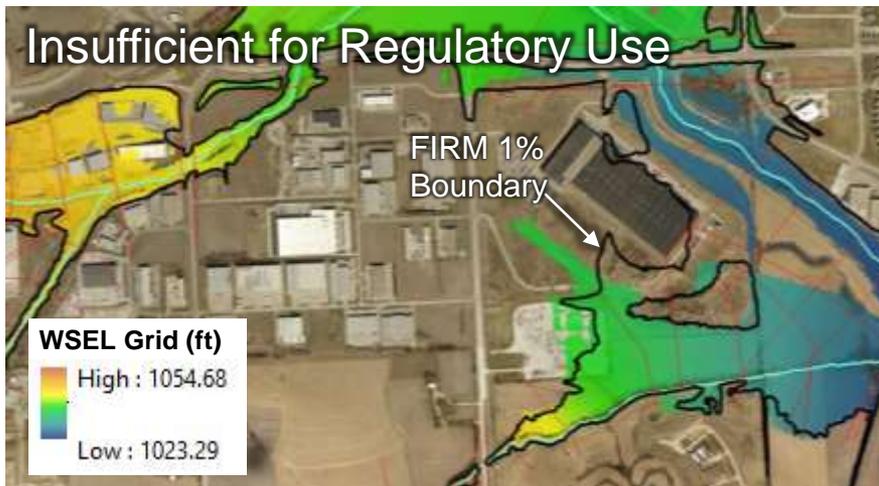
- Modernize and simplify the FIS Report – identify which aspects of the FIS Report are critical within a database-derived digital display environment
- Identify database design changes, including those needed to support automated retrieval of engineering model information
- Prioritize data collection and storage efforts for multi-frequency WSEL grids over back-population efforts
- Database-derived pilot and prototype
- Develop full implementation plan, taking care to identify a delivery strategy for communities requiring paper



# Regulatory-Quality WSEL Grids (“Point & Click BFEs”): Feasibility

## ■ Innovation Purpose

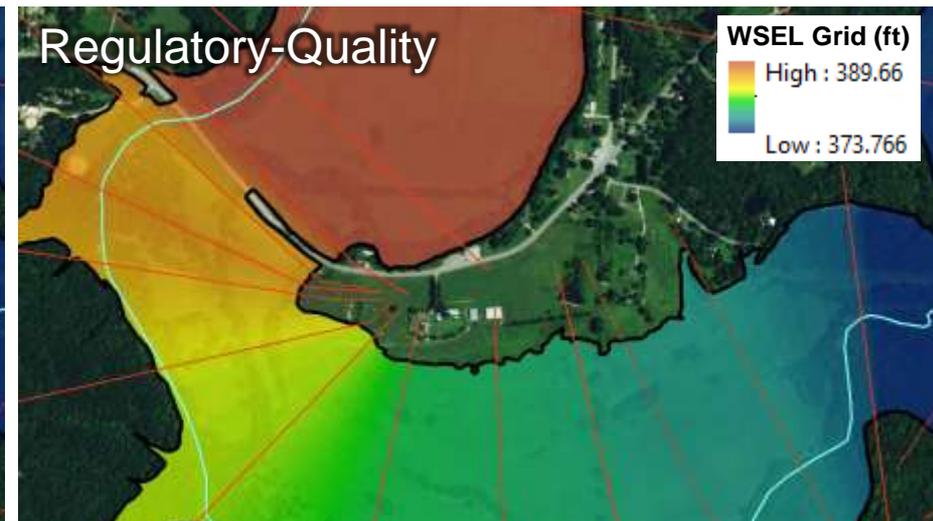
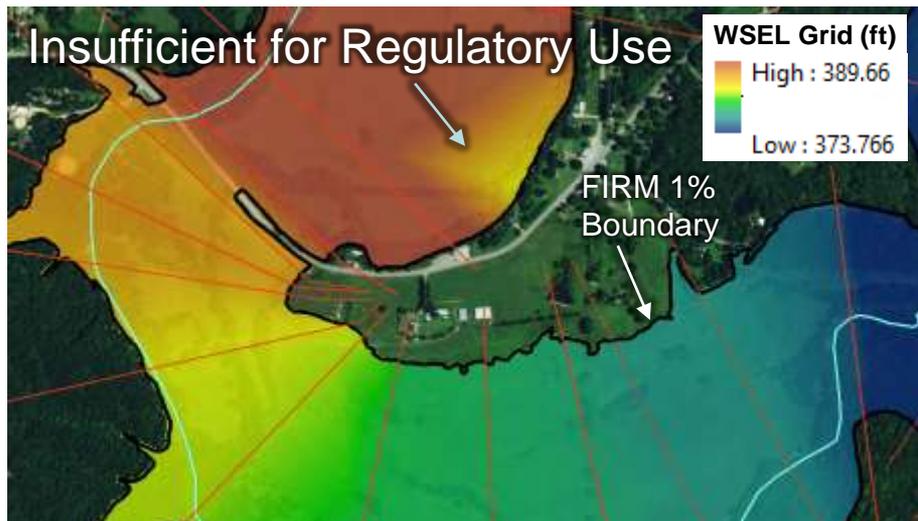
- As one of the critical underlying data elements needed to support a digital display environment and structure-based risk assessments, investigate the feasibility of developing regulatory-quality Water Surface Elevation (WSEL) grids
- Develop a QC methodology to ensure grids represent regulatory products (elevation and extent), and could eventually be used as a replacement for the flood profile in the FIS Report



# Regulatory-Quality WSEL Grids (“Point & Click BFEs”): Feasibility

## ■ Key Findings

- Risk MAP must move towards the creation and storage of regulatory-quality WSEL grid data to achieve its longer-term vision and objectives (especially digital display and structure-based risk)
- To be used for regulatory purposes, WSEL grids require a higher level of accuracy/quality than is being consistently delivered currently within the program
- WSEL grid creation will help improve floodplain mapping accuracy



# Regulatory-Quality WSEL Grids (“Point & Click BFEs”): Feasibility

## ■ Fall 2017 G&S Cycle

- Standards and guidance will be updated to increase the level of quality of the WSEL grids produced within the program

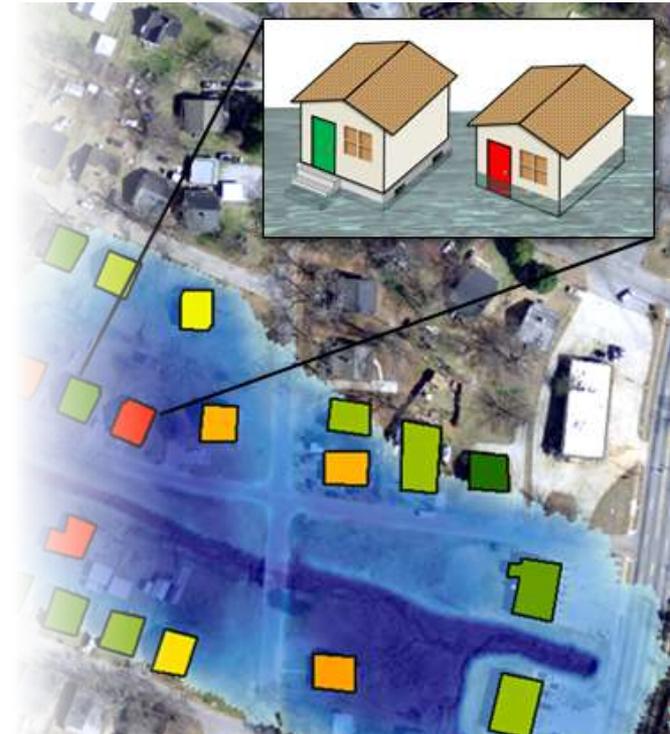
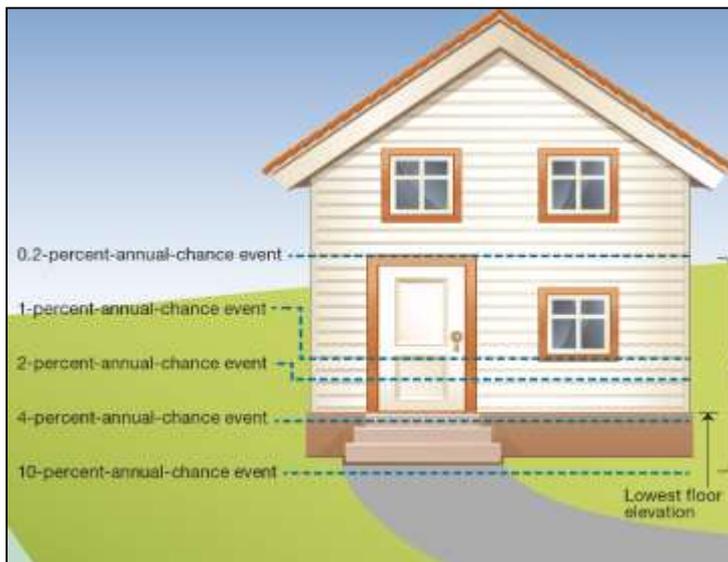
## ■ Potential Next Steps

- Prioritize and invest in WSEL grid creation for effective studies
- Implement QC processes and assurance on current WSEL grid inventory
- Develop automated QC tools that check the regulatory quality of WSEL grids
- Work with CNMS team to define critical/secondary criteria when WSEL grid production reveals problems in regulatory data
- Continue coordination with CDS to manage and track inventory of WSEL grids
- Pilot a larger-scale digital display project that validates the feasibility and benefits of delivering regulatory-quality WSEL data in a digital display environment

# Structure-Level Risk: Data & Methodology Investigations

## ■ Innovation Purpose

- Investigate various flood risk assessment and data processing methodologies to help FEMA in its overall evaluation of transitioning to a structure-based risk approach

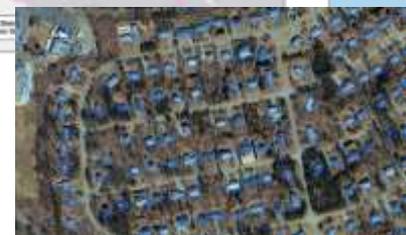


# Structure-Level Risk: Data & Methodology Investigations

## ■ Focus of Efforts

- Flood Risk Assessment Methodologies
  - Comparison of existing methodologies (Hazus, BCA, USACE, USBR, etc.)
  - Consideration of other factors into the calculation of risk (velocity, subassembly-level structure data, etc.)
- Structure-Level Data Investigations
  - Improving distribution of risk within census data
  - Assessing accuracy and potential of using automated building footprint extraction methods
  - Assessing accuracy and potential of estimating first floor and LAG elevations using building footprint and terrain data

Evaluation Factor	Generalized Findings
Data and Processing Needs	<ul style="list-style-type: none"> <li>• All methods resulting in a structure-based output required a high level of data collection and processing</li> <li>• Frequently required inputs (e.g., First floor elevation, elevation certificates, building replacement value) are not centralized</li> </ul>
Geographic	<ul style="list-style-type: none"> <li>• Most, though most had potential to scale (with modification)</li> </ul>
Methodology	<ul style="list-style-type: none"> <li>• Methods used by sector and type (e.g. GIS, engineering)</li> <li>• Methods (out of 40) identified (e.g., social, economic, environmental)</li> <li>• Hazard Creation (Hazus)</li> <li>• Risk Rating (MBE)</li> <li>• Method of results (MBE)</li> </ul>
Model	<ul style="list-style-type: none"> <li>• (NY HMP) Element Social Vulnerability Index (GAHMP)</li> <li>• (NC FIRM)</li> </ul>



# Structure-Level Risk: Data & Methodology Investigations

## ■ Potential Next Steps

- Perform additional analyses to confirm or expand upon initial findings
- Form a Subject Matter Expert panel or Work Group to review and make recommendations on how to model structure-level risk
- Define national structure-level risk and data storage needs
- Utilizing actual damage and hazard data from historic flood events, perform additional analyses to identify or confirm the correlation between various flood hazard parameters (depths, velocities, duration, etc.) and structure data (building type, age, occupancy, etc.)
- Update relevant guidance

# 2D Modeling: Zone AE Upgrade and Floodway Best Practices

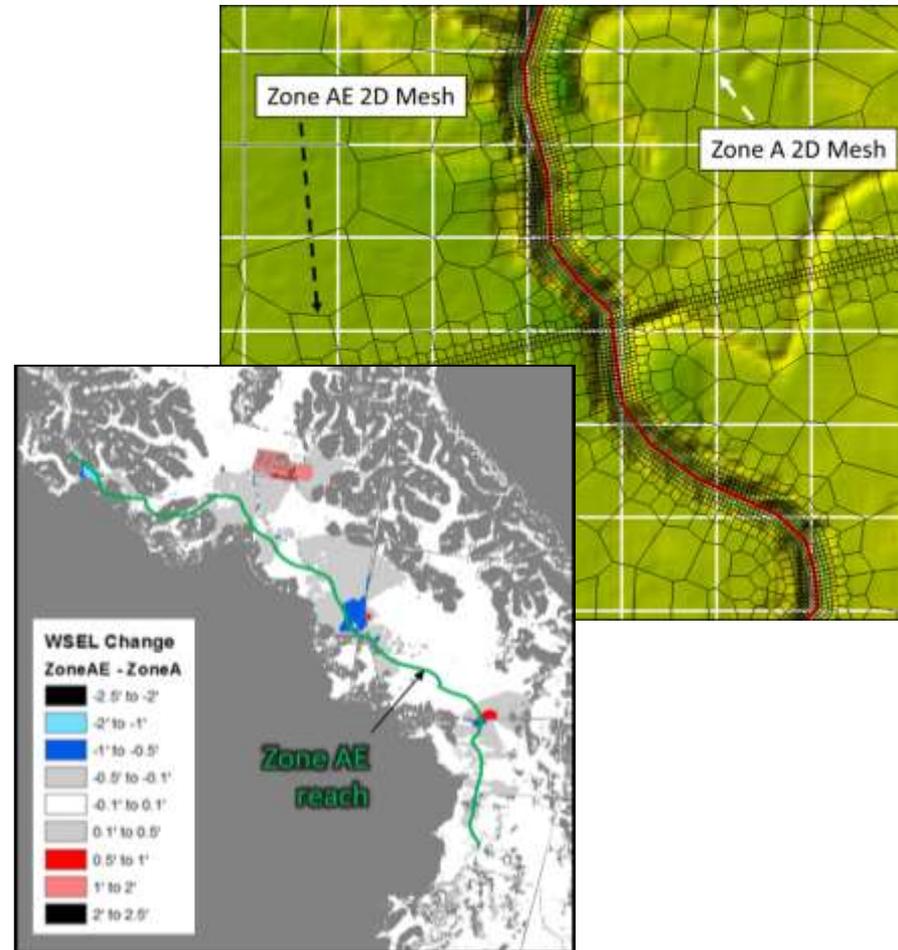
## ■ Innovation Purpose

- Provide recommendations for enhancing a watershed-wide 2D Zone A or BLE model to incorporate reaches of Zone AE stream with mapped BFEs
- Evaluate 2D floodway approaches and test viable methods, to provide recommendations for the NFIP, both near- and long-term, in support of leveraging 2D modeling
- Develop a Best Practices document that can be used within the program, and can be considered for future incorporation as Guidance
- (Note that testing was based on HEC-RAS 5.x)

# 2D Modeling: Zone AE Upgrade and Floodway Best Practices

## ■ Summary & Recommendations (2D Zone AE Upgrades)

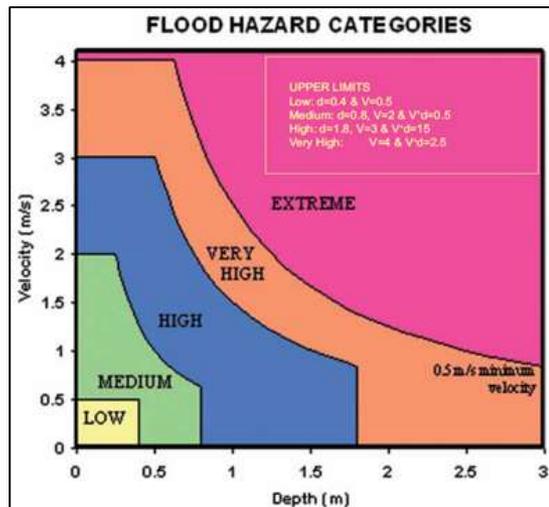
- Refine 2D mesh (breaklines) along stream channel and hydraulic crossings (as reflected in terrain)
- Incorporate hydraulic structures (crossing channel, and relevant overbank structures as appropriate)
- Perform additional validation / calibration checks
- Create a WSEL change grid between the original Zone A/BLE watershed-wide 2D model and the watershed model with Zone AE reach(es) incorporated



# 2D Modeling: Zone AE Upgrade and Floodway Best Practices

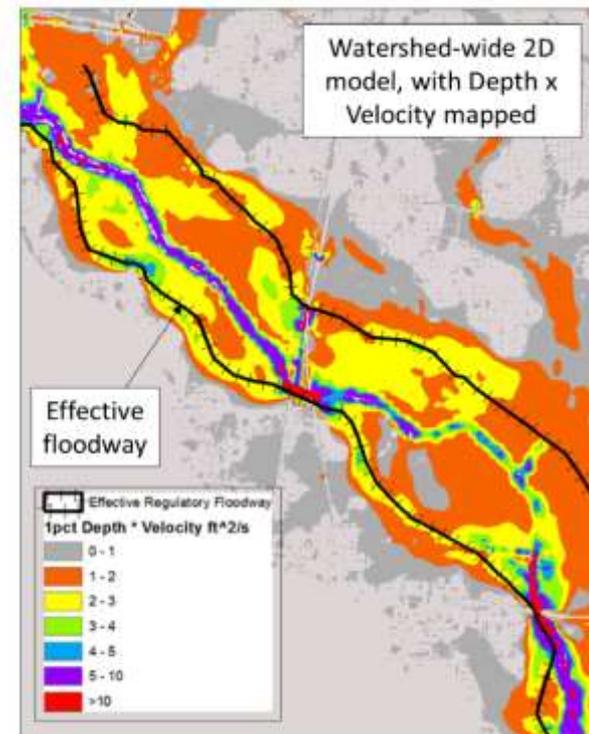
## Summary & Recommendations (2D Floodways)

- Long-term: Redefine the floodway concept altogether
- Short-term: Delineate 2D floodways that are primarily based on Depth x Velocity (DxV) – will be an iterative process until surcharges are within acceptable limits



From the May 2014 Flood Depth & Analysis Grids Guidance document

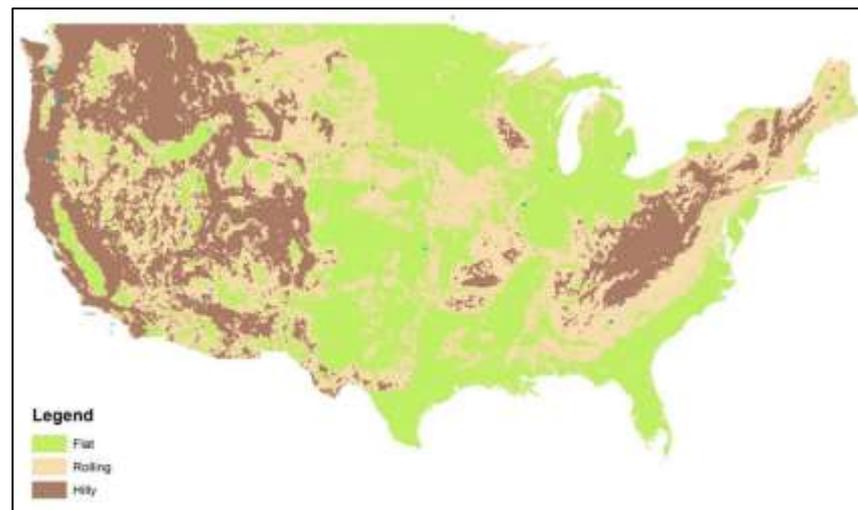
Flood Severity Category	Depth * Velocity Range (ft <sup>2</sup> /sec)	Depth * Velocity Range (m <sup>2</sup> /sec)
Low	< 2.2	< 0.2
Medium	2.2 – 5.4	0.2 – 0.5
High	5.4 – 16.1	0.5 – 1.5
Very High	16.1 – 26.9	1.5 – 2.5
Extreme	> 26.9	> 2.5



# Flood Hazard Modeling Parameters: Impact on BFEs and Top Width

## ■ Innovation Purpose

- Help users select the most cost-effective methods for hydraulic study by providing charts and data to support the value provided by each study ingredient
  - Looks at key factors to obtain most accurate BFEs and FP widths
  - Considers Return on Investment (ROI) of methods
- Reversed-engineered 30 stream models in five FEMA regions from full detailed to basic Zone A
- Grouped each stream by Flat, Hilly, Rolling (in reference to topo standards)



# Flood Hazard Modeling Parameters: Impact on BFEs and Top Width

- **Channel Bathymetry**

- Surveyed
- DEM only (LIDAR)

- **Structure Model Approach**

- Surveyed
- Assumed
- As Weirs
- No Structures

- **Manning's Roughness**

- Horizontal variation based on NLCD
- Bank-channel-bank
- Single value

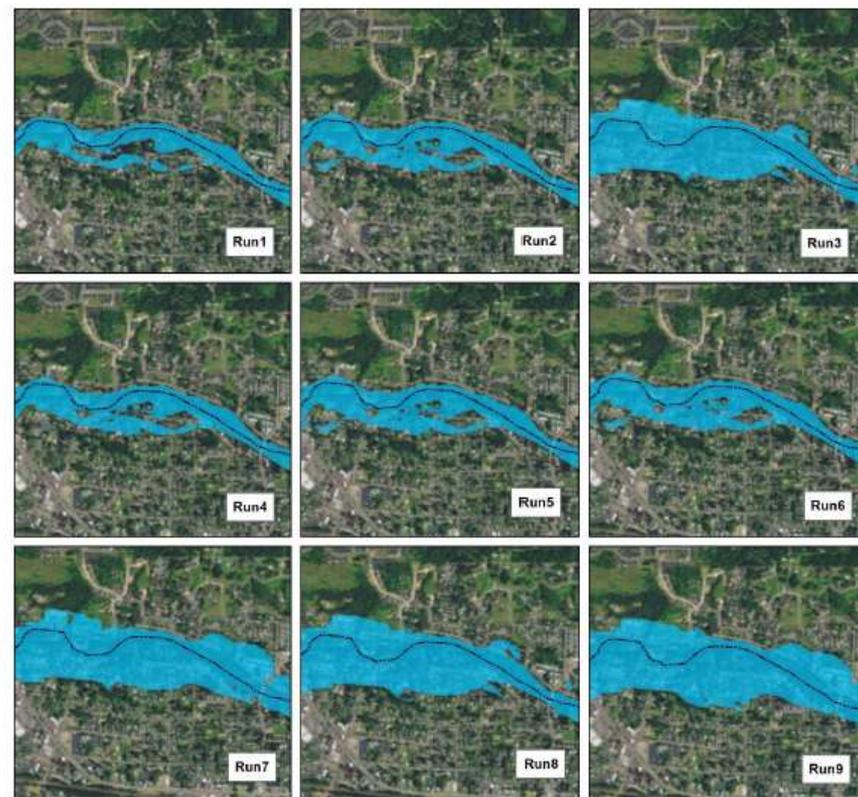
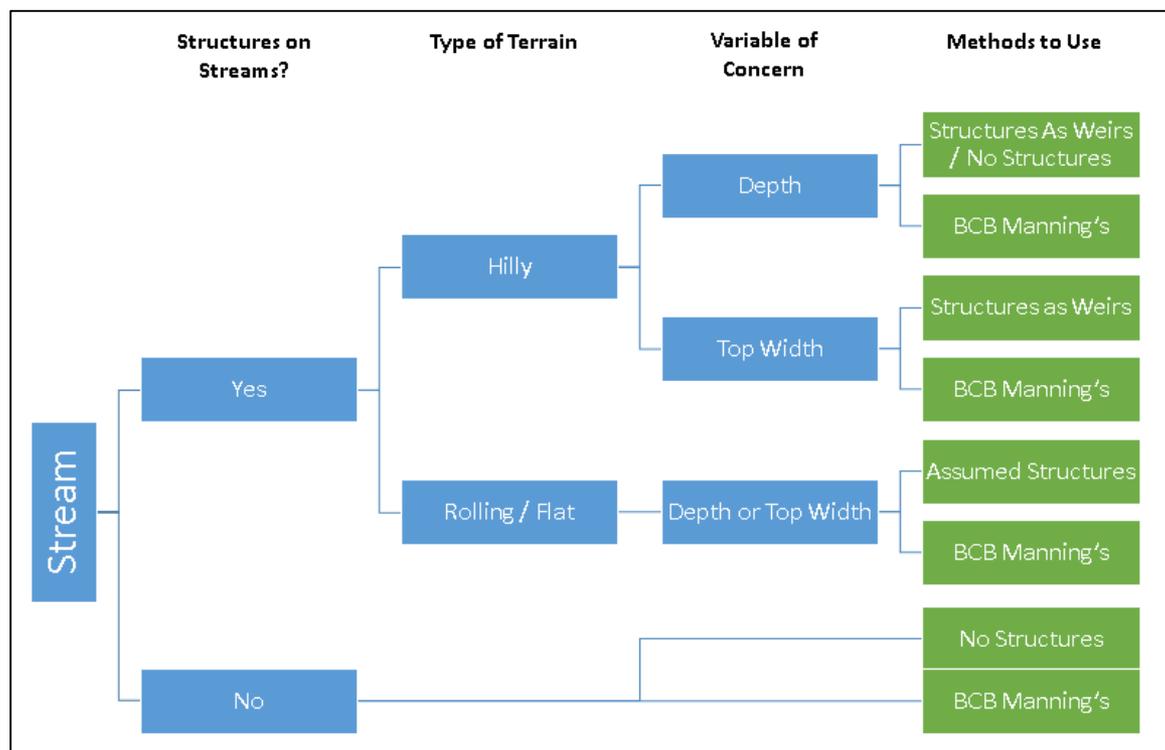


Figure 8: Inundation Maps of the Washougal River for Each of the Nine Test Runs

# Flood Hazard Modeling Parameters: Impact on BFEs and Top Width

## ■ Key Findings & Potential Next Steps

- Decision charts summarize results by terrain types (hilly, flat, rolling), variable of concern, and whether the stream has structures (bridges & culverts) on it
- Implement results of analysis in new guidance



# Mitigation Decision Support System (MDSS) Scenario Templates

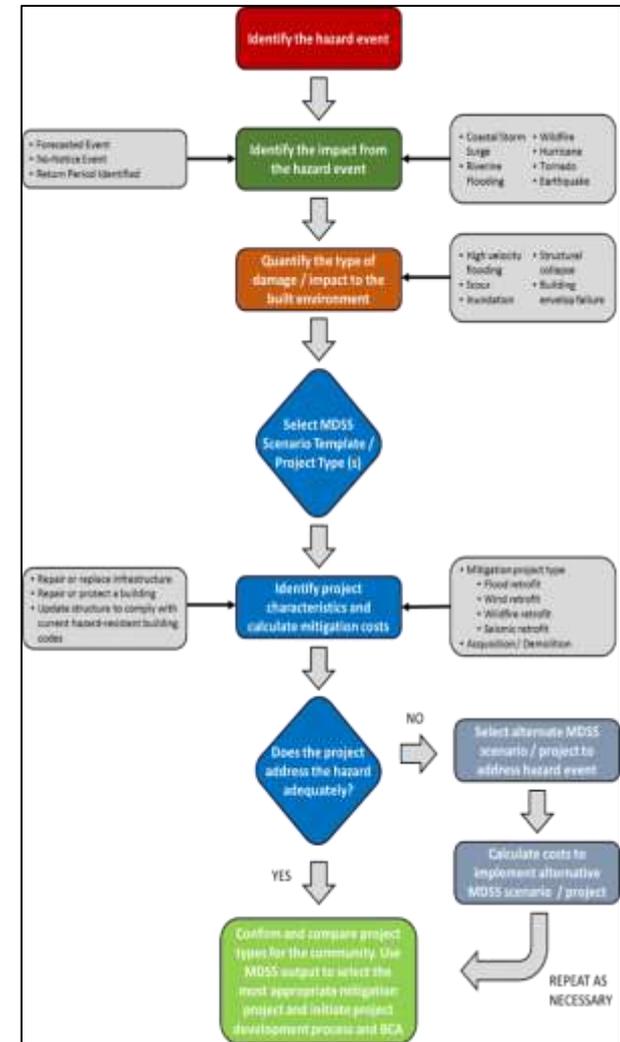
## ■ Innovation Purpose

- To provide FEMA with an array of mitigation project scenarios (Scenario Templates) to be included in the future Mitigation Decision Support System (MDSS) tool that is being contemplated by FEMA
- The project team reviewed current Hazard Mitigation Assistance (HMA) programs and guidance, as well as work that performed as part of the “Best Defense” application developed, but not fully deployed, following Hurricane Sandy.
- The scope of this initial phase was to identify scenario templates and vet the concept with FEMA Mitigation and FEMA Stakeholders.

# Mitigation Decision Support System (MDSS) Scenario Templates

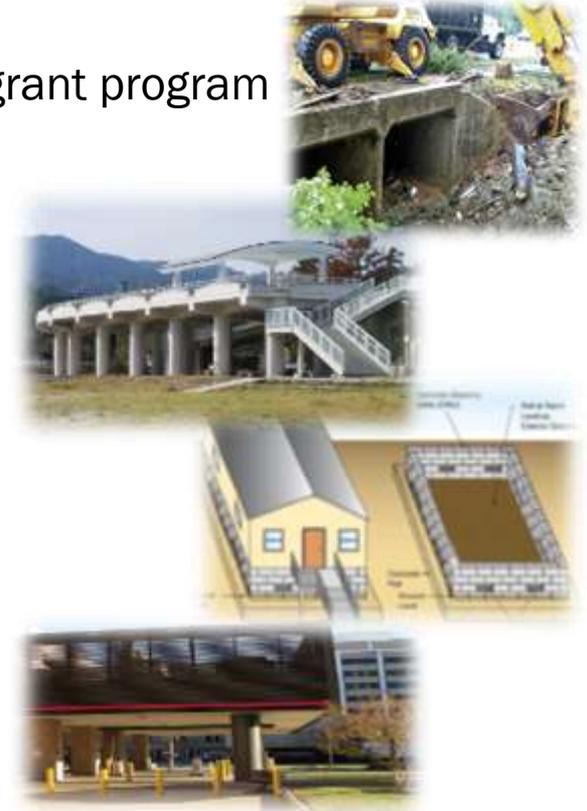
## ■ Project Execution

- Create templates covering the range of possibilities for 30 common mitigation projects
- Scenario templates will consider the major variables in the mitigation options. For example:
  - Implement an infrastructure improvement project
  - Raise house(s) 1-, 3-, 5-feet, etc.
  - Raise utilities within a structure
  - Acquisition – Relocation/Demolition
- Provide estimated construction costs for scenario templates for comparison and decision making



# 30 Scenario Templates Developed

- **Scenario templates selected based on**
  - Most common Hazard Mitigation Assistance (HMA) grant program submissions
  - New / innovative projects being supported by FEMA
- **Four groups of scenario templates**
  - Infrastructure Projects
  - Tsunami Projects
  - Residential Building Flood Protection Projects
  - Non-Residential Building Flood Protection Projects



# Mitigation Decision Support System (MDSS) Scenario Templates

## ■ Potential Next Steps

- Develop plan to implement MDSS in non-digital form for testing (something like a nomograph or decision chart)
- Further vet MDSS concept and templates with wider team

# What Resonates with You?

## ■ Innovation Summary

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# What Resonates with You?

- Which projects should be fast-tracked towards the Build phase?
- Which projects should we NOT pursue?