FEMA Region 3

Flood Risk Review Meeting

Berkeley County, WV - April 4, 2025

FEMA

Agenda

1. Welcome and Introductions
2. Where We Are - Draft Maps
3. Flood Study Update
4. Using Flood Risk Data to Reduce Risk
5. Floodplain Management
6. Discussion

FEMA

Introductions

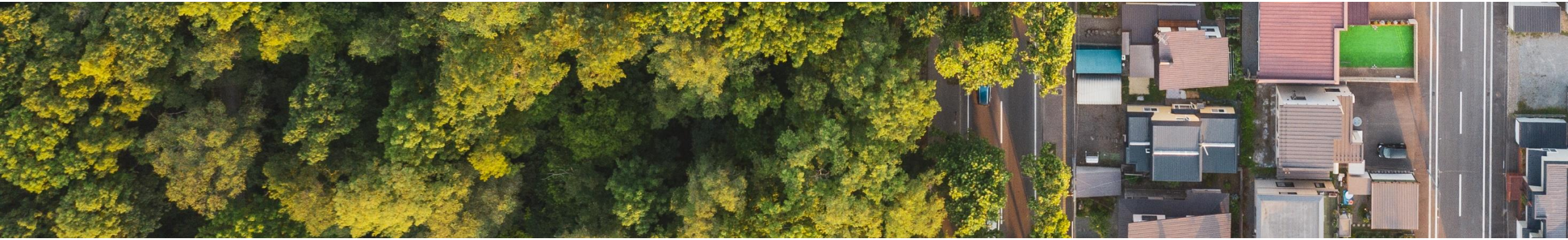
Please Introduce Yourself

- Name.
- Position.
- Organization.

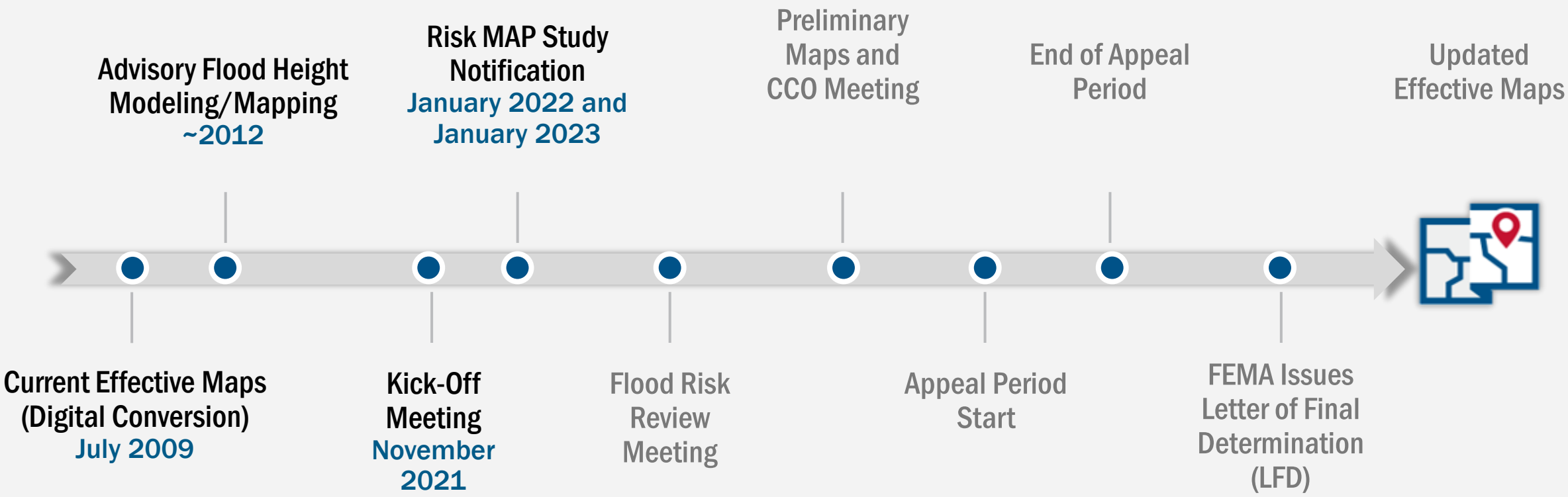
Where We Are – Draft Maps

3 Reasons We Are Here Today

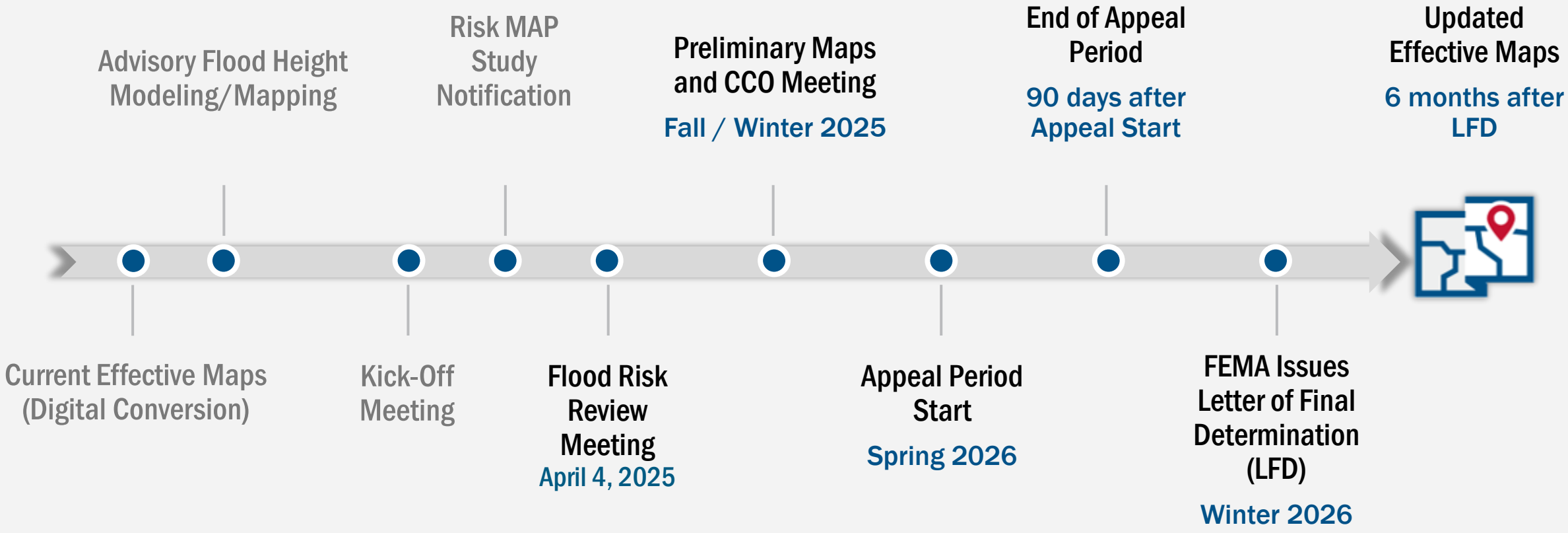
- To preview and discuss the updated Flood Insurance Study (FIS) report and Flood Insurance Rate Map (FIRM) for Berkeley County, West Virginia
- To examine the new study areas, discuss how the analysis and mapping have changed since the previous FIRM, and discuss current and future implications for these changes
- To present a timeline of next steps



Timeline – Looking Back



Timeline – Looking Ahead

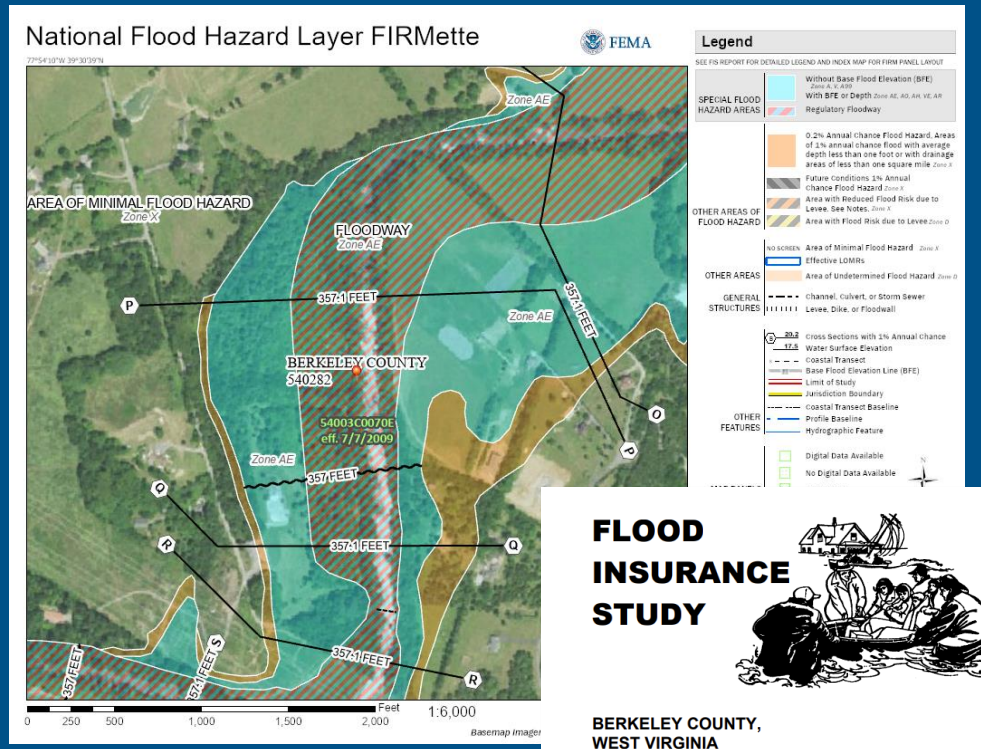


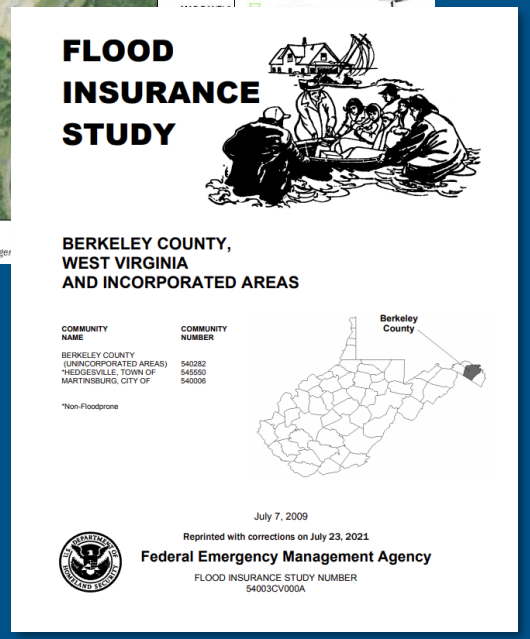
Flood Study Update

Flood Insurance Rate Maps and Studies

Key Terms:

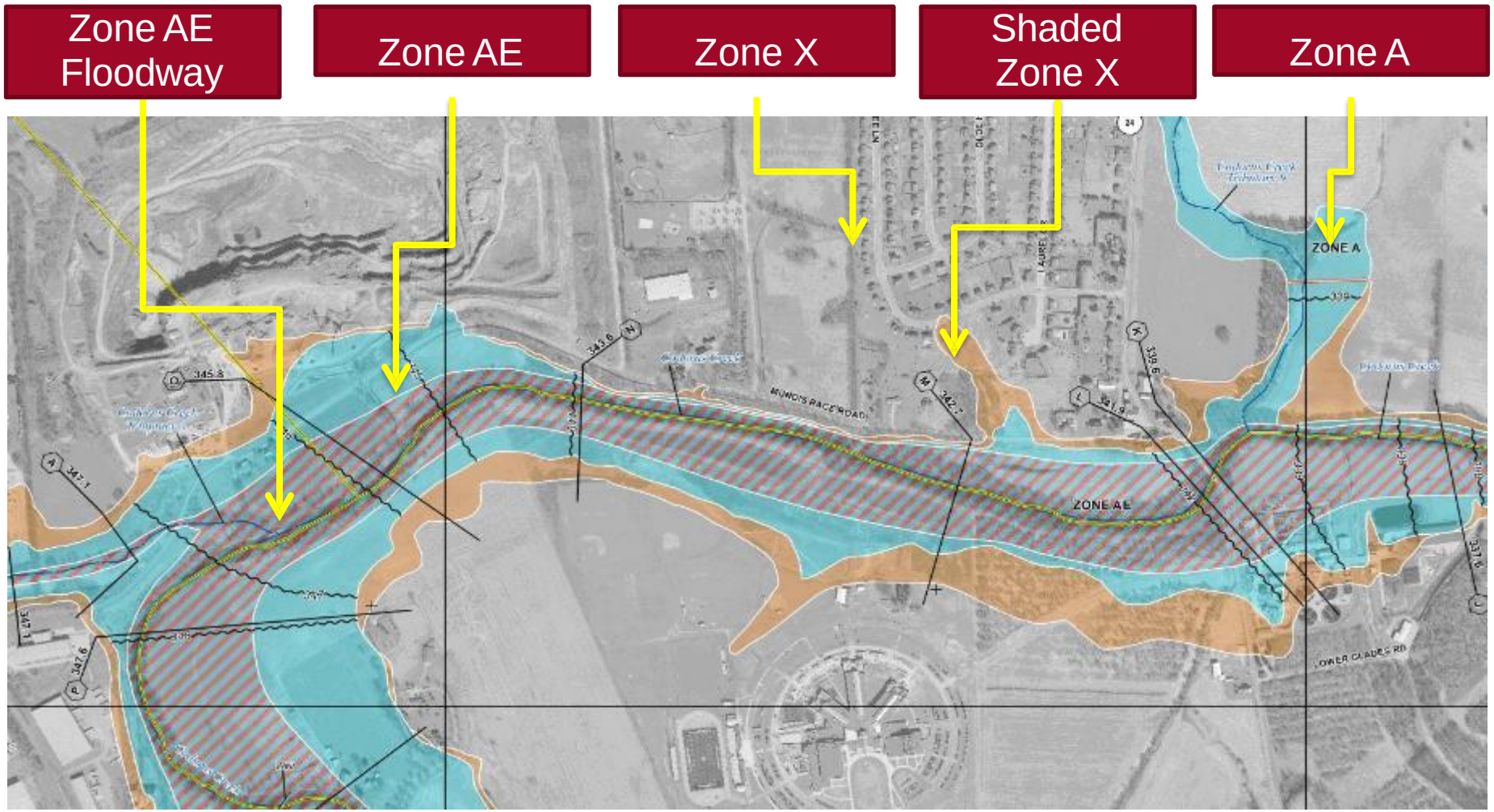
- Flood Insurance Rate Map (**FIRM**)
- Flood Insurance Study (**FIS**) Report
- Special Flood Hazard Area (**SFHA**)
- Flood Zone
- Base Flood Elevation (**BFE**)
- Regulatory Floodway
- Cross Section





FEMA

Typical FIRM Panel and Flood Zones



Floodplain Map Overview

HIGH RISK
(Special Flood Hazard Area)

MODERATE RISK

Regulatory Floodway

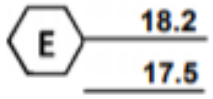
ZONE AE

1%-Annual-Chance Flood Hazard Area **with BFEs**

ZONE A

1%-Annual-Chance Flood Hazard Area **without published BFEs**

0.2%-Annual-Chance Flood Hazard Area



Cross Sections with 1%-Annual-Chance Water Surface Elevation Value

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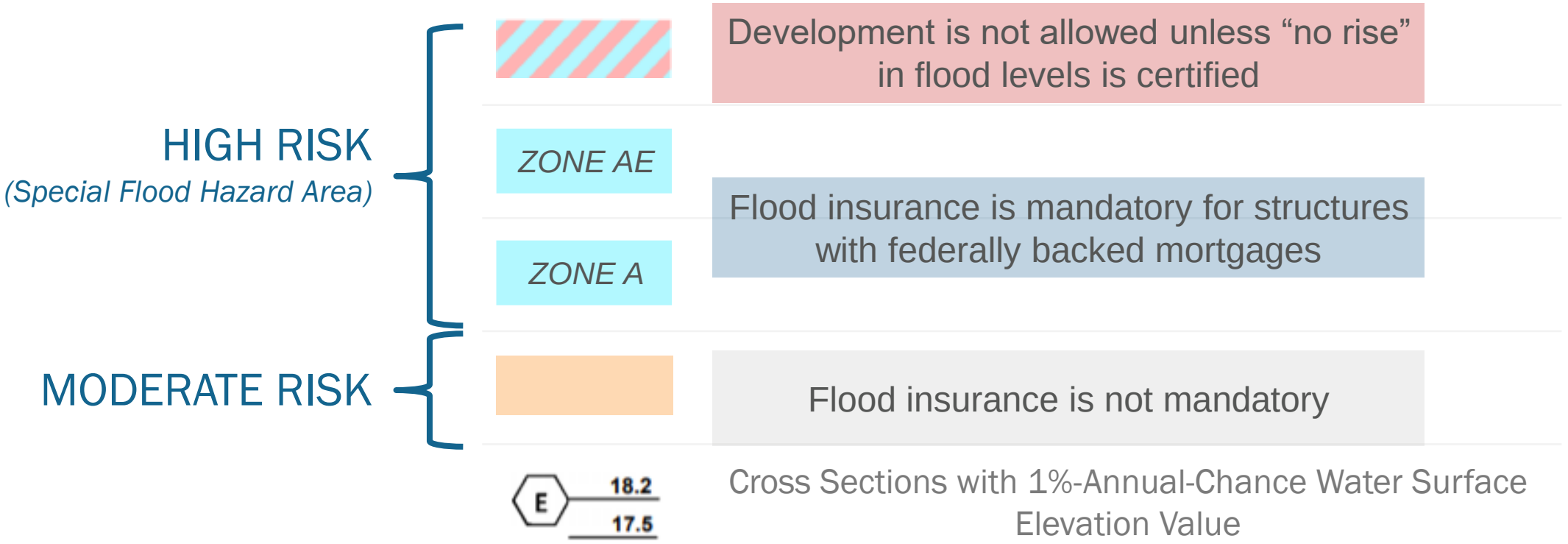
Floodplain Map Overview

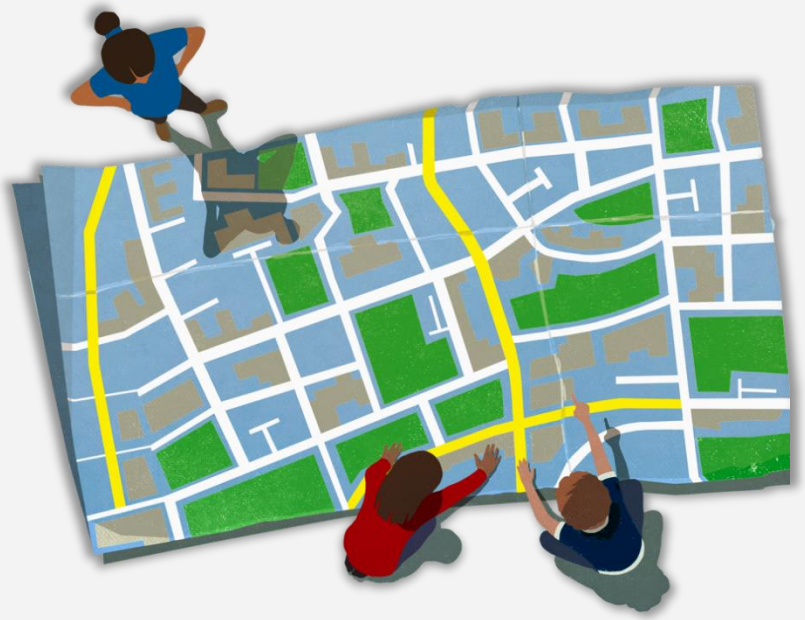


FEMA

Study Overview

Revised Modeling and Mapping, including:

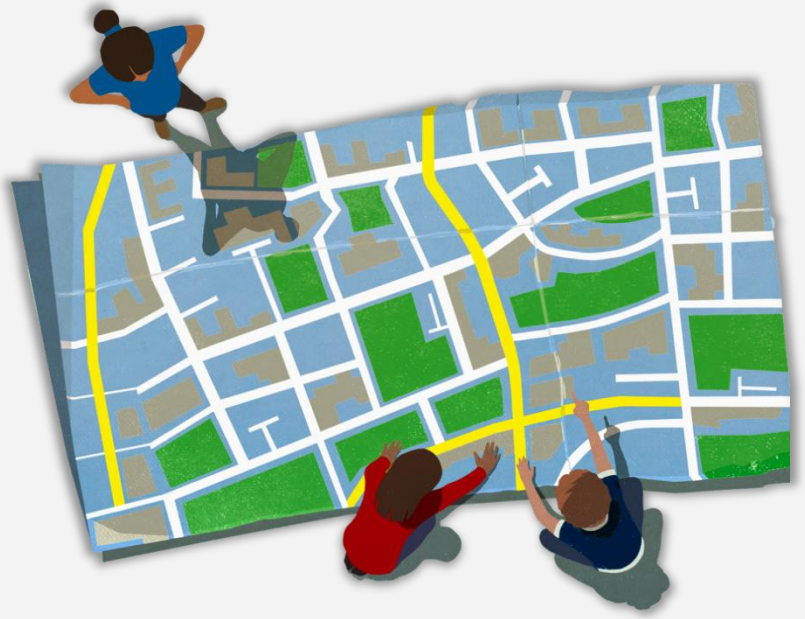
- ❑ Updated GIS-based regulatory products, including:
  - Updated FIRMs / GIS database / FIS report formats based on new FEMA guidelines and specifications
- ❑ High-resolution topographic data (for modeling and mapping)
- ❑ Detailed “Zone AE” Studies – 48 miles
- ❑ Model-backed Approximate “Zone A” Studies – 225 miles
- ❑ Floodplains on the Potomac River are **NOT** being updated as part of this study



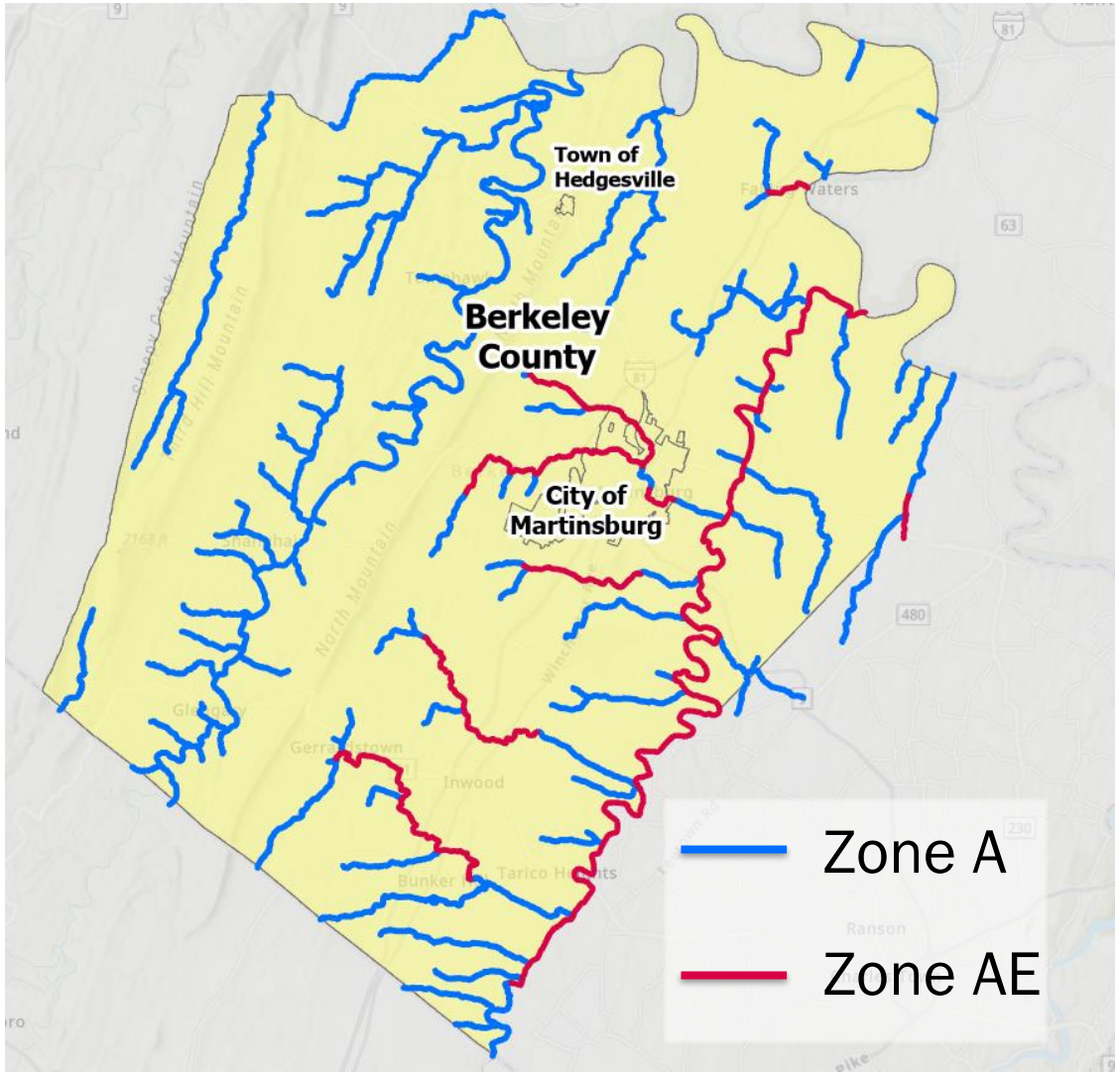
Study Overview (continued)

Revised Modeling and Mapping, including:

- ❑ Evaluation of Letters of Map Change (LOMCs)
  - Case-by-case results shown in a Summary of Map Actions (SOMA) that is sent to applicable communities with Preliminary Maps and Letters of Final Determination (LFDs)
  - Letters of Map Revision (LOMRs)
  - Letters of Map Amendment (LOMAs) – including rectified LOMA locations on the WV Flood Tool
- ❑ Production of associated non-regulatory flood risk



Study Area

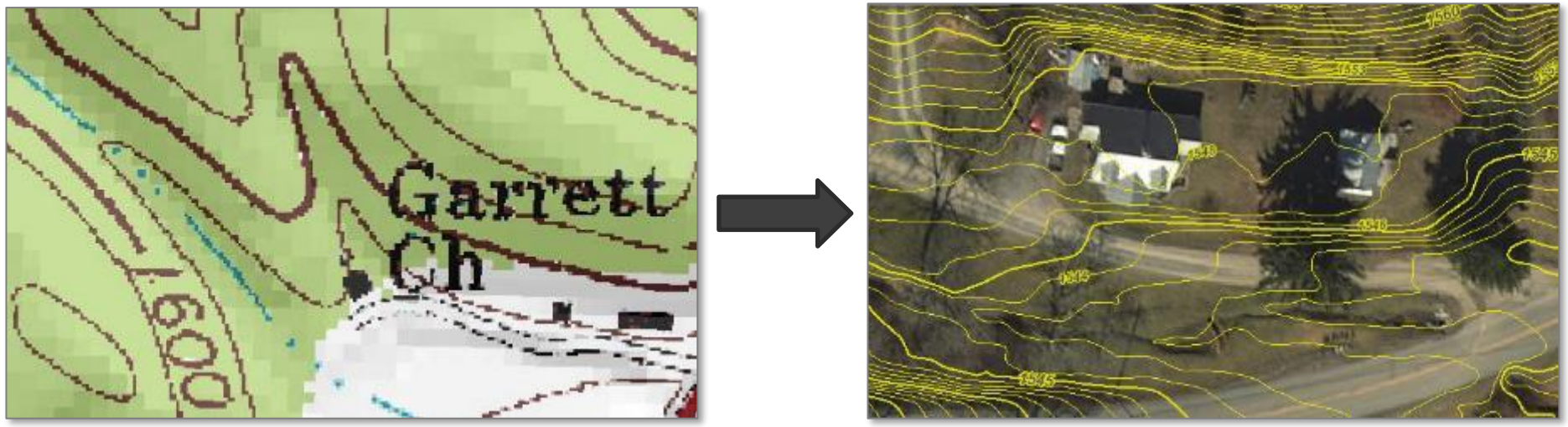

Town of Hedgesville
Berkeley County
City of Martinsburg
Zone A
Zone AE

Topographic Data

2012 LiDAR-Based Digital Elevation Model

LiDAR = Light Detection and Ranging

- *Uses light pulses and GPS to survey elevation data*
- *Improves the level of detail for hydraulic modeling and floodplain delineation*



Hydrologic Analyses

- Hydrologic study methods included:
  - USGS Regression Equations
  - Regression Equations Supplemented with USGS Gage Analysis (Bulletin 17C)
- A comprehensive **Hydrology Report** details the study methods for each reach and compares the effective and proposed discharges.
- The hydrologic study methods will be summarized and published in the forthcoming FIS Report.

Sample page from the Risk MAP Hydrology Report

3 APPROACH AND METHODOLOGY

3.1 ADJUSTMENTS FOR KARST

While developing the flow accumulation grid, an investigation was done for karst impact based off the National Hydrography Dataset (NHD) line network, ortho-imagery and high-resolution terrain. The NHD network was evaluated for disconnected features, the terrain was examined for sinkholes, and the ortho-imagery was used to confirm the presence of stream channels. We also investigated a karst layer map developed by USGS (Weary and Doctor, 2014). Berkeley County is underlain by karst-forming carbonate rocks. Our scoped approach to perform hydrology included estimating discharges based on regression equations from "Estimation of Flood-Frequency Discharges for Rural, Unregulated Streams in West Virginia" (Wiley and Atkins, 2010). The WV regression equations (2010) noted to be cautious when applying the equations to heavily karst areas. In the Berkeley County Flood Insurance study (FIS) report (FEMA, 2009), it is documented that equations developed specifically for limestone watershed were applied to certain reaches. Unfortunately, there was no additional documentation or reference to these applied equations and USGS has no knowledge about the FIS equations. We reached out to USACE, USGS, and WV Department of Transportation (DOT) to solicit input on karst impacts in Berkeley County. As a result, we proposed a methodology which includes applying a karst factor, from the WV DOT Drainage Manual to all the reaches impacted by karst (WVDOT, 2008). Each entity has endorsed this as a reasonable approach based on the data available.

Karst loss coefficient in Figure 3 below, from the WVDOH Drainage Manual was used to adjust the discharges calculated using regression equations (WVDOT, 2008).

% Karst	Storm Return Period				
	2	10	25	50	100
100	0.33	0.43	0.44	0.46	0.50
90	0.35	0.46	0.48	0.50	0.56
80	0.38	0.51	0.53	0.56	0.62
70	0.47	0.58	0.60	0.62	0.68
60	0.55	0.66	0.67	0.70	0.74
50	0.64	0.73	0.74	0.76	0.80
40	0.73	0.80	0.81	0.82	0.85
30	0.82	0.86	0.87	0.87	0.89
20	0.91	0.92	0.92	0.92	0.93
10	1.00	0.98	0.98	0.98	0.97
0	1.00	1.00	1.00	1.00	1.00

Source: Adjusting Hydrology Models for Karst Geology, John Laughland P.E.

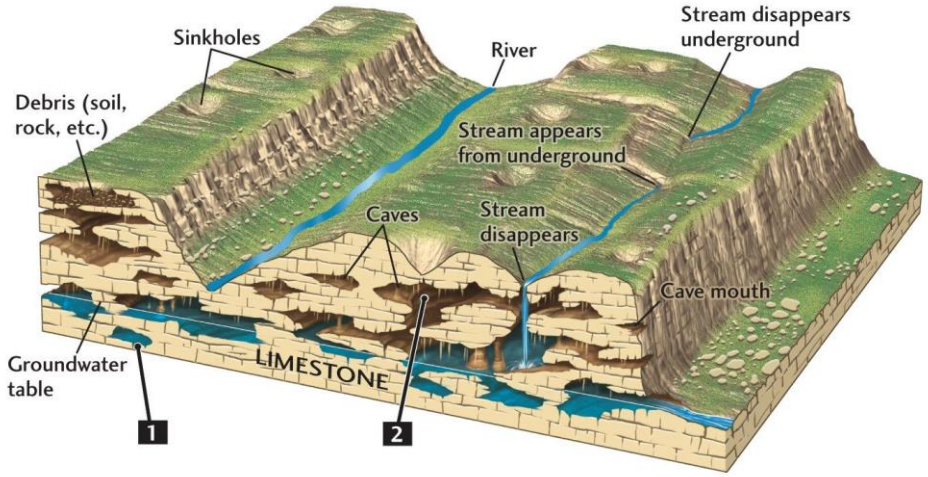
Figure 3. Karst Loss Coefficient

The US Karst layer map developed by USGS (Weary and Doctor, 2014) and the associated spatial files were converted into a raster that links the percent karst at each flow accumulation grid cell. All percent karst values were rounded to 1 significant figure. At each drainage point, the associated percent karst was determined. The regression flows were multiplied by the corresponding percent karst loss coefficient. The karst loss was only applied to regression flows.

The Karst Loss Coefficient table does not include a value for the 100 plus or 500-year event. The value defined for the 100 year was applied to the 100-plus event. The 500-year event was computed by created power trendline equations for each percent karst factors based on the associated karst factors for the different storm return periods.

Karst Topography

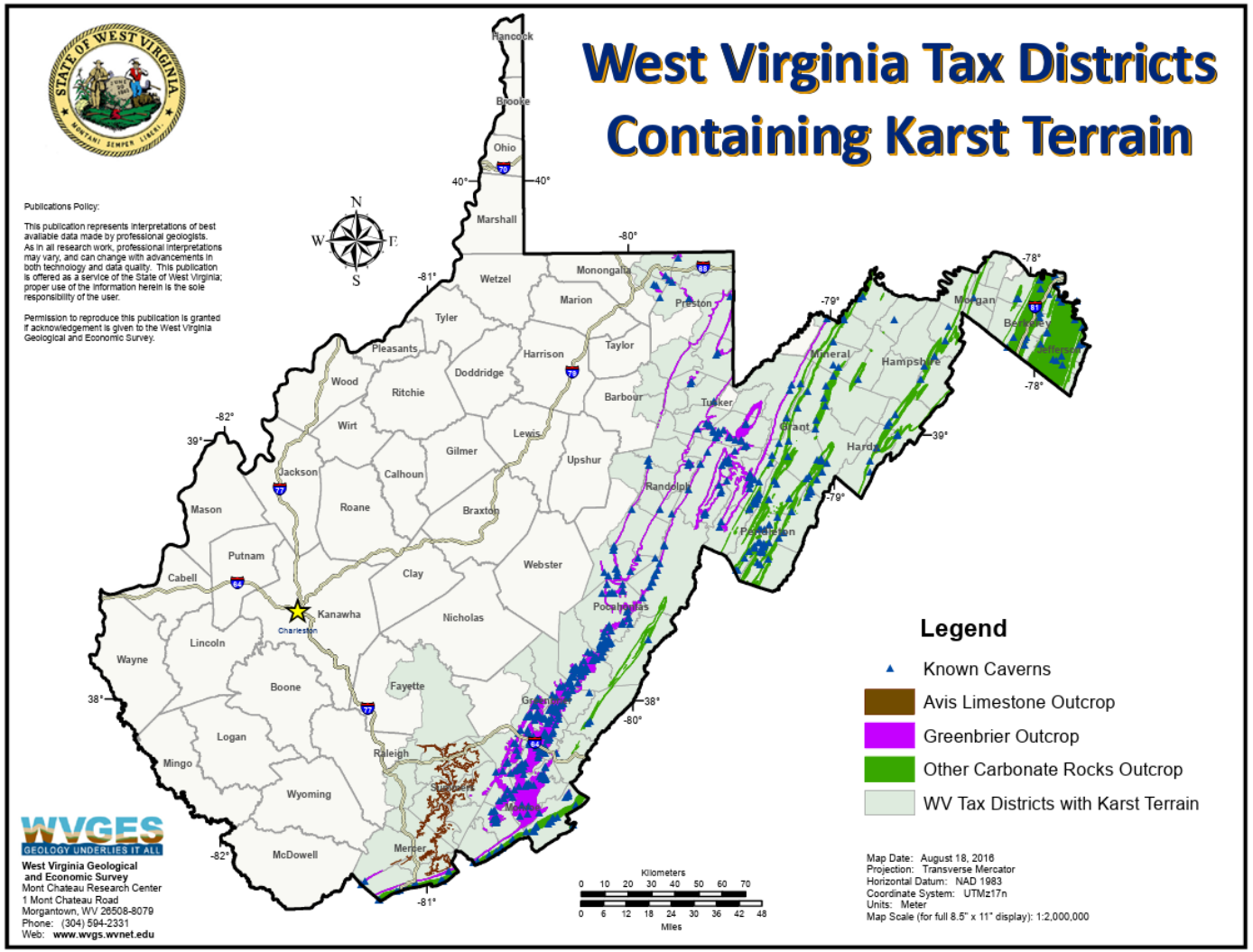
Karst Topography Characteristics



West Virginia woman struggles with massive sinkhole in front yard

By David Kaplan | **Published** October 16, 2024 4:57pm EDT | West Virginia | FOX 5 DC |

MARTINSBURG, W.Va. - A West Virginia woman is desperately seeking help after a large sinkhole, 15 feet deep and 6 feet wide, appeared in her front yard, leaving her fearful and frustrated.



Karst Correction Factor

- Karst Correction Factor applied to estimate discharges in watersheds where karst was present.
  - Karst Correction Factor values taken from West Virginia Department of Transportation Drainage Manual (2008)
  - Water flow during flood events reduced to account for higher amount of rainfall infiltrating into the limestone bedrock instead of running into streams

% Karst	Storm Return Period				
	2	10	25	50	100
100	0.33	0.43	0.44	0.46	0.50
90	0.35	0.46	0.48	0.50	0.56
80	0.38	0.51	0.53	0.56	0.62
70	0.47	0.58	0.60	0.62	0.68
60	0.55	0.66	0.67	0.70	0.74
50	0.64	0.73	0.74	0.76	0.80
40	0.73	0.80	0.81	0.82	0.85
30	0.82	0.86	0.87	0.87	0.89
20	0.91	0.92	0.92	0.92	0.93
10	1.00	0.98	0.98	0.98	0.97
0	1.00	1.00	1.00	1.00	1.00

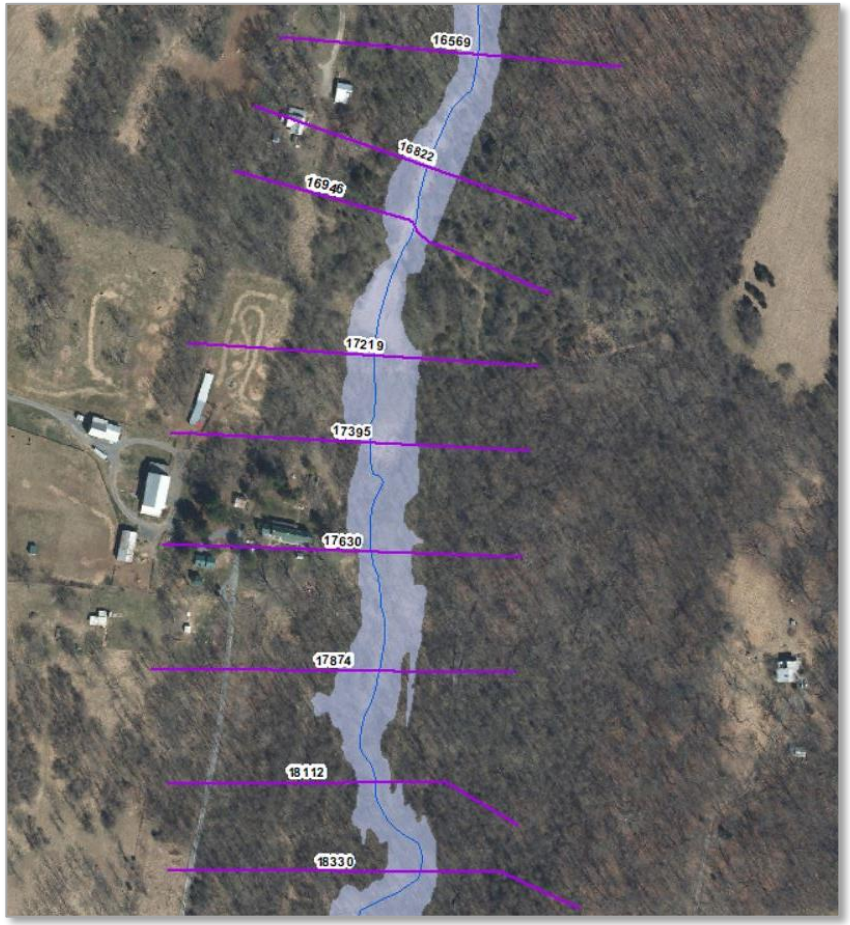
Source: Adjusting Hydrology Models for Karst Geology, John Laughland P.E.

Figure 3. Karst Loss Coefficient

Hydraulic Analyses – Zone A

Approximate "Zone A" Base Level Study (225 miles)

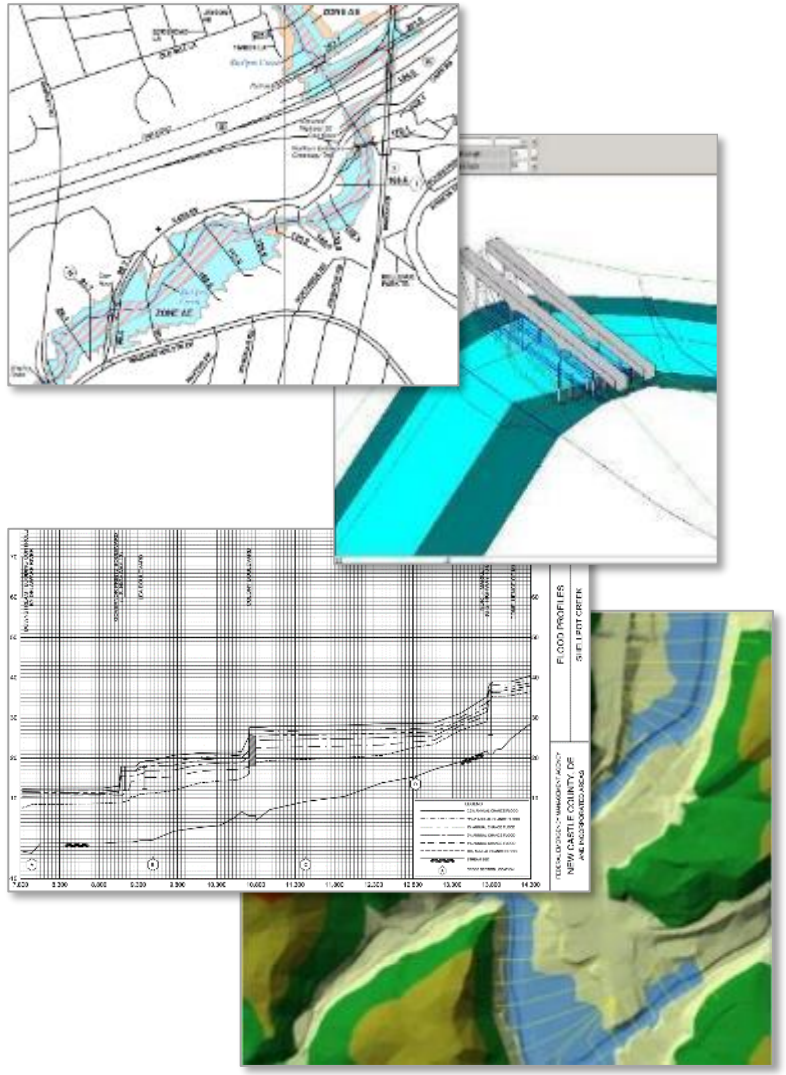
- Generally used in areas with lower development or lower development potential
- Cross sections generated from LiDAR
  - Does not include channel bathymetry
  - No hydraulic structures are surveyed or modeled
- FIRMs **will not** show Floodway or BFEs (but FIRM database will include cross sections and their associated water surface elevations in the FIRM GIS Database)
- FIS Report **will not** show flood profiles for Zone A reaches



Hydraulic Analyses – Zone AE

Detailed “Zone AE” Study (48 miles)

- Generally used in areas with higher development or higher development potential
- Cross sections use information from survey and field reconnaissance
  - Include channel bathymetry
  - Structures are modeled (e.g., culverts, bridges)
- Detailed hydraulic parameter refinement (coefficients, obstructions, Manning's ‘n’ values)
- FIRMs **will** show Floodway, BFEs, 1% and 0.2%-annual-chance event floodplains
- FIS Report **will** show flood profiles for 10-, 4-, 2-, 1-, 0.2-, and 1% Plus flood frequencies



Study Impacts

Significant Impacts Overview

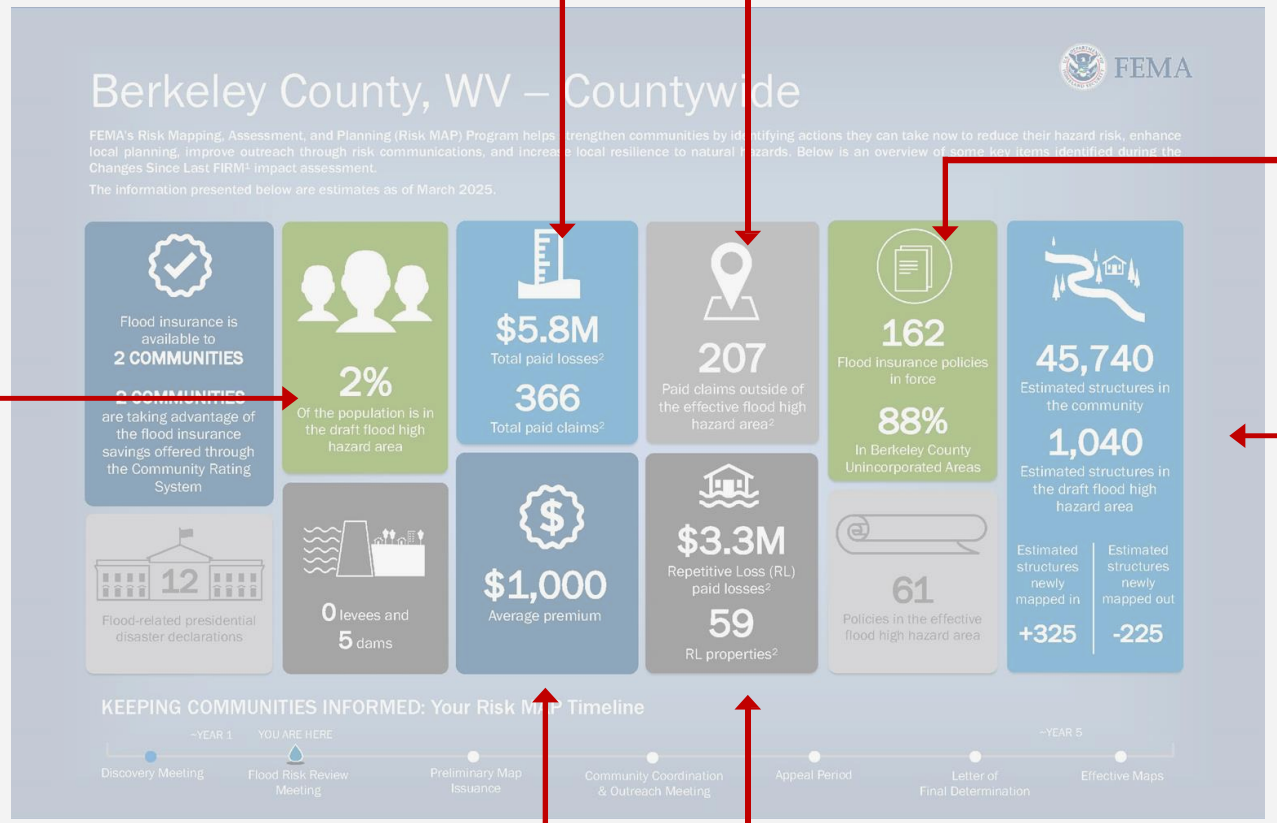
- Compared to the effective FIRMs, widening and narrowing of draft 1%-annual-chance floodplain (SFHA) extents were observed throughout the county.
  - SFHA increases: Opequon Creek, Dry Run, and Evans Run
  - SFHA decreases: Rocky Marsh Run, Middle Creek, and Potomac River Tributary 3
- Extended study reaches (with drainage areas of 1 square miles and greater, and not on current effective FIRMs) result in new properties within the SFHA.
- More structures will be mapped in than mapped out: +226/ -205

WV Flood Tool – SFHA Future Map Conditions*

Community	No Change SFHA	Mapped In SFHA	Mapped Out SFHA	Total Structures
Berkeley County (Unincorporated Areas)	380 *(+1 Floodway)*	206 *(+1 Floodway)*	184	772
Martinsburg, City of	39 *(+6 Floodway)*	19	21	85
Total	419 *(+7 Floodway)*	225 *(+1 Floodway)*	205	857

* Town of Hedgesville does not have any SFHA

Flood Risk Dashboard



NFIP FLOOD CLAIM PAYOUTS

CLAIMS OUTSIDE OF THE SFHA

NFIP FLOOD POLICIES

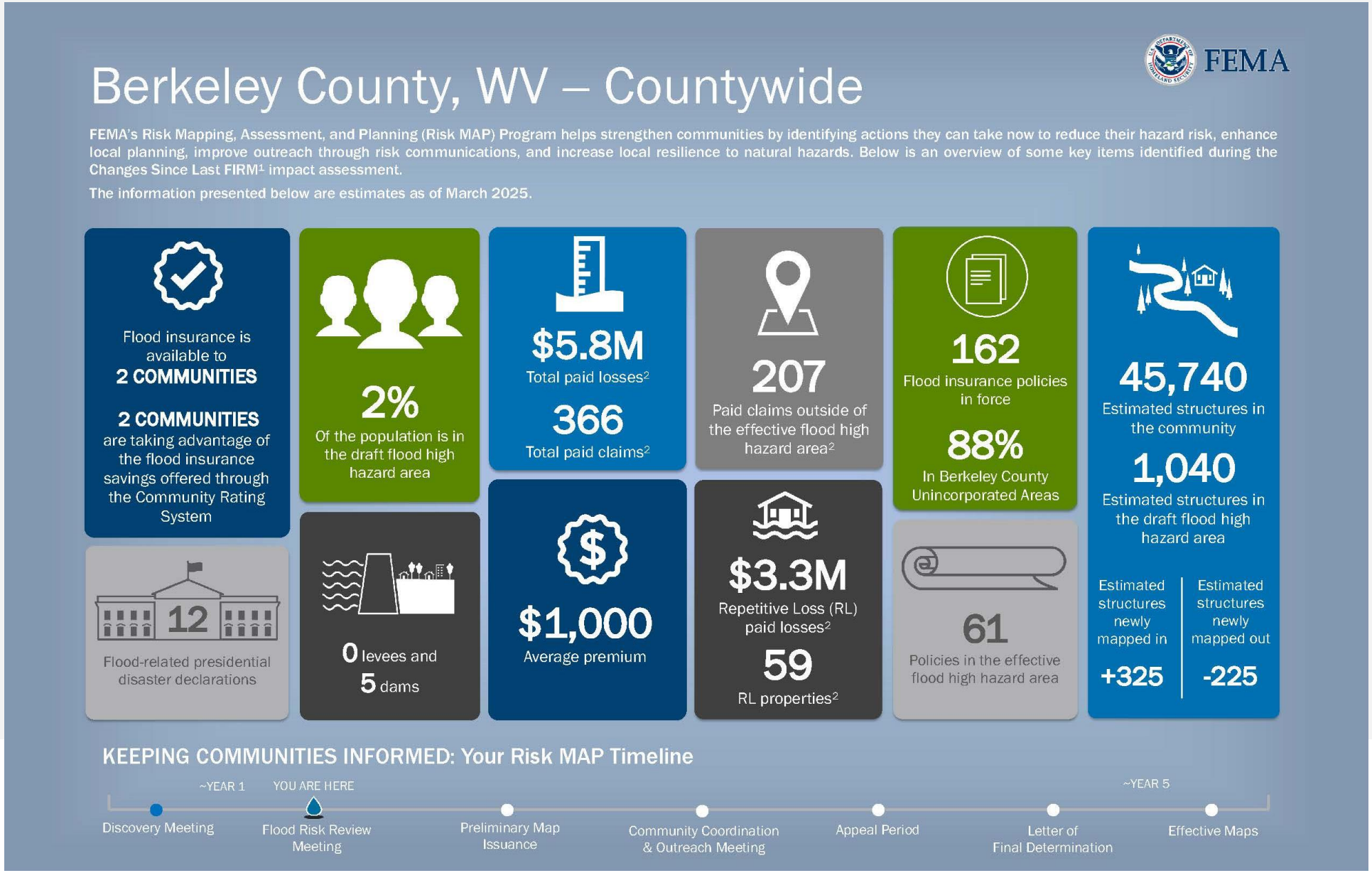
AFFECTED RESIDENTS

HIGH-RISK STRUCTURES

AVERAGE PREMIUM

REPETITIVE LOSSES

Flood Risk Dashboard



Flood Risk Dashboard (page 2)

TAKE ACTION: Next Steps

Your Hazard Mitigation Plan has been approved through January 31, 2027. Now may be the time to update and review. Some projects you identified to reduce flood risk were:

- Consider conducting acquisition and relocation projects in flood-prone areas.
- Continue coordinating county efforts to meet the requirements of participation in the CRS.

Find ideas to mitigate flood risk here:

Mitigation Ideas (fema.gov)

Immediate Next Steps:

1. Attend the Flood Risk Review Meeting

FRR Meeting is on **Friday, April 4, 2025.**

2. Review and comment on draft data

Review and comment on draft data ahead of preliminary FIRMs[1] anticipated for late 2025 or early 2026.

What's on the Horizon:

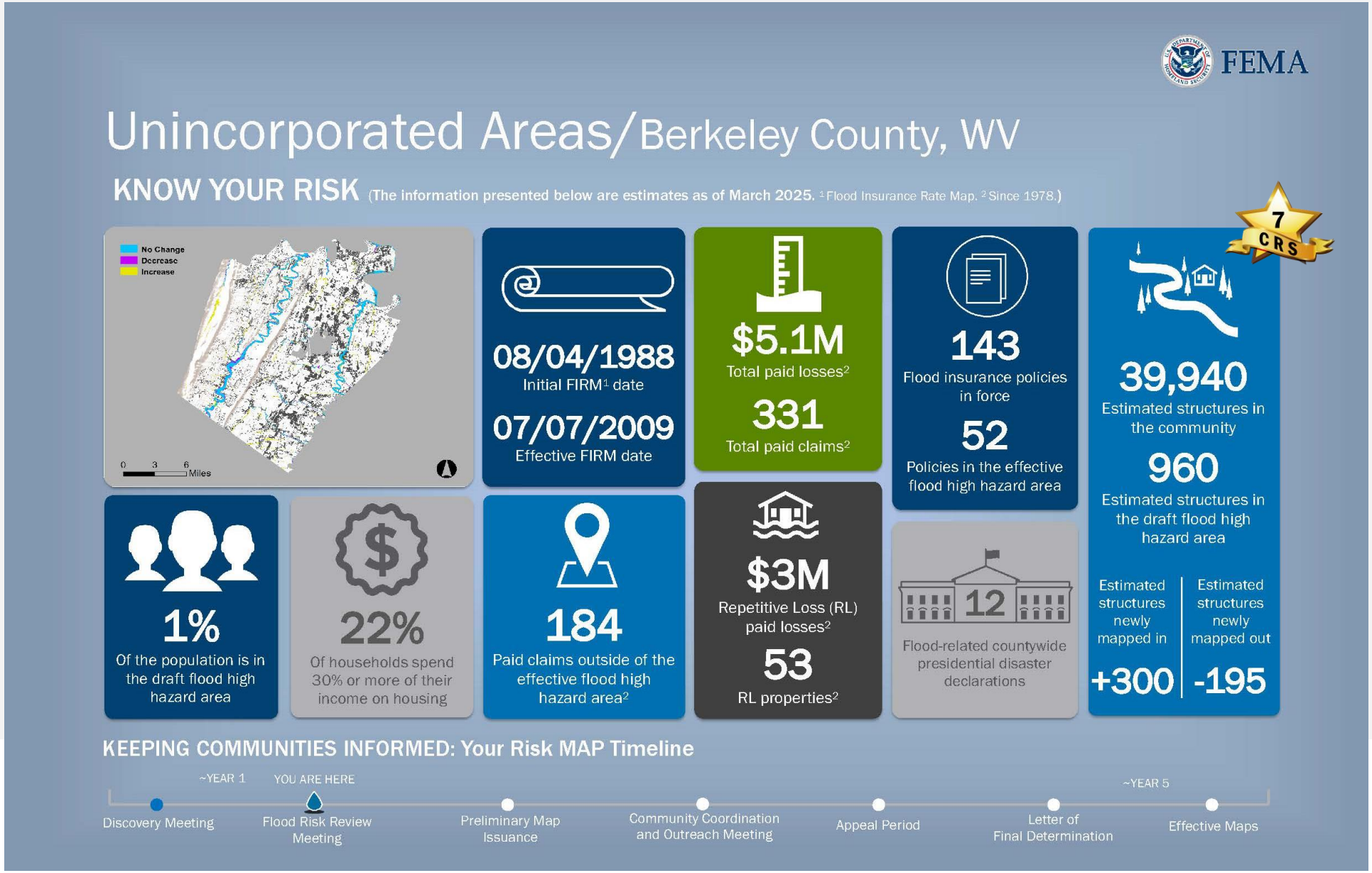
1. Preliminary FIRMs and **Community Coordination and Outreach (CCO) Meeting**

2. 90-day regulatory **Appeal Period** following the Community Coordination and Outreach Meeting

3. Letter of Final Determination issued following Appeal Period

[1] Flood Insurance Rate Map
[2] Since 1978

Flood Risk Dashboard

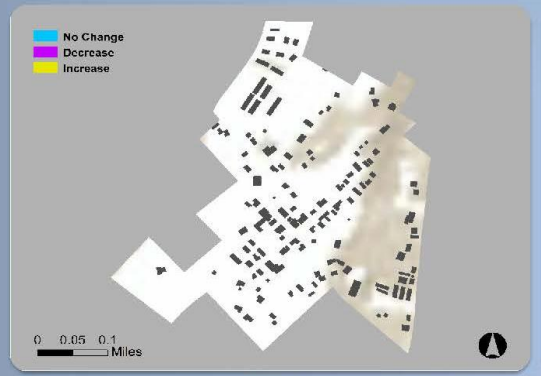


Flood Risk Dashboard

FEMA

Town of Hedgesville/Berkeley County, WV

KNOW YOUR RISK (The information presented below are estimates as of March 2025. [1] Flood Insurance Rate Map. [2] Since 1978.)



N/A
Initial FIRM[1] date

N/A
Effective FIRM date
Not participating in NFIP

$0
Total paid losses[2]

0
Total paid claims[2]

0
Flood insurance policies in force

0
Policies in the effective flood high hazard area

130
Estimated structures in the community

0
Estimated structures in the draft flood high hazard area

Estimated structures newly mapped in **+0**

Estimated structures newly mapped out **-0**

0%
Of the population is in the draft flood high hazard area

12%
Of households spend 30% or more of their income on housing

0
Paid claims outside of the effective flood high hazard area[2]

$0
Repetitive Loss (RL) paid losses[2]

0
RL properties[2]

12
Flood-related countywide presidential disaster declarations

KEEPING COMMUNITIES INFORMED: Your Risk MAP Timeline

~YEAR 1 — YOU ARE HERE — ~YEAR 5

- Discovery Meeting
- Flood Risk Review Meeting
- Preliminary Map Issuance
- Community Coordination and Outreach Meeting
- Appeal Period
- Letter of Final Determination
- Effective Maps

Flood Risk Dashboard

FEMA

City of Martinsburg/Berkeley County, WV

KNOW YOUR RISK (The information presented below are estimates as of March 2025. [1] Flood Insurance Rate Map. [2] Since 1978.)

12/18/1979
Initial FIRM[1] date

07/07/2009
Effective FIRM date

$700K
Total paid losses[2]

35
Total paid claims[2]

19
Flood insurance policies in force

9
Policies in the effective flood high hazard area

8 CRS

5,670
Estimated structures in the community

80
Estimated structures in the draft flood high hazard area

Estimated structures newly mapped in
+25

Estimated structures newly mapped out
-30

1%
Of the population is in the draft flood high hazard area

39%
Of households spend 30% or more of their income on housing

23
Paid claims outside of the effective flood high hazard area[2]

$300K
Repetitive Loss (RL) paid losses[2]

6
RL properties[2]

12
Flood-related countywide presidential disaster declarations

KEEPING COMMUNITIES INFORMED: Your Risk MAP Timeline

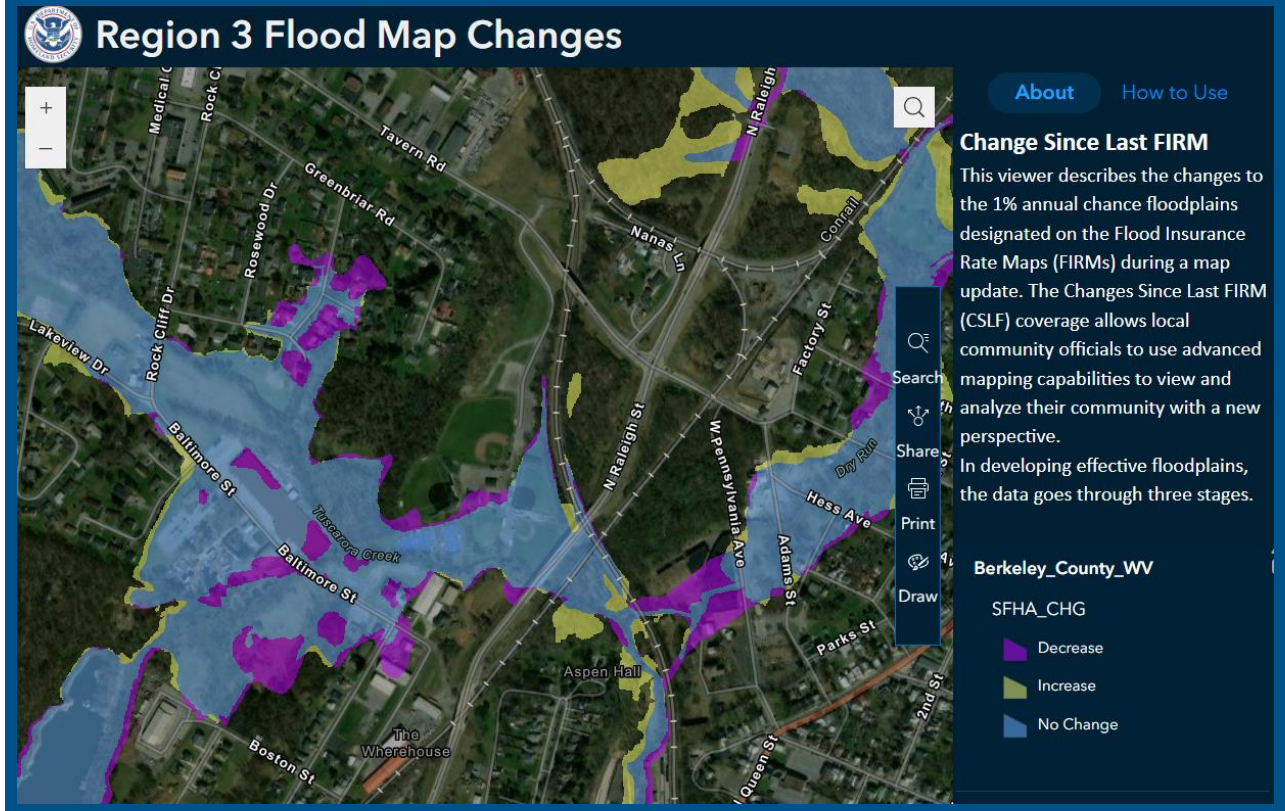
~YEAR 1 — YOU ARE HERE — ~YEAR 5

- Discovery Meeting
- Flood Risk Review Meeting
- Preliminary Map Issuance
- Community Coordination and Outreach Meeting
- Appeal Period
- Letter of Final Determination
- Effective Maps

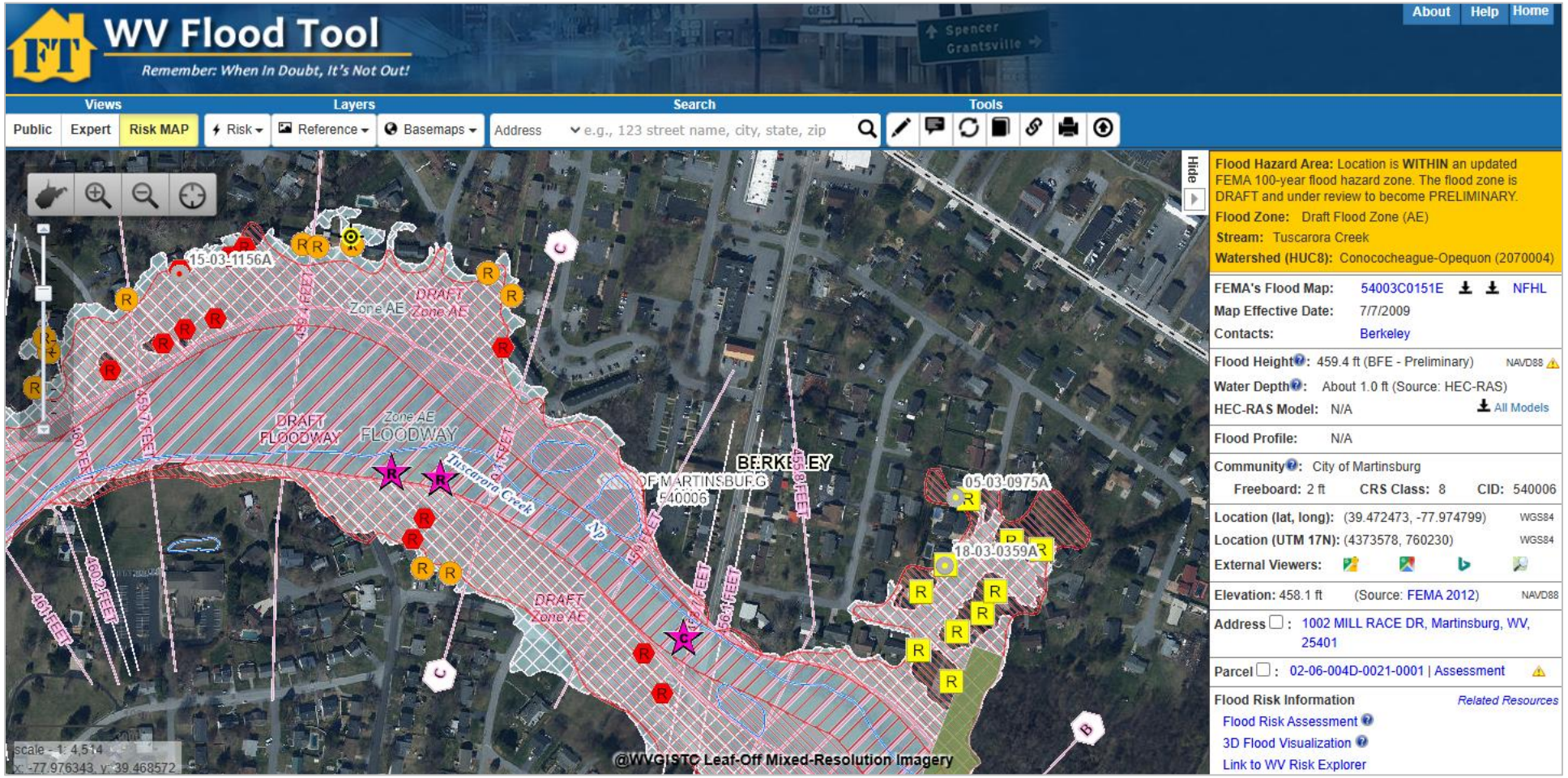
How Did the Floodplain Maps Change?

- FEMA Region 3
  Changes Since Last FIRM (CSLF) Viewer:
  https://arcg.is/ijSne
- Change in Floodplain Extents:
  - Purple – Decrease
  - Blue – Still Floodplain
  - Yellow – Increase

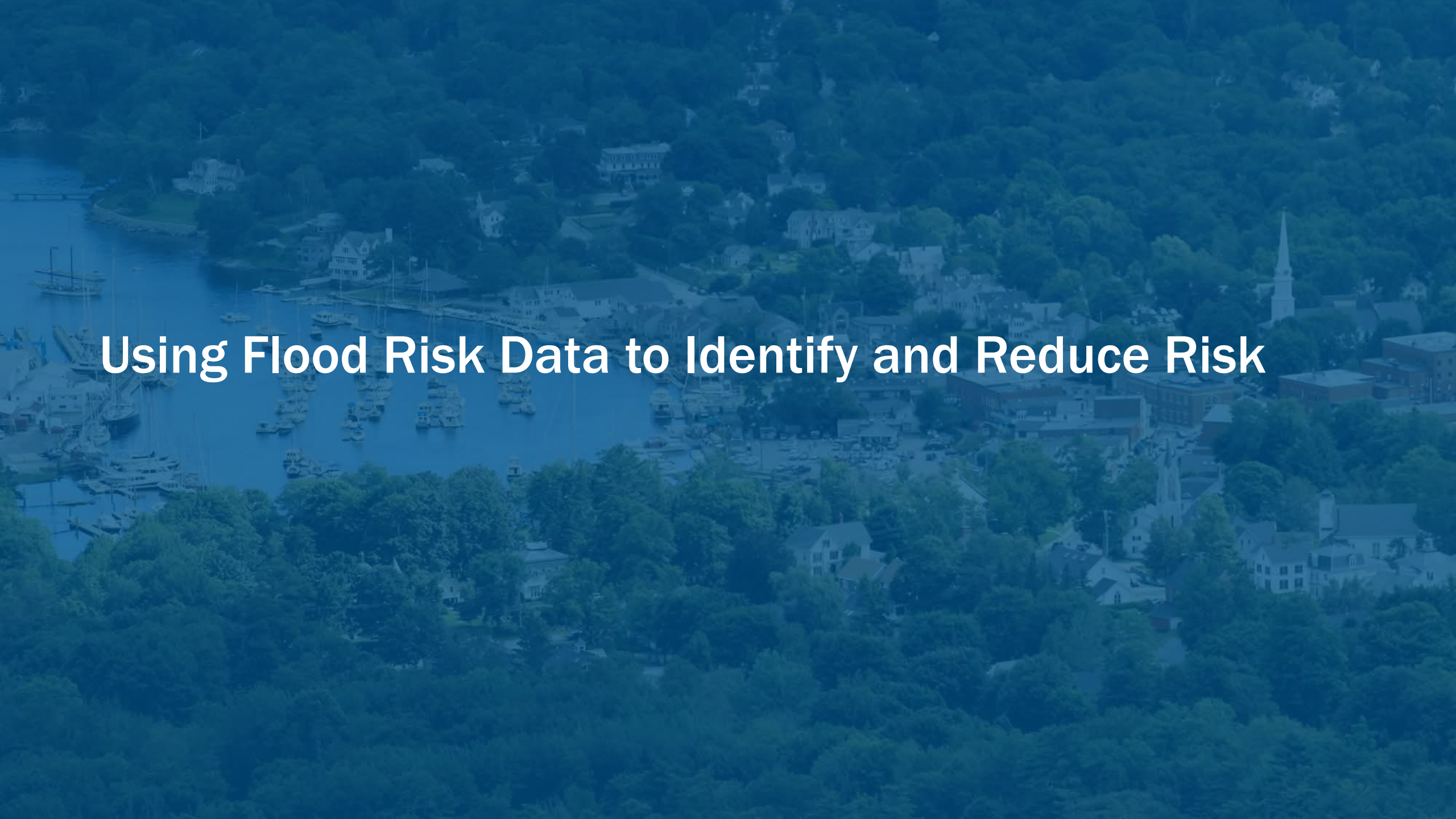
*Map view has scale-dependent layers



West Virginia Flood Risk Tool



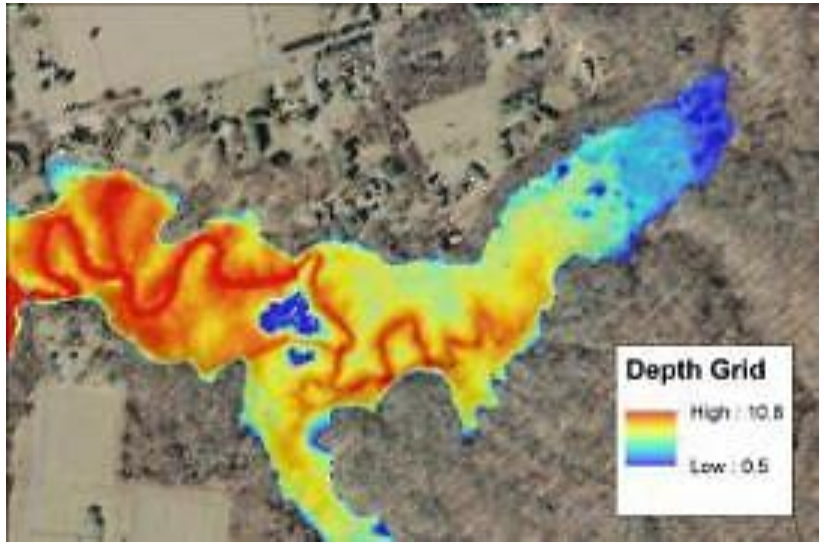
[WV Flood Tool (mapwv.gov)]



Using Flood Risk Data to Identify and Reduce Risk

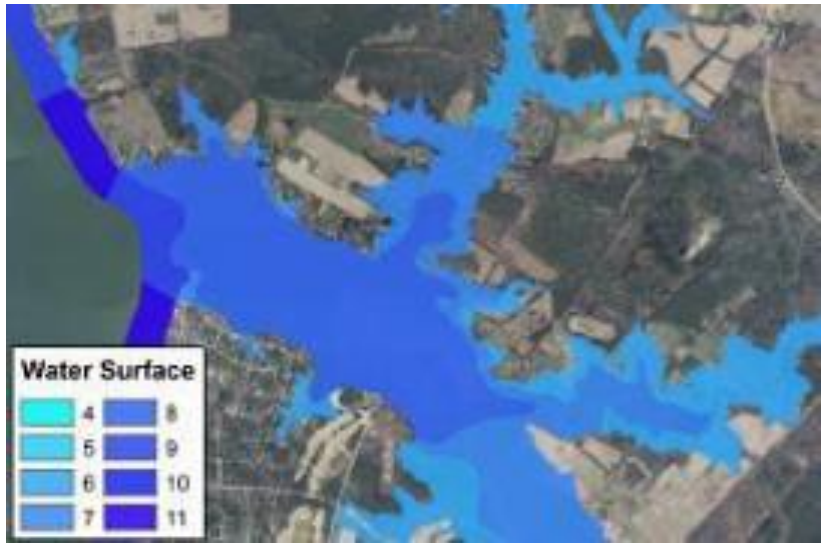
FEMA Flood Risk GIS Datasets

Flood Depth and Analysis Grids



Changes Since Last FIRM

Water Surface Elevation Grids



Flood Risk Assessment

Where to Find Flood Risk Data

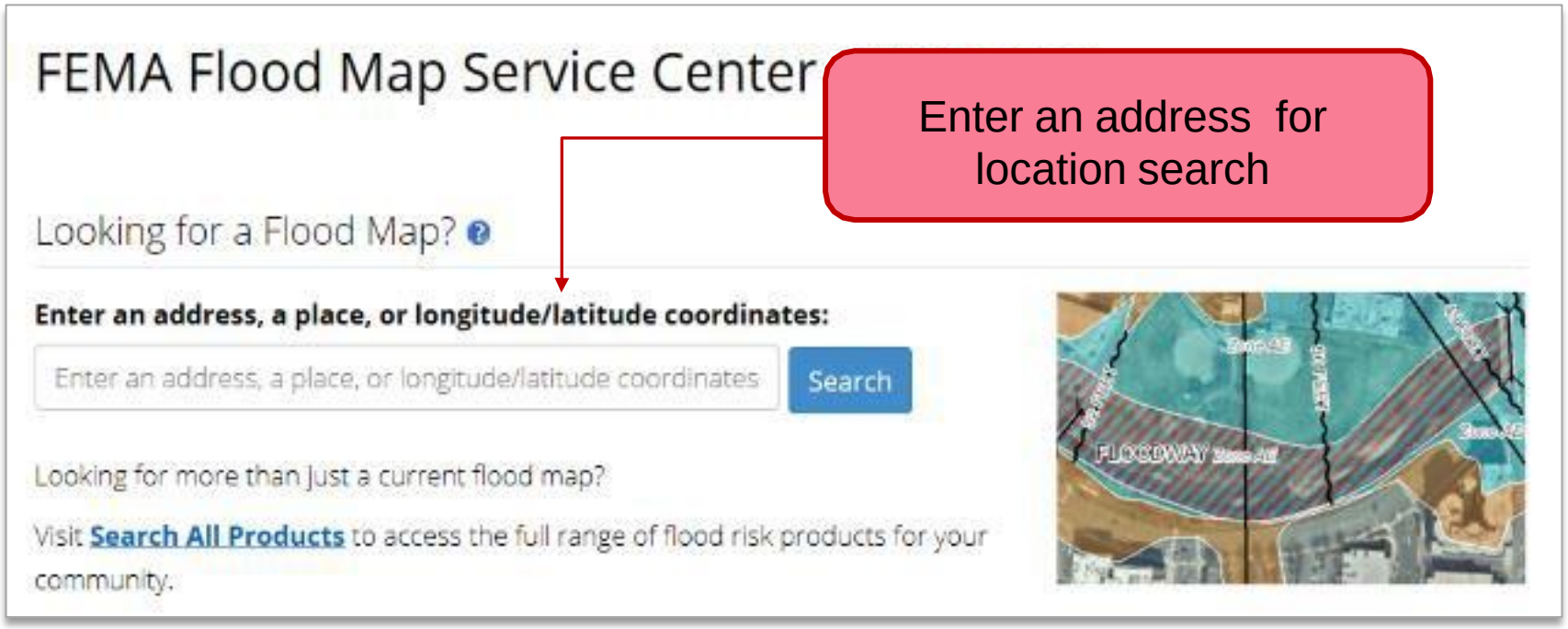
- FEMA's Flood Map Service Center (MSC)
  - Here, you can view effective maps online. You can also download current effective flood hazard data and additional hazard and risk data.
  - https://msc.fema.gov/portal/home

- National Flood Hazard Layer (NFHL)
  - This geospatial data viewer contains current effective flood hazard data.
  - https://www.fema.gov/flood-maps/national-flood-hazard-layer

- State Flood Tool
  - This geospatial data viewer contains current effective flood hazard data and additional hazard and risk data.

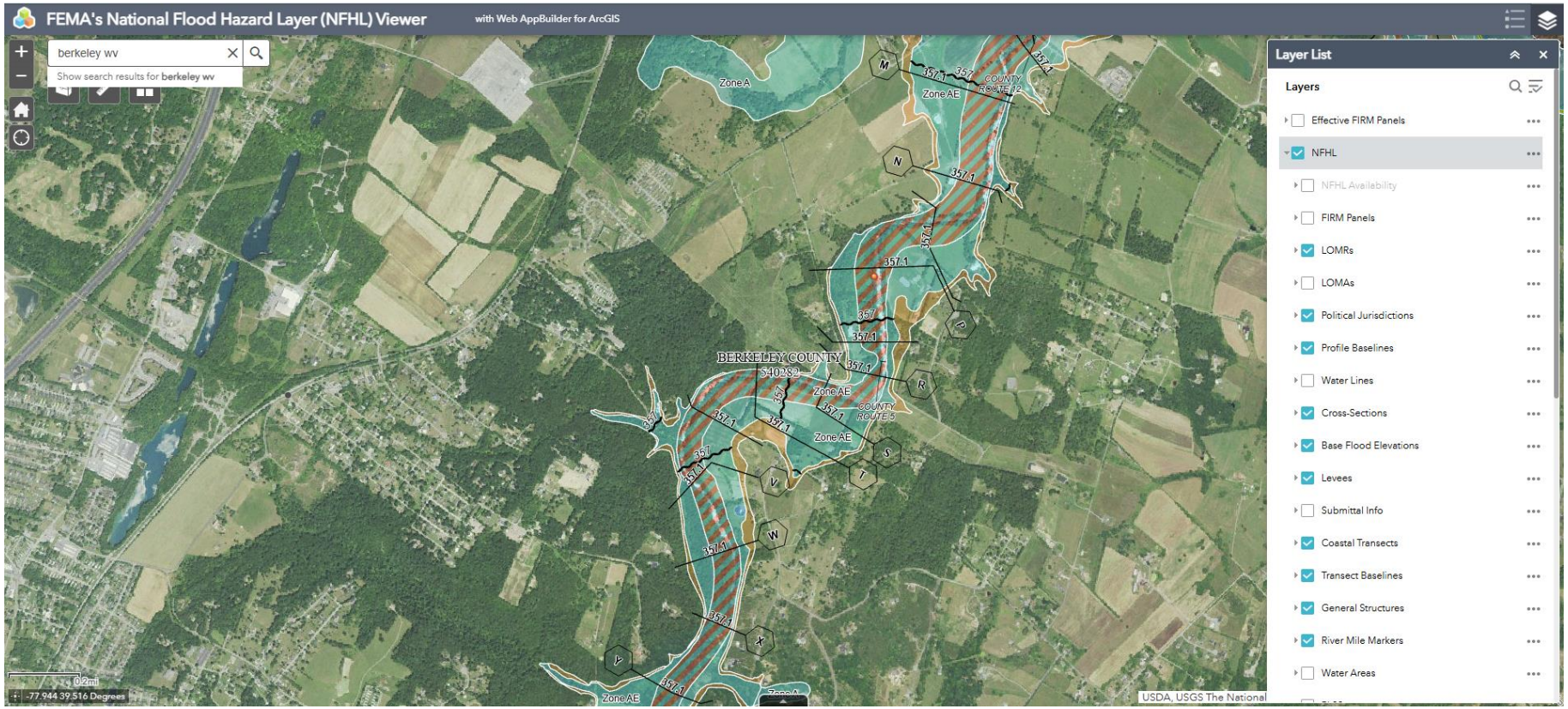
Where Can I Find My Flood Maps?

The FEMA Map Service Center (MSC) is the official public source for flood hazard information: https://msc.fema.gov/portal/home.



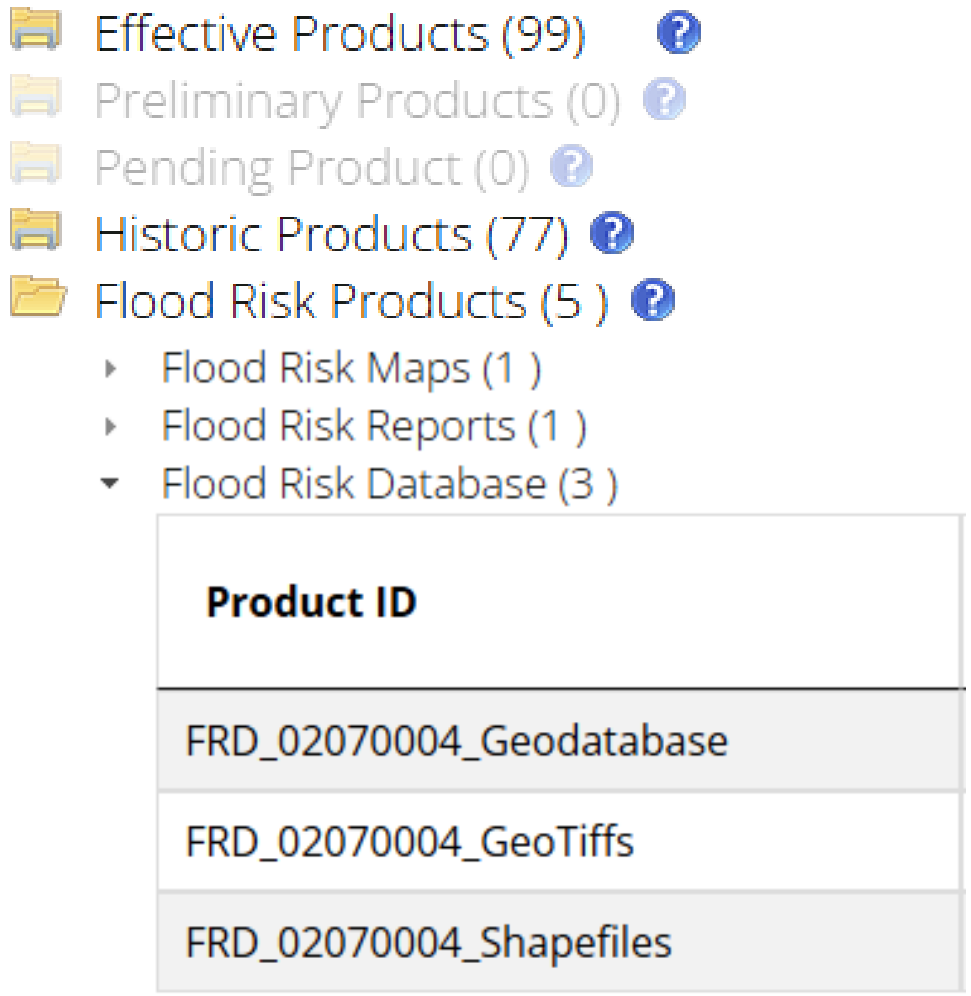
National Flood Hazard Layer

The NFHL shows the effective FEMA flood map data, including Letters of Map Revision (LOMRs).Visit https://www.fema.gov/national-flood-hazard-layer-nfhl for multiple options to view and download NFHL data.



Additional Hazard and Risk Data

If additional hazard and risk data are available for your community, the MSC Search Results will allow you to expand the Flood Risk Products folder.

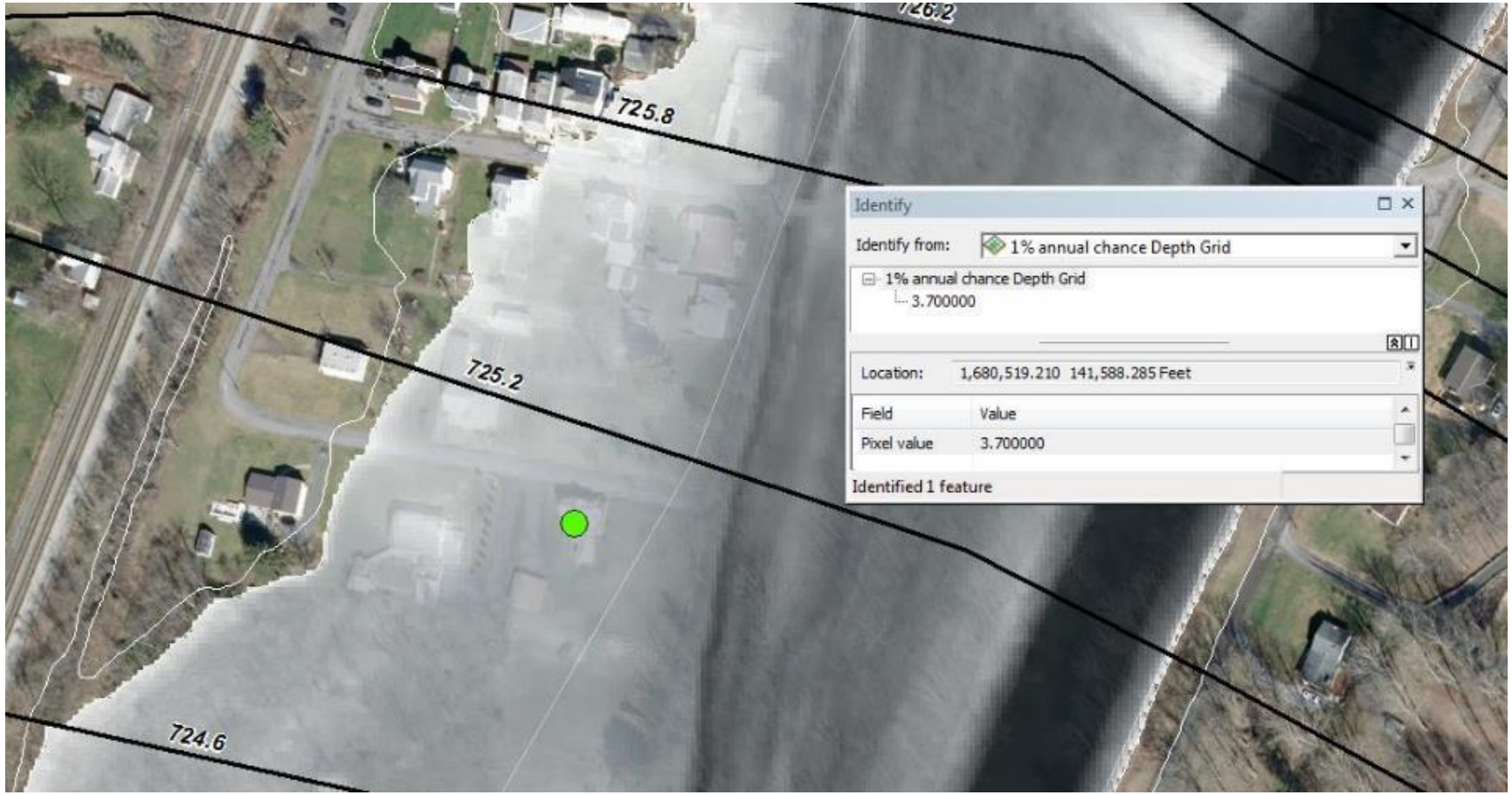


Water Surface Elevation Grids

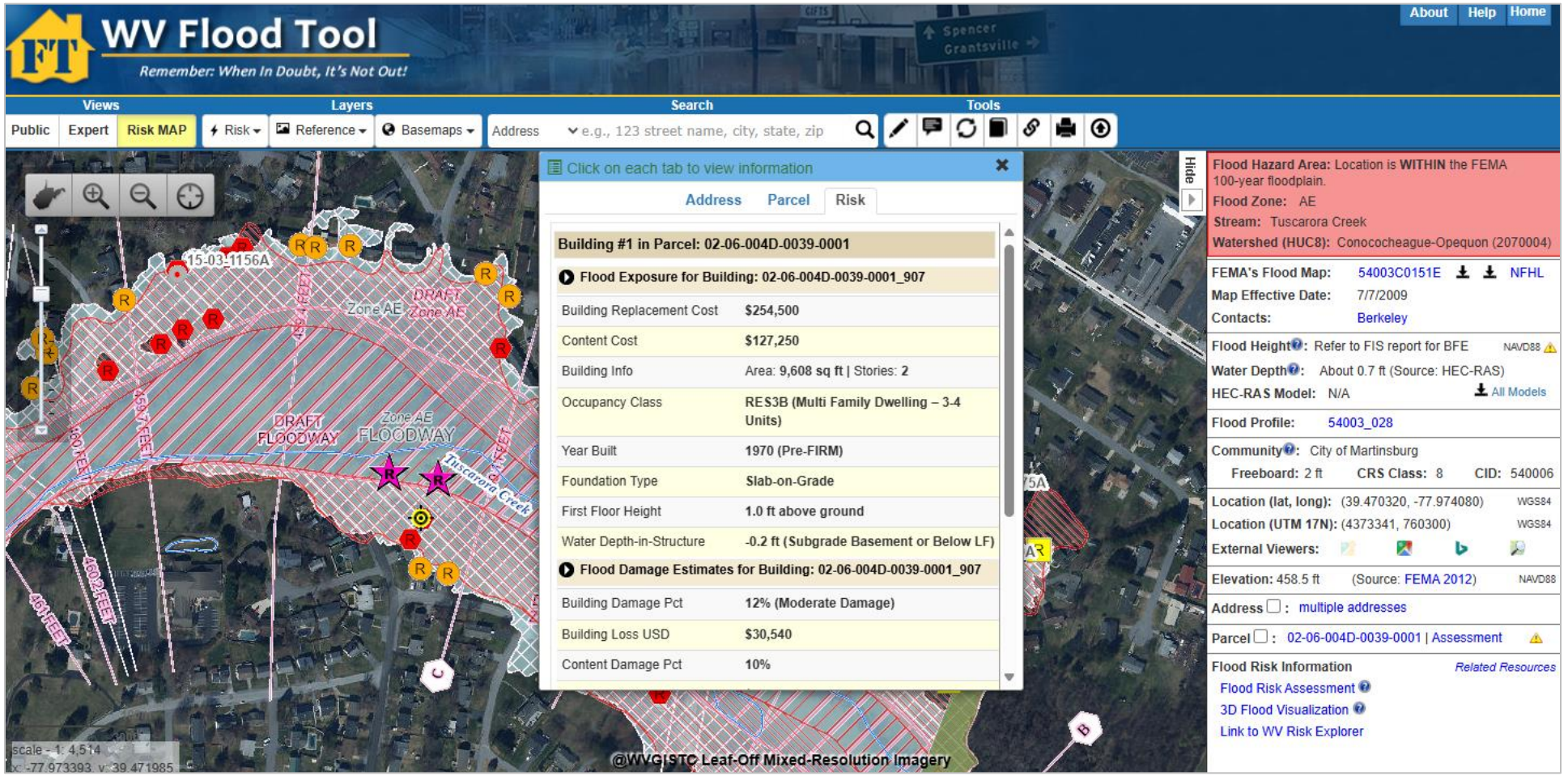
Represents the continuous water surface elevations (as determined at modeled cross sections and interpolated between cross sections) for each of the modeled flood frequencies.

Depth Grids

Represents the difference between the ground surface elevation and the water surface elevations in feet for each of the modeled flood frequencies.



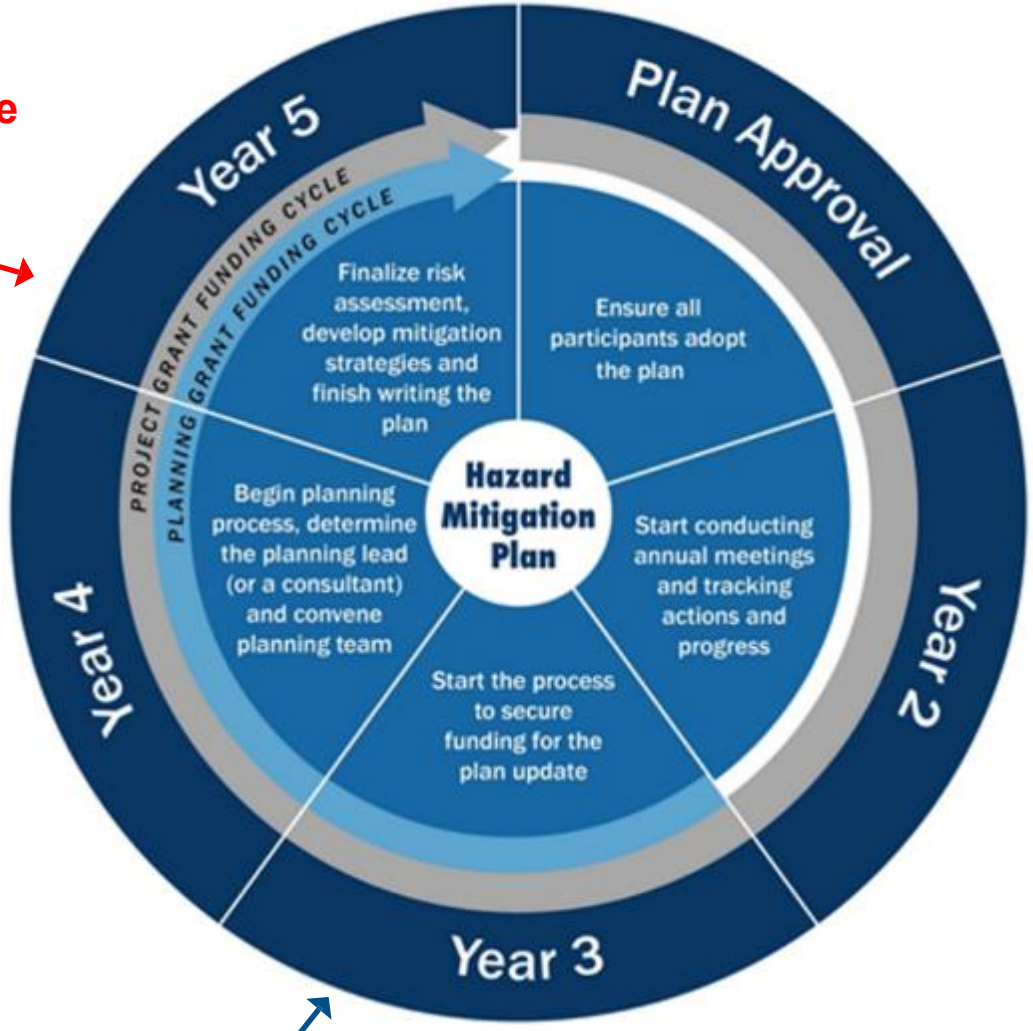
West Virginia Flood Risk Tool



[WV Flood Tool (mapwv.gov)]

Flood Hazard Mitigation Planning

It's time to update the risk assessment in your hazard mitigation plan

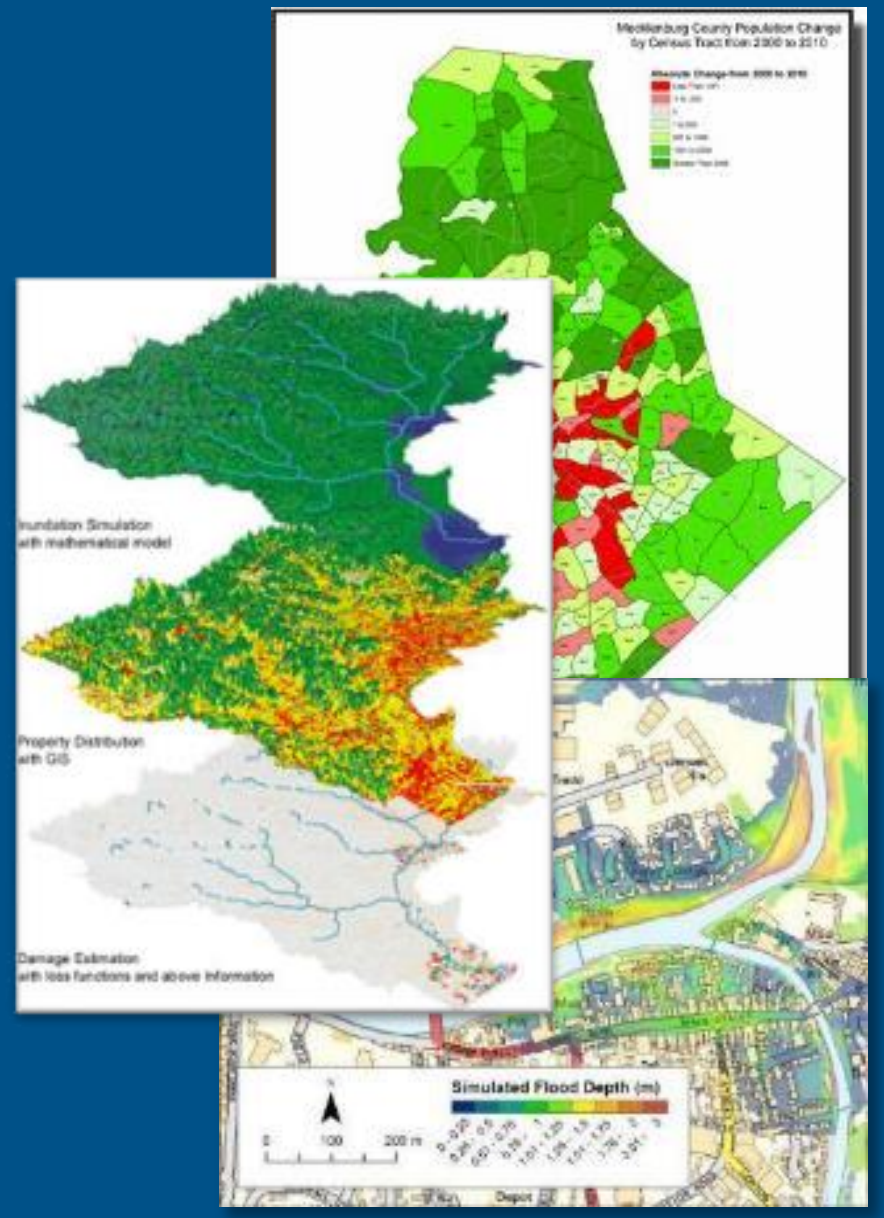


The Berkeley County HMP is here

FEMA

Using Flood Risk Data to Manage Development

- Structure-based depth of flooding analyses
- Prioritization of mitigation action
- Residential/commercial density in the floodplain
- Location/inundation area of historic events
- Properties with insurance policies and as a percentage of the population
- Areas of population growth
- Areas requiring protection



FEMA

Floodplain Management

Flood Risk Doesn't Stop at a Line

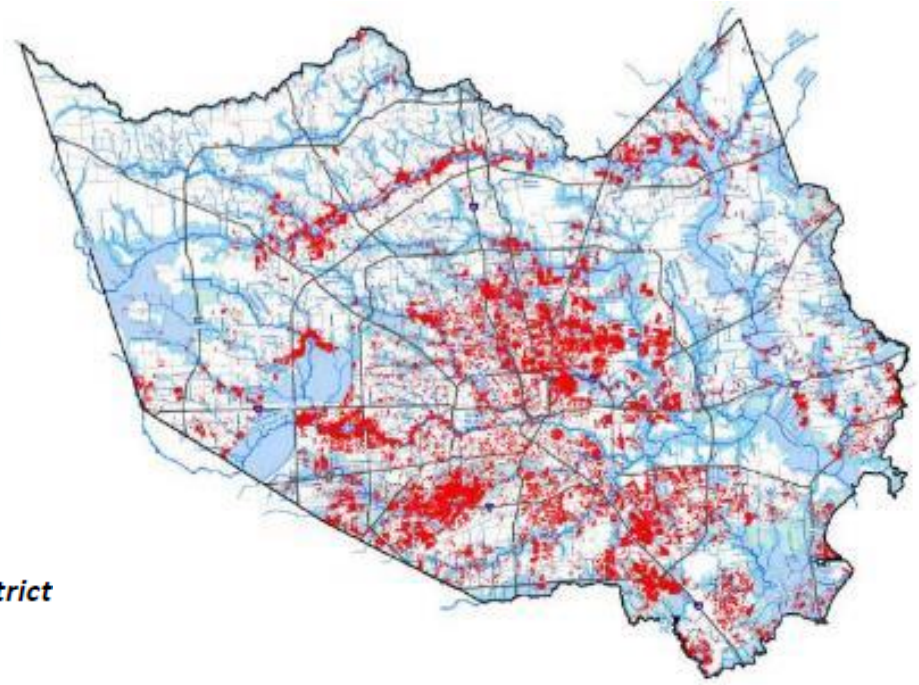
- 40% of all flood insurance claims come from outside high-risk areas.
- Your community can regulate to standards higher than the NFIP minimum standards. Consider strengthening regulations using:
  - 0.2%-annual-chance flood zone
  - "Freeboard" – require additional feet above a BFE
  - Buffer around SFHA
  - Flood depth grids

HURRICANE HARVEY
GREATER HOUSTON

154,170 Homes Flooded

32% < 100-yr
23% > 100 yr, < 500 yr
46% > 500 yr

SOURCE: Harris County Flood Control District



Floodplain Management at FRR

Look at where there are changes to the SFHA in your community

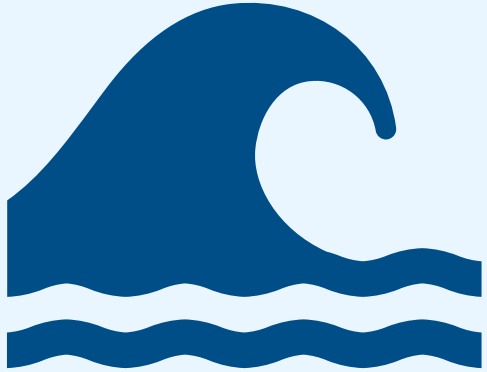
Share with permitting, planning, and other colleagues to direct development outside of the SFHA today and in future

Consider higher standards or joining the Community Rating System to support your community

FRR: Flood Risk Review
SFHA: Special Flood Hazard Area

Floodplain Management Big Picture

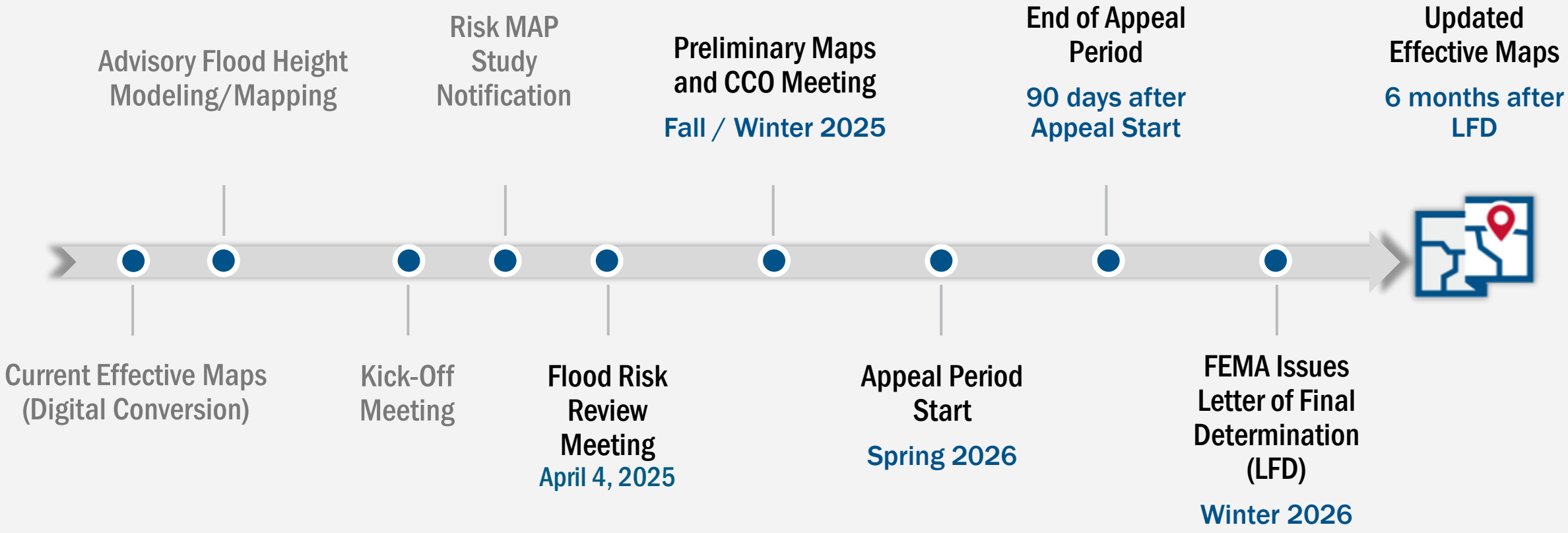
Build it right and lower the impact of future flood losses while improving resiliency



Build it wrong and the result could be increased flood losses and higher flood insurance premiums

Discussion

Timeline – Looking Ahead



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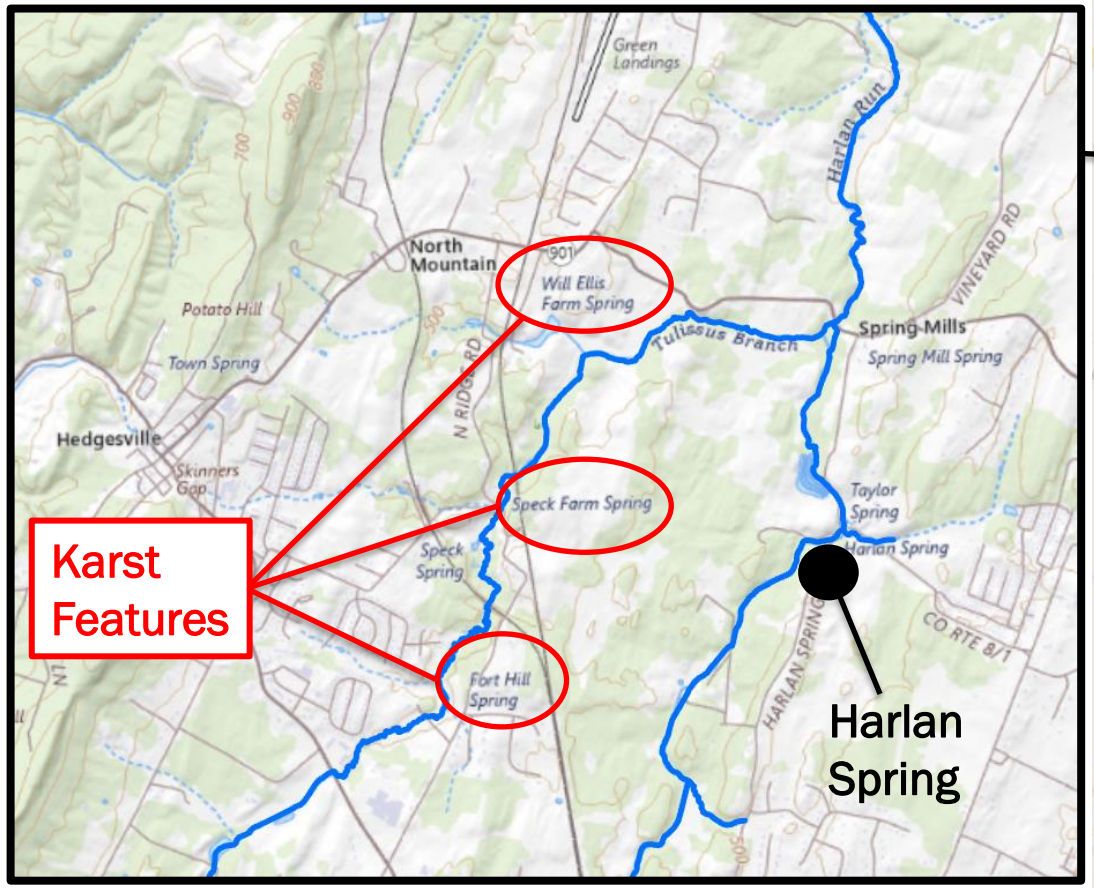
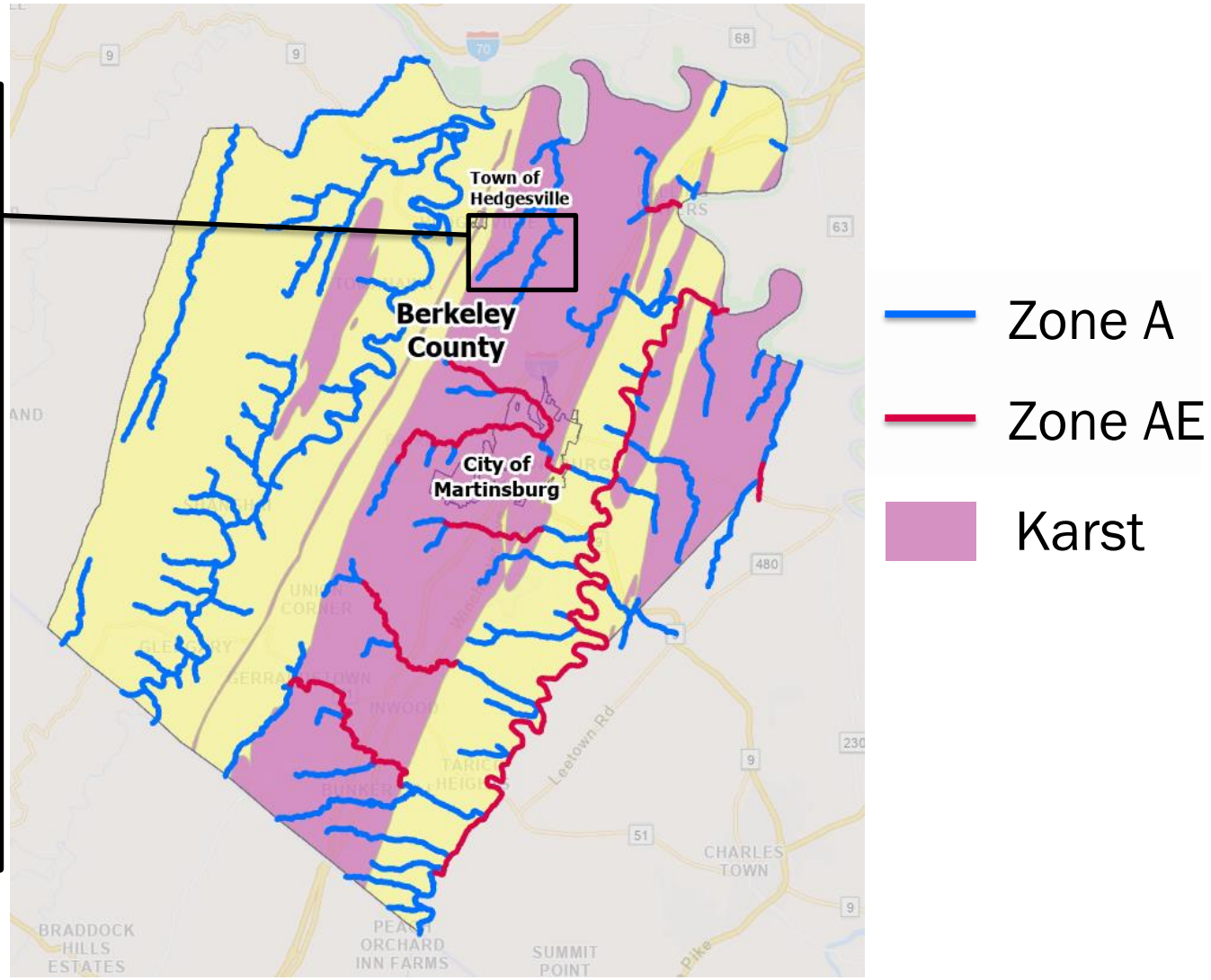
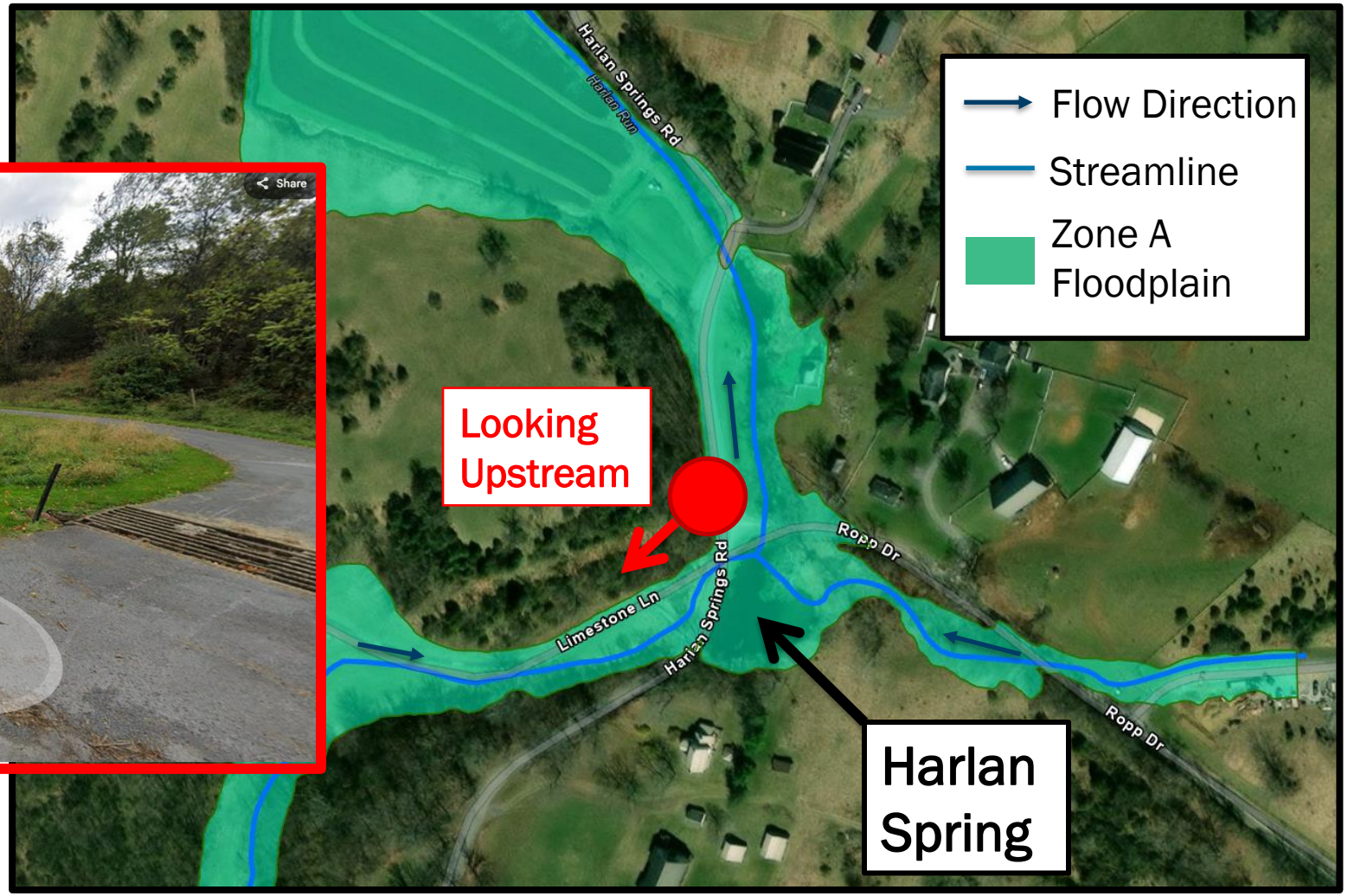
Karst in Berkeley County





Floodplain Mapping in Karst Areas: Harlan Spring Example



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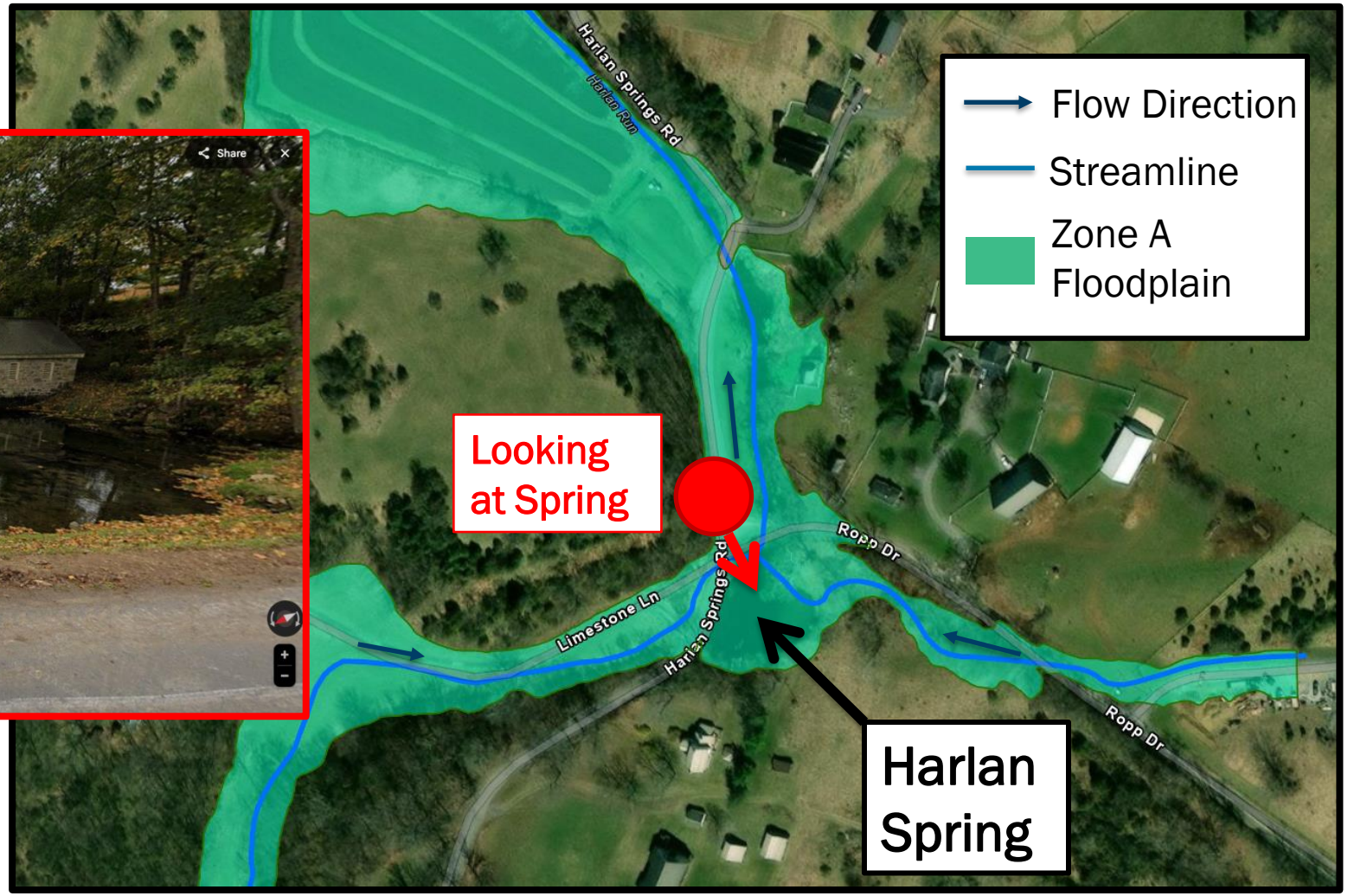

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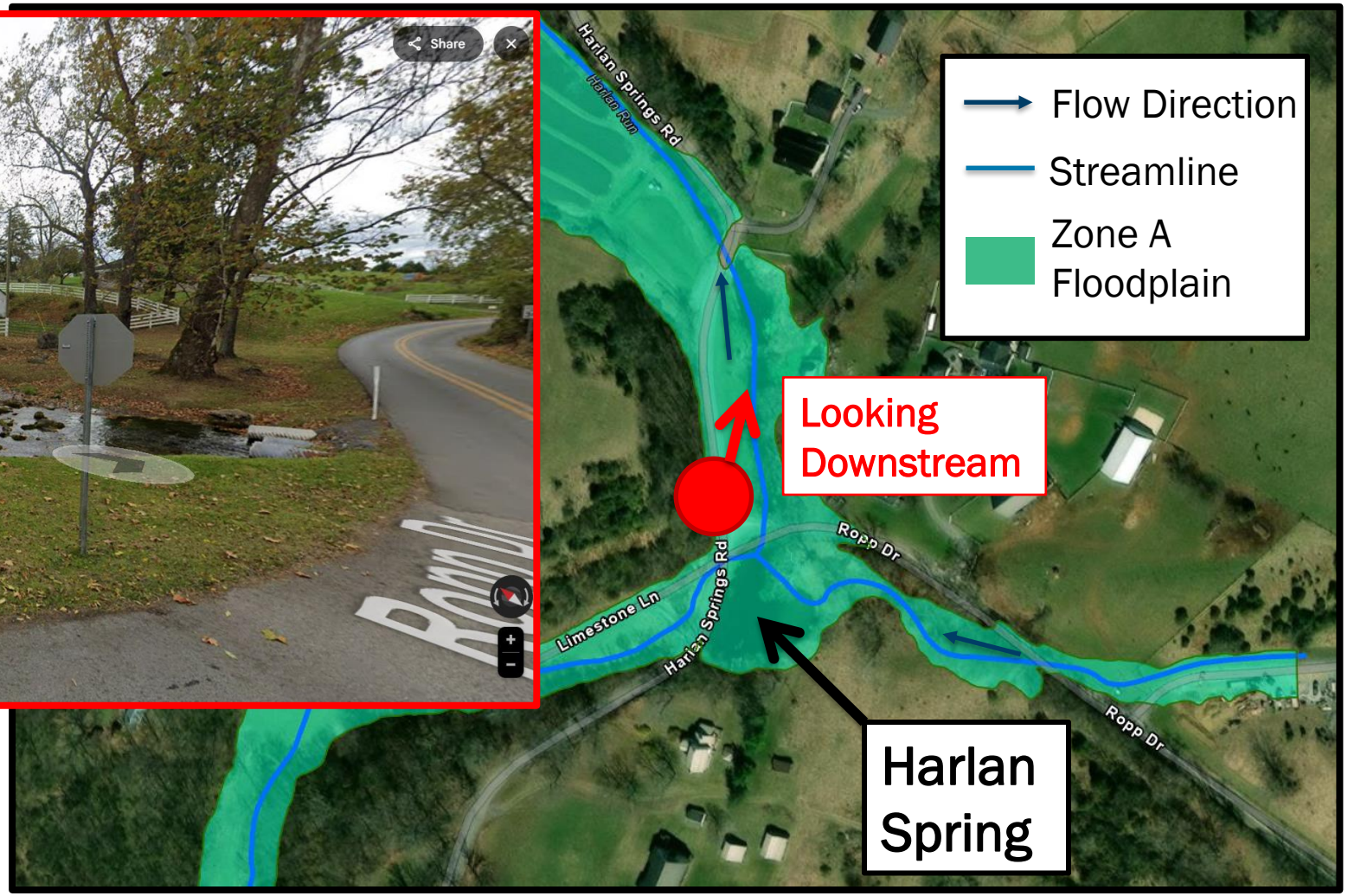

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