



Kurt Donaldson

Manager

West Virginia GIS Technical Center





West Virginia University

FEMA Coffee Break: Utilizing University Partnerships in Hazard Mitigation Planning

November 23, 2022

WVU Faculty Supporting Hazard Mitigation Projects

Partnerships among faculty members expand the subject matter expertise for hazard mitigation planning

HAZARD MITIGATION PROJECT	FUNDING SOURCE	FACULTY MEMBER	ORGANIZATION & EXPERTISE	LINK
Statewide Risk Assessments	HMGP, CTP	Kurt Donaldson 	WVU GIS Technical Center (online interactive map viewing applications, <i>TEIF/TEAL¹ risk assessments, flood visualizations</i>)	WV Flood Tool Statewide RA Products & Data WV Region 3 Plan w TEIF data
Landslide Susceptibility Modeling	HMGP	Aaron Maxwell 	WVU Geography Professor (<i>landslide modeling, machine learning, remote sensing</i>)	Published Landslide Paper
Flood Buyouts	NRCS	Katherine Garvey 	WVU Land Use and Sustainability Law Clinic (legal and planning services)	Region 3 Resilience Report WV Public Broadcasting
Community Recovery and Resiliency	NSF	Jamie Shinn 	WVU Geography Professor (<i>social science, community engagement</i>)	WV Public Broadcasting

¹ Total Exposure in Floodplain (TEIF), Total Exposure Area Landslide (TEAL)



FEMA



Example 1: Landslide Hazard Risk Assessment

Landslide damages Washington Bottom home, threatens others

LOCAL NEWS

APR 28, 2020

MICHAEL ERB
Staff Reporter
merb@newsandsentinel.com

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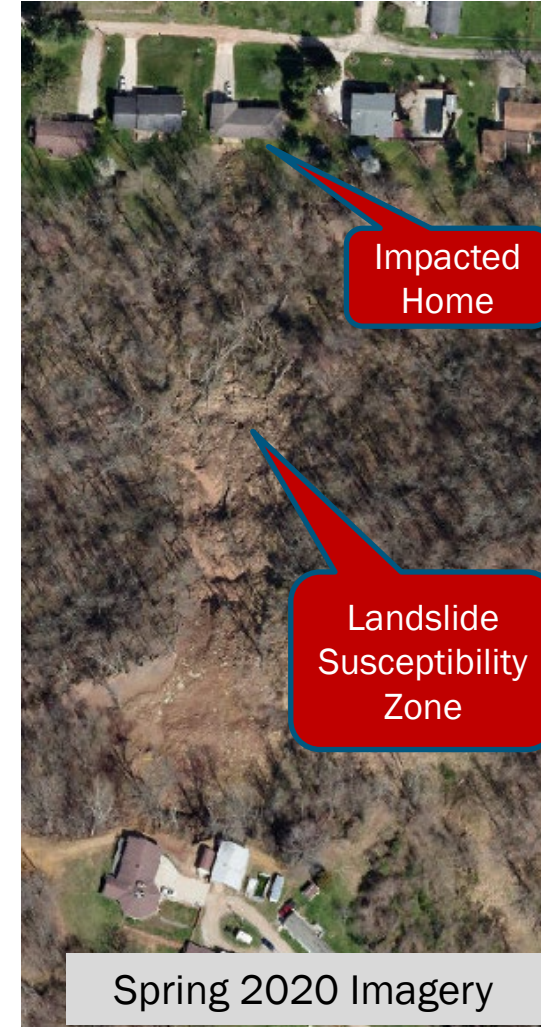
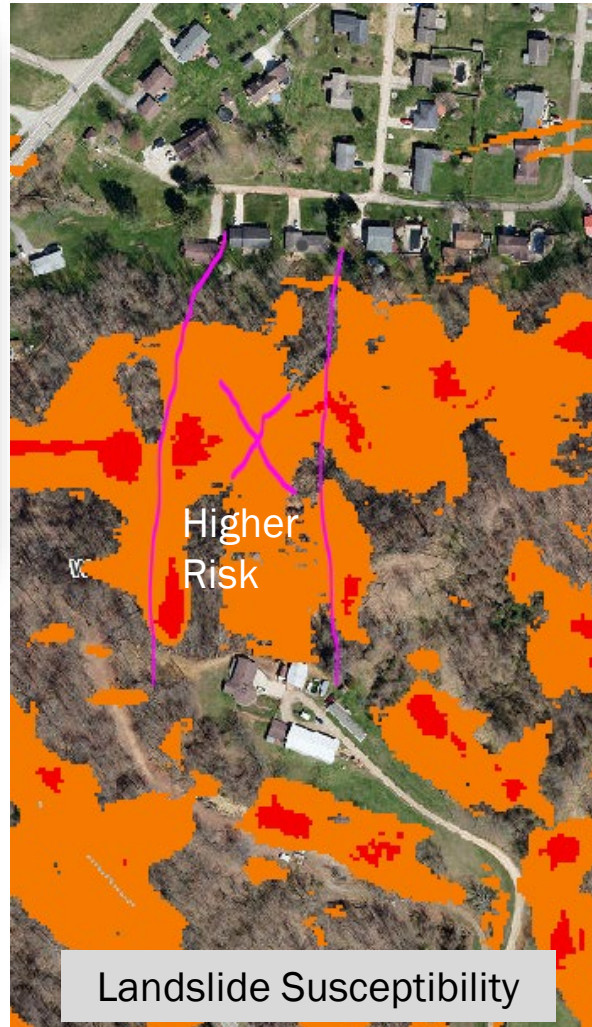


A landslide Sunday evening damaged a Washington Bottom home and forced the evacuation of several neighboring houses. (Photo by Michael Erb)

April 2020 Landslide

Wood County, WV

Impacted home moved from foundation



[WV Flood Tool](#)

[WV Landslide Tool](#)

A statewide *landslide susceptibility* (high, moderate, low risk) map was created from FEMA-purchased QL2 LiDAR data

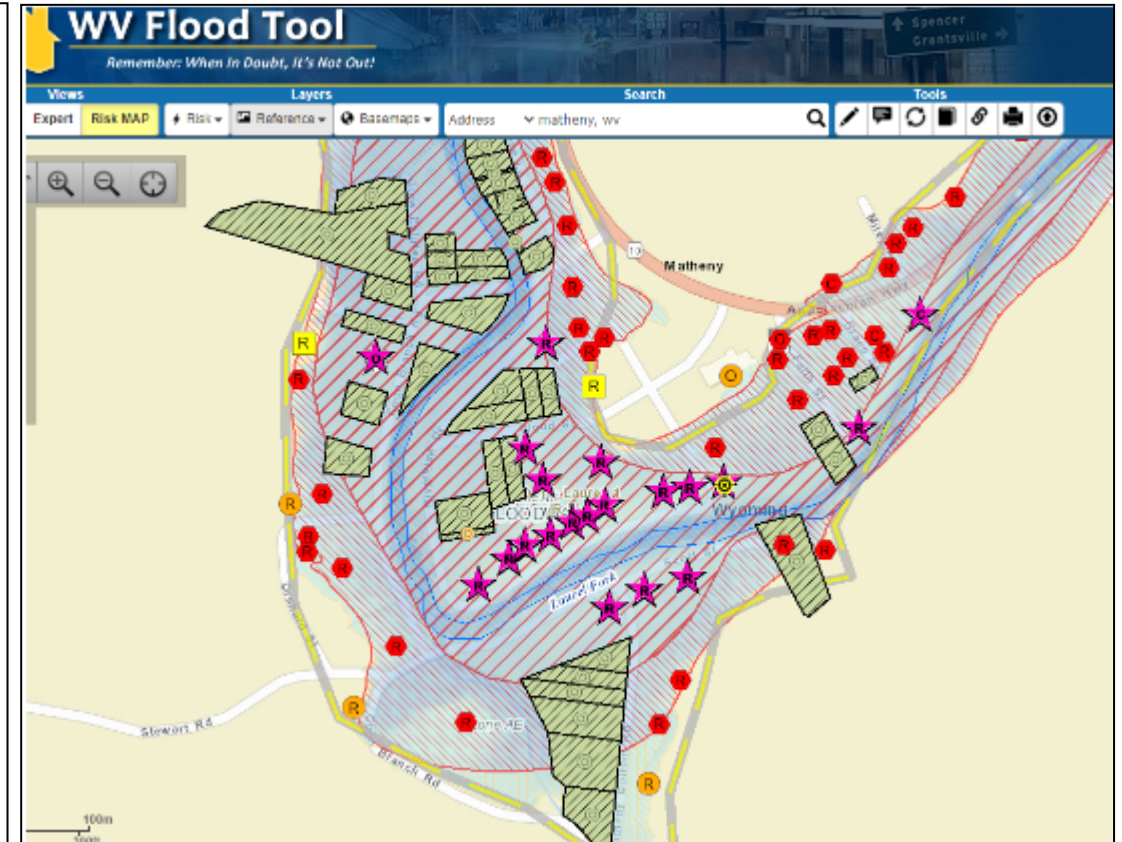
Example 2: Voluntary Floodplain Buyout Mitigation



Success Story: West Virginia Partnerships Drive Cost-Effective Mitigation

In 2018, the West Virginia University (WVU) Land Use and Sustainable Development Law Clinic began assisting the Natural Resources Conservation Service (NRCS) in watershed planning for McDowell County. Frequent flooding occurs in the Elkhorn Creek/Tug Fork River watershed and causes major damage to structures and infrastructure. The NRCS, the Land Use Clinic, and other local sponsors worked together to study the costs and benefits of a voluntary floodplain buyout project. Using data available through the [WV Flood Tool](#) saved time and money.

The Land Use Clinic and NRCS used data from the WV Flood Tool to identify the highest priority areas for buyouts and estimate damages to individual properties. Data gathered from the WV Flood Tool included information related to flood zones, structure type, flood depth, and real estate values. WVU also collected Total Exposure in Floodplain (TEIF) and Total Exposure Area Landslide (TEAL) structural-level data. This information helped the NRCS identify a list of 310 properties that would meet the goal of reducing flood damage. 30 properties may be eligible to participate in a voluntary buyout program.



[FEMA R3 Resiliency Report](#) | [WVPBS](#) | [Buyout Report](#)

[WV Flood Tool: Building-Level Risk Assessments](#)

Risk assessments using FEMA's Hazus methodology helped NRCS identify 310 properties in McDowell County for flood buyouts

Example 3: Community Hazard Planning (Focus Group Meetings)



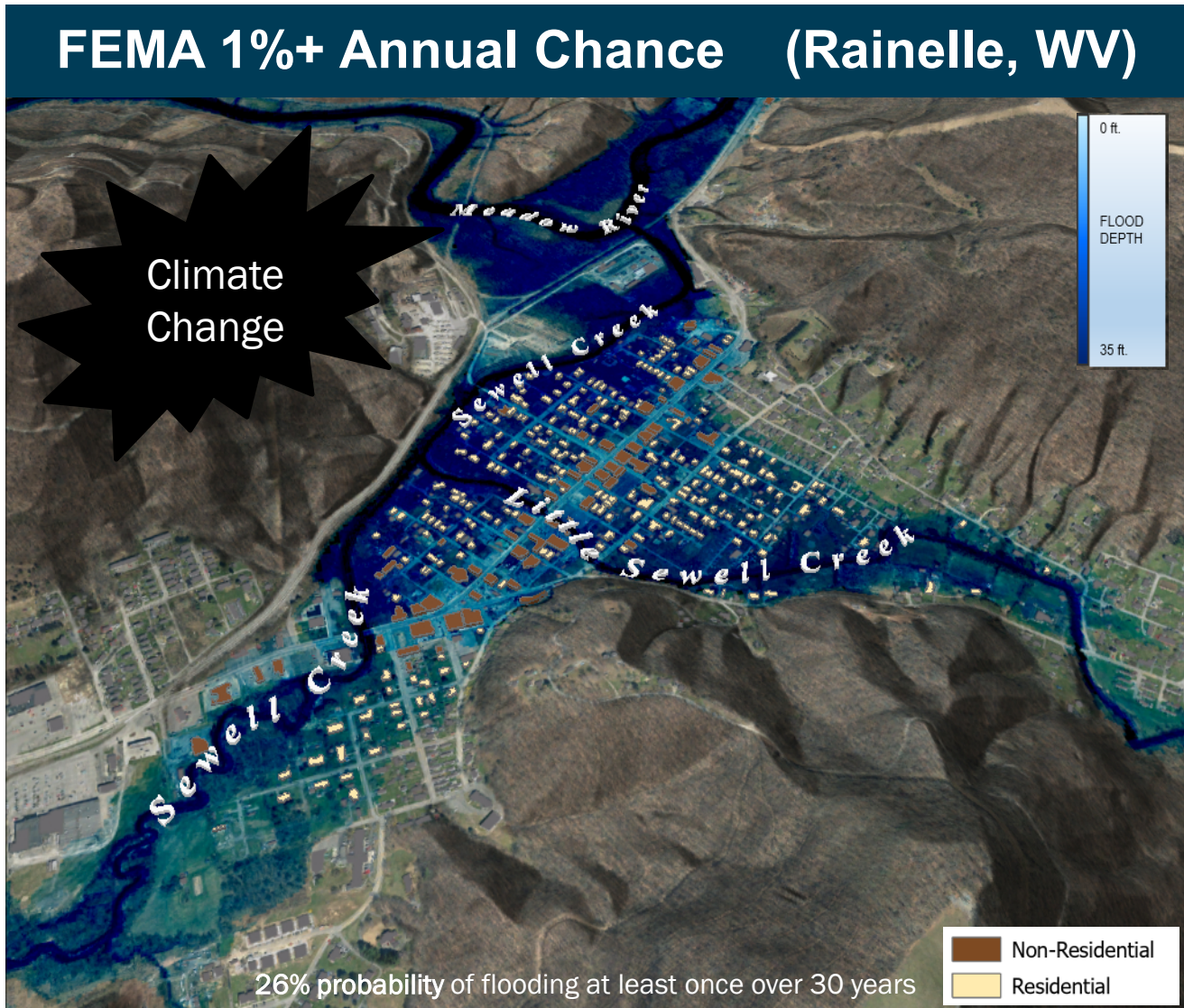
■ Feedback desired from Focus Groups:

- What lessons were learned from the immediate response and longer-term recovery from the 2016 flood?
- What priorities are needed for a stronger flood response and recovery plan in the event of a future flood?

■ Feedback of Flood Study Products:

- Flood Characteristics and Models
- Flood Risk Assessment (vulnerability, exposure, loss)
- Mitigation Maps
- Flood Visualization Tools









Example 3: Community Hazard Planning (Flood Characteristics)



Category	Flood Characteristic (in context to 2016 Flood)	White Sulphur Springs	Rainelle
Frequency (new flood maps)	<p>Probability that a flood of a specific size will be equaled or exceeded in any given year.</p> <p>FEMA Flood Models (new): 10-, 25-, 50-, 100-, 100+, and 500-year flood elevations.</p> <p>First Street Foundation Flood Models: 5-, 20-, 100-, and 500-year flood elevations.</p>	<p><u>2016 Flood</u> Between 100- and 500-year</p> <p><u>FEMA Climate BFE+6ft</u></p> <p><u>FSF Climate 2052 or 30 years in the future</u></p>	<p><u>2016 Flood</u> Between 100- and 500-year</p> <p><u>FEMA Climate BFE+1ft</u></p> <p><u>FSF Climate 2052 or 30 years in the future</u></p>
Depth	Flood depth. Source USGS high-water marks	6 feet	8 feet
Velocity	Speed at which the floodwaters are flowing	High	Moderate
Duration	Measure of how long water remains above normal levels	24 hours	72 hours
Rise and Fall	Floodwater that rises very quickly with little or no warning	Quick Rise	Quick Rise

Example 3: Community Hazard Planning (Risk Indicators)

Social Vulnerability Indicators White Sulphur Springs and Rainelle

Vulnerability Indicators	White Sulphur Springs	Rainelle	State Ratio	National Ratio
 Poverty Rate	14.4%	37.0%	17.3%	12.9%
 Unemployment Rate	21.4%	33.6%	23.8%	14.7%
 Vulnerable Ages Ratio	41.7%	39.8%	30.8%	28.3%
 Disability Ratio	17.8%	26.9%	18.7%	13.0%
 Population Growth Ratio	-9.1%	-20.9%	-3.2%	7.4%
 Renter-Occupied Ratio	42.8%	43.0%	26.8%	36.0%
 Housing Values Less than \$50K	3.9%	37.5%	16.9%	6.6%
 Housing Median Value	\$125,700	\$59,400	\$119,600	\$229,800

The red texts show more than 5% of difference, to the vulnerability side, from the state ratios.

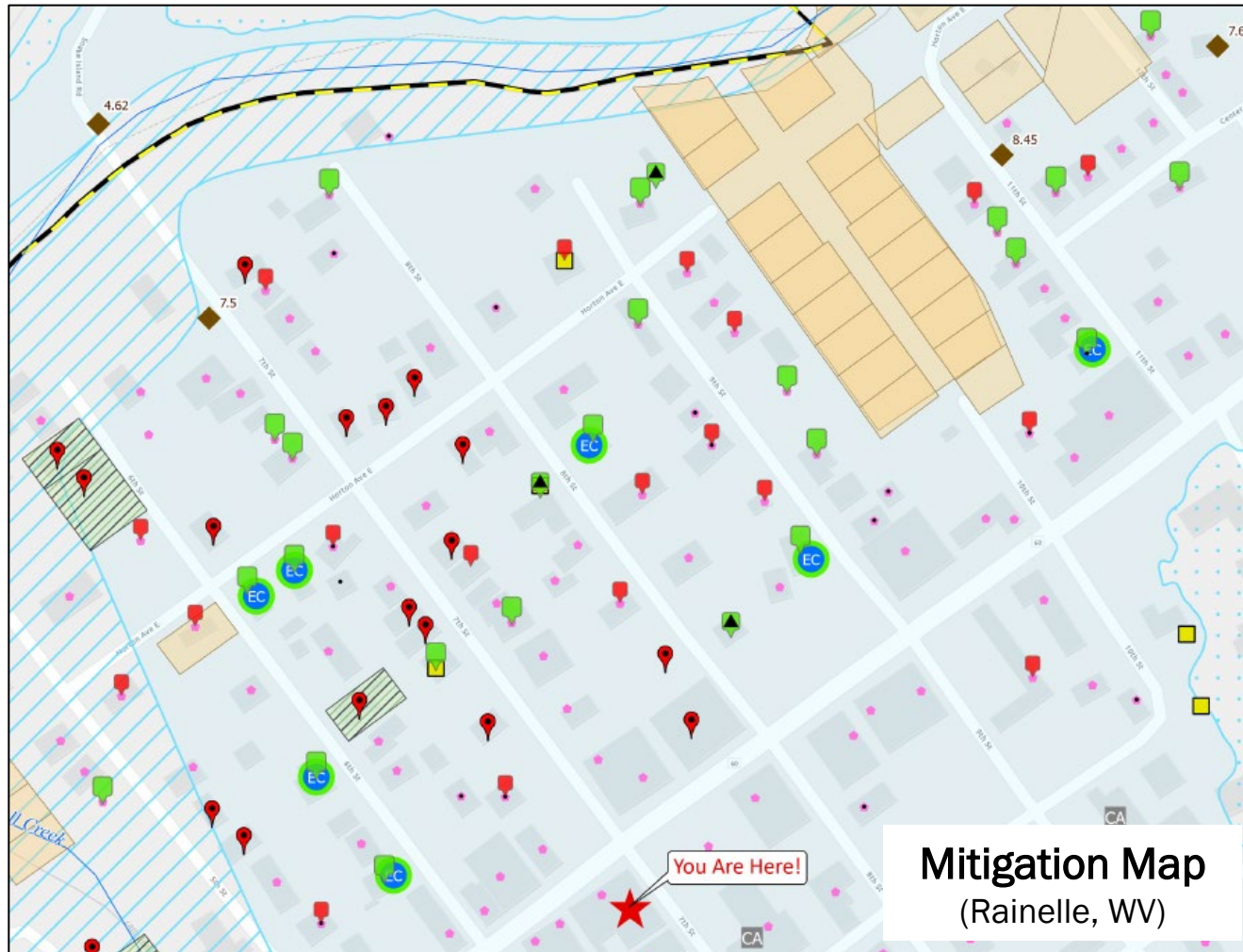
Building/Parcel Exposure White Sulphur Springs and Rainelle

Category	Exposure Indicator	White Sulphur Springs	Rainelle	Ratio* in WV Incorporated Areas (2021)
Buildings by Flood Zone (Count & Value)	Total Primary Building Count in Floodplain	423 (Rank***: 12 th)	338 (Rank: 18 th)	59 (Median)
	Building Ratio b/w Floodplain & Community Total	26%	34%	9%
	Total Primary Building Value in Floodplain of Community	\$40,881K (Rank: 16 th)	\$16,120K	\$6,417K (Median)
	Median Building Value in Floodplain	\$49K	\$38K	\$42K
	Building Count in Floodway** (High Velocity)	65 (Rank: 13 th)	9	12 (Avg.)
	Percent Building Count in Floodway** (High Velocity & Depth)	15%	3%	8%
	New Maps: Bldgs. "Mapped In" SFHA	72 (Rank: 12 th)	329 (Rank: 3 rd)	19 (Avg.)
	New Maps: Bldgs. % Count "Mapped In" SFHA	17%	97%	14%
	New Maps: Bldgs. "Mapped Out" SFHA	118 (Rank: 8 th)	0	19 (Avg.)
	New Maps: Bldgs. % Count "Mapped Out" SFHA	28%	0%	14%

*Vulnerability, Exposure, and Hazus Loss Indicators
for the disadvantaged communities of Rainelle and White Sulphur Springs*



Example 3: Community Hazard Planning (Mitigation Measures)



Mitigation Measures

Category	Mitigation Indicator	White Sulphur Springs	Rainelle
Mitigated Structures	Mitigation Reconstruction or Elevated Structures to Design Flood Elevation (DFE)	15	45
	Rehabilitated/Repaired Structures	394	278
	Unmitigated Low Value Structures	14	49
	Structures Removed (vacant parcel)	394	278
Open Space Preservation	Buyout Parcels (Deed Restricted)	16	18
	Community-Owned Vacant Parcels	66	88
	Area of Open Space Preservation (OSP)	5 Acres	3 Acres
	Ratio of Open Space Preservation (OSP to SFHA)	2.6%	4.5%
Building Value Recovery	Net Value 2016-2022 Tax Assessment Value	+ \$6.1 Million	- \$1.0 Million
Loss Avoidance 100-year Flood	Loss Avoidance by Elevating or Removing Structures (preliminary results)	\$2.6 million	\$2.3 million

Damaged or Demolished Buildings

- Structure Removed Post-2016 Flood (n=41)

Mitigated Properties

- Mitigation Reconstruction to DFE* (n=35)
- Mitigation Reconstruction not to DFE* (n=6)
- Elevation Certificate (n=11)
- Buyout Property (n=18)
- Open Space Preservation (Community-Owned)*** (n=88)

Unmitigated Properties

- Low Building Value (n=49)
- Repaired Structure** (n=311)

Significant Structures

- Essential Facility (n=1)
- Community Asset (n=7)

Vulnerable Structures

- Manufactured Home (n=14)
- Subgrade Basement (Full & Part)

Preliminary 1% Annual Chance Floodplain

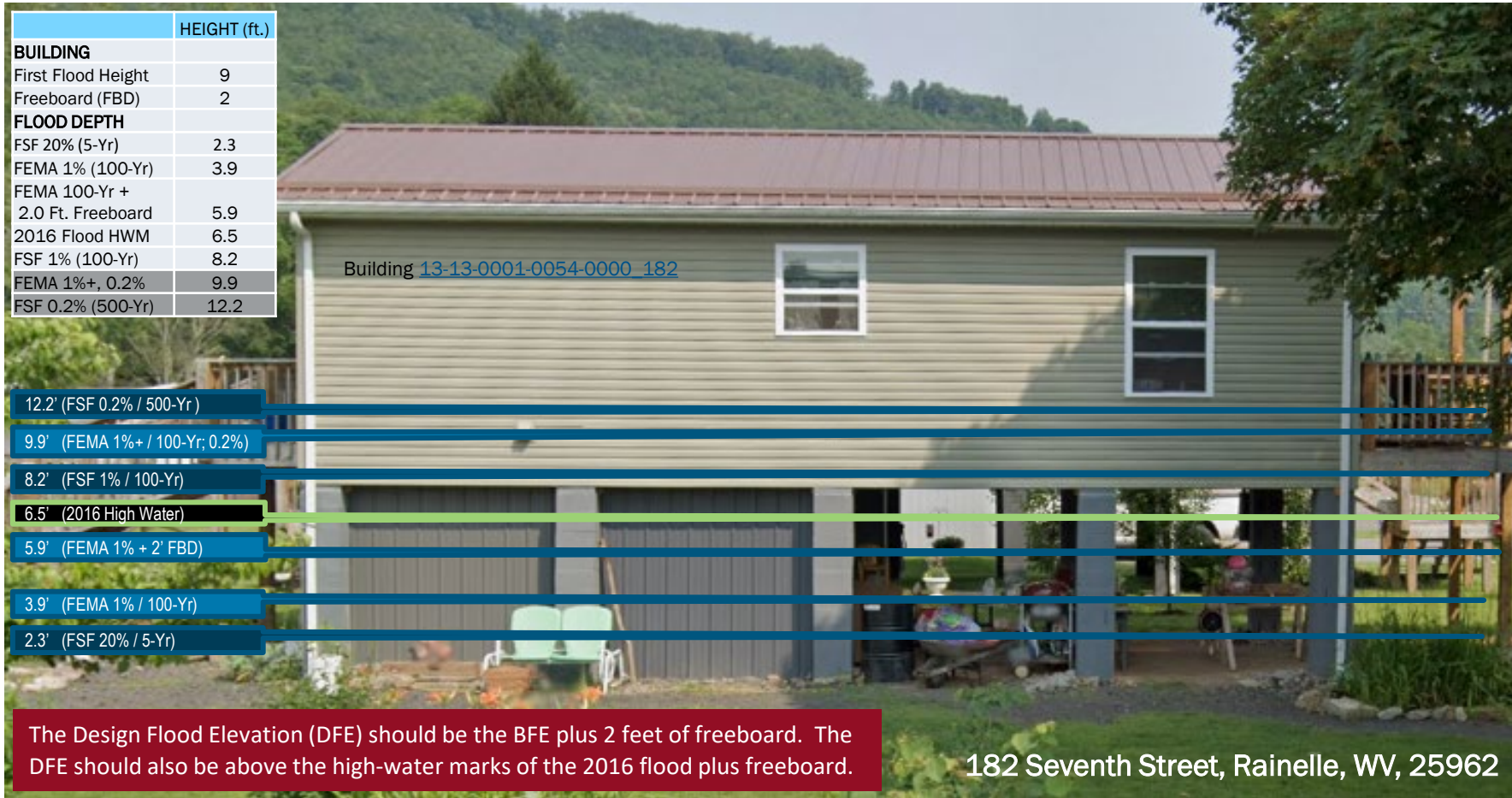
- Zone AE
- 0.2% Annual Chance Floodplain
- Zone AE - FLOODWAY

Other

- Stream Line
- Municipal Boundary
- 2016 High Water Mark (ft) (n=32)

Field verification and analysis of mitigation measures implemented by property owners and the community in context of the 2016 flood and local floodplain management regulations

Mitigation Reconstruction: Resiliency to Future Floods (Climate Change)



Flood Depths marked on Mitigated Structure

- FEMA
- First Street Foundation (FSF)
- USGS 2016 Flood High Water Mark



How well are mitigated structures protected from changing environmental factors due to climate change? The new FEMA flood maps for Rainelle reveal that the mitigated structure above is a risk for the 1%+ (100-yr) and 0.2-percent chance (500-yr) floods.