



West Virginia Risk Explorer

Localized risk assessment tools for analysis and visualization

Highlights for Emergency Management

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West Virginia Emergency Management Council Conference

October 2025



WV GIS Technical Center
West Virginia University



WV Flood Resiliency Framework (WVFRF)



A virtual hub of risk assessment, visualization, planning, and training resources for building community flood resiliency in WV

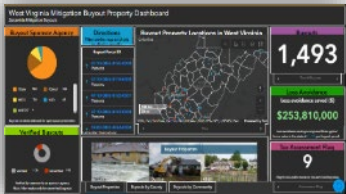
Flood Visualizations



WV Flood Tool



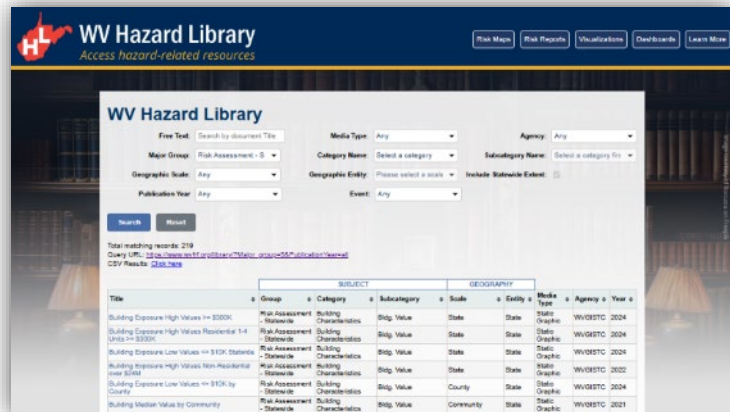
Flood Dashboards



WV Risk Explorer



Example Tools



Hazard Library

RISK TOOLS

- WV Risk Explorer
- WV Flood Tool
- Visualizations
- Dashboards

9 Geographic Scales

COMMUNITY ENGAGEMENT

- Focused Outreach Meetings
- Flood Symposium
- Resiliency Tools & Products
- Learning Resources & Reports



Community Engagement Meeting

HAZARD LIBRARY

Search online hazard resources by title, subject, media, event, geography, data, etc.

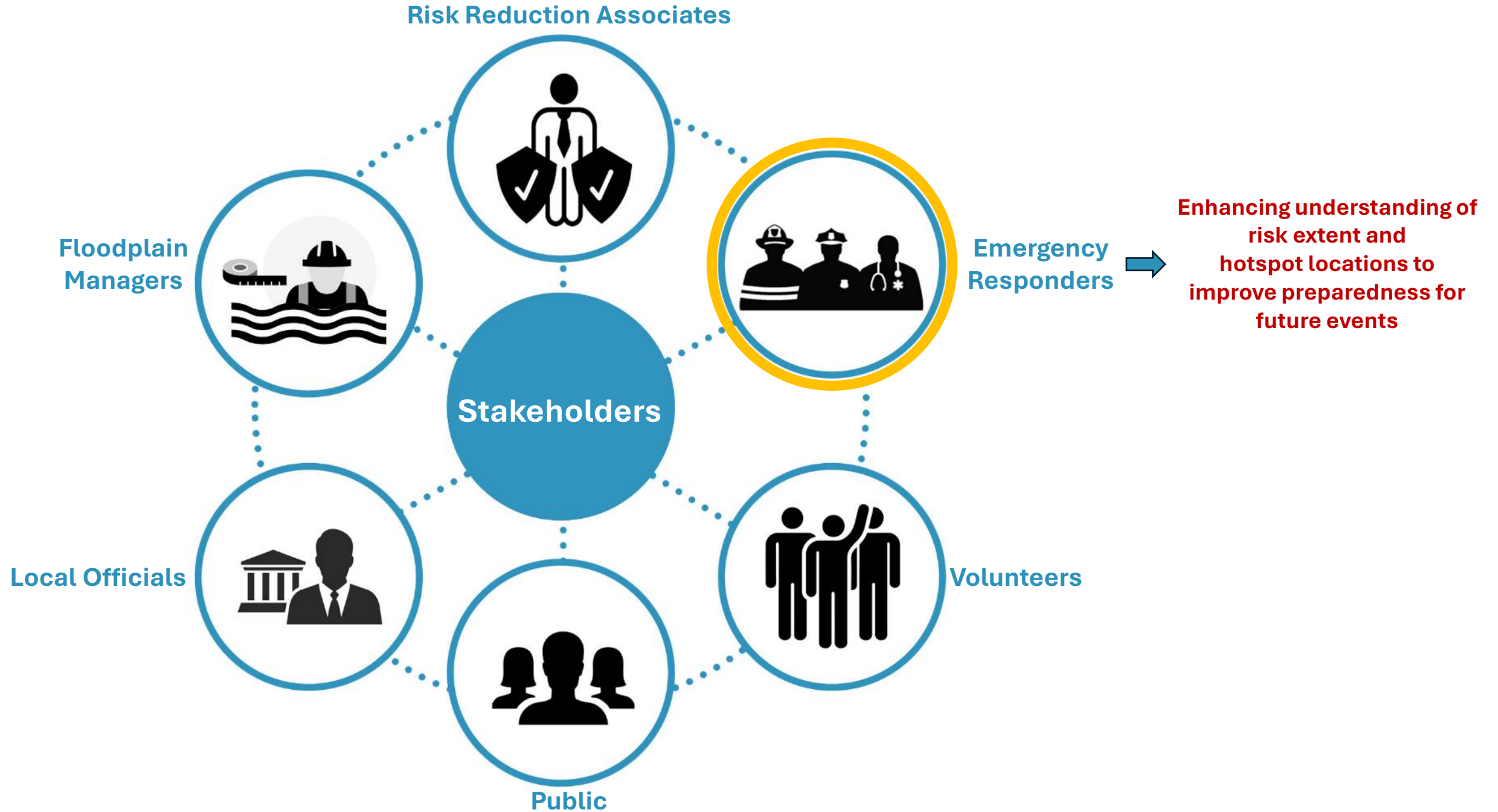
STAKEHOLDERS

- Risk Reduction Associates
- Emergency Responders
- Floodplain Managers
- Local Officials
- Volunteers
- Public



Flood Symposium Stakeholders

Stakeholders



WVFRF (BETA)

[PROJECT OVERVIEW](#) [WV RISK EXPLORER](#) [WV FLOOD TOOL](#) [CONTRIBUTORS](#) [CONTACT US](#)

WEST VIRGINIA FLOOD RESILIENCY FRAMEWORK



Image courtesy of The Atlantic

A virtual hub of risk assessment, visualization, planning, and training resources for building community flood resiliency in West Virginia

PRIMARY TOOLS



WV Risk Explorer



WV Flood Tool



WV Property Viewer



WV Hazard Library

WV Floodplain Building Inventory (BI)



Riverine Flood Exposure Assessment (Building-Level)

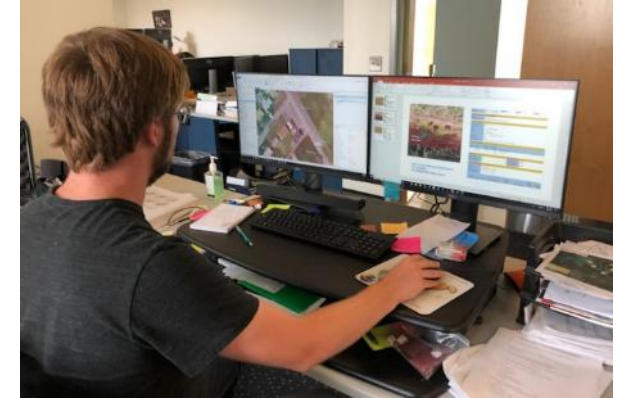
Funded by: FEMA Hazard Mitigation Grant Program (HMGP) and State Hazard Mitigation Office

- All primary (insurable) structures in FEMA's 1%-annual-chance (100-yr) floodplain
- Community Assets (Historical & Non-Historical) in the 100-yr floodplain
- Essential Facilities in the 100-yr and 500-yr floodplains

Essential Facilities



Community Assets



Detailed building characteristics from tax assessment

+

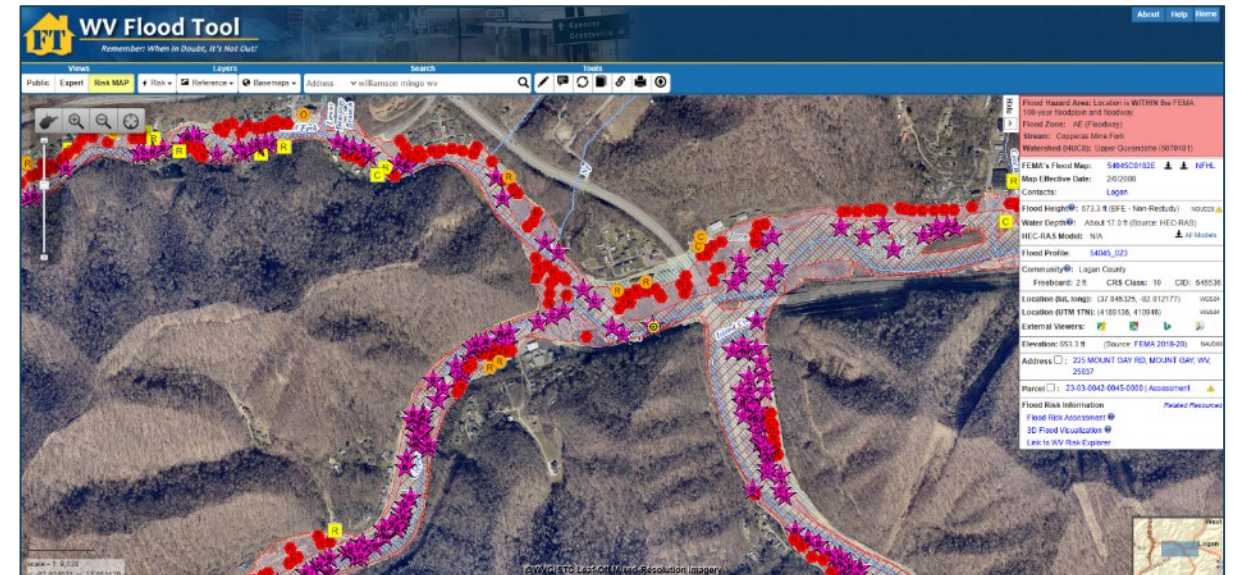
Population exposure and displacement estimates (100-yr flood)

Manual process of identification using Arc GIS

+

Programmed scripts to extract and process data

Product: WV Flood Tool  mapwv.gov/flood



Analytical & Visualization Tools at Multiple Scales



Political Boundaries

State



PDC Regions (11)



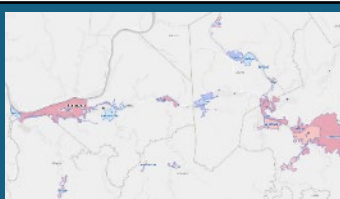
Counties (55)



Communities (284)



**Incorporated
Places
(229)**



**Unincorporated
Areas
(55)**



Drainage Areas / Streams

**Watersheds
(33)**



**Streams/Rivers
(156)**

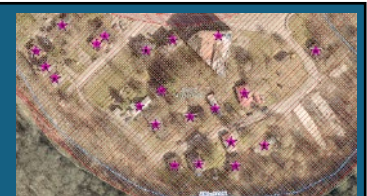


Property Levels

Parcels



Buildings



Overall Flood Risk

(1) FLOODPLAIN CHARACTERISTICS

Floodplain Area

Floodplain Length^{1 2}

Floodplain Depth^{1 2}

Flood Disaster Frequency

(2) BUILDING EXPOSURE

Building Floodplain Count^{1 2}

Building Floodway Count^{1 2}

Building Floodplain Ratio²

Building Density^{1 2}

(3) BUILDING CHARACTERISTICS

Building Value^{1 2}

Mobile Homes

Basement

One Story

Building Year*

(4) CRITICAL INFRASTRUCTURE

Essential Facilities

Roads Inundated

(5) COMMUNITY ASSETS

Historical Assets

Non-Historical Assets

(6) BUILDING DAMAGE LOSS

Substantial Damage Estimates^{*1 2}

Previous Claims

Repetitive Losses

(7) PEOPLE / SOCIAL VULNERABILITIES

Population in Floodplain

Population Displaced

WV Social Vulnerability Index

(8) OTHER HAZARDS

Landslides

Karst**

Dam/Levee Failure**

Used for the Index

* Multiple Indicators

** In Progress

¹ River/Stream Indicator

² Watershed Indicator

West Virginia Risk Explorer (WVRE)



■ Risk Assessment Tools

- Localized riverine flood risk assessment by quantifying and aggregating detailed building-level data at multiple scales
- Help identify the communities most at risk of riverine flooding for efficient allocation of limited mitigation resources

Building/Property-Level



Aggregated



■ Mitigation Assessment Tools

- Quantifies mitigation efforts such as elevation, relocation, and buyouts and calculation of loss estimates
- Enable planners and decision-makers to evaluate past and ongoing efforts, identify gaps, and prioritize future investments

Mitigated Structures Dashboard



Open-Space Mitigation Dashboard



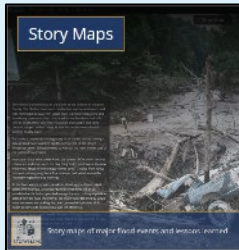
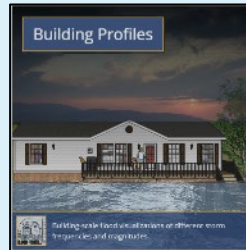
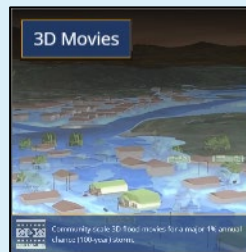
■ Risk Communication Tools

- Scenario-based 2D and 3D visualizations for effective risk communication
- Facilitate risk comprehension for various stakeholders to support informed decision-making and encourage public engagement

WV Flood Visualizations

Visualize 3D and 2D flood models at the community and building level scales.

Visualizations



■ Hazard Library and Data Access

- Access to online hazard resources including data, documents, and media searchable by title, subject, event, geography, and more.
- Allow users to access comprehensive datasets for use in analyses, maps, or applications to support planning, research, and decision-making related to hazard mitigation and response

WV Hazard Library

Search the document and visual media library for hazard information.

Hazard Library

Access Data

Download risk data for use in your own analyses, maps, or applications.

Access Data

Risk Tools Comparison



<https://www.mapwv.gov/flood>

WV Flood Tool

Determine the degree of flood risk for a **specific area** or **property** using the Public and Expert Views. View building risk assessments and mitigation measures using the Risk Map View.

Primary Components:

- Public View
- Expert View (Floodplain Management)
- RiskMap View (Risk Reduction)
- Reference Layers & Basemaps
- Property Search Tools
- Links to External Viewers & Resources



Applications:

- Flood Risk Determinations at Property Level
- Floodplain Management
- Mitigation Measures
- Damage Assessments
- Property Identification
- Flood Visualizations & Risk Communications
- CRS Map Credits
- Other Hazards

<https://wvfrf.org/wvre/>

WV Risk Explorer

View and analyze riverine flood risk at the **aggregate level** for community, county, region, watershed, and stream scales. **Compare risk** among different geographic entities, complete with risk scores and rankings, from the building level to state scales.

Primary Components:

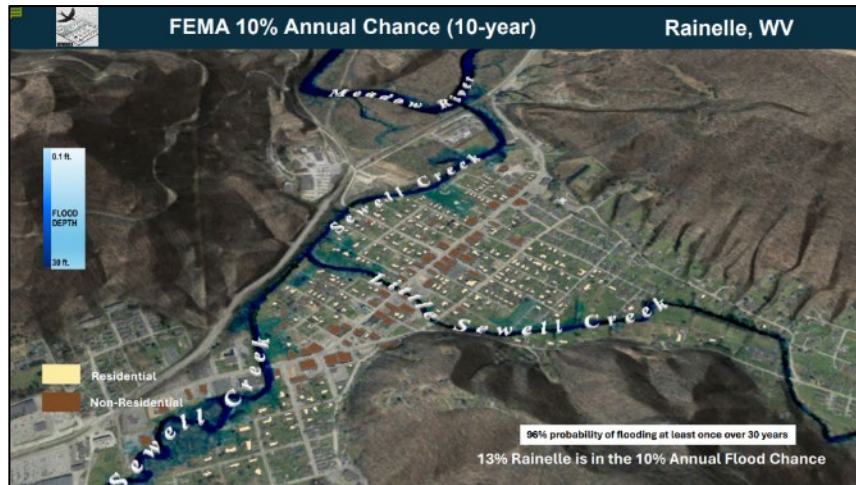
- Risk Maps Tool
- Risk Reports Tool
- Risk & Mitigation Dashboard Tools
- Building Level Risk Tools
- Flood Visualization Tools
- Data linkages WV Flood Tool & Hazard Library



Applications:

- Plans (Resiliency, Emergency Operations, Hazard Mitigation)
- Risk Studies (Risk MAP, Risk Reduction, Community Focused)
- Mitigation Measures, Tracking & Monitoring
- Flood Visualizations & Risk Communications
- CRS Programming Variables
- Other Hazards

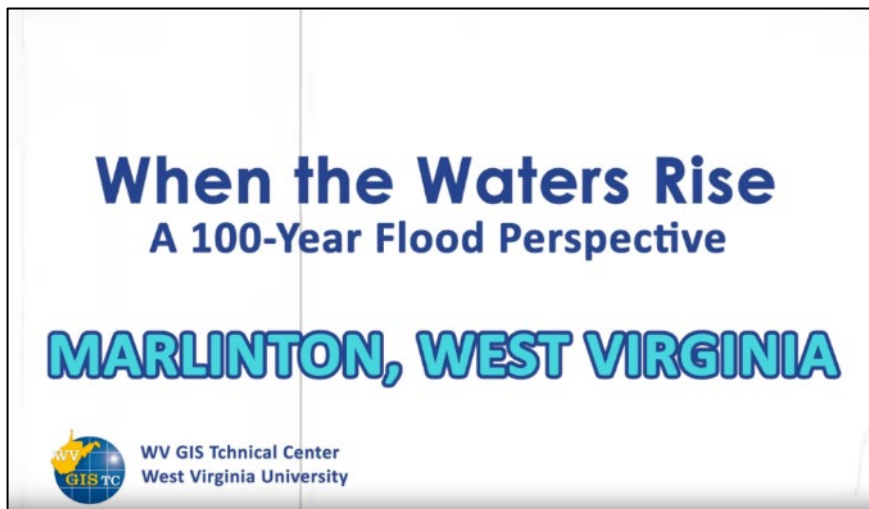
Visualization Examples



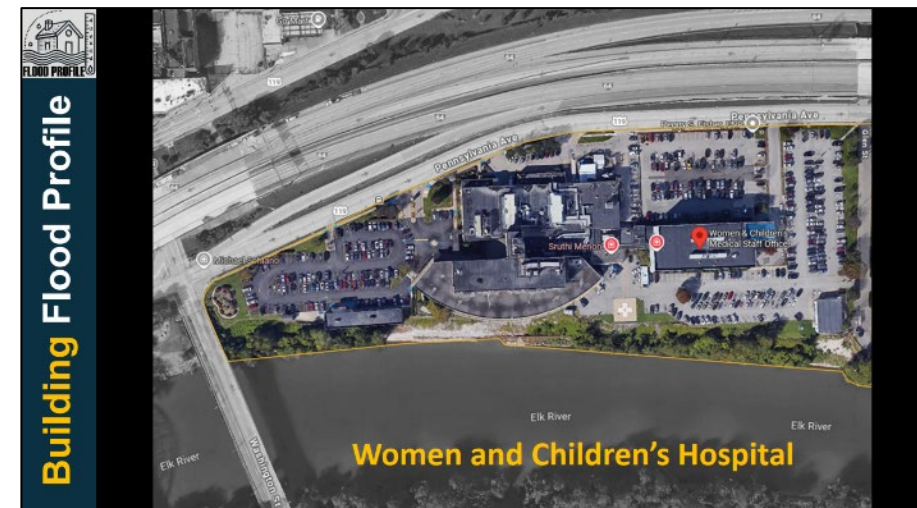
Viewshed for Rainelle



Building Profiles in Charleston



3D Movie for Marlinton



Mitigation Assessment Tools



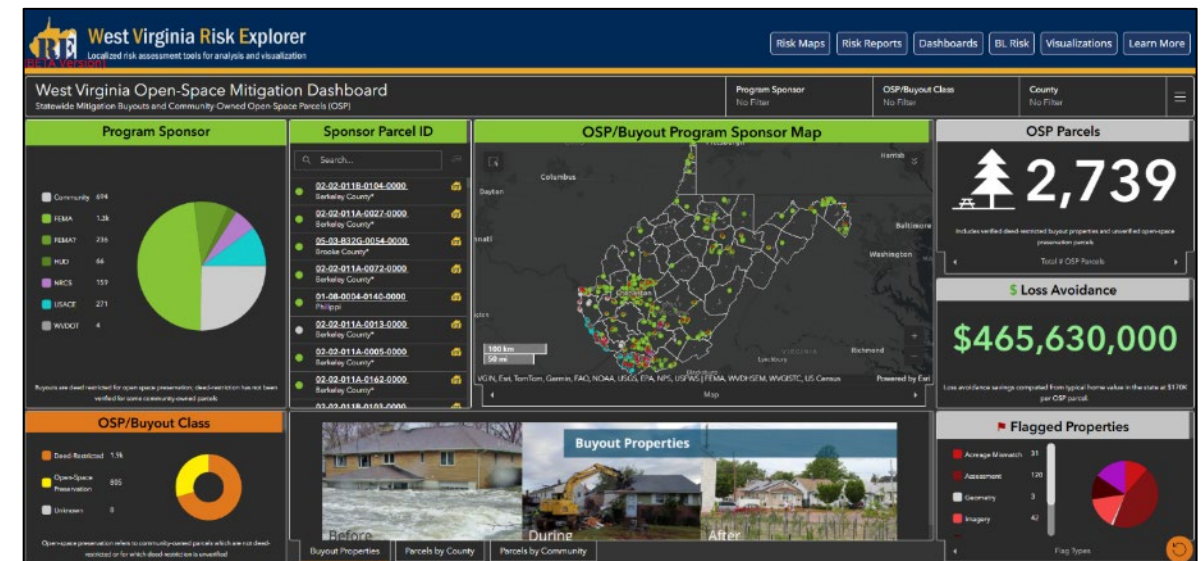
- Tracking mitigation efforts such as building elevation, relocation, acquisition, and buyouts

- Mitigated Structures Dashboard
- Open-Space Mitigation Dashboard



Mitigated Structures Inventoried

Mitigated/Buyout Parcels



- **Hazard Library Finalization (coming soon)**

Expanded catalog of hazard layers and supporting data

- **Planned Updates**

Regular feature data updates, additions, and indicator refinements

- **User Feedback Loop**

Reporting and feedback for tool improvements

- **Mobile-Friendly Access**

Responsive design for field use

- **Expanded Hazard Coverage**

Landslide, Dam Failure, and Karst

- **Future Maintenance**

Ongoing functioning and system performance improvements

- **Training & Support**

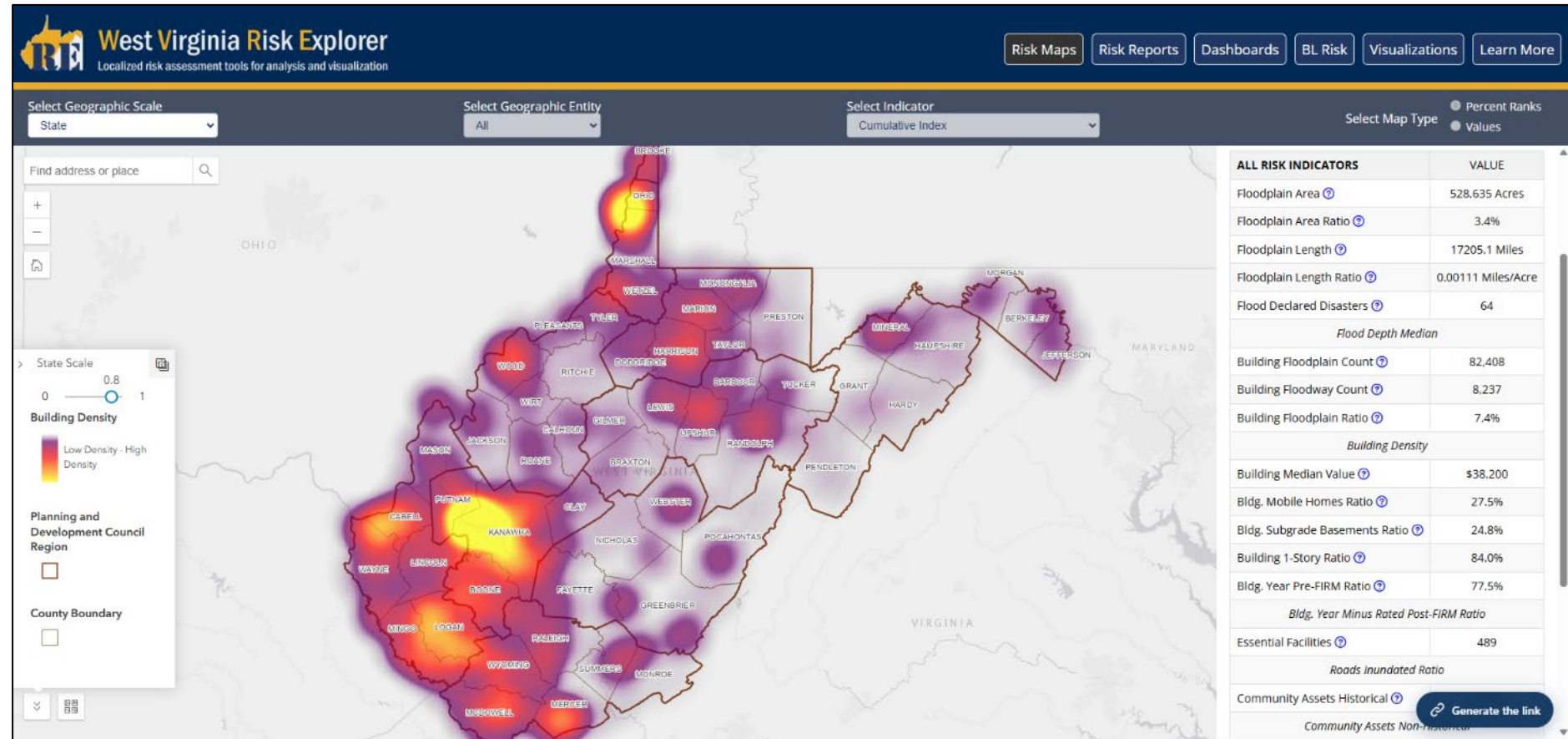
User training sessions, documentation, and guidance



An aerial photograph of a town street completely inundated with floodwater. The water is a murky brown color. Several houses are visible on both sides of the street, with water reaching up to their first floors. Two cars are partially submerged in the water. In the background, a church with a steeple is visible. The overall scene is one of significant flooding in a residential area.

Riverine Flood Risk Assessment Highlights for Emergency Management

Risk Maps



Geographic Entities at VERY HIGH Risk (Top 10%)



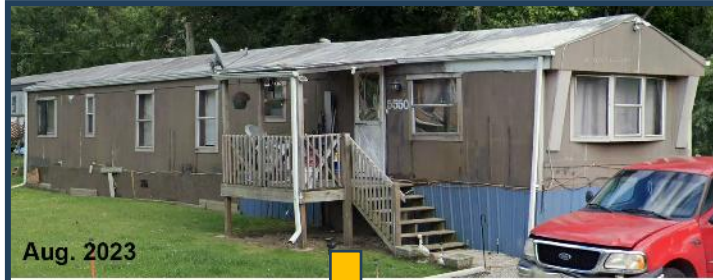
RANK	All Communities	Index Score	Incorporated Places	Index Score	Unincorporated Areas	Index Score	Counties	Index Score	Regions	Index Score
1	New Martinsville - Incorporated	100.0%	Clendenin - Incorporated	100.0%	Kanawha County* - Unincorporated	100.0%	Kanawha	100.0%	PDC Region 2	100%
2	Boone County* - Unincorporated	99.6%	New Martinsville - Incorporated	99.5%	Boone County* - Unincorporated	98.1%	Boone	98.1%	PDC Region 3	90%
3	Clendenin - Incorporated	99.2%	Alderson** - Incorporated	99.1%	Wayne County* - Unincorporated	96.2%	McDowell	96.2%		
4	Marlinton - Incorporated	98.9%	Marlinton - Incorporated	98.6%	McDowell County* - Unincorporated	94.4%	Logan	94.4%		
5	Wheeling** - Incorporated	98.5%	Kimball - Incorporated	98.2%	Mingo County* - Unincorporated	92.5%	Mingo	92.5%		
6	McDowell County* - Unincorporated	98.2%	Parsons - Incorporated	97.8%	Logan County* - Unincorporated	90.7%	Wyoming	90.7%		
7	Alderson** - Incorporated	97.8%	Wheeling** - Incorporated	97.3%						
8	Wayne County* - Unincorporated	97.5%	Northfork - Incorporated	96.9%						
9	Parsons - Incorporated	97.1%	Danville - Incorporated	96.4%						
10	Kanawha County* - Unincorporated	96.8%	Madison - Incorporated	96.0%						
11	Madison - Incorporated	96.4%	Milton - Incorporated	95.6%						
12	Kimball - Incorporated	96.1%	Oceana - Incorporated	95.1%						
13	Lincoln County* - Unincorporated	95.7%	Keystone - Incorporated	94.7%						
14	Milton - Incorporated	95.4%	Wellsburg - Incorporated	94.2%						
15	Mingo County* - Unincorporated	95.0%	Gary - Incorporated	93.8%						
16	Logan County* - Unincorporated	94.6%	Rowlesburg - Incorporated	93.4%						
17	Danville - Incorporated	94.3%	Grantsville - Incorporated	92.9%						
18	Wellsburg - Incorporated	93.9%	Richwood - Incorporated	92.5%						
19	Oceana - Incorporated	93.6%	Rainelle - Incorporated	92.1%						
20	Rowlesburg - Incorporated	93.2%	Mannington - Incorporated	91.6%						
21	Northfork - Incorporated	92.9%	Spencer - Incorporated	91.2%						
22	Gary - Incorporated	92.5%	Welch - Incorporated	90.7%						
23	Wyoming County* - Unincorporated	92.2%	Buckhannon - Incorporated	90.3%						
24	Welch - Incorporated	91.8%								
25	Summers County* - Unincorporated	91.5%								
26	Buckhannon - Incorporated	91.1%								
27	Richwood - Incorporated	90.8%								
28	Ceredo - Incorporated	90.4%								
29	Mannington - Incorporated	90.1%								

RANK	Streams (Top 20)	Index Score	Watersheds	Index Score
1	Coal River	100.0%	Lower Kanawha	100%
2	Ohio River	99.7%	Coal	96.7%
3	Little Coal River	99.5%	Upper Kanawha	93.5%
4	Greenbrier River	99.3%	Tug	90.3%
5	Davis Creek	99.1%		
6	Island Creek	98.9%		
7	Kanawha River	98.7%		
8	Campbells Creek	98.4%		
9	Wheeling Creek	98.2%		
10	Pocatalico River	98.0%		
11	Cacapon River	97.8%		
12	Big Coal River	97.6%		
13	Mud River	97.4%		
14	Cabin Creek	97.1%		
15	Pond Fork	96.9%		
16	Elk River	96.7%		
17	Twelvepole Creek	96.5%		
18	Buckhannon River	96.3%		
19	South Branch Potomac River	96.1%		
20	Paint Creek	95.8%		

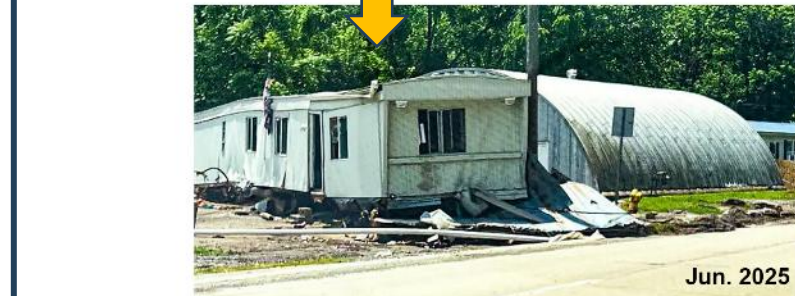
Last update: Aug. 2024
Streams & Watersheds: Jul. 2025
Colors:
Black --> Incorporated places
Black on yellow** --> Split communities
Black on blue: Incorporated communities included in the detailed risk report (Camden-on-Gauley, Clendenin, Marlinton, Rainelle, Richwood, and White Sulphur Springs)
Brown on gray --> Unincorporated areas
Green --> Counties (Total)

Building Characteristics: Mobile Homes

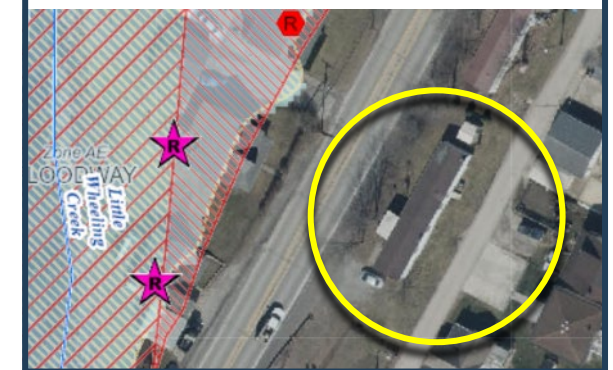
- Lightweight manufactured homes are not designed to withstand flooding and are more vulnerable to flood damage.



5550 National Rd, Triadelphia, WV
Ohio County
Building ID: [35-07-OTW7-0012-0000 5550](#)

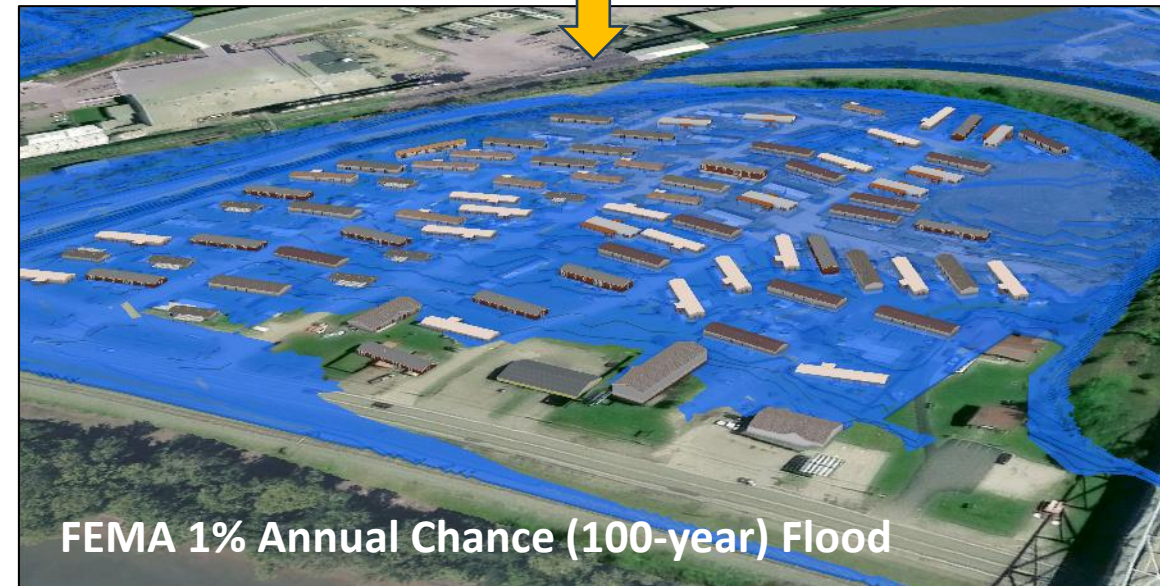
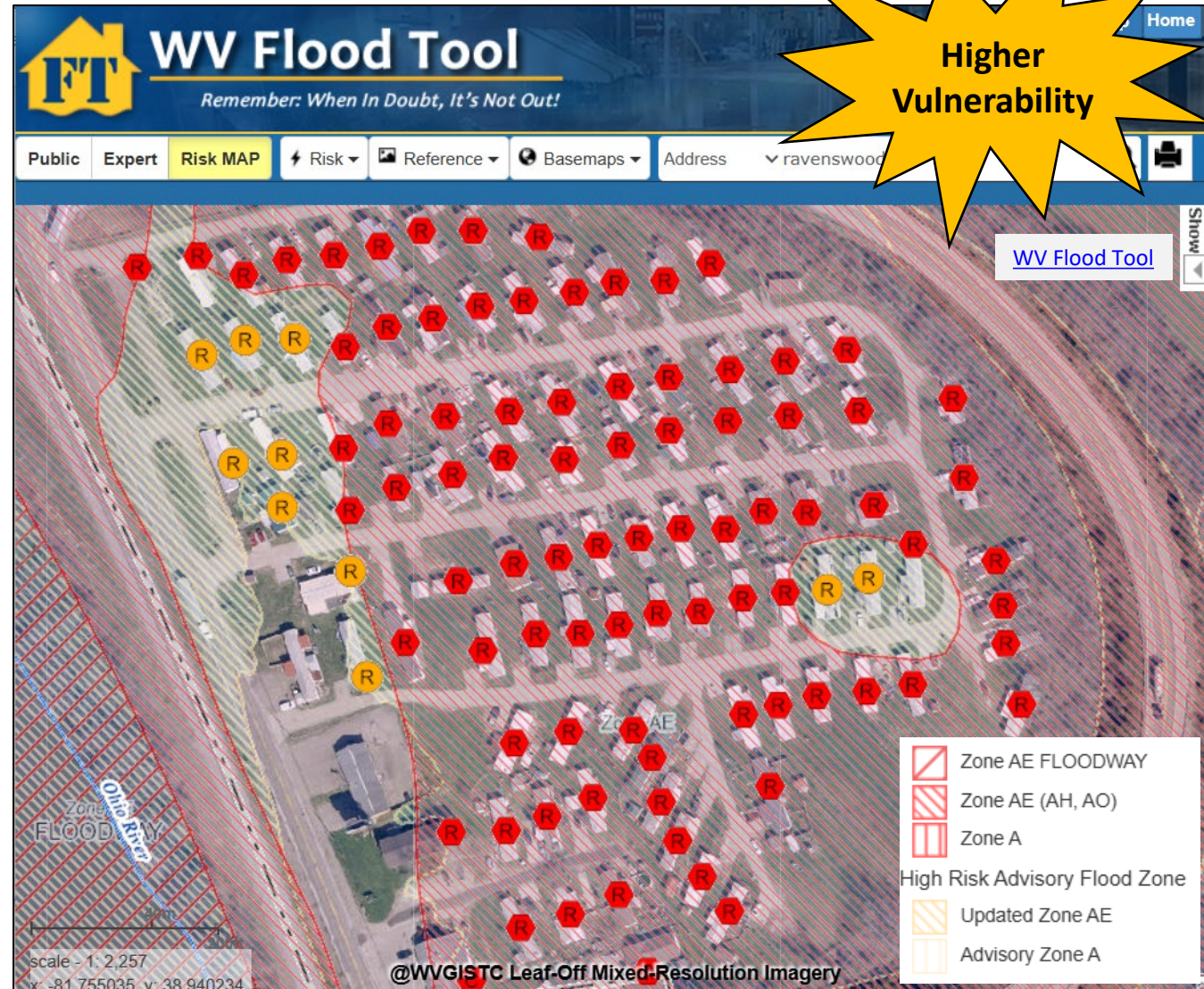


5736 National Rd, Triadelphia, WV
Ohio County
Building ID: [35-07-OTW7-0012-0000 5736](#)



5048 National Rd, Triadelphia, WV
Triadelphia, WV
[Not in Floodplain](#)

Mobile Home Park at Risk, Ravenswood, Jackson County



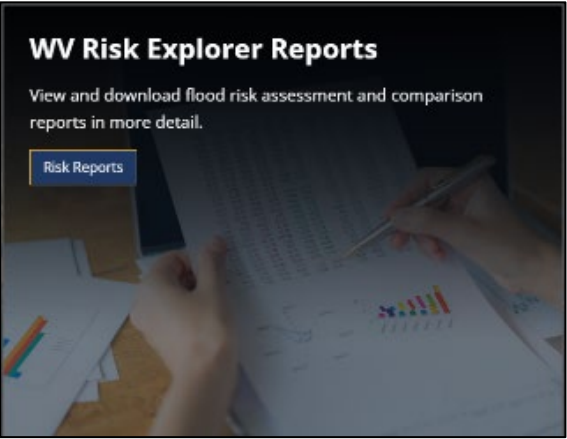
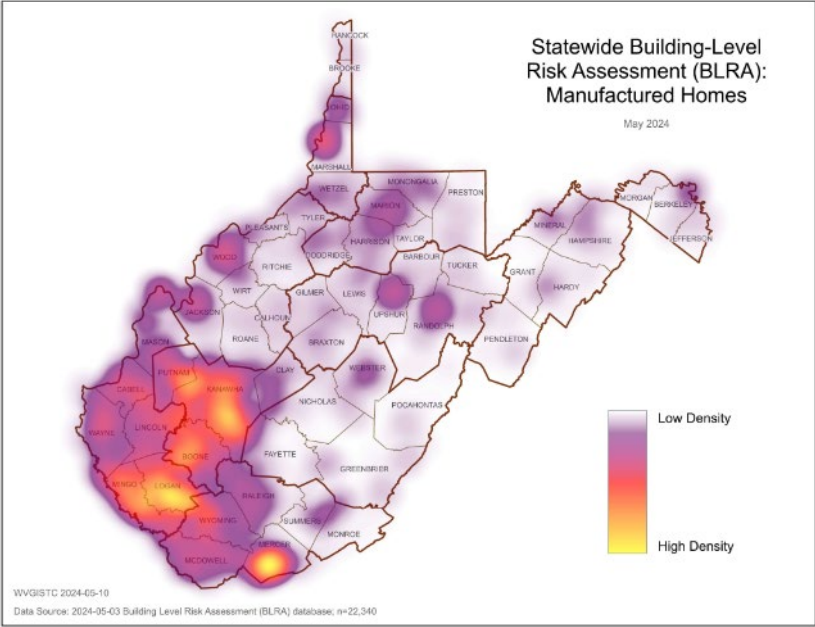
Mobile Homes in Floodplain (100-Yr)



WV / USA Comparison		
	West Virginia	Nationwide
Mobile Homes	120,734	8,182,612
Occupied Residential Units	859,437	139,647,020
% Mobile Home	14%	6%

Census Bureau 2021 ACS 5-year Estimates

Mobile Homes in Floodplain (Statewide)	
Mobile Homes in WV Floodplain	23,315
Total Mobile Homes in WV	120,734
% in Floodplain	19%
Total Single-Family Housing in WV Floodplain	84,778
% Mobile Homes in Single-Family in WV Floodplain	28%



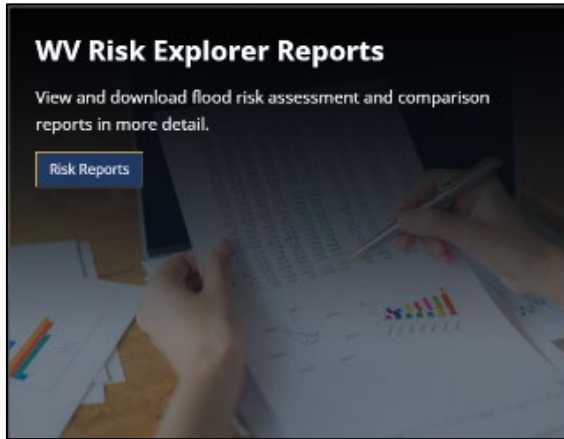
Top 5 Counties

Building Characteristics Comparison									
Table 4. Building Characteristics: Below is a comparison of 6 flood factors under the Building Characteristics category for the selected Counties.									
#	STATE CATEGORY RANK	COUNTY	BUILDING MEDIAN VALUE	BLDG. MOBILE HOMES RATIO	BLDG. SUBGRADE BASEMENTS RATIO	BUILDING 1-STORY RATIO	BLDG. YEAR PRE-FIRM RATIO	BLDG. YEAR MINUS RATED POST-FIRM RATIO	CATEGORY SCORE
1	43	Mercer	\$27,000	53.3%	17.3%	91.9%	72.7%	3.1%	22.2%
2	34	Mingo	\$28,000	49.8%	10.8%	94.1%	57.3%	7.9%	38.8%
3	4	Jackson	\$42,300	43.7%	21.0%	89.0%	65.9%	12.2%	94.4%
4	12	Mason	\$28,000	41.9%	20.8%	92.0%	58.4%	23.0%	79.6%
5	46	Lincoln	\$25,300	40.0%	10.4%	94.5%	66.7%	4.4%	11.1%

Building Characteristics: One-Story Buildings



- During a flood event, residents in single-story buildings face limited options for seeking higher elevations.



Statewide Ratio: 84% of structures in 100-Yr floodplain are one-story

Top 5

Counties

Building Characteristics Comparison

Table 4. Building Characteristics: Below is a comparison of 6 flood factors under the Building Characteristics category for the selected **Counties**.

#	STATE CATEGORY RANK	COUNTY	BUILDING CHARACTERISTICS						CATEGORY SCORE
			BUILDING MEDIAN VALUE	BLDG. MOBILE HOMES RATIO	BLDG. SUBGRADE BASEMENTS RATIO	BUILDING 1- STORY RATIO	BLDG. YEAR PRE-FIRM RATIO	BLDG. YEAR MINUS RATED POST-FIRM RATIO	
1	39	Clay	\$20,200	31.0%	15.0%	94.9%	71.1%	4.8%	27.7%
2	46	Lincoln	\$25,300	40.0%	10.4%	94.5%	66.7%	4.4%	11.1%
3	25	Summers	\$36,700	26.0%	13.4%	94.3%	63.5%	19.8%	53.7%
4	34	Mingo	\$28,000	49.8%	10.8%	94.1%	57.3%	7.9%	38.8%
5	3	Boone	\$33,300	36.9%	15.5%	93.5%	82.5%	5.9%	96.2%

Top 5

Incorporated Places

Table 4. Building Characteristics: Below is a comparison of 6 flood factors under the Building Characteristics category for the selected **Incorporated Places**.

#	STATE CATEGORY RANK	INCORPORATED PLACE	BUILDING CHARACTERISTICS						CATEGORY SCORE
			BUILDING MEDIAN VALUE	BLDG. MOBILE HOMES RATIO	BLDG. SUBGRADE BASEMENTS RATIO	BUILDING 1- STORY RATIO	BLDG. YEAR PRE- FIRM RATIO	BLDG. YEAR MINUS RATED POST- FIRM RATIO	
1	65	Sand Fork - Incorporated	\$22,600	31.3%	14.3%	100.0%	81.0%	5.3%	71.9%
2	140	Lester - Incorporated	\$24,435	56.7%	5.3%	97.4%	84.2%	0.0%	39.0%
3	17	Summersville - Incorporated	\$73,350	13.6%	16.7%	97.2%	61.2%	8.6%	92.9%
4	41	Rupert - Incorporated	\$41,190	18.4%	10.7%	96.4%	87.5%	3.6%	82.4%
5	141	Oak Hill - Incorporated	\$27,000	4.1%	25.5%	96.4%	90.9%	0.0%	38.5%

Critical Infrastructure: Essential Facilities

- Essential Facilities provide emergency services during a flood.
- Communities need to establish emergency protocols to maintain critical services amidst a flood.



Police Station



Fire Station



E-911 Dispatch



School



Hospital



Nursing Home



Clendenin Volunteer Fire Department
Kanawha County
Inundated, Jun. 2016
Building ID: [20-02-0007-0040-0000_109](#)

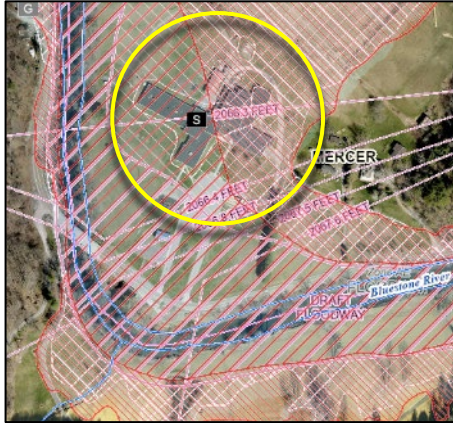


Marlinton Volunteer Fire Department
Pocahontas County
Inundated, Nov. 1985
Building ID: [38-08-0001-0095-0000_709B](#)

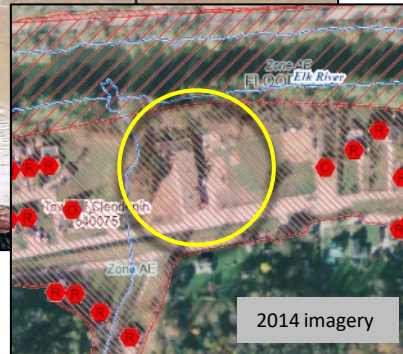


Flooded Essential Facilities

- Schools with children in vulnerable age groups often also serve as shelters during floods.



Spanishburg Elementary School
Mercer County
Inundated, Feb. 2025
Building ID: [28-11-0026-0075-0000 8544](#)



Clendenin Elementary School
Kanawha County
Inundated, Jun. 2016
(Demolished)



Bridge Elementary School
Kanawha County
Inundated, Jun. 2016
Building ID: [20-15-0023-0077-0000 5120](#)

Flooded Essential Facilities...



- Nursing homes and hospitals with immobile patients are particularly more susceptible to flooding.

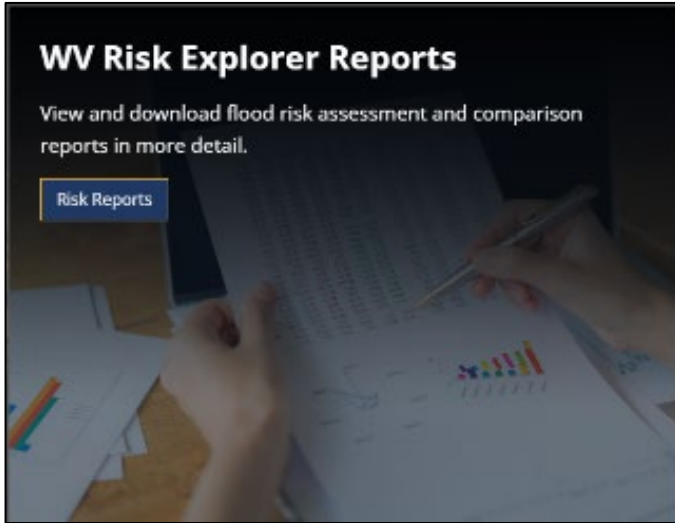


Nicholas County Nursing & Rehabilitation Center
Richwood
Inundated, June. 2016
(Not active anymore)
Building ID: [34-06-0010-0072-0000_18](#)

Pocahontas Center (Nursing Home)
Marlinton
Building ID: [38-08-0005-0065-0002_5](#)



Essential Facilities in Floodplains (100-, 500-Yr)



**Top
5**

Counties

**Top
5**

Incorporated Places

Essential Facilities (Statewide)							
Facility Type	Police Station	Fire Station	E-911 Center	School	Hospital	Nursing Home	Total
In Floodplains	88	187	10	170	15	19	489
Total in WV	312	548	54	828	67	111	1,920
% in Floodplains	28%	34%	19%	21%	22%	17%	25%

Critical Infrastructure Comparison

Table 5. Critical Infrastructure: Below is a comparison of 2 flood factors under the Critical Infrastructure category for the selected **Counties**.

#	STATE CATEGORY RANK	COUNTY	CRITICAL INFRASTRUCTURE		CATEGORY SCORE
			ESSENTIAL FACILITIES	ROADS INUNDATED RATIO	
1	1	Kanawha	80	11.8%	98.1%
2	3	McDowell	32	12.3%	94.4%
3	6	Wayne	22	11.7%	90.7%
4	7	Cabell	22	9.0%	88.8%
5	3	Mingo	21	16.2%	94.4%

Table 5. Critical Infrastructure: Below is a comparison of 2 flood factors under the Critical Infrastructure category for the selected **Incorporated Places**.

#	STATE CATEGORY RANK	INCORPORATED PLACE	CRITICAL INFRASTRUCTURE		CATEGORY SCORE
			ESSENTIAL FACILITIES	ROADS INUNDATED RATIO	
1	62	Charleston - Incorporated	20	5.6%	73.2%
2	54	Huntington - Incorporated	16	6.9%	76.7%
3	7	Wheeling - Incorporated	8	19.6%	97.3%
4	71	South Charleston - Incorporated	8	4.4%	69.2%
5	1	Wellsburg - Incorporated	7	42.7%	100.0%

Critical Infrastructure: Road Inundation



~1 Foot

Response focused on those who need additional assistance



~3 Feet

Near the limit to use High Profile Vehicles to perform high water rescues



~6 Feet

Boats and helicopters now required to perform high water rescues



~9 Feet

1st Floors completely inundated



Pleasant Valley, Marion County, Jul. 2025



Welch, McDowell County, Feb. 2025



I-79, Kanawha County, Jun. 2016



Fairmont, Marion County, Jul. 2025

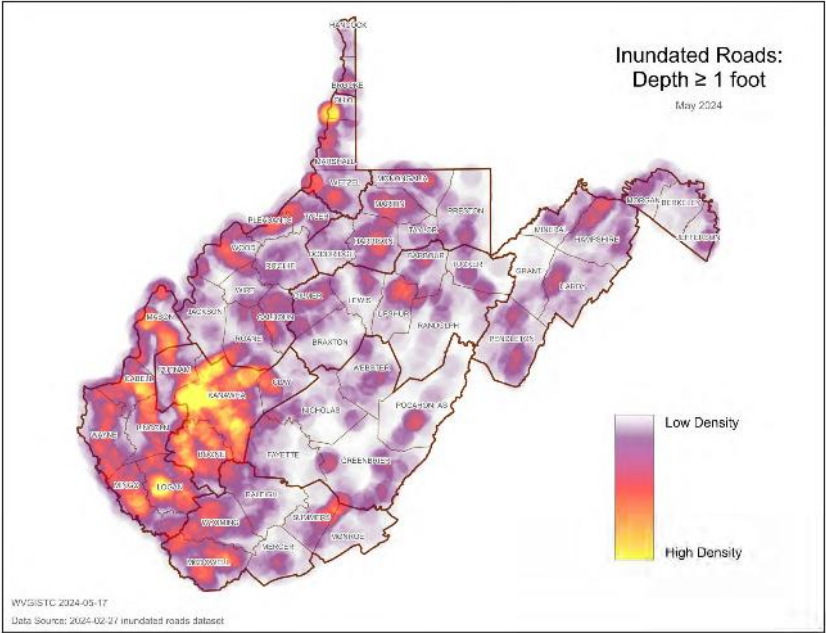


Williamson, Mingo County, Feb. 2025

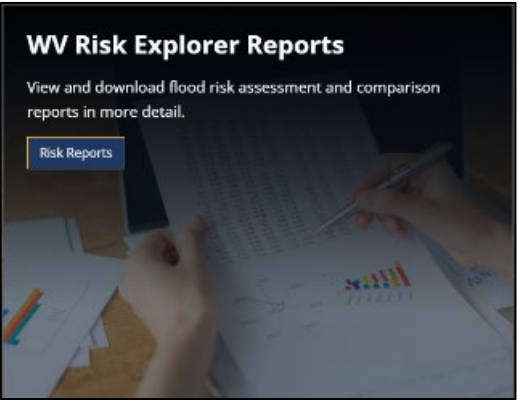
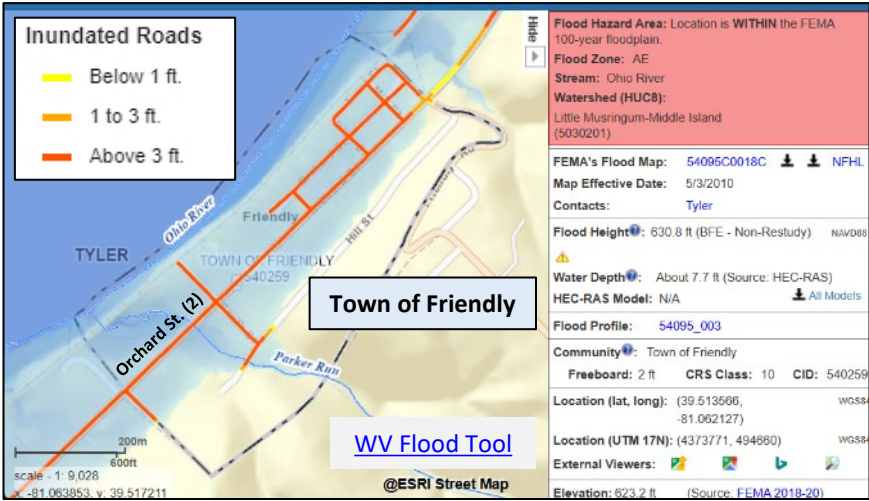


White Sulphur Springs, Greenbrier County, Jun. 2016

Critical Infrastructure: Road Inundation (100-Yr)



Road Inundation (Statewide)		
	Roads	Public Bridges
At Risk of Inundation	6,503 (Miles)	2,603
Total	109,052 (Miles)	7,349
% At Risk	6%	35%



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Counties

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Incorporated Places

Critical Infrastructure Comparison

Table 5. Critical Infrastructure: Below is a comparison of 2 flood factors under the Critical Infrastructure category for the selected Counties.

#	STATE CATEGORY RANK	COUNTY	CRITICAL INFRASTRUCTURE		CATEGORY SCORE
			ESSENTIAL FACILITIES	ROADS INUNDATED RATIO	
1	1	Boone	19	19.2%	98.1%
2	3	Mingo	21	16.2%	94.4%
3	5	Logan	18	14.6%	92.5%
4	9	Wyoming	9	12.9%	83.3%
5	3	McDowell	32	12.3%	94.4%

Table 5. Critical Infrastructure: Below is a comparison of 2 flood factors under the Critical Infrastructure category for the selected Incorporated Places.

#	STATE CATEGORY RANK	INCORPORATED PLACE	CRITICAL INFRASTRUCTURE		CATEGORY SCORE
			ESSENTIAL FACILITIES	ROADS INUNDATED RATIO	
1	102	Friendly - Incorporated	0	66.7%	55.7%
2	41	Hartford - Incorporated	1	60.1%	82.4%
3	104	Worthington - Incorporated	0	52.3%	54.8%
4	13	Clendenin - Incorporated	2	51.8%	94.7%
5	43	Sylvester - Incorporated	1	50.0%	81.5%

Community Assets: Non-Historical

- Non-Historical community assets such as churches often serve as emergency shelters during floods.
- Flooding can disrupt critical community lifelines including safety, health, shelter, water, and energy.



Religious
Organization



Educational
Building



Emergency Medical
Services



Government
Building



Utility



National Register
Historical Structure



In Historic District
Older than 1930



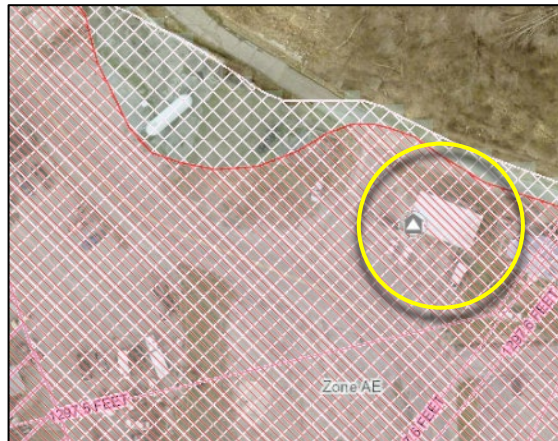
Other
Assets

Jan-Care of Guardian Angel (EMS)

Welch, McDowell County

Inundated, Feb. 2025

Building ID: [27-15-0002-0247-0000](#) 58



Flooded Community Assets



Aug. 2023

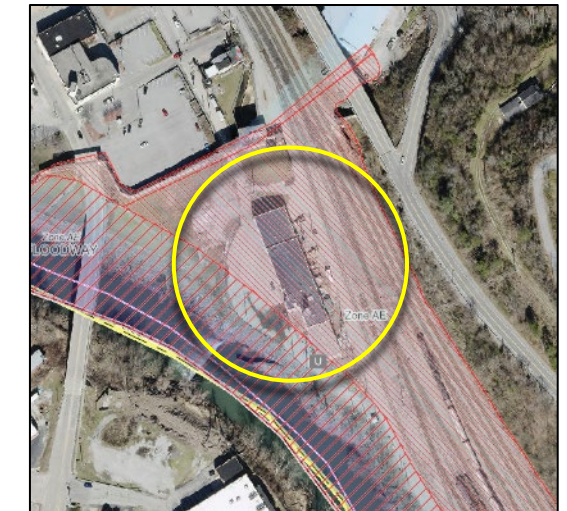
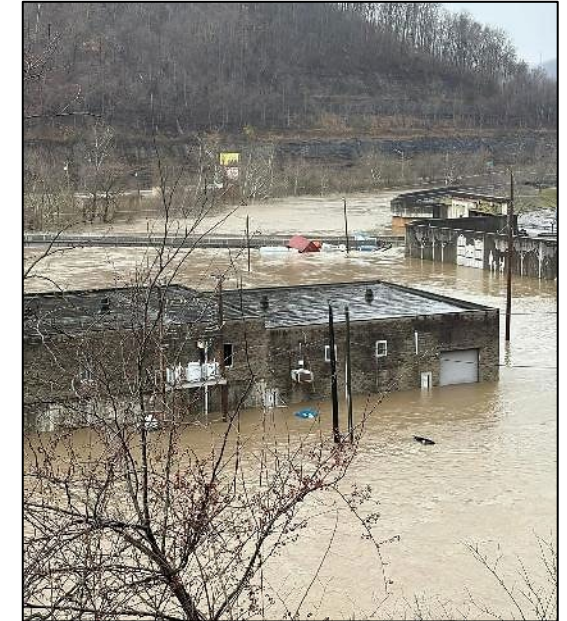


Jun. 2025

Valley Grove Assembly of God
Valley Grove, Ohio County
Inundated, Jun. 2025
Building ID: [35-08-OVG9-0083-0000](#) 8580



Williamson Water Plant (Veolia Water)
Williamson, Mingo County
Inundated, Feb. 2025
Building ID: [30-11-0007-0233-0000](#) 317



Flooded Community Assets...

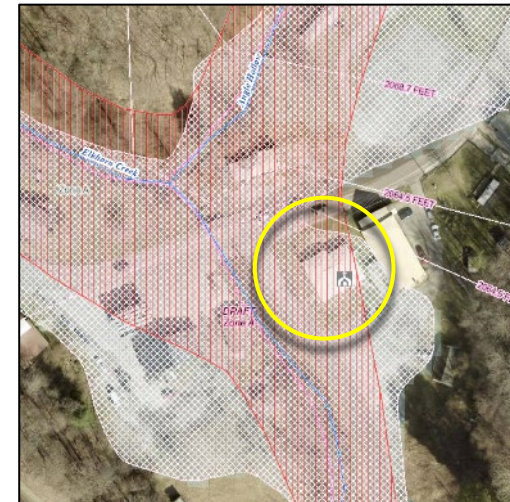


Borderland Baptist Church
Mingo County
Inundated, Feb. 2025
Building ID: [30-10-362K-0010-0000](#) 46



Cornerstone Church
Matewan, Mingo County
Inundated, Feb. 2025
Building ID: [30-08-0009-0071-0000](#) 1028

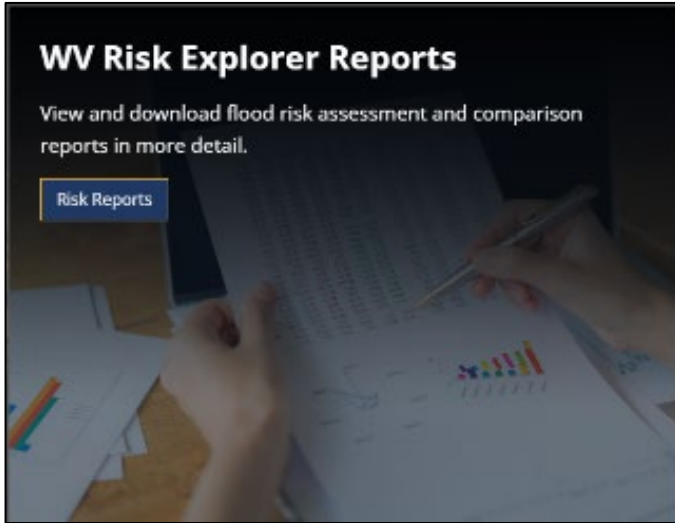
East Williamson Baptist Church
Williamson, Mingo County
Inundated, Feb. 2025
Building ID: [30-11-0010-0098-0000](#) 9999



Church Of God Ennis & Maybeury
McDowell County
6 inches of water in basement, Feb. 2025
Building ID: [27-06-0011-0019-0000](#) 40150



Non-Historical Community Assets in Floodplains (100-Yr)



Non-Historical Community Assets (Statewide)							
Facility Type	Religious	Postsecondary Educational	EMS	Government	Utility	Other	Total
In Floodplain	1,450	21	24	423	166	8	2,092

Top
5

Counties

Community Assets Comparison						
Table 6. Community Assets: Below is a comparison of 2 flood factors under the Community Assets category for the selected Counties .						
#	STATE CATEGORY RANK	COUNTY	COMMUNITY ASSETS		CATEGORY SCORE	
			COMMUNITY ASSETS HISTORICAL	COMMUNITY ASSETS NON-HISTORICAL		
1	1	Kanawha	208	261	100.0%	
2	5	McDowell	14	116	88.8%	
3	30	Logan	0	115	44.4%	
4	15	Boone	3	96	74.0%	
5	5	Wyoming	15	80	88.8%	

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Incorporated Places

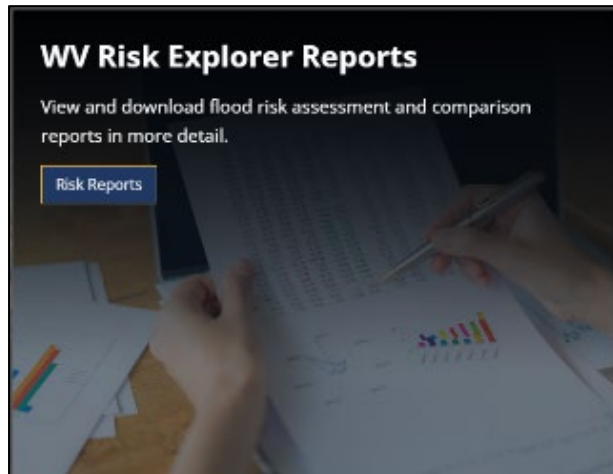
Table 6. Community Assets: Below is a comparison of 2 flood factors under the Community Assets category for the selected Incorporated Places .						
#	STATE CATEGORY RANK	INCORPORATED PLACE	COMMUNITY ASSETS		CATEGORY SCORE	
			COMMUNITY ASSETS HISTORICAL	COMMUNITY ASSETS NON-HISTORICAL		
1	2	Charleston - Incorporated	154	55	99.5%	
2	1	Wheeling - Incorporated	1,259	24	100.0%	
3	5	New Martinsville - Incorporated	38	18	98.2%	
4	8	Welch - Incorporated	9	17	96.9%	
5	3	Wellsburg - Incorporated	507	15	99.1%	
6	4	Clendenin - Incorporated	54	15	98.6%	

Estimated Displaced Population (100-Yr Flood)



Population (Statewide)	
Total Population *	1,801,049
In Floodplain	198,888
% in Floodplain	11.0%
Displaced Population	119,350
% Displaced	6.6%
Shelter Needs (Persons)	23,003
% in Need of Shelter	1.3%
Companion Pets in Shelters	6,411

* Census Bureau 2021 ACS 5-year Estimates



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Counties



People / Social Vulnerabilities Comparison

Table 8. People / Social Vulnerabilities: Below is a comparison of **3** flood factors under the People / Social Vulnerabilities category for the selected **Counties**.

#	STATE CATEGORY RANK	COUNTY	PEOPLE / SOCIAL VULNERABILITIES			CATEGORY SCORE
			POPULATION IN FLOODPLAIN RATIO	POPULATION DISPLACED RATIO	WV SOCIAL VULNERABILITY INDEX	
1	1	McDowell	45.0%	30.4%	100.0%	100.0%
2	5	Boone	37.5%	26.6%	79.6%	92.5%
3	2	Mingo	34.1%	20.5%	96.3%	98.1%
4	4	Logan	33.8%	23.0%	88.9%	94.4%
5	9	Lincoln	31.6%	8.8%	83.3%	85.1%


Table 8. People / Social Vulnerabilities: Below is a comparison of **3** flood factors under the People / Social Vulnerabilities category for the selected **Counties**.

#	STATE CATEGORY RANK	COUNTY	PEOPLE / SOCIAL VULNERABILITIES			CATEGORY SCORE
			POPULATION IN FLOODPLAIN RATIO	POPULATION DISPLACED RATIO	WV SOCIAL VULNERABILITY INDEX	
1	1	McDowell	45.0%	30.4%	100.0%	100.0%
2	5	Boone	37.5%	26.6%	79.6%	92.5%
3	4	Logan	33.8%	23.0%	88.9%	94.4%
4	8	Pocahontas	26.5%	21.2%	70.4%	87.0%
5	2	Mingo	34.1%	20.5%	96.3%	98.1%


- Communities with higher social vulnerability are less able to prepare for, respond to, and recover from flood disasters quickly and fully.

Social Vulnerability Index (WV SVI) (0% to 100%)


Combines indicators of:




Poverty Rate




Unemployment Rate




Vulnerable Ages Rate




Disability Rate




Population without a High School Diploma



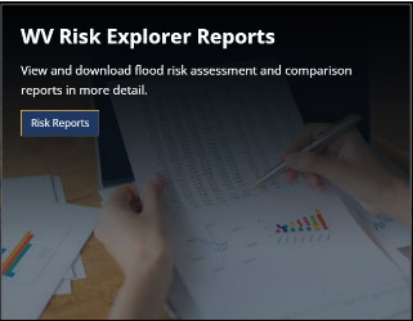
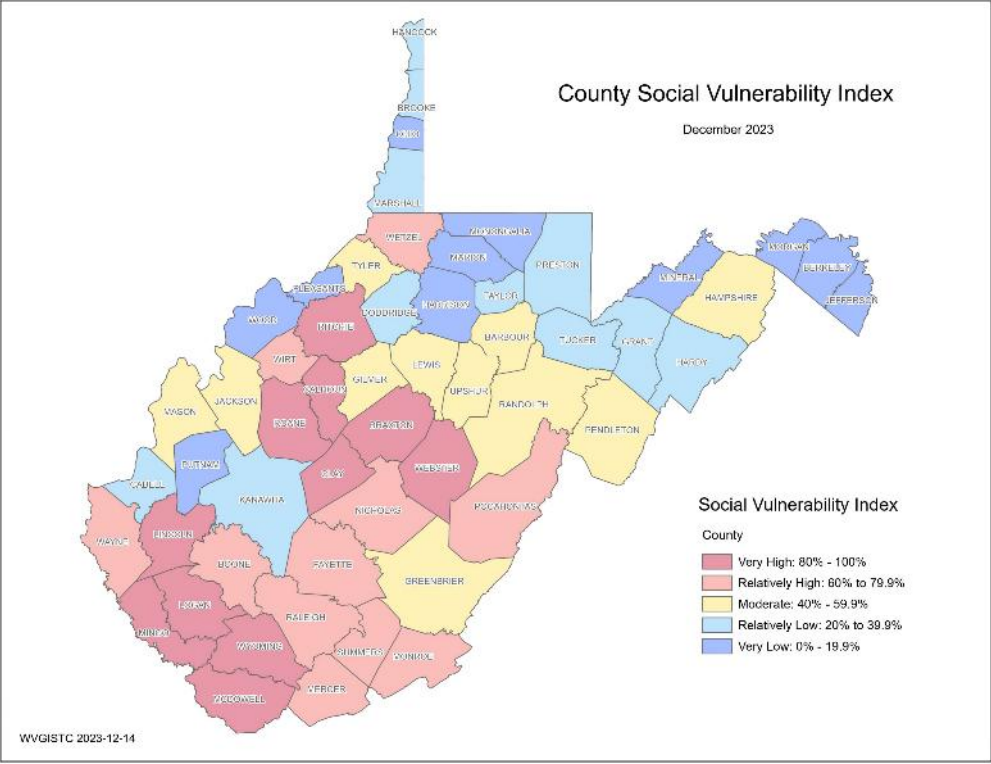
Population Change



Median Housing Unit Value



Percentage of Mobile Homes in Housing Units



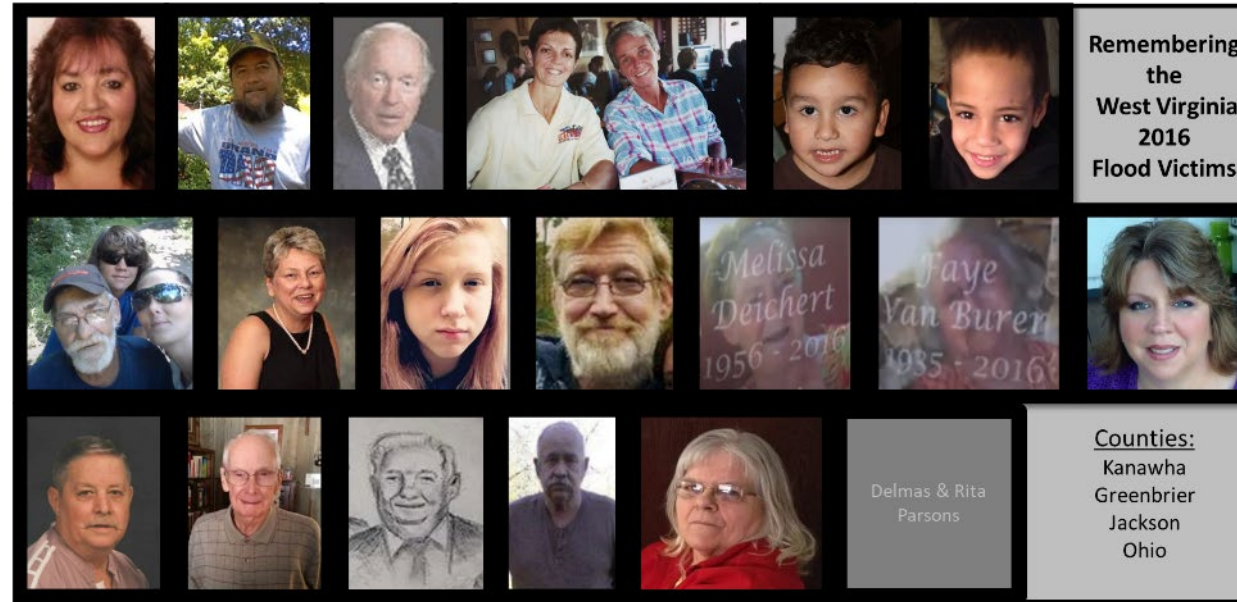
Top
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Counties

People / Social Vulnerabilities Comparison						
Table 8. People / Social Vulnerabilities: Below is a comparison of 3 flood factors under the People / Social Vulnerabilities category for the selected Counties.						
#	STATE CATEGORY RANK	COUNTY	PEOPLE / SOCIAL VULNERABILITIES			
			POPULATION IN FLOODPLAIN RATIO	POPULATION DISPLACED RATIO	WV SOCIAL VULNERABILITY INDEX	CATEGORY SCORE
1	1	McDowell	45.0%	30.4%	100.0%	100.0%
2	3	Wyoming	30.0%	17.6%	98.1%	96.2%
3	2	Mingo	34.1%	20.5%	96.3%	98.1%
4	7	Clay	25.8%	10.1%	94.4%	88.8%
5	6	Webster	28.4%	14.9%	92.6%	90.7%

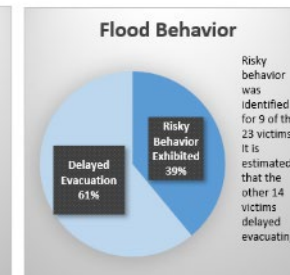
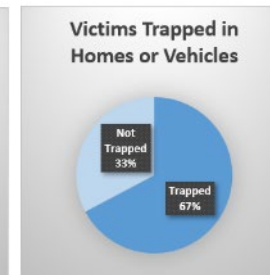
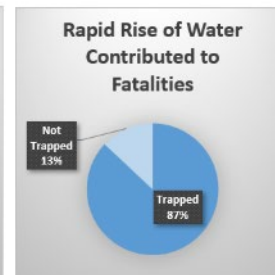
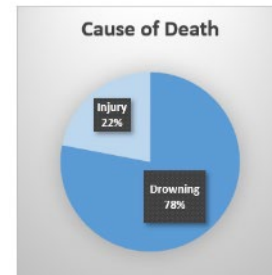
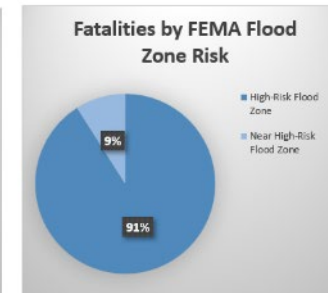
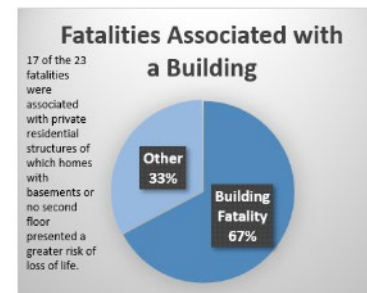
2016 Flood Fatality Analysis



23 Victims



Detailed Fatality Analysis



2016 Flood Fatality Analysis



23 Fatalities, Jun. 2016

Causes:	Deaths Count	% of Fatalities
Drowned due to High Flood Velocities and Flood Depths	18	78%
Flood Injuries (Heart Failure, Electrocutation, Severe burns)	5	22%

23 Fatalities, Jun. 2016

Building Characteristics:	Deaths Count	% of Fatalities
One-Story Buildings (including Mobile Homes)	17	74%

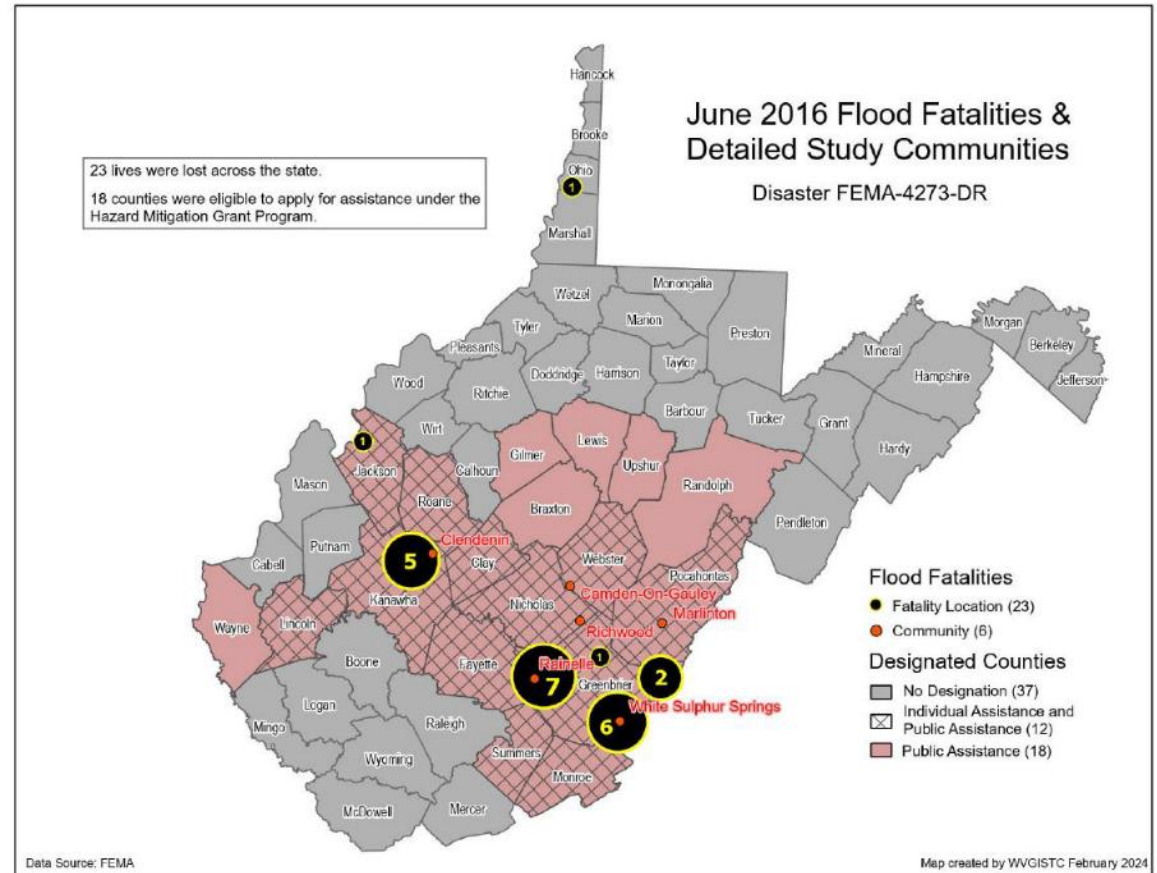
23 Fatalities, Jun. 2016

Behavior:	Deaths Count	% of Fatalities
Delayed Evacuation	14	61%
Risky Behavior	9	39%



Risky Behavior Examples:

- Driving into floodwaters
- Attempting to rescue pets
- Retrieve memorabilia from basements
- Playing near flooded creeks
- Crossing or viewing from bridges



A firefighter in a yellow helmet and jacket is in the foreground, looking out over a flooded landscape. In the distance, a small boat is on the water. The background shows a flooded area with trees and buildings.

Recommendations for Emergency Management

- Use the Aggregated-Level Risk Reports and Maps to identify the **hot spots of the risk and vulnerability**.

- [WV Risk Explorer Reports](#)
- [WV Risk Explorer Maps](#)

- Use Building-Level (BL) Tools & Tables to identify **most vulnerable structures**.
- Give priority to such structures for emergency response.

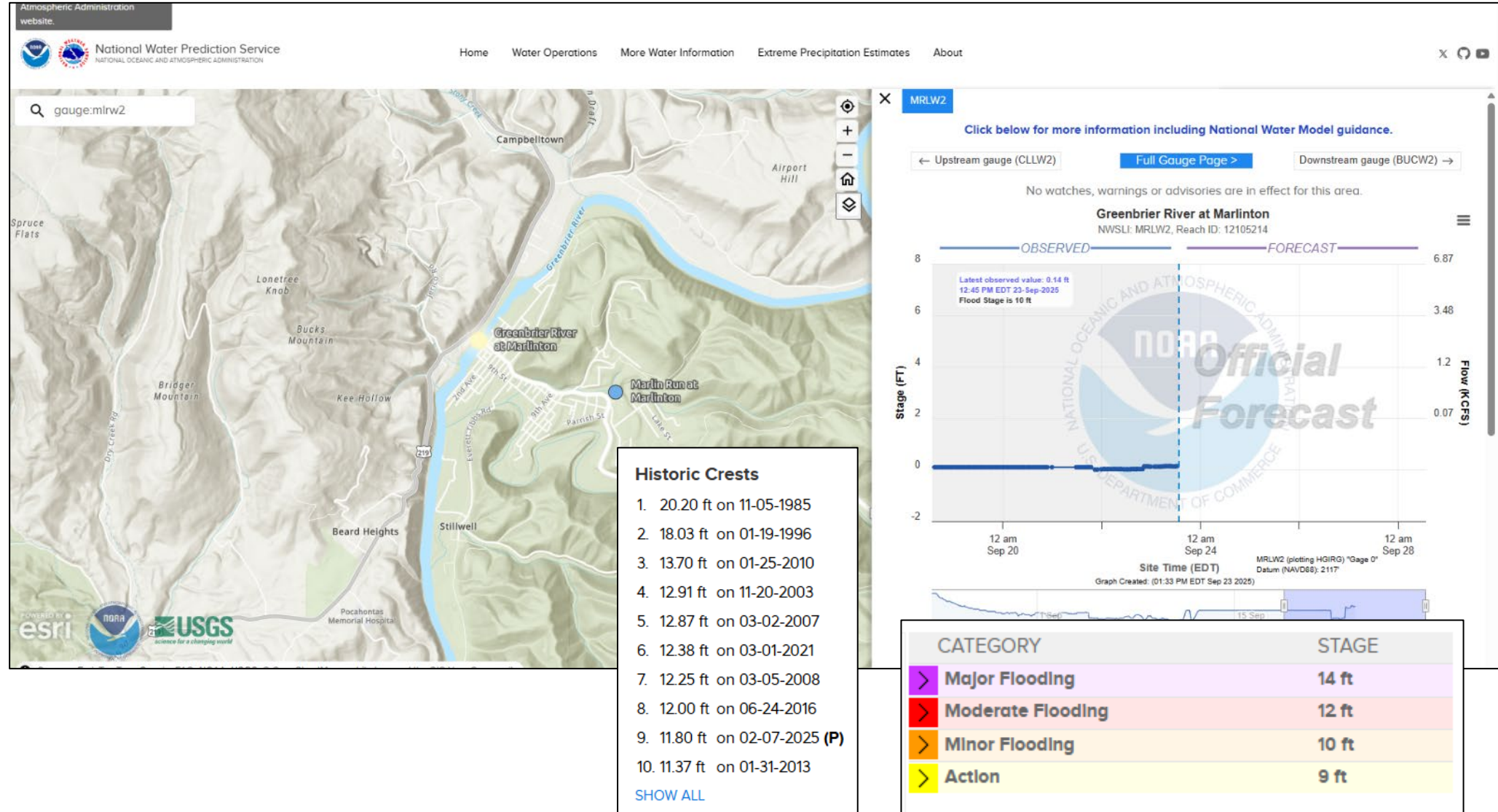
- [Statewide Building-Level Tool for Primary Structures](#)
- [Statewide Building-Level Tool for Significant Structures](#)
- [WV Flood Tool](#)
- [Statewide BLRA \(Table & GIS\)](#)



Plan with Stream Gauges



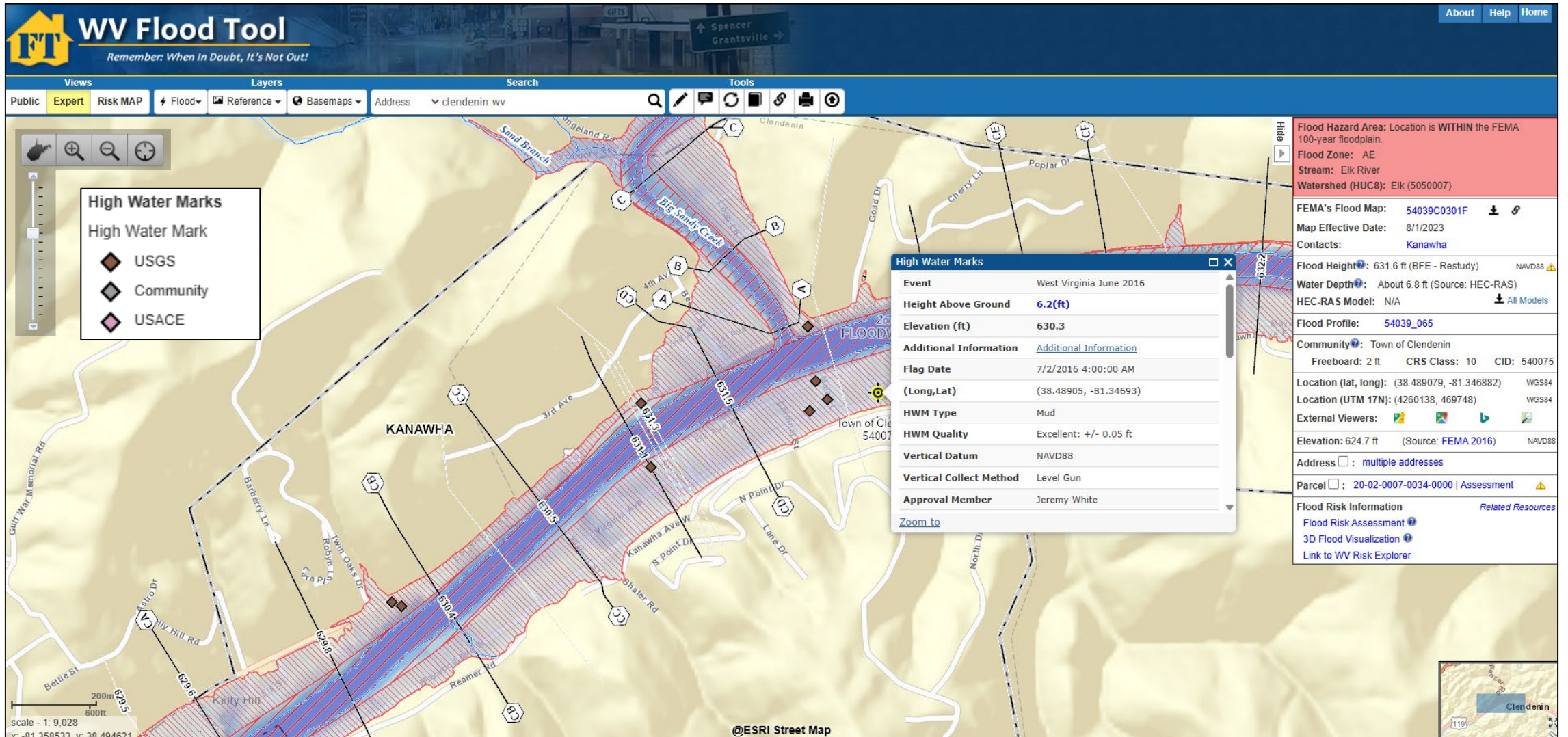
<https://water.noaa.gov>



Plan with High Water Marks



<https://www.mapwv.gov/flood>



Plan for Rapid High-Rising Floodwaters



All these homes along Jordan Creek Road near Clendenin were swept away during the flood of June 2016



Wheeling / Triadelphia, Ohio County, Jun. 2025



Identify At-Risk Significant Structures



- Fire Stations, Police Stations, E-911 Centers, & EMS in Floodplain ➡ Emergency Response Disruption!
- Nursing Homes, Hospitals, and Schools in Floodplain ➡ Vulnerable Groups at Risk!
- Churches in Floodplain ➡ Sheltering Disruption!
- Utilities in Floodplain ➡ Disruption of Critical Lifelines!



Welch, McDowell County, Feb. 2025

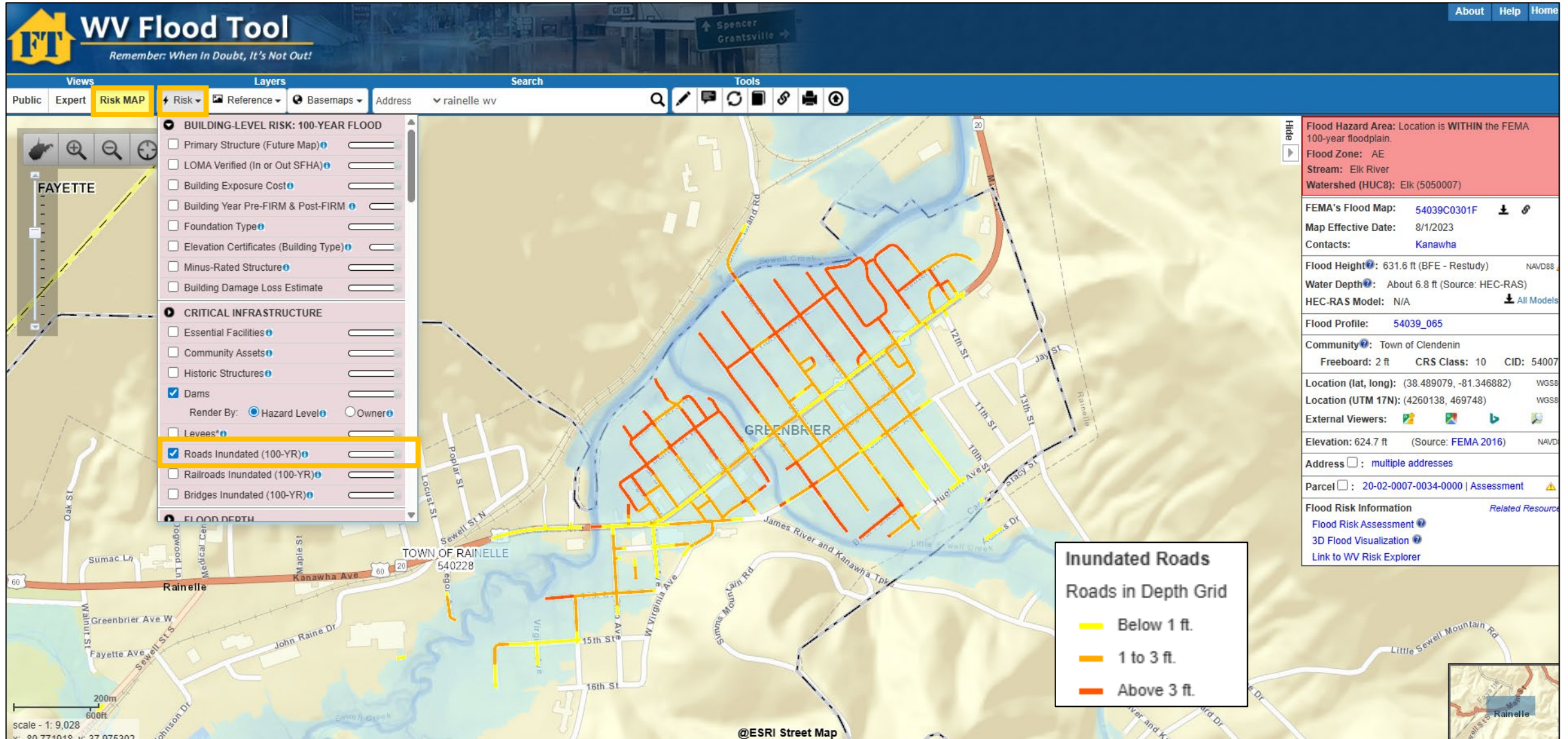


Clendenin, Greenbrier County, Jun. 2016

Plan for Inundated Road Impacts



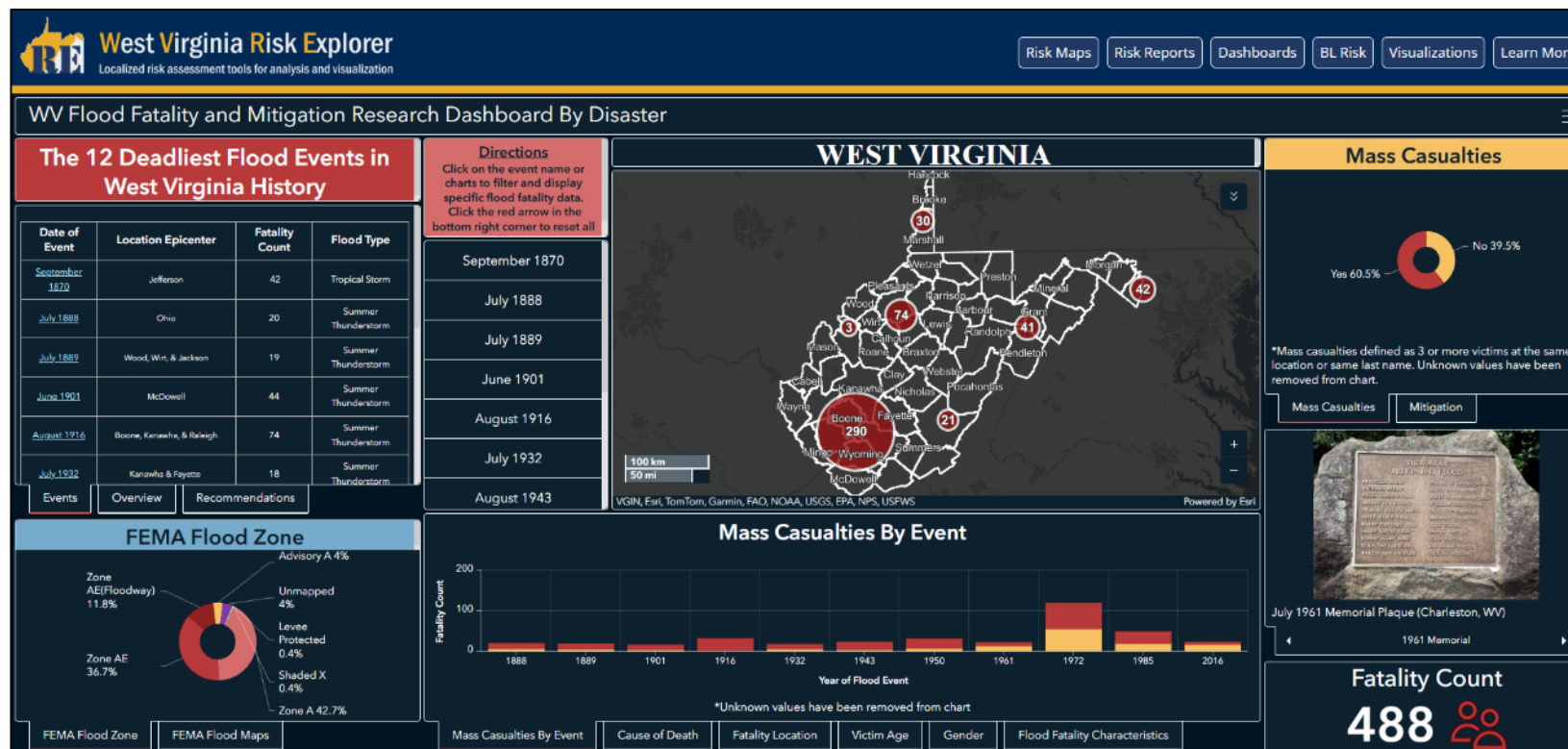
<https://www.mapwv.gov/flood>



Plan with Population Estimates



- Use the risk assessment tools and reports to have a better understanding of **population exposure**, **social vulnerability**, **evacuation estimates**, and **shelter needs**.
- Plan for pet-friendly shelters.
- Use the Flood Fatality Dashboard to better understand the **cause of deaths** of the past disasters.

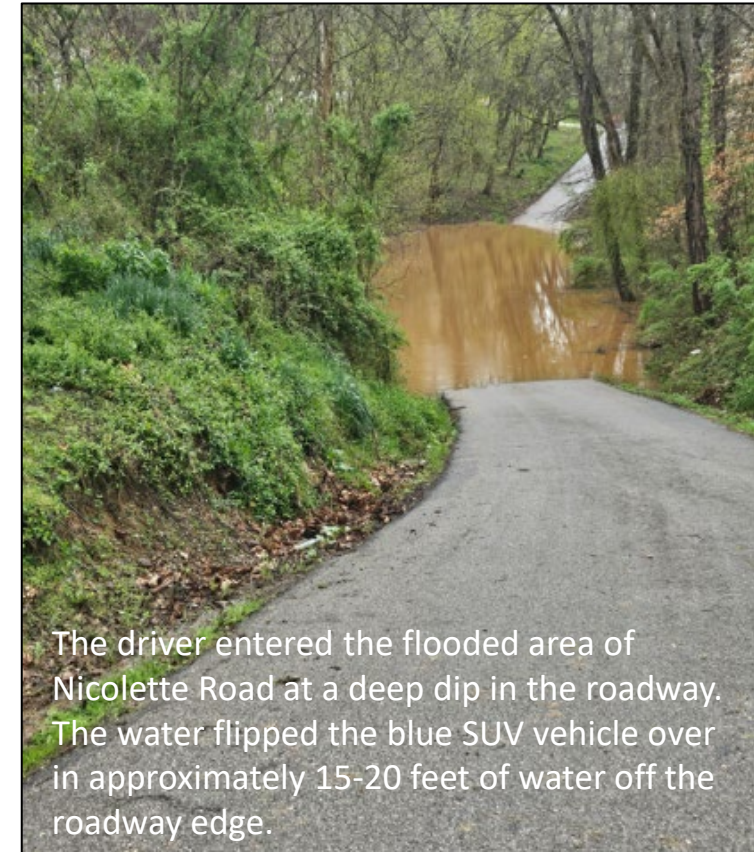
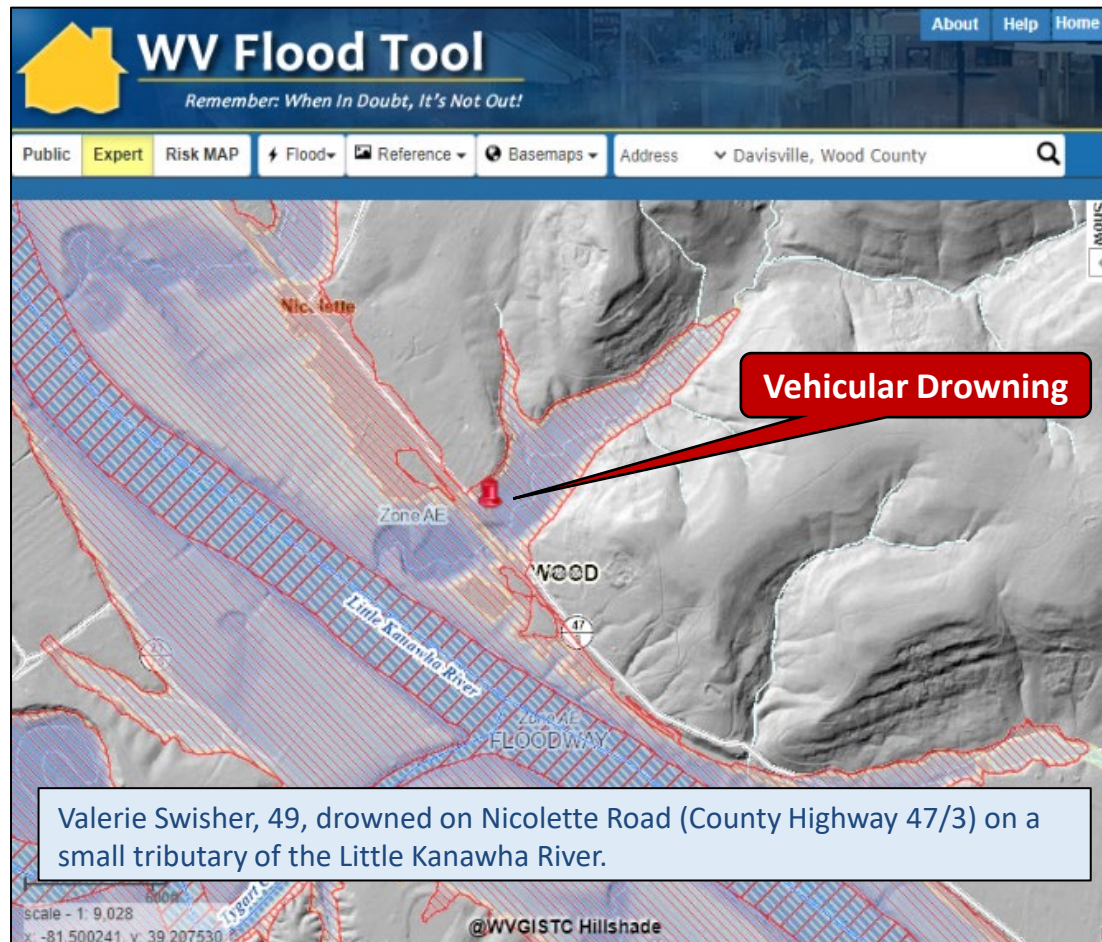


Educate to Avoid Risky Behavior

Risky Behavior Examples:

- Driving into floodwaters
- Attempting to rescue pets
- Retrieve memorabilia from basements
- Playing near flooded creeks
- Crossing or viewing from bridges

Vehicular Fatality Wood County Apr. 2024



Property-Level Mitigation by Owners



Purchase flood Insurance;
Elevate buildings;
Provide flood openings;
Seal foundations;
Elevate and anchor utilities;
Protect valuable possessions

<https://www.floodsmart.gov>
“What to do before a flood”



Links to Tools / Data



→ WV Flood Tool: <https://www.mapwv.gov/flood/>



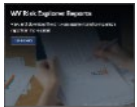
→ West Virginia Flood Resiliency Framework (WVFRF): <https://wvfrf.org/>



→ West Virginia Risk Explorer (WVRE) (Landing Page): <https://www.wvfrf.org/wvre/>



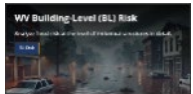
→ WV Risk Explorer Maps: https://wvfrf.org/wvre/map/?scaleid=3&gslid=&index=CUM_INDEX&type=pct



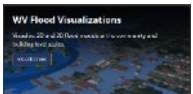
→ WV Risk Explorer Reports: <https://wvfrf.org/wvre/report/?entityid=68&scaleid=1&type=all>



→ WV Flood Dashboards: <https://wvfrf.org/wvre/dashboard/home/>



→ WV Building-Level (BL) Risk: <https://wvfrf.org/wvre/buildings/>



→ WV Flood Visualizations: <https://wvfrf.org/wvre/visualization/home/>



→ Access Data: <https://wvfrf.org/wvre/data/home/>



→ WV Hazard Library: <https://wvfrf.org/library/>



→ Landslide Tools: <https://wvfrf.org/wvre/landslides/>

Thank you!

Questions?



Email:

behrang.bidadian@mail.wvu.edu

kurt.donaldson@mail.wvu.edu

Backup Slides

Benefits of the Tools



■ Planning

- Enhancing state resiliency and hazard mitigation plans
- Updating emergency operation plans
- Prioritizing and allocating resources
- Identifying the need for more refined risk assessments



■ Risk Communications

- Encouraging community-level risk communication and engagement
- Educating new homeowners and renters
- Informing the insurance and mortgage industries



■ Mitigation

- Identifying areas of mitigation interest
- Supporting the development or enhancement of codes and standards
- Informing long-term community recovery



Unique Features of WV Risk Explorer Tools



- **Risk indicators Rankings to Identify Communities at Higher Risk in Risk Maps & Reports**

Interactively view and explore flood risk indicators on a map to identify areas of higher risk.

- **Interactive Downloadable Risk Reports by Multi-Scale Aggregation of Detailed Building-Level Inventory**

View and download flood risk assessment and comparison reports in more detail.

- **Sharable Queries for Risk Reports, Maps, and Tables**

Share your geographic selections along with data field queries for consistent use across teams.

- **Rationale and Recommendations for Risk Indicators**

Use the Technical Documentation to understand the rationale for the risk indicators and the recommendations associated with them.

- **Statewide Consistent Methodology and Risk Indicators**

In-depth flood risk indicators covering all of West Virginia uniformly, not just selected regions.

- **Flood Dashboards**

Use the interactive dashboards to analyze risk factors and mitigation measures.

- **Flood Visualizations**

Visualize 3D and 2D flood models at the community and building level scales.

- **Hazard Library Customized to West Virginia**

Search the document and visual media library for hazard information.

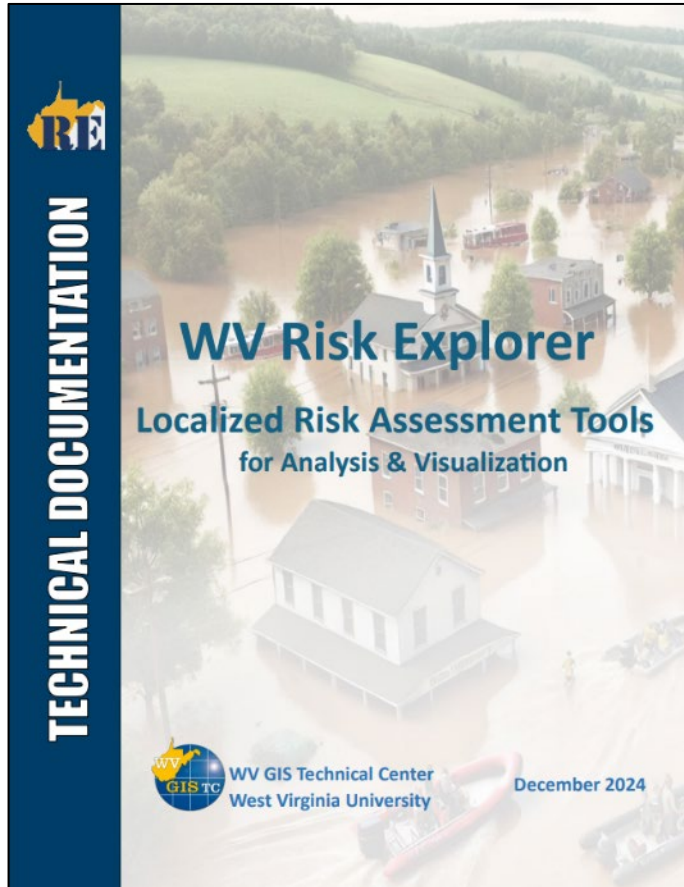
- **Data Access**

Download risk data for use in your own analyses, maps, or applications.

- **Scalable**

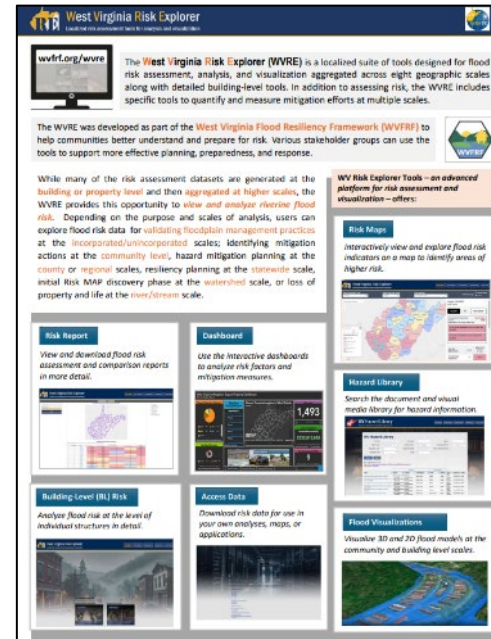
Scalable for other hazards such as landslides or enhancements to risk indicators.

WVRE Technical Document



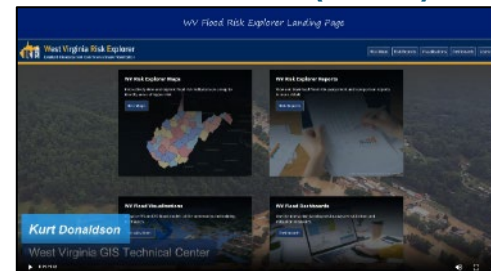
https://data.wvgis.wvu.edu/pub/RA/RI/WVRE/DOCS/WVRE_TechnicalDoc.pdf

WVRE One-Pager



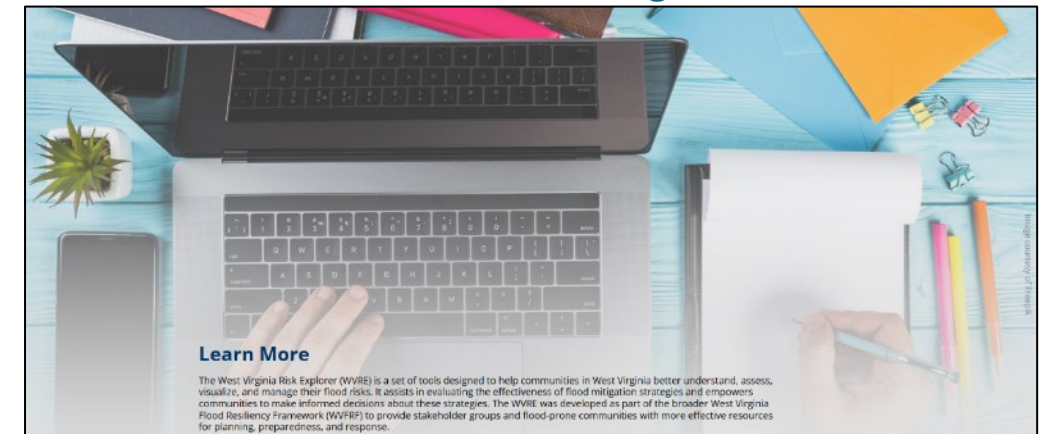
https://data.wvgis.wvu.edu/pub/RA/HL/WVFRF/Flyer/WVRE_Info_OnePager.pdf

WVRE Demo (Video)



https://data.wvgis.wvu.edu/pub/RA/HL/WVFRF/Video/WV_Risk_Explorer_Movie_20240826.mp4

WVRE Learn More Page



<https://wvrf.org/wvre/more/>

Metadata Documents

Data Dictionary (Metadata) WV Risk Index (Rankings/Scores)

https://data.wvgis.wvu.edu/pub/RA/HL/Data/RA-AL/1a_AL-RISK-INDEX/2_Metadata/WV_RiskIndex_DataDictionary.pdf

Data Dictionary (Metadata) Risk Full Data Matrix

https://data.wvgis.wvu.edu/pub/RA/HL/Data/RA-AL/1b_AL-MATRIX/2_Metadata/Full_Matrix_DataDictionary.pdf

Metadata, Full Building-Level Risk Assessment (BLRA) for Primary Structures

https://data.wvgis.wvu.edu/pub/RA/HL/Data/RA-BL/2a_BL-BLRA/3_Metadata/Full_BLRA_Metadata.pdf

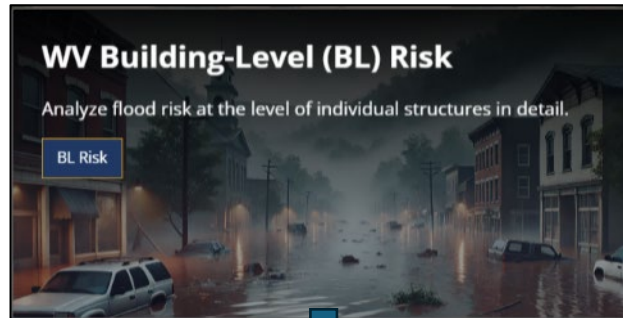
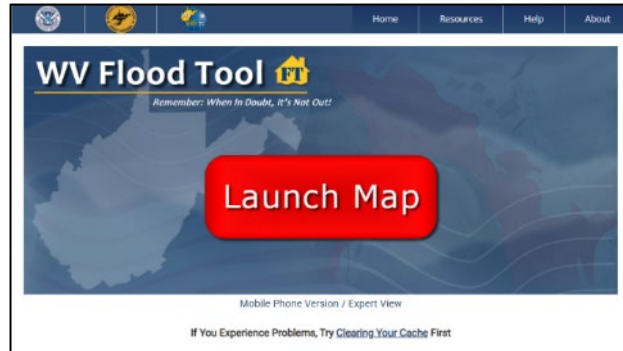
Metadata, Building-Level Significant Structures at Risk

https://data.wvgis.wvu.edu/pub/RA/HL/Data/RA-BL/2b_BL-SIG-STRC/1_All_Sig_Structures/2_Metadata/Significant_Structures_Metadata.pdf

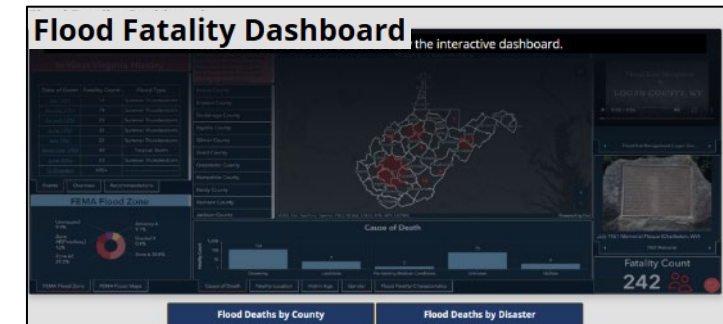
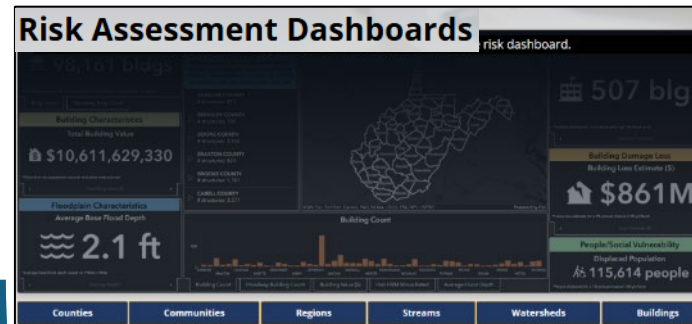
Risk Assessment Tools



Localized risk assessment tools for analysis



Building/Property-Level



Aggregated

Risk Communication Tools

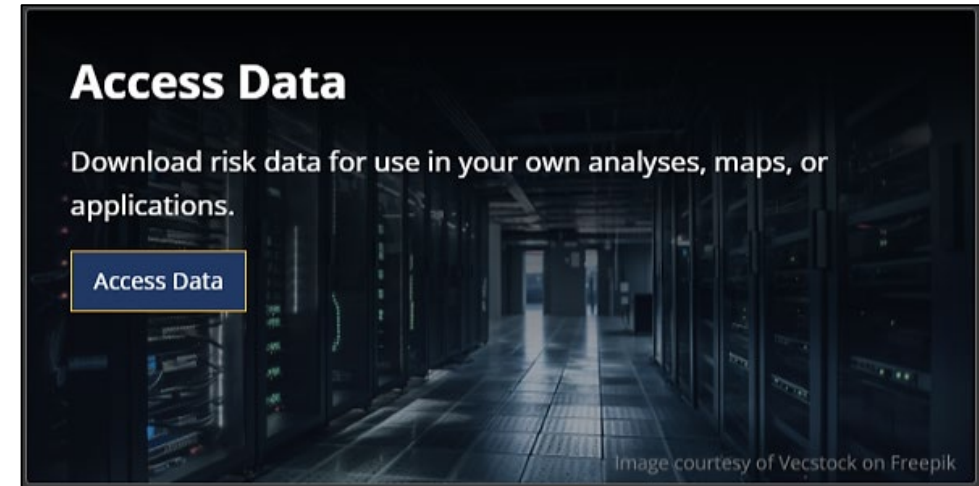
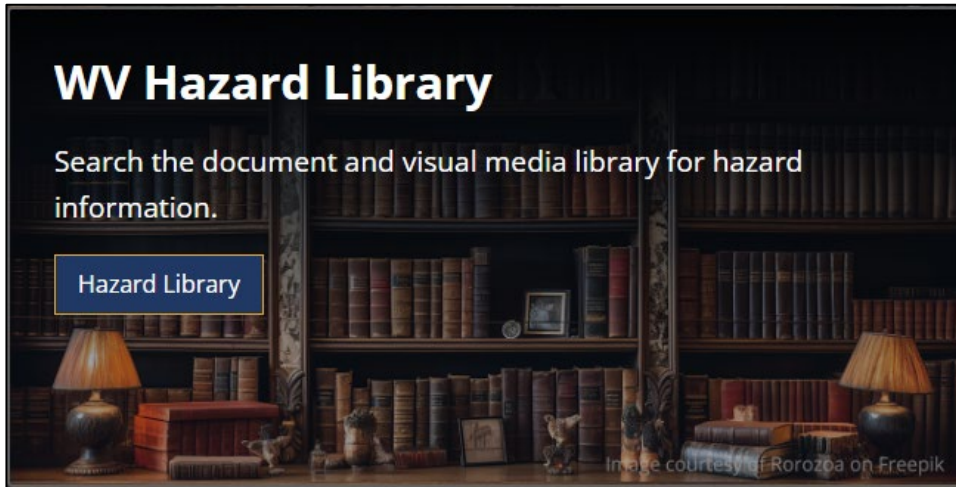
- Facilitating risk comprehension for different groups of stakeholders
(combined with other risk communication activities such as SFHA change letters, focus group meetings, presentations, etc.)



Hazard Library and Data Access



- Online hazard resources including comprehensive datasets, documents, and media



WV HAZARD LIBRARY		
TOPICS	MEDIA TYPES	SEARCH TYPES
<ul style="list-style-type: none">Risk Assessment & Planning<ul style="list-style-type: none">State Risk AssessmentsLocal Risk AssessmentsPlanning ResourcesWeb ToolsMitigation<ul style="list-style-type: none">Flood InsuranceFloodplain ManagementFloodplain MappingOther Mitigation MeasuresFlood Disaster<ul style="list-style-type: none">Flood EventFlood Research	<ul style="list-style-type: none">3D MovieBldg. ProfileDashboardData-GISData-MetadataData-TableFlyerGraphicGuideJournal ArticleLetterNews ArticlePicturePlanPosterReportSlidesSocial MediaStatic MapStory MapVideoViewshedWeb InfoWeb Tool	<ul style="list-style-type: none">AgencyDownloadable DataEvent DisasterEvent MeetingGeographic Scale<ul style="list-style-type: none">EntityMedia TypePublication DateSubject<ul style="list-style-type: none">Major GroupCategorySubcategorycross-indexingStakeholder TypeTitle (free text search)Predefined Searches<ul style="list-style-type: none">VisualizationsFloodplain Management Key Materials



Building-Level Flood Risk Data:

Building-Level Risk Assessment (BLRA)*:

[Table](#) | [Online BLRA Metadata](#) | [Full BLRA Metadata](#) | [GIS](#)

* Passcode required to access, please contact the [WVGISTC](#).

At-Risk Significant Structures:

[Table](#) | [Metadata](#) | [Essential Facilities GIS](#) | [Community Assets GIS](#)

Aggregated-Level Flood Risk Data:

Risk Index (Rankings/Scores):

[Table](#) | [Metadata](#)

Risk Full Matrix:

[Table](#) | [Metadata](#)

West Virginia Social Vulnerability Index (WV SVI):

[Table](#) | [Metadata](#)

Flood Mitigation Data:

Buyout Properties:

[Table](#) | [GIS](#) | [Metadata](#)

Floodplain Data:

[GIS](#) | [Effective Metadata](#) | [Advisory Metadata](#)

Landslide Data:

[Table](#) | [GIS](#) | [Metadata](#)