5.3 Earthquake

2023 SHMP Update Changes

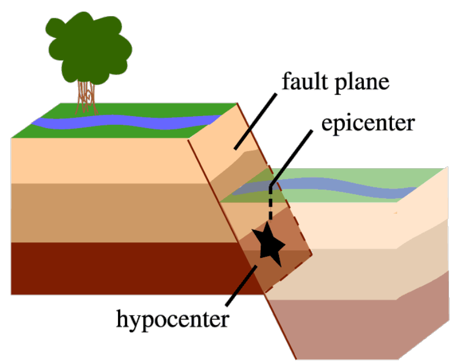
- Earthquake events that occurred in West Virginia from January 1, 2017, through December 31, 2022, were researched for this 2023 State Hazard Mitigation Plan (SHMP) update.
- New and updated figures from federal and state agencies are incorporated.
- This section now includes a discussion of how earthquakes impact socially vulnerable populations and community lifelines.

5.3.1 Hazard Profile

Hazard Description

Earthquakes occur when two blocks of the Earth suddenly slip past each other. The surface where they slip is called the fault, illustrated in Figure 5.3-1. The location below the Earth's surface where the earthquake starts is called the hypocenter, and the location directly above it on the surface is called the epicenter (USGS 2023). Earthquakes result in three basic phenomena: ground motion, surface faulting, and related ground failures. While most earthquakes tend to occur at the boundaries where tectonic plates meet, some earthquakes do occur in the middle of the plates (West Virginia Emergency Management Division 2018).

Figure 5.3-1. Earthquake Fault



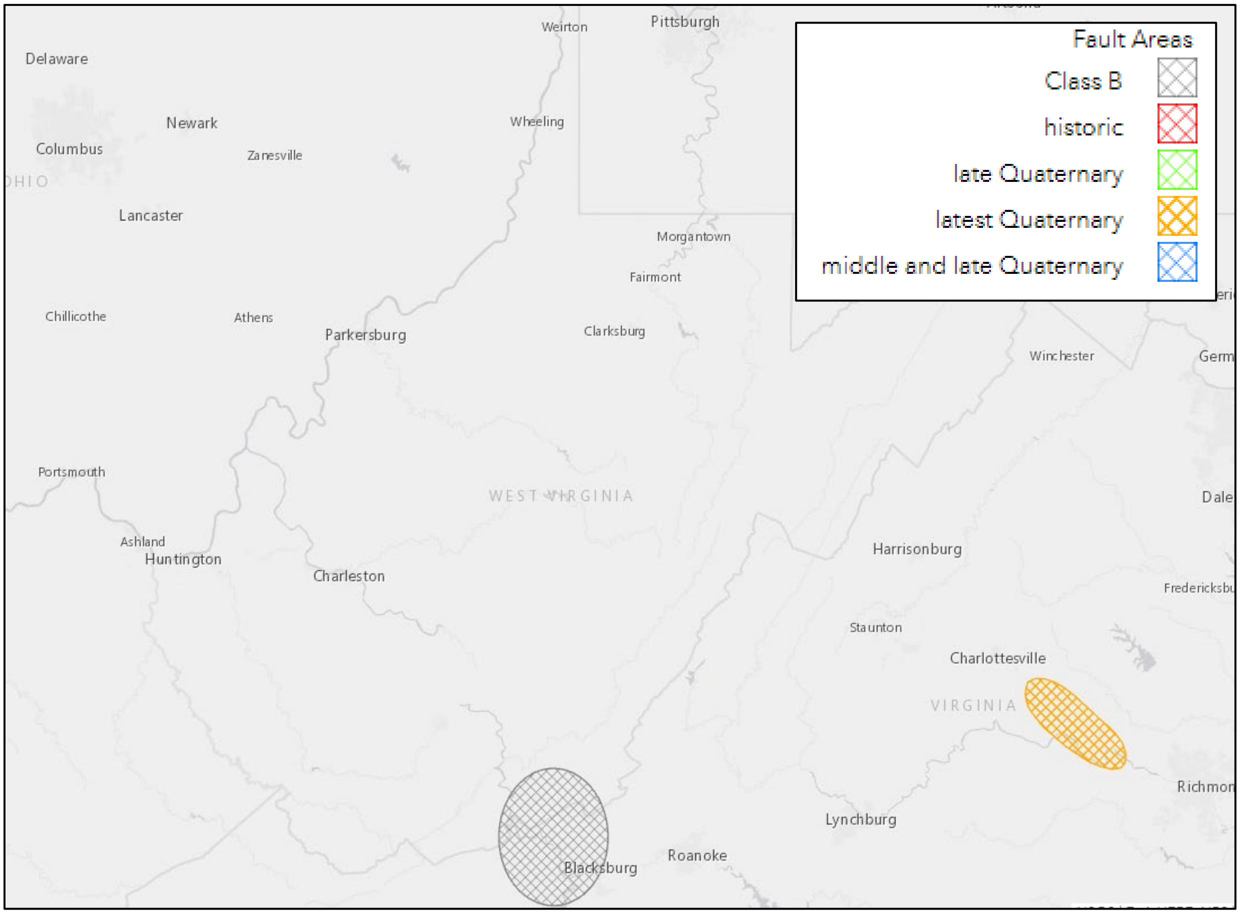
Source: USGS 2023

Location

Earthquakes occur along fault lines; however, they can impact anywhere in West Virginia. A majority of the earthquakes have occurred in the southern portion of the state where there is a higher seismic hazard.

Earthquakes occur along several fault lines crossing into West Virginia, but larger earthquakes develop in surrounding states and felt by many in West Virginia (West Virginia Emergency Management Division 2018). The Glee County Seismic Zone is located in southern West Virginia near the border of Virginia. This portion of the state has experienced the most earthquakes. Faults in this area trend toward Tennessee, and earthquakes in this zone can be associated with the Narrows Fault, the Saltville Fault, and/or the Holston Valley Fault (William & Mary University 2023) (see Figure 5.3-2).

Figure 5.3-2. Fault Lines and Areas in West Virginia



Source: U.S. Geological Survey 2023

EXTENT

The severity of an earthquake is classified by magnitude and intensity.

Measuring Earthquakes

Magnitude

Magnitude is the size of the earthquake. An earthquake has a single magnitude. The shaking that it causes has many values that vary from place to place based on distance, type of surface material, and other factors. Magnitude is expressed in whole numbers and decimal fractions. For example, a magnitude 5.3 is a moderate earthquake, and a 6.3 is a strong earthquake (U.S. Geological Survey 2023).

Magnitude is commonly expressed by ratings on the moment magnitude scale (Mw). It is based on the total moment release of the earthquake. Moment is a product of the distance a fault moved and the force required to move it (Michigan Tech 2023); (U.S. Geological Survey n.d.).

The scale is as follows:

- Great—Mw > 8

- Major—Mw = 7.0 – 7.9
- Strong—Mw = 6.0 – 6.9
- Moderate—Mw = 5.0 – 5.9
- Light—Mw = 4.0 – 4.9
- Minor—Mw = 3.0 – 3.9
- Micro—Mw < 3

Intensity

The intensity of an earthquake is based on the observed effects of ground shaking on people, buildings, and natural features and varies with location. Figure 5.3-3 and Table 5.3-1 show the ratings of the scale as well as the perceived shaking and damage potential for structures. The range of ground shaking depends on the distance from the earthquake, the rock and soil conditions at sites, and complexities in the structure of the Earth's crust that affect how the seismic waves radiate from the earthquake source.

The modified Mercalli intensity scale is generally represented visually using ShakeMaps, which show the expected ground shaking at any given location produced by an earthquake with a specified magnitude and epicenter. A ShakeMap shows the variation of ground shaking in a region immediately following significant earthquakes.

Figure 5.3-3. Modified Mercalli Scale

CIIM Intensity	People's Reaction	Furnishings	Built Environment	Natural Environment
I	Not felt			Changes in level and clarity of well water are occasionally associated with great earthquakes at distances beyond which the earthquakes felt by people.
II	Felt by a few.	Delicately suspended objects may swing.		
III	Felt by several; vibration like passing of truck.	Hanging objects may swing appreciably.		
IV	Felt by many; sensation like heavy body striking building.	Dishes rattle.	Walls creak; window rattle.	
V	Felt by nearly all; frightens a few.	Pictures swing out of place; small objects move; a few objects fall from shelves within the community.	A few instances of cracked plaster and cracked windows with the community.	Trees and bushes shaken noticeably.
VI	Frightens many; people move unsteadily.	Many objects fall from shelves.	A few instances of fallen plaster, broken windows, and damaged chimneys within the community.	Some fall of tree limbs and tops, isolated rockfalls and landslides, and isolated liquefaction.
VII	Frightens most; some lose balance.	Heavy furniture overturned.	Damage negligible in buildings of good design and construction, but considerable in some poorly built or badly designed structures; weak chimneys broken at roof line, fall of unbraced parapets.	Tree damage, rockfalls, landslides, and liquefaction are more severe and widespread wiht increasing intensity.
VIII	Many find it difficult to stand.	Very heavy furniture moves conspicuously.	Damage slight in buildings designed to be earthquake resistant, but severe in some poorly built structures. Widespread fall of chimneys and monuments.	
IX	Some forcibly thrown to the ground.		Damage considerable in some buildings designed to be earthquake resistant; buildings shift off foundations if not bolted to them.	
X			Most ordinary masonry structures collapse; damage moderate to severe in many buildings designed to be earthquake resistant.	

Source: U.S. Geological Survey 2022

Table 5.3-1. Modified Mercalli Intensity and PGA Equivalents

Modified Mercalli Scale	Perceived Shaking	Potential Structure Damage: Resistant Buildings	Potential Structure Damage: Vulnerable Buildings	Estimated PGA (%g)
I	Not Felt	None	None	Less than 0.17%
II-III	Weak	None	None	0.17% – 1.4%
IV	Light	None	None	1.4% – 3.9%
V	Moderate	Very Light	Light	3.9% – 9.2%
VI	Strong	Light	Moderate	9.2% – 18%
VII	Very Strong	Moderate	Moderate/Heavy	18% – 34%
VIII	Severe	Moderate/Heavy	Heavy	34% – 65%
IX	Violent	Heavy	Very Heavy	65% – 124%
X – XII	Extreme	Very Heavy	Very Heavy	More than124%

Source: U.S. Geological Survey n.d.

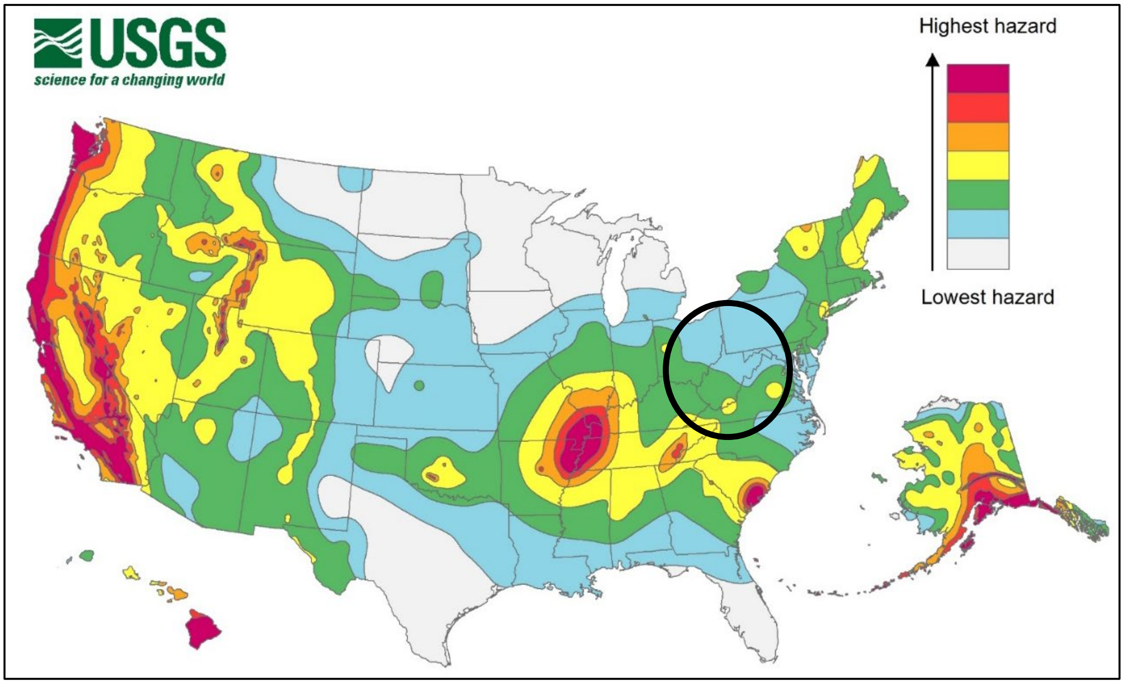
Ground Acceleration

One way to express an earthquake’s severity is to compare its acceleration to the normal acceleration due to gravity. Peak ground acceleration (PGA) is what is experienced by a particle on the ground. It measures the maximum force experienced by a small mass located at the surface of the ground during an earthquake (U.S. Geological Survey 2019). Figure 5.3-4 shows peak ground accelerations having a 2 percent probability of being exceeded in 50 years for a firm rock site. The highest hazard areas are shown in red, and the lowest hazard areas are shown in gray. West Virginia is shown predominantly as having a low hazard (light to moderate shaking), with a small portion of the state having a medium hazard (strong shaking).

Damage levels experienced in an earthquake vary with the intensity of ground shaking and with the seismic capacity of structures (U.S. Geological Survey 2021). The following generalized observations provide qualitative statements about the likely extent of damages for earthquakes with various levels of ground shaking (PGA) at a given site:

- Ground motions of 1 to 2%g are widely felt by people; hanging plants and lamps swing strongly, but damage levels, if any, are usually very low.
- Ground motions below 10%g usually cause only slight damage, except in unusually vulnerable facilities.
- Ground motions of 20 to 50%g may cause significant damage in some modern buildings and very high levels of damage (including collapse) in poorly designed buildings.
- Ground motions greater than 50%g may cause higher levels of damage in many buildings, even those designed to resist seismic forces (U.S. Geological Survey 2021).

Figure 5.3-4. 2018 Long-Term National Seismic Hazard Map



Source: U.S. Geological Survey 2018
Note: The models are based on seismicity and fault-slip rates, and take into account the frequency of earthquakes of various magnitudes. Locally, the hazard may be greater than shown, because site geology may amplify ground motions.

Warning Time

Under the Disaster Relief Act of 1974, the USGS has the federal responsibility to issue alerts for earthquakes, enhance public safety, and reduce losses through effective forecasts and warnings. The USGS currently issues rapid, automatic earthquake information via the internet, email messages, text messages, and social media (U.S. Geological Survey n.d.). Currently, there is no reliable way to predict the day or month that an earthquake will occur at any given location. The ShakeAlert® earthquake early warning system has been developed to monitor for significant earthquakes and issue alerts to warn that strong shaking is expected imminently. The ShakeAlert® system is being developed to cover California, Oregon, and Washington. Depending on how far a person is from the earthquake, these potential warning systems could give from a few seconds to a minute's notice that major shaking is about to occur (U.S. Geological Survey 2022). The warning time is very short, but it could allow for someone to get under a desk, step away from a hazardous material they are working with, or shut down a computer system. Currently, no such earthquake early warning system has been developed for West Virginia.

Previous Occurrences and Losses

Federal Emergency Management Agency (FEMA) Disaster Declarations

Between 1953 and 2022, the State was not included in any disaster (DR) or emergency (EM) declarations for earthquakes (FEMA 2023).

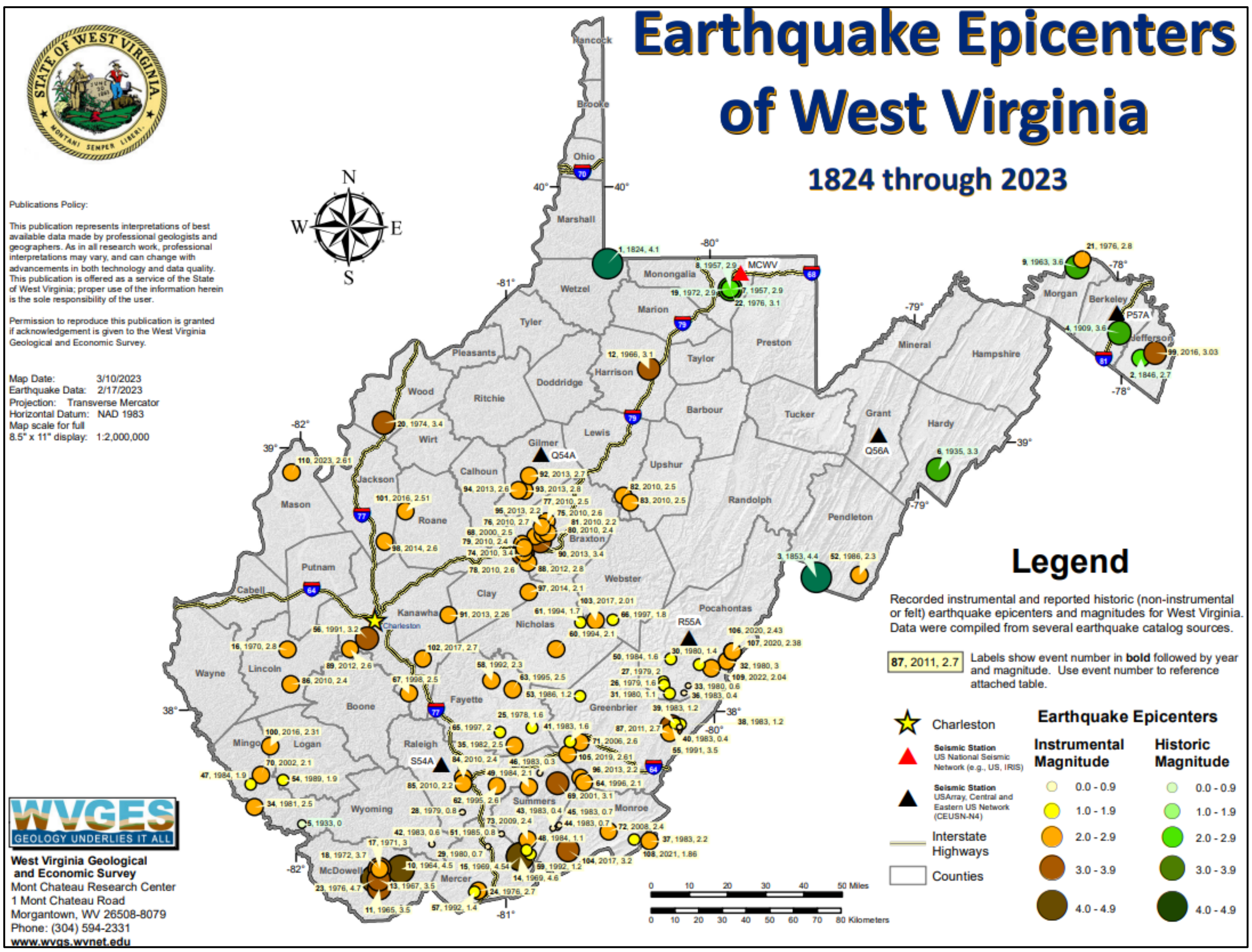
U.S. Department of Agriculture (USDA) Disaster Declarations

The Secretary of Agriculture from the USDA is authorized to designate counties as disaster areas to make emergency loans to producers suffering losses in those counties and in counties that are contiguous to a designated county. Between 2012 and 2022, West Virginia was not included in any agricultural disaster declarations pertaining to earthquakes (USDA 2023).

Previous Events

Figure 5.3-5 illustrates earthquakes with epicenters in West Virginia. Table 5.3-2 lists earthquake events that impacted the State since 1824. This table includes events identified in the 2018 SHMP events that occurred from January 1, 2017, through December 31, 2022. Due to the number of events, the table includes only those events with recorded damages or reports of people having felt the earthquake. For a full list of earthquakes, refer to the State's Geological and Economic Survey website (https://www.wvgs.wvnet.edu/).

Figure 5.3-5. Earthquake Epicenters in West Virginia, 1824 to 2023



Source: West Virginia Geological and Economic Survey 2023

Table 5.3-2. Earthquake Events in the State of West Virginia (1824 to 2022)

Date(s) of Event	Magnitude	Federal Disaster Declaration (if applicable)	Location (recorded epicenter)	Counties Affected	Description
1897	N/A	N/A	Not reported	Giles	Earthquake located in Giles County, Virginia was reported in Bluefield, West Virginia.
April 2, 1909	3.6	N/A	Not reported	Berkeley	Earthquake centered near Charles Town, WV caused pictures to be thrown from walls and residents were awakened by the 2:25am tremor.
1935	N/A	N/A	Quebec, Canada	Not reported	Earthquake located in Timiskaming, Quebec, Canada felt in West Virginia
1937	N/A	N/A	Anna, OH	Not reported	Earthquake in Anna, Ohio felt in Region 2 along the Ohio River.
1944	N/A	N/A	Not reported	Canada	Strong earthquake tremors in Canada reached Parkersburg.
1969	4.3	N/A	Not reported	Unknown	Earthquake with a 4.3 magnitude was the most widely felt earthquake in West Virginia's history. Epicenter location is not known.
1972	N/A	N/A	Not reported	Monongalia	Morgantown, WV experienced a minor tremor.
1974	N/A	N/A	Not reported	Giles	Giles County, Virginia was the center of a moderate disturbance, and a small earthquake in Ohio was felt in Parkersburg and other areas of Region 2.
April 29, 2010	2.6	N/A	3 km WNW of Gassaway, West Virginia	Braxton	According to USGS, seven people in West Virginia reported having felt the earthquake.
April 29, 2010	2.7	N/A	7 km W of Gassaway, West Virginia	Braxton	According to USGS, eight people in West Virginia reported having felt the earthquake.
May 7, 2010	2.6	N/A	14 km WSW of Gassaway, West Virginia	Braxton	According to USGS, four people in West Virginia reported having felt the earthquake.
August 21, 2010	2.5	N/A	19 km WNW of Helvetia, West Virginia	Upshur	According to USGS, four people in West Virginia reported having felt the earthquake.
August 25, 2011	2.7	N/A	14 km SE of Falling Spring, West Virginia	Greenbrier	West Virginians felt a 5.8 Md earthquake that had its epicenter in Virginia. That quake caused buildings in Charleston to sway, and was felt as far away as Charlotte, NC. According to USGS, 68 people in West Virginia reported having felt the earthquake.
January 10, 2012	2.8	N/A	14 km WNW of Birch River, West Virginia	Braxton	According to USGS, 28 people in West Virginia reported having felt the earthquake.
March 31, 2013	3.4	N/A	West Virginia	Braxton	According to USGS, 36 people in West Virginia reported having felt the earthquake.

Date(s) of Event	Magnitude	Federal Disaster Declaration (if applicable)	Location (recorded epicenter)	Counties Affected	Description
July 20, 2013	2.7	N/A	6 km SW of Glenville, West Virginia	Gilmer	Three low-magnitude earthquakes occurred. They ranged from 2.6 to 2.8 Md and were not reported, but rather showed up on sensing equipment.
July 30, 2013	2.8	N/A	12 km SSW of Glenville, West Virginia	Gilmer	Three low magnitude earthquakes occurred. They ranged from 2.6 to 2.8 Md and were not reported, but rather showed up on sensing equipment.
August 16, 2013	2.6	N/A	13 km SW of Glenville, West Virginia	Gilmer	Three low-magnitude earthquakes occurred. They ranged from 2.6 to 2.8 Md and were observed on sensing equipment. According to the USGS, seven people in West Virginia reported having felt the earthquake.
October 13, 2013	2.2	N/A	5 km NW of Gassaway, West Virginia	Braxton	A similar, small-scale earthquake was picked up by instrumentation.
October 19, 2013	2.2	N/A	2 km N of Alderson, West Virginia	Greenbrier	A similar, small-scale earthquake picked up by instrumentation.
June 6, 2014	2.6	N/A	13 km NNE of Sissonville, West Virginia	Jackson	A small, 2.6 Md earthquake was picked up by instruments but not reported.
January 17, 2016	3.0	N/A	3 km NE of Ranson, West Virginia	Jefferson	A 3.0 Md earthquake was reported by one person in Bolivar, WV.
August 6, 2016	2.3	N/A	6 km WNW of Verdunville, West Virginia	Mingo	A 2.3 Md earthquake picked up in Shamrock, WV.
September 13, 2017	3.2	N/A	11 km NE of Peterstown, West Virginia	Monroe	According to USGS, 81 people in West Virginia reported having felt the earthquake.
July 30, 2020	2.4	N/A	10 km ENE of Huntersville, West Virginia	Pocahontas	According to USGS, seven people in West Virginia reported having felt the earthquake.
December 7, 2021	1.9	N/A	16 km ESE of Union, West Virginia	Monroe	According to USGS, one person in West Virginia reported having felt the earthquake.
August 10, 2022	2.0	N/A	3 km S of Huntersville, West Virginia	Pocahontas	According to USGS, one person in West Virginia reported having felt the earthquake.

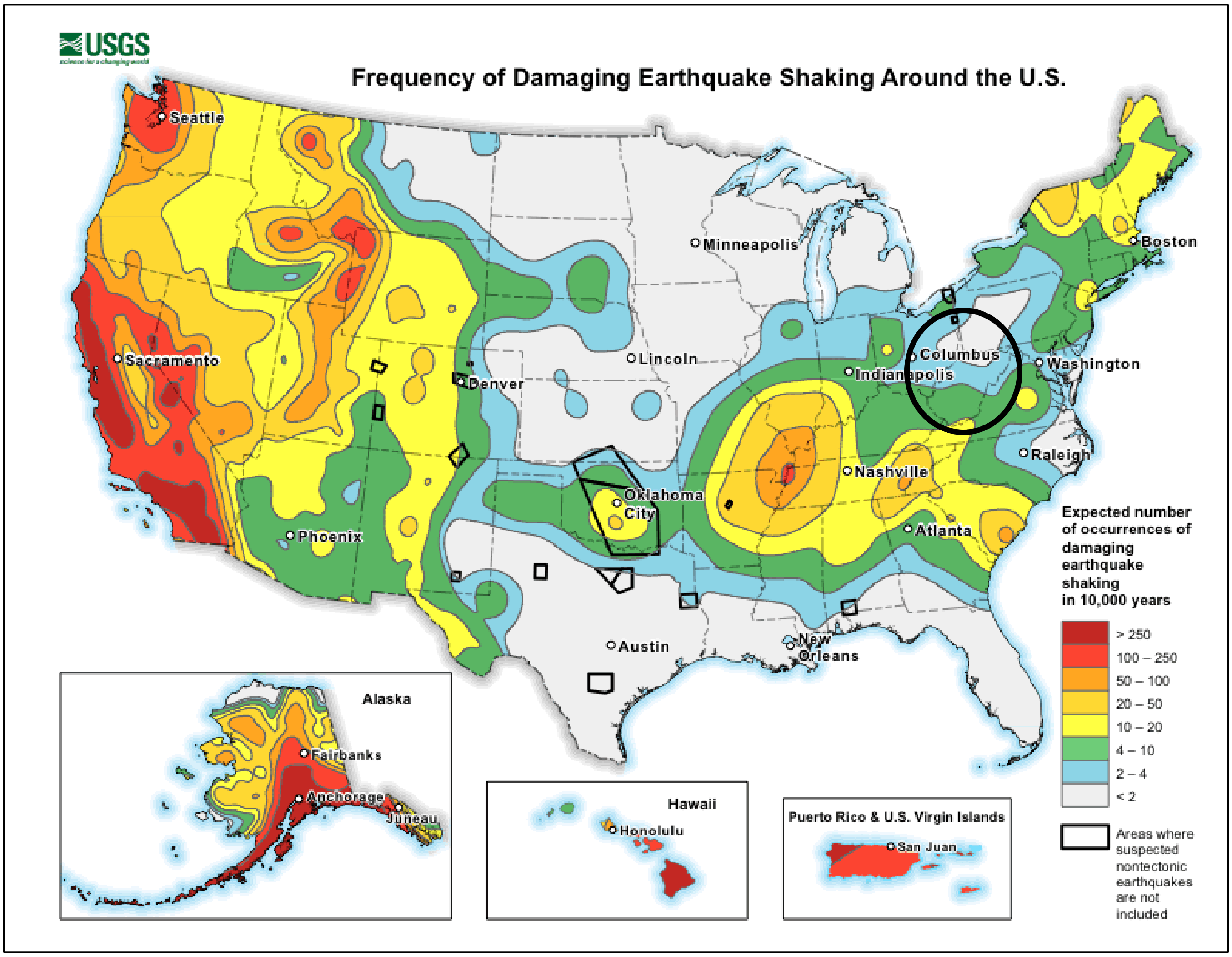
Sources: FEMA 2023; U.S. Geological Survey 2023; West Virginia Emergency Management Division 2018; West Virginia Geological and Economic Survey 2023

Probability of Future Hazard Events

Overall Probability

Figure 5.3-6 shows how many times earthquakes can cause damaging earthquakes (MMI VI or greater) in 10,000 years. However, earthquakes of any magnitude can happen at any time in West Virginia. The figure is showing that the northern portion of the state can expect between 2 and 4 damaging earthquakes in 10,000 years. The southern portion of the state can expect between 4 and 10 damaging earthquakes in 10,000 years (U.S. Geological Survey 2022).

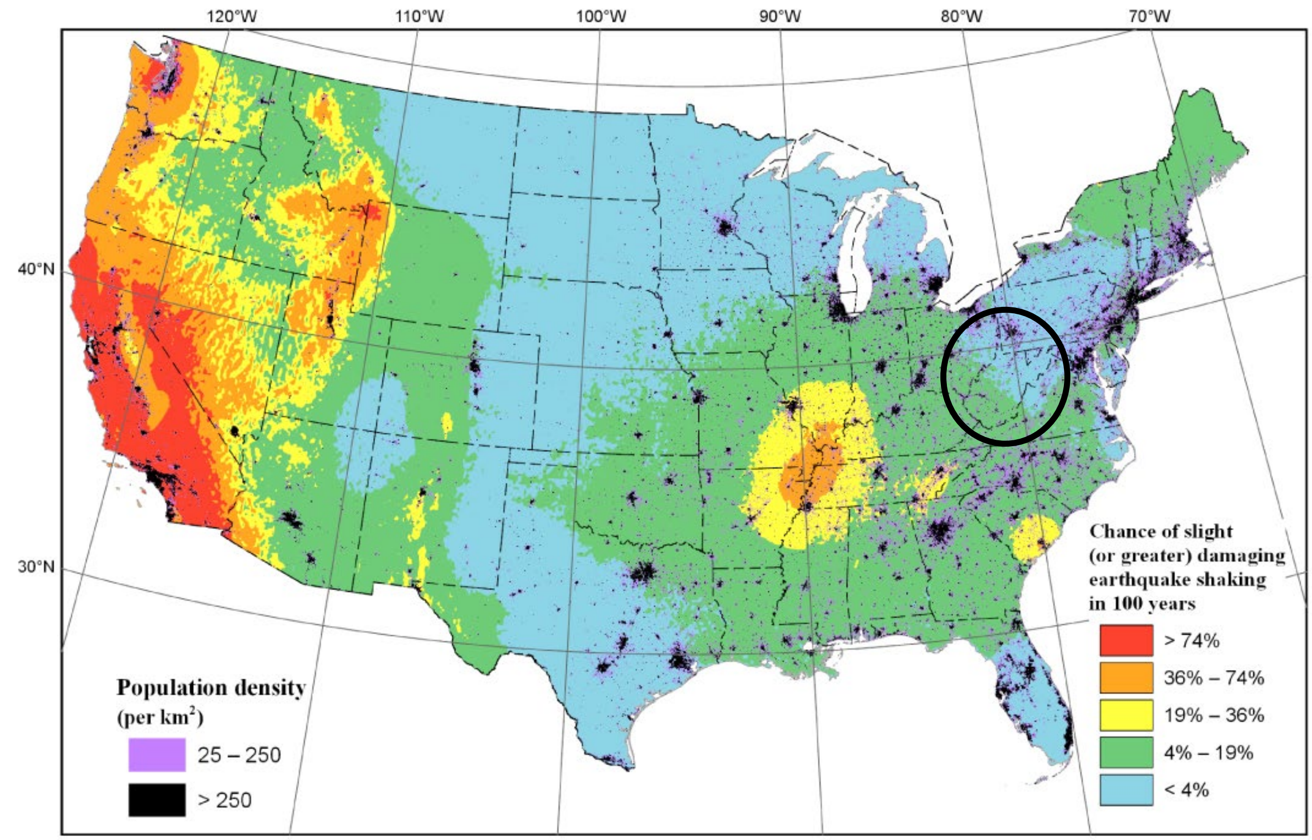
Figure 5.3-6. Frequency of Damaging Earthquake Shaking Around the United States



Source: U.S. Geological Survey 2022
Note: The location of West Virginia is shown with a black oval.

Figure 5.3-7 shows the locations of major populations and the chance of slight, or greater, damaging earthquake shaking occurring in 100 years. Southwestern West Virginia is shown as having between a 4 and 19 percent chance of a damaging earthquake occurring in 100 years, with the northeastern West Virginia having less than a 4 percent chance of a damaging earthquake.

Figure 5.3-7. Chance of Slight or Greater Damaging Earthquake Shaking in 100 Years



Source: U.S. Geological Survey 2022
Note: The location of West Virginia is shown with a black oval.

According to USGS, the West Virginia Geological and Economic Survey, and the 2018 SHMP, the State experienced 109 earthquakes with epicenters in West Virginia between 1824 and 2022, as summarized in Table 5.3-3. Overall, the state is likely to experience one earthquake every two years.

Table 5.3-3. Probability of Future Earthquake Events in West Virginia

Hazard Type	Number of Occurrences between 1824 and 2022	Percent Chance of Occurrence in Any Given Year
Earthquake	109	54.8%

Sources: West Virginia Geological and Economic Survey 2023; U.S. Geological Survey 2023

Projected Future Conditions

The potential direct impacts of projected future conditions on earthquake probability are unknown. Some scientists believe that melting glaciers could induce tectonic activity. As ice melts and water runs off, tremendous amounts of weight are shifted on the Earth's crust. As newly freed crust returns to its original, pre-glacier shape, it could cause seismic plates to slip and stimulate volcanic activity. Additionally, changes in the Earth's crust from periods of drought can be significant. Similarly, pumping of groundwater from underground aquifers for human use, which is exacerbated during times of drought, has been shown to impact patterns of stress loads by "unweighting" the Earth's crust (NASA 2019).

Secondary impacts of earthquakes could be magnified by projected future conditions. Earthquakes can cause large and sometimes disastrous landslides. Any steep slope is vulnerable to slope failure. Rising air temperatures can facilitate soil breakdown, allowing more water to penetrate soils and affect the rates of erosion, sediment control, and the likelihood of landslides. Projected future conditions may also increase the probability of more frequent, intense rainstorms. This can result in greater erosion, higher sediment transport in rivers and streams, and a higher probability of landslides, primarily as a result of higher soil content (University of Washington 2014).

5.3.2 Vulnerability Assessment

Probabilistic earthquake data in Hazus version 6.0 was used to assess the earthquake hazard in West Virginia. This section discusses statewide vulnerability of exposed state assets (state buildings and state roads), community lifelines, and critical facilities to the earthquake hazard.

State Assets

The total replacement cost value of state buildings is an estimated $6.1 million. Table 5.3-4 summarizes the values overall for the state. The potential damage estimated to state buildings associated with the 500-year probabilistic earthquake event is approximately $920 million, which represents approximately 15 percent of the inventory's total replacement cost value.

Table 5.3-4. State Buildings Exposure and Potential Losses to the 500-year Probabilistic Earthquake Event

Jurisdiction	Total Replacement Cost Value (RCV)	Earthquake 500-Year MRP	
		Estimated Total Damage	Percent of Total Building and Contents Replacement Cost Value
West Virginia State (Total)	$6,103,990,956	$920,036,000	15.07%

Sources: Hazus v6.0; U.S. Census 2020
Note: Results were not reported at the county level due to how minimal the results were

Critical Facilities and Community Lifelines

Transportation routes, including bridges and highways, are vulnerable to earthquakes, especially those exposed to the 500-year earthquake event. Aging infrastructure and those already in poor condition are most vulnerable. Additionally, interruption of utility infrastructure services can be impacted, affecting vulnerable populations and facilities that need to be in operation during a disaster. Table 5.3-5 summarizes the estimated damages to State-owned critical facilities, by community lifeline, exposed to the 500-year probabilistic earthquake event. Transportation lifelines have the highest percentage of total building and contents replacement cost value, followed by safety and security lifelines.

Table 5.3-5. State Critical Facilities and Community Lifelines and Potential Losses to the 500-year Probabilistic Earthquake Event

Lifeline Category	Total Replacement Cost Value (RCV)	Earthquake 500-Year MRP	
		Estimated Total Damage	Percent of Total Building and Contents Replacement Cost Value
Communications	$10,240,007	$2	0.00%
Energy	$0	$0	0.00%
Food, Water, Shelter	$2,384,067	$179,929	7.55%
Hazardous Material	$0	$0	0.00%
Health & Medical	$17,805,006	$2,415,003	13.56%
Safety & Security	$890,655,329	$299,248,433	33.60%
Transportation	$44,654,481	$24,932,095	55.83%
West Virginia State (Total)	$965,738,890	$326,775,462	33.84%

Sources: Hazus v6.0; U.S. Census 2020

Population

As seen in Figure 5.3-5, earthquakes have impacted all portions of the state; therefore, the entire population has the potential to be affected by an earthquake. However, the degree of exposure is dependent on many factors, including the age and type of construction people live in, the soil types their homes are located on, and the intensity of the earthquake. Populations considered most vulnerable are those located in/near the built environment, particularly those near unreinforced masonry construction. Whether directly or indirectly impacted, residents may be faced with business closures, road closures that could isolate population, and loss of function of critical facilities and utilities. As a result of an earthquake event, residents may be displaced or require temporary to long-term sheltering. The planning effort to develop the 2023 SHMP did not include running Hazus throughout the state. Statistics on the population affected, displaced, or requiring shelter can be found in the local hazard mitigation plans.

Impacts on Socially Vulnerable Populations

Overall, the entire population of the State is exposed and vulnerable to earthquakes. Therefore, the exposed socially vulnerable population to earthquake is equal to the statewide percentage: 60.4 percent of the total population. Factors leading to higher susceptibility for socially vulnerable populations include decreased mobility and financial ability to react or respond during a hazard and the location and construction quality of their housing.

Future Changes That May Impact State Vulnerability

Understanding future changes that may impact vulnerability in the state can assist in planning for future development and ensuring that appropriate mitigation, planning, and preparedness measures are in place. The state considered the following factors in examining potential conditions that may affect hazard vulnerability:

- Potential or projected development
- Projected changes in population
- Other identified conditions as relevant and appropriate, including impacts of future conditions

Potential or Projected Development

Any sections of growth and development, especially developing in areas near fault lines like the southern portion of the state, could be impacted by earthquakes.

Projected Changes in Population

While statewide population has declined over the past 10 years, population has increased in several areas throughout the state (e.g., Berkely, Jefferson, and Monongalia Counties). From 2010 to 2019, the state's overall population decreased by 3.3 percent, and it is projected to decrease 7.8 percent by 2040 (West Virginia Department of Transportation 2020). As the overall population decreases, fewer people will be exposed to earthquakes and its impacts. However, counties with projected population increases, especially those in areas in and around fault zones, will have an increased risk of earthquake impacts.

Other Factors of Change

As discussed above, it is unknown whether project future conditions will increase earthquake events. Refer to Projected Future Conditions for details on how future conditions can impact earthquakes.

5.3.3 Consequence Analysis

Impacts to the Public

It is anticipated that the State will be impacted by smaller earthquakes less than once every two years. Because of this probability, the impact to the public is assumed minimal. However, when an earthquake does occur, there is risk to the health and safety to the public from falling debris. If a strong earthquake occurs, it has the potential to impact the public, causing deaths, injuries, and extensive property damage (West Virginia Emergency Management Division 2018).

Impacts to Responders

Because of the low probability of a strong earthquake, the impact to the first responders is considered minimal. However, first responders will assist during and after an earthquake event, so they could be injured due to falling debris. First responders will follow state and county emergency procedures.

Impacts to Continuity of Operations

Little to no impacts to operations are anticipated in West Virginia due to the probability and severity of earthquakes in the state.

Impacts to Property, Facilities, and Infrastructure

Overall, minimal impacts are expected if an earthquake occurs. However, if a strong earthquake occurs, the impacts can be severe and cause significant damage. Ground shaking can lead to the collapse of buildings and bridges and disruption of gas and electric lines, phone service, and other critical utilities (West Virginia Emergency Management Division 2018).

Secondary impacts from earthquakes can impact buildings and infrastructure as well. These impacts include fire, hazardous material release, landslides, flash flooding, avalanches, and dam failure, all having the potential to cause significant damage in West Virginia (West Virginia Emergency Management Division 2018).

Impacts to the Environment

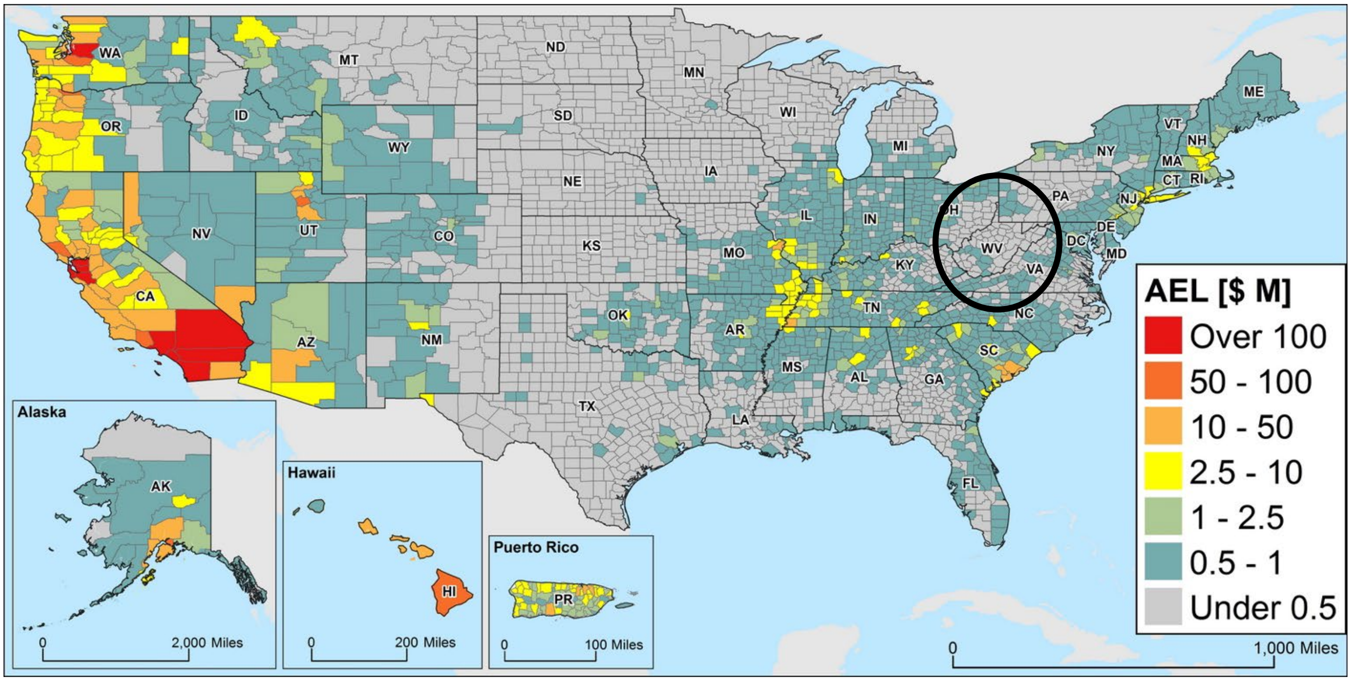
According to USGS, earthquakes can cause damage to the surface of the Earth in various forms depending on the magnitude and distribution of the event (USGS 2020). Surface faulting is one of the major seismic components to earthquakes that can create wide ruptures in the ground. Ruptures can have a direct impact on the landscape and natural environment because it can disconnect habitats for miles, isolating animal species or tearing apart plant roots.

Furthermore, ground failure as a result of soil liquefaction can have an impact on soil pores and retention of water resources (USGS 2020). The greater the seismic activity and liquefaction properties of the soil, the more likely drainage of groundwater can occur, which depletes groundwater resources. In areas where there is higher pressure of groundwater retention, the pores can build up more pressure and make soil behave more like a fluid rather than a solid increasing risk of localized flooding and deposition or accumulation of silt.

Impacts to the Economic Condition of the State

In April 2017, FEMA released a report that conducted a nationwide evaluation of earthquake losses in the United States: HAZUS-MH Estimated Annualized Earthquake Losses for the United States. FEMA's evaluation ranked West Virginia 41st in the Nation for Annualized Earthquake Loss Ratio (AELR) ($7.4 million) and 44th for Annualized Earthquake Losses (AEL) ($1.4 million) (West Virginia Emergency Management Division 2018). Figure 5.3-8 shows that a majority of West Virginia has minimal damages associated with earthquakes. There is a narrow band of counties with annualized damages between $500,000 and $1 million.

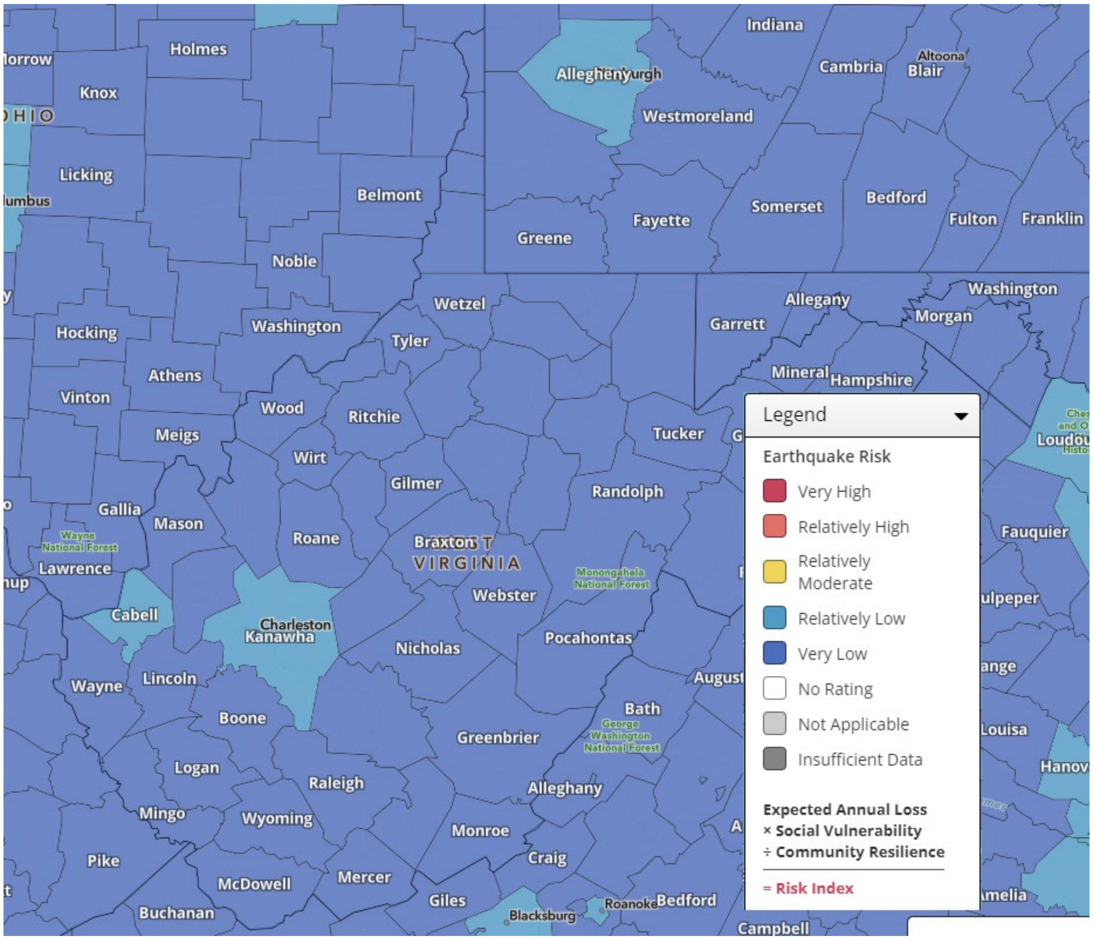
Figure 5.3-8. Annualized Earthquake Loss by County



Source: *West Virginia Emergency Management Division 2018*
Note: *The location of West Virginia is shown with a black oval.*

According to FEMA's National Risk Index, nearly all of West Virginia has very low expected annual losses ($3.6 million), with just two counties (Cabell [$360,000] and Kanawha [$507,000]) having a relatively low expected annual losses due to earthquakes (FEMA 2023).

Figure 5.3-9. FEMA National Risk Index – Earthquake



Source: FEMA 2023

IMPACTS TO PUBLIC CONFIDENCE IN STATE GOVERNANCE

Public confidence would largely depend upon how effectively the State and county and local governments prepare for and respond to an earthquake event. Little impact to public confidence in the state's governance is expected.