REGION 8
PLANNING & DEVELOPMENT COUNCIL
MULTI-JURISDICTIONAL
HAZARD MITIGATION PLAN UPDATE 2018

PREPARED BY
JH CONSULTING, LLC OF WEST VIRGINIA
JANUARY, 2018

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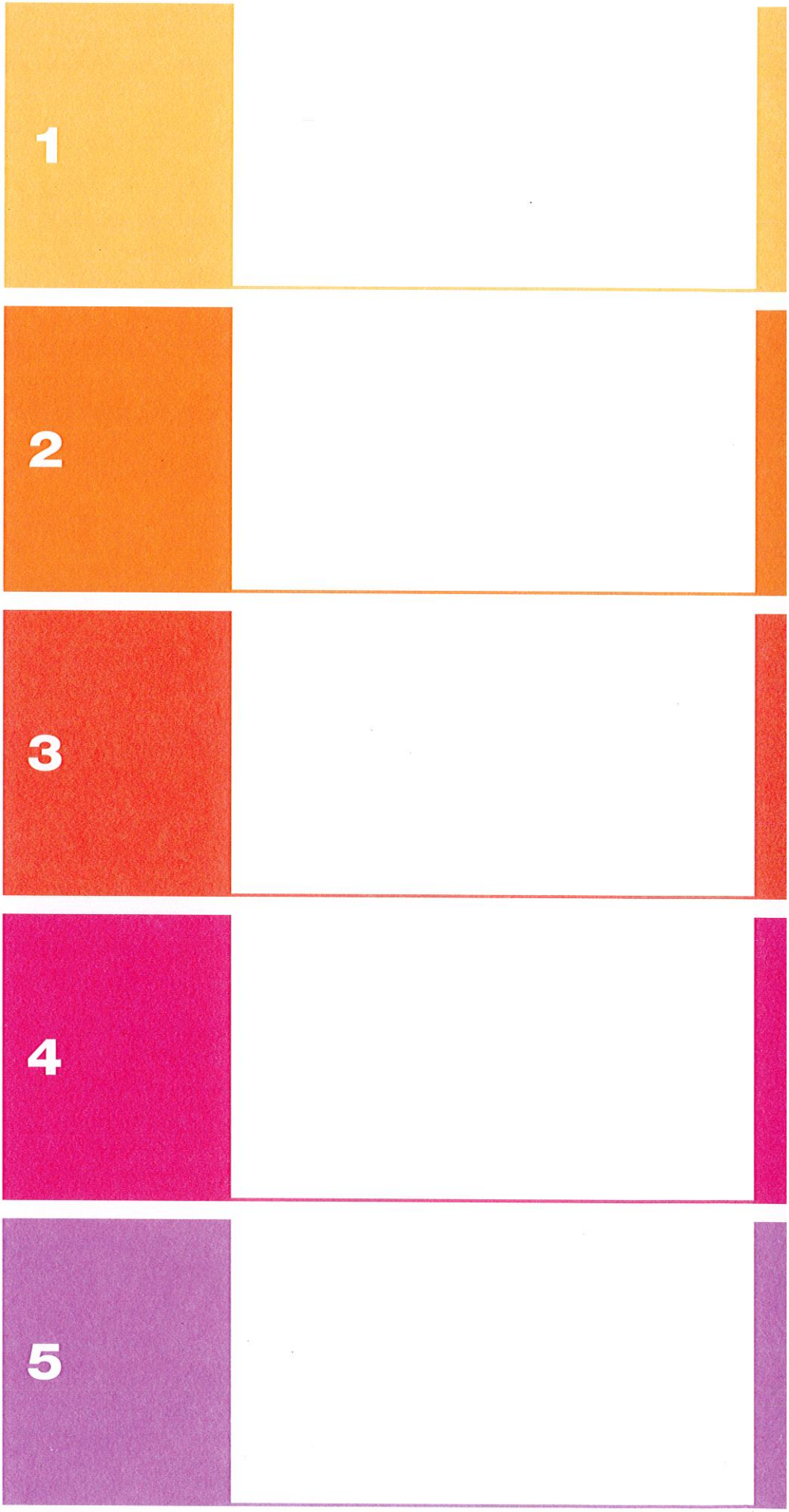
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1.0 INTRODUCTION

This section presents an introduction to the hazard mitigation plan and defines the authority, scope and purpose of the plan.

Plan Introduction

The *Region 8 Hazard Mitigation Plan* details natural and technological hazards that threaten Grant, Hampshire, Hardy, Mineral, and Pendleton Counties and their various municipalities. The plan fulfills the requirements set forth by the Disaster Mitigation Act of 2000 (DMA2K). This Act requires counties to formulate a hazard mitigation plan in order to be eligible for mitigation funds made available by the Federal Emergency Management Agency (FEMA).

Plan Authority

This multi-jurisdictional plan has been completed in accordance with Section 322 of the Robert T. Stafford Disaster Relief and Emergency Assistance Act, as enacted by Section 104 of the Disaster Mitigation Act of 2000. The guidelines for the completion of this plan appear in the Code of Federal Regulations under Title 44: Emergency Services, Part 201.6. Specific reference is made to the Local Mitigation Planning Handbook (USDHS/FEMA, 2013).

Plan Scope

The *Region 8 Hazard Mitigation Plan* includes all cities, villages, and townships within Grant, Hampshire, Hardy, Mineral, and Pendleton Counties. All hazards that have or can affect the residents of the region are analyzed. Hazard mitigation objectives, goals and projects are discussed, as are project lead agencies and potential funding sources.

Plan Purpose

The purpose of the *Region 8 Hazard Mitigation Plan* is to identify and evaluate all natural and technological hazards that can and may affect Grant, Hampshire, Hardy, Mineral, and Pendleton Counties and to describe mitigation strategies to address these hazards.

2018 Updates

The plan organization follows the previous plan's very closely; where appropriate, sections have been updated to reflect the most recent available information. In general, the plan has been reformatted to present information in a more user-friendly way (i.e., tables and graphics where appropriate). Each section includes a "2018 Update" where it describes the changes and updates more specifically.

1.1.2 Jurisdictional Involvement

All the jurisdictions and steering committee members had the opportunity to be involved in a variety of activities ranging from in-person meetings, teleconferences, email, and phone correspondence to discussing hazards, capabilities, projects, and development trends and challenges in their communities. The representatives from each jurisdiction and a description of how each one participated in the process, is outlined in Table 1.1.2.A.

TABLE 1.1.2.A JURISDICTIONAL INVOLVEMENT

Jurisdiction	*Participation Level*	*Representative(s)*	*Title*
Bayard, Town of	2, 3	Steven Durst	Mayor
Capon Bridge, Town of	2, 3	Penny Feather	Clerk
Carpendale, Town of	3	Butch Armentrout	Mayor
		Rhonda Vanmeter	
Elk Garden, Town of	3	Tom Braithwaite	Councilman
Franklin, Town of	1, 2, 3, 4	Frank Wehrle	Floodplain Manager
Grant County	1, 2, 3	Peggy Bobo-Alt	OEM Director
		Cullen Sherman	Sanitarian
Hampshire County	1, 2, 3, 4	Brian Malcolm	HSEM Director
Hardy County	1, 2, 3	Paul Lewis	OEM Director
		Melissa Scott	Floodplain Manager
Keyser, City of	2, 3	Brandi Paugh	Recorder
Mineral County	1, 2, 3, 4	Luke McKenzie	HSEM Director
		Drew Brubaker	Commissioner
		Roger Leatherman	Commissioner
Moorefield, City of	2, 3	Gary Stalnaker	Mayor
Pendleton County	1, 2, 3	Bruce Minor	OEM Director
		Gene McConnell	Commissioner
Petersburg, City of	3	Sheila Vanmeter	City Manager
Piedmont, City of	2, 3	Ben Smith	Mayor
Ridgeley, Town of	3	Mark Jones	Mayor
Romney, City of	1, 2, 3	Jessica Szabo	City Administrator
Wardensville, Town of	2, 3	Greg Alderman	Mayor
Region 8 PDC	1, 2, 3, 4	Terry Lively	Executive Director
		Carla Dent	Office Assistant

1. Involved in the steering committee by attending meetings and direct contact with the consultant.
2. Completed or provided at least one of the following: asset inventory update, jurisdictional project status update, new project worksheet completion, hazard information for the jurisdiction, NFIP survey, and/or the online capabilities survey.
3. Had direct contact with the Region 8 PDC, a steering committee member or the consultant about updates in their jurisdiction relevant to the project.
4. Posted or published the public survey online or in print.

Planning and steering committee members attended several in-person and teleconference meetings throughout the update process. The following table describes the meeting types, dates, and what was discussed as part of the update.

Government
Grant County Commission
Petersburg Mayor
Bayard Mayor
Romney Mayor
Hampshire County Commission
Wardensville Mayor
Mineral County Commissioner
Carpendale Mayor
Ridgeley Mayor
Keyser Mayor
Piedmont Mayor
Elk Garden Council
Franklin Council
Capon Bridge Mayor
Moorefield Mayor
Pendleton County Commission
Hardy County Commission

Quasi-Government
Grant County Development Authority
Region 7 Workforce Investment Board
Hardy County Rural Development Authority

Private Business
Bean & Bean Attorneys
Insurance Company
Farmers
Bed and Breakfast

Economic Asset
Capon Valley Bank
Pendleton Community Bank
Grant County Bank

Higher Education
Workforce Education EWVC

The Region 8 PDC also invited other partners that were not on the planning committee to provide feedback about hazards in their environments and to comment on their risks. The Region 8 PDC reached out to the following entities (see Appendix 2: Process and Participation for letters and emails sent out and responses received).

Quasi-Government
Region 4 Planning and Development Council
Region 7 Planning and Development Council
Region 9 Planning and Development Council
Mineral County Board of Education
Hardy County Board of Education
Grant County Board of Education
Pendleton County Board of Education

Higher Education
Eastern WV Community & Technical College

Private Business
Pilgrim's Pride
Allegheny Dimension
American Woodmark
Judy's Drug Store

Healthcare
Grant Memorial Hospital
Grant County Rehabilitation Center
Potomac Valley Hospital

information for such sections as Analyzing Development Trends, and (c) to support discussions surrounding mitigation projects. Those documents included the following.

TABLE 1.1.4.A GENERAL RESEARCH

Document Type	*Document Citation*	*How Incorporated Into Plan*
Technical Information	USDHS FEMA Region 2I. (July, 2015). *Plan Integration: Linking Local Planning Efforts.* Federal Government: Washington, D.C.	Used as guidance on incorporating local planning efforts/plans into the planning process.
Technical Information	USDHS FEMA. (June, 2016). *National Mitigation Framework.* Federal Government: Washington, DC	Used as general guidance on mitigation planning.
Technical Information	USDHS FEMA. (May, 2005). *Integrating Historic Property and Cultural Resource Considerations into Hazard Mitigation Planning.* Federal Government: Washington, D.C.	Used as general guidance for incorporating historic property and cultural protection.
Technical Information	USDHS FEMA. (March, 2013). *Local mitigation planning handbook.* Federal Government: Washington, D.C.	Used as general guidance on revised mitigation planning process
Technical Information	USDHS FEMA. (March, 2013). *Integrating Hazard Mitigation Into Local Planning.* Federal Government: Washington, D.C.	Used as general guidance on existing plan integration for hazard mitigation
Plan	Region 8 Planning and Development Council. (2017). *FY 2018 Regional Development Plan Update Comprehensive Economic Development Strategy.* Regional: Petersburg, WV.	Used for investigation of current mitigation projects and development trends in the area.
Report	Bureau of Business & Economic Research. (2014). *Potomac Highlands Economic Outlook.* Regional: Morgantown, WV.	Used as reference for economic status and development for the region.
Plan	Hampshire County (n.d.). *Floodplain Management Plan.* County Government: Romney, WV.	Used as reference for flooding in Hampshire County.
Plan	Hampshire County. (2009). *Hampshire County Comprehensive Plan.* County Government: Romney, WV.	Used for investigation of current mitigation projects and development trends in Hampshire County.
Plan	Town of Franklin. (2016). *Source Water Protection Plan.* Local Government: Franklin, WV.	Used for investigation of current mitigation projects and plans for Franklin.
Plan	Grant County Planning Commission. (2013). *Grant County Plan.* County Government: Morgantown, WV.	Used for investigation of current mitigation projects and development trends in Grant County.
Plan	Hardy County Planning Office. (August, 2011). *Hardy County Comprehensive Plan.* County Government: Moorefield, WV.	Used for investigation of current mitigation projects and development trends in Hardy County.
Plan	Mineral County Development Authority. (2014). *2014 Strategic Plan for the Mineral County Development Authority.* County Government: Keyser, WV.	Used for investigation of current mitigation projects and development trends in Mineral County.
Plan	Eastern Panhandle Health Response Team. (June, 2016). *All-Hazards Response Plan.* Regional.	Used for investigation of current mitigation projects and epidemiologic capabilities in the region.

1.2 DESCRIPTION OF THE PLANNING AREA

2017 UPDATE

As this section was updated, the section for development trends was moved to its own section in the risk assessment; geographical descriptions of the region as well as information on demographics, transportation, and utilities were updated. New subtitles under this section include medical services, media, jurisdictional capabilities, and disaster declarations.

1.2.1 Regional Geography, Climate, and Environment

Region 8 is located on the Eastern Panhandle of West Virginia between Maryland and Virginia. It consists of five counties, Grant, Hampshire, Hardy, Mineral and Pendleton, and all their municipalities which include a total of eight towns and three cities.

TABLE 1.2.1.A REGION 8 JURISDICTIONS

Name	*Type*	*County*
Bayard	Town	Grant
Capon Bridge	Town	Hampshire
Carpendale	Town	Mineral
Elk Garden	Town	Mineral
Franklin	Town	Pendleton
Grant	County	N/A
Hampshire	County	N/A
Hardy	County	N/A
Keyser	City	Mineral
Mineral	County	N/A
Moorefield	Town	Hardy
Pendleton	County	N/A
Petersburg	City	Grant
Piedmont	City	Mineral
Ridgeley	Town	Mineral
Romney	City	Hampshire
Wardensville	Town	Hardy

The Region 8 counties are nestled in the heart of the Appalachian region in an area called the Potomac Highlands. Some areas have mountain elevations of up to 4,500 feet. West Virginia has several physiographic provinces; most of the geographic area of Region 8 is located in the Valley and Ridge Province, and a small part in the Allegheny Mountain Section, divided by the Allegheny Font, a prominent geological feature which runs northeast-southwest across the state. The Valley and Ridge Province in the east contains folded and faulted rocks that range in age from late Precambrian to early Mississippian and the Allegheny Mountain Section combines elements of the folded mountains to the east and the dissected plateau (WVGES, 2017).

The main rivers in the region include the North Branch and South Branch of the Potomac River, Cacapon River, and North and South Forks of the South Branch which all flow in a northeastern direction to the Potomac River, ultimately ending up in the Chesapeake Bay, all forming part of the Chesapeake Bay Watershed (Geology.com, n.d.).

The Allegheny Mountains create a rain shadow, thus the western part of the state receives more precipitation than the eastern panhandle, but the mountains receive the

TABLE 1.2.2.A DEMOGRAPIC DATA FOR REGION 8						
Fact	*Grant County*	*Hampshire County*	*Hardy County*	*Mineral County*	*Pendleton County*	*Totals/Average*
Asian alone, percent, July 1, 2016, (V2016)	0.20%	0.30%	1.00%	0.50%	0.10%	**0.42%**
Two or More Races, percent, July 1, 2016, (V2016)	0.90%	1.20%	1.50%	1.40%	1.30%	**1.26%**
Hispanic or Latino, percent, July 1, 2016, (V2016)	1.30%	1.40%	4.80%	0.90%	1.20%	**1.92%**
White alone, not Hispanic or Latino, percent, July 1, 2016, (V2016)	96.70%	95.80%	89.90%	94.10%	95.10%	**94.32%**
Veterans, 2011-2015	870	1,615	1,110	2,169	706	**6470**
Foreign born persons, percent, 2011-2015	0.10%	0.40%	2.70%	0.50%	0.50%	**4.20%**
Housing						
Housing units, July 1, 2016, (V2016)	6,583	13,870	8,168	13,106	5,179	**46,906**
Median value of owner-occupied housing units, 2011-2015	$124,900	$121,400	$118,800	$128,300	$100,500	**$118,780**
Households, 2011-2015	4,175	10,194	5,156	11,289	3,095	**33,909**
Language other than English spoken at home, percent of persons age 5 years+, 2011-2015	1.90%	1.40%	5.70%	1.30%	1.00%	**2.26%**
Education						
High school graduate or higher, percent of persons age 25 years+, 2011-2015	81.90%	78.20%	79.40%	88.70%	80.20%	**81.68%**
Bachelor's degree or higher, percent of persons age 25 years+, 2011-2015	12.30%	10.10%	14.00%	12.40%	15.30%	**12.82%**
Health						
With a disability, under age 65 years, percent, 2011-2015	11.10%	16.80%	12.20%	16.00%	12.80%	**13.78%**
Persons without health insurance, under age 65 years, percent	7.70%	9.40%	9.70%	6.80%	8.40%	**8.40%**
Economy						
In civilian labor force, total, percent of population age 16 years+, 2011-2015	55.00%	50.10%	58.30%	52.00%	47.80%	**52.64%**
Mean travel time to work (minutes), workers age 16 years+, 2011-2015	27.2	38.1	25.3	27.9	30.2	**29.74**
Median household income (in 2015 dollars), 2011-2015	$39,088	$27,995	$40,303	$36,153	$36,953	**$36,098.40**
Per capita income in past 12 months (in 2015 dollars), 2011-2015	$20,052	$18,477	$22,195	$20,093	$21,979	**$20,559.20**
Persons in poverty, percent	15.90%	18.60%	14.40%	15.60%	16.40%	**16.18%**
Total employment, percent change, 2014-2015	3.20%	1.60%	1.50%	-4.90%	-3.30%	**-0.38%**
Other						
Population per square mile, 2010	25	37.4	24.1	86.1	11.1	**36.74**
Land area in square miles, 2010	477.37	640.25	582.31	327.83	696.05	**2723.81**

1.2.3 Transportation

Roads

The transportation network of the Region 8 area includes four-lane, divided highways, two-lane roadways, and single-lane roadways. This network passes through a

although several temporary logging railroads penetrated the county in the early 20th century (Taylor, 2013).

Air

There is one airport, categorized as a general aviation facility in Region 8: the Grant County Airport that serves Petersburg.

1.2.4 Economy

In all five counties, the economy (i.e., local work force) is driven by education, healthcare, and social assistance and manufacturing whereas five years ago it was government and the trade, transportation, and utilities industries. Table 1.2.4.B shows the top five industries in each county, with the percent of individuals employed by each.

TABLE 1.2.4.A TOP INDUSTRIES BY COUNTY

County	*INDUSTRY 1 Name (%)*	*INDUSTRY 2 Name (%)*	*INDUSTRY 3 Name (%)*	*INDUSTRY 4 Name (%)*	*INDUSTRY 5 Name (%)*
Grant	Education, Healthcare & Social Assistance (21.5%)	Manufacturing (16.8%)	Construction (15.0%)	Retail Trade (9.8%)	Transportation, Warehousing, and Utilities (6.5%)
Hampshire	Education, Healthcare & Social Assistance (26.2%)	Manufacturing (10.1%)	Retail Trade (14.8%)	Construction (10.1%)	Public Administration (6.9%)
Hardy	Manufacturing (26.6%)	Education, Healthcare & Social Assistance (20.2%)	Retail Trade (10.5%)	Arts, Entertainment, Recreation, Accommodation & Food Services (9.9%)	Construction (6.0%)
Mineral	Education, Healthcare & Social Assistance (24.5%)	Manufacturing (18.3%)	Retail Trade (13.7%)	Arts, Entertainment, Recreation, Accommodation & Food Services (10.0%)	Public Administration (7.5%)
Pendleton	Education, Healthcare & Social Assistance (27.1%)	Manufacturing (12.4%)	Construction (12.2%)	Retail Trade (10.5%)	Public Administration (8.9%)

Source: WVU County Data Profiles (2016)

Table 1.2.4.B shows the top ten employers in each county. The county Board of Education is one of the top three employers in every county.

1.2.6 Media

The type of media in Region 8 with most variety is the non-daily newspapers (six) followed by radio stations (three) and one each daily newspaper, college newspaper, and college radio.

TABLE 1.2.6.A MEDIA IN REGION 8

Type of Media	*Name*	*Location*
Daily Newspaper	Mineral Daily News-Tribune	Keyser
Non-Daily Newspaper	Echo (Weekender)	Keyser
Non-Daily Newspaper	Moorefield Examiner	Moorefield
Non-Daily Newspaper	Piedmont Herald	Piedmont
Non-Daily Newspaper	Grant County Press	Petersburg
Non-Daily Newspaper	Hampshire Review	Romney
Non-Daily Newspaper	Pendleton Times	Franklin
College Newspaper	Pasquino	Keyser
Radio	WQZK-FM 94.1	Keyser
Radio	WVa Public Radio-FM 89.5	Petersburg
Radio	WKLP-AM 1390	Keyser
College Radio	WJGF-FM 104.1	Romney

Source: wvmediaguide.com

1.2.7 Utilities

In Region 8 there are several services for utilities such as cable television, electric, gas, sewer, solid waste, and water. Table 1.2.7.A outlines each type of utility and the providers for the counties.

TABLE 1.2.7.A UTILITIES IN REGION 8

County	*Utility Name*
Cable Television	
Grant	C T & R Cable
Grant	Cequel III Communications II LLC
Grant	Shenandoah Cable Television, LLC
Hampshire	Atlantic Broadband (Penn), LLC
Hardy	Hardy Telecommunications, Inc.
Hardy	Atlantic Broadband (Penn), LLC
Hardy	C T & R Cable
Mineral	Atlantic Broadband (Penn), LLC
Mineral	Cequel III Communications II LLC
Mineral	Shenandoah Cable Television, LLC
Mineral	Comcast Communications
Pendleton	Cequel III Communications II LLC
Pendleton	Shenandoah Cable Television, LLC
Pendleton	Spruce Knob Seneca Rocks Telephone, Inc.
Electric	

TABLE 1.2.7.A UTILITIES IN REGION 8	
County	*Utility Name*
Mineral	LCS Services
Pendleton	LCS Services
Telephone	
Grant	Citizens Telecommunications Company of WV
Grant	Frontier West Virginia Inc.
Hampshire	Citizens Telecommunications Company of WV
Hardy	Hardy Telecommunications, Inc.
Hardy	Citizens Telecommunications Company of WV
Mineral	Citizens Telecommunications Company of WV
Mineral	Frontier West Virginia Inc.
Pendleton	Spruce Knob Seneca Rocks Telephone, Inc.
Pendleton	Frontier West Virginia Inc.
Water	
Grant	Grant County Public Service District
Grant	Mountain Top Public Service District
Hampshire	Central Hampshire Public Service District
Hardy	Hardy County Public Service District
Mineral	Fountain Public Service District
Mineral	Frankfort Public Service District
Mineral	Mountain Top Public Service District
Pendleton	Pendleton County Public Service District
Grant	Petersburg Water Department City of
Hampshire	Town of Capon Bridge (Water)
Hampshire	City of Romney (Water Department)
Hardy	Moorefield Municipal Water Works
Hardy	Town of Wardensville
Mineral	Town of Carpendale (Water)
Mineral	City of Keyser Water Department
Mineral	City of Piedmont Municipal Water Department
Mineral	Town of Ridgeley (Water Department)
Pendleton	Franklin Municipal Water Department
Hampshire	P & P Enterprises Utilities, LLC
Mineral	Lakewood Utilities, Inc.
Mineral	Mountain View Water System LLC
Hardy	Hardy County Rural Development Authority
Mineral	New Creek Water Association, Inc.

Source: Public Service Commission of West Virginia

1.2.8 Jurisdictional Capabilities

The counties and municipalities within Region 8 PDC have a number of capabilities that can support mitigation efforts including comprehensive plans, building codes, subdivision and land use ordinances, zoning ordinances, and floodplain regulations. The

that community to participate in the program. However, a community is permitted and encouraged to adopt standards which exceed NFIP requirements.

TABLE 1.2.8.A JURISDICTIONAL CAPABILITIES

Jurisdiction	Comprehensive Plan	Building Codes	Participate in NFIP	Subdivision or Land Use Ordinance	Zoning Ordinance	Capital Budget Funds for Mitigation Projects	Public Works Budget for Mitigation projects
Grant County	YES	NO	YES*	YES	NO	NO	NO
Hampshire County	YES	YES	YES*	YES	NO	NO	NO †
Hardy County	YES	NO	YES	YES	YES	NO	NO
Mineral County	YES	NO	YES	YES	NO	NO †	NO †
Pendleton County	NO	NO	YES*	NO	NO	NO	NO
Bayard, Town of	NO	YES	YES*	NO	NO	NO †	NO †
Franklin, Town of	YES	YES	YES*	NO	NO	NO †	NO †
Keyser, City of	NO	NO	YES	NO	NO	NO	NO
Moorefield, City of	YES	YES	YES*	YES	YES	NO †	YES
Piedmont, City of	NO	YES	YES	NO	NO	NO	NO
Romney, City of	NO	NO	YES	NO	YES	NO †	NO †
Wardensville, Town of	YES	NO	YES	YES	YES	NO †	NO †

** Exceeds the minimum standards of NFIP Requirements*
† No, but willing to consider for future projects

Administrative and Technical Capability

Administrative capability is described by an adequacy of departmental and personnel resources for the implementation of mitigation-related activities. Technical capability relates to an adequacy of knowledge and technical expertise of local government employees or the ability to contract outside resources for this expertise to effectively execute mitigation activities. Common examples of skill sets and technical personnel for hazard mitigation include planners with knowledge of land development/management practices, engineers or professionals trained in construction practices related to buildings and/or infrastructure (e.g., building inspectors), planners or engineers with an understanding of natural and/or human caused hazards, emergency managers, floodplain managers, land surveyors, scientists familiar with hazards in the community, staff with the education or expertise to assess community vulnerability to hazards, personnel skilled in geographic information systems, resource development staff or grant writers, and fiscal staff to handle complex grant application processes.

Self-Assessment

Representing the largest jurisdictions in Region 8, committee members completed a self-assessment for their jurisdictions to serve as representative capabilities within the region to effectively implement hazard mitigation activities. As part of this process, the Region 8 consultant encouraged members to consider barriers to implementing proposed mitigation strategies in addition to the mechanisms that could enhance or further such strategies. In response to the survey questionnaire, local officials classified each of the capabilities as either "limited," "moderate," or "high." Table 1.2.8.B summarizes the results of the self-assessment survey as a percentage of the eight responses received.

TABLE 1.2.8.B CAPBILITY SELF-ASSSESSMENT

Capability	*High*	*Moderate*	*Limited*
Planning & Regulatory	14.29%	57.14%	28.57%
Administrative & Technical	14.29%	42.86%	42.86%
Fiscal	0%	28.57%	71.43%
Political	0%	71.43%	28.47%

The 2017 self-assessment also included four questions to gauge community receptiveness to several types of mitigation strategies. Table 1.2.8.C details the results.

TABLE 1.2.8.C SELF-ASSSESSMENT: PROJECT CONSIDERATIONS

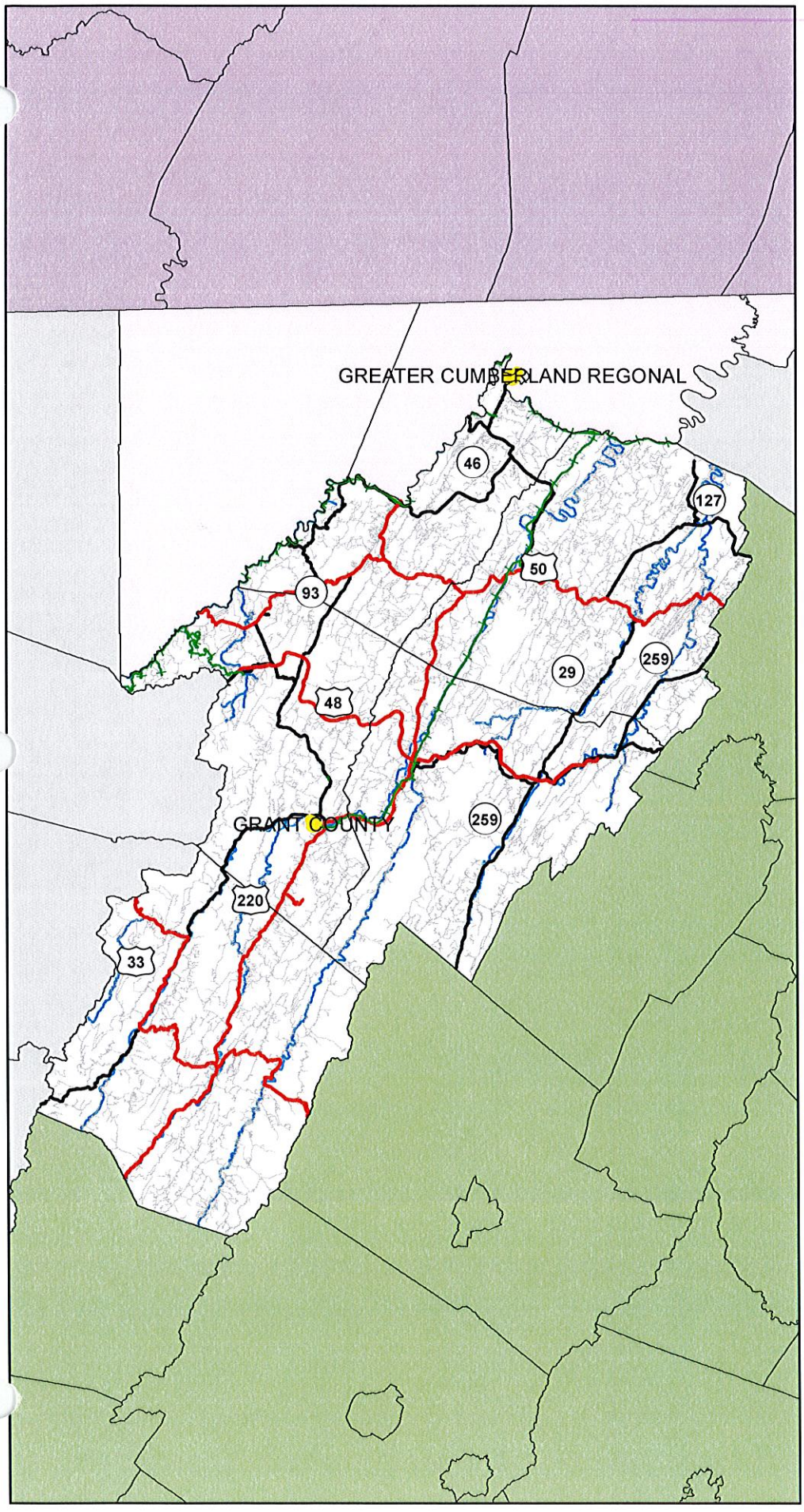
Sample Mitigation Strategy	*Very Willing*	*Willing*	*Neutral*	*Unwilling*	*Very Much Unwilling*
XYZ community guides development away from known hazard areas.	21.43%	42.86%	21.43%	14.29%	0%
XYZ community restricts public investments or capital improvements within hazard areas.	7.14%	50%	28.57%	14.29%	0%
XYZ community enforces local development standards (e.g., building codes, floodplain management ordinances, etc.) that go beyond minimum state or federal requirements.	14.29%	27.14%	21.43%	7.14%	0%
XYZ community offers financial incentives (e.g., through property tax credits) to individuals and businesses that employ resilient construction techniques (e.g., voluntarily elevate structures, employ landscape designs that establish buffers, install green infrastructure elements, etc.).	7.14%	28.57%	42.86%	21.43%	0%

1.2.9 Disaster Declarations

When a hazard incident occurs in a state, and the capabilities exceed those of the state, after the preliminary damage assessment, the Governor can request that the President declare an emergency or a disaster.

TABLE 1.2.9.A DECLARATIONS IN REGION 8 SINCE 2007				
Declaration Number	*Event Type*	*Counties Affected*	*Dates of Event*	*Public Assistance*
DR-1881	Severe Winter Storm and Snowstorm	Pendleton	December 18, 2009 - December 20, 2009	$3.66 per capita
DR-1696	Severe Storms, Flooding, Landslides, and Mudslides	Grant Hardy Pendleton	April 14, 2007 - April 18, 2007	$6,708,634.83 per event

On June 3, 2018, West Virginia Governor declared a state of emergency for all Region 8 PDC counties due to heavy rainfall that caused significant flooding.



REGION 8 HAZARD MITIGATION PLAN

Region 8 Transportation

Data Source(s):
US Census, Tiger Data
WV GIS Tech Center

Airports

Railroads

US Routes

State Routes

Roads

Miles
0 3 6 12 18 24

DISCLAIMER: Data is meant for use as reference only. Some sources may be intended to be used at national or regional scales and are thus used beyond their original intent for demonstrative purposes.

REGION 8

H Consulting, LLC

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2.0 RISK ASSESSMENT

§201.6(c)(2)(i)	[The risk assessment shall include a] description of the...location and extent of all natural hazards that can affect the jurisdiction. The plan shall include information on previous occurrences of hazard events and on the probability of future hazard events.

2018 UPDATE

Risk calculations have been moved to their own section here, formatted, updated, and expanded upon since the last plan update. Analysis of impacts and vulnerability for each hazard is new to this plan. All tables, maps, and charts have been updated to reflect the most up-to-date data available from a variety of sources.

OVERVIEW

A risk assessment analyzes "the potential for damage, loss, or other impacts created by the interaction of hazards with community assets" (FEMA, 2013). The risk assessment section contains information on:

- identified hazards that threaten the region in profiles,
- the vulnerability of the area as it relates to its assets,
- a list of community assets for Region 8, and
- an analysis of planned development and development challenges.

through risk mapping. Generally, the severity estimations will be less exact than probability estimations. The four classifications of severity are shown on the right.

TABLE 2.2.1.B. SEVERITY	
Description	*Definition*
Catastrophic	Death or major structural loss
Critical	Severe injury, severe illness, or marginal structural damage
Marginal	Minor injury, minor illness, or structural damage
Negligible	Less than minor injury, illness or structural damage

The combination of hazard probability and hazard severity results are shown in a table known as the Risk Assessment Matrix. There are many definitions for the level of risk (i.e. low or very low, high or very high); for the purposes of this plan, the determinations are made to follow the *2013 West Virginia Statewide Hazard Mitigation Plan Update* document so as to align this regional plan with the state's plan. The matrix is designed to show the hazards that are of most concern to Region 8. Each profile details the level of severity and probability, therefore generating the level of risk.

TABLE 2.2.1.C. RISK ASSESSMENT MATRIX						
		PROBABILITY				
		Frequent	*Probable*	*Occasional*	*Remote*	*Improbable*
SEVERITY	*Catastrophic*	High	High	Medium High	Medium	Medium Low
	Critical	Medium High	Medium High	Medium	Medium Low	Low
	Marginal	Medium High	Medium	Medium Low	Low	Low
	Negligible	Medium	Medium Low	Medium Low	Low	Low

2.1.2 Vulnerability

Vulnerability is a "measure of propensity of an object, area, individual, group, community, country, or other entity to incur the consequences of a hazard" (Coppola, 2015, p. 33). There are many aspects that contribute to the vulnerability of a people; these can include income disparity, class, race or ethnicity, gender, age, disability, health, and literacy (Thomas & Phillips, 2013, p. 2, 3). The following is a brief description of how each of the aspects can contribute to vulnerability to disasters.

- **Income Disparity**: Income disparities produce different outcomes from disasters that can cause more human suffering, and requiring more external support.
- **Class**: Lower-income families tend to live in housing that suffers disproportionately during disasters.
- **Race or Ethnicity**: Warning messages tend to be issued in the dominant language with an expectation that people will take the recommended action immediately.

flooding than the general public; this may be due to the deeper knowledge committee members have about occurrences in their areas. In contrast, the public is more concerned about severe summer weather and wildfires than the committee.

TABLE 2.1.3.B HAZARD LEVEL OF CONCERN

Hazard	*Committee*	*Public*
Dam Failure	Somewhat Concerned	Somewhat Concerned
Drought	Somewhat Concerned	Somewhat Concerned
Earthquake	Somewhat Concerned	Somewhat Concerned
Epidemic	Somewhat Concerned	Somewhat Concerned
Flooding	Very Concerned	Concerned
Hazmat	Concerned	Concerned
Land Subsidence	Somewhat Concerned	Somewhat Concerned
Severe Summer Weather	Somewhat Concerned	Concerned
Severe Winter Weather	Concerned	Concerned
Terrorism	Somewhat Concerned	Somewhat Concerned
Wildfire	Somewhat Concerned	Concerned

TABLE 2.2.1.A HAZARD IDENTIFICATION

Hazard	Status	Description	Research Sources
			• U.S. Environmental Protection Agency • Spatial Hazard Events and Losses Database (SHELDUS)
Hail	Included	See Section 2.3.8 Severe Summer Weather. Included because the area experiences many occurrences of severe summer weather including hail.	• National Centers for Environmental Information (NOAA) • Northeast Regional Climate Center • Spatial Hazard Events and Losses Database (SHELDUS)
Hazardous Materials Incident	Included	See Section 2.3.6. Hazardous Materials Incident. Included because the roads and facilities are susceptible to hazardous materials incidents at any time.	• Federal Railroad Administration • Pipeline and Hazardous Materials Safety Administration • National Transportation Safety Board • National Pipeline Mapping System • USCG National Response Center
Hurricanes	Not Included	The Atlantic East Coast, where hurricane paths are nearest, is approximately 350 miles away and the Pacific West Coast is approximately 2,200 miles away.	• Google Earth
Landslide	Included	See Section 2.3.7 Land Subsidence. Included because there have been instances of land and rock slides in the area.	• United States Geological Service • West Virginia Division of Highways • Spatial Hazard Events and Losses Database (SHELDUS)
Lightning	Included	See Section 2.3.8 Severe Summer Weather. Included because the area experiences many occurrences of severe summer weather including lightning	• National Centers for Environmental Information (NOAA) • Northeast Regional Climate Center • Spatial Hazard Events and Losses Database (SHELDUS)
Sea Level Rise	Not Included	Sea level rise occurs in the ocean; the Atlantic East Coast is approximately 350 miles away and the Pacific West Coast is approximately 2,200 miles away.	• Google Earth
Storm Surge	Not Included	Storm surges occur in the ocean; the Atlantic East Coast is approximately 350 miles away and the Pacific West Coast is approximately 2,200 miles away.	• Google Earth
Terrorism	Included	See Section 2.3.10 Terrorism. Included because the potential for terrorist activities in the region is present.	• Study of Terrorism and Responses to Terrorism (START) • West Virginia Department of Military Affairs and Public Safety (DMAPS)
Tornado	Included	See Section 2.3.8 Severe Summer Weather. Included because the area experiences many occurrences of severe summer weather including tornadoes.	• National Centers for Environmental Information (NOAA) • The Tornado Project • Spatial Hazard Events and Losses Database (SHELDUS)
Tsunamis	Not Included	The Atlantic East Coast, where tsunamis would be closest, is approximately 350 miles away and the Pacific West Coast is approximately 2,200 miles away.	• Google earth
Wind	Included	See Section 2.3.8 Severe Summer Weather. Included because the area experiences many occurrences of severe summer weather including wind events.	• National Centers for Environmental Information (NOAA) • Northeast Regional Climate Center

2.2.2 Complicating Variables

Direct consequences of disasters can include fatalities, injuries, and damages to humans, animals or property. However, disasters do not end there; there are a number of indirect effects, both tangible and intangible associated with disasters even before a disaster strikes. Some examples of these include loss of livelihood and income, loss of community and population, mental and psychosocial impacts, costs of rebuilding, repair or replacement, loss of inventory, wages and tax revenue, etc. (Coppola, 2015). All of these also have a cost associated with them but it is much more difficult to assign a specific dollar value and quantify accurately.

A variety of situations could occur that would result in a disruption to a number of critical systems throughout Region 8 counties. Some hazards are complicated by a series of loosely-related variables; these are often considered *cascading hazards*. For example, high winds may cause sporadic damage throughout the county, but often do not become a significant countywide concern until a large number of residents are without power.

A single event may not always reach all impacts described herein. However, it is important to understand that the impacts of hazards go beyond what is seen immediately before or after the event or incident. The effects of one event can be years or months in the making and last months or even years, especially where public health, social, economic, environmental and infrastructure impacts are concerned.

2.2.3 Hazards and Climate Change

Many natural hazards are related to climate such as droughts, severe weather, floods and wildfires. There is an important distinction between weather and climate. Weather refers to the atmospheric conditions of a geographical region over a short period of time, such as days or weeks. Climate, in contrast, refers to the atmospheric conditions of a geographical area over long periods of time, such as years, or even decades (Keller, Devecchio, 2015, pp. 406-407).

According to the U.S. Global Change Research Program (2016), there are several weather and climate changes that have already been observed in the United States.

- Since recordkeeping began in 1895, the average U.S. temperature has increased by 1.3°F to 1.9°F with most of the increase happening since 1970. In addition, the first decade of the 2000s has been the warmest on record.

2.3 HAZARD PROFILES

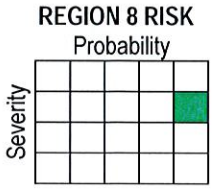
§201.6(c)(2)(i)	[The risk assessment shall include a] description of the...location and extent of all natural hazards that can affect the jurisdiction. The plan shall include information on previous occurrences of hazard events and on the probability of future hazard events.

The following table contains a summary of all the hazards analyzed, presented in alphabetical order. For a detailed description of the hazards and methodology for the information presented in the table, refer to each separate profile.

TABLE 2.3.A. HAZARD SNAPSHOTS

Hazard	Period of Occurrence	Warning Time	Potential Impacts	Probability	Severity	Risk	Loss/Damage Estimate
Subsidence	of occurrence increases following long periods of heavy rain, snowmelt, or near construction activity.	instances of land subsidence can occur quickly without warning, but often in the context of other storm events.	values, agrobusiness losses, disruption of utility and transportation systems, and costs for any litigation. May cause geological movement, causing infrastructure damages ranging from minimal to severe.			Low	road slips averages between $25K and $50K.
Severe Summer Weather	Hail – at any time, during thunderstorms. Thunderstorm – spring, summer, and fall months. Wind and tornado – at any time, primarily between months of March and August.	Hail – minutes to hours Thunderstorm – minutes to hours Wind and tornado – minutes to hours.	Hail - Large hail can minimally damage property (facilities) as well as crops Thunderstorm: Utility damage and outages, infrastructure damage (transportation and communication systems). Impacts human life, health, and public safety. Wind and tornado - Utility damage and outages, infrastructure damage (transportation and communication systems), structural damage, and damaged or destroyed critical facilities. Impacts human life, health, and public safety	Frequent	Critical	Medium High	Average cost per event is over $5K.
Severe Winter Weather	During winter months	Snow – Days Ice – Minutes to hours	Utility damage and outages, infrastructure damage (transportation and communication systems), structural damage, damaged critical facilities. Can cause severe transportation problems and make travel extremely dangerous. Power outages, which result in loss of electrical power and potentially loss of heat. Extreme cold temperatures may lead to frozen water mains and pipes, damaged car engines, and prolonged exposure to cold resulting in frostbite	Frequent	Marginal	Medium High	Average cost per event is over $2K
Terrorism	At any time	Minimal – Depends on the presence of a threat	Potential loss of human life, economic loss, environmental damage, disruption of lifeline facilities.	Improbable	Critical	Low	N/A
Wildfire	At any time – primarily during summer months	Minimal	Impacts human life, health, and public safety. Loss of wildlife habitat, increased soil erosion, and degraded water quality. Utility damage and outages, infrastructure damage (transportation and communication systems), and damaged or destroyed critical facilities.	Frequent	Negligible	Medium	Federal cost of firefighting averages around $285 per acre.

2.3.1 Dam Failure



A dam is a barrier, generally made of earth, concrete, or rock fill, that impounds water.

HAZARD OVERVIEW

The West Virginia Department of Environmental Protection (WVDEP) defines dams as man-made barriers or obstructions that impounds water and must be at least 25 feet or more in height and impound 15 or more acre-feet of water volume (WVDEP, 2009). The WVDEP is responsible for inspecting existing dams and those under construction, reviewing design plans, and reporting emergencies (WVDEP. 2016). There are four categories of dams; the Mine Safety and Health Administration defines them as follows.

- **Class 1 or High Hazard**: failure would probably cause loss of human life.
- **Class 2 or Significant Hazard**: failure would likely not result in loss of human life, but can cause economic loss, environmental damage, or disruption of lifeline facilities.
- **Class 3 or Low Hazard**: failure would result in no probable loss of human life and low economic and/or environmental loss.
- **Class 4 or Negligible Hazard**: losses would mainly be restricted to the dam.

Dams are used for a variety of purposes. In Region 8, the majority of the dams are used for flood control, water supply or recreation. The following describes these types of dams.

- **Flood Control:** Prevents loss of life and property caused by flooding. They impound floodwaters and either release them under control to the river below or store or divert the water for other uses.
- **Recreation**: These are designed for boating, skiing, camping, picnic areas, and boat launches and can all be supported by these dams.
- **Water Supply**: This type of type of dam is used to gather and supply water from rivers to urban areas.

POSSIBLE CAUSES

Dam failure is often the result of prolonged rainfall or flooding or, during prolonged dry periods, erosion. The primary hazard surrounding dam failure is the swift, unpredictable

TABLE 2.3.1.A DAMS IN REGION 8

Dam Name	Owner Type	Height (ft.)	Hazard Class	Primary Purpose	Dam Type	River	County
Lunice Creek No. 10	Local government	87	High	Flood control	Earth	Saltblock Run	Grant
Lunice Creek No. 11	Local government	83.4	High	Flood control	Earth	Lunice Creek	Grant
Mill Run WS Dam	Private	17	High	Water supply	Other	Mill Run	Grant
Mt. Storm Lake Dam	Public utility	153	High	Other	Rock fill, earth	Stony River	Grant
N&S Mill Creek No. 03	Local government	89	Significant	Flood control	Earth	Rough Run	Grant
N&S Mill Creek No. 04	Local government	68	Significant	Flood control	Earth	South Mill Creek	Grant
N&S Mill Creek No. 16	Local government	67	High	Flood control	Earth	Gum hollow	Grant
N&S Mill Creek site No. 07	Local government	75.2	High	Flood control	Rock fill, earth	South Mill Creek	Grant
New Creek No. 12 Dam	Local government	77	High	Flood control	Earth	U.T. Of New Creek	Grant
New Creek No. 14 Dam	Local government	110	High	Flood control	Earth	Linton Creek	Grant
Patterson Creek No. 01 Dam	Local government	52	High	Flood control	Earth	Patterson Creek	Grant
Patterson Creek No. 02 Dam	Local government	57.5	High	Flood control	Earth	Tr-Patterson Creek	Grant
Patterson Creek No. 03 Dam	Local government	55.5	High	Flood control	Earth	Thorn Run	Grant
Patterson Creek No. 04 Dam	Local government	69	Significant	Flood control	Earth	Middle Fork	Grant
Patterson Creek No. 06 Dam	Local government	82	High	Flood control	Earth	Elklick Run	Grant
Patterson Creek No. 12 Dam	Local government	75	Significant	Flood control	Earth	Thorn Run	Grant
Patterson Creek No. 13 Dam	Local government	86	Significant	Flood control	Earth	Rossen Run	Grant
Patterson Creek No. 41 Dam	Local government	88	High	Flood control	Earth	North Fork	Grant
Patterson Creek No. 49 Dam	Local government	48	High	Flood control	Earth	Patterson Creek	Grant
Pond No. 01 Dam	Public utility	0	Unknown	Water supply	Earth	Buffalo Creek	Grant
Stony River Dam	Private	48.5	Significant	Flood control	Gravity	Stony Rv of Potomac Rv	Grant
Boone farms Lake Dam	Private	31	Significant	Recreation	Earth	Little Cacapon	Hampshire
Crooked Run Lake Dam	Private	26	Significant	Recreation	Earth	Tr. Of Cacapon	Hampshire
Ferndale Farms Recreation Lake	Private	23	Significant	Recreation	Earth	U.T. South Branch	Hampshire
Wilson Big Hollow Dam	Private	32	Significant	Recreation	Other	-	Hampshire
Lost River No. 04 Dam	Local government	90.9	High	Flood control	Earth	Kimsey Run	Hardy
Lost River No. 10 Dam	Local government	0	Unknown	Flood control	Earth	Camp Branch	Hardy
Lost River No. 27 Dam	Local government	0	High	Flood control	Earth	Upper cove Run	Hardy
Norman Wratchford Lake	Unknown	Unknown	Unknown	Unknown	Unknown	South Fork South Branch Potomac	Hardy
Rock Cliff Dam	Federal	66	Low	Flood control	Earth	Trout Run	Hardy
South Fork No. 01 Dam	Local government	122	Significant	Flood control	Earth	Shook's Run	Hardy
South Fork No. 02 Dam	Local government	123.1	Significant	Flood control	Earth	Stump Run	Hardy
South Fork No. 04 Dam	Local government	116.7	High	Flood control	Earth	Rodabaugh Run	Hardy
South Fork No. 05 Dam	Local government	107	High	Flood control	Earth	Radabaugh	Hardy

TABLE 2.3.1.A DAMS IN REGION 8

Dam Name	Owner Type	Height (ft.)	Hazard Class	Primary Purpose	Dam Type	River	County
South Fork No. 27	Local government	71.2	High	Flood control	Earth	South Fork	Pendleton
South Fork No. 32	Local government	59.5	High	Flood control	Earth	South Fork	Pendleton
South Fork No. 33	Local government	59.9	High	Flood control	Earth	Fisher Run	Pendleton
South Fork No. 35	Local government	65.3	Significant	Flood control	Earth	South Fork	Pendleton
South Fork No. 36	Local government	53.9	High	Flood control	Earth	Little stony Run	Pendleton
South Fork No. 37	Local government	97.7	High	Flood control	Earth	Camp Run	Pendleton
South Fork No.10	Local government	75.6	Significant	Flood control	Earth	Stony Run	Pendleton
South Fork No.11	Local government	89.1	Significant	Flood control	Earth	Road Run	Pendleton
South Fork No.12	Local government	64	Significant	Flood control	Earth	Detimer Run	Pendleton
South Fork No.13	Local government	80.1	High	Flood control	Earth	Hawes Run	Pendleton
South Fork No.14	Local government	72.5	High	Flood control	Earth	Broad Run	Pendleton
South Fork No.15	Local government	88.4	High	Flood control	Earth	Mitter Run	Pendleton
South Fork No.16	Local government	73.6	Significant	Flood control	Earth	George Run	Pendleton
South Fork No.18	Local government	76	High	Flood control	Earth	Stony Run	Pendleton

Source: National Inventory of Dams and National Performance of Dams Program

Even though a region is defined geographically, it doesn't mean that it is self-containing; hazards originate in other areas outside the borders of Region 8 can still have an effect on the counties in Region 8. One example of this are the dams that are located in Maryland that, where they to fail, could impact counties in region 8. These dams include the following:

- Jennings Randolph Dam on the North Branch of the Potomac River
- Savage River Dam on the Savage River
- Industrial Dam on the North Branch of the Potomac River

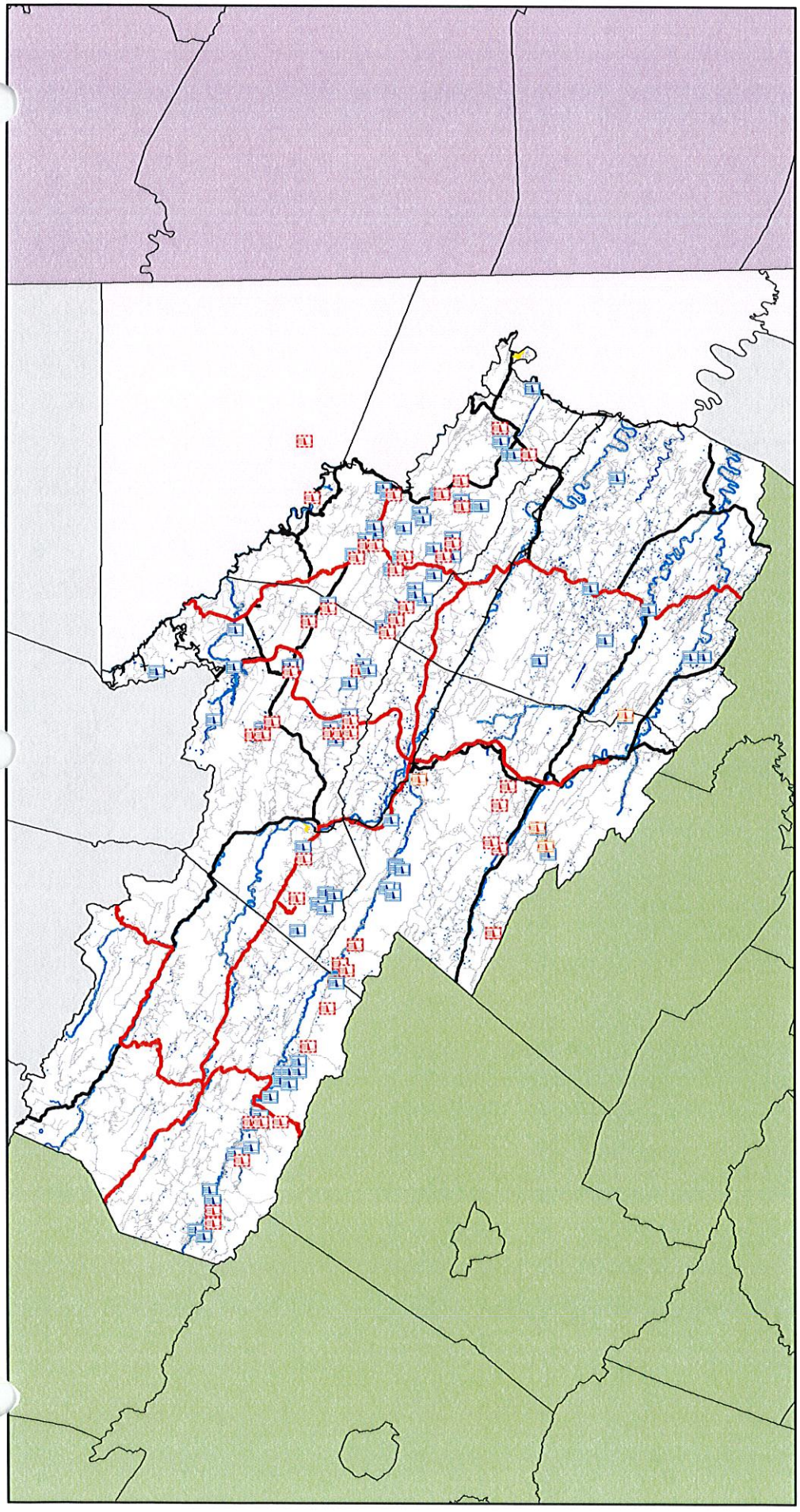
HISTORICAL OCCURRENCES

There have been only two incidents in all the counties of Region 8 that have been reported. The first was at Stony River Dam in Grant County; it experienced an inflow flood from a hydrologic event in 1914 (NPDP, n.d.).

According to NCEI, on July 29, 2017 in Bayard (Grant County) a strong upper level low interacted with a frontal boundary near the Mid-Atlantic region and low pressure formed along the boundary. High moisture content and thunderstorms led to widespread flooding across the Mid-Atlantic region. Due to this activity, a levee breached on Buffalo Creek pushing it out of its banks flooding nearby areas.

RISK ASSESSMENT

TABLE 2.3.1.B DAM FAILURE RISK CALCULATION				
Probability		*Severity*		*Risk*
IMPROBABLE		CRITICAL		LOW
Since 1914 there have been no dam failure events or incidents in the area. Because of the lack of historical occurrences and the programs that are in place to ensure proper maintenance of dams, this hazard has a low probability of occurrence to the area.	+	Many of the dams in the region are categorized as a high or significant hazard class meaning that there could potentially be loss of human life and damage to the environment and critical infrastructure.	=	According to the risk assessment matrix, a probability of 'improbable' and a severity of 'critical' puts dam failure risk at low.



REGION 8 HAZARD MITIGATION PLAN

Risk Map:
Dam Failure

Data Source(s):
Hardy County Planning
National Inventory of Dams
U.S. ACE (via WVGTC)

Dams

Low or Other

HAZARD

High

Significant

0 3 6 12 18 24 Miles

DISCLAIMER: Data is meant for use as reference only. Some sources may be intended to be used at national or regional scales and are thus used beyond their original intent for demonstrative purposes.

REGION 8

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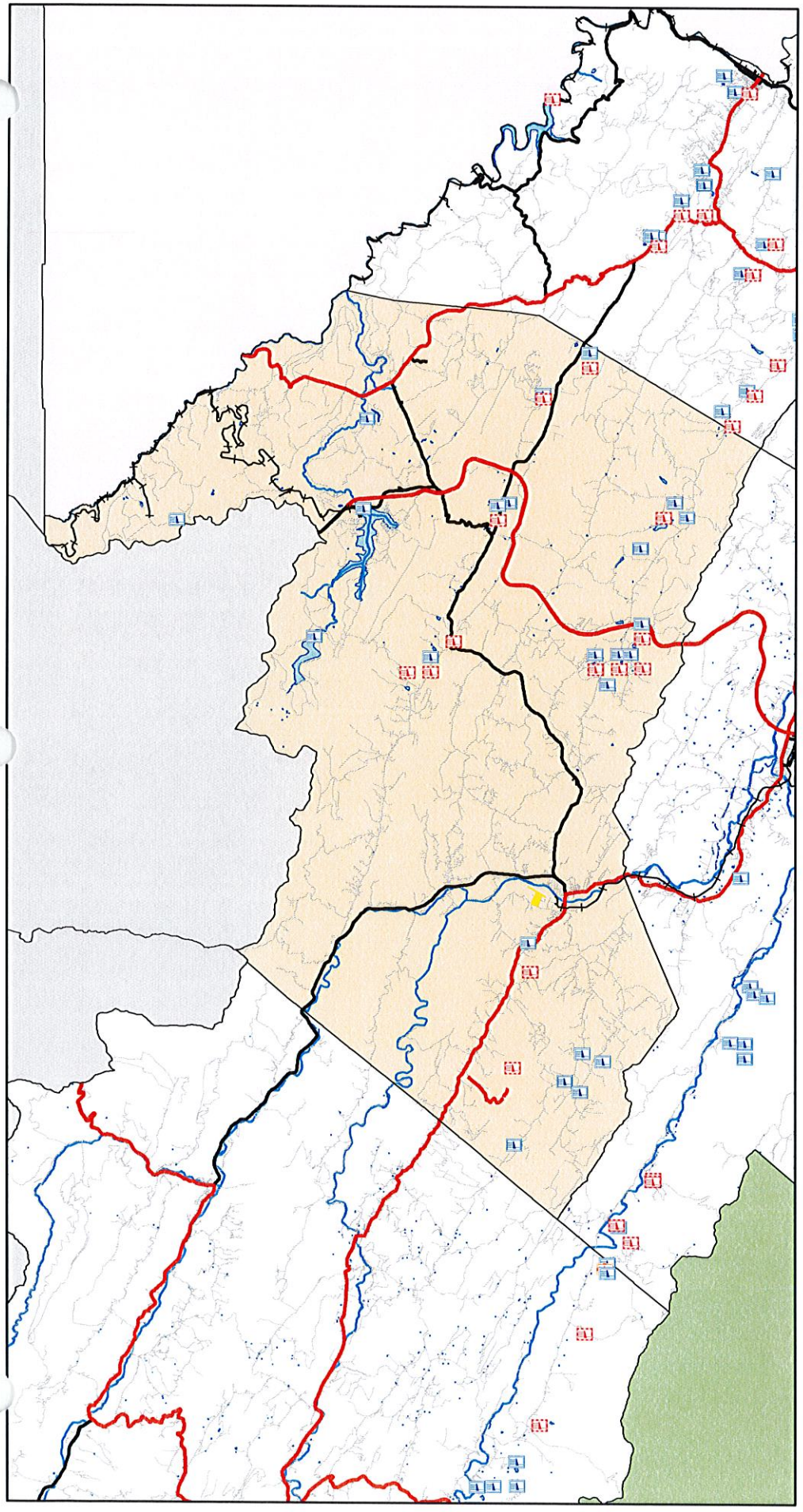

REGION 8 HAZARD MITIGATION PLAN

Grant Co. Risk Map: Dam Failure

Data Source(s):
Hardy County Planning
National Inventory of Dams
U.S. ACE (via WVGTC)

Dams

Low or Other

HAZARD

High

Significant

Grant Co.

Miles
0 1 2 4 6 8

DISCLAIMER: Data is meant for use as reference only. Some sources may be intended to be used at national or regional scales and are thus used beyond their original intent for demonstrative purposes.

REGION 8

H Consulting, LLC

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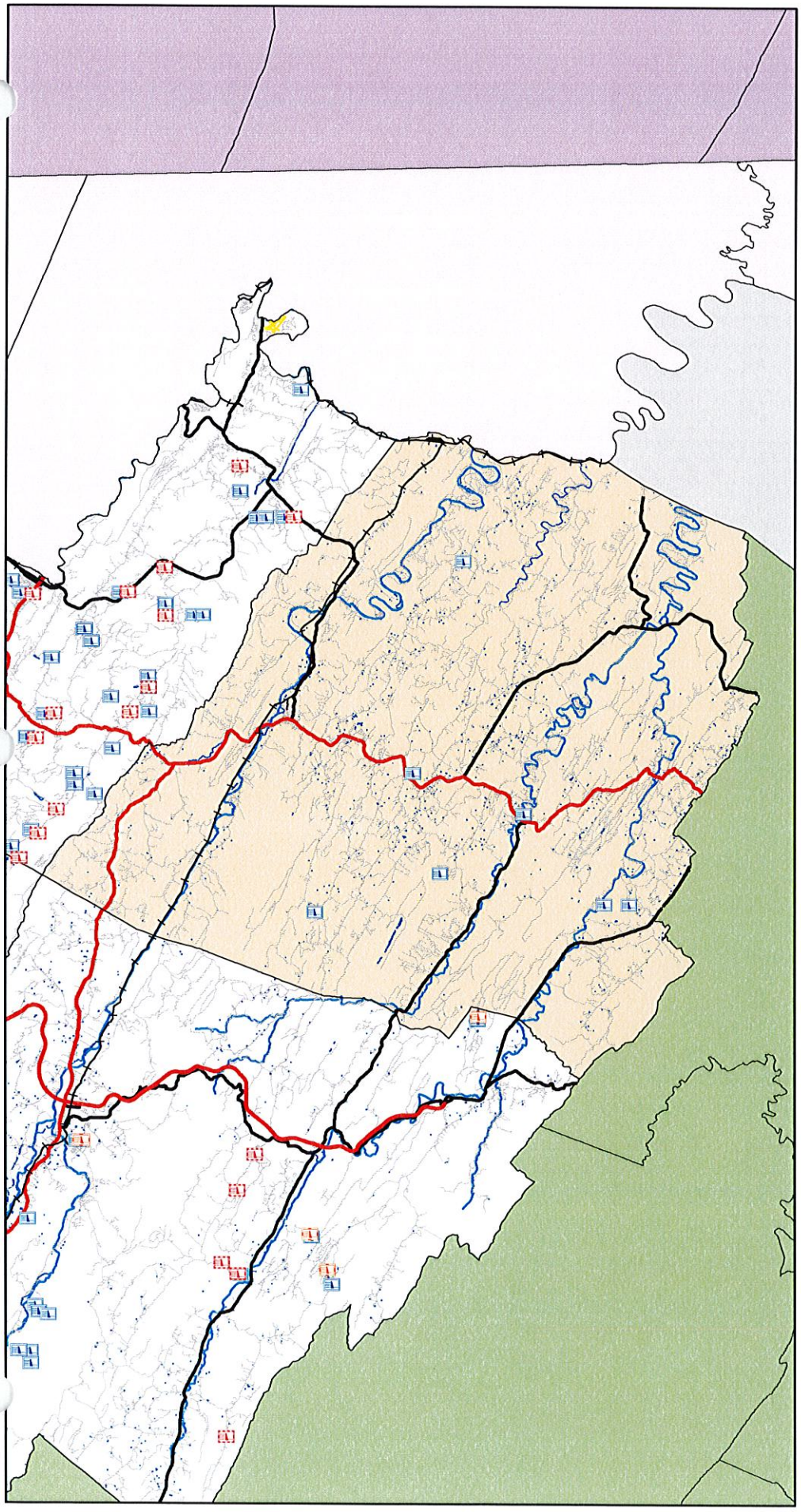


REGION 8 HAZARD MITIGATION PLAN

Hampshire Co. Risk Map: Dam Failure

Data Source(s):
Hardy County Planning
National Inventory of Dams
U.S. ACE (via WVGTC)

Dams

Low or Other

HAZARD

High

Significant

Hampshire Co.

Miles
0 1.5 3 6 9 12

DISCLAIMER: Data is meant for use as reference only. Some sources may be intended to be used at national or regional scales and are thus used beyond their original intent for demonstrative purposes.

REGION 8

JH Consulting, LLC

N

available from the WVGISTC, HMPs in WV have the opportunity to go above and beyond the minimum requirements for the plan update process and discuss at a structural level *why* a building is at risk and what *value* does it bring to the community. This requires the Plan Owners sharing specific documents, including available maps and structural level datasets, with the Plan Participants in order to engage in informed discussion on the community's risk and potential socio-economic impacts of a disaster.

Plan Participants should use the various risk assessment data sets to prioritize the areas of mitigation interest from highest to lowest. The evaluation and prioritization process helps the planning team weigh the pros and cons of different action alternatives. The intent of discussing these characteristics is for the Plan Participants to provide context on the value of the at-risk assets in their community. It is suggested that communities could rank the prioritization criteria below or add their own criteria to further develop the understanding of the asset's value to their community.

Some potential prioritization criteria include but are not limited to:

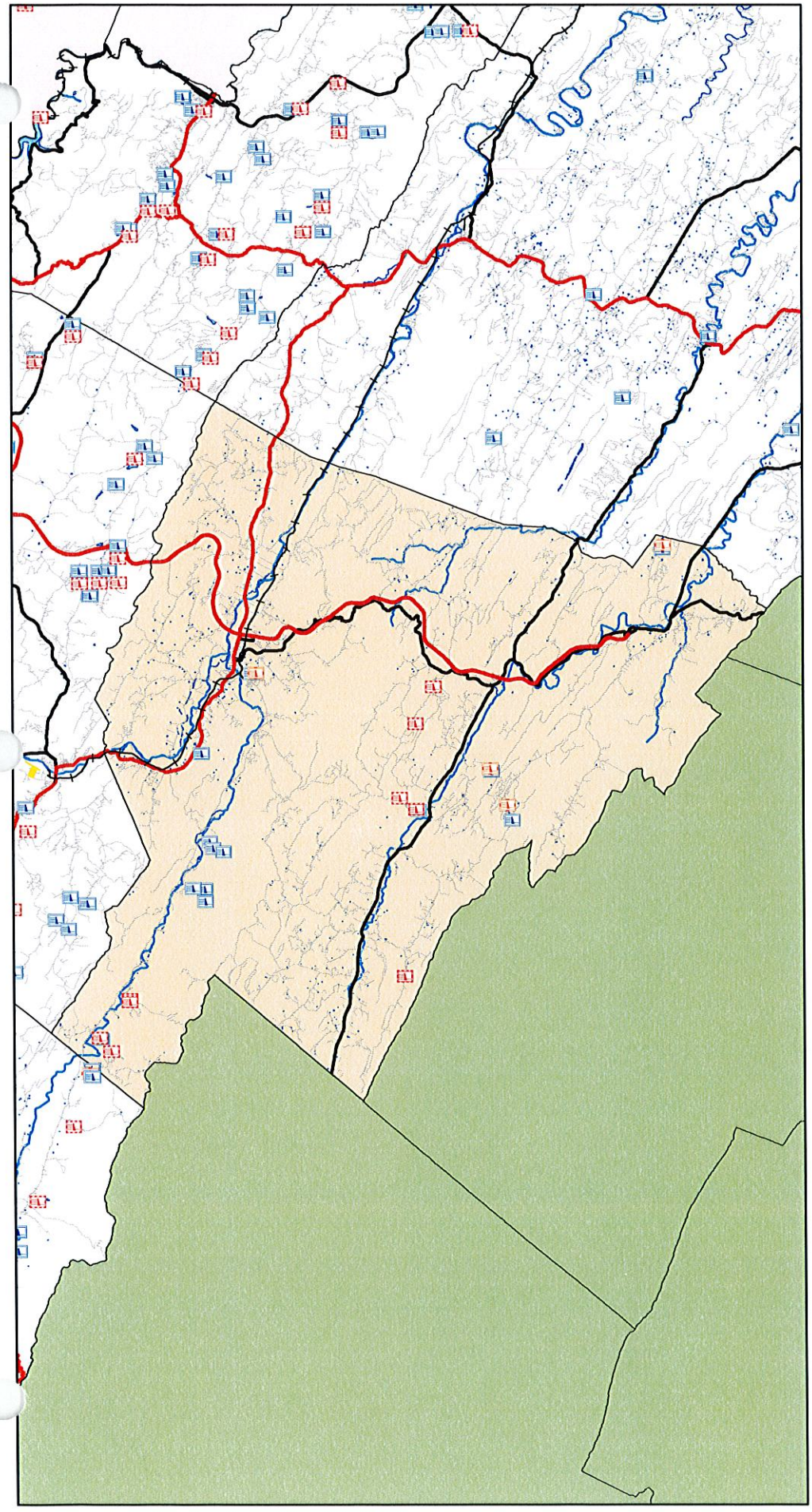
Physical Structure:

- Location/Proximity to hazard (floodway)
- Flood Depth
- Building Type
- Pre/Post FIRM
- Function of Asset
    - Complete Loss of Asset
    - Time Asset is Offline
    - Population Asset Serves
- Potential Loss Estimate
- Economic Asset
    - What are the financial implications of this asset being offline?
        - Number of employees
        - Loss of wages
        - Loss of taxes
- Repetitively Damaged Structures
- Historical Significance

Populations:

- Proximity to Hazard
- Vulnerable Population

Scenario: *Dangerville was provided a data packet that included, among other things, a list of structures in their community in the SFHA and information about their risk. Dangerville officials decided to prioritize 10 structures with a history of flooding that had the highest estimated potential damage-loss amount. Out of those 10, 3 were identified as priorities for the community. Two provided emergency services and one for its historic nature and function as a community gathering place. Dangerville officials confirmed that these structures were at risk due to being built below the base flood elevation level established in the current effective flood maps.*



REGION 8 HAZARD MITIGATION PLAN

Hardy Co. Risk Map: Dam Failure

Data Source(s):
Hardy County Planning
National Inventory of Dams
U.S. ACE (via WVGTC)

Dams

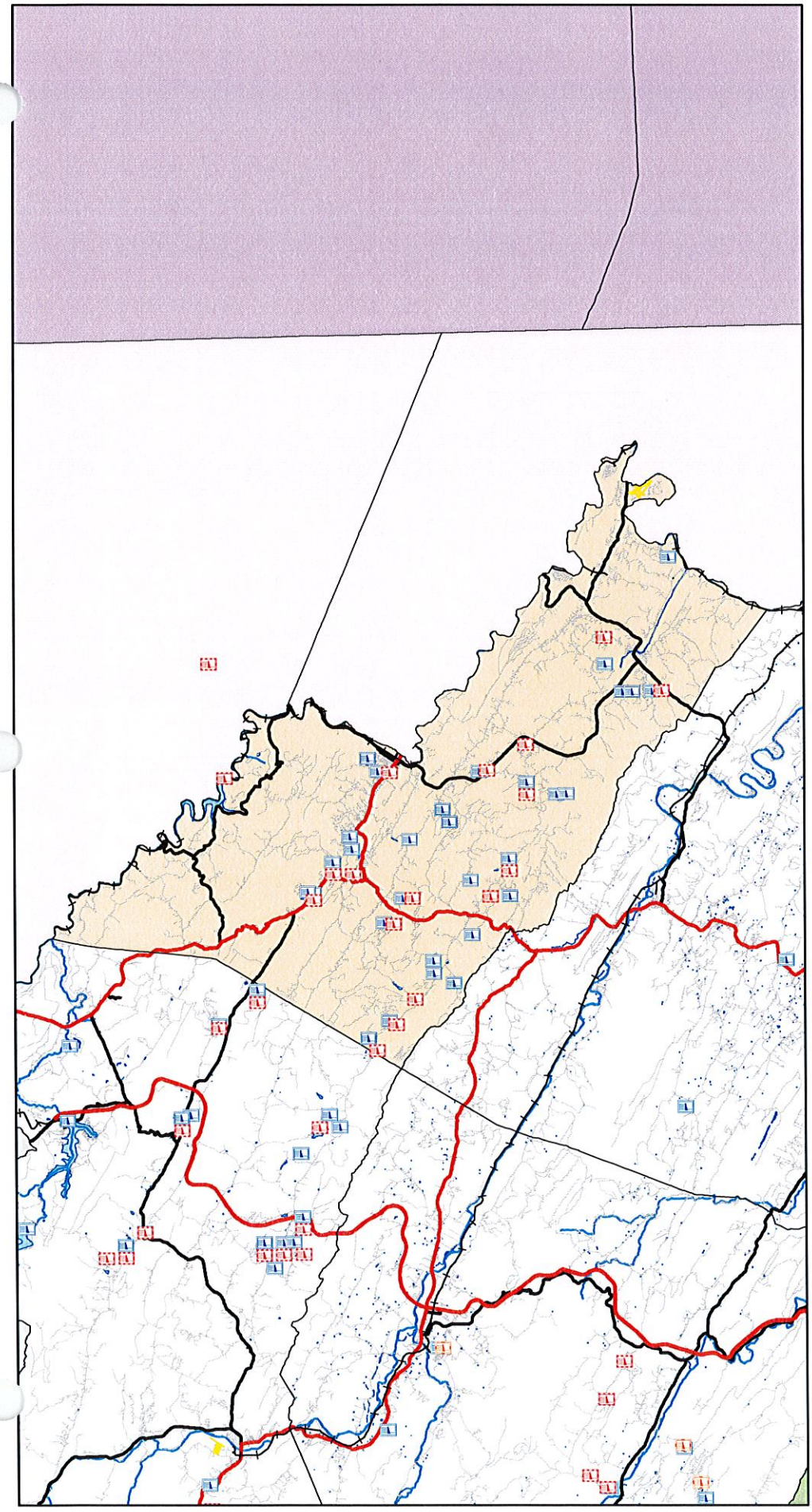
- Low or Other

HAZARD

- High
- Significant
- Hardy Co.

Miles
0 1.5 3 6 9 12

DISCLAIMER: Data is meant for use as reference only. Some sources may be intended to be used at national or regional scales and are thus used beyond their original intent for demonstrative purposes.



REGION 8 HAZARD MITIGATION PLAN

Mineral Co. Risk Map: Dam Failure

Data Source(s):
Hardy County Planning
National Inventory of Dams
U.S. ACE (via WVGTC)

Dams

Low or Other

HAZARD

High

Significant

Mineral Co.

Miles
0 1.25 2.5 5 7.5 10

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REGION 8

JH Consulting, LLC

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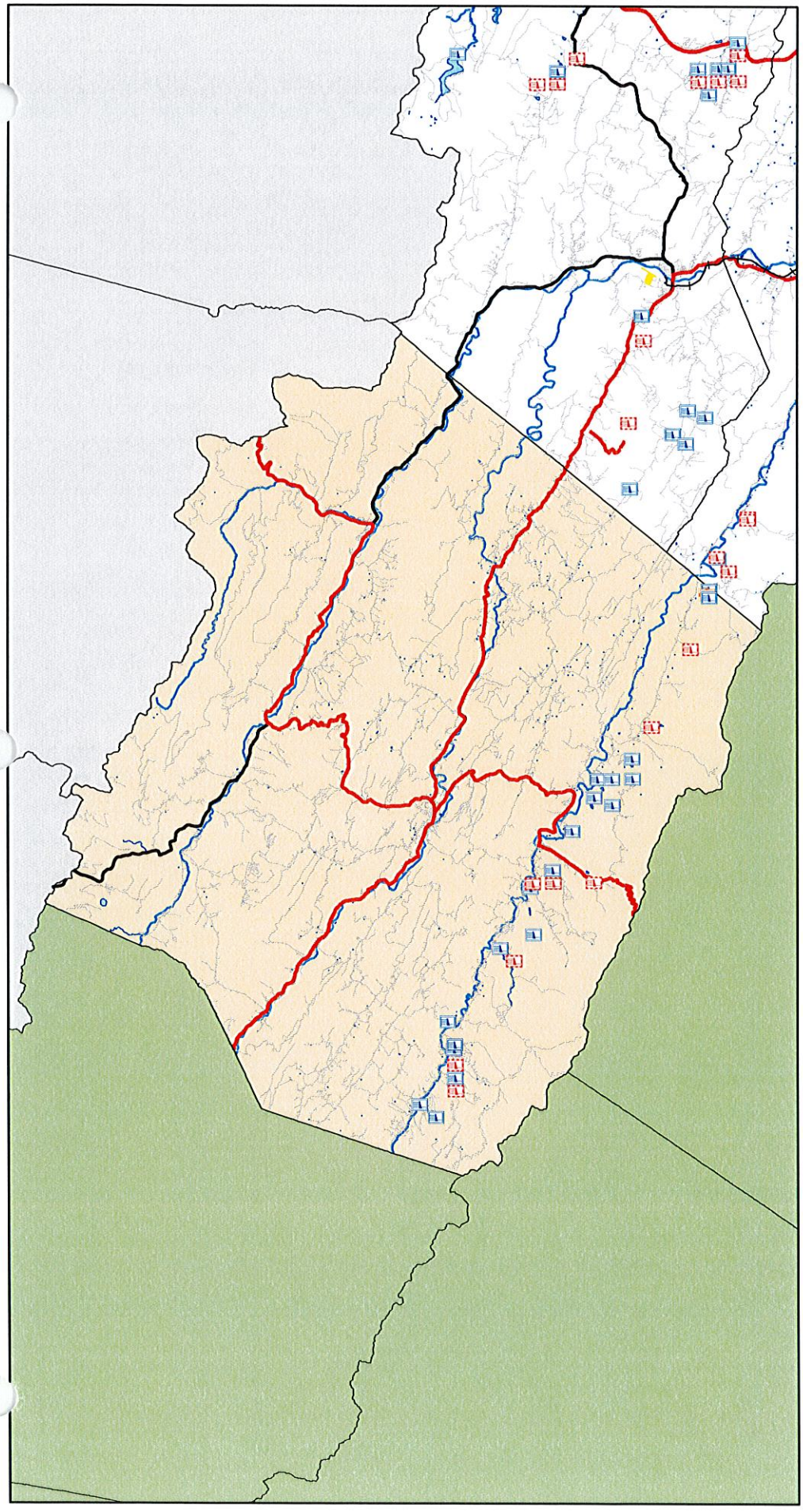

REGION 8 HAZARD MITIGATION PLAN

Pendleton Co. Risk Map: Dam Failure

Data Source(s):
Hardy County Planning
National Inventory of Dams
U.S. ACE (via WVGTC)

Dams

- Low or Other

HAZARD

- High
- Significant
- Pendleton Co.

Miles
0 1.25 2.5 5 7.5 10

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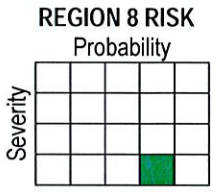
2.3.2 Drought



A drought is a natural phenomenon that occurs when an area or region does not receive the normal amount of precipitation and persists for several weeks or months.

HAZARD OVERVIEW

A drought is a "prolonged dry period in natural climate cycle. It is a slow-onset phenomenon caused by rainfall deficit combined with other predisposing factors. They are often predictable" (WHO).

The most prevalent method of measuring drought severity in the United States is the Palmer Drought Severity Index (PDSI) developed in 1965. The index takes a number of factors into account to assign a score between -4 (extremely dry) and +4 (extremely wet), with 0 being the "normal" value (Palmer, 1965). Palmer drought values typically reflect long term drought, but can be calculated both monthly and weekly. The PDSI is shown graphically to the right.

TABLE 2.3.2.A PALMER DROUGHT SEVERITY INDEX

< -4.0	Extreme drought
-3.99 to -3.0	Severe drought
-2.99 to -2.0	Moderate drought
-1.99 to -1.0	Mild drought
-0.99 to -0.5	Incipient drought
-0.49 to 0.49	Near normal
0.50 to 0.99	Incipient moist spell
1.0 to 1.99	Moist spell
2.0 to 2.99	Unusual moist spell
3.0 to 3.99	Very moist spell
> 4.0	Extreme moist spell

There are four types of droughts, increasing in severity level: meteorological drought, hydrological drought, agricultural drought, and socioeconomic drought.

- **Meteorological Drought**: Dry weather patterns dominating an area.
- **Hydrological Drought**: Usually after several months of meteorological drought, when low water supplies become noticeable (i.e. low water levels in streams and reservoirs).
- **Agricultural Drought**: When crops become affected by the drought conditions.
- **Socioeconomic Drought**: Relates the supply and demand of various commodities to drought.

Drought conditions are not the same everywhere. To know what drought conditions for the area are, it is necessary to know the normal precipitation amount and average climate of the region. The NCEI provides average "normal" of precipitation and temperatures; data was collected from weather stations located in the county seats for each

varying degrees of severity. In Region 8 counties, the extent of a drought would be equal given the region's geography and environmental qualities.

A drought can vary in severity throughout the year; what starts out as a mild drought can reach severe or extreme drought status and then return to a mild drought. This process could take weeks or even months and the effects could be felt even months after the drought conditions are over.

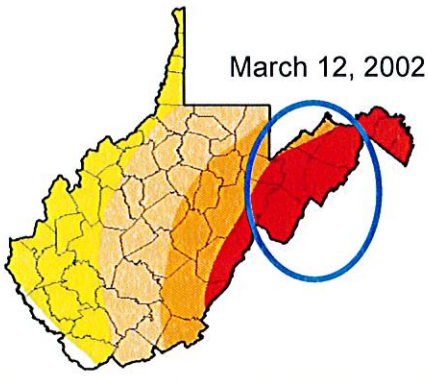
HISTORICAL OCCURRENCES

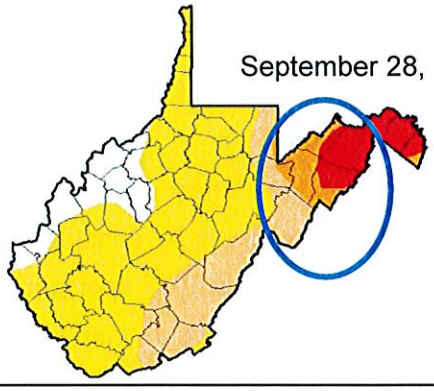
The table below represents the amount of weeks each county in Region 8 has spent under drought conditions since 2000. D-0 (Abnormally Dry) weeks are the total number of weeks there have been droughts in the counties; subsequent categories' weeks in drought conditions are not in addition to the previous drought severity weeks, but a part of them. For example, Grant County has spent 324 weeks in D-0 conditions, of which 78 were a moderate drought (D-1), of which 10 weeks were a severe drought (D-2), of which 9 were extreme drought (D-3) conditions. No counties have experienced exceptional droughts (D-4) since 2000.

TABLE 2.3.2.C WEEKS IN DROUGHT CONDITIONS SINCE 2000

County	D-0 Weeks	D-1 Weeks	D-2 Weeks	D-3 Weeks	D-4 Weeks
Grant	324	78	10	9	0
Hampshire	280	82	24	11	0
Hardy	293	88	28	12	0
Mineral	300	62	20	7	0
Pendleton	346	84	15	5	0

There have been two instances when there has been a severe drought in the counties of Region 8; the first instance was at the end of February through the middle of April of 2002, and the second was during September of 2010. The maps below illustrate the drought conditions in the state and in Region 8 on a select week of these extreme droughts.


March 12, 2002


September 28, 2010

Between the census years of 1997 and 2002, all counties increased their farms except Pendleton which lost six. However, the harvested acres of cropland and total sales increased in every county despite losses in previous census years.

TABLE 2.3.2.D USDA CENSUS DATA 1997-2002

Farms (units)

County	1997	2002	2007	2012	Δ (%) 1997-2002
Grant	375	357	471	486	30
Hampshire	547	635	677	798	46
Hardy	467	468	514	494	6
Mineral	343	465	493	429	25
Pendleton	590	546	600	556	-6
Totals	**2,322**	**2,471**	**2,755**	**2,763**	**19**

Harvested Cropland (Acres)

County	1997	2002	2007	2012	Δ (%) 1997-2002
Grant	14,730	14,758	15,922	18,519	26
Hampshire	25,121	27,851	25,993	30,623	22
Hardy	20,889	21,684	22,891	27,240	30
Mineral	13,934	15,012	14,708	13,946	0
Pendleton	18,237	19,804	17,158	21,692	19
Totals	**92,911**	**99,109**	**96,672**	**112,020**	**21**

Total Sales (Dollars)

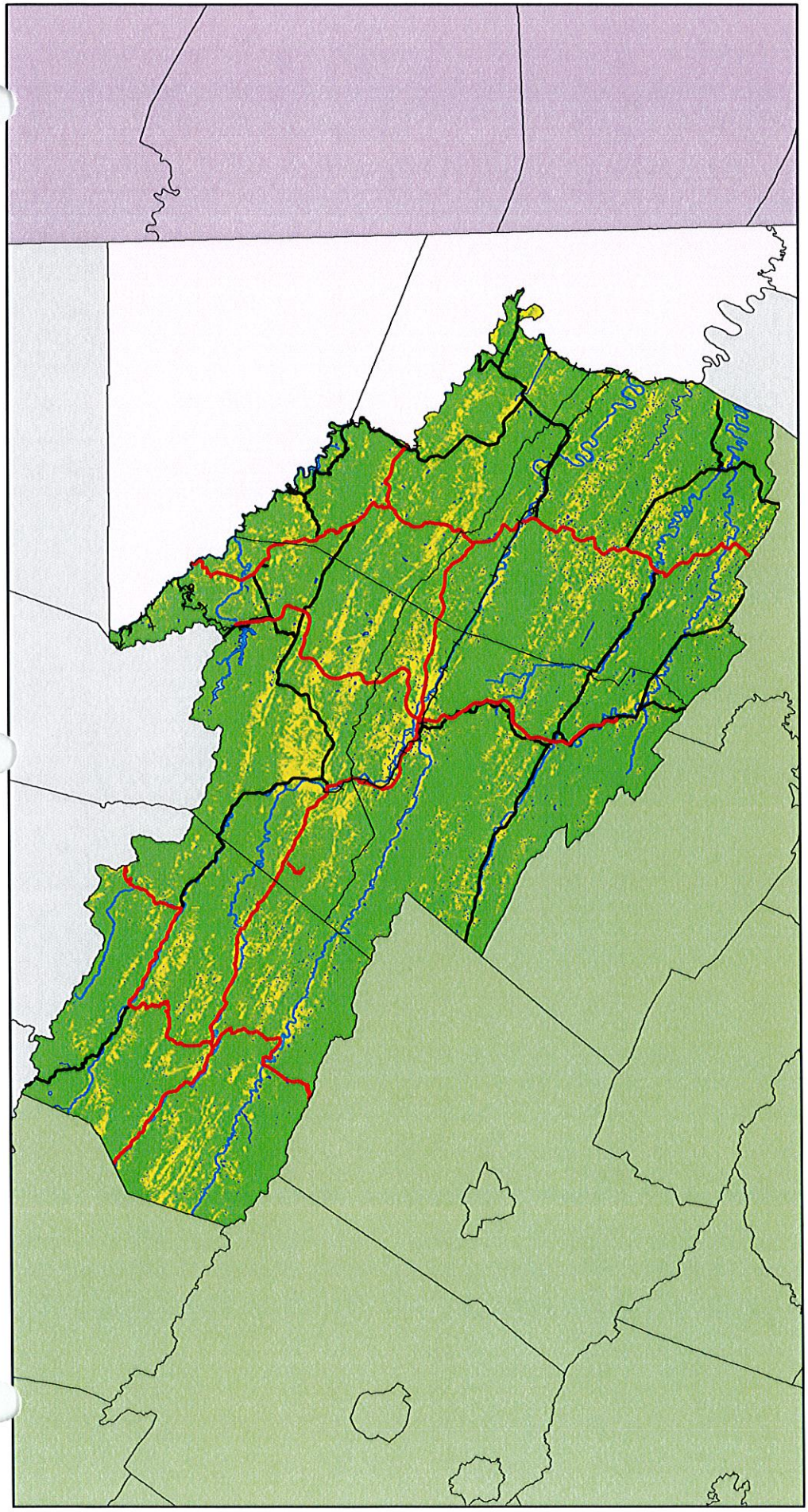
County	1997	2002	2007	2012	Δ (%) 1997-2002
Grant	$35,651,000	$39,251,000	$42,123,000	$51,272,000	30.6
Hampshire	$15,945,000	$19,642,000	$32,549,000	$39,183,000	99.5
Hardy	$111,541,000	$123,627,000	$148,029,000	$188,970,000	52.9
Mineral	$8,537,000	$14,195,000	$15,470,000	$22,243,000	56.7
Pendleton	$68,297,000	$74,012,000	$91,788,000	$118,766,000	60.5
Totals	**$239,971,000**	**$270,727,000**	**$329,959,000**	**$420,434,000**	**55.3**

Baseline information
Gain or no change from previous year
Loss from previous year

Even though the farms or harvested acres may have dropped from one census year to the next, the total sales in dollars have always increased. Therefore, overall, there have been zero economic losses from one year to the next.

RISK ASSESSMENT

To calculate probability, data was analyzed by drought type, using the county with the most consecutive weeks under those conditions as a representative of the region. The



REGION 8 HAZARD MITIGATION PLAN

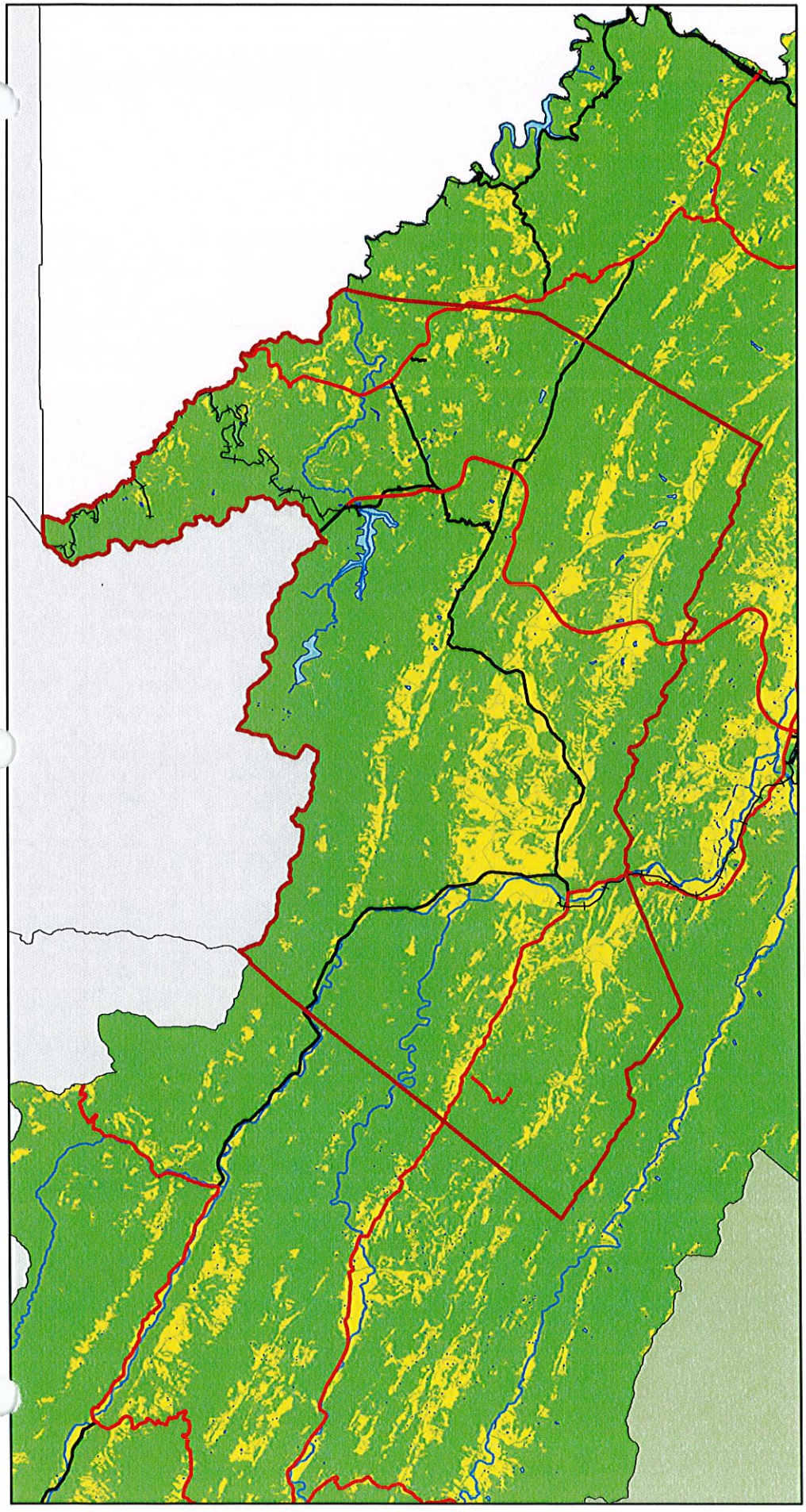
Risk Map: Drought

Data Source(s):
U.S. Geological Survey

Marginal Severity
Negligible Severity

0 3 6 12 18 24 Miles

DISCLAIMER: Data is meant for use as reference only. Some sources may be intended to be used at national or regional scales and are thus used beyond their original intent for demonstrative purposes.



REGION 8 HAZARD MITIGATION PLAN

Grant Co. Risk Map: Drought

Data Source(s):
U.S. Geological Survey

Marginal Severity
Negligible Severity
Grant Co.

Miles
0 1 2 4 6 8

DISCLAIMER: Data is meant for use as reference only. Some sources may be intended to be used at national or regional scales and are thus used beyond their original intent for demonstrative purposes.

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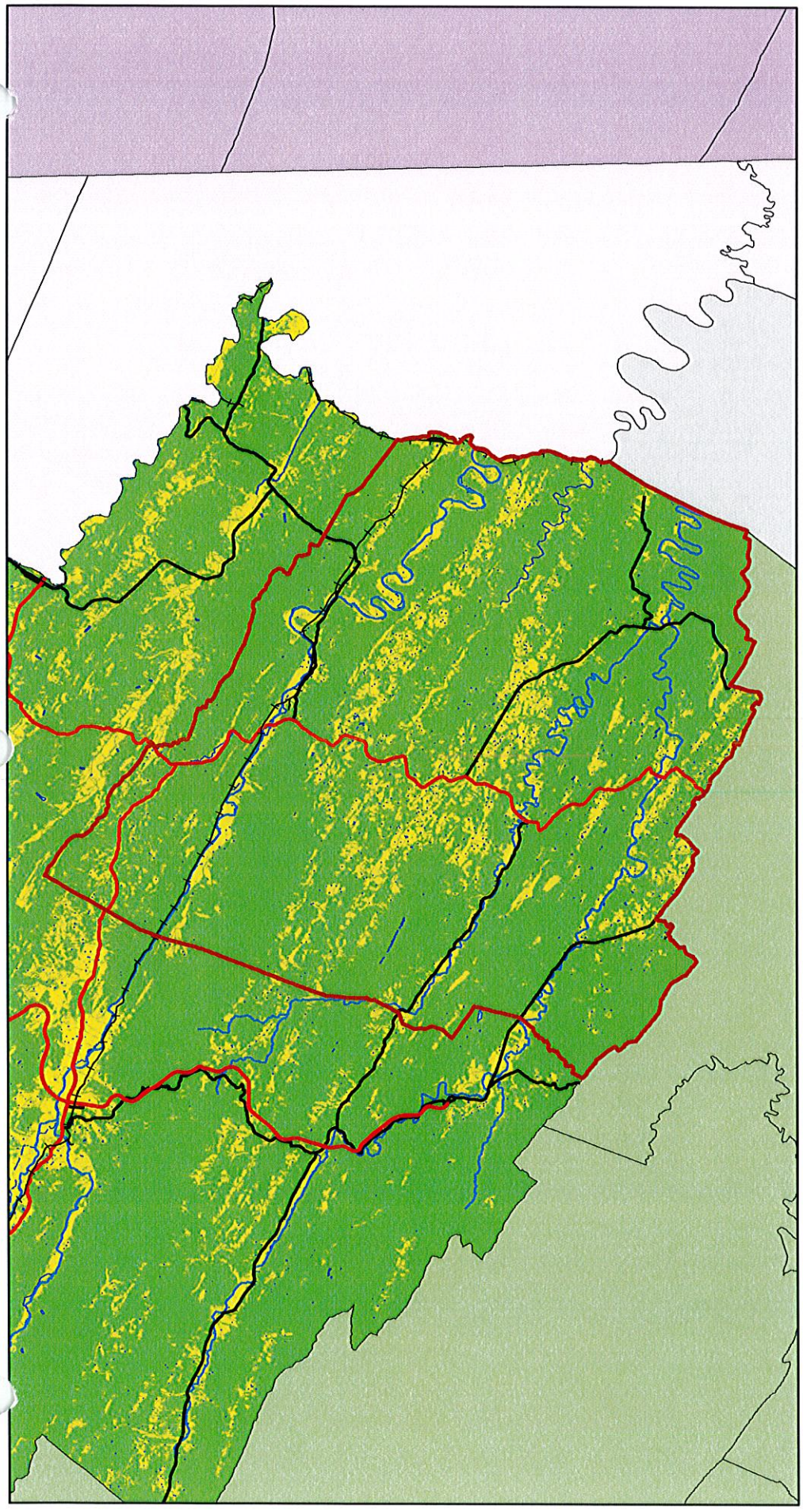

REGION 8 HAZARD MITIGATION PLAN

Hampshire Co. Risk Map: Drought

Data Source(s):
U.S. Geological Survey

Marginal Severity
Negligible Severity
Hampshire Co.

Miles
0 1.5 3 6 9 12

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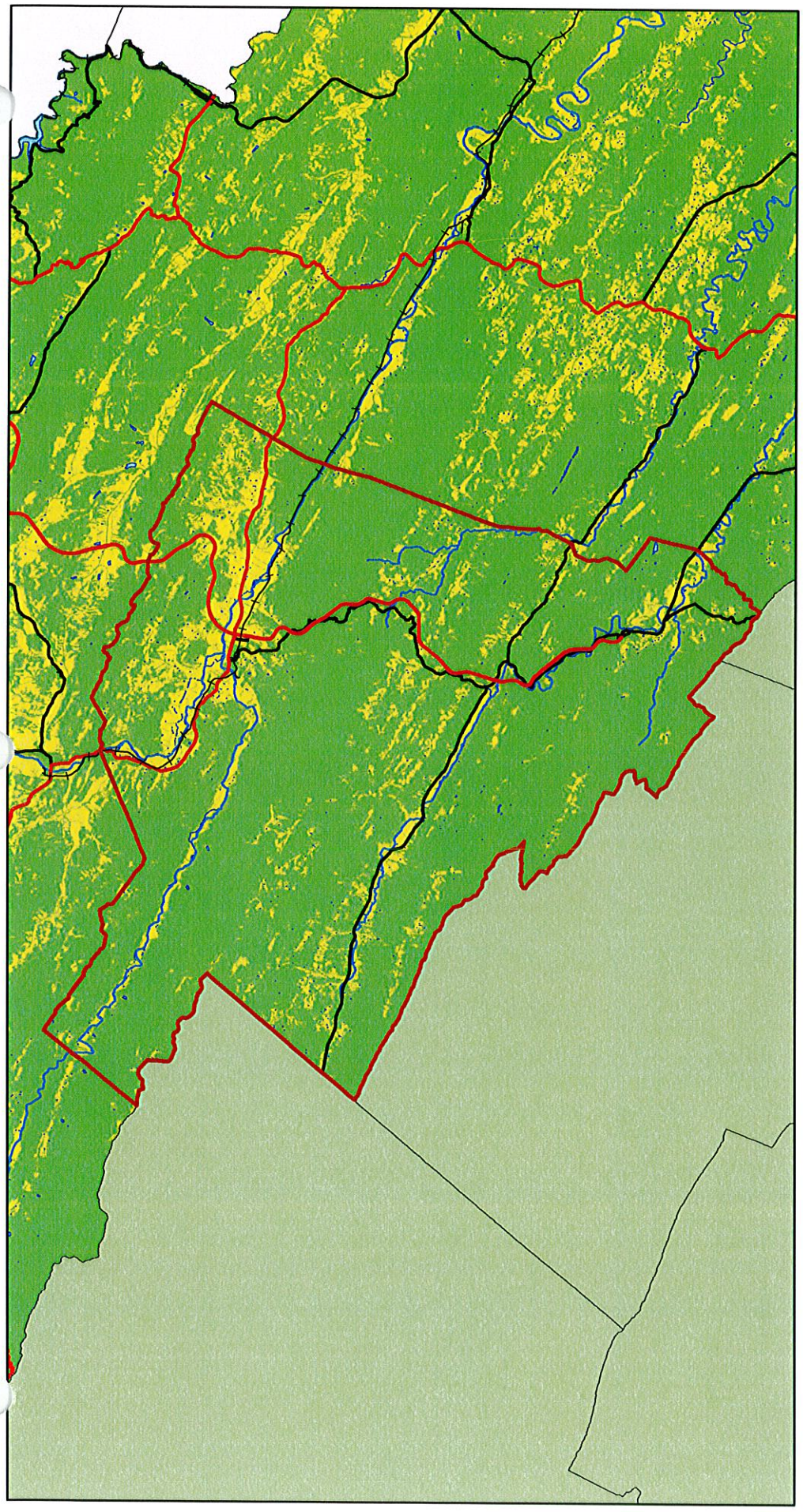

REGION 8 HAZARD MITIGATION PLAN

Hardy Co. Risk Map: Drought

Data Source(s):
U.S. Geological Survey

Marginal Severity
Negligible Severity
Hardy Co.

Miles
0 1.5 3 6 9 12

DISCLAIMER: Data is meant for use as reference only. Some sources may be intended to be used at national or regional scales and are thus used beyond their original intent for demonstrative purposes.

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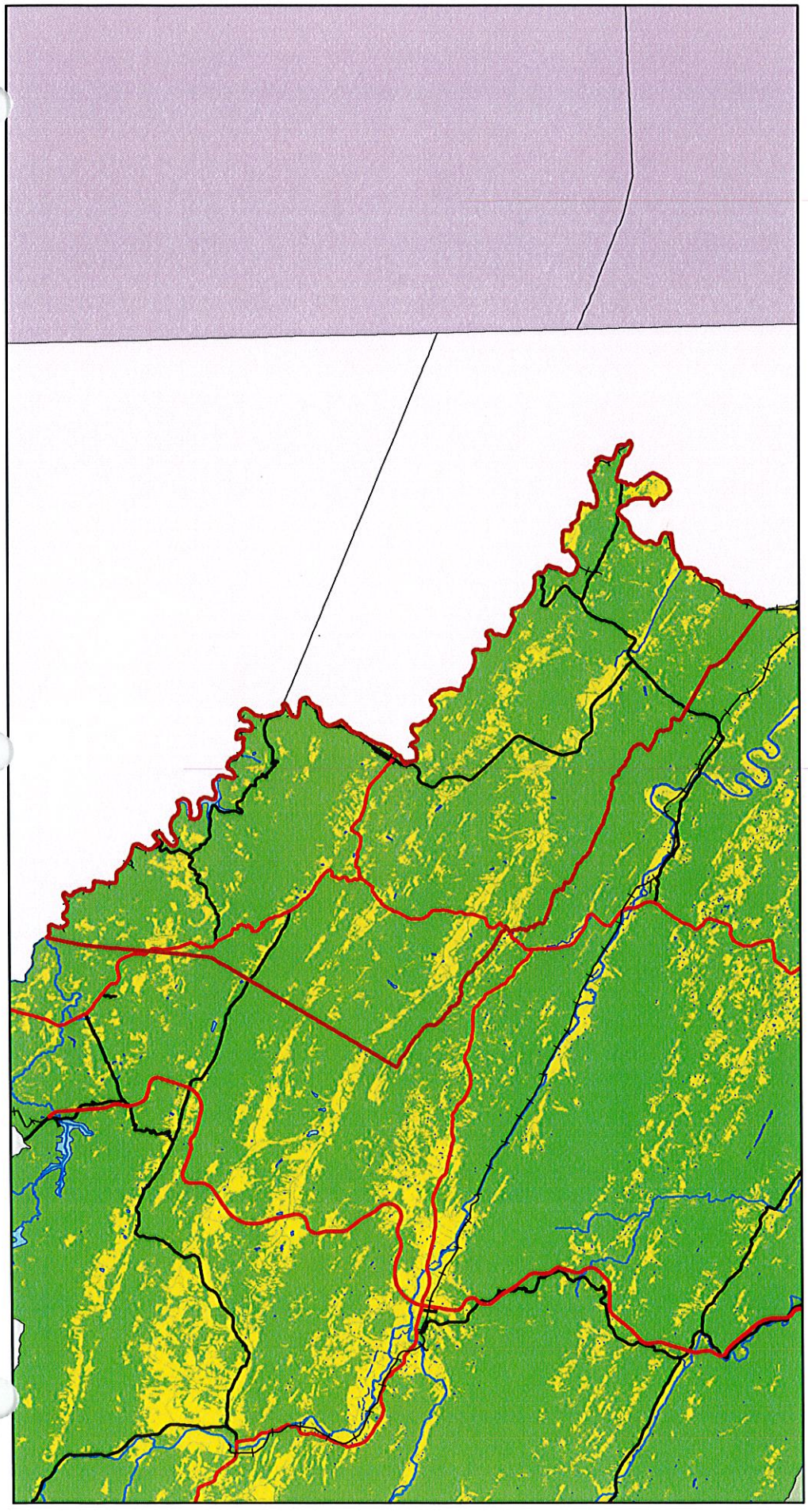

REGION 8 HAZARD MITIGATION PLAN

Mineral Co. Risk Map: Drought

Data Source(s):
U.S. Geological Survey

Marginal Severity
Negligible Severity
Mineral Co.

Miles
0 1.25 2.5 5 7.5 10

DISCLAIMER: Data is meant for use as reference only. Some sources may be intended to be used at national or regional scales and are thus used beyond their original intent for demonstrative purposes.

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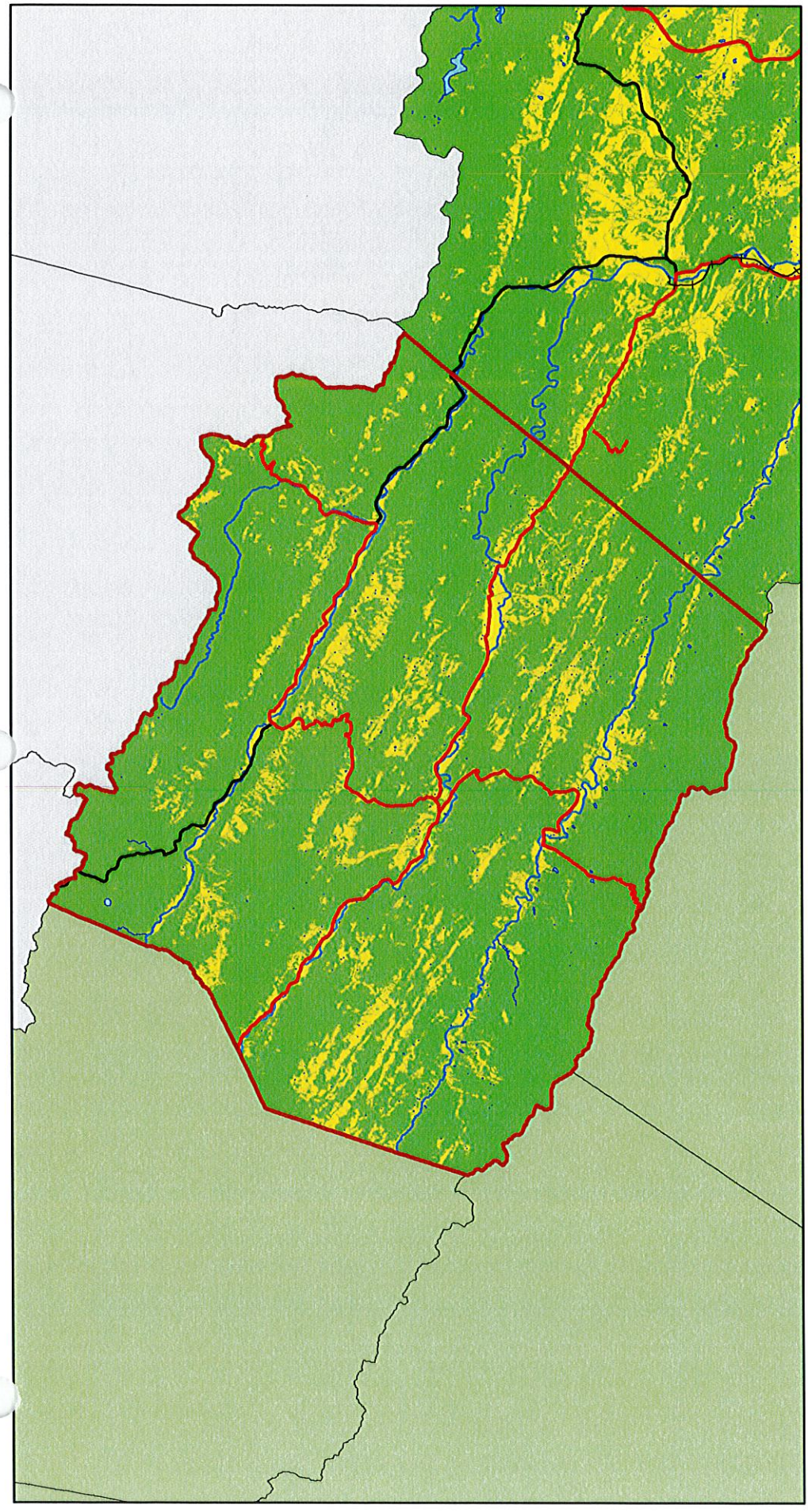

REGION 8 HAZARD MITIGATION PLAN

Pendleton Co. Risk Map: Drought

Data Source(s):
U.S. Geological Survey

Marginal Severity
Negligible Severity
Pendleton Co.

Miles
0 1.25 2.5 5 7.5 10

DISCLAIMER: Data is meant for use as reference only. Some sources may be intended to be used at national or regional scales and are thus used beyond their original intent for demonstrative purposes.

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2.3.3 Earthquake

The moving or shifting of the Earth's tectonic plates due to built-up pressure is known as an earthquake.

HAZARD OVERVIEW

The Earth's sudden release of stored energy may manifest itself by the shaking or displacement of the ground, known as an earthquake. According to the U.S. Geological Society, based on historical trends, the frequency of an earthquake occurrence inversely relates to its magnitude. There are an estimated 1.3 million earthquakes every year with a magnitude between 2.0 and 2.9 while there is, on average, one magnitude 8.0 or higher earthquake annually.

Earthquakes move or shake the earth in three different directions depending on the plate movements: convergent, divergent, and transform generating primary and secondary waves. There are three common ways to measure an earthquake:

- **Richter Scale**: Developed in 1935, the Richter scale measures the scale and severity of an earthquake, The magnitude of an earthquake can range between 0 and 10. The effects of an earthquake can extend far beyond the site of its occurrence.
- **Modified Mercalli Scale**: The modified Mercalli scale measures earthquakes based on their intensity on the surface. This scale uses roman numerals I through XII to denote detection and damage levels associated with an earthquake.
- **Peak Ground Acceleration (PGA):** PGA is "the maximum ground acceleration that occurred during earthquake shaking at a location. PGA is equal to the amplitude of the largest absolute acceleration recorded on an accelerogram at a site during a particular earthquake" (Douglas, 2003).

POSSIBLE CAUSES

The Earth is made up of tectonic plates; the boundary lines where these tectonic plates meet are called faults. Friction along the boundaries or faults causes the rocks to stress and strain. "When the stress of the rocks exceed their strength, that is, their ability to withstand the force, the rock rupture and are permanently displaced along the fault plane" (Keller & Devecchio, 2015) causing earthquakes that reach and affect the infrastructure on the surface.

HISTORICAL OCCURRENCES

Between the years of 1824 and 2016 there have been three epicenters of earthquakes in the Region 8 Counties; one in Hardy County in 1935 on November 1 with a magnitude of 3.3, and two in Pendleton County in 1853 on March 2 with a magnitude of 4.4, and 1986 on February 26 with a magnitude of 2.3, all along the Virginia border. Surrounding counties such as Morgan Berkeley, Jefferson and Pocahontas have also experienced earthquake epicenters. Grant, Mineral, and Hampshire Counties have not experienced epicenters.

IMPACTS AND VULNERABILITY

Earthquakes can affect people and structures alike, although older structures may be more susceptible to cracks and damage. "With most earthquakes, trauma caused by the collapse of buildings is the cause of most deaths and injuries. However, a surprisingly large number of patients require acute care for non-surgical problems such as acute myocardial infraction, exacerbation of chronic diseases such as diabetes or hypertension, anxiety and other mental health problems, respiratory disease from exposure to dust and asbestos fibers from rubble, and near-drowning because of flooding from broken dams. An earthquake may precipitate a major technologic disaster by damaging or destroying nuclear power stations, hospitals with dangerous biologic products, hydrocarbon storage areas, and hazardous chemical plants. As with most natural disasters, the risk of secondary epidemics is minimal, and only mas vaccination campaigns based on results of epidemiological surveillance are appropriate following earthquakes" (Noji, 1999).

LOSS & DAMAGES

The effects of a potential earthquake striking each county in Region 8 were analyzed using the HAZUS-MH program from the Federal Emergency Management Agency. The scenario depicts a 5.0 earthquake (the lowest possible magnitude to use in the program) located at the county seat of each county. The following tables describe the expected building damages by occupancy type and the building-related economic loss estimates.

TABLE 2.3.3.D HAMPSHIRE COUNTY HAZUS BUILDING-RELATED ECONOMIC LOSS ESTIMATES (MILLIONS OF DOLLARS)							
Category	*Area*	*Single Family*	*Other Residential*	*Commercial*	*Industrial*	*Others*	*Total*
Income Losses	Wage	0.00	0.72	2.33	0.08	0.34	3.47
	Capital Related	0.00	0.30	1.53	0.05	0.05	1.93
	Rental	1.73	0.94	1.12	0.02	0.10	3.92
	Relocation	6.41	2.05	1.98	0.15	0.83	11.41
	Subtotal	8.14	4.00	6.97	0.31	1.32	20.73
Capital Stock Losses	Structural	8.62	2.91	1.19	0.41	0.90	15.03
	Non Structural	28.43	8.97	5.86	1.35	2.26	46.86
	Content	10.26	1.97	3.22	0.88	1.31	17.64
	Inventory	0.00	0.00	0.11	0.20	0.04	0.35
	Subtotal	47.30	13.85	11.39	2.84	4.51	79.88
TOTAL		55.44	17.85	18.36	3.14	5.83	100.62

TABLE 2.3.3.E HARDY COUNTY EXPECTED BUILDING DAMAGE BY OCCUPANCY (HAZUS)										
	None		*Slight*		*Moderate*		*Extensive*		*Complete*	
	Count	*%*	*Count*	*%*	*Count*	*%*	*Count*	*%*	*Count*	*%*
Agriculture	25	0.51	7	0.46	4	0.44	1	0.47	0	0.37
Commercial	125	2.51	38	2.45	29	3.13	8	3.76	1	3.79
Education	7	0.14	2	0.13	2	0.17	0	0.19	0	0.21
Government	12	0.25	4	0.23	3	0.33	1	0.37	0	0.38
Industrial	56	1.12	15	0.96	12	1.27	3	1.32	0	1.25
Other Residential	1,104	22.20	444	28.30	418	44.45	99	46.82	11	35.54
Religion	13	0.26	4	0.24	2	0.26	1	0.30	0	0.32
Single Family	3,631	73.00	1,054	67.23	470	49.96	99	46.77	19	58.13
TOTAL	4,973		1,568		940		211		32	

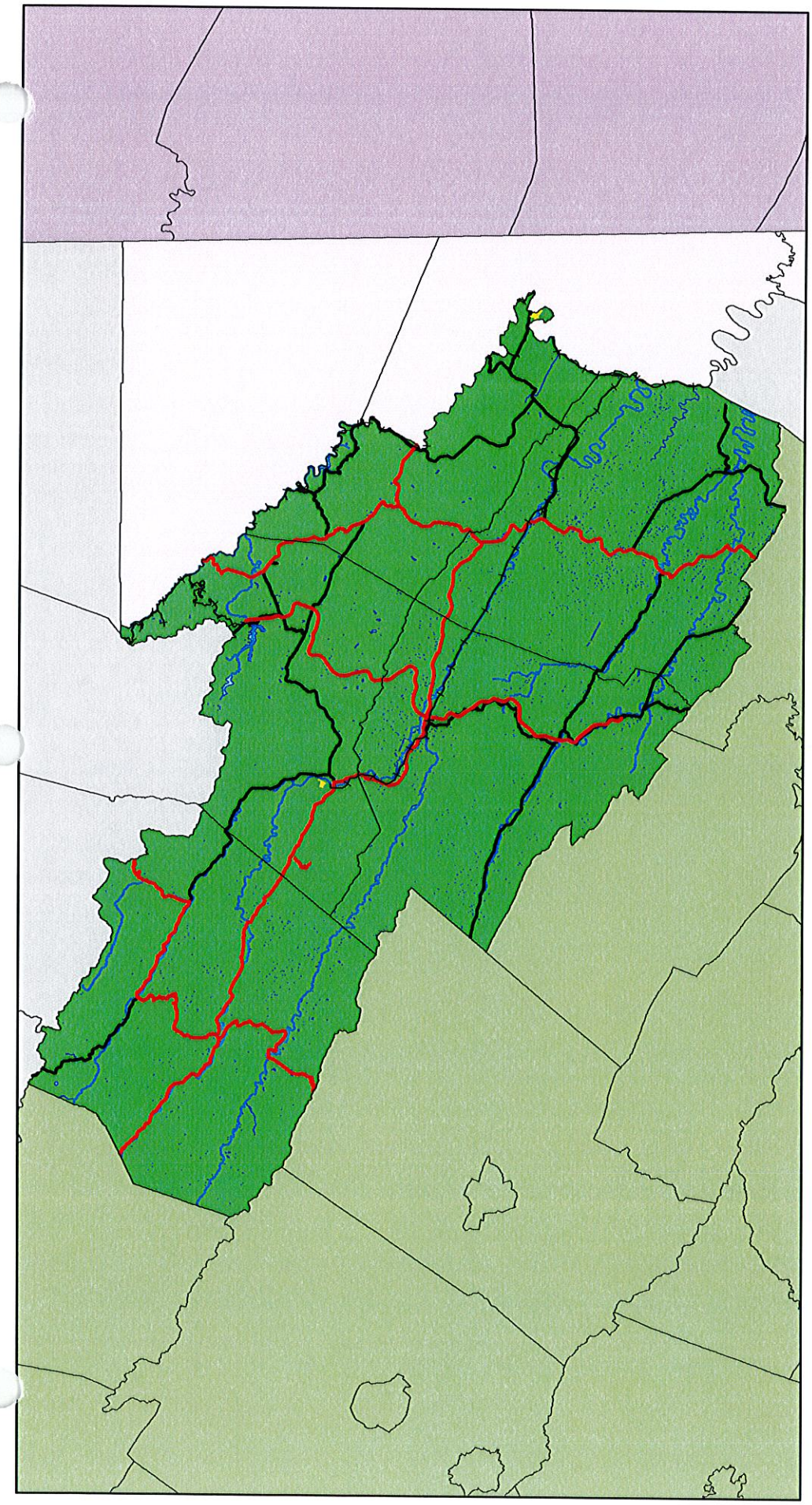
TABLE 2.3.3.F HARDY COUNTY HAZUS BUILDING-RELATED ECONOMIC LOSS ESTIMATES (MILLIONS OF DOLLARS)							
Category	*Area*	*Single Family*	*Other Residential*	*Commercial*	*Industrial*	*Others*	*Total*
Income Losses	Wage	0.00	0.14	0.87	0.20	0.25	1.46
	Capital Related	0.00	0.06	0.61	0.12	0.02	0.81
	Rental	0.92	0.29	0.45	0.07	0.05	1.78
	Relocation	3.42	0.84	0.76	0.24	0.38	5.63
	Subtotal	4.33	1.32	2.68	0.63	0.70	9.67
Capital Stock Losses	Structural	4.43	0.86	0.75	0.60	0.38	7.03
	Non Structural	14.54	2.45	2.06	2.29	1.01	22.35
	Content	5.33	0.50	1.22	1.81	0.65	9.43
	Inventory	0.00	0.00	0.05	0.56	0.02	0.63
	Subtotal	24.30	3.81	4.09	5.18	2.07	39.45
TOTAL		28.64	5.14	6.77	5.81	2.77	14.12

TABLE 2.3.3.J PENDLETON COUNTY HAZUS BUILDING-RELATED ECONOMIC LOSS ESTIMATES (MILLIONS OF DOLLARS)							
Category	*Area*	*Single Family*	*Other Residential*	*Commercial*	*Industrial*	*Others*	*Total*
Income Losses	Wage	0.00	1.01	1.20	0.20	0.35	2.75
	Capital Related	0.00	0.41	1.04	0.15	0.04	1.62
	Rental	1.39	0.67	0.63	0.15	0.08	2.91
	Relocation	5.14	1.21	0.96	0.73	0.65	8.67
	Subtotal	6.53	3.30	3.82	1.20	1.11	15.95
Capital Stock Losses	Structural	6.75	1.79	1.11	1.28	0.80	11.73
	Non Structural	23.03	5.32	2.97	4.17	1.80	37.29
	Content	8.45	1.14	1.56	3.08	1.07	15.30
	Inventory	0.00	0.00	0.06	0.47	0.04	0.58
	Subtotal	38.23	8.25	5.70	9.00	3.71	64.90
TOTAL		**44.76**	**11.55**	**9.53**	**10.20**	**4.82**	**80.85**

Total potential losses for a worst case scenario event in all counties in Region 8 could amount to over $443,470,000,000.

RISK ASSESSMENT

TABLE 2.3.3.K EARTHQUAKE RISK CALCULATION				
Probability		*Severity*		*Risk*
IMPROBABLE		MARGINAL		LOW
Based on past occurrences of earthquakes in the area, the probability of an epicenter occurring in one of the Region 8 counties is improbable.	+	The most likely damages to occur from an earthquake are minor structural losses.	=	The risk assessment matrix calculates the risk of earthquakes to the area to be low.



REGION 8 HAZARD MITIGATION PLAN

Risk Map: Earthquake

Data Source(s):
WV GIS Tech Center

Negligible Risk Area

0 3 6 12 18 24 Miles

DISCLAIMER: Data is meant for use as reference only. Some sources may be intended to be used at national or regional scales and are thus used beyond their original intent for demonstrative purposes.

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2.3.4 Epidemic

An epidemic is a sudden increase in the number of cases of an infectious disease above what is normally expected.

HAZARD OVERVIEW

According to the Centers for Disease Control and Prevention (CDC), there are various levels that refer to the amount or extent of a disease occurrence (CDC, 2012).

- **Endemic** refers to the constant presence and/or usual prevalence of a disease or infectious agent in a population within a geographic area; it is the amount of a particular disease that is usually present in a community or baseline.
- **Sporadic** refers to a disease that occurs infrequently and irregularly.
- **Hyper endemic** refers to persistent, high levels of disease occurrence.
- **Cluster** refers to an aggregation of cases grouped in place and time that are suspected to be greater than the number expected, even though the expected number may not be known.
- **Epidemic** refers to an increase, often sudden, in the number of cases of a disease above what is normally expected in that population in that area. Epidemics occur when an agent and susceptible hosts are present in adequate numbers, and the agent can be effectively conveyed from a source to the susceptible hosts. More specifically, an epidemic may result from:
  - a recent increase in amount or virulence of the agent,
  - the recent introduction of the agent into a setting where it has not been before,
  - an enhanced mode of transmission so that more susceptible persons are exposed,
  - a change in the susceptibility of the host response to the agent, and/or
  - factors that increase host exposure or involve introduction through new portals of entry.
- **Outbreak** carries the same definition of epidemic, but is often used for a more limited geographic area.
- **Pandemic** refers to an epidemic that has spread over several countries or continents, usually affecting a large number of people.

- The animal exposure data also only includes those exposures involving humans. Any exposures that only involve animals, i.e. dog attacked by skunk, etc., are investigated by the health department, but are not in the electronic system.
- The numbers provided are from confirmed and probable cases, because that is what is reported to CDC. Suspect cases and those deemed to not be cases are not reported, and were pulled out from the data set.
- There are more reportable diseases than there are listed on the table; this is because the disease has been removed from the list if there have been no instances of occurrence in the last five years. Examples include Anthrax, Influenza-related death or people under age 18, Plague, etc.
- Influenza has not been tracked until 2017 and therefore is not on the list or reportable diseases.

TABLE 2.3.4.A HEALTH DEPARTMENT REPORTED DISEASES PER COUNTY

Disease	2012					2013					2014					2015					2016				
	Grant	Hampshire	Hardy	Mineral	Pendleton	Grant	Hampshire	Hardy	Mineral	Pendleton	Grant	Hampshire	Hardy	Mineral	Pendleton	Grant	Hampshire	Hardy	Mineral	Pendleton	Grant	Hampshire	Hardy	Mineral	Pendleton
Salmonella	3	2	1	1	0	1	0	3	3	0	0	2	2	1	1	0	2	3	3	0	1	0	1	1	0
Streptotoccal Toxic Shock Syndrome	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Streptococcus, Group A invasive	1	0	0	0	1	1	0	0	1	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0
Streptococcus, Group B invasive	0	2	0	3	0	3	0	1	1	0	1	2	0	2	1	1	1	0	1	1	0	3	1	3	0
Streptococcus pneumoniae, invasive	1	0	0	3	2	8	0	1	3	1	1	5	2	5	1	1	2	1	4	0	2	2	0	5	0
Yersiniosis	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Zika Virus Disease	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0
TOTAL	**57**	**84**	**38**	**60**	**60**	**55**	**86**	**26**	**42**	**54**	**61**	**132**	**54**	**57**	**47**	**49**	**117**	**38**	**135**	**44**	**64**	**167**	**62**	**142**	**49**

REGION 8 REPORTABLE DISEASES

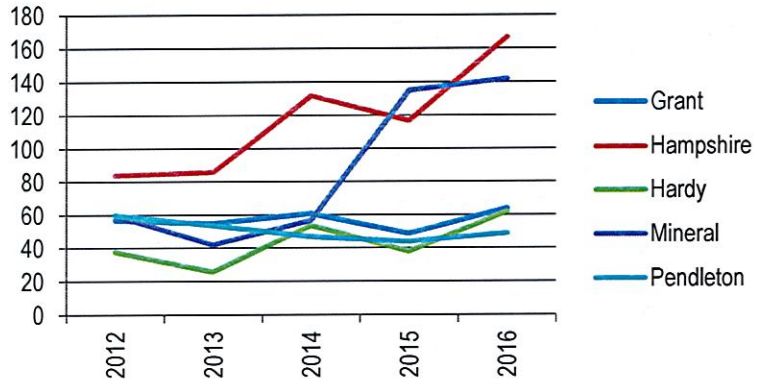


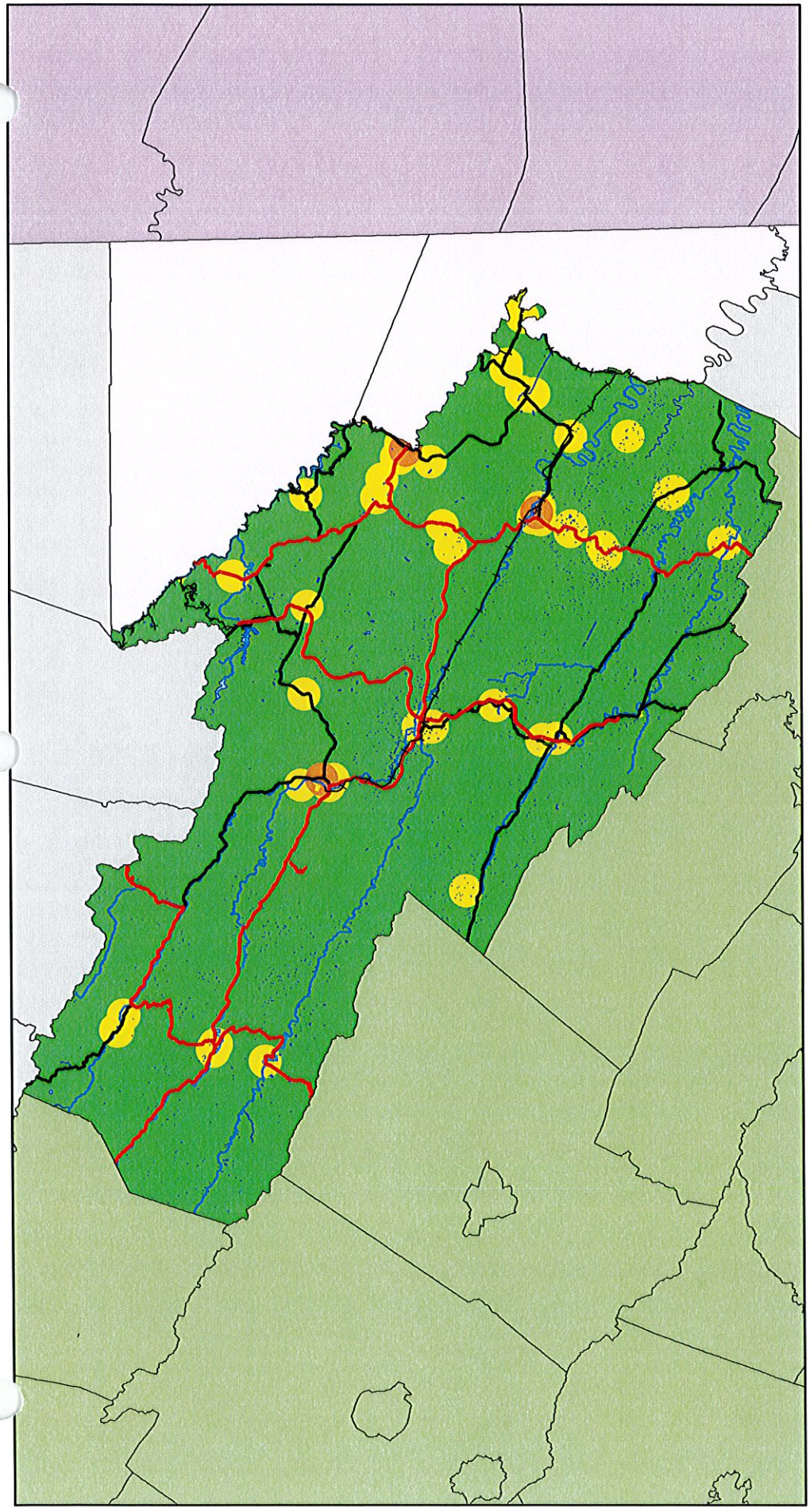
TABLE 2.3.4.B REPORTABLE DISEASE SUMMARY

County	2012	2013	2014	2015	2016	Total (County)	Average Per Year (County)
Grant	57	55	61	49	64	286	**57.2**
Hampshire	84	86	132	117	167	586	**117.2**
Hardy	38	26	54	38	62	218	**43.6**
Mineral	60	42	57	135	142	436	**87.2**
Pendleton	60	54	47	44	49	254	**50.8**
Total (Region 8)	299	263	351	383	484	1780	**356**
Average Per Year (Region 8)	**59.8**	**52.6**	**70.2**	**76.6**	**96.8**	**356**	**71.2**

RISK ASSESSMENT

TABLE 2.3.4.C EPIDEMIC RISK CALCULATION

Probability		*Severity*		*Risk*
OCCASIONAL		CRITICAL		MEDIUM
Although there are on average 71 cases of reportable diseases in Region 8 annually, this does not indicate the presence of an epidemic. However, due to the prevalence of Influenza (although not reported) in the area, the probability is set at occasional.	+	Historically in the area, there has been a low impact from epidemics. Even calculating economic implications, the loss is less than $500 per person per year. There is no damage to structures from epidemics, but due to the potential illness and loss of life, the severity is critical.	=	The risk assessment matrix estimates that the risk of an epidemic to Region 8, based on probability and severity, is medium.



REGION 8 HAZARD MITIGATION PLAN

Risk Map: Epidemic

Data Source(s):
WV GIS Tech Center

Critical Severity

Marginal Severity

Negligible Severity

Miles
0 3 6 12 18 24

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REGION 8

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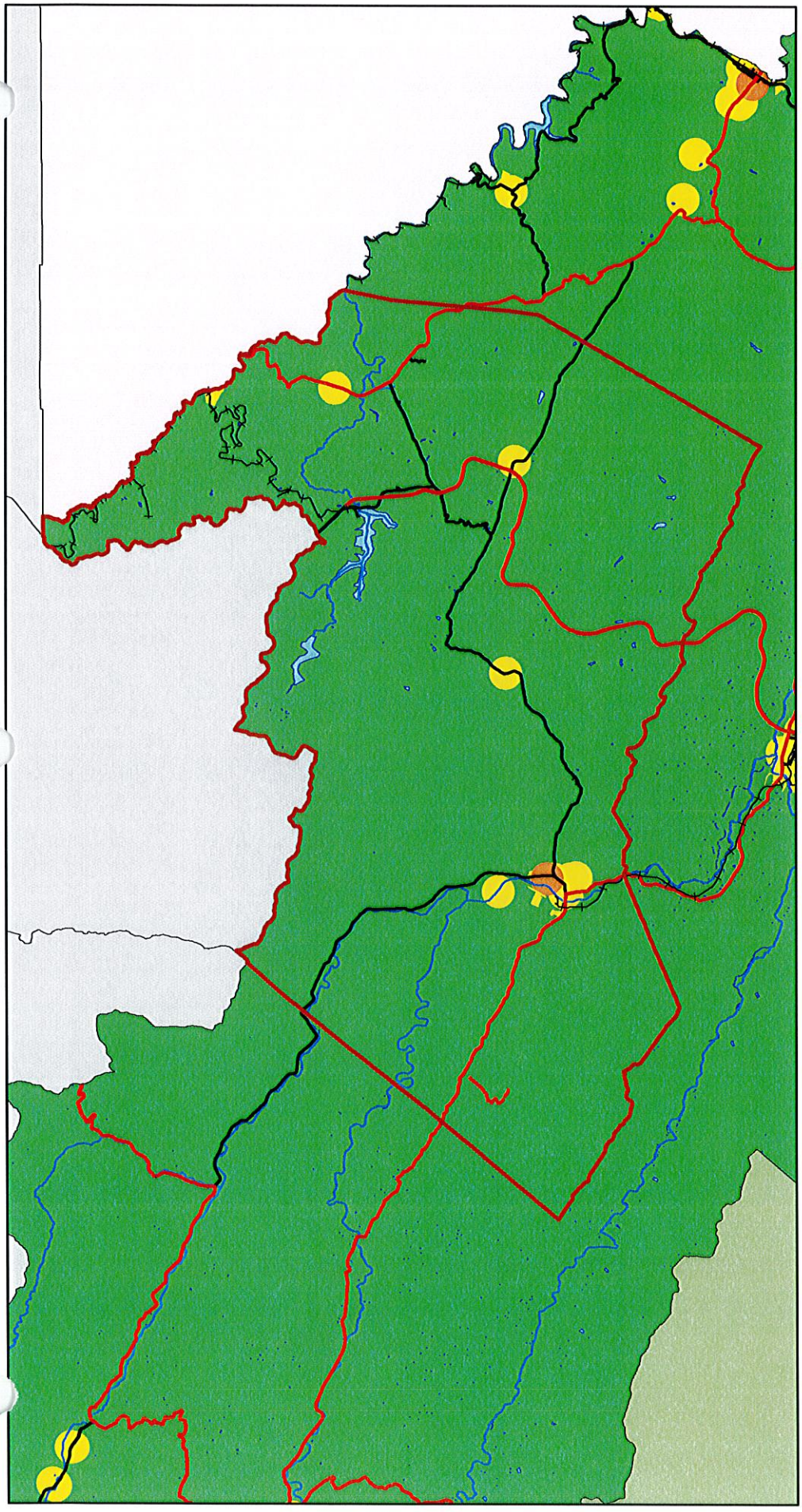


REGION 8 HAZARD MITIGATION PLAN

Grant Co. Risk Map: Epidemic

Data Source(s):
WV GIS Tech Center

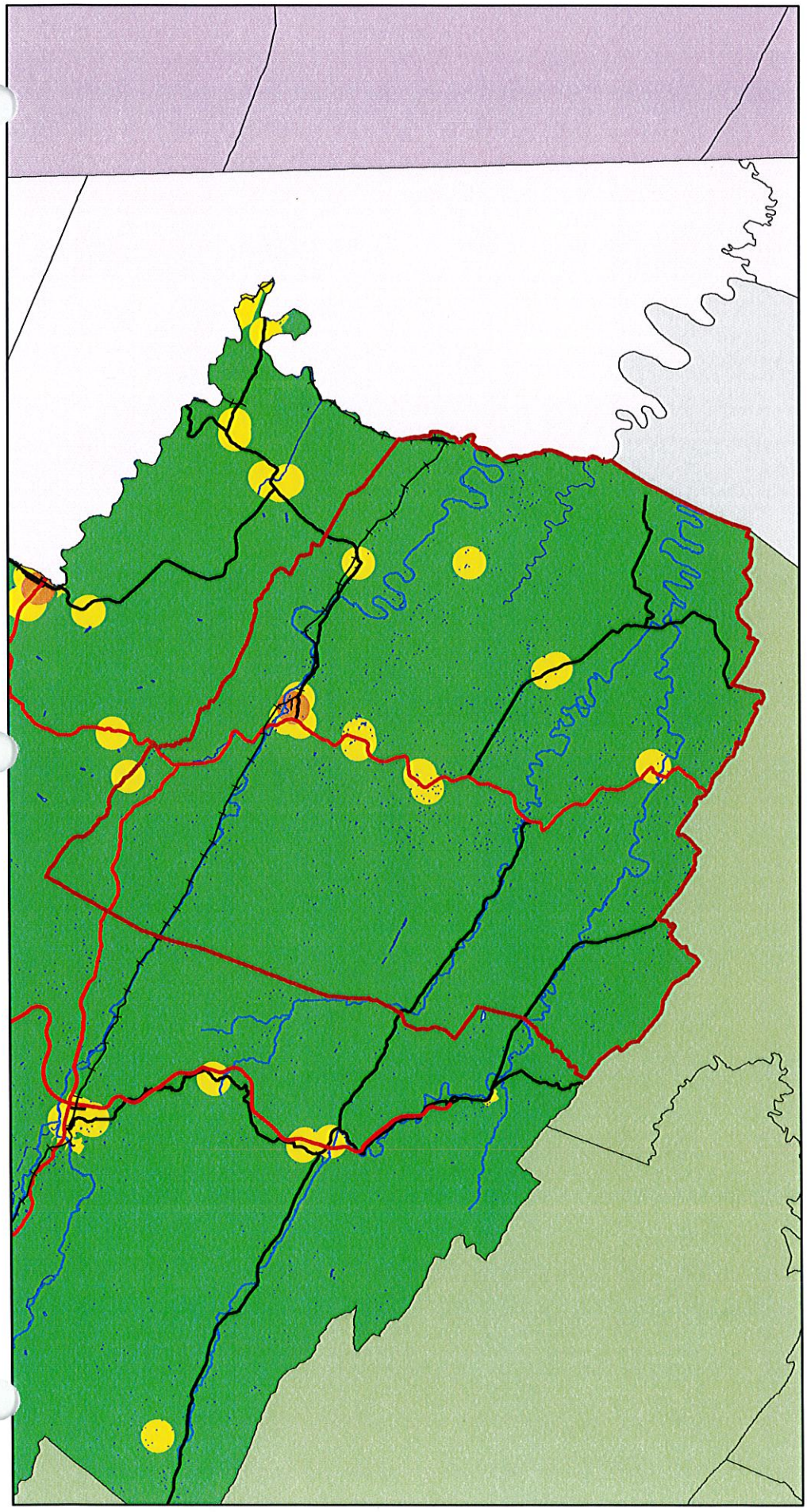
- Critical Severity
- Marginal Severity
- Negligible Severity
- Grant Co.

Miles
0 1 2 4 6 8

DISCLAIMER: Data is meant for use as reference only. Some sources may be intended to be used at national or regional scales and are thus used beyond their original intent for demonstrative purposes.

REGION 8

JH Consulting LLC



REGION 8 HAZARD MITIGATION PLAN

Hampshire Co. Risk Map: Epidemic

Data Source(s):
WV GIS Tech Center

- Critical Severity
- Marginal Severity
- Negligible Severity
- Hampshire Co.

Miles
0 1.5 3 6 9 12

DISCLAIMER: Data is meant for use as reference only. Some sources may be intended to be used at national or regional scales and are thus used beyond their original intent for demonstrative purposes.

REGION 8

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