

# 2678 - Central Shenandoah Regional Flood Resilience Plan

## Application Details

Funding Opportunity:	2335-Virginia Community Flood Preparedness Fund - Capacity Building/Planning Grants - CY24 Round 5
Funding Opportunity Due Date:	Mar 28, 2025 11:59 PM
Program Area:	Virginia Community Flood Preparedness Fund
Status:	Under Review
Stage:	Final Application
Initial Submit Date:	Jan 24, 2025 12:43 PM
Initially Submitted By:	Zach Beard
Last Submit Date:	
Last Submitted By:	

## Contact Information

### Primary Contact Information

Active User*:	Yes
Type:	External User
Name*:	Mr. Zach Beard Salutation First Name Last Name
Title:	Program Manager
Email*:	<a href="mailto:zach@cspdc.org">zach@cspdc.org</a>
Address*:	112 MacTanly Place

Staunton Virginia 24401  
City State/Province Postal Code/Zip

Phone*:	540-885-5174 Ext. Phone ###-###-####
Fax:	###-###-####
Comments:	

### Organization Information

Status*:	Approved
Name*:	Central Shenandoah Planning District Commission
Organization Type*:	State Government
Tax ID*:	54-0857625
Unique Entity Identifier (UEI)*:	FMNSWBBXJHR3
Organization Website:	<a href="https://www.cspdc.org/">https://www.cspdc.org/</a>

**Address\*:** 112 MacTanly Place

Staunton Virginia 24401-  
City State/Province Postal Code/Zip

**Phone\*:** 540-885-5174 Ext.  
#### #### ####

**Fax:** #### #### ####

**Benefactor:**

**Vendor ID:**

**Comments:**

## VCFPF Applicant Information

### *Project Description*

**Name of Local Government\*:** Central Shenandoah Planning District Commission

Your locality's CID number can be found at the following link: [Community Status Book Report](#)

**NFIP/DCR Community Identification Number (CID)\*:** 510155

If a state or federally recognized Indian tribe,

**Name of Tribe:**

**Authorized Individual\*:** Ann Cundy  
First Name Last Name

**Mailing Address\*:** 112 MacTanly Place  
Address Line 1  
Address Line 2

Staunton Virginia 24401  
City State Zip Code

**Telephone Number\*:** 540-885-5174

**Cell Phone Number\*:** 307-690-8622

**Email\*:** ann@cspd.org

Is the contact person different than the authorized individual?

**Contact Person\*:** Yes

**Contact:** Zach Beard  
First Name Last Name  
112 MacTanly Place  
Address Line 1  
Address Line 2

Staunton Virginia 24401  
City State Zip Code

**Telephone Number:** 540-885-5174

**Cell Phone Number:** 540-560-0968

**Email Address:** zach@cspd.org

Enter a description of the project for which you are applying to this funding opportunity

**Project Description\*:**

The Central Shenandoah Planning District Commission (CSPDC) is the largest district commission in the state by area and number of localities, and most localities do not have the capacity or funding to address flooding and stormwater issues. A regional resilience plan focusing on the most

acute needs and prioritizing practical, site-specific projects with planning, design, and cost estimates will help increase project readiness and competitiveness for future grant applications.

Low-income geographic area means any locality, or community within a locality, that has a median household income that is not greater than 80 percent of the local median household income, or any area in the Commonwealth designated as a qualified opportunity zone by the U.S. Secretary of the Treasury via his delegation of authority to the Internal Revenue Service. A project of any size within a low-income geographic area will be considered.

Is the proposal in this application intended to benefit a low-income geographic area as defined above?

**Benefit a low-income geographic area\***: Yes

Information regarding your census block(s) can be found at [census.gov](http://census.gov)

**Census Block(s) Where Project will Occur\***: N/A

**Is Project Located in an NFIP Participating Community?\***: Yes

**Is Project Located in a Special Flood Hazard Area?\***: Yes

**Flood Zone(s) (if applicable)**: Various; this proposal covers a region

**Flood Insurance Rate Map Number(s) (if applicable)**: See attached.

## Eligibility - Round 4

### ***Eligibility***

Is the applicant a local government (including counties, cities, towns, municipal corporations, authorities, districts, commissions, or political subdivisions created by the General Assembly or pursuant to the Constitution or laws of the Commonwealth, or any combination of these)?

**Local Government\***: Yes  
Yes - Eligible for consideration  
No - Not eligible for consideration

If the applicant is not a town, city, or county, are letters of support from all affected local governments included in this application?

**Letters of Support\***: Yes  
Yes - Eligible for consideration  
No - Not eligible for consideration

Has this or any portion of this project been included in any application or program previously funded by the Department?

**Previously Funded\***: No  
Yes - Not eligible for consideration  
No - Eligible for consideration

Has the applicant provided evidence of an ability to provide the required matching funds?

**Evidence of Match Funds\***: Yes  
Yes - Eligible for consideration  
No - Not eligible for consideration  
N/A- Match not required

## Scoring Criteria for Capacity Building & Planning - Round 4

### ***Scoring***

Eligible Capacity Building and Planning Activities (Select all that apply) ? Maximum 100 points. To make multiple selections, Hold CTRL and click the desired items.

**Capacity Building and Planning\***: Resilience Plan Development

Is the project area socially vulnerable? (based on [ADAPT Virginia's Social Vulnerability Index Score](#))

**Social Vulnerability Scoring:**

Very High Social Vulnerability (More than 1.5)

High Social Vulnerability (1.0 to 1.5)

Moderate Social Vulnerability (0.0 to 1.0)

Low Social Vulnerability (-1.0 to 0.0)

Very Low Social Vulnerability (Less than -1.0)

**Socially Vulnerable\***: High Social Vulnerability (1.0 to 1.5)

Is the proposed project part of an effort to join or remedy the community's probation or suspension from the NFIP?

**NFIP\*:**

No

Is the proposed project in a low-income geographic area as defined below?

"Low-income geographic area" means any locality, or community within a locality, that has a median household income that is not greater than 80 percent of the local median household income, or any area in the Commonwealth designated as a qualified opportunity zone by the U.S. Secretary of the Treasury via his delegation of authority to the Internal Revenue Service. A project of any size within a low-income geographic area will be considered.

**Low-Income Geographic Area\*:**

Yes

Does this project provide ?community scale? benefits?

**Community Scale Benefits\*:**

More than one census block

**Comments:**

This is a region-wide plan.

## Scope of Work and Budget Narrative - Capacity Building and Planning - Round 4

### **Scope of Work - General Information**

Upload your Scope of Work

Please refer to Part IV, Section B. of the grant manual for guidance on how to create your scope of work

**Scope of Work Attachment\*:**

[Resilience Plan\\_Scope of Work.pdf](#)

**Comments:**

Scope of Work

### **Budget Narrative**

**Budget Narrative Attachment\*:**

[Resilience Plan\\_Budget Narrative.pdf](#)

**Comments:**

Budget Narrative

## Scope of Work Supporting Information - Capacity Building and Planning

### **Scope of Work Supporting Information**

Describe identified resource needs including financial, human, technical assistance, and training needs

**Resource need identification\*:**

Most localities in the Central Shenandoah region confront significant resource constraints for flooding and stormwater planning and project implementation due to a lack of local staff time and limited to no funding for project planning, design, and implementation of flood and stormwater mitigation projects. Localities are able to identify and document reoccurring flooding and stormwater needs, but do not have the understanding or knowledge of what potential improvements are available, and are unfamiliar with the variety of best management practice (BMP) project types.

Technical assistance is required for every aspect of resilience-related planning, from existing conditions collection, needs identification, GIS analysis, design with engineering-level expertise, and project prioritization. Human resource needs include dedicated staff time for project management, grant administration, and ongoing maintenance of implemented projects. Training needs include enhanced capabilities in flood mapping, project prioritization methodologies, and BMP project maintenance management for localities.

Describe the plan for developing, increasing, or strengthening knowledge, skills and abilities of existing or new staff. This may include training of existing staff, hiring personnel, contracting consultants or advisors

**Development of Existing or New Staff\*:**

The CSPDC will strengthen organizational capacity by leveraging the expertise of contracted consultants to provide technical training to existing staff in areas such as existing conditions collection, analysis, and project evaluation methodology. Staff will participate in DCR-sponsored training sessions on flood resilience planning and grant management, explore training and certification opportunities through Virginia Floodplain Management Association to have a certified floodplain manager on staff to assist localities in the region, enroll in the Chesapeake Bay Landscape Professional program, and pursue DEQ certifications related to stormwater management.

The development of the resilience plan will establish a set of standard operating procedures and documentation to retain institutional knowledge and support the capability of CSPDC staff to better identify local flooding and stormwater needs, identify and development future projects, and identify the best grant funding programs to implement projects. The CSPDC will continue to strengthen the Environmental program and develop the internal expertise and credentials necessary to provide more timely, direct assistance for localities.

Where capacity is limited by funding, what strategies will be developed to increase resources in the local government? (This may include work with non-

governmental organization, or applying for grants, loans, or other funding sources)

#### **Resource Development Strategies\*:**

The Flooding and Stormwater Resilience Plan process and project list will position localities for competitive grant applications to multiple funding sources, including FEMA hazard mitigation grants, CFPF implementation grants, and Chesapeake Bay restoration funding. Additionally, the CSPDC continues to strengthen established partnerships with regional environmental organizations and localities through the Watershed Implementation Plan (WIP) program, which assists with facilitating regional collaboration with stakeholders such as non-profits, soil and water conservation districts, and localities to address regional flooding and stormwater issues. The CSPDC will continue to staff and coordinate quarterly MS4 stormwater stakeholder meetings with localities, which provides an opportunity for MS4 public works and community development staff to convene and share best practices.

Describe policy management and/or development plans

#### **Policy management and/or development\*:**

The flood resilience plan will establish standard procedures for project identification, evaluation, and prioritization that can be applied at the local government level. The CSPDC will schedule regular resilience plan updates and integration with the Hazard Mitigation Plan cycle, which as noted previously, will improve the PDC's internal capacity to provide more knowledgeable and informed assistance to address local needs, and strengthen the PDC's Environmental program.

The plan will also allow the CSPDC and localities to establish the connection between flood resilience and other aspects of municipal planning, such as economic development and resilience, housing, transportation, and overall community quality of life, and incorporate flood resilience needs, strategies, and goals into overlapping projects.

Describe plans for stakeholder identification, outreach, and education strategies

#### **Stakeholder identification, outreach, and education strategies\*:**

CSPDC staff will coordinate regional stakeholders in the planning process, including local community development, public works, and floodplain managers, conservation organizations, and environmental groups through interviews and site visits. Educational components will include meetings on nature-based solutions, project prioritization criteria, and funding opportunities. The CSPDC will maintain regular communication with stakeholders through quarterly updates and will establish a process for sharing project information and gathering locality input on flooding and stormwater needs.

The CSPDC is developing an online web portal through the Social Pinpoint platform for all PDC programs. Social Pinpoint is a public engagement firm focused on improving communication between local government and the public. Staff will consider using this platform to provide real-time updates on the planning process, which will allow a more accessible and streamlined method for collecting community and public input as the project progresses.

## Budget

### **Budget Summary**

#### **Grant Matching Requirement\*:**

LOW INCOME - Planning and Capacity Building - Fund 90%/Match 10%

\*Match requirements for Planning and Capacity Building in low-income geographic areas will not require match for applications requesting less than \$3,000.

Is a match waiver being requested?

**Match Waiver Request**                          No

Note: only low-income communities are eligible for a match waiver.

\*:

**I certify that my project is in a low-income geographic area:** Yes

**Total Project Amount (Request + Match)\*:** \$300,000.00

\*\*This amount should equal the sum of your request and match figures

**REQUIRED Match Percentage Amount:** \$30,000.00

## BUDGET TOTALS

Before submitting your application be sure that you meet the match requirements for your project type.

**Match Percentage:** 10.00%

Verify that your match percentage matches your required match percentage amount above.

<b>Total Requested Fund Amount:</b>	\$270,000.00
<b>Total Match Amount:</b>	\$30,000.00
<b>TOTAL:</b>	\$300,000.00

#### *Personnel*

Description	Requested Fund Amount	Match Amount	Match Source
CSPDC Staff Salary and Indirect	\$0.00	\$30,000.00	CSPDC Watershed Implementation Plan (WIP) Program
	<b>\$0.00</b>	<b>\$30,000.00</b>	

#### *Fringe Benefits*

Description	Requested Fund Amount	Match Amount	Match Source
No Data for Table			

#### *Travel*

Description	Requested Fund Amount	Match Amount	Match Source
No Data for Table			

#### *Equipment*

Description	Requested Fund Amount	Match Amount	Match Source
No Data for Table			

#### *Supplies*

Description	Requested Fund Amount	Match Amount	Match Source
No Data for Table			

#### *Construction*

Description	Requested Fund Amount	Match Amount	Match Source
No Data for Table			

#### *Contracts*

Description	Requested Fund Amount	Match Amount	Match Source
Contractual Services	\$270,000.00	\$0.00	
	<b>\$270,000.00</b>	<b>\$0.00</b>	

#### *Pre-Award and Startup Costs*

Description	Requested Fund Amount	Match Amount	Match Source
No Data for Table			

#### *Other Direct Costs*

Description	Requested Fund Amount	Match Amount	Match Source

No Data for Table

## Supporting Documentation - General

### Supporting Documentation

Named Attachment	Required	Description	File Name	Type	Size	Upload Date
Detailed map of the project area(s) (Projects/Studies)		CSPDC Regional Map	Resilience Plan_Region Map.pdf	pdf	4 MB	01/23/2025 01:27 PM
FIRMette of the project area(s) (Projects/Studies)		FIRMnumbers for each participating locality	Resilience Plan_FIRM Numbers.pdf	pdf	125 KB	01/23/2025 02:06 PM
Historic flood damage data and/or images (Projects/Studies)						
Alink to or a copy of the current floodplain ordinance		Links to Floodplain Ordinances for every participating locality	Resilience Plan_Comp Plans and Floodplain Ordinances.pdf	pdf	58 KB	01/23/2025 01:59 PM
Maintenance and management plan for project						
Alink to or a copy of the current hazard mitigation plan		2020 CSPDC Hazard Mitigation Plan	Resilience Plan_2020 CSPDC HMP.pdf	pdf	23 MB	01/23/2025 02:13 PM
Alink to or a copy of the current comprehensive plan		Links to Comprehensive Plans for every participating locality	Resilience Plan_Comprehensive Plans.pdf	pdf	48 KB	01/23/2025 02:10 PM
Social vulnerability index score(s) for the project area		Social Vulnerability Score	Resilience Plan_Social Vulnerability Score.pdf	pdf	135 KB	01/23/2025 01:27 PM
Authorization to request funding from the Fund from governing body or chief executive of the local government		CSPDC Executive Director grant consideration request and match confirmation letter	Resilience Plan_CSPDC Match Confirmation Letter.pdf	pdf	65 KB	01/24/2025 11:40 AM
Signed pledge agreement from each contributing organization						
Maintenance Plan						
<i>Benefit-cost analysis must be submitted with project applications over \$2,000,000. in lieu of using the FEMA benefit-cost analysis tool, applicants may submit a narrative to describe in detail the cost benefits and value. The narrative must explicitly indicate the risk reduction benefits of a flood mitigation project and compares those benefits to its cost-effectiveness.</i>						
Benefit Cost Analysis						
Other Relevant Attachments		CSPDC Region Special Flood Hazard Areas	Resilience Plan_Special Flood Hazard Areas.pdf	pdf	5 MB	01/23/2025 01:28 PM

### Letters of Support

Description	File Name	Type	Size	Upload Date
LOS_Augusta County	Resilience Plan_LOS_Augusta County.pdf	pdf	344 KB	01/23/2025 02:14 PM
LOS_Bath	Resilience Plan_LOS_Bath.pdf	pdf	39 KB	01/23/2025 02:14 PM
LOS_Bridgewater	Resilience Plan_LOS_Bridgewater.pdf	pdf	63 KB	01/24/2025 09:35 AM
LOS_Broadway	Resilience Plan_LOS_Broadway.pdf	pdf	456 KB	01/23/2025 02:15 PM
LOS_Dayton	Resilience Plan_LOS_Dayton.pdf	pdf	415 KB	01/23/2025 02:15 PM
LOS_Elkton	Resilience Plan_LOS_Elkton.pdf	pdf	54 KB	01/23/2025 02:15 PM
LOS_Glasgow	Resilience Plan_LOS_Glasgow.pdf	pdf	546 KB	01/23/2025 02:15 PM
LOS_Goshen	Resilience Plan_LOS_Goshen.pdf	pdf	380 KB	01/23/2025 02:16 PM
LOS_Harrisonburg	Resilience Plan_LOS_Harrisonburg.pdf	pdf	101 KB	01/23/2025 02:16 PM
LOS_Highland County	Resilience Plan_LOS_Highland County.pdf	pdf	88 KB	01/23/2025 02:18 PM

LOS_Lexington	<a href="#">Resilience Plan_LOS_Lexington.pdf</a>	pdf	148 KB	01/23/2025 02:16 PM
LOS_Mount Crawford	<a href="#">Resilience Plan_LOS_Mount Crawford.pdf</a>	pdf	1 MB	01/23/2025 02:17 PM
LOS_Rockbridge County	<a href="#">Resilience Plan_LOS_Rockbridge County.pdf</a>	pdf	507 KB	01/23/2025 02:17 PM
LOS_Rockingham County	<a href="#">Resilience Plan_LOS_Rockingham County.pdf</a>	pdf	1 MB	01/23/2025 02:17 PM
LOS_Staunton	<a href="#">Resilience Plan_LOS_Staunton.pdf</a>	pdf	45 KB	01/23/2025 02:17 PM
LOS_Timberville	<a href="#">Resilience Plan_LOS_Timberville.pdf</a>	pdf	171 KB	01/23/2025 02:18 PM
LOS_Waynesboro	<a href="#">Resilience Plan_LOS_Waynesboro.pdf</a>	pdf	20 MB	01/23/2025 02:18 PM



## **Central Shenandoah Planning District Commission (CSPDC) 2025 Community Flood Preparedness Fund (CFPF) Grant Application Scope of Work**

### **Project Description and Narrative**

#### **1. Background**

The Central Shenandoah Planning District Commission (CSPDC) is the largest planning district commission in the state by area and number of localities, and most localities do not have the capacity, funding, or resources to address flooding and stormwater issues. Based on locality input from the region's current Hazard Mitigation Plan update process and continued interest in addressing flooding, stormwater, and green infrastructure issues through the CSPDC Chesapeake Bay Watershed Implementation Plan (WIP) program, the CSPDC is seeking to address the region's flooding and stormwater issues through a regional plan focusing on identifying practical, site-specific best management practice (BMP) projects that will include planning, design, and a high-level of project readiness to increase competitiveness for future grant applications. The HMP is scheduled to be complete in spring 2026, and the CSPDC will utilize the current HMP process to inform the plan and incorporate the resilience plan into future HMP updates.

#### **2. Purpose and Need**

##### *Purpose and Goals*

CSPDC localities continue to express a need for a prioritized list of practical flooding and stormwater projects to be better prepared for grant funding opportunities and compliment the flooding mitigation goals and strategies identified in the HMP. The project list and project evaluation criteria will establish a baseline for localities in the region to understand what types of projects can be constructed.

The plan includes five goals:

1. Establish eligibility in the DCR CFPF project implementation funding by meeting the criteria in DCR CFPF Grant Guide Appendix F Plan Requirements, to include nature-based infrastructure projects, identifying all flooding areas, repetitive loss properties, debris management, and procedures for development of structures within the SFHA.
2. Develop a list of site-specific candidate grant projects for flooding and stormwater projects and BMPs, stream restoration, and maintenance that include project descriptions and cost estimates.
3. Establish a project evaluation process that localities can use as a baseline for identifying and prioritizing future BMP projects.
4. Identify the top priority projects in each non-MS4 locality and develop 10% project design sketches and cost estimates to establish a high-degree of project readiness for future grant opportunities.

5. Utilize the resilience plan as a companion document to the current 2025 HMP update, and incorporate the resilience plan into future CSPDC HMP updates and local planning documents such as comprehensive plans and capital improvement plans.

#### ***Study Need***

The draft 2025 CSPDC Hazard Mitigation Plan (HMP) identifies flooding as the most significant natural hazard vulnerability. The region is defined by small, rural communities with limited resources unable to plan, assess, prioritize, or fund flooding and stormwater projects, and none of the 19 participating localities in the CSPDC region are eligible for submitting DCR CFPF project implementation grants due to a lack of flood resilience plan.

The region's varied topography is characterized by steep slopes and narrow ravines along the Blue Ridge and Allegheny Mountain ranges, entirely mountainous areas along the Alleghany front in Bath, Highland and Rockbridge counties, and rolling hills and bowled depressions in the Valley. Moreover, the headwaters for three of the Commonwealth's largest rivers – the Shenandoah, Potomac, and James – originate in the Central Shenandoah region and include dozens of tributaries.

High-intensity rainfall overwhelms small creeks in flashfloods and tropical weather events, with tropical storm Helene having a significant impact on the region in fall 2024. Many of the region's lower-income households live in structures built along flood plains.

#### **3. Study Area**

The Central Shenandoah Resilience Plan will include 19 localities:

- Counties: Augusta, Bath, Highland, Rockbridge, and Rockingham
- Cities: Harrisonburg, Lexington, Staunton, and Waynesboro
- Towns: Broadway, Bridgewater, Craigsville, Dayton, Elkton, Glasgow, Goshen, Grottoes, Mount Crawford, and Timberville

Augusta County and the cities of Harrisonburg, Staunton, and Waynesboro are MS4 localities and have existing plans that identify projects. The resilience plan planning process will only include region-based flood risk mapping and assessment for the MS4 localities, and not include project identification or evaluation.

#### **4. Study Tasks**

The CSPDC is requesting grant funding to contract a consultant to provide planning services. CSPDC staff will coordinate with each locality and the consultant to conduct the following tasks. The study will include a regional overview and stand-alone community profiles for each locality.

##### ***Task 1: Project Management and Coordination***

CSPDC staff will be responsible for grant administration, project coordination between the consultant and localities, and meeting planning and facilitation. CSPDC staff will also be responsible for providing the consultant with existing conditions data as requested and coordinating and conducting field visits as needed. The consultant will provide technical assistance, data gathering and analysis, project identification, design, and prioritization, and plan writing.

### *Meetings*

The CSPDC anticipates the plan will be complete within nine to twelve months. The CSPDC and the consultant will conduct a plan kick-off meeting to review the scope, expectations, schedule, and deliverables.

The CSPDC and the consultant will conduct monthly virtual coordination meetings, and the consultant will provide written meeting summary memos after each meeting reviewing the meeting discussion and identifying future action items. CSPDC staff will be responsible for updating regional stakeholders and localities on the status of the plan development.

### ***Task 2: Regional Overview and Existing Conditions***

The plan will include a regional needs assessment to include detailed GIS analysis of flood-prone areas, stormwater infrastructure, and vulnerable populations, along with mapping of repetitive loss properties and areas of recurring flooding. The assessment will identify gaps in existing flood mitigation infrastructure while evaluating current stormwater management capacity and needs, and utilize information from existing plans such as the Hazard Mitigation Plan, comprehensive plans, and stormwater management plans.

### ***Task 3: Community Coordination***

The CSPDC will conduct interviews with locality staff, to include town managers, planners, floodplain managers, and public works to identify flooding and stormwater needs. CSPDC will work with localities and the consultant to conduct in-field site assessments as needed, which could include windshield surveys or site-specific data collection.

The CSPDC recently contracted and is developing an online web portal through the [Social Pinpoint platform](#) for all PDC programs. Social Pinpoint is a public engagement firm focused on improving communication between local government and the public. Staff will consider using this platform to provide real-time updates on the planning process through a dedicated CSPDC resilience plan webpage, which will allow a more accessible, centralized, and streamlined method for collecting community and public input as the project progresses instead of one-time surveys or site visits.

### ***Task 4: Project Identification***

Based on existing studies and plans, locality input, and site visits conducted by CSPDC staff, the consultant will prepare a project list based on the project evaluation methodology outlined in Task 5, which focuses on projects addressing flood mitigation impact and pollutant reduction impacts with an emphasis on nature-based green infrastructure best management practices.

Each project will be site specific and include a description and planning-level cost estimate. The project list will include a minimum of five projects for each of the 15 non-MS4 localities<sup>1</sup>. Additional projects may be included and dependent on consultant capacity. Projects ideas that are not site-specific, do not have a specific improvement identified, and require further study will be placed on a Vision List. Localities can utilize the Vision List to track and further study and evaluate projects in the future.

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<sup>1</sup> The counties of Augusta and Rockingham, the cities of Harrisonburg, Staunton, and Waynesboro, and the Town of Bridgewater are MS4 localities and have existing plans that identify projects. The resilience plan planning process will only include region-based flood risk mapping and assessment for the MS4 localities, and not include project identification or evaluation.

Project types will include – but is not limited to – new BMPs, BMP retrofits, stream restoration, and repetitive loss properties and projects emphasizing nature-based improvements, including:

- Stream restoration and stabilization
- Wetland creation and enhancement
- Rain gardens and bioretention areas
- Pervious pavement installations
- Urban tree canopy expansion
- Floodplain reconnection projects
- Green infrastructure retrofits

Conventional structural flood mitigation and stormwater project improvements should also be identified as necessary. Each project will include a site-specific location, project description, BMP type, and planning-level cost estimate and be prioritized based on the flood reduction benefits, environmental impact, cost-effectiveness, and implementation feasibility scoring factors outlined in Task 5.

#### ***Task 5: Project Evaluation and Prioritization***

The CSPDC will coordinate with localities and the consultant to identify the project evaluation criteria to prioritize each project and establish the prioritized project list for each locality. At least five projects will be scored for each non-MS4 locality. Additional projects may be scored based on consultant capacity. Project ideas that do not address a direct flooding or stormwater need and do not have a definitive improvement identified will not be prioritized and placed on a Vision List for project ideas or needs that require further evaluation.

The methodology will be a tool for localities to utilize when identifying and assessing future potential flooding and stormwater projects and inform local decision-making when assessing which flood and stormwater projects are most appropriate for the site and locality. The methodology should emphasize projects that protect critical facilities and infrastructure, reduce repetitive losses, enhance water quality, and are cost effective. The methodology should consider – but not be limited to – the following project scoring factors. The factors are listed as a general guide and baseline. The final methodology will be informed by locality input and the consultant.

#### ***Flood Mitigation Impact***

Projects providing the most immediate and direct benefit for protecting critical infrastructure and habitat, protect vulnerable populations, and restore natural floodplain function. Highest scores are awarded to projects addressing documented flooding or infrastructure risks in known problem areas, with partial credit for projects providing detention benefits in non-problem areas, and lowest ranking for water quality projects.

#### ***Water Quality Improvement***

Projects addressing regional Chesapeake Bay pollution reduction goals for total nitrogen, phosphorus, and sediment pollutant removal capacity receive the highest consideration, with the highest performing project setting the benchmark and other projects scored as a percentage of that maximum.

*Cost Effectiveness and Total Project Cost*

Cost effectiveness could be calculated by dividing total project cost number of structures protected or pounds of pollutants removed, with projects scored as a percentage of the most cost-effective project to determine their ranking. Project Cost would be based on total costs including design and construction, with lower-cost projects receiving higher scores.

*Project Readiness*

This criteria could include land acquisition, site constraints and utility conflicts, and implementation schedule. Projects on public property may receive highest consideration, those requiring minimal easements receive partial credit, and those requiring significant private property acquisition rank lowest. Projects free from major constraints like large trees or underground utilities score highest, with decreasing ranks based on the complexity of utility conflicts, access limitations, and site challenges. Highest consideration is given to projects achievable within 12 months without permits, with decreasing scores for longer timelines and additional permitting requirements.

*Maintenance Burden*

Projects requiring minimal long-term maintenance receive highest consideration, those with moderate maintenance needs receive partial credit, and those demanding extensive staff time and resources rank lowest.

*Visual Appeal*

Projects that enhance site aesthetics through landscaping or blight removal receive higher consideration.

*Project Integration*

Projects that integrate with existing or planned development, align with existing locality ordinances and plans provide additional environmental co-benefits, and provide enhanced site aesthetics.

***Task 6: Priority Project Concept Development***

The consultant will prioritize the top project for each non MS4 locality totaling 15 proposed projects with descriptions of the proposed project activities and locations. For each project, the consultant team will develop 10% design plan view drawings visualizing the proposed design implementation over aerial imagery as well as cost estimates for design and implementation anticipated to bring projects to completion. The consultant team will conduct site visits to each location to evaluate feasibility and identify any potential concerns and pertinent information to inform the design and cost estimate. Graphic cut sheets will be designed for the top priority project to assist in communication and grant applications. Priority project refinement will allow localities to address the upfront cost burdens required for initial design and engineering consultation and increase the level of project readiness for future grants.

***Task 7: Document Development and Deliverables***

The consultant will develop a draft plan including Tasks 1 through 6, and submit the document to CSPDC. The CSPDC will distribute the draft Plan for review with localities and DCR to address each component of the resilience plan. The CSPDC will approve the final plan as a companion document to the 2025 HMP. The CSPDC will include and update resilience plan in tandem with the HMP every five years, and formally incorporate the resilience plan to the next HMP update process. The governing body of each participating locality will consider adoption of the final resilience plan.

CSPDC staff will be responsible for presenting the final plan recommendations to the CSPDC Board and locality governing bodies as requested.



## **Central Shenandoah Planning District Commission (CSPDC) 2025 Community Flood Preparedness Fund (CFPF) Grant Application Budget Narrative**

### **1. Budget Overview**

The total project cost is \$300,000 based upon a fee proposal provided by The Berkley Group. The project serves low-income geographic areas and qualifies for the 10% match. As a result, the CSPDC is requesting 90% of the project cost for a total of \$270,000.

The CSPDC will fund the 10% match of \$300,000 with in-kind staff time. The CSPDC is providing the in-kind match funding through CSPDC Watershed Implementation Plan (WIP) program funds received through the Department of Environmental Quality (DEQ), which are pass-through federal funds that address Chesapeake Bay water quality goals. CSPDC staff will administer the grant, project management and coordination between DCR, the consultant, and localities, and provide technical assistance for each task as needed. The CSPDC attached funding confirmation letter outlines the CSPDC's commitment to providing the plan match.

### **2. Consultant Fee Proposal**

This Project Budget includes the following assumptions and activities below developed by the consultant the Berkley Group based on the Scope of Work provided by the CSPDC for each work task.

**Table 1. Budget by Scope of Work Task**

<b>Task</b>	<b>Description</b>	<b>Total</b>
1	Project Management and Coordination	\$23,870
2	Regional Overview and Existing Conditions	\$20,975
3	Community Coordination	\$11,310
4	Project Identification	\$85,540
5	Project Evaluation and Prioritization	\$28,410
6	Priority Project Concept Development	\$71,110
7	Plan Drafting and Approval	\$16,660
	Subtotal	\$257,875
	5% Indirect Costs	\$12,893.75
	<b>Total</b>	<b>\$270,769</b>

*Additional assumptions:*

1. The consultant team assumes involvement of senior level staff for the majority of project work due to the varied and nuanced nature of the project.
2. In-person meetings assumed to be held near-centrally to the Central Shenandoah Resilience Plan study area.
3. The 75 plans for planning level cost estimates will be provided in a batch to enable economy-of-scale.
4. Per project costs assume feasible projects will fall into 8-10 general practice types. We assume this will allow for efficiencies associated with applying a single strategy to multiple discrete locations.
5. Indirect costs are included at 5%.

### 3. Budget Summary

The entire CFPF request will be used for contractual services. The CSPDC is providing the 10% match through in-kind CSPDC staff time and indirect costs funded by the CSPDC WIP program. The budget includes approximated salary and indirect hours for two full-time staff members: Program Manager (205 hours) and Regional Planner (179 hours). Actual hour allocation may vary depending on staff capacity and will also include some work by finance and administrative staff.

**Table 2. Budget Summary**

	<b>CFPF Request</b>	<b>CSPDC Matching Funds</b>	<b>Total</b>
Contractual Services	\$270,000		\$270,000
Salary		\$20,979.02	\$20,979.02
Indirect (43%)		\$9,020.98	\$9,020.98
Total	\$270,000	\$30,000	\$300,000



# Central Shenandoah Hazard Mitigation Plan 2020 Update



*"Reducing the impact of disasters on citizens  
of the Central Shenandoah Region  
through planning, preparedness,  
mitigation, and education."*

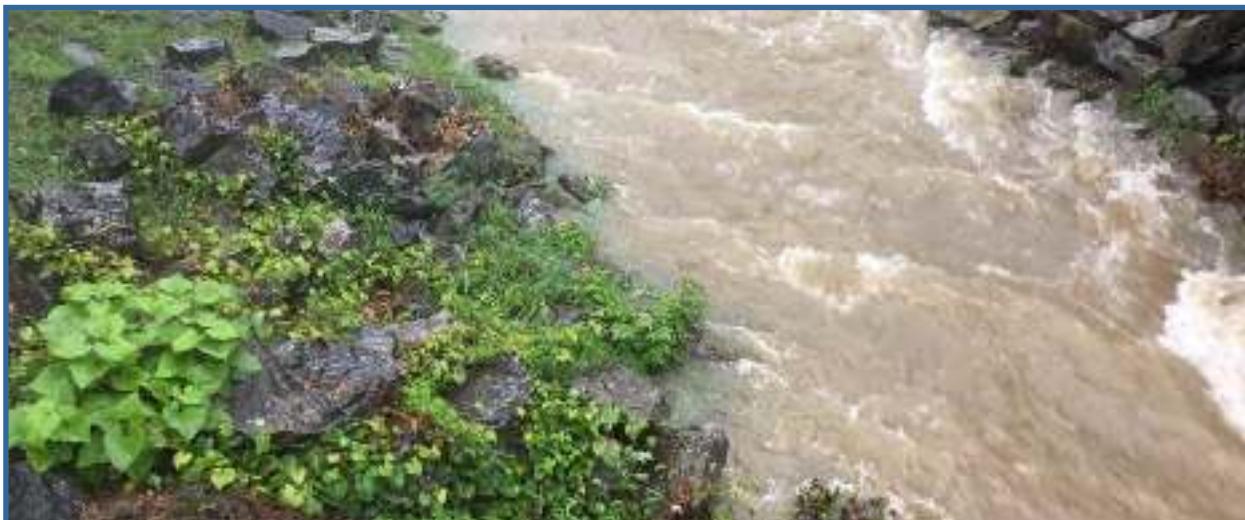
Prepared by the:  
Central Shenandoah  
Planning District Commission

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## CSHMP Executive Summary

- ◆ The Central Shenandoah Hazard Mitigation Plan (CSHMP) identifies natural and other hazards that impact the five counties, five cities, and eleven towns within the Central Shenandoah Region.
- ◆ The identified hazards were analyzed to determine risk and vulnerabilities in the Region. The highest ranked hazards include Flooding/Dam Failure, Drought, Hurricanes, and Severe Winter Weather.
- ◆ This Plan also includes four categories of mitigation goals and strategies:
  1. Local Plans and Regulations
  2. Structure and Infrastructure Projects
  3. Natural Systems Protection
  4. Education and Awareness Programs
- ◆ The twenty-one jurisdictions of the Central Shenandoah Region were actively engaged in the planning process. The local jurisdictions shared their past mitigation projects and created strategies for future mitigation activities.
- ◆ The public's input was gathered during numerous presentations and a region-wide survey. The results of the survey are included in this Plan.
- ◆ Included in the Appendices of the CSHMP is a chapter on Climate Adaptation and the new Central Shenandoah Regional Wildfire Protection Plan.

*The purpose of this plan is to increase the resilience of all the communities in the Central Shenandoah Region.*



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## I. INTRODUCTION

### 1. Purpose

The Central Shenandoah Hazard Mitigation Plan (CSHMP) was developed in accordance with the Disaster Mitigation Act of 2000 (DMA2K), requirements of the Federal Emergency Management Agency (FEMA) Section 322 local hazard mitigation planning regulations, and Title 44 Code of Federal Regulations (CFR) §201.6. DMA2K was enacted on October 10, 2000, when President Clinton signed the Act (Public Law 106-390). The legislation reinforces the importance of mitigation planning and emphasizes planning for disasters before they occur. This Act is also the basis for FEMA mitigation planning requirements for state, local, and tribal governments as a condition of mitigation grant assistance. DMA2K amended the Robert T. Stafford Disaster Relief and Emergency Assistance Act (Public Law 100-707) which was signed into law on November 23, 1988. In turn, the Stafford Act amended the Disaster Relief Act of 1974. The purpose of Title 44 CFR §201.6 is to provide information on the policies and procedures for local mitigation planning under the Stafford Act. It is also FEMA's official source for defining the requirements of original and updated mitigation plans.

The Disaster  
Mitigation Act  
of 2000  
(DMA2K)  
was enacted  
October 10,  
2000.

The CSHMP is a  
regional plan  
covering  
21 localities,  
including  
5 counties,  
5 cities and  
11 towns.

The purpose of the Plan is to identify natural hazards that impact the Region and to offer mitigation strategies that will lessen the effects that these hazards have on the citizens, property, and businesses in the Region. The Plan was developed on a multi-regional basis which included the five counties of Augusta, Bath, Highland, Rockbridge, and Rockingham, the five cities of Buena Vista, Harrisonburg, Lexington, Staunton, and Waynesboro, and eleven incorporated towns Glasgow, Goshen, Craigsville, Grottoes, Bridgewater, Broadway, Dayton, Elkton, Mt. Crawford, Timberville, and Monterey.

The CSHMP was initially adopted in 2005.

The Central Shenandoah Hazard Mitigation Plan was initially adopted in 2005. The planning process was led by the Mitigation and Planning Work Group of the Shenandoah Valley Project Impact and supported by staff of the Central Shenandoah Planning District Commission (CSPDC). The Hazard Identification Risk Assessment (HIRA) was prepared by Virginia Tech's Center for Geospatial Information Technology. Funding for the development of the Plan was provided in large part through a grant from the Virginia Department of Emergency Management (VDEM) with matching funds provided by the Central Shenandoah Planning District Commission.

Updates to the Plan took place from 2010 through 2013, and most recently from 2019 to 2020.

An update of the Plan took place from 2010 through 2013. The update process was led by a Steering Committee made up of local government staff, regional representatives of State agencies, interested citizens, and other organizations. The update was supported by CSPDC staff, who also updated the 2013 HIRA. Funding for the update of the Plan was provided in large part through a Pre-disaster Mitigation Grant from the Federal Emergency Management Agency (FEMA) with matching funds provided by the Virginia Department of Emergency Management and local jurisdictions within the Central Shenandoah Planning District.

The most recent version of the Plan was updated from 2019 to 2020. The update was led by a Steering Committee composed of appointees and alternates from all twenty-one localities, as well as appointees and alternates from twenty-five other organizations including federal agencies, state agencies, other local government agencies, educational institutions, healthcare institutions, business and industry interests, and citizens groups. The update was supported by CSPDC staff. The HIRA was updated by staff of the CSPDC, with assistance from staff at the Northern Shenandoah Valley Regional Commission. Funding for the update of the Plan was provided by Pre-disaster Mitigation Grant from FEMA with matching funds provided by VDEM and the CSPDC.

## II. PLANNING PROCESS

### 1. Planning Process

The planning process actually began in 1995 when local government officials recognized a void in flood planning and prevention after the devastating floods in 1995 and 1996. They called on the Central Shenandoah Planning District Commission (CSPDC) to develop a local mitigation strategy and offer planning and technical assistance to abate future damages.

The planning process began in 1995 after devastating floods in the Region.

Over the next several years and flood events, the CSPDC assisted many of the localities in identifying at-risk properties, applying for state and federal funds, and administering flood mitigation projects. Since 1995, the CSPDC has secured nearly \$10,000,000 in federal, state and local funds to elevate, move, acquire or floodproof nearly 200 structures and provide a disaster preparedness and mitigation education program in the Region. In 1999, the Region began looking at ways to prevent floods from becoming disasters through a viable planning process with effective public input. A committee comprised of elected officials, local government staff, and private citizens as well as technical experts from various natural resource agencies was created to assess the problem, review possible solutions, and recommend actions for the Region to take.

Since 1995, CSPDC has helped secure nearly \$10 million in funding for these projects.



Photo II-1: Flooding in Rockingham County, Hurricane Fran, 1996



Photo II-2: Town of Glasgow, Flood Mitigation

Project, 1997-2002

The Central Shenandoah Valley Regional Flood Mitigation Plan was completed in 1999.

The Region became a Project Impact Community, with the formation of Shenandoah Valley Project Impact.

Led by the Central Shenandoah Planning District Commission, the Committee met over the course of a year and half to produce the Central Shenandoah Valley Regional Flood Mitigation Plan. The Plan addressed the flood hazards that put each of our 21 communities at risk. The Plan identified and illustrated flood risks and recorded the history of flooding. It described the projects and efforts that localities have implemented to reduce flood damage and more importantly it explains what still needs to be done. The Plan offered sound and effective mitigation options and guidance with options for dealing with floods, setting priorities, and effectively planning to minimize future damage and protect floodplain resources.

From there, the Region was directed by the Federal Emergency Management Agency and the Virginia Department of Emergency Management to look at other natural hazards that impact the Central Shenandoah Valley. The Flood Mitigation Committee that was created in 1999 to oversee the Central Shenandoah Regional Flood Mitigation Plan was called back into action to address the requirements of the Disaster Mitigation Act of 2000. In the meantime, the Central Shenandoah Region became a Project Impact Community, and named this new program, Shenandoah Valley Project Impact. The purpose of Project Impact was to develop a sustainable long-term program of disaster-resistance education in the Shenandoah Valley. The Central Shenandoah Project Impact structure was made up of a Steering Committee and 4 work groups: 1) Mitigation and Planning; 2) Business Continuity, 3) Public Awareness and 4) Special Populations. Under this structure the former Flood Mitigation Committee was reinstated and reorganized and became Project Impact's Mitigation and Planning Workgroup. The purpose of this committee was to promote mitigation methods that protect homes, public buildings, critical facilities, and natural spaces in the Shenandoah Valley.

The main task of the Mitigation and Planning Workgroup was to develop the Hazard Mitigation Plan. The Mitigation and Planning Workgroup was comprised of elected officials, city, county, and town staff, business persons, and interested citizens. All local jurisdictions were involved in the planning process either through direct representation on the committee or through involvement with Shenandoah Valley Project Impact.

Others involved throughout the planning process included representatives of local government, nonprofit organizations, human service agencies, the business community, universities and colleges, local libraries, the Red Cross, and other organizations interested in disaster mitigation. These persons served on the Project Impact/Citizen Corps Council and met on a regular basis throughout the development of the plan.

From 2010 to 2013, a new Steering Committee was formed consisting of former members of the Mitigation and Planning Committee as well as others to help with the task of reviewing the data and information in the original Plan and making revisions and adding additional information where needed.

From 2019 to 2020, an update to the Plan was led by a Steering Committee composed of appointees and alternates from all twenty-one local jurisdictions, as well as appointees and alternates from twenty-five other organizations including federal agencies, state agencies, other local government agencies, educational institutions, healthcare institutions, business and industry interests, and citizens groups. The appointees and alternates are listed in Table II-1 and Table II-2.

The 2020  
Steering  
Committee  
involved  
representatives  
from 21 localities  
and 25 other  
organizations.

91 individuals  
were nominated  
as appointees or  
alternates to  
serve on the  
Steering  
Committee.



Photo II-4: June 2019 Steering Committee Meeting

Photo II-3: June 2019 Steering Committee Meeting,  
CSPDC Staff

**Table II-1: 2020 Steering Committee, Local Government Members**

<b>Local Government</b>	<b>Name / Title</b>	<b>Role</b>
City of Buena Vista	Thomas Roberts, Director of Planning & Community Development	Appointee
City of Buena Vista	Lt. Waylon Miller, Emergency Management Coordinator	Alternate
City of Buena Vista	Chief Keith Hartman, Police Chief	Alternate
City of Harrisonburg	Paul Helmuth, Administrative Officer	Appointee
City of Harrisonburg	Ian Bennett, Fire Chief	Alternate
City of Lexington	Trent Roberts, Emergency Management Coordinator	Appointee
City of Lexington	Arne Glaeser, Director of Planning & Development/Floodplain Administrator	Alternate
City of Staunton*	Colten Lotts, Deputy Emergency Management Coordinator	Appointee
City of Staunton*	Scott Garber, Fire Chief/ Emergency Management Coordinator	Appointee
City of Staunton*	Perry Weller, Deputy Fire Chief/ Deputy Emergency Management Coordinator	Alternate
City of Waynesboro	Gary Critzer, Director, Emergency Management	Appointee
County of Augusta	Donna Good, EOC Director & Emergency Management Coordinator	Appointee
County of Augusta	Anthony Ramsey, Assistant Emergency Management Coordinator	Alternate
County of Augusta	Doug Wolfe, County Engineer/Floodplain Administrator	Alternate
County of Bath	Andy Seabolt, Emergency Manager	Appointee
County of Bath	Sherry Ryder, Planning and Zoning Administrator	Alternate
County of Highland	Harley Gardner, Emergency Services Coordinator	Appointee
County of Highland	Carl Williams, Deputy Chief of EMS	Alternate
County of Rockbridge	Captain Kevin Moore, Fire/Rescue	Appointee
County of Rockbridge	Chief Nathan Ramsey, Fire/Rescue	Alternate
County of Rockingham	Jeremy Holloway, Fire/Rescue Chief	Appointee
County of Rockingham	Jeff Michael, Deputy Chief	Alternate

**Table II-1: 2020 Steering Committee, Local Government Members , continued**

<b>Local Government</b>	<b>Name / Title</b>	<b>Role</b>
Town of Bridgewater*	Patrick Wilcox, Town Planner	Appointee
	Betsy Putney, Public Works Coordinator	Appointee
Town of Bridgewater*	John Ware, Environmental Agent	Alternate
Town of Broadway	Ross Clem, Project Manager	Appointee
Town of Broadway	Kyle O'Brien, Town Manager	Alternate
Town of Craigsville	Mayor Richard Fox	Appointee
	John Temple, Public Works Superintendent	Appointee
Town of Craigsville	Sgt. Corey Wood, Police Department	Appointee
Town of Dayton	Chief Daniel Hanlon, Police Dept	Appointee
Town of Dayton	Lt. Justin Trout, Police Dept	Alternate
Town of Dayton	Joe Paxton, Interim Town Manager	Alternate
Town of Elkton	Joshua Gooden, Mayor	Appointee
	Jon Ellestad, Interim Town Manager/ Floodplain Administrator	Appointee
Town of Glasgow	Eric Pollitt, Town Manager/ Floodplain Administrator	Appointee
Town of Glasgow	Chief Nathan Ramsey, Fire/Rescue	Alternate
Town of Glasgow	Captain Kevin Moore, Fire/Rescue	Alternate
Town of Goshen	Megan Deel, Clerk/Treasurer	Appointee
Town of Goshen	Lisa Landrum, Council Member	Alternate
Town of Grottoes	Nathan Garrison, Town Manager	Appointee
	AJ Hummel, Public Works Director	Alternate
Town of Monterey	Richard Robinson, Council Member	Appointee
Town of Monterey	Denise Simmons, Council Member	Alternate
Town of Mount Crawford	Eric Ensley, Council Member	Appointee
Town of Mount Crawford	Neal Dillard, Council Member	Alternate
Town of Mount Crawford	Dennis Driver, Council Member	Alternate
Town of Timberville	Austin Garber, Town Manager	Appointee

\* CRS Community

**Table II-2: 2020 Steering Committee, Non-Local Government Members**

<b>Organization</b>	<b>Name / Title</b>	<b>Role</b>
Augusta County Service Authority	Brett Sinclair, Safety Manager	Appointee
Augusta County Service Authority	Tina Solak, Director of Human Resources	Alternate
Augusta Health	Francis Caruccio	Appointee
Augusta Health	Karen Clark	Alternate
Blue Ridge Community College	William Wilkerson, Chief of Police	Appointee
Blue Ridge Community College	Laura Dwyer, Administrative Assistant, Buildings and Grounds	Alternate
Bridgewater College	Milton Franklin, Chief of Police	Appointee
Central Shenandoah Health District, VDH	Hilary Cronin, District Emergency Planner	Appointee
Central Shenandoah Health District, VDH	Dr. Laura Kornegay, District Health Director	Alternate
Central Shenandoah Health District, VDH	Michael Keatts, Northwest Emergency Coordinator	Alternate
Cherry Orchard Homeowners Association	Deane Dozier, Director	Appointee
Dixie Gas and Oil Corporation	Steven Craig, Safety and Regulatory Compliance Manager	Appointee
Greater Augusta Regional Chamber of Commerce	Annette Medlin, President/CEO	Appointee
Greater Augusta Regional Chamber of Commerce	Kim Wilbur, Communications Director	Alternate
Harrisonburg-Rockingham Chamber of Commerce	Chris Ellis, BB&T, Chamber Public Policy Committee	Appointee
Harrisonburg-Rockingham Community Services Board	Dan Jenkins, Risk Management Specialist	Appointee
Harrisonburg-Rockingham Community Services Board	Holly Albrite	Alternate
Harrisonburg-Rockingham Regional Sewer Authority	Sharon Foley, Executive Director	Appointee
Harrisonburg-Rockingham Regional Sewer Authority	Anita Riggleman, Environmental & Safety Manager	Alternate
Holtzman Oil Corp.	Keith Taylor, Safety Director	Appointee
Holtzman Oil Corp.	Calvin R. Lokey	Alternate
James Madison University	Robbie Symons, Emergency Management Coordinator	Appointee
James Madison University	Dale Chestnut, Stormwater Coordinator	Alternate
Lexington-Rockbridge Chamber of Commerce	Tracy Lyons, Executive Director	Appointee
Sentara Rockingham Memorial Hospital	Scott Masincup	Alternate
Shenandoah National Park, NPS	David Robinson	Appointee

**Table II-2: 2020 Steering Committee, Non-Local Government Members, continued**

<b>Organization</b>	<b>Name / Title</b>	<b>Role</b>
Shenandoah Valley Project Impact	Nancy Sorrells	Appointee
Shenandoah Valley Project Impact	Sharon Angle	Appointee
Shenandoah Valley Project Impact	Steve Strawderman	Appointee
Shenandoah Valley Regional Airport	Gary Craun, Director of Operations/Chief	Appointee
Shenandoah Valley Regional Airport	Chris Cary, Captain	Alternate
USDA-NRCS	Kathy Holm, Assistant State Conservationist (Field Operations)	Appointee
USDA-NRCS	Philip Davis, Soil Conservationist	Alternate
Valley Community Services Board	Roger Ramsey, Facility Manager	Appointee
Virginia Department of Environmental Quality	Jennifer Welcher, Pollution Response Coordinator	Appointee
Virginia Department of Forestry	Patti Nylander, Senior Area Forester- Mountain Valley Area	Appointee
Virginia Department of Forestry	Clint Folks, Area Forester	Alternate
Virginia Military Institute	Jay Williams, Post Engineer	Appointee
Virginia Military Institute	David Williams, Director, Auxiliary Services	Alternate
Washington and Lee University	Paul Burns, Director of Environmental Health & Safety	Appointee
Washington and Lee University	Brendan Perry, Director of MEP Services	Alternate
Western State Hospital	Patrick Robertson, Risk Manager	Appointee
Western State Hospital	David Mawyer	Alternate

The 2020 Steering Committee held three meetings.

61 people attended the kick-off meeting.

Information was gathered from the localities and stakeholders in the Region as a group through Steering Committee meetings and in one-on-one input sessions. The Steering Committee met three times during 2019 to develop the Plan. Below in Table II-3 is a list of the meeting dates, agenda topics, and the number of attendees. A list of attendees and meeting agenda packets can be viewed in Appendix A – Planning Process and Public Engagement. Surveys of individual Steering Committee members and in-depth group discussions were conducted in order to prioritize the hazards in the Region and revise the mitigation strategies from the previous HMP. CSPDC staff also consulted with individual local jurisdictions and stakeholder organizations representatives individually either in person or by phone to discuss their community's unique vulnerabilities and mitigation goals. CSPDC staff also consulted with individual members of the Steering Committee to gather information regarding critical facilities, damage assessments, capabilities, and mitigation strategies. Following this process, CSPDC staff incorporated the newly updated information and Steering Committee recommendations into the 2013 Plan to create the 2020 edition of the Central Shenandoah Hazard Mitigation Plan.

**Table II-3: Steering Committee Meetings**

Meeting Date	Agenda Topics	Number of Attendees
04/03/2019	Regional Hazard Identification Regional/Local Mitigation Goals and Strategies Public Outreach	61
06/05/2019	Regional Hazard Identification 2019 Ranking Results - Ranking of Prior Hazards - Consideration of Other Hazards Regional/Local Mitigation Goals and Strategies Public Input and Outreach	37
10/07/2019	Project Status Update and Timeline Update on HIRA and Critical Facilities Maps Damage Assessments Regional Strategies Local Strategies VDEM and FEMA Review Process Locality Adoption Process	45

## 2. Staff Training

Throughout the course of the planning process, CSPDC staff participated in training related to the development of the Plan as well as sponsored a number of training workshops for the public.

**Table II-4: Training Attended by Staff / Committee**

Date	Topic
02/19/2019	Virginia Department of Conservation and Recreation Dam Safety/Floodplain Program Grant Training
03/06/2019	Virginia Department of Emergency Management Hazard Mitigation Grant Program Briefing
03/14/2019	Environmental Protection Agency Webinar: Integrating Water Quality/Nature-based Approaches into Hazard Mitigation Plans
03/28/2019	Webinar: Plain Language Communication for Results
05/15/2019	Federal Emergency Management Agency Region III Webinar: Floodplain Management and Hazard Mitigation Planning
06/12/2019	United States Forest Service Webinar: Planning in the Wildland Urban Interface
07/10/2019	Federal Emergency Agency Region III Webinar: Engaging the Arts in Mitigation Planning
08/13/2019	Natural Hazards Center Webinar: Aligning Mitigation Investment for the Whole Community
08/15/2019	Planning Information Exchange Webinar: Planning for Drought and Cascading Hazards
09/10/2019	Making Mitigation Work Series Webinar: Ethical/Efficient Infrastructure Resilience - The Battle For Better Building Codes
09/19/2019	Webinar: The Art of the Narrative: Creating CEDS and Other Plans that People Want To Read
10/08/2019	Making Mitigation Work Series Webinar: Moving Mitigation Forward - the Past, Present, and Future of Hazard Mitigation Assistance
10/30/2019	Environmental Protection Agency Webinar: Integrating the EPA and Hazard Mitigation Planning

### 3. Partnering/Mentoring Opportunities

Throughout the planning process, CSPDC staff partnered with staff from other Planning District Commissions, and students at James Madison University:

- CSPDC staff consulted with staff from the Northern Shenandoah Valley Regional Commission (NSVRC) in analyzing data with HAZUS software. This partnership and the assistance received is discussed in more detail in the HIRA section of the Plan.
- CSPDC staff shared ideas and strategies with staff from the Central Virginia Planning District Commission (CVPDC). CSPDC staff attended a Steering Committee meeting for the CVPDC's Hazard Mitigation Plan on July 11, 2019 in Lynchburg. During the meeting, the CVPDC Steering Committee discussed their Hazard Identification and Risk Assessment (HIRA). Staff from the CSPDC and the CVPDC also met to share information during the Resilient Virginia Conference held at the Darden School of Business at the University of Virginia in Charlottesville on July 18 - 19, 2019.
- Students from the School of Integrated Sciences at James Madison University spent Spring Semester 2019 assisting in the update of the Hazard Mitigation Plan. The students researched issues related to climate adaptation in the Region, sharing information about population, land use, changes to climate and weather patterns, hazard profiles and recommendations, and social impacts. The information was compiled into a chapter on Climate Adaptation that can be viewed in Appendix B.



Photo II-5: James Madison University Students.

## III. PUBLIC PARTICIPATION

### 1. Public Participation

In 2000, the Central Shenandoah Region was designated a Project Impact Community by FEMA. Through Shenandoah Valley Project Impact (SVPI), thousands of citizens, businesses, and community organizations have been educated regarding disaster preparedness and mitigation. Through SVPI, many opportunities have been made available to gather public input into the planning process for the original Plan, the 2013 update, and this current update. Numerous presentations were made to civic groups, human service organizations, and other groups working with citizens (young and old) in the Valley. Educational materials have been distributed to thousands of citizens at community events. In January 2003, the Central Shenandoah Region also became a Citizen Corps Council enabling the Region to continue the work and programs initiated by Project Impact. In 2020, Shenandoah Valley Project Impact will turn twenty years old. Included in Table III-1 are events where the general public was given the opportunity to learn more about disaster preparedness, mitigation, and most importantly, the current update of the Plan.

The Region was designated as a Project Impact Community in 2000.

Shenandoah Valley Project Impact (SVPI) has provided disaster preparedness and mitigation education in the region.



Figure III-1: Project Impact Logo



Figure III-2: Citizens Corps Council Logo

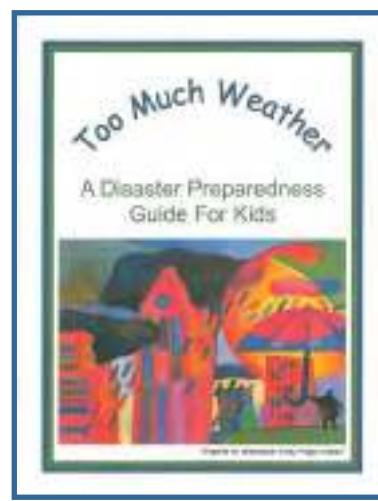


Figure III-3: Shenandoah Valley Project Impact, Disaster Preparedness Guide

The CERT Basic Course Has Been Offered 38 times and over 603 people have been trained.

Another avenue used to reach the public and gain their input into the planning process was through the Community Emergency Response Team (CERT) program. CERT is a national program offered through FEMA. The goal of CERT is for emergency personnel to train members of neighborhoods, community organizations or workplaces in basic response skills like disaster preparedness, fire safety, emergency first aid, search and rescue, and terrorism awareness. The Central Shenandoah Planning District began offering CERT classes in September 2003. Since then, 38 courses have been held resulting in a total of 603 volunteers trained in CERT. For this update of the Plan, CERT members provided input by filling out the public survey, participating in planning meetings, and assisting in public outreach activities.



Photo III-1 : Staunton-Augusta-Waynesboro CERT Volunteers



Photo III-2: CERT Volunteers participating in 2018 Shenandoah Valley Regional Airport Disaster Drill

Public participation again played a key role in the revision process for this update of the Plan. Public input was received by creating a new survey. The survey was widely distributed through an email blast, and a press release to a variety of media outlets in the Region, including local newspapers, radio and television stations. The survey and discussion of the Plan was also incorporated into many public education and awareness events (listed in Table III-1). The survey could be completed online, through a paper copy, or by a phone call with CSPDC staff. 557 surveys were completed and tabulated. A report of the survey results can be found in Appendix A - Planning Process and Public Engagement. Information from the public survey was used to guide the Steering Committee and CSPDC staff as they updated the Hazard Mitigation Plan. Public input from the survey included confirmation that the disasters respondents are most concerned about are the ones that occur the most frequently in the Region, are the ones ranked highest by steering committee and stakeholders, and are the ones that have the most emphasis in the Plan. Another valuable insight that was gained through the public survey is that the mitigation and preparedness education efforts in the Region are having a positive effect. Public education is one of the mitigation strategies included in the HMP. Also, during the update process, a copy of the original Plan was kept on the CSPDC website to allow for comment from the public as well.

During the adoption process of the update of the Plan by the 21 jurisdictions in the Region, the public will have another opportunity to provide input during the public comment period held at each Board of Supervisors, City Council, or Town Council meeting where adoption of the Plan will be on the agenda. The CSPDC will also have the Plan on their website for public comment as well. The CSPDC will issue a press release regarding the adoption process and the opportunity for additional public comment to the media throughout the Region. Any public comments received during the adoption process will be recorded and included in the Plan.

After the Plan has been approved by the Federal Emergency Management Agency and been adopted by the local jurisdictions, the Hazard Mitigation Plan will be kept on the CSPDC website for public comment throughout the five year plan update cycle. Over the five years between revisions of the Plan, public comment will be allowed and any comments received will be recorded.

**Table III-1: Public Involvement Activities, 2019**

Date	Event
03/05/2019	Valley Community Service Board Day Program Presentation - Staunton/Augusta County/Waynesboro
03/11/2019	Pleasant View/Spring Hill Ruritan Club - Augusta County
04/11/2019 - 05/23/2019	SAW Basic Training Course - Staunton/Augusta County/Waynesboro
04/24/2019	Harrisonburg Health and Safety Fair - Harrisonburg
04/27/2019	Dooms Fire Department Kids Fun Day - Augusta County/Waynesboro
05/14/2019	Gypsy Hill House Senior Apartments Presentation - Staunton
05/18/2019	Green Valley Book Fair Kids Safety Day - Rockingham County
05/28/2019	Plaza Apartments for Seniors/Persons with Disabilities - Staunton and Augusta County
06/14/2019	Historic Staunton Foundation Brown Bag Talk - Flooding Presentation - Staunton
07/16-2019 and 09/12/2019	Grace Lutheran Church Presentations - Waynesboro
09/17/2019	Bath County Local Emergency Planning Committee Meeting - Bath County
09/20/2019	Virginia Department of Health Staff Retreat Presentation - Regionwide
09/25/2019	Bath County Housing Study Community Meeting - Bath County
09/26/2019 11/14/2019	SAW Basic Training Course - Staunton/Augusta County/Waynesboro
09/28/2019	Girl Scout Preparedness Fair - Rockbridge County
10/06/2019	Touch-A-Fire Truck Event - Staunton/Augusta County/Waynesboro

## IV. HAZARD IDENTIFICATION RISK ASSESSMENT (HIRA)

### 1. Purpose

In accordance with the requirements of **Title 44 Code of Federal Regulations (CFR) § 201.6** for local jurisdictions to have a Hazard Mitigation Plan (HMP), communities must conduct a hazard identification risk assessment (HIRA) to be included in the Plan. Having the HIRA in place allows local jurisdictions in the Region to better understand local hazards and the risks posed by them, begin to develop mitigation activities to lessen the impacts, and to acquire disaster-related grants in the aftermath of a disaster. The HIRA was developed to serve as a guide to all communities in the Region for assessing potential vulnerabilities to natural and other hazards. When developing this section, every effort was made to use the best data available to assure that the results of this analysis were as accurate as possible.

The planning area for this assessment includes the 21 jurisdictions of the Central Shenandoah Planning District Commission (CSPDC). All jurisdictions located in the CSPDC Region have been included in this portion of the study, as this analysis has been completed on a regional basis. It should be noted that the local jurisdictions included in the Plan were engaged participants in providing input throughout the entire planning process.

The purpose of the HIRA is to:

1. Identify hazards that have impacted and/or could affect the Central Shenandoah Planning District Commission Region.
2. Profile hazard events and determine what areas and community assets are the most vulnerable to damage from these hazards.
3. Estimate losses and prioritize the potential risks to the community.

## Methodology for Identifying and Prioritizing Hazards

One of the first steps in the planning process and the hazards identification risk assessment phase was to identify each of the hazards that can occur and impact the Region. CSPDC staff reviewed hazards that were included in the 2005 Plan and the 2013 update of the Plan. These hazards were previously identified based upon extensive research and review of historical data provided through studies, reports and existing plans. During those planning processes, hazards were prioritized by members of the Steering Committee and survey results collected from the general public.

At the April 2019 Steering Committee Meeting, CSPDC staff presented information on the previously identified hazards to members of the committee. The members were asked to rank the hazards based upon the impact that the hazard has on their community. Categories were provided for significant, high, medium, low or none. Members were also asked to identify and rank any hazards that had not been previously included.

The results of the rankings were shared at the June 2019 Steering Committee Meeting. CSPDC staff presented information on the other hazards that had been newly identified by the members of the committee. A second ranking occurred for the newly identified hazards with categories provided for significant, high, medium, low or none. Members that could not attend the meeting were also contacted and requested to submit their rankings.

CSPDC staff reviewed the results of the rankings and the comments submitted by the Steering Committee to identify and prioritize the hazards in our region. These hazards are the focus of the 2020 Plan and the mitigation strategies developed. The following hazards were identified and are described in detail below:

- Flooding or Dam Failure
- Drought
- Hurricane

- Severe Winter Weather
- Land Subsidence/Karst
- Wind (Tornado, Derecho, Straight-Line Winds)
- Wildfire
- Landslide
- Earthquake
- Hazardous Materials (Transportation and Industrial)
- Terrorism
- Power Outages

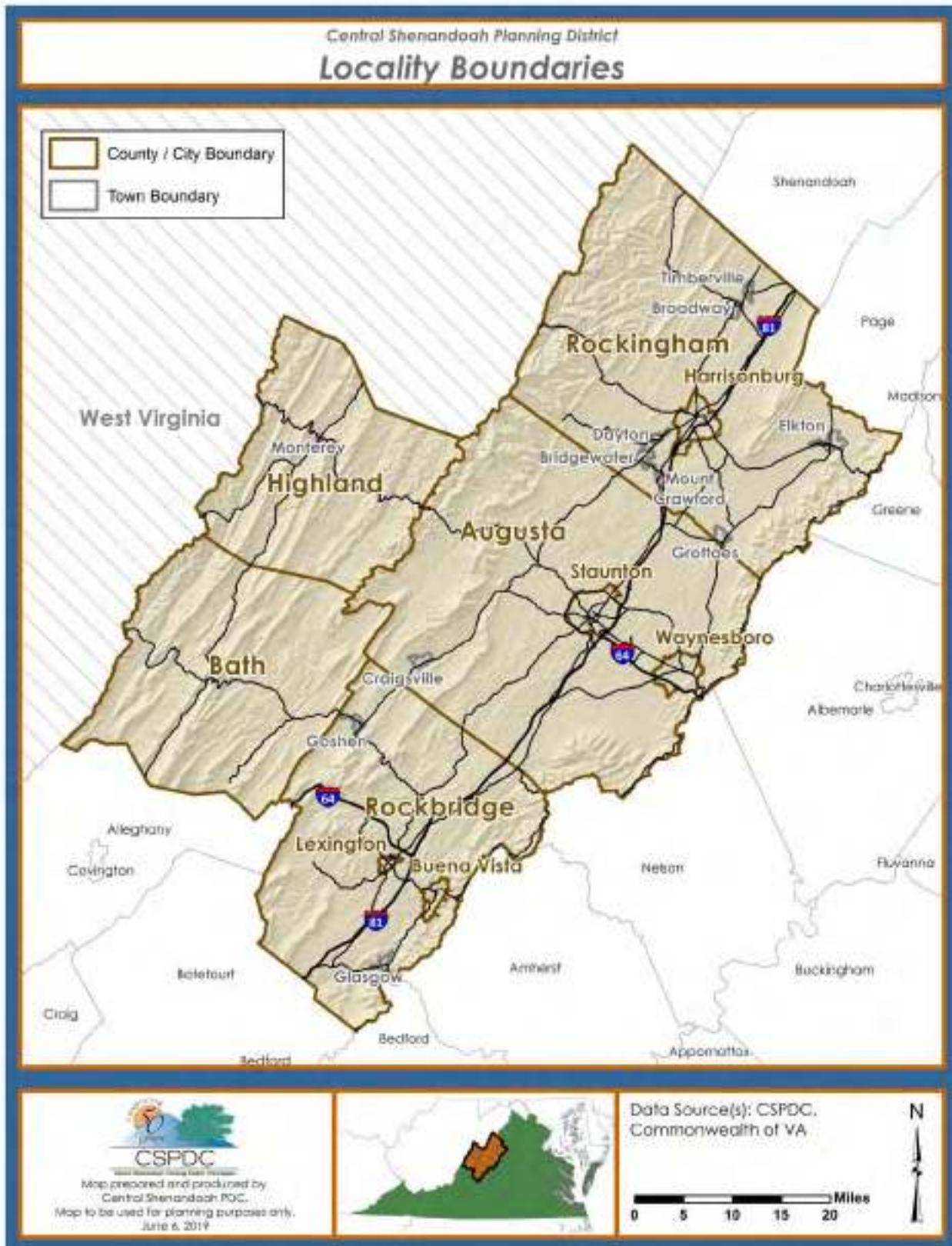
The CSPDC is the largest geographic planning district region in Virginia.

## Project Study Area and Planning District Description

The Project Study Area is located in the historic Shenandoah Valley in western Virginia and includes the 21 jurisdictions of the Central Shenandoah Planning District Commission (CSPDC). Interstate 81 and Interstate 64 run through the Region, which is approximately 45 miles north of Roanoke, 68 miles south of the Virginia Inland Port, 100 miles west of Richmond, 125 miles southwest of Washington, D.C., and 200 miles northwest of the Port of Hampton Roads. With a land area of 3,439 square miles, the CSPDC is the largest geographic planning district in the Commonwealth. As shown in Figure IV-1, the Region is comprised of Augusta, Bath, Highland, Rockbridge and Rockingham counties, and the independent cities of Buena Vista, Harrisonburg, Lexington, Staunton and Waynesboro. The Region also has 11 incorporated towns including Bridgewater, Broadway, Craigsville, Dayton, Elkton, Goshen, Glasgow, Grottoes, Monterey, Mount Crawford, and Timberville.

The Region is comprised of five Counties, five Cities and eleven incorporated Towns.

Table IV-1 provides an overview of land area and demographic information for each of the communities in the Region, and Figure IV-2 illustrates population density by Census Block Group. The Region is home to an estimated population of 294,719 individuals (Weldon Cooper Center, 2017 Population Estimates). According to the American Community Survey 5-Year Estimates (2013-2017), there are 128,853 housing units in the Region and 58.3% are owner-occupied.

**Figure IV-1: Central Shenandoah Planning District Boundaries**

**Table IV-1: Central Shenandoah Planning District Commission Demographics**

Locality	Area (Square Miles)	2017 Population	2017 Population Per Square Mile	Median Home Value	Total Housing Units
Augusta County	971	74,390	76.61	\$206,300	32,153
Craigsville, Town of	2.07	956	461.84	\$118,400	475
Bath County	535	4,458	8.33	\$151,100	3,353
Buena Vista City	7	6,495	927.86	\$111,700	2,895
Harrisonburg City	17	53,064	3,121.41	\$196,200	18,154
Highland County	416	2,213	5.32	\$184,000	2,069
Monterey, Town of	0.3	156	520.00	\$152,900	146
Lexington City	3	7,113	2,371.00	\$252,500	2,248
Rockbridge County	600	22,440	37.40	\$197,200	11,352
Glasgow, Town of	1.53	1,298	848.37	\$98,600	549
Goshen, Town of	1.75	317	181.14	\$96,300	205
Rockingham County	854	78,653	92.10	\$206,700	34,891
Bridgewater, Town of	2.52	5,930	2,353.17	\$220,000	2,170
Broadway, Town of	2.4	3,793	1,580.42	\$197,200	1,644
Dayton, Town of	1.03	1,622	1,574.76	\$214,200	659
Elkton, Town of	3.21	2,795	870.72	\$180,600	1,395
Grottoes, Town of	2.07	2,734	1,320.77	\$165,000	1,198
Mt. Crawford, Town of	0.49	403	822.45	\$235,700	205
Timberville, Town of	1.29	2,592	2,009.30	\$154,900	1,132
Staunton City	20	24,273	1,213.65	\$162,500	11,782
Waynesboro City	15	21,620	1,441.33	\$161,600	9,956

Source: U.S. Census, American Community Survey 5-Year Estimates, 2013-2017

Note: Town totals are included in County totals.

The Region is part of the Valley and Ridge, and the Blue Ridge Physiographic Provinces.

Of the Region's 2.2 million acres of land, over 1 million acres of land are publicly held and protected.

The top three industries by employment include Government, Manufacturing and Health Care and Social Assistance, with an average earnings of \$45,859 across all industries and an estimated 144,466 people in the civilian labor force (Central Shenandoah Valley Regional Data Center, 2019).

The Region is bounded on the east by the crest of the Blue Ridge Mountains and on the west by the Allegheny Mountains and West Virginia Border. The Region is part of the Valley and Ridge Physiographic Province, which is characterized by gently rolling and hilly valleys, as well as gradual mountain slopes. The extreme eastern edge of the Region is within the Blue Ridge Physiographic Province which is distinguished by mountain peaks. The western edge of the Region is characterized by high, narrow, mountain ridges that run northeast to southwest forming relatively narrow river valleys. Elevations range from a high of 4,546 feet above sea level in Highland County, to a low of 720 feet above sea level near Glasgow in Rockbridge County.

Soils in the valley range from carbonate soils to alluvial soils along rivers and streams. Colluvial soils resulting from the weathering of the sandstone and shale mountains are found in the foothills paralleling the valley. The mountain areas are covered with shallow, rocky, excessively drained soils that derive from the weathering of acidic sandstone, shale, quartz, and granite parent material. The predominant geological structure underlying the Region is a complex formation of limestone, calcareous shale, and dolomite, with smaller amounts of sandstone, conglomerate, and chert.

Of the Region's 2.2 million acres of land, over 1 million acres are publicly held and protected. The Region contains a high quality and quantity of natural resources, made evident by large areas held in national forest and park land.

The region's land use is extremely diversified containing rural, agricultural areas to cities with the characteristics of small urban centers including universities, industries, and public transportation. Local jurisdictions deal with anticipated future land use issues through the mandated creation and updating of local Comprehensive Plans. Hazards and vulnerabilities are examined through the planning process.

The region's land use is mostly dominated by forest and agriculture. Much of the forested area in the Region is within either Shenandoah National Park or the George Washington and Jefferson National Forests. Forest resources are important in maintaining the local forestry industry, watersheds, wildlife habitats, and outdoor recreation. The dominant forest type in the Region is mixed hardwoods, specifically oaks, hickories, and maples.

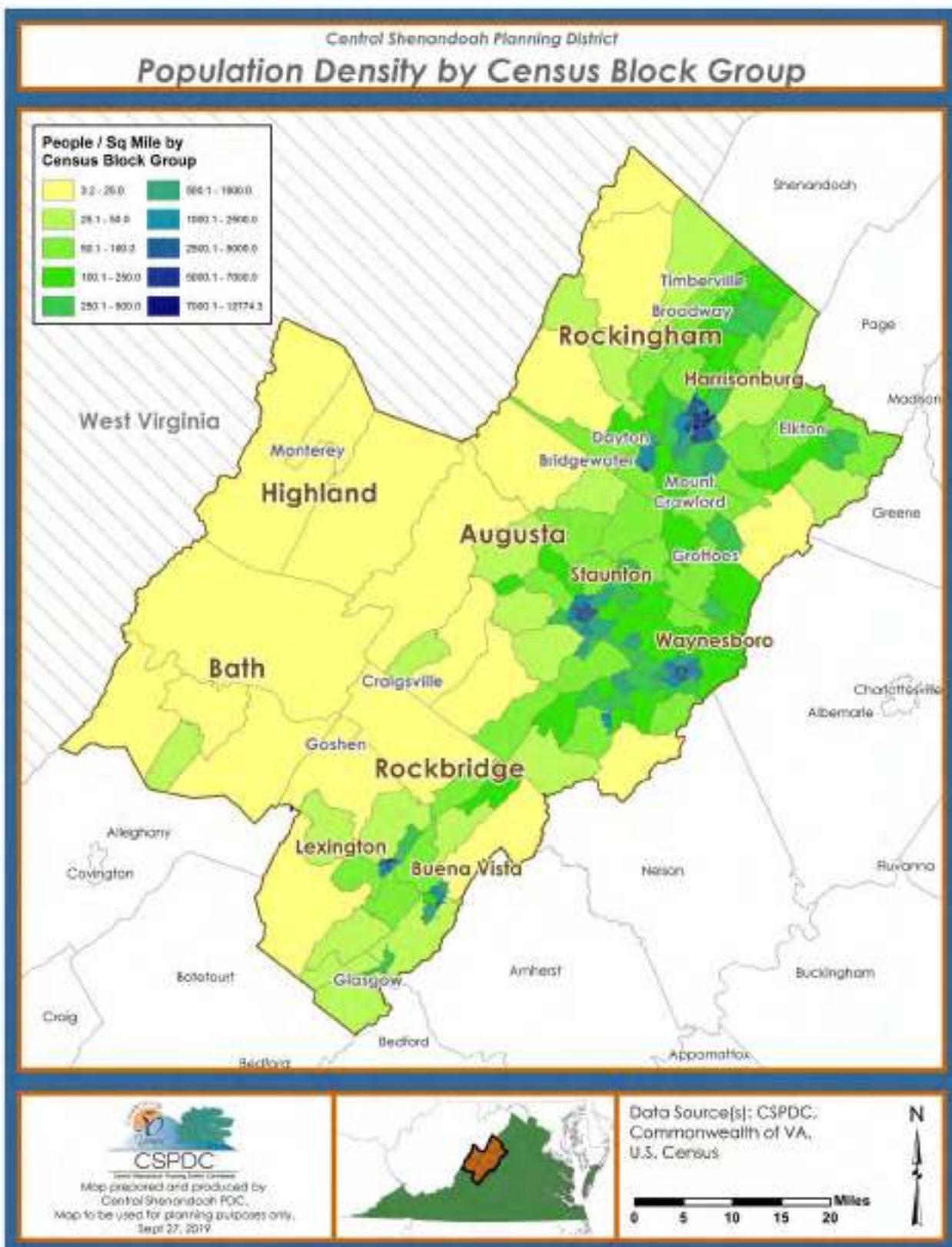
Figure IV-3 illustrates the location of the hydrologic basins and hydrography for the Region. Surface water in the Region drains into the Potomac River basin and the James River basin. The major tributaries to the Potomac River basin and the James River basin in the Region include the Bullpasture River, Calfpasture River, Cowpasture River, Little Calfpasture River, Jackson River, Middle River, the North Fork of the Shenandoah River, North River, South Fork South Branch Potomac River, the South Fork of the Shenandoah River, South River (Maury River tributary) and South River (South Fork Shenandoah River tributary).

Many of these major waterways are used as public water supply sources. The Region is also home to several reservoir impoundments that have uses such as public water supply, flood control measures, or outdoor recreation opportunities. Lake Moomaw in Bath County, with a surface area of 2,530 acres, is the second largest multi-purpose reservoir in western Virginia and was completed in the 1980s with the construction of the Gathright Dam on the Jackson River by the U.S. Army Corps of Engineers.

This information about the Region will prove to be a key component in determining the risk to communities from natural hazards.

The Region  
drains into the  
Potomac River  
basin and the  
James River  
basin.

Lake Moomaw  
is the second  
largest multi-  
purpose  
reservoir in  
western  
Virginia.

**Figure IV-2: Central Shenandoah Planning District Population Density**

## Critical Facilities

According to the FEMA State and Local Plan Interim Criteria, a critical facility is defined as a facility in either the public or private sector that provides essential products and services to the general public, is otherwise necessary to preserve the welfare and quality of life in the local jurisdiction, or fulfills important public safety, emergency response, and/or disaster recovery functions.

In the past, critical facilities were identified based upon data provided by the CSPDC, ESRI and the Virginia Tech Center for Geospatial Information Technology (CGIT). During this update of the Plan, each of the 21 jurisdictions was requested to review the local critical facility list for their community. Feedback was provided on revisions including additions or deletions of critical facilities from the list. For the CSPDC region, 1,153 critical facilities were identified. The coordinate locations for the critical facilities were intersected with floodplain data and other hazard data for the region. Figure IV-4 shows the location of critical facilities in the region in comparison to one percent annual chance of flood hazards in the FEMA floodplains.

Each of the 21 jurisdictions were requested to review the critical facility list for their community.

In the CSPDC region, 1,153 critical facilities were identified.

## Data Limitations

Inadequate information posed a problem for developing loss estimates for most of the identified hazards. The limiting factor for the data was the hazard mapping precision at only the jurisdiction level. Many of the hazards do not have defined damage estimate criteria. Available data for this Plan was very limited. The FEMA guidelines emphasize using “best available” data for this Plan. The impact of these data limitations will be shown through the different vulnerability assessment and loss estimation methods used for hazards.

Emergency Managers in the Region were contacted and information was requested on damage assessments for past events that have occurred in the Region since 2000. Information was requested on weather, rainfall/precipitation totals, wind speeds, and financial damages for damages to structures, infrastructure or agricultural losses. Unit Coordinators with Virginia Cooperative Extension for each of the five counties within the Region were contacted and information on agricultural losses was requested. The responses that were received were incorporated into the Plan, but information received was limited. At the October 2019 Steering Committee Meeting, a

recommendation was made to the members of the Steering Committee to start tracking this information within their localities to assist with future Plan updates.

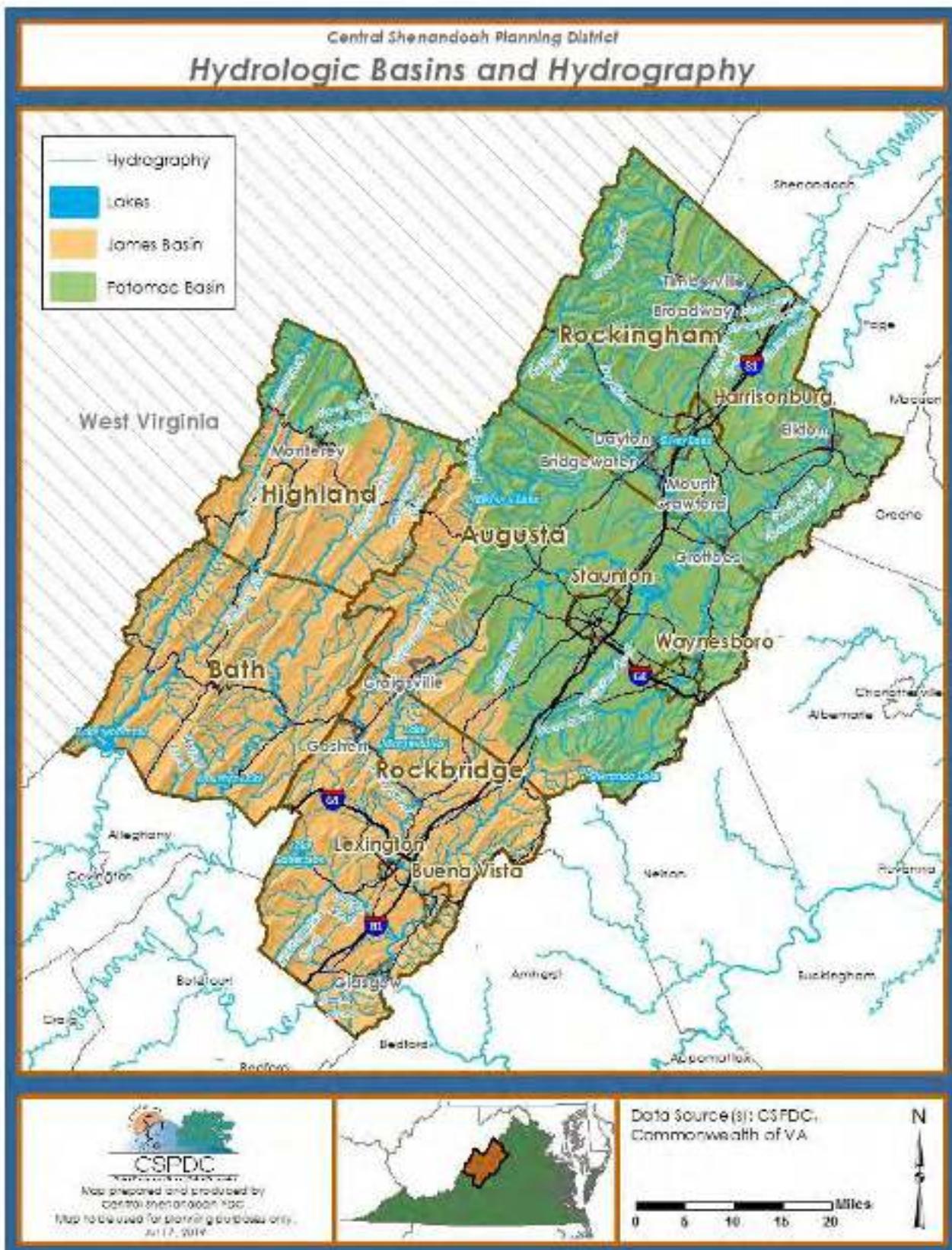
Critical facilities were determined based on best available data which were reviewed and updated by the 21 localities. Critical facilities, residential and industrial buildings within the 100 year floodplain were identified for flood analysis (CSPD Flood Mitigation Plan).

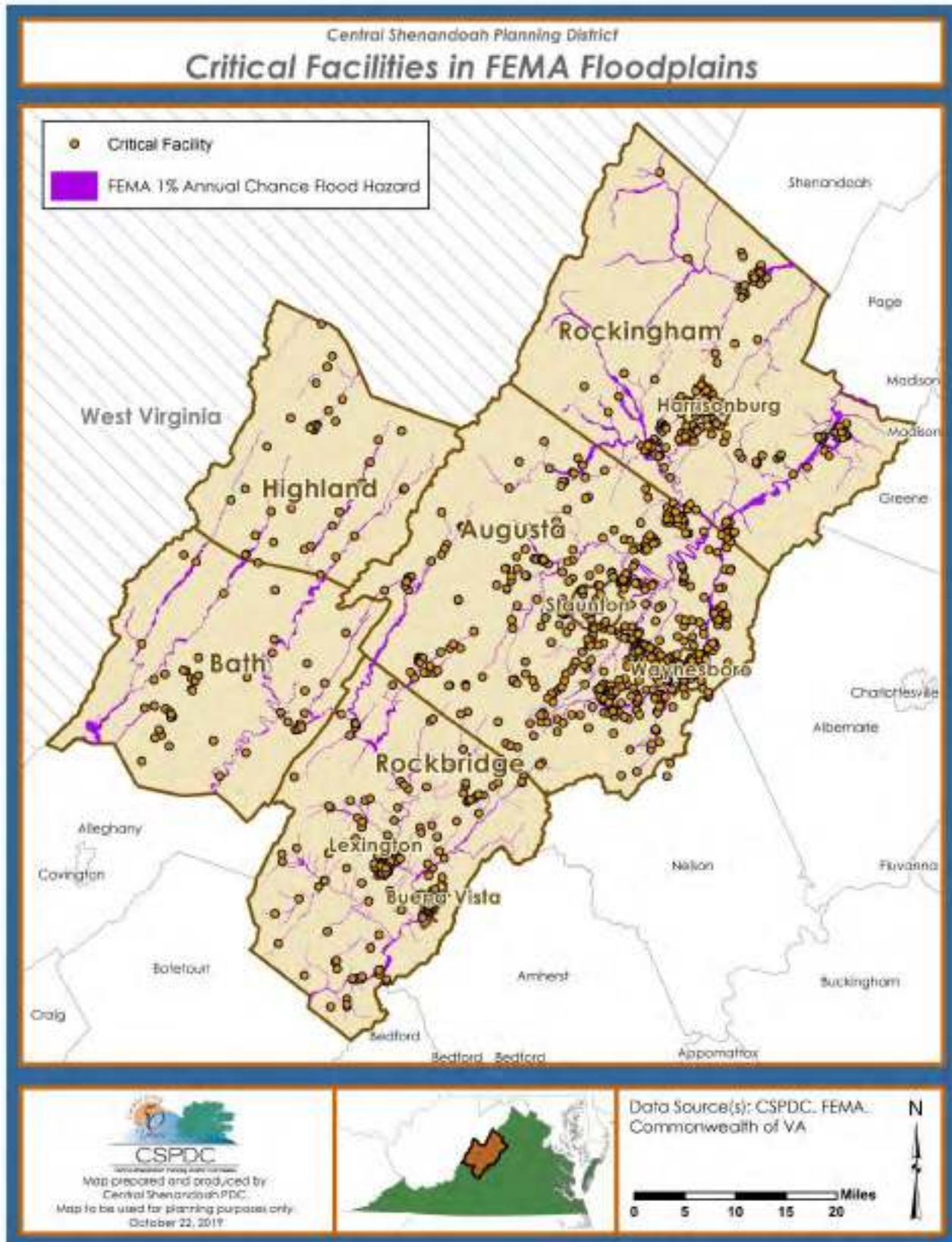
The HAZUS-MH model was used to estimate damage from flooding, hurricanes, and earthquakes in the Central Shenandoah region. The CSPDC had several issues with the HAZUS software and after attempting to contact the HAZUS help team, the CSPDC decided to partner with the Northern Shenandoah Regional Commission to run HAZUS reports for the CSPDC region. One of the main issues is that the current HAZUS software provided by FEMA is not compatible with the most recent version of ESRI's ArcMap software. The ESRI software must be uninstalled to install the HAZUS software, which makes the process very difficult. We recommend that FEMA improve HAZUS to be more compatible with current ESRI software.

The CSPDC also had difficulty accessing the FEMA's Repetitive Loss Property information for the Region. Some of this data is restricted or is unable to be shared publicly due to privacy concerns.

## Future Conditions of Hazard Activity

Climate change is expected to have a major impact on hazard activity around the world, and in the Central Shenandoah region. Our region will experience more frequent, severe storms and natural disasters, resulting in disruptions in the economy and overall safety concerns for residents in our area. All hazards listed in this plan could be potentially affected by climate change and to address these growing issues, there is a separate chapter on Climate Adaptation. This chapter shares information about the region's population, land use, changes to climate and weather patterns, hazard profiles and recommendations, and social impacts. The Climate Adaptation chapter can be viewed in Appendix B.

**Figure IV-3: Central Shenandoah Planning District Hydrologic Basins and Hydrography**

**Figure IV-4: Critical Facilities in FEMA Floodplains**

## Glossary

**A-Zone** – An area that would be flooded by the Base Flood, and is the same as a Special Flood Hazard Area (SFHA) or a 100-year floodplain. A-Zones are found on all Flood Hazard Boundary Maps and Flood Insurance Rate Maps (FIRMS).

**Acquisition** – Removal of structures from the floodplain through purchase and demolition with the property to be forever maintained as open space.

**Aftershock** – An earthquake of similar or lesser intensity that follows the main earthquake.

**Alluvium** – Sand, mud and other material deposited by a flowing current.

**Annual Flood** – The flood that is considered the most significant flood event in a one-year cycle of a floodplain.

**Backwater** – Rise in water caused by downstream obstruction or restriction or by high stage on an intersecting stream. Also referred to as “heading up.”

**Base Flood** – Sometimes referred to as a 100-year flood, it is a flood of the magnitude that has a one percent chance of occurring in any given year.

**Base Flood Elevation (BFE)** – Elevation of the 100-year flood. This elevation is the basis of the insurance and floodplain management requirements of the National Flood Insurance Program.

**Basin** – The largest watershed management unit. A basin drains to a major receiving water such as a large river, estuary or lake.

**Benefits** – Future losses and damages prevented by a project.

**Benefit Cost Analysis (BCA)** – An assessment of project data to determine whether or not the cost of the project is justified by its benefits.

**Berm** – Small levees, usually built from fill dirt.

**Blizzard Warning** – Winds or frequent gusts to 35 miles per hour or greater and considerable falling or blowing snow expected to prevail for a period of three hours or longer.

**Buffer** – Vegetated strips of land surrounding ecosystems.

**Buyout** – Commonly used term for property acquisition.

**Catchment** – The smallest watershed management unit. The area that drains an individual development site to its first intersection with a stream.

**Channel** – A natural or artificial watercourse with definite bed and banks to confine and conduct flowing water.

**Check Dam** - A small, low dam constructed in a gully or other watercourse to decrease the velocity of stream flow, for minimizing channel scour.

**Community Rating System (CRS)** – A system, administered by the Federal Emergency Management Agency (FEMA), where communities are recognized for their mitigation efforts that exceed the National Flood Insurance Program (NFIP)'s minimum standards for floodplain regulation. NFIP policyholders in the community are rewarded with reduced annual flood insurance premiums as part of this program.

**Confluence** – The section where one stream joins another stream.

**Crest** – The maximum stage or elevation reached or expected to be reached by the water of a specific flood at a given location.

**Critical Facility** – Facilities that are critical to the health and welfare of the population and are especially important following hazard events. Critical facilities include, but are not limited to, shelters, police and fire stations, and hospitals.

**Debris/Debris Flow** – Materials (broken bits and pieces of wood, stone, glass, etc.) carried by wind or floodwaters, including objects of various sizes.

**Declaration** – Presidential finding that a jurisdiction of the United States may receive Federal aid as a result of damages from a major disaster or emergency.

**Design Wind Speed Map** – A map of the United States developed by the American Civil Engineers that depicts wind zones based on frequency and strength of past tornadoes and hurricanes.

**Development** – Any man-made change to improved or unimproved real estate, including, but not limited to, buildings or other structures, mining, grading, paving, excavation or drilling or storage of equipment or materials.

**Digitize** – To convert points, lines and area boundaries shown on maps electronically into coordinates for use in computer applications.

**Disaster Resistant Communities** – A community based initiative that seeks to reduce vulnerability to natural hazards for the entire designated area through mitigation actions. This approach requires cooperation between individuals and the business sectors of a community to implement effective mitigation strategies.

**Drought** - a period of abnormally dry weather that persists long enough to produce serious effects like crop damage, water supply shortages, etc.

**Dry Floodproofing** – Protecting a building by sealing its exterior walls to prevent the entry of flood waters.

**Earthquake** – A sudden slipping or movement of a portion of the earth's crust accompanied and followed by a series of vibrations.

**Elevation** – The process of raising a house or other building so that it is above the height of a given flood to minimize or prevent flood damage.

**Emergency** – Any hurricane, tornado, storm, flood, high water, wind-driven water, tidal wave, tsunami, earthquake, volcanic eruption, landslide, mudslide, snowstorm, drought, fire, explosion, or other catastrophe in any part of the United States which requires Federal emergency assistance to supplement State and local efforts to save lives and protect property, public health and safety, or to avert or lessen the threat of a disaster.

**Emergency Operations Plan (EOP)** – Sets forth actions to be taken by the State or local governments in response to emergencies or major disasters.

**Encroachment** – Any physical object placed in a floodplain that hinders the passage of water or otherwise affects flood flow, such as landfills or buildings.

**Enhanced Fujita Scale** – Rates tornadoes with number value from EF0 to EF5 based on damage indicators and variables to assign wind speed rating.

**Epicenter** – The area of the earth's surface directly above the origin of an earthquake.

**Erosion** – The process of the gradual wearing away of land masses during a flood or storm or over a period of years through the action of wind, water, or other geologic processes.

**Fault** – An area of weakness where two sections of the earth's crust have separated.

**Federal Emergency Management Agency (FEMA)** – began as an independent agency of the Federal government established in 1979, reporting to the President. In 2003, FEMA became part of the U.S. Department of Homeland Security. FEMA's mission is to help people before, during, and after disasters. It reduces loss of life and property damage and protects critical infrastructure from all types of hazards through a comprehensive, risk-based emergency management program of mitigation, preparedness, response, and recovery.

**First Floor Elevation** – The elevation of the lowest finished floor of a structure.

**Flash Flood** – A sudden, violent flood that rises quickly and usually is characterized by high flow velocities. Flash floods often result from intense rainfall over a small area, usually in areas of steep terrain with little or no warning where water levels rise at an extremely fast rate.

**Flood** – A partial or complete inundation of normally dry land areas from 1) the overland flow of a lake, river, stream, ditch, etc.; 2) the unusual and rapid accumulation or runoff of surface waters; or 3) mudflows or the sudden collapse of shoreline land.

**Flood Control** – Measures taken to keep the flood waters away from specific developments or populated areas by the construction of flood storage reservoirs, channel alterations, dikes and levees, bypass channels, or other engineering works.

**Flood Depth** – Height of the floodwater surface above the ground surface.

**Flood Duration** – The length of time a stream is above flood stage or overflowing its banks.

**Flood Frequency** – A statistical expression referring to how often a flood of a given magnitude can be expected. (Note: the word "frequency" often is omitted to avoid repetition).

Examples:

10-year flood – the flood which can be expected to be equaled or exceeded on average once in 10 years; and which would have a 10 percent chance of being equaled or exceeded in any given year.

50-year flood - .... two percent chance...in any given year.

100-year flood - .... one percent chance...in any given year.

500-year flood - ....two-tenths percent chance...in any given year.

**Flood Fringe** – The portion of the floodplain that lies beyond the floodway and serves as a temporary storage area for floodwaters during a flood.

**Flood Insurance Rate Map (FIRM)** – An official map of a community prepared by FEMA on which areas that may or may not require flood insurance are delineated. These maps also provide flood elevations and velocity zones.

**Flood Insurance Study (FIS)** – A study prepared by FEMA that provides an examination, evaluation, and determination of flood hazards and, if appropriate, corresponding water surface elevations in a community or communities.

**Flood Mitigation Assistance Program (FMA)** - Provides pre-disaster grants to State and local governments for both planning and implementation of mitigation strategies. Each State is awarded a minimum level of funding which may be increased depending upon the number of NFIP policies in force and repetitive claims paid.

**Floodplain** – Land adjoining a stream (or other body of water) which has been or may be covered with water.

**Floodplain Management** – The operation of an overall program of corrective and preventive measure for reducing flood damage, including but not limited to emergency preparedness plans, flood control work and floodplain management regulations such as zoning ordinances, subdivision regulations, building codes and floodplain ordinances.

**Floodproofing** – Any combination of structural and nonstructural additions, changes or adjustments to properties and structures which reduce or eliminate flood damage to lands, water, and sanitary facilities, structures, and contents of buildings. May include structural elevation, relocation, acquisition, or other measures.

**Floodwall** – Flood barrier constructed of manmade materials, such as concrete or masonry designed to keep water away from a structure.

**Flood Warning** – A warning term that means flooding is already occurring or will occur soon in your area.

**Flood Watch** – A warning term that means that a flood is possible in your area.

**Floodway** – The channel of a river or other watercourse and the adjacent land areas required to carry and discharge the base flood without cumulatively increasing the water-surface elevation more than one foot at any point.

**Floodway Fringe** – The area between the floodway and the 100-year floodplain boundaries.

**Freeboard** – An additional amount of height usually expressed in feet above the Base Flood Elevation used as a factor of safety in determining the level at which a structure's lowest floor must be elevated or floodproofed to be in accordance with State or community floodplain management regulations.

**Freezing Rain** – Rain that freezes when it hits the ground, creating a coating of ice on roads, walkways, trees, and power lines.

**Frost/Freeze Warning** – Below freezing temperatures are expected.

**Geographic Information System (GIS)** - A computerized mapping and analysis tool. GIS can be a useful tool in mapping at-risk structures and infrastructure in the floodplain.

**Greenways** – Greenways are linear parks or corridors of open space that may extend across many communities. They can provide walking and biking links between parks, businesses, and culturally important sites. They embody a strategy for keeping riverside areas largely undeveloped, which provide recreational, cultural and aesthetic resources. Greenways can help to protect stretches of floodplain ecosystems.

**Hail** – Hail or hailstones are irregular pellets or balls of ice falling from a cumulonimbus clouds.

**Hazard** – A source of potential danger or adverse condition. Hazards include naturally occurring events such as floods, earthquakes, tornadoes, tsunami, coastal storms, landslides, and wildfires that strike populated areas. A natural event is a hazard when it has the potential to harm people or property.

**Hazard Mitigation** – A plan to alleviate or make less severe the effects of a major disaster. Hazard mitigation can reduce the severity of the effects of a flood on people and property by reducing the cause or occurrence of the hazard and reducing exposure to the hazard.

**Hazard Mitigation Grant Program (HMGP)** – Authorized under Section 404 of the Stafford Act; provides funding for cost-effective hazard mitigation projects in conformance with the post-disaster mitigation plan.

**Hazard Mitigation Plan** – A plan resulting from a systematic evaluation of the nature and extent of vulnerability to the effects of natural hazards present in a community that includes the actions needed to minimize future vulnerability to hazards.

**HAZUS** – A GIS-based nationally standardized loss estimation tool developed by FEMA.

**Headwater** – Highest reaches of a stream in a drainage basin.

**Hurricane** – A severe tropical disturbance in the North Atlantic Ocean, Caribbean Sea, or Gulf of Mexico that achieves a sustained wind force of at least 74 miles per hour.

**Hydrology** – The science of the behavior of water in the atmosphere, on the earth's surface, and underground.

**Hydrostatic Pressure** – Forces imposed on an object, such as a structure, by standing water.

**Increased Cost of Compliance (ICC)** – Coverage under a standard NFIP flood insurance policy. ICC helps pay for the cost of mitigation, including demolition and relocation for a flood-insured structure that sustains a flood loss and is declared to be substantially or repetitively damaged.

**Infrastructure** – Public services that have a direct impact on the quality of life such public water supplies and sewer treatment facilities, and transportation networks such as airports, roads and railways.

**Integrated Flood Observing and Warning System (IFLOWS)** - A flood warning system developed by the National Weather Service that combines sensors, communication, and computer technology with advanced forecasting to provide timely guidance and advice to local emergency services staff.

**Karst** – A land area with topographic depressions such as sinkholes, springs, sinking streams, and caves caused by underground solution of limestone bedrock.

**Landslide** - Downward movement of a slope and materials under the force of gravity.

**Levee** – A man-made flood barrier constructed of compacted soil designed to contain, control, or divert the flow of water.

**Lightning** – Lightning is an electrical circuit that is generated in cumulonimbus clouds (thunderheads) which have a negative electrical charge at the base and a positive charge at the top.

**Lowest Floor** – Under the NFIP program, the lowest floor of the lowest enclosed area, including a basement. An unfinished or flood-resistant enclosure such as a garage or storage area is not considered a building's lowest floor.

**Magnitude** – Measurement of the relative size of the earthquake compared to other standard earthquakes based on a logarithmic scale.

**Mitigation** – Sustained action that reduces or eliminates long term risk to people and property from natural hazards and their effects.

**Mitigation Reconstruction** – The construction of an improved, elevated building on the same site where an existing building and/or foundation had been partially or completely demolished or destroyed. Mitigation reconstruction is only permitted outside of the regulatory floodway or Coastal High Hazard Area (Zone V) as identified by the existing best available flood hazard data.

**Mudflows** – Sometimes called debris flows; mudflows are rivers of rock, earth, and debris saturated with water. They develop when water accumulates rapidly in the ground, so that earth becomes a flowing river of mud (called a slurry).

**National Flood Insurance Program (NFIP)** – Provides the availability of flood insurance in exchange for the adoption and enforcement of a minimum local floodplain management ordinance. The ordinance regulates new and substantially damaged or improved development in identified flood hazard areas. The Federal Emergency Management Agency administers this program.

**Open Space** – An area of land that is free of development, i.e. houses and other buildings that alter the area's natural appearance and impede the area's ability to covey flood flows. Open space can be used for parks, ball fields, hiking trails, garden spaces and other compatible open space uses.

**Palmer Drought Severity Index (PDSI)** – A measurement index which tracks moisture conditions and severity of drought conditions ranging from -10 (dry) to +10 (wet). Values below -3 represent severe to exceptional drought.

**Pre-FIRM/Post-FIRM** – Pre-FIRM means that a building was constructed before the date of the initial Flood Insurance Rate Map (FIRM) issued to the community or before December 31, 1974, whichever is later. Post-FIRM means the building was constructed on or after the date of community initial FIRM, or after December 31, 1974, whichever is later.

**Preparedness** – Activities to ensure that people are ready for a disaster and respond to it effectively. Preparedness requires figuring out what will be done if essential services break down, developing a plan for contingencies, and practicing the plan.

**Project Impact** – A project introduced by FEMA to reduce the damage of disasters. It helped communities protect themselves by taking actions to reduce disruption and loss.

**Rain Gardens** – A water quality practice in which plants and soils are used to remove pollutants from stormwater. Also known as bio-retention.

**Recovery** – Activities necessary to rebuild after a disaster. Recovery activities include rebuilding homes, businesses, and public facilities; clearing debris; repairing roads and bridges; and restoring water, sewer and other essential services.

**Recurrence Interval** – The time between hazard events of similar size in a given location. It is based on the probability that the given event will be equaled or exceeded in any give year.

**Relocation** – The process of moving a house or other building to a new location outside the flood hazard area.

**Repetitive Loss Property** – 1. The National Flood Insurance Program defines Repetitive Loss as 2 or more claims of at least \$1000 over a 10 year rolling period. This is the data that appears in this plan. 2. The Hazard Mitigation Assistance program defines Repetitive Loss as having incurred flood-related damage on 2 occasions, in which the cost of the repair, on the average, equaled or exceeded 25 percent of the market value of the structure at the time of each such flood event; and, at the time of the second incidence of flood-related damage, the contract for flood insurance contains increased cost of compliance coverage.

**Response** – Activities to address the immediate and short-term effects of an emergency or disaster. Response activities include immediate actions to save lives, protect property, and meet basic human needs.

**Retrofitting** – Making changes to an existing house or other building to protect it from flooding or other hazards.

**Richter Scale** – A numerical scale of earthquake magnitude devised by seismologist C. F. Richter in 1935.

**Riparian System** – Ecosystem occurring in the interface between aquatic and terrestrial systems, in floodplains and adjacent to rivers and streams. Riparian systems are subject to direct influences of ground and or surface waters, and occasional flooding.

**Riprap** – Broken stone, cut stone blocks, or rubble that is placed on slopes to protect them from erosion or scouring caused by floodwaters.

**Riverine** – Relating to, formed by, or resembling a river, including tributaries, streams, brooks, etc. Riverine flooding occurs when a river or stream overflows its banks and causes considerable inundation of nearby land and roads.

**Seismic** – Describes activity related to earthquakes.

**Seismic Waves** – Vibrations that travel outward from the center of the earthquake at speeds of several miles per second.

**Severe Thunderstorm Watch** – A severe thunderstorm is expected in the next six hours within an area approximately 120 to 150 miles wide and 300 to 400 miles wide.

**Severe Thunderstorm Warning** – Indicates a severe thunderstorm is occurring or is imminent in about 30 minutes to 1 hour.

**Sinkholes** – Natural depressions in the landscape caused by solution and subsidence of earth materials.

**Sleet** – Rain that turns to ice pellets before reaching the ground. Sleet also causes roads to freeze and become slippery.

**Special Flood Hazard Area (SFHA)** - The shaded area on a FIRM map that identifies an area that has 1% chance of being flooded in any given year (100-year floodplain).

**Stafford Act** – Robert T. Stafford Disaster Relief and Emergency Assistance Act, PL 100-707, signed into law November 23, 1988; amended the Disaster Relief Act of 1974, PL 93-288. The statutory authority for most Federal disaster response activities especially as they pertain to FEMA and FEMA programs.

**Stormwater** – Water from precipitation that flows across the ground and pavement when it rains, floods, or when snow and ice melt. The water seeps into the ground or drains into what we call storm sewers.

**Substantial Damage** – Damage of any origin sustained by a structure whereby the cost of restoring the structure to its pre-damaged condition would equal or exceed 50 percent of the market value of the structure before the damage occurred.

**Topography** – The elevations of the land surface.

**Tornado** – A violently rotating column of air extend from thunderstorm to the ground.

**Tornado Warning** – A tornado has been sighted or indicated by weather radar. Take shelter immediately.

**Tornado Watch** – Tornadoes are possible.

**Tropical Storm** – A tropical cyclone with maximum sustained winds greater than 39 mph and less than 74 mph.

**Urban-Wildland Interface Zone** – The developed area that occupies the boundary between an urban or settled area and the undeveloped natural forest environment.

**Vulnerability** – A term used to describe how exposed or susceptible to damage an asset is. Vulnerability depends on an asset's construction, contents and the economic value of its function.

**Watershed** – The area of land that is drained by a river and its tributaries. Ridges or divides separate watersheds from each other.

**Waterspout** – A tornado that forms over water.

**Wet Floodproofing** – Protecting a building by allowing flood waters to enter so that internal and external hydrostatic pressure is equalized. Usually enclosed areas used for parking, storage, or building access are wet floodproofed.

**Wetlands** – Those areas that are inundated or saturated by surface or ground water at a frequency and duration sufficient to support a prevalence of vegetation typically adapted for life in saturated soil conditions. Wetlands generally include swamps, marshes, bogs and similar areas.

**Wildfire** - An uncontrollable fire spreading through vegetative fuels, exposing and possibly consuming structures.

**Wildland Fire** – A fire in which development is essentially nonexistent, except for roads, railroads, power lines and similar facilities.

**Winter Storm Watch** – A winter storm is possible in your area.

**Winter Storm Warning** – A winter storm is occurring, or will soon occur in your area.

## 2. Hazard Identification

### Types of Hazards

While nearly all disasters are possible for any given area in the United States, the most likely hazards that could potentially affect the communities in the Central Shenandoah Planning District generally include:

- Flooding or Dam Failure
- Drought
- Hurricane
- Severe Winter Weather
- Land Subsidence/Karst
- Wind (Tornado, Derecho or Straight-line Winds)
- Wildfire
- Landslide
- Earthquake
- Hazardous Materials (Transportation and Industrial)
- Terrorism
- Power Outages

### Probability of Hazards

Hazards were ranked by the Steering Committee to determine what hazards have the largest impact on their communities. The results are summarized in Table IV-2. Analysis level was determined by the type of data available and the scale of data available for the analysis.

**Table IV-2: Central Shenandoah PDC Planning Consideration Levels**

<b>Hazard Identification Results</b>	
<b>Hazard Type</b>	<b>Ranking</b>
Flooding or Dam Failure	Significant
Drought	High
Hurricane	High
Severe Winter Weather	High
Land Subsidence/Karst	Medium
Wind (Tornado, Derecho or Straight-Line Winds)	Medium
Wildfire	Medium
Landslide	Low
Earthquake	Low
Hazardous Materials (Transportation and Industrial)	Medium
Terrorism	Low
Power Outages	Medium

### 2020 Plan Update Steering Committee Comments

At meetings in April and June 2019, the Steering Committee charged with updating the Plan discussed the Hazard Identification and Rankings for the Region. Based upon review of the ranking results, it was determined the rankings would remain the same, especially since we have not had any large scale disasters since the previous Plan update. In addition to examining the rankings, the Steering Committee discussed other hazards where they felt the Region faces vulnerability including derechos, hazardous materials, livestock and poultry disease, opioid/drug abuse, infectious disease/pandemic, criminal behavior, power outages, environmental/water quality issues, dam failure, and civil unrest. As a result of this discussion and additional rankings, it was determined to include hazardous materials (transportation and industrial), dam failure (in the flood section), derechos and straight line winds (in the tornado section), and power outages. While some of these hazards may be limited in mitigation options it was important to include these topics because they are seen as vulnerabilities by the Region's communities.

## Major Disasters

Since 1969, there have been 22 Major Disaster Declarations in the Region. As of July 23, 2019, individual communities in the Region have been included within the Major Disaster Declarations a combined total of 108 times. Table IV-3 includes information on the number of Major Disaster Declarations in the Region by individual community. Data for Towns is not separated from the County totals. Table IV-4 shows the types of hazards, the date of the declaration and disaster declaration number, and descriptions of the events for the 22 Major Disaster Declarations in the Region. For more detailed historical information on the individual events, refer to the hazard history sections found under each hazard type.

Since 1969,  
there have  
been 22 Major  
Disaster  
Declarations in  
the Region.

**Table IV-3: Central Shenandoah PDC - Number of Major Disaster Declarations by Community (last updated 7/23/2019)**

Communities	Number of Major Disaster
Augusta County	14
Bath County	14
Buena Vista City	12
Harrisonburg City	7
Highland County	14
Lexington City	7
Rockbridge County	15
Rockingham County	10
Staunton City	7
Waynesboro City	8
Total	108

Rockbridge  
County has had  
the highest  
number of  
Major Disaster  
Declarations in  
the Region,  
with 15.

**Table IV-4: Central Shenandoah PDC - Major Disaster Declarations**

<b>Community</b>	<b>Date Of Declaration</b>	<b>Disaster Declaration Number</b>	<b>Description</b>
Augusta, Bath, Rockbridge	8/23/1969	DR - 274	Hurricane Camille was a major storm that made landfall out of the Gulf as a category 5 and weakened to a tropical depression before reaching the state. Flooding and landslides, triggered by saturated soils, resulted in catastrophic damage.
Bath, Buena Vista, Harrisonburg, Lexington, Rockbridge, Rockingham, Staunton, Waynesboro	6/23/1972	DR - 339	Hurricane Agnes produced devastating flooding throughout the Mid-Atlantic States.
Buena Vista	10/7/1972	DR – 358	Severe Storms and Flooding
Augusta, Buena Vista, Rockbridge, Rockingham	10/10/1972	DR – 359	Severe Storms and Flooding

**Table IV-4: Central Shenandoah PDC - Major Disaster Declarations—continued**

<b>Community</b>	<b>Date Of Declaration</b>	<b>Disaster Declaration Number</b>	<b>Description</b>
Augusta, Bath, Buena Vista, Harrisonburg, Highland, Lexington, Rockbridge, Rockingham, Waynesboro	11/9/1985	DR-755	Hurricane Juan brought heavy rain, causing record-breaking floods.
Augusta, Bath, Buena Vista, Lexington, Rockbridge, Rockingham	5/19/1992	DR - 944	Severe Storms and Flooding
Bath, Buena Vista, Rockbridge	3/10/1994	DR - 1014	Severe Ice Storms, Flooding
Augusta, Highland	4/11/1994	DR-1021	Winter Storm brought ice, freezing rain and sleet.
Augusta, Bath, Buena Vista, Lexington, Rockbridge, Staunton	7/1/1995	DR-1059	A week-long period of ground saturating rains fell, resulting in flash flooding.

**Table IV-4: Central Shenandoah PDC - Major Disaster Declarations—continued**

<b>Community</b>	<b>Date Of Declaration</b>	<b>Disaster Declaration Number</b>	<b>Description</b>
Augusta, Bath, Buena Vista, Harrisonburg, Highland, Lexington, Rockbridge, Rockingham, Staunton, Waynesboro	1/13/1996	DR - 1086	Severe winter weather resulted in a blizzard, followed by two additional snowstorms bringing over a foot of snow. Snowpack was on the ground for an extended period of time. It was thawed by higher temperatures and heavy rain, resulting in severe flooding.
Augusta, Bath, Buena Vista, Harrisonburg, Highland, Rockbridge, Rockingham, Waynesboro	1/27/1996	DR - 1098	Flooding was caused by melting snow.
Augusta, Bath, Buena Vista, Harrisonburg, Highland, Lexington, Rockbridge, Rockingham, Staunton, Waynesboro	9/6/1996	DR – 1135	Hurricane Fran brought record-level flooding to many locations in the region.
Augusta, Bath, Highland, Rockbridge, Rockingham	2/28/2000	DR-1318	Winter Storms brought a blizzard to the East Coast that impacted the region from January 25 through January 30, 2000.

**Table IV-4: Central Shenandoah PDC - Major Disaster Declarations—continued**

<b>Community</b>	<b>Date Of Declaration</b>	<b>Disaster Declaration Number</b>	<b>Description</b>
Bath	7/12/2001	DR - 1386	Severe Storms and Flooding from July 8, 2001 through August 27, 2001.
Highland	3/27/2003	DR - 1458	Severe Winter Storm, Snowfall, Heavy Rain, Flooding and Mudslides from February 15, 2003 through February 28, 2003.
Augusta, Buena Vista, Harrisonburg, Highland, Rockbridge, Rockingham, Staunton, Waynesboro	9/18/2003	DR – 1491	Hurricane Isabel brought significant rainfall to the region, resulting in major flooding.
Bath, Highland, Rockbridge	7/13/2006	DR -1655	Severe storms, tornadoes, and flooding occurred from June 23 – July 6, 2006.
Augusta, Bath, Highland, Rockbridge, Staunton, Waynesboro	2/16/2010	DR – 1874	Severe winter storm and snowstorm occurred from December 18, 2009.
Augusta, Highland, Waynesboro	4/27/2010	DR – 1905	Severe winter storm and snowstorms occurred from February 5-11, 2010.

**Table IV-4: Central Shenandoah PDC - Major Disaster Declarations—continued**

<b>Community</b>	<b>Date Of Declaration</b>	<b>Disaster Declaration Number</b>	<b>Description</b>
Augusta, Bath, Buena Vista, Harrisonburg, Highland, Lexington, Rockbridge, Rockingham, Staunton	7/27/2012	DR-4072	Severe Storms and straight-line winds from derecho during the period from June 29-July 1, 2012.
Highland	11/26/2012	DR-4092	Impacts from Hurricane Sandy caused damage to utility infrastructure.
Highland	3/7/2016	DR-4262	Severe winterstorm and snowstorm.

## Agricultural Disasters

The Region has a strong agricultural heritage and is home to some of Virginia's top agricultural producing counties. The total market value of products sold in the Region is over \$1.1 billion. Rockingham County produces 20 percent of agriculture sales in Virginia. It is ranked number one in total market value of products sold; number one in livestock, poultry, and products; and number four in crops in Virginia. Augusta County produces 7 percent of agricultural sales in Virginia. It is ranked number two in total market value of products sold; number two in livestock, poultry, and products, and number ten in crops in Virginia. Table IV-5 provides an overview of 2017 Agricultural Census Data by County for the Region.

The total market value for agricultural products sold in the region is over \$1.1 billion

**Table IV-5: Central Shenandoah PDC - Agricultural Census Data**

County	Number of Farms	Land in Farms (Acres)	Total Producers	Total Market Value of Products Sold
Augusta	1,665	290,911	2,841	\$292,547,000
Bath	110	47,854	193	\$6,747,000
Highland	275	92,950	419	\$26,120,000
Rockbridge	752	134,789	1,241	\$30,983,000
Rockingham	2,026	228,542	3,491	\$795,919,000
Regional Total	4,828	795,046	8,185	\$1,152,316,000

Rockingham County ranks #1 in total market value of products sold, and in livestock, poultry and products.

Source Data: National Agricultural Statistics Service (NASS), U.S. Department of Agriculture, 2017 Census of Agriculture, State and County Profiles.

The Farm Service Agency administers four types of disaster designations.

Eligible producers can receive low-interest emergency loans.

As a top agricultural producing region in Virginia, the Region is susceptible to impacts from natural disasters on the agricultural industry. The Farm Service Agency administers four types of disaster designations that provide for the ability of low-interest emergency loans to eligible producers. The four disaster designations include:

- U.S. Department of Agriculture Secretarial Disaster Designation;
- Presidential Major Disaster and Presidential Emergency Declaration;
- Farm Service Agency Administrator's Physical Loss Notification; and
- Quarantine designations by the Secretary under the Plant Protection Act or animal quarantine laws.

A locality may be considered for disaster designation if it has experienced an eligible disaster that has impacted farmers and caused production losses. For a Secretarial Disaster Designation for droughts, the locality may be eligible if any portion experiences the D2 Severe Drought intensity value for eight consecutive weeks, or if the locality experiences a higher drought intensity value for any period of time. For other natural disasters, the locality may be eligible if it experiences a 30 percent production loss of at least one crop, or if after surveying producers it is determined that emergency financing may not be available from other sources.

Table IV-6 provides information on U.S. Department of Agriculture Secretarial Disaster Declarations in the Region since 2012. Table IV-7 provides information on Presidential Major Disaster and Presidential Emergency Declarations in the Region since 2017.

**Table IV-6: U.S. Secretary of Agriculture Disaster Designations, 2012-2019**

<b>Designation Number</b>	<b>Locality</b>	<b>Primary or Contiguous</b>	<b>Approval Date</b>	<b>Begin Date</b>	<b>End Date</b>	<b>Description of Disaster</b>	<b>Crop Disaster Year</b>
S3418	Augusta Rockbridge Rockingham	Contiguous	10/10/2012	6/28/2012	7/3/2012	Excessive rain, hail, high winds and lightning associated with a Derecho Windstorm	2012
S3422	Rockbridge Rockingham	Contiguous	10/17/2012	1/1/2012	Continuing	Drought and related disasters, including excessive heat and high winds	2012
S3443	Rockingham	Contiguous	11/26/2012	6/29/2012	Continuing	Drought, excessive heat	2012
S3782	Augusta Bath Highland Rockbridge	Primary (Bath); Contiguous (Other Localities)	1/28/2015	8/22/2014	10/15/2014	Drought	2014
S3793	Augusta Bath Highland	Primary (Highland); Contiguous (Other Localities)	2/11/2015	6/1/2014	10/31/2014	Drought	2014
S4297	Rockingham	Contiguous	3/29/2018	6/30/2017	Continuing	Drought and Excessive Heat	2017
S4493	Augusta Harrisonburg Rockingham	Primary (Rockingham); Contiguous (Other Localities)	7/9/2019	4/15/2018	Continuing	Excessive rain, flash flooding, flooding and hail	2018

Source Data: Farm Service Agency, U.S. Department of Agriculture, Disaster Designation Information, U.S. Secretary of Agriculture Disaster Designation, 2012-2019

**Table IV-7: Presidential Major Disaster and Presidential Emergency Declarations, 2017-2019**

<b>Designation Number</b>	<b>Locality</b>	<b>Primary or Contiguous Designation</b>	<b>Approval Date</b>	<b>Begin Date</b>	<b>End Date</b>	<b>Description of Disaster</b>	<b>Crop Disaster Year</b>
4378	Augusta Highland	Contiguous	7/12/2018	5/28/2018	6/3/2018	Severe Storms, Flooding, Landslides, and Mudslides	2018
4401	Rockbridge	Contiguous	10/15/2018	9/8/2018	9/21/2018	Hurricane Florence	2018
4455	Augusta Highland Rockingham Harrisonburg Staunton Waynesboro	Contiguous	8/2/2019	6/29/2019	6/30/2019	Severe Storms, Flooding, Landslides and Mudslides	2019

Source Data: Farm Service Agency, U.S. Department of Agriculture, Disaster Designation Information, Presidential Major Disaster and Presidential Emergency Declarations, 2017-2019

## Level of Hazard

Table IV-8 provides a breakdown of the natural hazards addressed in the Plan. The level of planning consideration given to each hazard was determined by the committee members. Based on the input of committee members, the hazards were broken into four distinct categories which represent the level of consideration they will receive throughout the planning process.

In order to focus on the most critical hazards that may affect the communities of the Region, the hazards assigned a level of *Significant*, *High* and *Medium* will receive the most extensive attention in the remainder of the planning analysis.

**Table IV-8: Central Shenandoah PDC Natural Hazards HIRA Overview**

Hazard	Type	Ranking	Data Reference
Flooding or Dam Failure	Riverine	Significant	FEMA, DCR, FEMA HAZUS-MH, NID, NHD
Drought	Including excessive heat	High	Drought Monitor Task Force, Water Systems, US Census, Commonwealth of Virginia, NCEI/NCDC
Hurricane	Wind	High	FEMA HAZUS-MH, NOAA
Severe Winter Weather	Including winter storms, ice storms, and excessive cold	High	NOAA National Weather Service Records, VirginiaView PRISM, Climate Source, Commonwealth of Virginia, NCEI/NCDC
Karst/Land Subsidence	Karst/Land Subsidence	Medium	USGS, VT Mines & Minerals
Wind	Tornado, Derecho or Straight-line Winds	Medium	NOAA, Commonwealth of Virginia, NCEI, NCEI/NCDC
Wildfire	Wildfire	Medium	Virginia Department of Forestry, USGS, DCR
Landslide	Landslide	Low	USGS
Terrorism	Terrorism	Low	Addressed in depth in community Emergency Operation Plans (EOP)
Earthquake	Earthquake	Low	FEMA, VDEM, FEMA HAZUS-MH
Hazardous Materials	Transportation and Industrial	Low	Addressed in depth in community Hazardous Materials Plan (HMP)
Power Outages	Power Outages	Low	No maps included.

### 3. Flooding or Dam Failure (Significant Ranking)

#### Flooding Hazard History

Listed below are flooding events that have occurred in the Region. In Appendix C - Flood History and Dam Risk Assessment and Inventory, flooding events have been broken down by the date of occurrence and when available, by individual community descriptions. When no community specific description is available, the general description should be used as representing the entire planning area.

- July 13, 1842
- 1846
- January 1854
- August 4, 1860
- September 28 - 30, 1870
- August 28, 1893
- September 29, 1896
- August 15, 1906
- November - December 1934
- March 16 - 17, 1936
- April 1937
- October 1942
- June 18, 1949
- September 10, 1950
- Hurricane Hazel - October 15, 1954
- Hurricanes Connie and Diane - August 1955
- Hurricane Gracie - September 29, 1959
- Hurricane Camille - August 19, 1969
- Hurricane Agnes - June 19, 1972
- October 7, 1972
- October 10, 1972
- Hurricane Juan - November 4 - 7, 1985
- May 19, 1992
- April 1993

- March 10, 1994
- June 22 - 28, 1995
- January 13, 1996
- January 27, 1995
- Hurricane Fran - September 6, 1996
- July 8– August 21, 2001
- February 15-February 28, 2003
- August 8, 2003
- Hurricane Isabel – September 18, 2003
- Hurricane Charley—August 2004
- Hurricane Frances—August 2004
- Hurricane Ivan– September 2004
- Hurricane Jeanne– September 2004
- Hurricane Cindy– July 2005
- November 29, 2005
- June 23 - July 6, 2006 “Mid-Atlantic United States Flood”
- Hurricane Hanna- August and September 2008
- January 25, 2010
- April 11-12, 2011
- April 16, 2011
- April 27-28, 2011
- Hurricane Sandy– October 2012
- May 9, 2013
- June 17, 2013
- April 15-16, 2018
- May 14, 2018
- May 21, 2018
- May 28-June 3, 2018
- June 21-June 22, 2018
- June 27-30, 2018
- August 30, 2018
- Hurricane Florence- September 2018
- June 29-June 30, 2019

## Flooding Hazard Profile

A flood is a natural event for rivers and streams. Excess water from snowmelt, rainfall, or storm surge accumulates and overflows onto the banks and adjacent floodplains. Floodplains are lowlands, adjacent to rivers, lakes, and oceans that are subject to recurring floods. Under natural conditions, a flood causes little or no damage. Flood problems only exist when the built environment is damaged by nature's water or when property and lives are jeopardized. Floods in the Region are almost always associated with hurricanes, tropical storms, and tropical depressions. However, some of the Region's flooding is caused by sustained heavy rains, severe thunderstorms, and even rapid snowmelts.

The Region has received 15 Major Disaster Declarations due to flooding.

The Central Shenandoah Region experiences both riverine flooding and urban flooding. Most riverine flooding occurs from either the Shenandoah River or James River or their tributaries that are found throughout the Central Shenandoah Region. The Region's cities and towns experience flash flooding from stormwater runoff but a majority of their flooding is riverine due to the tributary creeks and small streams of the major river systems that run through them. Some of these streams are actually underground, buried as communities developed, especially during a "boom" in the late 1800s. Because of the historic nature of the Shenandoah Valley, most communities were developed long before floodplains were mapped.

Individual localities have been included in the Major Disaster Declarations a combined total of 81 times.

While the Region experiences nearly all types of natural disasters, including snow storms, ice storms, wildfires, and tornadoes, flooding is perhaps the most common and devastating type of disaster. It is also the most common hazard in the United States with hundreds of floods occurring every year causing an average of 150 deaths annually.

Since 1969, the Central Shenandoah Valley Region has received fifteen Major Disaster Declarations due to flooding. Individual localities in the Region have been included in the Major Disaster Declarations a combined total of 81 times. Floods in 1969, 1972, 1985, 1992, 1994, 1995, 1996, 2001, 2003, and 2006 have had severe and long-term effects on property owners, local businesses,

Flooding can jeopardize lives and cause damage to buildings, infrastructure and the environment.

A 1% Annual Chance Flood is commonly referred to as a 100-Year Flood

industry, and our economy. Flooding has also impacted agriculture in the region, with one Secretarial Disaster Declaration since 2012 and three Presidential Major Disaster and Presidential Emergency Declarations since 2017. The Secretarial Disaster Declaration included three localities, and the Presidential Major Disaster and Presidential Emergency Declarations included 10 localities.

Floods typically are characterized by frequency. For example, the “1%-annual chance flood” is commonly referred to as a “100-year” flood. While more frequent floods do occur, as well as larger events that have lower probabilities of occurrence, for most regulatory and hazard identification purposes, the 1%-percent annual chance flood is used.

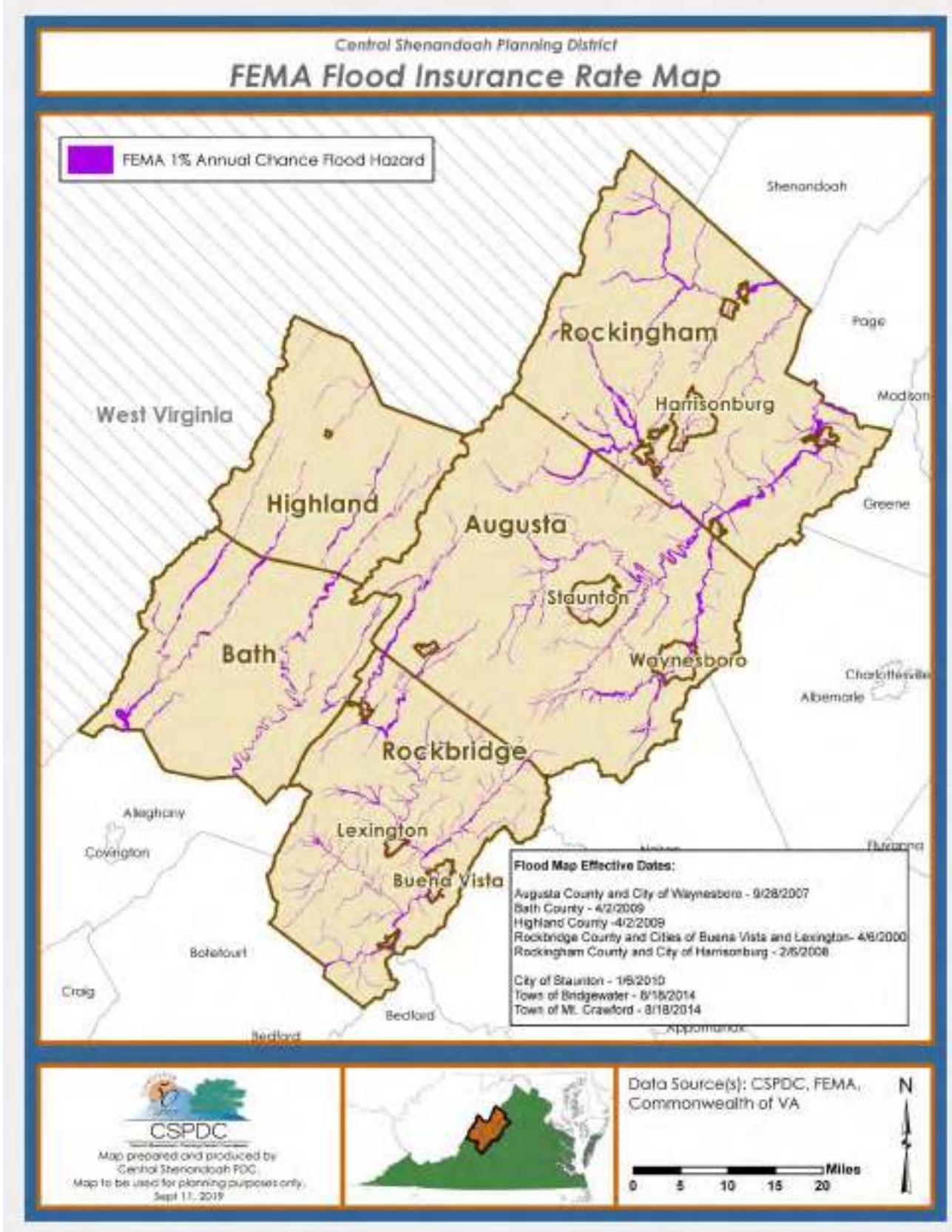
Homes and businesses may suffer damage and be susceptible to collapse. Floods pick up chemicals, sewage, and toxins from roads, factories, and farms. Any property affected by the flood may be contaminated with hazardous materials. Debris from vegetation and man-made structures may also be hazardous following the occurrence of a flood. In addition, floods may threaten water supplies and water quality, as well as initiate power outages.

## Secondary Effects

Flooding can pose some significant secondary impacts to the area where the event has taken place. Some of the impacts to consider include infrastructure and utility failure and impacts to roadways, water service, and wastewater treatment. These impacts can affect the entire Region, making the area vulnerable to limited emergency services.

## Flood Maps

FEMA’s National Flood Hazard Layer (NFHL) was used for all locality flood mapping and analysis. This layer is a geospatial database that contains current flood hazard data and supports the National Flood Insurance Program. This GIS data was used to better understand the region’s level of flood risk.

**Figure IV-5: Central Shenandoah PDC - FEMA Floodplains - 1% Annual Chance Flood**

## Vulnerability Analysis

There are 175 repetitive loss properties in the CSPDC region.

Approximately 6.61% of the CSPDC total structures are vulnerable to flooding.

Many factors contribute to the relative vulnerabilities of areas within the floodplain. Some of these factors include development which increases the presence of people and property in the floodplain, flood depth, velocity, elevation, construction type, and flood duration. Specific areas that are susceptible to flooding were determined by the CSPDC when developing the Central Shenandoah Valley Regional Flood Mitigation Plan.

FEMA's HAZUS software was used to complete a 100-year flood scenario for the CSPDC localities. Figure IV-5 shows the 1% Annual Chance Flood Hazard for the Region. For more detailed flood maps and critical facilities by locality, see Appendix D. These maps provide detailed information on areas susceptible to flooding. These areas were taken into account when completing the hazard identification and risk assessment.

### FEMA-Designated Repetitive Loss Properties

FEMA provides a Repetitive Loss List of the properties in a community. A Repetitive Loss Property is a structure covered by a contract for flood insurance made available under the National Flood Insurance Program (NFIP). The NFIP defines Repetitive Loss as 2 or more claims of at least \$1000 over a 10 year rolling period. This is the data that appears in the Plan. Please see Appendix E to view tables for the number of repetitive losses and severe repetitive losses for each locality or contact your local NFIP coordinator for specific information. There are 175 repetitive loss properties and 6 severe repetitive loss properties in the Region (Appendix E). Note that FEMA designates counties, cities and towns separately in the table.

**Table IV-9: Structures at Risk Due to Flooding from the CSPDC Flood Mitigation Plan**

<b>Community</b>	<b>Structures at Risk</b>	<b>Total Structures</b>	<b>% of Structures at Risk</b>	<b>% of Structures not at Risk</b>
Augusta County	2,851	69,338	4.11%	95.89%
Bath County	238	3,628	6.56%	93.44%
Highland County	85	2,106	4.04%	95.96%
Rockbridge County	1,183	12,195	9.70%	90.30%
Rockingham County	6,383	88,855	7.18%	92.82%
City of Buena Vista	815	2920	27.91%	72.09%
City of Harrisonburg	1,034	20,494	5.05%	94.95%
City of Lexington	36	2,298	1.57%	98.43%
City of Staunton	668	14,698	4.54%	95.46%
City of Waynesboro	1,048	13,512	7.76%	92.24%
Town of Bridgewater	206	3,223	6.39%	93.61%
Town of Broadway	114	2,625	4.34%	95.66%
Town of Craigsville	240	890	26.97%	73.03%
Town of Dayton	114	1,347	8.46%	91.54%
Town of Elkton	283	2,510	11.27%	88.73%
Town of Glasgow	197	553	35.62%	64.38%
Town of Goshen	61	228	26.75%	73.25%
Town of Grottoes	620	2,325	26.67%	73.33%
Town of Monterey	19	180	10.56%	89.44%
Town of Mt. Crawford	29	453	6.40%	93.60%
Town of Timberville	63	1,891	3.33%	96.67%
<b>Total</b>	<b>16,288</b>	<b>246,267</b>	<b>6.61%</b>	<b>93.39%</b>

## Structures at Risk-Vulnerability

To determine an estimated number of structures vulnerable to flooding in the CSPDC region, a GIS analysis was performed. Using the Virginia Geographic Information Network (VGIN) structure layer, structures were overlaid with FEMA's flood zones with 1% and 0.2% annual chances. These structures that intersected with these zones were extracted and then calculated for each locality. Table IV-9 is a summary of these at risk structures.

The Town of Glasgow has the highest percentage of at risk structures at 35.62%. The City of Buena Vista is estimated to have 815 structures at risk to flooding, which is 27.91% of the City's total structures. Approximately 6.61% of the CSPDC total structures are vulnerable to flooding.

## Estimating Losses

FEMA's HAZUS-MH software was used to generate 100 year flood scenarios for all of the 21 jurisdictions of the CSPDC Region to better understand the estimated damage and losses associated with flooding. On the county level, drainage areas of 10 miles were identified to develop a stream network. On the City and Town level, the drainage areas were delineated at 2 miles. It is noted that this version of HAZUS utilizes 2010 Census Data and totals produced by HAZUS only reflect data for those census tracts/blocks included in the study region.

HAZUS-MH software produces Quick Assessment (QA) reports providing locality statistics, including building exposure estimated in dollar amounts. The QA report also list the results of the 100 year flood scenario. A summary of the results from the HAZUS-MH Quick Assessment reports for each jurisdiction are shown in Table IV-10. See Appendix G to view flooding HAZUS reports.

**Table IV-10: CSPDC HAZUS-MH 100 Year Flood Scenario Quick Analysis**

HAZUS-MH 100 Year Flood Scenario Quick Analysis							
Locality	Residential Building Exposure (\$ Millions)	Total Building Exposure (\$ Millions)	Displaced Households	People Seeking Shelter	Residential Property (Capital Stock) Losses (\$ Millions)	Total Property (Capital Stock) Losses (\$ Millions)	Business Income Interruption Losses (\$ Millions)
<b>Augusta County</b>	6,296	7,634	702	35	68	108	56
<i>Craigsville</i>	64	70	34	0	3	3	1
<b>Bath County</b>	739	818	91	0	30	52	23
<b>Highland County</b>	320	367	51	1	12	13	2
<i>Monterey</i>	25	37	0	0	0	0	0
<b>Rockbridge County</b>	2,182	2,612	300	6	44	105	57
<i>Glasgow</i>	81	116	8	0	1	9	2
<i>Goshen</i>	28	29	14	0	2	2	1
<b>Rockingham County</b>	6,609	7,870	809	25	75	117	63
<i>Bridgewater</i>	473	586	19	0	2	2	1
<i>Broadway</i>	311	379	23	0	2	6	7
<i>Dayton</i>	118	151	20	1	1	5	2
<i>Elkton</i>	241	295	5	0	0	0	0
<i>Grottoes</i>	186	228	35	2	1	1	1
<i>Mt. Crawford</i>	261	306	24	0	2	3	1
<i>Timberville</i>	219	238	14	0	2	2	1
<b>City of Buena Vista</b>	510	725	269	13	23	46	44
<b>City of Harrisonburg</b>	3,460	5,091	476	110	31	68	121
<b>City of Lexington</b>	715	958	25	1	2	3	2
<b>City of Staunton</b>	2,264	3,047	98	3	10	75	147
<b>City of Waynesboro</b>	1,831	2,667	567	65	63	280	182
<b>CSPDC Total</b>	<b>26,933</b>	<b>34,224</b>	<b>3,584</b>	<b>262</b>	<b>374</b>	<b>900</b>	<b>714</b>

**Table IV-11: CSPDC Critical Facilities within FEMA Designated Floodplain**

Type	Number of Facilities
CELL TOWER	3
CHILD DAY CARE	3
CHURCH	29
EMERGENCY GENERATOR	4
EMERGENCY RESPONSE	9
GOVERNMENT	15
IFLOWS GAUGE	8
INDUSTRY	13
JAIL	1
POWER UTILITY	2
PUBLIC WORKS	1
SCHOOL	2
SENIOR LIVING	1
TOWN HALL	1
WASTEWATER PUMP STATION	2
WASTEWATER TREATMENT	10
WATER TREATMENT	3
WELL	2
<b>TOTAL</b>	<b>109</b>

## Critical Facilities

The impacts of flooding on critical facilities can significantly increase the overall effect of a flood event on a community. It should be noted that these facilities have been determined to be in the floodplain using Geographic Information Systems (GIS) and should be used only as a planning tool. In order to accurately determine if a structure is actually in the floodplain, site-specific information must be available. 109 critical facilities were determined to be within the FEMA designated floodplain. Table IV-11 denotes the critical facilities that are located within or in close proximity to the FEMA designated 100 year and 500 year floodplains. Using GIS, the critical facility points were intersected with the FEMA flood zones. A 30-foot buffer on the facilities provided a radial distance from the center of the building that was used to determine the proximity to the floodplain. While Table IV-11 shows 109 critical facilities are located near or in the floodplain, there is great diversity in the type of facility located within or in close proximity to the floodplain. See Appendix D for the maps of the critical facilities within the floodplain for each locality.

109 critical facilities were determined to be within the FEMA designated Floodplain.

Critical Facility Points were intersected with FEMA flood zones.

## Dam Failure Hazard Profile\*

### Description

*Flooding due to impoundment failure refers to a collapse, breach, or other failure that causes an uncontrolled release of water or sludge from an impoundment, resulting in downstream flooding. Dam or levee failures can occur with little warning in either wet or dry conditions. Intense storms may produce a flood in a few hours or even minutes from upstream locations. Flash floods can occur within six hours of the beginning of heavy rainfall, and impoundment failure may occur within hours of the first sign of breaching. Other failures and breaches can take much longer to occur, from days to weeks, because of debris jams or the accumulation of melting snow.*

### Levee/Floodwall Failure

*FEMA defines a levee as "a man-made structure, usually a earthen embankment, designed and constructed in accordance with sound engineering practices to contain, control, or divert the flow of water to reduce the risk from temporary flooding. A levee designed to provide flood protection from at least the 1% annual chance flood is eligible for accreditation by FEMA. When accredited, the area protected by the levee will be mapped as a moderate risk zone instead of a high-risk zone on the Flood Insurance Rate Map (FIRM). In the CSPDC region, the Bridgewater Levee System in Rockingham County in Rockingham County had record of levee coordination with FEMA through the Provisionally Accredited Levee (PAL) process. It is important to note that many of the causes and effects of levee failure are similar to dam failure.*

\* *Information in the Dam Failure Hazard Profile is taken from the Commonwealth of Virginia Hazard Mitigation Plan, Chapter 3 - HIRA, Section 3.11 Flooding Due To Impoundment Failure and is in italics.*

***Dams Impoundments in the Commonwealth of Virginia***

*Dams and associate lakes, ponds, and impoundments are part of the Commonwealth's overall water resource landscape. As such, a dam failure or breach can have an extensive impact on the magnitude of downstream flooding which could result in wide scale damages. The Virginia Department of Conservation and Recreation's Division of Dam Safety and Floodplain Management (Virginia DSFPM) administers the Virginia Dam Safety Program, under the authority of the Virginia Soil and Water Conservation Board (Virginia SWCB). The Virginia DSFPM by authority of the Virginia SWCB is the key regulatory entity for dams in Virginia not otherwise regulated by the Virginia State Corporation Commission, Virginia Department of Mining, Minerals, and Energy (DMME), United States Government, or as defined in Section 4VAC50-20-30 of the Virginia Impounding Structure Regulations. Any references to VA DSFPM shall be made with the understanding that the VA DSFPM administers the Virginia Dam Safety Program under direct authority of the Virginia SWCB.*

*The Virginia SWCB regulates impounding structures in the Commonwealth to ensure that they are properly and safely constructed, maintained, and operated. Per section 4VAC50-20-50 of the Virginia Impounding Regulations, "an impounding structure shall be regulated if the impounding structure is 25 feet or greater in height and creates a maximum impounding capacity of 15 acre-feet or greater, or the impounding structures is six feet or greater in height and creates a maximum impounding capacity of 50 acre-feet or greater and is not otherwise exempt from regulation by the Code of Virginia." The regulations, known as the Virginia Impounding Structure Regulations are promulgated to achieve these ends and are recorded in the Virginia Administrative Code Ongoing dam inspections and Virginia's participation in the National Dam Safety Program administered by FEMA and the US Army Corps of Engineers serve as a preventative measure against dam failures. Disaster recovery programs include assistance to dam owners and local officials in assessing the condition of dams following a flood disaster and assuring the repairs and reconstruction of damaged structures are in compliance with the National Flood Insurance Program (NFIP) regulations.*

*Per current Virginia Impounding Structure Regulations, an "impounding structure" or "dam" can be defined as the following: "a man-made structure, whether a dam across a watercourse or structure outside a watercourse, used to be used to retain or store waters or other materials." Dams are classified with a hazard potential depending on the downstream impacts during a dam failure event situation. Hazard potential is not related to the structural integrity of a dam or environmental impacts but strictly to the potential for adverse downstream effects if the dam were to fail. Regulatory requirements, such as the frequency of dam inspection, the standards for spillway design, and actions within established emergency plans, are dependent upon the dam's assigned hazard potential classification.*

*The Owner(s) of each regulated high, significant, or low hazard potential dam is required to apply to Virginia DSFPM for a Regular Operation and Maintenance Certificate every 6 years. The application must include an assessment of the dam by a licensed Virginia Professional Engineer, an Emergency Plan (EAP – Emergency Action plan or EPP - Emergency Preparedness Plan), the appropriate forms, and the appropriate fee(s), submitted separately. An executed copy of the Emergency Plan*

*be filed with the appropriate local emergency management official and the Virginia Department of Emergency Management. Please note the Emergency Plan may also be routinely updated by the dam Owner during the term of the six-year certificate if any relevant information has changed.*

*Virginia DSFPM issues Regular Operation and Maintenance Certificates to the dam Owner for a period of six years. If a dam has a deficiency but does not pose imminent danger, Virginia DSFPM may issue a Conditional Operation and Maintenance Certificate, during which time the dam Owner is to correct the deficiency. After a dam has been granted a Regular Operation and Maintenance Certificate by Virginia DSFPM, annual inspections are required either by a Professional Engineer or the dam Owner, and the Annual Inspection Report is submitted to the appropriate Virginia DSFPM Regional Dam Safety Engineer.*

Please See Appendix C for Dam Risk Assessment and Inventory of dams in the CSPDC region regulated and not regulated by the Virginia DSFPM.

According to the National Inventory of Dams, there are 70 regulated dams in the Region.

## Dam Failure Vulnerability Analysis

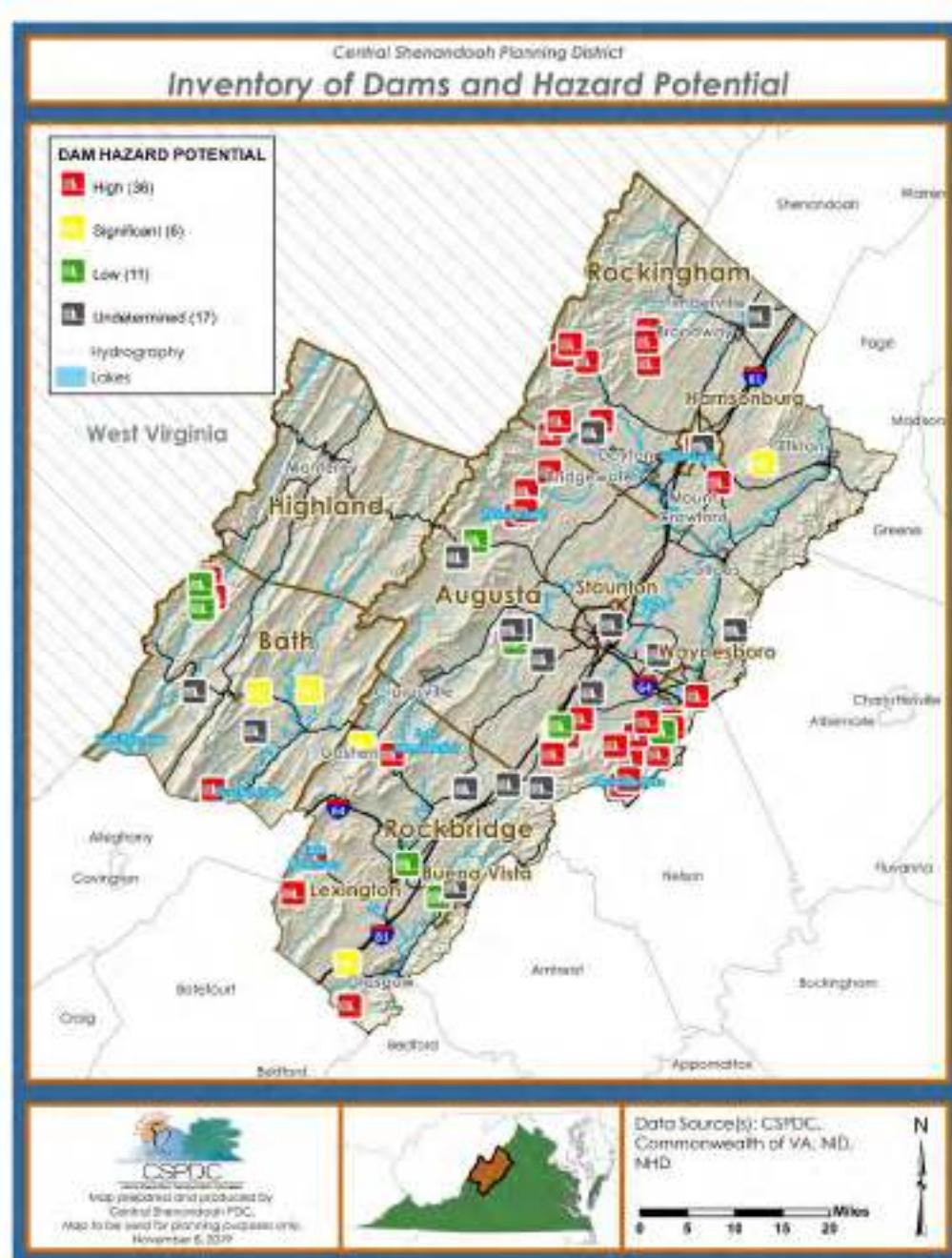
The Dam Safety Impounding Structure Regulations require that dams be classified based upon potential impacts from dam failure. The classifications are not based upon the condition of the dam itself. The classifications consider the potential for impact in the area downstream, known as the inundation zone, by assessing potential impacts on loss of life and property damage. The classification can also change over time if land use downstream changes. The classifications include:

- **High:** Upon failure would cause probable loss of life or serious economic damage. (Annual owner inspection and Professional Engineer inspection every 2 years is required).
- **Significant:** Upon failure might cause loss of life or appreciable economic damage. (Annual owner inspection and Professional Engineer inspection every 3 years is required).
- **Low:** Upon failure would lead to no expected loss of life or significant economic damage. This classification includes dams that upon failure would cause economic damage only to the property of the dam owner. (Annual owner inspection and Professional Engineer inspection every 6 years is required).

36 dams have a high hazard potential and 6 dams have a significant hazard potential in the Region.

Figure IV-6 displays data from the National Inventory of Dams (NID). The map shows regulated dams within the CSPDC region and indicates their hazard potential status. According to NID, there are 70 regulated dams in the CSPDC region and 36 dams have a high hazard potential. 6 dams are in the significant hazard level status. This results in 60% of total regulated dams in the region with a high or significant hazard status. NID also estimates that the average age of a dam in Virginia is 56 years old.

Figure IV-6: Inventory of Dams and Hazard Potential



## 4. Drought (High Ranking)

### Hazard History

Table IV-12 includes descriptions of droughts that have occurred in Virginia and the Region. Events have been broken down by the date of occurrence and when available, by individual community descriptions. When no community specific description is available, the general description should be used as representing the entire planning area. Data compiled from the U.S. Drought Monitor for the time period from 2000 to 2019 showing the history of D1 Moderate Droughts through D4 Exceptional Droughts by locality in the Region can be reviewed in Appendix F. Since 2012, the U.S. Secretary of Agriculture has declared five Agriculture Disaster Designations for localities within the Region impacted by drought.

**Table IV-12: CSPDC Drought Hazard History**

Date	Damages
1930-1932	Considered the worst drought in Virginia history. Piedmont area recorded only 21 inches of rainfall in 1930. The three largest rivers (Potomac, Rappahannock and Rapidan) were reduced to mere puddles.
1938-1942	Less severe than the previous 1930 drought. Saw below average levels of rainfall and low stream flow levels in local rivers.
1962-1971	Also, less severe than the previous 30'-32' drought, however, the cumulative stream flow deficit was the greatest of all the major droughts because of its lengthy duration.
1976 - 1977	Ten months of below average precipitation. The drought began in November of 1976 when rainfall totaled to only 50% to 75% of normal. During the rest of the winter, the storms tracked across the Gulf. During the spring and summer the storms tracked across the Great Lakes. These weather patterns created significant drought throughout most of Virginia.
5/1980-8/1980	Warm and dry conditions prevailed through the beginning of the summer. June precipitation data show that much of Virginia received record low rainfall. No crop damage reported.

**Table IV-12: CSPDC Drought Hazard History - continued**

Date	Damages
1985 - 1986	Very little rainfall began in December and the trend continued throughout the summer. Total precipitation for January and February was 2 inches. Palmer Index values dropped below -2 by June. High temperatures along with scarce precipitation created a drought that lasted well into the fall.
6/1988 - 7/1988	A heat wave over the southeast produced warm and dry conditions over much of Virginia. Although the news reported stories of a drought in Virginia, the Drought Monitoring Team never stated in a report that these conditions were indicative of a drought. Palmer Drought Index values were above -2.
5/1993 - 8/1993	Very warm temperatures and little rain were noted beginning June 5, 1993. Precipitation shortages were greater than five inches for southwestern and southeastern Virginia from May through July. Surface soil moisture levels were low enough to result in significant agricultural damage. However groundwater remained at normal levels.
6/1999- 9/1999	Northern Virginia and Shenandoah Valley experienced one of the worst droughts of the 20th Century. Moisture shortages first became apparent in the summer of 1998. Record low stream flows on the Rappahannock. Crops, cattle and fisheries were all suffering. Farm ponds completely dried up and fish died in the tepid backwaters of the Chesapeake Bay. The drought was beginning to move into the Piedmont. The Shenandoah River was drier than it had been since the early 1930s drought. Considered "one of the most profound droughts in Virginia during the 20 <sup>th</sup> century".
2000-2004	Beginning in late 2000, some areas of the Region began to show moderate drought conditions. From November 2000 to October 2002, the Region experienced moderate, severe and extreme drought conditions. All locations within the Region were impacted at various times throughout this period. The Governor of Virginia banned lawn watering, car washing and the filling of swimming pools. Wells dried up in rural areas as the water table dropped drastically. In November 2002, the U.S. Secretary of Agriculture approved 45 counties for primary disaster designation.
2005	In the Fall of 2005, the counties of Augusta, Rockbridge and Rockingham, and the cities of Waynesboro, Staunton and Harrisonburg experienced moderate drought conditions.
2006	At various times throughout the spring and summer of 2006, the counties of Augusta, Rockbridge and Rockingham, and the cities of Lexington, Buena Vista, Waynesboro, Staunton and Harrisonburg experienced moderate drought conditions.

**Table IV-12: CSPDC Drought Hazard History - continued**

Date	Damages
2007-2009	From the Summer of 2007 to Spring 2009, moderate drought conditions were experienced by all localities within the Region at various times during that period. Highland County and Rockingham County also experienced moderate drought conditions in the Fall of 2009. The counties of Augusta and Rockingham experienced moderate drought conditions in October 2007.
2010-2011	From Summer 2010 to Spring 2011, all localities within the Region experienced moderate drought conditions at various times during that period. Rockingham County experienced severe drought conditions in August and September 2010. Rockingham County leaders applied for agriculture disaster designation.
2012-2013	Rockingham County experienced moderate drought conditions in July 2012. From November 2012 to January 2013, all localities within the Region experienced moderate drought conditions at various times during that period. Rockbridge County and Rockingham County received agriculture disaster designations as contiguous counties in two designations by the U.S. Secretary of Agriculture (S3422 and S3443).
2014	The U.S. Secretary of Agriculture declared two agriculture disaster designations for the Region (S3782 and S3793). The first included Bath County as a primary county, and the counties of Augusta, Highland and Rockbridge as contiguous counties. The second declared Highland County as a primary county, and the counties of Augusta and Bath as contiguous counties.
2016	In the Spring of 2016, the counties of Augusta, Highland and Rockingham experienced moderate drought conditions.
2017-2018	Moderate drought conditions in the Region began in February 2017 and ended in May 2017. All localities within the Region experienced moderate drought conditions at various times during that period. Moderate drought conditions were experienced in Augusta, Rockbridge, Rockingham, Lexington, Buena Vista, Staunton and Waynesboro from December 2017 to February 2018. Due to the drought, the Augusta County Service Authority provided two locations for people to purchase water. One water source was non-potable for livestock or gardening use. The second water source provided drinking water for purchase. The U.S. Secretary of Agriculture declared an agriculture disaster designation for Rockingham County as a contiguous county (S4297).

**Table IV-12: CSPDC Drought Hazard History - continued**

Date	Damages
Droughts are a normal and recurrent feature of climate, and is a period of abnormally dry weather.	Following a long-term wetness that was experienced in the Spring and Summer of 2019, the region experienced a “flash drought” in the Fall of 2019. The “flash drought” was caused by a significant lack of rain and unusual high temperatures. A statewide drought advisory was issued by the Virginia Department of Environmental Quality. During the “flash drought,” the counties of Augusta, Bath, Rockbridge, and Rockingham, and the cities of Lexington, Buena Vista, and Waynesboro experienced moderate drought conditions. Bath, Rockbridge and Buena Vista also experienced severe drought conditions in October 2019. The “flash drought” caused stress on

Droughts can have serious effects like agricultural losses and water supply shortages

### Hazard Profile

Droughts are a normal and recurrent feature of climate that can affect vast regions and large population numbers. A drought is a period of abnormally dry weather that persists long enough to produce serious effects like agricultural losses; water supply shortages; and impacts on public health and energy production. Drought increases the risk of other hazards like fire, flash flood, and possible landslide and debris flow. The severity of the drought depends upon the degree of moisture deficiency, the duration, and the size of the affected area, as well as, the demands of human activity and agriculture on water supplies.

According to the National Weather Service, there are four types of drought:

- Meteorological drought, which “is based on the degree of dryness or rainfall deficit and the length of the dry period.”
- Hydrological drought, which is “based on the impact of rainfall deficits on the water supply such as stream flow, reservoir and lake levels, and ground water table decline.”
- Agricultural drought, which “refers to the impacts on agriculture by factors such as rainfall deficits, soil water deficits, reduced ground water, or reservoir levels needed for irrigation.”

- Socioeconomic drought, which “considers the impact of drought conditions...on supply and demand of some economic goods...”

A drought is a silent but very damaging phenomenon and unlike other natural disasters can last for years. Drought can have significant impacts on local and regional economies focused on agriculture and tourism. Statistics indicate that roughly every 22 years, a major drought occurs in the United States, most seriously affecting the Prairie and Midwestern states. The disastrous drought of the 1930s during which a large areas of the Great Plains became known as the Dust Bowl is one example.

The U.S. Drought Monitor, managed by the National Drought Mitigation Center (NDMC), the National Oceanic and Atmospheric Administration (NOAA) and the U.S. Department of Agriculture, releases weekly data that reflects the short-term and long-term drought status for the United States. It is utilized by federal, state and local agencies to determine drought status and responses. The data is used by the U.S. Department of Agriculture when determining eligibility for agriculture disaster declarations and low-interest loans.

The U.S. Drought Monitor uses several data sources to classify drought status, including the Palmer Drought Severity Index (PDSI), the Standardized Precipitation Index (SPI), the KEECH-BYRAM DROUGHT INDEX for fire, and indicators for vegetation health, soil moisture, hydrologic data, and other climatological inputs. The Palmer Drought Severity Index (PDSI) is a standardized index for meteorological drought that estimates dryness using temperature and precipitation data. The range on the PDSI is from -10 (dry) to +10 (wet). Values below -3 represent severe to exceptional drought. The PDSI is useful in determining long-term drought conditions.

Drought conditions are reflected in five classifications in the U.S. Drought Monitor. D0 Abnormally Dry are those areas going into or coming out of drought. D1 Moderate Drought through D4 Exceptional Drought classifies the four levels of drought. Table IV-13 provides an overview of the U.S. Drought Monitor classifications and possible impacts.

The U.S.  
Drought  
Monitor  
releases weekly  
data that  
reflects drought  
status.

Drought  
conditions are  
reflected in five  
classifications,  
from D0 to D4.

**Table IV-13 Drought Severity Classification**

<b>Category</b>	<b>Description</b>	<b>Possible Impacts</b>
D0	Abnormally Dry	Going into drought: short-term dryness slowing planting, growth of crops or pastures; fire risk above average.  Coming out of drought: some lingering water deficits; pastures or crops not fully recovered.
D1	Moderate Drought	Some damage to crops, pastures; fire risk high; streams, reservoirs, or wells low, some water shortages developing or imminent, voluntary water use restrictions requested.
D2	Severe Drought	Crop or pasture losses likely; fire risk very high; water shortages common; water restrictions imposed.
D3	Extreme Drought	Major crop/pasture losses; extreme fire danger; widespread water shortages or restrictions.
D4	Exceptional Drought	Exceptional and widespread crop/pasture losses; exceptional fire risk; water emergencies created by shortages of water in reservoirs, streams and wells.

Source: National Drought Mitigation Center (NDMC), U.S. Department of Agriculture (USDA) and the National Oceanic and Atmospheric Association (NOAA); U.S. Drought Monitor, Drought Classification

**Table IV-13: CSPDC Drought Vulnerability (from 1990 Census)**

Percent Population with Public/Private Water Systems				
Community	High (< 25%)	Medium (25% - 50%)	Low <th>Total</th>	Total
Augusta County	18,936	8,105	27,636	54,677
*Craigsville, Town of	0	0	812	812
Bath County	1,333	851	2,615	4,799
Buena Vista City	0	0	6,406	6,406
Harrisonburg City	0	0	30,707	30,707
Highland County	1,722	913	0	2,635
*Monterey, Town of	0	222	0	222
Lexington City	0	0	6,959	6,959
Rockbridge County	9,788	6,409	2,153	18,350
*Glasgow, Town of	0	0	1140	1140
*Goshen, Town of	0	366	0	366
Rockingham County	28,040	11,204	18,238	57,482
*Bridgewater, Town of	0	0	3,918	3918
*Broadway, Town of	0	50	1159	1209
*Dayton, Town of	0	0	921	921
*Elkton, Town of	0	85	1850	1935
*Grottoes, Town of	0	0	1455	1455
*Mt. Crawford, Town of		228	0	228
*Timberville, Town of	0	1596	0	1596
Staunton City	0	0	24,461	24,461
Waynesboro City	0	0	18,549	18,549
<b>Total</b>	<b>59,819</b>	<b>27,482</b>	<b>137,724</b>	<b>225,025</b>

\*Denotes town values that are also included in totals for the perspective County.

## Vulnerability Analysis

The U.S. Drought Monitor is an assessment of prior drought conditions that occurs weekly; it is not a forecast of anticipated drought. Based upon best available data, the 1990 U.S. Census data has been utilized for the vulnerability analysis. It contains detailed information about source of water per Census block group. For purposes of this analysis, it was assumed that areas with populations having less than 25% of public/private water systems had a high vulnerability ranking. When a drought occurs, these areas would likely have a larger impact since most homes receive their water from wells, which may dry up during a drought.

Table IV-14 provides a summary of the 1990 population in three categories of drought vulnerability. Note that the Table contains information specific to the towns; this information has also been included with the county totals. As a result of using 1990 U.S. Census data at the block group level, there are some discrepancies with the town boundaries. Boundary adjustments into “high vulnerability” areas are a result of the older census data, which is a data limitation issue. This water source information is no longer updated by the Census, but it was determined that this drought analysis was the best available data available to the CSPDC at this time. Based on the percentage of the population in the high vulnerability category, Highland County has the highest percentage of people vulnerable to drought (65%) followed by the counties of Rockbridge (53%) and Rockingham (49%). Figure IV-7 shows these categories for each of the communities.

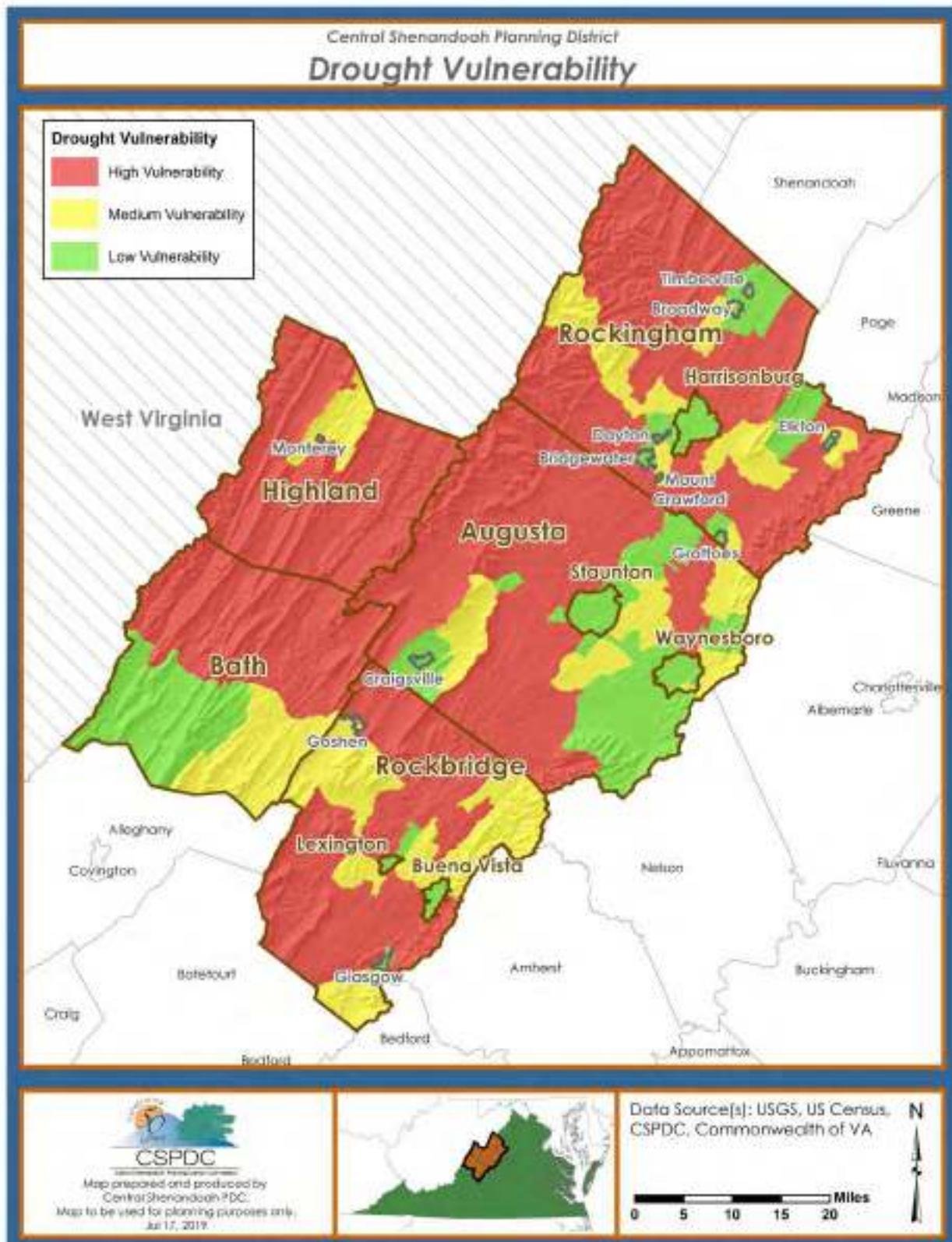
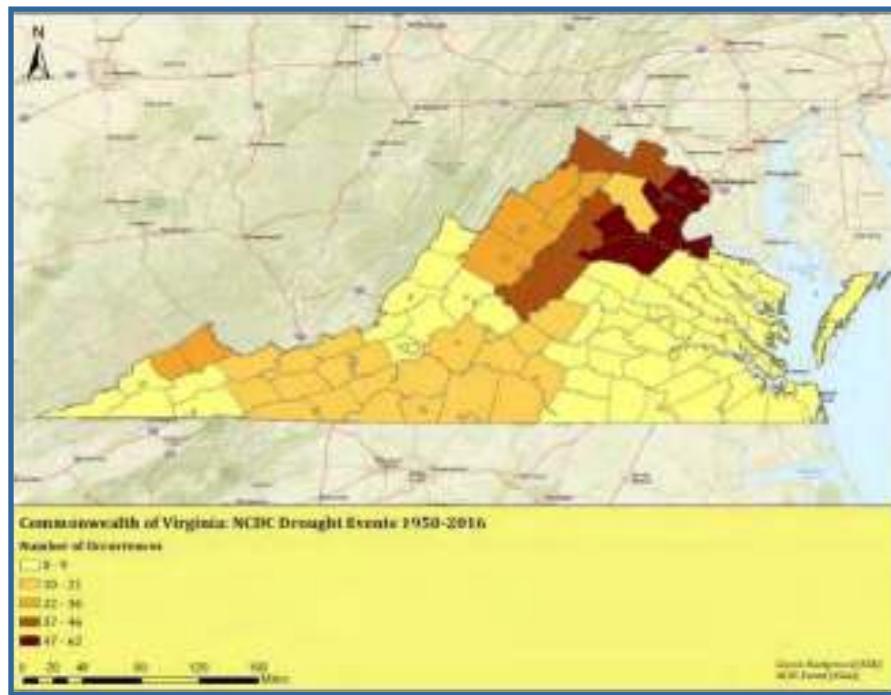
**Figure IV-7: CSPDC Drought Vulnerability**

Figure IV-8 is a map included in the Commonwealth of Virginia's Hazard Mitigation Plan and shows National Climatic Data Center data for drought events in Virginia from 1950 –2016. Rockingham and Augusta Counties and the Cities of Staunton, Waynesboro, and Harrisonburg are all shown in the 22 to 26 occurrences range. As an alternative to the 1990 Census data, if the vulnerability analysis were based upon this historical data it would appear that these localities are more susceptible to drought than other localities in the Region.

As discussed in the section on Agricultural Disasters, Rockingham County and Augusta County rank number one and number two in the total market value of products sold in the Commonwealth. They also rank number one and number two in livestock, poultry and products, and are both in the top ten for crops in Virginia. Droughts can cause considerable agricultural damages and financial losses impacting cropland, pastureland and livestock due to soil moisture content; available water supplies for irrigation or livestock watering; and available forage for feeding. Since 2012, the U.S. Secretary of Agriculture has declared five Agriculture Disaster Designations for localities within the Region impacted by drought.

**Figure IV-8: Virginia NCDC Drought Events**



Source: Virginia's Hazard Mitigation Plan, 2018

## 5. Hurricane (High Ranking)

### Hazard History

This section discusses wind impacts related to Hurricanes. Information regarding impacts from flooding is included in the Flooding section. See Appendix C - Flood History and Dam Risk Assessment and Inventory for detailed information on the flooding impacts of hurricanes in the Region. Listed below are major hurricanes that have resulted in wind damages in the Region:

- Hurricane Camille - August 1969
- Hurricane Agnes - June 1972
- Hurricane Juan - November 1985
- Hurricane Fran - September 1996
- Hurricane Isabel – September 2003
- Hurricane Sandy - November 2012

Figure IV-9 depicts the historical storm system track for tropical depressions, tropical storms and hurricanes that have passed through the Region from 1842 to 2017. The category of the hurricane shown on the map does not necessarily mean that the storm was at this intensity level when it traveled through the Region. Additionally, hurricanes that do not have a historical storm system track through the Region have still have resulted in catastrophic impacts, such as Hurricane Camille. Secondary impacts from storms have resulted in loss of life, injury, property damage and widespread infrastructure damage.

See Appendix C, for detailed information on the flooding impacts of hurricanes in the Region.

Hurricanes that do not have a historical storm system track through the Region have still have resulted in catastrophic impacts, such as Hurricane Camille in 1969.

### Hazard Profile

A tropical cyclone is the generic term for a non-frontal synoptic scale low-pressure system over tropical or sub-tropical waters with organized convection

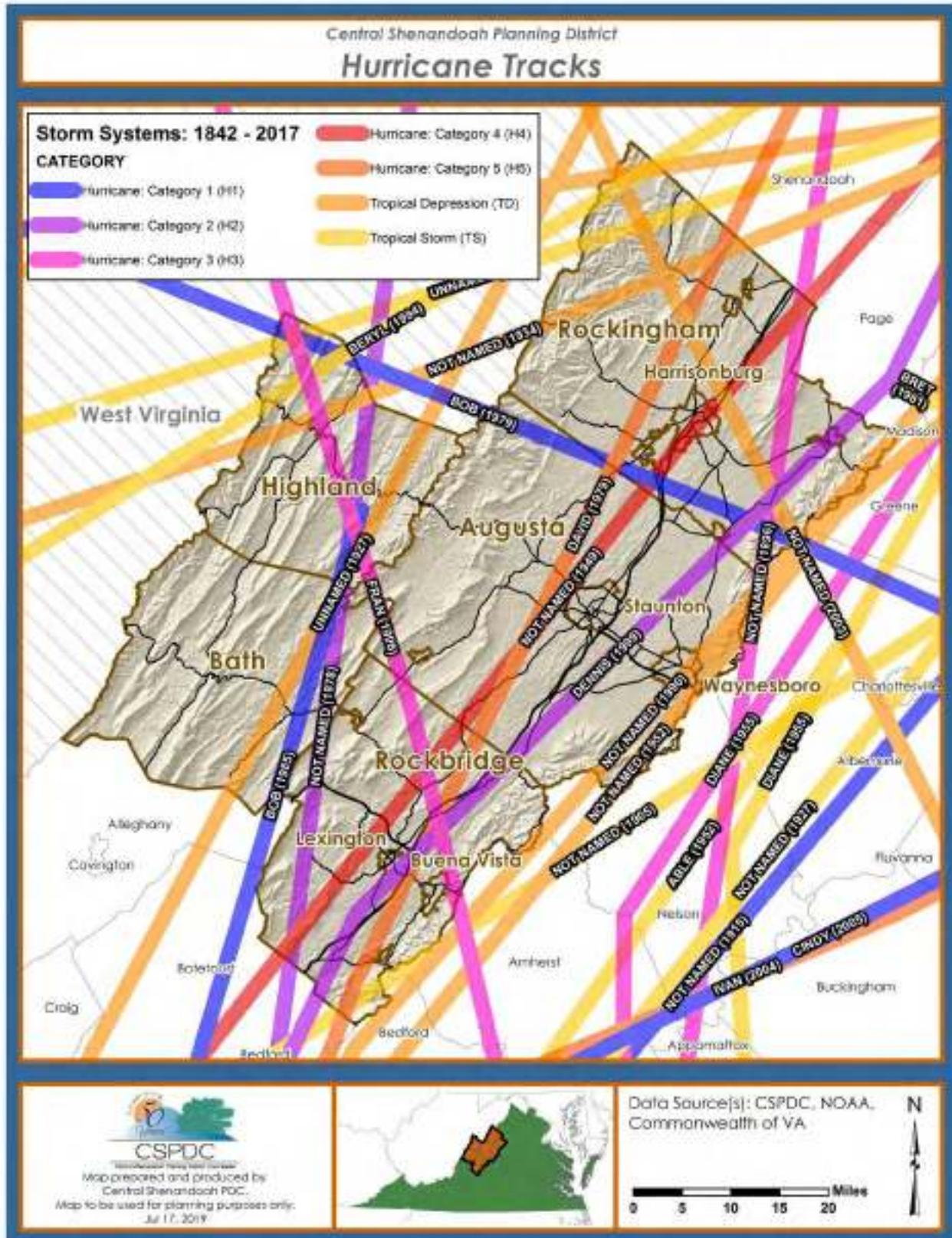
and definite cyclonic surface wind circulation. Depending on strength, they are classified as tropical depressions, tropical storms or hurricanes. Tropical cyclones involve both atmospheric and hydrologic characteristics, such as severe windstorms, surge flooding, high waves, coastal erosion, extreme rainfall, thunderstorms, lightning, and, in some cases, tornadoes. Storm surge flooding can push inland, and riverine flooding associated with heavy inland rains can be extensive. High winds are associated with hurricanes, with two significant effects: widespread debris and power outages. Widespread debris is due to damaged and downed trees and damaged buildings.

## Secondary Hazards

Secondary hazards from a hurricane event could include high winds, flooding, heavy waves, and tornadoes. Once inland, the hurricane's band of thunderstorms produces torrential rains and, sometimes, tornadoes. A foot or more of rain may fall in less than a day causing flash floods and mudslides. The rain eventually drains into the large rivers, which may still be flooding for days after the storm has passed. The storm's driving winds can topple trees, utility poles, and damage buildings. Communication and electricity may be lost for days. Roads may be impassable due to fallen trees and debris.

## Hurricane Damage Scale

Hurricanes are categorized by the Saffir-Simpson Hurricane Wind Scale as listed below in Table IV-15. Included in the table are detailed descriptions of each category and the potential damage caused by each. The Saffir-Simpson Hurricane Wind Scale contains a 1 to 5 rating that estimates potential damage based upon sustained wind speeds. Major hurricanes are considered storms to be ranked a Category 3 or higher. Category 1 and Category 2 storms can still cause impacts and damages.

**Figure IV-9: Central Shenandoah Planning District Hurricane Tracks**

**Table IV-15: Saffir - Simpson Hurricane Wind Scale**

Hurricane Category	Sustained Winds (mph)	Description
1	74 – 95	<b>Very dangerous winds will produce some damage:</b> Well-constructed frame homes could have damage to roof, shingles, vinyl siding and gutters. Large branches of trees will snap and shallowly rooted trees may be toppled. Extensive damage to power lines and poles likely will result in power outages that could last a few to several days.
2	96 – 110	<b>Extremely dangerous winds will cause extensive damage:</b> Well-constructed frame homes could sustain major roof and siding damage. Many shallowly rooted trees will be snapped or uprooted and block numerous roads. Near-total power loss is expected with outages that could last from several days to weeks.
3	111 – 129	<b>Devastating damage will occur:</b> Well-built framed homes may incur major damage or removal of roof decking and gable ends. Many trees will be snapped or uprooted, blocking numerous roads. Electricity and water will be unavailable for several days to weeks after the storm passes.
4	130 – 156	<b>Catastrophic damage will occur:</b> Well-built framed homes can sustain severe damage with loss of most of the roof structure and/or some exterior walls. Most trees will be snapped or uprooted and power poles downed. Fallen trees and power poles will isolate residential areas. Power outages will last weeks to possibly months. Most of the area will be uninhabitable for weeks or months.
5	≥ 157	<b>Catastrophic damage will occur:</b> A high percentage of framed homes will be destroyed, with total roof failure and wall collapse. Fallen trees and power poles will isolate residential areas. Power outages will last for weeks to possibly months. Most of the area will be uninhabitable for weeks or months.

Source: Saffir-Simpson Hurricane Wind Scale, National Weather Service

## Vulnerability Analysis

### HAZUS-MH

FEMA's HAZUS-MH software (4.2) was used to generate hurricane damage and loss estimates for the CSPDC region. Level 1, with default parameters, was used for the hurricane analysis in this Plan. It is noted that this version of HAZUS utilizes 2010 Census Data and totals produced by HAZUS only reflect data for those census tracts/blocks included in the study region. HAZUS-MH uses historical hurricane tracks and computer modeling to identify the probable tracks of a range of hurricane events at the US Census tract level. Results from the model are used to develop the annualized damages. The impacts of various events are then combined to create a total annualized loss or the expected value of loss in any given year. The Hurricane Wind Probabilistic Model with HAZUS-MH predicts hurricane tracks, based on historical hurricane, for different return periods. All hurricane quick assessment and global risk report results can be found in Appendix G.

### Building Types

The Global Risk probabilistic 100 year return period scenario report for the CSPDC Region includes estimated information such as building damage, debris generation and possible economic losses. Table IV-16 summarizes the expected damage by general building type. According to HAZUS, Masonry and Wood are the most common building types and expected damage would occur mostly with masonry buildings. The regional report also estimates that a large percentage of this damage would be to residential homes.

Table IV-16: CSPDC Expected Building Damage by Building Type (100 yr Event)

Building Type	None		Minor		Moderate		Severe		Destruction	
	Count	(%)	Count	(%)	Count	(%)	Count	(%)	Count	(%)
Concrete	1,148	99.58	5	0.42	0	0.00	0	0.00	0	0.00
Masonry	27,676	99.82	50	0.18	1	0.00	0	0.00	0	0.00
MH	9,682	100.00	0	0.00	0	0.00	0	0.00	0	0.00
Steel	4,316	99.67	14	0.33	0	0.00	0	0.00	0	0.00
Wood	75,626	99.98	14	0.02	0	0.00	0	0.00	0	0.00

Source: HAZUS-MH 4.2

## Loss Estimation

To estimate loss for each County and City in the CSPDC Region, HAZUS was used to generate the following hurricane reports for each locality:

- Quick Assessment
- Global Risk Reports (10, 20 , 50, 100 , 500, and 100 year return periods).

Table IV-17 is from the CSPDC's Quick Assessment report and estimates that the region as a whole would have a combined or annualized total Capital Stock loss of \$379,000. Income losses are estimates at \$20,000 which results in a total of loss of \$399,000 for the region. To see annualized losses broken down by locality, see Table IV-18. The CSPDC also used the Hurricane Quick Assessment reports for each County and City in the Region to summarize building damage and economic losses for a 100-year Event. See Table IV-19 to view this information for each locality for a 100 year return period and see Appendix G to view the HAZUS reports.

**Table IV-17: CSPDC Estimated Economic Loss (\$)**

Economic Loss (x 1000)			
Return Period	Property Damage /Capital Stock Losses		Business Interruption (Income) Losses
	Residential	Total	
10	0	0	0
20	0	0	0
50	214	214	0
100	4,956	5,064	5
200	15,705	16,347	32
500	44,891	46,220	1,022
1000	76,205	78,679	4,886
Annualized		359	20

Source: HAZUS-MH 4.2

**Table IV-18: CSPDC HAZUS-MH Annualized Expected Losses to Hurricanes by Locality (\$)**

<b>Annualized Economic Loss (x1000) by Locality</b>			
<b>Locality</b>	<b>Property Damage (Capital Stock) Residential</b>	<b>Property Damage (Capital Stock) Total</b>	<b>Business Interruption (Income) Losses</b>
<b>Augusta County</b>	111	116	6
<b>Bath County</b>	7	7	0
<b>Highland County</b>	3	3	0
<b>Rockbridge County</b>	41	43	2
<b>Rockingham County</b>	104	109	6
<b>City of Buena Vista</b>	9	10	1
<b>City of Harrisonburg</b>	35	39	3
<b>City of Lexington</b>	10	11	1
<b>City of Staunton</b>	31	33	2
<b>City of Waynesboro</b>	30	33	2

Source: HAZUS-MH 4.2

**Table IV-19: CSPDC HAZUS-MH Hurricane Probabilistic Scenario Quick Assessment**

HAZUS-MH Hurricane Probabilistic Scenario Quick Assessment (100 yr Return Period)							
Locality	Residential Building Exposure (\$ K)	Total Building Exposure (\$ K)	Number of Residential Buildings Damaged	Number of Buildings Damaged	Residential Property (Capital Stock) Losses (x 1000)	Total Property (Capital Stock) Losses (x 1000)	Business Income Interruption Losses (x 1000)
Augusta County	6,296,301	7,633,931	8	13	1,448	1,472	0
Bath County	739,486	817,609	0	1	20	20	0
Highland County	320,363	367,309	0	0	8	8	0
Rockbridge County	2,182,496	2,612,294	2	3	475	795	0
Rockingham County	6,609,137	7,869,924	9	13	1,071	1,105	1
City of Buena Vista	509,866	724,767	1	2	87	87	0
City of Harrisonburg	3,460,375	5,090,915	9	13	314	315	0
City of Lexington	714,506	957,848	2	2	141	141	0
City of Staunton	2,264,098	3,046,627	5	8	403	403	0
City of Waynesboro	1,830,829	2,666,599	4	6	410	410	0
<b>CSPDC Total</b>	<b>24,927,457</b>	<b>31,787,823</b>	<b>40</b>	<b>61</b>	<b>4,377</b>	<b>4,756</b>	<b>1</b>

Source: HAZUS-MH 4.2

## 6. Severe Winter Weather (High Ranking)

### Hazard History

Listed below in Table IV-20 are major winter storm events that have occurred in the Region. Major events have been broken down by the date of occurrence and when available, by individual community descriptions. When no community specific description is available, the general description should be used as representing the entire Region.

**Table IV-20: CSPDC Severe Winter Weather Hazard History**

Date	Description and Damages
1/28/1772	A severe snowstorm struck the Mid-Atlantic, dropping anywhere from 30-36 inches across the region. The storm became known as the "Washington and Jefferson" snowstorm because they were mentioned in both their diaries.
1/15/1831	Snows of over 13 inches fell on the Shenandoah Valley.
1/19/1857	Extreme cold hampered cleanup from a 12+ inch snowfall. The storm also brought high winds with the snowfall, and a prolonged period of near-zero temperatures froze all rivers in the state. Snowfall was steady for over 24 hours. Train service in the Valley was suspended for ten days. Two buildings belonging to the Central Virginia Railroad caught fire but it was so cold the fire hydrants froze and there was no way to put out the fires.
1/18/1881	Sleet and freezing rain fell all day and everything was coated with ice. Several citizens had injuries from falling. There were several collisions between sleds and horse-drawn coaches. To walk on the icy roads, people wrapped pieces of blanket around their feet.
2/1899	The Great Arctic Outbreak and Great Eastern Blizzard brought the harshest winter conditions ever experienced to the region. Mail service was postponed, countless pipes burst and railroads were shut down, causing fear that coal supplies would run out.  <b>Harrisonburg:</b> 14" of snow, temperature of -23°F recorded <b>Highland County:</b> temperature of -29°F recorded in Monterey <b>Lexington:</b> temperature of -9°F recorded, North River froze completely over <b>Rockingham County:</b> 30" of snow in parts of the county, temperature of -36°F recorded in Timberville, temperature of -32°F recorded in Edom, temperature of -40°F recorded in Brock's Gap <b>Staunton:</b> 18" of snow, temperature of -18°F recorded

Virginia has a historic record of significant winter that goes back over two hundred years thanks to George Washington and Thomas Jefferson.

**Table IV-20: CSPDC Severe Winter Weather Hazard History - continued**

Date	Description and Damages
1/14/1912	<p>An Arctic cold wave struck the region with subzero temperatures. Across the area, water pipes froze, kitchen ranges exploded, trains were delayed, and thousands of birds and small animals died.</p> <p><b>Harrisonburg:</b> temperature of -15°F recorded  <b>Rockingham County:</b> temperature of -18°F recorded at Bridgewater, temperature of -18°F recorded at Dayton, temperature of -20°F recorded at McGaheysville  <b>Staunton:</b> temperature of -25°F recorded. One man froze to death.</p>
11/25/1938	<p>An average of 6" of snow fell across the Shenandoah Valley.</p> <p><b>Rockingham County:</b> Between 50 and 75 cars were stranded on Rt. 33. Many people were traveling during this Thanksgiving holiday weekend.</p>
3/5/1962-3/9/1962	<p>A severe Nor'easter struck the entire east coast, dumping especially heavy snow on western Virginia.</p> <p><b>Harrisonburg:</b> 20" of snow.  <b>Lexington:</b> 20" of snow fell.  <b>Rockingham County:</b> 27" of snow fell, stranding travelers overnight on U.S. Rt. 11 near Lacey Springs.  <b>Staunton:</b> 26" of snow fell.</p>
3/26/1978	<p>An Easter weekend ice storm brought branches and whole trees crashing down onto power lines, with over 1" of ice accumulating in some places. Over 30,000 in the Shenandoah Valley were without power, and over 2,000 were without telephone service. Radio stations were knocked off the air and many basements were flooded.</p>
2/11/1983	<p>The Blizzard of '83 struck Virginia, dropping heavy snow with drifts up to 6 feet high.</p> <p><b>Augusta County:</b> 18-20" of snow fell.  <b>Harrisonburg:</b> 20" of snow fell. James Madison University and Eastern Mennonite University were closed, several tractor trailers jack-knifed on I-81.  <b>Lexington:</b> 18" of snow fell.  <b>Rockbridge County:</b> 15-24" of snow fell.</p>

**Table IV-20: CSPDC Severe Winter Weather Hazard History - continued**

Date	Description and Damages
3/13/1993	<p>The Storm of the Century struck the east coast, causing 4 feet of snow in some areas and drifts of up to 15 feet. One hundred and fifty (150) Americans lost their lives to the storm. In the Region, the storm dropped between 12" and 22" of snow, with near hurricane-force winds creating drifts of 8' to 10' deep. Extremely low wind chills caused problems for farmers trying to feed livestock and drifts prevented farmers trying to move the animals to sheltered places.</p> <p><b>Harrisonburg:</b> Roofs of 2 businesses collapsed under the weight of the 10' snow drifts.</p> <p><b>Rockbridge County:</b> 12"-22" of snow fell and 5,000 people lost power.</p> <p><b>Rockingham County:</b> 13"-22" of snow fell; winds of up to 70 m.p.h. caused drifts of 6'-7'.</p> <p><b>Staunton:</b> 18" of snow fell and 200 people were without power. The National Guard was deployed in Staunton.</p>
2/8/1994– 2/12/1994	<p>A severe ice storm struck Virginia, bringing 1"-3" of solid ice, causing flooding and \$105.8 million (2019 dollars) in damage. In the Region, Bath County Rockbridge County and the City of Buena Vista were included in a federal disaster declaration (DR-1014). Conditions were treacherous across the Central Shenandoah Valley Region, where 24 out of the past 54 days had winter precipitation.</p>
3/1/1994– 3/5/1994	<p>A severe winter storm and ice storm hit Virginia. Augusta County and Highland County were included in a federal disaster declaration (DR-1021).</p>

**Table IV-20: CSPDC Severe Winter Weather Hazard History - continued**

Date	Description and Damages
January 1996	<p>The Blizzard of 1996 struck the east coast, killing 40. The blizzard paralyzed the I-95 corridor and reached westward into the Appalachians where snow depths of over 48 inches were recorded. To compound things, the blizzard was followed the next week by two additional heavy snowstorms bringing over a foot of snow. Snowpack was on the ground for an extended period of time. It was thawed by higher temperatures and heavy rain, resulting in severe flooding.</p> <p>The Governor declared a State of Emergency in Virginia, with the hardest hit area being the Shenandoah Valley, with over 40" of snow reported in areas of Shenandoah National Park. The Region reported an average of 28"-30" of snowfall. Local governments also declared states of emergency and all non-essential travel was banned. Several local governments and schools were closed for more than a week. Dozens of hikers were stranded in the Shenandoah Valley. Eight hundred (800) persons throughout the State required shelter. In Virginia, snow removal costs were estimated at \$81.9 million (2019 dollars) and another \$11.4 million (2019 dollars) was spent in repairs to damaged infrastructure. VDOT needed crawler tractors to plow the snow in higher elevations because the snow was too deep for regular plows.</p> <p>Two federal major disaster declarations (DR-1086 and DR-1098) were declared. DR-1086 included Augusta County, Bath County, the City of Buena Vista, the City of Harrisonburg, Highland County, the City of Lexington, Rockbridge County, Rockingham County, the City of Staunton and the City of Waynesboro. DR-1098 included all of the same localities, except for Lexington and Waynesboro.</p> <p><b>Highland:</b> 24"-30" of snowfall was reported.  <b>Staunton:</b> The National Guard's humvees were used by rescue personnel to assist with emergency calls.</p>
1/25/2000- 1/30/2000	<p>Winter storms brought a blizzard to the East Coast that impacted the Region. Augusta County, Bath County, Highland County, Rockbridge County and Rockingham County were included in a federal major disaster declaration. (DR-1318)</p>

**Table IV-20: CSPDC Severe Winter Weather Hazard History - continued**

Date	Description and Damages
2/14/2003- 2/18/2003	<p>A complex storm system known as the “Presidents’ Day Storm” dropped snow and sleet across the State of Virginia. In some places, schools were closed for a week. Across the northern Central Shenandoah Valley, 12 to 20 inches of snow and sleet fell. Across the southern Central Shenandoah Valley, 7 to 12 inches of snow and sleet fell.</p> <p><b>Augusta County:</b> \$2.1 million (2019 dollars) worth of damages reported. Barns and turkey sheds collapsed killing livestock. A 39 year old man died after sledding into the path of a car in Craigsville.</p> <p><b>Bath County:</b> Received 5 to 8 inches of snow and sleet.</p> <p><b>Highland County:</b> A turkey house collapsed near McDowell and killed 500 turkeys. Highland County was included in a federal major disaster declaration (DR-1458) for the severe winter storm, snowfall, heavy rain, flooding and mudslides that occurred during a period from February 15 through February 28.</p> <p><b>Rockingham County:</b> Twelve (12) chicken/turkey houses collapsed killing 37,000 chickens/turkeys. A dairy barn collapsed in Grottoes, killing one cow and injuring 17.</p>
2/12/2007	<p>Complex storm of snow and sleet. In Northwestern and Central Virginia, snowfall ranged from 1 - 7 inches with sleet between 1/10 and 3/4 of an inch. There were dozens of automobile accidents, including pileups of dozens of cars on Afton Mountain. The storm caused 22 deaths in the U.S. In the Region, as many as 20,000 people lost power at the height of the storm. Ice was followed by gusty winds and bitter cold. Virginia Governor declared a State of Emergency for the State.</p> <p><b>Augusta County:</b> Augusta County was the hardest area hit in the Central Shenandoah Region and the County declared a local state of emergency.</p> <p><b>Bath and Highland County:</b> The storm brought sleet and ice causing downed trees, downed power lines and power outages.</p>
1/17/2008	<p>Severe winter weather resulted in snowfall in the region. Augusta County received between 2.5 inches and 8 inches of snow, as well as ice on trees. Highland County received 4.8 inches of snow. Rockingham County received between 3.5 inches and 6 inches of snow.</p>

**Table IV-20: CSPDC Severe Winter Weather Hazard History - continued**

Date	Description and Damages
12/18/2009– 12/20/2009	<p>A strong area of low pressure tracked up the Mid-Atlantic Coast and tapped into moisture from the Gulf of Mexico and the Atlantic Ocean causing copious amounts of precipitation to develop. The severe winter storm that hit the Shenandoah Valley in December 2009 was one of the biggest snow falls in the past 13 years. Snow fall was recorded ranging from 18 inches to 28 inches of snow during the 2 day storm throughout the Valley. The Virginia State Police estimated the storm caused a 42% increase in calls for service. State Troopers responded to more than 4,000 traffic crashes and disabled vehicles. Officials reported only 2 traffic fatalities. Interstates 81 and 77 were hit the heaviest with traffic accidents. A federal major disaster declaration (DR-1874) included Augusta County, Bath County, Highland County, Rockbridge County, the City of Staunton and the City of Waynesboro.</p> <p><b>Harrisonburg:</b> 13 inches of snow recorded.</p> <p><b>Rockingham County:</b> Received up to 2 feet of snow.</p> <p><b>Staunton:</b> Used 96' storm experience in preparation for 09' storm. They had 20 people in the armory on stand-by to get people out of trouble. Biggest community problem was the amount of disabled vehicles on the road.</p>
2/5/2010 - 2/11/2010	<p>Governor McDonnell declared Virginia in a state of emergency as the second severe storm of the season hit in February, dropping nearly 2 feet of snow throughout the state on February 5 - 6, 2010. This was followed by another system that dropped more snowfall on February 9 - 10, 2010. Gov. McDonnell assisted the state by deploying National Guard soldiers and emergency response teams. VDOT used up all \$79 million budgeted for statewide snow removal and nearly exhausted their \$25 million reserve. The National Weather Service described the storm as very heavy, wet snow with strong winds. Dominion Virginia power reported half of the 200,000 power outages came from the Charlottesville and Shenandoah Valley region, while Appalachian Power reported an additional 40,000 outages in the Valley. Virginia State Police responded to more than 2,000 traffic crashes and disabled vehicles along with 2 traffic fatalities. A federal disaster declaration (DR-1905) included Augusta County, Highland County and the City of Waynesboro.</p> <p><b>Staunton</b> – accumulated 15 inches of snowfall.</p> <p><b>Augusta County</b> - received 16 inches of snowfall.</p> <p><b>Waynesboro</b> – accumulated 13.5 inches of snowfall.</p> <p><b>Rockingham County</b> - received between 13 and 17 inches of snowfall. During the second snowfall, parts of Rockingham received an additional 6 inches.</p> <p><b>Bath County</b> - totals were between 15 - 18 inches for both storms.</p>

**Table IV-20: CSPDC Severe Winter Weather Hazard History - continued**

Date	Description and Damages
3/7/2013	Severe winter weather brought wet, heavy snow approaching 20 inches in the Region. The area received some of the highest snowfall levels in the state, including the highest level of 20.3 inches in Fishersville. A state of emergency was declared by Governor Bob McDonnell. Power outages were reported for more than 200,000 customers in the state, and the Town of Craigsville water and sewer plant was left without power. Slick roads resulted in abandoned vehicles, and police responding to hundreds of crashes, including two tractor trailer accidents. In the Highlands, 16 inches of snow was reported in Bath County and 14 inches of snow was reported in Highland County.
2/13/2014	A nor'easter brought more than 24 hours of steady snowfall to the Region closing schools, governments and businesses. Governor McAuliffe declared a state of emergency. More than 1,000 pieces of equipment were deployed in the VDOT Staunton District. No deaths or major injuries were reported in the Shenandoah Valley. The storm cancelled flights. Statewide, the Virginia State Police responded to more than 4,052 calls for service, with 1,095 crashes and 905 disabled vehicles. Bath County received 15 inches of snow.
3/17/2014	Winter weather brought snowfall to the region. 6 inches were reported in Augusta County and up to 13.5 inches were reported in Rockingham County.
3/7/2015	A strong storm steered by upper level winds from the northwest and Ohio Valley, resulted in a winter storm warning for the area. 11.5 inches of snow were reported in Waynesboro, and there were more than 200,000 power outages statewide. One of the heaviest areas for calls to service to the Virginia State Police was in Augusta County.
1/22/2016-1/23/2016	A nor'easter storm known as Winter Storm Jonas brought a blizzard to the Northeast and Mid-Atlantic, affecting nearly one-third of the U.S. population. The storm brought heavy snowfall to our region. Governor McAuliffe declared a state of emergency and deployed the Virginia National Guard. Heavy snowfall caused the roof of a bowling alley in Waynesboro to collapse, leading to its condemnation and later demolition. Areas of Bath and Highland County received 17-20 inches of snow. Highland County was included in a federal disaster declaration (DR-4262). The countywide per capita impact for Highland was \$23.69.
12/17/2016	A light coating of ice fell in the region, impacting roadways in Augusta County.

**Table IV-20 CSPDC Severe Winter Weather Hazard History - continued**

Date	Description and Damages
11/15/2018	A winter ice storm brought widespread power outages to the entire Region. More than 40,000 customers were without power in Rockingham, Augusta, Staunton and Waynesboro. In Rockbridge County, around 1,800 Dominion customers were without power. In the BARC service area in Rockbridge and Bath counties, around 4,758 customers were without power due to downed trees and ice on the power lines. Businesses, including grocery food retailers, were also impacted causing financial losses of perishable food products. A CenturyLink fiber optic line was damaged by heavy ice in Rockbridge County, causing outages for customers. The storm caused road closures and impacted traffic signals in Rockbridge County, and an accident between a semi-tractor trailer and a pickup truck was reported in Buena Vista.

### Hazard Profile

Winter storms may include a variety of cold weather conditions such as heavy snowfall, extreme cold temperatures, freezing rain, sleet, ice, and high winds. Blizzards are a type of winter storm with high winds and considerable blowing snow. Winter storms may last from just a few hours to several days and affect the entire Region. The impacts of winter storms include downed power lines and trees, hazardous walking and driving conditions, road closures, and business, government facilities and school closures. Health risks include hypothermia and frostbite if exposed to winter storm conditions and heart attacks due to overexertion. Winter storms are considered deceptive killers because most deaths are not directly related to the actual storm event. The leading cause of death and injury during winter storms is automobile accidents when freezing rain and sleet cause road surfaces to become extremely treacherous and dangerous to motorists. Other dangers related to winter weather and extreme cold include exposure, hypothermia, and asphyxiation due to improper use of heating systems. House fires occur more frequently in the winter months and during winter storms because of the use of alternative heating sources. Frozen water lines and limited access to waterlines poses a significant risk for fighting fires in the winter weather. Injury or death caused by chain-saw accidents and electrocution are also possible in the aftermath of the winter storm as residents try to remove fallen trees and power lines.

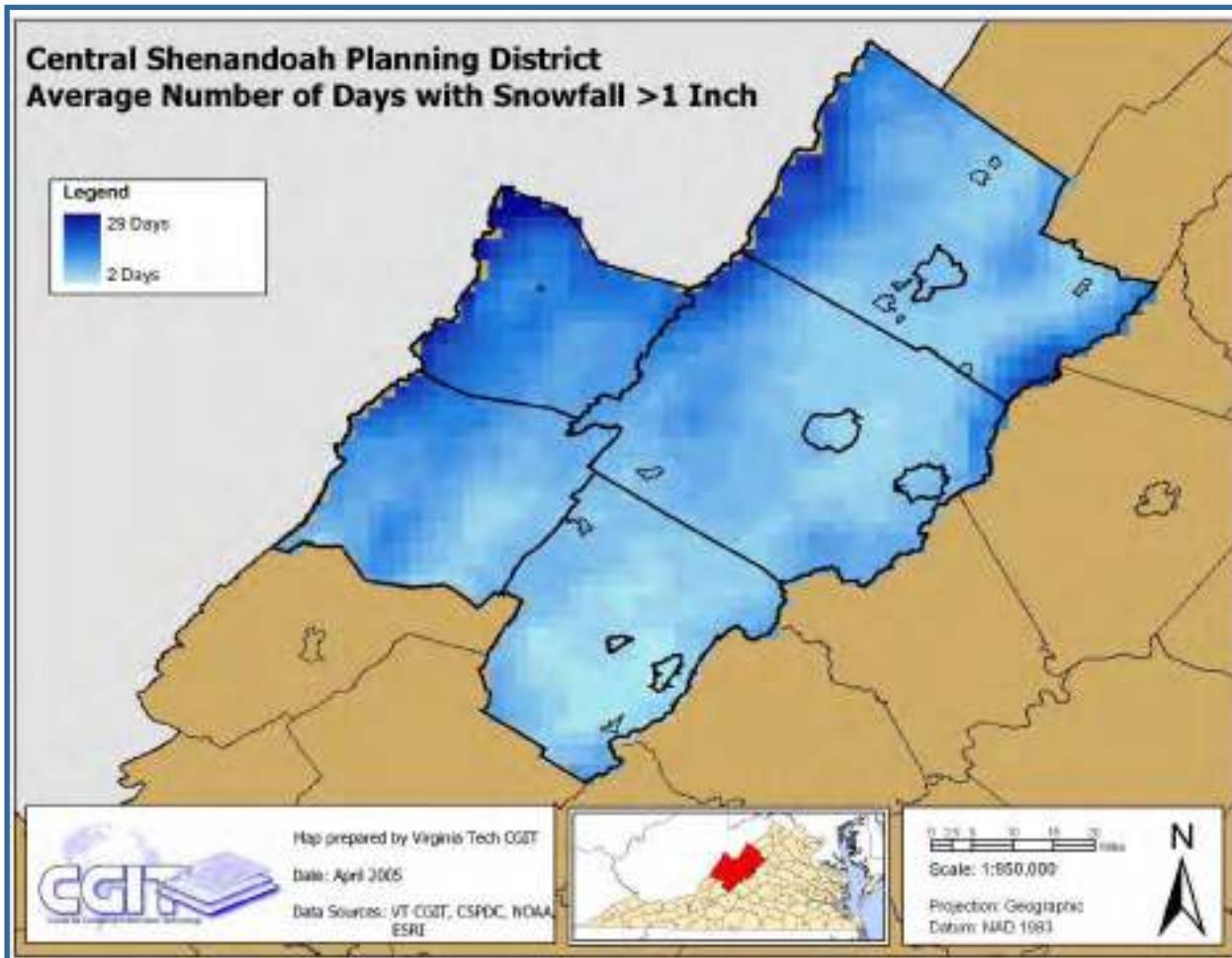
Winter storms also impact our economy. Public funds are generally associated with labor and equipment costs for snow removal, road clean-up and repair and utility restoration. Business losses are attributed to closures and the inability of employees and customers to travel. Electrical, communication and utility disruption also impact the private sector. Buildings may be damaged or destroyed when heavy snow loads collapse roofs. The agricultural economy can also suffer as a result of winter storms especially those that occur later in the season affecting crops and livestock.

### Predictability and Frequency

Winter storms can be a combination of heavy snowfall, high winds, ice and extreme cold. These are classified as extra-tropical cyclones that originate as mid-latitude depressions. Winter weather impacts the Region between the months of November and April, with varied intensities from east to west. In the last Plan, winter weather hazard potential maps were created that capture this variability, gridded climate data was obtained from the Climate Source and through the VirginiaView program. This data was developed by the Oregon State University Spatial Climate Analysis Service (SCAS) using **PRISM** (Parameter-elevation Regressions on Independent Slopes Model). This climate mapping system is an analytical tool that uses point weather station observation data, a digital elevation model, and other spatial data sets to generate gridded estimates of monthly, yearly, and event-based climatic parameters.

The winter storm analysis from the 2013 plan was kept for this Plan update. The CSPDC determined that the analysis and maps were still representative of the CSPDC region's snow and ice risk. In this analysis, a criterion of greater than 1 inch was selected for winter snowfall severity assessment because this depth will result in complete road coverage that can create extremely dangerous driving conditions and will require snow removal by the local community. This amount of snowfall in a 24-hour period can also lead to business closure and school delays or cancellation. Figure IV-10 shows the average number of days with snowfall greater than one inch for the Region.

Figure IV-10: CSPDC Average Number of Days with Snowfall > 1 inch



## **Ice Potential**

Another challenge with winter weather in Virginia and the Region is the amount of ice that often comes as part of winter weather. Snowfall and ice potential are generated based on the percentage difference between the total precipitation from November to April and the corresponding liquid equivalent snowfall depth. Since snowfall is in a frozen state, it does not accumulate on the surface the same way that liquid rainfall would. In order to account for this difference, there are characteristic snow/rain relationships that have been created. For example, a value of 1 would mean that all of the precipitation at the location falls as liquid rainfall, and a value of 0.5 would mean that half of the precipitation falls as liquid rainfall and half falls as frozen precipitation. It is assumed that the lower the percentage, the greater potential that precipitation within these months is falling as snow. The values in the middle of the two extremes would represent regions that favor ice conditions over rain and snow. A five quantile distribution was applied to the output statewide grid to split the percentages into five characteristic climatological winter weather categories (snow, snow/ice, ice, rain/ice, and rain). This ice potential analysis was used in the last Plan to create a relative ice risk map. The CSPDC decided to continue using this map since it is the best known available data for the Region's ice potential. See Figure IV-12 for relative ice risk map.

## **Vulnerability Analysis**

Figures IV-11 and IV-12 show relative risk or vulnerability based on the previous analysis. These were developed by assigning a high risk to those census blocks within the regions with the greatest potential for snowy days ( $> 1$  in of snow) or ice. Division into high, medium and low were based on the levels predicted from potential maps. Future revision of this Plan will need to develop a method to calculate the potential loss from these winter storms.

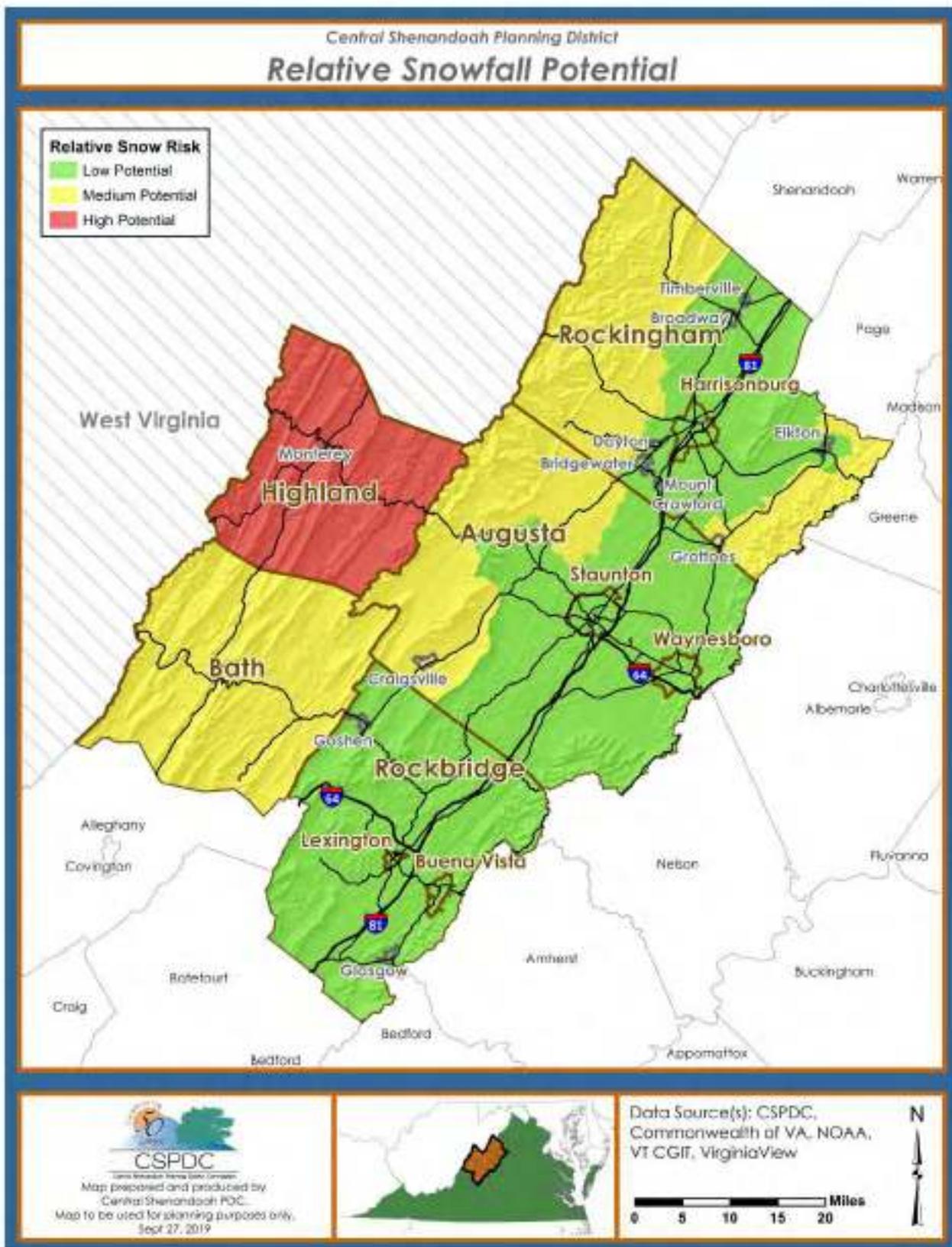
Relative snowfall risk (Figure IV-11) illustrates Highland County and the Town of Monterey with the highest relative potential for snow, followed by a band of medium snow potential in the counties of Rockingham, Augusta and Bath and in the Town of Craigsville. The southeast portion of the Region has a relatively low potential for snow, with the exception being the eastern portion of Rockingham County and the Town of Grottoes.

Relative ice risk (Figure IV-12) characterizes the Region as low and medium potential for receiving ice as the dominant type of winter weather. Areas with medium potential for ice are clustered around Rockbridge and Augusta Counties, including the cities of Lexington, Waynesboro and Buena Vista and the towns of Goshen and Glasgow.

To view maps of relative ice and snowfall risk overlaid with the region's critical facilities, please see Appendix D.

Figure IV-13 is from the 2018 Commonwealth of Virginia, Hazard Mitigation Plan and is a map of winter weather event occurrences from 1950 to 2016 for the State. Five out of the 11 CSPDC localities are in the highest range of occurrences: Augusta, Rockingham and Highland Counties, and the Cities of Staunton, Waynesboro and Harrisonburg.

Figure IV-14 is from the National Oceanic and Atmospheric Administration (NOAA) and displays data for 3-Day snowfall extremes from 1914 to June 2018 in inches. According to this map, Rockingham County is more vulnerable to heavy 3-day snowfalls compared to the rest of the localities in the CSPDC Region.

**Figure IV-11: Central Shenandoah PDC Snowfall Relative Risk**

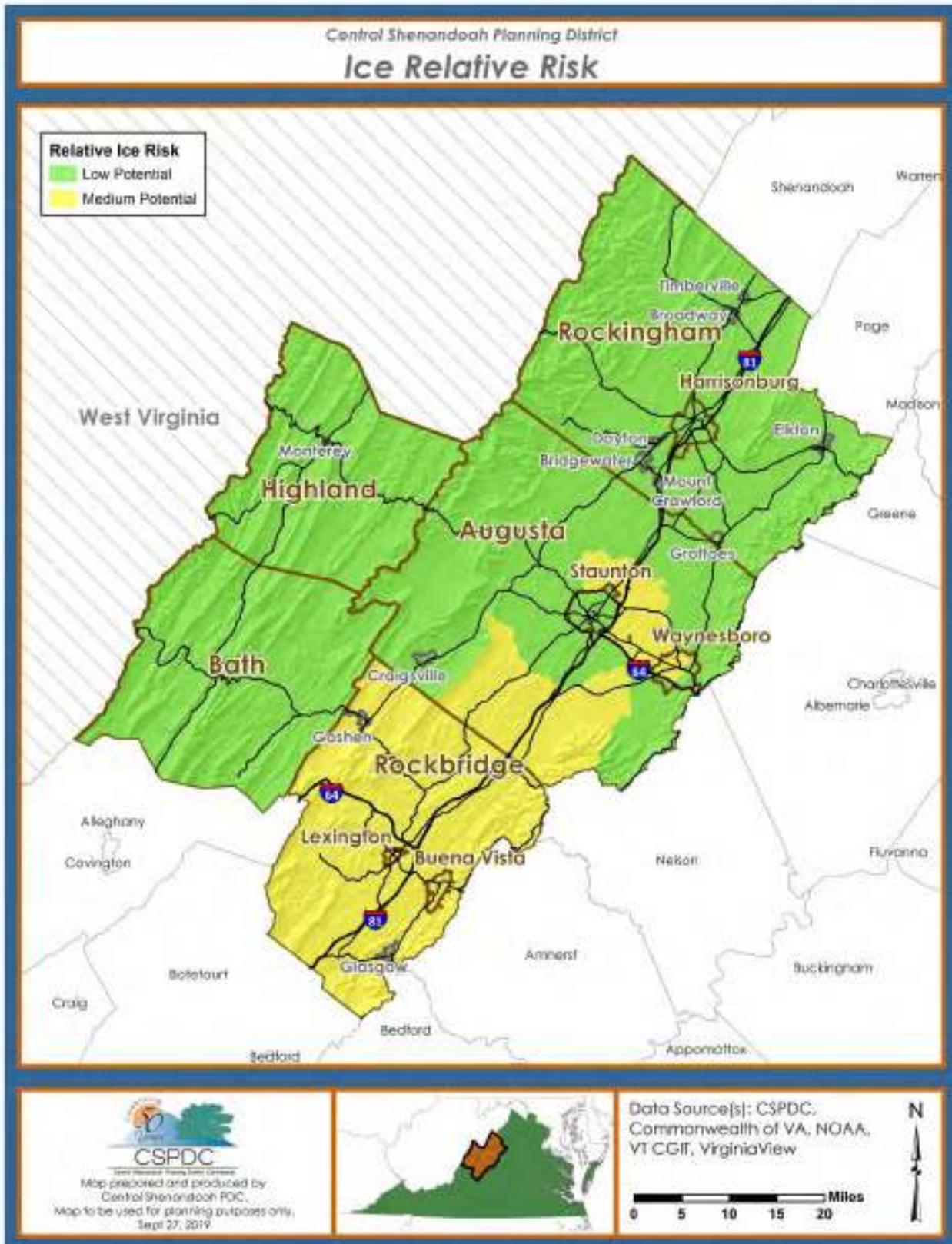
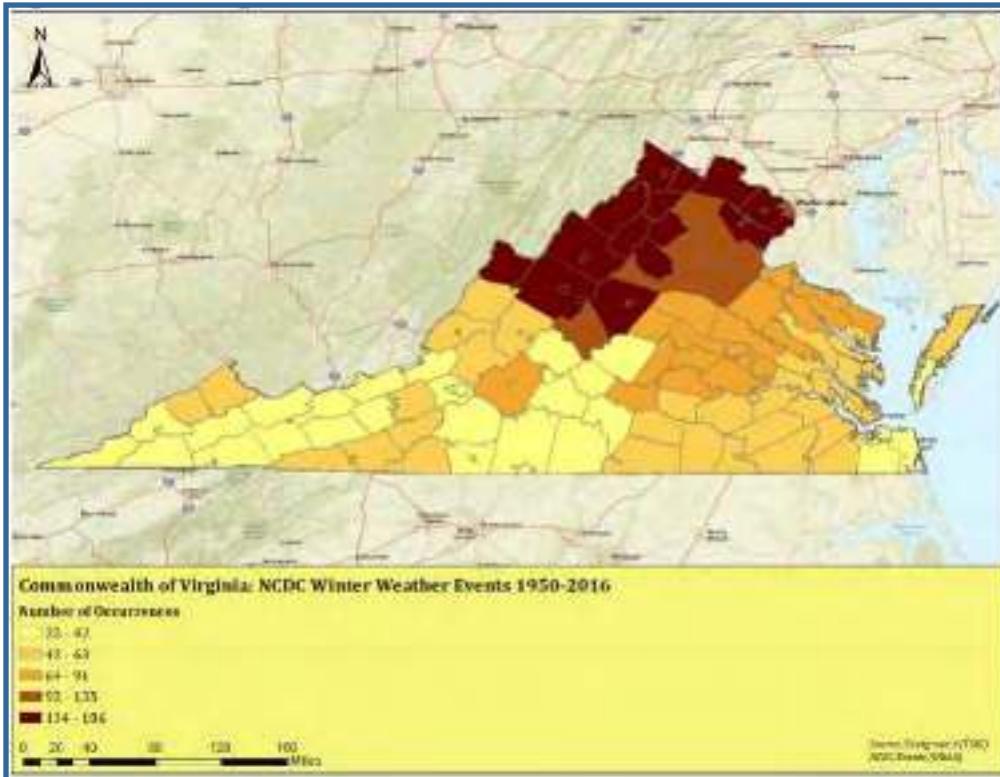
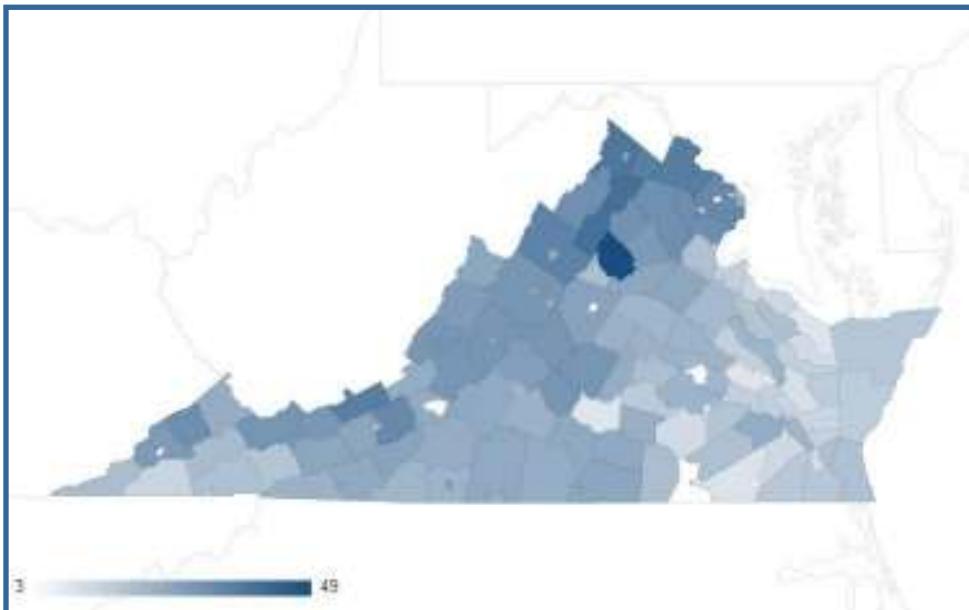
**Figure IV-12: Central Shenandoah PDC Relative Ice Risk**

Figure IV-13: NCDC Winter Weather Events 1950-2016



Source: Commonwealth of Virginia, Hazard Mitigation Plan, 2018

Figure IV-14: NDCC and NOAA 3-Day Snowfall Extremes (1914 -June 2018) in Inches



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## 7. Land Subsidence/Karst (Medium Ranking)

### Hazard History

There is no existing long-term record of sinkholes for our region or for Virginia because sinkholes caused by karst are very site-specific and often occur in undeveloped areas. A number of sinkholes over the years have opened up on Interstate 81 which runs through the Region. Documented occurrences of sinkholes are included in Table IV-21.

Thirty-two sinkholes were reported after 7" of rain fell in April 2000 after a long dry spell.

**Table IV-21: Central Shenandoah PDC Karst and Land Subsidence History**

Date	Damages
8/11/1910—The Big Cave-In	<b>Staunton:</b> Three sinkholes opened up on Lewis and Baldwin Street and Central Avenue that were 60 feet deep. The sinkholes impacted homes, a fire station and a school. One worker was killed when he fell into one of the chasms caused by the sinkhole as it was being repaired.
4/16/1961 - 8/4/1961 2/1962 - 4/1962 3/2/1963 – 3/22/1963 11/21/1972 4/2/1982 4/12/1983	<b>Timberville:</b> Incidences of sinkholes opening up in the Town.
April 2000	Thirty-two sinkholes were reported after 7" of rain fell in April after a long dry spell.
3/1/2001	<b>Augusta County:</b> Interstate 81 was closed for a nine-mile stretch due to the sudden appearance of three sinkholes. The largest sinkhole measured 20 feet long, 11 feet wide and 22 feet deep, costing over \$145,000 (2019 dollars) to repair.
10/28/2001	<b>Staunton:</b> A 45-feet deep sinkhole opened up at the corner of Lewis Street and Baldwin Street in Downtown Staunton, damaging three vehicles.
10/7/2005	<b>Timberville:</b> A sinkhole opened up in the Town.

In June 2017, A sinkhole opened up on Interstate 81 near Greenville closing the right lane of southbound I-81

**Table IV-21: Central Shenandoah PDC Karst and Land Subsidence Hazard Histories—continued**

Date	Damages
9/30/2015	<b>Augusta County:</b> A sinkhole opened up on a Dominion Virginia Power electric transmission line easement near Breezy Knoll Lane and Warren Oaks Lane. The sinkhole exposed telephone, cable and high voltage electric lines on the underground easement.
1/26/2016	<b>Staunton:</b> Following a snowstorm with 18 inches of snow in Staunton, fluctuating temperatures caused 9 water main breaks. Three occurred on Skymont Road, leaving several homes without water. During the same period, a sinkhole opened up on Skymont Road swallowing a car and condemning a house.
6/5/2016	<b>Augusta County:</b> A sinkhole opened up on Broad Run Road (Route 774) in Mount Sidney.
6/23/2017	<b>Augusta County:</b> A sinkhole opened up on Interstate 81 near Greenville closing the right lane of southbound I-81. The closure caused traffic backups of 10 miles on the interstate, and traffic congestion on Route 11.
9/27/2018	<b>Augusta County:</b> A sinkhole opened up on Hundley Mill Road in Staunton measuring about three feet wide, six feet long and fifteen feet deep. A 700-pound cow fell into the sinkhole. After attempts to rescue the cow alive by County authorities, a veterinarian and a backhoe operator were unsuccessful, the animal had to be euthanized.



**Photo IV-1 and IV-2: The Big Cave-In Occurred in Staunton in August 1910, when three large sinkholes opened up, along Baldwin Avenue and Central Avenue.**

## Hazard Profile

Land subsidence is caused by the gradual settling or sudden sinking of the ground due to subsurface movement. It commonly occurs in areas with karst terrain, which is a type of topography formed by dissolution of soluble rock such as limestone and dolomite. The soluble rock dissolves when acidic water percolates through the soil. Karst terrain is characterized by the presence of sinkholes, caves, springs, sinking streams and solution valleys.

Land  
subsidence is  
caused by the  
gradual settling  
or sudden  
sinking of the  
ground.

Sinkholes are natural depressions of the land surface that are bowl-shaped, funnel-shaped or vertical sided. Sinkholes are formed when the land surface sinks or collapses because the soluble rock underneath dissolves. Sinkholes are a natural geological process but can be impacted by human activities that can cause issues with subsidence, flooding and pollution.

Sinkholes are a  
natural  
geological  
process, but  
can be  
impacted by  
human  
activities.

Human activities that impact the hydrology, such as groundwater pumping, mining, and leaking water from sewer and stormwater pipes, can accelerate the natural processes of land subsidence. Sinkhole flooding can be caused by natural conditions or man-made conditions. Increased surface runoff can result in sedimentation blocking the natural drain, resulting in ponding or flooding.

Groundwater contamination from pollution is a significant concern in areas with karst terrain. As water percolates through the underlying rock, contaminants can be transferred into the groundwater polluting water supplies. Examples of contaminants include chemical based products such as petroleum, herbicides, solvents and fertilizers; sewage from leaking septic systems or utilities; and household garbage. While it is prohibited by the Code of Virginia, the dumping of wastes, such as household garbage, agricultural waste, and dead livestock have occurred.

Land subsidence and sinkholes can result in damages to buildings and personal property, transportation infrastructure and utility infrastructure. Impacts to infrastructure can occur damaging roadways, bridges, railroads, storm drains, sanitary sewer, water lines, gas lines, power lines and telecommunications.

## Hazard Areas

In Virginia, the areas mostly impacted by sinkholes are in the Valley and Ridge physiographic province.

Transportation infrastructure within the Region has been impacted along the interstate corridors.

In Virginia, the areas that are mostly impacted by sinkholes are in the Valley and Ridge physiographic province. The Valley and Ridge province has long parallel ridges and valleys underlain by limestone and dolomite rock. The vast majority of the localities in the Region are located in the Valley and Ridge province. Very small portions of the Region including the eastern boundaries of Augusta, Rockbridge and Rockingham Counties, and the cities of Buena Vista and Lexington are located in the Blue Ridge province, which runs along the Blue Ridge Mountains.

Interstate 81 also runs through the Valley and Ridge province, from Washington County in the south to Frederick County in the north. In the region, Interstate 81 runs through Rockbridge County, Augusta County, the City of Staunton, Rockingham County and the City of Harrisonburg. Interstate 64 also runs through Rockbridge County, the City of Lexington, Augusta County, the City of Staunton and the City of Waynesboro. In the area from the City of Lexington to the City of Staunton, Interstate 64 runs concurrently along Interstate 81 in Rockbridge and Augusta Counties.

Due to the karst terrain, transportation infrastructure within the Region has been impacted along the interstate corridors. Past sinkholes have resulted in the closure of Interstate 81/Interstate 64, resulting in significant traffic backups and congestion along alternate routes in the Region along a major trucking corridor. The Virginia Department of Transportation maintains an emergency contract for sinkhole repair, and repair costs can range anywhere from tens of thousands of dollars to hundreds of thousands of dollars per sinkhole. The interstate systems in the Region also increase the vulnerability of groundwater contamination from the transportation of hazardous materials. If an accident occurs that leaks hazardous materials, the chemicals can remain in the groundwater for many years.

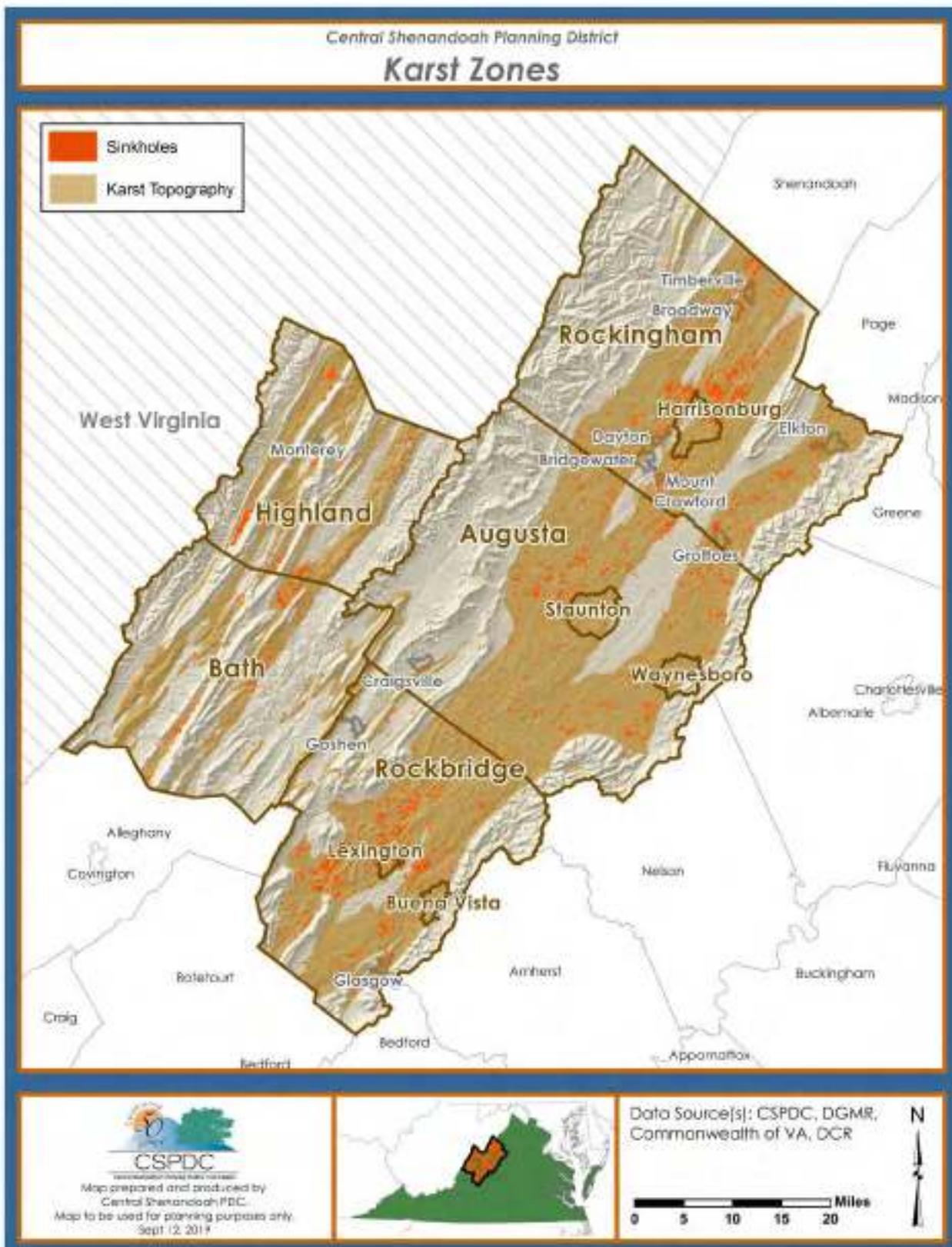
In the Region, private and public water supplies can be impacted by groundwater contamination due to the karst terrain. Karst aquifers are vulnerable to contamination, especially in populated areas. Contaminated groundwater can impact local governments, private citizens, businesses, agriculture, and industry. Rockingham County and Augusta County are the top two agricultural producing counties in Virginia. The Region is also home to industries that rely on the water supply to operate.

Figure IV-15 shows the locations in the Region that contain karst topography. Sinkholes identified by the Virginia Division of Geology and Mineral Resources are also shown. The sinkhole data is meant to provide a general guide to the presence of sinkholes in the Region, and does not reflect the presence of all sinkholes. These areas are broadly defined and mapped with a general understanding of karst hazard risks. A more detailed study would be required to determine the actual vulnerable structures at individual sites within these risk areas.

As seen in Figure IV - 15, karst topography is more prevalent in the lower valley regions and the probability of sinkholes and land subsidence is higher in these areas; however, this map is generally a reference of karst geology and does not portray hazards associated with karst. Karst development is always changing, making it harder to predict the probability of hazardous events. Since karst topography is present throughout the region's urban areas, it can be assumed that risk of karst related events will be increased as there is more development around these urban areas. Many human induced sinkholes can be created by construction or changing the land's natural drainage and hydrology. Climate change is also a concern for increasing karst hazards in our region due to greater rainfalls and longer periods of saturated soil.

Karst aquifers are vulnerable to groundwater contamination, especially in populated areas.

Contaminated groundwater can impact local governments, private citizens, businesses, agriculture and industry.

**Figure IV-15: Central Shenandoah PDC Karst Zones**

## Vulnerability Analysis

Table IV-22 illustrates the number of critical facilities and structures in the mapped karst zones. The Cities of Lexington and Staunton have the largest amount of structures in the karst zone at around 99% of their total structures. Figure IV-15 also shows, generally, the distribution of karst-related sinkholes in the region. This sinkhole data was mapped by the Virginia Division of Geology and Mineral Resources (DGMR). Rockingham and Rockbridge counties have the highest amount of sinkholes in the CSPDC region according to this DGMR data.

**Table IV-22: CSPDC Structures and Critical Facilities Near Mapped Karst Zones**

Community	Structures in Karst Zones	Critical Facilities in Karst Zones
Augusta County	53,833	356
Bath County	1,385	22
Buena Vista City	2,540	40
Harrisonburg City	16,558	65
Highland County	979	17
Lexington City	2,302	53
Rockbridge County	10,260	104
Rockingham County	68,035	137
Staunton City	14,497	39
Waynesboro City	11,270	80
<b>Total</b>	<b>181,659</b>	<b>913</b>

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## 8. Wind (Tornado, Derecho, or Straight-Line Winds); (Medium Ranking)

### Hazard History

Throughout its history, the Region has experienced wind damage from tornadoes, straight-line winds and a derecho. For information on wind damage from hurricanes, refer to Section IV-5 on hurricanes. Wind events have caused fatalities, injuries, and property damage in the Region. Table IV-23 details major wind events in the Region.

**Table IV-23: Wind Hazard History**

Date	Location	Description and Damages
6/14/1834	Rockbridge County	A tornado had a damage path 18 miles long and 16 miles wide. Trees were flattened and windows broken. Hail was "hen egg" size, measuring 8 - 9 inches in diameter. Wind/hail most destructive to residents within their memory.
6/4/1911	Staunton, Augusta County (Possibly started in Mt. Solon area, blew southeast to Staunton where it zigzagged north and east. It also hit Greenville, Fishersville, and Verona. From Augusta County, it crossed into Nelson and Amherst Counties)	The tornado damage path was 30 miles long and 7 miles wide – shaped like an hour glass. Hail ranged in size from marbles to goose eggs. Damages included broken windows, roofs blown off, barns destroyed, water damage to houses, and impacts on crops and livestock. People were injured but there were no fatalities. Many people were caught outdoors on Sunday afternoon outings. The Staunton property loss was estimated between \$600,000 to \$1.3 million (2019 dollars). The county crop loss was \$27 million (2019 dollars). Turkeys/chickens killed at farms. Boy Scouts helped clean up damaged houses. Four carloads of glass were sold to replace broken windows in Staunton.
9/22/1921	Augusta County (1 mi. west of Mint Springs - moved to Barterbrook)	An F2 tornado had a damage path 5 miles long and 100 yards wide. The damage amounts are not known. No reports of fatalities. A mother and child were severely injured when their home was destroyed and scattered a ½ mile.

**Table IV-23: Wind Hazard History –continued**

Date	Location	Description and Damages
5/2/1929 “Virginia’s Deadliest Tornado Outbreak”	Bath County	<p>A storm swept across 12 states from Florida to Missouri to Virginia. More than 200 were injured and 40 killed in the United States. There were five tornadoes in Virginia that resulted in 22 people killed and over 150 injured. There were approximately \$7.5 million (2019 dollars) in damages. In the state, 4 schools were destroyed including one school at Rye Cove in Scott County where 12 children and 1 teacher were killed and 42 injured.</p> <p>A tornado occurred in the Cowpasture Valley in Bath County at an elevation of 1,500 feet. Ten people were injured but no one was killed. Roofs were blown off, barns destroyed and two schools were damaged. Students had already been released. Several homes and a church at Nimrod Hall were destroyed. Weather turned cold and snow fell after the storm.</p> <p>“In some places, where a house, a barn, a garage or other building stood, there is only a bare spot to indicate where a structure stood, not even a splinter of the building being left.” – Lexington News-Gazette 5/7/1929</p>
4/5/1952	Augusta County, Rockingham County	Two tornados occurred in the region. A tornado in Augusta County tracked 1 mile and had a damage path 150 yards wide. No fatalities and 2 people injured. In Rockingham County, a tornado had a damage path 4.9 miles long and 100 yards wide. No damage amounts are known.
4/28/1959	Highland County	An F1 tornado hit Highland County. The path is not known. Damage to property estimated at over \$22,000 (2019 dollars)
7/1/1959	Augusta County	An F1 tornado hit Augusta County. It tracked 11.3 miles with a damage path of 100 yards. No fatalities or injuries were reported. Damage to property was over \$220,000 (2019 dollars).
8/6/1960	Rockingham County	An F2 tornado occurred in Rockingham County where the damage path is unknown. There were no reported injuries. Damage amounts to property were over \$217,000 (2019 dollars)
11/29/1963	Augusta County	An F2 tornado hit Augusta County where the damage path was one mile long. The width is not known. There were no fatalities or injuries. A house under construction was leveled and the roof came off another house. Damage estimated at over \$420,000 (2019 dollars).
4/4/1974 “Super Outbreak”	Augusta County, Staunton, Bath County, Highland County	In Augusta County, an F2 tornado struck near Westview, and moved northeast to Weyers Cave. The damage path was 18 miles long and 200 yards wide. The tornado damaged over 90 barns, destroyed 2 homes, and damaged 4 homes, outbuildings and a school. The Verona area was hit hard and Fort Defiance High School lost part of the roof. Damages in Augusta County were \$13 million (2019 dollars). There was roof damage to Staunton City Hall. In Bath County, Bacova Junction and Millboro were affected. In Millboro, roofs were blown off, windows broken, and barns damaged. There was a possible touchdown in the Big Valley area of Highland County. These tornadoes were the last of the Super Outbreak which totaled 148 tornadoes over 2 days affecting 13 states. Most of the tornadoes were recorded in a 24 hour period. The average path length of the tornadoes was 18.7 miles. Six of the tornadoes during the Super Outbreak were F5s. 330 people died in the United States with two deaths in Virginia. Nineteen counties in Virginia were hit with thunderstorms or tornadoes.

**Table IV-23: Wind Hazard History –continued**

Date	Location	Description and Damages
6/5/1975	Augusta County, Rockbridge County	An F0 Tornado struck near Lyndhurst. The weak tornado tracked 0.2 miles with a damage path of 30 yards wide. It destroyed a small building and 25-30 trees. Damage estimated at over \$9,000 (2019 dollars). No deaths or injuries were reported. A tornado struck near Collierstown damaging trees and fences. Damage was estimated at over \$4,000 (2019 dollars).
8/15/1975	Rockingham County	An F1 tornado struck the Melrose area which is 6 miles northwest of Harrisonburg. The damage path was 1 mile long and 27 yards wide. No injuries were reported. The tornado overturned a trailer, ripped off a roof, and carried away outbuildings. Damages were over \$119,000 (2019 dollars)
10/2/1979	Town of Dayton	An F1 tornado had a damage path 1.1 miles long and 37 yards wide. No injuries were reported. It snapped off tree tops and utility poles, and broke windows. The storm flipped an unoccupied trailer. Damages were over \$88,000 (2019 dollars).
5/4/1990	Augusta County	An F2 tornado had a damage track 7 miles long and 27 yards wide. It hit Augusta Springs and Swoope. The tornado tracked a mile through the community of Augusta Springs. It lifted 2,500 feet over mountains and set back down again on other side. 2 people were killed in a mobile home in Swoope. Three people were injured in Swoope and 7 were injured in Augusta Springs. Damages were \$4.9 million (2019 dollars). The tornado formed in a thunderstorm along a warm front well out ahead of the expected threat area.
6/10/1995	Waynesboro, Augusta County	A strong F2 touched down on the west side of Waynesboro. It tracked 3.5 miles through the County and southwest portion of the City, and had an average damage path of 300 yards wide. No deaths or injuries were reported. It hit an industrial area, peeling off roofs and damaging 15-20 homes. The tornado flipped a 22.5 ton crane and mowed down over 100 pine trees in a park. Quarter sized hail accompanied the storm. Damages were \$3.3 million (2019 dollars).
6/24/1996	Town of Broadway	An F1 tornado had a damage path that was 0.5 miles long and 100 yards wide. No injuries were reported. The tornado tore roofs off 2 homes and 2 poultry houses, and damaged trees. Several chimneys were blown off homes. Damage estimates were over \$65,000 (2019 dollars).
7/11/1999	Harrisonburg, Rockingham County	An F0 tornado had a damage path that was 0.1 mile long and 15 yards wide. No injuries were reported. The storm damaged a store's tin roof and singles on a home. Damages were estimated at more than \$3,000 (2019 dollars).

**Table IV-23: Wind Hazard History –continued**

Date	Location	Description and Damages
7/31/1999	Augusta County	An F1 tornado struck 5 miles east of Staunton. The damage path was 0.1 mile long and 100 yards wide. It destroyed a barn, damaged a greenhouse, and took down trees. No injuries were reported. The storm produced 3/4 inch diameter hail. A 100 pound beam from a barn roof was buried in the ground and the roof rolled into a ball by the force of the wind. Damage estimates were over \$23,000 (2019 dollars).
5/9/2003	Augusta County	An F0 tornado touched down in Verona, then moved southeast to Hermitage. The tornado downed a 195-foot radio tower. The path of the tornado was 5 miles long and 100 yards wide. The storm also downed trees in New Hope and produced hail near Mt. Solon.
6/23/2006-7/6/2006	Augusta County	Severe storms and tornadoes resulted in flooding in Augusta County.
2/10/2008	Augusta County	High wind resulted in significant damage to trees, utility lines and utility poles in Augusta County.
8/2/2008	Town of Elkton, Rockingham County	An EF0 tornado touched down on the banks of the South Fork of the Shenandoah River along Park Avenue. The tornado's path was 1/4 mile long and 70 yards wide. This series of strong thunderstorms also produced large hail. Witnesses spotted swirling wind and a funnel cloud. Hail and damaging winds also occurred in other parts of Rockingham County downing trees.
4/16/2011	Augusta County, Bath County, Highland County, Lexington, Rockbridge County, Town of Glasgow	An EF1 tornado reached wind speeds in excess of 95 mph traveling 4.1 miles in Augusta County. The tornado damaged 37 structures and downed numerous trees and powerlines. Preliminary damage estimates from Augusta County listed storm damage to 12 residences, 3 businesses, 15 outbuildings, 2 mobile structures and 5 barns. Preliminary damage cost is estimated at over 2.5 million dollars (2019 dollars). An EF0 tornado touched down near Vesuvius in Rockbridge County causing minor damage to a barn and a house, and slightly moving another barn off its foundation. The twister left a path about 100 yards wide and 1.3 miles in length. Wind speeds were estimated at 80 mph. Rockbridge also experienced 3.5 inches of rain and reports of quarter size hail. Numerous trees were reported downed in Lexington and countywide in Rockbridge. In Glasgow, the Maury River reached near flood stage at 18 feet. As many as 33 roads were closed due to high waters and fallen trees, the worst being Rt. 631, Furrs Mill Road. A swift water rescue was required to retrieve two women and two small children stranded in a van. 350 Dominion Power customers lost power. In Bath County, downtown Hot Springs flooded. Flooding, mud and rock slides also occurred in other areas of Bath County damaging roads, driveways, homes and the Warm Springs Pools at the Homestead. Highland County experienced power outages, downed trees and flooded roadways. Highland County Supervisors declared the County a disaster area.

**Table IV-23: Wind Hazard History –continued**

Date	Location	Description and Damages
4/28/2011	Augusta County, Bath County, Rockbridge County, Rockingham County	Four tornadoes touched down in Augusta County and Rockingham County. The strongest was an EF-2 that started in Fulks Run and traveled 33.2 miles into Shenandoah County, damaging homes and farm buildings; downing trees and causing 2 injuries. An EF-1 tornado occurred in Churchville in Augusta County, and traveled for 4 miles damaging homes, downing trees and destroying outbuildings. Two EF-1 tornadoes occurred in Rockingham. A tornado in Keezletown was on the ground for 2.7 miles causing tree damage and damage to two homes, farm buildings and an outbuilding. A tornado in Linville traveled for 0.9 miles causing tree damage. Other reported storm damage from the Region included reports of downed trees in Bath County, Rockbridge County, Augusta County and Rockingham County. A tree fell on a trailer in the Colen Hollow area of Rockbridge and damage was reported to houses in Rockingham. The storm brought heavy rains and flooding in Bath County. It caused downed trees and powerlines, washed debris in the road and damaged roads in Burnsville and Williamsville. Rt. 614 Muddy Run Road in front of the Burnsville Volunteer Fire Department and Rescue Squad was washed out. Flooding damaged a home in Williamsville.
6/29/2012	Entire Region	Severe storms and straight-line winds from a derecho impacted the entire Central Shenandoah Region bringing high winds, excessive rain, hail and lightning. In the days afterwards, it was followed by excessive heat. The derecho traveled over 600 miles in about 10 hours. Peak wind gusts were 80-100 mph. In the Valley, a quarter million people lost power. The storm damaged homes, businesses, trees and powerlines. Nine localities were included in a federal major disaster declaration (DR-4072) including Augusta County, Bath County, Buena Vista, Harrisonburg, Highland County, Lexington, Rockbridge County, and Staunton. Three localities- Augusta County, Rockbridge County and Rockingham County- were included in a federal agricultural disaster declaration (S3418).
5/14/2018	Augusta County, Rockbridge County, Rockingham County, Staunton and Waynesboro.	A series of severe thunderstorms with high winds, heavy rain and hail caused flash flooding in the central Shenandoah Valley, resulting in downed trees and power outages. Several homes or businesses in the Region were damaged. In Verona, a family was displaced when flooding caused their basement wall to collapse leading to the condemnation of their home. Homeowners insurance denied the claim since the property was not covered by flood insurance. Strong winds struck a local bank branch during business hours, damaging the building, while employees and customers took shelter in the bank vault. A tree fell damaging a home in Waynesboro. Hail was reported in Verona, and half dollar size hail was reported in Rockbridge County. Trees were reported downed in other areas of Augusta County, Rockingham County and the City of Staunton. 21,000 Dominion Power customers were without power in the region.
10/31/2019	Rockingham County	An EF-0 tornado touched down at 6:04 p.m. on Halloween night in Rockingham County near Timberville. It had a maximum wind speed of 75 mph and a damage path of 0.5 miles long and 25 years wide. There were no injuries and no fatalities. The tornado was produced by a segment of thunderstorms and damaged corn crops and a grove of trees. It destroyed a barn and a small shed. A piece of lumber from the barn impaled the windshield of a nearby vehicle. The path of the tornado ended shortly before it would have crossed several propane tanks at Southern States. Further west on VA-211, straight line winds caused scattered tree limb damage. Prior to the tornado hitting, the entire Region had been placed into a risk level 3 for severe weather with the timeframe of largest concern being during peak trick-or-treating hours. Many festivities in the region were rescheduled as a result.

## Hazard Profile

From 1991 to 2010, Virginia averaged 18 tornadoes per year.

Tornadoes are classified into six categories using the Enhanced Fujita Scale.

In the Region, damaging winds have typically been associated with tornadoes, hurricanes or straight-line winds. In 2012, the Region also experienced a derecho. For information on wind hazards from hurricanes, refer to Section IV-5 on hurricanes.

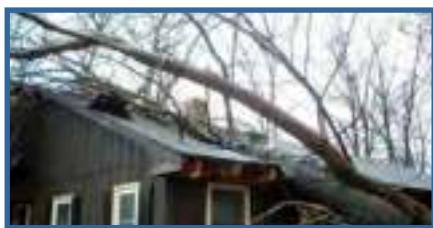
Tornadoes are classified as a violently rotating column of wind that extends between a thunderstorm cloud and the earth's surface. The rotating column of air often resembles a funnel shaped cloud. The widths of tornados are usually several yards across, with infrequent events being over a mile wide. Tornadoes can occur at any time throughout the year, but tornado activity normally spans from March through May with a peak in April. Tornadoes may be produced by thunderstorms, hurricanes or tropical storms. Those tornadoes produced by hurricanes or tropical storms are typically on the eastern half of the outer bands. From 1991 to 2010, Virginia averaged 18 tornadoes each year. The total number may be higher as incidents may occur over areas with sparse populations, or may not cause any property damage.

Tornadoes and their resultant damage can be classified into six categories using the Enhanced Fujita Scale, as shown in Table IV-24. The Enhanced Fujita Scale replaced the original Fujita Scale in 2007. The scale assesses damage in comparison to damage indicators and varying degrees of damage. This assessment is used to estimate wind speeds and assign the rating.

A majority of Virginia's tornadoes are EF-0 and E-F1 on the Fujita Scale/ Enhanced Fujita Scale, as shown in Table IV-24, which result in light or moderate damage. Table IV-23, the Wind Hazard History Chart for the Region has information on twenty-eight tornadoes documented since 1834. In reviewing Table IV-23, the Region has experienced ten F-1 or EF-1 tornadoes, seven F-2 or EF-2 tornadoes, six F-0 or EF-0 tornadoes, and six tornadoes whose rankings are not documented in the table. Figure IV-16 shows the location and intensity of tornado touchdowns in the Region since 1950.

Since tornadoes are less frequent for the Region, the Hurricane Wind analysis covers more probable high wind occurrences. It is also interesting to note that there are no recorded tornadoes in the national forests and parks. This is a result of tornadoes only being recorded when impacts affect people or property. Some areas in the Region appear to be slightly more prone to tornadoes than others. It is thought that this is caused by topographical influences on thunderstorms such as the change in low-level wind flow and humidity caused by the orientation of the mountains. One such area is near the cities of Staunton and Harrisonburg. It should be noted that areas with denser population are more likely to report a tornado than less populated areas.

While the tornadoes that have occurred in the Region do not compare to the numbers or strength of the tornadoes that have touched down in Tornado Alley in the Midwest, the tornadoes that have occurred in the Region have caused property damage, injuries and fatalities. The tornadoes that the Region does experience are most frequently spawned from thunderstorms and have little to no warning time. Tornadoes did affect the Region in three significant events-Virginia's Deadliest Tornado Outbreak in 1929, the Super Outbreak of 1974 and the 2011 Super Outbreak.

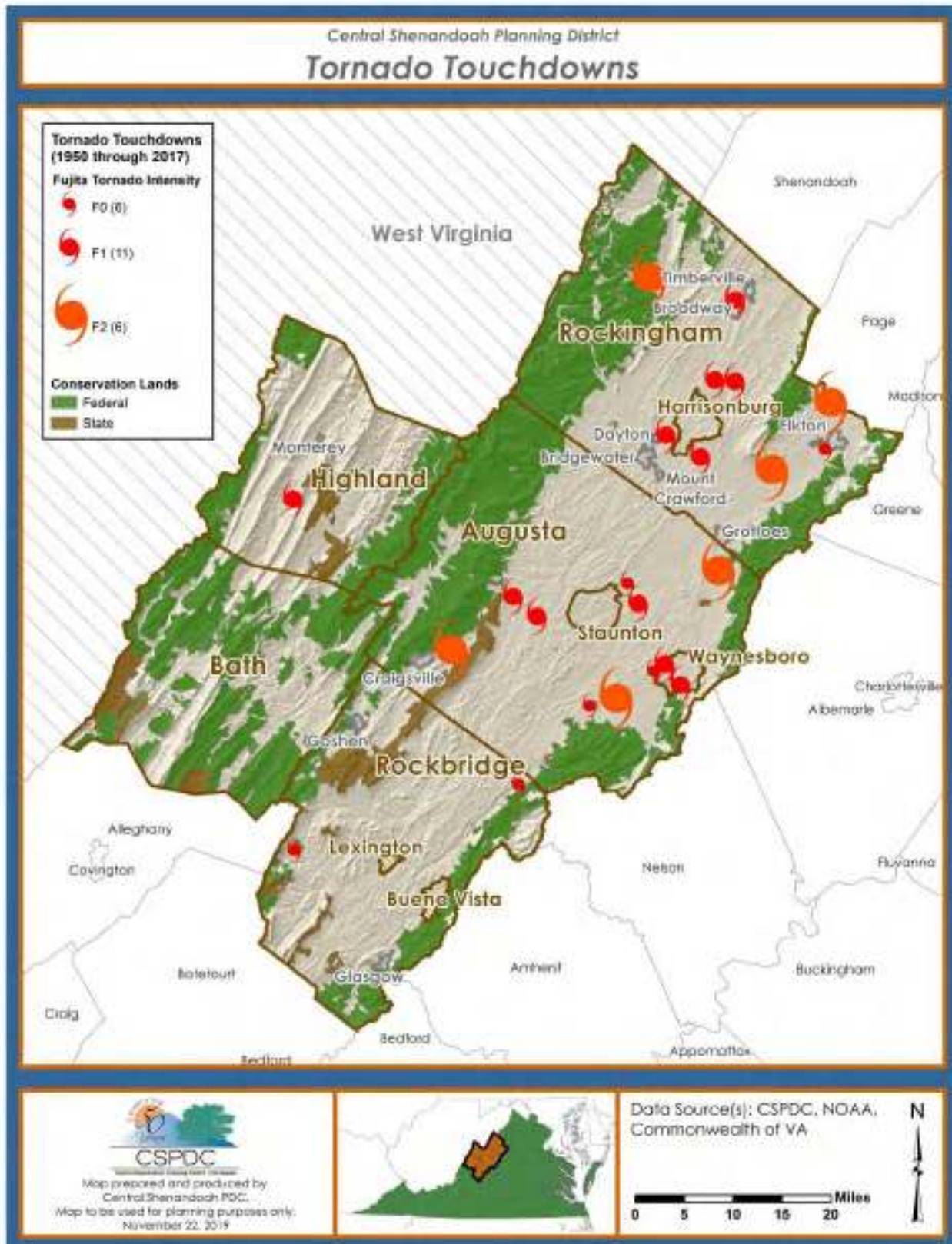


Photos IV: 3-5: Structural damages from the April 2011 Tornadoes in Rockbridge County and Augusta County.

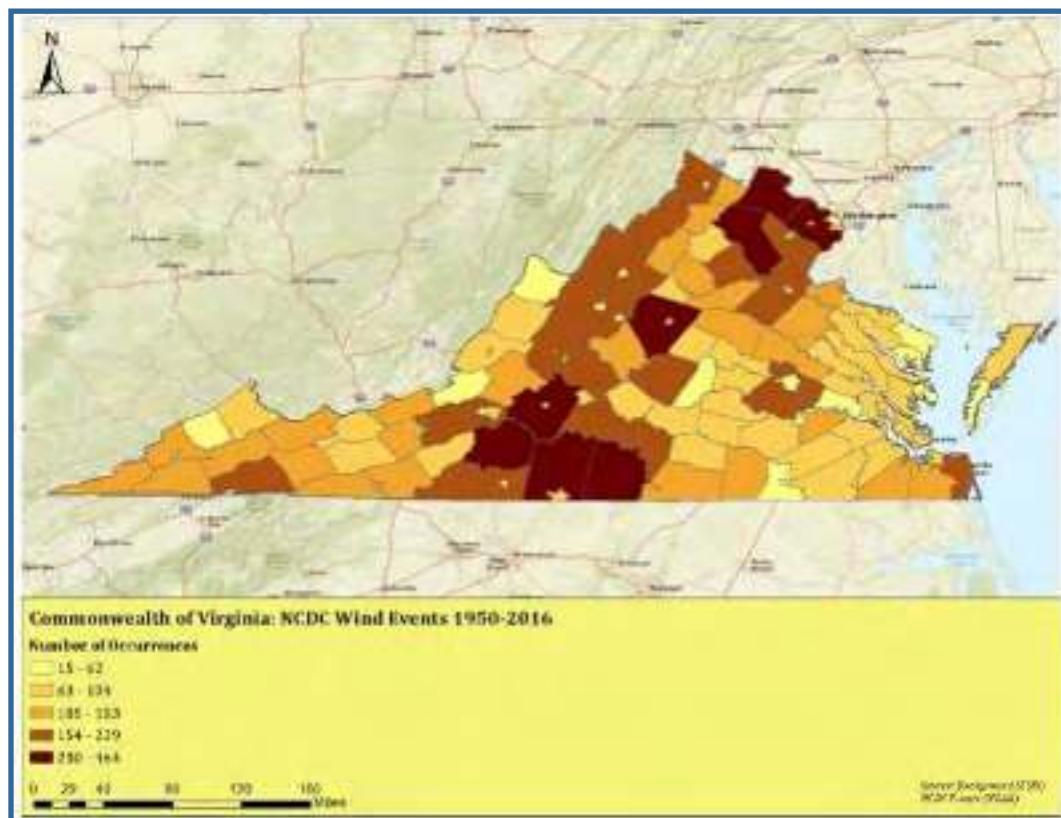
**Table IV-24: Enhanced Fujita Scale**

<b>EF Rating</b>	<b>3 Second Gust (MPH)</b>	<b>Damage Level</b>
EF-0	65 to 85	Light Damage
EF-1	86 to 110	Moderate Damage
EF-2	111 to 135	Considerable Damage
EF-3	136 to 165	Severe Damage
EF-4	166-200	Devastating Damage
EF-5	Over 200	Incredible Damage
<b>Damage Level</b>	<b>Description</b>	
Light Damage	Peels surface off some roofs; some damage to gutters or siding; branches broken off trees; shallow-rooted trees pushed over. Confirmed tornadoes with no reported damage ( i.e. those that remain in open fields) are supposed to be rated EF0 as a matter of policy; however, some NWS local offices have adopted an "EFU" (for "unknown") rating for such tornadoes.	
Moderate Damage	Roofs severely stripped; mobile homes overturned or badly damaged; loss of exterior doors; windows and other glass broken.	
Considerable Damage	Roofs torn off from well-constructed houses; foundations of frame homes shifted; mobile homes completely destroyed; large trees snapped or uprooted; light-object missiles generated; cars lifted off ground.	
Severe Damage	Entire stories of well-constructed houses destroyed; severe damage to large buildings such as shopping malls; trains overturned; trees debarked; heavy cars lifted off the ground and thrown; structures with weak foundations are badly damaged.	
Devastating Damage	Well-constructed and whole frame houses completely leveled; some frame homes may be swept away; cars and other large objects thrown and small missiles generated.	
Incredible Damage	Strong-framed, well-built houses leveled off foundations and swept away; steel-reinforced concrete structures are critically damaged; tall buildings collapse or have severe structural deformations; cars, trucks, and trains can be thrown approximately 1 mile.	

Source: National Weather Service; The Weather Channel; and Wikipedia.

**Figure IV-16: Central Shenandoah PDC Tornado Touchdowns**

**Figure IV-17: NCDC Significant Non-Rotational Wind Events in Virginia (1950 –2016)**



Source: Commonwealth of Virginia, 2018 Hazard Mitigation Plan

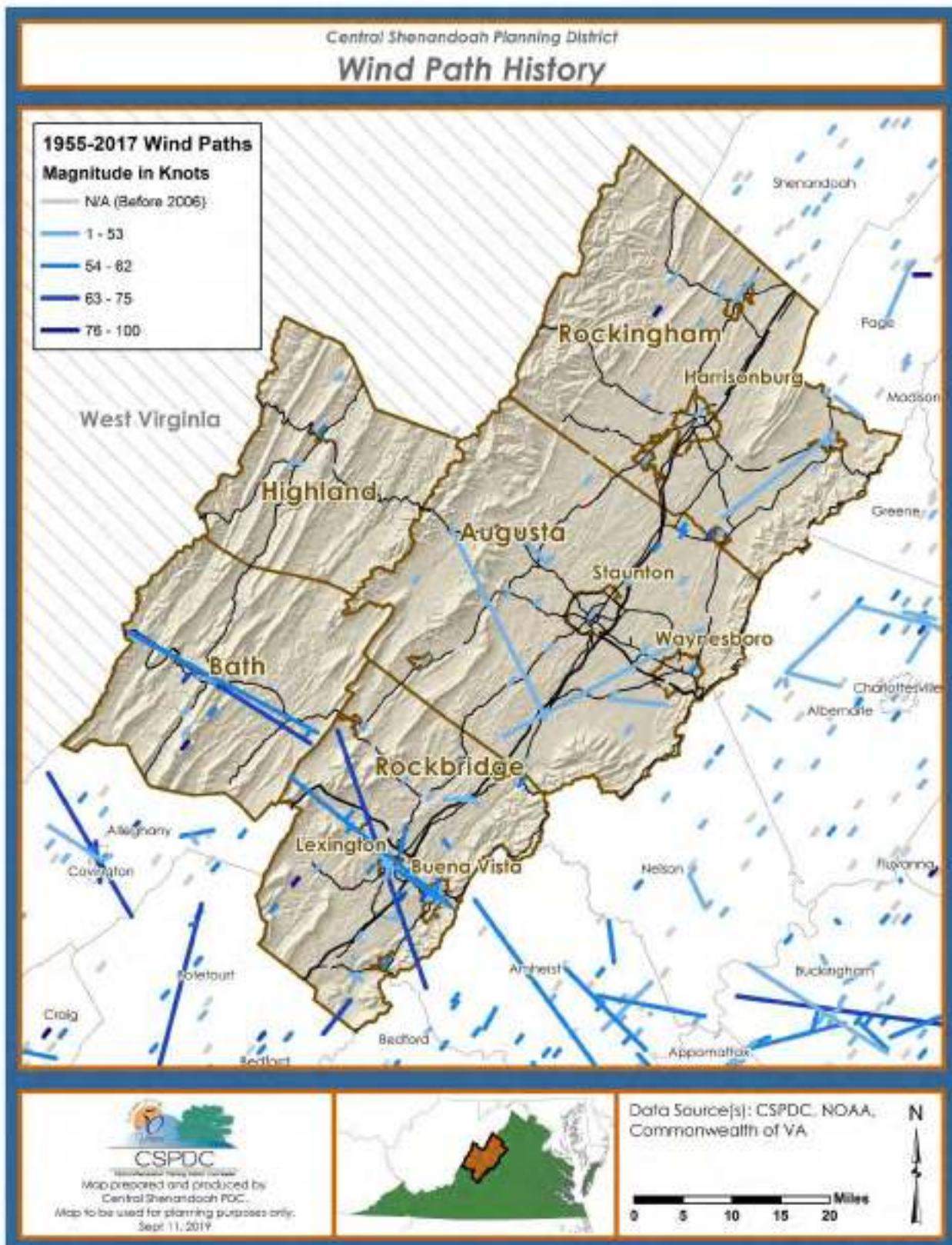
In addition to tornadoes, the Region has also experienced non-rotational wind events including isolated “downburst” or “straight-line” winds, as well as a derecho.

Straight-line winds are associated with thunderstorms and can cause extensive property damage. A more severe type of damage occurs from straight-line winds experienced during a derecho. A derecho is a wind storm that is widespread and long-lived. It is associated with rapidly moving thunderstorms that are in a curved shape, and called bow echoes. Wind speeds during a derecho do vary and are not constant. A storm may be classified as a derecho if the storm includes several wind gusts of 75 mph or greater, wind gusts of at least 58 mph along most of its length, and extends for more than 250 miles. During the storm, straight-line wind damage from downbursts, microbursts and burst swaths occurs, but the damage is similar to that produced by a tornado.

Derechos are more common from May through August during warm weather and intense heat waves. They can be hazardous causing injuries, fatalities and widespread property damage. Due to their rapid movement and short notice, those participating in outdoor activities, as well as those driving vehicles are more vulnerable and at risk. Examples of damages that can occur during a derecho storm include downed trees, utility poles and electrical lines; damaged or overturned vehicles and mobile homes; structural damages to buildings; and injuries or fatalities to people from flying debris. Widespread damage caused to utility poles and electrical lines can cause long-lasting power outages, while the area is also dealing with high temperatures.

While derechos are rare in our region, other occurrences of straight-line wind are more common. Figure IV-17 is from the Commonwealth of Virginia Hazard Mitigation Plan and shows the number of occurrences for wind events in the state using National Climatic Data Center (NCDC) data. According to this map, Rockingham, Augusta, and Rockbridge counties are in the 154 to 229 event range, which are the highest occurrences for the region. The wind events depicted are non-rotational, and do not include weather events such as tornados or hurricanes. Figure IV-18 is a map of wind path history from 1955 to 2017 with magnitudes for the Region using data from the NOAA. Strong wind paths can be seen in Bath and Rockbridge Counties between 76 to 100 knots.

The entire region's population and infrastructure are vulnerable to tornados, derechos and straight-line winds based on the historical occurrences and volatility. Previous tornado events appear to be more common in less mountainous landscapes in the region, especially in Augusta and Rockingham counties, although tornadoes have been known to occur in mountainous areas. However, historical occurrences of derechos and straight-line winds have impacted the entire region. Tornadoes and derechos may occur less frequently in the region but can have a high impact. The severity of damage will depend on the intensity of the wind event and the population density of the storm's path. With the climate changing, this could increase the number of thunderstorms and other wind events in the future.

**Figure IV-18: CSPDC Wind Path History**

## 9. Wildfire (Medium Ranking)

### Hazard History

The Virginia Department of Forestry (VDOF) website provided fire incidence data for fire years 1995-2001. The data provided by VDOF was summarized into the following tables.

From 1995 to 2001, there were 386 wildfires in the Region.

Table IV-25 provides information on the number of wildfires per county. Table IV-26 is a summary of the number of acres and total damages of wildfires in the Region. Note that the tables do not include data for Towns or Cities; this data was not available through VDOF. Table IV-27 illustrates the cause of fire, broken down by County. The data shows that 27% of fires were caused by debris, followed by 21% caused by incendiary devices and 21% caused under miscellaneous conditions.

See Table IV-28 for a list of wildfires that have occurred recently in the Region. This list includes the fires of Rocky Mountain, Goshen Pass and Tye River, which burned thousands of acres.

The Rocky Mountain Fire in 2016 was the second largest forest fire in the history of Shenandoah National Park.

**Table IV-25: Wildfire Statistics by Fire Year 1995-2001**

County	1995	1996	1997	1998	1999	2000	2001	Total
Augusta County	17	6	2	20	9	18	24	96
Bath County	5	2		4	6	3	6	26
Highland County	2	1	2	1	4	1	1	12
Rockbridge County	5	3	5	6	5	1	7	32
Rockingham County	36	20	17	18	40	13	76	220
<b>Total</b>	<b>65</b>	<b>32</b>	<b>26</b>	<b>49</b>	<b>64</b>	<b>36</b>	<b>114</b>	<b>386</b>

Source: Virginia Department of Forestry

Table IV-26: Wildfire Summary 1995 - 2001

Fire Year	1995		1996		1997		1998		1999		2000		2001			
	County	Total Acres	Total Damage	Total Acres	Total Damage	Total Acres	Total Damage	Total Acres	Total Damage	Total Acres	Total Damage	Total Acres	Total Damage	Total Acres	Total Damage	Damages Total
Augusta County	61.3	\$1,600	6.2	\$2,500	2.5	\$1,500	482.3	\$206,275	113.2	\$10,000	214.5	\$35,700	355.8	\$31,801	1235.8	\$289,376
Bath County	17	\$4,100	3	\$8,500	0	\$0	17.3	\$2,825	53	\$11,200	23	\$23,500	93	\$58,800	206.3	\$108,925
Highland County	29	\$1,700	2	\$500	2	\$500	35	\$7,000	35.3	\$4,000	0.3	\$0	5	\$500	108.6	\$14,200
Rockbridge County	4.9	\$405	0.3	\$20	481.1	\$6,360	4.6	\$170	100.3	\$5,150	2	\$1,900	31	\$112,950	624.2	\$126,955
Rockingham County	166.7	\$75,560	8.3	\$33,725	16.1	\$100	24.4	\$2,100	151.6	\$5,950	10	\$0	147	\$728,095	524.1	\$845,530
<b>Total</b>	<b>278.9</b>	<b>\$83,365</b>	<b>19.8</b>	<b>\$45,245</b>	<b>501.7</b>	<b>\$8,460</b>	<b>563.6</b>	<b>\$218,370</b>	<b>453.4</b>	<b>\$36,300</b>	<b>249.8</b>	<b>\$61,100</b>	<b>631.8</b>	<b>\$932,146</b>	<b>2699</b>	<b>\$1,384,986</b>

Source: Virginia Department of Forestry

**Table IV-27: Wildfire Causes 1995-2001**

<b>County</b>	<b>Lightning</b>	<b>Camp</b>	<b>Smoking</b>	<b>Debris</b>	<b>Incendiary</b>	<b>Equip. Use</b>	<b>R&amp;R</b>	<b>Child</b>	<b>Misc.</b>	<b>Total</b>
Augusta County	2	3	14	25	17	4	5	3	23	96
Bath County	2	4	1	6	2	5	0	1	5	26
Highland County	5	1	0	2	0	1	0	0	3	12
Rockbridge County	5	0	3	10	1	1	0	2	10	32
Rockingham County	4	4	11	61	61	26	1	12	40	220
<b>Total</b>	<b>18</b>	<b>12</b>	<b>29</b>	<b>104</b>	<b>81</b>	<b>37</b>	<b>6</b>	<b>18</b>	<b>81</b>	<b>386</b>

Source: Virginia Department of Forestry

**Table IV-28: Recent Wildfires in the Region**

<b>Name</b>	<b>Year</b>	<b>Locality</b>	<b>Description</b>
Rocky Mountain Fire (SNP)	2016	Rockingham County	This fire started on 4/16/2016 in Shenandoah National Park and burned 10,326 acres. It was the second largest forest fire in the history of Shenandoah National Park. On April 29 the fire was fully contained.
Goshen Pass Wildfire	2017	Rockbridge County	3,100 Acres were burned from this fire that started on 4/10/2017 in the Goshen area.
Tye River Fire	2018	Rockbridge County Augusta County	This fire was caused by a vehicle fire that quickly spread onto National Forest lands and nearby private lands. The fire was first reported on 5/3/2018 and burned approximately 2,057 acres.

Source: Virginia Department of Forestry

## Hazard Profile

A wildfire is an uncontrollable fire spread through vegetative fuels, exposing and possibly consuming structures. They often begin unnoticed and spread quickly and are usually signaled by dense smoke that fills the area for miles around. Naturally occurring and non-native species of grasses, brush, and trees fuel wildfires. Wildfire behavior is based on three primary factors:

1. Fuel - The type, and amount of fuel, as well as its burning qualities and level of moisture affect wildfire potential. The continuity of fuels, expressed in both horizontal and vertical components is also a factor.
2. Topography – The topography is important because it affects the movement of air, fueling the fire over the ground surface. The slope and shape of terrain can change the rate of speed at which the fire travels. In general terms, the steeper the slope of the land, the faster a fire can spread up the slope.
3. Weather – The weather affects the probability of wildfires and has a significant effect on its behavior. Temperature, humidity and wind affect the severity and duration of wildfires. Areas that have experienced prolonged droughts or are excessively dry are also at risk for wildfires.

People start more than four out of every five wildfires, usually due to debris burns, arson, or carelessness. Lightning strikes are the next leading cause of wildfires.

## Hazard Areas

Figure IV-19 shows the wildfire vulnerability map with data developed by the Virginia Department of Forestry (VDOF). In 2002 and 2003, VDOF examined which factors influence the occurrence and advancement of wildfires and how

these factors could be represented in a GIS model. VDOF determined that historical fire incidents, land cover (fuels surrogate), topographic characteristics, population density, and distance to roads were critical variables in a wildfire risk analysis. The resulting high, medium, and low risk category reflect the results of this analysis. The large percentage of high risk areas are in national forests and parks. These areas of concern are managed and monitored by the Virginia Department of Forestry.

## Vulnerability Analysis

Tables IV-29 and IV-30 illustrate the number of homes in woodland homes and communities, as designated by the Virginia Department of Forestry. In the Region, 71% of the woodland homes are considered to have high potential for a wildfire, while 63% of woodland communities in the planning area are considered at high risk for wildfire.

The CSPDC also used VDOF data to create the Wildland Fire Incident map seen in Figure IV-21. This data shows a high number of incidents in Augusta and Rockingham counties. There are a total of 522 incidents in the region.

71% of the woodland homes are considered to have high potential for a wildfire in the Region.

Approximately 14% of the Region's critical facilities are located in a high risk area for wildfires.

## Critical Facilities at Risk

Table IV-31 shows the percentages of critical facilities in fire risk zones. Approximately 14% of the Region's critical facilities are located in a high risk area. Figure IV-20 shows the locations of critical facilities in relation to fire risk zones.



Photos IV: 6-7: Goshen Pass Wildfire, April 2017 (Source: VDOF)

**Table IV-29: Woodland Communities Wildfire Risk**

County	Low Potential	Medium Potential	High Potential	Total	% High Risk
Augusta	0	21	19	40	48%
Bath	0	4	4	8	50%
Highland	N/A	N/A	N/A	N/A	N/A
Rockbridge	1	6	9	16	56%
Rockingham		1	25	26	96%
<b>Total</b>	<b>1</b>	<b>32</b>	<b>57</b>	<b>90</b>	<b>63%</b>

**Table IV-30: Woodland Homes Wildfire Risk**

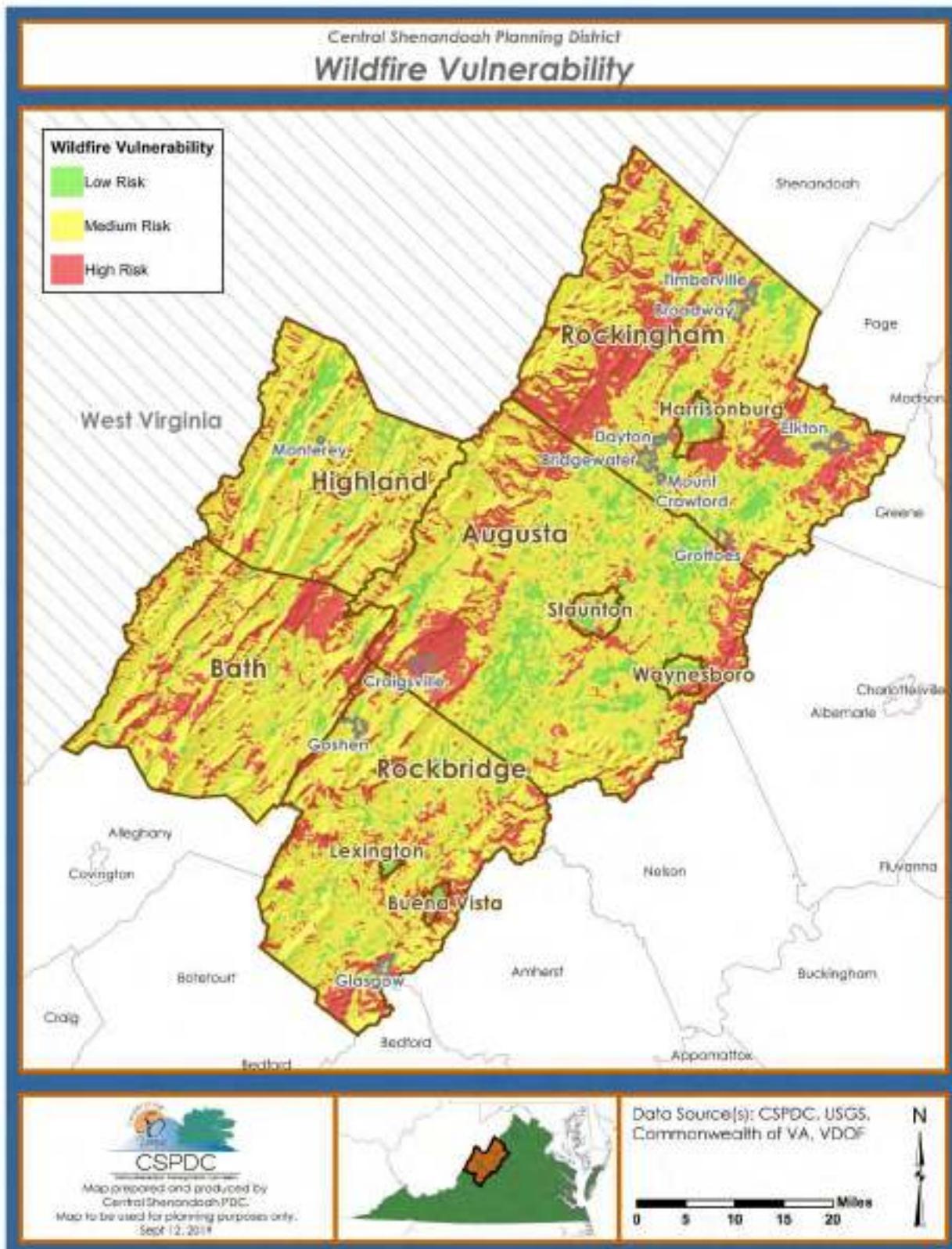
County	Low Potential	Medium Potential	High Potential	Total	% High Risk
Augusta	0	493	580	1,073	54%
Bath	0	120	65	185	35%
Highland	0	20	10	30	33%
Rockbridge	300	82	458	840	55%
Rockingham	0	25	1,523	1,548	98%
<b>Total</b>	<b>300</b>	<b>761</b>	<b>2,636</b>	<b>3,697</b>	<b>71%</b>

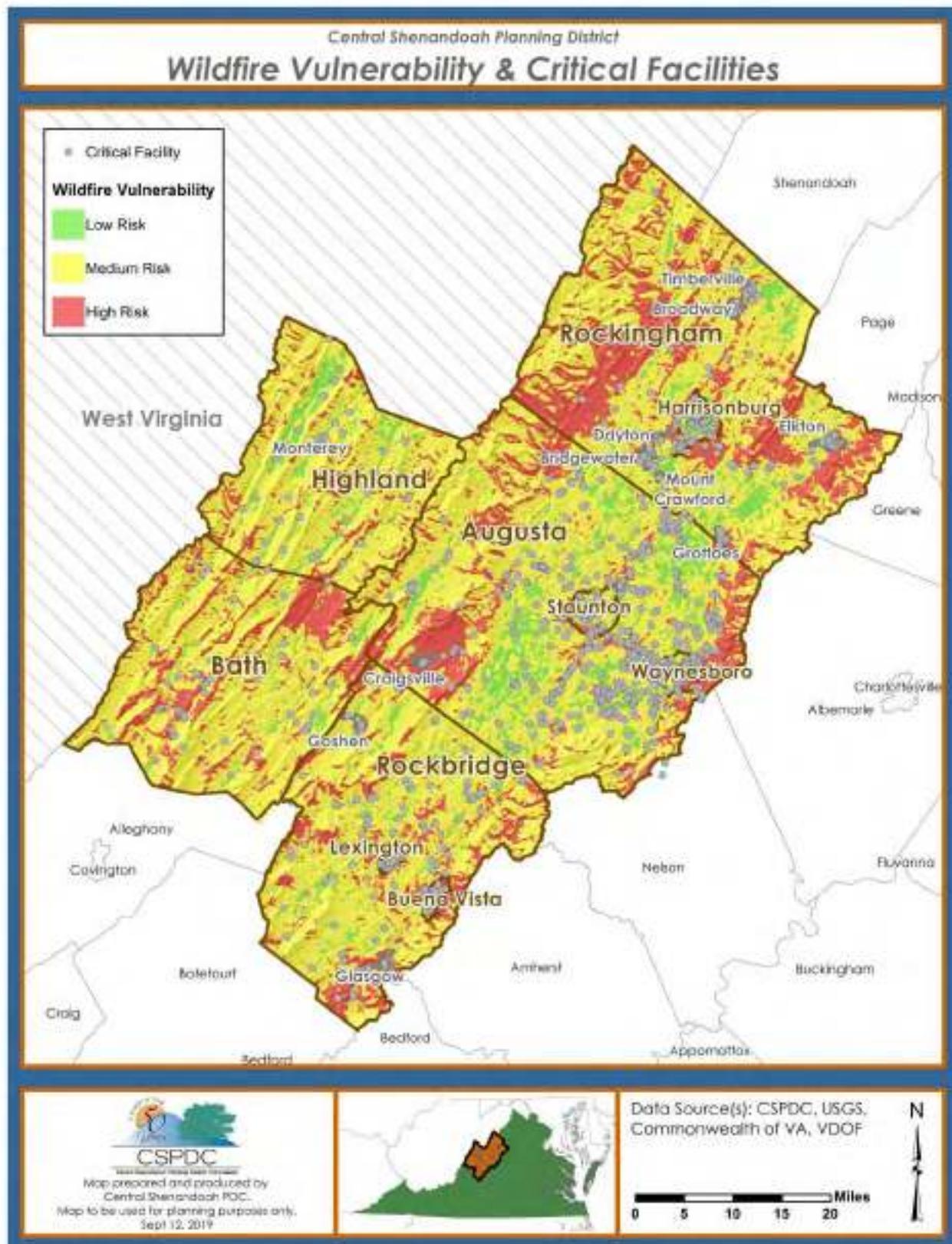


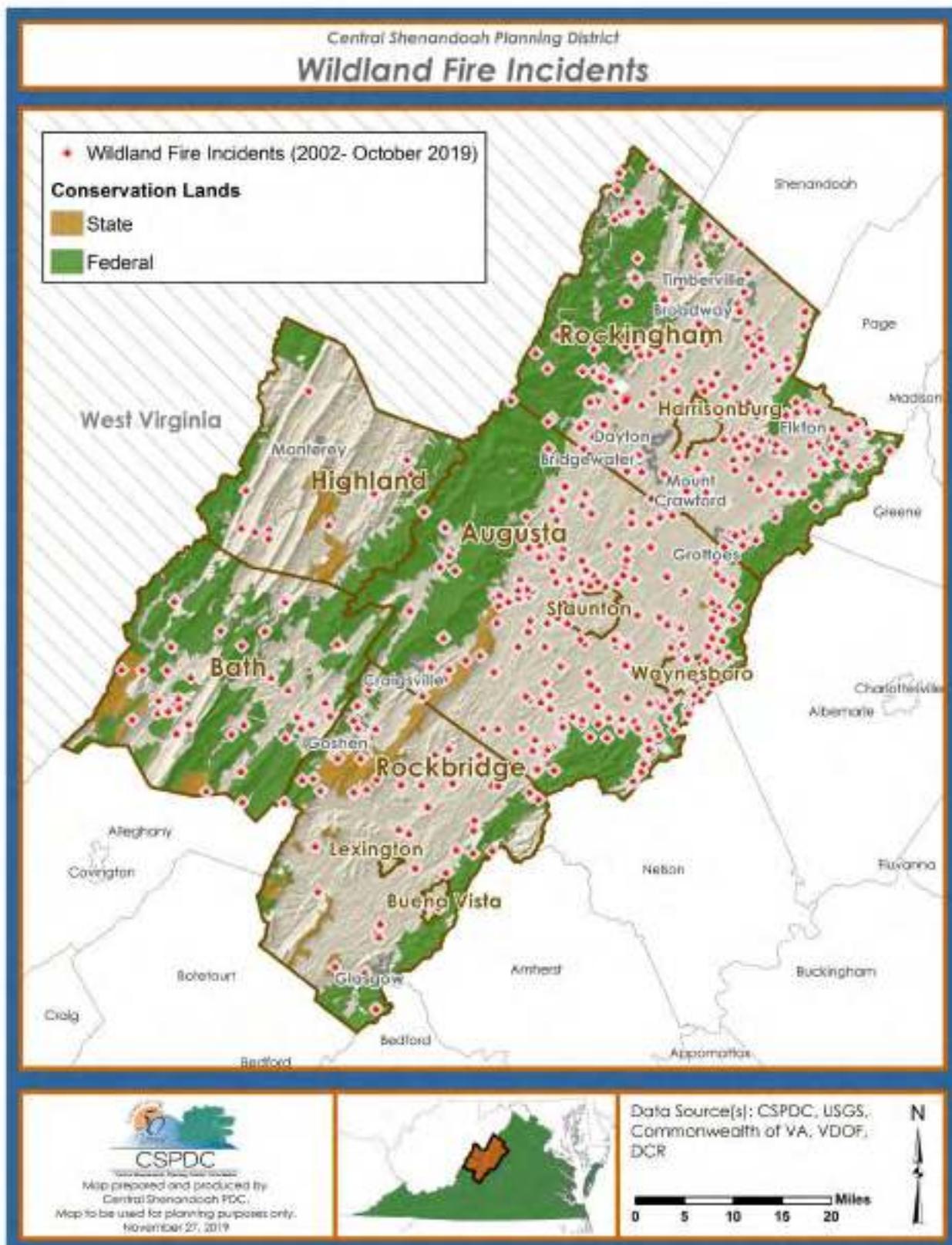
Photos IV: 8-9: Tye River Wildfire, May 2018 (Source: Sandra Berry)

**Table IV-31: CSPDC Critical Facilities Wildfire Vulnerability**

<b>County</b>	<b>Low Potential</b>	<b>Medium Potential</b>	<b>High Potential</b>	<b>Grand Total</b>	<b>% High Risk</b>
Augusta County	72	325	94	<b>491</b>	19%
Bath County	5	38	13	<b>56</b>	23%
Buena Vista City	35	4	2	<b>41</b>	5%
Harrisonburg City	45	19	8	<b>72</b>	11%
Highland County	13	22	3	<b>38</b>	8%
Lexington City	48	1	3	<b>52</b>	6%
Rockbridge County	11	96	14	<b>121</b>	12%
Rockingham County	57	78	18	<b>153</b>	12%
Staunton City	28	7	3	<b>38</b>	8%
Waynesboro City	70	17	4	<b>91</b>	4%
<b>Total</b>	<b>384</b>	<b>606</b>	<b>159</b>	<b>1,153</b>	14%

**Figure IV-19: Wildfire Vulnerability**

**Figure IV-20: Wildfire Vulnerability And Critical Facilities**

**Figure IV-21: Wildland Fire Incidents**

## Central Shenandoah Valley Community Wildfire Protection Plan

The CSPDC completed the 2020 Central Shenandoah Valley Community Wildfire Protection Plan. This Plan was created to provide a strategy for the community to decrease vulnerability to wildfires that may occur in the Region. The Plan consists of several components including hazardous fuels reduction and fire prevention, vulnerability mitigation, and effective response to incidents that occur. Please see Appendix H to view this Plan.



Photo IV: 10: Rocky Mountain Fire, April 2016 (Source: Bob Adamek)

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## 10. Landslide (Low Ranking)

### Hazard History

The best predictor of future landslides is past landslides in the same place. Figure IV-22 illustrates potential risk areas for the Region. Additionally, areas with steep slopes, poor drainage, and erosion have a greater probability of landslides. Developed hillsides and slopes denuded by wildfires can also lead to landslides. One area in our Region where rock slides are common is Interstate 64 at Afton Mountain, both in Nelson (outside the CSPDC region) and Augusta counties. Many thousands of dollars have been spent removing debris from the highway and installing barriers since the highway was constructed in the late 1960s. The worst landslide in and adjacent to our Region occurred as a result of Hurricane Camille in 1969, where catastrophic debris flows were responsible for the deaths of more than 150 people in the Virginia Blue Ridge. Table IV-32 provides an overview of the history of some of the landslides, mudslides and rockslides in the region. Additional events may have occurred but are not listed.

**Table IV-32: History of Landslides**

Date	Description and Damages
August 19, 1969	Hurricane Camille was a major storm that made landfall out of the Gulf as a category 5 and weakened to a tropical depression before reaching the state. Flooding and landslides, triggered by saturated soils, resulted in catastrophic damage. Augusta County, Bath County and Rockbridge County were included in a federal major disaster declaration (DR-274).
February 15- February 28, 2003	A severe winter storm brought snowfall, heavy rain, flooding and mudslides. Highland County was included in a federal major disaster declaration (DR-1458).
April 11- April 12, 2011	Heavy rains caused mud and rock slides in Bath County, downing trees and blocking roads. The Cowpasture River crossed Route 42, and flooding, rock slides and mud slides occurred in areas near Burnsville, Williamsville, Bacova, and Bolar. No homes were damaged, but several road washouts occurred. Flooding occurred in northern Augusta County.

**Table IV-32: History of Landslides - continued**

Date	Description and Damages
April 16, 2011	An EF1 tornado reached wind speeds in excess of 95 mph traveling 4.1 miles in Augusta County. The tornado damaged 37 structures and downed numerous trees and powerlines. Preliminary damage estimates from Augusta County listed storm damage to 12 residences, 3 businesses, 15 outbuildings, 2 mobile structures and 5 barns. Preliminary damage cost is estimated at over 2.5 million dollars (2019 dollars). An EF0 tornado touched down near Vesuvius in Rockbridge County causing minor damage to a barn and a house, and slightly moving another barn off its foundation. The twister left a path about 100 yards wide and 1.3 miles in length. Wind speeds were estimated at 80 mph. Rockbridge also experienced 3.5 inches of rain and reports of quarter size hail. Numerous trees were reported downed in Lexington and countywide in Rockbridge. In Glasgow, the Maury River reached near flood stage at 18 feet. As many as 33 roads were closed due to high waters and fallen trees, the worse being Rt. 631, Furr's Mill Road. A swift water rescue was required to retrieve two women and two small children stranded in a van. 350 Dominion Power customers lost power. In Bath County, downtown Hot Springs flooded. Flooding, mud and rockslides also occurred in other areas of Bath County damaging roads, driveways, homes and the Warm Springs Pools at the Homestead. Highland County experienced power outages, downed trees and flooded roadways. Highland County Supervisors declared the County a disaster area.
July 12, 2018	Augusta County, Highland County, and Rockingham County were included in an agricultural disaster designation (4378) for severe storms, flooding, landslides and mudslides.
June 29-June 30, 2019	Severe storms resulted in flooding, landslides and mudslides. Augusta County, Highland County, Rockingham County, Harrisonburg, Staunton and Waynesboro were included in an agricultural disaster designation (4455).

## Hazard Profile

A landslide is a downward movement of a slope and masses of rock, earth or debris materials under the force of gravity. Some move slowly causing gradual damage, while others move rapidly destroying property unexpectedly. They are activated by rainstorms, snowmelts, earthquakes, fires, volcanoes and by human modification to the land such as mining and construction. They are common all over the United States and cause up to 2 billion dollars in damages and from 25 to 50 deaths annually. Common types of landslides include rock slides, slumps, mudslides, debris flows, avalanches, and earth flows. Types of landslides vary depending on the amount of water and type of materials that they carry. Landslides usually affect infrastructure such as roads and bridges,

but they can also affect individual buildings and businesses, especially those located close to dangerous topographic features such as the top or bases of slopes or in valleys.

Landslides occur in every state and U.S. territory and are common throughout the Appalachian Region, particularly where there are steep slopes, clay-rich soils, periodic heavy rains and vegetation loss caused by wildfires. A debris flow event can be expected to occur somewhere in the southern Appalachian Mountains on the order of once every three years.

Several natural and human factors may contribute to or influence landslides. How these factors interrelate is important in understanding the hazard. The three principal natural factors are topography, geology, and precipitation. The principle human activities are cut-and-fill construction for highways, construction of buildings and railroads, and mining operations.

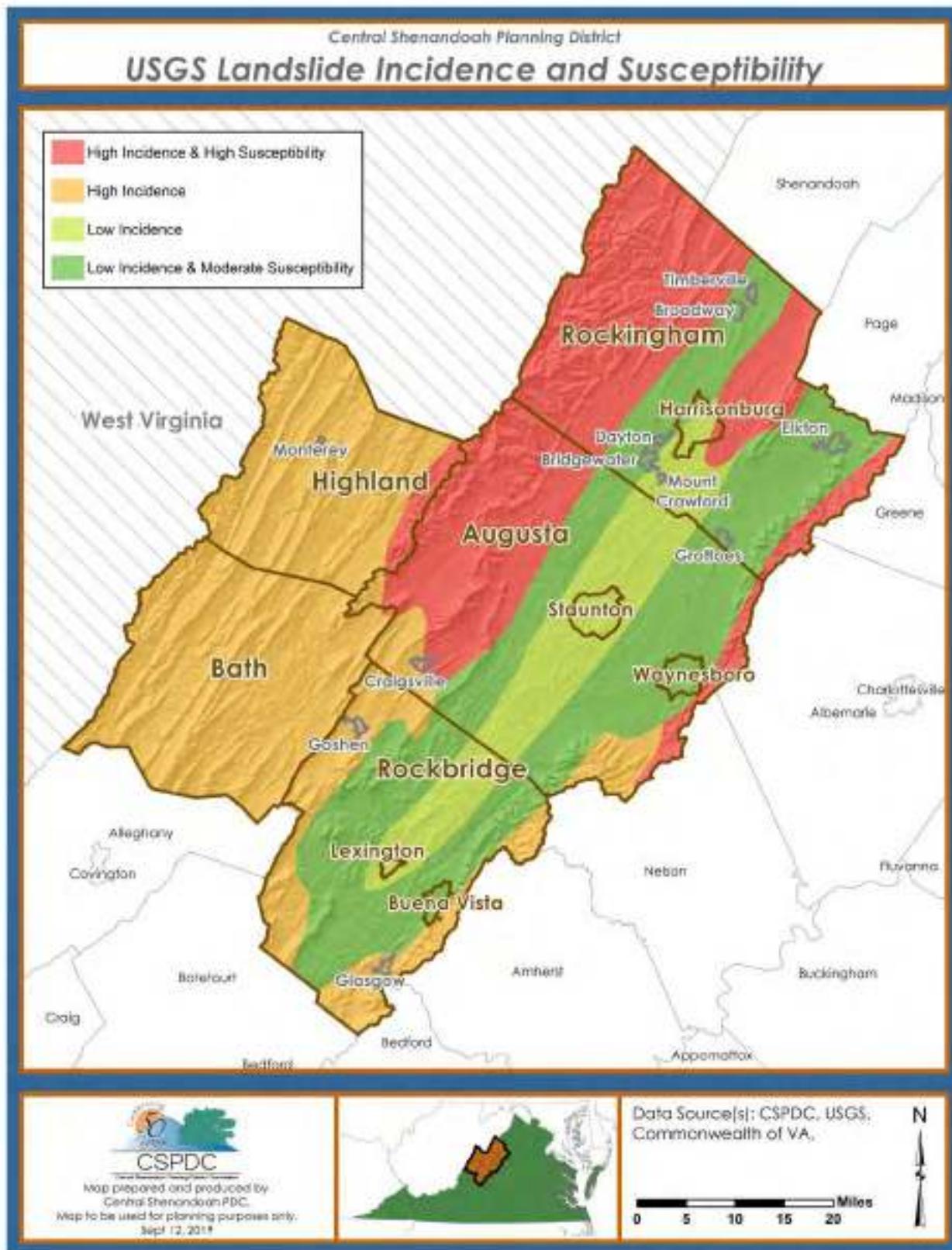
The USGS recognizes four major impacts caused by land subsidence:

- changes in elevation and slope of streams, canals, and drains;
- damage to bridges, roads, railroads, storm drains, sanitary sewers, canals, and levees;
- damage to private and public buildings;
- and failure of well casings from forces generated by compaction of fine-grained materials in aquifer systems.

Landslides can cause serious damage to highways, buildings, homes, and other structures that support a wide range of economies and activities. Landslides commonly coincide with other natural disasters. Expansion of urban development contributes to greater risk of damage by landslides.

## Hazard Areas

According to the landslide susceptibility and incidence map (Figure IV-22) Augusta and Rockingham Counties have the highest susceptibility and incidence risk in the region. The remaining areas are characterized as areas of high incidence. These areas are broadly defined and mapped with a general understanding of landslide hazard risks. A more detailed study would be required to determine the actual vulnerable structures at individual sites within these risk areas.

**Figure IV-22: USGS Landslide Susceptibility**

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## 11. Earthquake (Low Ranking)

### Hazard History

Since 1853, there have been 9 earthquake epicenters within, or within very close proximity to the Region. Some of these earthquakes were of a low intensity level and may not have been felt by humans or caused property damage. Refer to Table IV-33 and Figure IV-23 for the earthquake description and damages, as well as the epicenter location.

The Region has also been impacted by earthquakes with epicenters in other areas. Table IV-34 and Table IV-35 provide an overview of historic and modern earthquakes felt within the region with epicenters in other locations of Virginia. Historic earthquakes are those that were documented based on observations and historical records. Modern earthquakes are those that have been recorded since a network of seismometers was installed in 1963. Figure IV-24 shows the epicenter locations of all earthquakes in Virginia from 1744 to 2017. Based on review of records, property damage in the region has thus far been minimal.

Since 1853, there have been 9 earthquakes with epicenters within, or within close proximity to the Region.

The highest magnitude level with an epicenter in the Region was 4.6 Mb recorded during an 1853 earthquake.

**Table IV-33: Historic and Modern Earthquake Epicenters located within or within close proximity to the Region**

Date	Description and Damages
May 2, 1853	A 4.6 magnitude (Mb) earthquake had an epicenter near the Highland County, Virginia/Pendleton County, West Virginia border with a VI intensity. It occurred at 9:20 a.m. and was felt across a multi-state area from Washington D.C., Virginia, West Virginia and Ohio. Reports indicate the earthquake was felt in an area between 61,400 sq. miles and 72,000 sq. miles. No damage was reported.
February 8, 1910	A 3.2 magnitude (MAG) earthquake had an epicenter near New Market, VA, in close proximity to the Rockingham County/Shenandoah County border. It was felt in the Shenandoah Valley over an area of 500 to 1,000 square miles. The main shock was felt at 9:00 a.m., with two aftershocks following at 9:05 a.m. and 9:30 a.m.

**Table IV-33: Historic and Modern Earthquake Epicenters located within or within close proximity the Region - continued**

Date	Description and Damages
June 10, 1927	A 3.6 magnitude (MAG) earthquake had an epicenter in southeastern Augusta County at 2:16 a.m.. It was felt over a 2,500-2,900 square mile area which included Augusta County, Charlottesville, Richmond, and Campbell County. No damage was reported, but the earthquake did rattle windows and wake people up in Richmond.
November 5, 1980	A 2.8 magnitude (ML) earthquake had an epicenter in Bath County near the Virginia/West Virginia state line at 4:48 p.m. with a depth of 3.8 km.
June 6, 1981	A 0.5 magnitude (Mc) earthquake had an epicenter in southeastern Highland County, near the Augusta County border at 4:06 a.m. with a depth of 14 km.
November 23, 1981	A 2.1 magnitude (MLD) earthquake with a depth of 9.8 km had an epicenter in Augusta County, north of the City of Staunton at 8:15 a.m. Loud noises were reported, with descriptions ranging from a blast or sonic boom to a low rumble or muffled explosion. The earthquake caused houses to shake, with rattling windows and picture frames.
June 16, 1982	A 2.1 magnitude (MLD) earthquake with a depth of 10.9 km had an epicenter in Augusta County, northeast of the City of Waynesboro at 1:41 p.m.
May 29, 1984	A 1.3 magnitude (MLD) earthquake with a depth of 7.4 km had an epicenter in Augusta County, northeast of the City of Waynesboro. It was located near Jarmans Gap and occurred at 6:29 a.m.
December 27, 1997	A 2.2 magnitude (Mc) earthquake had an epicenter in southwestern Bath County, near Healing Springs at 2:45 a.m.

Source: Anne C. Witt, Wendy S. Kelly,, Matthew J. Heller, and David B. Spears, 2017, Virginia Department of Mines, Mineral and Energy, Division of Geology and Mineral Resources, "GIS Fault Mapping of Virginia Seismic Zones"

**Table IV-34: Historic Earthquakes Felt Within the Region**

Date	Description and Damages
February 21, 1774	An earthquake with an estimated magnitude (Mb) of 4.5 and a probable epicenter southeast of Richmond was felt over an 130,000 sq. km. area of Virginia and North Carolina. Near the epicenter, serious structural damage to homes were reported. The earthquake caused houses to shake across the state, and a loud noise was heard in Richmond. Aftershocks were reported on February 22 and February 23. A portion of the Region is estimated to have been included in the felt area.
March 9, 1828	An earthquake with an estimated magnitude (Mb) of 5.0 and a MMI intensity of V was felt over a 500,000 sq. km. area of Pennsylvania, Maryland, Delaware, Washington, D.C., West Virginia, Ohio, Kentucky, Tennessee and South Carolina. The probable epicenter was southwestern Virginia. A loud rumbling was reported; and dishes, windows and doors shook.
August 27, 1833	An earthquake with an estimated magnitude (Mb) of 5.0 and a maximum intensity of VI had a felt area of 150,000 sq. km. in Virginia, Maryland, and North Carolina. No damage was reported, but a loud rumbling sound was reported, and two coal miners were killed. Documents record that in our region, the earthquake was felt in Lexington.
April 29, 1852	An earthquake with an estimated magnitude (mbLg) of 4.9 and a maximum intensity of VI had a felt area of 490,000 sq. km. in Virginia, Maryland, North Carolina, Ohio, Pennsylvania and Tennessee. The probable epicenter was Wytheville and two separate shocks were reported. In the region, the earthquake caused buildings to violently shake in Staunton.
May 2, 1853	An earthquake with an estimated magnitude (Mb) of 4.6 and a maximum intensity of VI had a felt area of 190,000 sq. km. The probable epicenter was located west of the Central Virginia Seismic Zone, and was felt as far away as Ohio. No damage was reported.
December 22, 1875	An earthquake with an estimated magnitude (MbLG) of 4.5 and a maximum intensity of VII was felt over a 130,000 sq. km area including Virginia, Maryland and North Carolina. The probable epicenter was 50 miles northwest of Richmond. The shock caused property damage in Richmond. Prior to the August 23, 2011 earthquake, this earthquake was the most damaging earthquake to occur with an epicenter in the Central Virginia Seismic Zone. The region was included in the felt area and had estimated intensity levels of III to IV.

**Table IV-34: Historic Earthquakes Felt Within the Region—continued**

Date	Description and Damages
May 31, 1897	An earthquake with an estimated magnitude (Mw) of 5.5 and a maximum intensity of VII was felt over an 780,000 sq. km. area from Georgia to Pennsylvania, and as far away as Indiana. It is on record as one of Virginia's largest earthquakes. The epicenter was in Giles County, in southwest Virginia. Property damage to homes were reported near the epicenter, and in a wide area around the epicenter in Virginia, West Virginia, Tennessee and North Carolina. The earthquake also disturbed springs and triggered landslides. In addition to the main shock on May 31, 1897, a foreshock and a series of aftershocks were recorded. The foreshock occurred on May 3, 1897 and caused property damage in southwest Virginia and North Carolina with an intensity of VII. The series of aftershocks did not cause any significant damage. They were reported on June 28, September 3 and October 20, 1897. The June 28 aftershock was felt in Lexington.
February 13, 1899	An earthquake with an estimated magnitude (Mb) of 4.7 and a maximum intensity of V was felt over an 80,000 sq. km. area. The epicenter was near Wytheville. As many as four separate shocks were felt, causing buildings to shake, furniture to move and a rumbling noise reported. No property damage was reported. Portions of the region were included in the estimated felt area.
April 9, 1918	An earthquake with an estimated magnitude MI of 4.6 and a maximum intensity of VI was felt over an 180,000 sq. km area including Virginia, West Virginia, Maryland, Pennsylvania, Delaware and New Jersey. As many as three shocks, and several aftershocks were reported. The epicenter was near the Town of Luray and in the Shenandoah Valley, the earthquake resulted in property damage from broken windows and cracked plaster.

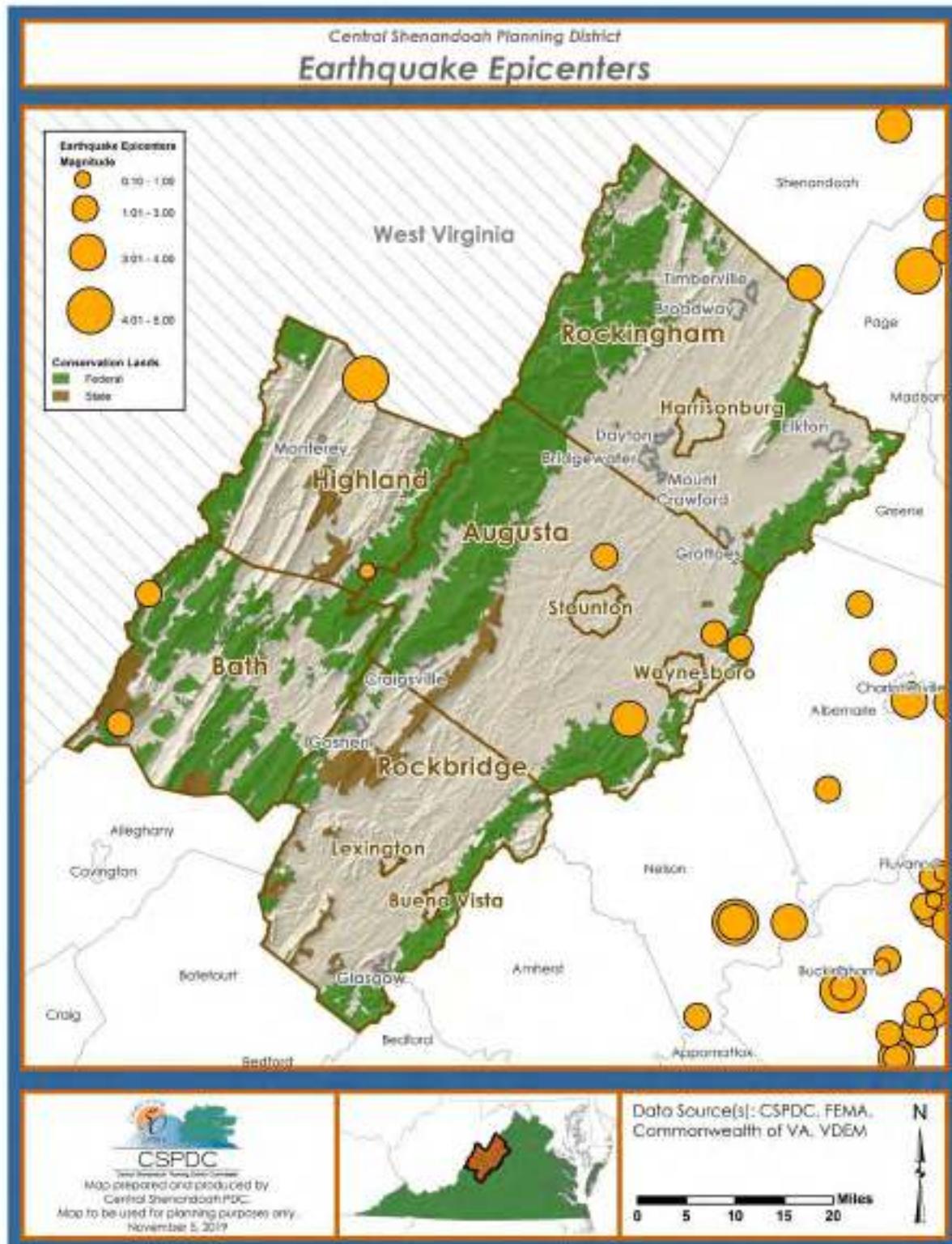
Source: Wendy S. Kelly, Anne C. Witt, Matthew J. Heller, and Martin C. Chapman, 2017, Virginia Department of Mines, Mineral and Energy, Division of Geology and Mineral Resources, Publication 185, "Seismic History of Virginia"

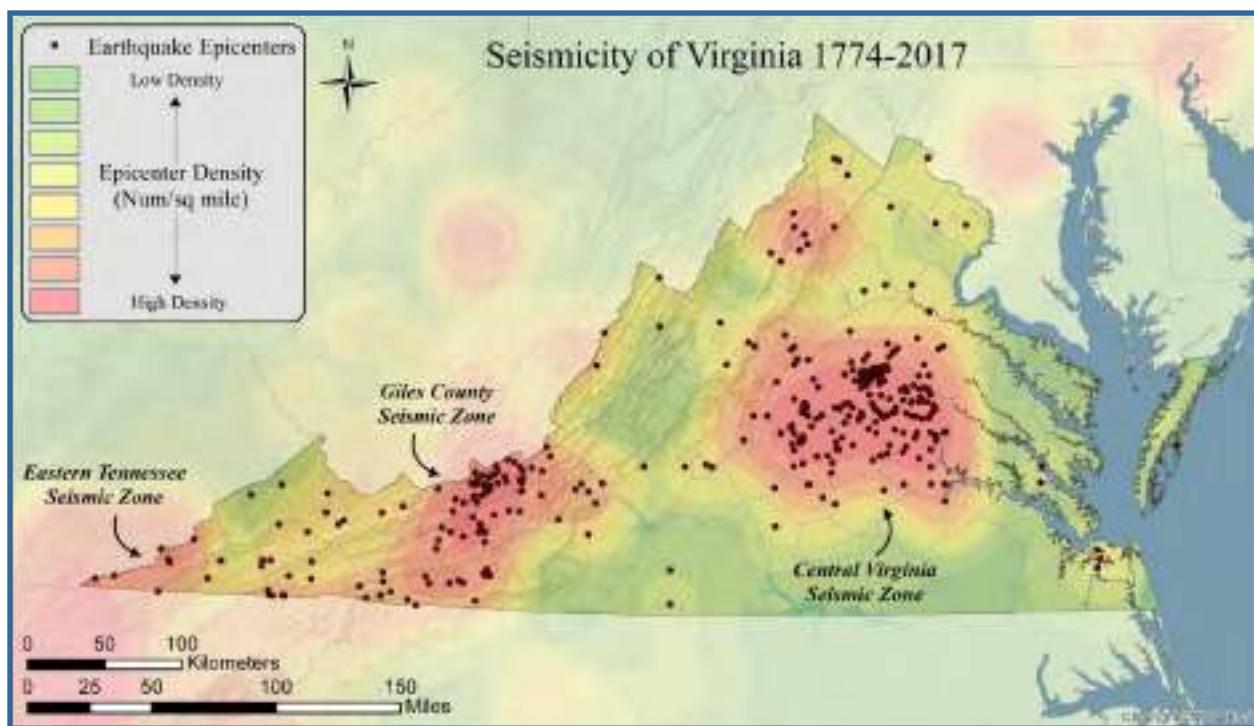
**Table IV-35: Modern Earthquakes Felt Within the Region**

Date	Description and Damages
December 9, 2003	An earthquake with a magnitude (MbLg) of 4.5 and a maximum intensity of VI was felt in Virginia, North Carolina, South Carolina, Tennessee, Kentucky, West Virginia, Ohio, Pennsylvania, New Jersey, Delaware and Maryland. The earthquake had a focal depth of 10 km and the epicenter was 60 km west of Richmond. The earthquake included two 4.5 magnitude shocks that occurred 12 seconds and 300 meters apart. No structural damage was reported. Earlier in the year, the shock had been preceded by a 3.6 magnitude shock with an epicenter a few kilometers away.
August 23, 2011	An earthquake with a magnitude (Mw) of 5.8 and a maximum intensity of VIII was felt over the entire eastern United States and into Canada. The epicenter was located near the Town of Mineral in Louisa County, within the Central Virginia Seismic Zone. It is the most damaging earthquake ever felt in Virginia and had a depth of 8 km. Total damages from the earthquake exceeded \$343 million (2019 dollars), and eight counties were declared as a federal disaster area (DR-4042). In Louisa County, over 1,500 damage reports were received. Seven homes were destroyed, and 120 homes received major damage. Louisa County Public Schools experienced more than \$68 million (2019 dollars) in damages, with two schools damaged beyond repair and condemned. Students were in school when the earthquake hit. Fortunately, no major injuries or fatalities were reported. The school system had to shut-down for several weeks. An automatic shutdown occurred at North Anna Nuclear Generating Station, located only 11 miles from the epicenter. No critical facilities at the nuclear station were affected, and the station experienced only minor damage. Public infrastructure was damaged, including damage to two small dams, the failure of a water main in the Town of Mineral, and power outages. Disturbance in wells and groundwater levels were reported. Damage was reported as far away as Maryland, and the National Cathedral and the Washington Monument were damaged. In the Central Shenandoah Valley Region, minimal damage occurred which included cracks in the foundations of structures and falling pictures. Following the earthquake, a series of over 500 aftershocks were recorded.

Source: Wendy S. Kelly, Anne C. Witt, Matthew J. Heller, and Martin C. Chapman, 2017, Virginia Department of Mines, Mineral and Energy, Division of Geology and Mineral Resources, Publication 185, "Seismic History of Virginia"

**Figure IV-23: Earthquake Epicenters located within, or in close proximity to the Region**



**Figure IV-24: Seismicity of Virginia, 1744-2017**

Source: Wendy S. Kelly, Anne C. Witt, Matthew J. Heller, and Martin C. Chapman, 2017, Virginia Department of Mines, Mineral and Energy, Division of Geology and Mineral Resources, Publication 185, "Seismic History of Virginia"

## Hazard Profile

An earthquake is the result of a sudden release of energy in the Earth's crust.

Earthquakes are measured both in magnitude and in intensity.

Earthquakes are caused mostly by rupture of geologic faults, but also by volcanic activity, landslides, mine blasts, changes in groundwater storage, and nuclear tests. An earthquake is the result of a sudden release of energy in the Earth's crust that creates seismic waves. An earthquake's point of initial rupture is called its focus or hypocenter. The point at ground level directly above the hypocenter is the epicenter. The focal depth is the depth from the epicenter to the hypocenter. Once the seismic waves reach the surface, they become surface waves and travel away from the epicenter, causing shaking.

Earthquakes are measured both in magnitude and intensity level. Magnitude is a measurement of the relative size of the earthquake compared to other standard earthquakes based on a logarithmic scale. Over time, magnitude has been measured on different scales, with moment magnitude (Mw) being used since 2000. Earthquake intensity is measured based upon the impacts on humans and man-made structures using the Modified Mercalli Intensity (MMI) Scale. It uses a scale of I to XII, with I being rarely felt and XII causing total damage. The intensity of the shaking lessens the further away from the epicenter location. Figure IV-25 depicts earthquake magnitude and the typical correlated intensity.

Earthquake hazards exist in both plate boundaries and intraplate settings. The largest percentage of earthquakes on Earth, 81 percent, occur in the “Ring of Fire” along the Circum-Pacific seismic belt. In this region, earthquakes are caused by the subduction of the ocean crust along the boundaries of the tectonic plates. The other two prominent areas include the Alpine earthquake belt and a belt that follows the Mid-Atlantic Ridge.

Virginia is located in an intraplate setting, within the North American tectonic plate where the tectonic strain is diffused. The state has thousands of geologic faults and three seismic zones—Central Virginia Seismic Zone, the Giles County Seismic Zone and the Eastern Tennessee Seismic Zone. Seismic zones are areas

**Figure IV-25: Earthquake magnitude and typical correlated intensity**

Magnitude	Intensity (Modified Mercalli)
1.0 - 3.0	I Rarely felt by humans
3.0 - 5.9	II Felt by only a few people at rest, especially on upper floors of buildings
	III Felt quite noticeably by persons indoors, especially on upper floors of buildings. Many people do not recognize it as an earthquake. Standing motor vehicles may rock slightly. Vibrations similar to the passing of a truck. Duration estimated.
	IV Felt indoors by many, outdoors by few during the day. At night some people are awakened. Dishes, windows, doors disturbed; walls make cracking sound. Sensation like heavy truck striking striking building. Standing motor vehicles rocked noticeably.
	V Felt by nearly everyone; many awakened. Some dishes, windows broken. Unstable objects overturned. Pendulum clocks may stop.
	VI Felt by all, many frightened. Some heavy furniture moved; a few instances of fallen plaster. Damage slight.
	VII Damage negligible in buildings of good design and construction; slight to moderate in well-built ordinary structures; considerable damage in poorly built or badly designed structures; some chimneys broken.
	VIII Damage slight in specially designed structures; considerable damage in ordinary substantial buildings with partial collapse. Damage great in poorly built structures. Fall of chimneys, factory stacks, columns, monuments, walls. Heavy furniture overturned.
	IX Damage considerable in specially designed structures; well-designed frame structures thrown out of plumb. Damage great in substantial buildings, with partial collapse. Buildings shifted off foundations.
	X Some well-built wooden structures destroyed; most masonry and frame structures destroyed with foundations. Rails bent.
	XI Few, if any (masonry) structures remain standing. Bridges destroyed. Rails bent greatly.
	XII Damage total. Lines of sight and level are distorted. Objects thrown into the air.

Source: Wendy S. Kelly, Anne C. Witt, Matthew J. Heller, and Martin C. Chapman, 2017, Virginia Department of Mines, Mineral and Energy, Division of Geology and Mineral Resources, Publication 185, "Seismic History of Virginia"

with elevated seismic activity. The nearest seismic zone to the Region is the Central Virginia Seismic Zone, which extends into Albemarle County, adjacent to the Region. The largest earthquake to occur in Virginia's history is the August 23, 2011 earthquake which had an epicenter in Mineral, located within the Central Virginia Seismic Zone.

Although the Region is not located within a seismic zone, based upon historical records, nine earthquakes with epicenters in the Region have occurred since 1853. The majority of the earthquakes have had a magnitude below 3.0, which has a corresponding intensity level rarely felt by humans. The earthquake with the largest magnitude size was a May 2, 1853 earthquake near the Highland County/Pendleton County line. It had a magnitude of 4.6 Mb with an intensity level of VI on the Modified Mercalli Intensity Scale.

## Hazard Areas

Following the August 23, 2011 earthquake in Louisa County, the Virginia Department of Mines, Minerals and Energy Division of Geology and Mineral Resources received Hazard Mitigation Grant funding from FEMA and the Virginia Department of Emergency Management (HGMP-4042-000-014). The purpose of the funding was to reduce the impact of future earthquakes in Virginia through:

- Creating a report with a map of prior documented events about past damaging earthquakes in the state.
- Compiling identified faults from existing geologic maps into an ArcGIS geodatabase.
- Conducting geological field studies to verify and classify identified faults.
- Studying the epicentral area of the 2011 earthquake using LiDaR data to identify faults.
- Identifying communities and infrastructure at greatest risk of future damage by conducting GIS analysis.
- Presenting the results in the affected communities to planning and emergency management agencies.

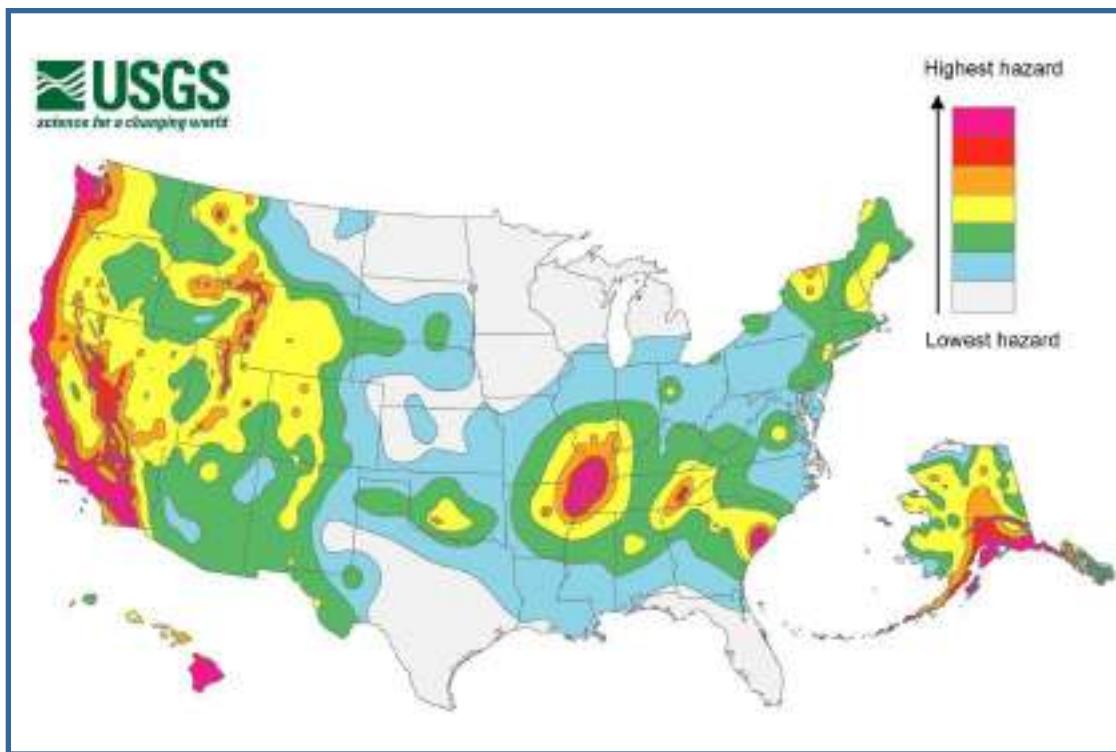
The analysis by the Division of Geology and Mineral Resources resulted in key findings including:

- “Earthquakes are common and widespread in Virginia. Since 1774, 476 earthquakes have been reported. 56 of 95 Virginia counties contain an earthquake epicenter. Earthquakes have occurred in 21 or 27 of Virginia’s planning districts.”
- “Earthquakes are more common in some parts of Virginia. Since 1774, approximately 90% of seismic events have been spatially associated with the Central Virginia Seismic Zone, the East Tennessee Seismic Zone or the Giles County Seismic Zone...”
- “Damaging earthquakes are rare in Virginia...”

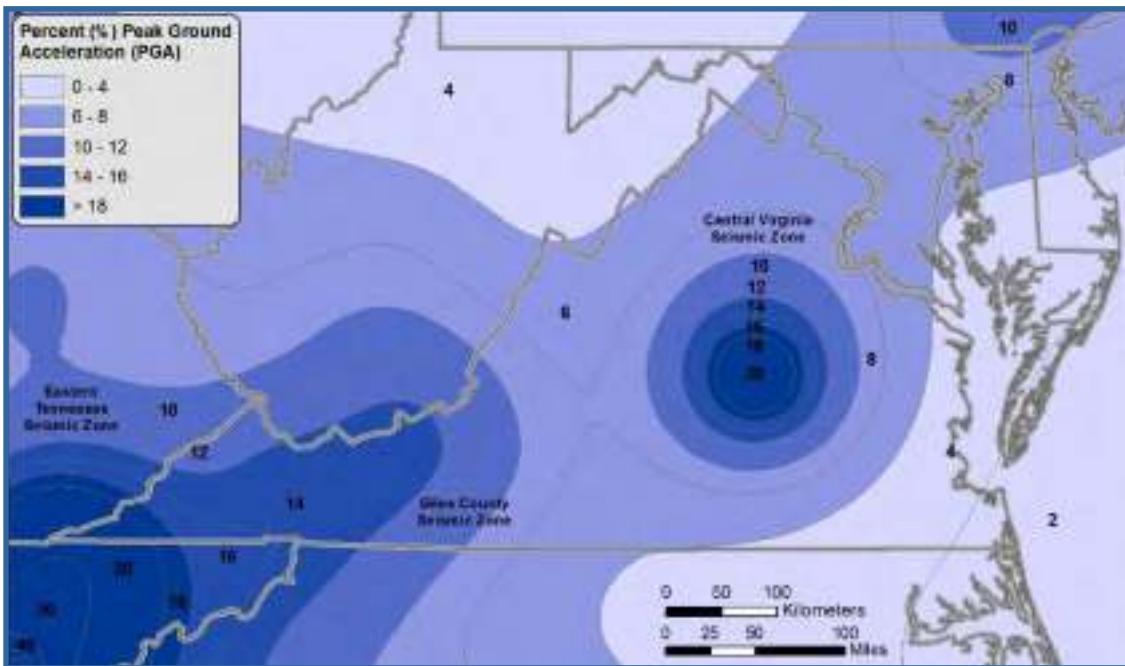
- “Many thousands of faults exist in Virginia...”
- “Most of the faults in Virginia are geologically very old and are not active...”
- “Mapped fault locations at the surface of the Earth do not correlate well with historic epicenter locations in Virginia...in light of this information it is not appropriate to use the locations of mapped faults to assign seismic hazard or risk.”

The report discussed that the three seismic zones in the state— the Central Virginia Seismic Zone, the Giles County Seismic Zone and the Eastern Tennessee Seismic Zone— are recognized as having a higher frequency of earthquakes based upon historical records. Over 90% of seismic events have been located in these zones. It was noted though that earthquakes do occur outside of those boundaries, and as a result the zones should not be used to assess seismic hazard. A recommended resource to assess seismic risk and hazard is Figure IV-26, a Seismic Hazard Map produced by the U.S. Geologic Survey. Based on the map, the Region is located in the second lowest hazard ranking.

The Division of Geology and Mineral Resources also conducted a GIS analysis to identify those communities and infrastructure that were at greatest risk for future earthquakes based upon the peak ground acceleration for a two percent probability of exceedance in a 50 year period. The results of the analysis are shown in Figure IV-27. Areas of the Region are identified as having a 6% or a 4% probability. Those percentages are designated as being in either the very light damage category (6-8%) or the no damage category (0-4%). The very light damage category generally results in little to no reported damage other than broken dishes, broken windows, stopping of pendulum clocks, or overturning of unstable objects.

**Figure IV-26: 2014 USGS National Seismic Hazard Map**

Source: U.S. Geological Survey

**Figure IV-27: Statewide map showing U.S. Geological Survey Percent Peak Ground Acceleration for a 2% probability of exceedance in a 50 year period.**

Source: Anne C. Witt, Wendy S. Kelly,, Matthew J. Heller, and David B. Spears, 2017, Virginia Department of Mines, Mineral and Energy, Division of Geology and Mineral Resources, "GIS Fault Mapping of Virginia Seismic Zones"

In addition to reviewing the findings of the report completed by the Virginia Department of Mines, Mineral and Energy, Division of Geology and Mineral Resources, FEMA's HAZUS-MH software was also utilized to generate a Earthquake Global Assessment Report for the CSPDC region. For this report, the 100 year Probabilistic Earthquake, Magnitude 5 scenario was performed. It is noted in the report that HAZUS utilizes 2010 Census Data and result totals only reflect data for those census tracts/blocks included in the user's study region. The HAZUS report can be viewed in Appendix G and summarizes building inventory, and the estimated damage, social impact and economic losses for the Region as a whole.

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## **12. Hazardous Materials (Transportation and Industrial) (Medium Ranking)**

### **Hazard History**

There have not been any catastrophic Hazardous Materials Incidents in recent history. There have been minor to major incidents at manufacturing/industrial sites or during transportation of hazardous materials. A typical incident would involve an accident on either interstates I-64 or I-81, where a tractor trailer has been damaged causing the release of hazardous materials on the roadway or possibly to nearby soil or a body of water. These incidents while potentially harmful, stressful, and inconvenient are handled in a routine manner by first responders, who are trained and have the proper equipment. The Region has a vulnerability to Hazardous Materials Incidents based on its agriculture, industry and manufacturing, and transportation network. Because of this vulnerability, the Plan's Steering Committee has chosen to include Hazardous Materials in this update of the Hazard Mitigation Plan. The Steering Committee has given this hazard a medium ranking.

### **Hazard Profile**

In 1986, Congress passed the Emergency Planning and Community Right-to-Know Act (EPCRA). As part of the requirements of this Act, local jurisdictions must form Local Emergency Planning Committees (LEPCs) that must meet regularly and maintain a current Emergency Response Plan. EPCRA also requires that facilities that transport hazardous materials or use them at their site, must comply with certain reporting requirements. Through the LEPCs, local Emergency Management, Fire, Medical, and Law Enforcement officials are aware of the hazardous materials in their jurisdiction and plan the response to incidents that potentially could occur. Response is the primary focus in dealing with Hazardous Materials. For local jurisdictions, mitigation for Hazardous Materials Incidents involves planning, training, and ensuring first responders have the proper equipment available prior to an incident. For facilities that use,

store, and/or transport hazardous materials, they can similarly mitigate the occurrence of an incident with the same advance steps of planning, training, and proper equipment to ensure these hazardous materials are handled properly.

## **Hazard Areas And Vulnerability**

Throughout the Region, agricultural communities and manufacturing/industrial centers can be found. A broad transportation network that includes interstate highways, rail and air also covers the Region. Because of these factors, it is possible that a Hazardous Materials Incident could impact any of the 21 localities in the Region.

## 13. Terrorism (Low Ranking)

### Hazard History

To date, there are no recorded terrorism incidents in recent history to include in this Plan. Due to several characteristics of the Region, the Steering Committee for the Hazard Mitigation Plan felt terrorism should be included but with a low ranking.

### Hazard Profile

Currently there is no universal definition for terrorism. The Code of Federal Regulations defines terrorism as “the unlawful use of force and violence against persons or property to intimidate or coerce a government, civilian population, or any segment thereof, in furtherance of political or social objectives.” (28 C.F.R. Section 0.85) Characteristics that make this Region vulnerable include:

- Proximity to several large urban centers, including Washington, D.C., Richmond, Virginia, and the Hampton-Roads area of Virginia;
- The regional transportation network that includes two major interstates (I-81 and I-64), the Shenandoah Valley Regional Airport and several smaller airports, and rail lines that carry both passenger and freight trains;
- Manufacturing and industrial facilities that use a variety of hazardous chemicals;
- and several colleges, universities, and other residential institutions that house large numbers of people.

These characteristics possessed by the Region are similar to many communities in Virginia and across the United States. Like others, the communities in this Region have to evaluate the level of “acceptable risk” they have for terrorist events.

## Hazard Areas

Unlike other hazards, specific vulnerable areas in the Region are not included in the scope of this Plan because of the security risk of terrorism.

## Vulnerability Analysis

A regionwide vulnerability analysis has not been conducted. Due to security concerns, the local jurisdictions in the Region were not asked to share any vulnerability analyses or risk assessments of particular structures or locations within their communities. In terms of hazard mitigation for terrorism, protective measures involving buildings can be successful in reducing vulnerability and decreasing threat.

## 14. Power Outages (Medium Ranking)

A power outage is an unplanned loss of the electric power network's supply to an end user. Faults at power stations, damage to any part of the electric distribution system, short circuits, cascading failures, or problems with fuses or circuit breaker operations can cause a power outage. These damages to the electric power network may be caused by natural hazards, such as wind, fire, and severe weather; human-causes; the results of mechanical failure; or a variety of other factors.

### Hazard History

There have been no catastrophic power outages in recent history. Two events where extended power outages occurred were the derecho in June 2012 and the ice storm in November 2018. Because a power outage can be its own disaster independent of another natural or man-made hazard, the Hazard Mitigation Plan's Steering Committee has chosen to include this hazard and has given it a medium ranking.

### Hazard Profile

Power outages can be extremely disruptive and affect the whole community and the economy. Community impacts on communication, water and other utilities, vital services, transportation, and businesses are caused by power outages. Individuals can also be impacted by significant issues such as the inability to use power-dependent medical devices, food spoilage, water contamination, and sanitation issues.

For communities it is important to mitigate the effects of power outages through planning and providing back-up resources that can keep essential personal needs met and community services running. Communities can create Emergency Assurance Plans (EAPs). During the development of an EAP, a community will examine its local and regional energy infrastructure, review supply contracts, establish relationships with energy providers, identify back-up power sources, and ensure adequate emergency fuel supplies. Pre-established plans are not the only mitigation tool for communities. Installing equipment at critical locations to supply back-up power during an outage is a key strategic step in mitigating this hazard. Large-scale generators, generator quick connects, and Uninterruptible Power Supply/Sources (UPS) are valuable for keeping power running and protecting hardware such as computers, telecommunicators, and data centers.

## Hazard Areas And Vulnerability

The Region receives its electricity from five service providers: BARC Electric Cooperative, Dominion Energy Virginia, Harrisonburg Electric Commission, Shenandoah Valley Electric Cooperative, and the Town of Elkton which supplies the electricity to its residents. As is common across the United States, the 21 jurisdictions in the Region are dependent on electricity for all manner of services. Each jurisdiction has the possibility of experiencing a power outage.

## V. MITIGATION GOALS, STRATEGIES AND PROJECTS

We cannot always prevent the natural or manmade hazards that make us vulnerable, but through proactive planning and mitigation activities we can reduce their impact. The following section describes the four types of mitigation actions (local plans and regulations, structure and infrastructure projects, natural systems protection, and education and awareness programs) that are the focus of the Central Shenandoah Hazard Mitigation Plan's regional mitigation goals. These regional goals are included in this section as well. Following the mitigation goals, the local mitigation strategies are included. Each of the 21 jurisdictions in the Central Shenandoah Planning District has created a set of mitigation strategies for their local community.

### 1. Mitigation Actions

The four categories of mitigation actions are:

1. **Local Plans and Regulations:** These actions include government authorities, policies, or codes that influence the way land and buildings are developed and built. Examples include: comprehensive plans, land use ordinances, building codes and enforcement, the National Flood Insurance Program's Community Rating System, and stormwater management regulations.
  
2. **Structure and Infrastructure Projects:** These actions involve modifying existing structures and infrastructure to protect them from a hazard or remove them from a hazard area. This could apply to public or private structures as well as critical facilities and infrastructure. This type of action also involves projects to construct manmade structures to reduce the impact of hazards. Examples include: Acquisitions, elevations, and mitigation reconstructions of structures in flood prone areas, utility undergrounding, structural retrofits, floodwalls and retaining walls, detention and retention structures, culverts, and safe rooms.

3. **Natural Systems Protection:** These are actions that minimize damage and losses and also preserve or restore the functions of natural systems. Examples include: sediment and erosion control, stream corridor restoration, forest management, conservation easements, and wetland restoration and preservation.
  
4. **Education and Awareness Programs:** These are actions to inform and educate citizens, elected officials, and property owners about hazards and potential ways to mitigate them. These actions may also include participation in national programs, such as StormReady or Firewise Communities. Although this type of mitigation reduces risk less directly than structural projects or regulation, it is an important foundation. Examples include: websites with maps and information, media spots, real estate disclosure, presentations to school groups or neighborhood organizations, mailings to residents in hazard-prone areas.

#### **Prioritization Methodology:**

Regional goals and strategies have always been included in the CSHMP. For the 2020 HMP, the goals and strategies from the previous HMP were reviewed and discussed by the Steering Committee and relevant ones were revised to reflect the current situation. Additional goals and strategies were also added to address present gaps and vulnerabilities. While all mitigation actions move a community towards resilience, prioritization of goals and strategies in the Plan are based on those that will create the largest beneficial impacts. Mitigation Education and Awareness Program goals are the first priority because they can be conducted at a regional scale, require minimal resources, can be accomplished through existing partnerships, and encourage people to make safer initial choices that lessen the need for mitigation later. The second priority of goals include mitigation activities that impact a whole community. These goals fall into the Local Plans and Regulations, Natural Systems Protection, and Infrastructure Projects mitigation categories. The goals in the third category of priority are those that make a smaller scale impact at the neighborhood or even individual property level. These goals fall under the mitigation category of Structure and Infrastructure Projects.

## 2. Regional Mitigation Goals and Strategies

**Goal 1: Improve local government operations, planning, zoning, land use regulations, and code enforcement to reduce the impact of natural and man-made hazards and disasters.**

### Strategies

- 1.1 For flood hazards, strengthen current floodplain, zoning and site development ordinances by adopting higher standards that provide additional protection and limit or restrict further development in the floodplain, i.e. additional freeboard, flood protection setbacks, limitation on fill, minimization of hydrostatic pressure, protection for mechanical and utility systems, etc. For drought hazards, utilize growth management tools like zoning and land use regulations to encourage low-impact development and forest preservation. For land subsidence hazards, strengthen enforcement of land use, zoning regulations and building ordinances that regulate construction in areas susceptible to landslides and sinkholes i.e. steep slopes, intermittent stream channels, and karst topography.
- 1.2 Encourage water supply planning and ground water protection projects. Seek and research alternative water supplies for communities. Improve forecasting and monitoring of drought conditions.
- 1.3 Ensure that floodplain ordinances and building codes are clearly understood by staff, property owners, developers, bankers and insurance companies.
- 1.4 Implement zoning tools that steer development away from hazardous areas or natural areas deserving preservation. Include Department of Forestry personnel in subdivision review for new development in woodland-urban interface areas.
- 1.5 Provide for tax incentives, donated easements, and other approaches that can assist in preserving land in the floodplain and other environmentally sensitive areas for agricultural, environmental, recreational or educational uses.

- 1.6 Rezone to open space or acquire undeveloped portions of floodplain to prohibit future residential building.
- 1.7 Limit government expenditures for public infrastructure such as roads and water and sewer service in hazard-prone areas.
- 1.8 Provide necessary staff and staff training to enforce floodplain regulations and building codes.
- 1.9 Provide training and appropriate equipment/tools for local fire fighters to respond to woodland fires.
- 1.10 Sponsor workshops for Building Officials that focus on floodplain ordinances and FEMA and NFIP regulations.
- 1.11 Develop a Continuity of Operations Plan for each locality.

**Goal 2: Increase awareness of the National Flood Insurance Program (NFIP) and the Community Rating System (CRS) in local communities in the Region.**

**Strategies**

- 2.1 Introduce local jurisdictions to the Community Rating System (CRS) and assist them in applying for CRS certification for their communities.
- 2.2 Encourage communities to remain active and compliant with the NFIP program.
- 2.3 Encourage citizens to purchase flood insurance. Partner with insurance companies, lenders, and real-estate agents to market the NFIP program.
- 2.4 Conduct NFIP training workshops for insurance providers.

**Goal 3: Continue to improve stormwater management for the infrastructure throughout the Region.**

**Strategies**

- 3.1 Consider conducting a Regional Storm Water Management Study which would guide the localities in developing the most cost-effective storm water management system, not only within the political boundaries of each locality, but within the locality's watershed.

- 3.2 Seek funding to prepare site-specific hydrologic and hydraulic studies that look at areas that have chronic and repetitive flooding problems.
- 3.3 Consider utilizing special utility assessment districts where property owners who directly benefit from a specific public improvement are charged a fee that is proportional to the benefits received.
- 3.4 Support projects that call for improved ditching, replacement of inadequate and undersized culverts, enlargements of bridge openings, and drainage piping needed to minimize flooding.
- 3.5 Develop regular maintenance programs and standard operation procedures and budget accordingly.
- 3.6 Encourage routine maintenance of stormwater management conveyances and culverts to allow more water to be carried with special emphasis placed on culverts where there are repeated problems.
- 3.7 Notify property owners living along stormwater conveyances to enhance riparian buffers and to be aware of large debris such as deadfall and trees.

**Goal 4: Conduct planning and studies for the implementation of stormwater and flood mitigation projects at the watershed level when applicable.**

**Strategies**

- 4.1 Develop a regional, broad-based watershed plan among localities within a watershed in order to achieve effective and long-term flood protection and a healthy riverine environment.
- 4.2 Develop a watershed partnership, i.e. watershed roundtable to coordinate planning and program activities among natural resource agencies and stakeholders.
- 4.3 Conduct a site analysis mapping study to determine and understand the karst topography in our region.

**Goal 5: Conduct proactive planning focused on developing mitigation strategies and projects that focus on wildfire mitigation at the landscape scale in wildland areas across communities or at a regional level; to address vulnerabilities of the Wildland Urban Interface in the Region.**

**Strategies**

- 5.1 Advocate the return of mitigation strategies back in the Wildland Urban Interface (WUI) International Code.
- 5.2 Encourage Building Codes and Zoning Regulations that support wildfire mitigation in the WUI and other woodland areas.
- 5.3 Implement public education programs that teach woodland homeowners their responsibilities for choosing to live in areas potentially vulnerable to wildfires.
- 5.4 Promote inter-agency coordination for wildfire response in the areas of daily communication, training, and especially pre-planning. Include this information in the Central Shenandoah Wildfire Protection Plan as well.

**Goal 6: Reduce the impact of natural and man-made hazards and disasters on private residential structures and properties.**

**Strategies**

- 6.1 Develop a program to elevate, relocate, floodproof, acquire flood-prone houses, or offer substantial reconstruction in order to provide protection to private residential structures and reduce future damages.
- 6.2 Continue residential buyout and elevation projects of identified structures most at risk of future flooding with priority given to houses that are repetitively flooded.
- 6.3 For properties where elevation, relocation or acquisition is not feasible, introduce retrofitting measures to protect existing structures from flood damage. Retrofitting is relatively inexpensive and can include dry floodproofing, wet floodproofing, installing sewer backflow valves, berms, and sump pumps.

- 6.4 Design and landscape structures with wildfire safety in mind by utilizing fire-resistant materials when building especially in the urban-wilderness interface areas. Create safety and defensible space around structures. Provide adequate water resources/dry hydrants nearby woodland communities. Improve access for fire trucks and equipment. Increase knowledge of controlled burns and use of fire-retardant vegetations.
- 6.5 Offer financial incentives such as tax abatements, conservation easements, and low-interest loans to encourage property owners to elevate, relocate or floodproof buildings.
- 6.6 Educate and provide guidance and technical assistance to citizens about measures they can take on their own to protect their properties.
- 6.7 For properties located in known karst and landslide areas, use corrective measures recommended by a professional site analysis (geotechnical or structural engineer) to protect homes.
- 6.8 Encourage developers to integrate mitigation techniques into new construction and renovation.

**Goal 7:** Assist with emergency planning, preparedness education, and hazard mitigation to individuals with access and functional needs and service providers. Access and functional needs include but are not limited to physical, sensory, cognitive, or emotional disabilities; medical issues; and communication barriers.

### Strategies

- 7.1 Educate persons with access and functional needs on disaster preparedness and mitigation methods at community events and through public awareness campaigns.
- 7.2 Provide disaster preparedness and mitigation materials in alternate formats such as large print, digitally, and languages other than English to make materials accessible for a wider audience in the community. Also provide sign language interpreters at community events, workshops, and other educational programs.
- 7.3 Work with the first responder community to educate them about the access and functional needs that may impact people during a disaster.

- 7.4 Encourage persons with access and functional needs to contact their local emergency management office so their needs can be noted in the 911 system.
- 7.5 Offer emergency sheltering for all persons that can provide accommodations that consider access and functional needs including the use of medical equipment requiring electrical power, etc.
- 7.6 Provide training in emergency operations planning and preparedness to organizations that serve persons with access and functional needs to reduce down-time in service provision, to protect lives of staff and clients, and to reduce damage to facilities.
- 7.7 Work with emergency managers to make sure that weather alerts and warnings are in accessible formats for all citizens to receive essential information during a disaster.
- 7.8 Ensure that accessible transport vehicles for evacuations are available for persons with access and functional needs.
- 7.9 Educate pet owners and farmers so they will include their pets and livestock in their family's preparedness planning.
- 7.10 Work with local animal welfare organizations to provide emergency sheltering for pets and livestock.

**Goal 8: Reduce the impact of natural and man-made hazards and disasters on commercial and industrial structures, properties, and businesses.**

**Strategies**

- 8.1 Identify and seek funding to provide engineering and design services that would determine the most cost-effective mitigation option for each business.
- 8.2 Seek funding to floodproof and retrofit commercial buildings where acquisition and elevation are not feasible.
- 8.3 Sponsor workshops that educate local business and industry about mitigation measures they can install to protect their structures and inventory during a disaster.
- 8.4 Develop a program to assist local business and industry in developing emergency and business continuity plans.

**Goal 9: Improve systems that are used for daily monitoring and that alert local emergency management officials of impending severe weather, emergencies, and disasters.**

**Strategies**

- 9.1 Identify areas with recurring flood problems and request additional IFLOW stream/rain gauges to ensure that these areas are adequately covered and monitored.
- 9.2 Seek funding to purchase, install, and maintain public emergency notification systems, Integrated Flood Observing and Warning System (*IFLOWS*) gauges, and other state-of-the-art disaster response and recovery equipment.

**Goal 10: Improve community warning systems in the region.**

**Strategies**

- 10.1 Develop Emergency Action Plans for specific sites such as mobile home parks, apartment complexes, assisted living facilities, industrial facilities, and essential public facilities within disaster-prone areas and develop specific warning or notification plans for each identified site. These plans should include the designation of a point of contact or resident coordinator, with alternates, to receive warnings, the dispatch of police, sheriff, fire rescue units to these sites to issue warnings and pre-designation of routes. These specific warnings will supplement the general television or radio warnings, which most people receive.
- 10.2 Encourage businesses and public facilities located in high hazard areas to purchase NOAA Weather Radios. By receiving early notification of potential inclement weather, businesses and public facilities can benefit from additional time to prepare for natural disasters. Local governments may be eligible for grants to purchase equipment to be distributed in public facilities, businesses, and industries throughout their jurisdictions.
- 10.3 Utilize emergency preparedness and evacuation plans for people living in high-hazard areas, especially people with access and functional needs.
- 10.4 Work with the National Weather Service to expand transmission of Weather Radios or other notification systems.

**Goal 11: Reduce the impact of natural and man-made hazards on public utilities, critical infrastructure, and public properties/lands.****Strategies**

- 11.1 Evaluate and provide retrofit measures to prevent disruption of services. Measures can include elevating electrical controls and equipment and installing watertight doors where practicable at water and wastewater treatment plants.
- 11.2 Bury underground lines deeper and further away from waterways with stronger encasements in floodprone areas with erodible soils.
- 11.3 Increase the number of wind-secured critical facilities including schools, daycares, hospitals, and shelters.
- 11.4 Increase number of functional backup generators and generator quick connects at critical facilities.
- 11.5 Urge local utilities to implement a routine schedule for trimming trees/limbs around power lines to prevent power outages during wind events and ice storms.
- 11.6 Limit the construction of new infrastructure in high hazard areas whenever feasible.
- 11.7 Conduct vulnerability assessments and develop security plans on public utility systems in accordance with the Bioterrorism Act of 2002.

**Goal 12: Improve dam safety throughout the Region.****Strategies**

- 12.1 Examine the risks posed by dams in watersheds that drain in the Region and consider adopting ordinances to restrict development around these dams because of the potential flooding danger in areas below and behind the dams.
- 12.2 Encourage maintenance and improvements to the dams in the Region. Require regular inspection and maintenance schedules.

**Goal 13: Implement stream and natural systems protection actions that not only minimize damage and losses but also preserve and restore these systems.**

**Strategies**

- 13.1 When implementing stream remediation projects consideration should be given when designing these structures and consider stream characteristics that influence the selection of these measures such as channel width, bank height, bend radii, storm event, channel velocities and flood depth, and floodplain configuration.
- 13.2 Obtain maintenance and access easements from property owners for annual maintenance work.
- 13.3 Coordinate with and support the U.S. Department of Agriculture's Emergency Watershed Protection Program that is activated during a Presidential Declaration or State Conservation Disaster.

**Goal 14: Implement a disaster preparedness and mitigation education program.**

**Strategies**

- 14.1 Develop comprehensive public information and education programs on disasters, including preparedness, recovery, mitigation and prevention. Other educational topics would also include transportation, the life-safety impact of disasters, and general maintenance of generators. This can be accomplished through presentations, workshops and marketing materials for citizens, business, schools, local staff and elected officials in the Region. Much of this has been and can be accomplished through Shenandoah Valley Project Impact.
- 14.2 Develop a public education program to educate citizens about water conservation, to use of water-conserving appliances, and irrigation practices in agricultural areas. Written materials could be developed to teach developers and homeowners about native and/or drought-tolerant grasses, shrubs, and trees to be planted around residential structures.

- 14.3 Increase public education and awareness regarding the dangers of winter storms including driving/traveling during a winter storm event. (Automobile accidents are the leading cause of death during a winter storm event.). Also, increase public awareness to health risks associated with winter storms including exposure, hypothermia, frostbite, overexertion, and accidents from falling/slipping.
- 14.4 Encourage communities to become involved with the Department of Forestry's Firewise program. Its goal is to encourage and acknowledge action that minimizes home loss to wildfire by preparing for a fire before it occurs.
- 14.5 Encourage communities to become involved in the National Weather Service program "Storm Ready". This program assists communities with local safety, planning, education, and communication programs needed to save lives and property before and during weather- related disasters.
- 14.6 Provide Community Emergency Response Team (CERT) training to citizens and maintain a CERT organization. Having an active CERT program will not only educate citizens about preparedness and mitigation measures, it will also provide a pool of trained volunteers that can assist during an emergency or disaster.
- 14.7 Develop a media campaign to educate the general public throughout the year about disasters when they may be likely to occur. For example a Spring campaign on tornado safety, winter storm preparedness in the Fall, and hurricane safety prior to the start of Hurricane Season. This holistic campaign would be designed to reach a multi-generational audience and would include mitigation and preparedness information.
- 14.8 Increase the number and use of NOAA weather radios or battery-powered radios or TVs. Improve the effectiveness of NOAA weather radios in the valley.
- 14.9 Utilize the services of amateur radio operators in the region.
- 14.10 Sponsor Hazard Mitigation Workshops designed to give information to contractors, property owners, and business owners on mitigation strategies such as acquisition, relocation, elevation, and floodproofing.
- 14.11 Develop Hazard Awareness programs with the local schools, youth programs, and libraries to disseminate information on natural hazards and mitigation actions. Utilize student environmental clubs to volunteer for projects.

- 14.12 Notify renters of homes, mobile homes, apartments that they are in an area that is subject to flooding and should consider purchasing flood insurance for their contents. Notification could be done via lease agreements.
- 14.13 Establish and maintain Hazard Resource Library/ Self Help Programs on natural hazards, mitigation and safety and related topics in a central location and available to or disseminated to property owners and businesses.
- 14.14 Strategically place flood elevation reference markers throughout the Region to educate and remind people of historical floods. The markers could show the elevation of the high water from previous floods as well as the 100-year flood levels.
- 14.15 Notify potential homebuyers of flood hazards and requirements for flood insurance. Programs should be developed with the cooperation of banks, real estate agents, and insurance agents as well as community development staff.
- 14.16 Implement programs to provide property owners with flood elevation certificates in order to alert them to the fact that their property is in the floodplain.
- 14.17 Provide appropriate local government staff with technical expertise and training on flood protection measures, retrofitting, flood insurance, flood warning and response, etc. in order to help citizens meet and understand floodplain requirements and flood hazards.

**Goal 15: Improve hazard data collection and GIS for the Region.****Strategies**

- 15.1 Encourage communities to participate in FEMA's Cooperating Technical Partners (CTP) Program. This FEMA initiative establishes partners with local jurisdictions to develop and maintain up-to-date flood maps and other flood hazards. Mapping activities may include hydrologic and hydraulic analysis, floodplain mapping, preparation of digital FIRMs, and refinement of floodplain boundaries. Also take advantage of any training on FEMA's HAZUS mapping software that is offered in the Region.

- 15.2 Consider creating a consortium of communities to tackle the problem of outdated FIRM maps and how to update the FIRM maps on a regional basis.
- 15.3 Ensure that all localities have digitized FIRM maps and that they are current, and correct.
- 15.4 Acquire technology to assist in managing storm water, floodplain, and other land-based resources.
- 15.5 Utilize GIS technology to inventory at-risk infrastructure and public and private structures within at-risk areas.
- 15.6 Determine and map landslide/land subsidence, karst, and sinkhole vulnerable areas in the region. Archive events in a database to monitor trends and recurring sites. Coordinate with VDOT on sites impacting transportation infrastructure.
- 15.7 Identify and map assisted living centers, nursing homes, and facilities that serve people with special needs that require additional services during disasters.

**Goal 16:** Implement activities that promote resilience in the Region by enabling communities to better prepare, adapt to changing conditions, and become stronger to withstand and recover rapidly from stresses, shocks, and adverse situations.

#### Strategies

- 16.1 Develop local and regional Resilience Plans.

**Goal 17:** Review Mitigation and Community Improvement Plans in the aftermath of an event in order to encourage the implementation of mitigation projects during the recovery process.

#### Strategies

- 17.1 Encourage learning opportunities of best practices and challenges across the Region.
- 17.2 Conduct After Action Reviews in the aftermath of a disaster.
- 17.3 Share Community Improvement Plans with other localities in the Region.

### **3. Local Mitigation Strategies**

Each of the 21 jurisdictions in the Central Shenandoah Planning District has created a set of mitigation strategies for their local community. Mitigation strategies were also created by James Madison University, a public university in the City of Harrisonburg. The strategies for each community are listed in the tables that follow in the order below:

- Augusta County
- Bath County
- Highland County
- Rockbridge County
- Rockingham County
- City of Buena Vista
- City of Harrisonburg
- City of Lexington
- City of Staunton
- City of Waynesboro
- Town of Bridgewater
- Town of Broadway
- Town of Craigsville
- Town of Dayton
- Town of Elkton
- Town of Glasgow
- Town of Goshen
- Town of Grottoes
- Town of Monterey
- Town of Mt. Crawford
- Town of Timberville
- James Madison University

## Central Shenandoah Hazard Mitigation Plan: Local Mitigation Strategies

Community: <b>Augusta County</b>
NFIP Community Number: <b>510013</b>

Regional Strategy ID #	Mitigation Strategy	Hazard	Priority High Medium Low	Project Status Delayed On-going Completed	If Not Completed, Why?	Responsible Party	Time Frame
14.1	Continue membership and participation in Shenandoah Valley Project Impact, the regional disaster preparedness and mitigation education program that was started in September 2000. Shenandoah Valley Project Impact educates citizens in the region about disaster preparedness and mitigation through public awareness campaigns, workshops and trainings, and an extensive resource library.	Multi- Hazards	High	On-going	N/A	CSPDC	On-going
14.1	Maintain a relationship with the Southern Shenandoah Chapter of Virginia Voluntary Organizations Active in Disaster (VOAD), to share knowledge and resources throughout the preparation, response, and recovery phases of a disaster.	Multi- Hazards	High	On-going	N/A	County	On-going
6.1 – 6.8 8.1, 8.2 10.1 – 10.4 12.1	Support implementation of structural and non-structural mitigation activities on private or public property to reduce exposure to and provide protection from natural and man-made hazards. Eligible projects include but are not limited to acquisition, elevation, minor structural flood control projects, relocation of structures, retrofitting of existing structures, infrastructure protection measures, stormwater and wastewater management improvements, advanced warning systems, hazard gauging systems, hazard education, and wildfire mitigation projects.	Multi- Hazards	High	On-going	N/A	County	On-going

Regional Strategy ID #	Mitigation Strategy	Hazard	Priority High Medium Low	Project Status Delayed On-going Completed	If Not Completed, Why?	Responsible Party	Time Frame
2.1 – 2.4	Maintain the community's compliance with the National Flood Insurance Program (NFIP) by engaging in various activities included in the three basic components of the NFIP program; 1. floodplain identification and mapping risk, 2. responsible floodplain management, and 3. flood insurance. Sample activities include but are not limited to: maintaining publicly accessible and accurate Flood Insurance Rate Maps (FIRMs), adopting and enforcing a compliant floodplain ordinance, and provide general assistance and education to community members regarding the flood insurance program.	Flood	High	On-going	N/A	County	On-going
5.1 – 5.4	Encourage the lessening of potential wildfires in our community and the region by; 1. Education and outreach to residents, especially those that live in woodland areas and the Wildland Urban Interface (WUI). 2. Reduction of hazardous fuels throughout the community. 3. Reduction of structural ignitability to limit injury, loss of life, and property and structural damage. 4. Having trained first responders with proper tools and equipment that will serve as a frontline defense against a wildfire.	Wildfire	High	On-going	N/A	County	On-going
12.1 – 12.2	Continue study of dam risk assessment. Seek funding to inspect, maintain, and upgrade older dams.  * Note: The December 2009 Floodplain Ordinance revision added floodpool areas to the Special Flood Hazard Area. The County continues to work with the HWSWCD, Staunton, and Waynesboro to map inundation zones for all publicly owned, regulated dams in Augusta County.	Flood	Medium	Robinson Hollow Dam 310 – A has been upgraded with reinforced spillways	Completed	County	On-going

Regional Strategy ID #	Mitigation Strategy	Hazard	Priority High Medium Low	Project Status Delayed On-going Completed	If Not Completed, Why?	Responsible Party	Time Frame
				and concrete retaining wall.  Inch Branch Dam has been upgraded with increased spillway capacity and a new riser structure.* Currently work is being done on the Hearth Stone dam on Tillman Road.	Completed  On-going		
1.3	Floodplain Ordinance – Update and revise ordinance; include floodplain overlay district to zoning ordinance.  *Note 2009 revision includes a general prohibition on development on new lots in the floodplain and institutes compensatory storage for any fill in the floodplain.	Flood	Medium	Completed  Floodplain Ordinance revised in December 2009*.	N/A	County	N/A

Regional Strategy ID #	Mitigation Strategy	Hazard	Priority High Medium Low	Project Status Delayed On-going Completed	If Not Completed, Why?	Responsible Party	Time Frame
15.3	Update FEMA's flood maps for the following areas in the County that have repetitive flooding problems: North Mountain Estates on East Dry Branch, Deerfield on Hamilton Branch, Crawford Manor at East Dry Branch, Joliet Springs on South River, near Crimora, Stuarts Draft, and Augusta Springs on Little Calfpasture River.	Flood	Medium	Completed  FEMA finished up a Physical Map Revision that has the effective date of <b>08/3/15</b> . Other revisions remain on the list for future updates.	N/A	FEMA and County	N/A
14.1	Continue to provide citizens with in-school programs, communication classes, tours, and emergency management seminars.	Multi- Hazards	High	On-going	N/A	County	On-going
10	Increase emergency communications capability including Reverse 9-1-1, Ind. Map, Emergency Action Plans (EAPs), Dam Protocols, Mass E-mails, and "Child Is Missing" Hotline.	Multi- Hazards	High	On-going	N/A	County	On-going
9.1	Maintain IFLOWS Rain-Stream Gauge. Install new gauges in Verona and Swoope.	Flood	High	On-going	N/A	County	On-going
12	Restoration of Dams in Robinson Hollow, Tom Branch, and Mills Creek.	Flood	High	Completed	N/A	County	On-going
13.1 –13.2	County has been an active participant in stream remediation projects through the Emergency Watershed	Flood	High	On-going	N/A	County	On-going

Regional Strategy ID #	Mitigation Strategy	Hazard	Priority High Medium Low	Project Status Delayed On-going Completed	If Not Completed, Why?	Responsible Party	Time Frame
	Protection Program. Maintenance work has been and will continue to be performed when required on a large-scale project on the Saint Mary's River.						
16	Create and keep updated a regional Emergency Operations Plan (EOP) with the cities of Staunton and Waynesboro to more effectively and efficiently utilize the resources of the three localities.	Multi- Hazards	High	Completed On-going	N/A	County and Cities	On-going
5	Complete a wildfire protection plan to assess vulnerable woodland areas and propose mitigation techniques and projects to reduce wildfire risk in the County.	Wildfire	High	Completed	N/A	County	Completed in 2013
7.9 –7.10	Continue development and implementation of planning, preparedness, and response strategies for pets, livestock, and other animals in the County. Maintain regional animal sheltering trailer to assist with animal needs during a disaster.	Multi- Hazards	High	On-going	N/A	County	On-going
16	Continue to partner with the Shenandoah Valley Regional Airport in training and implementation of their Airport Emergency Response Plan.	Multi- Hazards	High	On-going	N/A	County and Airport	On-going
14.6	Maintain the Staunton-Augusta-Waynesboro Community Emergency Response Team (S-A-W CERT).	Multi- Hazards	High	On-going	N/A	County and Cities	On-going
12	Yearly, participate in a Regional Dam Exercise that also includes private dam owners.	Flooding	Medium	On-going	N/A	County	On-going
11	Work with the Virginia Department of Transportation (VDOT) to keep roadways and stormwater drainage free from debris particularly when severe weather is anticipated.	Multi- Hazards	High	On-going	N/A	County VDOT	On-going
10	Implement a smoke installation program for mobile home and residential structures in the County.	Fire	High	Completed	N/A	County	2018-19



## Central Shenandoah Hazard Mitigation Plan: Local Mitigation Strategies

Community: <b>Bath County</b>
NFIP Community Number: <b>51096</b>

Regional Strategy ID#	Mitigation Strategy	Hazard	Priority High Medium Low	Project Status Delayed On-going Completed	If Not Completed, Why?	Responsible Party	Time Frame
14.1	Continue membership and participation in Shenandoah Valley Project Impact, the regional disaster preparedness and mitigation education program that was started in September 2000. Shenandoah Valley Project Impact educates citizens in the region about disaster preparedness and mitigation through public awareness campaigns, workshops and trainings, and an extensive resource library.	Multi- Hazards	High	On-going	N/A	CSPDC	On-going
14.1	Maintain a relationship with the Southern Shenandoah Chapter of Virginia Voluntary Organizations Active in Disaster (VOAD), to share knowledge and resources throughout the preparation, response, and recovery phases of a disaster.	Multi- Hazards	High	On-going	N/A	County	On-going
6.1 – 6.8 8.1, 8.2 10.1 – 10.4 12.1	Support implementation of structural and non-structural mitigation activities on private or public property to reduce exposure to and provide protection from natural and man-made hazards. Eligible projects include but are not limited to acquisition, elevation, minor structural flood control projects, relocation of structures, retrofitting of existing structures, infrastructure protection measures, stormwater and wastewater management improvements, advanced warning systems, hazard gauging systems, hazard education, and wildfire mitigation projects.	Multi- Hazards	High	On-going	N/A	County	On-going

Regional Strategy ID#	Mitigation Strategy	Hazard	Priority High Medium Low	Project Status Delayed On-going Completed	If Not Completed, Why?	Responsible Party	Time Frame
2.1 – 2.4	Maintain the community's compliance with the National Flood Insurance Program (NFIP) by engaging in various activities included in the three basic components of the NFIP program; 1. floodplain identification and mapping risk, 2. responsible floodplain management, and 3. flood insurance. Sample activities include but are not limited to: maintaining publicly accessible and accurate Flood Insurance Rate Maps (FIRMs), adopting and enforcing a compliant floodplain ordinance, and provide general assistance and education to community members regarding the flood insurance program.	Flood	High	On-going	N/A	County	On-going
5.1 – 5.4	<p>Encourage the lessening of potential wildfires in our community and the region by;</p> <ol style="list-style-type: none"> <li>1. Education and outreach to residents, especially those that live in woodland areas and the Wildland Urban Interface (WUI).</li> <li>2. Reduction of hazardous fuels throughout the community.</li> <li>3. Reduction of structural ignitability to limit injury, loss of life, and property and structural damage.</li> <li>4. Having trained first responders with proper tools and equipment that will serve as a frontline defense against a wildfire.</li> </ol>	Wildfire	High	On-going	N/A	County	On-going
6.1	Develop a program to elevate, relocate, floodproof or acquire floodprone structures in order to reduce or eliminate future damages with priority given to structures that are repetitively flooded. Areas of concern where flooding is repetitive include Hot Springs, Jackson River, Mill Creek, Millboro, Millboro Springs, Mountain Grove, and Pads Creek.	Flood	High	Pending – County continues to seek NFWF or other funding.	No funding	County State Federal	Unknown

Regional Strategy ID#	Mitigation Strategy	Hazard	Priority High Medium Low	Project Status Delayed On-going Completed	If Not Completed, Why?	Responsible Party	Time Frame
15.3	Explore the possibility of revising the County 's Flood Insurance Rate Maps (FIRMS) through the Physical Map Revision Process to address changes in the current floodplain delineation.	Flood	High	Pending	No funding	County	Unknown
9.1	Maintain current IFLOWS rain/stream gauges and consider installing additional gauges in areas of concern if funding is available.	Flood	High	On-going	N/A	County	On-going
10	Implement the Code Red Emergency Notification system throughout the County. This system allows for telephone notification for the entire County or targeted areas during emergency situations that require immediate action.	Multi- Hazards	High	Completed	N/A	County	On-going
10	Construct new E-911 Center which will contain an enhanced 911 hardware and software program that will allow dispatches to receive telephone calls from land lines as well as cell phones and create location maps.	Multi- Hazards	High			County	
11.4	Continue to implement and expand Emergency Sheltering Program in the County by partnering with the Red Cross and applying for grant funding for emergency generators for shelters.	Multi- Hazards	High	On-going	N/A	County	On-going
16	Continue participation in the Bath County Local Emergency Planning Committee (LEPC).	Multi- Hazards	High	On-going	N/A	County	On-going
13	Consider flood mitigation actions in the County focused on natural systems protection.	Flood	High				On-going

## Central Shenandoah Hazard Mitigation Plan: Local Mitigation Strategies

Community: <b>Highland County</b>
NFIP Community Number: <b>510311</b>

Regional Strategy ID #	Mitigation Strategy	Hazard	Priority High Medium Low	Project Status Delayed On-going Completed	If Not Completed, Why?	Responsible Party	Time Frame
14.1	Continue membership and participation in Shenandoah Valley Project Impact, the regional disaster preparedness and mitigation education program that was started in September 2000. Shenandoah Valley Project Impact educates citizens in the region about disaster preparedness and mitigation through public awareness campaigns, workshops and trainings, and an extensive resource library.	Multi- Hazards	High	On-going	N/A	CSPDC	On-going
14.1	Maintain a relationship with the Southern Shenandoah Chapter of Virginia Voluntary Organizations Active in Disaster (VOAD), to share knowledge and resources throughout the preparation, response, and recovery phases of a disaster.	Multi- Hazards	High	On-going	N/A	County	On-going
6.1 – 6.8 8.1, 8.2 10.1 – 10.4 12.1	Support implementation of structural and non-structural mitigation activities on private or public property to reduce exposure to and provide protection from natural and man-made hazards. Eligible projects include but are not limited to acquisition, elevation, minor structural flood control projects, relocation of structures, retrofitting of existing structures, infrastructure protection measures, stormwater and wastewater management improvements, advanced warning systems, hazard gauging systems, hazard education, and wildfire mitigation projects.	Multi- Hazards	High	On-going	N/A	County	On-going

Regional Strategy ID #	Mitigation Strategy	Hazard	Priority High Medium Low	Project Status Delayed On-going Completed	If Not Completed, Why?	Responsible Party	Time Frame
2.1 – 2.4	Maintain the community's compliance with the National Flood Insurance Program (NFIP) by engaging in various activities included in the three basic components of the NFIP program; 1. floodplain identification and mapping risk, 2. responsible floodplain management, and 3. flood insurance. Sample activities include but are not limited to: maintaining publicly accessible and accurate Flood Insurance Rate Maps (FIRMs), adopting and enforcing a compliant floodplain ordinance, and provide general assistance and education to community members regarding the flood insurance program.	Flood	High	On-going	N/A	County	On-going
5.1 – 5.4	Encourage the lessening of potential wildfires in our community and the region by; 1. Education and outreach to residents, especially those that live in woodland areas and the Wildland Urban Interface (WUI). 2. Reduction of hazardous fuels throughout the community. 3. Reduction of structural ignitability to limit injury, loss of life, and property and structural damage. 4. Having trained first responders with proper tools and equipment that will serve as a frontline defense against a wildfire.	Wildfire	High	On-going	N/A	County	On-going
13	Consider mitigation actions in the County that are focused on natural systems protection.	Flood	High				On-going

## Central Shenandoah Hazard Mitigation Plan: Local Mitigation Strategies

Community: <b>Rockbridge County</b>
NFIP Community Number: <b>510205</b>

Regional Strategy ID#	Mitigation Strategy	Hazard	Priority High Medium Low	Project Status Delayed On-going Completed	If Not Completed, Why?	Responsible Party	Time Frame
14.1	Continue membership and participation in Shenandoah Valley Project Impact, the regional disaster preparedness and mitigation education program that was started in September 2000. Shenandoah Valley Project Impact educates citizens in the region about disaster preparedness and mitigation through public awareness campaigns, workshops and trainings, and an extensive resource library.	Multi- Hazards	High	On-going	N/A	CSPDC	On-going
14.1	Maintain a relationship with the Southern Shenandoah Chapter of Virginia Voluntary Organizations Active in Disaster (VOAD), to share knowledge and resources throughout the preparation, response, and recovery phases of a disaster.	Multi- Hazards	High	On-going	N/A	County	On-going
6.1 – 6.8 8.1, 8.2 10.1 – 10.4 12.1	Support implementation of structural and non-structural mitigation activities on private or public property to reduce exposure to and provide protection from natural and man-made hazards. Eligible projects include but are not limited to acquisition, elevation, minor structural flood control projects, relocation of structures, retrofitting of existing structures, infrastructure protection measures, stormwater and wastewater management improvements, advanced warning systems, hazard gauging systems, hazard education, and wildfire mitigation projects.	Multi- Hazards	High	On-going	N/A	County	On-going

Regional Strategy ID#	Mitigation Strategy	Hazard	Priority High Medium Low	Project Status Delayed On-going Completed	If Not Completed, Why?	Responsible Party	Time Frame
2.1 – 2.4	Maintain the community's compliance with the National Flood Insurance Program (NFIP) by engaging in various activities included in the three basic components of the NFIP program; 1. floodplain identification and mapping risk, 2. responsible floodplain management, and 3. flood insurance. Sample activities include but are not limited to: maintaining publicly accessible and accurate Flood Insurance Rate Maps (FIRMs), adopting and enforcing a compliant floodplain ordinance, and provide general assistance and education to community members regarding the flood insurance program.	Flood	High	On-going	N/A	County	On-going
5.1 – 5.4	Encourage the lessening of potential wildfires in our community and the region by; 1. Education and outreach to residents, especially those that live in woodland areas and the Wildland Urban Interface (WUI). 2. Reduction of hazardous fuels throughout the community. 3. Reduction of structural ignitability to limit injury, loss of life, and property and structural damage. 4. Having trained first responders with proper tools and equipment that will serve as a frontline defense against a wildfire.	Wildfire	High	On-going	N/A	County	On-going
6.1	Complete the South River Flood Mitigation Project which calls for the acquisition of up to 35 properties that were destroyed or damaged in Hurricane Isabel.	Flood	High	Completed	N/A	County State Federal	N/A
3.2	Develop a St. Mary's/South River Watershed feasibility study – a joint project with Augusta County and the Army Corps of Engineers to study the flooding along the St. Mary's and South River watersheds.	Flood	Medium	On-hold	N/A	County Federal	N/A

Regional Strategy ID#	Mitigation Strategy	Hazard	Priority High Medium Low	Project Status Delayed On-going Completed	If Not Completed, Why?	Responsible Party	Time Frame
13.1	Continue the stream remediation and bank stabilization work by NRCS on the South River that was affected by Hurricane Isabel and prior flooding events.	Flood	Medium	Complete	N/A	County Federal	N/A

## Central Shenandoah Hazard Mitigation Plan: Local Mitigation Strategies

Community: Rockingham County
NFIP Community Number: 510133

Regional Strategy ID#	Mitigation Strategy	Hazard	Priority High Medium Low	Project Status Delayed On-going Completed	If Not Completed, Why?	Responsible Party	Time Frame
14.1	Continue membership and participation in Shenandoah Valley Project Impact, the regional disaster preparedness and mitigation education program that was started in September 2000. Shenandoah Valley Project Impact educates citizens in the region about disaster preparedness and mitigation through public awareness campaigns, workshops and trainings, and an extensive resource library.	Multi- Hazards	High	On-going	N/A	CSPDC	On-going
14.1	Maintain a relationship with the Southern Shenandoah Chapter of Virginia Voluntary Organizations Active in Disaster (VOAD), to share knowledge and resources throughout the preparation, response, and recovery phases of a disaster.	Multi- Hazards	High	On-going	N/A	County	On-going
6.1 – 6.8 8.1, 8.2 10.1 – 10.4 12.1	Support implementation of structural and non-structural mitigation activities on private or public property to reduce exposure to and provide protection from natural and man-made hazards. Eligible projects include but are not limited to acquisition, elevation, minor structural flood control projects, relocation of structures, retrofitting of existing structures, infrastructure protection measures, stormwater and wastewater management improvements, advanced warning systems, hazard gauging systems, hazard education, and wildfire	Multi- Hazards	High	On-going	N/A	County	On-going

Regional Strategy ID#	Mitigation Strategy	Hazard	Priority High Medium Low	Project Status Delayed On-going Completed	If Not Completed, Why?	Responsible Party	Time Frame
	mitigation projects.						
2.1 – 2.4	Maintain the community's compliance with the National Flood Insurance Program (NFIP) by engaging in various activities included in the three basic components of the NFIP program; 1. floodplain identification and mapping risk, 2. responsible floodplain management, and 3. flood insurance. Sample activities include but are not limited to: maintaining publicly accessible and accurate Flood Insurance Rate Maps (FIRMs), adopting and enforcing a compliant floodplain ordinance, and provide general assistance and education to community members regarding the flood insurance program.	Flood	High	On-going	N/A	County	On-going
5.1 – 5.4	Encourage the lessening of potential wildfires in our community and the region by; 1. Education and outreach to residents, especially those that live in woodland areas and the Wildland Urban Interface (WUI). 2. Reduction of hazardous fuels throughout the community. 3. Reduction of structural ignitability to limit injury, loss of life, and property and structural damage. 4. Having trained first responders with proper tools and equipment that will serve as a frontline defense against a wildfire.	Wildfire	High	On-going	N/A	County	On-going
13.1	Begin the stream remediation projects sponsored by NRCS on Germany River, Naked Creek, and Dry Run River that call for streambank restoration, removal of watershed impairments and installation of debris basins to repair damage caused by Hurricane Isabel.	Flood	High	Complete	N/A	Federal County	NA

Regional Strategy ID#	Mitigation Strategy	Hazard	Priority High Medium Low	Project Status Delayed On-going Completed	If Not Completed, Why?	Responsible Party	Time Frame
14.4	Continue participation in Department of Forestry's Firewise Program, a community awareness and education program that encourages and acknowledges woodland communities to take action that minimizes home loss to wildfires by preparing for a fire before it occurs	Wildfire	High	On-going	N/A	State County	N/A
6.1	Seek funding to continue county-wide residential flood mitigation project that calls for acquisition, elevation, floodproofing of properties identified as at-risk of future flooding. Most of these houses are located in the Naked Creek, Rawley Springs, and Bergton/Criders area of the County.	Flood	High	Delayed	These properties are now mitigated as a result of the Germany River Project.	N/A	N/a
9.1	Rockingham and Page Counties to install an I-Flow gauge on Naked Creek as well as complete stream remediation.	Flood	N/A	Completed	N.A	County	N/A
16	Continue support of the Harrisonburg-Rockingham Disaster Recovery Committee, a volunteer group made up of representatives of local churches, the Red Cross, Salvation Army, United Way, VOAD, Social Services, Rockingham County and others that work with residents affected by disasters in providing assistance not covered by federal and state recovery programs.	Multi-Hazards	High	On-going	N/A	County	N/A
7.10	Continue support of the Harrisonburg and Rockingham SPCA emergency shelter for pets and livestock during a disaster. Volunteers trained to work with animals during disaster situations staff the shelter. Fire Chief also serves on the State Animal Response Committee as well. Completed a grant-funded project that provided a pet emergency supply trailer including supplies and training.	Multi-Hazards	Medium	On-going	N/A	County	On-going

Regional Strategy ID#	Mitigation Strategy	Hazard	Priority High Medium Low	Project Status Delayed On-going Completed	If Not Completed, Why?	Responsible Party	Time Frame
6.1	Acquire houses located in the floodplain along Naked Creek and have land deeded in Open Space.	Flood	High	Delayed	Property owners not willing to sell.	Federal State County	N/A
9.1	Install and maintain I-FLOW gauges in two dams: Dry River and Hone Quarry in the middle of each dam.	Flood	High	Completed	N/A	County and Shenandoah	N/A
3.4 – 3.6	Implement mitigation strategies within the Lake Shenandoah watershed to address recurrent urban flooding. Continue work to select suitable mitigation strategies, including increased detention capacity and increased conveyance capacity. Once suitable options are determined, move forward with implementation when resources are available.	Flood	High	On-going	N/A	Lake Shenandoah Stormwater Control Authority and County	N/A

## Central Shenandoah Hazard Mitigation Plan: Local Mitigation Strategies

Community: <b>City of Buena Vista</b>
NFIP Community Number: <b>510027</b>

Regional Strategy ID #	Mitigation Strategy	Hazard	Priority High Medium Low	Project Status Delayed On-going Completed	If Not Completed, Why?	Responsible Party	Time Frame
14.1	Continue membership and participation in Shenandoah Valley Project Impact, the regional disaster preparedness and mitigation education program that was started in September 2000. Shenandoah Valley Project Impact educates citizens in the region about disaster preparedness and mitigation through public awareness campaigns, workshops and trainings, and an extensive resource library.	Multi- Hazards	High	On-going	N/A	CSPDC	On-going
14.1	Maintain a relationship with the Southern Shenandoah Chapter of Virginia Voluntary Organizations Active in Disaster (VOAD), to share knowledge and resources throughout the preparation, response, and recovery phases of a disaster.	Multi- Hazards	High	On-going	N/A	City	On-going
6.1 – 6.8 8.1, 8.2 10.1 – 10.4 12.1	Support implementation of structural and non-structural mitigation activities on private or public property to reduce exposure to and provide protection from natural and man-made hazards. Eligible projects include but are not limited to acquisition, elevation, minor structural flood control projects, relocation of structures, retrofitting of existing structures, infrastructure protection measures, stormwater and wastewater management improvements, advanced warning systems, hazard gauging systems, hazard education, and wildfire mitigation projects.	Multi- Hazards	High	On-going	N/A	City	On-going

Regional Strategy ID #	Mitigation Strategy	Hazard	Priority High Medium Low	Project Status Delayed On-going Completed	If Not Completed, Why?	Responsible Party	Time Frame
2.1 – 2.4	Maintain the community's compliance with the National Flood Insurance Program (NFIP) by engaging in various activities included in the three basic components of the NFIP program; 1. floodplain identification and mapping risk, 2. responsible floodplain management, and 3. flood insurance. Sample activities include but are not limited to: maintaining publicly accessible and accurate Flood Insurance Rate Maps (FIRMs), adopting and enforcing a compliant floodplain ordinance, and provide general assistance and education to community members regarding the flood insurance program.	Flood	High	On-going	N/A	City	On-going
5.1 – 5.4	Encourage the lessening of potential wildfires in our community and the region by; 1. Education and outreach to residents, especially those that live in woodland areas and the Wildland Urban Interface (WUI). 2. Reduction of hazardous fuels throughout the community. 3. Reduction of structural ignitability to limit injury, loss of life, and property and structural damage. 4. Having trained first responders with proper tools and equipment that will serve as a frontline defense against a wildfire.	Wildfire	Medium	On-going	N/A	City	On-going
8	Continue study of acquiring and demolishing the Reeves Brothers plant, a major industrial site that was closed in 1985 after Hurricane Juan severely damaged the plant.	Flood	Low	Cancelled, Reeves Brothers Plan has been sold.	N/A	N/A	N/A
3.4	Continue the Buena Vista Watershed Project to prevent flooding from four of the interior streams that flow through Buena Vista. The project funded by the USDA	Flood	High	On-going	Funding has been cut.	Federal City	N/A

Regional Strategy ID #	Mitigation Strategy	Hazard	Priority High Medium Low	Project Status Delayed On-going Completed	If Not Completed, Why?	Responsible Party	Time Frame
	would protect 240 residences, 70 commercial structures, and utilities by constructing debris basins, replacing culverts and bridges, and improving stream channels.						
6.1	Seek funding to continue city-wide residential flood mitigation project that calls for the acquisition, elevation, floodproofing of properties identified as at-risk of future flooding.	Flood	High	On-going	Lack of funding.	N/A	N/A

## Central Shenandoah Hazard Mitigation Plan: Local Mitigation Strategies

Community: <b>City of Harrisonburg</b>
NFIP Community Number: <b>510076</b>

Regional Strategy ID #	Mitigation Strategy	Hazard	Priority High Medium Low	Project Status Delayed On-going Completed	If Not Completed, Why?	Responsible Party	Time Frame
14.1	Continue membership and participation in Shenandoah Valley Project Impact, the regional disaster preparedness and mitigation education program that was started in September 2000. Shenandoah Valley Project Impact educates citizens in the region about disaster preparedness and mitigation through public awareness campaigns, workshops and trainings, and an extensive resource library.	Multi- Hazards	High	On-going	N/A	CSPDC	On-going
14.1	Maintain a relationship with the Southern Shenandoah Chapter of Virginia Voluntary Organizations Active in Disaster (VOAD), to share knowledge and resources throughout the preparation, response, and recovery phases of a disaster.	Multi- Hazards	High	On-going	N/A	City	On-going
6.1 – 6.8 8.1, 8.2 10.1 – 10.4 12.1	Support implementation of structural and non-structural mitigation activities on private or public property to reduce exposure to and provide protection from natural and man-made hazards. Eligible projects include but are not limited to acquisition, elevation, minor structural flood control projects, relocation of structures, retrofitting of existing structures, infrastructure protection measures, stormwater and wastewater management improvements, advanced warning systems, hazard gauging systems, hazard education, and wildfire mitigation projects.	Multi- Hazards	High	On-going	N/A	City	On-going

Regional Strategy ID #	Mitigation Strategy	Hazard	Priority High Medium Low	Project Status Delayed On-going Completed	If Not Completed, Why?	Responsible Party	Time Frame
2.1 – 2.4	Maintain the community's compliance with the National Flood Insurance Program (NFIP) by engaging in various activities included in the three basic components of the NFIP program; 1. floodplain identification and mapping risk, 2. responsible floodplain management, and 3. flood insurance. Sample activities include but are not limited to: maintaining publicly accessible and accurate Flood Insurance Rate Maps (FIRMs), adopting and enforcing a compliant floodplain ordinance, and provide general assistance and education to community members regarding the flood insurance program.	Flood	High	On-going	N/A	City	On-going
5.1 – 5.4	Encourage the lessening of potential wildfires in our community and the region by; 1. Education and outreach to residents, especially those that live in woodland areas and the Wildland Urban Interface (WUI). 2. Reduction of hazardous fuels throughout the community. 3. Reduction of structural ignitability to limit injury, loss of life, and property and structural damage. 4. Having trained first responders with proper tools and equipment that will serve as a frontline defense against a wildfire.	Wildfire	Medium	On-going	N/A	City	On-going
15.1	Continue participation in FEMA's Cooperating Technical Program (CTP), a technical assistance program sponsored by FEMA that will assist the City in re-mapping the entire floodplain boundary in the City.	Flood	Medium	Complete	N/A	Federal City	N/A
16	Continue support of the Harrisonburg-Rockingham Disaster Recovery Committee, a volunteer group made up of representatives of local churches, the Red Cross, Salvation Army, United Way, VOAD, Social Services,	Multi- Hazards	High	On-going	N/A	City	On-going

Regional Strategy ID #	Mitigation Strategy	Hazard	Priority High Medium Low	Project Status Delayed On-going Completed	If Not Completed, Why?	Responsible Party	Time Frame
	Rockingham County and others that work with residents affected by disasters in providing assistance not covered by federal and state recovery programs.						
12.2	Decommission the dam at James Madison University* <i>* Note: Over-topping protection was constructed in 2014-15 to protect impoundment failure.</i>	Flood	High	Alternate construction completed.	N/A	JMU	N/A
3.4	Replace a deteriorating culvert bridge on Madison Street with upsized culverts which will trap less debris during storm events.	Flood	High	Completed	N/A	City	N/A
3.2, 3.4	Identify and implement drainage improvement projects to mitigate flooding throughout the City. Projects may be identified through the Drainage Improvement Program, the Stormwater Improvement Plan, or other methods.	Flood	High	On-going	N/A	City	On-going
13	Consider mitigation actions in the City that are focused on natural systems protection.	Flood	High				On-going

## Central Shenandoah Hazard Mitigation Plan: Local Mitigation Strategies

Community: <b>City of Lexington</b>
NFIP Community Number: <b>510089</b>

Regional Strategy ID #	Mitigation Strategy	Hazard	Priority High Medium Low	Project Status Delayed On-going Completed	If Not Completed, Why?	Responsible Party	Time Frame
14.1	Continue membership and participation in Shenandoah Valley Project Impact, the regional disaster preparedness and mitigation education program that was started in September 2000. Shenandoah Valley Project Impact educates citizens in the region about disaster preparedness and mitigation through public awareness campaigns, workshops and trainings, and an extensive resource library.	Multi- Hazards	High	On-going	N/A	CSPDC	On-going
14.1	Maintain a relationship with the Southern Shenandoah Chapter of Virginia Voluntary Organizations Active in Disaster (VOAD), to share knowledge and resources throughout the preparation, response, and recovery phases of a disaster.	Multi- Hazards	High	On-going	N/A	City	On-going
6.1 – 6.8 8.1, 8.2 10.1 – 10.4 12.1	Support implementation of structural and non-structural mitigation activities on private or public property to reduce exposure to and provide protection from natural and man-made hazards. Eligible projects include but are not limited to acquisition, elevation, minor structural flood control projects, relocation of structures, retrofitting of existing structures, infrastructure protection measures, stormwater and wastewater management improvements, advanced warning systems, hazard gauging systems, hazard education, and wildfire mitigation projects.	Multi- Hazards	High	On-going	N/A	City	On-going

Regional Strategy ID #	Mitigation Strategy	Hazard	Priority High Medium Low	Project Status Delayed On-going Completed	If Not Completed, Why?	Responsible Party	Time Frame
2.1 – 2.4	Maintain the community's compliance with the National Flood Insurance Program (NFIP) by engaging in various activities included in the three basic components of the NFIP program; 1. floodplain identification and mapping risk, 2. responsible floodplain management, and 3. flood insurance. Sample activities include but are not limited to: maintaining publicly accessible and accurate Flood Insurance Rate Maps (FIRMs), adopting and enforcing a compliant floodplain ordinance, and provide general assistance and education to community members regarding the flood insurance program.	Flood	High	On-going	N/A	City	On-going
5.1 – 5.4	<p>Encourage the lessening of potential wildfires in our community and the region by;</p> <ol style="list-style-type: none"> <li>1. Education and outreach to residents, especially those that live in woodland areas and the Wildland Urban Interface (WUI).</li> <li>2. Reduction of hazardous fuels throughout the community.</li> <li>3. Reduction of structural ignitability to limit injury, loss of life, and property and structural damage.</li> <li>4. Having trained first responders with proper tools and equipment that will serve as a frontline defense against a wildfire.</li> </ol>	Wildfire	Medium	On-going	N/A	City	On-going
13.1	Complete the Woods Creek Restoration Project to address water quality/quantity problems along Woods Creek, which runs through the City. The project includes establishing riparian buffers, control storm runoff, modify existing stormwater retention facilities and educate property owners about water quality/quantity issues.	Flood	Medium	On-going	N/A	N/A	N/A

## Central Shenandoah Hazard Mitigation Plan: Local Mitigation Strategies

Community: <b>City of Staunton</b>
NFIP Community Number: <b>510155</b>

Regional Strategy ID #	Mitigation Strategy	Hazard	Priority High Medium Low	Project Status Delayed On-going Completed	If Not Completed, Why?	Responsible Party	Time Frame
14.1	Continue membership and participation in Shenandoah Valley Project Impact, the regional disaster preparedness and mitigation education program that was started in September 2000. Shenandoah Valley Project Impact educates citizens in the region about disaster preparedness and mitigation through public awareness campaigns, workshops and trainings, and an extensive resource library.	Multi- Hazards	High	On-going	N/A	CSPDC	On-going
14.1	Maintain a relationship with the Southern Shenandoah Chapter of Virginia Voluntary Organizations Active in Disaster (VOAD), to share knowledge and resources throughout the preparation, response, and recovery phases of a disaster.	Multi- Hazards	High	On-going	N/A	City	On-going
6.1 – 6.8 8.1, 8.2 10.1 – 10.4 12.1	Support implementation of structural and non-structural mitigation activities on private or public property to reduce exposure to and provide protection from natural and man-made hazards. Eligible projects include but are not limited to acquisition, elevation, minor structural flood control projects, relocation of structures, retrofitting of existing structures, infrastructure protection measures, stormwater and wastewater management improvements, advanced warning systems, hazard gauging systems, hazard education, and wildfire mitigation projects.	Multi- Hazards	High	On-going	N/A	City	On-going

Regional Strategy ID #	Mitigation Strategy	Hazard	Priority High Medium Low	Project Status Delayed On-going Completed	If Not Completed, Why?	Responsible Party	Time Frame
2.1 – 2. 4	Maintain the community's compliance with the National Flood Insurance Program (NFIP) by engaging in various activities included in the three basic components of the NFIP program; 1. floodplain identification and mapping risk, 2. responsible floodplain management, and 3. flood insurance. Sample activities include but are not limited to: maintaining publicly accessible and accurate Flood Insurance Rate Maps (FIRMs), adopting and enforcing a compliant floodplain ordinance, and provide general assistance and education to community members regarding the flood insurance program.	Flood	High	On-going	N/A	City	On-going
5.1 – 5.4	Encourage the lessening of potential wildfires in our community and the region by; 1. Education and outreach to residents, especially those that live in woodland areas and the Wildland Urban Interface (WUI). 2. Reduction of hazardous fuels throughout the community. 3. Reduction of structural ignitability to limit injury, loss of life, and property and structural damage. 4. Having trained first responders with proper tools and equipment that will serve as a frontline defense against a wildfire.	Wildfire	Medium	On-going	N/A	City	On-going
3.4	Complete construction of the Churchville Avenue storm sewer project that is vital to reducing and alleviating downstream flooding in the central business district.	Flood	High	Completed	N/A	City	N/A
3.2	Seek funding to prepare site-specific hydrologic and hydraulic studies that look at the downtown commercial/historic areas that have chronic and repetitive flooding problems. After study is completed, implement recommended mitigation strategies.	Flood	High	Delayed	Lack of funding	N/A	N/A

Regional Strategy ID #	Mitigation Strategy	Hazard	Priority High Medium Low	Project Status Delayed On-going Completed	If Not Completed, Why?	Responsible Party	Time Frame
9, 16	Increase expenditures for state-of the-art equipment, communication systems, and heavy equipment to respond to natural disasters in an effective and efficient manner.	Multi- Hazards	Low	Delayed	Lack of funding	N/A	N/A
8.2	Provide floodproofing measures to approximately 12 commercial structures in the downtown area that have been identified as at-risk of flooding. Six additional commercial structures needing floodproofing remain.	Flood	High	Completed	N/A	City State Federal	N/A
3.4	Demolish structures in floodplain on Central Avenue and complete process of "daylighting" a tributary of Lewis Creek.	Flood	High	Completed	N/A	City and Pvt. Citizen	N/A
10	Install emergency notification system with "Reverse 911" capability and notification by text. <i>City now has the "Staunton Alert Message" system.</i>	Multi- Hazards	High	Completed	N/A	N/A	N/A
6.3	Implement a floodproofing project throughout the City that will strap down above ground storage tanks in the floodplain.	Flood	High	Delayed	Lack of Funding	N/A	N/A
11.4	Install generators at all the designated emergency shelters in the City.	Multi- Hazards	High	Completed	N/A	N/A	N/A
7.10	Maintain an animal supply trailer and all the supplies needed to stock the mandated animal shelter which will be located at Augusta Expo.	Multi-Hazards	High	Completed	N/A	N/A	N/A
13	Create a retention pond in the western portion of the City and install other stormwater facilities throughout the City as needed to address stormwater issues.	Flood	High	Delayed	Lack of Funding	N/A	N/A
16	City departments will undergo an annual review of the planning process to evaluate their preparedness.	Multi- Hazards	High	On-going	N/A	City	N/A

Regional Strategy ID #	Mitigation Strategy	Hazard	Priority High Medium Low	Project Status Delayed On-going Completed	If Not Completed, Why?	Responsible Party	Time Frame
16	Create a regional Emergency Operations Plan (EOP) with the City of Waynesboro and Augusta County to more effectively and efficiently utilize the resources of the three localities.	Multi-Hazards	High	Completed	N/A	County and Cities	N/A
14.6	Maintain the Staunton-Augusta-Waynesboro Community Emergency Response Team (S-A-W CERT).	Multi-Hazards	High	On-going	N/A	County and Cities	On-going
11.1	Move the fire station located at 500 N. Augusta Street out of the floodplain.	Flood	High	Delayed	Lack of Funding	City	N/A
13	Consider mitigation actions in the City that are focused on natural systems protection.	Flood	High				On-going

## Central Shenandoah Hazard Mitigation Plan: Local Mitigation Strategies

Community: <b>City of Waynesboro</b>
NFIP Community Number: <b>515532</b>

Regional Strategy ID#	Mitigation Strategy	Hazard	Priority High Medium Low	Project Status Delayed On-going Completed	If Not Completed, Why?	Responsible Party	Time Frame
14.1	Continue membership and participation in Shenandoah Valley Project Impact, the regional disaster preparedness and mitigation education program that was started in September 2000. Shenandoah Valley Project Impact educates citizens in the region about disaster preparedness and mitigation through public awareness campaigns, workshops and trainings, and an extensive resource library.	Multi-Hazards	High	On-going	N/A	CSPDC	On-going
14.1	Maintain a relationship with the Southern Shenandoah Chapter of Virginia Voluntary Organizations Active in Disaster (VOAD), to share knowledge and resources throughout the preparation, response, and recovery phases of a disaster.	Multi- Hazards	High	On-going	N/A	City	On-going
6.1 – 6.8 8.1,8.2 10.1 – 10.4 12.1	Support implementation of structural and non-structural mitigation activities on private or public property to reduce exposure to and provide protection from natural and man-made hazards. Eligible projects include but are not limited to acquisition, elevation, minor structural flood control projects, relocation of structures, retrofitting of existing structures, infrastructure protection measures, stormwater and wastewater management improvements, advanced warning systems, hazard gauging systems, hazard education, and wildfire mitigation projects.	Multi- Hazards	High	On-going	N/A	City	On-going

Regional Strategy ID#	Mitigation Strategy	Hazard	Priority High Medium Low	Project Status Delayed On-going Completed	If Not Completed, Why?	Responsible Party	Time Frame
2.1 – 2.4	Maintain the community's compliance with the National Flood Insurance Program (NFIP) by engaging in various activities included in the three basic components of the NFIP program; 1. floodplain identification and mapping risk, 2. responsible floodplain management, and 3. flood insurance. Sample activities include but are not limited to: maintaining publicly accessible and accurate Flood Insurance Rate Maps (FIRMs), adopting and enforcing a compliant floodplain ordinance, and provide general assistance and education to community members regarding the flood insurance program.	Flood	High	On-going	N/A	City	On-going
5.1 – 5.4	Encourage the lessening of potential wildfires in our community and the region by; 1. Education and outreach to residents, especially those that live in woodland areas and the Wildland Urban Interface (WUI). 2. Reduction of hazardous fuels throughout the community. 3. Reduction of structural ignitability to limit injury, loss of life, and property and structural damage. 4. Having trained first responders with proper tools and equipment that will serve as a frontline defense against a wildfire.	Wildfire	Medium	On-going	N/A	City	On-going
6.1	Complete the acquisition and relocation of tenants of the Race Ave. Trailer Park, a 33-unit trailer park that has been repetitively and seriously damaged in numerous flood events.	Flood	High	Completed	N/A	N/A	N/A
6.2	Continue city-wide residential flood mitigation project that calls for the acquisition, elevation, or floodproofing of more than 50 properties identified as at-risk for future flooding. Most of the houses are in the River Shores/Club	Flood	High	On-going	Lack of Funding	N/A	On-going

Regional Strategy ID#	Mitigation Strategy	Hazard	Priority High Medium Low	Project Status Delayed On-going Completed	If Not Completed, Why?	Responsible Party	Time Frame
	Court and adjacent to downtown areas of the City. Sixteen properties have been purchased and kept in "open space".						
6.1	Complete a project to elevate houses, floodproof utilities, and install flood vents for 12 properties located on residential areas adjacent to downtown area in the floodplain	Flood	High	On-going	Lack of Funding	State and Local	On-going
13	Implement greenways project along South River to keep floodplain in "Open Space".	Flood	High	Completed	N/A	N/A	N/A
3.4	Implement stormwater project for Wayne Hills Field in front of the Public Works Building by creating retention pond and connecting drop inlets with piping to travel to retention pond.	Flood	High	On-going	N/A	City	N/A
6.2	Seek funding to implement a flood mitigation project to provide floodproofing and retrofitting measures to Waynesboro's downtown commercial area.	Flood	Medium	On-going	Lack of Funding	N/A	N/A
3.1	Update a master stormwater study that identifies, analyzes, and prioritizes flooding in areas throughout the City. Hire a stormwater manager for the City.	Flood	Medium	On-going	N/A	Local	N/A
12	Install a flood control dam in Jones Hollow to address problem of ingress and egress of property owners near the mountain whose houses don't flood but people get trapped.	Flood	High	Completed	N/A	N/A	N/A
16	Create a regional Emergency Operations Plan (EOP) with the City of Staunton and Augusta County to more effectively and efficiently utilize the resources of the three localities.	Multi-Hazards	High	On-going	N/A	County and Cities	N/A

Regional Strategy ID#	Mitigation Strategy	Hazard	Priority High Medium Low	Project Status Delayed On-going Completed	If Not Completed, Why?	Responsible Party	Time Frame
14.6	Maintain the Staunton-Augusta-Waynesboro Community Emergency Response Team (S-A-W CERT)	Multi-Hazards	High	On-going	N/A	County and Cities	N/A

## Central Shenandoah Hazard Mitigation Plan: Local Mitigation Strategies

Community: <b>Town of Bridgewater</b>
NFIP Community Number: <b>510134</b>

Regional Strategy ID #	Mitigation Strategy	Hazard	Priority High Medium Low	Project Status Delayed On-going Completed	If Not Completed, Why?	Responsible Party	Time Frame
14.1	Continue membership and participation in Shenandoah Valley Project Impact, the regional disaster preparedness and mitigation education program that was started in September 2000. Shenandoah Valley Project Impact educates citizens in the region about disaster preparedness and mitigation through public awareness campaigns, workshops and trainings, and an extensive resource library.	Multi - Hazards	High	On-going	N/A	CSPDC	On-going
14.1	Maintain a relationship with the Southern Shenandoah Chapter of Virginia Voluntary Organizations Active in Disaster (VOAD), to share knowledge and resources throughout the preparation, response, and recovery phases of a disaster.	Multi - Hazards	High	On-going	N/A	Town	On-going
6.1 – 6.8 8.1, 8.2 10.1 – 10.4 12.1	Support implementation of structural and non-structural mitigation activities on private or public property to reduce exposure to and provide protection from natural and man-made hazards. Eligible projects include but are not limited to acquisition, elevation, minor structural flood control projects, relocation of structures, retrofitting of existing structures, infrastructure protection measures, stormwater and wastewater management improvements, advanced warning systems, hazard gauging systems, hazard education, and wildfire mitigation projects.	Multi - Hazards	High	On-going	N/A	Town	On-going

Regional Strategy ID #	Mitigation Strategy	Hazard	Priority High Medium Low	Project Status Delayed On-going Completed	If Not Completed, Why?	Responsible Party	Time Frame
2.1 – 2.4	Maintain the community's compliance with the National Flood Insurance Program (NFIP) by engaging in various activities included in the three basic components of the NFIP program; 1. floodplain identification and mapping risk, 2. responsible floodplain management, and 3. flood insurance. Sample activities include but are not limited to: maintaining publicly accessible and accurate Flood Insurance Rate Maps (FIRMs), adopting and enforcing a compliant floodplain ordinance, and provide general assistance and education to community members regarding the flood insurance program.	Flood	High	On-going	N/A	Town	On-going
5.1 – 5.4	Encourage the lessening of potential wildfires in our community and the region by; 1. Education and outreach to residents, especially those that live in woodland areas and the Wildland Urban Interface (WUI). 2. Reduction of hazardous fuels throughout the community. 3. Reduction of structural ignitability to limit injury, loss of life, and property and structural damage. 4. Having trained first responders with proper tools and equipment that will serve as a frontline defense against a wildfire.	Wildfire	Medium	On-going	N/A	Town	On-going
6.2	Seek funding to complete the Bridgewater Flood Mitigation Project where structures have been identified at-risk of flooding and mitigation options such as acquisition, elevation, and/or floodproofing is recommended.	Flood	High	Completed	N/A	Federal State Local	N/A
3.4-3.5	Aggressively improve the Town's levee system. Maintain levee annually.	Flood	High	On-going	N/A	Federal Local	N/A

Regional Strategy ID #	Mitigation Strategy	Hazard	Priority High Medium Low	Project Status Delayed On-going Completed	If Not Completed, Why?	Responsible Party	Time Frame
3	Implement plans and regulations at the local level to meet revised storm water management regulations.	Flood	High	On-going	N/A	Local	N/A
13	Consider mitigation actions in the Town that are focused on natural systems protection.	Flood	High				On-going

## Central Shenandoah Hazard Mitigation Plan: Local Mitigation Strategies

Community: <b>Town of Broadway</b>
NFIP Community Number: <b>510135</b>

Regional Strategy ID #	Mitigation Strategy	Hazard	Priority High Medium Low	Project Status Delayed On-going Completed	If Not Completed, Why?	Responsible Party	Time Frame
14.1	Continue membership and participation in Shenandoah Valley Project Impact, the regional disaster preparedness and mitigation education program that was started in September 2000. Shenandoah Valley Project Impact educates citizens in the region about disaster preparedness and mitigation through public awareness campaigns, workshops and trainings, and an extensive resource library.	Multi - Hazards	High	On-going	N/A	CSPDC	On-going
14.1	Maintain a relationship with the Southern Shenandoah Chapter of Virginia Voluntary Organizations Active in Disaster (VOAD), to share knowledge and resources throughout the preparation, response, and recovery phases of a disaster.	Multi - Hazards	High	On-going	N/A	Town	On-going
6.1 – 6.8 8.1, 8.2 10.1 – 10.4 12.1	Support implementation of structural and non-structural mitigation activities on private or public property to reduce exposure to and provide protection from natural and man-made hazards. Eligible projects include but are not limited to acquisition, elevation, minor structural flood control projects, relocation of structures, retrofitting of existing structures, infrastructure protection measures, stormwater and wastewater management improvements, advanced warning systems, hazard gauging systems, hazard education, and wildfire mitigation projects.	Multi - Hazards	High	On-going	N/A	Town	On-going

Regional Strategy ID #	Mitigation Strategy	Hazard	Priority High Medium Low	Project Status Delayed On-going Completed	If Not Completed, Why?	Responsible Party	Time Frame
2.1 – 2.4	Maintain the community's compliance with the National Flood Insurance Program (NFIP) by engaging in various activities included in the three basic components of the NFIP program; 1. floodplain identification and mapping risk, 2. responsible floodplain management, and 3. flood insurance. Sample activities include but are not limited to: maintaining publicly accessible and accurate Flood Insurance Rate Maps (FIRMs), adopting and enforcing a compliant floodplain ordinance, and provide general assistance and education to community members regarding the flood insurance program.	Flood	High	On-going	N/A	Town	On-going
5.1 – 5.4	Encourage the lessening of potential wildfires in our community and the region by;  1. Education and outreach to residents, especially those that live in woodland areas and the Wildland Urban Interface (WUI). 2. Reduction of hazardous fuels throughout the community. 3. Reduction of structural ignitability to limit injury, loss of life, and property and structural damage. 4. Having trained first responders with proper tools and equipment that will serve as a frontline defense against a wildfire.	Wildfire	Medium	On-going	N/A	Town	On-going
1.3	Complete a stream bank restoration project on the full length of Linville Creek to repair erosion that has already occurred and lessen future erosion. Linville Creek is the back-up water supply for the Town. The purpose of this project is to protect water and sewer lines, floodplain management, protect the water intake.	Multi-hazards		Delayed	Lack of Funding		N/A
6.1	Acquire structures in the floodplain in Town.	Flood		Delayed	Lack of Funding		N/A

Regional Strategy ID #	Mitigation Strategy	Hazard	Priority High Medium Low	Project Status Delayed On-going Completed	If Not Completed, Why?	Responsible Party	Time Frame
3.4	Remove a sewer line that is above grade	Multi-hazards		Delayed	Lack of Funding		N/A

## Central Shenandoah Hazard Mitigation Plan: Local Mitigation Strategies

Community: <b>Town of Craigsville</b>
NFIP Community Number: <b>510014</b>

Regional Strategy ID #	Mitigation Strategy	Hazard	Priority High Medium Low	Project Status Delayed On-going Completed	If Not Completed, Why?	Responsible Party	Time Frame
14.1	Continue membership and participation in Shenandoah Valley Project Impact, the regional disaster preparedness and mitigation education program that was started in September 2000. Shenandoah Valley Project Impact educates citizens in the region about disaster preparedness and mitigation through public awareness campaigns, workshops and trainings, and an extensive resource library.	Multi- Hazards	High	On-going	N/A	CSPDC	On-going
14.1	Maintain a relationship with the Southern Shenandoah Chapter of Virginia Voluntary Organizations Active in Disaster (VOAD), to share knowledge and resources throughout the preparation, response, and recovery phases of a disaster.	Multi- Hazards	High	On-going	N/A	Town	On-going
6.1 – 6.8 8.1, 8.2 10.1 – 10.4 12.1	Support implementation of structural and non-structural mitigation activities on private or public property to reduce exposure to and provide protection from natural and man-made hazards. Eligible projects include but are not limited to acquisition, elevation, minor structural flood control projects, relocation of structures, retrofitting of existing structures, infrastructure protection measures, stormwater and wastewater management improvements, advanced warning systems, hazard gauging systems, hazard education, and wildfire mitigation projects.	Multi- Hazards	High	On-going	N/A	Town	On-going

Regional Strategy ID #	Mitigation Strategy	Hazard	Priority High Medium Low	Project Status Delayed On-going Completed	If Not Completed, Why?	Responsible Party	Time Frame
2.1 – 2.4	Maintain the community's compliance with the National Flood Insurance Program (NFIP) by engaging in various activities included in the three basic components of the NFIP program; 1. floodplain identification and mapping risk, 2. responsible floodplain management, and 3. flood insurance. Sample activities include but are not limited to: maintaining publicly accessible and accurate Flood Insurance Rate Maps (FIRMs), adopting and enforcing a compliant floodplain ordinance, and provide general assistance and education to community members regarding the flood insurance program.	Flood	High	On-going	N/A	Town	On-going
5.1 – 5.4	Encourage the lessening of potential wildfires in our community and the region by; 1. Education and outreach to residents, especially those that live in woodland areas and the Wildland Urban Interface (WUI). 2. Reduction of hazardous fuels throughout the community. 3. Reduction of structural ignitability to limit injury, loss of life, and property and structural damage. 4. Having trained first responders with proper tools and equipment that will serve as a frontline defense against a wildfire.	Wildfire	Medium	On-going	N/A	Town	On-going
3.4	Seek funding to replace and improve infrastructure in key locations throughout the town to reduce flood damage caused by the interior streams, as well as inadequate culverts and infrastructure. Coordinate project with VDOT.	Flood	High	Delayed	Lack of Funding	N/A	N/A
13	Consider mitigation actions in the Town that are focused on natural systems protection.	Flood	High				On-going

## Central Shenandoah Hazard Mitigation Plan: Local Mitigation Strategies

Community: <b>Town of Dayton</b>
NFIP Community Number: <b>510136</b>

Regional Strategy ID#	Mitigation Strategy	Hazard	Priority High Medium Low	Project Status Delayed On-going Completed	If Not Completed, Why?	Responsible Party	Time Frame
14.1	Continue membership and participation in Shenandoah Valley Project Impact, the regional disaster preparedness and mitigation education program that was started in September 2000. Shenandoah Valley Project Impact educates citizens in the region about disaster preparedness and mitigation through public awareness campaigns, workshops and trainings, and an extensive resource library.	Multi- Hazards	High	On-going	N/A	CSPDC	On-going
14.1	Maintain a relationship with the Southern Shenandoah Chapter of Virginia Voluntary Organizations Active in Disaster (VOAD), to share knowledge and resources throughout the preparation, response, and recovery phases of a disaster.	Multi- Hazards	High	On-going	N/A	Town	On-going
6.1 – 6.8 8.1, 8.2 10.1 – 10.4 12.1	Support implementation of structural and non-structural mitigation activities on private or public property to reduce exposure to and provide protection from natural and man-made hazards. Eligible projects include but are not limited to acquisition, elevation, minor structural flood control projects, relocation of structures, retrofitting of existing structures, infrastructure protection measures, stormwater and wastewater management improvements, advanced warning systems, hazard gauging systems, hazard education, and wildfire mitigation projects.	Multi- Hazards	High	On-going	N/A	Town	On-going

Regional Strategy ID#	Mitigation Strategy	Hazard	Priority High Medium Low	Project Status Delayed On-going Completed	If Not Completed, Why?	Responsible Party	Time Frame
2.1 – 2.4	Maintain the community's compliance with the National Flood Insurance Program (NFIP) by engaging in various activities included in the three basic components of the NFIP program; 1. floodplain identification and mapping risk, 2. responsible floodplain management, and 3. flood insurance. Sample activities include but are not limited to: maintaining publicly accessible and accurate Flood Insurance Rate Maps (FIRMs), adopting and enforcing a compliant floodplain ordinance, and provide general assistance and education to community members regarding the flood insurance program.	Flood	High	On-going	N/A	Town	On-going
5.1 – 5.4	Encourage the lessening of potential wildfires in our community and the region by; 1. Education and outreach to residents, especially those that live in woodland areas and the Wildland Urban Interface (WUI). 2. Reduction of hazardous fuels throughout the community. 3. Reduction of structural ignitability to limit injury, loss of life, and property and structural damage. 4. Having trained first responders with proper tools and equipment that will serve as a frontline defense against a wildfire.	Wildfire	Medium	On-going	N/A	Town	On-going
11	Put fencing around water treatment plant with locked gates and surveillance equipment and alarms for water levels getting too low.	Multi-Hazards	N/A	Completed	N/A	N/A	N/A
14	Implement a fire education program to educate citizens on the fire code and burning permits.	Wildfire	N/A	Delayed	Lack of Funding and Staff	N/A	N/A

Regional Strategy ID#	Mitigation Strategy	Hazard	Priority High Medium Low	Project Status Delayed On-going Completed	If Not Completed, Why?	Responsible Party	Time Frame
3.2	Conduct a hydrologic study and floodplain analysis to determine vulnerable areas in the Town that receive flooding from Cook's Creek. Implement mitigation measures where needed.	Flood	N/A	Completed in part – Mill Street project	Priority area completed	N/A	N/A
3.4	Implement a stormwater drainage project to address the stormwater issues on Main Street and College Street.	Flood	N/A	Ongoing – to be completed in 2020	In progress	N/A	N/A
11	Add lightning protection to the Town's Water Plant.	Severe Storms	High	Completed	N/A	Town	N/A
13	Consider mitigation actions in the Town that are focused on natural systems protection.	Flood	High				On-going

## Central Shenandoah Hazard Mitigation Plan: Local Mitigation Strategies

Community: <b>Town of Elkton</b>
NFIP Community Number: <b>510137</b>

Regional Strategy ID #	Mitigation Strategy	Hazard	Priority High Medium Low	Project Status Delayed On-going Completed	If Not Completed, Why?	Responsible Party	Time Frame
14.1	Continue membership and participation in Shenandoah Valley Project Impact, the regional disaster preparedness and mitigation education program that was started in September 2000. Shenandoah Valley Project Impact educates citizens in the region about disaster preparedness and mitigation through public awareness campaigns, workshops and trainings, and an extensive resource library.	Multi - Hazards	High	On-going	N/A	CSPDC	On-going
14.1	Maintain a relationship with the Southern Shenandoah Chapter of Virginia Voluntary Organizations Active in Disaster (VOAD), to share knowledge and resources throughout the preparation, response, and recovery phases of a disaster.	Multi - Hazards	High	On-going	N/A	Town	On-going
6.1 – 6.8 8.1, 8.2 10.1 – 10.4 12.1	Support implementation of structural and non-structural mitigation activities on private or public property to reduce exposure to and provide protection from natural and man-made hazards. Eligible projects include but are not limited to acquisition, elevation, minor structural flood control projects, relocation of structures, retrofitting of existing structures, infrastructure protection measures, stormwater and wastewater management improvements, advanced warning systems, hazard gauging systems, hazard education, and wildfire mitigation projects.	Multi - Hazards	High	On-going	N/A	Town	On-going

Regional Strategy ID #	Mitigation Strategy	Hazard	Priority High Medium Low	Project Status Delayed On-going Completed	If Not Completed, Why?	Responsible Party	Time Frame
2.1 – 2.4	Maintain the community's compliance with the National Flood Insurance Program (NFIP) by engaging in various activities included in the three basic components of the NFIP program; 1. floodplain identification and mapping risk, 2. responsible floodplain management, and 3. flood insurance. Sample activities include but are not limited to: maintaining publicly accessible and accurate Flood Insurance Rate Maps (FIRMs), adopting and enforcing a compliant floodplain ordinance, and provide general assistance and education to community members regarding the flood insurance program.	Flood	High	On-going	N/A	Town	On-going
5.1 – 5.4	Encourage the lessening of potential wildfires in our community and the region by; 1. Education and outreach to residents, especially those that live in woodland areas and the Wildland Urban Interface (WUI). 2. Reduction of hazardous fuels throughout the community. 3. Reduction of structural ignitability to limit injury, loss of life, and property and structural damage. 4. Having trained first responders with proper tools and equipment that will serve as a frontline defense against a wildfire.	Wildfire	Medium	On-going	N/A	Town	On-going
13	Consider mitigation actions in the Town that are focused on natural systems protection.	Flood	High				On-going

## Central Shenandoah Hazard Mitigation Plan: Local Mitigation Strategies

Community: <b>Town of Glasgow</b>
NFIP Community Number: <b>515526</b>

Regional Strategy ID #	Mitigation Strategy	Hazard	Priority High Medium Low	Project Status Delayed On-going Completed	If Not Completed, Why?	Responsible Party	Time Frame
14.1	Continue membership and participation in Shenandoah Valley Project Impact, the regional disaster preparedness and mitigation education program that was started in September 2000. Shenandoah Valley Project Impact educates citizens in the region about disaster preparedness and mitigation through public awareness campaigns, workshops and trainings, and an extensive resource library.	Multi- Hazards	High	On-going	N/A	CSPDC	On-going
14.1	Maintain a relationship with the Southern Shenandoah Chapter of Virginia Voluntary Organizations Active in Disaster (VOAD), to share knowledge and resources throughout the preparation, response, and recovery phases of a disaster.	Multi- Hazards	High	On-going	N/A	Town	On-going
6.1 – 6.8 8.1, 8.2 10.1 – 10.4 12.1	Support implementation of structural and non-structural mitigation activities on private or public property to reduce exposure to and provide protection from natural and man-made hazards. Eligible projects include but are not limited to acquisition, elevation, minor structural flood control projects, relocation of structures, retrofitting of existing structures, infrastructure protection measures, stormwater and wastewater management improvements, advanced warning systems, hazard gauging systems, hazard education, and wildfire mitigation projects.	Multi-Hazards	High	On-going	N/A	Town	On-going

Regional Strategy ID #	Mitigation Strategy	Hazard	Priority High Medium Low	Project Status Delayed On-going Completed	If Not Completed, Why?	Responsible Party	Time Frame
2.1 – 2.4	Maintain the community's compliance with the National Flood Insurance Program (NFIP) by engaging in various activities included in the three basic components of the NFIP program; 1. floodplain identification and mapping risk, 2. responsible floodplain management, and 3. flood insurance. Sample activities include but are not limited to: maintaining publicly accessible and accurate Flood Insurance Rate Maps (FIRMs), adopting and enforcing a compliant floodplain ordinance, and provide general assistance and education to community members regarding the flood insurance program.	Flood	High	On-going	N/A	Town	On-going
5.1 – 5.4	Encourage the lessening of potential wildfires in our community and the region by; 1. Education and outreach to residents, especially those that live in woodland areas and the Wildland Urban Interface (WUI). 2. Reduction of hazardous fuels throughout the community. 3. Reduction of structural ignitability to limit injury, loss of life, and property and structural damage. 4. Having trained first responders with proper tools and equipment that will serve as a frontline defense against a wildfire.	Wildfire	Medium	On-going	N/A	Town	On-going
6.2	Seek funding to complete the Glasgow Residential Flood Mitigation Project that calls for the acquisition, relocation, and elevation of approximately 10 residential properties that have been severely damaged in the past flood events.	Flood	High	Delayed	Lack of Funding	N/A	N/A
3.4, 13.1	Seek funding to complete the Glasgow Interior Stream Drainage Project to prevent or reduce flooding along Sallings Mountain and Miller Mountain. The project calls for the construction of a debris basin, flood diversion wall,	Flood	High	Delayed	Lack of Funding	N/A	N/A

<b>Regional Strategy ID #</b>	<b>Mitigation Strategy</b>	<b>Hazard</b>	<b>Priority</b> High Medium Low	<b>Project Status</b> Delayed On-going Completed	<b>If Not Completed, Why?</b>	<b>Responsible Party</b>	<b>Time Frame</b>
	improved channelization, and replacement of several culverts throughout Town. To date ditches have been cleaned out but that is all.						
3.2	Complete a hydrologic, floodplain, and stormwater study to access new and continued vulnerable areas in the Town and to provide recommendations for improvements to be made to the Town's stormwater system.	Flood	High	Delayed	Lack of Funding	N/A	N/A
3.4	Create a stormwater retention pond in north Glasgow. i.e. 1 <sup>st</sup> Street and Pocahontas.	Flood	High	Delayed	Lack of Funding	N/A	N/A
11	Implement a project to safeguard the Town's water system and 2 municipal wells through a wellhead protection project that includes proper abandonment of unused wells, fencing, and other security measures, routine inspections of utility lines, and education for property owners, business, industry, and railroad. Also create another well.	Multi-hazards	Medium	On-going	Lack of Funding	N/A	N/A
3.4	Implement check-valve system or other floodproofing option to prevent culverts from backing up as they enter the Maury River when rainwater inundates the stormwater drainage system as the river water simultaneously rises.	Flood	High	Delayed	Lack of Funding	N/A	N/A
11	Remove the Glasgow Fire Department from the location of its current building in the floodplain to a less vulnerable location.	Flood	High	Delayed	Lack of Funding	N/A	N/A
6.1	Implement a flood mitigation project to acquire, relocate, or elevate structures on 53 properties located in the floodplain in the Town.	Flood	High	Completed	N/A	Federal, State, and Local	N/A

## Central Shenandoah Hazard Mitigation Plan: Local Mitigation Strategies

Community: <b>Town of Goshen</b>
NFIP Community Number: <b>510217</b>

Regional Strategy ID #	Mitigation Strategy	Hazard	Priority High Medium Low	Project Status Delayed On-going Completed	If Not Completed, Why?	Responsible Party	Time Frame
14.1	Continue membership and participation in Shenandoah Valley Project Impact, the regional disaster preparedness and mitigation education program that was started in September 2000. Shenandoah Valley Project Impact educates citizens in the region about disaster preparedness and mitigation through public awareness campaigns, workshops and trainings, and an extensive resource library.	Multi-Hazards	High	On-going	N/A	CSPDC	On-going
14.1	Maintain a relationship with the Southern Shenandoah Chapter of Virginia Voluntary Organizations Active in Disaster (VOAD), to share knowledge and resources throughout the preparation, response, and recovery phases of a disaster.	Multi- Hazards	High	On-going	N/A	Town	On-going
6.1 – 6.8 8.1, 8.2 10.1 – 10.4 12.1	Support implementation of structural and non-structural mitigation activities on private or public property to reduce exposure to and provide protection from natural and man-made hazards. Eligible projects include but are not limited to acquisition, elevation, minor structural flood control projects, relocation of structures, retrofitting of existing structures, infrastructure protection measures, stormwater and wastewater management improvements, advanced warning systems, hazard gauging systems, hazard education, and wildfire mitigation projects.	Multi- Hazards	High	On-going	N/A	Town	On-going

Regional Strategy ID #	Mitigation Strategy	Hazard	Priority High Medium Low	Project Status Delayed On-going Completed	If Not Completed, Why?	Responsible Party	Time Frame
2.1 – 2.4	Maintain the community's compliance with the National Flood Insurance Program (NFIP) by engaging in various activities included in the three basic components of the NFIP program; 1. floodplain identification and mapping risk, 2. responsible floodplain management, and 3. flood insurance. Sample activities include but are not limited to: maintaining publicly accessible and accurate Flood Insurance Rate Maps (FIRMs), adopting and enforcing a compliant floodplain ordinance, and provide general assistance and education to community members regarding the flood insurance program.	Flood	High	On-going	N/A	Town	On-going
5.1 – 5.4	Encourage the lessening of potential wildfires in our community and the region by; 1. Education and outreach to residents, especially those that live in woodland areas and the Wildland Urban Interface (WUI). 2. Reduction of hazardous fuels throughout the community. 3. Reduction of structural ignitability to limit injury, loss of life, and property and structural damage. 4. Having trained first responders with proper tools and equipment that will serve as a frontline defense against a wildfire.	Wildfire	Medium	On-going	N/A	Town	On-going
11	Seek funding to relocate the Goshen Town Hall out of the floodplain. This critical facility is located on Main Street in close proximity to Mill Creek in a low-lying area that receives repeated flooding and affects the operation of the Town. The Town has purchased 40 acres out of the floodplain that could be used as an alternative site.	Flood	Medium	Delayed	Lack of Funding	N/A	N/A
13	Consider mitigation actions in the Town that are focused on natural systems protection.	Flood	High				On-going



## Central Shenandoah Hazard Mitigation Plan: Local Mitigation Strategies

Community: <b>Town of Grottoes</b>
NFIP Community Number: <b>510138</b>

Regional Strategy ID #	Mitigation Strategy	Hazard	Priority High Medium Low	Project Status Delayed On-going Completed	If Not Completed, Why?	Responsible Party	Time Frame
14.1	Continue membership and participation in Shenandoah Valley Project Impact, the regional disaster preparedness and mitigation education program that was started in September 2000. Shenandoah Valley Project Impact educates citizens in the region about disaster preparedness and mitigation through public awareness campaigns, workshops and trainings, and an extensive resource library.	Multi - Hazards	High	On-going	N/A	CSPDC	On-going
14.1	Maintain a relationship with the Southern Shenandoah Chapter of Virginia Voluntary Organizations Active in Disaster (VOAD), to share knowledge and resources throughout the preparation, response, and recovery phases of a disaster.	Multi - Hazards	High	On-going	N/A	Town	On-going
6.1 – 6.8 8.1, 8.2 10.1 – 10.4 12.1	Support implementation of structural and non-structural mitigation activities on private or public property to reduce exposure to and provide protection from natural and man-made hazards. Eligible projects include but are not limited to acquisition, elevation, minor structural flood control projects, relocation of structures, retrofitting of existing structures, infrastructure protection measures, stormwater and wastewater management improvements, advanced warning systems, hazard gauging systems, hazard education, and wildfire mitigation projects.	Multi - Hazards	High	On-going	N/A	Town	On-going

Regional Strategy ID #	Mitigation Strategy	Hazard	Priority High Medium Low	Project Status Delayed On-going Completed	If Not Completed, Why?	Responsible Party	Time Frame
2.1 – 2.4	Maintain the community's compliance with the National Flood Insurance Program (NFIP) by engaging in various activities included in the three basic components of the NFIP program; 1. floodplain identification and mapping risk, 2. responsible floodplain management, and 3. flood insurance. Sample activities include but are not limited to: maintaining publicly accessible and accurate Flood Insurance Rate Maps (FIRMs), adopting and enforcing a compliant floodplain ordinance, and provide general assistance and education to community members regarding the flood insurance program.	Flood	High	On-going	N/A	Town	On-going
5.1 – 5.4	Encourage the lessening of potential wildfires in our community and the region by; 1. Education and outreach to residents, especially those that live in woodland areas and the Wildland Urban Interface (WUI). 2. Reduction of hazardous fuels throughout the community. 3. Reduction of structural ignitability to limit injury, loss of life, and property and structural damage. 4. Having trained first responders with proper tools and equipment that will serve as a frontline defense against a wildfire.	Wildfire	Medium	On-going	N/A	Town	On-going
3.4	Complete the Grottoes Stormwater Drainage Improvement Project to address flooding caused by ponding and poor drainage along Miller Run and Dry Run. Project Improvements such as ditching, replacement of undersized culverts, and drainage piping will protect between 30 and 50 structures and eliminate water on roads, yards, and crawl spaces. Clean-up of Miller Run takes place every year.	Flood	High	Initial project completed and maintenance is on-going.	N/A	Local	N/A

Regional Strategy ID #	Mitigation Strategy	Hazard	Priority High Medium Low	Project Status Delayed On-going Completed	If Not Completed, Why?	Responsible Party	Time Frame
11	Extend earthen berm in Grottoes Town Park to provide protection to the park which periodically receives flooding from the South River.	Flood	High	Complete	N/A	N/A	N/A
11	Implement bank stabilization project at Grand Caverns to protect area from erosion and flooding.	Flood	High	On - going	N/A	State	N/A
13	Consider mitigation actions in the Town that are focused on natural systems protection.	Flood	High				On-going

## Central Shenandoah Hazard Mitigation Plan: Local Mitigation Strategies

Community: <b>Town of Monterey</b>
NFIP Community Number: <b>510379</b>

Regional Strategy ID #	Mitigation Strategy	Hazard	Priority High Medium Low	Project Status Delayed On-going Completed	If Not Completed, Why?	Responsible Party	Time Frame
14.1	Continue membership and participation in Shenandoah Valley Project Impact, the regional disaster preparedness and mitigation education program that was started in September 2000. Shenandoah Valley Project Impact educates citizens in the region about disaster preparedness and mitigation through public awareness campaigns, workshops and trainings, and an extensive resource library.	Multi- Hazards	High	On-going	N/A	CSPDC	On-going
14.1	Maintain a relationship with the Southern Shenandoah Chapter of Virginia Voluntary Organizations Active in Disaster (VOAD), to share knowledge and resources throughout the preparation, response, and recovery phases of a disaster.	Multi- Hazards	High	On-going	N/A	Town	On-going
6.1 – 6.8 8.1, 8.2 10.1 – 10.4 12.1	Support implementation of structural and non-structural mitigation activities on private or public property to reduce exposure to and provide protection from natural and man-made hazards. Eligible projects include but are not limited to acquisition, elevation, minor structural flood control projects, relocation of structures, retrofitting of existing structures, infrastructure protection measures, stormwater and wastewater management improvements, advanced warning systems, hazard gauging systems, hazard education, and wildfire mitigation projects.	Multi- Hazards	High	On-going	N/A	Town	On-going

Regional Strategy ID #	Mitigation Strategy	Hazard	Priority High Medium Low	Project Status Delayed On-going Completed	If Not Completed, Why?	Responsible Party	Time Frame
2.1 – 2.4	Maintain the community's compliance with the National Flood Insurance Program (NFIP) by engaging in various activities included in the three basic components of the NFIP program; 1. floodplain identification and mapping risk, 2. responsible floodplain management, and 3. flood insurance. Sample activities include but are not limited to: maintaining publicly accessible and accurate Flood Insurance Rate Maps (FIRMs), adopting and enforcing a compliant floodplain ordinance, and provide general assistance and education to community members regarding the flood insurance program.	Flood	High	On-going	N/A	Town	On-going
5.1 – 5.4	Encourage the lessening of potential wildfires in our community and the region by; 1. Education and outreach to residents, especially those that live in woodland areas and the Wildland Urban Interface (WUI). 2. Reduction of hazardous fuels throughout the community. 3. Reduction of structural ignitability to limit injury, loss of life, and property and structural damage. 4. Having trained first responders with proper tools and equipment that will serve as a frontline defense against a wildfire.	Wildfire	Medium	On-going	N/A	Town	On-going
13	Consider mitigation actions in the Town that are focused on natural systems protection.	Flood	High				On-going

## Central Shenandoah Hazard Mitigation Plan: Local Mitigation Strategies

Community: <b>Town of Mt. Crawford</b>
NFIP Community Number: <b>510224</b>

Regional Strategy ID #	Mitigation Strategy	Hazard	Priority High Medium Low	Project Status Delayed On-going Completed	If Not Completed, Why?	Responsible Party	Time Frame
14.1	Continue membership and participation in Shenandoah Valley Project Impact, the regional disaster preparedness and mitigation education program that was started in September 2000. Shenandoah Valley Project Impact educates citizens in the region about disaster preparedness and mitigation through public awareness campaigns, workshops and trainings, and an extensive resource library.	Multi-Hazards	High	On-going	N/A	CSPDC	On-going
14.1	Maintain a relationship with the Southern Shenandoah Chapter of Virginia Voluntary Organizations Active in Disaster (VOAD), to share knowledge and resources throughout the preparation, response, and recovery phases of a disaster.	Multi-Hazards	High	On-going	N/A	Town	On-going
6.1 – 6.8 8.1, 8.2 10.1 – 10.4 12.1	Support implementation of structural and non-structural mitigation activities on private or public property to reduce exposure to and provide protection from natural and man-made hazards. Eligible projects include but are not limited to acquisition, elevation, minor structural flood control projects, relocation of structures, retrofitting of existing structures, infrastructure protection measures, stormwater and wastewater management improvements, advanced warning systems, hazard gauging systems, hazard education, and wildfire mitigation projects.	Multi-Hazards	High	On-going	N/A	Town	On-going

Regional Strategy ID #	Mitigation Strategy	Hazard	Priority High Medium Low	Project Status Delayed On-going Completed	If Not Completed, Why?	Responsible Party	Time Frame
2.1 – 2.4	Maintain the community's compliance with the National Flood Insurance Program (NFIP) by engaging in various activities included in the three basic components of the NFIP program; 1. floodplain identification and mapping risk, 2. responsible floodplain management, and 3. flood insurance. Sample activities include but are not limited to: maintaining publicly accessible and accurate Flood Insurance Rate Maps (FIRMs), adopting and enforcing a compliant floodplain ordinance, and provide general assistance and education to community members regarding the flood insurance program.	Flood	High	On-going	N/A	Town	On-going
5.1 – 5.4	Encourage the lessening of potential wildfires in our community and the region by; 1. Education and outreach to residents, especially those that live in woodland areas and the Wildland Urban Interface (WUI). 2. Reduction of hazardous fuels throughout the community. 3. Reduction of structural ignitability to limit injury, loss of life, and property and structural damage. 4. Having trained first responders with proper tools and equipment that will serve as a frontline defense against a wildfire.	Wildfire	Medium	On-going	N/A	Town	On-going
11	Make improvements to the Town Hall property to include, but not limited to: 1. Public Park; 2. Public river access and landing This is to include floodplain management and environmental conservation and preservation.	Multi-Hazards	High	On-going	N/A	Town	On-going
13	Consider mitigation actions in the Town that are focused on natural systems protection.						

## Central Shenandoah Hazard Mitigation Plan: Local Mitigation Strategies

Community: <b>Town of Timberville</b>
NFIP Community Number: <b>510139</b>

Regional Strategy ID #	Mitigation Strategy	Hazard	Priority High Medium Low	Project Status Delayed On-going Completed	If Not Completed, Why?	Responsible Party	Time Frame
14.1	Continue membership and participation in Shenandoah Valley Project Impact, the regional disaster preparedness and mitigation education program that was started in September 2000. Shenandoah Valley Project Impact educates citizens in the region about disaster preparedness and mitigation through public awareness campaigns, workshops and trainings, and an extensive resource library.	Multi-Hazards	High	On-going	N/A	CSPDC	On-going
14.1	Maintain a relationship with the Southern Shenandoah Chapter of Virginia Voluntary Organizations Active in Disaster (VOAD), to share knowledge and resources throughout the preparation, response, and recovery phases of a disaster.	Multi - Hazards	High	On-going	N/A	Town	On-going
6.1 – 6.8 8.1, 8.2 10.1 – 10.4 12.1	Support implementation of structural and non-structural mitigation activities on private or public property to reduce exposure to and provide protection from natural and man-made hazards. Eligible projects include but are not limited to acquisition, elevation, minor structural flood control projects, relocation of structures, retrofitting of existing structures, infrastructure protection measures, stormwater and wastewater management improvements, advanced warning systems, hazard gauging systems, hazard education, and wildfire mitigation projects.	Multi - Hazards	High	On-going	N/A	Town	On-going

Regional Strategy ID #	Mitigation Strategy	Hazard	Priority High Medium Low	Project Status Delayed On-going Completed	If Not Completed, Why?	Responsible Party	Time Frame
2.1 – 2.4	Maintain the community's compliance with the National Flood Insurance Program (NFIP) by engaging in various activities included in the three basic components of the NFIP program; 1. floodplain identification and mapping risk, 2. responsible floodplain management, and 3. flood insurance. Sample activities include but are not limited to: maintaining publicly accessible and accurate Flood Insurance Rate Maps (FIRMs), adopting and enforcing a compliant floodplain ordinance, and provide general assistance and education to community members regarding the flood insurance program.	Flood	High	On-going	N/A	Town	On-going
5.1 – 5.4	Encourage the lessening of potential wildfires in our community and the region by; 1. Education and outreach to residents, especially those that live in woodland areas and the Wildland Urban Interface (WUI). 2. Reduction of hazardous fuels throughout the community. 3. Reduction of structural ignitability to limit injury, loss of life, and property and structural damage. 4. Having trained first responders with proper tools and equipment that will serve as a frontline defense against a wildfire.	Wildfire	Medium	On-going	N/A	Town	On-going
3.1, 3.2	Conduct a stormwater management study to determine the effectiveness of the Town's stormwater system, highlight vulnerable areas to flooding, and provide recommendations for ways to improve the system.	Flood		Delayed	Lack of Funding	N/A	N/A
16	Complete a detailed Emergency Operations Plan written specifically for the Town.	Multi- hazards		Delayed	Lack of Funding	N/A	N/A

Regional Strategy ID #	Mitigation Strategy	Hazard	Priority High Medium Low	Project Status Delayed On-going Completed	If Not Completed, Why?	Responsible Party	Time Frame
11	Explore options with the Army Corps of Engineers for the feasibility of dredging the river.	Flooding	High	Delayed	Lack of Funding	Federal Local	N/A
11	Implement security measures to protect the Town's water source.	Multi- hazards	High	Delayed	Lack of Funding	Town	N/A

## Central Shenandoah Hazard Mitigation Plan: Local Mitigation Strategies

Organization: James Madison University
Location (Town, City, or County): City of Harrisonburg

Regional Strategy ID #	Mitigation Strategy	Hazard	Priority High Medium Low	Project Status Delayed On-going Completed	If Not Completed, Why?	Responsible Party	Time Frame
14.1	Participate in Shenandoah Valley Project Impact, the regional disaster preparedness and mitigation education program that was started in September 2000. Shenandoah Valley Project Impact educates citizens in the region about disaster preparedness and mitigation through public awareness campaigns, workshops and trainings, and an extensive resource library.	Multi- Hazards	High	On-going	N/A	CSPDC	On-going
6.1 – 6.8 8.1, 8.2 10.1 – 10.4 12.1	Support implementation of structural and non-structural mitigation activities on our property, if needed to reduce exposure to and provide protection from natural and man-made hazards. Eligible projects include but are not limited to acquisition, elevation, minor structural flood control projects, relocation of structures, retrofitting of existing structures, infrastructure protection measures, stormwater and wastewater management improvements, advanced warning systems, hazard gauging systems, hazard education, and wildfire mitigation projects.	Multi - Hazards	High	On-going	N/A	Organization	On-going
13	Consider mitigation actions at the University that are focused on natural systems protection.	Flood	High				On-going

## VI. CAPABILITIES ASSESSMENT

### 1. Capabilities Assessment

This portion of the Plan assesses the current capacity of the communities of the Central Shenandoah Valley Region to mitigate the effects of the natural hazards mentioned in Section IV, Hazard Identification Risk Assessment. Determining the ability of local governments to implement mitigation strategies and where potential opportunities to increase these abilities exist is the purpose of the Capabilities Assessment.

This Capabilities Assessment has two primary components: an inventory of the plans and programs that the local governments in the Central Shenandoah Valley Region possess, and an analysis of the government's abilities to implement mitigation strategies and measures based on this inventory. Table VI-1 provides an inventory of local plans for the Counties, Cities and Towns. Table VI-2 provides an inventory of the administrative and technical capabilities of local government staff for the Counties and Cities. Since Towns are considered part of the Counties where they are located and have access to County resources, Towns are not listed separately for this review.

**\*\* Table VI-1: Local Plans (Augusta County)** Please note: In 2013, Augusta County completed its own Community Wildfire Protection Plan (CWPP) that was adopted by the Board of Supervisors through a resolution. As part of the regional planning process, this plan was updated and included in the 2020 Central Shenandoah Wildfire Protection Plan (CSWPP). The CSWPP when completed will be included as Appendix H in the Central Shenandoah Hazard Mitigation Plan (CSHMP). The Wildfire Protection Plan will be adopted by the 5 Counties, 5 Cities, and 11 Towns of the Central Shenandoah Planning District through the local jurisdictions as part of the CSHMP.

**Table VI-1: Local Plans**

Local Plans	Hazard Mitigation Plan	Comprehensive Land Use Plan	Wildfire Protection Plan	Emergency Operations Plan	SARA Title III Hazardous Materials Emergency Response Plan	Capital Improvement Plan
Augusta County**	Y	Y	Y	Y	Y	Y
Bath County	Y	Y	Y	Y	Y	Y
Highland County	Y	Y	Y	Y	U	U
Rockbridge County	Y	Y	Y	Y	N	Y
Rockingham County	Y	Y	Y	Y	Y	Y
City of Buena Vista	Y	Y	Y	Y	N	Y
City of Harrisonburg*	Y	Y	Y	Y	Y	Y
<b>* Also has Stormwater Improvement Plan and Chesapeake Bay TMDL Action Plan</b>						
City of Lexington	Y	Y	Y	Y	Y	Y
City of Staunton	Y	Y	Y	Y	Y	Y
City of Waynesboro	Y	Y	Y	Y	Y	Y
Town of Bridgewater	Y	Y	Y	Y	Y	Y
Town of Broadway	Y	Y	Y	Y	Y	Y
Town of Craigsville	Y	Y	Y	Y	Y	U
Town of Dayton	Y	Y	Y	Y	Y	U
Town of Elkton	Y	Y	Y	Y	Y	Y
Town of Glasgow	Y	Y	Y	Y	N	U
Town of Goshen	Y	Y	Y	Y	N	U
Town of Grottoes	Y	Y	Y	Y	Y	U
Town of Monterey	Y	Y	Y	Y	U	U
Town of Mount Crawford	Y	Y	Y	Y	Y	U
Town of Timberville	Y	Y	Y	Y	Y	N

Table Legend: Y = Yes; N = No; U = Unknown

Note: Towns are included in the County's Emergency Operations Plan and Hazardous Materials Emergency Response Plan where they are located.

**Table VI-2: Administrative and Technical Capabilities of Local Government Staff**

Administrative and Technical Capabilities of Local Government Staff	City of Staunton	City of Waynesboro	City of Lexington	City of Harrisonburg	City of Buena Vista	Rockbridge County	Rockingham County	Bath County	Highland County	Augusta County
Land use planners or planners with knowledge of land development and land management practices	Y	Y	U	Y	Y	Y	Y	Y	Y	Y
Engineers or professionals trained in construction practices related to buildings or infrastructure	Y	Y	U	Y	Y	Y	Y	Y	Y	Y
Staff with an understanding of natural or human caused hazards	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
Emergency Manager	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
Floodplain Manager	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
Staff with the education and/or expertise to assess the community's vulnerability to hazards	Y	Y	Y	Y	Y	N	Y	N	Y	Y
Resource development and grant writing staff	N	N	N	N	Y	Y	Y	N	Y	N
Internet Access	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
Fire and Rescue Paid or Volunteer Staff	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
The 11 towns in the Central Shenandoah Region: Bridgewater, Broadway, Craigsville, Dayton, Elkton, Glasgow, Goshen, Grottoes, Monterey, Mount Crawford, and Timberville use the resources of the County where they are located.										

Table Legend: Y = Yes; N = No; U = Unknown

## 2. Capabilities Assessment Findings

### Existing Local Plans

Planning capability is based on the creation and implementation of plans that demonstrate a jurisdiction's commitment to guiding and managing growth in a responsible manner; encouraging public safety; preserving the local economy; protecting environmental, historic, and cultural resources; and maintaining the general welfare of the community. Planning initiatives present significant opportunity to integrate hazard mitigation principles and practices into the community. The jurisdictions of the Central Shenandoah Region have many planning mechanisms in place that include mitigation information and techniques including:

**Hazard Mitigation Plan:** A hazard mitigation plan represents a community's blue print for how it intends to reduce the impact of natural and human-caused hazards on people and the built environment. All twenty-one jurisdictions in the Region have adopted the 2013 update of the Central Shenandoah Hazard Mitigation Plan.

**Comprehensive Land Use Plan:** A comprehensive land use plan establishes the overall vision for what a community wants to be and serves as a guide to future governmental decision making. A comprehensive plan contains sections on demographic conditions, land use, natural resources, economic development, transportation, and community facilities. Community strategies included in these plans can encourage the achievement of risk reduction goals. The five Counties and Cities in the Region have Comprehensive Land Use Plans.

**Community Wildfire Protection Plan (CWPP):** The Healthy Forests Restoration Act (HFRA) of 2003 created the opportunities for local governments to prioritize goals and needs for the wildland areas in their communities through community wildfire protection plans. A CWPP addresses issues in a community such as wildfire response, hazard mitigation, community preparedness, and structure protection. Augusta County has adopted a Community Wildfire Protection Plan.

**Emergency Operations Plan (EOP):** An emergency operations plan outlines responsibilities and the means by which resources are deployed during and following an emergency or disaster. A section that specifically deals with mitigation is included in these plans. The five counties and five cities in the Region either have their own EOP or participate in regional EOPs.

**SARA Title III Emergency Response Plan (ERP):** Required by federal law under Title III of the Superfund Amendments and Re-authorization Act (SARA), these plans outline the procedures to be followed in the event of a chemical emergency such as the accidental release of toxic substances. The five counties and cities in the Region either have their own individual ERP or participate in regional ERPs.

Based on the types of planning initiatives by all of the jurisdictions in the Region, the opportunities to incorporate mitigation concepts into local planning processes is very possible for the Central Shenandoah Region. After the 2020 Central Shenandoah Hazard Mitigation Plan has been approved by FEMA and adopted by the 21 jurisdictions in the Region, CSPDC staff will contact the planning staff of each local jurisdiction to notify them of the updated HMP and discuss plan integration. CSPDC staff will prepare a fact sheet to give to local planning staff pertinent information about the useful elements of the HMP that could be included in local planning efforts such as for the Comprehensive Plan. During the annual review of the HMP, CSPDC staff will reach out to local planning and emergency management staff to discuss the community and emergency planning that will be done in the upcoming year and how integration of information from the HMP might occur.

### **Expertise of Local Planning Staff**

As described previously, the Central Shenandoah Region consists of 21 jurisdictions (5 counties, 5 cities, and 11 towns). The Counties in the Region are led by an elected Board of Supervisors who appoints a County Administrator to manage the day to day operations of the government. In the Cities, a City Council are the elected officials and a City Manager, appointed by Council, manages the day to day operations.

Mitigation cuts across many disciplines. For a successful mitigation program, it is necessary to have a broad range of people involved with diverse backgrounds. Across the jurisdictions in the Central Shenandoah Valley Region, this expertise can be found in local government staff in the following areas or departments:

- Community Development and Building Inspection Departments have the ability to conduct land use planning based on knowledge of land development and land management practices. They may also possess expertise in resource development and grant writing. These departments may also house a community's floodplain manager and other staff with the ability to assess the natural hazards vulnerability of the community. As all of the communities are in good standing in the National Flood Insurance Program (NFIP), these departments may also enforce NFIP requirements.
- Engineering and Public Works Departments have the training in construction practices related to buildings and infrastructure. The Engineering Department may oversee the design and construction of infrastructure including roadways and stormwater facilities. The Public Works Department oversees the maintenance of the community's infrastructure, water treatment and sewer facilities.
- Emergency Management, Fire and Rescue Staff are involved with natural and man-made hazards and disasters and are closely involved with mitigation as it is one of the four cornerstones of the emergency management cycle. Fire and Rescue departments provide fire suppression and medical aid at the scene of disasters and may be involved with hazardous materials incidents.

This Capability Assessment illustrates the variety of staff and departments in local governments in the Central Shenandoah Region that possess the expertise to identify and implement mitigation activities.

The other resource that the 21 jurisdictions of the Region have is partnerships with private organizations, non-governmental organizations (NGOs), and neighboring jurisdictions. The Counties and Cities have Memorandums of Understanding and Mutual Aid agreements with these organizations and jurisdictions surrounding our Region for assistance in the event of emergencies and disasters for supplies, equipment, and manpower.

More informal partnerships also exist in non-disaster times between local government staff from all departments to their counterparts in neighboring jurisdictions for technical assistance and the sharing of resources. When applicable, these partners are often included in the mitigation planning process and other hazard mitigation activities to share their expertise. These partnerships only further the depth of capabilities that the local jurisdictions of the Central Shenandoah Region possess.

### **3. Local National Flood Insurance Program Surveys**

All twenty-one jurisdictions in the Region participate in the National Flood Insurance Program (NFIP). As part of the Hazard Mitigation planning process, the Counties and Cities were asked to complete surveys providing information on floodplain identification and mapping, Floodplain Management, and Flood Insurance. Because much of the floodplain management for the Towns is done through the County where they are located, the information provided by the each County was relevant for the Towns in that County as well. The surveys are included in Appendix I.

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## VII: PLAN MAINTENANCE

According to the Disaster Mitigation Act of 2000 (DMA2K), local plans are required to include a method and schedule of monitoring, evaluating, and updating the hazard mitigation plan within a five-year cycle as well as a description of continued public involvement in the hazard mitigation planning process.

The Central Shenandoah Valley Region will use its Hazard Mitigation Plan Steering Committee as the body responsible for the review, monitoring, and update of the Central Shenandoah Hazard Mitigation Plan. This group includes representatives from local government and other relevant organizations throughout the Region. The Steering Committee is staffed by the Central Shenandoah Planning District Commission. In the event that the Steering Committee shall dissolve, then each local jurisdiction will be responsible for the maintenance and update of the Plan.

Through the Hazard Mitigation Plan Steering Committee, the Central Shenandoah Hazard Mitigation Plan will be reviewed on an annual basis and updated when and where needed. Each local jurisdiction will be asked to review the Plan and submit a report when necessary that outlines any revisions, projects, or activities that impact the Plan. These annual reports will be reviewed by the Hazard Mitigation Plan Steering Committee, when necessary, and revisions will be made to the Plan by CSPDC staff. In addition, any local, state, or federal regulations that change or impact the Plan will be incorporated. Local governments will be apprised of any substantial changes to the Plan. An annual report will be developed and submitted as needed.

In addition to an annual review, local governments will be asked to reference the Central Shenandoah Hazard Mitigation Plan in their Emergency Operations Plan (EOP). The Virginia Emergency Management and Disaster Law of 2000 requires that the State, and each County and City within the State develop and maintain a current Emergency Operations Plan (EOP) which addresses their planned response to extraordinary emergency situations. As part of the basic EOP, an appendix that addresses hazard mitigation activities is required. CSPDC staff will request that each of the Cities and Counties refer to the Central Shenandoah Hazard Mitigation Plan as a resource document as part of their EOP's Hazard Mitigation Annex and request local government review of the Hazard Mitigation Plan as part of their annual EOP review. In addition, a request will be made to each local jurisdiction to include the Hazard Mitigation Plan in other planning documents such as comprehensive plans and capital improvement plans.

The Plan will undergo a comprehensive review every 5 years. The Hazard Mitigation Plan Steering Committee will be the entity responsible for the review, evaluation, and update of the Plan. The criteria used to evaluate the Plan will be developed in accordance with the requirements of the Federal Emergency Management Agency (FEMA) as well as additional guidance documents provided by FEMA and Virginia Department of Emergency Management. The method used to update the Plan will include a request from each jurisdiction for a report that describes the progress of mitigation strategies identified in the Plan and any activities or projects that have been implemented. Other factors that could necessitate a revision to the Plan may include any new local, state, or federal regulations or requirements that impact the Plan; any Presidentially-declared disasters that have impacted the Region, or an increase or decrease in a community's vulnerability to a natural disaster. The 5-year update will be submitted to each of the local governments, the Virginia Department of Emergency Management, and FEMA as required. Significant changes to the Plan will include public input.

Public participation was an integral part of the development of this Plan and will continue through the course of its existence. Activities to involve the public in the maintenance, evaluation and revision of the Plan may include a yearly “Disaster Resistance Forum” meeting where the general public is invited, utilizing the websites of the Central Shenandoah Planning District Commission to notify the public of meetings, agendas, and revisions of the Plan, and employing the media to notify the public of any upcoming activities or public input sessions regarding the Plan and the Plan update.

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## VIII. ADOPTION PROCESS AND DOCUMENTATION

The Central Shenandoah Hazard Mitigation Plan was developed as a multi-jurisdictional plan. Therefore, to meet the requirements of the Disaster Mitigation Act of 2000 (DMA2K), the Federal Emergency Management Agency (FEMA) Section 322 local hazard mitigation planning regulations, and Title 44 Code of Federal Regulations (CFR) §201.6, the 2020 update of the Plan will be adopted by each of the 21 municipalities in our Region. Resolutions from this adoption process for each of the jurisdictions in the Central Shenandoah Planning District will be included in Appendix J.

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## IX. REFERENCES

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**D. Print Media**

Newspaper	Date	Pages
Augusta Angus	2/14/1899	pg. 3
Augusta Angus	6/8/1897	pg. 4
Buena Vista News	3/27/1936	pg. 1
Buena Vista News	6/30/1972	Special Flood Section pg 1-12
Buena Vista News	12/6/1934	Cover
Harrisonburg Daily News Record	3/16/1936	pg. 5
Harrisonburg Daily News Record	3/18/1936	pg. 1, 6
Harrisonburg Daily News Record	3/19/1936	pg. 1, 7, 8
Harrisonburg Daily News Record	3/20/1936	pg. 1, 6
Harrisonburg Daily News Record	3/21/1936	pg. 1, 6
Harrisonburg Daily News Record	3/23/1936	pg. 1, 5, 7
Harrisonburg Daily News Record	6/18/1949	pg. 1, 2
Harrisonburg Daily News Record	6/20/1949	pg. 1, 2
Harrisonburg Daily News Record	6/21/1949	pg. 1, 9, 12
Harrisonburg Daily News Record	6/22/1949	pg. 1, 2, 4, 9
Harrisonburg Daily News Record	6/23/1949	pg. 1, 2, 12
Harrisonburg Daily News Record	6/24/1949	pg. 1, 16
Harrisonburg Daily News Record	6/27/1949	pg. 1, 2, 8, 10
Harrisonburg Daily News Record	8/21/1969	Cover, pg. 18, 19
Harrisonburg Daily News Record	8/22/1969	Cover, pg. 8
Harrisonburg Daily News Record	8/23/1969	Cover, pg. 8, 9
Harrisonburg Daily News Record	8/25/1969	pg. 2, 6
Harrisonburg Daily News Record	8/26/1969	Cover, pg. 2
Harrisonburg Daily News Record	6/22/1972	Cover, pg. 12
Harrisonburg Daily News Record	6/23/1972	Cover, pg. 2, 15
Harrisonburg Daily News Record	11/5/1985	pg. 14, 18
Harrisonburg Daily News Record	11/6/1985	Cover, pg. 2, 13
Harrisonburg Daily News Record	9/7/1996	pg. 19
Harrisonburg Daily News Record	9/9/1996	Cover, pg. 15, 17
Harrisonburg Daily News Record	9/10/1996	Cover
Harrisonburg Daily News Record	9/16/1996	Flood of 1996 Section pg.1-12
Harrisonburg Daily News Record	10/16/1954	Cover, pg. 13
Harrisonburg Daily News Record	8/13/1955	pg. 2
Harrisonburg Daily News Record	8/19/1955	Cover, pg. 2, 4
Harrisonburg Daily News Record	2/14/2007	Cover, A5
Harrisonburg Daily News Record	2/15/2007	Cover, A3
Harrisonburg Daily News Record	12/19/2009	Cover, A6
Harrisonburg Daily News Record	12/21/2009	Cover, A10
Harrisonburg Daily News Record	12/22/2009	Cover, A10

Harrisonburg Daily News Record	5/3/2009	Cover, pg. 6
Harrisonburg Daily News Record	5/4/2009	Cover, pg. 5
Harrisonburg Daily News Record	1/15/2010	Cover
Harrisonburg Daily News Record	11/25/1938	Cover
Harrisonburg Daily News Record	3/6/1962	Cover, pg. 2, 7
Harrisonburg Daily News Record	3/7/1962	pg. 12
Harrisonburg Daily News Record	3/8/1962	pg. 13
Harrisonburg Daily News Record	3/9/1962	pg. 8
Harrisonburg Daily News Record	3/27/1978	Cover, pg. 5, 15
Harrisonburg Daily News Record	3/28/1978	pg. 11
Harrisonburg Daily News Record	3/29/1978	pg. 6, 17
Harrisonburg Daily News Record	3/13/1993	pg. 2
Harrisonburg Daily News Record	3/15/1993	Cover, pg. 2, 5
Harrisonburg Daily News Record	2/12/1983	Cover, pg. 3, 11
Harrisonburg Daily News Record	2/13/1983	Cover
Harrisonburg Daily News Record	2/11/1994	Cover, pg. 2, 3
Harrisonburg Daily News Record	2/12/1994	Cover, pg. 2
Harrisonburg Daily News Record	1/8/1996	Cover
Harrisonburg Daily News Record	1/9/1996	Cover, pg. 2, 4
Harrisonburg Daily News Record	8/24/2011	Cover, A5
Lexington News-Gazette	3/20/1936	pg. 1, 8
Lexington News-Gazette	10/20/1954	Cover
Lexington News-Gazette	8/17/1955	pg. 7
Lexington News-Gazette	9/30/1959	Cover
Lexington News-Gazette	7/21/1842	pg. 2
Lexington News-Gazette	8/31/1893	
Lexington News-Gazette	5/16/2001	A12
Lexington News-Gazette	2/21/2007	Cover
Lexington News-Gazette	2/28/2007	C1
Lexington News-Gazette	5/7/1929	Cover
Lexington News-Gazette	1/17/1912	pg. 5
Lexington News-Gazette	3/7/1962	Cover
Lexington News-Gazette	3/29/1978	pg. 13
Lexington News-Gazette	2/16/1983	pg. 12
Lexington News-Gazette	3/17/1993	Cover, pg. 10, 11
News Virginian	6/28/2005	
News Virginian	6/29/2006	
News Virginian	2/13/2007	Cover, A5
News Virginian	2/15/2007	Cover, A5
News Virginian	12/20/2009	Cover, A2, A5
News Virginian	12/21/2009	Cover, A2

Newspaper	Date	Pages
News Virginian	12/22/2009	Cover, A3, A5
News Virginian	8/24/2011	Cover, A2, A3
NOAA Event Records	2/12/2007	Storm
NOAA Event Records	2/14-2/18/2003	Storm
NOAA Event Records	12/19/2009	Storm
NOAA Event Records	1/16/1996	Storm
NOAA Event Records	12/18-12/19/2009	Winter Storm
NOAA Event Records	2/5-2/10/2010	Winter Storm
Richmond Times Dispatch	8/21/1969	Cover, A4, A5, C3, pg. 5
Richmond Times Dispatch	8/22/1969	Cover, A5, B1, pg. 8
Richmond Times Dispatch	8/23/1969	Cover, A4
Richmond Times Dispatch	8/24/1969	Cover, A15, B1, B2
Richmond Times Dispatch	6/20/1972	Cover, pg. 2
Richmond Times Dispatch	6/21/1972	A3
Richmond Times Dispatch	6/22/1972	Cover, pg. 2
Richmond Times Dispatch	6/23/1972	Cover, A4, A16
Richmond Times Dispatch	6/24/1972	Cover, A4, pg. 5, 12
Rockbridge County News	2/16/1899	pg. 3
Rockbridge County News	6/3/1897	pg. 3
Rockingham Register	10/2/1896	pg. 2, 3
Rockingham Register	8/21/1906	Cover, pg. 3
Rockingham Register	2/10/1899	pg. 3
Rockingham Register	2/17/1899	pg. 3
Rockingham Register	2/24/1899	pg. 2, 3
Rockingham Register	6/4/1897	Cover
Staunton Daily News Leader	11/5/1985	Cover, A3
Staunton Daily News Leader	11/6/1985	Cover, A7
Staunton Daily News Leader	11/7/1985	Cover, A5
Staunton Daily News Leader	11/8/1985	Cover
Staunton Daily News Leader	6/23/1995	Cover
Staunton Daily News Leader	6/24/1995	Cover, A5
Staunton Daily News Leader	6/25/1995	Cover
Staunton Daily News Leader	6/29/1995	Cover, A2
Staunton Daily News Leader	6/30/1995	Cover
Staunton Daily News Leader	9/6/1996	Cover, A2
Staunton Daily News Leader	9/7/1996	Cover, A2, A3
Staunton Daily News Leader	9/8/1996	Cover, A2
Staunton Daily News Leader	9/9/1996	Cover, A2
Staunton Daily News Leader	10/18/1954	Cover, pg. 4
Staunton Daily News Leader	8/13/1955	Cover

Newspaper	Date	Pages
Staunton Daily News Leader	8/14/1955	pg. 4
Staunton Daily News Leader	10/1/1959	Cover, pg. 3
Staunton Daily News Leader	8/18/1955	Cover, pg. 2
Staunton Daily News Leader	8/20/1955	pg. 7
Staunton Daily News Leader	6/28/2006	
Staunton Daily News Leader	4/27/1937	Cover
Staunton Daily News Leader	5/12/2007	B8
Staunton Daily News Leader	1/2/2010	A5
Staunton Daily News Leader		(1881 Storm)
Staunton Daily News Leader	2/14/2007	Cover, A Back Page
Staunton Daily News Leader	2/15/2007	Cover, A5
Staunton Daily News Leader	4/16/2005	B6
Staunton Daily News Leader	2/5/2010	A3
Staunton Daily News Leader	2/6/2010	Cover, A3, A6, A10
Staunton Daily News Leader	2/7/2010	Cover, A4, A12
Staunton Daily News Leader	2/8/2010	Cover, A4, A5
Staunton Daily News Leader	2/9/2010	Cover, A8
Staunton Daily News Leader	12/20/2009	Cover, A3, A4, A5, A12
Staunton Daily News Leader	12/21/2009	Cover, A8
Staunton Daily News Leader	12/22/2009	Cover, A3, A8
Staunton Daily News Leader	6/5/1911	Cover
Staunton Daily News Leader	6/7/1911	Cover, pg. 3
Staunton Daily News Leader	5/3/1929	Cover
Staunton Daily News Leader	4/4/1974	Cover, pg. 2
Staunton Daily News Leader	1/5/1912	Cover
Staunton Daily News Leader	3/6/1962	Cover
Staunton Daily News Leader	3/7/1962	Cover
Staunton Daily News Leader	3/27/1978	Cover, pg. 2
Staunton Daily News Leader	3/28/1978	Cover
Staunton Daily News Leader	2/13/1983	Cover, pg. 2
Staunton Daily News Leader	3/14/1993	Cover
Staunton Daily News Leader	3/15/1993	Cover
Staunton Daily News Leader	1/9/1996	Cover, pg. 3
Staunton Daily News Leader	1/13/1996	Cover
Staunton News Leader	8/24/2011	Cover, A3
Staunton Spectator	10/4/1870	Cover
Staunton Spectator	9/30/1896	Cover
Staunton Spectator	8/10/1896	
Staunton Vindicator	9/23/1870	Cover
Staunton Vindicator	10/7/1870	Cover
Staunton Vindicator	2/16/1899	pg. 2
Staunton Vindicator	6/3/1897	pg. 3

<b>Newspaper</b>	<b>Date</b>	<b>Pages</b>
The Recorder	11/?/1985	Cover, pg. 3
The Recorder	1/26/1996	Cover, pg. 2
The Recorder	2/9/2001	pg. 17
The Recorder	4/9/1993	pg. 9
Washington Post	12/24/2009	Cover, A8
Washington Post	12/20/2009	Cover, A8, A10
Yosts Weekly	10/2/1896	Cover
Staunton News Leader	3/7/2013	A1-A3, A8
Staunton News Leader	3/9/2013	A1
Staunton News Leader	2/13/2014	A1, A5, A6
Staunton News Leader	2/14/2014	A1, A5, A8
Staunton News Leader	1/27/2016	A3
Staunton News Leader	1/25/2016	A1, A6
The News-Gazette	11/21/2018	A2
Daily News Record	3/7/2013	A1-A3
Daily News Record	2/13/2014	A1, A6
Daily News Record	2/14/2014	A1, A2, A5, A6
The News-Virginian	3/9/2013	
The News-Virginian	3/7/2015	A1, A4

### **E. Other Resources**

- Annals of Augusta Co Va from 1726-1871. Waddel. Pg. 441-449
- Buena Vista News: Hurricane Camille - A Review
- Debris-Flow Hazards In Areas. Morgan and Wieczorek
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- Major Earthquakes in Virginia: Adopted from Seismicity of the United States, 1568-1989. Carl W. Stover and Jerry L. Coffman
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- Virginia Hazard Mitigation Plan: Emergency Operations Plan Volume 6, Barbara McNaught Watson
- Virginia Tornadoes, Barbara McNaught Watson
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- 100 Years of Dreams, Lynda Mundy-Norris
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## **Appendix A – Planning Process and Public Engagement**

**Steering Committee Meetings  
Attendance and Agenda Packets**

**Central Shenandoah Valley Hazard Mitigation Plan**  
**Steering Committee Meeting**  
**April 3, 2019**  
**Sign-In Sheet**

Name	Locality or Organization	Email Address	Phone
KEITH TAYLOR	HOLTZMAN OIL CORP.	KMAYLOR@HOLTZMANOIL.COM	540-477-3131
Calvin Loken	Holtzman Oil Corp	Calvinl@holtzmanoil.com	540-477-3131
Kevin Moore	Rockbridge County	Kmoore@rockbridgecounty.va.gov	540-319-9878
Kevin Moore	Town of Glasgow	Kmoore@rockbridgecounty.va.gov	540-319-9878
Carl Williams	Highland County	Cwilliams@highlandva.com	540-632-7331
Anthony Foretich	JMU	foretiae@dukes.jmu.edu	703-638-5972
Alex Cherney	JMU	cherneax@dukes.jmu.edu	703-785-9795
Joe Ziegler	JMU	ziegelm@dukes.jmu.edu	443-766-9885
Megan Deal	Town of Goshen	townofGoshen-va@yahoo.com	540-997-5525
Steven Craig	Dixie Gas and Oil Corp.	Craigse@dixiegas.com	540-248-6273
Harley Gardner	Highland Co	hgardner@yahoo.com	540 292 0456

## Central Shenandoah Valley Hazard Mitigation Plan

## Steering Committee Meeting

April 3, 2019

## Sign-In Sheet

Name	Locality or Organization	Email Address	Phone
Scott Masinup	Sentara RMH Medical Ctr	BKMASINC@sentara.com	540-292-3762
Gary Crum	SHD Airport	gwcrum@flyshd.com	540-607-4000
Robbie Symons	JMU	symonsrx@jmu.edu	540-476-1192
Dak Chertel	JMU	chertel@jmu.edu	540 568 7606
Jennifer Welch	DEQ	jennifer.welch@deq.virginia.gov	540 - 574 - 7854
Dr. Richard Robin	Montgomery	Dot.Robin1@Gmail.com	540-290-5842
Paul Helmuth	Harrisonburg	paul.helmuth.Clarendonva.gov	540-476-0860
Trent Roberts	Lexington	TBRobertsLexingtonva.gov	463 3210
Tom Roberts	Burma Vista	trubots@bvcity.org	540 317 8004
Waylon Miller	Burke Vista	brds@bvcity.org	540 317 1444
Colter Lotts	Staunton	lottscrci.staunton.	540-532-3289

Central Shenandoah Valley Hazard Mitigation Plan  
 Steering Committee Meeting  
 April 3, 2019  
 Sign-In Sheet

Name	Locality or Organization	Email Address	Phone
Jon Ellestad	Glasgow	jerlestad@glasgowvirginia.org	540-258-2246
COREY Wood	Craigsville	woodca.craigsvillepd@outlook.com	540-917-5814
David Williams	VMT	dwilliams@vmt.edu	(540) 444-7095
Milton Franklin	Bridgewater College	mfranklin@bridgew.edu	540 830 5807
Austin Garber	Town of Timberlake	townmanager@townoftimberlake.com	540-896-7058
Keith Hartman	Bear's Vista Rd	KHARTMAN@BUCUS.org	540-261-6174
Paul Burns	Washington & Lee Univ.	p.burns@wlu.edu	540-464-6207
Roger Ramsey	Valley Community Services	RERAMSEY@VCSB.ORG	540 480-0667
Donna Good	Augusta ECC	dgood@Co.Augusta.VA.US	540 245-5503
Anthony Ramsey	Augusta ECC	abramsey@Co.Augusta.VA.US	816-245-5508
Laura Dwyer	Blue Ridge CC	dwyerl@brcc.edu	540-453-2533

## Central Shenandoah Valley Hazard Mitigation Plan

## Steering Committee Meeting

April 3, 2019

## Sign-In Sheet

Name	Locality or Organization	Email Address	Phone
William Wilkerson	Blue Ridge Community College	wilkerson@wrbcc.edu	304 939-8909
Brett Sinclair	ACSA	bsinclair@co.augusta.wv.us	340-430-3437
Deane Dozier	Citizen organizer Homeowner	deanedozier@gmail.com	540-949-8853
Philip Davis	USDA-NRCS	Philip.Davis@va.usda.gov	540-433-2853 x117
Gary Carter	Waynesboro Dem/Gms	carterg@ci.waynesboro.va.us	540 942 6698
Perry Weller	Staunton Fire - Rescue	wellerp@ci.staunton.va.us	540-332-3720
Betsy Putney	Town of Bridgewater	bputney@bridgewater.town	540-908-3397
Patrick Wilson	"	p.wilcox@"	"
Chris Bruce	VDEM	chris.bruce@vdem.virginia.gov	804-516-5776
Karen Clarke	Augusta Health	kclarke@augustastatehealth.com	540 332 4540
Jeremy Holloway	Rockingham County	JHolloway@rockinghamcountypva.gov	540-564-2175

**Central Shenandoah Valley Hazard Mitigation Plan**  
**Steering Committee Meeting**  
**April 3, 2019**  
**Sign-In Sheet**

Name	Locality or Organization	Email Address	Phone
Jeff Michael	Rockingham County F/R	j.michael@rockinghamcountypa.org	540-426-3242
Sharon Foley	Harrisonburg-Rockingham RRA	sfoley@hrrsa.org	540-820-0498
Anita Riggleman	HRRSA	ariggleman@hrrsa.org	540-434-1053
David Mawyer	Western State	mawyer@gmail.com	540-569-0479
Patrick Robertson	WSH	patr.wk.robertson@chhdc.virginia.gov	540-332-7368
Dan Jenkins	HRCB	djenkins@wsb.org	540-434-1941
Ross Clem	Town of Broadway	rclem@town-broadway.org	540-578-0486
Cherry Ryder	Beth Co.	bethbpc@tds.net	540-859-7236
Heath Clevin	CENTRAL SHENANDOAH HUMAN DISTRICT - VA	Heath.Clevin@vhd.virginia.gov	540-290-4100
Brendan Berry	Washington and Lee Univ.	bberry@wlu.edu	540-958-4467
Nathan Garrison	Town of Grottoes	ngarrison@ci.grottoes.va.us	540-249-5896

Central Shenandoah Valley Hazard Mitigation Plan  
Steering Committee Meeting  
April 3, 2019  
Sign-In Sheet

Name	Locality or Organization	Email Address	Phone
Daniel Hanlon	Dayton ID	dhanlon@daytonva.us	540-879-2161 ext 517
Chris Ells	Harrisonburg Chamber	christopher.ells@BBandT.com	540/292-3940
Patti Nylander	Va. Dept. of Forestry	patricia.nylander@dof.virginia.gov	434-962-8172
Doug Wolfe	County of Augusta	d.wolfe@co.augusta.va.us	540-245-5700
Tracy Hibbitts	CSPPC		
Rebecca Joyce	CSPPC		
Hunter Moore	CSPPC		



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**Central Shenandoah Valley Hazard Mitigation Plan  
Steering Committee Meeting  
BRITE Transit Facility Meeting Room, Fishersville  
Wednesday, April 3, 2019  
10 a.m. – 12 p.m.**

**Agenda**

**10:00 a.m.      Welcome and Introductions**

- Ms. Rebecca Joyce, Community Program Manager, CSPDC

**10:15 a.m.      Regional Hazard Identification**

- Ms. Hunter Moore, Regional Planner/GIS Coordinator, CSPDC
- Ms. Tracy Hibbitts, Regional Planner, CSPDC

**11:00 a.m.      Break**

**11:10 a.m.      Regional/Local Mitigation Goals and Strategies**

- Ms. Rebecca Joyce, Community Program Manager, CSPDC

**11:40 a.m.      Public Outreach**

- Ms. Rebecca Joyce, Community Program Manager, CSPDC
- Ms. Tracy Hibbitts, Regional Planner, CSPDC
- Ms. Hunter Moore, Regional Planner/GIS Coordinator, CSPDC

**11:55 a.m.      Closing and Adjournment**

- Ms. Tracy Hibbitts, Regional Planner, CSPDC



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## Central Shenandoah Valley Hazard Mitigation Plan

### 2019 Steering Committee Members

#### Administrative

Central Shenandoah Planning District Commission  
Virginia Department of Emergency Management

#### Local Government

City of Buena Vista  
City of Harrisonburg  
City of Lexington  
City of Staunton  
City of Waynesboro  
County of Augusta  
County of Bath  
County of Highland  
County of Rockbridge  
County of Rockingham  
Town of Bridgewater  
Town of Broadway  
Town of Craigsville  
Town of Dayton  
Town of Elkton  
Town of Glasgow  
Town of Goshen  
Town of Grottoes  
Town of Monterey  
Town of Mount Crawford  
Town of Timberville

#### Other Organizations or Government Agencies

Augusta County Service Authority  
Augusta Health  
Blue Ridge Community College  
Bridgewater College  
Central Shenandoah Health District, Virginia  
Department of Health  
Cherry Orchard Homeowners Association  
Dixie Gas and Oil Corporation  
Greater Augusta Regional Chamber of Commerce  
Harrisonburg-Rockingham Chamber of Commerce  
Harrisonburg-Rockingham Community Services Board  
Harrisonburg-Rockingham Regional Sewer Authority  
Holtzman Oil Corp.  
James Madison University  
Sentara Rockingham Memorial Hospital  
Shenandoah National Park, National Park Service  
Shenandoah Valley Project Impact  
Shenandoah Valley Regional Airport  
USDA- Natural Resources Conservation Service  
Valley Community Services Board  
Virginia Department of Environmental Quality  
Virginia Department of Forestry  
Virginia Military Institute  
Washington and Lee University  
Western State Hospital



## Federal Insurance and Mitigation Administration

## LOCAL HAZARD MITIGATION PLANNING

**Hazard Mitigation Planning for Resilient Communities**

Disasters can cause loss of life; damage buildings and infrastructure; and have devastating consequences for a community's economic, social, and environmental well-being. Hazard mitigation is the effort to reduce loss of life and property by lessening the impact of disasters. In other words, hazard mitigation keeps natural hazards from becoming natural disasters.

Hazard mitigation is best accomplished when based on a comprehensive, long-term plan developed before a disaster strikes. Mitigation planning is the process used by state, tribal, and local leaders to understand risks from natural hazards and develop long-term strategies that will reduce the impacts of future events on people, property, and the environment.

**The Local Mitigation Planning Process**

The mitigation plan is a community-driven, living document. The planning process itself is as important as the resulting plan because it encourages communities to integrate mitigation with day-to-day decision making regarding land use planning, floodplain management, site design, and other functions. Mitigation planning includes the following elements:

**Public Involvement** – Planning creates a way to solicit and consider input from diverse interests, and promotes discussion about creating a safer, more disaster-resilient community. Involving stakeholders is essential to building community-wide support for the plan. In addition to emergency managers, the planning process involves other government agencies, businesses, civic groups, environmental groups, and schools.

**Risk Assessment** – Mitigation plans identify the natural hazards and risks that can impact a community based on historical experience, estimate the potential frequency and magnitude of disasters, and assess potential losses to life and property. The risk assessment process provides a factual basis for the activities proposed in the mitigation strategy.

**Mitigation Strategy** – Based on public input, identified risks, and available capabilities, communities develop mitigation goals and objectives as part of a strategy for mitigating hazard-related losses. The strategy is a community's approach for implementing mitigation activities that are cost-effective, technically feasible, and environmentally sound as well as allowing strategic investment of limited resources.

**Disaster Mitigation Act of 2000**

The Robert T. Stafford Disaster Relief and Emergency Assistance Act, as amended by the Disaster Mitigation Act of 2000, is intended to "reduce the loss of life and property, human suffering, economic disruption, and disaster assistance costs resulting from natural disasters."

Under this legislation, state, tribal, and local governments must develop a hazard mitigation plan as a condition for receiving certain types of non-emergency disaster assistance through the Hazard Mitigation Assistance Programs. The regulatory requirements for local hazard mitigation plans can be found at Title 44 Code of Federal Regulations §201.6.

For more information about FEMA's Hazard Mitigation Assistance Grants, visit: [www.fema.gov/hazard-mitigation-assistance](http://www.fema.gov/hazard-mitigation-assistance).

## Benefits of Hazard Mitigation

Mitigation is an investment in your community's future safety and sustainability. Mitigation planning helps you take action now, before a disaster, to reduce impacts when a disaster occurs. Hazard mitigation planning helps you think through how you choose to plan, design, and build your community and builds partnerships for risk reduction throughout the community. Consider the critical importance of mitigation to:

- Protect public safety and prevent loss of life and injury.
- Reduce harm to existing and future development.
- Maintain community continuity and strengthen the social connections that are essential for recovery.
- Prevent damage to your community's unique economic, cultural, and environmental assets.
- Minimize operational downtime and accelerate recovery of government and business after disasters.
- Reduce the costs of disaster response and recovery and the exposure to risk for first responders.
- Help accomplish other community objectives, such as capital improvements, infrastructure protection, open space preservation, and economic resiliency.

Having a hazard mitigation plan will increase awareness of hazards, risk, and vulnerabilities; identify actions for risk reduction; focus resources on the greatest risks; communicate priorities to state and federal officials; and increase overall awareness of hazards and risks.

## Mitigation Activities for Risk Reduction

Possible mitigation activities may include:



Adoption and enforcement of regulatory tools, including ordinances, regulations, and building codes, to guide and inform land use, development, and redevelopment decisions in areas affected by hazards.



Acquisition or elevation of flood-damaged homes or businesses retrofit public buildings, schools, and critical facilities to withstand extreme wind events or ground shaking from earthquakes.



Creating a buffer area by protecting natural resources, such as floodplains, wetlands, or sensitive habitats. Additional benefits to the community may include improved water quality and recreational opportunities.



Implement outreach programs to educate property owners and the public about risk and about mitigation measures to protect homes and businesses.

## Mitigation Plan Implementation & Monitoring

History shows that hazard mitigation planning and the implementation of risk reduction activities can significantly reduce the physical, financial, and emotional losses caused by disasters. Putting the plan into action will be an ongoing process that may include initiating and completing mitigation projects and integrating mitigation strategies into other community plans and programs. Monitoring the plan's implementation helps to ensure it remains relevant as community priorities and development patterns change.

## Planning Guidance, Tools, and Resources

FEMA provides a variety of guidance, tools, and resources to help communities develop hazard mitigation plans. These resources and more can be found online at: [www.fema.gov/hazard-mitigation-planning-resources](http://www.fema.gov/hazard-mitigation-planning-resources).

- [Hazard mitigation planning laws, regulations, and policies](#) guide development of state, local, and tribal FEMA-approved hazard mitigation plans.
- The [Local Mitigation Planning Handbook](#) is the official guide for governments to develop, update, and implement local plans. The Handbook includes guidance, tools, and examples communities can use to develop their plans.
- [Mitigation Ideas: A Resource for Reducing Risk to Natural Hazards](#) provides ideas for mitigation actions.
- Visit [www.fema.gov/hazard-mitigation-training](#) for more information on available online and in-person mitigation planning training.

*"FEMA's mission is to support our citizens and first responders to ensure that as a nation we work together to build, sustain, and improve our capability to prepare for, protect against, respond to, recover from, and mitigate all hazards."*

**Central Shenandoah Valley Hazard Mitigation Plan  
2019 Hazard Identification Ranking**

Name: \_\_\_\_\_

Locality/Organization: \_\_\_\_\_

*Please select one ranking category below for each identified hazard. Please rank the hazards based upon what impact you feel they have on your community. An other category is provided if you have additional identified hazards you would like included.*

	Significant	High	Medium	Low	None
Flooding					
Drought					
Hurricane					
Severe Winter Weather					
Land Subsidence/Karst					
Tornado					
Wildfire					
Landslide					
Terrorism					
Earthquake					
Other: _____					

*Please select all dates that you might be available to attend a Steering Committee meeting. One meeting will be held in June and one meeting will be held in October. The meeting dates will be announced soon.*

June:

Wednesday, June 5, 10 a.m. - 12 p.m. \_\_\_\_\_

Wednesday, June 12, 10 a.m. - 12 p.m. \_\_\_\_\_

Thursday, June 13, 10 a.m. - 12 p.m. \_\_\_\_\_

October:

Wednesday, October 2, 10 a.m. - 12 p.m. \_\_\_\_\_

Monday, October 7, 10 a.m. - 12 p.m. \_\_\_\_\_

Thursday, October 10, 10 a.m. - 12 p.m. \_\_\_\_\_

**Goal 1: Improve local government planning, zoning, land use regulations and code enforcement to reduce impact of natural disasters.**

**Hazard:** All Hazards

**Location:** Region-wide

**Category:** Prevention

**Goal Statement:** Perhaps the most cost-effective way to reduce damages due to natural hazards is to incorporate mitigation measures into planning, zoning ordinances, land use regulations, and code enforcement as described in the strategies below. Most of the hazards that impact our region can be reduced by addressing them upfront in planning and prevention and through code enforcement and regulatory activities.

**Strategies**

- 1.1 For flood hazards, strengthen current floodplain, zoning and site development ordinances by adopting higher standards that provide additional protection and limit or restrict further development in the floodplain, i.e. additional freeboard, flood protection setbacks, limitation on fill, minimization of hydrostatic pressure, protection for mechanical and utility systems, etc. For drought hazards, utilize growth management tools like zoning and land use regulations to encourage low-impact development and forest preservation. For land subsidence hazards, strengthen enforcement of land use, zoning regulations and building ordinances that regulate construction in areas susceptible to landslides and sinkholes i.e. steep slopes, intermittent stream channels, and karst topography.
- 1.2 Provide funds for water supply planning and ground water protection projects and seek and research alternative water supplies for communities. Improve forecasting and monitoring of drought conditions.
- 1.3 Ensure that floodplain ordinances and building codes are clearly understood by staff, property owners, developers, bankers and insurance companies.
- 1.4 Implement zoning tools that steer development away from hazardous areas or natural areas deserving preservation. Include Department of Forestry personnel in subdivision review for new development in woodland-urban interface areas.
- 1.5 Provide for tax incentives, donated easements, and other approaches that can assist in preserving land in the floodplain and other environmentally sensitive areas for agricultural, environmental, recreational or educational uses.
- 1.6 Rezone to open space or acquire undeveloped portions of floodplain to prohibit future residential building.

- 1.7 Limit government expenditures for public infrastructure such as roads and water and sewer service in hazard-prone areas.
- 1.8 Provide necessary staff and staff training to enforce floodplain regulations and building codes.
- 1.9 Provide training and appropriate equipment/tools for local fire fighters to respond to woodland fires.
- 1.10 Sponsor workshops for Building Officials that focus on floodplain ordinances and FEMA regulations.

**Goal 2: Promote the Community Rating System (CRS).**

**Hazard:** Flood/Hurricane  
**Location:** Region-wide  
**Category:** Prevention

**Goal Statement:** The National Flood Insurance Program (NFIP) administers a program called the Community Rating System (CRS) whereby the cost of flood insurance is reduced in those jurisdictions which carry out floodplain management activities which are more protective than the minimum requirements of the NFIP. Examples include public outreach, mapping and regulations, damage reduction, and preparedness activities. The benefit of CRS participation, other than the reduced cost of flood insurance premiums to policyholders, is the increased overall awareness of flood hazards in the community and decreased flood damages in the future.

**Strategy**

- 2.1 Introduce local jurisdictions to the Community Rating System (CRS) and assist them in applying for CRS certification for their communities.

**Goal 3: Improve storm water management throughout the region.**

**Hazard:** Flood/Hurricane  
**Location:** Region-wide  
**Category:** Prevention

**Goal Statement:** Development, whether in or out of the floodplain, has the potential to increase flooding throughout the watershed. Without due consideration of storm water management, development can increase runoff, causing areas previous unaffected by flooding to become flooded and flood depths to increase in other areas.

**Strategies**

- 3.1 Consider conducting a Regional Storm Water Management Study which would guide the localities in developing the most cost-effective storm water management system, not only within the political boundaries of each locality, but within the locality's watershed.
- 3.2 All communities benefiting from a regional storm water management plan could share in the cost of preparing the plan.
- 3.3 Seek funding to prepare site-specific hydrologic and hydraulic studies that look at areas that have chronic and repetitive flooding problems.
- 3.4 Consider utilizing special utility assessment districts where property owners who directly benefit from a specific public improvement are charged a fee that is proportional to the benefits received.

**Goal 4: Implement watershed planning programs and conduct watershed analysis studies.**

**Hazard:** Flood/Hurricane, Karst/Sinkholes  
**Location:** Region-wide  
**Category:** Prevention

**Goal Statement:** While it is important for communities to plan and take responsibility for the land uses that occur in their own floodplains, it must be recognized that flooding and water quality can be affected by land use activities that occur elsewhere. In order to address the wide range of water quality, water quantity, and stream stability problems that exist in our Region an integrated approach is needed. Watershed planning allows localities to look holistically at water resource problems beyond jurisdictional lines.

### Strategies

- 4.1 Develop a regional, broad-based watershed plan among localities within a watershed in order to achieve effective and long-term flood protection and a healthy riverine environment.
- 4.2 Develop a watershed partnership, i.e. watershed roundtable to coordinate planning and program activities among natural resource agencies and stakeholders.
- 4.3 Conduct a site analysis mapping study to determine and understand the karst topography in our region.

### **Goal 5: Increase awareness of flood insurance and the National Flood Insurance Program (NFIP).**

**Hazard:** Flood/Hurricane

**Location:** Region-wide

**Category:** Prevention

**Goal Statement:** Insurance does not prevent disaster damage, but it provides financial protection to support recovery, repairs, and reconstruction. All 21 localities in the Region participate and are in good standing with the National Flood Insurance Program (NFIP). This program is designed to provide flood insurance at affordable rates to policyholders. In return, the local jurisdictions agree to adopt and administer local floodplain management measures directed at protecting lives, existing property, and future construction from future flooding. Only about 25% of the structures in our region that are in the floodplain are covered by flood insurance.

### Strategies

- 5.1 Encourage communities to remain active and compliant with the NFIP program.
- 5.2 Encourage citizens to purchase flood insurance. Partner with insurance companies, lenders, and real-estate agents to market the NFIP program.
- 5.3 Conduct NFIP training workshops for insurance providers.

**Goal 6: Reduce the impact of natural disasters on private residential properties.**

**Hazard:** Flood/Hurricane, Wildfires, Tornado/Wind, Winterstorms  
**Location:** Region-wide  
**Category:** Property Protection

**Goal Statement:** There are hundreds of residential structures located in hazardous areas, particularly the floodplain, throughout our region. Most of these structures were built in the floodplain or other vulnerable areas before the enactment of zoning ordinances and other regulations that prohibited building in these areas. For these existing as well as new structures, there are numerous measures that can be taken to reduce the impact of disasters.

**Strategies**

- 6.1 Develop a program to elevate, relocate, floodproof or acquire flood-prone houses in order to provide protection to these homes and reduce future damages.
- 6.2 Continue residential buyout and elevation projects of identified structures most at risk of future flooding with priority given to houses that are repetitively flooded.
- 6.3 For properties where elevation, relocation or acquisition is not feasible, introduce retrofitting measures to protect existing structures from flood damage. Retrofitting is relatively inexpensive and can include dry floodproofing, wet floodproofing, installing sewer backflow valves, berms, and sump pumps.
- 6.4 Design and landscape structures with wildfire safety in mind by utilizing fire-resistant materials when building especially in the urban-wilderness interface areas. Create safety and defensible space around structures. Provide adequate water resources/dry hydrants nearby woodland communities. Improve access for fire trucks and equipment. Increase knowledge of controlled burns and use of fire-retardant vegetations.
- 6.5 Include in local building codes a requirement for manufactured home tie downs and hurricane straps in high wind hazard and flood prone areas.
- 6.6 Offer financial incentives such as tax abatements, conservation easements, and low-interest loans to encourage property owners to elevate, relocate or floodproof buildings.
- 6.7 Encourage property owners to take advantage of NFIP's Increased Cost of Compliance (ICC). ICC helps pay for the cost of mitigation, including demolition and relocation, up to \$15,000 for a flood- insured structure that sustains a flood loss and is declared to be substantially or repetitively damaged.

- 6.8 Provide guidance and technical assistance to citizens about measures they can take on their own to protect their properties.
- 6.9 For properties located in known karst and landslide areas, use corrective measures recommended by a professional site analysis (geotechnical or structural engineer) to protect homes.
- 6.10 Encourage developers to integrate mitigation techniques into new construction and renovation.

**Goal 7: Improve disaster education and planning services for persons with special needs.**

**Hazard:** All Hazards

**Location:** Region-wide

**Category:** Public Education and Awareness

**Goal Statement:** Our region is home to many persons with special needs. A number of state-run facilities, assisted living facilities, group homes, retirement communities, nursing homes, and other agencies that serve persons with special needs are also in our region. Persons with special needs are dramatically affected by disasters and include persons with medical issues, physical and mental disabilities, visual and hearing impairments, and the elderly. Non-English speaking citizens and pet owners are also considered to have special needs as well. Education programs and planning are essential to helping persons with special needs minimize the effects of disasters on their lives and homes.

**Strategies**

- 7.1 Educate persons with special needs on disaster preparedness and mitigation methods at community events and through public awareness campaigns.
- 7.2 Provide disaster preparedness and mitigation materials in alternate formats such as large print, audio-cassette, and languages other than English to make materials accessible for a wider audience in the community. Also provide sign language interpreters at community events, workshops, and other educational programs.
- 7.3 Work with the first responder community to educate them about the special needs that people may have during a disaster.
- 7.4 Encourage persons with special needs to contact their local emergency management office so their needs can be noted in the 911 system.
- 7.5 Offer emergency sheltering for persons with disabilities that can provide accommodations that take into account their special needs including the use of medical equipment requiring electrical power, etc.

- 7.6 Provide training in emergency operations planning and preparedness to organizations that serve persons with special needs to reduce down-time in service provision, to protect lives of staff and clients, and to reduce damage to facilities.
- 7.7 Work with emergency managers to make sure that weather alerts and warnings are in accessible formats for all citizens to receive essential information during a disaster.
- 7.8 Ensure that emergency vehicles are accessible for persons with special needs and available to assist in evacuation if needed.
- 7.9 Educate pet owners and farmers so they will include their pets and livestock in their family's preparedness planning.
- 7.10 Work with local animal welfare organizations to provide emergency sheltering for pets and livestock.

**Goal 8: Reduce the impact of natural disasters on commercial property and businesses.**

**Hazard:** Flood/Hurricane

**Location:** Region-wide

**Category:** Property Protection

**Goal Statement:** Many of the Region's older commercial districts, downtowns, and factories were built near the water. In particular are the Cities of Waynesboro and Buena Vista, in which businesses and industry have been flooded many times costing millions of dollars in property damage, lost revenue, and jobs. Projects that provide funds to floodproof and retrofit commercial buildings would not only provide protection from future flooding but could also preserve the downtown commercial districts.

**Strategies**

- 8.1 Identify and seek funding to provide engineering and design services that would determine the most cost-effective mitigation option for each business.
- 8.2 Seek funding to floodproof and retrofit commercial buildings where acquisition and elevation are not feasible.
- 8.3 Sponsor workshops that educate local business and industry about mitigation measures they can install to protect their structures and inventory during a disaster.
- 8.4 Develop a program to assist local business and industry in developing emergency and business continuity plans.

**Goal 9: Improve community warning systems in the region.**

**Hazard:** Flood/Hurricane, Wildfire, Winter Storms Tornadoes/Wind  
**Location:** Region-wide  
**Category:** Emergency Services

**Goal Statement:** Many of localities participate in a flood warning system developed by the National Weather Service called the Integrated Flood Observing and Warning System (IFLOWS). There are numerous IFLOW stream and rain gauges located throughout our Region. Two of our jurisdictions (Rockingham County and the City of Waynesboro) have “Reverse 911” systems installed. This system allows the locality to alert property owners, businesses, and industry of impending emergencies such as a chemical leak, tornado, flood, etc. through a recorded telephone message. Both the IFLOW and Reverse 911 systems are excellent and effective means to warn citizens of impending disasters. However, not all areas of our Region are covered sufficiently and effectively by this technology.

**Strategies**

- 9.1 Identify areas with recurring flood problems and request additional IFLOW stream/rain gauges to ensure that these areas are adequately covered and monitored. Areas that would benefit from an early warning system include the Greenlee Bridge on the James River near Natural Bridge Station in Rockbridge County.
- 9.2 Develop Emergency Action Plans for specific sites such as mobile home parks, apartment complexes, assisted living facilities, industrial facilities, and essential public facilities within disaster-prone areas and develop specific warning or notification plans for each identified site. These plans should include the designation of a point of contact or resident coordinator, with alternates, to receive warnings, the dispatch of police, sheriff, fire rescue units to these sites to issue warnings and pre-designation of routes. These specific warnings will supplement the general television or radio warnings, which most people receive.
- 9.3 Seek funding to purchase, install, and maintain Reverse 911 emergency warning systems and other state-of-the-art disaster response and recovery equipment.
- 9.4 Encourage businesses and public facilities located in high hazard areas to purchase NOAA Weather Radios. By receiving early notification of potential inclement weather, businesses and public facilities can benefit from additional time to prepare for natural disasters. Local governments may be eligible for grants to purchase equipment to be distributed in public facilities, businesses, and industries through out their jurisdictions.
- 9.5 Utilize emergency preparedness and evacuation plans for people living in high-hazard areas, especially people with special needs and mobility impairments.

**Goal 10: Increase protection of public utilities and critical facilities.**

**Hazard:** Flood/Hurricane, Wildfire, Winter Storms, Tornados/Wind  
**Location:** Region-wide  
**Category:** Structural Protection

**Goal Statement:** Most communities provide some public utility service such as water, sewer, and stormwater systems. Most of these facilities have been upgraded to meet environmental protection design criteria and to remain operational during a disaster. However, in some instances these facilities have failed or services have been disrupted.

Strategies

- 10.1 Evaluate and provide retrofit measures to prevent disruption of services. Measures can include elevating electrical controls and equipment and installing watertight doors where practicable at water and wastewater treatment plants.
- 10.2 Bury underground lines deeper and further away from waterways with stronger encasements in floodprone areas with erodible soils.
- 10.3 Increase the number of wind-secured critical facilities including schools, daycares, hospitals, and shelters.
- 10.4 Increase number of functional backup generators at critical facilities.
- 10.5 Establishing routine schedule for trimming trees/limbs around power lines to prevent power outages during wind events and ice storms.
- 10.6 Limit government spending on infrastructure in high hazard areas.
- 10.7 Conduct vulnerability assessments and develop security plans on public utility systems in accordance with the Bioterrorism Act of 2002.

**Goal 11: Improve dam safety throughout the region.**

**Hazard:** Flood/Hurricane, Land Subsidence

**Location:** Region-wide

**Category:** Structural Protection

**Goal Statement:** There are 28 flood control dams in the Region built between 1954 and 1980. Many are at or near the end of their planned design life and may pose a threat to public safety. The Soil and Water Conservation Districts have the responsibility for the operation and maintenance of most of these dams. Many of the dams in our Region require significant and costly rehabilitation and maintenance.

**Strategies**

- 11.1 Examine the risks posed by dams in watersheds that drain in the Region and consider adopting ordinances to restrict development around these dams because of the potential flooding danger in areas below and behind the dams.
- 11.2 Consider local government funding to maintain and upgrade these dams. Require regular inspection and maintenance schedules.

**Goal 12: Improve storm drainage systems in the region.**

**Hazard:** Flood/Hurricane

**Location:** Region-wide

**Category:** Structural Protection

**Goal Statement:** Much of the flooding problems in our Region are a result of poor drainage and inadequate infrastructure. Drainage systems are designed to provide a certain level of protection when maintained in proper condition. Systems that are not maintained on a regular basis may become clogged with debris caused by either natural events or dumping of lawn debris, appliances, and other materials. To minimize the amount of debris accumulation in the drainage system, a combination of public education, regulation, and maintenance programs are needed.

**Strategies**

- 12.1 Support projects that call for improved ditching, replacement of inadequate and undersized culverts, enlargements of bridge openings, and drainage piping needed to minimize flooding.
- 12.2 Develop regular maintenance programs and standard operation procedures and budget accordingly.

- 12.3 Encourage routine maintenance of creek beds and culverts to allow more water to be carried with special emphasis placed on culverts where there are repeated problems.
- 12.4 Notify property owners living along interior streams to keep the creek beds clear of debris, weeds, and high grass.

**Goal 13: Implement stream remediation projects where needed.**

**Hazard:** Flood/Hurricane  
**Location:** Region-wide  
**Category:** Structural Protection

**Goal Statement:** Local communities in the Region recognize the importance of protecting existing bank lines and bridge substructures. This can be accomplished with rip rap or gabion revetments, flood retarding structures, bulkheads and berms, and riparian buffers that have been properly designed or constructed.

**Strategies**

- 13.1 When implementing stream remediation projects consideration should be given when designing these structures and take into account stream characteristics that influence the selection of these measures such as channel width, bank height, bend radii, storm event, channel velocities and flood depth, and floodplain configuration.
- 13.2 Obtain maintenance and access easements from property owners for annual maintenance work.
- 13.3 Coordinate with and support the Region's Soil and Water Conservation Districts' Emergency Watershed Protection Programs.

**Goal 14: Implement a disaster preparedness and mitigation education program.**

**Hazard:** All Hazards  
**Location:** Region-wide  
**Category:** Public Education and Awareness

**Goal Statement:** There are many ways that citizens and business owners can protect themselves and reduce their losses caused by natural disasters. However, many citizens, even recent victims are unaware of these measures. Listed below are a number of activities that can be implemented in the Region to increase public awareness to the hazard and mitigation actions that can be taken to reduce future damage, injury, and death caused by the natural disasters.

**Strategies**

- 14.1 Develop comprehensive public information and education programs on disasters, including preparedness, recovery, mitigation and prevention. This can be accomplished through presentations, workshops and marketing materials for citizens, business, schools, local staff and elected officials in the Region. Much of this has been and can be accomplished through Shenandoah Valley Project Impact.
- 14.2 Develop a public education program to educate citizens about water conservation, to use of water-conserving appliances, and irrigation practices in agricultural areas. Written materials could be developed to teach developers and home owners about native and/or drought-tolerant grasses, shrubs, and trees to be planted around residential structures.
- 14.3 Increase public education and awareness regarding the dangers of winter storms including driving/traveling during a winter storm event. (Automobile accidents are the leading cause of death during a winter storm event.). Also, increase public awareness to health risks associated with winter storms including exposure, hypothermia, frostbite, overexertion, and accidents from falling/slipping.
- 14.4 Encourage communities to become involved with the Department of Forestry's Firewise program. Its goal is to encourage and acknowledge action that minimizes home loss to wildfire by preparing for a fire before it occurs.
- 14.5 Encourage communities to become involved in the National Weather Service program "Storm Ready". This program assists communities with local safety, planning, education, and communication programs needed to save lives and property before and during weather-related disasters.
- 14.6 Provide Community Emergency Response Team (CERT) training to citizens and maintain a CERT organization. Having an active CERT program will not only educate citizens about preparedness and mitigation measures, it will also provide a pool of trained volunteers that can assist during an emergency or disaster.
- 14.7 Develop a media campaign to educate the general public throughout the year about disasters when they may be likely to occur. For example a Spring campaign on tornado safety, winter storm preparedness in the Fall, and hurricane safety prior to the start of Hurricane Season. This holistic campaign would be designed to reach a multi-generational audience and would include mitigation and preparedness information.
- 14.8 Increase the number and use of NOAA weather radios or battery-powered radios or TVs. Improve the effectiveness of NOAA weather radios in the valley.

- 14.9 Utilize the services of amateur radio operators in the region.
- 14.10 Sponsor Hazard Mitigation Workshops designed to give information to contractors, property owners, and business owners on mitigation strategies such as acquisition, relocation, elevation, and floodproofing.
- 14.11 Develop Hazard Awareness programs with the local schools, youth programs, and libraries to disseminate information on natural hazards and mitigation actions. Utilize student environmental clubs to volunteer for projects.
- 14.12 Notify renters of homes, mobile homes, and apartments that they are located in an area that is subject to flooding and should consider purchasing flood insurance for their contents. Notification could be done via lease agreements.
- 14.13 Establish and maintain Hazard Resource Library/ Self Help Programs on natural hazards, mitigation and safety and related topics in a central location and available to or disseminated to property owners and businesses.
- 14.14 Strategically place flood elevation reference markers throughout the Region in an effort to educate and remind people of historical floods. The markers could show the elevation of the high water from previous floods as well as the 100-year flood levels in a particular area.
- 14.15 Notify potential homebuyers of flood hazards and requirements for flood insurance. Programs should be developed with the cooperation of banks, real estate agents, and insurance agents as well as community development staff.
- 14.16 Implement programs to provide property owners with flood elevation certificates in order to alert them to the fact that their property is in the floodplain.
- 14.17 Provide appropriate local government staff with technical expertise and training on flood protection measures, retrofitting, flood insurance, flood warning and response, etc. in order to help citizens meet and understand floodplain requirements and flood hazards.

**Goal 15: Improve hazard data collection and GIS for region.**

**Hazard:** All Hazards  
**Location:** Region-wide  
**Category:** Public Information

**Goal Statement:** Many of the Flood Insurance Rate Maps (FIRM) produced by FEMA are outdated - most over 15 years old - and unreliable. These maps do not always reflect man-made alterations to floodplains caused by development that can change drainage patterns and increase flood hazards. Accurate and dependable maps are critical in helping the Region develop floodplain management strategies aimed at limiting the devastation caused by floods to area businesses and residents. Improved mapping, along with GIS, a computerized mapping and analysis tool, aids in the administration of building codes, land use plans, and efforts to identify risk areas and develop mitigation actions.

**Strategies**

- 15.1 Encourage communities to participate in FEMA's Cooperating Technical Partners (CTP) Program. This FEMA initiative establishes partners with local jurisdictions to develop and maintain up-to-date flood maps and other flood hazards. Mapping activities may include hydrologic and hydraulic analysis, floodplain mapping, preparation of digital FIRMs, and refinement of floodplain boundaries.
- 15.2 Consider creating a consortium of communities to tackle the problem of outdated FIRM maps and how to update the FIRM maps on a regional basis.
- 15.3 Ensure that all localities have digitized FIRM maps.
- 15.4 Acquire technology to assist in managing storm water, floodplain, and other land-based resources.
- 15.5 Utilize GIS technology to inventory at-risk infrastructure and public and private structures within at-risk areas.
- 15.6 Determine and map landslide/land subsidence, karst, and sinkhole vulnerable areas in the region. Archive events in a database to monitor trends and recurring sites. Coordinate with VDOT on sites impacting transportation infrastructure.
- 15.7 Identify and map assisted living centers, nursing homes, and facilities that serve people with special needs that require additional services during disasters.

**Central Shenandoah Valley Hazard Mitigation Plan**  
**Steering Committee Meeting**  
**June 5, 2019**  
**Sign-In Sheet**

Name	Locality or Organization	Email Address	Phone
Kevin Moore	Rockbridge County	kmoore@rockbridgecountyva.gov	540-319-9878
Harley Gardner	Highland Co	hgardner@yahoo.com	540-292-0456
Derek Taylor	Mt Jackson, VA.	KTAYLOR@FBI-LEXINGTON.COM	540-477-3131
Chris Bruce	VDEM	Chris.Bruce@VDEM.Virginia.gov	540-515-5796
Steven Craig	Dixie Gas and Oil Corporation	CraigS@dixiegas.com	540-248-6273
Annie Sonnen	Bath County	bathcoodss@icloud.com	540-839-7236
Richard Robison	Monterey	DOT.Robin106m	540-290-5842
Steve Strawderman	SVPI	strawderman@juno.com	540-209-5919
Patti Nylander	Va. Dept. of Forestry	patricia.nylander@dot.virginia.gov	434-962-8172
Sharon Angle	City of Staunton	—	—
Dan Hanlon	Town of Dayton	—	—

**Central Shenandoah Valley Hazard Mitigation Plan**  
**Steering Committee Meeting**  
**June 5, 2019**  
**Sign-In Sheet**

Name	Locality or Organization	Email Address	Phone
Ross E. Clem	Town of Broadway	reclena@town.broadway.Va.us	540-578-0486
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Paul Helmuth	Harrisonburg	paul.helmuth@harrisonburg.virginia.us	540-476-0860
COREY WOOD	Craigsville	woodcraig@prodigy.net	977-5935
Dave Robinson	NPS-Shenandoah NP	david.robinson@nps.gov	928-622-2694

**Central Shenandoah Valley Hazard Mitigation Plan**  
**Steering Committee Meeting**  
**June 5, 2019**  
**Sign-In Sheet**

Name	Locality or Organization	Email Address	Phone
ANITA RIGGLEMAN	HRRSA	ariggleman@hrrsa.org	(540)434-1052
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Gaither Hart	Town of ECKTON	ghart@townofeckton.com	540-578-0563
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Jeff Michael	Rockingham County	Jmichael@rockinghamcounty.org	540-426-3242
Alie Gratesen	CITY OF LEXINGTON	Agratesen@lexingtonva.gov	540 462 4730
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**Central Shenandoah Valley Hazard Mitigation Plan  
Steering Committee Meeting  
June 5, 2019  
Sign-In Sheet**



**Central Shenandoah Valley Hazard Mitigation Plan  
Steering Committee Meeting  
Augusta Health, Augusta Community Care Building  
Conference Room 3  
Wednesday, June 5, 2019  
10 a.m. – 12 p.m.**

**Agenda**

- I. **Welcome** - Rebecca Joyce, Community Program Manager
- II. **Regional Hazard Identification 2019 Ranking Results**
  - a. **Ranking of Prior Hazards** - Tracy Hibbitts, Regional Planner
  - b. **Consideration of Other Hazards** - Hunter Moore, Regional Planner/GIS Coordinator
- III. **Break**
- IV. **Regional/Local Mitigation Goals and Strategies** - Rebecca Joyce, Community Program Manager
- V. **Public Input and Outreach** - Rebecca Joyce, Community Program Manager
- VI. **Closing and Adjournment** - Tracy Hibbitts, Regional Planner
  - a. **Next Meeting: Monday, October 7, 10 a.m. – 12 p.m. – Augusta Health, Augusta Community Care Building, Conference Rooms 1 & 2**



## Central Shenandoah Valley Hazard Mitigation Plan 2019 Steering Committee Members

### Administrative

Central Shenandoah Planning District Commission  
Virginia Department of Emergency Management

### Local Government

City of Buena Vista  
City of Harrisonburg  
City of Lexington  
City of Staunton  
City of Waynesboro  
County of Augusta  
County of Bath  
County of Highland  
County of Rockbridge  
County of Rockingham  
Town of Bridgewater  
Town of Broadway  
Town of Craigsville  
Town of Dayton  
Town of Elkton  
Town of Glasgow  
Town of Goshen  
Town of Grottoes  
Town of Monterey  
Town of Mount Crawford  
Town of Timberville

### Other Organizations or Government Agencies

Augusta County Service Authority  
Augusta Health  
Blue Ridge Community College  
Bridgewater College  
Central Shenandoah Health District, Virginia  
Department of Health  
Cherry Orchard Homeowners Association  
Dixie Gas and Oil Corporation  
Greater Augusta Regional Chamber of Commerce  
Harrisonburg-Rockingham Chamber of Commerce  
Harrisonburg-Rockingham Community Services  
Board  
Harrisonburg-Rockingham Regional Sewer Authority  
Holtzman Oil Corp.  
Lexington-Rockbridge Chamber of Commerce  
James Madison University  
Sentara Rockingham Memorial Hospital  
Shenandoah National Park, National Park Service  
Shenandoah Valley Project Impact  
Shenandoah Valley Regional Airport  
USDA- Natural Resources Conservation Service  
Valley Community Services Board  
Virginia Department of Environmental Quality  
Virginia Department of Forestry  
Virginia Military Institute  
Washington and Lee University  
Western State Hospital

## Hazard Identification Results

Hazard Type	2013 Rank	2019 Rank
Flooding	Significant	Significant
Drought	High	High
Hurricane	High	High
Severe Winter Weather	High	High
Land Subsidence/Karst	Medium	Medium
Tornado	Medium	Medium
Wildfire	Medium	Medium
Landslide	Low	Low
Earthquake	Low	Low
Terrorism	Low	Low

## Central Shenandoah Valley Hazard Mitigation Plan

### 2019 Other Hazard Identification Ranking

Name: \_\_\_\_\_

Locality/Organization: \_\_\_\_\_

*Please select one ranking category below for each identified hazard. Please rank the hazards based upon what impact you feel they have on your community.*

Transportation of Hazardous Materials / Industrial Event

Dam Failure

Livestock / Poultry Disease

Derecho

Opioids/Drugs

Civil Unrest

Infectious Disease / Pandemic Emergency

Criminal Behavior

Power Outages

Environmental/ Water Quality

	Significant	High	Medium	Low	None
Transportation of Hazardous Materials / Industrial Event					
Dam Failure					
Livestock / Poultry Disease					
Derecho					
Opioids/Drugs					
Civil Unrest					
Infectious Disease / Pandemic Emergency					
Criminal Behavior					
Power Outages					
Environmental/ Water Quality					

## Central Shenandoah Hazard Mitigation Plan - Mitigation Goals

### 2020 Mitigation Goals

#### *2013 Mitigation Goals*

**Goal 1:** Improve local government planning, zoning, land use regulations, and code enforcement to reduce the impact of natural and man-made hazards and disasters.

*Goal 1: Improve local government planning, zoning, land use regulations, and code enforcement to reduce the impact of natural disasters.*

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**Goal 2:** Increase awareness of the National Flood Insurance Program (NFIP) and the Community Rating System (CRS) in local communities in the Region.

*Goal 2: Promote the Community Rating System (CRS).*

*Goal 5: Increase awareness of flood insurance and the National Flood Insurance Program (NFIP).*

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**Goal 3:** Continue to improve stormwater management and infrastructure throughout the Region.

*Goal 3: Improve stormwater management throughout the region.*

*Goal 12: Improve storm drainage systems in the region.*

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**Goal 4:** Conduct planning and studies and implementation of stormwater and flood mitigation projects at the watershed level when applicable.

*Goal 4: Implement watershed planning programs and conduct watershed analysis studies.*

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**Goal 5:** Conduct planning and studies and implementation of wildfire mitigation projects in wildland areas, across communities, or at a regional level to address vulnerabilities of the Wildland Urban Interface in the Region.

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**Goal 6:** Reduce the impact of natural and man-made hazards and disasters on private residential structures and properties.

*Goal 6: Reduce the impact of natural disasters on private residential properties.*

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**Goal 7:** Assist with emergency planning, preparedness education, and hazard mitigation to individuals with special needs and service providers.

*Goal 7: Improve disaster education and planning services for persons with special needs.*

**Goal 8:** Reduce the impact of natural and man-made hazards and disasters on commercial structures and properties and businesses.

*Goal 8: Reduce the impact of natural disasters on commercial property and businesses.*

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**Goal 9:** Improve access to systems that alert local emergency management officials of impending disasters from natural hazards such as rain and river gauges that alert to impending flooding that then allow for more advanced and informed warning to the public in the Region.

*Goal 9: Improve community warning systems in the region.*

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**Goal 10:** Increase protection of public utilities, infrastructure, and critical facilities.

*Goal 10: Increase protection of public utilities and critical facilities.*

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**Goal 11:** Improve dam safety throughout the Region.

*Goal 11: Improve dam safety throughout the region.*

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**Goal 12:** Implement natural systems protection actions that not only minimize damage and losses but also preserve and restore these systems.

*Goal 13: Implement natural stream remediation projects where needed.*

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**Goal 13:** Implement a disaster preparedness and mitigation and education program.

*Goal 14: Implement a disaster preparedness and mitigation and education program.*

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Remove this goal.

*Goal 15: Improve hazard data collection and GIS for the region.*

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**Goal 14:** Implement activities that promote resilience in the Region by enabling communities to better prepare, adapt to changing conditions, and become stronger to withstand and recover rapidly from stresses, shocks, and adverse situations.

**Central Shenandoah Valley Hazard Mitigation Plan**  
**Steering Committee Meeting**  
**October 3, 2019**  
**Sign-In Sheet**

Name	Locality or Organization	Email Address	Phone
COREY Wood	Craigsville P.	woodca.craigville@outlook.com	540-292-9133
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Sharon Angle	CSPDC	lady.staunton@verizon.net	540-980-4566
Storm Craig	Dixie Gas and Oil Corporation	craigs@dixiegas.com	(540) 294-1328
Greg Cirtina	City of Waynesboro	Cirtina@waynesboro.va.us	540-291-2298
Scott Massey	Sentara RMH	BXMASINCEsentara	540-292-3762
TB Roberts	City of Lexington	tbroberts@lexingtonva.gov	540-463-3210
Dennis Driver	Mt. Crawford	doubledfour@comcast.net	540-421-2349
Paul Helmuth	Harrisonburg	paul.helmuth@harrisonburgva.gov	540-476-0860
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Carl Williams	Highland County	Cwilliams@highlandrescue.org	540-632-7331

**Central Shenandoah Valley Hazard Mitigation Plan**  
**Steering Committee Meeting**  
**October 3, 2019**  
**Sign-In Sheet**

Name	Locality or Organization	Email Address	Phone
Harley Gardner	Highland	hgardn@yahoo.com	540 292 0456
Barbara Hunt	TOWN OF ELKTON	ghunt@TOWNOFELKTON.COM	540-578-0563
Dee Chastain	VMU	chastain@vmu.edu	540 968 7606
Kathy Hahn	USDA-NRCS	Kathy.Hahn@usda.gov	✓
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Ross E. Clem	Town of Broadway	rclem@Town.broadway.VA.US	540-578-0486
JAMES L WILLIAMS	VMU	WILLIAMS.L@VMU.EDU	540-464-7119
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Michael Keats	Volt	michael_keats@voltenergy.com	540 220 2773
Kris Hartman	Burn Vision	Kris.Hartman@burnvision.org	540-817-0029

**Central Shenandoah Valley Hazard Mitigation Plan**  
**Steering Committee Meeting**  
**October 3, 2019**  
**Sign-In Sheet**

Name	Locality or Organization	Email Address	Phone
Chris Cary	SHENANDOAH VALLEY AIRPORT	ccary@flyshd.com	540-414-4052
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Anthony Abramsy	Augusta EOC	abramsy@co.augusta.va.us	540-245-5508
Perry Weller	City of Staunton	wellerpw@ci.staunton.va.us	540-372-3720
Cory Smith	City of Staunton	smithrc@ci.staunton.va.us	540-332-3720
Betsy Putney	Town of Bridgewater	bputney@bridgewatertva.org	540-908-4212
Patrice Wilson	" " "	patrice@ " . " "	" " "
Kevin Moore	Rockbridge County	Kmoore@rockbridgecountytva.gov	540-319-9878
Amy Sartori	Bath County	bathcodeofficial@bathcountytva.net	540-829-7236

**Central Shenandoah Valley Hazard Mitigation Plan  
Steering Committee Meeting  
October 3, 2019  
Sign-In Sheet**

Name	Locality or Organization	Email Address	Phone
Brett Sinclair	ACSA	b.sinclair@co.augusta.va.us	540-430-3437
Dey Wolfe	Park Co	dewolf@co.augusta.va.us	245-5700
Kurt Taylor	Holtzman Oil	k.taylor@holtzmanoil.com	477-3131
Nathan Garrison	Town of Grottoes	ngarrison@ci.grottoes.va.us	271-4589
ANITA RIGGLEMAN	HRRSA	ariggleman@hrrsa.org	540-434-1053
Francis Canicedo	Augusta Health	francis@augustahost	540-332-4788
Laura Dwyer	Blue Ridge Community College	dwyerl@brcc.edu	540-453-2533
Chief William Wilkerson	BRCC	wilkersonw@brcc.edu	540-453-2370
Deane Dozier	Citrus & Orchard Growers	deanedozier@gmail.com	540-444-8853
Tracy Hibbitts	CSPPC		
Rebecca Joyce	CSPPC		
Hunter Moore	CSPPC		



**Central Shenandoah Valley Hazard Mitigation Plan  
Steering Committee Meeting  
Augusta Health, Augusta Community Care Building  
Conference Rooms 1 & 2  
Monday, October 7, 2019  
10 a.m.**

**Agenda**

- I. **Welcome** - Sharon Angle, Chair, Shenandoah Valley Project Impact
- II. **Project Status Update and Timeline** - Rebecca Joyce, Community Program Manager
- III. **Update on HIRA and Critical Facilities Maps** – Hunter Moore, Regional Planner/GIS Coordinator
- IV. **Damage Assessments** – Tracy Hibbitts, Regional Planner
- V. **Regional Strategies** - Rebecca Joyce, Community Program Manager and Tracy Hibbitts, Regional Planner
- VI. **Local Strategies** - Rebecca Joyce, Community Program Manager
- VII. **VDEM and FEMA Review Process** - Tracy Hibbitts, Regional Planner
- VIII. **Locality Adoption Process** - Rebecca Joyce, Community Program Manager
- IX. **Closing**- Sharon Angle, Chair, Shenandoah Valley Project Impact



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## Central Shenandoah Valley Hazard Mitigation Plan

### 2019 Steering Committee Members

#### Administrative

Central Shenandoah Planning District Commission  
Virginia Department of Emergency Management

#### Local Government

City of Buena Vista  
City of Harrisonburg  
City of Lexington  
City of Staunton  
City of Waynesboro  
County of Augusta  
County of Bath  
County of Highland  
County of Rockbridge  
County of Rockingham  
Town of Bridgewater  
Town of Broadway  
Town of Craigsville  
Town of Dayton  
Town of Elkton  
Town of Glasgow  
Town of Goshen  
Town of Grottoes  
Town of Monterey  
Town of Mount Crawford  
Town of Timberville

#### Other Organizations or Government Agencies

Augusta County Service Authority  
Augusta Health  
Blue Ridge Community College  
Bridgewater College  
Central Shenandoah Health District, Virginia  
Department of Health  
Cherry Orchard Homeowners Association  
Dixie Gas and Oil Corporation  
Greater Augusta Regional Chamber of Commerce  
Harrisonburg-Rockingham Chamber of Commerce  
Harrisonburg-Rockingham Community Services  
Board  
Harrisonburg-Rockingham Regional Sewer Authority  
Holtzman Oil Corp.  
Lexington-Rockbridge Chamber of Commerce  
James Madison University  
Sentara Rockingham Memorial Hospital  
Shenandoah National Park, National Park Service  
Shenandoah Valley Project Impact  
Shenandoah Valley Regional Airport  
USDA- Natural Resources Conservation Service  
Valley Community Services Board  
Virginia Department of Environmental Quality  
Virginia Department of Forestry  
Virginia Military Institute  
Washington and Lee University  
Western State Hospital

## **Central Shenandoah Hazard Mitigation Plan – Regional Goals and Strategies**

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**Goal 1:** Improve local government operations, planning, zoning, land use regulations, and code enforcement to reduce the impact of natural and man-made hazards and disasters.

### **Strategies**

- 1.1 For flood hazards, strengthen current floodplain, zoning and site development ordinances by adopting higher standards that provide additional protection and limit or restrict further development in the floodplain, i.e. additional freeboard, flood protection setbacks, limitation on fill, minimization of hydrostatic pressure, protection for mechanical and utility systems, etc. For drought hazards, utilize growth management tools like zoning and land use regulations to encourage low-impact development and forest preservation. For land subsidence hazards, strengthen enforcement of land use, zoning regulations and building ordinances that regulate construction in areas susceptible to landslides and sinkholes i.e. steep slopes, intermittent stream channels, and karst topography.
- 1.2 Encourage water supply planning and ground water protection projects. Seek and research alternative water supplies for communities. Improve forecasting and monitoring of drought conditions.
- 1.3 Ensure that floodplain ordinances and building codes are clearly understood by staff, property owners, developers, bankers and insurance companies.
- 1.4 Implement zoning tools that steer development away from hazardous areas or natural areas deserving preservation. Include Department of Forestry personnel in subdivision review for new development in woodland-urban interface areas.
- 1.5 Provide for tax incentives, donated easements, and other approaches that can assist in preserving land in the floodplain and other environmentally sensitive areas for agricultural, environmental, recreational or educational uses.
- 1.6 Rezone to open space or acquire undeveloped portions of floodplain to prohibit future residential building.
- 1.7 Limit government expenditures for public infrastructure such as roads and water and sewer service in hazard-prone areas.
- 1.8 Provide necessary staff and staff training to enforce floodplain regulations and building codes.
- 1.9 Provide training and appropriate equipment/tools for local fire fighters to respond to woodland fires.

- 1.10 Sponsor workshops for Building Officials that focus on floodplain ordinances and FEMA regulations.

**Goal 2:** Increase awareness of the National Flood Insurance Program (NFIP) and the Community Rating System (CRS) in local communities in the Region.

**Strategies**

- 2.1 Introduce local jurisdictions to the Community Rating System (CRS) and assist them in applying for CRS certification for their communities.
- 2.2 Encourage communities to remain active and compliant with the NFIP program.
- 2.3 Encourage citizens to purchase flood insurance. Partner with insurance companies, lenders, and real-estate agents to market the NFIP program.
- 2.4 Conduct NFIP training workshops for insurance providers.

**Goal 3:** Continue to improve stormwater management for the infrastructure throughout the Region.

**Strategies**

- 3.1 Consider conducting a Regional Storm Water Management Study which would guide the localities in developing the most cost-effective storm water management system, not only within the political boundaries of each locality, but within the locality's watershed.
- 3.2 Seek funding to prepare site-specific hydrologic and hydraulic studies that look at areas that have chronic and repetitive flooding problems.
- 3.3 Consider utilizing special utility assessment districts where property owners who directly benefit from a specific public improvement are charged a fee that is proportional to the benefits received.
- 3.4 Support projects that call for improved ditching, replacement of inadequate and undersized culverts, enlargements of bridge openings, and drainage piping needed to minimize flooding.
- 3.5 Develop regular maintenance programs and standard operation procedures and budget accordingly.

- 3.6 Encourage routine maintenance of creek beds and culverts to allow more water to be carried with special emphasis placed on culverts where there are repeated problems.
- 3.7 Notify property owners living along interior streams to keep the creek beds clear of debris, weeds, and high grass.

**Goal 4:** Conduct planning and studies for the implementation of stormwater and flood mitigation projects at the watershed level when applicable.

#### **Strategies**

- 4.1 Develop a regional, broad-based watershed plan among localities within a watershed in order to achieve effective and long-term flood protection and a healthy riverine environment.
- 4.2 Develop a watershed partnership, i.e. watershed roundtable to coordinate planning and program activities among natural resource agencies and stakeholders.
- 4.3 Conduct a site analysis mapping study to determine and understand the karst topography in our region.

**Goal 5:** Conduct proactive planning focused on developing mitigation strategies and projects that focus on wildfire mitigation at the landscape scale in wildland areas across communities or at a regional level; to address vulnerabilities of the Wildland Urban Interface in the Region.

**Goal 6:** Reduce the impact of natural and man-made hazards and disasters on private residential structures and properties.

#### **Strategies**

- 6.1 Develop a program to elevate, relocate, floodproof or acquire flood-prone houses in order to provide protection to these homes and reduce future damages.
- 6.2 Continue residential buyout and elevation projects of identified structures most at risk of future flooding with priority given to houses that are repetitively flooded.

- 6.3 For properties where elevation, relocation or acquisition is not feasible, introduce retrofitting measures to protect existing structures from flood damage. Retrofitting is relatively inexpensive and can include dry floodproofing, wet floodproofing, installing sewer backflow valves, berms, and sump pumps.
- 6.4 Design and landscape structures with wildfire safety in mind by utilizing fire-resistant materials when building especially in the urban-wilderness interface areas. Create safety and defensible space around structures. Provide adequate water resources/dry hydrants nearby woodland communities. Improve access for fire trucks and equipment. Increase knowledge of controlled burns and use of fire-retardant vegetations.
- 6.5 Include in local building codes a requirement for manufactured home tie downs and hurricane straps in high wind hazard and flood prone areas.
- 6.6 Offer financial incentives such as tax abatements, conservation easements, and low-interest loans to encourage property owners to elevate, relocate or floodproof buildings.
- 6.7 Provide guidance and technical assistance to citizens about measures they can take on their own to protect their properties.
- 6.8 For properties located in known karst and landslide areas, use corrective measures recommended by a professional site analysis (geotechnical or structural engineer) to protect homes.
- 6.9 Encourage developers to integrate mitigation techniques into new construction and renovation.

**Goal 7:** Assist with emergency planning, preparedness education, and hazard mitigation to individuals with special needs and service providers. Special needs include but are not limited to physical, sensory, cognitive, or emotional disabilities; medical issues, and communication barriers.

### **Strategies**

- 7.1 Educate persons with special needs on disaster preparedness and mitigation methods at community events and through public awareness campaigns.
- 7.2 Provide disaster preparedness and mitigation materials in alternate formats such as large print, digitally, and languages other than English to make materials accessible for a wider audience in the community. Also provide sign language interpreters at community events, workshops, and other educational programs.
- 7.3 Work with the first responder community to educate them about the special needs that

people may have during a disaster.

- 7.4 Encourage persons with special needs to contact their local emergency management office so their needs can be noted in the 911 system.
- 7.5 Offer emergency sheltering for persons with disabilities that can provide accommodations that consider their special needs including the use of medical equipment requiring electrical power, etc.
- 7.6 Provide training in emergency operations planning and preparedness to organizations that serve persons with special needs to reduce down-time in service provision, to protect lives of staff and clients, and to reduce damage to facilities.
- 7.7 Work with emergency managers to make sure that weather alerts and warnings are in accessible formats for all citizens to receive essential information during a disaster.
- 7.8 Ensure that emergency vehicles are accessible for persons with special needs and available to assist in evacuation if needed.
- 7.9 Educate pet owners and farmers so they will include their pets and livestock in their family's preparedness planning.
- 7.10 Work with local animal welfare organizations to provide emergency sheltering for pets and livestock.

**Goal 8:** Reduce the impact of natural and man-made hazards and disasters on commercial and industrial structures, properties, and businesses.

- 8.1 Identify and seek funding to provide engineering and design services that would determine the most cost-effective mitigation option for each business.
- 8.2 Seek funding to floodproof and retrofit commercial buildings where acquisition and elevation are not feasible.
- 8.3 Sponsor workshops that educate local business and industry about mitigation measures they can install to protect their structures and inventory during a disaster.
- 8.4 Develop a program to assist local business and industry in developing emergency and business continuity plans.

**Goal 9:** Improve access to systems that alert local emergency management officials of impending severe weather, emergencies, and disasters.

**Goal 10:** Improve community warning systems in the region.

### **Strategies**

- 10.1 Identify areas with recurring flood problems and request additional IFLOW stream/rain gauges to ensure that these areas are adequately covered and monitored. Areas that would benefit from an early warning system include the Greenlee Bridge on the James River near Natural Bridge Station in Rockbridge County.
- 10.2 Develop Emergency Action Plans for specific sites such as mobile home parks, apartment complexes, assisted living facilities, industrial facilities, and essential public facilities within disaster-prone areas and develop specific warning or notification plans for each identified site. These plans should include the designation of a point of contact or resident coordinator, with alternates, to receive warnings, the dispatch of police, sheriff, fire rescue units to these sites to issue warnings and pre-designation of routes. These specific warnings will supplement the general television or radio warnings, which most people receive.
- 10.3 Seek funding to purchase, install, and maintain Reverse 911 emergency warning systems and other state-of-the-art disaster response and recovery equipment.
- 10.4 Encourage businesses and public facilities located in high hazard areas to purchase NOAA Weather Radios. By receiving early notification of potential inclement weather, businesses and public facilities can benefit from additional time to prepare for natural disasters. Local governments may be eligible for grants to purchase equipment to be distributed in public facilities, businesses, and industries throughout their jurisdictions.
- 10.5 Utilize emergency preparedness and evacuation plans for people living in high-hazard areas, especially people with special needs and mobility impairments.

**Goal 11:** Reduce the impact of natural and man-made hazards on public utilities, critical infrastructure, and public properties/lands.

### **Strategies**

- 11.1 Evaluate and provide retrofit measures to prevent disruption of services. Measures can include elevating electrical controls and equipment and installing watertight doors where practicable at water and wastewater treatment plants.
- 11.2 Bury underground lines deeper and further away from waterways with stronger encasements in floodprone areas with erodible soils.
- 11.3 Increase the number of wind-secured critical facilities including schools, daycares, hospitals, and shelters.
- 11.4 Increase number of functional backup generators at critical facilities.
- 11.5 Establishing routine schedule for trimming trees/limbs around power lines to prevent power outages during wind events and ice storms.
- 11.6 Limit government spending on infrastructure in high hazard areas.
- 11.7 Conduct vulnerability assessments and develop security plans on public utility systems in accordance with the Bioterrorism Act of 2002.

**Goal 12:** Improve dam safety throughout the Region.

### **Strategies**

- 12.1 Examine the risks posed by dams in watersheds that drain in the Region and consider adopting ordinances to restrict development around these dams because of the potential flooding danger in areas below and behind the dams.
- 12.2 Consider local government funding to maintain and upgrade these dams. Require regular inspection and maintenance schedules.

**Goal 13:** Implement natural systems protection actions that not only minimize damage and losses but also preserve and restore these systems.

**Strategies**

- 13.1 When implementing stream remediation projects consideration should be given when designing these structures and consider stream characteristics that influence the selection of these measures such as channel width, bank height, bend radii, storm event, channel velocities and flood depth, and floodplain configuration.
- 13.2 Obtain maintenance and access easements from property owners for annual maintenance work.
- 13.3 Coordinate with and support the Region's Soil and Water Conservation Districts' Emergency Watershed Protection Programs.

**Goal 14:** Implement a disaster preparedness and mitigation education program.

**Strategies**

- 14.1 Develop comprehensive public information and education programs on disasters, including preparedness, recovery, mitigation and prevention. This can be accomplished through presentations, workshops and marketing materials for citizens, business, schools, local staff and elected officials in the Region. Much of this has been and can be accomplished through Shenandoah Valley Project Impact.
- 14.2 Develop a public education program to educate citizens about water conservation, to use of water-conserving appliances, and irrigation practices in agricultural areas. Written materials could be developed to teach developers and homeowners about native and/or drought-tolerant grasses, shrubs, and trees to be planted around residential structures.
- 14.3 Increase public education and awareness regarding the dangers of winter storms including driving/traveling during a winter storm event. (Automobile accidents are the leading cause of death during a winter storm event.). Also, increase public awareness to health risks associated with winter storms including exposure, hypothermia, frostbite, overexertion, and accidents from falling/slipping.
- 14.4 Encourage communities to become involved with the Department of Forestry's Firewise program. Its goal is to encourage and acknowledge action that minimizes home loss to wildfire by preparing for a fire before it occurs.

- 14.5 Encourage communities to become involved in the National Weather Service program "Storm Ready". This program assists communities with local safety, planning, education, and communication programs needed to save lives and property before and during weather-related disasters.
- 14.6 Provide Community Emergency Response Team (CERT) training to citizens and maintain a CERT organization. Having an active CERT program will not only educate citizens about preparedness and mitigation measures, it will also provide a pool of trained volunteers that can assist during an emergency or disaster.
- 14.7 Develop a media campaign to educate the general public throughout the year about disasters when they may be likely to occur. For example a Spring campaign on tornado safety, winter storm preparedness in the Fall, and hurricane safety prior to the start of Hurricane Season. This holistic campaign would be designed to reach a multi-generational audience and would include mitigation and preparedness information.
- 14.8 Increase the number and use of NOAA weather radios or battery-powered radios or TVs. Improve the effectiveness of NOAA weather radios in the valley.
- 14.9 Utilize the services of amateur radio operators in the region.
- 14.10 Sponsor Hazard Mitigation Workshops designed to give information to contractors, property owners, and business owners on mitigation strategies such as acquisition, relocation, elevation, and floodproofing.
- 14.11 Develop Hazard Awareness programs with the local schools, youth programs, and libraries to disseminate information on natural hazards and mitigation actions. Utilize student environmental clubs to volunteer for projects.
- 14.12 Notify renters of homes, mobile homes, apartments that they are in an area that is subject to flooding and should consider purchasing flood insurance for their contents. Notification could be done via lease agreements.
- 14.13 Establish and maintain Hazard Resource Library/ Self Help Programs on natural hazards, mitigation and safety and related topics in a central location and available to or disseminated to property owners and businesses.
- 14.14 Strategically place flood elevation reference markers throughout the Region to educate and remind people of historical floods. The markers could show the elevation of the high water from previous floods as well as the 100-year flood levels.
- 14.15 Notify potential homebuyers of flood hazards and requirements for flood insurance. Programs should be developed with the cooperation of banks, real estate agents, and insurance agents as well as community development staff.

14.16 Implement programs to provide property owners with flood elevation certificates in order to alert them to the fact that their property is in the floodplain.

14.17 Provide appropriate local government staff with technical expertise and training on flood protection measures, retrofitting, flood insurance, flood warning and response, etc. in order to help citizens meet and understand floodplain requirements and flood hazards.

**Goal 15:** Improve hazard data collection and GIS for the region.

**Strategies**

- 15.1 Encourage communities to participate in FEMA's Cooperating Technical Partners (CTP) Program. This FEMA initiative establishes partners with local jurisdictions to develop and maintain up-to-date flood maps and other flood hazards. Mapping activities may include hydrologic and hydraulic analysis, floodplain mapping, preparation of digital FIRM, and refinement of floodplain boundaries.
- 15.2 Consider creating a consortium of communities to tackle the problem of outdated FIRM maps and how to update the FIRM maps on a regional basis.
- 15.3 Ensure that all localities have digitized FIRM maps.
- 15.4 Acquire technology to assist in managing storm water, floodplain, and other land-based resources.
- 15.5 Utilize GIS technology to inventory at-risk infrastructure and public and private structures within at-risk areas.
- 15.6 Determine and map landslide/land subsidence, karst, and sinkhole vulnerable areas in the region. Archive events in a database to monitor trends and recurring sites. Coordinate with VDOT on sites impacting transportation infrastructure.
- 15.7 Identify and map assisted living centers, nursing homes, and facilities that serve people with special needs that require additional services during disasters.

**Goal 16:** Implement activities that promote resilience in the Region by enabling communities to better prepare, adapt to changing conditions, and become stronger to withstand and recover rapidly from stresses, shocks, and adverse situations.

**Goal 17:** Review Mitigation and Community Improvement Plans in the aftermath of an event in order to encourage the implementation of mitigation projects during the recovery process.

## Central Shenandoah Hazard Mitigation Plan: Local Mitigation Strategies

Community:
NFIP Community Number:

Regional Goals FEMA/VDEM Goals Required To Be Included In Plan Regional Wildfire Mitigation Plan Goals

Mitigation Strategy	Hazard	Priority High Medium Low	Project Status Delayed On-going Completed	If Not Completed, Why?	Responsible Party	Time Frame
Continue membership and participation in Shenandoah Valley Project Impact, the regional disaster preparedness and mitigation education program that was started in September 2000. Shenandoah Valley Project Impact educates citizens in the region about disaster preparedness and mitigation through public awareness campaigns, workshops and trainings, and an extensive resource library.	All Hazards	High	On-going	N/A	CSPDC	On-going
Maintain a relationship with the Southern Shenandoah Chapter of Virginia Voluntary Organizations Active in Disaster (VOAD), to share knowledge and resources throughout the preparation, response, and recovery phases of a disaster.	All Hazards	High	On-going	N/A	County City Town	On-going
Support implementation of structural and non-structural mitigation activities on private or public property to reduce exposure to and provide protection from natural and man-made hazards. Eligible projects include but are not limited to acquisition, elevation, minor structural flood control projects, relocation of structures, retrofitting of existing structures, infrastructure protection measures, stormwater and wastewater management improvements, advanced warning systems, hazard gauging systems, hazard education, and wildfire mitigation projects.	All Hazards	High	On-going	N/A	County City Town	On-going

Mitigation Strategy	Hazard	Priority High Medium Low	Project Status Delayed On-going Completed	If Not Completed, Why?	Responsible Party	Time Frame
Maintain the community's compliance with the National Flood Insurance Program (NFIP) by engaging in various activities included in the three basic components of the NFIP program; 1. floodplain identification and mapping risk, 2. responsible floodplain management, and 3. flood insurance. Sample activities include but are not limited to: maintaining publicly accessible and accurate Flood Insurance Rate Maps (FIRMs), adopting and enforcing a compliant floodplain ordinance, and provide general assistance and education to community members regarding the flood insurance program.	Flood	High	On-going	N/A	County City Town	On-going
Encourage the lessening of potential wildfires in our community and the region by; 1. Education and outreach to residents, especially those that live in woodland areas and the Wildland Urban Interface (WUI). 2. Reduction of hazardous fuels throughout the community. 3. Reduction of structural ignitability to limit injury, loss of life, and property and structural damage. 4. Having trained first responders with proper tools and equipment that will serve as a frontline defense against a wildfire.	Wildfire	High Medium	On-going	N/A	County City Town	On-going

## Public Survey and Survey Results

## 2019 Central Shenandoah Valley Natural Hazards Survey

The Central Shenandoah Planning District Commission is in the process of updating its Central Shenandoah Valley Hazard Mitigation Plan. Hazard mitigation is the effort to reduce loss of life and property by lessening the impact of disasters before it happens. Mitigation plans allow a community to assess its risks, vulnerabilities and create strategies to reduce damage to structures, infrastructure, and properties. These plans help communities to become more resilient. By completing this survey, you will help the hazard mitigation planning team gain a better understanding of the public's perceptions and opinions regarding natural hazards.

Thank you for your help!

**\* 1. Have you or someone in your household experienced any of the natural disasters below? (Please check ALL that apply)**

- |   |  |
|---|--|
| <input type="checkbox"/> Coastal Erosion          | <input type="checkbox"/> Landslide/Debris Flow |
| <input type="checkbox"/> Drought                  | <input type="checkbox"/> Tsunami               |
| <input type="checkbox"/> Dust Storm               | <input type="checkbox"/> Volcanic Eruption     |
| <input type="checkbox"/> Earthquake               | <input type="checkbox"/> Wildfire              |
| <input type="checkbox"/> Flood                    | <input type="checkbox"/> Windstorm             |
| <input type="checkbox"/> Household Fire           | <input type="checkbox"/> Winter Storm/Blizzard |
| <input type="checkbox"/> Hurricane/Tropical Storm |  |

**\* 2. How concerned are you about the following natural hazards affecting our area? (Please check only ONE box for each hazard)**

	Extremely Concerned	Very Concerned	Concerned	Somewhat Concerned	Not Concerned
Drought	<input type="radio"/>				
Earthquake	<input type="radio"/>				
Flood	<input type="radio"/>				
Household Fire	<input type="radio"/>				
Hurricane	<input type="radio"/>				
Ice Storm	<input type="radio"/>				
Landslide/Debris Flow	<input type="radio"/>				
Wildfire	<input type="radio"/>				
Wind Storm/Derecho	<input type="radio"/>				
Winter Storm/Blizzard	<input type="radio"/>				
Tornado	<input type="radio"/>				

Other (please specify)

\* 3. For each activity below please select: what you have done, plan to do in the near future, have not done, or are unable to do, in your household. (*Please check ONE answer per activity*)

	Have Done	Plan To Do	Not Done	Unable To Do
Attend meetings or received written information on natural disasters or emergency preparedness?	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Developed a plan for what everyone would do in the event of a household emergency?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Prepared a "Disaster Supply Kit" (Stored extra food, etc.)?	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
In the last year, has anyone in your household trained in first aid or CPR?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Purchased Flood Insurance?	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Implemented fire-resistance or floodproofing techniques on your home or business?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Installed smoke detectors and fire extinguishers in your home or business?	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

\* 4. How concerned are you of an occurrence of a natural hazard on your property?

- Extremely Concerned
- Very Concerned
- Concerned
- Somewhat Concerned
- Not Concerned

\* 5. How much money are you willing to spend to better protect your family and home from natural disasters? (*Please check only ONE*)

- \$50- 99
- \$100-\$999
- \$1,000-\$4,999
- \$5,000 and above
- None

\* 6. What modifications have you made or would you consider making to protect your home from natural disasters? (*Please check ALL that apply*)

- |   |   |
|---|---|
| <input type="checkbox"/> Anchor bookcases, cabinets to wall                             | <input type="checkbox"/> Find out if you live in a floodplain   |
| <input type="checkbox"/> Secure water heater to wall                                    | <input type="checkbox"/> Avoid building in a floodplain   |
| <input type="checkbox"/> Install latches on drawers/cabinets                            | <input type="checkbox"/> Elevate your house at least one foot above the 100-year flood elevation                                  |
| <input type="checkbox"/> Fit gas appliances with flexible connections                   | <input type="checkbox"/> Relocate your home outside of the floodplain   |
| <input type="checkbox"/> Purchase flood insurance                                       | <input type="checkbox"/> Select fire-resistant materials to build your home such as flame-retardant roof shingles                 |
| <input type="checkbox"/> Keep culverts, ditches, and gutters free of debris             | <input type="checkbox"/> Landscape your yard with fire-resistant vegetation   |
| <input type="checkbox"/> Elevate utilities and move appliances out of basements         | <input type="checkbox"/> Keep gutters clean   |
| <input type="checkbox"/> Seal basement walls and windows with waterproofing compounds   | <input type="checkbox"/> Dispose of stove, grill and fireplace ashes properly   |
| <input type="checkbox"/> Install check valves to keep sewer lines from backing up       | <input type="checkbox"/> Stack firewood at least 30 feet away and uphill from your home and clear combustible materials around it |
| <input type="checkbox"/> Secure home to its foundation                                  | <input type="checkbox"/> Place metal screens over structure openings  |
| <input type="checkbox"/> Brace un-reinforced masonry and concrete walls and foundations | <input type="checkbox"/> None   |

\* 7. Which of the following incentives, if any, would motivate you to take additional steps to better protect your family and home from a natural disaster? (*Please check ALL that apply*)

- |   |   |
|---|---|
| <input type="checkbox"/> Insurance discount   | <input type="checkbox"/> Mortgage discount      |
| <input type="checkbox"/> Free (brief) training on preparation and prevention of property disaster | <input type="checkbox"/> Federal or state grant |
| <input type="checkbox"/> Low interest rate loan   | <input type="checkbox"/> Tax break or incentive |
| <input type="checkbox"/> Lower new home construction costs  | <input type="checkbox"/> None                   |
| <input type="checkbox"/> Free wildfire mitigation home assessment                                 |   |
| <input type="checkbox"/> Other (please specify)   |   |

8. In what county, city, or town do you live?

9. Do you own or rent your dwelling?

Own

Rent

10. Additional Comments:

11. Thank you for your participation!

*This survey may be submitted anonymously; however, if you would like to receive information regarding upcoming public meetings for the hazard mitigation plan update, please provide your name and contact information:*

Name	<input type="text"/>
Address	<input type="text"/>
Address 2	<input type="text"/>
City/Town	<input type="text"/>
State/Province	<input type="text"/>
ZIP/Postal Code	<input type="text"/>
Email Address	<input type="text"/>

Thank you for your time and providing this information!

For more information about the survey, please contact:

Rebecca Joyce, Community Program Manager  
Central Shenandoah Planning District Commission  
112 MacTanly Place  
Staunton, Virginia 24401

by phone: (540)885-5174  
e-mail: [rebecca@cspd.org](mailto:rebecca@cspd.org)

## **Central Shenandoah Valley All Hazards Mitigation Plan – 2020 Update**

### **Natural Hazards Survey Report**

#### **Summary**

Beginning in April 2018 with the Central Shenandoah Regional Wildfire Protection Plan until October 2019, the CSPDC conducted a survey of the citizens of the twenty-one jurisdictions in the Region. The purpose of this survey was to receive public input regarding perceptions about natural hazards experienced by individuals in the Central Shenandoah Region, their knowledge regarding mitigation techniques, and their willingness to implement mitigation measures.

Distribution of the survey was purposely widespread throughout the Region. Individuals had the option to complete the survey on-line, as a paper copy, or by telephone interview. A press release explaining the survey and how citizens could obtain a copy was distributed in a mass e-mail to contacts throughout the Region and to various media outlets such as newspapers and local television stations.

Five hundred and fifty-seven (557) people completed the survey. The majority of completed surveys were from Augusta County, 156; the City of Staunton, 65; and Rockingham County, 54 based on the responses of the 478 people who answered the question regarding where they live.

#### **Results**

- The survey asked respondents which natural disasters they had experienced. The top four natural disasters were; winter storms (82%), windstorms (49%), hurricanes/tropical storms (48%), and floods (44%). With the survey done for the last update of the Plan, windstorms were not included as a top category. This change may be the result of the 2012 Derecho and several smaller, localized windstorms we have had since the last update.
- Respondents were asked to state their concerns about natural hazards affecting the Shenandoah Valley. The largest percentages for each disaster fell in the middle of the rating scale in the *Concerned* category: with the largest being household fire (35%), windstorm/derecho (32%), winter storm (32%), drought (31%), and hurricanes (30%). The *Very Concerned* or *Extremely Concerned* categories did not receive a majority for any hazard. In the survey for the 2013 update, respondents were *Very Concerned* about winter storms/ blizzards (35%) and ice storms (33%). Hurricanes (31%), drought (32%), and floods (30%) had respondents *Concerned* in their response to that survey.

- The survey listed several mitigation activities and asked respondents which of these they had completed. Answers for this survey are in **bold**. Answers from the previous survey are in *italics*. Completed activities included:
  - Installed smoke detectors. **(90%)** (88%)
  - Attended meetings or received information about natural disasters or emergency preparedness. **(67%)** (54%)
  - Trained in First Aid or CPR in the last year. **(49%)** (53%)
  - Prepared a disaster supply kit. **(46%)** (37%)
  - Developed a household emergency plan. **(50%)** (34%)
  - Implemented fire-resistance or floodproofing techniques. **(27%)** (19%)
  - Purchased flood insurance. **(7%)** (8%)
- Less than 20% of respondents are *Very Concerned* or *Extremely Concerned* about an occurrence of a natural hazard on their property.
- When asked how much money would respondents be willing to spend to better protect their family and homes from natural disasters; forty-seven percent (47%) said they would spend up to one thousand dollars (\$1,000), twenty-five percent (25%) said they would spend up to five thousand dollars (\$5,000), and seven percent (7%) would spend five thousand dollars (\$5,000) or above.
- The survey listed several types of modifications people have made or would make to protect their home from natural disasters. The three most popular modifications were:
  - Eighty-seven percent (87%) of respondents would keep gutters clean.
  - Sixty-nine percent (69%) of respondents would keep culverts, ditches, and gutters free of debris to allow the free flow of potential floodwaters.
  - Sixty-six percent (66%) of respondents would dispose of stove, grill, and fireplace ashes properly.

- Respondents were asked what incentives would motivate them to take additional steps to better protect their family and homes from a natural disaster. The three incentives that received the most responses were:
  - Seventy-three percent (73%) of respondents said an insurance discount would be a motivating factor.
  - Fifty percent of respondents (50%) said a tax break or incentive would be a motivating factor.
  - Forty-seven percent (47%) of respondents said a federal or state grant would be a motivating factor.

## Conclusions

What conclusions can be drawn by examining the responses of the five hundred and fifty-seven (557) individuals that completed the survey?

- The most common natural disasters that respondents have experienced are the ones that have happened most frequently. Windstorms/Derechos are new to this list.
- The disasters respondents expressed the most concern about are the ones that occur the most frequently. Windstorms/Derechos are new to this list. House fires are more of a concern than in the past.
- Mitigation and preparedness information is being distributed and received by citizens throughout the Central Shenandoah Region.
- Since the last HMP update more respondents are doing the three most essential tasks needed to prepare for emergencies and disasters; creating a family plan, assembling a disaster supply kit, and receiving information about hazards preparedness.
- Fire safety education in the Central Shenandoah Valley continues to be extremely effective as illustrated by 90% of respondents having installed smoke detectors. This has stayed consistent since the previous update of the HMP.
- Yard work and home maintenance activities that reduce combustible debris and assist with the proper drainage of stormwater are simple mitigation methods a majority of respondents are willing to undertake to prevent damage to their property.

- Not more than one thousand dollars (\$1,000.00) is the amount of financial resources that the majority of respondents are willing to spend to protect their families and properties from natural hazards. This trend has not changed since the previous HMP.
- Financial incentives whether through insurance discounts, tax breaks, or grants are the most motivating factors to respondents in order to implement steps to protect their homes and families. The most motivating factor is now insurance discounts compared to the last HMP where tax breaks were the most popular incentive.

In conclusion, while the Central Shenandoah Valley continues to make strides in its progress towards disaster-resistance and resilience there is still much work to be done.

**Appendix B -**  
**James Madison University**  
**Climate Adaptation Chapter**

# CLIMATE ADAPTATION

Submitted to the Central Shenandoah Planning District Commission

Raven Brubach, Macon Thompson, Alex Cherney, Anton  
Foretich, Jake Rehm, Joe Ziegler, Jesse Faas

James Madison University

April 29, 2019

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## **Introduction**

The impacts of climate change have the potential to be hazardous to the communities and environment of the Central Shenandoah Valley. As the impacts from climate change increase, the region will face more frequent, severe storms and natural disasters. These threaten local commercial and agricultural industries and infrastructure, as well as the safety and well-being of residents within the Central Shenandoah Planning District Commission (CSPDC) region. As population continues to grow, the risk of supplementary physical damage and economic loss will rise, as well.

## **Population**

The population of the individual cities and counties of the CSPDC region vary considerably (Table 1). Rockingham and Augusta counties have the highest populations as well as the highest median household income, median property value, and number employed (Data USA, 2019-h; Data USA, 2019-b). Each locality is expected to see an increase in population except for Bath County, Highland County and the City of Buena Vista, where the populations are slowly declining (Data USA, 2019-b; Data USA, 2019-d; Data USA, 2019-c). The city of Harrisonburg has a population growth rate of 2.09%, the fastest growing within the region; it also has the third highest median property value behind Rockingham and Augusta counties (Data USA, 2018-e; Data USA, 2019-h). Amongst the most common occupations within the localities are administrative, sales and management positions; however, there are comparatively high numbers of residents working within the farming, fishing, and forestry occupations as well as firefighting and prevention, and other protective service jobs. (Data USA, 2019-a-j). As people continue to move into the area, prompting further infrastructure and development, the risk of economic and social losses will increase unless additional hazard mitigation measures are taken to match the threat of increasingly destructive weather.

## **Land Use**

The Central Shenandoah Valley region consists of 3,439 square miles located in western Virginia between the Blue Ridge and Allegany Mountains (Central Shenandoah Valley Region, 2015). According to each county's latest comprehensive plan, the majority of Central Shenandoah Valley land is dominated by forest and agriculture. The region's growing

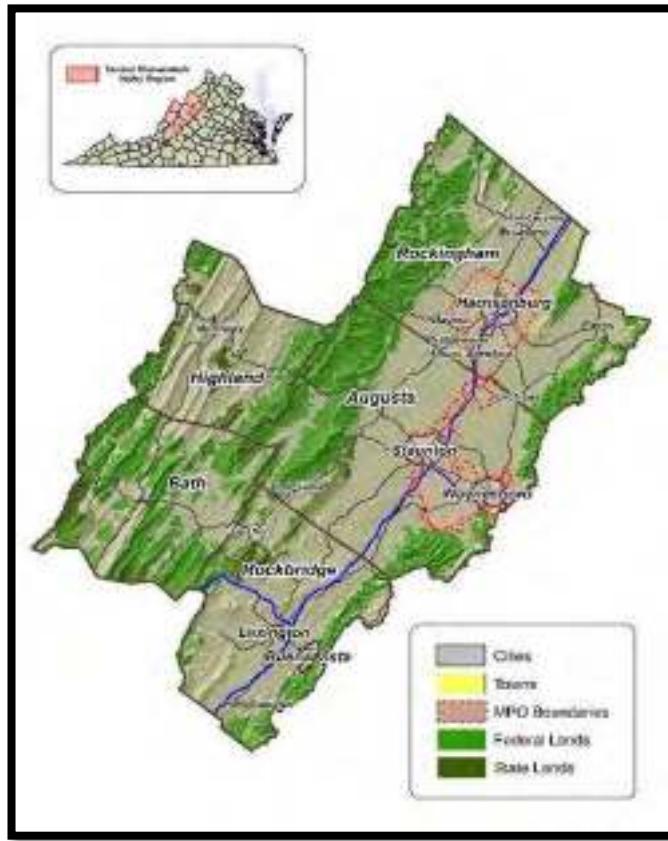
*Table 1. Population Data for Central Shenandoah Region (Data USA, 2019).*

County/City	Population	Population Growth Rate (Between 2015-2016)	Median Household Income	Median Property Value	Number of Employees
<b>Augusta</b>	74,330	0.37%	\$56,802	\$199,700	34,486
<b>Bath</b>	4,558	-0.55%	\$44,985	\$146,400	2,209
<b>Highland</b>	2,230	-0.62%	\$44,877	\$160,800	982
<b>Rockbridge</b>	22,450	0.03%	\$52,478	\$193,300	10,184
<b>Rockingham</b>	78,427	0.83%	\$55,029	\$200,900	38,083
<b>Buena Vista</b>	6,495	-1.74%	\$33,672	\$111,700	2,806
<b>Lexington</b>	7,113	1.09%	\$37,309	\$252,500	2,257
<b>Harrisonburg</b>	53,064	2.09%	\$43,009	\$196,200	26,008
<b>Staunton</b>	24,273	0.161%	\$46,435	\$162,500	11,848
<b>Waynesboro</b>	21,620	1.19%	\$42,112	\$161,600	9,976

recreational and agricultural industries are supported by such land use. All five counties within the CSDPC region have over 10% of land use devoted to agriculture; however, the largest percentages are in Rockbridge and Rockingham counties that respectively utilize 73% and 46% of their land for agriculture. State and Federal lands such as Shenandoah National Park, George Washington National Forest, and Jefferson National Forest are located within the CSPDC bounds and are a significant attraction to the area (Figure 1). Within the region, efforts to increase lands dedicated to conservation and recreation purposes are being made with intent to preserve their intrinsic value.

## Changes to Weather and Climate Patterns

“Climate” describes the long-term weather patterns in a specific region. Regions with the same climate are likely to have similar averages of precipitation, temperature, wind, insolation, and humidity. These averages are referred to as “climate normals” (NOAA, 2018). Earth’s climate goes through periodic cycles that normally take place over a span of



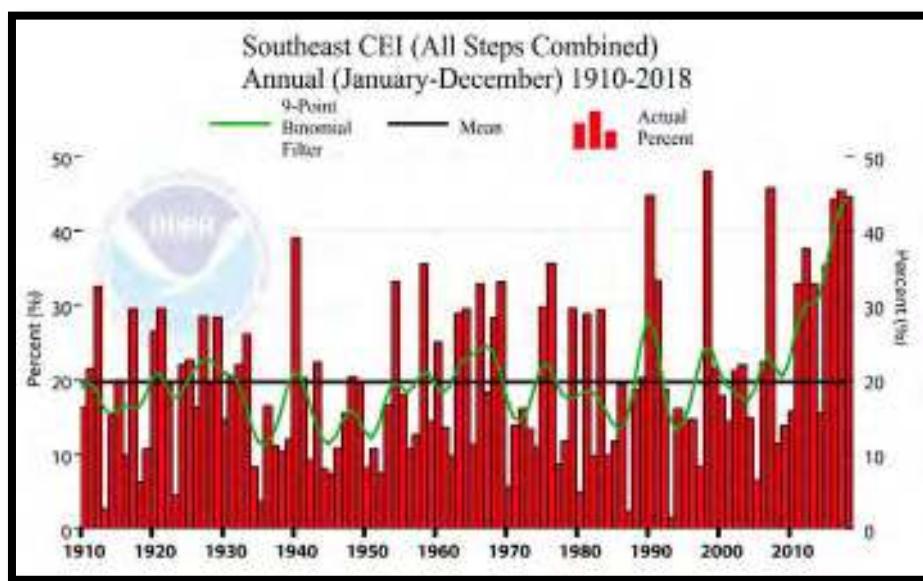
*Figure 1. Map of Localities in Central Shenandoah Valley Region (CSDPC, 2019).*

thousands of years (NASA, 2014). However, this process is accelerated due to anthropogenic causes (environmental pollution caused by humans), such as the increase of carbon dioxide and other greenhouse gases in the atmosphere. The rapid rate at which climate change is taking place is concerning and increasingly impacting world economies and human health. Within the past 100 years, Earth's average temperature has risen one-degree Fahrenheit and is expected to increase up to 10 degrees over the next 100 years (NASA, 2014). Climate change can increase the frequency and severity of hazardous weather events such as hurricanes, tornadoes, winter storms, droughts, wildfires, and floods. In the Central Shenandoah Valley, climate change will present hazards to the sustainability of the agricultural, commercial, residential, urban, and recreation sectors. It is important for local communities to be aware of these hazards in order to plan for resilience and adaptation.

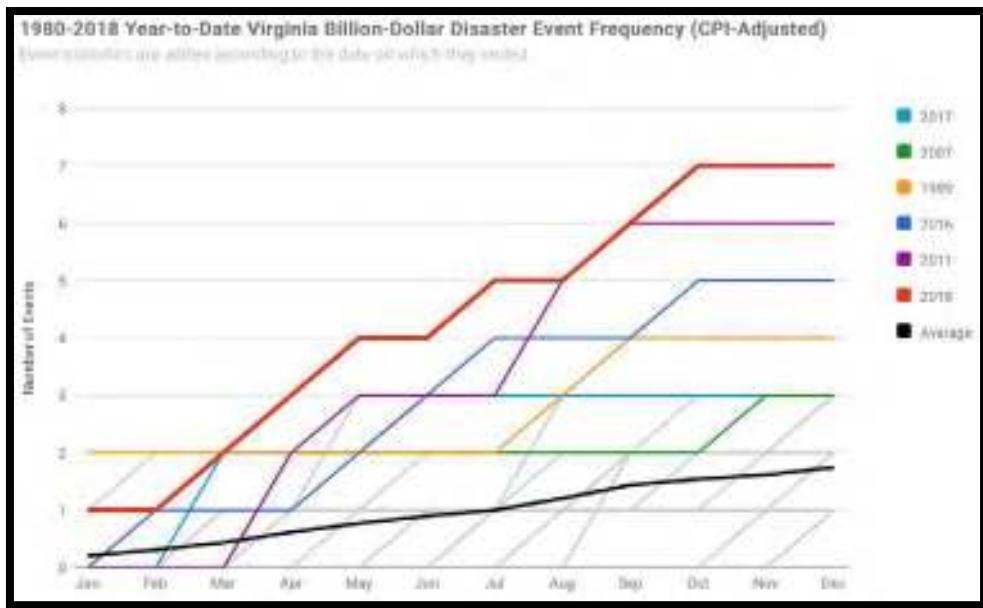
The effects of climate change on local weather are seen throughout the Central Shenandoah Valley, which displays varied topography and elevation. Data compiled by the National Oceanic and Atmospheric Administration (NOAA) clearly demonstrates that local, regional and national trends in temperature, extreme climate variations, as well as natural disaster frequency have increased over the past century (NOAA, 2019-b; NOAA, 2019-c; NOAA, 2019-e). The southeast region of the United States has been experiencing a recent increase in climate extremes. NOAA (2019-e) quantifies extreme variations of climate cycles

using the Climate Extremes Index (CEI). The regional CEI consists of five indicators compiled to create an annual timeline from 1910 to 2018. The indicators, called steps, include: extremes in maximum temperature, minimum temperature, Palmer Drought Severity Index (PDSI), 1-day precipitation, as well as days with and without precipitation. In the Southeast (Figure 2), there is a sharp increase in the percentage of indicators per year within the past decade (NOAA 2019-e). The green trendline, or 9-point binomial filter, reached past 40% for the first time in 1990, doubling the overall average of 19.7%. This occurs in five other instances within a 20-year span from 1998-2018. Extreme changes have taken place in a short time period, increasing in frequency as the graph approaches present day. It is likely that this trend will continue and the southeast, including Virginia, will experience more drastic weather patterns and potentially more dangerous and destructive hazards as a result (National Climate Assessment, 2014; States at Risk-Virginia, 2019; United States Environmental Protection Agency, 2016).

NOAA's graph (2019-b) of billion-dollar weather climate disasters for Virginia reveals a trend similar to that of seen in the Southeast's extreme climate variations. Within the past 20 years, the number of natural disasters that caused a billion or more dollars in damage has increased drastically within Virginia (Figure 3). The brightly colored trendlines, representing years with the highest costs for disaster events, are all located above the black trendline, representing the average number of events from 1980-2018. The most expensive year for Virginia took place in 2018, where all 12 months exceeded the average, and some months tripled the average cost of disasters per month.

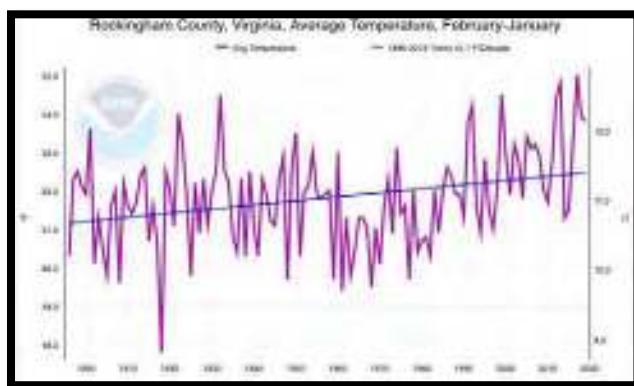


*Figure 2. Graph of Climate Extremes Index for southeast (NOAA, 2019-e).*

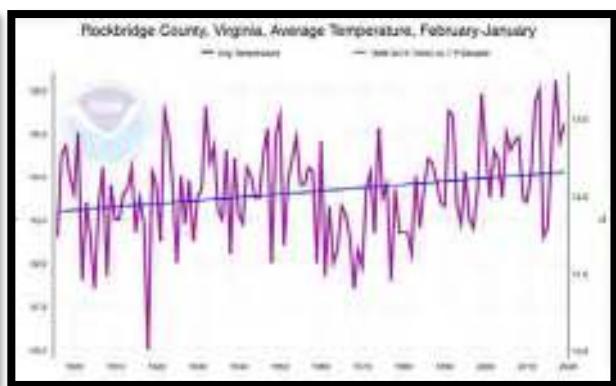


*Figure 3. 1980-2018 Year-to-Date Billion-Dollar Disaster Event Frequency (CPI-Adjusted), (NOAA, 2019-b).*

The Central Shenandoah Valley has witnessed an increase in precipitation and temperature throughout the last century. According to NASA's (2019) description of the patterns expected as climate change continues, dry areas will become drier, wet areas are expected to face an increase in precipitation brought on by higher average temperatures, and storms are expected to become more intense. Rockingham and Rockbridge counties have experienced an overall increase in the annual average temperature since 1896 (Figures 4, 5) (NOAA, 2019-c; NOAA, 2019-d). This tendency is observed throughout the remaining counties within CSPDC, as well.



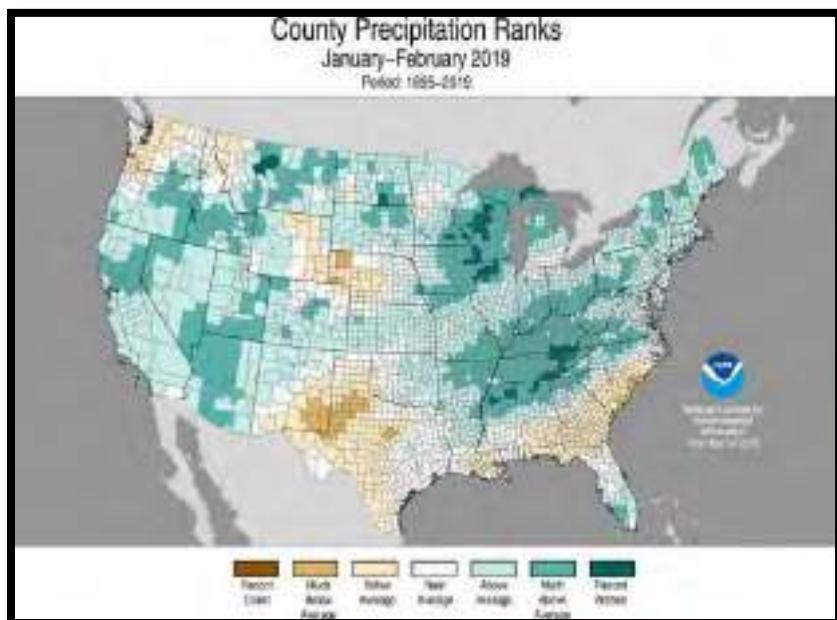
*Figure 4. Rockingham County's annual average temperature from 1896-2019 (NOAA, 2019-d).*



*Figure 5. Rockbridge County's annual average temperature from 1896-2019 (NOAA, 2019-c).*

As of February 2019, the entirety of Virginia has experienced higher amounts of precipitation than normal (Figure 6). While Rockingham, Highland, and Augusta counties have had above

average precipitation, both Bath and Rockbridge counties have had well above average precipitation, according to NOAA (2019-c; 2019-d).



*Figure 6. United States County Precipitation Ranks as of January–February 2019 (NOAA, 2019-f)*

While the region is experiencing higher amounts of rain than normal and increased probability of flooding, there is still the possibility of severe drought due to the Central Shenandoah's geographic location. Bath and Highland counties sit within the Allegheny Mountains, with Rockingham, Rockbridge, and Augusta counties bordering on the Allegheny Mountains to the west and the Blue Ridge Mountains to the east. (Central Shenandoah Valley Region, 2015). Even with more frequent storms, if the Central Shenandoah Valley becomes drought stricken, rain will not alleviate the symptoms. Once soil moisture evaporates the ground becomes hard and dense, making it difficult for it to absorb any water. When it does rain, the water ends up running off into rivers and streams instead of infiltrating into the soil (Climate Reality Project, 2016).

## Hazard Profile

### Agriculture: Livestock

The agriculture industry is among the most important sectors of the economies of the five counties (data not available on the cities) within Central Shenandoah. With a large economic output of \$959,013,000 collectively amongst the counties, the importance of mitigating the hazards to the industry into the future of climate change is apparent (U.S. Agricultural Census, 2012). In all five counties, livestock production provides far greater economic output than that of crop production. Therefore, livestock production must be a priority in terms of allocating resources to hazard mitigation programs. Data on the agricultural industry within the five counties for analysis of the hazards particular to it is provided in (Table 2).

**Table 2. Data on the number of farms, their average acreage, economic output for livestock and crop production, the types of livestock with top economic output, and the quantity of the top livestock within the county presented. The data was retrieved from the Virginia Community Profile websites for each of the respective counties within the jurisdiction of the CSPDC. The websites are maintained by the Virginia Employment Commission (Virginia Employment Commission, 2019) (U.S. Agricultural Census, 2012).**

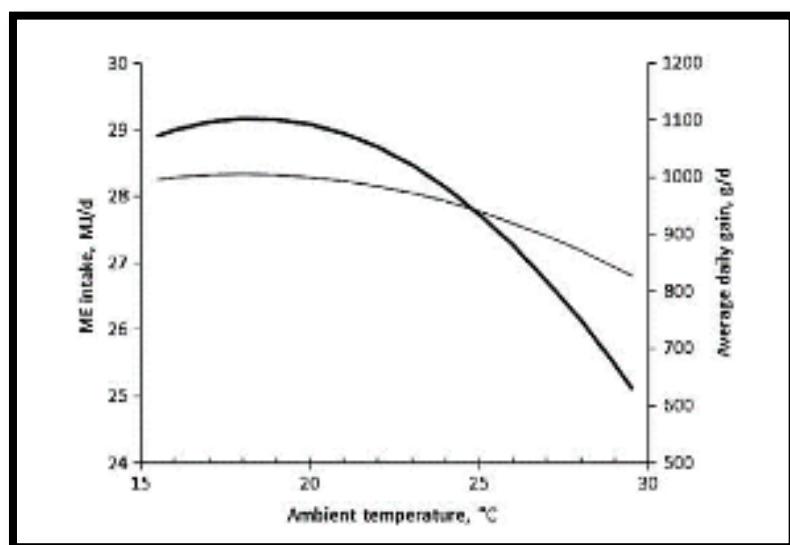
Variable	Rockingham	Rockbridge	Bath	Augusta	Highland	Total
Number of Farms	1902	833	116	1,706	261	4,818
Land in Farms (acres)	222,049	168,376	41,332	360,137	93,080	884,974
Average Size of Farm	117	202	356	152	357	1,184
Crop Sales (dollars)	47,606,000	6,974,000	1,340,000	27,685,000	1,362,000	84,967,000
Livestock Sales (dollars)	611,389,000	24,804,000	4,717,000	204,432,000	28,705,000	874,047,000
Total Value of Agricultural Products Sold	658,995,000	31,778,000	6,057,000	232,117,000	30,067,000	959,014,000
Top Livestock Inventory Item	Broilers/meat-type Chickens	Turkeys	Cattle/calves	Broilers/meat-type Chickens	Turkeys	N/A
Quantity of Top Livestock Item Within County	12,879,488	49,376	5,707	3,496,853	152,165	16,583,589
Ratio of Men to Women within Agricultural Industry	7.05	6.57	7.92	7	7.41	AVG= 7

Temperature increases related to climate change increasingly threaten the livestock sector by decreasing feeding efficiency, water availability, milk production, egg production, and livestock reproduction. It also simultaneously degrades the industry by increasing industry water demands, pest related illnesses, lignin (a complex organic polymer which makes the cell walls of many plants rigid and difficult to digest) in plants, and pathogen

contact (Harrigan, 2017). Every hazard represents threats to the economic viability of the livestock industry within the Central Shenandoah Valley region. Nationwide, heat stress (which is the hazard of most concern to the livestock industry here) is already responsible for annual economic losses between 1.69 and 2.36 billion dollars, of which 50% occurs in the dairy industry supported by livestock (Harrigan, 2017).

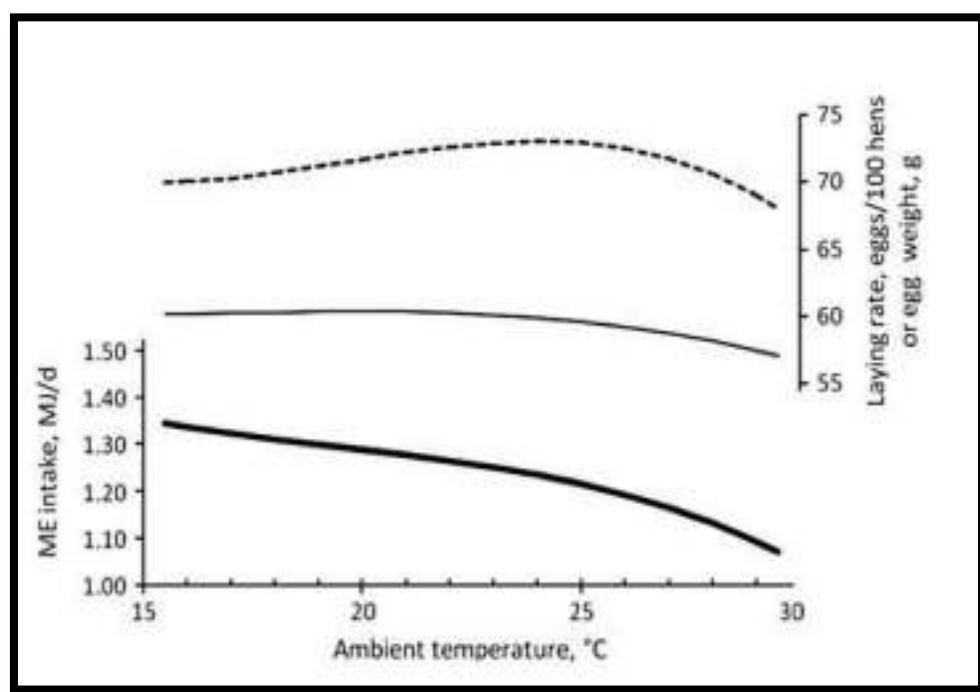
Livestock have a “thermal neutral zone,” the range of temperatures to which the animals can be subjected before physiologically responding negatively (Harrigan, 2017). Each species of livestock has a different thermal neutral zone; however, lighter fur color and smaller size favor higher temperature thresholds (Renaudeau, 2012). When livestock are subjected to temperatures above this thermal neutral zone, the response to heat stress includes reductions to feed intake, increases to water intake, and changes in respiration rate (Johnson, 2018). The reduced feed intake means a reduction in weight, making livestock less valuable. Additionally, heat stresses also cause a reduction in milk production, egg production, and the efficiency of feed conversion, all of which reduce the economic output of the livestock (Harrigan, 2017). Heat stress can also reduce reproductive rates in livestock (Johnson, 2018). With the general increases in temperatures (Figures 4, 5), it is projected that heat stress will increasingly threaten the economy of the Central Shenandoah and its agricultural industries.

A reduction in nutrient intake rate (the amount of nutrients livestock intake from eating in a given time) will be a critical climate change hazard to the livestock industry. The relationship between increased temperatures and average nutrient intake for growing pigs along with daily bodyweight gain (Figure 7) reveals a steep drop off in energy intake and body weight gain as temperatures exceeded 22 degrees Celsius.



*Figure 7: The increasing effect of ambient temperatures between 15-30 degrees Celsius on growing pigs and their daily nutrient intake (Renaudeau, 2012).*

The poultry industry in Rockingham County, which includes almost thirteen million broilers, will be more vulnerable to the hazards associated with climate change (U.S. Agricultural Census, 2012). In Rockingham County alone (where agricultural economic output is greatest), \$611,389,000 of the \$658,995,000 total agricultural economic output comes from livestock production, and most of that from broilers/meat-type chickens. Temperatures higher than 30 degrees Celsius (86°F) can subject the poultry to heat stress (Harrigan, 2017), which means reduced weight gain, feed intake, carcass weight, and protein/muscle calorie content. Egg production from poultry can also be compromised with increased temperatures, as ovulation can be interrupted. Heat stress can reduce egg numbers, total weight, shell weight, and shell thickness (Harrigan, 2017). Feed intake has been shown to be reduced in chickens by 1-1.5% per degree of ambient temperature rise from 20-30 degrees Celsius (68 °F-86°F) and by 5% per degree from 32-38 degrees Celsius (89.6 °F-100.4°F) (Renaudeau, 2012). Egg production is decreased heavily at temperatures higher than 30 degrees Celsius. From 15-30 degrees Celsius, there are steep reductions in egg laying rate and egg weight (Figure 8).



*Figure 8: The effect of increasing temperature on hen egg laying rate and average egg weight (Renaudeau, 2012).*

The dairy industry will also be threatened by climate change. Rockingham County is the largest milk producing county in the Central Shenandoah, with an annual economic

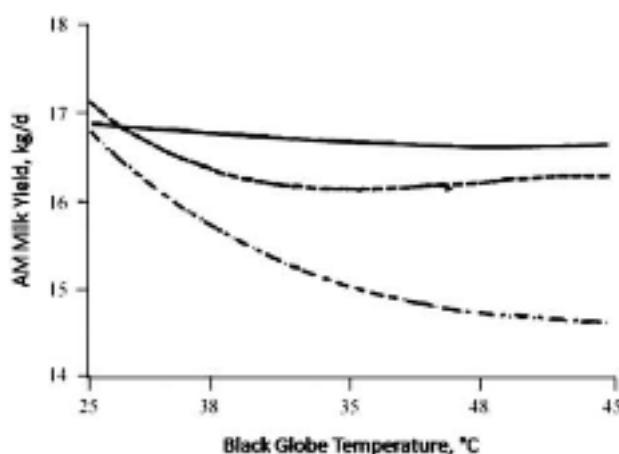
output of more than \$53 million (U.S. Agricultural Census, 2012). The economic output of milk production within the five counties in the Central Shenandoah is quantified in Table 3.

**Table 3.** Provides data on the economic output from milk production in each county (U.S. Agricultural Census, 2012).

Bath county data on countywide milk production not available.

County	Rockingham	Rockbridge	Bath	Augusta	Highland	Total
Annual (Dollars)	53,563,000	6,792,000	N/A	27,640,000	12,518,000	100,513,000

The reduction in nutrient intake caused by heat stress has been linked in cattle to reduced milk production (Renaudeau, 2012). For every one-degree Celsius increase past the thermal neutral zone, an 0.85 kg reduction in cattle feed intake occurs, resulting in a ~36% reduction in milk production (Pragna, 2017).



**Figure 9.** The effect of ambient temperature on dairy cow performance during lactation. Milk yield in units of kg/d was plotted against increasing temperatures from 25-45 degrees Celsius. The effect of cows subjected to heat stress, both two days prior (—\*\*—), and 1 day prior to (— —), and the day of (—) is shown for milk production. (Renaudeau, 2012).

Reproductive rates of livestock are known to be reduced when temperatures exceed the thermal neutral zone. When the temperature humidity index exceeds 72.9 for beef cows in pasture, a reduction in pregnancy rates can be witnessed (Bernabucci, 2010). In summertime, conception rate already drops by 24% due to the higher temperatures (Renaudeau, 2012). As climate change and global temperatures increase, breeders of cattle in the Central Shenandoah must be aware of these threats to their reproducing livestock.

In the last few decades as the global climate has changed, rates of pest related diseases have increased greatly in the US (CDC, 2019). Nine new germs spread by mosquitoes were discovered during the last 13 years. In addition to these, Zika, West Nile, Lyme, and chikungunya are among the diseases increasingly being spread by pests (CDC, 2019). These diseases pose hazards to both humans and livestock alike. The US as a whole is witnessing a large increase in pest populations and related illnesses, and Virginia happens to be in among the states most heavily impacted. The nationwide increase in pest related illnesses is described (Figure 10). These nationwide phenomena are of special concern to Virginia as the state ranks in the top 20% in the US for the sheer number of reported disease cases from ticks and other pests at 16,454 between 2004-2016 (CDC, 2019).

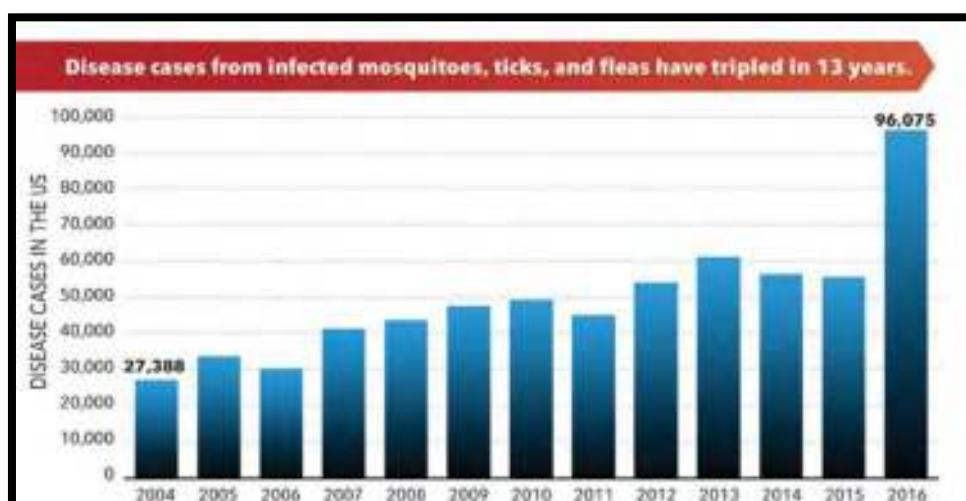


Figure 10: The number of reported mosquito, tick, and flea bite related illnesses (CDC, 2019).

## Livestock Recommendations

Farmers should be familiar with the thermal neutral zones for all their livestock breeds. When temperatures exceed those thermal neutral zones, farmers should take measures to cool livestock. Creating a dependable water infrastructure for livestock to utilize as they acclimate to warmer temperatures is perhaps one of the most obvious and important adaptations for the industry into the future of climate change (Korthaus, 2015). Providing shade for livestock is also critically important, as it keeps them out of the sun's hottest rays. Planting trees is a cost-effective method for providing such shade and also serves to help with flooding and water infrastructure (Korthaus, 2015).

On hot days, working cattle should only be working in the early morning or later in the day in order to mitigate the chances of subjecting the cattle to heat stress. Other methods

include selecting livestock for purchase that are adapted to warmer climates. Having a lighter hide color and thickness are advantageous traits in warmer conditions. As calves are the most susceptible to heat stress, it is recommended that calving be started around May as to not have them born in the hottest part of the year (Korthaus, 2015).

Feeding livestock and specifically broiler high fat diets can help to reduce the hazard of heat stress (Renaudeau, 2012). Under heat-stress conditions of 35-36 degrees Celsius, broilers that receive a high-fat diet of 5 to 10 percent fat were able to gain more body weight than those with low fat diets. Such a switch can, in hens, increase the thermal neutral zone upper range from 22-24 degrees Celsius to 25-29 degrees Celsius (Renaudeau, 2012). Additionally, reducing the stocking density of hens can help to reduce the temperature in their facilities as radiant from the animals would be reduced. Increasing ventilation within the facilities can also help to reduce temperature (Renaudeau, 2012).

The typical systematic approach to pest control must also be revolutionized, as increased temperatures are likely to increase pest abundance (EPA, 2016). Increasing the amount of pesticides used to deal with the increased pests will result in increased bio-magnification (the increasing concentration of a substance within higher levels of the food chain) and our food will become more toxic (EPA, 2016). The CDC advises that adapting to the increased hazards of pest diseases involves “Reducing the spread of these diseases and responding to outbreaks effectively will require additional capacity at the state and local level for tracking, diagnosing, and reporting cases; controlling mosquitoes and ticks; and preventing new infections; and for the public and private sector to develop new diagnostic and vector control tools” (CDC, 2019). Additional recommendations for mitigating pest related hazards include improving coordination between federal, state, and local officials for pest control programs and to use modeling to predict and pinpoint the likelihoods of pest-related disease outbreaks. (Renaudeau, 2012). Managers of livestock can also find and remove ticks from their livestock daily to further reduce pest-related hazards.

## Agriculture: Crops

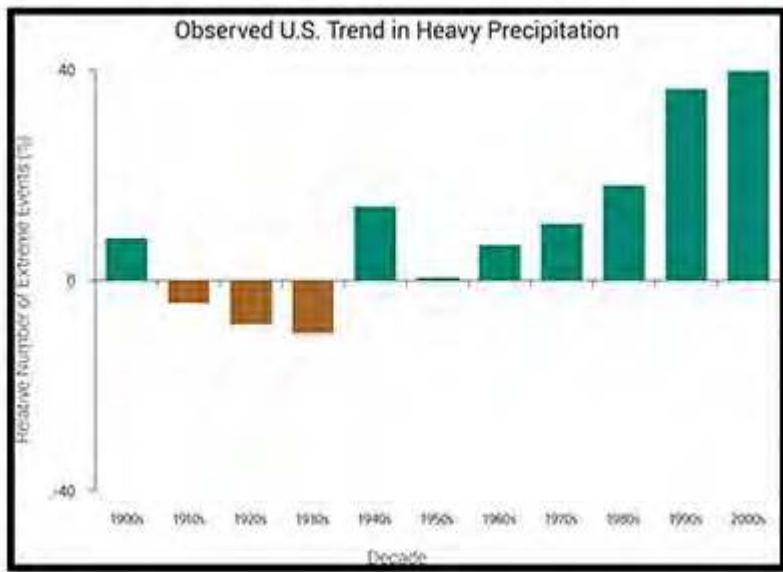
Climate change has the potential to impact the economy and the health of the people in the Central Shenandoah Valley by affecting crop agriculture through plant dehydration from longer and more severe droughts, physical damage from extreme storms, damage to soil health from increased carbon dioxide and temperatures, and increased insecticide use on crops (U.S. EPA, 2019).

A major concern of the impact of climate change on crop production is the degradation of cropland soil (Islam, 2017). Elevated levels of carbon dioxide cause an increase in the weathering of rocks and minerals, which disrupts carbon biotic cycles in the soil and reduces the productivity of plants (Islam, 2017). Increased frequencies of extreme weather patterns such as droughts, floods, and heat waves can also have negative effects on agricultural soils by changing the drying and rewetting cycles of the soil (Islam, 2017). This disturbance of the drying and rewetting cycles reduces nutrient uptake by plants and increases nutrient competition, resulting in a decline in productivity and yield (Islam, 2017).

Droughts will be an increasing threat to crop production in the Central Shenandoah Valley. It is predicted that drought frequency will increase by 100% by the mid-21st century and by 200% at the end of the 21st century for most regions (Sheffield, 2008). Agriculture accounts for 80% of the total water use in the United States; therefore, the agricultural industry is most affected by drought (Chou, 2016). Droughts cause significant yield reductions for rain-fed and irrigated crops and can cause complete loss of crops (Ray, 2018). Water helps move nutrients from the soil throughout the plant and is critical to the production of plant food through photosynthesis (UCSB, 2012).

Central Shenandoah Valley farmers will increasingly encounter extreme storms and flooding. Heavy downpours from storms are increasing in the amount of precipitation and frequency by more than 30% of the average from 1901-1960 (Figure 11). This correlates to an increase in floods because these areas are getting a large amount of water in a short amount of time (National Climate Assessment, 2014). The greatest danger to crops from flooding is oxygen deprivation. Roots in plants do not photosynthesize, unlike the rest of the plant, requiring the roots to consume oxygen and respire (UCSB, 2004). Water contains less oxygen than the air pockets in the soil, so when flooded, the crops do not receive enough oxygen. This reduces yield production and can cause plant death through deprivation of oxygen (U. Missouri, 2015). Another consequence of a low-oxygen environment is the performance of anaerobic respiration (similar to fermentation) by crops. Anaerobic respiration has a byproduct of lactic acid, which can be harmful to plants as it changes the pH of the cells, resulting in tissue damage and reduced productivity (U. Missouri, 2015).

An increasing impact of climate change on agricultural crops is an increase in pests such as harmful insects and funguses, all associated with longer growing seasons from increased temperatures and a warmer climate (Conrow, 2018). To combat this issue, farmers are likely to use more pesticides, which will not only add to the costs of farming but may



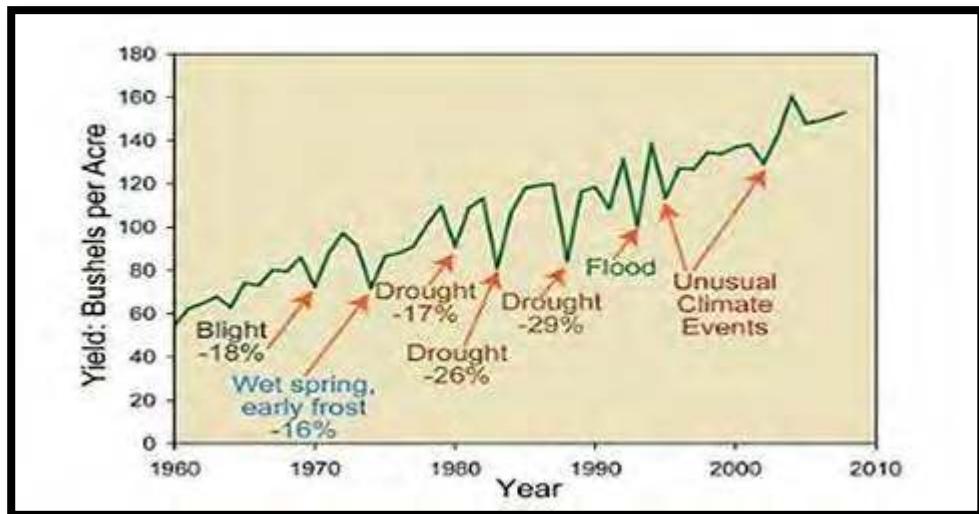
*Figure 11. Heavy precipitation trends in the U.S. (National Climate Assessment, 2014).*

also pose a danger to the farmers and consumers. Negative effects generally present themselves over a long period of exposure from the bioaccumulation of these chemicals (Miller, 2005).

The total net income of all the farms in the CSPDC was \$959 million in 2012. (U.S. Census of Agriculture, 2012) (Table 2). Approximately \$85 million of this was associated with crop production, and this is a significant amount of income that has the potential to negatively affect the economy if profits drop (U.S. Census of Agriculture, 2012). Even though the number of farms in the CSPDC region remained relatively stable from 2007 to 2012, the income from farms is still increasing (Table 2), underscoring the potential for loss.

Despite the potential for climate change to reduce yields due to extreme weather events, overall yields are still increasing as a result of new technologies and better farming techniques that raise the production of farms (EPA, 2016). Even with the increased yield trend, though, climate change has already set production back by almost 30% in some years due to droughts and extreme weather events (EPA, 2016; Figure 12).

The most common crops in the CSPD are corn, soybeans, and barley (U.S. Census of Agriculture, 2012). All of these crops are sensitive to environmental stresses such as droughts and floods because they were chosen for high yield capacity, not resiliency (Mustroph, 2018). In a Stanford study (Lobell 2016), it was determined that corn and soybean crops are especially sensitive to drought. At the current rate of sensitivity increase, it is predicted that crop yields could decline by 15% over the next 50 years, even though yields are increasing because of better farm practices (Lobell, 2016).



*Figure 12. Crop yield fluctuations from extreme weather events 1960-2009 (EPA, 2016).*

Yield reduction of crops has economic impacts on farmers and the people who buy crops from them, as food prices will increase if the farmers experience a decline in yield (Sherony et al, 1991).

The CSPDC region has already seen effects of crop loss in recent years. In 2017, the USDA's Farm Service Agency (FSA) had corn indemnity payment rates of \$45.83 to \$63.60 per acre in Rockingham, Augusta, and Rockbridge counties. These payments were distributed to farmers as compensation for corn losses that reduced their revenue below the guaranteed crop revenue set by the FSA (USDA, 2019). In the same year, the FSA distributed even more indemnity payments in the range of \$23.71 to \$33.85 per acre for wheat losses in the same counties and including Highland County (USDA, 2019). In 2015, the FSA's soybean indemnity payment rates to Augusta County reached the maximum range of \$51.71 to \$76.10 per acre (USDA, 2019). Indemnity payments to farmers have been increasing over the past decade and are expected to further increase into the future (USDA, 2018). As a result, farm insurance payments are likely to rise, which can negatively affect the economic status of farmers in the Central Shenandoah Valley (USDA, 2018).

## Crops Recommendations

There are many strategies for adaptation to climate-related impacts on the Central Shenandoah Valley, including regulation, planning, information/education, tax incentives, ecosystem management, and community engagement tools (City of Lewes, 2011). The main strategies for the adaptation to agricultural crop impacts revolve around the events that influence production the most, such as droughts, floods, and increased pests from higher temperatures. Although droughts cannot be prevented, local governments can regulate the

water consumption during periods of drought to reduce the impacts on farmers. To discourage large quantities of water usage during droughts the government can also tax excess water use heavily, which will make more water available to farmers (City of Lewes, 2011). To adapt for more frequent flooding, farmers should consider identifying areas on the farm that are prone to flooding and possibly create runoff ponds on their farm to limit the damage. This strategy can also be used along with rain gardens on areas near impervious surfaces that could potentially be adding more runoff to farms. Farmers might also consider loosening soil to allow more water to seep through the ground to prevent high levels of flooding. To manage increased pests on the farm, investment by farmers and local governments into genetically modified crops that are resistant to damages from pests are a promising way to reduce health effects from pesticides. They can also invest in safer and cheaper pesticides to decrease the effect of pests on crop production and human health.

## Built Environment: Commercial Areas

The commercial sector of the Central Shenandoah Valley will be affected by climate change. The history of flooding in the region is well-documented (CSPDC 2013), but with the predicted increase in precipitation and severe weather, property damage will increase. Many of the region's commercial districts, downtowns, and factories can be found near water in vulnerable flooding areas. The cities of Waynesboro and Buena Vista have already experienced millions of dollars in flood losses by property damage, lost revenue and jobs (Figure 13; FEMA, 2017). These losses are due to combination of vulnerabilities found in building structures, in addition to their proximity to a hazard prone area. The monetary value of the built environment exposure throughout the CSPDC (Table 4) is an indication of potential losses.

If a business or residence is in a FEMA-designated flood area, it is important to take precautions to avoid unnecessary additional damages. For example, without flood insurance, any flood damage costs will likely come out of pocket and be catastrophic to local businesses and their employees. Insurance can be expected to cost more in areas that are vulnerable to flooding. In many cases, relocation out of a flood zone is the most fiscally responsible long-term option. Another line of defense is retrofitting and flood-proofing existing buildings to be more flood resistant (FEMA, 2017). In the coming years, businesses and residences not previously located in an established flood zone must take precautions. Even structures located in a low or moderate flood risk area, are five times more likely to experience a

*Table 4. Monetary vulnerability of structures within the CSPDC, organized by building occupancy (CSPDC, 2013)*

Community	Residential	Commercial	Industrial	Agric.	Religion	Gov't	Ed.	Total
Augusta County	\$3,217,697	\$326,175	\$194,572	\$20,448	\$35,973	\$3,908	\$8,845	\$3,807,618
* Craigsville, Town of	\$48,009	\$4,867	\$2,903	\$305	\$537	\$58	\$132	\$56,811
Bath County	\$452,878	\$21,892	\$7,852	\$907	\$4,392	\$2,607	\$3,971	\$494,499
Buena Vista City	\$332,182	\$25,453	\$9,893	\$0	\$5,015	\$1,265	\$724	\$374,532
Harrisonburg City	\$1,820,119	\$527,791	\$135,296	\$14,926	\$39,652	\$3,703	\$116,243	\$2,657,730
Highland County	\$206,296	\$12,188	\$2,437	\$1,790	\$1,335	\$1,099	\$213	\$225,358
* Monterey, Town of	\$12,853	\$759	\$152	\$112	\$83	\$68	\$13	\$14,040
Lexington City	\$384,287	\$88,390	\$1,165	\$259	\$8,293	\$3,875	\$25,032	\$511,301
Rockbridge County	\$1,098,775	\$76,022	\$54,564	\$7,212	\$15,469	\$4,433	\$3,267	\$1,259,742
* Glasgow, Town of	\$55,234	\$3,822	\$2,743	\$363	\$778	\$223	\$164	\$63,326
* Goshen, Town of	\$21,439	\$1,483	\$1,065	\$141	\$302	\$86	\$64	\$24,580
Rockingham County	\$3,308,546	\$242,667	\$106,619	\$52,367	\$47,450	\$5,857	\$9,211	\$3,772,717
* Bridgewater, Town of	\$254,180	\$18,643	\$8,191	\$4,023	\$3,645	\$450	\$708	\$289,840
* Broadway, Town of	\$107,085	\$7,854	\$3,451	\$1,695	\$1,536	\$190	\$298	\$122,108
* Dayton, Town of	\$65,658	\$4,816	\$2,116	\$1,039	\$942	\$116	\$183	\$74,869
* Elkton, Town of	\$99,757	\$7,317	\$3,215	\$1,579	\$1,431	\$177	\$278	\$113,753
* Grottoes, Town of	\$103,275	\$7,575	\$3,328	\$1,635	\$1,481	\$183	\$288	\$117,763
* Mt. Crawford, Town of	\$12,409	\$910	\$400	\$196	\$178	\$22	\$35	\$14,149
* Timberville, Town of	\$84,955	\$6,231	\$2,738	\$1,345	\$1,218	\$150	\$237	\$96,873
Staunton City	\$1,348,576	\$213,605	\$16,783	\$1,884	\$22,150	\$8,174	\$15,886	\$1,627,058
Waynesboro City	\$1,039,554	\$153,293	\$23,731	\$5,156	\$13,249	\$57	\$1,198	\$1,236,238
TOTAL	\$14,073,764	\$1,751,752	\$583,213	\$117,381	\$205,108	\$36,702	\$186,988	\$16,954,907
All values are in thousands of dollars								

\*Denotes town values that are also included in totals for the perspective County.

flood than a fire over the next 30 years (FEMA, 2017). It is also important to note that properties not in a designated flood zone may also purchase flood insurance for their protection and often at a much lower rate. As the severity and frequency of storms increase, flooding is possible outside of designated flood zones as well.

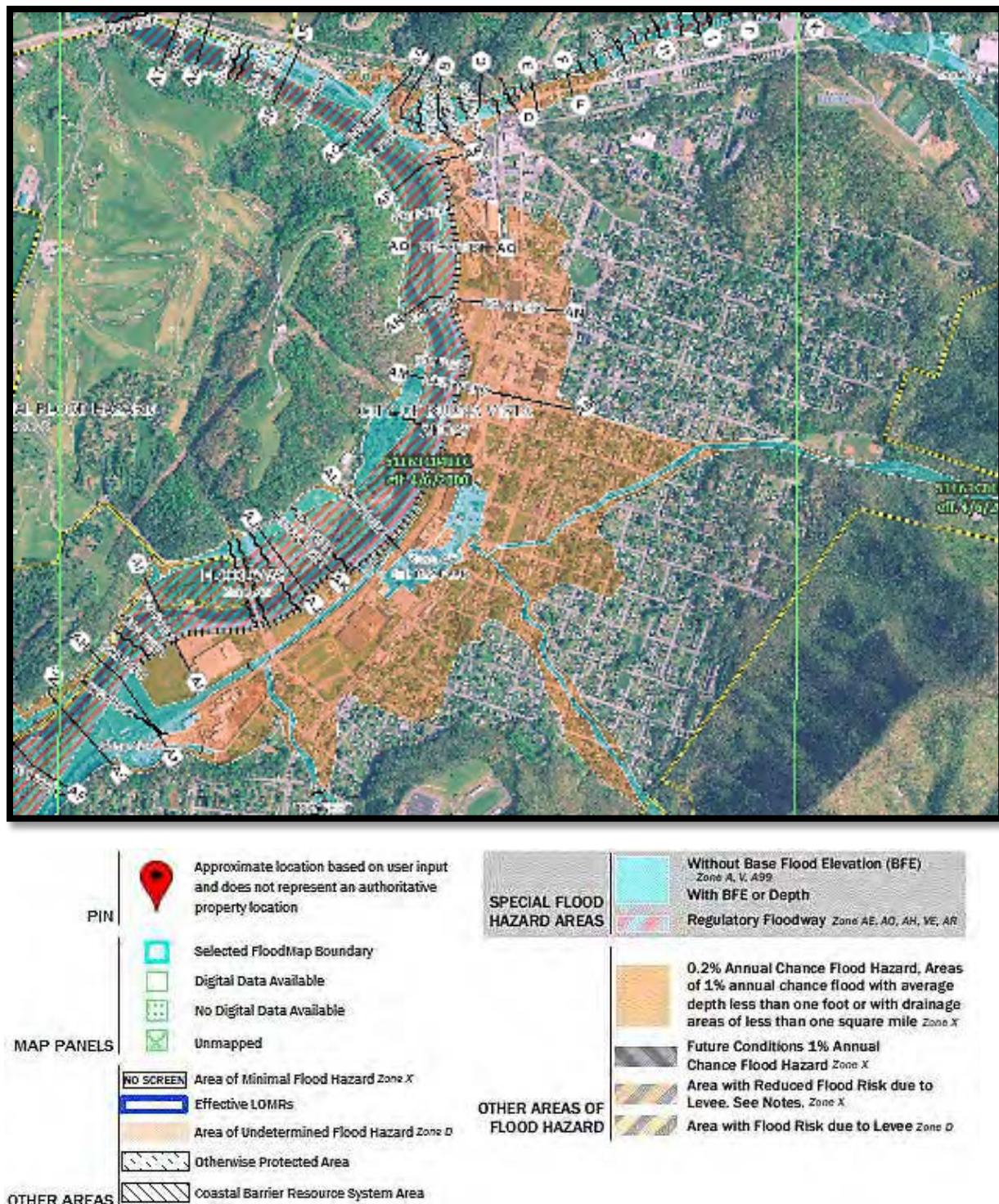


Figure 13. Flood prone areas in the City of Buena Vista. (FEMA, 2017).

## Commercial Areas Recommendations

Strategies for the commercial sector adaptations to climate change-related events include discouraging new construction in flood-prone areas; as flooding worsens, damage and higher insurance rates will follow. An effort should be made to inform businesses about

FEMA's flood map tool, as flood zones will continue to increase. Businesses should be encouraged to invest in flood insurance to protect assets, and to avoid paying for damages out of pocket. The National Flood Insurance Program can cost less than \$400 a year (FEMA, 2017). Businesses in flood-prone areas should be encouraged to invest in retrofitting and flood proofing buildings to limit damages. Businesses in areas that are shown to be extremely vulnerable by FEMA's flood map tool should consider moving to an area less prone to flooding. New buildings being constructed should be built to be both wind and flood resistant, as the frequency of hurricanes and high wind storms in the area is expected to increase.

## Built Environment: Residential Areas

The most likely climate change impacts to residential areas in the Central Shenandoah Valley are the increased frequencies of natural hazards such as flooding, hurricanes, and wildfires (CSPDC, 2013). Homeowners whose properties that have been damaged in a severe weather event have the option to claim recovery compensation. As outlined the 2005 CSPDC Hazard Mitigation plan, "recovery activities include rebuilding homes, businesses and public facilities; clearing debris; repairing roads and bridges; and restoring water, sewer and other essential services" (Central Shenandoah Valley All Hazards Mitigation Plan, 2005). In 2003, when the Hurricane Isabel recovery option was widely used, homeowners in the Central Shenandoah Valley had \$12,114,793 worth of repair/building claims compared to \$36,434,940 worth of total building value. \$7,600,258 of those fees were devoted to building repair payments, while \$4,514,535 were devoted to contents compensation payments (Central Shenandoah Valley All Hazards Mitigation Plan, 2005). A strong mitigation plan for dealing with natural hazards can help to reduce the need of such recovery plans. At least 10% of the housing units in the CSPDC's member counties are at risk from flooding (CSPDC, 2013). Increased precipitation that comes with climate change will most likely increase that number. The structural vulnerability value estimates and total loss estimates per the localities within the Central Shenandoah (Table 5, 6) are indicators of these impacts.

Augusta and Rockingham counties could see \$2.5 million in structural losses to flooding (CSPDC, 2013), while Bath, Highland, and Rockbridge counties combined could see less than 300 thousand. These numbers have the possibility to increase or decrease depending on both the variability in weather conditions and the manner in which the counties address flooding problems. Even though there is some investment in flood insurance,

*Table 5. Structures at Risk due to Flooding 2013 (CSPDC, 2013).*

Community	Houses at Risk	Housing Units	% of Housing Units
Augusta County	2,608	24,818	10.51%
Bath County	250	2,053	12.18%
*Bridgewater, Town of	70	1,850	3.78%
*Broadway, Town of	100	976	10.25%
*Glasgow, Town of	138	494	28%
*Goshen, Town of	64	214	30%
*Grottoes, Town of	40	894	4.47%
Rockbridge County	703	8,486	8.28%
Rockingham County	5,017	25,355	19.79%
Staunton City	200	9,676	2.07%
Waynesboro City	958	8,332	11.50%
Total	9,736	78,720	12.37%

*Table 6. Structure vulnerability and losses due to flooding (CSPDC, 2013).*

Community	Flood Policies	Total Housing Units	Medium Home Value	Total Structure Value Vulnerability	Total Loss Estimate
Augusta County	261	24,818	\$110,900	\$289,227,200	\$926,612
*Craigsville, Town of	28	474	\$64,800	\$2,495,117	\$7,994
Bath County	32	2,053	\$79,700	\$19,925,000	\$63,835
Buena Vista City	91	2,547	\$72,900	\$22,817,700	\$73,159
Harrisonburg City	88	13,133	\$122,700	\$87,239,700	\$279,525
Highland County	12	1,131	\$83,700	\$1,841,400	\$5,899
*Monterey, Town of	5	141	\$84,200	\$2,105,000	\$6,744
Lexington City	8	2,232	\$131,900	\$19,785,000	\$63,571
Rockbridge County	273	8,486	\$92,400	\$64,957,200	\$208,107
*Glasgow, Town of	40	494	\$66,400	\$9,163,200	\$29,357
*Goshen, Town of	13	214	\$59,100	\$3,782,400	\$12,118
Rockingham County	489	25,355	\$107,700	\$540,330,900	\$1,731,085
*Bridgewater, Town of	57	1,850	\$126,300	\$8,841,000	\$28,324
*Broadway, Town of	19	976	\$101,100	\$10,110,000	\$32,390
*Dayton, Town of	10	565	\$120,600	\$10,502,628	\$33,648
*Elkton, Town of	25	919	\$94,800	\$14,362,028	\$46,012
*Grottoes, Town of	29	894	\$90,500	\$3,620,000	\$11,598
*Mt. Crawford, Town of	2	109	\$96,700	\$1,741,441	\$5,579
*Timberville, Town of	8	770	\$82,300	\$7,966,640	\$25,523
Staunton City	114	9,676	\$87,500	\$17,500,000	\$56,066
Waynesboro City	185	8,332	\$89,300	\$85,549,400	\$274,079
Total	1,789	97,763		\$1,149,173,500	\$3,681,938

\*Denotes town values that are also included in totals for the perspective County.

vulnerable areas can still suffer great losses in the case of a severe storm. Residential areas impacted by climate hazards are in need of adaptation programs. The CSPDC hosted a Floodplain Management Workshop to provide updated training on floodplain management requirements for localities (CSPDC, 2018). As identified in the workshop, the main issue in residential areas is flood risk.

**Table 7. Building Stock Loss by General Occupancy (From HAZUS-MH Hurricane Model (CSPDC, 2013).**

Community	Residential	Commercial	Industrial	Agriculture	Religion	Government	Education	Total
Augusta County	\$219.57	\$11.76	\$9.75	\$0.89	\$0.99	\$0.16	\$0.27	\$243.39
*Craigsdale, Town of	\$3.28	\$0.18	\$0.15	\$0.01	\$0.01	\$0.00	\$0.00	\$3.63
Bath County	\$18.66	\$0.39	\$0.14	\$0.03	\$0.07	\$0.05	\$0.06	\$19.41
Buena Vista City	\$28.27	\$1.22	\$0.84	\$0.00	\$0.20	\$0.06	\$0.03	\$30.62
Harrisonburg City	\$121.09	\$20.34	\$8.56	\$0.81	\$1.26	\$0.19	\$4.66	\$156.91
Highland County	\$10.19	\$0.25	\$0.05	\$0.05	\$0.02	\$0.03	\$0.00	\$10.60
*Monterey, Town of	\$0.63	\$0.02	\$0.00	\$0.00	\$0.00	\$0.00	\$0.00	\$0.66
Lexington City	\$34.69	\$5.31	\$0.06	\$0.02	\$0.39	\$0.24	\$1.47	\$42.17
Rockbridge County	\$76.78	\$2.79	\$3.00	\$0.34	\$0.47	\$0.24	\$0.11	\$83.73
* Glasgow, Town of	\$3.86	\$0.14	\$0.15	\$0.02	\$0.02	\$0.01	\$0.01	\$4.21
* Goshen, Town of	\$1.50	\$0.05	\$0.06	\$0.01	\$0.01	\$0.00	\$0.00	\$1.63
Rockingham County	\$210.67	\$7.35	\$3.57	\$2.31	\$1.27	\$0.25	\$0.31	\$225.72
* Bridgewater, Town of	\$16.18	\$0.56	\$0.27	\$0.18	\$0.10	\$0.02	\$0.02	\$17.34
* Broadway, Town of	\$6.82	\$0.24	\$0.12	\$0.07	\$0.01	\$0.01	\$0.01	\$7.31
* Dayton, Town of	\$4.18	\$0.15	\$0.07	\$0.05	\$0.03	\$0.00	\$0.01	\$4.48
* Elkhorn, Town of	\$6.35	\$0.22	\$0.11	\$0.07	\$0.04	\$0.01	\$0.01	\$6.81
* Grottoes, Town of	\$6.58	\$0.23	\$0.11	\$0.07	\$0.04	\$0.01	\$0.01	\$7.05
* Mt. Crawford, Town of	\$0.79	\$0.03	\$0.01	\$0.01	\$0.00	\$0.00	\$0.00	\$0.85
* Timberville, Town of	\$5.41	\$0.19	\$0.09	\$0.06	\$0.03	\$0.01	\$0.01	\$5.80
Staunton City	\$105.78	\$8.84	\$0.82	\$0.10	\$0.80	\$0.46	\$0.67	\$117.48
Waynesboro City	\$95.88	\$7.95	\$1.45	\$0.29	\$0.56	\$0.00	\$0.07	\$106.21
Total	\$977.16	\$68.20	\$29.38	\$5.39	\$6.36	\$1.76	\$7.73	\$1,095.99
All values are in thousands of dollars								

The metric of stock loss (how much value each area's buildings have declined since bought value) is an indication of the impacts of severe weather on valuation. Predicted stock loss (per \$1000) associated with hurricanes (Table 7) is significant for the Central Shenandoah Valley.

Wildfire is also a concern for the region. Most of the high potential wildfire risk to communities and homes are in Rockbridge, Augusta and Rockingham counties because they

have higher populations and have more communities closer to forested lands. 71% of woodland homes are considered to have high potential for a wildfire, while 63% of woodland communities in the Central Shenandoah Valley are considered at high risk for wildfire (Tables 8, 9; CSPDC, 2013). This could increase as cycles of prolonged drought become common in this region.

*Table 8. Woodland Communities Wildfire Risk (CSPDC, 2013).*

County	Low Potential	Medium Potential	High Potential	Total	% High Risk
Augusta	0	21	19	40	48%
Bath	0	4	4	8	50%
Highland	N/A	N/A	N/A	N/A	N/A
Rockbridge	1	6	9	16	56%
Rockingham		1	25	26	96%
Total	1	32	57	90	63%

*Table 9. Woodland Homes Wildfire Risk (CSPDC, 2013)*

County	Low Potential	Medium Potential	High Potential	Total	% High Risk
Augusta	0	493	580	1,073	54%
Bath	0	120	65	185	35%
Highland	0	20	10	30	33%
Rockbridge	300	82	458	840	55%
Rockingham	0	25	1,523	1,548	98%
Total	300	761	2,636	3,697	71%

## Residential Recommendations

The well-being of communities should be a major priority in catastrophic situations. At issue is the lack of knowledge pertaining to important response procedures for each hazard. To address this, residential areas within each locality should have meetings that address past impacts and plan for hazards. The hazard most impactful to residential areas within all localities within the CSPDC region is flooding. What is needed is an up-to-date

response unit in case of floods and other hazards. An example is the Community Emergency Response Team (CERT), a national program offered through FEMA. “The goal of CERT is for emergency personnel to train members of neighborhoods, community organizations or workplaces in basic response skills like disaster preparedness, fire safety, emergency first aid and crime prevention” (CSPDC, 2013). CSPDC began offering CERT classes to the Staunton, Augusta and Waynesboro communities in September 2003. Since then, there have been 25 courses held resulting in a total of 423 trained volunteers (CSPDC, 2013). This program should be encouraged in all localities within the Central Shenandoah Valley with the goal of training as many people as possible

## Built Environment: Urban Areas

The CSPDC works with the cities of Buena Vista, Harrisonburg, Lexington, Staunton, and Waynesboro. Urban areas are at high risk for climate-induced hazards because of their dense populations and high levels of activity. There is a parallel between high populations with high levels of energy usage and climate hazard potential (U.S. EPA, 2014). Cities experience increased temperatures due to the amount of heat and emissions produced in a given day, creating urban heat islands. Energy is needed for heating/cooling buildings, electricity, and transportation. Along with the high levels of energy use comes a high level of waste heat which is released from sources such as buildings and cars. It is important for cities to monitor their energy usage and make economically and environmentally suitable decisions.

**Table 10. Expected Increase in Population (Virginia Population Projections, 2019)**

Geography Name	2010 Census	Projected Population		
		2025	2035	2045
Buena Vista	6,650	7,089	7,298	7,455
Harrisonburg	48,914	62,920	70,837	78,204
Lexington	7,042	7,898	8,145	8,333
Staunton	23,746	25,378	25,480	25,403
Waynesboro	21,006	23,167	24,339	25,332

According to the U.S. Census Bureau (2017), all the urban areas in the CSPDC’s jurisdiction except Buena Vista are expected to continue increasing in population (Table 10). As population increases, more heat will be produced through the movement of people and goods. And, as the temperatures outside rise, so does the need for cooler temperatures inside.

This means the energy to heat buildings is in high demand: about 1.5-2% more for every 1°F increase in air temperatures (U.S. EPA, 2014). This not only leads to high energy bills but can also bring with it climate hazards that can have impacts on the community. Extreme heat can cause health related illnesses in the population, higher levels of pollution and harmful chemicals, poor water quality from heated storm water runoff and in some cases can even cause death (U.S. EPA, 2014). According to the Centers for Disease Control and Prevention, more than 600 people in the U.S. alone are killed by extreme heat in cities every year (CDC, 2019). With proper adaptation and changes made to the infrastructure of the city, the increase of temperatures in cities can be slowed to improve the general health and wellness of its people.

High temperatures not only increase the likelihood of heat waves, but they can even cause more rain, which can lead to flooding. The heat causes pockets of air to rise and change the normal wind patterns, while the humidity pulls moisture into the air, forming rain clouds (NASA/Goddard Space Flight Center, 2002). Excess rain, especially in a city, can lead to flooding and put the urban area at greater risk. In turn, this can lead to power outages, destruction of buildings, sickness/disease from flooded sewage, injury, and potentially even death (U.S. EPA, 2014). Fortunately, these outcomes can be avoided with the correct precautions and preparations.

Low-lying areas that are prone to flooding under normal conditions will see an increased threat as precipitation rates increase with climate change. In the Central Shenandoah Valley, urban areas that have grown up around prolific springs and streams are especially at risk. For example, the City of Staunton's West End community, with its low base flood elevation, is the focus of a flood probability study for the Lewis Creek floodplain (Fair, 2018). A flood insurance study of Augusta County (FEMA, 2014) identified runoff from impervious surfaces and inadequate drainage structures as sources of flooding in the City of Staunton, a problem that will be exacerbated by climate change-related precipitation. The same study identified the downtown area of the City of Waynesboro as vulnerable, due to the development of the large floodplains of the South River. In promoting flood protection measures, the Natural Resources Conservation Service (NRCS, 2005) described the impacts of four streams that flow through the City of Buena Vista, including ponding problems and overland flooding. At that time, NRCS predicted that a 100-year storm would flood 245 residences, 70 commercial properties, and infrastructure, resulting in \$9.5 million in urban damages. Urban areas within the CSPDC region will be affected by flooding, making the

availability of online mapping tool especially important for residents who must make decision about flood protection.

It is easy to overlook the slight increase in temperature in the Central Shenandoah Valley and its impacts on urban areas because the effects have not yet become detrimental to residents. However, as the temperature rises and populations continue to rise, so too will hazardous conditions (McCarthy, 2010).

There are many options for an urban area to change the way it combats and prepares for the increasing hazards, including green rooftops, LED lighting, insulation, and changing the color of the city's surfaces so that they reflect (and not absorb) the sun's rays (Hawken, 2018). These adaptations not only influence the environment of the cities, but also have potential to be economically beneficial to the urban development (Hawken, 2018).

## **Urban Recommendations**

One practice that can help to lower temperatures in the atmosphere of urban areas and help to absorb some of the rainfall is planting vegetation on the roofs of buildings. The foliage helps to protect the roof from the sun's rays, while at the same time sequestering carbon and filtering the air. Plants also need a lot of water to survive, so instead of the rain water going down a storm water system, it can be absorbed by the plants. Not only are green roofs helpful to the environment of the urban area, but they can also have economic benefits. It is estimated that if 30% of the roofs in cities around the world were vegetated, the cities would not only reduce the temperature of rooftops and cool buildings, but also produce \$988.5 billion dollars in net savings (Hawken, 2018). Green roofs are just one of the many measures that can be taken to help a city lower its risk of hazards induced by high temperatures, all the while saving money by reducing the amount of energy needed to heat the inside of buildings.

Insulation is another important development that can help an urban area reduce the amount of waste heat it produces as well as save money in the long run. Pockets of temperature move from warm to cold and vice versa depending on the time of year and the temperature inside and outside (McCarthy, 2010). Without enough insulation, heat will escape the building in the winter and the cool air will leave through the cracks of the building in the summer, causing the heaters and air conditioners to work harder and expend more energy. It is easy to determine whether a building is insulated properly. If it is not, insulation can be added to structures under construction or standing buildings. Insulating a building is

relatively cheap and can save money on utility bills, help to keep moisture out of the air, and improve overall air quality (Hawken, 2018).

The final measure that can be taken to not only help the cities in the Shenandoah Valley reduce the amount of waste heat, but also save money in the long run is painting the rooftops of buildings or the pavement white. Cities are typically black and grey in color, absorbing heat from the sun and increasing temperatures within these buildings. By painting the surfaces of the pavement and rooftops white, the sun's rays are reflected into the atmosphere, keeping the building cooler than if the surface were black. One of the biggest reasons that cities have higher temperatures than the surrounding suburbs is that the buildings trap the heat in overnight (Hawken, 2018). Night time temperatures in cities have been recorded to be as high as 22°F warmer than the surrounding suburban neighborhoods (U.S. EPA, 2014). Painting the rooftops or city walkways white will help to lower the temperature of that individual buildings and the city overall.

## Recreation

People travel from all over the country to visit Shenandoah National Park (SNP) each year and in return stimulate the economy. The counties within the CSPDC region that have lands included in SNP, Augusta and Rockingham, especially benefit from its visitation. The National Park Service (NPS) reported that in 2017 over 1.45 million patrons



*Figure 14. Entrance to George Washington National Forest (USDA Forest Service)*

visited Shenandoah National Park, which contributed over \$125 billion to the local economy (Comer, 2018). This economic boost has been felt across widely the Valley. The NPS claims that within 60 miles of SNP, economic effects include over \$18 billion in spending across the local community, over \$35 billion to the national economy, and the creation of hundreds of thousands of jobs nationally (Comer, 2018). Tourism is an essential economic sector for the Central Shenandoah region, which means that the impacts of climate change on these natural and cultural settings will reverberate through communities. In areas where recreation spending is a large share of the economy, as in rural communities, climate-induced changes in economic impacts will be significant (Askew & Bowker, 2018). Impacts to the tourism industry will be detrimental to the economy of the area because so many families are financially dependent on business generated from tourists and recreation-centered activities.

National Parks are an important source of revenue for the areas surrounding park boundaries. In the United States in 2018, more than 318 million people visited parks across the nation. One of the top grossing US National Parks falls within the CSPDC region: The Blue Ridge Parkway, which competes with parks like Grand Canyon National Park, Yosemite National Park, and Yellowstone. The Blue Ridge Parkway, which extends through portions of Augusta and Rockbridge counties, was surpassed by the Golden Gate Bridge and was ranked number two in 2018 (NPS, 2019 ). George Washington and Jefferson National Forests are important recreation areas for the Central Shenandoah Valley (Figure 14). Within the four Ranger Districts included in the CSPDC region (Glenwood-Pedlar Ranger District that serves Augusta and Rockbridge counties; Lee Ranger District serving Rockingham County; North River Ranger District serving Augusta, Highland, and Rockingham counties; and Warm Springs Ranger District serving Bath and Highland counties), both developed and undeveloped campsites are spread through the forest. There are opportunities for four-wheeling and off-roading, horseback riding, hiking, fishing, hunting, and more (USDA, 2019). The U.S. Forest Service has 6 recreation areas around Lake Moomaw that are enjoyed by the general public. Lake Moomaw is stocked with over 14 types of fish which has grown to make the lake and surrounding recreation areas a draw for sport fishing (DGIF, 2019). Changes to the local climate will impact fish populations in Lake Moomaw, among other lakes, rivers, and streams across the region, because of the sensitivity of cold water fish species to warmer waters and changes in water pH (CSPDC, 2015).

As this region gets warmer and wetter, winter recreation activities like skiing, snowboarding, and snow tubing will suffer from shorter seasons, a rise in artificial snow use, and higher costs to the tourism industry because of more measures being taken to provide for

a cold, snow-filled season (U. of Arizona, 2019). At Massanutten Ski Resort, located in Rockingham County, the natural snow season is estimated to be only a day or two in length because of a warming climate, and the Resort relies on a “snow gun” to provide enough snow for all the ski and tubing slopes for the rest of the winter recreation season (Jenner, 2018). According to the State Climatology Office, every 10 years the number of cold winter days has dropped by more than 7 days which reveals that this region of the state is seeing fewer freezing days and nights and a rising average temperature (Jenner, 2018). Resorts like the Homestead Ski Area in Bath County are becoming proactive in the climate change discussion as one of several hundred organizations supporting the “We Are Still In” coalition and taking measures to limit carbon dioxide and greenhouse gas emissions (CTA, 2013; Ceres Policy Network, 2019).

The unique conditions of the Shenandoah Valley such as its topography, highly variable precipitation across short distances, and a wide variety of soil types all contribute toward variation in climate-related impacts, both in intensity and frequency (Nash, 2019). As this region becomes more vulnerable to climate change, more financial strains will be placed on the region, its workers, and public lands resources. The impacts most likely to affect Shenandoah National Park, the Blue Ridge Parkway, George Washington and Jefferson National Forests, or neighboring public lands include heavy precipitation and flood events, wildfire, extreme winds, and debris flows (Nash 2019). Also, shifts in seasonal patterns associated with climate change will impact tourism tied to the well-known four-season climate of the Virginia uplands (Nash, 2019). A comparison of the Blue Ridge Parkway to other well-known parks in the U.S., in terms of income from human labor, number of jobs created, the economic output stimulated by the parks, the amount of spending by visitors to the park, and total value added to the economy (Table 11) shows that the Central Shenandoah Valley benefits from these resources.

Unfortunately, severe weather events can cause closures of recreation areas, loss of tourism, loss of public lands, and alterations to public spaces many Virginians use for recreational purposes year-round (U. of Arizona, 2019). As the climate shifts and temperatures continue to rise, changes in available land use and shifting population centers will begin to impact the Valley. Targeting specific recreation locations helps officials focus adaptation strategies on public lands and natural resources that are most vulnerable.

**Table 11. Comparison of popular sites from ranking of The Top 15 US National Parks by economic contributions across different categories (Visitor Spending Effects NPS, 2019).**

Park Name	Labor Income (USD)	Jobs	Economic Output (USD)	Visitor Spending (USD)	Value Added (USD)
Blue Ridge Parkway	\$459 million	15.4 k	\$1.4 billion	\$1 billion	\$786 million
Grand Canyon	\$329 million	9,420	\$938 million	\$667 million	\$582 million
Yosemite	\$205 million	6,670	\$589 million	\$452 million	\$336 million

## Recreation Recommendations

Conservation efforts that focus on protecting lands for future generations should be at the forefront of any climate adaptation strategy applied to recreational areas. Conservation of public lands and forested areas are essential when planning for the future of Virginia in terms of climate adaptation. The management of resources, specifically the creation of long-term plans for all different land use areas, will result in long-term benefits to the Central Shenandoah region. Programs that combine efforts from government, non-governmental organizations, academic institutions, and the general public will result in more thorough plans, increased outreach and education among local citizens which will result in better, more informed policy as an outcome (NWF, 2018).

Additionally, there are technical solutions that can be implemented to at risk areas to prevent future devastation, including storm water treatment, the addition of Green Infrastructure to urban and rural areas, raising roads, and flood buffer technology. Specifically, employing a technique like Green Infrastructure can guide floodplain management strategies and reduce the stress on local water supplies by integrating rain gardens or “green streets” (Green Infrastructure, 2016). Benefits to implementing Green Infrastructure techniques include reduced incidents of flooding, increased preparedness for times of drought, lessened heat island effect in cities, reductions in energy demands and indoor air temperature from adding shading to buildings, and reductions in water pumping/treatment that will lessen spending on water management (Green Infrastructure, 2016).

Climatic variations caused by increasing global temperatures are already impacting the Shenandoah Valley and will have a widespread impact on recreational and economic activity across the region. The Shenandoah Valley is rich in natural beauty, outdoor attractions, millions of acres of public land, and outdoor recreation including hunting, fishing, and boating. Historically, this region has been vulnerable to flooding, drought, and severe weather events that can have a lasting impact on outdoor recreation spaces and increase financial resources required to manage impacts from these events (CSPDC, 2013). Droughts impact communities directly by straining crop production, lowering the viability of livestock, and stressing local water supplies. Droughts also have secondary effects, such as fewer opportunities to participate in water recreation activities which will have a lasting negative impact on tourism as well as the local economy and livelihoods of local residents (U. of Arizona, 2019). Another hazard relevant to the region is flooding which could result in property loss or heavily polluted storm water. Secondary impacts from higher-than-average water levels allow for more opportunities for warm weather water recreation but with fewer opportunities for winter recreational activities, like skiing and snowboarding, because of less below-freezing days as well as a shorter winter season (U. of Arizona, 2019).

## Forestry

Forests are highly productive ecosystems that can be used for raw materials and ecosystem services such as filtering air pollutants, sequestering carbon, and protecting water, (Paul, 2011). Over half (62%) of Virginia's lands are forestland and most of that forested land is owned privately, with only a small percentage owned by forestry related companies. If impacts of a changing climate force people from their homes and more humans migrate to the CSPDC region there will be changes for the forests and land use across the region. Rising populations have a negative effect on land availability because more residents must have more space to support the population growth. Farmland, forested lands, and rural spaces are undergoing development to meet the need for more housing complexes, businesses, and infrastructure. Over 1 million acres of undeveloped land in Virginia has been developed since 1987 (Paul, 2011). While this number is expected to continue to rise, conservation efforts have been increasing to protect ecosystem services, resources, as well as public, forested, and other lands that could be degraded or destroyed by construction projects and development.

Wildfires are another hazard that poses a significant risk to this region. Each year from 2008 to 2017, The Virginia Department of Forestry (VDOF), put out hundreds of fires

that resulted in approximately 12,000 acres of burned lands annually. Most of these fires are set by humans and cause loss of life, resources, and land (NPS, 2015). Within the Central Shenandoah Valley, the Ranger Districts are responsible for National Forest management, projects, and planning. Much of the area under the jurisdiction of the Ranger Districts is remote, which has made it a popular recreation destination having over 3 million visitors come to George Washington and Jefferson National Forests every year (USDA, 2019). As climate change hazards intensify over the coming years, the 1.8 million acres of public forest land will be at a higher risk (USDA(b), 2019). Additionally, the most vulnerable species and habitats are Appalachian (hemlock)/northern hardwood forests, large stream floodplain, riparian forests, small stream riparian forests, and spruce/fir forests (Butler, 2015). Whether future population growth will result in land clearing and development, or tree species will suffer from climate-induced hazards, the region's forests are at risk.

## **Forestry Recommendations**

Forestland conservation efforts are driven because the forestry industry is credited with providing \$21.5 billion in revenue for Virginia (DOF, 2018). Educating landowners about the value of passing their land down to the next generation of foresters, through programs like Generation NEXT, is one way to improve conservation efforts statewide (VDOF, 2018). Educating residents about the environmental and economic benefits forestlands provide will help grow additional efforts of conservation.

## **Water Availability**

As a result of warmer days, warmer water temperatures will be measured in streams and rivers of the region, and less vegetation will shade river areas, which will lead to declines in local populations of freshwater fish native to the region, including brook trout, which is a staple to the Blue Ridge Mountains and Shenandoah Valley (CSPDC, 2015). In addition to threats posed to wildlife, rising temperatures will also put more stress on how Virginians access and allocate available fresh water. Virginia's Department of Environmental Quality (DEQ) has several measures in place that protect water across the state and aims to provide clean water for years into the future for residents. Specifically, the Water Supply Planning Program plans for water availability, the use of alternate sources of water, and protection of water across Virginia (DEQ, 2019). In the natural environment, the presence of wetlands, forested lands, and reservoirs are ecosystem resources that are highly undervalued. It is estimated that reservoirs in Virginia are valued at over \$200 million in ecosystem services.

These reservoirs play a crucial role in regulating the water supply and storing water naturally that can be used for human consumption and industrial operations, among other sectors (Paul, 2011).

## **Water Availability Recommendations**

As water resources become more strained across the Central Shenandoah Valley region, alternate sources of water must be identified to help ease planning efforts. Incentives will be applied to limit/decrease water use in the area, and innovative solutions will need to be promoted to guarantee that every locality has a nearby water supply equipped for a growing population. Plans for the future of that supply must consider projected population values so each locality can plan accordingly for necessary changes (DEQ, 2019). A Virginia State University College of Agriculture research project predicted that as climate change impacts intensify, they will bring more precipitation and more extreme temperatures. As a result, the availability of good quality, clean water supplies for the region may be compromised (Logan, 2019).

## **Social Impacts**

### **Environmental Justice**

“Environmental justice is the fair treatment and meaningful involvement of all people regardless of race, color, national origin, or income, with respect to the development, implementation, and enforcement of environmental laws, regulations, and policies. This goal will be achieved when everyone enjoys: the same degree of protection from environmental and health hazards, and equal access to the decision-making process to have a healthy environment in which to live, learn, and work” (US EPA, 2019).

As more frequent and severe weather events occur in the Shenandoah Valley, it will become necessary to consider the ways in which these impacts differentially affect communities. Citizens of the respective localities will be impacted differently because of variations in geography (e.g., low-lying, flood-prone areas) and in the ability to respond. The evaluation of issues of environmental justice requires an understanding of differences in economic well-being, resource allocation, and education, especially during the aftermath of an environmental disaster or severe weather event. Statistically, low income communities take longer to recover from environmental catastrophes than economically prosperous areas,

(Jones, 2011). Rural communities are often geographically isolated and suffer a greater impact of environmental hazards than other communities in more heavily populated and industrialized areas. Rural communities in Virginia are not guaranteed the same protections, access to federal aid, and are controlled frequently by outside corporations that drive the local economy from which they profit (Jones, 2011). The added vulnerability to environmental degradation is sometimes attributed to the residents' choice to live in a rural community, instead of long-term inequities that are magnified by environmentally hazardous conditions (Jones, 2011). These areas can be identified using data on about poverty rates, income, and percentage risk of suffering from local hazards. With this information, planners can suggest changes to policies and budgets to close gaps and protect more citizens' lives and livelihoods.

United Way of Northern Shenandoah Valley, the local program of the national organization, created an acronym, A.L.I.C.E. or “Asset Limited, Income Constrained, Employed,” which serves residents in the Central Shenandoah region who fall just above the poverty line but are not considered financially stable. An interactive ALICE Map has compiled research from across Virginia and enumerates at the county and city level the specific areas that have fallen below the ALICE threshold. Specifically, this tool can map the “Geographic Distribution of Vulnerable Populations” and pinpoint the exact locations of increased vulnerability within every county and city in the Commonwealth of Virginia (ALICE, 2019). Specific “Places” within each county and city that fall below the ALICE Threshold are shown for the CSPDC region (Table 12).

Regionally, one of the most important issues to address is equality of opportunity, meaning that all citizens in these localities, regardless of race, income, and location are entitled to the same coverage under any regulations and policies and are treated fairly when enduring physical and economic losses (EPA, 2019). In New Orleans, Louisiana after Hurricane Katrina in 2005, low income communities suffered for over 10 years after the storm hit. More recently, Hurricane Harvey in 2017 caused millions of dollars of devastation to poor communities because of insufficient federal aid, under-preparedness by local entities, and lack of infrastructure. These disadvantaged groups were systematically stunted and recovery efforts slowed or stopped altogether because many homeowners did not have flood insurance to protect them from damages incurred from hurricane destruction or the financial stability to afford the costs of natural disasters. Additionally, low-income groups tend to be pushed toward the floodplain and other damage prone areas because of exceedingly high property costs in more advantageous and better prepared areas because of their

*Table 12. ALICE Map Data for CSPDC Region (ALICE, 2019).*

	Augusta	Bath	Highland	Rockbridge	Rockingham	Staunton City	Lexington	Buena Vista City	Harrisonburg City	Waynesboro City
<b>Total Households</b>	29,664	2,104	1,121	9,277	31,186	10,383	1,856	2,709	16,626	9,044
<b>% Poverty</b>	9	11	12	12	10	14%	19%	26%	26%	14%
<b>% ALICE</b>	29	25	27	31	29	34%	25%	38%	38%	31%
<b>% above ALICE Threshold</b>	62	64	61	57	61	52%	56%	36%	36%	55%

affordability (Krause, 2017).

Since the Central Shenandoah region is agriculturally-centered and rural in nature, it poses its own unique issues of environmental justice. Understanding how environmental justice shapes community planning, legislation, funding, and recovery is crucial because it will help these counties improve their adaptation strategies to benefit the greatest number of citizens when climate occurrences disturb daily life.

## Environmental Justice Recommendations

When addressing issues of environmental justice, it is important that planning efforts are at the forefront. More detailed comprehensive plan hazard mitigation and adaptation strategies, planning for possible situations, and covering all necessary bases are the best way to be adequately prepared for the pending impacts of climate change. Since many citizens may not understand their associated risks of living in the Central Shenandoah Valley region, they also may not know how to prepare themselves, their homes, businesses, and communities for disaster. As a result, increasing outreach and education across the community will ensure that citizens do more on their own to protect themselves as well as become more informed.

## Food Deserts

Food Deserts are defined by the U.S. Department of Agriculture as “areas where people cannot access affordable and nutritious food” (Virginia Tech, 2014). Food deserts are

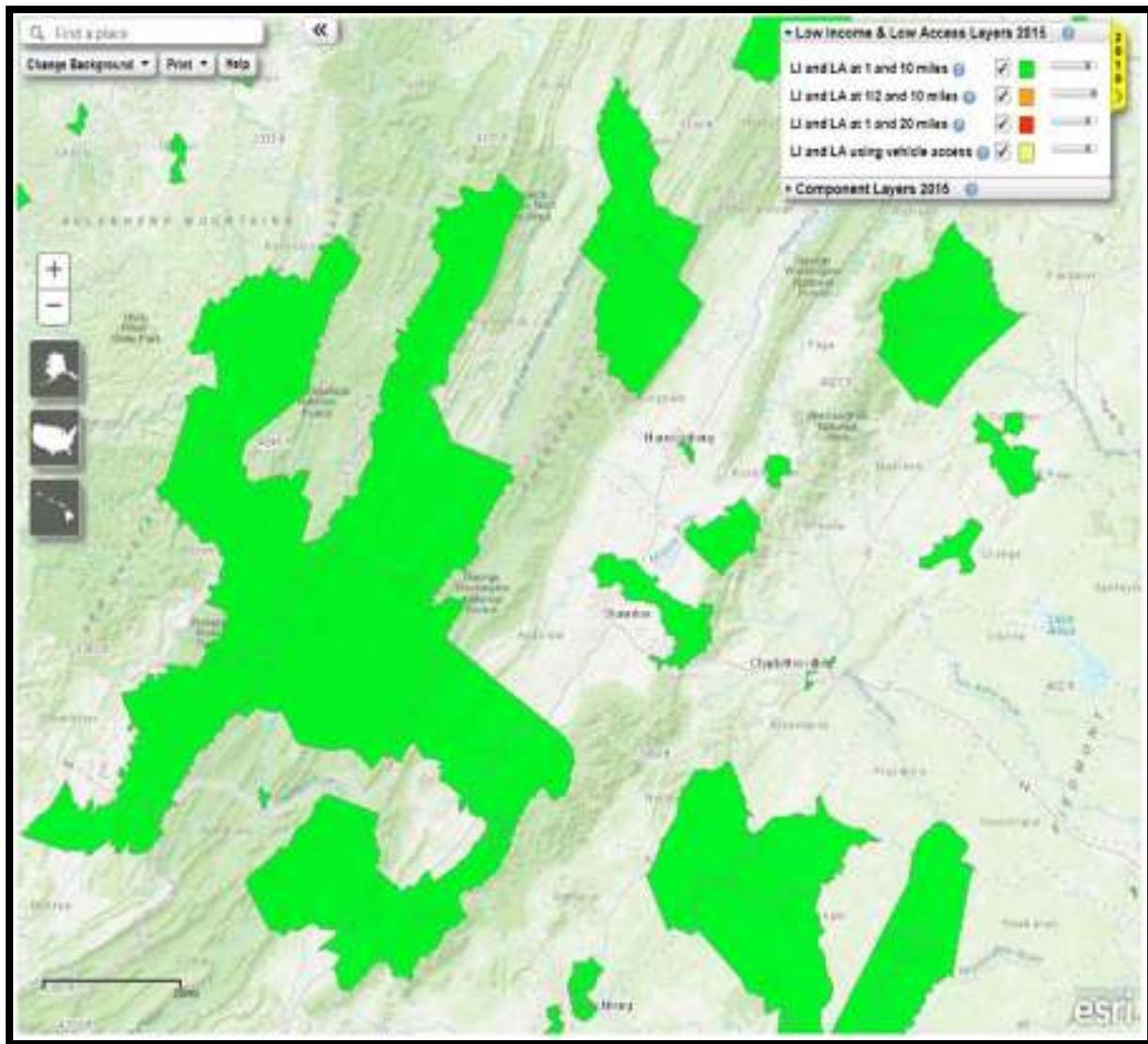
an issue of environmental justice because they are usually located in rural regions that have higher rates of poverty and low-income residents (Virginia Tech, 2014; CDC, 2019). Within CSPDC's service area, there are several pockets within the counties and most of the cities where residents do not have equal access to healthy food that meets all nutritional requirements (Dutko, 2012; Virginia Tech, 2014). Factors that contribute the most to the prevalence of food deserts are the lack of public transportation (or transportation, in general), lack of available retail food locations within a 10-mile vicinity in rural communities, and low incomes of resident in those communities (Dutko, 2012; Virginia Tech, 2014).

## **Food Desert Recommendations**

Food deserts formed because inequalities across space, lacking grocery infrastructure, and little/no access to adequate transportation. Recommendations for reducing food deserts include: creating shared resources like a community garden, hosting local farmer's markets where residents can buy affordable, fresh produce and meat, establishing food banks/food pantries for in-need community members, starting a garden, and growing your own food. (CDC, 2019, Virginia Tech, 2014). Additionally, a program could be implemented to grant money to areas designated as food deserts to decrease the amount of Virginian's who are considered food insecure. Addressing food deserts could provide healthy food to community members across the CSPDC's jurisdiction who are suffering adverse health effects (including increased rates of obesity) from inadequate food availability (Hall & Berti, 2019; Virginia Tech, 2014).

## **Coastal Migration and Future Population**

Sea level rise will impact many urban areas across the globe. For example, in the United States, nearly 40% of citizens live in "high population-density coastal areas" (Lindsey, 2018). Around the world there are large numbers of people who will be at risk of displacement over the coming years due to sea level rise. People displaced by sea level rise are known as environmental refugees, a term coined in the 1970s for people who could no longer inhabit their land due to dangerous environmental conditions (Doran, 2015). However, environmental refugees do not fall into the traditional definition of refugee, which has allowed for debate around the legitimacy of climate refugees (Doran, 2015). For this reason, there is not an international infrastructure set in place for this type of refugee to find a place



*Figure 15. Food Deserts showing Low Income & Low Access Areas in the CSPDC region (Ploeg, 2017).*

of asylum. Nevertheless, 25 million climate refugees currently exist, and this number is expected to increase to 200 million by 2065 (Doran, 2015).

The largest city in Virginia is Virginia Beach. This coastal city has 35 miles of shoreline (City of Virginia Beach, 2017) and an estimated 450,435 citizens within the 248-square mile radius (U.S. Census Bureau, 2018). Here, sea level rise has the potential to displace thousands of people within this city alone. Other coastal or tidewater cities within Virginia will face an important question in the coming years: where will environmental refugees go?

Climate change will also exacerbate the frequency and intensity of natural disasters, including floods and hurricanes. Along with other natural disasters, the number of environmental refugees is expected to spike in coming years causing a global crisis. The

CSPDC has population projections for the next 25 years (Table 13). However, the uncertainty that comes with this issue makes it hard to predict just how much population in the area may grow due to environmental refugees. Current projections place the growth in climate migrants for Augusta, Bath, and Rockingham, anywhere between 1 and 50,000 new residents, while in Rockbridge and Highland there is no significant expected increase (Hauer, 2017).

*Table 13. Projected populations in the Central Shenandoah Planning District (CSPDC, 2013).*

Geography Name	2010 Census	Projected Population		
		2025	2035	2045
Virginia	8,001,024	9,145,616	9,874,244	10,528,817
CSPDC	286,781	319,248	340,290	358,808
Augusta County	73,750	78,582	83,570	87,939
Bath County	4,731	4,592	4,318	4,016
Highland County	2,321	2,140	1,941	1,730
Rockbridge County	22,307	22,365	22,944	23,359
Rockingham County	76,314	85,116	91,418	97,037
Buena Vista city	6,650	7,089	7,298	7,455
Harrisonburg city	48,914	62,920	70,837	78,204
Lexington city	7,042	7,898	8,145	8,333
Staunton city	23,746	25,378	25,480	25,403
Waynesboro city	21,006	23,167	24,339	25,332

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**Appendix C –**

**Flood History and**

**Dam Risk Assessment and Inventory**

## C-I. FLOOD HISTORY

Flood	Description and Damages*
July 13, 1842	<ul style="list-style-type: none"> <li>Occurred in Rockbridge County and also affected Covington, Buchanan, Lynchburg.</li> <li>Floods in Rockbridge affected Irish Creek, Mill Creek, Jackson Run, North River (now known as the Maury River), and James River.</li> <li>Furnaces, forges, mills, and bridges washed away.</li> <li>Caused by a week of heavy rains.</li> <li>Destroyed crops: corn, wheat, oats, and hay.</li> <li>Fences along rivers washed away.</li> <li>Flooding along James River did not reach Scottsville.</li> <li>Canal seriously damaged in Lynchburg.</li> </ul> <p><i>"The heavy rains of last week were succeeded by the most disastrous freshet with which our county has ever been visited."</i>  <i>- Lexington Gazette July 21, 1842</i></p>
1846	<p><i>"... a stranger walking thru the business portion of Staunton, would not imagine that the place was liable to be devastated by floods, there being no water force visible to the eye. Yet the town had several times suffered severely from the cause."</i></p> <p><i>- Annals of Augusta County, Virginia from 1726 to 1871</i> by Jos. A. Waddel</p>
January 1854	<ul style="list-style-type: none"> <li>Heavy rains caused the James River to flood Balcony Falls and Glasgow in Rockbridge County.</li> <li>On January 21, 1854, the canal boat Clinton and its passengers became stranded in the raging waters. Frank Padget, a skilled boatman and an enslaved person, led four other men to rescue them. As Padget was trying to save the last passenger, he drowned in the rushing current. Capt. Edward Echol's, who witnessed the rescue, was so moved he commissioned the construction of a granite monument which now stands in Glasgow's Centennial Park.</li> </ul>
August 4, 1860	<ul style="list-style-type: none"> <li>Flashflood in City of Staunton caused by a severe thunderstorm.</li> <li>Sidewalks were pulled up along Augusta Street.</li> <li>Many stores in downtown Staunton received thousands of dollars of damages.</li> <li>A chimney at St. Francis church was blown down.</li> <li>A stable was lifted off it's foundation and destroyed.</li> </ul> <p><i>"It is sufficient to arouse our citizens to the absolute necessity of arming themselves against a recurrence of the disastrous results which have followed this freshet."</i>  <i>- Staunton Spectator, August 10, 1860</i></p>

**Description and Damages\*:** Please note that in this section where stated, dollar amounts were calculated for inflation and shown in 2019 dollars in most instances. Some amounts were kept in dollars for the year they occurred either due to how long ago the event occurred or that the large size of the number didn't make an inflation calculation easy to report.

Flood	Description and Damages
September 28 - 30, 1870	<p>The flood of September 28-30, 1870 was one of the earliest floods in the history of the Shenandoah Valley where written accounts are widely available. The flood event occurred throughout the central Valley from the north in Rockingham County and to the south in Rockbridge. The rain was first welcomed after a period of drought and a summer where rivers had been running below normal. As the rain continued, rivers rose to swirling torrents. The Shenandoah River with its expanded and rapid course carried away houses, trees, and bridges in Rockingham County and northward. The Village of Port Republic was reportedly under 15 feet of water at one time during the event. An example of destruction caused by this flood could be seen in Harper's Ferry, West Virginia, the confluence of the Shenandoah and Potomac Rivers where 47 people died.</p> <p>In Augusta and Rockbridge Counties, extensive damage occurred. Some reports measured nine inches of rain with this storm. In Staunton, flooding along Lewis Creek caused damage to its downtown and washed away a railroad bridge and wood and brick houses. The C &amp; O railroad was damaged, including another bridge that washed away in Waynesboro. In Rockbridge County, Lexington was particularly hard hit in The Point area where several houses were swept away. Also in Rockbridge County, farms, crops, and fences, were destroyed by the flood event. Throughout the Shenandoah Valley, communication lines and transportation routes were blocked. With images of the Civil War still fresh in the minds of people, rebuilding from the flood of September 1870, became another challenge in the recovery they were already experiencing.</p> <p><i>"... some idea may be obtained of the immense destruction which has spread over many portions of our beloved old State, greater, by far, than the devastations of four years war. Our people however, have exhibited in the past a wonderful recuperative power. They will not be downcast now, but will bow with humble resignation to the will of Heaven, and will still hope and strive for the best." – Staunton Vindicator, October 7, 1870</i></p>
August 28, 1893	<ul style="list-style-type: none"> <li>• Flood caused by heavy rainfall affected Rockbridge County.</li> <li>• Rain started at around 9 a.m. in the morning and continued until midnight.</li> <li>• The North River (now known as the Maury River) before the rainfall had been so low there wasn't enough electricity to run the electric plant. As a result of the storm, water was 3 feet over the roadway at The Point.</li> </ul>

Flood	Description and Damages
September 29, 1896	<p>On the twenty-sixth anniversary to the day of the flood of 1870, the Shenandoah Valley was hit by another significant flood event. This flood most likely occurred as a result of a tropical storm that was tracking through Virginia during this time. The rain, which fell steadily all day on September 30, 1896, increased in volume through the evening and culminated in torrential flooding that night.</p> <p><i>"The gentle, soaking rain which gladdened the hearts of Rockingham farmers Tuesday morning, continuing its steady downpour all day long, at night became a raging equinoctial storm which carried death and destruction in its wake."</i></p> <p><i>– Rockingham Register, October 2, 1896</i></p> <p>The City of Staunton was the hardest hit locality in the region. Lewis Creek and its tributaries overflowed their banks, devastating Staunton's downtown. Houses, sheds, and stables were swept away. Thirty - forty horses drowned. This flood caused significant damage to the downtown business district. The archway under Augusta Street and the arch bridge over Middlebrook Road survived but nearby buildings in the vicinity of both were severely undermined and many homes were washed off their foundations. The dam at the Fair Grounds broke. Six lives were lost in Staunton.</p> <p>While the Flood of 1896 was the most dramatic flood in Staunton's history, flooding also occurred in other parts of the region, though not at such a level. In Rockingham County, three lives were lost, crops destroyed, and railroad and telegraph lines were damaged. In Rockingham, flooding hit Bridgewater, Elkton, and Keezletown. It was estimated that damages to public roads and bridges reached \$600,000 (2019 dollars) in Rockingham County. In Harrisonburg, houses along Black's Run were flooded. Damage estimates for Harrisonburg were a few thousand dollars (2019 dollars). At the weather station at Dale Enterprise, six and a half inches of rain reportedly fell over an 18-hour period in Rockingham County.</p> <p>The Flood of 1896, believed to be part of a tropical system, was short lived but during its brief period was able to drop much rain in the northern part of the Central Shenandoah Region during its visit. The heavy, localized flooding was swift and its damage was difficult to grasp. The Flood of 1896 is the flood of record for the City of Staunton.</p>



City of Staunton, September 1896

Flood	Description and Damages
August 15, 1906	<p>August 1906 was a wet month in the Central Shenandoah Valley. For a period of three to four weeks, rain fell daily in the northwestern part of the Region. The steady rainfall combined with a storm system that stalled against the mountains, caused heavy flooding in Highland County on August 15, 1906.</p> <p><i>"The damage to growing crops, public roads, farmland, etc. cannot be given nor even intelligently estimated, but the loss of one human life, reported from, Forks of Water, seven miles north of town, is the saddest feature of the storm"</i> - <i>The Recorder, August 17, 1906.</i></p> 
Farm Land In Highland County	<p>The storm started with a sustained cloudburst that caused small, mountain streams to rage and overflow their banks. Throughout the Valley, residents coped with the dampness brought on by the repetitive rainfall that month. Farmers, building contractors, and other businesses faced losses because of the long period of rainy weather. In Highland County, and in particular the Town of Monterey, they also faced flood damages including a foot and a half of water in the Monterey Hotel Stables. The Flood of 1906 is an excellent example of a flash flood, where intense rainfall from a stalled storm system causes tremendous damage over a geographically concentrated area. A flash flood event, like other types of flooding, may cause just as much damage and can be just as deadly.</p>
November-December 1934	<ul style="list-style-type: none"> <li>Flooding in Rockbridge County, including Long Hollow Road where damage was estimated at over \$28,000 (2019 dollars).</li> <li>A week later, water still surrounded many homes and flooded basements.</li> </ul>
<p>March 16 - 17, 1936          "The Great Spring Flood"          "The Great St. Patrick's Day Flood"</p>	<p>The winter of 1935-1936 was a brutal one in Virginia. Across the State that winter, low temperatures and heavy snowfalls were common. March began with milder temperatures, but in mid-March, storms tracked across the eastern parts of the United States, dumping heavy snowfalls and torrential rains in its path. Up to 200 deaths nationwide were attributed to this storm. Damage estimates for the United States reached millions of dollars. In Virginia, the James, Potomac, Rappahannock, Shenandoah, and York River watersheds were flooded.</p> <p>Much of the Central Shenandoah Valley suffered the effects of this storm. In Rockingham County, 3.10 – 6.25 inches of rain fell over a two-day period. In the Shenandoah Watershed, streams and creeks reached record depths in Bridgewater, Brock's Gap, Rawley Springs, Lynwood, Keezletown, and Port Republic. The Town of Elkton was cut off as roads were blocked and bridges washed out. The City of Harrisonburg lost power as Black's Run flooded areas surrounding Main Street.</p> <p>Much of the Central Shenandoah Valley suffered the effects of this storm. In Rockingham County, 3.10 – 6.25 inches of rain fell over a two-day period. In the Shenandoah Watershed, streams and creeks reached record depths in Bridgewater, Brock's Gap, Rawley Springs, Lynwood, Keezletown, and Port Republic. The Town of Elkton was cut off as roads were blocked and bridges washed out. The City of Harrisonburg lost power as Black's Run flooded areas surrounding Main Street. <i>(Continued On Next Page)</i></p>

Flood	Description and Damages
<i>(Continued From Previous Page)</i>	In Augusta County, Waynesboro's DuPont Plant was forced to close due to flooding by the South River. Torrential rains along with the melting of 18 inches of snow quickly filled Back Creek and the South River beyond their banks. In Waynesboro, many homes were flooded and cars washed away.
March 16 - 17, 1936 “The Great Spring Flood”	Staunton reported heavy rainfall, at one point recording 2.5 inches of rain in a twelve-hour period. Craigsville reported flooding six feet in depth at an underpass on the Craigsville Fordwick Highway.
“The Great St. Patrick’s Day Flood”	Flooding along the James River watershed, hit Rockbridge County, Lexington, Buena Vista, and Glasgow. Lexington escaped heavy damage, but several residents were forced to evacuate their homes and oil company storage plants were flooded. Buena Vista suffered significant damage. In Buena Vista several industries were damaged by the flood including the Columbia Paper Company, the Majestic Silk Mills, the Buena Vista Throwing Company, and the W.V. Darling Manufacturing Company.
	<p><i>“Buena Vista was the scene of a bad flood causing one death and costing the factories, townspeople, it is estimated, about three million dollars [\$55.5 million in 2019 dollars] in goods and property.”</i></p> <p><i>– Lexington Gazette, March 20, 1936</i></p>
	In Glasgow, its major manufacturer, the Blue Ridge Company, rug makers, remained dry while Locher and Company, brick manufacturers, did get some water but had little damage. The residential area of Glasgow wasn't as lucky; many people had to be rescued by boat from their homes. It was reported that water reached between eight and ten feet on the main road through Town.
	In March of 1936, flooding, thunderstorms, landslides, and deep snows caused devastation up and down the East Coast of the United States. A harsh winter that was followed by an equally challenging spring wreaked havoc over many states. The Central Shenandoah Region was not exempt from the storms of 1936 that caused what would come to be known as “The Great Spring Flood”.

Flood	Description and Damages
April 1937	<ul style="list-style-type: none"> <li>• Flooding in six states caused numerous rivers to overflow their banks.</li> <li>• There were reports of high water on all roads leading into Staunton. Drainage systems were taxed with the large amounts of rainfall.</li> </ul>
October 1942	<ul style="list-style-type: none"> <li>• Prolonged rainfall over several days caused flooding.</li> <li>• The rain gauge just below Afton mountain recorded 11.27" of rainfall.</li> <li>• City of Waynesboro was hardest hit in the Central Shenandoah Valley. The amount of water was 3.5 inches higher at the Chestnut Avenue gauge than it had ever been recorded, and up to two feet higher in the Rife-Loth Plant and 17 inches higher at the Main Street service than ever before.</li> <li>• Damages across Augusta County, including the Cities of Staunton and Waynesboro, were estimated at over \$30,000,000 (2019 dollars).</li> </ul>
June 18, 1949	<p>In the Summer of 1949, when the rest of the Central Shenandoah Valley was experiencing the post-World War II economic boom, the Town of Bridgewater was forced to focus its energy and resources on re-building itself after flash flooding ravaged the Town. Parts of Rockingham and Augusta Counties were also struck hard by this storm. On June 17<sup>th</sup>, rain fell steadily throughout the day and into the night. Rising waters turned into floodwaters in the early hours of June 18<sup>th</sup>. Rising floodwaters filled Mossy Creek, Dry River, and Briery Branch. These rivers passed along their floodwaters to the already swollen North River.</p> <p>The Town of Bridgewater faced the worst flood event in its history. Floodwaters reached the second story in many houses. "A News-Record Reporter covering the story, reported that the roar of the raging river could be heard in the extreme northern end of Bridgewater. 'It sounds like the roar of Niagara Falls,' he said." – Harrisonburg Daily News Record, June 18, 1949. In Bridgewater, three lives were lost, one home was completely washed away, approximately 100 homes and many businesses damaged, and between 25-30 cars were smashed or washed away. Damage estimates were reported to range from \$1,076,000 to \$11 million (2019 dollars).</p> <p>(Continued On Next Page)</p>



1949 Flood - Stokesville - Alan Cramer Collection



1949 Flood - Stokesville - Alan Cramer Collection

Flood	Description and Damages
(continued from previous page) June 18, 1949	<p>One of the saddest events of the Flood of 1949, was the three deaths that occurred in Bridgewater, including Mrs. C.R. Bowman, Margaret Bricker, and her nine-year-old daughter, Frances. The Bricker's were killed when their house was washed off its foundation in a fifteen-foot wave of water. Mrs. Bricker's twelve-year-old daughter, Betty, who had also been in the house, was rescued from a submerged tree.</p> <p><i>"This two-story frame house was hit by the flood at midnight, and, at 1:30 Saturday morning, was lifted from its foundations, carried a quarter of a mile, and smashed to bits, it's tin roof being all that [was left] of it against a tree on College Street."</i></p> <p>- Harrisonburg Daily News Record, June 20, 1949.</p> <p>Ironically, the day the house washed away was also Frances' ninth birthday. It took a week for Frances Bricker's body to be recovered. The lengthy search to recover her body and the senseless death of "little" Frances Bricker, as she was known, personified the loss that the whole Town felt in the aftermath of this horrific flood.</p> <p>To the west, along the North River, parts of Rockingham and Augusta Counties were also hard hit by severe flooding. Up to 15 bridges were removed by flooding. Small roads covering the area were washed out leaving residents stranded. Aerial views of fields revealed that tons of topsoil had been washed away, leaving only red clay to be exposed. Damage to the George Washington National Forest was estimated at \$1.6 million (2019 dollars).</p> <p>In Augusta County, Stokesville experienced a great deal of flood damage. Fortunately, there was no loss of life in Stokesville but more than 12 homes were completely demolished as a result of the flood and many others were heavily damaged. Because of the loss of topsoil, many small farmers were unable to replant crops. Poultry in the thousands and heads of livestock in the hundreds were destroyed in the Stokesville area. In the immediate aftermath of the flood, Stokesville was unable to rebound as quickly as Bridgewater because they faced a tremendous shortage of resources and an inability to get tools and materials needed to clean and make repairs. The flash flood of June 1949 left the Town of Bridgewater, the community of Stokesville, and parts of Rockingham and Augusta Counties forever changed.</p>

Flood	Description and Damages
September 10, 1950	<ul style="list-style-type: none"> <li>• Flash flood after 24 hour period of rainfall.</li> <li>• 3.8" of rain at Dale Enterprise and 3.86" of rain at Timberville in Rockingham County.</li> <li>• 5.81" of rainfall near Balcony Falls in Rockbridge County.</li> <li>• 3.9" of rainfall in Augusta Springs in Augusta County.</li> <li>• Black's Run overflowed in Harrisonburg on Main Street.</li> <li>• In Rockbridge County two people drowned; the Town of Glasgow was completely cut off; Buena Vista flooded; Buffalo Creek and Whistle Creek left their banks. Many homes and hundreds of cars were washed away. 35 bridges and 50 bridge approaches were washed away.</li> <li>• Rockbridge County damages were estimated at \$21 million (2019 dollars) with \$369,000 of that in damage to secondary roads and over \$421,000 of that in damage to primary roads.</li> </ul> <p>"At Whistle Creek Carl H. 'Doc' Collett... got up at 4:45 a.m. to close a window against the rain and saw his refrigerator float by downstairs. Within 10 minutes water rose downstairs from two feet to five feet downstairs and the Colletts were trapped upstairs."  - Lexington News-Gazette May 16, 2001 Page A12</p>
October 15, 1954 "Hurricane Hazel"	<ul style="list-style-type: none"> <li>• Hazel struck land as a Category 4 hurricane on October 15, 1954.</li> <li>• The storm caused a national total of 95 deaths and \$2.6 billion in damages (2019 dollars) and was considered the worst storm of the 1954 hurricane season.</li> <li>• Observers in Washington, D.C. reported 78mph wind gusts.</li> <li>• Twelve people were killed in Virginia, including four crewmembers of the tugboat Indian, which sank in the James River as a result of the turbulent wind and water.</li> <li>• Turkey growers in the Shenandoah Valley lost between 150,000 and 250,000 turkeys when poultry sheds were wrecked.</li> <li>• The Staunton/Augusta area received five to six inches of rain, and roofs, roadways, and bridges throughout the area sustained significant damage.</li> </ul>

Flood	Description and Damages
August 1955 “Hurricanes Connie and Diane”	<p>Hurricanes Connie and Diane teamed up to spin a relentless one-two punch on the eastern portion of the United States, causing widespread flooding in numerous states.</p> <p>Hurricane Connie struck South Carolina as a Category 1 hurricane on August 12, 1955, inflicting flooding and high winds that killed 41 people and resulted in \$144 million in damages (2019 dollars). Connie caused extensive damage to Virginia tobacco and corn crops, and flooded low-lying areas throughout the state, but caused little to no damage locally.</p> <p>Hurricane Diane, also a Category 1 storm, made landfall in North Carolina on August 17, 1955. With the ground already saturated from Connie’s rain, Diane caused intense flooding, resulting in 184 to 200 deaths and \$31.2 billion (2019 dollars) in damages, making it the sixth most costly U.S. hurricane of the 20<sup>th</sup> century. Virginia received about three inches of rain from Diane. The storm also caused widespread flooding throughout Augusta County, an automobile accident, a backup of Harrisonburg’s flood and sewer systems into homes and businesses, and a 4 by 200 foot chunk of concrete to be swept away from the Harrisonburg hydroelectric dam.</p>

Flood	Description and Damages
August 19, 1969 "Hurricane Camille"	<p><b>Camille.</b> In the western part of Virginia this name is synonymous with unequalled destruction. The remnants of Hurricane Camille caused flooding during the evening hours of August 19, 1969 and the morning hours of August 20, 1969 that broke all flooding records in modern history along the James and Maury Rivers.</p> <p>On August 17, 1969, Hurricane Camille made landfall on the gulf coast of Mississippi as a Category Five Hurricane – the deadliest type of hurricane. Gusts of up to two hundred miles an hour were reported. The storm surge was the highest ever recorded in the United States. One hundred and forty-three people died as a result of this hurricane on the gulf coast of the United States.</p> <p>Hurricane Camille had weakened to a tropical depression by the time it had reached the Mississippi/Tennessee border. Rain was forecast for the western part of Virginia but it was the combination of three factors that caused the rain to turn into torrential downpours of unparalleled amounts.</p>



Nelson County in the aftermath of Hurricane Camille.

*"As Camille reached Virginia, it ran into three influences—a westerly flow of cold air, an 'orthographic lifting' of air over the mountains, and a stationary cold front over the northern part of the state. The counter clockwise flow of air created by the storm drew moisture, apparently in great amounts, from the Atlantic Ocean into the center of the storm. The 'orthographic lifting' or updrafts of air created by the mountains, forced the moisture up to the westerly flow of cold air, where it was cooled to a 'release point' and then came down in torrents of rain. The cold front acted as a blocking force, causing the storm to move eastward over the mountains where the updrafts of air continued to force the moisture upward."*

*—excerpt from the Richmond Times-Dispatch in [Hurricane Camille: A Review](#).*

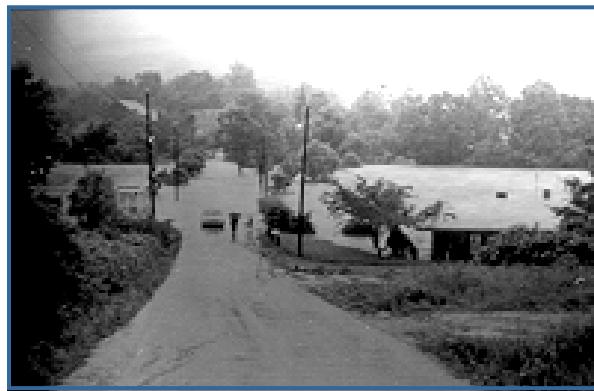
Nelson County was the hardest hit in all of Virginia receiving from between 27 to 31 inches of rain, most of which fell in a five-hour period during the middle of the night while people were sleeping. Homes in Massie's Mill and Lovingston were washed off their foundations and completely destroyed. Whole families died either in their homes or as they tried to escape the floodwaters. As the land became saturated, tons of topsoil streamed down the mountainsides, toppling trees and creating mammoth landslides. An example of this devastation could be seen after the flood where for a five-mile stretch of Davis Creek, logs were piled 30 feet high. One hundred and seventeen people died in Virginia and a majority of those people were in Nelson County.

In the Central Shenandoah Region, three localities—Augusta, Bath and Rockbridge Counties were included in the federal major disaster declaration (DR-274). Rockbridge County was severely impacted by Hurricane Camille. For the City of Buena Vista and the Town of Glasgow, Camille would become their flood of record. Up to eight inches of rain fell in the southeastern part of Rockbridge County. Twenty-three people died in Rockbridge County including three members of the Rion family of Glasgow, and eight members of the Clark family in Cornwall. In Buena Vista, 69 year-old Hansford Odell Allen died in Camille also. *(Continued On Next Page)*

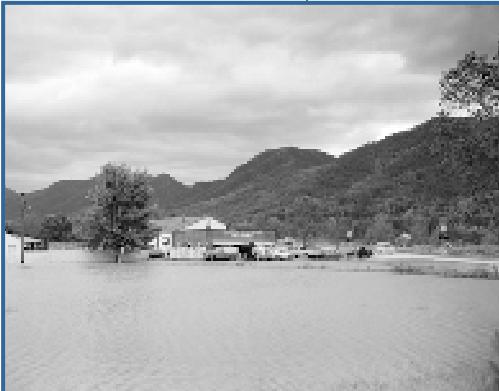
Flood	Description and Damages
(continued from previous page) August 19, 1969 "Hurricane Camille"	<p>Both Buena Vista and Glasgow's business districts were flooded with six feet and fourteen feet of water respectively. At least 75 homes were damaged in Buena Vista, and in Glasgow a quarter of the residences were damaged by the floodwaters. In Goshen, the Stillwater plant was inundated with water.</p> <p>Not only were lives lost, homes destroyed, and businesses devastated, but agriculture in Rockbridge County was also affected. One hundred and fifty head of cattle were lost, crops were ravished, and fertile topsoil washed away. Damages in Rockbridge County exceeded \$208 million (2019 dollars).</p> <p>Hurricane Camille affected both Mississippi and Virginia. Two hundred and sixty lives were lost as the result of the hurricane and the flash flooding it created. Camille caused over 3 billion dollars (2019 dollars) in damages throughout Virginia. The year following Hurricane Camille was full of loss and a struggle to recover for thousands of residents in western Virginia. This struggle is best illustrated through the words on a plaque given by the Lion's Club to the citizens of the City of Buena Vista, "To the citizens of Buena Vista and their good friends from far and near, in grateful recognition of their collective efforts and achievements in the rebuilding of Buena Vista following the flood which came in the wake of Hurricane Camille on August 20, 1969. This plaque expresses appreciation for the labors, moneys, services, supplies, equipment, leadership, and the spirit of cooperation which were extended by individuals, organizations, agencies, and companies; both local and throughout the nation; to relieve the flood devastation and to restore order to our city. In unity lies our strength." Camille, its colossal rainfall, and the total destruction it left in its wake have yet to be surpassed and will be imprinted in the memories of many for a lifetime. The stories of Camille will be passed on for generations.</p>



Glasgow's business district flooded by Hurricane Camille.  
Photo by Ralph Ogden



Rising water in Waynesboro from Hurricane Camille.

Flood	Description and Damages
 Hurricane Agnes in the Town of Glasgow	<p>June 19, 1972 “Hurricane Agnes”</p> <p>On June 19, 1972 Hurricane Agnes, a weak disorganized hurricane, made landfall in Florida. Barely able to reach hurricane status, it quickly disintegrated to a tropical storm, and quickly a depression. Although it was a weak hurricane, it was a large storm with a diameter of 1,000 miles. It made its way up the Appalachians and exited back out to sea off the coast of North Carolina. Sponging up moisture from the Atlantic Ocean, it regained strength. On June 21, 1972, Agnes now back to tropical storm status reached the Virginia coast and made its way up the Eastern seaboard. Several states received record flooding. From Virginia to New York, several places received rainfall totaling 15 inches or more. An example of the devastation was witnessed in Wilkes-Barre, Pennsylvania where they had built a dike, 37 feet high, to protect them from floods similar to the Flood of 1936, their flood of record, where the Susquehanna River crested at 33 feet above its normal levels. As a result of Agnes, the river crested at 40 feet, pouring water over the dike and flooding the Town. In Kingston, Pennsylvania, only 20 of its 6,600 homes were above water.” ‘Agnes re-wrote the book on inland flooding and the impact a tropical storm can have hundreds of miles from the coast.’ – Sol Summer, National Weather Service, from <i>Storms of the Century</i>, <a href="http://www.weather.com">www.weather.com</a>”. Damage from Hurricane Agnes in the United States was over \$19 billion (2019 dollars), the second costliest hurricane in U.S. history and caused 120 deaths.</p>

Flood	Description and Damages
October 7, 1972	Severe storms resulted in flooding. Buena Vista was included in a federal major disaster declaration (DR-358).
October 10, 1972	Severe storms resulted in flooding. Augusta, Buena Vista, Rockbridge and Rockingham were included in a federal major disaster declaration (DR-359).
November 4 - 7, 1985 "Hurricane Juan" "Election Day Flood"	<p>The Flood of November 1985 will be remembered in Virginia for its flash flooding. Flooding was caused when a slow-moving low pressure system, possibly containing remnants of Hurricane Juan, moved northeasterly through West Virginia and Virginia dumping torrential rains over a four-day period. Known as the "Election Day Flood", because it occurred during election day, the storm caused 22 deaths. Damages across the state reached nearly \$1.8 billion (2019 dollars). This flood was the worst flood for the City of Roanoke, where the Roanoke River rose seven feet in one hour and eighteen feet in six hours.</p> <p>Areas all across the Central Shenandoah Region were affected by the flooding. Nine localities—Augusta, Bath, Buena Vista, Harrisonburg, Highland, Lexington, Rockbridge and Rockingham—were included in the federal major disaster declaration (DR-755). In Rockingham County, the western part of the County was hardest hit. A railroad bridge built in 1896 was washed out in Elkton. The Town of Bridgewater experienced limited damage because of a levy built after the disastrous flood of 1949. Bridgewater did receive damage to roads, their hydroelectric plant, and the athletic field at Bridgewater College. In Highland County, at least 50 homes and 300 farms received damages from the flooding. In Highland County, road damage was estimated at a little over \$4.7 million (2019 dollars). In Bath County, bridges were washed out, and property damage was estimated in the thousands of dollars.</p> <p>Communities in Augusta County were inundated by floodwater. The swollen Middle River damaged homes, property, and roads in areas like Frank's Mill, Fort Defiance, and Verona. Buffalo Creek washed away bridges and roads in the Buffalo Gap area. Damages to roads in Augusta County were estimated at \$18 million (2019 dollars) and homes, businesses, and public facilities at \$16.5 million (2019 dollars). The rains had minimal affects on the City of Staunton except for the water treatment plant that was damaged and the evacuation of residents of the Beverly Hotel where the flooded basement caused concerns. The City of Waynesboro, on the other hand, experienced significant damages. Waynesboro's South River created record flood levels and caused damages to 140 homes, 32 mobile homes, and 41 businesses. The City's sewage treatment plant was also severely damaged. Damage estimated for the City of Waynesboro directly after the flood exceeded \$7 million (2019 dollars).</p> <p style="text-align: right;"><i>(Continued On Next Page)</i></p>

Flood	Description and Damages
(continued from previous page)	In Rockbridge County, Goshen, Glasgow, and Buena Vista were the areas most affected by the flooding. Goshen experienced the heaviest damage due to the swiftness of the floodwaters. Damages in Buena Vista and Glasgow equaled or surpassed what they had experienced during Hurricane Camille in 1969. In Buena Vista, three to six feet of water flooded homes and businesses. In Glasgow, almost half of the homes and two-thirds of the businesses were hit by floodwaters. In Lexington, the waste water treatment plant was covered by the waters of the Maury River. Damages in Rockbridge County were estimated at \$236 million (2019 dollars), well exceeding the cost of Hurricane Camille. In the 1985 Flood, 584 homes and 32 businesses were damaged in Rockbridge County.
November 4 - 7, 1985 "Hurricane Juan" "Election Day Flood"	The November 1985 Flood reached its watery fingers throughout the Central Shenandoah Region, grasping homes, public facilities, and businesses. The three-day period of sustained rains caused flash flooding all over the Region. It is no doubt that the Election Day Flood created one of the lowest poll turnouts in history.
May 19, 1992	Severe storms resulted in flooding. Six localities- Augusta, Bath, Buena Vista, Lexington, Rockbridge and Rockingham- were included in a federal major disaster declaration.
April 1993	<ul style="list-style-type: none"> <li>· Flooding in Bath and Highland Counties caused by heavy, localized rainfall. Between 1 and 6 inches of rain fell.</li> <li>· A corridor running north-south from Pendleton County, WVA into Bath County, between the east side of Lantz Mountain and the west sides of Jack and Warm Springs Mountains, sustained the most damage.</li> <li>· Streams were inundated along U.S. 220 and Rt. 642 and culverts, small bridges, and fences washed out.</li> <li>· Livestock had to escape floodwaters on many farms.</li> <li>· Some areas experienced more damage than they did in 1985.</li> <li>· Gardens including all their topsoil were washed away.</li> </ul>
March 10, 1994	Severe ice storms resulted in flooding. Bath, Buena Vista and Rockbridge were included in a federal major disaster declaration.

Flood	Description and Damages
June 22 - 28, 1995	<p>A week-long period of ground saturating rains fell over the western part of Virginia, causing flash floods and landslides. Madison and Greene Counties were the most devastated in the State, when an intense rainfall stalled over the mountains. On June 27, 1995, in a fifty mile area of Madison County, 30 inches of rain fell in a 16-hour period, with as much as 25 inches falling in a five-hour period in some areas. This caused debris flows and mudslides that uprooted trees, removed topsoil, and caused extensive alterations in the landscape. Rainfall had not been seen there in such a concentrated level over such a short duration since pre-historic times.</p> <p>In the Central Shenandoah Region, six localities—Augusta, Bath, Buena Vista, Lexington, Rockbridge and Staunton were included in a federal major disaster declaration (DR-1059). The week of rains caused flash flooding in Augusta and Rockbridge Counties. In Augusta County, the Town of Craigsville was flooded when 12 inches of rain fell over an 11-hour period. Trees were uprooted in yards, basements caved in, and 40 people were forced to evacuate their homes. Damage estimates exceeded \$843,000 (2019 dollars) for the Town. <i>“Craigsville Mayor Herbert Campbell called Thursday’s flood much worse than the 1985 flood which caused damage that some residents believed would never be equaled.” – Staunton Daily News Leader, June 24, 1995.</i></p> <p>In the Town of Glasgow, flooding from interior mountain streams became more of a problem than river flooding with this event. At least 42 homes in Glasgow experienced flooding on the first floor of their homes and 64 homes had flooded basements or crawl spaces. In the City of Staunton, Gypsy Hill Park was flooded when Lewis Creek overflowed its banks. The Park’s duck pond also overflowed causing sinkholes and creating other problems.</p>
January 13, 1996	<p>Severe winter weather resulted in a blizzard, followed by two additional snowstorms bringing over a foot of snow. Snowpack was on the ground for an extended period of time. It was thawed by higher temperatures and heavy rain, resulting in severe flooding. Ten localities—Augusta, Bath, Buena Vista, Harrisonburg, Highland, Lexington, Rockbridge, Rockingham, Staunton and Waynesboro—were included in a federal major disaster declaration (DR-1086).</p>
January 27, 1996	<p>Flooding was caused by melting snow. Eight localities—Augusta, Bath, Buena Vista, Harrisonburg, Highland, Rockbridge, Rockingham and Waynesboro—were included in a federal major disaster declaration (DR- 1098).</p>



Town of Goshen Flood of June 1995

Flood	Description and Damages
September 6, 1996 "Hurricane Fran"	<p>Hurricane Fran made landfall in North Carolina as a Category Three hurricane on September 6, 1996. In the Central Shenandoah Region, ten localities—Augusta, Bath, Buena Vista, Harrisonburg, Highland, Lexington, Rockbridge, Rockingham, Staunton and Waynesboro were included in the federal major disaster declaration (DR-1135). The Counties of Augusta and Rockingham were most affected by Fran. Fran dropped eight inches of rain in parts of the Valley and up to thirteen inches of rain in the Big Meadows area of the Shenandoah National Park. Hurricane Fran broke almost all flood records along the Shenandoah River and its tributaries, including those set in 1972 with Hurricane Agnes and in 1985. Damages in the Shenandoah Valley were estimated at over \$97 million (2019 dollars).</p> <p>The Naked Creek area in Rockingham County, north of Elkton, sustained severe damage by the flood. The flood carved new channels and filled yards and homes with debris. Areas in the Town of Bridgewater were flooded when the North River overflowed its banks. Broadway, Mount Crawford, and Dayton were among the other communities in Rockingham County that experienced flooding. The City of Harrisonburg received flooding along Blacks Run but damage was minimal in comparison to other areas in Rockingham. More than 125 roads were closed in Rockingham as a result of the floods. In the County, 16 homes and 18 mobile homes were completely destroyed by Fran, and 334 additional structures received damage.</p> <p>In Augusta County, National Guard troops evacuated people in the Mount Solon and Churchville areas. Buffalo Gap, Augusta Springs, and Sherando were also vulnerable to the high waters caused by the heavy tropical rains. Twenty-nine roads were closed in Augusta County. Two deaths resulted in Augusta County when people tried to cross the flood-swollen Middle River in two separate incidents. In the City of Staunton, much of downtown was closed due to flooding in the Wharf parking lot area and damage was done to roads at the Frontier Culture Museum. The City of Waynesboro also experienced flooding in their downtown business area when the South River reached flood stage. Waynesboro streets became clogged with debris and tree limbs as the storm progressed.</p> <p>In Virginia, damage from Hurricane Fran was estimated at \$466 million (2019 dollars) and caused eight deaths. Two hundred and thirty-three homes were destroyed and over seven thousand homes were damaged in Virginia.</p>



Hurricane Fran in Rockingham County

Flood	Description and Damages
July 8-August 21, 2001	Severe Storms caused flooding. Bath County was included in a federal major disaster declaration (DR-1386).
February 15 – February 28, 2003	A severe winter storms brought snowfall, heavy rain, flooding and mudslides. Highland County was included in a federal major disaster declaration (DR-1458).
August 8, 2003 "Hurricane Isabel"	<p>Flooding occurred in the City of Staunton after a thunderstorm cell stalled out over Staunton's downtown area, dropping between 4-6 inches of rain in an hour. This heavy rainfall caused structures downtown to fill with 2 - 7 feet of water. Floodwaters receded within several hours leaving \$1.8 million (2019 dollars) in damages to 55 businesses and up to 70 homes. Gypsy Hill Park and the City's Johnson Street parking garage also sustained damage. In Augusta County, countywide impacts occurred from the storm.</p>  <p>The Wharf District in Staunton's downtown</p> <p>Hurricane Isabel made landfall on September 18, 2003, along the Outer Banks of North Carolina. Isabel made landfall as a Category 2 Hurricane. It moved northwestward through Virginia and Maryland, finally dissipating near Erie, Pennsylvania.</p> <p>In Virginia, as Isabel passed through, some areas had sustained winds of 100 mph. Also, for twenty-nine hours tropical storm winds lasted throughout Virginia. Communities located along either the Chesapeake Bay or the Atlantic Coast felt the effects of a storm surge of 5-8 feet.</p> <p>In the Central Shenandoah Region, seven localities—Augusta, Buena Vista, Harrisonburg, Highland, Rockbridge, Rockingham, Staunton and Waynesboro—were included in a federal major disaster declaration (DR-1491). Augusta County received the most rainfall and Rockbridge County received the most damage due to severe flooding along the South River. In Augusta County, the heaviest rain occurred in the Sherando area, which is located at the foothills of the Blue Ridge Mountains. The Upper Sherando monitoring station recorded a rainfall total of 20.6 inches.</p> <p>In Augusta County, damage estimates equaled \$2.2 million (2019 dollars). For the City of Waynesboro, damages equaled \$1.39 million (2019 dollars). The South River at Waynesboro crested at 13.46 feet, above flood stage of 9.5 feet. In Staunton, damages were minimal but one death occurred as a result of carbon monoxide poisoning from the improper use of a generator. In Rockingham County, damage was mainly confined to roads, downed trees, and agricultural lands. Two deaths were caused a few days after the storm, when a man and his daughter tried to cross a swollen stream in a horse and buggy. In Harrisonburg, downed trees were the major problem as a result of rain soaked soil. A JMU student drowned when his canoe overturned in Black's Run the morning after the storm. <i>(Continued On Next Page)</i></p>

Flood	Description and Damages
(continued from previous page) September 18, 2003 “Hurricane Isabel”	<p>The northeastern part of Rockbridge County sustained the most damage when the South River flooded along Rt. 608. The South River is fed by the St. Mary's, Big Mary's, and Little Mary's Creeks which flow down the west side of the Blue Ridge Mountains. During Isabel, the South River began rising by 9 p.m. and the River jumped its bank by 11 p.m. Significant damage to property and infrastructure occurred from the northern Rockbridge County border down stream to the South River's confluence with the Maury River. Rt. 608, which parallels the South River was washed out or undermined in several places. Three permanent bridges over the South River were destroyed. An abandoned C&amp;O railroad bridge, that was part of the Chessie trail system, was washed off its supports as well. In Rockbridge County, property damages were estimated at \$9.3 million (2019 dollars), damage to South River Road was estimated at \$5.5 million (2019 dollars), and agricultural losses were estimated at \$6.9 million (2019 dollars) (which included the loss of 25-30 head of livestock). Amazingly, there were no serious injuries or fatalities in Rockbridge County as a result of this flood event.</p> <p>In the U.S., forty deaths were attributed to Hurricane Isabel and damages were estimated at over \$4.17 billion (2019 dollars). It was one of the top thirty most expensive storms in U.S. history.</p>



Hurricane Isabel - South River in Rockbridge County

Flood	Description and Damages
August 9-August 15, 2004 Hurricane Charley	Impacts from Hurricane Charley were felt countywide in Augusta County.
August 24—September 10, 2004 Hurricane Frances	Hurricane Frances resulted in flooding in Augusta County.
September 2—September 25, 2004 Hurricane Ivan	Hurricane Ivan brought flooding to Augusta County and resulted in road closures in the Staunton area.
September 13-September 26, 2004 Hurricane Jeanne	Hurricane Jeanne resulted in flooding countywide in Augusta.
July 3-July 12, 2005 Hurricane Cindy	Hurricane Cindy brought countywide flooding to Augusta County and resulted in road closures in Western Augusta.
November 29, 2005	Flooding occurred in the Sherando area.

Flood	Description and Damages
June 23 - July 6, 2006 “Mid-Atlantic United States Flood”	The Mid-Atlantic United States Flood of 2006 affected much of the Mid-Atlantic region of the eastern U.S. It is widely considered the worst flooding in the region since Hurricane David in 1979. At least 16 deaths in the U.S. were caused by this flood event. The flooding occurred because of a stalling of the jet stream just west of the Appalachian Mountains, a “Bermuda high” over the Atlantic Ocean, and the influence of a tropical low off the coast of North Carolina. The National Weather Service stated that rain events of this size take place in the region only once every 200 years.  In Virginia, flooding occurred in the northern regions and mudslides were also witnessed in the mountainous regions. In the Central Shenandoah Valley, flooding occurred countywide in Augusta County. In the Brand Flats area along U.S. 250 when Christians Creek spilled over its banks. Residents of 50 trailers in Knox Mobile City were cut off by the flooding. The American Red Cross assisted 1,600 citizens during the week, providing food, clothing, and shelter.
August 28-September 12, 2008 Hurricane Hanna	Hurricane Hanna resulted in flooding impacts countywide in Augusta County.
January 25, 2010	Storms brought flash flooding to Augusta County, resulting in impacts county wide with evacuations and water rescues. Flooding impacted the Pastures District, bringing streams out of their banks and washing out roads. The South River at Waynesboro crested at 10.01 feet, above flood stage of 9.5 feet, resulting in minor flooding.
April 11—April 12, 2011	Heavy rains caused mud and rock slides in Bath County, downing trees and blocking roads. The Cowpasture River crossed Rt 42, and flooding, rock slides and mudslides occurred in areas near Burnsville, Williamsville, Bacova and Bolar. No homes were damaged, but several road washouts occurred. Flooding occurred in northern Augusta County.

Flood	Description and Damages
April 16 , 2011	An EF1 tornado reached wind speeds in excess of 95 mph traveling 4.1 miles in Augusta County. The tornado damaged 37 structures and downed numerous trees and powerlines. Preliminary damage estimates from Augusta County listed storm damage to 12 residences, 3 businesses, 15 outbuildings, 2 mobile structures and 5 barns. Preliminary damage cost is estimated at over 2.5 million (2019 dollars). An EF0 tornado touched down near Vesuvius in Rockbridge County causing minor damage to a barn and a house, and slightly moving another barn off its foundation. The twister left a path about 100 yards wide and 1.3 miles in length. Wind speeds were estimated at 80 mph. Rockbridge also experienced 3.5 inches of rain and reports of quarter size hail. Numerous trees were reported downed in Lexington and countywide in Rockbridge. In Glasgow, the Maury River reached near flood stage at 18 feet. As many as 33 roads were closed due to high waters and fallen trees, the worse being Rt. 631, Furrs Mill Road. A swift water rescue was required to retrieve two women and two small children stranded in a van. 350 Dominion Power customers lost power. In Bath County, downtown Hot Springs flooded. Flooding, mud and rock slides also occurred in other areas of Bath County damaging roads, driveways, homes and the Warm Springs Pools at the Homestead. Highland County experienced power outages, downed trees and flooded roadways. Highland County Supervisors declared the County a disaster area.
April 27-April 28, 2011	Four tornados touched down in Augusta County and Rockingham County. The strongest was an EF-2 that started in Fulks Run and traveled 33.3 miles into Shenandoah County, damaging homes and farm buildings; downing trees and causing 2 injuries. An EF-1 Tornado occurred in Churchville in Augusta County, and traveled for 4 miles damaging homes, downing trees and destroying outbuildings. Two EF-1 tornados occurred in Rockingham. A tornado in Keezletown was on the ground for 2.7 miles causing tree damage and damage to two homes, farms buildings and outbuildings. A tornado in Linville traveled for 0.9 miles causing tree damage. Other reported storm damage from the region included reports of downed trees in Bath County, Rockbridge County, Augusta County and Rockingham County. A tree fell on a trailer in the Colen Hollow area of Rockbridge and damage was reported to houses in Rockingham. The storm brought heavy rains and flooding in Bath County, causing downed trees and powerlines, washing debris into the roads, and damaging roads in Burnsville and Williamsville. Rt. 614 Muddy Run Road in front of the Burnsville Volunteer Fire Department and Rescue Squad was washed out. Flooding damaged a home in Williamsville.
October 22- November 2, 2012 Hurricane Sandy	Hurricane Sandy brought rain to the Central Shenandoah Valley region, resulting in flooding. Governor McDonnell declared a State of Emergency for Virginia. A transmission line serving the Monterey substation failed due to high winds, resulting in a widespread, extended power outage to 90% of Highland County. County officials declared a state of emergency. Following the storm, Highland County was deemed eligible for FEMA public assistance funding in DR-4092 due to damage to public infrastructure. The countywide per capita impact for Highland County was \$7.26 (2012 dollars)
May 9, 2013	A slow moving low pressure system caused rain to fall over saturated ground from previous rainfall. The storm resulted in flash flooding, closing roads, delaying schools systems and causing accidents. More than 40 sections of roadways were flooded in Augusta County.

Flood	Description and Damages
June 17, 2013	Rain and thunderstorms brought flooding to the Dooms area in eastern Augusta County. Route 340 was closed in several locations, and several cars were swept away. No injuries were reported.
April 15-16, 2018	A severe storm moved through the region with moderate to heavy rain, strong winds and hail, causing flooding. The South River crested at 11.38 feet, above flood stage of 9.5 feet. A tornado warning was issued for southeastern Augusta County. While the Central Shenandoah Valley was spared and a tornado touchdown did not occur in the region, the same storm system produced an EF3 tornado which touched down in neighboring Amherst County earlier in the evening. Rockingham County, Augusta County and Harrisonburg were included in a agricultural disaster declaration (S4493).
May 14, 2018	A series of thunderstorms with high winds, heavy rain and hail caused flash flooding in the central Shenandoah Valley, resulting in downed trees and power outages. Several homes or businesses in the region were damaged. In Verona, a family was displaced when flooding caused their basement wall to collapse leading to the condemnation of their home. Homeowners insurance denied the claim since the property was not covered by flood insurance. Strong winds struck a local bank branch during business hours, damaging the building, while employees and customers took shelter in the bank vault. A tree fell damaging a home in Waynesboro. Hail was reported in Verona, and half dollar size hail was reported in Rockbridge County. Trees were reported downed in other areas of Augusta County, Rockingham County and the City of Staunton. 21,000 Dominion Power customers were without power in the region.
May 21, 2018	Five inches of rain were estimated to have fallen in less than 2 hours causing flooding in Bath County. Flooding closed roads on Jackson River Turnpike, Douthat Park State Park and Route 687. Damages were reported to three homes, an auto shop, roads, private driveways and a vehicle. One structure (a garage) had significant damage. Flash flooding in Rockingham County occurred, washing out or temporarily closing roads in Fulks Run, Harrisonburg and other areas of the County. Flooding in Fulks Run damaged houses, farm buildings and roads. Augusta County also experienced county-wide flooding impacts.
May 28-June 3, 2018	A line of thunderstorms brought heavy rains and flash flooding to western and central Virginia. In Rockingham County, including the areas of Harrisonburg, Dayton, and Bridgewater, 2 inches of rain fell in a short amount of time. During the heaviest deluge, rain fell at a rate of 6 inches per hour. The storm stranded vehicles and resulted in several swift water rescues of stranded drivers. Flooding closed several roadways in Augusta County and Rockingham County, including Route 11 in Harrisonburg and Route 42 in Dayton. Route 33 near Swift Run Gap was closed due to a series of mudslides. Businesses in downtown Harrisonburg, as well as City parks flooded. In Dayton, the Cargill Poultry Plant suspended operations when it flooded. A daycare center in Broadway flooded, impacting 95 families, when the center temporarily closed to clean up. Augusta, Highland and Rockingham were included in an agricultural disaster declaration (4378).

Flood	Description and Damages
June 21-22, 2018	A stalled out front caused flooding and damage in Rockingham County and the City of Staunton. In Staunton, a flash flood damaged two homes, four businesses, two vehicles and park amenities at Gypsy Hill Park. The Bergton area of Rockingham County was hit the hardest leading to flooding in low-lying areas. Flooding and downed trees caused road closures in Augusta County and Rockingham County.
June 27-28, 2018	Flooding occurred in the Augusta County area.
August 30, 2018	Severe thunderstorms caused flooding and damages including downed trees, power outages and closed roads in Augusta and Rockingham Counties. The storms included wind gusts of at least 60 mph. Over three inches of rain fell in the area, with the Mount Solon area in northwestern Augusta County being the hardest hit and receiving over four inches. Damaging winds and pea-sized hail were reported.
September 9-September 28, 2018 Hurricane Florence	Hurricane Florence, a category 4 hurricane which downgraded to a tropical depression, widespread flooding in Staunton, Waynesboro and Augusta County closing roads and causing property damage. In Grottoes, the Middle River exceeded the 12 foot flood stage, cresting at 17 feet. The Jennings Branch area and Churchville area experienced flooding, including at Churchville Community Park. Basements and a vehicle flooded in Waynesboro. Staunton declared a local emergency. Augusta and Waynesboro provided sandbags to residents and businesses, and opened emergency shelters. In the Bridgewater area of Rockingham County, Wildwood Park flooded. Rockbridge County was included in an agricultural disaster declaration (4401).
June 29-June 30, 2019	Severe storms resulted in flooding, landslides and mudslides. Augusta, Highland, Rockingham, Harrisonburg, Staunton and Waynesboro were included in an agricultural disaster declaration (4455).

## C-II. DAM RISK ASSESSMENT AND INVENTORY

Information in the Dam Risk Assessment and Inventory is taken from the Commonwealth of Virginia Hazard Mitigation Plan, Chapter 3 - HIRA, Section 3.11 Flooding.

### **Dam Failure**

*Flooding following a dam failure may occur due to any one or a combination of the following causes:*

- *Prolonged periods of rainfall and flooding;*
- *Inadequate spillway capacity;*
- *Internal erosion caused by embankment or foundation leakage or piping;*
- *Improper maintenance, including failure to remove trees and/or woody vegetation, repair internal seepage problems, replace lost material from the cross section of the dam and abutments, failure to clean and remove debris or obstructions, or maintain gates, valves, or other operational components;*
- *Improper design, including the use of improper construction materials and incorrect construction practices or methods;*
- *Improper operation, including failure to remove or open gates or valves during high flow periods;*
- *Failure of upstream dams on the same waterway (dams in serious condition);*
- *High winds, which can cause significant wave action and result in substantial erosion; or Intentional terrorism or criminal acts*

### **Historic Occurrence**

*There are no comprehensive databases of historical dam failures, breaches, or dam related flooding in Virginia. Most dam related failures occur due to lack of maintenance, overtopping events, seismic situations, seepage or internal erosion issues, major precipitation events such as hurricanes and thunderstorms, or a combination of any of these factors.*

*There are not any known historic, catastrophic dam failures in the Central Shenandoah Region to include in this plan.*

## Risk Assessment

*Virginia uses its hazard classification system to determine the level of risk a regulated impounding structure may pose to life and property. According to Virginia law and regulations adopted by the Virginia Soil and Water Conservation Board, hazard classification is based on the potential for loss of life and damage to downstream structures, including but not limited to residences, businesses, occupied structures or roadways. Under this regulatory structure, dams are given a classification in the following manner: High Hazard – “probable loss of life or serious economic damage”; Significant Hazard - “may cause loss of life or appreciable economic damage”; Low Hazard – “no expected loss of life and cause no more than minimal economic damage.” As a result, when determining the “risk” of any particular dam, Virginia relies on the determined hazard classification.*

*Virginia Impounding Structure Regulations require predictive modeling related to dam failure risk under specified conditions. In addition, as part of determining the hazard classification, engineering analyses that result in inundation zone maps include detailed information about potential downstream impacts. These analyses offer predictions of the downstream consequences if a dam were to fail during a storm event or on a “sunny day.” These analyses also include maps which aid emergency personnel in warnings and evacuations of downstream homes, schools, or businesses.*

*The Code of Virginia and the Impounding Structure Regulations can also, on a case by case basis, determine which structures, by virtue of their condition have some greater risk than others. For example, a “Conditional Operation and Maintenance Certificate” defines those elements of the impounding structure that are not in compliance with the regulations and may identify situations where risk factors are increased. Deficiencies can be expressed in inspection reports that follow incidents or other activities on or around the structure. Further, the Department can unilaterally take action under authority granted in §10.1 -608 and §10.1 – 609 for unsafe dams presenting imminent or non-imminent failure. Although in all cases, the hazard classification of the dam is the foundation for any analysis by the Department.*

*To aid in the implementation of mitigation actions and activities for state regulated dams, especially high hazard dams that pose an unacceptable risk to the public, the Commonwealth of Virginia has available the Virginia Dam Safety, Flood Prevention and Protection Assistance Fund to local governments and private entities for specified dam safety and floodplain management issues. The fund was established to provide matching grants to local governments, including local Soil and Water Conservation Districts, and to private entities owning regulated dams to improve dam safety. This*

*includes matching grants to local governments for orphan-type dams that are within their jurisdiction. State-owned and federally-owned dams, or dams not regulated pursuant to the Virginia Dam Safety Act are ineligible. The fund also provides matching grants to any local government for the purposes of assisting the local government with improvements to flood prevention or protection. Grants are awarded through a competitive application process, as spelled out in a yearly issued Grant Manual and awards are approved by the Virginia Soil and Water Conservation Board. Scoring criteria for dam safety projects, as outlined in Appendix C of the Grant Manual provides for higher point value assignments for high hazard potential classification dams with unacceptable risks to the public. This includes but is not limited to those high hazard potential classified dams with confirmed spillway deficiencies, large dams with no hazard classification determinations, dams with high numbers of residential units within the dam's probable dam break/inundation zone, and proposed grant projects which focus on critical dam safety program elements such as hazard potential classification analysis, (PMP) impact analysis and certification, and emergency plan (EAP-emergency action plan or EPP-emergency preparedness plan) development.*

*The Virginia DSFPM also consistently seeks opportunities for assistance from established federal and industry association dam safety grant opportunities that implement mitigation actions and measures for high hazard potential classification dams. Such examples include the Notice of Funding Opportunity (NOFO), Department of Homeland Security (DHS), Rehabilitation of High Hazard Potential Dams (HHPD) and initiatives by the Association of State Dam Safety Officials (ASDSO).*

### ***Probability***

*Predicting the probability of flooding due to dam failure requires a detailed, site-specific engineering analysis for each dam in question. Failure may result from hydrologic and hydraulic design limitations, from geotechnical or operational factors, or from force majeure weather events. The data and time necessary to perform a probabilistic failure analysis for each dam in Virginia is beyond the scope of this plan and regulatory capabilities of Virginia DSFPM. The probability of dam failure due to hydrologic and hydraulic design limitations is related to the regulatory standards for dam spillway design in Virginia. Dams are required to safely pass a spillway design flood (SDF) without failure based on their assigned hazard potential classification, as indicated below in Table 3.11-2.*

**Table 3.11-2: Performance Standards for Dams**

<b>Hazard Potential</b>	<b>Spillway Design Flood (SDF)</b>	<b>Spillway Design Flood (SDF) for Existing Impounding Structures</b>	<b>Minimum Threshold for Incremental Damage Analysis (IDA)</b>
High	PMF	0.9 PMP	100-YR
Significant	0.50 PMF	0.50 PMF	100-YR
Low	100-YR	100-YR	50-YR

PMF = Probable Maximum Flood; PMP = Probable Maximum Precipitation; YR = Year

Note that a dam may be designed to a slightly lower standard than the spillway design flood based on a detailed incremental damage analysis showing that designing the dam to a higher spillway design flood does not further protect the public downstream of the impoundment (i.e. infrastructure downstream already under water / destroyed before any danger from a dam failure were to develop). Low hazard dams expected to result in no loss of human life and no economic damage to any property, except the dam owners, may qualify for a Special Low Hazard rating lowering the required spillway design flood to the 50-year event as well as possibly being exempt from other standards required by the regulations.

## Impact and Vulnerability

Failure of dams may result in catastrophic localized damages at both the dam location and downstream areas. Vulnerability to dam failure is dependent on dam operations planning and the nature of downstream development. Depending on the elevation and storage volume of the impoundment, the impact of flooding due to dam failure may include loss of human life, economic losses such as property damage and infrastructure disruption, and environmental impacts such as destruction of habitat. Evaluation of vulnerability and impact is highly dependent on site-specific conditions; no broad-brush approach can be applied at a statewide level.

Owners of impounding structures are required to have dam break inundation zone maps that meet the standards of the Virginia Impounding Structure Regulations. The properties that are identified within the dam break inundation zone are recorded in the dam safety Emergency Plan (EAP – Emergency Action plan or EPP - Emergency Preparedness Plan) for that impoundment. Please note that due to the overall limitations of this Report, the impact and vulnerability to downstream state facilities and critical facilities due to dam failure was not estimated.

Dams with known deficiencies continue to create an ever-growing public safety issue for downstream residents, communities, and overall infrastructure. Virginia DSFPM's main goals are to protect public safety and ensure regulated dams within the Commonwealth of Virginia adhere to the current Impounding Structure Regulations. Virginia DSFPM's yearly Grant Program provides potential financial

*aid through a 50% match to dam owners looking to work on their regulated dams to keep them in compliance. In addition, Virginia DSFPM provides dam focused educational trainings to the public to help dam owners understand their dam related regulatory / maintenance responsibilities and to ensure private engineers understand dam related requirements.*

*As dam related infrastructure continues to age, Virginia DSFPM continues to look into ways to keep dams safe, continues to work to bring newly located dams into compliance, and continues to offer the yearly Grant Program to dam owners. Avenues are being considered to help increase the Virginia DSFPM staff to better manage existing workloads and staff are looking into creative ways to institute online video based training centered around dam related information / dam ownership.*

*Virginia DSFPM has implemented a new online database called DSIS which continues to be populated with dam related data for dams. By continuing to maintain and populate DSIS with important data such as inundation studies and Emergency Plans, Virginia DSFPM has real-time access to critical dam information which is invaluable during emergencies and helpful in planning situations (development downstream). Access to a system like DSIS helps to reduce long term dam related vulnerabilities within the Commonwealth and decrease the ever-growing unacceptable risk to the general public.*

## **Risk**

*As of May 2019, Virginia DSFPM is aware of approximately 3,590 dams within the Commonwealth based on information provided in DSIS (see previous discussions within this section regarding DSIS (Dam Safety Inventory System)) and the 2018 National Inventory of Dams data from the US Army Corps of Engineers. Out of those 3,590 known dams, Virginia DSFPM is known to regulate approximately 2,034 dams (57%). When evaluating the 2,034 dams; it is known that there are approximately 313 high hazard (15%), 166 significant hazard (8%), 262 low hazard (13%), and 1,293 unknown hazard (64%) dams regulated by Virginia DSFPM. At this time Virginia DSFPM has decided to utilize the label "unknown hazard potential classification" for dams where an inundation study is required to be performed by the dam owner's engineer and submitted, reviewed, and approved (confirmed) by Virginia DSFPM prior to assignment of a final hazard potential classification.*

*Dam related data including geographically based information is constantly being revised and updated within the Commonwealth of Virginia as better data / technology becomes available. As a result, latitude / longitude coordinates were provided for all included high hazard dams (see above) for the use by the public to locate high hazard dams rather than pre-made geographic maps. Please contact either the Virginia Department of Emergency Management (VDEM) GIS section or Virginia DSFPM if geographically based maps are required. This approach regarding geographic based maps will ensure that the most up-to-date dam related information is being provided at the time of the mapping request.*

*Please note that it is recommended by Virginia DSFPM that the dam related information presented in Section 3.11 of the Virginia Hazard Mitigation Plan be reviewed annually and updated as necessary to ensure accurate information is provided for planning, public safety, and emergency management purposes.*

### **Future Conditions Considerations**

*As precipitation amounts fluctuate and extreme weather events become more common, the flood control and impoundment infrastructure in Virginia becomes more of a concern. Like most of the country, the infrastructure in Virginia is overwhelmingly privately owned and maintained, and it is aging – in many cases, to the end of its design life. The occurrence of more frequent high intensity rainfall events may create conditions that exceed the original design criteria of these aging facilities.*

*During the 20-year period of January 1, 1996 to December 31, 2016, the NCEI (National Centers for Environmental Information) recorded 1,154 heavy rain events in Virginia. This equates to an average of 57.7 heavy rain events per year. A review of the individual records suggests that this type of event is increasing in both frequency and intensity over time. While a 20-year data set is too limited to establish a long-term outlook, it does indicate a trend. If this trend continues, it could be detrimental to flood control and impoundment infrastructure throughout Virginia. More frequent and/or more intense rain events may increase the risk of potential failure, which increases the risk to downstream properties and residents.*

**Table C-1: Known High Hazard Potential Classification Dams Regulated by Virginia Dam Safety and Floodplain Management**

VDEM Region	VA ID #	Dam Name	Regulatory	Owners	Hazard	City/County	Latitude	Longitude
3	165001	Lower North River #80	VA DSFPM	Shenandoah Valley SWCD	High	Rockingham County	38.4717	-79.0613
3	165002	Lower North River #78	VA DSFPM	Shenandoah Valley SWCD	High	Rockingham County	38.45	-79.1598
3	165003	Lower North River #83	VA DSFPM	Shenandoah Valley SWCD	High	Rockingham County	38.4707	-79.1428
3	165004	Lower North River #22B	VA DSFPM	Shenandoah Valley SWCD	High	Rockingham County	38.562	-79.0904
3	165005	Lake Shenandoah Dam	VA DSFPM	VA DGIF	High	Rockingham County	38.3789	-78.8326
3	165006	Lower North River #81C	VA DSFPM	City of Harrisonburg	High	Rockingham County	38.5718	-79.1377
3	165007	Lower North River #82	VA DSFPM	Shenandoah Valley SWCD	High	Rockingham County	38.5885	-79.1219
3	165009	Shoemaker River #1A	VA DSFPM	Shenandoah Valley SWCD	High	Rockingham County	38.5589	-78.9696
3	165010	Shoemaker River #4C	VA DSFPM	Shenandoah Valley SWCD	High	Rockingham County	38.6108	-78.9711
3	165011	Shoemaker River #3B	VA DSFPM	Shenandoah Valley SWCD	High	Rockingham County	38.592	-78.9738
3	660001	Newman Lake Dam	VA DSFPM	James Madison	High	City of Harrisonburg	38.4314	-78.8748

**Table C-1: Known High Hazard Potential Classification Dams Regulated by Virginia Dam Safety and Floodplain Management**

VDEM Region	VA ID #	Dam Name	Regulatory Agency	Owners	Hazard Class	City/County	Latitude	Longitude
3	015001	South River Dam #26	VA DSFPM	Headwaters SWCD	High	Augusta County	38.0144	-78.9241
3	015002	South River Dam #25	VA DSFPM	Headwaters SWCD	High	Augusta County	37.9641	-78.9479
3	015004	South River Dam #10A	VA DSFPM	Augusta County	High	Augusta County	37.9532	-79.0006
3	015005	Upper North River Dam #10	VA DSFPM	Headwaters SWCD	High	Augusta County	38.3639	-79.2058
3	015006	Upper North River Dam #76	VA DSFPM	City of Staunton	High	Augusta County	38.3266	-79.2234
3	015007	Upper North River Dam #77	VA DSFPM	Headwaters SWCD	High	Augusta County	38.3938	-79.1602
3	015008	South River Dam #23	VA DSFPM	Headwaters SWCD	High	Augusta County	38.0046	-78.9202
3	015009	South River Dam #6	VA DSFPM	Headwaters SWCD	High	Augusta County	37.9911	-79.1221
3	015011	South River Dam #4	VA DSFPM	Headwaters SWCD	High	Augusta County	37.9627	-79.1502
3	015012	South River Dam #11	VA DSFPM	Headwaters SWCD	High	Augusta County	37.9925	-78.9905
3	015014	South River Dam #19	VA DSFPM	Headwaters SWCD	High	Augusta County	38.0133	-78.9695

**Table C-1 : Known High Hazard Potential Classification Dams Regulated by Virginia Dam Safety and Floodplain Management**

VDEM Region	VA ID #	Dam Name	Regulatory	Owners	Hazard	City/County	Latitude	Longitude
3	015018	Staunton Dam	VA DSFPM	City of Staunton	High	Augusta County	38.3333	-79.2065
3	015019	Coles Run Dam	VA DSFPM	Augusta County	High	Augusta County	37.9761	-79.0303
3	015022	South River Dam #7	VA DSFPM	Headwaters SWCD	High	Augusta County	38.0175	-79.0962
3	820001	South River Dam #8A	VA DSFPM	City of Waynesboro	High	City of Waynesboro	38.0526	-78.8732
6	163001	Goshen Dam	VA DSFPM	B.S.A., National	High	Rockbridge County	37.9597	-79.4592
6	163002	Robertson Dam	VA DSFPM	VA DGIF	High	Rockbridge County	37.8015	-79.6053
6	163003	Moore's Creek Dam	VA DSFPM	City of Lexington	High	Rockbridge County	37.7473	-79.6462
6	163007	Turner Pond Dam	VA DSFPM	VCLF Land Trust & DCR State Parks	High	Rockbridge County	37.6416	-79.5413
6	163013	Natural Bridge Dam #5	VA DSFPM	VCLF Land Trust & DCR State Parks	High	Rockbridge County	37.624	-79.543
6	017001	Douthat Lake Dam	VA DSFPM	Virginia DCR - State Parks	High	Bath County	37.9037	-79.8039

**Table C-2: Known High Hazard Potential Classification Dams NOT Regulated by Virginia Dam Safety and Floodplain Management**

VDEM Region	VA ID #	Dam Name	Regulatory Agency	Owners	Hazard Class	City/County	Latitude	Longitude
6	017006	Bath County Pumped Storage - Upper Dam	FERC	Dominion Energy, Bath County LLC, and Allegheny Power	High	Bath County	38.2266	-79.823
6	017007	Bath County Pumped Storage - Lower Dam	FERC	Dominion Energy, Bath County LLC, and Allegheny Power	High	Bath County	38.1973	-79.8065

## **Appendix D - Critical Facilities Maps**

# Critical Facilities and FEMA Floodplains - Augusta County

FEMA 1% Annual Chance Flood Hazard	Structures (1% Annual Chance)
FEMA 0.2% Annual Chance Flood Hazard	Structures (0.2% Annual Chance)
Roads (1% Annual Chance)	Waterbody
Conservation Lands	Federal
Roads (0.2% Annual Chance)	State

Highland

Rockingham

Bath

Albemarle

Rockbridge

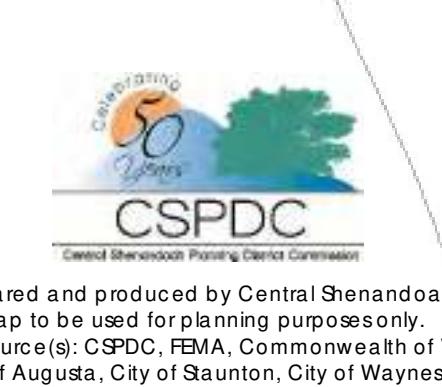
Nelson

West Virginia

Harrisonburg

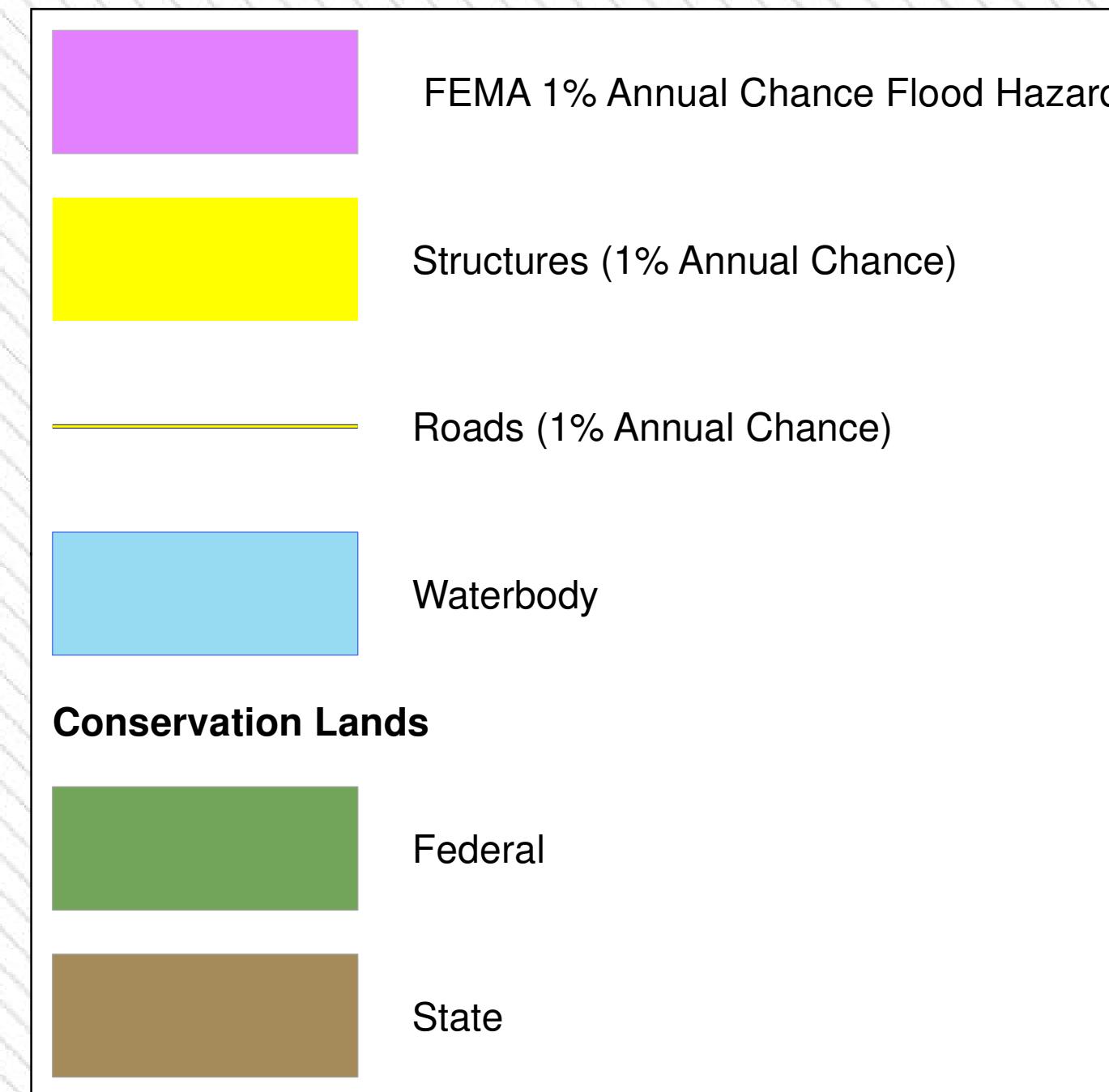
Critical Facility	
AIRPORT	GOVERNMENT
CELL TOWER	HOSPITAL
CHILD DAY CARE	IFLOWS GAUGE
CHURCH	INDUSTRY
COMMUNITY CENTER	JAIL
CORRECTIONAL FACILITY	LANDFILL
EMERGENCY GENERATOR	MEDICAL FACILITY
EMERGENCY RESPONSE	OTHER
GOVERNMENT	POWER UTILITY
HOSPITAL	PUBLIC WORKS
IFLOWS GAUGE	SCHOOL
INDUSTRY	SENIOR LIVING
JAIL	WASTEWATER TREATMENT
LANDFILL	WATER TANK
MEDICAL FACILITY	WATER TREATMENT
OTHER	WELL

0 3 6 9 Miles



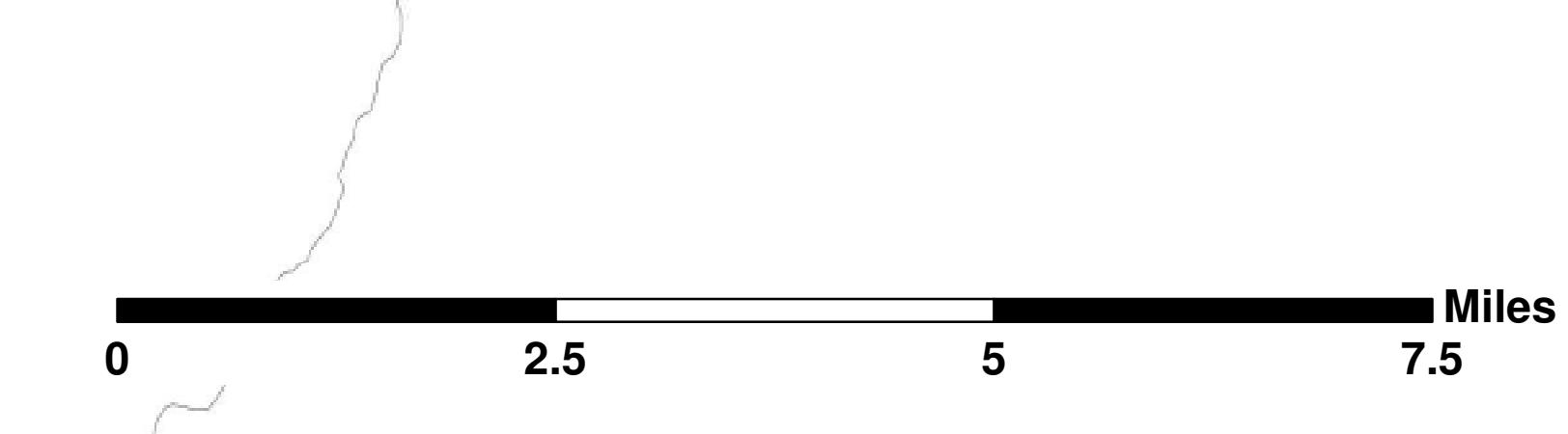
Map prepared and produced by Central Shenandoah PDC.  
Map to be used for planning purposes only.  
Data Source(s): CSPDC, FEMA, Commonwealth of VA,  
County of Augusta, City of Staunton, City of Waynesboro,  
Town of Craswile  
Oct 17, 2019

# Critical Facilities and FEMA Floodplains - Bath County



Critical Facility											
■ AIRPORT	■ GOVERNMENT	■ POWER UTILITY									
■ CHILD DAY CARE	■ HOSPITAL	■ SCHOOL									
■ CHURCH	■ INDUSTRY	■ SENIOR LIVING									
■ COURTHOUSE	■ JAIL	■ UTILITY									
■ EMERGENCY RESPONSE	▲ LANDFILL	■ WASTEWATER TREATMENT									


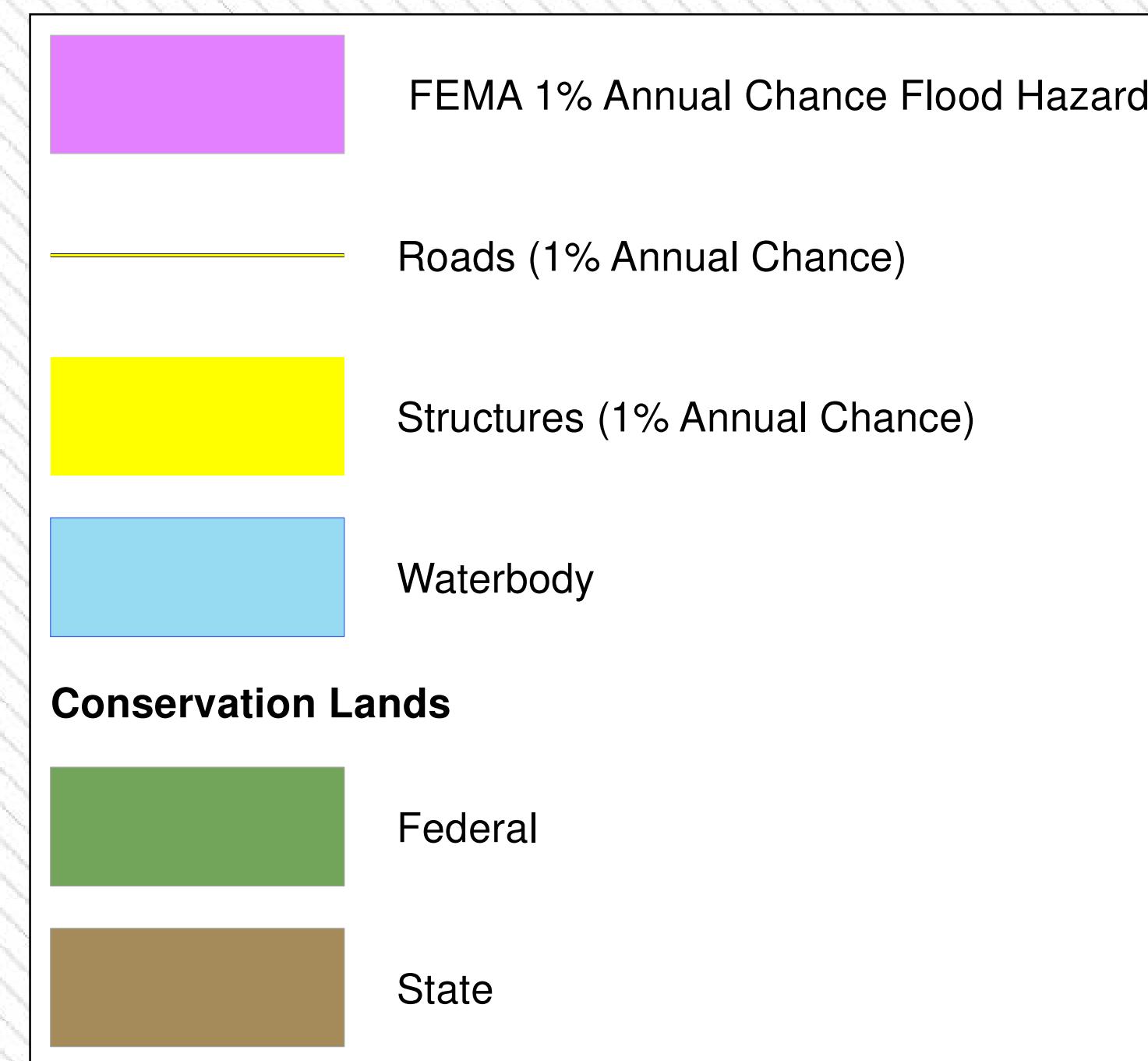
Govington



N  
Map prepared and produced by Central Shenandoah PDC.  
Map to be used for planning purposes only.  
Data Source(s): CSPDC, FEMA, Commonwealth of VA.  
Bath County  
October 18, 2019



# Critical Facilities and FEMA Floodplains - Highland County



Critical Facility					
CHURCH	EMERGENCY RESPONSE	SCHOOL			
COURTHOUSE	GOVERNMENT	WASTEWATER TREATMENT			

Map prepared and produced by Central Shenandoah PDC.  
Map to be used for planning purposes only.  
Data Source(s): CSPDC, FEMA, Commonwealth of VA,  
Highland County, Town of Monterey  
Sept. 25, 2019



# Critical Facilities and FEMA Floodplains - Rockbridge County

FEMA 1% Annual Chance Flood Hazard	Structures (1% Annual Chance)
FEMA 0.2% Annual Chance Flood Hazard	Structures (0.2% Annual Chance)
Roads (1% Annual Chance)	Waterbody
Roads (0.2% Annual Chance)	Conservation Lands
	Federal
	State

Augusta

Bath

Alleghany

Nelson

Amherst

Botetourt

Bedford

## Critical Facility


CHILD DAY CARE	HOSPITAL	SUBSIDIZED HOUSING
CHURCH	INDUSTRY	TRAVEL CENTER
COMMUNITY CENTER	JAIL	VISITOR'S CENTER
CORRECTIONAL FACILITY	LANDFILL	WASTEWATER TREATMENT
COURTHOUSE	MEDICAL FACILITY	WATER TANK
EMERGENCY RESPONSE	POWER UTILITY	WATER TREATMENT
EOC AND COMMUNICATION	SCHOOL	WELL
GOVERNMENT	SENIOR LIVING	

0 2.5 5 Miles



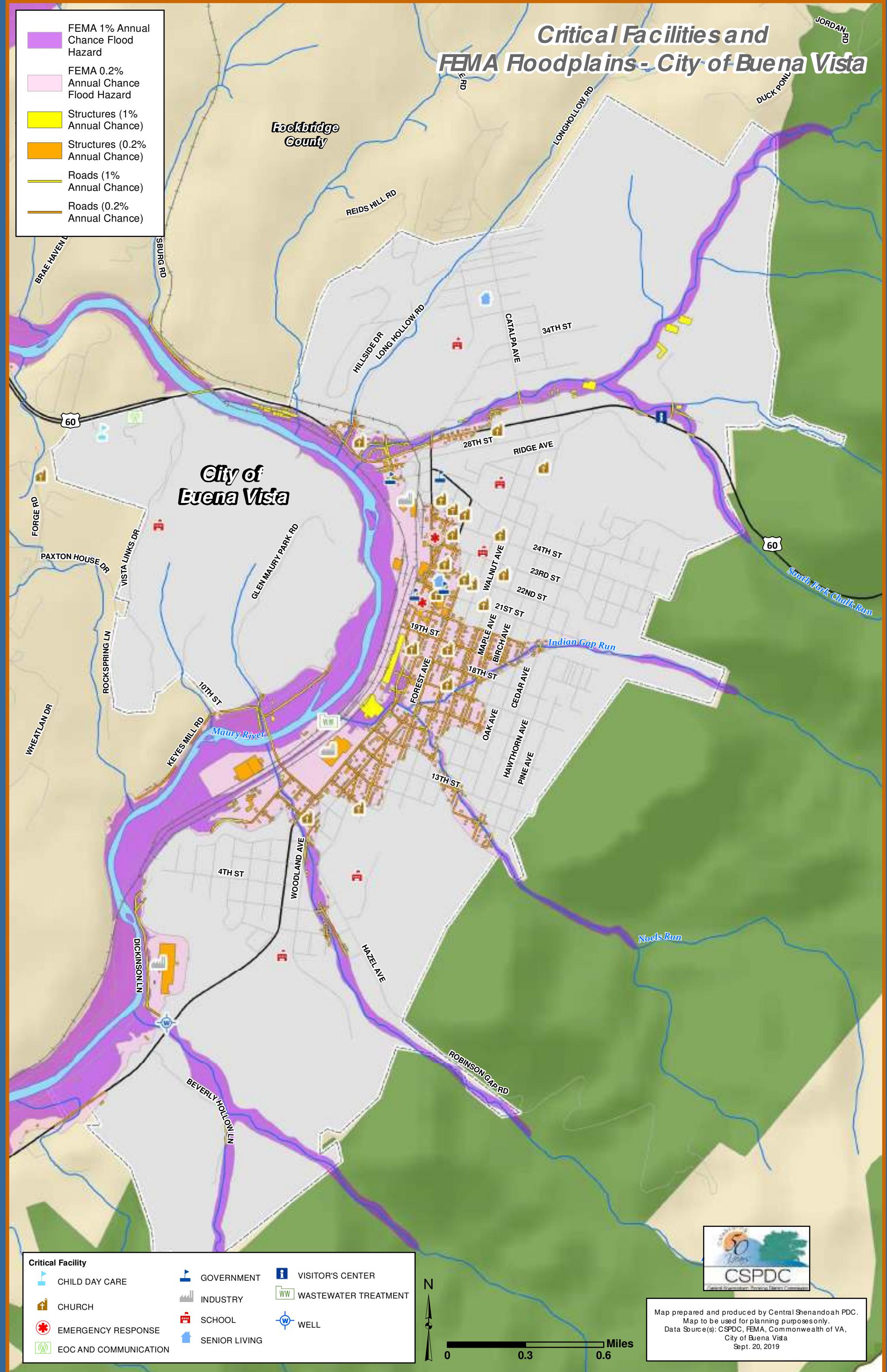
# *Critical Facilities and FEMA Floodplains - Rockingham County*

Warren

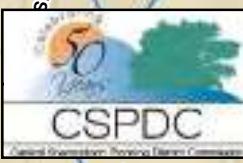
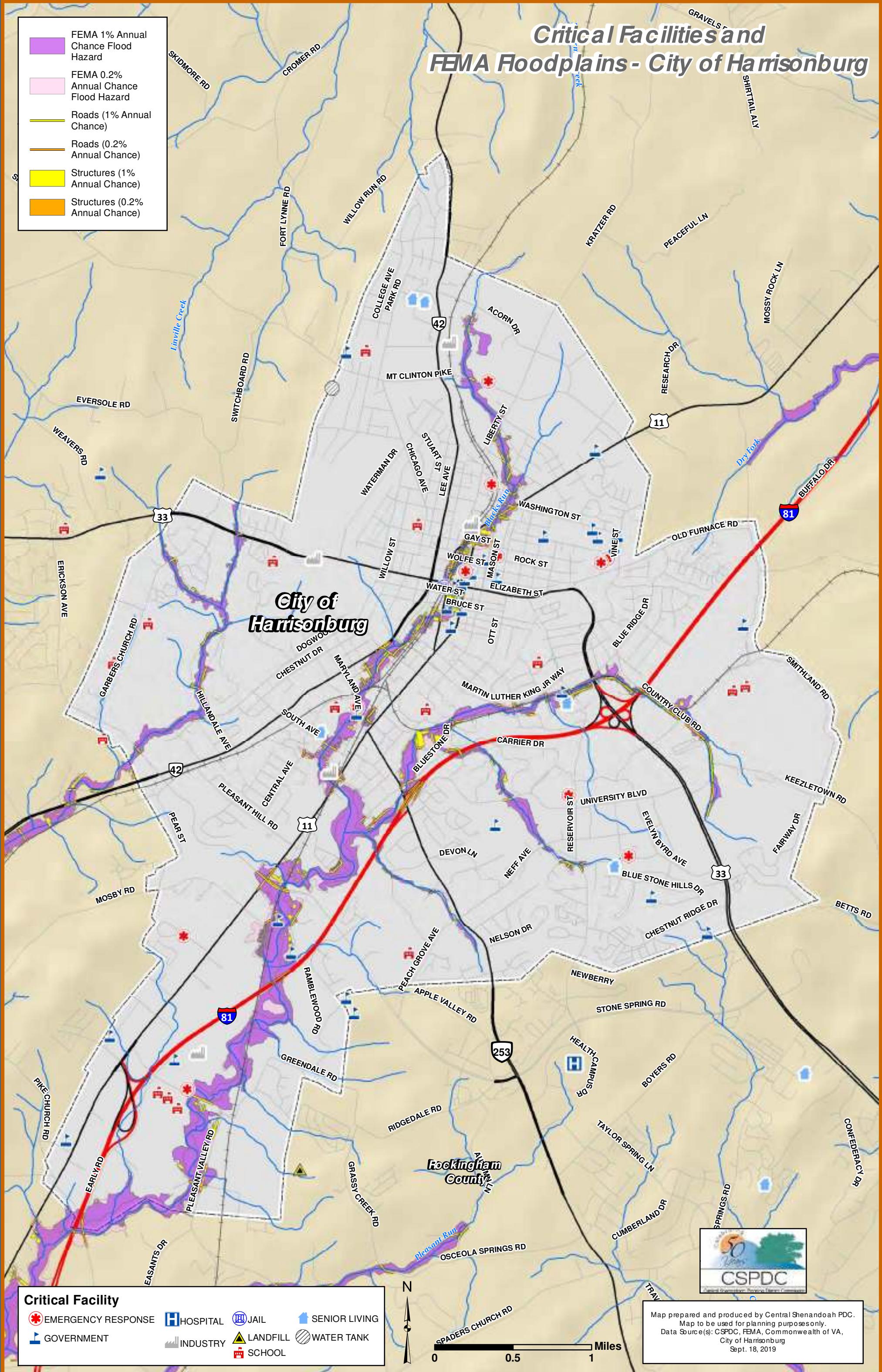
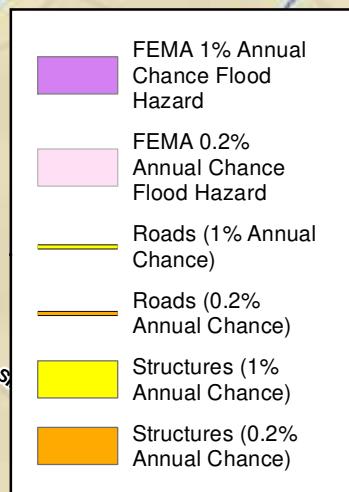


# *Critical Facilities and FEMA Floodplains - City of Buena Vista*

- FEMA 1% Annual Chance Flood Hazard
- FEMA 0.2% Annual Chance Flood Hazard
- Structures (1% Annual Chance)
- Structures (0.2% Annual Chance)
- Roads (1% Annual Chance)
- Roads (0.2% Annual Chance)



# Critical Facilities and FEMA Floodplains - City of Harrisonburg



## Critical Facility

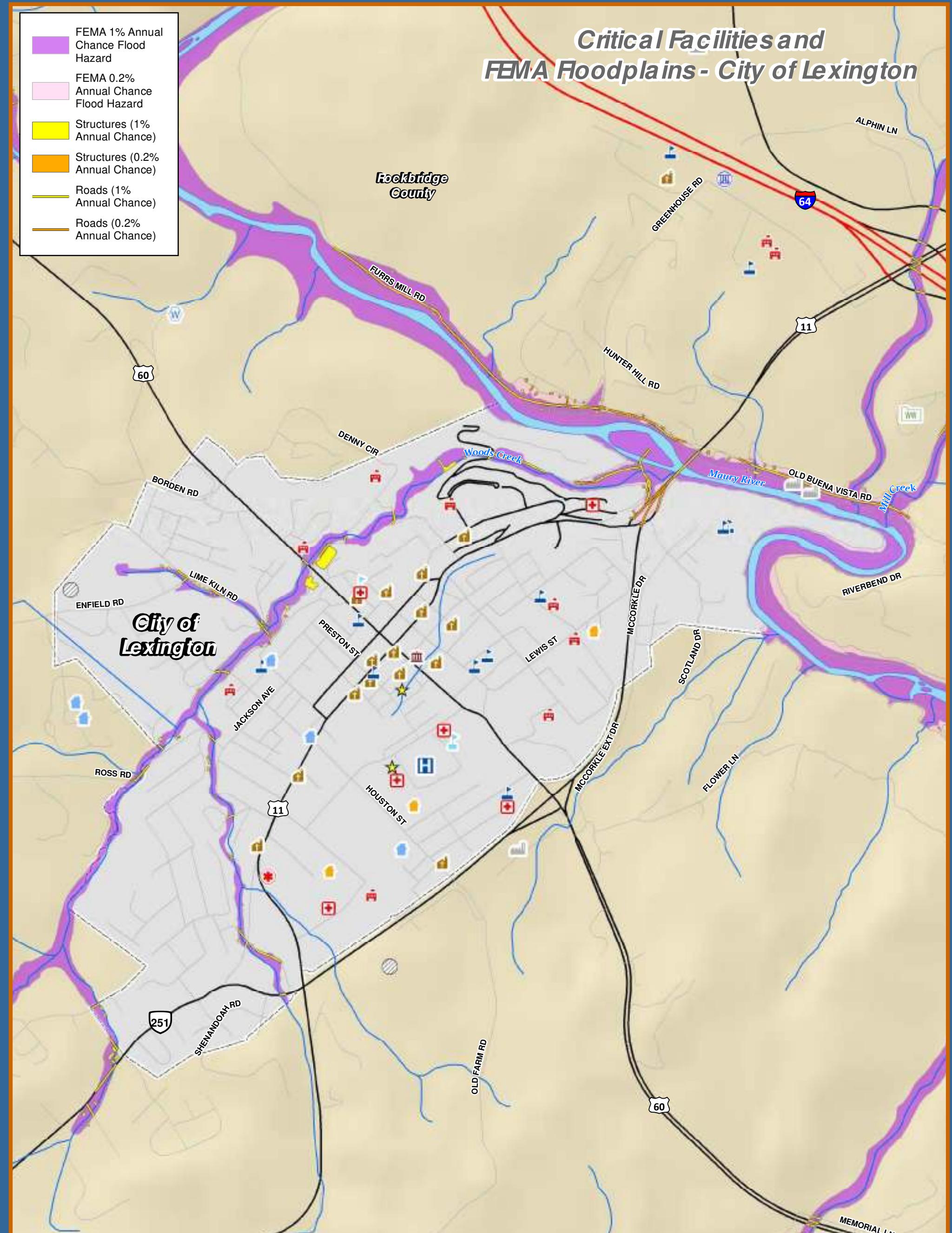
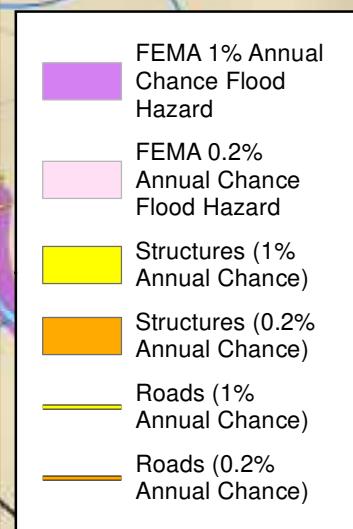
- |                    |          |          |               |
|--------------------|----------|----------|---------------|
| EMERGENCY RESPONSE | HOSPITAL | JAIL     | SENIOR LIVING |
| GOVERNMENT         | INDUSTRY | LANDFILL | WATER TANK    |
| SCHOOL             |          |          |               |



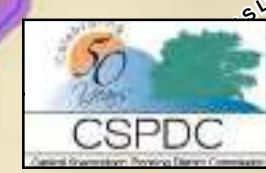
0 0.5 1 Miles

Map prepared and produced by Central Shenandoah PDC.  
Map to be used for planning purposes only.  
Data Source(s): CSPDC, FEMA, Commonwealth of VA,  
City of Harrisonburg  
Sept. 18, 2019

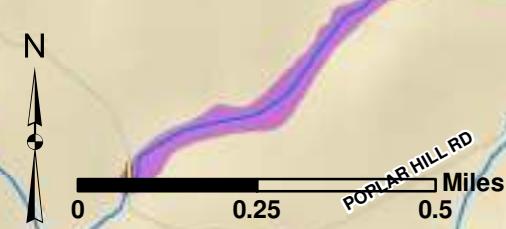
# Critical Facilities and FEMA Floodplains - City of Lexington



Critical Facility	
CHILD DAY CARE	JAIL
CHURCH	MEDICAL FACILITY
COMMUNITY CENTER	SCHOOL
COURTHOUSE	SENIOR LIVING
EMERGENCY RESPONSE	SUBSIDIZED HOUSING
GOVERNMENT	WASTEWATER TREATMENT
HOSPITAL	WATER TANK
INDUSTRY	WATER TREATMENT

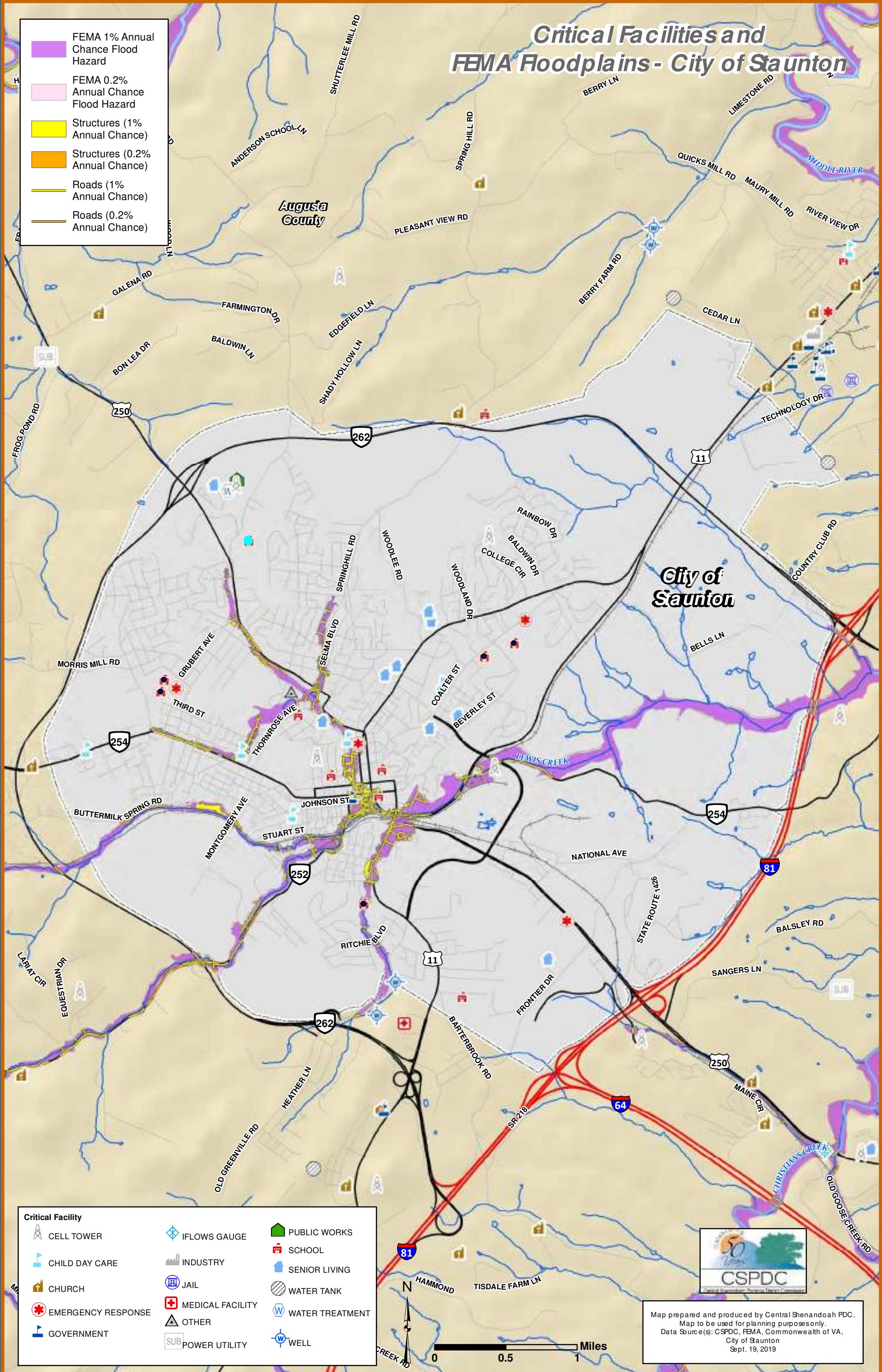


Map prepared and produced by Central Shenandoah PDC.  
Map to be used for planning purposes only.  
Data Source(s): CSPDC, FEMA, Commonwealth of VA,  
City of Lexington  
October 17, 2019

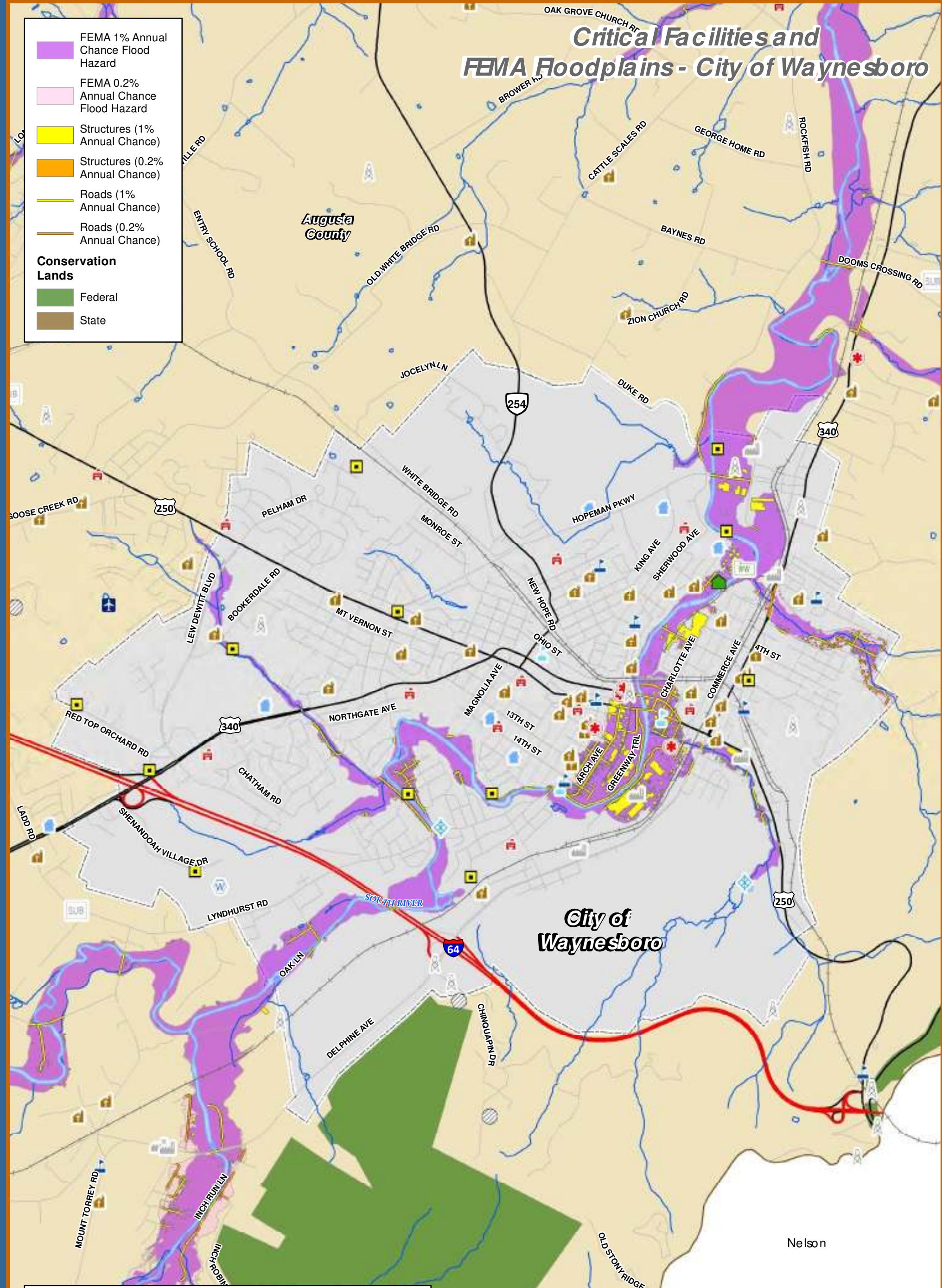
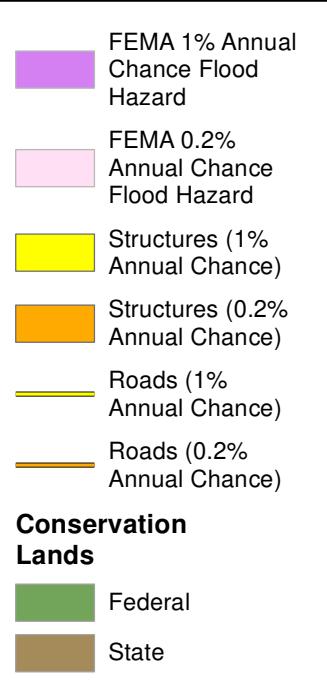


# Critical Facilities and FEMA Floodplains - City of Staunton

FEMA 1% Annual Chance Flood Hazard
FEMA 0.2% Annual Chance Flood Hazard
Structures (1% Annual Chance)
Structures (0.2% Annual Chance)
Roads (1% Annual Chance)
Roads (0.2% Annual Chance)



# Critical Facilities and FEMA Floodplains - City of Waynesboro



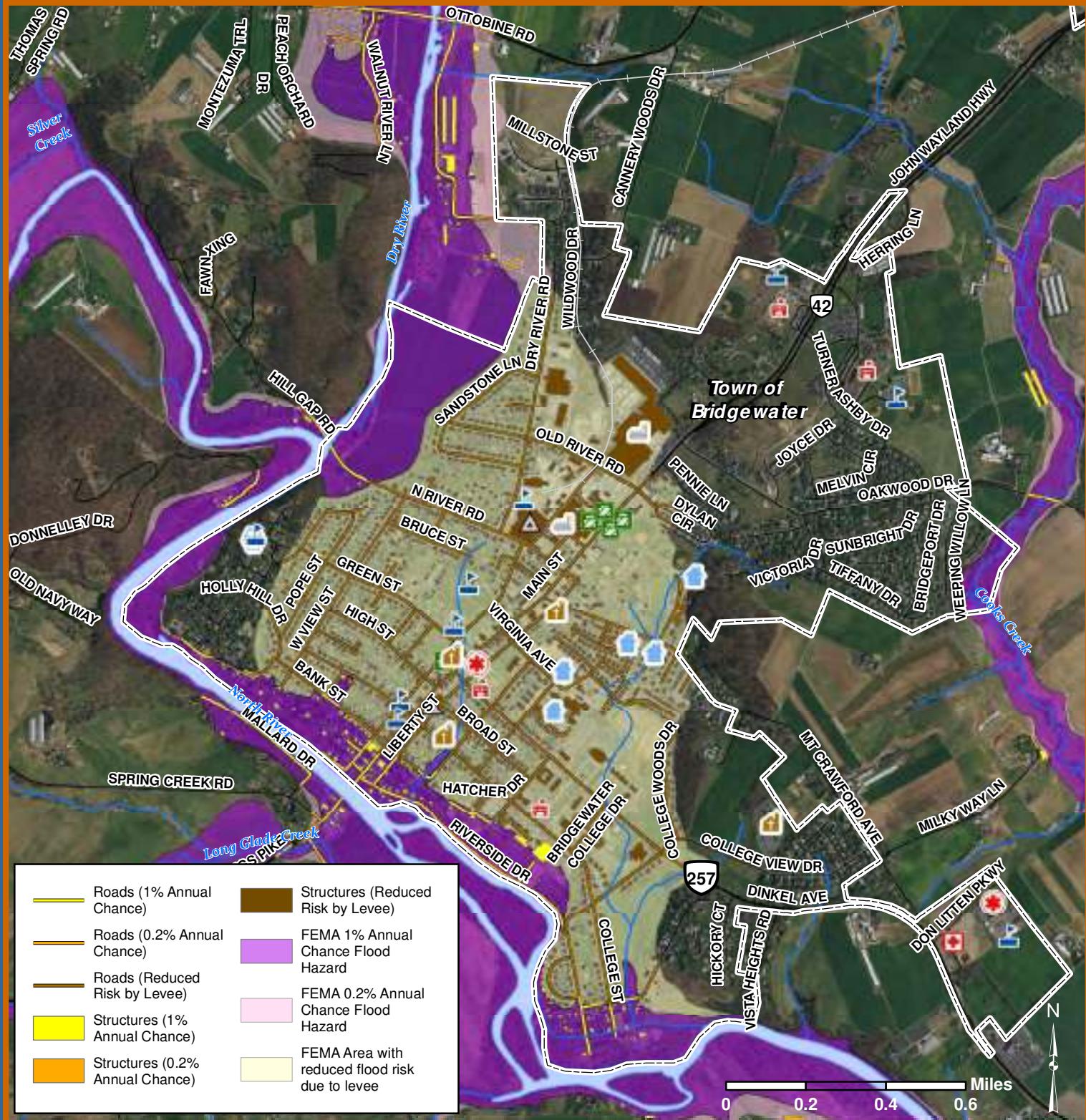
Critical Facility	
AIRPORT	GOVERNMENT
CELL TOWER	SENIOR LIVING
CHILD DAY CARE	INFLOWS GAUGE
CHURCH	INDUSTRY
EMERGENCY GENERATOR	POWER UTILITY
EMERGENCY RESPONSE	PUBLIC WORKS
	SCHOOL
	WATER TREATMENT
	WATER TANK
	WELL



Map prepared and produced by Central Shenandoah PDC.  
Map to be used for planning purposes only.  
Data Source(s): CSPDC, FEMA, Commonwealth of VA,  
City of Waynesboro  
Sept. 19, 2019

N  
0 0.5 Miles

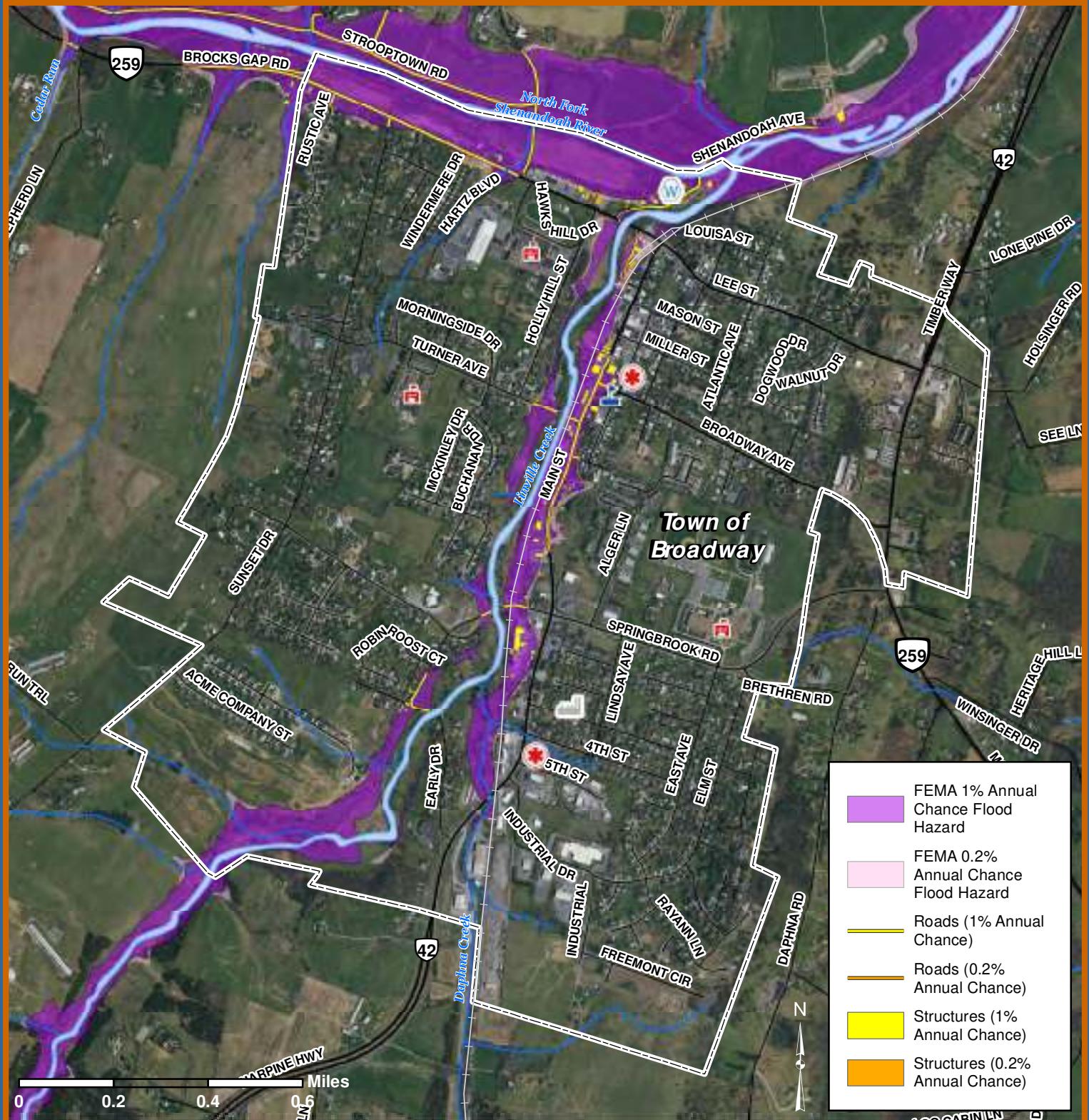
**Critical Facilities and FEMA Floodplains - Town of Bridgewater**



Map prepared and produced by Central Shenandoah PDC.  
Map to be used for planning purposes only.  
Data Source(s): CSPDC, FEMA, Commonwealth of VA,  
Town of Bridgewater  
Sept. 16, 2019

## Critical Facility

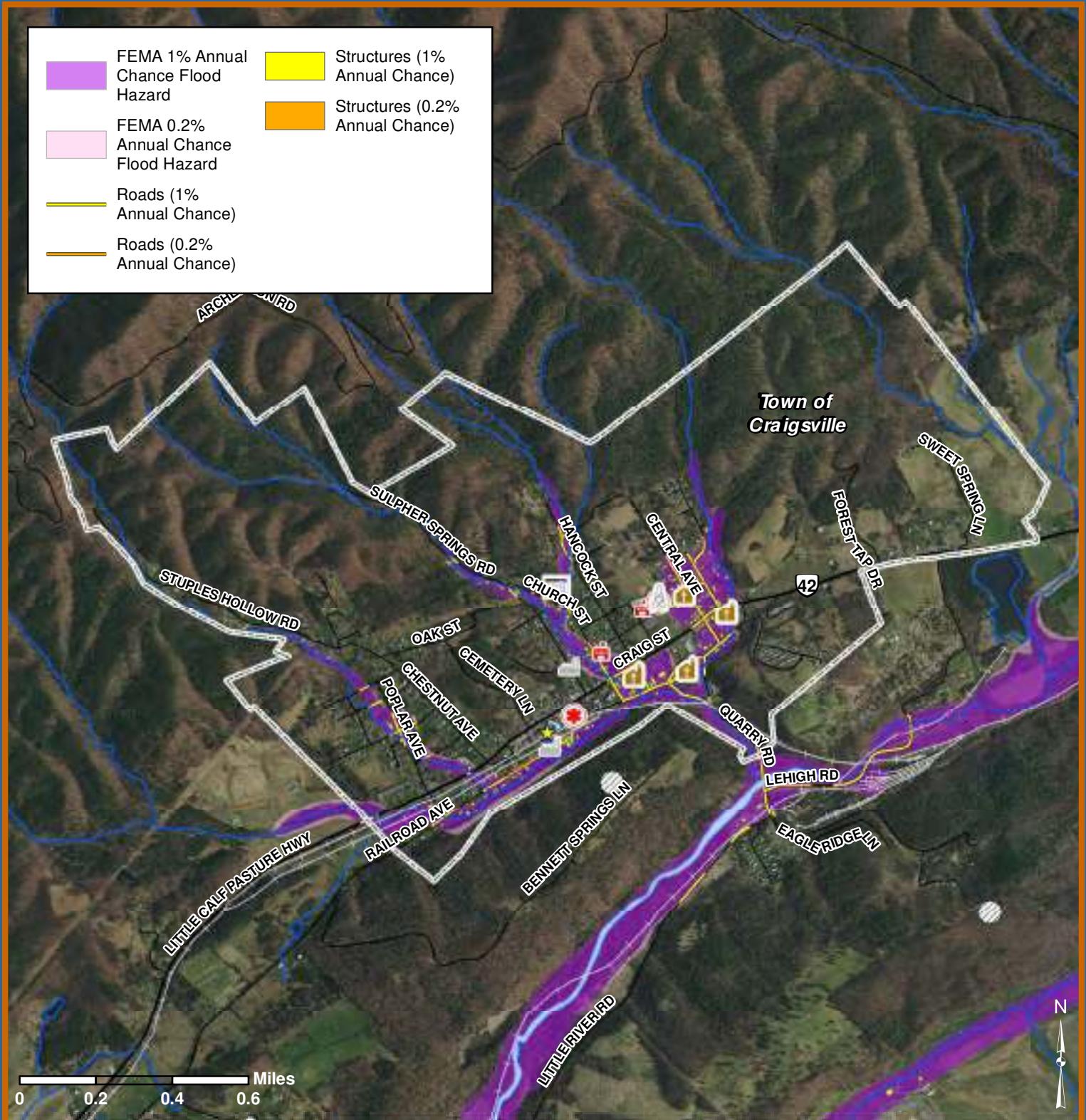
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**Critical Facilities and FEMA Floodplains - Town of Broadway**

Map prepared and produced by Central Shenandoah PDC.  
Map to be used for planning purposes only.  
Data Source(s): CSPDC, FEMA, Commonwealth of VA,  
Town of Broadway  
Sept. 17, 2019

**Critical Facility**

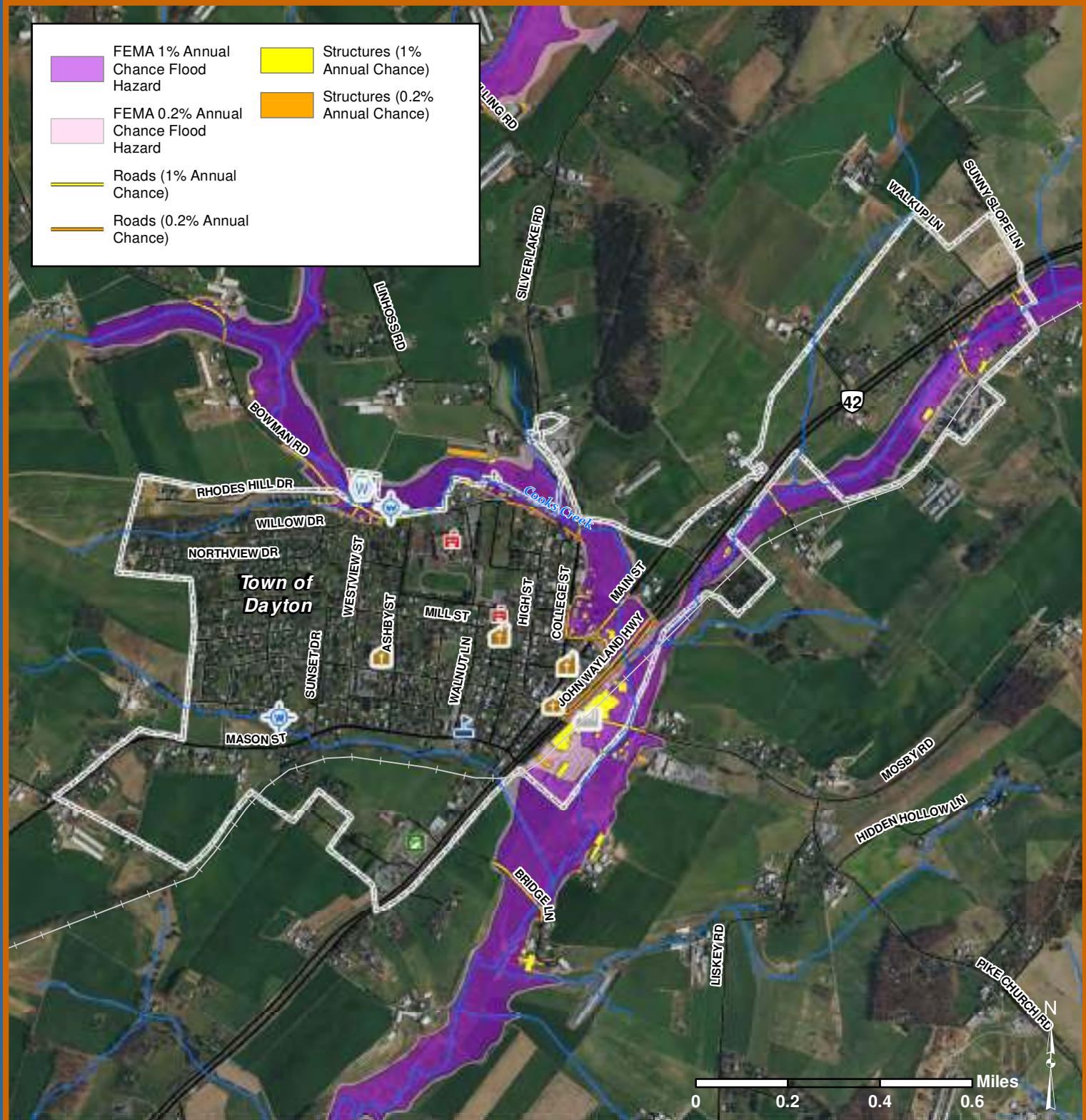
- |  |                    |  |          |
|--|--------------------|--|----------|
|  | EMERGENCY RESPONSE |  | INDUSTRY |
|  | GOVERNMENT         |  | SCHOOL   |
|  | WATER TREATMENT    |  |          |

**Critical Facilities and FEMA Floodplains - Town of Craigsville**

Map prepared and produced by Central Shenandoah PDC.  
Map to be used for planning purposes only.  
Data Source(s): CSPDC, FEMA, Commonwealth of VA,  
Town of Craigsville  
October 17, 2019

**Critical Facility**

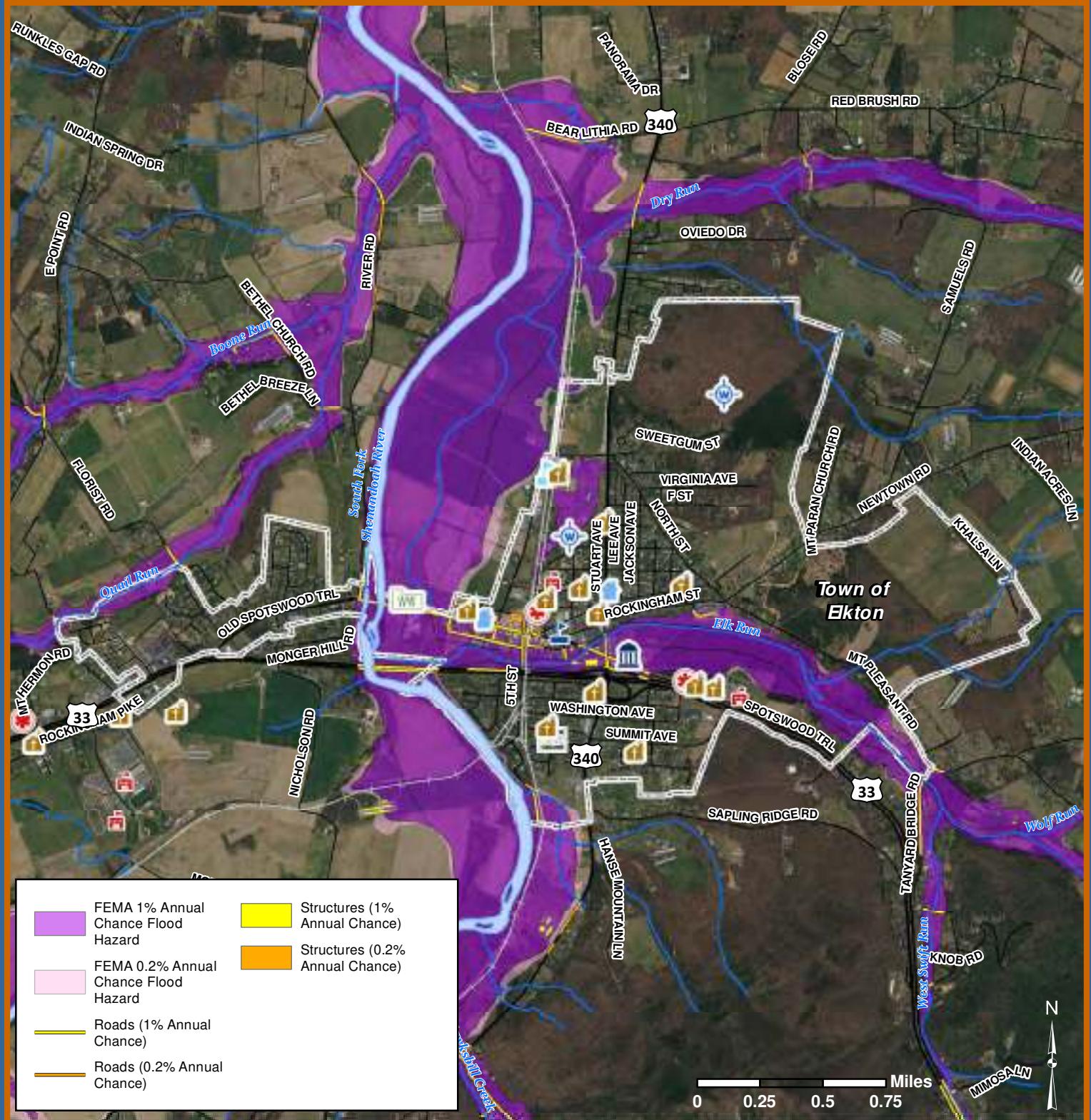
- |                  |                    |               |
|------------------|--------------------|---------------|
| CELL TOWER       | EMERGENCY RESPONSE | INDUSTRY      |
| CHURCH           | GOVERNMENT         | POWER UTILITY |
| COMMUNITY CENTER | IFLOWS GAUGE       | SCHOOL        |
|                  |                    | WATER TANK    |

**Critical Facilities and FEMA Floodplains - Town of Dayton**

Map prepared and produced by Central Shenandoah PDC.  
Map to be used for planning purposes only.  
Data Source(s): CSPDC, FEMA, Commonwealth of VA,  
Town of Dayton  
Sept. 18, 2019

**Critical Facility**

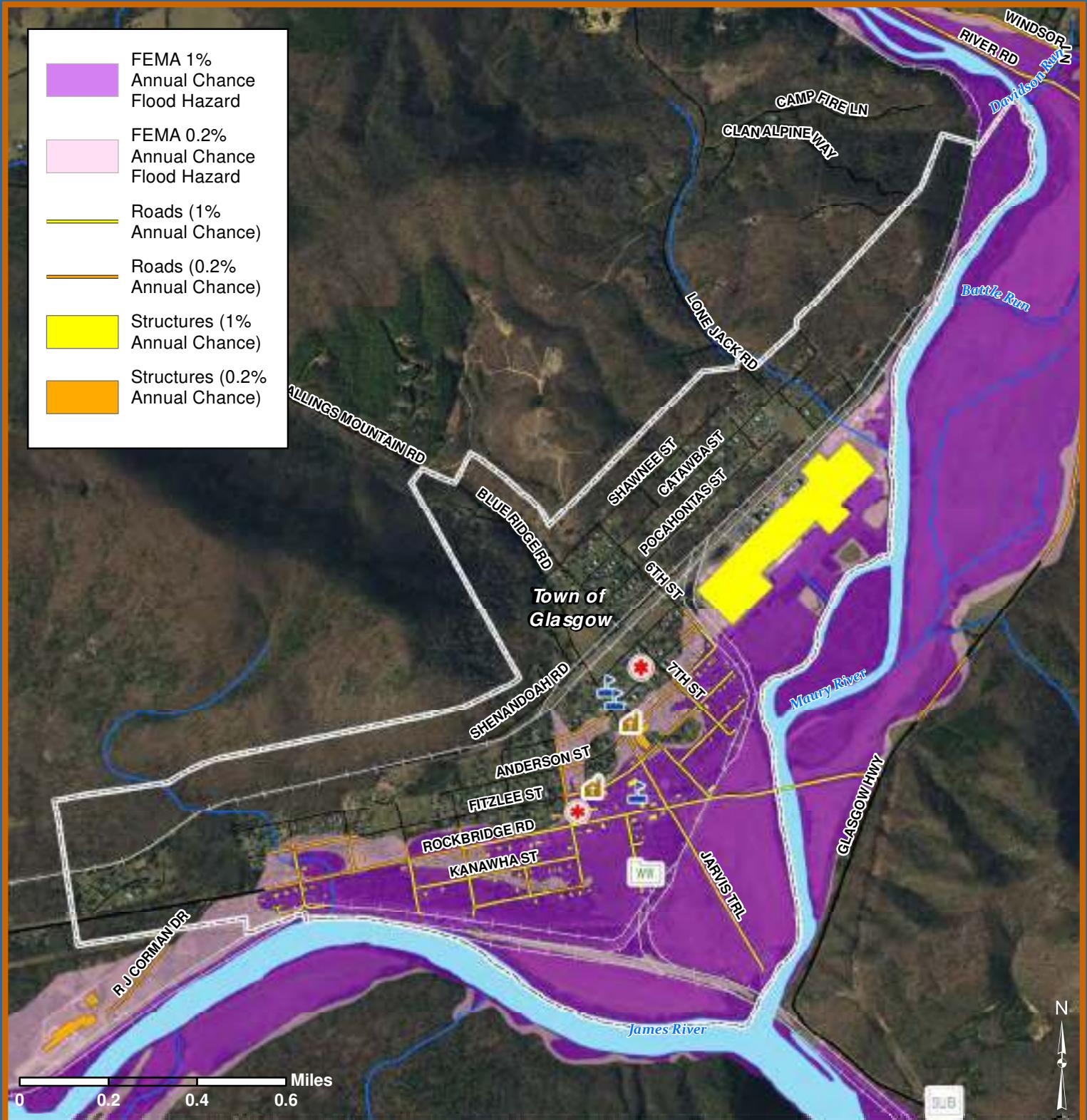
- |            |          |                 |
|------------|----------|-----------------|
| CHURCH     | INDUSTRY | WATER TREATMENT |
| GOVERNMENT | RETAIL   | WELL            |
|            | SCHOOL   |                 |

**Critical Facilities and FEMA Floodplains - Town of Elkton**

Map prepared and produced by Central Shenandoah PDC.  
Map to be used for planning purposes only.  
Data Source(s): CSPDC, FEMA, Commonwealth of VA,  
Town of Elkton  
October 17, 2019

**Critical Facility**

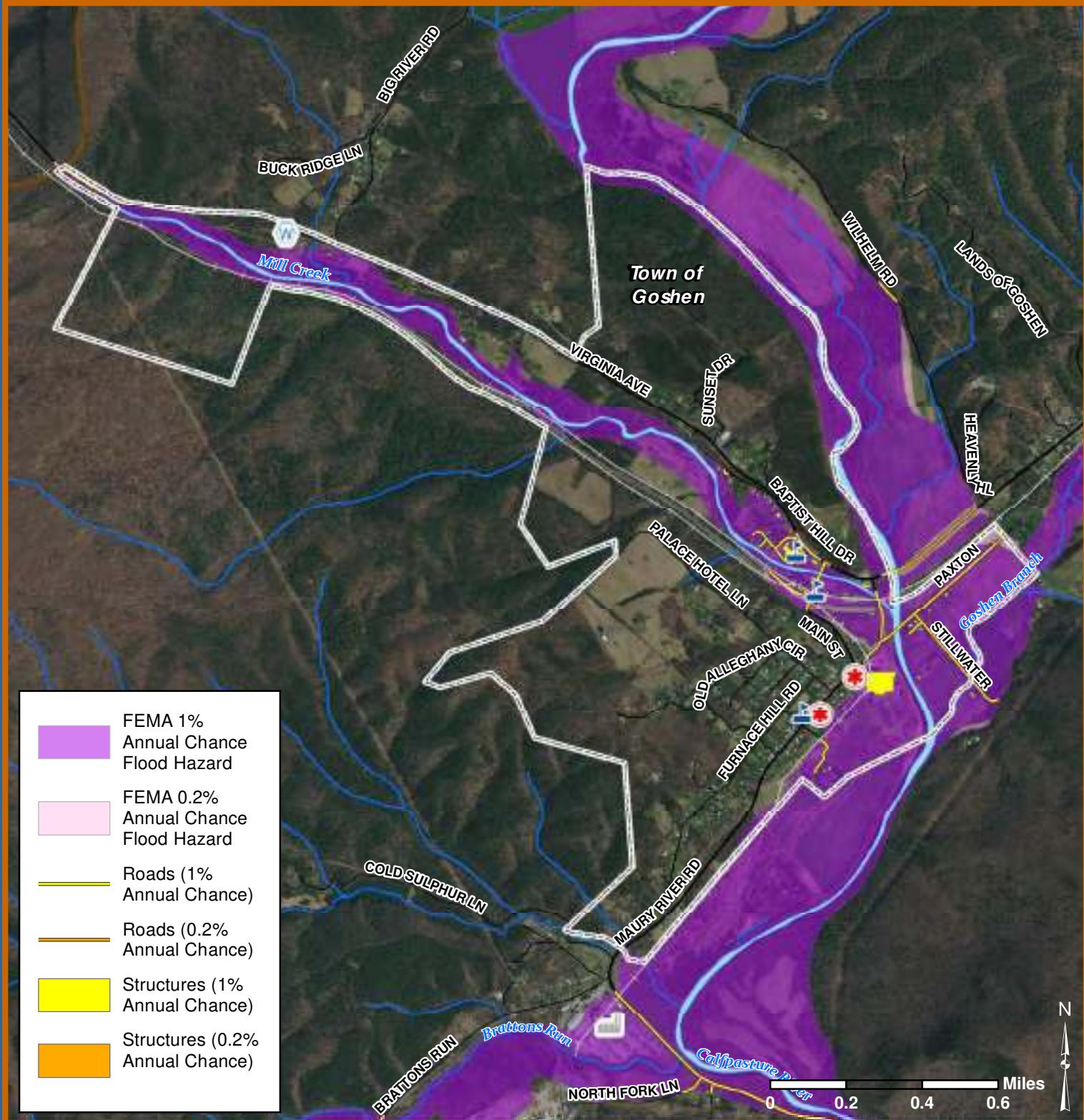
- |                |                    |               |                      |
|----------------|--------------------|---------------|----------------------|
| CHILD DAY CARE | EMERGENCY RESPONSE | SCHOOL        | WASTEWATER TREATMENT |
| CHURCH         | GOVERNMENT         | SENIOR LIVING | WELL                 |
|                | POWER UTILITY      |               |                      |

**Critical Facilities and FEMA Floodplains - Town of Glasgow**

Map prepared and produced by Central Shenandoah PDC.  
Map to be used for planning purposes only.  
Data Source(s): CSPDC, FEMA, Commonwealth of VA,  
Town of Glasgow  
Sept. 18, 2019

**Critical Facility**

- |  |                    |  |                      |
|--|--------------------|--|----------------------|
|  | CHURCH             |  | POWER UTILITY        |
|  | EMERGENCY RESPONSE |  | WASTEWATER TREATMENT |
|  | GOVERNMENT         |  |                      |

**Critical Facilities and FEMA Floodplains - Town of Goshen**

Map prepared and produced by Central Shenandoah PDC.  
Map to be used for planning purposes only.  
Data Source(s): CSPDC, FEMA, Commonwealth of VA,  
Town of Goshen  
Sept. 18, 2019

**Critical Facility**

EMERGENCY RESPONSE



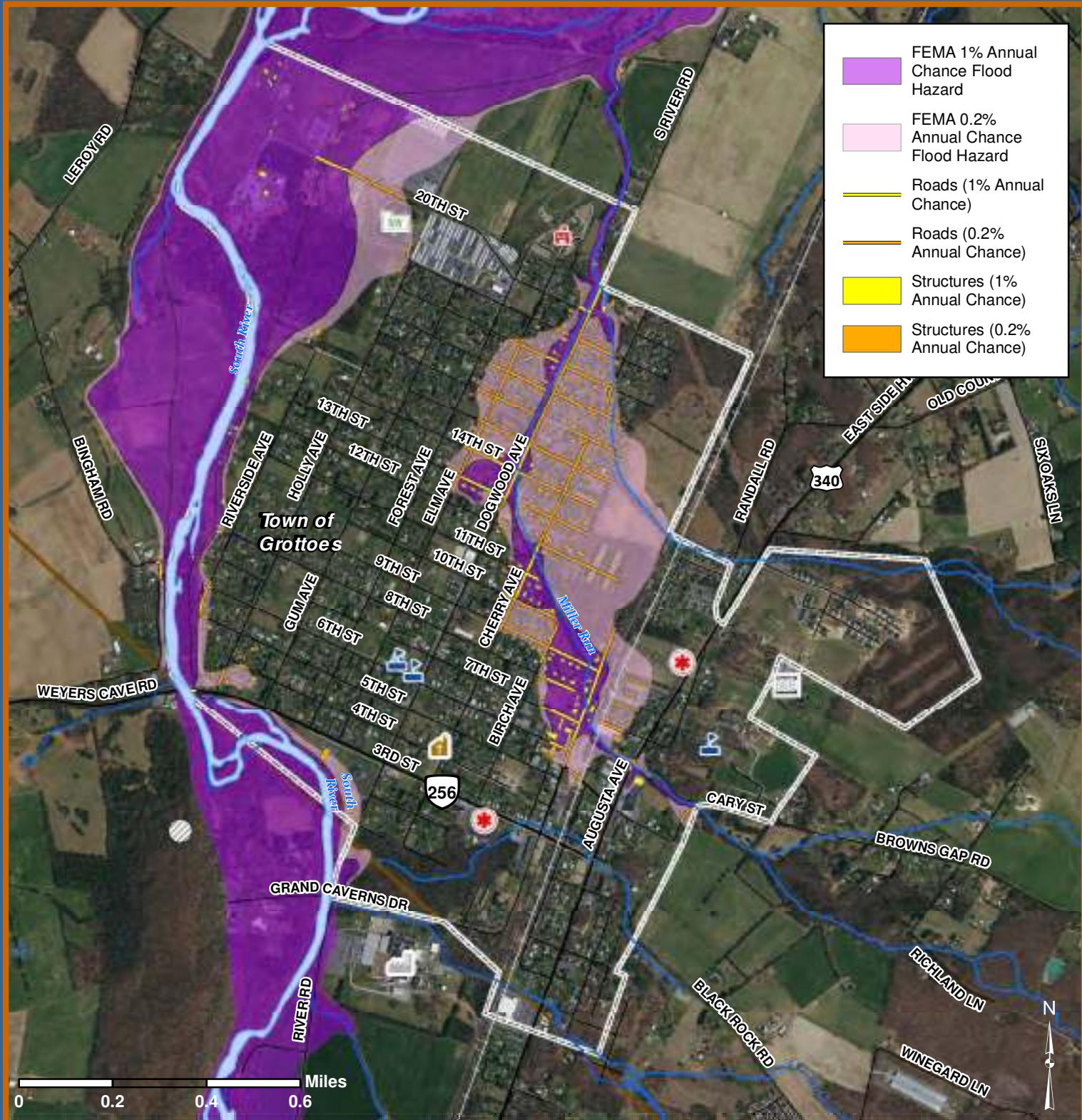
INDUSTRY



GOVERNMENT



WATER TREATMENT

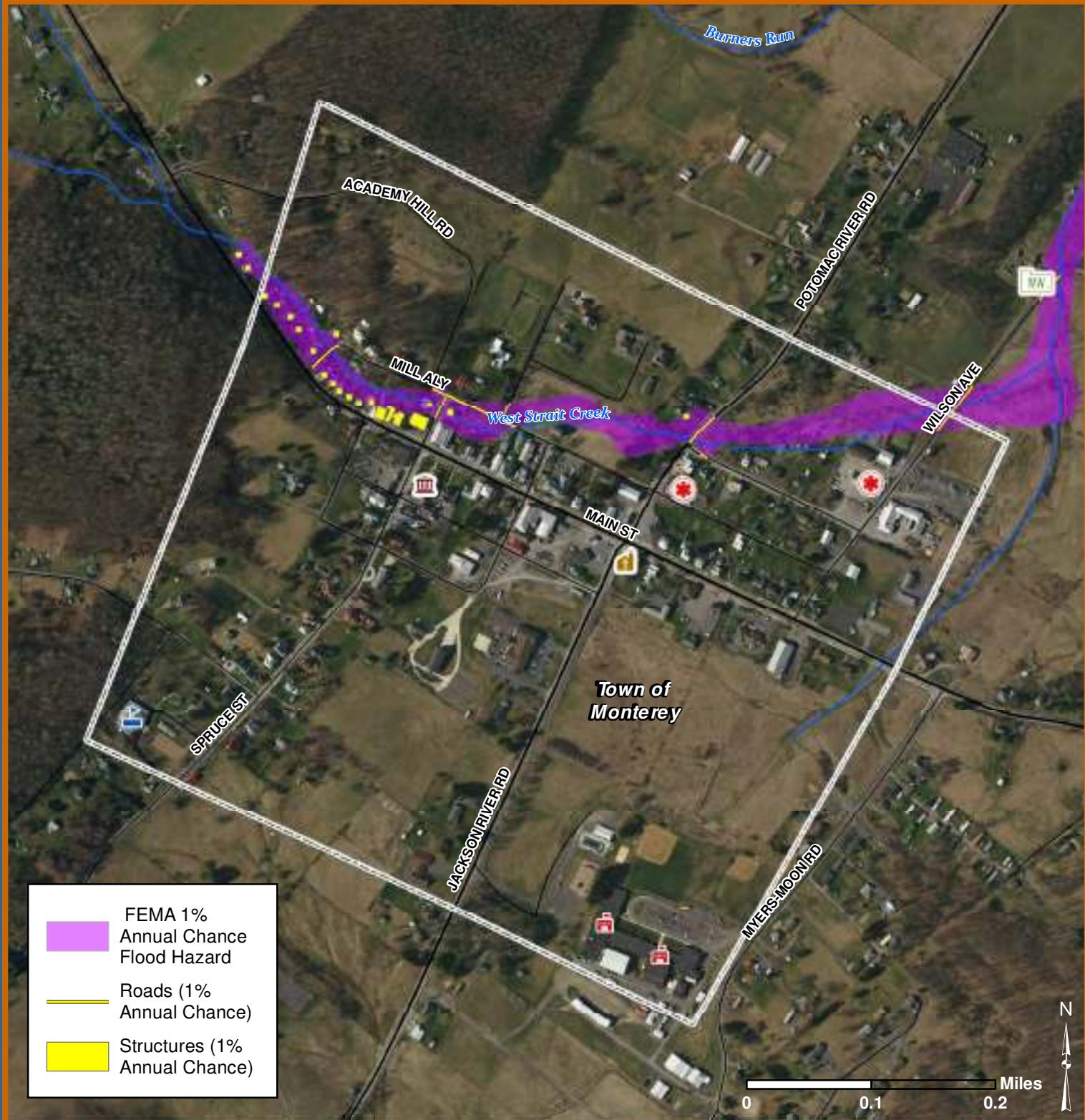
**Critical Facilities and FEMA Floodplains - Town of Grottoes**

Map prepared and produced by Central Shenandoah PDC.  
Map to be used for planning purposes only.  
Data Source(s): CSPDC, FEMA, Commonwealth of VA,  
Town of Grottoes  
October 17, 2019

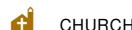
**Critical Facility**

- CHURCH
- EMERGENCY RESPONSE

- GOVERNMENT
- POWER UTILITY
- WASTEWATER TREATMENT
- INDUSTRY
- SCHOOL
- WATER TANK

**Critical Facilities and FEMA Floodplains - Town of Monterey**

Map prepared and produced by Central Shenandoah PDC.  
Map to be used for planning purposes only.  
Data Source(s): CSPDC, FEMA, Commonwealth of VA,  
Town of Monterey  
Sept. 18, 2019

**Critical Facility**

CHURCH



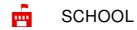
COURTHOUSE



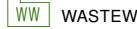
EMERGENCY RESPONSE



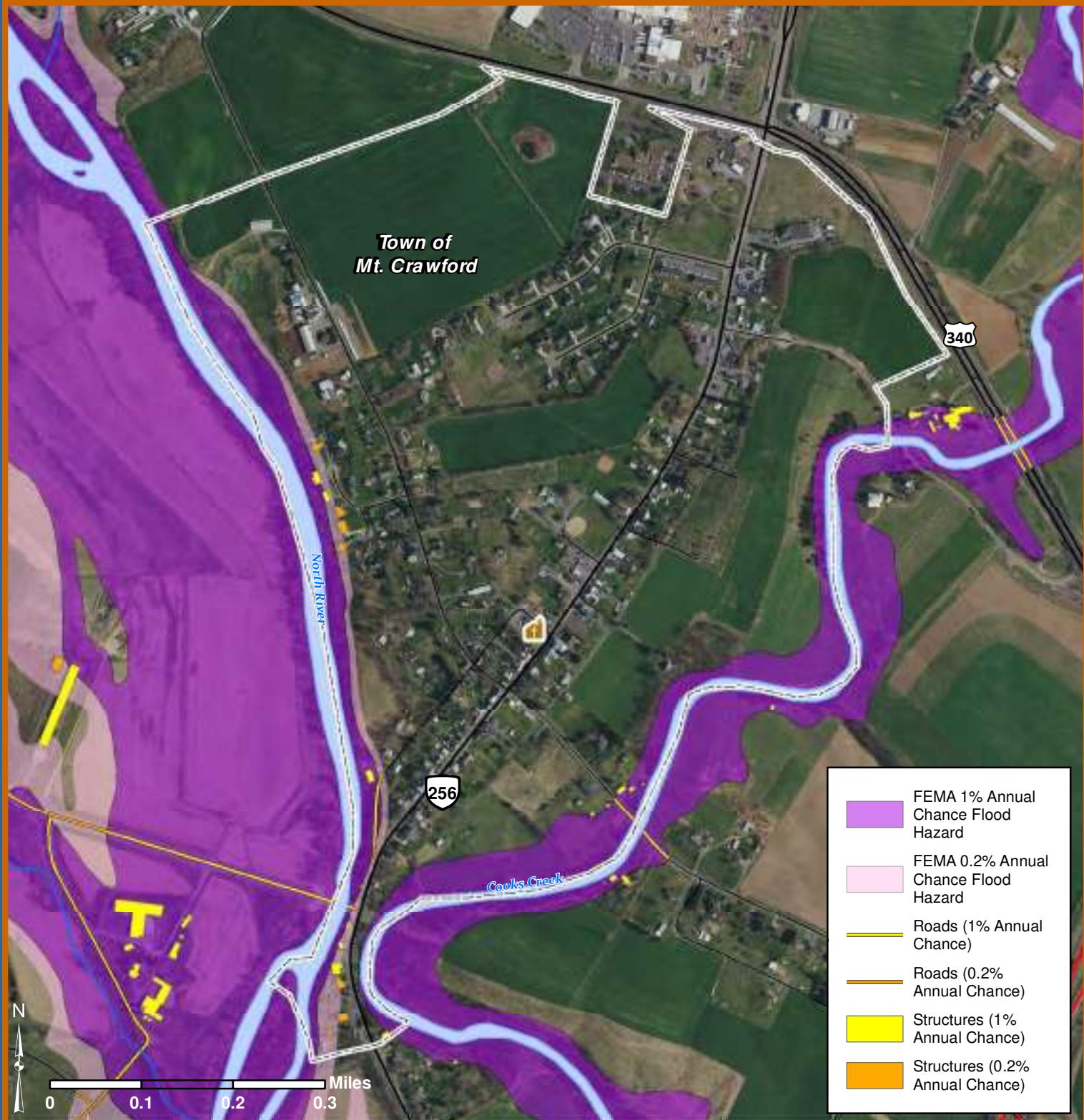
GOVERNMENT



SCHOOL



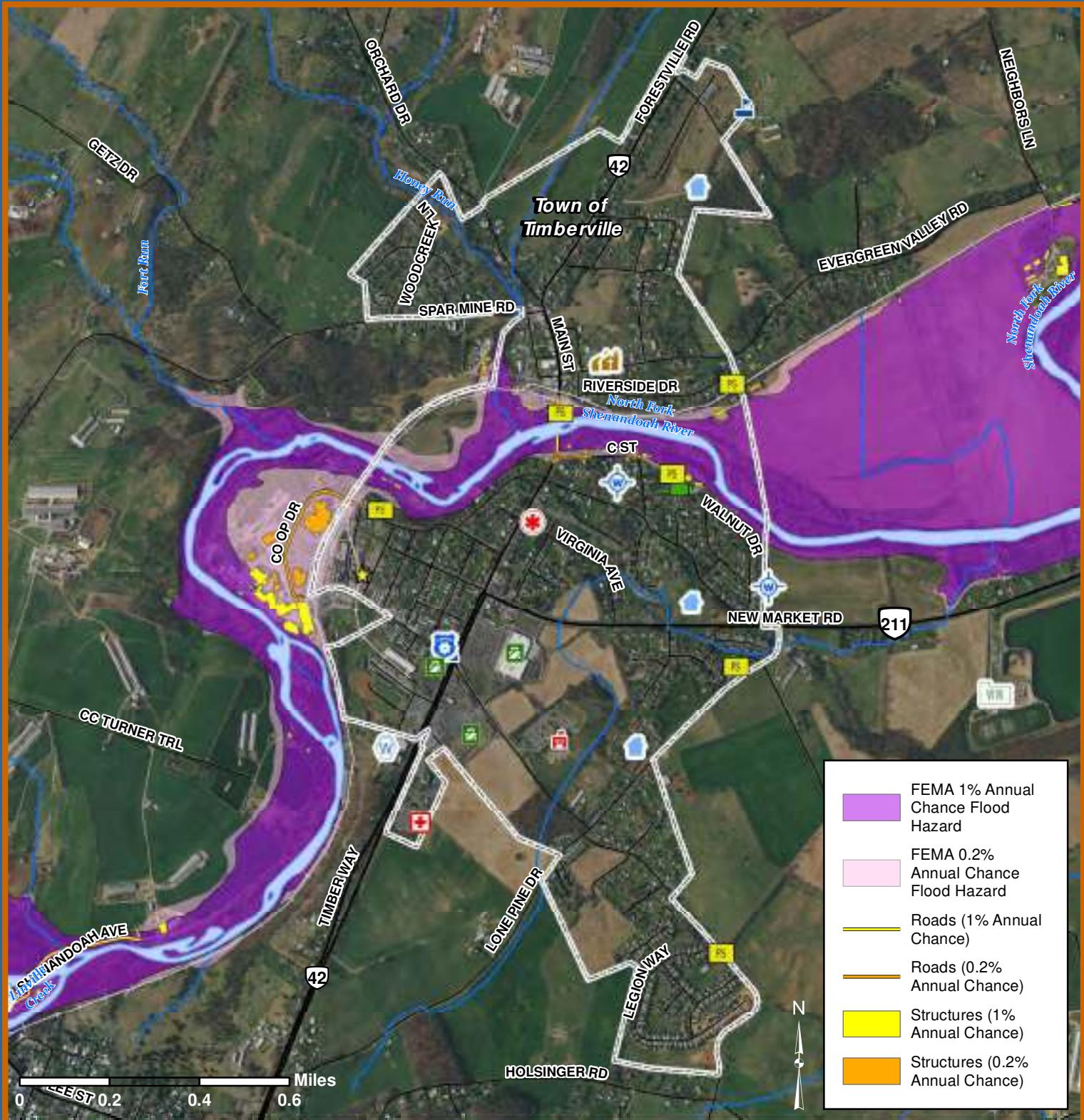
WASTEWATER TREATMENT

**Critical Facilities in FEMA Floodplains - Town of Mt. Crawford**

Map prepared and produced by Central Shenandoah PDC.  
Map to be used for planning purposes only.  
Data Source(s): CSPDC, FEMA, Commonwealth of VA,  
Town of Mt. Crawford  
Sept. 18, 2019

**Critical Facility**

CHURCH

**Critical Facilities and FEMA Floodplains - Town of Timberville**

Map prepared and produced by Central Shenandoah PDC.  
Map to be used for planning purposes only.  
Data Source(s): CSPDC, FEMA, Commonwealth of VA,  
Town of Timberville  
Sept. 18, 2019

**Critical Facility**

CHURCH	MEDICAL FACILITY	SCHOOL	WATER TREATMENT
COMMUNITY CENTER	POLICE DEPT	SENIOR LIVING	WELL
EMERGENCY RESPONSE	PUBLIC WORKS	WASTEWATER PUMP STATION	WASTEWATER TREATMENT
GOVERNMENT	RETAIL		

• Critical Facility

**Relative Snow Risk**

Low Potential

Medium Potential

High Potential

**CSPDC Critical Facilities and  
Relative Snow Risk**

West Virginia

Highland

Bath

Rockbridge

Lexington

Buena Vista

Rockingham

Harrisonburg

Augusta

Staunton

Waynesboro

Alleghany

Covington

Craig

Botetourt

Bedford

Salem

Roanoke

Franklin

Lynchburg

Campbell

Appomattox

Cumberland

Prince Edward

N

0

8.5

17

Miles

Pittsylvania

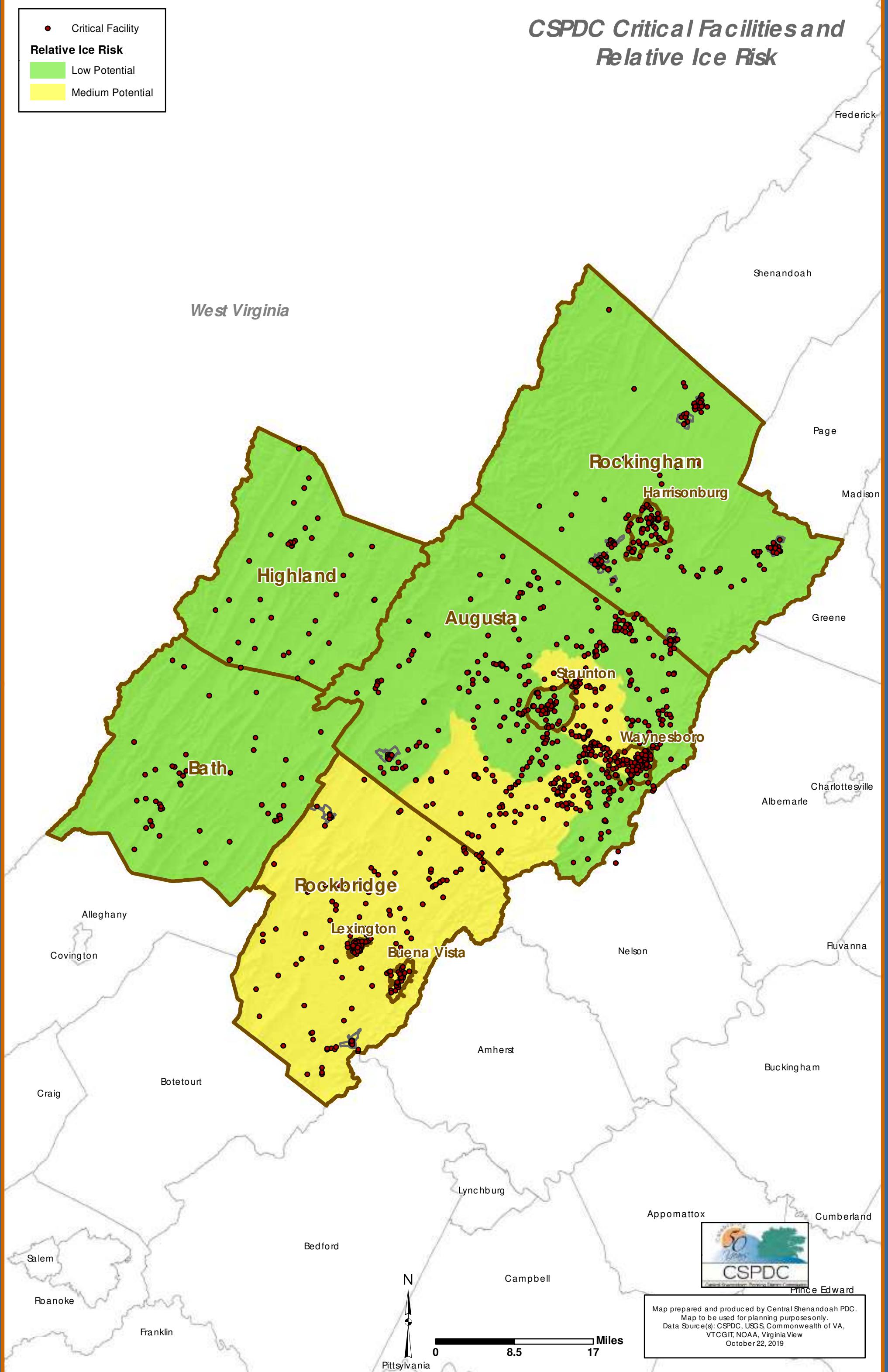


Map prepared and produced by Central Shenandoah PDC.  
Map to be used for planning purposes only.  
Data Source(s): CSPDC, USGS, Commonwealth of VA,  
VTCGIT, NOAA, Virginia View  
October 22, 2019

- Critical Facility
- Relative Ice Risk
  - Low Potential
  - Medium Potential

## CSPDC Critical Facilities and Relative Ice Risk

West Virginia



## Appendix E - Repetitive Losses

## Appendix E. Repetitive Losses in the CSPDC region

Community Name	NFIP Community Number	Number of Repetitive Loss Properties
AUGUSTA COUNTY	510013	13
BATH COUNTY	510196	2
BRIDGEWATER, TOWN OF	510134	2
BROADWAY, TOWN OF	510135	2
BUENA VISTA, CITY OF	510027	39
CRAIGSVILLE, TOWN OF	510014	1
DAYTON, TOWN OF	510136	0
ELKTON, TOWN OF	510137	1
GLASGOW, TOWN OF	515526	11
GOSHEN, TOWN OF	510217	3
GROTTIES, TOWN OF	510138	0
HARRISONBURG, CITY OF	510076	2
HIGHLAND COUNTY	510311	0
LEXINGTON, CITY OF	510089	4
MONTEREY, TOWN OF	510379	0
MT. CRAWFORD, TOWN OF	510224	0
ROCKBRIDGE COUNTY	510205	24
ROCKINGHAM COUNTY	510133	18
STAUNTON, CITY OF	510155	1
TIMBERVILLE, TOWN OF	510139	0
WAYNESBORO, CITY OF	515532	52
<b>TOTAL FOR CSPDC REGION:</b>		<b>175</b>

Community Name	NFIP Community Number	Number of Severe Repetitive Loss Properties
AUGUSTA COUNTY	510013	0
BATH COUNTY	510196	0
BRIDGEWATER, TOWN OF	510134	0
BROADWAY, TOWN OF	510135	0
BUENA VISTA, CITY OF	510027	0
CRAIGSVILLE, TOWN OF	510014	1
DAYTON, TOWN OF	510136	0
ELKTON, TOWN OF	510137	0
GLASGOW, TOWN OF	515526	0
GOSHEN, TOWN OF	510217	0
GROTTIES, TOWN OF	510138	0
HARRISONBURG, CITY OF	510076	0
HIGHLAND COUNTY	510311	0
LEXINGTON, CITY OF	510089	0
MONTEREY, TOWN OF	510379	0
MT. CRAWFORD, TOWN OF	510224	0
ROCKBRIDGE COUNTY	510205	1
ROCKINGHAM COUNTY	510133	0
STAUNTON, CITY OF	510155	0
TIMBERVILLE, TOWN OF	510139	0
WAYNESBORO, CITY OF	515532	4
<b>TOTAL FOR CSPDC REGION:</b>		<b>6</b>

## Appendix F - Drought History











Month	Year	Augusta	Bath	Highland	Rockbridge	Rockingham	Lexington	Buena Vista	Waynesboro	Staunton	Harrisonburg
February	2017	D1				D1			D1		
March	2017	D1	D1	D1	D1	D1	D1	D1	D1	D1	D1
April	2017	D1	D1	D1	D1	D1	D1	D1	D1	D1	D1
May	2017	D1	D1	D1		D1			D1	D1	D1
June	2017										
July	2017										
August	2017										
September	2017										
October	2017										
November	2017										
December	2017	D1			D1	D1	D1	D1	D1	D1	D1
January	2018	D1			D1	D1	D1	D1	D1	D1	D1
February	2018	D1			D1	D1		D1	D1	D1	D1
March	2018										
April	2018										
May	2018										
June	2018										
July	2018										
August	2018										
September	2018										
October	2018										
November	2018										
December	2018										
January	2019										
February	2019										
March	2019										
April	2019										
May	2019										
June	2019										
July	2019										
August	2019										
September	2019	D1	D1		D1		D1	D1	D1		
October	2019	D1	D1, D2		D1, D2	D1	D1	D1, D2	D1		
November	2019										
December	2019										

Source: National Drought Mitigation Center (NDMC), U.S. Department of Agriculture (USDA), and the National Oceanic and Atmospheric Association (NOAA); U.S. Drought Monitor Statistics, 2000 to 2019.

Note: Data was only compiled for drought intensities of D1 Moderate Drought through D4 Exceptional Drought. Data was not included on this chart for D0 Abnormally Dry Conditions.

## **Appendix G – HAZUS Reports**



# Hazus: Flood Global Risk Report

**Region Name:** CSPDC

**Flood Scenario:** 100

**Print Date:** Monday, August 19, 2019

***Disclaimer:***

*This version of Hazus utilizes 2010 Census Data.*

*Totals only reflect data for those census tracts/blocks included in the user's study region.*

*The estimates of social and economic impacts contained in this report were produced using Hazus loss estimation methodology software which is based on current scientific and engineering knowledge. There are uncertainties inherent in any loss estimation technique. Therefore, there may be significant differences between the modeled results contained in this report and the actual social and economic losses following a specific Flood. These results can be improved by using enhanced inventory data and flood hazard information.*



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**RiskMAP**  
Increasing Resilience Together



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<b>Building Inventory</b>	
<b>General Building Stock</b>	4
<b>Essential Facility Inventory</b>	5
<b>Flood Scenario Parameters</b>	6
<b>Building Damage</b>	
<b>General Building Stock</b>	7
<b>Essential Facilities Damage</b>	9
<b>Induced Flood Damage</b>	10
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<b>Social Impact</b>	10
<b>Shelter Requirements</b>	
<b>Economic Loss</b>	12
<b>Building-Related Losses</b>	
<b>Appendix A: County Listing for the Region</b>	15
<b>Appendix B: Regional Population and Building Value Data</b>	16



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## General Description of the Region

Hazus is a regional multi-hazard loss estimation model that was developed by the Federal Emergency Management Agency (FEMA) and the National Institute of Building Sciences (NIBS). The primary purpose of Hazus is to provide a methodology and software application to develop multi-hazard losses at a regional scale. These loss estimates would be used primarily by local, state and regional officials to plan and stimulate efforts to reduce risks from multi-hazards and to prepare for emergency response and recovery.

- Virginia

Note:

Appendix A contains a complete listing of the counties contained in the region.

The geographical size of the region is approximately 3,438 square miles and contains 17,149 census blocks. The region contains over 111 thousand households and has a total population of 286,781 people (2010 Census Bureau data). The distribution of population by State and County for the study region is provided in Appendix B.

There are an estimated 118,565 buildings in the region with a total building replacement value (excluding contents) of 31,788 million dollars. Approximately 92.00% of the buildings (and 78.42% of the building value) are associated with residential housing.



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## Building Inventory

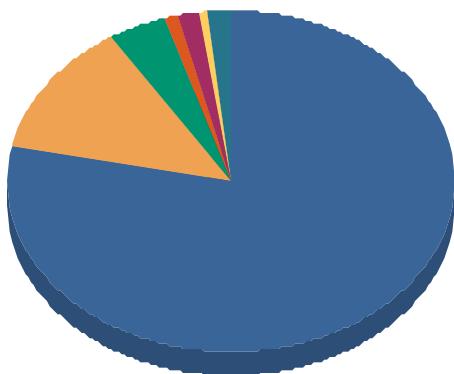
### General Building Stock

Hazus estimates that there are 118,565 buildings in the region which have an aggregate total replacement value of 31,788 million dollars. Table 1 and Table 2 present the relative distribution of the value with respect to the general occupancies by Study Region and Scenario respectively. Appendix B provides a general distribution of the building value by State and County.

**Table 1**  
**Building Exposure by Occupancy Type for the Study Region**

Occupancy	Exposure (\$1000)	Percent of Total
Residential	24,927,457	78.4%
Commercial	4,053,304	12.8%
Industrial	1,273,474	4.0%
Agricultural	254,378	0.8%
Religion	558,559	1.8%
Government	174,125	0.5%
Education	546,526	1.7%
<b>Total</b>	<b>31,787,823</b>	<b>100%</b>

**Building Exposure by Occupancy Type for the Study Region  
(\$1000's)**



Residential	\$24,927,457
Commercial	\$4,053,304
Industrial	\$1,273,474
Agricultural	\$254,378
Religion	\$558,559
Government	\$174,125
Education	\$546,526
Total:	\$31,787,823



**FEMA**



**Table 2**  
**Building Exposure by Occupancy Type for the Scenario**

Occupancy	Exposure (\$1000)	Percent of Total
Residential	3,810,435	75.9%
Commercial	658,005	13.1%
Industrial	329,164	6.6%
Agricultural	58,172	1.2%
Religion	86,295	1.7%
Government	28,178	0.6%
Education	50,813	1.0%
<b>Total</b>	<b>5,021,062</b>	<b>100%</b>

Building Exposure by Occupancy Type for the Scenario (\$1000's)



### Essential Facility Inventory

For essential facilities, there are 7 hospitals in the region with a total bed capacity of 543 beds. There are 144 schools, 52 fire stations, 28 police stations and 9 emergency operation centers.



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**Risk MAP**  
Increasing Resilience Together

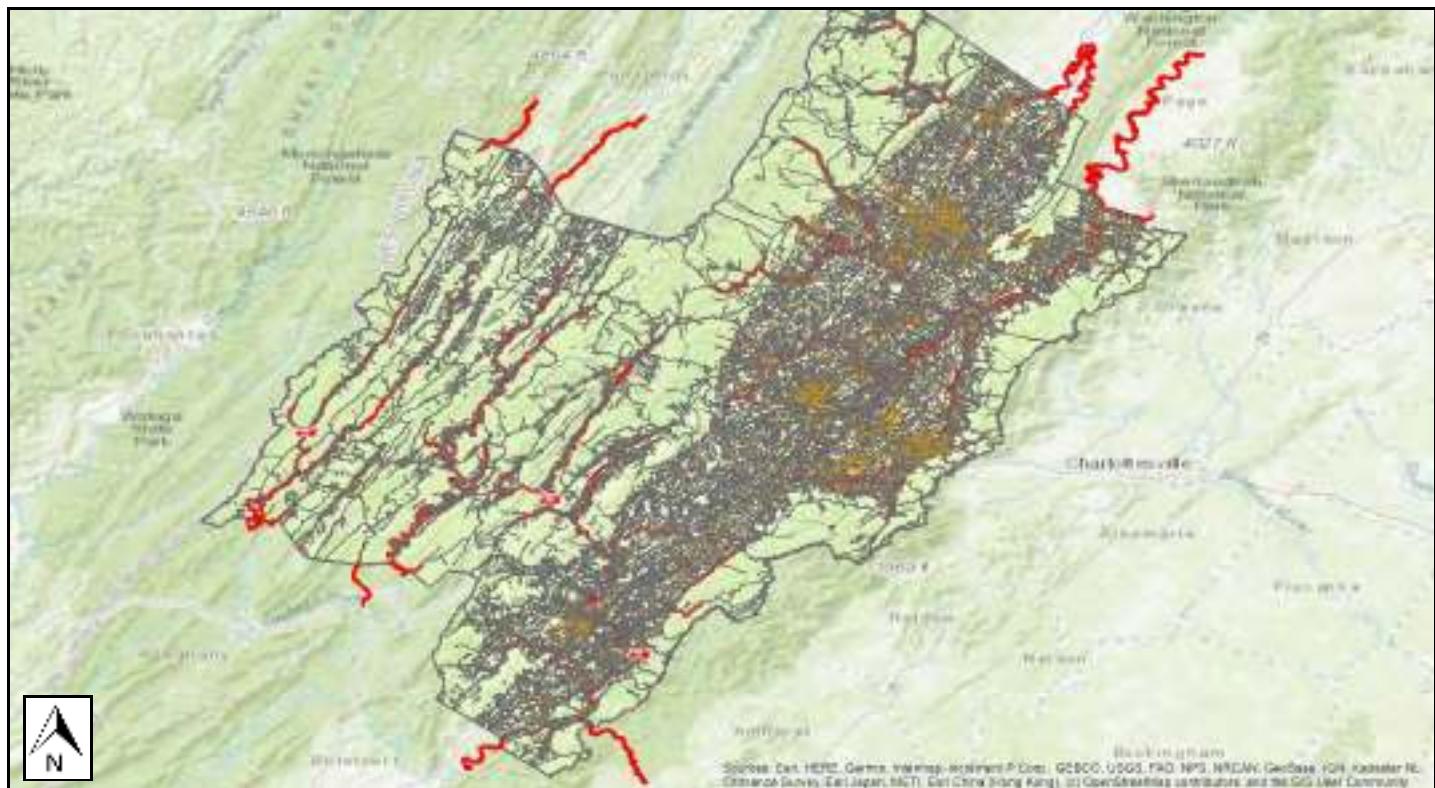
## Flood Scenario Parameters

Hazus used the following set of information to define the flood parameters for the flood loss estimate provided in this report.

<b>Study Region Name:</b>	CSPDC
<b>Scenario Name:</b>	100
<b>Return Period Analyzed:</b>	100
<b>Analysis Options Analyzed:</b>	No What-Ifs

### Study Region Overview Map

Illustrating scenario flood extent, as well as exposed essential facilities and total exposure



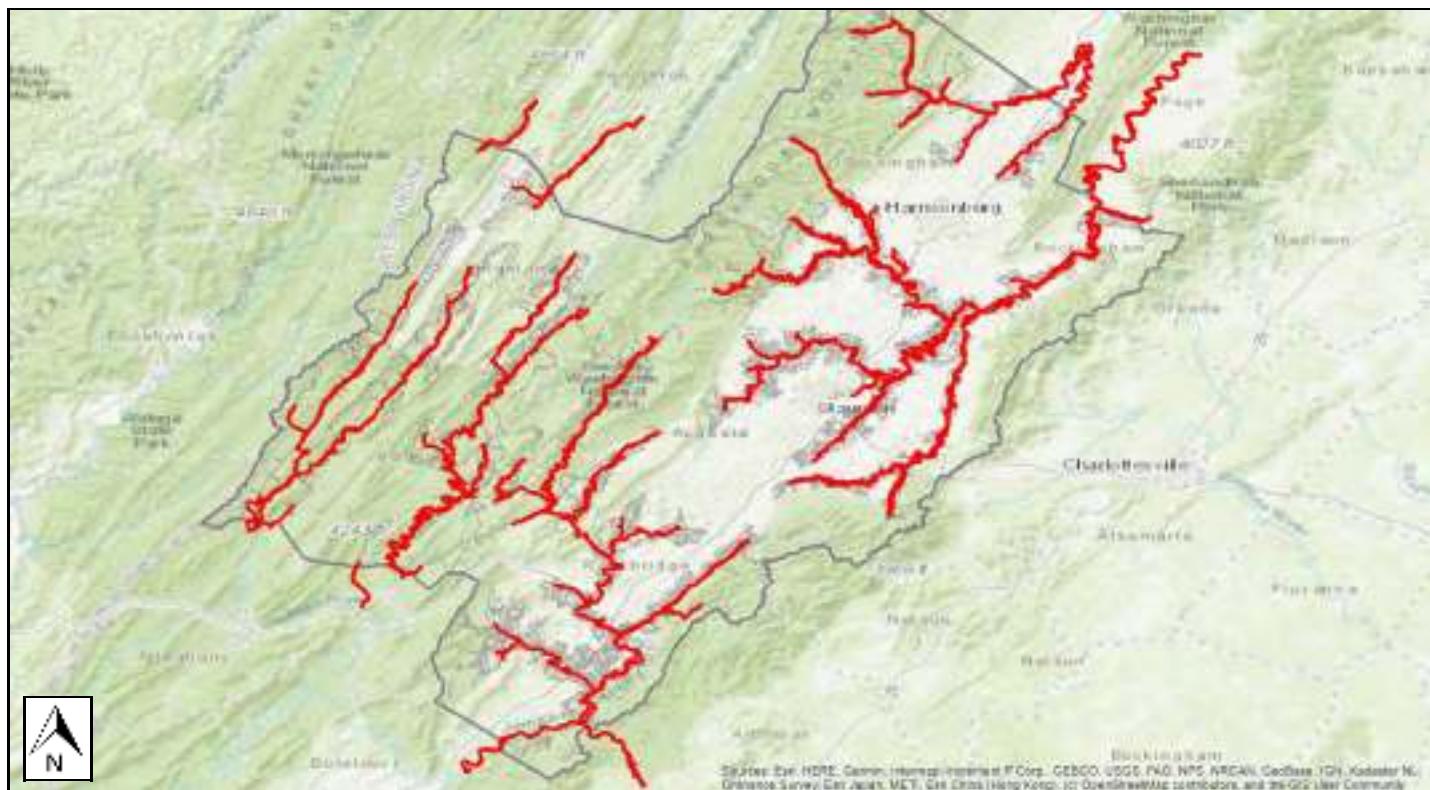
**FEMA**

## Building Damage

### General Building Stock Damage

Hazus estimates that about 486 buildings will be at least moderately damaged. This is over 55% of the total number of buildings in the scenario. There are an estimated 146 buildings that will be completely destroyed. The definition of the 'damage states' is provided in the Hazus Flood Technical Manual. Table 3 below summarizes the expected damage by general occupancy for the buildings in the region. Table 4 summarizes the expected damage by general building type.

**Total Economic Loss (1 dot = \$300K) Overview Map**

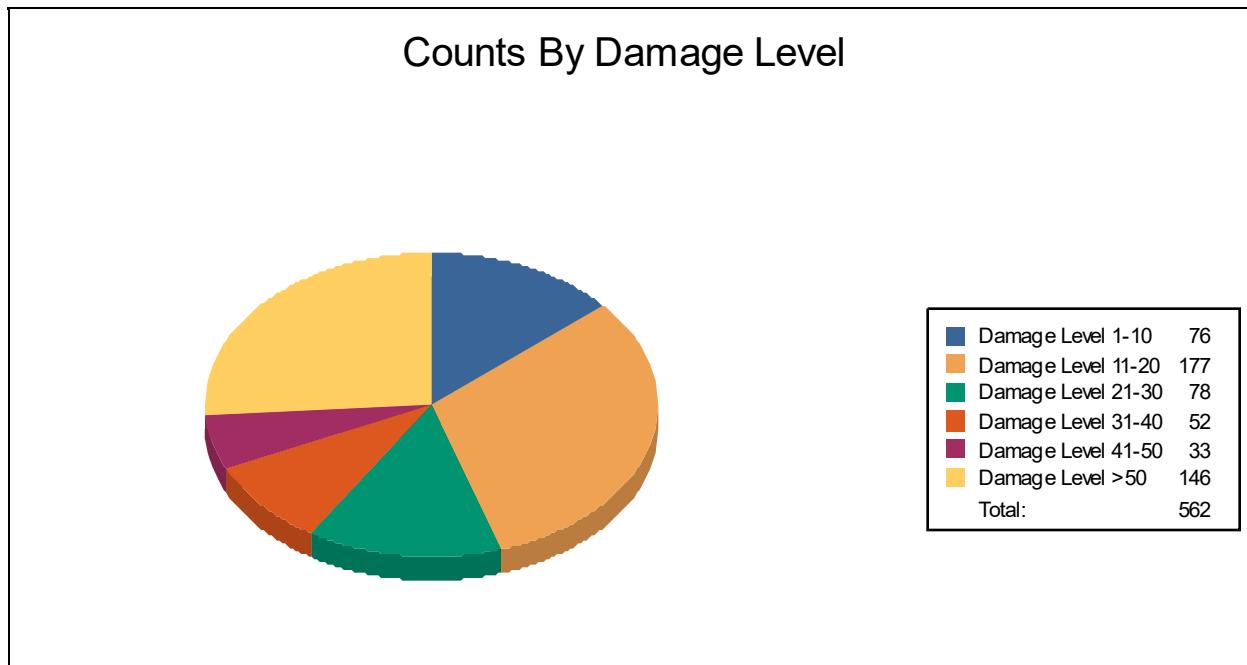


**FEMA**



Table 3: Expected Building Damage by Occupancy

Occupancy	1-10		11-20		21-30		31-40		41-50		>50	
	Count	(%)	Count	(%)	Count	(%)	Count	(%)	Count	(%)	Count	(%)
Agriculture	0	0	0	0	0	0	0	0	0	0	0	0
Commercial	9	26	14	40	7	20	2	6	1	3	2	6
Education	0	0	0	0	0	0	0	0	0	0	0	0
Government	0	0	1	50	0	0	1	50	0	0	0	0
Industrial	0	0	3	43	0	0	1	14	2	29	1	14
Religion	0	0	6	100	0	0	0	0	0	0	0	0
Residential	67	13	153	30	71	14	48	9	30	6	143	28
<b>Total</b>	<b>76</b>		<b>177</b>		<b>78</b>		<b>52</b>		<b>33</b>		<b>146</b>	



FEMA



**Table 4: Expected Building Damage by Building Type**

Building Type	1-10		11-20		21-30		31-40		41-50		>50	
	Count	(%)										
Concrete	0	0	0	0	0	0	0	0	0	0	0	0
Manuf Housing	0	0	0	0	0	0	0	0	0	0	4	100
Masonry	15	16	30	33	12	13	8	9	4	4	23	25
Steel	5	17	12	41	6	21	3	10	1	3	2	7
Wood	60	13	138	29	66	14	46	10	30	6	131	28



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## Essential Facility Damage

Before the flood analyzed in this scenario, the region had 543 hospital beds available for use. On the day of the scenario flood event, the model estimates that 543 hospital beds are available in the region.

**Table 5: Expected Damage to Essential Facilities**

Classification	Total	# Facilities		
		At Least Moderate	At Least Substantial	Loss of Use
Emergency Operation Centers	9	0	0	0
Fire Stations	52	3	0	3
Hospitals	7	0	0	0
Police Stations	28	1	0	1
Schools	144	0	0	0

If this report displays all zeros or is blank, two possibilities can explain this.

- (1) None of your facilities were flooded. This can be checked by mapping the inventory data on the depth grid.
- (2) The analysis was not run. This can be tested by checking the run box on the Analysis Menu and seeing if a message box asks you to replace the existing results.



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## Induced Flood Damage

### Debris Generation

Hazus estimates the amount of debris that will be generated by the flood. The model breaks debris into three general categories: 1) Finishes (dry wall, insulation, etc.), 2) Structural (wood, brick, etc.) and 3) Foundations (concrete slab, concrete block, rebar, etc.). This distinction is made because of the different types of material handling equipment required to handle the debris.

**Analysis has not been performed for this Scenario.**

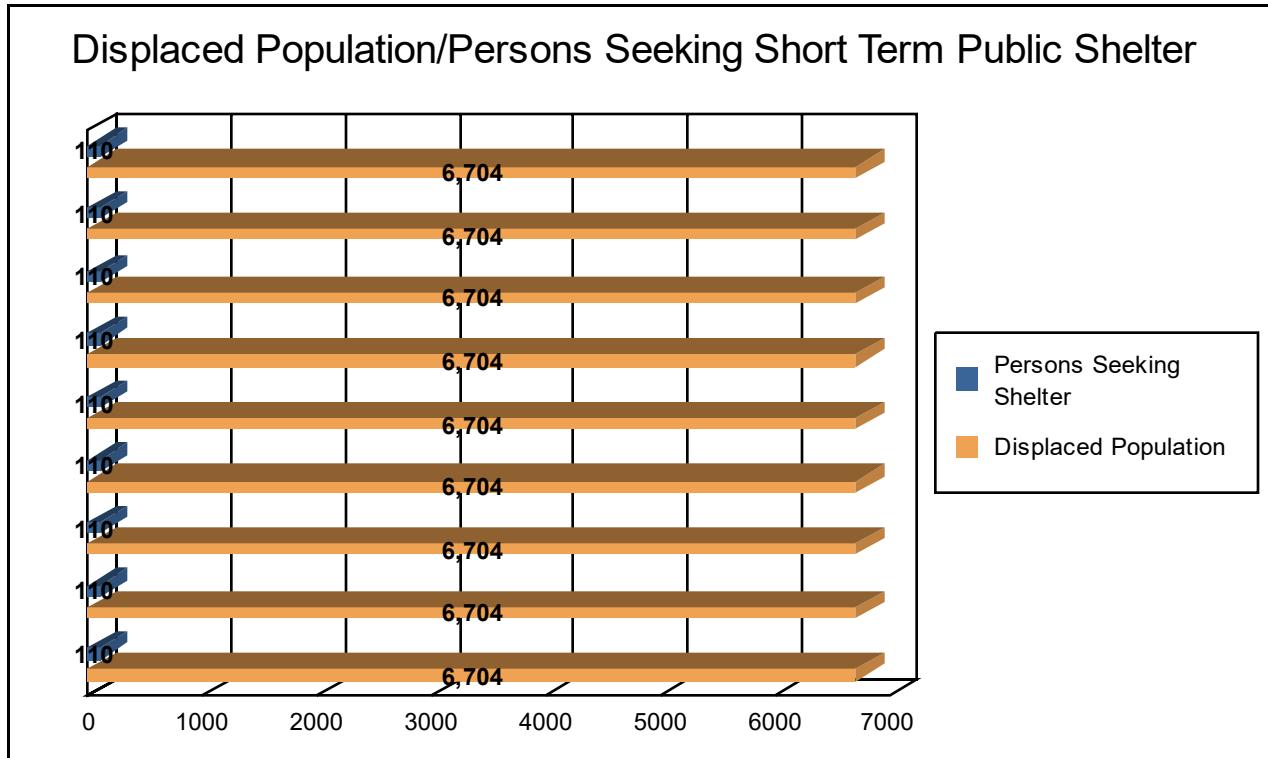


**FEMA**

## Social Impact

### Shelter Requirements

Hazus estimates the number of households that are expected to be displaced from their homes due to the flood and the associated potential evacuation. Hazus also estimates those displaced people that will require accommodations in temporary public shelters. The model estimates 2,235 households (or 6,704 of people) will be displaced due to the flood. Displacement includes households evacuated from within or very near to the inundated area. Of these, 110 people (out of a total population of 286,781) will seek temporary shelter in public shelters.



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## Economic Loss

The total economic loss estimated for the flood is 1,003.58 million dollars, which represents 19.99 % of the total replacement value of the scenario buildings.

### Building-Related Losses

The building losses are broken into two categories: direct building losses and business interruption losses. The direct building losses are the estimated costs to repair or replace the damage caused to the building and its contents. The business interruption losses are the losses associated with inability to operate a business because of the damage sustained during the flood. Business interruption losses also include the

The total building-related losses were 606.05 million dollars. 40% of the estimated losses were related to the business interruption of the region. The residential occupancies made up 33.62% of the total loss. Table 6 below provides a summary of the losses associated with the building damage.



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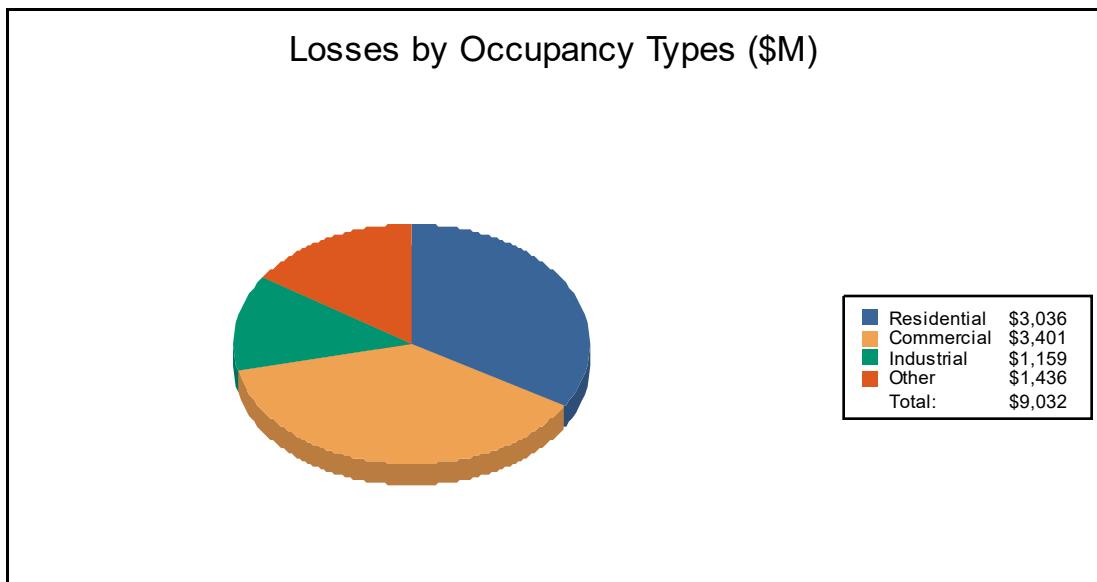
**Risk MAP**  
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**Table 6: Building-Related Economic Loss Estimates**

(Millions of dollars)

Category	Area	Residential	Commercial	Industrial	Others	Total
<b>Building Loss</b>						
	Building	1,653.99	396.05	295.10	67.04	2,412.19
	Content	842.51	1,023.56	670.28	328.27	2,864.62
	Inventory	0.00	36.97	136.64	4.02	177.63
	<b>Subtotal</b>	<b>2,496.50</b>	<b>1,456.59</b>	<b>1,102.02</b>	<b>399.33</b>	<b>5,454.44</b>
<b>Business Interruption</b>						
	Income	13.03	737.01	14.14	105.98	870.16
	Relocation	370.14	225.90	15.80	46.48	658.32
	Rental Income	125.67	166.58	3.96	5.74	301.95
	Wage	31.02	815.08	22.91	878.29	1,747.31
	<b>Subtotal</b>	<b>539.87</b>	<b>1,944.57</b>	<b>56.82</b>	<b>1,036.49</b>	<b>3,577.73</b>
ALL	<b>Total</b>	<b>3,036.37</b>	<b>3,401.15</b>	<b>1,158.84</b>	<b>1,435.82</b>	<b>9,032.18</b>



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## Appendix A: County Listing for the Region

### Virginia

- Augusta
- Bath
- Highland
- Rockbridge
- Rockingham
- Buena Vista
- Harrisonburg
- Lexington
- Staunton
- Waynesboro



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## Appendix B: Regional Population and Building Value Data

	Building Value (thousands of dollars)			
	Population	Residential	Non-Residential	Total
<b>Virginia</b>				
Harrisonburg	48,914	3,460,375	1,630,540	5,090,915
Rockingham	76,314	6,609,137	1,260,787	7,869,924
Lexington	7,042	714,506	243,342	957,848
Highland	2,321	320,363	46,946	367,309
Staunton	23,746	2,264,098	782,529	3,046,627
Rockbridge	22,307	2,182,496	429,798	2,612,294
Augusta	73,750	6,296,301	1,337,630	7,633,931
Buena Vista	6,650	509,866	214,901	724,767
Bath	4,731	739,486	78,123	817,609
Waynesboro	21,006	1,830,829	835,770	2,666,599
<b>Total</b>	<b>286,781</b>	<b>24,927,457</b>	<b>6,860,366</b>	<b>31,787,823</b>
<b>Total Study Region</b>	<b>286,781</b>	<b>24,927,457</b>	<b>6,860,366</b>	<b>31,787,823</b>



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## Quick Assessment Report

**RiskMAP**  
Increasing Resilience Together

August 16, 2019

**Study Region :** CSPDC  
**Scenario :** 100  
**Return Period:** 100  
**Analysis Option:** 0

### Regional Statistics

<b>Area (Square Miles)</b>	3,438
<b>Number of Census Blocks</b>	17,149
<b>Number of Buildings</b>	
Residential	109,076
Total	118,565
<b>Number of People in the Region (x 1000)</b>	287
<b>Building Exposure (\$ Millions)</b>	
Residential	24,927
Total	31,788

### Scenario Results

#### Shelter Requirements

Displaced Population (# Households)	2,235
Short Term Shelter (# People)	110

#### Economic Loss

Residential Property (Capital Stock) Losses (\$ Millions)	0
Total Property (Capital Stock) Losses (\$ Millions)	0
Business Interruption (Income) Losses (\$ Millions)	0

#### **Disclaimer:**

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## Quick Assessment Report

RiskMAP  
Increasing Resilience Together

October 31, 2019

**Study Region :** Augusta  
**Scenario :** 100  
**Return Period:** 100  
**Analysis Option:** 0

### Regional Statistics

<b>Area (Square Miles)</b>	971
<b>Number of Census Blocks</b>	4,370
<b>Number of Buildings</b>	
Residential	29,645
Total	31,566
<b>Number of People in the Region (x 1000)</b>	74
<b>Building Exposure (\$ Millions)</b>	
Residential	6,296
Total	7,634

### Scenario Results

#### Shelter Requirements

Displaced Population (# Households)	702
Short Term Shelter (# People)	35

#### Economic Loss

Residential Property (Capital Stock) Losses (\$ Millions)	68
Total Property (Capital Stock) Losses (\$ Millions)	108
Business Interruption (Income) Losses (\$ Millions)	56

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## Quick Assessment Report

RiskMAP  
Increasing Resilience Together

November 1, 2019

**Study Region :** Bath  
**Scenario :** 100  
**Return Period:** 100  
**Analysis Option:** 0

### Regional Statistics

<b>Area (Square Miles)</b>	535
<b>Number of Census Blocks</b>	777
<b>Number of Buildings</b>	
Residential	3,262
Total	3,360
<b>Number of People in the Region (x 1000)</b>	5
<b>Building Exposure (\$ Millions)</b>	
Residential	739
Total	818

### Scenario Results

#### Shelter Requirements

Displaced Population (# Households)	91
Short Term Shelter (# People)	0

#### Economic Loss

Residential Property (Capital Stock) Losses (\$ Millions)	30
Total Property (Capital Stock) Losses (\$ Millions)	52
Business Interruption (Income) Losses (\$ Millions)	23

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## Quick Assessment Report

RiskMAP  
Increasing Resilience Together

October 29, 2019

**Study Region :** Bridgewater  
**Scenario :** 100  
**Return Period:** 100  
**Analysis Option:** 0

### Regional Statistics

<b>Area (Square Miles)</b>	2
<b>Number of Census Blocks</b>	99
<b>Number of Buildings</b>	
Residential	1,670
Total	1,825
<b>Number of People in the Region (x 1000)</b>	6
<b>Building Exposure (\$ Millions)</b>	
Residential	473
Total	586

### Scenario Results

#### Shelter Requirements

Displaced Population (# Households)	19
Short Term Shelter (# People)	0

#### Economic Loss

Residential Property (Capital Stock) Losses (\$ Millions)	2
Total Property (Capital Stock) Losses (\$ Millions)	2
Business Interruption (Income) Losses (\$ Millions)	1

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## Quick Assessment Report

RiskMAP  
Increasing Resilience Together

October 29, 2019

**Study Region :** Broadway  
**Scenario :** 100  
**Return Period:** 100  
**Analysis Option:** 0

### Regional Statistics

<b>Area (Square Miles)</b>	2
<b>Number of Census Blocks</b>	64
<b>Number of Buildings</b>	
Residential	1,359
Total	1,459
<b>Number of People in the Region (x 1000)</b>	4
<b>Building Exposure (\$ Millions)</b>	
Residential	311
Total	379

### Scenario Results

#### Shelter Requirements

Displaced Population (# Households)	23
Short Term Shelter (# People)	0

#### Economic Loss

Residential Property (Capital Stock) Losses (\$ Millions)	2
Total Property (Capital Stock) Losses (\$ Millions)	6
Business Interruption (Income) Losses (\$ Millions)	7

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## Quick Assessment Report

RiskMAP  
Increasing Resilience Together

November 7, 2019

**Study Region :** BuenaVista  
**Scenario :** 100  
**Return Period:** 100  
**Analysis Option:** 0

### Regional Statistics

<b>Area (Square Miles)</b>	7
<b>Number of Census Blocks</b>	551
<b>Number of Buildings</b>	
Residential	2,607
Total	2,897
<b>Number of People in the Region (x 1000)</b>	7
<b>Building Exposure (\$ Millions)</b>	
Residential	510
Total	725

### Scenario Results

#### Shelter Requirements

Displaced Population (# Households)	269
Short Term Shelter (# People)	13

#### Economic Loss

Residential Property (Capital Stock) Losses (\$ Millions)	23
Total Property (Capital Stock) Losses (\$ Millions)	46
Business Interruption (Income) Losses (\$ Millions)	44

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## Quick Assessment Report

**RiskMAP**  
Increasing Resilience Together

October 28, 2019

**Study Region :** Craigsville  
**Scenario :** 100  
**Return Period:** 100  
**Analysis Option:** 0

### Regional Statistics

<b>Area (Square Miles)</b>	2
<b>Number of Census Blocks</b>	49
<b>Number of Buildings</b>	
Residential	423
Total	436
<b>Number of People in the Region (x 1000)</b>	1
<b>Building Exposure (\$ Millions)</b>	
Residential	64
Total	70

### Scenario Results

#### Shelter Requirements

Displaced Population (# Households)	34
Short Term Shelter (# People)	0

#### Economic Loss

Residential Property (Capital Stock) Losses (\$ Millions)	3
Total Property (Capital Stock) Losses (\$ Millions)	3
Business Interruption (Income) Losses (\$ Millions)	1

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## Quick Assessment Report

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October 29, 2019

**Study Region :** Dayton  
**Scenario :** 100  
**Return Period:** 100  
**Analysis Option:** 0

### Regional Statistics

<b>Area (Square Miles)</b>	1
<b>Number of Census Blocks</b>	71
<b>Number of Buildings</b>	
Residential	524
Total	585
<b>Number of People in the Region (x 1000)</b>	2
<b>Building Exposure (\$ Millions)</b>	
Residential	118
Total	151

### Scenario Results

#### Shelter Requirements

Displaced Population (# Households)	20
Short Term Shelter (# People)	1

#### Economic Loss

Residential Property (Capital Stock) Losses (\$ Millions)	1
Total Property (Capital Stock) Losses (\$ Millions)	5
Business Interruption (Income) Losses (\$ Millions)	2

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## Quick Assessment Report

**RiskMAP**  
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October 29, 2019

**Study Region :** Elkton  
**Scenario :** 100  
**Return Period:** 100  
**Analysis Option:** 0

### Regional Statistics

<b>Area (Square Miles)</b>	3
<b>Number of Census Blocks</b>	126
<b>Number of Buildings</b>	
Residential	1,147
Total	1,262
<b>Number of People in the Region (x 1000)</b>	3
<b>Building Exposure (\$ Millions)</b>	
Residential	241
Total	295

### Scenario Results

#### Shelter Requirements

Displaced Population (# Households)	5
Short Term Shelter (# People)	0

#### Economic Loss

Residential Property (Capital Stock) Losses (\$ Millions)	0
Total Property (Capital Stock) Losses (\$ Millions)	0
Business Interruption (Income) Losses (\$ Millions)	0

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## Quick Assessment Report

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Increasing Resilience Together

October 28, 2019

**Study Region :** Glasgow  
**Scenario :** 100  
**Return Period:** 100  
**Analysis Option:** 0

### Regional Statistics

<b>Area (Square Miles)</b>	1
<b>Number of Census Blocks</b>	42
<b>Number of Buildings</b>	
Residential	480
Total	506
<b>Number of People in the Region (x 1000)</b>	1
<b>Building Exposure (\$ Millions)</b>	
Residential	81
Total	116

### Scenario Results

#### Shelter Requirements

Displaced Population (# Households)	8
Short Term Shelter (# People)	0

#### Economic Loss

Residential Property (Capital Stock) Losses (\$ Millions)	1
Total Property (Capital Stock) Losses (\$ Millions)	9
Business Interruption (Income) Losses (\$ Millions)	2

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## Quick Assessment Report

RiskMAP  
Increasing Resilience Together

October 28, 2019

**Study Region :** Goshen  
**Scenario :** 100  
**Return Period:** 100  
**Analysis Option:** 0

### Regional Statistics

<b>Area (Square Miles)</b>	2
<b>Number of Census Blocks</b>	24
<b>Number of Buildings</b>	
Residential	188
Total	192
<b>Number of People in the Region (x 1000)</b>	0
<b>Building Exposure (\$ Millions)</b>	
Residential	28
Total	29

### Scenario Results

#### Shelter Requirements

Displaced Population (# Households)	14
Short Term Shelter (# People)	0

#### Economic Loss

Residential Property (Capital Stock) Losses (\$ Millions)	2
Total Property (Capital Stock) Losses (\$ Millions)	2
Business Interruption (Income) Losses (\$ Millions)	1

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## Quick Assessment Report

**RiskMAP**  
Increasing Resilience Together

October 29, 2019

**Study Region :** Grottoes  
**Scenario :** 100  
**Return Period:** 100  
**Analysis Option:** 0

### Regional Statistics

<b>Area (Square Miles)</b>	2
<b>Number of Census Blocks</b>	126
<b>Number of Buildings</b>	
Residential	1,027
Total	1,100
<b>Number of People in the Region (x 1000)</b>	3
<b>Building Exposure (\$ Millions)</b>	
Residential	186
Total	228

### Scenario Results

#### Shelter Requirements

Displaced Population (# Households)	35
Short Term Shelter (# People)	2

#### Economic Loss

Residential Property (Capital Stock) Losses (\$ Millions)	1
Total Property (Capital Stock) Losses (\$ Millions)	1
Business Interruption (Income) Losses (\$ Millions)	1

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## Quick Assessment Report

RiskMAP  
Increasing Resilience Together

November 6, 2019

**Study Region :** Harrisonburg  
**Scenario :** 100  
**Return Period:** 100  
**Analysis Option:** 0

### Regional Statistics

<b>Area (Square Miles)</b>	17
<b>Number of Census Blocks</b>	818
<b>Number of Buildings</b>	
Residential	11,175
Total	12,756
<b>Number of People in the Region (x 1000)</b>	49
<b>Building Exposure (\$ Millions)</b>	
Residential	3,460
Total	5,091

### Scenario Results

#### Shelter Requirements

Displaced Population (# Households)	476
Short Term Shelter (# People)	110

#### Economic Loss

Residential Property (Capital Stock) Losses (\$ Millions)	31
Total Property (Capital Stock) Losses (\$ Millions)	68
Business Interruption (Income) Losses (\$ Millions)	121

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## Quick Assessment Report

RiskMAP  
Increasing Resilience Together

November 5, 2019

**Study Region :** Highland  
**Scenario :** 100  
**Return Period:** 100  
**Analysis Option:** 0

### Regional Statistics

<b>Area (Square Miles)</b>	416
<b>Number of Census Blocks</b>	745
<b>Number of Buildings</b>	
Residential	1,814
Total	1,887
<b>Number of People in the Region (x 1000)</b>	2
<b>Building Exposure (\$ Millions)</b>	
Residential	320
Total	367

### Scenario Results

#### Shelter Requirements

Displaced Population (# Households)	51
Short Term Shelter (# People)	1

#### Economic Loss

Residential Property (Capital Stock) Losses (\$ Millions)	12
Total Property (Capital Stock) Losses (\$ Millions)	13
Business Interruption (Income) Losses (\$ Millions)	2

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## Quick Assessment Report

RiskMAP  
Increasing Resilience Together

November 6, 2019

**Study Region :** Lexington  
**Scenario :** 100  
**Return Period:** 100  
**Analysis Option:** 0

### Regional Statistics

<b>Area (Square Miles)</b>	3
<b>Number of Census Blocks</b>	219
<b>Number of Buildings</b>	
Residential	2,030
Total	2,344
<b>Number of People in the Region (x 1000)</b>	7
<b>Building Exposure (\$ Millions)</b>	
Residential	715
Total	958

### Scenario Results

#### Shelter Requirements

Displaced Population (# Households)	25
Short Term Shelter (# People)	1

#### Economic Loss

Residential Property (Capital Stock) Losses (\$ Millions)	2
Total Property (Capital Stock) Losses (\$ Millions)	3
Business Interruption (Income) Losses (\$ Millions)	2

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## Quick Assessment Report

RiskMAP  
Increasing Resilience Together

October 28, 2019

**Study Region :** Monterey  
**Scenario :** 100  
**Return Period:** 100  
**Analysis Option:** 0

### Regional Statistics

<b>Area (Square Miles)</b>	0
<b>Number of Census Blocks</b>	20
<b>Number of Buildings</b>	
Residential	118
Total	135
<b>Number of People in the Region (x 1000)</b>	0
<b>Building Exposure (\$ Millions)</b>	
Residential	25
Total	37

### Scenario Results

#### Shelter Requirements

Displaced Population (# Households)  
Short Term Shelter (# People)

#### Economic Loss

Residential Property (Capital Stock) Losses (\$ Millions)	0
Total Property (Capital Stock) Losses (\$ Millions)	0
Business Interruption (Income) Losses (\$ Millions)	0

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## Quick Assessment Report

RiskMAP  
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October 29, 2019

**Study Region :** MountCrawford  
**Scenario :** 100  
**Return Period:** 100  
**Analysis Option:** 0

### Regional Statistics

<b>Area (Square Miles)</b>	35
<b>Number of Census Blocks</b>	228
<b>Number of Buildings</b>	
Residential	1,358
Total	1,474
<b>Number of People in the Region (x 1000)</b>	4
<b>Building Exposure (\$ Millions)</b>	
Residential	261
Total	306

### Scenario Results

#### Shelter Requirements

Displaced Population (# Households)	24
Short Term Shelter (# People)	0

#### Economic Loss

Residential Property (Capital Stock) Losses (\$ Millions)	2
Total Property (Capital Stock) Losses (\$ Millions)	3
Business Interruption (Income) Losses (\$ Millions)	1

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## Quick Assessment Report

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November 6, 2019

**Study Region :** Rockbridge  
**Scenario :** 100  
**Return Period:** 100  
**Analysis Option:** 0

### Regional Statistics

<b>Area (Square Miles)</b>	601
<b>Number of Census Blocks</b>	2,540
<b>Number of Buildings</b>	
Residential	10,703
Total	11,468
<b>Number of People in the Region (x 1000)</b>	22
<b>Building Exposure (\$ Millions)</b>	
Residential	2,182
Total	2,612

### Scenario Results

#### Shelter Requirements

Displaced Population (# Households)	300
Short Term Shelter (# People)	6

#### Economic Loss

Residential Property (Capital Stock) Losses (\$ Millions)	44
Total Property (Capital Stock) Losses (\$ Millions)	105
Business Interruption (Income) Losses (\$ Millions)	57

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## Quick Assessment Report

RiskMAP  
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November 5, 2019

**Study Region :** Rockingham  
**Scenario :** 100  
**Return Period:** 100  
**Analysis Option:** 0

### Regional Statistics

<b>Area (Square Miles)</b>	853
<b>Number of Census Blocks</b>	5,531
<b>Number of Buildings</b>	
Residential	31,035
Total	33,500
<b>Number of People in the Region (x 1000)</b>	76
<b>Building Exposure (\$ Millions)</b>	
Residential	6,609
Total	7,870

### Scenario Results

#### Shelter Requirements

Displaced Population (# Households)	809
Short Term Shelter (# People)	25

#### Economic Loss

Residential Property (Capital Stock) Losses (\$ Millions)	75
Total Property (Capital Stock) Losses (\$ Millions)	117
Business Interruption (Income) Losses (\$ Millions)	63

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## Quick Assessment Report

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November 6, 2019

**Study Region :** Staunton  
**Scenario :** 100  
**Return Period:** 100  
**Analysis Option:** 0

### Regional Statistics

<b>Area (Square Miles)</b>	20
<b>Number of Census Blocks</b>	711
<b>Number of Buildings</b>	
Residential	9,111
Total	10,118
<b>Number of People in the Region (x 1000)</b>	24
<b>Building Exposure (\$ Millions)</b>	
Residential	2,264
Total	3,047

### Scenario Results

#### Shelter Requirements

Displaced Population (# Households)	98
Short Term Shelter (# People)	3

#### Economic Loss

Residential Property (Capital Stock) Losses (\$ Millions)	10
Total Property (Capital Stock) Losses (\$ Millions)	75
Business Interruption (Income) Losses (\$ Millions)	147

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## Quick Assessment Report

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October 29, 2019

**Study Region :** Timberville  
**Scenario :** 100  
**Return Period:** 100  
**Analysis Option:** 0

### Regional Statistics

<b>Area (Square Miles)</b>	1
<b>Number of Census Blocks</b>	57
<b>Number of Buildings</b>	
Residential	1,060
Total	1,112
<b>Number of People in the Region (x 1000)</b>	3
<b>Building Exposure (\$ Millions)</b>	
Residential	219
Total	238

### Scenario Results

#### Shelter Requirements

Displaced Population (# Households)	14
Short Term Shelter (# People)	0

#### Economic Loss

Residential Property (Capital Stock) Losses (\$ Millions)	2
Total Property (Capital Stock) Losses (\$ Millions)	2
Business Interruption (Income) Losses (\$ Millions)	1

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## Quick Assessment Report

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November 6, 2019

**Study Region :** Waynesboro  
**Scenario :** 100  
**Return Period:** 100  
**Analysis Option:** 0

### Regional Statistics

<b>Area (Square Miles)</b>	15
<b>Number of Census Blocks</b>	887
<b>Number of Buildings</b>	
Residential	7,694
Total	8,669
<b>Number of People in the Region (x 1000)</b>	21
<b>Building Exposure (\$ Millions)</b>	
Residential	1,831
Total	2,667

### Scenario Results

#### Shelter Requirements

Displaced Population (# Households)	567
Short Term Shelter (# People)	65

#### Economic Loss

Residential Property (Capital Stock) Losses (\$ Millions)	63
Total Property (Capital Stock) Losses (\$ Millions)	280
Business Interruption (Income) Losses (\$ Millions)	182

#### Disclaimer:

Totals only reflect data for those census tracts/blocks included in the user's study region.

The estimates of social and economic impacts contained in this report were produced using Hazus loss estimation methodology software which is based on current scientific and engineering knowledge. There are uncertainties inherent in any loss estimation technique. Therefore, there may be significant differences between the modeled results contained in this report and the actual social and economic losses following a specific flood. These results can be improved by using enhanced inventory data and flood hazard information.



# Hazus: Hurricane Global Risk Report

**Region Name:** CSPDC\_Hurricane

**Hurricane Scenario:** Probabilistic 100-year Return Period

**Print Date:** Wednesday, October 30, 2019

***Disclaimer:***

*This version of Hazus utilizes 2010 Census Data.*

*Totals only reflect data for those census tracts/blocks included in the user's study region.*

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## General Description of the Region

Hazus is a regional multi-hazard loss estimation model that was developed by the Federal Emergency Management Agency and the National Institute of Building Sciences. The primary purpose of Hazus is to provide a methodology and software application to develop multi-hazard losses at a regional scale. These loss estimates would be used primarily by local, state and regional officials to plan and stimulate efforts to reduce risks from multi-hazards and to prepare for emergency response and recovery.

The hurricane loss estimates provided in this report are based on a region that includes 10 county(ies) from the following state(s):

- Virginia

Note:

Appendix A contains a complete listing of the counties contained in the region.

The geographical size of the region is 3,437.64 square miles and contains 62 census tracts. There are over 110 thousand households in the region and a total population of 286,781 people (2010 Census Bureau data). The distribution of population by State and County is provided in Appendix B.

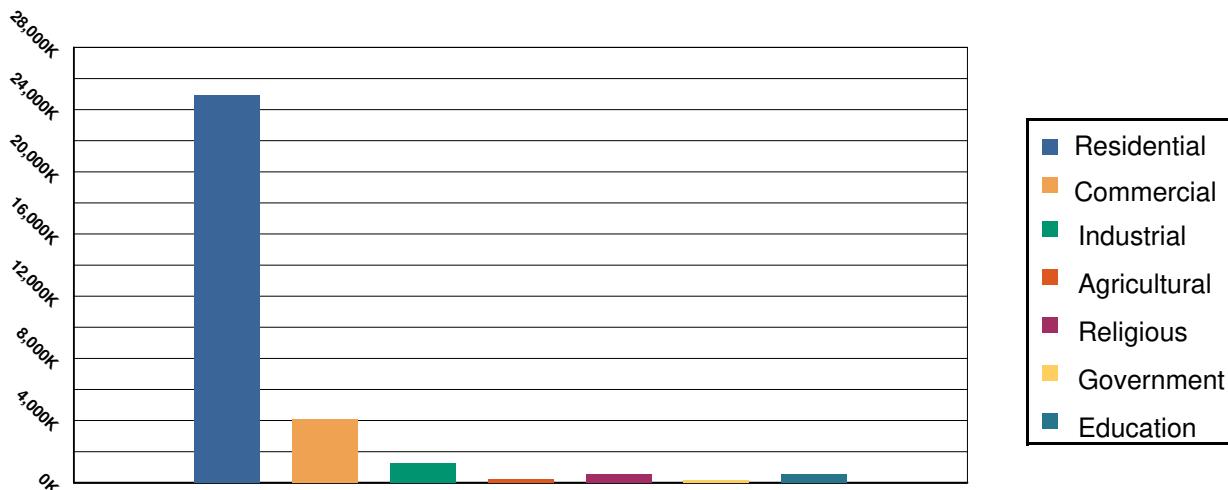
There are an estimated 118 thousand buildings in the region with a total building replacement value (excluding contents) of 31,788 million dollars (2014 dollars). Approximately 92% of the buildings (and 78% of the building value) are associated with residential housing.

## Building Inventory

### General Building Stock

Hazus estimates that there are 118,565 buildings in the region which have an aggregate total replacement value of 31,788 million (2014 dollars). Table 1 presents the relative distribution of the value with respect to the general occupancies. Appendix B provides a general distribution of the building value by State and County.

### Building Exposure by Occupancy Type



**Table 1: Building Exposure by Occupancy Type**

Occupancy	Exposure (\$1000)	Percent of Tot
Residential	24,927,457	78.42 %
Commercial	4,053,304	12.75%
Industrial	1,273,474	4.01%
Agricultural	254,378	0.80%
Religious	558,559	1.76%
Government	174,125	0.55%
Education	546,526	1.72%
<b>Total</b>	<b>31,787,823</b>	<b>100.00%</b>

### Essential Facility Inventory

For essential facilities, there are 7 hospitals in the region with a total bed capacity of 543 beds. There are 144 schools, 52 fire stations, 28 police stations and 9 emergency operation facilities.

## Hurricane Scenario

Hazus used the following set of information to define the hurricane parameters for the hurricane loss estimate provided in this report.

**Scenario Name:** Probabilistic

**Type:** Probabilistic

## Building Damage

### General Building Stock Damage

Hazus estimates that about 1 buildings will be at least moderately damaged. This is over 0% of the total number of buildings in the region. There are an estimated 0 buildings that will be completely destroyed. The definition of the 'damage states' is provided in the Hazus Hurricane technical manual. Table 2 below summarizes the expected damage by general occupancy for the buildings in the region. Table 3 summarizes the expected damage by general building type.

### Expected Building Damage by Occupancy

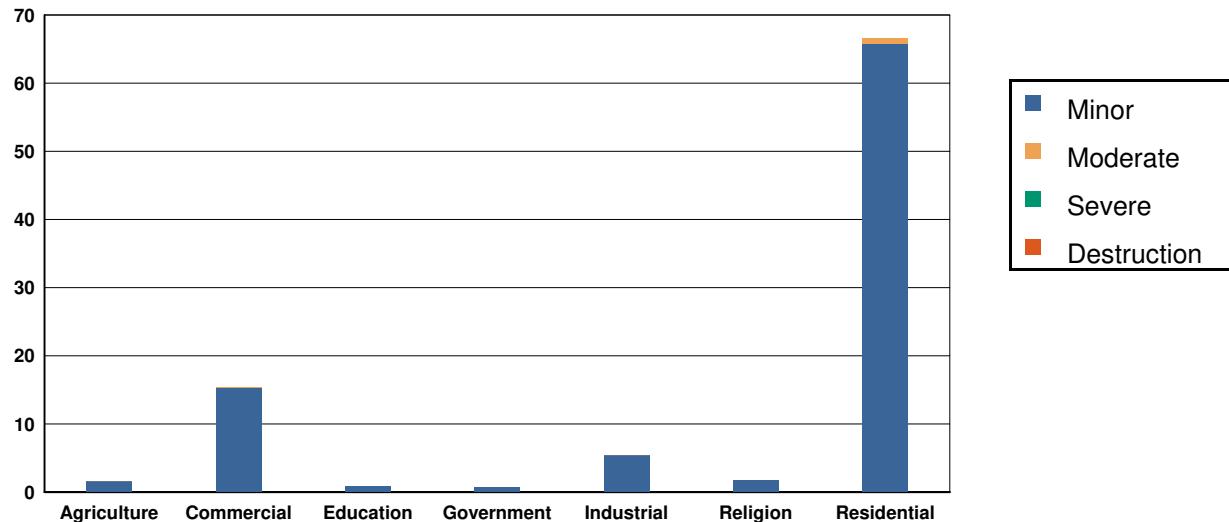


Table 2: Expected Building Damage by Occupancy : 100 - year Event

Occupancy	None		Minor		Moderate		Severe		Destruction	
	Count	(%)	Count	(%)	Count	(%)	Count	(%)	Count	(%)
Agriculture	786.47	99.81	1.53	0.19	0.00	0.00	0.00	0.00	0.00	0.00
Commercial	5,665.63	99.73	15.34	0.27	0.02	0.00	0.00	0.00	0.00	0.00
Education	276.14	99.69	0.86	0.31	0.00	0.00	0.00	0.00	0.00	0.00
Government	220.27	99.67	0.73	0.33	0.00	0.00	0.00	0.00	0.00	0.00
Industrial	1,704.59	99.68	5.41	0.32	0.01	0.00	0.00	0.00	0.00	0.00
Religion	810.26	99.79	1.74	0.21	0.00	0.00	0.00	0.00	0.00	0.00
Residential	109,009.36	99.94	65.82	0.06	0.83	0.00	0.00	0.00	0.00	0.00
Total	118,472.71		91.43		0.85		0.00		0.00	

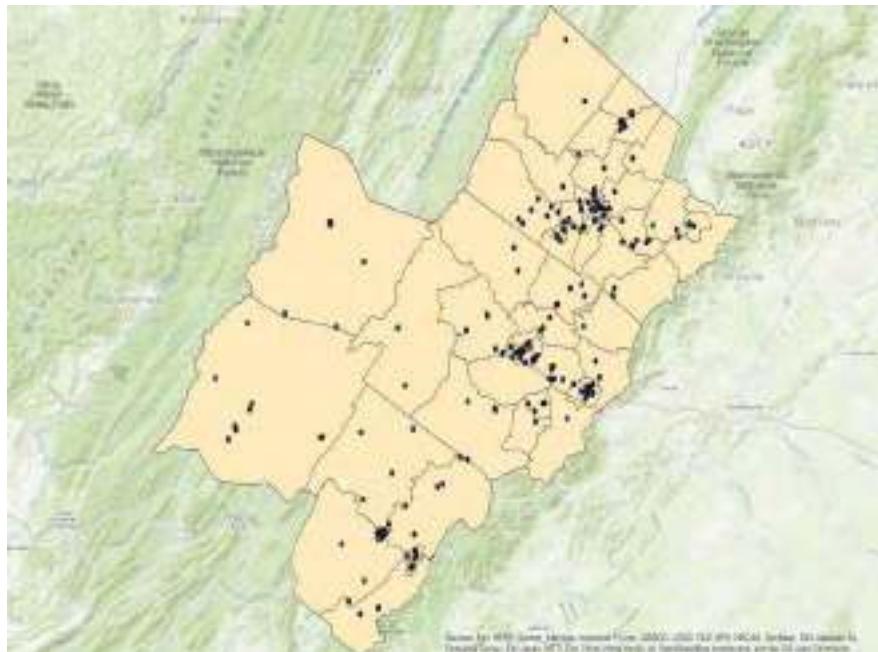
**Table 3: Expected Building Damage by Building Type : 100 - year Event**

Building Type	None		Minor		Moderate		Severe		Destruction	
	Count	(%)	Count	(%)	Count	(%)	Count	(%)	Count	(%)
Concrete	1,146	99.58	5	0.42	0	0.00	0	0.00	0	0.00
Masonry	27,676	99.82	50	0.18	1	0.00	0	0.00	0	0.00
MH	9,682	100.00	0	0.00	0	0.00	0	0.00	0	0.00
Steel	4,316	99.67	14	0.33	0	0.00	0	0.00	0	0.00
Wood	75,626	99.98	14	0.02	0	0.00	0	0.00	0	0.00

## **Essential Facility Damage**

Before the hurricane, the region had no hospital beds available for use. On the day of the hurricane, the model estimates that 543 hospital beds (0%) are available for use by patients already in the hospital and those injured by the hurricane. After one week, none of the beds will be in service. By 30 days, none will be operational.

**Thematic Map of Essential Facilities with greater than 50% moderate**



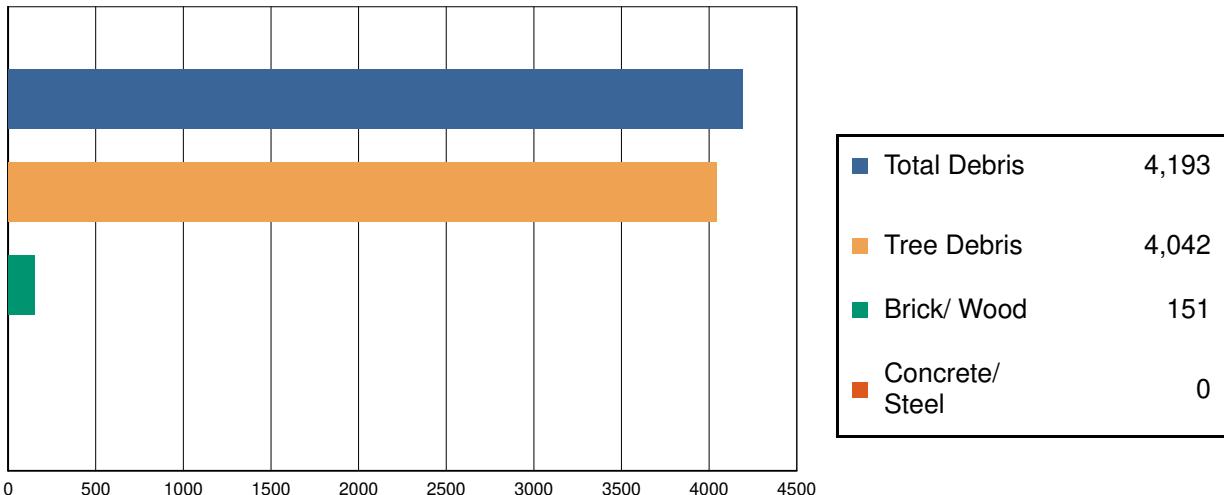
**Table 4: Expected Damage to Essential Facilities**

<b>Classification</b>	<b>Total</b>	<b># Facilities</b>		
		<b>Probability of at Least Moderate Damage &gt; 50%</b>	<b>Probability of Complete Damage &gt; 50%</b>	<b>Expected Loss of Use &lt; 1 day</b>
EOCs	9	0	0	9
Fire Stations	52	0	0	52
Hospitals	7	0	0	7
Police Stations	28	0	0	28
Schools	144	0	0	144

## Induced Hurricane Damage

### Debris Generation

**Estimated Debris (Tons)**

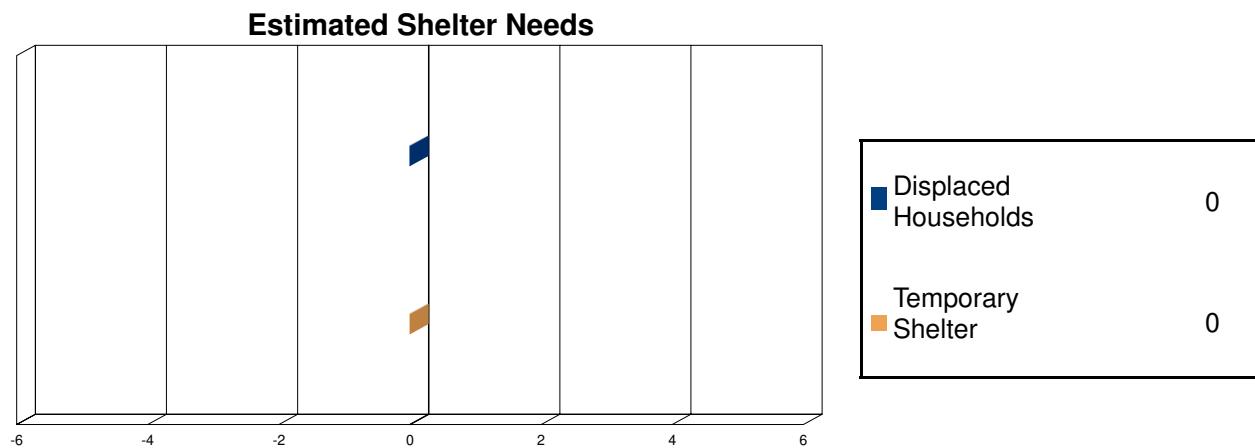


Hazus estimates the amount of debris that will be generated by the hurricane. The model breaks the debris into four general categories: a) Brick/Wood, b) Reinforced Concrete/Steel, c) Eligible Tree Debris, and d) Other Tree Debris. This distinction is made because of the different types of material handling equipment required to handle the debris.

The model estimates that a total of 4,193 tons of debris will be generated. Of the total amount, 3,065 tons (73%) is Other Tree Debris. Of the remaining 1,128 tons, Brick/Wood comprises 13% of the total, Reinforced Concrete/Steel comprises of 0% of the total, with the remainder being Eligible Tree Debris. If the building debris tonnage is converted to an estimated number of truckloads, it will require 6 truckloads (@25 tons/truck) to remove the building debris generated by the hurricane. The number of Eligible Tree Debris truckloads will depend on how the 977 tons of Eligible Tree Debris are collected and processed. The volume of tree debris generally ranges from about 4 cubic yards per ton for chipped or compacted tree debris to about 10 cubic yards per ton for bulkier, uncompacted debris.

## Social Impact

### Shelter Requirement



Hazus estimates the number of households that are expected to be displaced from their homes due to the hurricane and the number of displaced people that will require accommodations in temporary public shelters. The model estimates 0 households to be displaced due to the hurricane. Of these, 0 people (out of a total population of 286,781) will seek temporary shelter in public shelters.

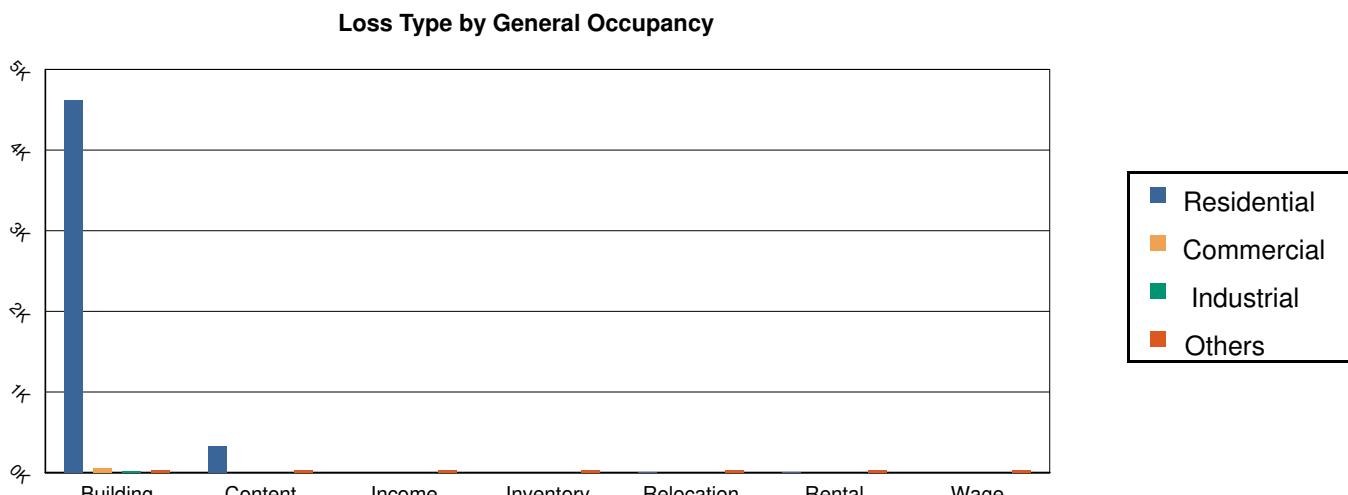
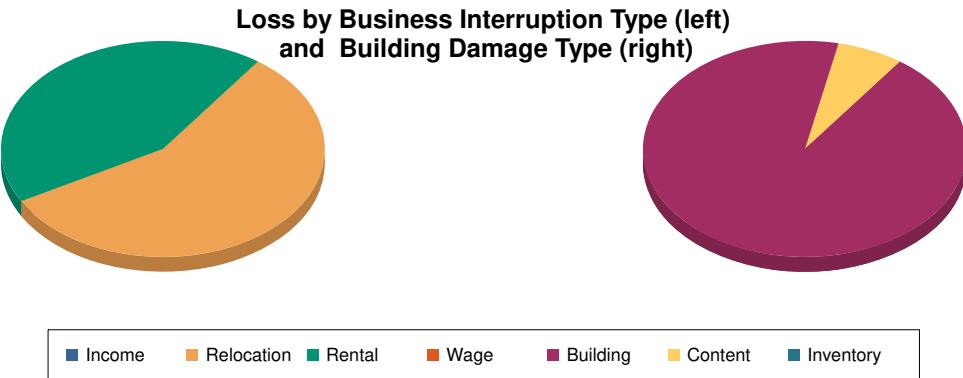
## Economic Loss

The total economic loss estimated for the hurricane is 5.1 million dollars, which represents 0.02 % of the total replacement value of the region's buildings.

### **Building-Related Losses**

The building related losses are broken into two categories: direct property damage losses and business interruption losses. The direct property damage losses are the estimated costs to repair or replace the damage caused to the building and its contents. The business interruption losses are the losses associated with inability to operate a business because of the damage sustained during the hurricane. Business interruption losses also include the temporary living expenses for those people displaced from their homes because of the hurricane.

The total property damage losses were 5 million dollars. 0% of the estimated losses were related to the business interruption of the region. By far, the largest loss was sustained by the residential occupancies which made up over 98% of the total loss. Table 5 below provides a summary of the losses associated with the building damage.



**Table 5: Building-Related Economic Loss Estimates**  
(Thousands of dollars)

Category	Area	Residential	Commercial	Industrial	Others	Total
<b>Property Damage</b>						
Building		4,622.01	56.56	23.83	27.76	4,730.16
Content		334.04	0.00	0.00	0.00	334.04
Inventory		0.00	0.00	0.00	0.00	0.00
<b>Subtotal</b>		<b>4,956.05</b>	<b>56.56</b>	<b>23.83</b>	<b>27.76</b>	<b>5,064.20</b>
<b>Business Interruption Loss</b>						
Income		0.00	0.00	0.00	0.00	0.00
Relocation		2.81	0.10	0.00	0.00	2.91
Rental		2.21	0.00	0.00	0.00	2.21
Wage		0.00	0.00	0.00	0.00	0.00
<b>Subtotal</b>		<b>5.02</b>	<b>0.10</b>	<b>0.00</b>	<b>0.00</b>	<b>5.12</b>



FEMA

Total

Total	4,961.07	56.66	23.83	27.76	5,069.32
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### **Appendix A: County Listing for the Region**

#### Virginia

- Augusta
- Bath
- Highland
- Rockbridge
- Rockingham
- Buena Vista
- Harrisonburg
- Lexington
- Staunton
- Waynesboro

## Appendix B: Regional Population and Building Value Data

	Population	Building Value (thousands of dollars)		
		Residential	Non-Residential	Total
<b>Virginia</b>				
Augusta	73,750	6,296,301	1,337,630	7,633,931
Bath	4,731	739,486	78,123	817,609
Buena Vista	6,650	509,866	214,901	724,767
Harrisonburg	48,914	3,460,375	1,630,540	5,090,915
Highland	2,321	320,363	46,946	367,309
Lexington	7,042	714,506	243,342	957,848
Rockbridge	22,307	2,182,496	429,798	2,612,294
Rockingham	76,314	6,609,137	1,260,787	7,869,924
Staunton	23,746	2,264,098	782,529	3,046,627
Waynesboro	21,006	1,830,829	835,770	2,666,599
<b>Total</b>	<b>286,781</b>	<b>24,927,457</b>	<b>6,860,366</b>	<b>31,787,823</b>
<b>Study Region Total</b>	<b>286,781</b>	<b>24,927,457</b>	<b>6,860,366</b>	<b>31,787,823</b>

## Quick Assessment Report

October 30, 2019

**Study Region :** CSPDC\_Hurricane

**Scenario :** Probabilistic

### Regional Statistics

<b>Area (Square Miles)</b>	3,438	
<b>Number of Census Tracts</b>	62	
<b>Number of People in the Region</b>	286,781	
<b>General Building Stock</b>		
<i>Occupancy</i>	<i>Building Count</i>	<i>Dollar Exposure (\$ K)</i>
Residential	109,076	24,927,457
Commercial	5,681	4,053,304
Other	3,808	2,807,062
Total	118,565	31,787,823

### Scenario Results

#### Number of Residential Buildings Damaged

<i>Return Period</i>	<i>Minor</i>	<i>Moderate</i>	<i>Severe</i>	<i>Destruction</i>	<i>Total</i>
10	0	0	0	0	0
20	0	0	0	0	0
50	20	0	0	0	20
100	66	1	0	0	67
200	158	3	0	0	161
500	880	35	0	0	915
1000	2,228	110	1	1	2,339

#### Number of Buildings Damaged

<i>Return Period</i>	<i>Minor</i>	<i>Moderate</i>	<i>Severe</i>	<i>Destruction</i>	<i>Total</i>
10	0	0	0	0	0
20	0	0	0	0	0
50	31	0	0	0	31
100	91	1	0	0	92
200	194	4	0	0	198
500	961	38	1	0	1,000
1000	2,374	121	2	1	2,498

#### Shelter Requirements

<i>Return Period</i>	<i>Displaced Households (#Households)</i>	<i>Short Term Shelter (#People)</i>
10	0	0
20	0	0
50	0	0
100	0	0
200	0	0
500	0	0
1000	0	0

**Economic Loss (x 1000)**

Return Period	Property Damage (Capital Stock) Losses		Business Interruption (Income) Losses
	Residential	Total	
10	0	0	0
20	0	0	0
50	214	214	0
100	4,956	5,064	5
200	15,705	16,347	32
500	44,891	46,220	1,022
1000	76,205	78,679	4,886
Annualized	359	379	20

**Disclaimer:**

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## Quick Assessment Report

October 31, 2019

**Study Region :** Augusta

**Scenario :** Probabilistic

### Regional Statistics

<b>Area (Square Miles)</b>	971	
<b>Number of Census Tracts</b>	13	
<b>Number of People in the Region</b>	73,750	
<b>General Building Stock</b>		
<i>Occupancy</i>	<i>Building Count</i>	<i>Dollar Exposure (\$ K)</i>
Residential	29,645	6,296,301
Commercial	1,029	744,145
Other	892	593,485
Total	31,566	7,633,931

### Scenario Results

#### Number of Residential Buildings Damaged

<i>Return Period</i>	<i>Minor</i>	<i>Moderate</i>	<i>Severe</i>	<i>Destruction</i>	<i>Total</i>
10	0	0	0	0	0
20	0	0	0	0	0
50	2	0	0	0	2
100	8	0	0	0	8
200	38	0	0	0	39
500	266	7	0	0	273
1000	683	25	0	1	709

#### Number of Buildings Damaged

<i>Return Period</i>	<i>Minor</i>	<i>Moderate</i>	<i>Severe</i>	<i>Destruction</i>	<i>Total</i>
10	0	0	0	0	0
20	0	0	0	0	0
50	5	0	0	0	5
100	13	0	0	0	13
200	46	0	0	0	47
500	286	7	0	0	293
1000	719	28	0	1	748

#### Shelter Requirements

<i>Return Period</i>	<i>Displaced Households (#Households)</i>	<i>Short Term Shelter (#People)</i>
10	0	0
20	0	0
50	0	0
100	0	0
200	0	0
500	0	0
1000	0	0

**Economic Loss (x 1000)**

Return Period	Property Damage (Capital Stock) Losses		Business Interruption (Income) Losses
	Residential	Total	
10	0	0	0
20	0	0	0
50	8	8	0
100	1,448	1,472	0
200	4,685	4,814	11
500	13,402	13,674	374
1000	22,154	22,729	1,237
Annualized	111	116	6

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## Quick Assessment Report

November 1, 2019

**Study Region :** Bath

**Scenario :** Probabilistic

### Regional Statistics

<b>Area (Square Miles)</b>	535	
<b>Number of Census Tracts</b>	1	
<b>Number of People in the Region</b>	4,731	
<b>General Building Stock</b>		
<i>Occupancy</i>	<i>Building Count</i>	<i>Dollar Exposure (\$ K)</i>
Residential	3,262	739,486
Commercial	49	43,825
Other	49	34,298
Total	3,360	817,609

### Scenario Results

#### Number of Residential Buildings Damaged

<i>Return Period</i>	<i>Minor</i>	<i>Moderate</i>	<i>Severe</i>	<i>Destruction</i>	<i>Total</i>
10	0	0	0	0	0
20	0	0	0	0	0
50	0	0	0	0	0
100	0	0	0	0	0
200	1	0	0	0	1
500	8	0	0	0	8
1000	26	0	0	0	26

#### Number of Buildings Damaged

<i>Return Period</i>	<i>Minor</i>	<i>Moderate</i>	<i>Severe</i>	<i>Destruction</i>	<i>Total</i>
10	0	0	0	0	0
20	0	0	0	0	0
50	0	0	0	0	0
100	1	0	0	0	1
200	1	0	0	0	1
500	9	0	0	0	9
1000	26	1	0	0	27

#### Shelter Requirements

<i>Return Period</i>	<i>Displaced Households (#Households)</i>	<i>Short Term Shelter (#People)</i>
10	0	0
20	0	0
50	0	0
100	0	0
200	0	0
500	0	0
1000	0	0

**Economic Loss (x 1000)**

Return Period	<u>Property Damage (Capital Stock) Losses</u>		<u>Business Interruption (Income) Losses</u>
	Residential	Total	
10	0	0	0
20	0	0	0
50	0	0	0
100	20	20	0
200	241	249	0
500	721	729	2
1000	1,376	1,392	17
Annualized	7	7	0

**Disclaimer:**

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## Quick Assessment Report

November 7, 2019

**Study Region :** BuenaVista

**Scenario :** Probabilistic

### Regional Statistics

<b>Area (Square Miles)</b>	7	
<b>Number of Census Tracts</b>	1	
<b>Number of People in the Region</b>	6,650	
<b>General Building Stock</b>		
<i>Occupancy</i>	<i>Building Count</i>	<i>Dollar Exposure (\$ K)</i>
Residential	2,607	509,866
Commercial	163	60,555
Other	127	154,346
Total	2,897	724,767

### Scenario Results

#### Number of Residential Buildings Damaged

<i>Return Period</i>	<i>Minor</i>	<i>Moderate</i>	<i>Severe</i>	<i>Destruction</i>	<i>Total</i>
10	0	0	0	0	0
20	0	0	0	0	0
50	1	0	0	0	1
100	1	0	0	0	1
200	4	0	0	0	4
500	24	1	0	0	24
1000	82	4	0	0	86

#### Number of Buildings Damaged

<i>Return Period</i>	<i>Minor</i>	<i>Moderate</i>	<i>Severe</i>	<i>Destruction</i>	<i>Total</i>
10	0	0	0	0	0
20	0	0	0	0	0
50	1	0	0	0	1
100	2	0	0	0	2
200	5	0	0	0	5
500	26	1	0	0	27
1000	89	4	0	0	93

#### Shelter Requirements

<i>Return Period</i>	<i>Displaced Households (#Households)</i>	<i>Short Term Shelter (#People)</i>
10	0	0
20	0	0
50	0	0
100	0	0
200	0	0
500	0	0
1000	0	0

**Economic Loss (x 1000)**

Return Period	Property Damage (Capital Stock) Losses		Business Interruption (Income) Losses
	Residential	Total	
10	0	0	0
20	0	0	0
50	1	1	0
100	87	87	0
200	336	357	2
500	909	948	7
1000	1,849	2,004	145
Annualized	9	10	1

**Disclaimer:**

Totals only reflect data for those census tracts/blocks included in the user's study region.

The estimates of social and economic impacts contained in this report were produced using HAZUS loss estimation methodology software which is based on current scientific and engineering knowledge. There are uncertainties inherent in any loss estimation technique. Therefore, there may be significant differences between the modeled results contained in this report and the actual social and economic losses following a specific Hurricane. These results can be improved by using enhanced inventory data.

## Quick Assessment Report

November 6, 2019

**Study Region :** Harrisonburg

**Scenario :** Probabilistic

### Regional Statistics

Area (Square Miles)	17	
Number of Census Tracts	11	
Number of People in the Region	48,914	
General Building Stock		
Occupancy	Building Count	Dollar Exposure (\$ K)
Residential	11,175	3,460,375
Commercial	1,128	1,093,970
Other	453	536,570
Total	12,756	5,090,915

### Scenario Results

#### Number of Residential Buildings Damaged

Return Period	Minor	Moderate	Severe	Destruction	Total
10	0	0	0	0	0
20	0	0	0	0	0
50	0	0	0	0	0
100	9	0	0	0	9
200	18	1	0	0	19
500	86	6	0	0	92
1000	206	16	0	0	222

#### Number of Buildings Damaged

Return Period	Minor	Moderate	Severe	Destruction	Total
10	0	0	0	0	0
20	0	0	0	0	0
50	0	0	0	0	0
100	13	0	0	0	13
200	24	1	0	0	25
500	99	6	0	0	105
1000	227	17	0	0	245

#### Shelter Requirements

Return Period	Displaced Households (#Households)	Short Term Shelter (#People)
10	0	0
20	0	0
50	0	0
100	0	0
200	0	0
500	0	0
1000	0	0

**Economic Loss (x 1000)**

Return Period	Property Damage (Capital Stock) Losses		Business Interruption (Income) Losses
	Residential	Total	
10	0	0	0
20	0	0	0
50	0	0	0
100	314	315	0
200	1,313	1,473	2
500	4,369	4,685	95
1000	7,750	8,208	717
Annualized	35	39	3

**Disclaimer:**

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## Quick Assessment Report

November 5, 2019

**Study Region :** Highland

**Scenario :** Probabilistic

### Regional Statistics

Area (Square Miles)	416	
Number of Census Tracts	1	
Number of People in the Region	2,321	
General Building Stock		
Occupancy	Building Count	Dollar Exposure (\$ K)
Residential	1,814	320,363
Commercial	37	21,392
Other	36	25,554
Total	1,887	367,309

### Scenario Results

#### Number of Residential Buildings Damaged

Return Period	Minor	Moderate	Severe	Destruction	Total
10	0	0	0	0	0
20	0	0	0	0	0
50	0	0	0	0	0
100	0	0	0	0	0
200	0	0	0	0	0
500	4	0	0	0	4
1000	13	0	0	0	14

#### Number of Buildings Damaged

Return Period	Minor	Moderate	Severe	Destruction	Total
10	0	0	0	0	0
20	0	0	0	0	0
50	0	0	0	0	0
100	0	0	0	0	0
200	1	0	0	0	1
500	4	0	0	0	4
1000	14	0	0	0	14

#### Shelter Requirements

Return Period	Displaced Households (#Households)	Short Term Shelter (#People)
10	0	0
20	0	0
50	0	0
100	0	0
200	0	0
500	0	0
1000	0	0

**Economic Loss (x 1000)**

Return Period	Property Damage (Capital Stock) Losses		Business Interruption (Income) Losses
	Residential	Total	
10	0	0	0
20	0	0	0
50	0	0	0
100	8	8	0
200	103	107	0
500	322	327	1
1000	626	634	5
Annualized	3	3	0

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## Quick Assessment Report

November 6, 2019

**Study Region :** Lexington

**Scenario :** Probabilistic

### Regional Statistics

<b>Area (Square Miles)</b>	3	
<b>Number of Census Tracts</b>	1	
<b>Number of People in the Region</b>	7,042	
<b>General Building Stock</b>		
<i>Occupancy</i>	<i>Building Count</i>	<i>Dollar Exposure (\$ K)</i>
Residential	2,030	714,506
Commercial	204	144,783
Other	110	98,559
Total	2,344	957,848

### Scenario Results

#### Number of Residential Buildings Damaged

<i>Return Period</i>	<i>Minor</i>	<i>Moderate</i>	<i>Severe</i>	<i>Destruction</i>	<i>Total</i>
10	0	0	0	0	0
20	0	0	0	0	0
50	1	0	0	0	1
100	2	0	0	0	2
200	4	0	0	0	4
500	18	1	0	0	19
1000	58	4	0	0	62

#### Number of Buildings Damaged

<i>Return Period</i>	<i>Minor</i>	<i>Moderate</i>	<i>Severe</i>	<i>Destruction</i>	<i>Total</i>
10	0	0	0	0	0
20	0	0	0	0	0
50	2	0	0	0	2
100	2	0	0	0	2
200	5	0	0	0	5
500	20	1	0	0	21
1000	64	5	0	0	69

#### Shelter Requirements

<i>Return Period</i>	<i>Displaced Households (#Households)</i>	<i>Short Term Shelter (#People)</i>
10	0	0
20	0	0
50	0	0
100	0	0
200	0	0
500	0	0
1000	0	0

**Economic Loss (x 1000)**

Return Period	Property Damage (Capital Stock) Losses		Business Interruption (Income) Losses
	Residential	Total	
10	0	0	0
20	0	0	0
50	1	1	0
100	141	141	0
200	344	368	0
500	999	1,047	12
1000	2,082	2,181	167
Annualized	10	11	1

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## Quick Assessment Report

November 6, 2019

**Study Region :** Rockbridge

**Scenario :** Probabilistic

### Regional Statistics

<b>Area (Square Miles)</b>	601	
<b>Number of Census Tracts</b>	4	
<b>Number of People in the Region</b>	22,307	
<b>General Building Stock</b>		
<i>Occupancy</i>	<i>Building Count</i>	<i>Dollar Exposure (\$ K)</i>
Residential	10,703	2,182,496
Commercial	424	233,051
Other	341	196,747
Total	11,468	2,612,294

### Scenario Results

#### Number of Residential Buildings Damaged

<i>Return Period</i>	<i>Minor</i>	<i>Moderate</i>	<i>Severe</i>	<i>Destruction</i>	<i>Total</i>
10	0	0	0	0	0
20	0	0	0	0	0
50	1	0	0	0	1
100	2	0	0	0	2
200	12	0	0	0	12
500	78	2	0	0	80
1000	273	11	0	0	285

#### Number of Buildings Damaged

<i>Return Period</i>	<i>Minor</i>	<i>Moderate</i>	<i>Severe</i>	<i>Destruction</i>	<i>Total</i>
10	0	0	0	0	0
20	0	0	0	0	0
50	3	0	0	0	3
100	3	0	0	0	3
200	15	0	0	0	16
500	84	2	0	0	86
1000	289	13	0	0	302

#### Shelter Requirements

<i>Return Period</i>	<i>Displaced Households (#Households)</i>	<i>Short Term Shelter (#People)</i>
10	0	0
20	0	0
50	0	0
100	0	0
200	0	0
500	0	0
1000	0	0

**Economic Loss (x 1000)**

Return Period	Property Damage (Capital Stock) Losses		Business Interruption (Income) Losses
	Residential	Total	
10	0	0	0
20	0	0	0
50	11	11	0
100	475	495	0
200	1,524	1,565	4
500	4,541	4,624	120
1000	8,781	9,027	524
Annualized	41	43	2

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## Quick Assessment Report

November 5, 2019

**Study Region :** Rockingham

**Scenario :** Probabilistic

### Regional Statistics

Area (Square Miles)	853	
Number of Census Tracts	19	
Number of People in the Region	76,314	
General Building Stock		
Occupancy	Building Count	Dollar Exposure (\$ K)
Residential	31,035	6,609,137
Commercial	1,310	607,664
Other	1,155	653,123
Total	33,500	7,869,924

### Scenario Results

#### Number of Residential Buildings Damaged

Return Period	Minor	Moderate	Severe	Destruction	Total
10	0	0	0	0	0
20	0	0	0	0	0
50	2	0	0	0	2
100	9	0	0	0	9
200	41	1	0	0	41
500	245	7	0	0	252
1000	769	40	0	2	811

#### Number of Buildings Damaged

Return Period	Minor	Moderate	Severe	Destruction	Total
10	0	0	0	0	0
20	0	0	0	0	0
50	5	0	0	0	5
100	13	0	0	0	13
200	51	1	0	0	52
500	267	8	0	0	275
1000	817	45	1	2	864

#### Shelter Requirements

Return Period	Displaced Households (#Households)	Short Term Shelter (#People)
10	0	0
20	0	0
50	0	0
100	0	0
200	0	0
500	0	0
1000	0	0

### Economic Loss (x 1000)

Return Period	<u>Property Damage (Capital Stock) Losses</u>		<u>Business Interruption (Income) Losses</u>
	Residential	Total	
10	0	0	0
20	0	0	0
50	3	3	0
100	1,071	1,105	1
200	4,339	4,442	18
500	12,259	12,534	436
1000	22,278	22,979	1,191
Annualized	104	109	6

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## Quick Assessment Report

November 6, 2019

**Study Region :** Staunton

**Scenario :** Probabilistic

### Regional Statistics

Area (Square Miles)	20	
Number of Census Tracts	6	
Number of People in the Region	23,746	
General Building Stock		
Occupancy	<i>Building Count</i>	<i>Dollar Exposure (\$ K)</i>
Residential	9,111	2,264,098
Commercial	670	521,766
Other	337	260,763
Total	10,118	3,046,627

### Scenario Results

#### Number of Residential Buildings Damaged

<i>Return Period</i>	<i>Minor</i>	<i>Moderate</i>	<i>Severe</i>	<i>Destruction</i>	<i>Total</i>
10	0	0	0	0	0
20	0	0	0	0	0
50	2	0	0	0	2
100	5	0	0	0	5
200	12	0	0	0	12
500	68	4	0	0	71
1000	174	11	0	0	185

#### Number of Buildings Damaged

<i>Return Period</i>	<i>Minor</i>	<i>Moderate</i>	<i>Severe</i>	<i>Destruction</i>	<i>Total</i>
10	0	0	0	0	0
20	0	0	0	0	0
50	3	0	0	0	3
100	8	0	0	0	8
200	15	0	0	0	16
500	75	4	0	0	79
1000	189	11	0	0	200

#### Shelter Requirements

<i>Return Period</i>	<i>Displaced Households (#Households)</i>	<i>Short Term Shelter (#People)</i>
10	0	0
20	0	0
50	0	0
100	0	0
200	0	0
500	0	0
1000	0	0

**Economic Loss (x 1000)**

Return Period	Property Damage (Capital Stock) Losses		Business Interruption (Income) Losses
	Residential	Total	
10	0	0	0
20	0	0	0
50	1	1	0
100	403	403	0
200	1,163	1,241	1
500	3,893	4,035	34
1000	6,679	6,894	471
Annualized	31	33	2

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## Quick Assessment Report

November 6, 2019

**Study Region :** Waynesboro

**Scenario :** Probabilistic

### Regional Statistics

Area (Square Miles)	15	
Number of Census Tracts	5	
Number of People in the Region	21,006	
General Building Stock		
Occupancy	Building Count	Dollar Exposure (\$ K)
Residential	7,694	1,830,829
Commercial	667	582,153
Other	308	253,617
Total	8,669	2,666,599

### Scenario Results

#### Number of Residential Buildings Damaged

Return Period	Minor	Moderate	Severe	Destruction	Total
10	0	0	0	0	0
20	0	0	0	0	0
50	3	0	0	0	3
100	4	0	0	0	4
200	14	0	0	0	15
500	74	3	0	0	78
1000	179	10	0	0	189

#### Number of Buildings Damaged

Return Period	Minor	Moderate	Severe	Destruction	Total
10	0	0	0	0	0
20	0	0	0	0	0
50	5	0	0	0	5
100	6	0	0	0	6
200	18	0	0	0	19
500	83	4	0	0	87
1000	194	11	0	0	206

#### Shelter Requirements

Return Period	Displaced Households (#Households)	Short Term Shelter (#People)
10	0	0
20	0	0
50	0	0
100	0	0
200	0	0
500	0	0
1000	0	0

**Economic Loss (x 1000)**

Return Period	Property Damage (Capital Stock) Losses		Business Interruption (Income) Losses
	Residential	Total	
10	0	0	0
20	0	0	0
50	2	2	0
100	410	410	0
200	1,407	1,491	7
500	3,911	4,054	48
1000	6,380	6,681	428
Annualized	30	33	2

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FEMA

RiskMAP  
Increasing Resilience Together

# Hazus: Earthquake Global Risk Report

**Region Name:** CSPDC\_EQ

**Earthquake Scenario:** 100yr Probabilistic Earthquake - Mag 5

**Print Date:** August 19, 2019

**Disclaimer:**

*This version of Hazus utilizes 2010 Census Data.*

*Totals only reflect data for those census tracts/blocks included in the user's study region.*

*The estimates of social and economic impacts contained in this report were produced using Hazus loss estimation methodology software which is based on current scientific and engineering knowledge. There are uncertainties inherent in any loss estimation technique. Therefore, there may be significant differences between the modeled results contained in this report and the actual social and economic losses following a specific earthquake. These results can be improved by using enhanced inventory, geotechnical, and observed ground motion data.*

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**Appendix A: County Listing for the Region**

**Appendix B: Regional Population and Building Value Data**



FEMA

## General Description of the Region

Hazus-MH is a regional earthquake loss estimation model that was developed by the Federal Emergency Management Agency (FEMA) and the National Institute of Building Sciences. The primary purpose of Hazus is to provide a methodology and software application to develop multi-hazard losses at a regional scale. These loss estimates would be used primarily by local, state and regional officials to plan and stimulate efforts to reduce risks from multi-hazards and to prepare for emergency response and recovery.

The earthquake loss estimates provided in this report was based on a region that includes 10 county(ies) from the following state(s):

Virginia

Note:

Appendix A contains a complete listing of the counties contained in the region.

The geographical size of the region is 3,436.75 square miles and contains 62 census tracts. There are over 110 thousand households in the region which has a total population of 286,781 people (2010 Census Bureau data). The distribution of population by Total Region and County is provided in Appendix B.

There are an estimated 118 thousand buildings in the region with a total building replacement value (excluding contents) of 31,787 (millions of dollars). Approximately 92.00 % of the buildings (and 78.00% of the building value) are associated with residential housing.

The replacement value of the transportation and utility lifeline systems is estimated to be 6,448 and 3,038 (millions of dollars), respectively.

## Building and Lifeline Inventory

### Building Inventory

Hazus estimates that there are 118 thousand buildings in the region which have an aggregate total replacement value of 31,787 (millions of dollars) . Appendix B provides a general distribution of the building value by Total Region and County.

In terms of building construction types found in the region, wood frame construction makes up 64% of the building inventory. The remaining percentage is distributed between the other general building types.

### Critical Facility Inventory

Hazus breaks critical facilities into two (2) groups: essential facilities and high potential loss facilities (HPL). Essential facilities include hospitals, medical clinics, schools, fire stations, police stations and emergency operations facilities. High potential loss facilities include dams, levees, military installations, nuclear power plants and hazardous material sites.

For essential facilities, there are 7 hospitals in the region with a total bed capacity of 543 beds. There are 144 schools, 52 fire stations, 28 police stations and 9 emergency operation facilities. With respect to high potential loss facilities (HPL), there are no dams identified within the inventory. The inventory also includes 120 hazardous material sites, no military installations and no nuclear power plants.

### Transportation and Utility Lifeline Inventory

Within Hazus, the lifeline inventory is divided between transportation and utility lifeline systems. There are seven (7) transportation systems that include highways, railways, light rail, bus, ports, ferry and airports. There are six (6) utility systems that include potable water, wastewater, natural gas, crude & refined oil, electric power and communications. The lifeline inventory data are provided in Tables 1 and 2.

The total value of the lifeline inventory is over 9,486.00 (millions of dollars). This inventory includes over 741.92 miles of highways, 778 bridges, 42,400.49 miles of pipes.

**Table 1: Transportation System Lifeline Inventory**

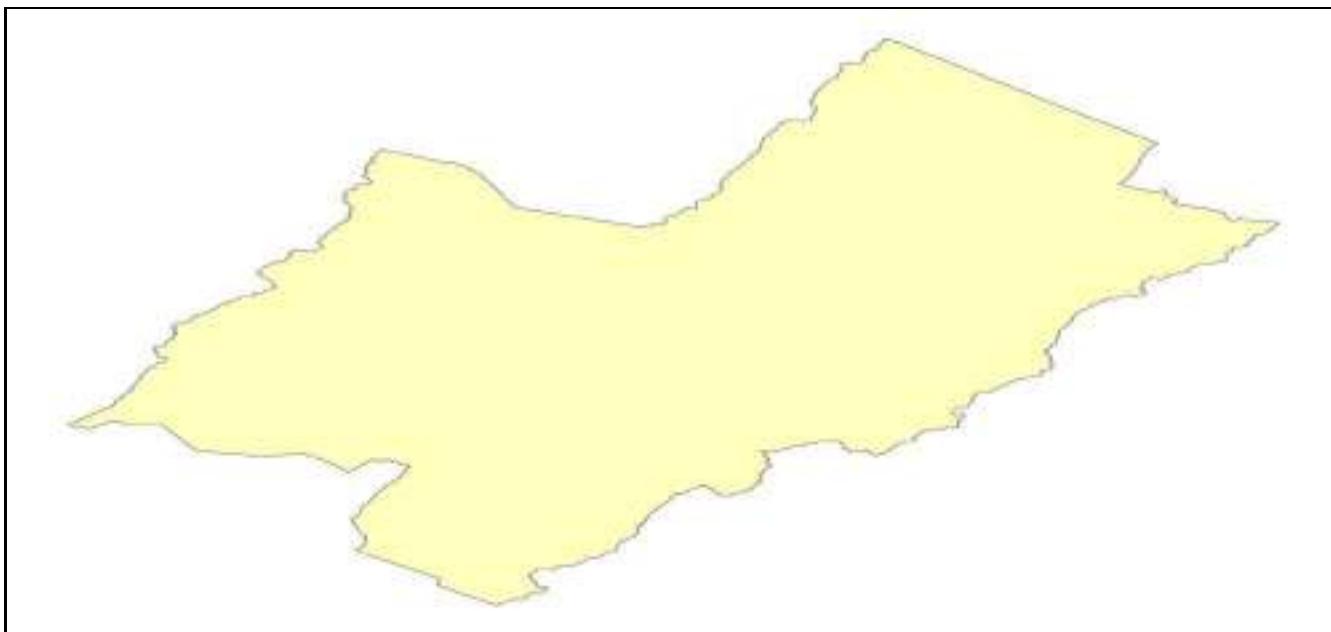
System	Component	# Locations/ # Segments	Replacement value (millions of dollars)
<b>Highway</b>	Bridges	778	460.7884
	Segments	297	5423.5850
	Tunnels	0	0.0000
	Subtotal		<b>5884.3734</b>
<b>Railways</b>	Bridges	3	0.1171
	Facilities	2	5.3260
	Segments	222	412.3045
	Tunnels	0	0.0000
	Subtotal		<b>417.7476</b>
<b>Light Rail</b>	Bridges	0	0.0000
	Facilities	0	0.0000
	Segments	0	0.0000
	Tunnels	0	0.0000
	Subtotal		<b>0.0000</b>
<b>Bus</b>	Facilities	1	1.0137
	Subtotal		<b>1.0137</b>
<b>Ferry</b>	Facilities	0	0.0000
	Subtotal		<b>0.0000</b>
<b>Port</b>	Facilities	0	0.0000
	Subtotal		<b>0.0000</b>
<b>Airport</b>	Facilities	3	31.9530
	Runways	3	113.8920
	Subtotal		<b>145.8450</b>
	Total		<b>6,449.00</b>

**Table 2: Utility System Lifeline Inventory**

System	Component	# Locations / Segments	Replacement value (millions of dollars)
<b>Portable Water</b>	Distribution Lines	NA	682.3788
	Facilities	12	371.6280
	Pipelines	0	0.0000
	Subtotal		<b>1054.0068</b>
<b>Waste Water</b>	Distribution Lines	NA	409.4273
	Facilities	16	991.0080
	Pipelines	0	0.0000
	Subtotal		<b>1400.4353</b>
<b>Natural Gas</b>	Distribution Lines	NA	272.9515
	Facilities	1	1.0137
	Pipelines	0	0.0000
	Subtotal		<b>273.9652</b>
<b>Oil Systems</b>	Facilities	0	0.0000
	Pipelines	0	0.0000
	Subtotal		<b>0.0000</b>
<b>Electrical Power</b>	Facilities	3	306.9000
	Subtotal		<b>306.9000</b>
<b>Communication</b>	Facilities	29	2.6970
	Subtotal		<b>2.6970</b>
	Total		<b>3,038.00</b>

## Earthquake Scenario

Hazus uses the following set of information to define the earthquake parameters used for the earthquake loss estimate provided in this report.



<b>Scenario Name</b>	100yr Probabilistic Earthquake - Mag 5
<b>Type of Earthquake</b>	Probabilistic
<b>Fault Name</b>	NA
<b>Historical Epicenter ID #</b>	NA
<b>Probabilistic Return Period</b>	100.00
<b>Longitude of Epicenter</b>	NA
<b>Latitude of Epicenter</b>	NA
<b>Earthquake Magnitude</b>	5.00
<b>Depth (km)</b>	NA
<b>Rupture Length (Km)</b>	NA
<b>Rupture Orientation (degrees)</b>	NA
<b>Attenuation Function</b>	NA

## Direct Earthquake Damage

### Building Damage

Hazus estimates that about 0 buildings will be at least moderately damaged. This is over 0.00 % of the buildings in the region. There are an estimated 0 buildings that will be damaged beyond repair. The definition of the 'damage states' is provided in Volume 1: Chapter 5 of the Hazus technical manual. Table 3 below summarizes the expected damage by general occupancy for the buildings in the region. Table 4 below summarizes the expected damage by general building type.

### Damage Categories by General Occupancy Type

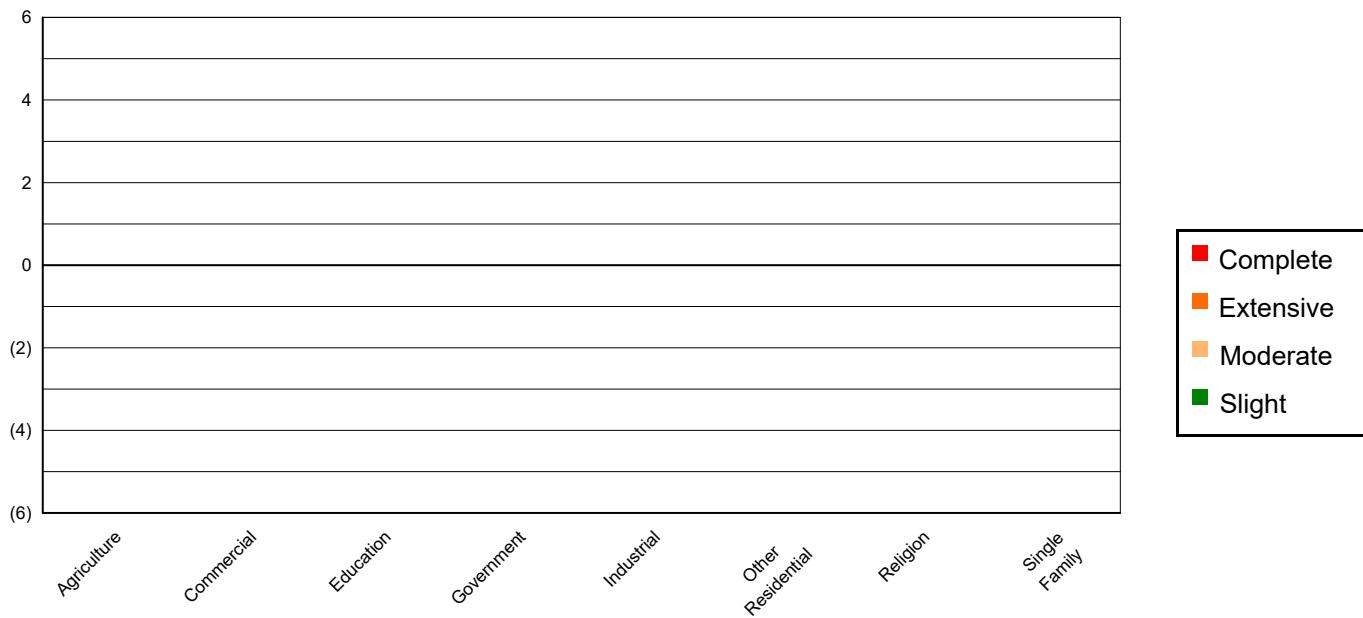


Table 3: Expected Building Damage by Occupancy

	None		Slight		Moderate		Extensive		Complete	
	Count	(%)	Count	(%)	Count	(%)	Count	(%)	Count	(%)
<b>Agriculture</b>	788.00	0.66	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
<b>Commercial</b>	5681.00	4.79	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
<b>Education</b>	277.00	0.23	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
<b>Government</b>	221.00	0.19	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
<b>Industrial</b>	1710.00	1.44	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
<b>Other Residential</b>	14316.00	12.07	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
<b>Religion</b>	812.00	0.68	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
<b>Single Family</b>	94760.00	79.92	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
<b>Total</b>	<b>118,565</b>		<b>0</b>		<b>0</b>		<b>0</b>		<b>0</b>	

**Table 4: Expected Building Damage by Building Type (All Design Levels)**

	None		Slight		Moderate		Extensive		Complete	
	Count	(%)	Count	(%)	Count	(%)	Count	(%)	Count	(%)
<b>Wood</b>	75641.90	63.80	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
<b>Steel</b>	4344.47	3.66	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
<b>Concrete</b>	822.76	0.69	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
<b>Precast</b>	324.04	0.27	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
<b>RM</b>	1151.37	0.97	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
<b>URM</b>	26595.46	22.43	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
<b>MH</b>	9685.00	8.17	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
<b>Total</b>	<b>118,565</b>		<b>0</b>		<b>0</b>		<b>0</b>		<b>0</b>	

\*Note:

RM Reinforced Masonry  
 URM Unreinforced Masonry  
 MH Manufactured Housing

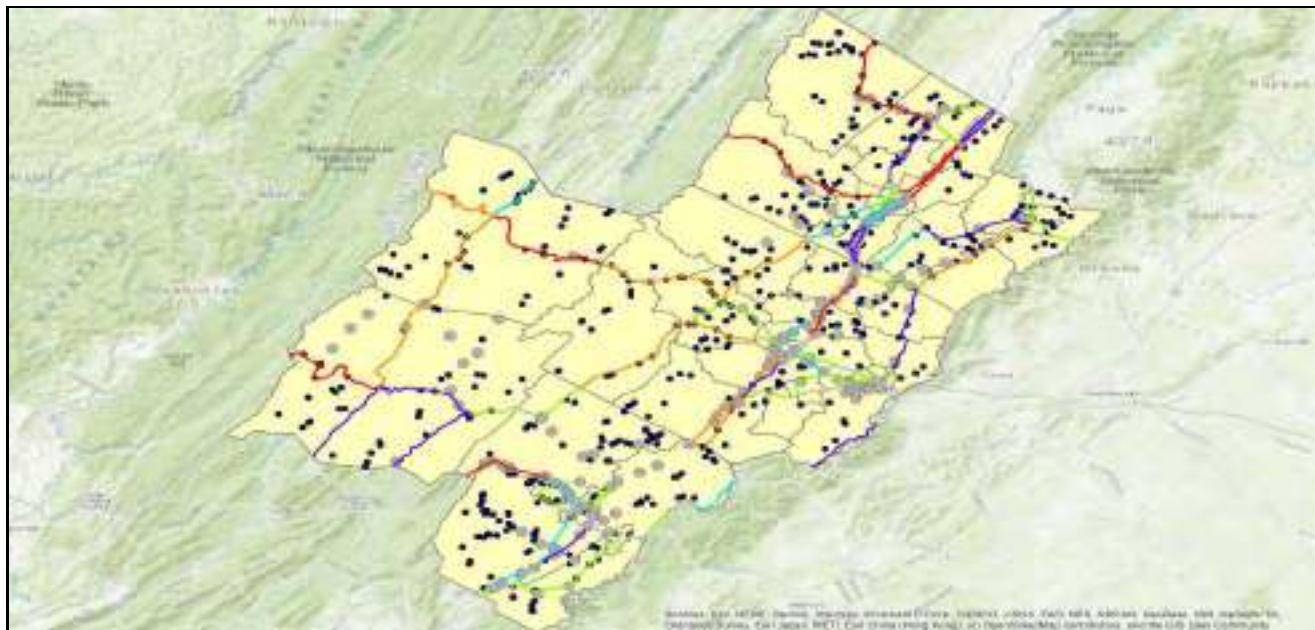
## Essential Facility Damage

Before the earthquake, the region had 543 hospital beds available for use. On the day of the earthquake, the model estimates that only 540 hospital beds (100.00%) are available for use by patients already in the hospital and those injured by the earthquake. After one week, 100.00% of the beds will be back in service. By 30 days, 100.00% will be operational.

**Table 5: Expected Damage to Essential Facilities**

Classification	Total	# Facilities		
		At Least Moderate Damage > 50%	Complete Damage > 50%	With Functionality > 50% on day 1
<b>Hospitals</b>	7	0	0	7
<b>Schools</b>	144	0	0	144
<b>EOCs</b>	9	0	0	9
<b>Police Stations</b>	28	0	0	28
<b>Fire Stations</b>	52	0	0	52

**Transportation Lifeline Damage**



**Table 6: Expected Damage to the Transportation Systems**

System	Component	Locations/ Segments	Number of Locations		
			With at Least Mod. Damage	With Complete Damage	With Functionality > 50 %
			After Day 1	After Day 7	
<b>Highway</b>	Segments	297	0	0	297
	Bridges	778	0	0	778
	Tunnels	0	0	0	0
<b>Railways</b>	Segments	222	0	0	222
	Bridges	3	0	0	3
	Tunnels	0	0	0	0
	Facilities	2	0	0	2
<b>Light Rail</b>	Segments	0	0	0	0
	Bridges	0	0	0	0
	Tunnels	0	0	0	0
	Facilities	0	0	0	0
<b>Bus</b>	Facilities	1	0	0	1
<b>Ferry</b>	Facilities	0	0	0	0
<b>Port</b>	Facilities	0	0	0	0
<b>Airport</b>	Facilities	3	0	0	3
	Runways	3	0	0	3

Table 6 provides damage estimates for the transportation system.

Note: Roadway segments, railroad tracks and light rail tracks are assumed to be damaged by ground failure only. If ground failure maps are not provided, damage estimates to these components will not be computed.

Tables 7-9 provide information on the damage to the utility lifeline systems. Table 7 provides damage to the utility system facilities. Table 8 provides estimates on the number of leaks and breaks by the pipelines of the utility systems. For electric power and potable water, Hazus performs a simplified system performance analysis. Table 9 provides a summary of the system performance information.

**Table 7 : Expected Utility System Facility Damage**

System	Total #	# of Locations			
		With at Least Moderate Damage	With Complete Damage	with Functionality > 50 %	
Potable Water	12	0	0	12	12
Waste Water	16	0	0	16	16
Natural Gas	1	0	0	1	1
Oil Systems	0	0	0	0	0
Electrical Power	3	0	0	3	3
Communication	29	0	0	29	29

**Table 8 : Expected Utility System Pipeline Damage (Site Specific)**

System	Total Pipelines Length (miles)	Number of Leaks	Number of Breaks
Potable Water	21,201	2	0
Waste Water	12,720	1	0
Natural Gas	8,480	0	0
Oil	0	0	0

**Table 9: Expected Potable Water and Electric Power System Performance**

	Total # of Households	Number of Households without Service				
		At Day 1	At Day 3	At Day 7	At Day 30	At Day 90
Potable Water	110,702	0	0	0	0	0
Electric Power		0	0	0	0	0

## Induced Earthquake Damage

### Fire Following Earthquake

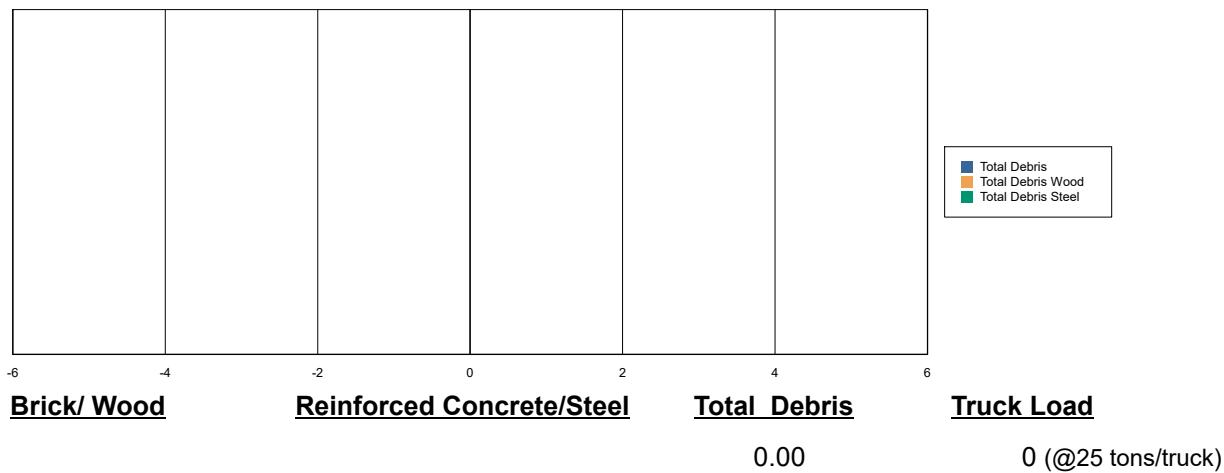
Fires often occur after an earthquake. Because of the number of fires and the lack of water to fight the fires, they can often burn out of control. Hazus uses a Monte Carlo simulation model to estimate the number of ignitions and the amount of burnt area. For this scenario, the model estimates that there will be 0 ignitions that will burn about 0.00 sq. mi 0.00 % of the region's total area.) The model also estimates that the fires will displace about 0 people and burn about 0 (millions of dollars) of building value.

### Debris Generation

Hazus estimates the amount of debris that will be generated by the earthquake. The model breaks the debris into two general categories: a) Brick/Wood and b) Reinforced Concrete/Steel. This distinction is made because of the different types of material handling equipment required to handle the debris.

The model estimates that a total of 0 tons of debris will be generated. Of the total amount, Brick/Wood comprises % of the total, with the remainder being Reinforced Concrete/Steel. If the debris tonnage is converted to an estimated number of truckloads, it will require 0 truckloads (@25 tons/truck) to remove the debris generated by the earthquake.

**Earthquake Debris (millions of tons)**



## Social Impact

### **Shelter Requirement**

Hazus estimates the number of households that are expected to be displaced from their homes due to the earthquake and the number of displaced people that will require accommodations in temporary public shelters. The model estimates 0 households to be displaced due to the earthquake. Of these, 0 people (out of a total population of 286,781) will seek temporary shelter in public shelters.

#### **Displaced Households/ Persons Seeking Short Term Public Shelter**

Displaced households as a result of the earthquake	Persons seeking temporary public shelter
0	0

### **Casualties**

Hazus estimates the number of people that will be injured and killed by the earthquake. The casualties are broken down into four (4) severity levels that describe the extent of the injuries. The levels are described as follows;

- Severity Level 1:Injuries will require medical attention but hospitalization is not needed.
- Severity Level 2:Injuries will require hospitalization but are not considered life-threatening
- Severity Level 3:Injuries will require hospitalization and can become life threatening if not promptly treated.
- Severity Level 4:Victims are killed by the earthquake.

The casualty estimates are provided for three (3) times of day: 2:00 AM, 2:00 PM and 5:00 PM. These times represent the periods of the day that different sectors of the community are at their peak occupancy loads. The 2:00 AM estimate considers that the residential occupancy load is maximum, the 2:00 PM estimate considers that the educational, commercial and industrial sector loads are maximum and 5:00 PM represents peak commute time.

Table 10 provides a summary of the casualties estimated for this earthquake

**Table 10: Casualty Estimates**

		Level 1	Level 2	Level 3	Level 4
<b>2 AM</b>	Commercial	0.00	0.00	0.00	0.00
	Commuting	0.00	0.00	0.00	0.00
	Educational	0.00	0.00	0.00	0.00
	Hotels	0.00	0.00	0.00	0.00
	Industrial	0.00	0.00	0.00	0.00
	Other-Residential	0.00	0.00	0.00	0.00
	Single Family	0.00	0.00	0.00	0.00
	<b>Total</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>0</b>
<b>2 PM</b>	Commercial	0.00	0.00	0.00	0.00
	Commuting	0.00	0.00	0.00	0.00
	Educational	0.00	0.00	0.00	0.00
	Hotels	0.00	0.00	0.00	0.00
	Industrial	0.00	0.00	0.00	0.00
	Other-Residential	0.00	0.00	0.00	0.00
	Single Family	0.00	0.00	0.00	0.00
	<b>Total</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>0</b>
<b>5 PM</b>	Commercial	0.00	0.00	0.00	0.00
	Commuting	0.00	0.00	0.00	0.00
	Educational	0.00	0.00	0.00	0.00
	Hotels	0.00	0.00	0.00	0.00
	Industrial	0.00	0.00	0.00	0.00
	Other-Residential	0.00	0.00	0.00	0.00
	Single Family	0.00	0.00	0.00	0.00
	<b>Total</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>0</b>

## Economic Loss

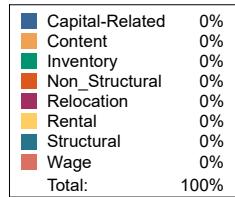
The total economic loss estimated for the earthquake is 0.02 (millions of dollars), which includes building and lifeline related losses based on the region's available inventory. The following three sections provide more detailed information about these losses.

## Building-Related Losses

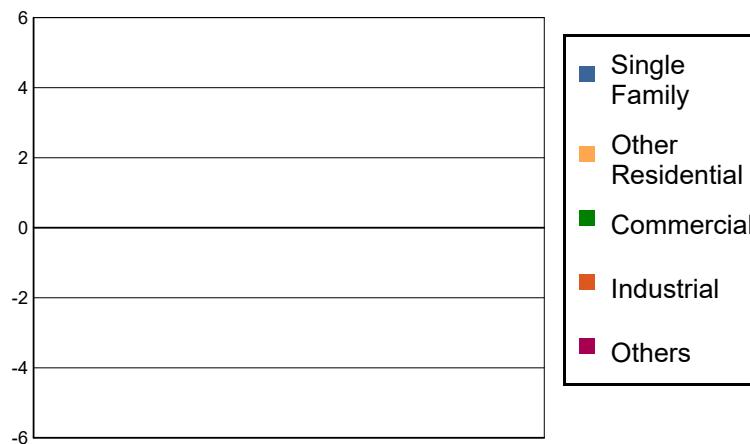
The building losses are broken into two categories: direct building losses and business interruption losses. The direct building losses are the estimated costs to repair or replace the damage caused to the building and its contents. The business interruption losses are the losses associated with inability to operate a business because of the damage sustained during the earthquake. Business interruption losses also include the temporary living expenses for those people displaced from their homes because of the earthquake.

The total building-related losses were 0.00 (millions of dollars); 0 % of the estimated losses were related to the business interruption of the region. By far, the largest loss was sustained by the residential occupancies which made up over 0 % of the total loss. Table 11 below provides a summary of the losses associated with the building damage.

Earthquake Losses by Loss Type (\$ millions)



Earthquake Losses by Occupancy Type (\$ millions)



**Table 11: Building-Related Economic Loss Estimates**

(Millions of dollars)

Category	Area	Single Family	Other Residential	Commercial	Industrial	Others	Total
<b>Income Losses</b>							
	Wage	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
	Capital-Related	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
	Rental	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
	Relocation	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
	<b>Subtotal</b>	<b>0.0000</b>	<b>0.0000</b>	<b>0.0000</b>	<b>0.0000</b>	<b>0.0000</b>	<b>0.0000</b>
<b>Capital Stock Losses</b>							
	Structural	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
	Non_Structural	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
	Content	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
	Inventory	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
	<b>Subtotal</b>	<b>0.0000</b>	<b>0.0000</b>	<b>0.0000</b>	<b>0.0000</b>	<b>0.0000</b>	<b>0.0000</b>
	<b>Total</b>	<b>0.00</b>	<b>0.00</b>	<b>0.00</b>	<b>0.00</b>	<b>0.00</b>	<b>0.00</b>

## Transportation and Utility Lifeline Losses

For the transportation and utility lifeline systems, Hazus computes the direct repair cost for each component only. There are no losses computed by Hazus for business interruption due to lifeline outages. Tables 12 & 13 provide a detailed breakdown in the expected lifeline losses.

**Table 12: Transportation System Economic Losses**  
 (Millions of dollars)

System	Component	Inventory Value	Economic Loss	Loss Ratio (%)
Highway	Segments	5423.5850	0.0000	0.00
	Bridges	460.7884	0.0000	0.00
	Tunnels	0.0000	0.0000	0.00
	Subtotal	<b>5884.3734</b>	<b>0.0000</b>	
Railways	Segments	412.3045	0.0000	0.00
	Bridges	0.1171	0.0000	0.00
	Tunnels	0.0000	0.0000	0.00
	Facilities	5.3260	0.0007	0.01
	Subtotal	<b>417.7476</b>	<b>0.0007</b>	
Light Rail	Segments	0.0000	0.0000	0.00
	Bridges	0.0000	0.0000	0.00
	Tunnels	0.0000	0.0000	0.00
	Facilities	0.0000	0.0000	0.00
	Subtotal	<b>0.0000</b>	<b>0.0000</b>	
Bus	Facilities	1.0137	0.0001	0.01
	Subtotal	<b>1.0137</b>	<b>0.0001</b>	
Ferry	Facilities	0.0000	0.0000	0.00
	Subtotal	<b>0.0000</b>	<b>0.0000</b>	
Port	Facilities	0.0000	0.0000	0.00
	Subtotal	<b>0.0000</b>	<b>0.0000</b>	
Airport	Facilities	31.9530	0.0038	0.01
	Runways	113.8920	0.0000	0.00
	Subtotal	<b>145.8450</b>	<b>0.0038</b>	
	Total	<b>6,448.98</b>	<b>0.00</b>	

**Table 13: Utility System Economic Losses**  
(Millions of dollars)

System	Component	Inventory Value	Economic Loss	Loss Ratio (%)
<b>Potable Water</b>	Pipelines	0.0000	0.0000	0.00
	Facilities	371.6280	0.0005	0.00
	Distribution Line	682.3788	0.0087	0.00
	<b>Subtotal</b>	<b>1054.0068</b>	<b>0.0092</b>	
<b>Waste Water</b>	Pipelines	0.0000	0.0000	0.00
	Facilities	991.0080	0.0006	0.00
	Distribution Line	409.4273	0.0044	0.00
	<b>Subtotal</b>	<b>1400.4353</b>	<b>0.0050</b>	
<b>Natural Gas</b>	Pipelines	0.0000	0.0000	0.00
	Facilities	1.0137	0.0000	0.00
	Distribution Line	272.9515	0.0015	0.00
	<b>Subtotal</b>	<b>273.9652</b>	<b>0.0015</b>	
<b>Oil Systems</b>	Pipelines	0.0000	0.0000	0.00
	Facilities	0.0000	0.0000	0.00
	<b>Subtotal</b>	<b>0.0000</b>	<b>0.0000</b>	
<b>Electrical Power</b>	Facilities	306.9000	0.0000	0.00
	<b>Subtotal</b>	<b>306.9000</b>	<b>0.0000</b>	
<b>Communication</b>	Facilities	2.6970	0.0000	0.00
	<b>Subtotal</b>	<b>2.6970</b>	<b>0.0000</b>	
	<b>Total</b>	<b>3,038.00</b>	<b>0.02</b>	

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**Appendix A: County Listing for the Region**

Augusta,VA

Bath,VA

Highland,VA

Rockbridge,VA

Rockingham,VA

Buena Vista,VA

Harrisonburg,VA

Lexington,VA

Staunton,VA

Waynesboro,VA

## Appendix B: Regional Population and Building Value Data

State	County Name	Population	Building Value (millions of dollars)		
			Residential	Non-Residential	Total
<b>Virginia</b>	Augusta	73,750	6,296	1,337	7,633
	Bath	4,731	739	78	817
	Highland	2,321	320	46	367
	Rockbridge	22,307	2,182	429	2,612
	Rockingham	76,314	6,609	1,260	7,869
	Buena Vista	6,650	509	214	724
	Harrisonburg	48,914	3,460	1,630	5,090
	Lexington	7,042	714	243	957
	Staunton	23,746	2,264	782	3,046
	Waynesboro	21,006	1,830	835	2,666
<b>Total Region</b>		<b>286,781</b>	<b>24,923</b>	<b>6,854</b>	<b>31,781</b>

## **Appendix H-**

### **2020 Central Shenandoah Regional Wildfire Protection Plan**

## APPENDIX H: Central Shenandoah Regional Wildfire Protection Plan

Concurrent to the Central Shenandoah Hazard Mitigation Plan (CSHMP) , Central Shenandoah Planning District Commission staff is completing the Central Shenandoah Regional Wildfire Protection Plan (CSRWPP). The CSRWPP will be a companion document to the CSHMP.

The purpose of this Wildfire Protection Plan is to help the local jurisdictions in the Central Shenandoah Region begin the steps to address forest planning at local level by refining and clarifying their priorities for the protection of life, property, and critical infrastructure in the Wildland Urban Interface (WUI). The CSRWPP is a planning process that involves collaboration between government agencies and other stakeholders involved with the wildland areas in the Region. The Plan examines the vulnerabilities communities in the region have to wildfire and includes strategies for prioritizing fuel reduction and structural ignitability.

The Central Shenandoah Regional Wildfire Plan will be a complimentary and valuable resource for communities interested in wildfire mitigation.

**Appendix I –  
National Flood Insurance Program (NFIP) Surveys**

## NATIONAL FLOOD INSURANCE PROGRAM (NFIP) SURVEY

**MUNICIPALITY: AUGUSTA COUNTY**

<b>1. FLOODPLAIN IDENTIFICATION AND MAPPING</b>			
<i>Requirement</i>	<i>Recommended Action</i>	<i>Yes/No</i>	<i>Comments</i>
a. Does the municipality maintain accessible copies of an effective Flood Insurance Rate Map (FIRM)/Digital Flood Insurance Rate Map (DFIRM)? Does the municipality maintain accessible copies of the most recent Flood Insurance Study (FIS)?	Place these documents in the local libraries or make available publicly.	Yes	Paper copies are available at the Community Development Office. Digital is incorporated into the online GIS available to the public
b. Has the municipality adopted the most current DFIRM/FIRM and FIS?	State the date of adoption, if approved.	Yes	Latest revision adopted 8/3/2015
c. Does the municipality support request for map updates?	If yes, state how.	Yes	Augusta County has worked with FEMA through the Cooperating Technical Partners (CTP) program to provide improved mapping along select waterways
d. Does the municipality share with Federal Emergency Management Agency (FEMA) any new technical or scientific data that could result in map revisions within 6 months of creation or identification of new data?	If yes, specify how.	Yes	Any project that would impact other properties is required to obtain a Letter of Map Revision (LOMR) from FEMA
e. Does the municipality provide assistance with local floodplain determinations?	If yes, specify how.	Yes	County will make determinations upon request
f. Does the municipality maintain a record of approved Letters of Map Change?	If yes, specify the responsible office.	Yes	County maintains all LOMC in paper and digital format

<b>2. FLOODPLAIN MANAGEMENT</b>			
<i>Requirement</i>	<i>Recommended Action</i>	<i>Yes/No</i>	<i>Comments</i>
a. Has the municipality adopted a compliant floodplain management ordinance that, at a minimum, regulates the following:	If yes, answer questions (1) through (4) below.		Yes
(1) Does the municipality issue permits for all proposed development in the Special Flood Hazard Areas (SFHAs)?	If yes, specify the office responsible.	Yes	Office of Community Development
(2) Does the municipality obtain, review, and utilize any Base Flood Elevation (BFE) and floodway data, and/or require BFE data for subdivision proposals and other development proposals larger than 50 lots or 5 acres?	If yes, specify the office responsible.	Yes	Office of Community Development
(3) Does the municipality identify measures to keep all new and substantially improved construction reasonably safe from flooding to or above the BFE, including anchoring, using flood-resistant materials, and designing or locating utilities and service facilities to prevent water damage?	If yes, specify the office responsible.	Yes	Office of Community Development
(4) Does the municipality document and maintain records of elevation data that document lowest floor elevation for new or substantially improved structures?	If yes, specify the office responsible.	Yes	Office of Community Development
b. If a compliant floodplain ordinance was adopted, does the municipality enforce the ordinance by monitoring compliance and taking remedial action to correct violations?	If yes, specify how.	Yes	Zoning inspection and upon receipt of complaints

<b>2. FLOODPLAIN MANAGEMENT</b>			
<i>Requirement</i>	<i>Recommended Action</i>	<i>Yes/No</i>	<i>Comments</i>
c. Has the municipality considered adopting activities that extend beyond the minimum requirements? Examples include: <ul style="list-style-type: none"> <li>• Participation in the Community Rating System</li> <li>• Prohibition of production or storage of chemicals in SFHA</li> <li>• Prohibition of certain types of structures, such as hospitals, nursing homes, and jails in SFHA</li> <li>• Prohibition of certain types of residential housing (manufactured homes) in SFHA</li> <li>• Floodplain ordinances that prohibit any new residential or nonresidential structures in SFHA</li> </ul>	If yes, specify activities.	Yes	County prohibits creation of new lots in the floodplain, requires 1 ft of freeboard, and restricts development in the pool area of flood control dams
<b>3. FLOOD INSURANCE</b>			
<i>Requirement</i>	<i>Recommended Action</i>	<i>Yes/No</i>	<i>Comments</i>
a. Does the municipality educate community members about the availability and value of flood insurance?	If yes, specify how.	Yes	Education provided by CSPDC through Shen Valley Project Impact
b. Does the municipality inform community property owners about changes to the DFIRM/FIRM that would impact their insurance rates?	If yes, specify how.	Yes	Part of the approval process of adopting revised maps
c. Does the municipality provide general assistance to community members regarding insurance issues?	If yes, specify how.	No	Augusta County directs residents and property owners to their insurance provider

**NATIONAL FLOOD INSURANCE PROGRAM (NFIP) SURVEY****MUNICIPALITY: BATH COUNTY**

<b>1. FLOODPLAIN IDENTIFICATION AND MAPPING</b>			
<i>Requirement</i>	<i>Recommended Action</i>	<i>Yes/No</i>	<i>Comments</i>
a. Does the municipality maintain accessible copies of an effective Flood Insurance Rate Map (FIRM)/Digital Flood Insurance Rate Map (DFIRM)? Does the municipality maintain accessible copies of the most recent Flood Insurance Study (FIS)?	Place these documents in the local libraries or make available publicly.	yes	
b. Has the municipality adopted the most current DFIRM/FIRM and FIS?	State the date of adoption, if approved.	Yes 8/29/2011	
c. Does the municipality support request for map updates?	If yes, state how.	n/a	
d. Does the municipality share with Federal Emergency Management Agency (FEMA) any new technical or scientific data that could result in map revisions within 6 months of creation or identification of new data?	If yes, specify how.	n/a	
e. Does the municipality provide assistance with local floodplain determinations?	If yes, specify how.	Yes	Documentation and guidance on obtaining assumed elevations
f. Does the municipality maintain a record of approved Letters of Map Change?	If yes, specify the responsible office.	Yes	Building, Planning & Zoning

<b>2. FLOODPLAIN MANAGEMENT</b>			
<i>Requirement</i>	<i>Recommended Action</i>	<i>Yes/No</i>	<i>Comments</i>
a. Has the municipality adopted a compliant floodplain management ordinance that, at a minimum, regulates the following:	If yes, answer questions (1) through (4) below.	Yes	
(1) Does the municipality issue permits for all proposed development in the Special Flood Hazard Areas (SFHAs)?	If yes, specify the office responsible.	Yes	Building, Planning & Zoning
(2) Does the municipality obtain, review, and utilize any Base Flood Elevation (BFE) and floodway data, and/or require BFE data for subdivision proposals and other development proposals larger than 50 lots or 5 acres?	If yes, specify the office responsible.	Yes	Building, Planning & Zoning
(3) Does the municipality identify measures to keep all new and substantially improved construction reasonably safe from flooding to or above the BFE, including anchoring, using flood-resistant materials, and designing or locating utilities and service facilities to prevent water damage?	If yes, specify the office responsible.	Yes	Building, Planning & Zoning
(4) Does the municipality document and maintain records of elevation data that document lowest floor elevation for new or substantially improved structures?	If yes, specify the office responsible.	Yes	Building, Planning & Zoning
b. If a compliant floodplain ordinance was adopted, does the municipality enforce the ordinance by monitoring compliance and taking remedial action to correct violations?	If yes, specify how.	Yes	Corrected to be brought into compliance

<b>2. FLOODPLAIN MANAGEMENT</b>			
<i>Requirement</i>	<i>Recommended Action</i>	<i>Yes/No</i>	<i>Comments</i>
c. Has the municipality considered adopting activities that extend beyond the minimum requirements? Examples include: <ul style="list-style-type: none"> <li>• Participation in the Community Rating System</li> <li>• Prohibition of production or storage of chemicals in SFHA</li> <li>• Prohibition of certain types of structures, such as hospitals, nursing homes, and jails in SFHA</li> <li>• Prohibition of certain types of residential housing (manufactured homes) in SFHA</li> <li>• Floodplain ordinances that prohibit any new residential or nonresidential structures in SFHA</li> </ul>	If yes, specify activities.	n/a	
<b>3. FLOOD INSURANCE</b>			
<i>Requirement</i>	<i>Recommended Action</i>	<i>Yes/No</i>	<i>Comments</i>
a. Does the municipality educate community members about the availability and value of flood insurance?	If yes, specify how.	Yes	Supply phone number for them to call
b. Does the municipality inform community property owners about changes to the DFIRM/FIRM that would impact their insurance rates?	If yes, specify how.	Yes	Public hearings when applicable
c. Does the municipality provide general assistance to community members regarding insurance issues?	If yes, specify how.	Yes	Provide information as available

**NATIONAL FLOOD INSURANCE PROGRAM (NFIP) SURVEY****MUNICIPALITY: ROCKBRIDGE COUNTY**

<b>1. FLOODPLAIN IDENTIFICATION AND MAPPING</b>			
<i>Requirement</i>	<i>Recommended Action</i>	<i>Yes/No</i>	<i>Comments</i>
a. Does the municipality maintain accessible copies of an effective Flood Insurance Rate Map (FIRM)/Digital Flood Insurance Rate Map (DFIRM)? Does the municipality maintain accessible copies of the most recent Flood Insurance Study (FIS)?	Place these documents in the local libraries or make available publicly.	yes	In the Office of Community Development and a GIS layer available on our web site
b. Has the municipality adopted the most current DFIRM/FIRM and FIS?	State the date of adoption, if approved.	yes	April 6, 2000
c. Does the municipality support request for map updates?	If yes, state how.	yes	Provide information for Land surveyors
d. Does the municipality share with Federal Emergency Management Agency (FEMA) any new technical or scientific data that could result in map revisions within 6 months of creation or identification of new data?	If yes, specify how.	yes	If we had such data
e. Does the municipality provide assistance with local floodplain determinations?	If yes, specify how.	yes	Floodplain Determination Letters
f. Does the municipality maintain a record of approved Letters of Map Change?	If yes, specify the responsible office.	yes	Office of Community Development

<b>2. FLOODPLAIN MANAGEMENT</b>			
<i>Requirement</i>	<i>Recommended Action</i>	<i>Yes/No</i>	<i>Comments</i>
a. Has the municipality adopted a compliant floodplain management ordinance that, at a minimum, regulates the following:	If yes, answer questions (1) through (4) below.	yes	
(1) Does the municipality issue permits for all proposed development in the Special Flood Hazard Areas (SFHAs)?	If yes, specify the office responsible.	yes	Office of Community Development Building Department
(2) Does the municipality obtain, review, and utilize any Base Flood Elevation (BFE) and floodway data, and/or require BFE data for subdivision proposals and other development proposals larger than 50 lots or 5 acres?	If yes, specify the office responsible.	yes	Office of Community Development
(3) Does the municipality identify measures to keep all new and substantially improved construction reasonably safe from flooding to or above the BFE, including anchoring, using flood-resistant materials, and designing or locating utilities and service facilities to prevent water damage?	If yes, specify the office responsible.	yes	
(4) Does the municipality document and maintain records of elevation data that document lowest floor elevation for new or substantially improved structures?	If yes, specify the office responsible.	yes	Building Department
b. If a compliant floodplain ordinance was adopted, does the municipality enforce the ordinance by monitoring compliance and taking remedial action to correct violations?	If yes, specify how.	yes	Office of Community Development Building Department

<b>2. FLOODPLAIN MANAGEMENT</b>			
<i>Requirement</i>	<i>Recommended Action</i>	<i>Yes/No</i>	<i>Comments</i>
c. Has the municipality considered adopting activities that extend beyond the minimum requirements? Examples include: <ul style="list-style-type: none"> <li>• Participation in the Community Rating System</li> <li>• Prohibition of production or storage of chemicals in SFHA</li> <li>• Prohibition of certain types of structures, such as hospitals, nursing homes, and jails in SFHA</li> <li>• Prohibition of certain types of residential housing (manufactured homes) in SFHA</li> <li>• Floodplain ordinances that prohibit any new residential or nonresidential structures in SFHA</li> </ul>	If yes, specify activities.	no	
<b>3. FLOOD INSURANCE</b>			
<i>Requirement</i>	<i>Recommended Action</i>	<i>Yes/No</i>	<i>Comments</i>
a. Does the municipality educate community members about the availability and value of flood insurance?	If yes, specify how.	yes	Provide information -
b. Does the municipality inform community property owners about changes to the DFIRM/FIRM that would impact their insurance rates?	If yes, specify how.	no	
c. Does the municipality provide general assistance to community members regarding insurance issues?	If yes, specify how.	yes	Provide maps to landowners and insurance companies

**NATIONAL FLOOD INSURANCE PROGRAM (NFIP) SURVEY****MUNICIPALITY: ROCKINGHAM COUNTY****1. FLOODPLAIN IDENTIFICATION AND MAPPING**

<i>Requirement</i>	<i>Recommended Action</i>	<i>Yes/No</i>	<i>Comments</i>
a. Does the municipality maintain accessible copies of an effective Flood Insurance Rate Map (FIRM)/Digital Flood Insurance Rate Map (DFIRM)? Does the municipality maintain accessible copies of the most recent Flood Insurance Study (FIS)?	Place these documents in the local libraries or make available publicly.	Yes	
b. Has the municipality adopted the most current DFIRM/FIRM and FIS?	State the date of adoption, if approved.	Yes	August 18, 2014
c. Does the municipality support request for map updates?	If yes, state how.	No	I don't understand this question. If this means does the County undertake mapping projects, then no.
d. Does the municipality share with Federal Emergency Management Agency (FEMA) any new technical or scientific data that could result in map revisions within 6 months of creation or identification of new data?	If yes, specify how.	Yes	Will be doing this process going forward based on recent conversation with DCR Floodplain Staff.
e. Does the municipality provide assistance with local floodplain determinations?	If yes, specify how.	Yes	Provide limited assistance in Approximate A zones, but generally require P.E. involvement.
f. Does the municipality maintain a record of approved Letters of Map Change?	If yes, specify the responsible office.	Yes	Community Development

<b>2. FLOODPLAIN MANAGEMENT</b>			
<i>Requirement</i>	<i>Recommended Action</i>	<i>Yes/No</i>	<i>Comments</i>
a. Has the municipality adopted a compliant floodplain management ordinance that, at a minimum, regulates the following:	If yes, answer questions (1) through (4) below.	Yes	
(1) Does the municipality issue permits for all proposed development in the Special Flood Hazard Areas (SFHAs)?	If yes, specify the office responsible.	Yes	Community Development
(2) Does the municipality obtain, review, and utilize any Base Flood Elevation (BFE) and floodway data, and/or require BFE data for subdivision proposals and other development proposals larger than 50 lots or 5 acres?	If yes, specify the office responsible.	Yes	Community Development
(3) Does the municipality identify measures to keep all new and substantially improved construction reasonably safe from flooding to or above the BFE, including anchoring, using flood-resistant materials, and designing or locating utilities and service facilities to prevent water damage?	If yes, specify the office responsible.	Yes	Community Development
(4) Does the municipality document and maintain records of elevation data that document lowest floor elevation for new or substantially improved structures?	If yes, specify the office responsible.	Yes	This process (collecting the 2 <sup>nd</sup> Elevation Certificate) could be improved on our part.
b. If a compliant floodplain ordinance was adopted, does the municipality enforce the ordinance by monitoring compliance and taking remedial action to correct violations?	If yes, specify how.	Yes	Enforcement through building inspection processes if still under construction. If the violations are pre-existing, letters are sent detailing requirements for compliance.

<b>2. FLOODPLAIN MANAGEMENT</b>			
<i>Requirement</i>	<i>Recommended Action</i>	<i>Yes/No</i>	<i>Comments</i>
c. Has the municipality considered adopting activities that extend beyond the minimum requirements? Examples include: <ul style="list-style-type: none"> <li>• Participation in the Community Rating System</li> <li>• Prohibition of production or storage of chemicals in SFHA</li> <li>• Prohibition of certain types of structures, such as hospitals, nursing homes, and jails in SFHA</li> <li>• Prohibition of certain types of residential housing (manufactured homes) in SFHA</li> <li>• Floodplain ordinances that prohibit any new residential or nonresidential structures in SFHA</li> </ul>	If yes, specify activities.	Yes	<p>Attempted to prohibit manufactured homes from being constructed in the floodplain, but were challenged by the Virginia Manufactured and Modular Housing Association and did not codify the prohibition.</p> <p>Have considered joining CRS, but do not currently have adequate staffing capacity to manage program requirements.</p>
<b>3. FLOOD INSURANCE</b>			
<i>Requirement</i>	<i>Recommended Action</i>	<i>Yes/No</i>	<i>Comments</i>
a. Does the municipality educate community members about the availability and value of flood insurance?	If yes, specify how.	Yes	Only by request – no proactive outreach.
b. Does the municipality inform community property owners about changes to the DFIRM/FIRM that would impact their insurance rates?	If yes, specify how.	Yes	Per FEMA letter notification requirements.
c. Does the municipality provide general assistance to community members regarding insurance issues?	If yes, specify how.	Yes	Available to answer questions via phone, email, or in person.

**NATIONAL FLOOD INSURANCE PROGRAM (NFIP) SURVEY****MUNICIPALITY: CITY OF BUENA VISTA**

<b>1. FLOODPLAIN IDENTIFICATION AND MAPPING</b>			
<i>Requirement</i>	<i>Recommended Action</i>	<i>Yes/No</i>	<i>Comments</i>
a. Does the municipality maintain accessible copies of an effective Flood Insurance Rate Map (FIRM)/Digital Flood Insurance Rate Map (DFIRM)? Does the municipality maintain accessible copies of the most recent Flood Insurance Study (FIS)?	Place these documents in the local libraries or make available publicly.	Yes	
b. Has the municipality adopted the most current DFIRM/FIRM and FIS?	State the date of adoption, if approved.	Not Known	City always references most recent DFIRM/FIRM
c. Does the municipality support request for map updates?	If yes, state how.	Yes	City provides contact information and letters of support if needed.
d. Does the municipality share with Federal Emergency Management Agency (FEMA) any new technical or scientific data that could result in map revisions within 6 months of creation or identification of new data?	If yes, specify how.	No	City is unaware of process for this, or of what data would qualify.
e. Does the municipality provide assistance with local floodplain determinations?	If yes, specify how.	Yes	City uses GIS maps to provide general flood hazard zone location, and directs to surveying firms for confirmation.
f. Does the municipality maintain a record of approved Letters of Map Change?	If yes, specify the responsible office.	Yes	Community & Economic Development

<b>2. FLOODPLAIN MANAGEMENT</b>			
<i>Requirement</i>	<i>Recommended Action</i>	<i>Yes/No</i>	<i>Comments</i>
a. Has the municipality adopted a compliant floodplain management ordinance that, at a minimum, regulates the following:	If yes, answer questions (1) through (4) below.	Yes	
(1) Does the municipality issue permits for all proposed development in the Special Flood Hazard Areas (SFHAs)?	If yes, specify the office responsible.	Yes	Community & Economic Development
(2) Does the municipality obtain, review, and utilize any Base Flood Elevation (BFE) and floodway data, and/or require BFE data for subdivision proposals and other development proposals larger than 50 lots or 5 acres?	If yes, specify the office responsible.	Yes	Community & Economic Development
(3) Does the municipality identify measures to keep all new and substantially improved construction reasonably safe from flooding to or above the BFE, including anchoring, using flood-resistant materials, and designing or locating utilities and service facilities to prevent water damage?	If yes, specify the office responsible.	Yes	Community & Economic Development
(4) Does the municipality document and maintain records of elevation data that document lowest floor elevation for new or substantially improved structures?	If yes, specify the office responsible.	Yes	Community & Economic Development
b. If a compliant floodplain ordinance was adopted, does the municipality enforce the ordinance by monitoring compliance and taking remedial action to correct violations?	If yes, specify how.	Yes	Building Official/Property Maintenance Official enforces through same process as other code violations

<b>2. FLOODPLAIN MANAGEMENT</b>			
<i>Requirement</i>	<i>Recommended Action</i>	<i>Yes/No</i>	<i>Comments</i>
c. Has the municipality considered adopting activities that extend beyond the minimum requirements? Examples include: <ul style="list-style-type: none"> <li>• Participation in the Community Rating System</li> <li>• Prohibition of production or storage of chemicals in SFHA</li> <li>• Prohibition of certain types of structures, such as hospitals, nursing homes, and jails in SFHA</li> <li>• Prohibition of certain types of residential housing (manufactured homes) in SFHA</li> <li>• Floodplain ordinances that prohibit any new residential or nonresidential structures in SFHA</li> </ul>	If yes, specify activities.	Yes	City evaluated CRS in 2015 but determined not cost-effective at the time. Other measures listed have not been considered.
<b>3. FLOOD INSURANCE</b>			
<i>Requirement</i>	<i>Recommended Action</i>	<i>Yes/No</i>	<i>Comments</i>
a. Does the municipality educate community members about the availability and value of flood insurance?	If yes, specify how.	No	Education/promotion plan in development to launch in 2020
b. Does the municipality inform community property owners about changes to the DFIRM/FIRM that would impact their insurance rates?	If yes, specify how.	No	Education/promotion plan in development to launch in 2020
c. Does the municipality provide general assistance to community members regarding insurance issues?	If yes, specify how.	No	Education/promotion plan in development to launch in 2020

## NATIONAL FLOOD INSURANCE PROGRAM (NFIP) SURVEY

**MUNICIPALITY: CITY OF HARRISONBURG**

<b>1. FLOODPLAIN IDENTIFICATION AND MAPPING</b>			
<i>Requirement</i>	<i>Recommended Action</i>	<i>Yes/No</i>	<i>Comments</i>
a. Does the municipality maintain accessible copies of an effective Flood Insurance Rate Map (FIRM)/Digital Flood Insurance Rate Map (DFIRM)? Does the municipality maintain accessible copies of the most recent Flood Insurance Study (FIS)?	Place these documents in the local libraries or make available publicly.	Yes	
b. Has the municipality adopted the most current DFIRM/FIRM and FIS?	State the date of adoption, if approved.	2008	
c. Does the municipality support request for map updates?	If yes, state how.	Yes	Send out adjacent property owner notifications before, during, and after sign off on FEMA applications
d. Does the municipality share with Federal Emergency Management Agency (FEMA) any new technical or scientific data that could result in map revisions within 6 months of creation or identification of new data?	If yes, specify how.	No	
e. Does the municipality provide assistance with local floodplain determinations?	If yes, specify how.	Yes	Local Floodplan Administrator makes the determination.
f. Does the municipality maintain a record of approved Letters of Map Change?	If yes, specify the responsible office.	Yes	Depart of Community Development

<b>2. FLOODPLAIN MANAGEMENT</b>			
<i>Requirement</i>	<i>Recommended Action</i>	<i>Yes/No</i>	<i>Comments</i>
a. Has the municipality adopted a compliant floodplain management ordinance that, at a minimum, regulates the following:	If yes, answer questions (1) through (4) below.	Yes	
(1) Does the municipality issue permits for all proposed development in the Special Flood Hazard Areas (SFHAs)?	If yes, specify the office responsible.	Yes	Community Development
(2) Does the municipality obtain, review, and utilize any Base Flood Elevation (BFE) and floodway data, and/or require BFE data for subdivision proposals and other development proposals larger than 50 lots or 5 acres?	If yes, specify the office responsible.	Yes	Community Development
(3) Does the municipality identify measures to keep all new and substantially improved construction reasonably safe from flooding to or above the BFE, including anchoring, using flood-resistant materials, and designing or locating utilities and service facilities to prevent water damage?	If yes, specify the office responsible.	Yes	Community Development
(4) Does the municipality document and maintain records of elevation data that document lowest floor elevation for new or substantially improved structures?	If yes, specify the office responsible.	Yes	Community Development
b. If a compliant floodplain ordinance was adopted, does the municipality enforce the ordinance by monitoring compliance and taking remedial action to correct violations?	If yes, specify how.	Yes	It's enforced through the Zoning Ordinance and has a progressive action process starting with written notification and ending through the court system.

<b>2. FLOODPLAIN MANAGEMENT</b>			
<i>Requirement</i>	<i>Recommended Action</i>	<i>Yes/No</i>	<i>Comments</i>
c. Has the municipality considered adopting activities that extend beyond the minimum requirements? Examples include: <ul style="list-style-type: none"> <li>• Participation in the Community Rating System</li> <li>• Prohibition of production or storage of chemicals in SFHA</li> <li>• Prohibition of certain types of structures, such as hospitals, nursing homes, and jails in SFHA</li> <li>• Prohibition of certain types of residential housing (manufactured homes) in SFHA</li> <li>• Floodplain ordinances that prohibit any new residential or nonresidential structures in SFHA</li> </ul>	If yes, specify activities.	No	
<b>3. FLOOD INSURANCE</b>			
<i>Requirement</i>	<i>Recommended Action</i>	<i>Yes/No</i>	<i>Comments</i>
a. Does the municipality educate community members about the availability and value of flood insurance?	If yes, specify how.	No	Unless they specifically ask
b. Does the municipality inform community property owners about changes to the DFIRM/FIRM that would impact their insurance rates?	If yes, specify how.	Yes	Notify adjacent properties of changes
c. Does the municipality provide general assistance to community members regarding insurance issues?	If yes, specify how.	Yes	During permitting processes and when asked.

**NATIONAL FLOOD INSURANCE PROGRAM (NFIP) SURVEY****MUNICIPALITY: CITY OF LEXINGTON**

<b>1. FLOODPLAIN IDENTIFICATION AND MAPPING</b>			
<i>Requirement</i>	<i>Recommended Action</i>	<i>Yes/No</i>	<i>Comments</i>
a. Does the municipality maintain accessible copies of an effective Flood Insurance Rate Map (FIRM)/Digital Flood Insurance Rate Map (DFIRM)? Does the municipality maintain accessible copies of the most recent Flood Insurance Study (FIS)?	Place these documents in the local libraries or make available publicly.	Yes	
b. Has the municipality adopted the most current DFIRM/FIRM and FIS?	State the date of adoption, if approved.	Yes	April 6, 2000
c. Does the municipality support request for map updates?	If yes, state how.	?	Have not had a map update request during my tenure (3.5 years)
d. Does the municipality share with Federal Emergency Management Agency (FEMA) any new technical or scientific data that could result in map revisions within 6 months of creation or identification of new data?	If yes, specify how.	?	If we were creating any new technical or scientific data, we would surely share with FEMA
e. Does the municipality provide assistance with local floodplain determinations?	If yes, specify how.	Yes	By request of the floodplain manager
f. Does the municipality maintain a record of approved Letters of Map Change?	If yes, specify the responsible office.	No	FEMA has those

<b>2. FLOODPLAIN MANAGEMENT</b>			
<i>Requirement</i>	<i>Recommended Action</i>	<i>Yes/No</i>	<i>Comments</i>
a. Has the municipality adopted a compliant floodplain management ordinance that, at a minimum, regulates the following:	If yes, answer questions (1) through (4) below.	Yes	
(1) Does the municipality issue permits for all proposed development in the Special Flood Hazard Areas (SFHAs)?	If yes, specify the office responsible.	Yes	Planning and Development
(2) Does the municipality obtain, review, and utilize any Base Flood Elevation (BFE) and floodway data, and/or require BFE data for subdivision proposals and other development proposals larger than 50 lots or 5 acres?	If yes, specify the office responsible.	Yes	Planning and Development office reviews BFE and floodway data, but there is not enough land in Lexington available for 50 lot subdivisions
(3) Does the municipality identify measures to keep all new and substantially improved construction reasonably safe from flooding to or above the BFE, including anchoring, using flood-resistant materials, and designing or locating utilities and service facilities to prevent water damage?	If yes, specify the office responsible.	Yes	Planning and Development
(4) Does the municipality document and maintain records of elevation data that document lowest floor elevation for new or substantially improved structures?	If yes, specify the office responsible.	Yes	Planning and Development
b. If a compliant floodplain ordinance was adopted, does the municipality enforce the ordinance by monitoring compliance and taking remedial action to correct violations?	If yes, specify how.	Yes	Compliance is achieved through building permit review process and have not needed to take corrective action in the last 3.5 years

<b>2. FLOODPLAIN MANAGEMENT</b>			
<i>Requirement</i>	<i>Recommended Action</i>	<i>Yes/No</i>	<i>Comments</i>
c. Has the municipality considered adopting activities that extend beyond the minimum requirements? Examples include: <ul style="list-style-type: none"> <li>• Participation in the Community Rating System</li> <li>• Prohibition of production or storage of chemicals in SFHA</li> <li>• Prohibition of certain types of structures, such as hospitals, nursing homes, and jails in SFHA</li> <li>• Prohibition of certain types of residential housing (manufactured homes) in SFHA</li> <li>• Floodplain ordinances that prohibit any new residential or nonresidential structures in SFHA</li> </ul>	If yes, specify activities.	No	
<b>3. FLOOD INSURANCE</b>			
<i>Requirement</i>	<i>Recommended Action</i>	<i>Yes/No</i>	<i>Comments</i>
a. Does the municipality educate community members about the availability and value of flood insurance?	If yes, specify how.	No	
b. Does the municipality inform community property owners about changes to the DFIRM/FIRM that would impact their insurance rates?	If yes, specify how.	No	No changes to the DFIRM/FIRM have occurred in the last 3.5 years
c. Does the municipality provide general assistance to community members regarding insurance issues?	If yes, specify how.	No	

**NATIONAL FLOOD INSURANCE PROGRAM (NFIP) SURVEY****MUNICIPALITY: CITY OF STAUNTON**

<b>1. FLOODPLAIN IDENTIFICATION AND MAPPING</b>			
<i>Requirement</i>	<i>Recommended Action</i>	<i>Yes/No</i>	<i>Comments</i>
a. Does the municipality maintain accessible copies of an effective Flood Insurance Rate Map (FIRM)/Digital Flood Insurance Rate Map (DFIRM)? Does the municipality maintain accessible copies of the most recent Flood Insurance Study (FIS)?	Place these documents in the local libraries or make available publicly.	Yes	On the GIS
b. Has the municipality adopted the most current DFIRM/FIRM and FIS?	State the date of adoption, if approved.	Yes	1/6/2010
c. Does the municipality support request for map updates?	If yes, state how.	Yes	
d. Does the municipality share with Federal Emergency Management Agency (FEMA) any new technical or scientific data that could result in map revisions within 6 months of creation or identification of new data?	If yes, specify how.	Yes	
e. Does the municipality provide assistance with local floodplain determinations?	If yes, specify how.	Yes	We answer requests
f. Does the municipality maintain a record of approved Letters of Map Change?	If yes, specify the responsible office.	Yes	Building Services Division

<b>2. FLOODPLAIN MANAGEMENT</b>			
<i>Requirement</i>	<i>Recommended Action</i>	<i>Yes/No</i>	<i>Comments</i>
a. Has the municipality adopted a compliant floodplain management ordinance that, at a minimum, regulates the following:	If yes, answer questions (1) through (4) below.		
(1) Does the municipality issue permits for all proposed development in the Special Flood Hazard Areas (SFHAs)?	If yes, specify the office responsible.	Yes	Building Services Division
(2) Does the municipality obtain, review, and utilize any Base Flood Elevation (BFE) and floodway data, and/or require BFE data for subdivision proposals and other development proposals larger than 50 lots or 5 acres?	If yes, specify the office responsible.	Yes	Building Services Division
(3) Does the municipality identify measures to keep all new and substantially improved construction reasonably safe from flooding to or above the BFE, including anchoring, using flood-resistant materials, and designing or locating utilities and service facilities to prevent water damage?	If yes, specify the office responsible.	Yes	Building Services Division
(4) Does the municipality document and maintain records of elevation data that document lowest floor elevation for new or substantially improved structures?	If yes, specify the office responsible.	Yes	Building Services Division
b. If a compliant floodplain ordinance was adopted, does the municipality enforce the ordinance by monitoring compliance and taking remedial action to correct violations?	If yes, specify how.	Yes	Notices sent for violations

<b>2. FLOODPLAIN MANAGEMENT</b>			
<i>Requirement</i>	<i>Recommended Action</i>	<i>Yes/No</i>	<i>Comments</i>
c. Has the municipality considered adopting activities that extend beyond the minimum requirements? Examples include: <ul style="list-style-type: none"> <li>• Participation in the Community Rating System</li> <li>• Prohibition of production or storage of chemicals in SFHA</li> <li>• Prohibition of certain types of structures, such as hospitals, nursing homes, and jails in SFHA</li> <li>• Prohibition of certain types of residential housing (manufactured homes) in SFHA</li> <li>• Floodplain ordinances that prohibit any new residential or nonresidential structures in SFHA</li> </ul>	If yes, specify activities.	Yes	Currently application in process for CRS
<b>3. FLOOD INSURANCE</b>			
<i>Requirement</i>	<i>Recommended Action</i>	<i>Yes/No</i>	<i>Comments</i>
a. Does the municipality educate community members about the availability and value of flood insurance?	If yes, specify how.	Yes	Educational programs with the CSPDC.
b. Does the municipality inform community property owners about changes to the DFIRM/FIRM that would impact their insurance rates?	If yes, specify how.	Yes	Public hearing and or Notice
c. Does the municipality provide general assistance to community members regarding insurance issues?	If yes, specify how.	Yes	Meet with and make recommendations.

**NATIONAL FLOOD INSURANCE PROGRAM (NFIP) SURVEY****MUNICIPALITY: WAYNESBORO**

<b>1. FLOODPLAIN IDENTIFICATION AND MAPPING</b>			
<i>Requirement</i>	<i>Recommended Action</i>	<i>Yes/No</i>	<i>Comments</i>
a. Does the municipality maintain accessible copies of an effective Flood Insurance Rate Map (FIRM)/Digital Flood Insurance Rate Map (DFIRM)? Does the municipality maintain accessible copies of the most recent Flood Insurance Study (FIS)?	Place these documents in the local libraries or make available publicly.	yes	
b. Has the municipality adopted the most current DFIRM/FIRM and FIS?	State the date of adoption, if approved.	yes	06/2012
c. Does the municipality support request for map updates?	If yes, state how.	no	
d. Does the municipality share with Federal Emergency Management Agency (FEMA) any new technical or scientific data that could result in map revisions within 6 months of creation or identification of new data?	If yes, specify how.	yes	
e. Does the municipality provide assistance with local floodplain determinations?	If yes, specify how.	yes	
f. Does the municipality maintain a record of approved Letters of Map Change?	If yes, specify the responsible office.	yes	zoning

<b>2. FLOODPLAIN MANAGEMENT</b>			
<i>Requirement</i>	<i>Recommended Action</i>	<i>Yes/No</i>	<i>Comments</i>
a. Has the municipality adopted a compliant floodplain management ordinance that, at a minimum, regulates the following:	If yes, answer questions (1) through (4) below.	yes	
(1) Does the municipality issue permits for all proposed development in the Special Flood Hazard Areas (SFHAs)?	If yes, specify the office responsible.	yes	
(2) Does the municipality obtain, review, and utilize any Base Flood Elevation (BFE) and floodway data, and/or require BFE data for subdivision proposals and other development proposals larger than 50 lots or 5 acres?	If yes, specify the office responsible.	yes	
(3) Does the municipality identify measures to keep all new and substantially improved construction reasonably safe from flooding to or above the BFE, including anchoring, using flood-resistant materials, and designing or locating utilities and service facilities to prevent water damage?	If yes, specify the office responsible.	yes	
(4) Does the municipality document and maintain records of elevation data that document lowest floor elevation for new or substantially improved structures?	If yes, specify the office responsible.	yes	
b. If a compliant floodplain ordinance was adopted, does the municipality enforce the ordinance by monitoring compliance and taking remedial action to correct violations?	If yes, specify how.	yes	

<b>2. FLOODPLAIN MANAGEMENT</b>			
<i>Requirement</i>	<i>Recommended Action</i>	<i>Yes/No</i>	<i>Comments</i>
c. Has the municipality considered adopting activities that extend beyond the minimum requirements? Examples include: <ul style="list-style-type: none"> <li>• Participation in the Community Rating System</li> <li>• Prohibition of production or storage of chemicals in SFHA</li> <li>• Prohibition of certain types of structures, such as hospitals, nursing homes, and jails in SFHA</li> <li>• Prohibition of certain types of residential housing (manufactured homes) in SFHA</li> <li>• Floodplain ordinances that prohibit any new residential or nonresidential structures in SFHA</li> </ul>	If yes, specify activities.	yes	No crs, cup per regulations from fema
<b>3. FLOOD INSURANCE</b>			
<i>Requirement</i>	<i>Recommended Action</i>	<i>Yes/No</i>	<i>Comments</i>
a. Does the municipality educate community members about the availability and value of flood insurance?	If yes, specify how.	yes	
b. Does the municipality inform community property owners about changes to the DFIRM/FIRM that would impact their insurance rates?	If yes, specify how.	no	
c. Does the municipality provide general assistance to community members regarding insurance issues?	If yes, specify how.	yes	

## **Appendix J - Locality Resolutions**

*The Plan will go before each of the 21 jurisdictions for adoption after approval of the Plan is received from VDEM and FEMA. The final copy of the Plan will include the Locality Resolutions.*

## **RESOLUTION**

### **Adoption of the Central Shenandoah Hazard Mitigation Plan 2020 Update**

**WHEREAS**, the City Council of Buena Vista, Virginia recognizes the threat that natural and man-made hazards pose to people within the City of Buena Vista; and

**WHEREAS**, the Disaster Mitigation Act of 2000, as amended, requires that local governments develop and adopt natural hazard mitigation plans in order to receive certain federal assistance and update these plans; and

**WHEREAS**, the Central Shenandoah Hazard Mitigation Plan (CSHMP) identifies mitigation strategies to reduce or eliminate long-term risk to people and property in our community and in the Central Shenandoah Region from the impacts of future hazards and disasters; and

**WHEREAS**, the CSHMP Steering Committee representing the 21 local jurisdictions of the Central Shenandoah Planning District convened in order to review the original Plan and study the Region's risks from and vulnerability to natural hazards, and to make recommendations on mitigating the effects of such hazards on the Region; and

**WHEREAS**, the Steering Committee was provided staff support by the Central Shenandoah Planning District Commission; and

**WHEREAS**, the efforts of the Steering Committee, the staff of the Central Shenandoah Planning District Commission, as well as members of the public, private, and nonprofit sectors, have resulted in the development of the 2020 Update of the Central Shenandoah Hazard Mitigation Plan for the City of Buena Vista; and

**WHEREAS**, the Central Shenandoah Regional Wildfire Community Protection Plan (CSRWP) is an annex to the Central Shenandoah Hazard Mitigation Plan and is included in this resolution,

**NOW THEREFORE, BE IT RESOLVED** by the City Council of Buena Vista, Virginia that the Central Shenandoah Hazard Mitigation Plan 2020 Update is hereby approved and adopted for the City of Buena Vista.

Adopted by the City Council this 6<sup>th</sup> day of May, 2021.  
(The City of Buena Vista)

APPROVED:



William H. Fitzgerald, Mayor

ATTEST:



Dawn M. Wheeler  
Dawn M. Wheeler, Clerk of Council

**RESOLUTION OF THE CITY COUNCIL OF THE CITY OF HARRISONBURG, VIRGINIA  
ADOPTING THE CENTRAL SHENANDOAH HAZARD MITIGATION PLAN 2020 UPDATE**

WHEREAS, the City Council of the City of Harrisonburg recognizes the threat that natural and man-made hazards pose to people within the City of Harrisonburg and

WHEREAS, the Disaster Mitigation Act of 2000, as amended, requires that local governments develop and adopt natural hazard mitigation plans in order to receive certain federal assistance and update these plans; and

WHEREAS, the Central Shenandoah Hazard Mitigation Plan (CSHMP) identifies mitigation strategies to reduce or eliminate long-term risk to people and property in our community and in the Central Shenandoah Region from the impacts of future hazards and disasters; and

WHEREAS, the CSHMP Steering Committee representing the 21 local jurisdictions of the Central Shenandoah Planning District convened in order to review the original Plan and study the Region's risks from and vulnerability to natural hazards, and to make recommendations on mitigating the effects of such hazards on the Region; and

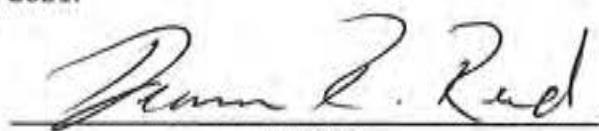
WHEREAS, the Steering Committee was provided staff support by the Central Shenandoah Planning District Commission; and

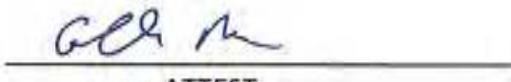
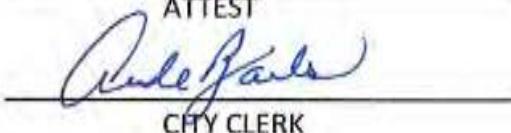
WHEREAS, the efforts of the Steering Committee, the staff of the Central Shenandoah Planning District Commission, as well as members of the public, private, and nonprofit sectors, have resulted in the development of the 2020 Update of the Central Shenandoah Hazard Mitigation Plan for the Region; and

WHEREAS, the Central Shenandoah Regional Wildfire Community Protection Plan (CSRWP) is an annex to the Central Shenandoah Hazard Mitigation Plan and is included in this resolution,

NOW THEREFORE, BE IT RESOLVED BY THE CITY COUNCIL OF THE CITY OF HARRISONBURG, VIRGINIA that the Central Shenandoah Hazard Mitigation Plan 2020 Update is hereby approved and adopted for the City of Harrisonburg.

Adopted this 25 day of May, 2021.

  
MAYOR

  
ATTEST  
  
CITY CLERK

ADOPTION OF THE CENTRAL SHENANDOAH HAZARD  
MITIGATION PLAN 2020 UPDATE

WHEREAS, The Lexington City Council recognizes the threat that natural and man-made hazards pose to people within the City of Lexington, and

WHEREAS, the Disaster Mitigation Act of 2000, as amended, requires that local governments develop and adopt natural hazard mitigation plans in order to receive federal assistance and update these plans; and

WHEREAS, the Central Shenandoah Hazard Mitigation Plan (CSHMP) identifies mitigation strategies to reduce or eliminate long-term risk to people and property in our community and in the Central Shenandoah Region from the impacts of future hazards and disasters; and

WHEREAS, the CSHMP Steering Committee representing the 21 local jurisdictions of the Central Shenandoah Planning District convened in order to review the original Plan and study the Region's risks from and vulnerability to natural hazards, and to make recommendations on mitigating the effects of such hazards on the Region; and

WHEREAS, the Steering Committee was provided staff support by the Central Shenandoah Planning District Commission; and

WHEREAS, the efforts of the Steering Committee, the staff of the Central Shenandoah Planning District Commission, as well as members of the public, private, and nonprofit sectors, have resulted in the development of the 2020 Update of the Central Shenandoah Hazard Mitigation Plan for the Region; and

WHEREAS, the Central Shenandoah Regional Wildfire Community Protection Plan (CSRWP) is an annex to the Central Shenandoah Hazard Mitigation Plan and is included in this resolution.

NOW, THEREFORE, BE IT RESOLVED by the Lexington City Council that the Central Shenandoah Hazard Mitigation Plan 2020 Update is hereby approved and adopted for the City of Lexington.

Adopted: June 3, 2021

LEXINGTON CITY COUNCIL

FRANK W. FRIEDMAN, Mayor

Attest:

Jani Hostetter, Clerk of Council

**RESOLUTION  
OF THE  
COUNCIL OF THE CITY OF STAUNTON  
AUTHORIZING THE ADOPTION OF THE CENTRAL SHENANDOAH  
HAZARD MITIGATION PLAN 2020 UPDATE**

**Recitals**

- A. Staunton City Council recognizes the threat that natural and man-made hazards pose to people within the City;
- B. The federal Disaster Mitigation Act of 2000, as amended, requires that local governments develop and adopt natural hazard mitigation plans in order to receive certain federal assistance and update these plans;
- C. The Central Shenandoah Hazard Mitigation Plan (CSHMP) (Plan) identifies mitigation strategies to reduce or eliminate long-term risk to people and property in our community and in the Central Shenandoah Region (Region) from the impacts of future hazards and disasters;
- D. The original Plan was approved by the Federal Emergency Management Agency and was adopted by Staunton City Council at its October 12, 2005 regular meeting;
- E. The Plan was subsequently updated and adopted by Staunton City Council at its December 12, 2013 regular meeting;
- F. The CSHMP Steering Committee (Steering Committee) representing the 21 local jurisdictions of the Central Shenandoah Planning District convened in order to review the Plan and study the Region's risks from and vulnerability to natural hazards, and to make recommendations on mitigating the effects of such hazards on the Region;
- G. The Steering Committee was provided staff support by the Central Shenandoah Planning District Commission;
- H. The efforts of the Steering Committee, the staff of the Central Shenandoah Planning District Commission, as well as members of the public, private, and nonprofit sectors, have resulted in the development of the 2020 Update of the Central Shenandoah Hazard Mitigation Plan for the Region;
- I. The Central Shenandoah Regional Wildfire Community Protection Plan (CSRWP) is an annex to the Central Shenandoah Hazard Mitigation Plan and is incorporated into this resolution by reference; and
- J. These recitals are an integral part of this resolution.

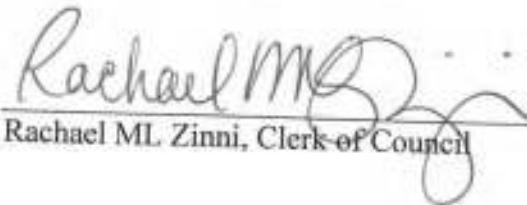
**NOW, THEREFORE, BE IT RESOLVED** by the Council of the City of Staunton, Virginia, that the Central Shenandoah Hazard Mitigation Plan 2020 Update is hereby approved and adopted for the City of Staunton.

Adopted this 12<sup>th</sup> day of August, 2021.



Andrea W. Oakes, Mayor

Attest:



Rachael ML Zinni, Clerk of Council

CITY COUNCIL OF WAYNESBORO, VIRGINIA

**RESOLUTION** (021-11)



**BE IT RESOLVED** by the Council of the City of Waynesboro, Virginia, that the City Council authorizes the updates to the Central Shenandoah Valley Hazards Mitigation Plan.

Resolved this 28th day of June, 2021.

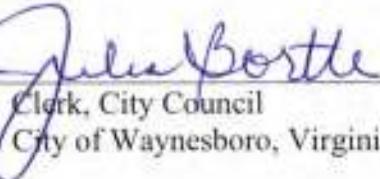
**CERTIFICATE**

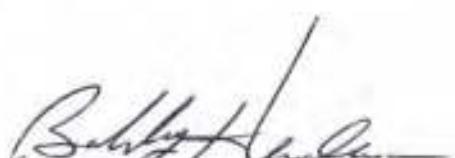
The undersigned Mayor and Clerk of the City Council of City of Waynesboro, Virginia hereby certify that the foregoing constitutes a true and correct copy of a resolution entitled Resolution authorizing the Central Shenandoah Valley Hazards Mitigation Plan, Virginia, adopted by the City Council at a meeting held on June 28, 2021.

Date: June 28, 2021

[SEAL]

ATTEST:

  
Julie Bortle  
Clerk, City Council  
City of Waynesboro, Virginia

  
Bobby Hales  
Mayor, City Council  
City of Waynesboro, Virginia



## Resolution

### Adoption of the Central Shenandoah Hazard Mitigation Plan 2020 Update

WHEREAS, the **Board of Supervisors** recognizes the threat that natural and man-made hazards pose to people within the **County of Augusta**, and

WHEREAS, the Disaster Mitigation Act of 2000, as amended, requires that local governments develop and adopt natural hazard mitigation plans in order to receive certain federal assistance and update these plans; and

WHEREAS, the Central Shenandoah Hazard Mitigation Plan (CSHMP) identifies mitigation strategies to reduce or eliminate long-term risk to people and property in our community and in the Central Shenandoah Region from the impacts of future hazards and disasters; and

WHEREAS, the CSHMP Steering Committee representing the 21 local jurisdictions of the Central Shenandoah Planning District convened in order to review the original Plan and study the Region's risks from and vulnerability to natural hazards, and to make recommendations on mitigating the effects of such hazards on the Region; and

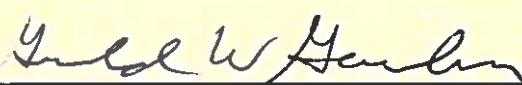
WHEREAS, the Steering Committee was provided staff support by the Central Shenandoah Planning District Commission; and

WHEREAS, the efforts of the Steering Committee, the staff of the Central Shenandoah Planning District Commission, as well as members of the public, private, and nonprofit sectors, have resulted in the development of the 2020 Update of the Central Shenandoah Hazard Mitigation Plan for the Region; and

WHEREAS, the Central Shenandoah Regional Wildfire Community Protection Plan (CSRWP) is an annex to the Central Shenandoah Hazard Mitigation Plan and is included in this resolution,

NOW THEREFORE, BE IT RESOLVED by the **Board of Supervisors** that the Central Shenandoah Hazard Mitigation Plan 2020 Update is hereby approved and adopted for the **County of Augusta**.

Adopted: May 12, 2021

  
\_\_\_\_\_  
Chairman, Augusta County Board of Supervisors

Edward T. Hicklin, Chair  
Roy W. Burns, Vice Chair  
Ronald R. Shifflet, Supervisor  
H. Lee Fry, Supervisor  
Thomas S. Burns, Supervisor



Bath County Courthouse  
P.O. Box 309  
Warm Springs, Virginia 24484  
540.839.7221 Phone  
540.839.7222 Fax

**RESOLUTION NO. 2021-2**  
**Adoption of the Central Shenandoah Hazard Mitigation Plan 2020 Update**

WHEREAS, the Bath County Board of Supervisors recognizes the threat that natural and man-made hazards pose to people within Bath County, and

WHEREAS, the Disaster Mitigation Act of 2000, as amended, requires that local governments develop and adopt natural hazard mitigation plans in order to receive certain federal assistance and update these plans; and

WHEREAS, the Central Shenandoah Hazard Mitigation Plan (CSHMP) identifies mitigation strategies to reduce or eliminate long-term risk to people and property in our community and in the Central Shenandoah Region from the impacts of future hazards and disasters; and

WHEREAS, the CSHMP Steering Committee representing the 21 local jurisdictions of the Central Shenandoah Planning District convened in order to review the original Plan and study the Region's risks from and vulnerability to natural hazards, and to make recommendations on mitigating the effects of such hazards on the Region; and

WHEREAS, the Steering Committee was provided staff support by the Central Shenandoah Planning District Commission; and

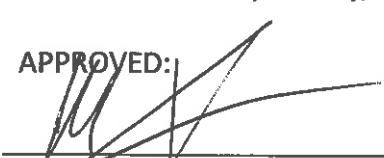
WHEREAS, the efforts of the Steering Committee, the staff of the Central Shenandoah Planning District Commission, as well as members of the public, private, and nonprofit sectors, have resulted in the development of the 2020 Update of the Central Shenandoah Hazard Mitigation Plan for the Region; and

WHEREAS, the Central Shenandoah Regional Wildfire Community Protection Plan (CSRWP) is an annex to the Central Shenandoah Hazard Mitigation Plan and is included in this resolution,

NOW THEREFORE, BE IT RESOLVED by the Bath County Board of Supervisors that the Central Shenandoah Hazard Mitigation Plan 2020 Update is hereby approved and adopted for Bath County.

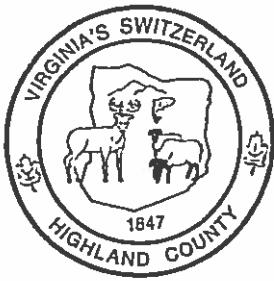
Adopted by the Bath County Board of Supervisors this 11th day of May, 2021.

APPROVED:

  
Edward T. Hicklin, Chairman

ATTEST:

  
Ashton N. Harrison, Clerk



COUNTY ADMINISTRATOR  
ROBERTA A. LAMBERT  
MONTEREY, VIRGINIA

## HIGHLAND COUNTY BOARD OF SUPERVISORS

P. O. BOX 130  
MONTEREY, VIRGINIA 24465  
Phone: 540-468-2347 Fax: 540-468-3447  
E-mail: [hcbboard@htcnet.org](mailto:hcbboard@htcnet.org)  
Website: [www.highlandcova.org](http://www.highlandcova.org)

### BOARD MEMBERS:

DAVID W. BLANCHARD  
MONTEREY, VIRGINIA

HARRY B. SPONAUGLE  
DOE HILL, VIRGINIA

JOHN L. MOYERS, JR.  
MCDOWELL, VIRGINIA

### RESOLUTION

#### **Adoption of the Central Shenandoah Hazard Mitigation Plan 2020 Update**

WHEREAS, the Highland County Board of Supervisors recognizes the threat that natural and man-made hazards pose to people within the County of Highland, and

WHEREAS, the Disaster Mitigation Act of 2000, as amended, requires that local governments develop and adopt natural hazard mitigation plans in order to receive certain federal assistance and update these plans; and

WHEREAS, the Central Shenandoah Hazard Mitigation Plan (CSHMP) identifies mitigation strategies to reduce or eliminate long-term risk to people and property in our community and in the Central Shenandoah Region from the impacts of future hazards and disasters; and

WHEREAS, the CSHMP Steering Committee representing the 21 local jurisdictions of the Central Shenandoah Planning District convened in order to review the original Plan and study the Region's risks from and vulnerability to natural hazards, and to make recommendations on mitigating the effects of such hazards on the Region; and

WHEREAS, the Steering Committee was provided staff support by the Central Shenandoah Planning District Commission; and

WHEREAS, the efforts of the Steering Committee, the staff of the Central Shenandoah Planning District Commission, as well as members of the public, private, and nonprofit sectors, have resulted in the development of the 2020 Update of the Central Shenandoah Hazard Mitigation Plan for the Region; and

WHEREAS, the Central Shenandoah Regional Wildfire Community Protection Plan (CSRWP) is an annex to the Central Shenandoah Hazard Mitigation Plan and is included in this resolution,

NOW THEREFORE, BE IT RESOLVED by the Highland County Board of Supervisors that the Central Shenandoah Hazard Mitigation Plan 2020 Update is hereby approved and adopted for the County of Highland.

Adopted by the Highland County Board of Supervisors this 5<sup>th</sup> day of April, 2022.

APPROVED:

John L. Moyers, Jr., Chairman

ATTEST:

Roberta A. Lambert

Roberta A. Lambert, Clerk of the Board



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ROCKBRIDGE COUNTY BOARD OF SUPERVISORS

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ADOPTION RESOLUTION OF THE CENTRAL SHENANDOAH HAZARD  
MITIGATION PLAN 2020 UPDATE

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**WHEREAS**, the Board of Supervisors of Rockbridge County recognizes the threat that natural and man-made hazards pose to people within the Rockbridge County, and,

**WHEREAS**, the Disaster Mitigation Act of 2000, as amended, requires that local governments develop and adopt natural hazard mitigation plans in order to receive certain federal assistance and update these plans; and,

**WHEREAS**, the Central Shenandoah Hazard Mitigation Plan (CSHMP) identifies mitigation strategies to reduce or eliminate long-term risk to people and property in our community and in the Central Shenandoah Region from the impacts of future hazards and disasters; and,

**WHEREAS**, the CSHMP Steering Committee representing the 21 local jurisdictions of the Central Shenandoah Planning District convened in order to review the original Plan and study the Region's risks from and vulnerability to natural hazards, and to make recommendations on mitigating the effects of such hazards on the Region; and,

**WHEREAS**, the Steering Committee was provided staff support by the Central Shenandoah Planning District Commission; and,

**WHEREAS**, the efforts of the Steering Committee, the staff of the Central Shenandoah Planning District Commission, as well as members of the public, private, and nonprofit sectors, have resulted in the development of the 2020 Update of the Central Shenandoah Hazard Mitigation Plan for the Region; and,

**WHEREAS**, the Central Shenandoah Regional Wildfire Community Protection Plan (CSRWP) is an annex to the Central Shenandoah Hazard Mitigation Plan and is included in this resolution.

**NOW THEREFORE, BE IT RESOLVED** by the Board of Supervisors of Rockbridge County that the Central Shenandoah Hazard Mitigation Plan 2020 Update is hereby approved and adopted for Rockbridge County.

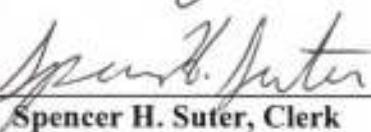
Adopted this 10<sup>th</sup> day of May, 2021.

**Recorded Vote:**

AYES: Day, Lewis, Ayers, McDaniel, Lyons  
NAYES: None  
ABSENT: None  
ABSTAIN: None

**ROCKBRIDGE COUNTY BOARD OF SUPERVISORS:**

By:   
Daniel E. Lyons, Chairman

Attest:   
Spencer H. Suter, Clerk



STEPHEN G. KING  
County Administrator



BOARD OF SUPERVISORS  
DEWEY L. RITCHIE  
Election District No. 1  
SALLIE WOLFE-GARRISON  
Election District No. 2  
RICK L. CHANDLER  
Election District No. 3  
WILLIAM B. KYGER, JR.  
Election District No. 4  
MICHAEL A. BREEDEN  
Election District No. 5

## ROCKINGHAM COUNTY RESOLUTION

### Adoption of the Central Shenandoah Hazard Mitigation Plan 2020 Update

WHEREAS, the Board of Supervisors of the County of Rockingham recognizes the threat that natural and man-made hazards pose to people within the County of Rockingham, and

WHEREAS, the Disaster Mitigation Act of 2000, as amended, requires that local governments develop and adopt natural hazard mitigation plans in order to receive certain federal assistance and update these plans; and

WHEREAS, the Central Shenandoah Hazard Mitigation Plan (CSHMP) identifies mitigation strategies to reduce or eliminate long-term risk to people and property in our community and in the Central Shenandoah Region from the impacts of future hazards and disasters; and

WHEREAS, the CSHMP Steering Committee representing the 21 local jurisdictions of the Central Shenandoah Planning District convened in order to review the original Plan and study the Region's risks from and vulnerability to natural hazards, and to make recommendations on mitigating the effects of such hazards on the Region; and

WHEREAS, the Steering Committee was provided staff support by the Central Shenandoah Planning District Commission; and

WHEREAS, the efforts of the Steering Committee, the staff of the Central Shenandoah Planning District Commission, as well as members of the public, private, and nonprofit sectors, have resulted in the development of the 2020 Update of the Central Shenandoah Hazard Mitigation Plan for the Region; and

WHEREAS, the Central Shenandoah Regional Wildfire Community Protection Plan (CSRWP) is an annex to the Central Shenandoah Hazard Mitigation Plan and is included in this resolution.

NOW THEREFORE, BE IT RESOLVED by the Board of Supervisors of the County of Rockingham that the Central Shenandoah Hazard Mitigation Plan 2020 Update is hereby approved and adopted for the County of Rockingham.

Adopted by the Board of Supervisors of the County of Rockingham, this 26<sup>th</sup> day of May, 2021.

APPROVED:

A handwritten signature in black ink that reads "Rick L. Chandler".

ATTEST:

A handwritten signature in black ink that reads "Stephen G. King".

# **Adoption of the Central Shenandoah Hazard Mitigation Plan 2020 Update**

Resolution R2021-04

**Whereas**, the Bridgewater Town Council recognizes the threat that natural and man-made hazards pose to people within the Town of Bridgewater, Virginia; and

**Whereas**, the Disaster Mitigation Act of 2000, as amended, requires that local governments develop and adopt natural hazard mitigation plans in order to receive certain federal assistance and update these plans; and

**Whereas**, the Central Shenandoah Hazard Mitigation Plan (CSHMP) identifies mitigation strategies to reduce or eliminate long-term risk to people and property in our community and in the Central Shenandoah Region from the impacts of future hazards and disasters; and

**Whereas**, the CSHMP Steering Committee representing the 21 local jurisdictions of the Central Shenandoah Planning District convened in order to review the original Plan and study the Region's risks from and vulnerability to natural hazards, and to make recommendations on mitigating the effects of such hazards on the Region; and

**Whereas**, the Steering Committee was provided staff support by the Central Shenandoah Planning District Commission; and

**Whereas**, the efforts of the Steering Committee, the staff of the Central Shenandoah Planning District Commission, as well as members of the public, private, and nonprofit sectors, have resulted in the development of the 2020 Update of the Central Shenandoah Hazard Mitigation Plan for the Region; and

**Whereas**, the Central Shenandoah Regional Wildfire Community Protection Plan (CSRWP) is an annex to the Central Shenandoah Hazard Mitigation Plan and is included in this resolution,

**Now therefore, be it resolved** by the Bridgewater Town Council that the Central Shenandoah Hazard Mitigation Plan 2020 Update is hereby approved and adopted for the Town of Bridgewater, Virginia.

**Resolved** this 8<sup>th</sup> day of June, 2021



Thaddeus W. Berry  
Mayor

ATTEST:



Betsy Putney  
Clerk

RESOLUTION

**Adoption of the Central Shenandoah Hazard Mitigation Plan 2020 Update**

WHEREAS, the **Broadway Town Council** recognizes the threat that natural and man-made hazards pose to people within the **Town of Broadway**, and

WHEREAS, the Disaster Mitigation Act of 2000, as amended, requires that local governments develop and adopt natural hazard mitigation plans in order to receive certain federal assistance and update these plans; and

WHEREAS, the Central Shenandoah Hazard Mitigation Plan (CSHMP) identifies mitigation strategies to reduce or eliminate long-term risk to people and property in our community and in the Central Shenandoah Region from the impacts of future hazards and disasters; and

WHEREAS, the CSHMP Steering Committee representing the 21 local jurisdictions of the Central Shenandoah Planning District convened in order to review the original Plan and study the Region's risks from and vulnerability to natural hazards, and to make recommendations on mitigating the effects of such hazards on the Region; and

WHEREAS, the Steering Committee was provided staff support by the Central Shenandoah Planning District Commission; and

WHEREAS, the efforts of the Steering Committee, the staff of the Central Shenandoah Planning District Commission, as well as members of the public, private, and nonprofit sectors, have resulted in the development of the 2020 Update of the Central Shenandoah Hazard Mitigation Plan for the Region; and

WHEREAS, the Central Shenandoah Regional Wildfire Community Protection Plan (CSRWP) is an annex to the Central Shenandoah Hazard Mitigation Plan and is included in this resolution,

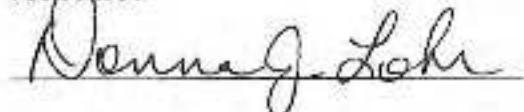
NOW THEREFORE, BE IT RESOLVED by the **Broadway Town Council** that the Central Shenandoah Hazard Mitigation Plan 2020 Update is hereby approved and adopted for the **Town of Broadway**.

Adopted by the Broadway Town Council this 5<sup>th</sup> day of DECEMBER, 2023.

APPROVED:



ATTEST:



## RESOLUTION

### **Adoption of the Central Shenandoah Hazard Mitigation Plan 2020 Update**

WHEREAS, the Town of Craigsville recognizes the threat that natural and man-made hazards pose to people within the Town, and

WHEREAS, the Disaster Mitigation Act of 2000, as amended, requires that local governments develop and adopt natural hazard mitigation plans in order to receive certain federal assistance and update these plans; and

WHEREAS, the Central Shenandoah Hazard Mitigation Plan (CSHMP) identifies mitigation strategies to reduce or eliminate long-term risk to people and property in our community and in the Central Shenandoah Region from the impacts of future hazards and disasters; and

WHEREAS, the CSHMP Steering Committee representing the 21 local jurisdictions of the Central Shenandoah Planning District convened in order to review the original Plan and study the Region's risks from and vulnerability to natural hazards, and to make recommendations on mitigating the effects of such hazards on the Region; and

WHEREAS, the Steering Committee was provided staff support by the Central Shenandoah Planning District Commission; and

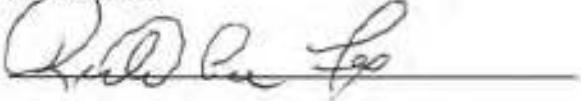
WHEREAS, the efforts of the Steering Committee, the staff of the Central Shenandoah Planning District Commission, as well as members of the public, private, and nonprofit sectors, have resulted in the development of the 2020 Update of the Central Shenandoah Hazard Mitigation Plan for the Region; and

WHEREAS, the Central Shenandoah Regional Wildfire Community Protection Plan (CSRWP) is an annex to the Central Shenandoah Hazard Mitigation Plan and is included in this resolution,

NOW THEREFORE, BE IT RESOLVED by the Town Council that the Central Shenandoah Hazard Mitigation Plan 2020 Update is hereby approved and adopted for the Town of Craigsville.

Adopted by the Town of Craigsville this 1st day of July, 2021.

APPROVED:



ATTEST:



## **RESOLUTION OF TOWN COUNCIL OF THE TOWN OF DAYTON, VIRGINIA**

### **Adoption of the Central Shenandoah Hazard Mitigation Plan 2020 Update**

**WHEREAS**, the Dayton Town Council recognizes the threat that natural and man-made hazards pose to people within the Town of Dayton, and

**WHEREAS**, the Disaster Mitigation Act of 2000, as amended, requires that local governments develop and adopt natural hazard mitigation plans in order to receive certain federal assistance and update these plans; and

**WHEREAS**, the Central Shenandoah Hazard Mitigation Plan (CSHMP) identifies mitigation strategies to reduce or eliminate long-term risk to people and property in our community and in the Central Shenandoah Region from the impacts of future hazards and disasters; and

**WHEREAS**, the CSHMP Steering Committee representing the 21 local jurisdictions of the Central Shenandoah Planning District convened in order to review the original Plan and study the Region's risks from and vulnerability to natural hazards, and to make recommendations on mitigating the effects of such hazards on the Region; and

**WHEREAS**, the Steering Committee was provided with a staff support by the Central Shenandoah Planning District Commission; and

**WHEREAS**, the efforts of the Steering Committee, the staff of the Central Shenandoah Planning District Commission, as well as members of the public, private, and nonprofit sectors, have resulted in the development of the 2020 Update of the Central Shenandoah Hazard Mitigation Plan for the Region; and

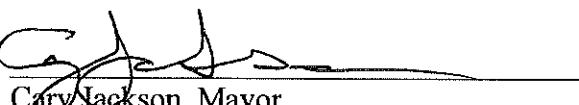
**WHEREAS**, the Central Shenandoah Regional Wildfire Community Protection Plan (CSRWP) is an annex to the Central Shenandoah Hazard Mitigation Plan and is included in this resolution,

**NOW THEREFORE, BE IT RESOLVED** by the Dayton Town Council that the Central Shenandoah Hazard Mitigation Plan 2020 Update is hereby approved and adopted for the Town of Dayton.

Adopted: July 12, 2021

**TOWN OF DAYTON**

By:



Cary Jackson, Mayor

**CERTIFICATION**

I hereby certify that I am the Clerk of the Town of Dayton, Virginia, and that the foregoing is a true copy of a Resolution adopted by the Council of the Town of Dayton in a duly assembled meeting on the 12<sup>th</sup> day of July, 2021, upon the following vote:

NAME	AYE	NAY	ABSTAIN	ABSENT
Mayor Cary Jackson	X			
Vice Mayor Dale Rodgers	X			
Bradford Dyjack	X			
Heidi Hoover	X			
Robert Seward	X			
Emily Estes	X			
Susan Mathias	X			



Christa Hall

Christa Hall, Town Clerk

# **TOWN OF ELKTON**



## **VIRGINIA**

### **Adoption of the Central Shenandoah Hazard Mitigation Plan 2020 Update**

WHEREAS, the Elkton Town Council recognizes the threat that natural and man-made hazards pose to people within the Town of Elkton, and

WHEREAS, the Disaster Mitigation Act of 2000, as amended, requires that local governments develop and adopt natural hazard mitigation plans in order to receive certain federal assistance and update these plans; and

WHEREAS, the Central Shenandoah Hazard Mitigation Plan (CSHMP) identifies mitigation strategies to reduce or eliminate long-term risk to people and property in our community and in the Central Shenandoah Region from the impacts of future hazards and disasters; and

WHEREAS, the CSHMP Steering Committee representing the 21 local jurisdictions of the Central Shenandoah Planning District convened in order to review the original Plan and study the Region's risks from and vulnerability to natural hazards, and to make recommendations on mitigating the effects of such hazards on the Region; and

WHEREAS, the Steering Committee was provided staff support by the Central Shenandoah Planning District Commission; and

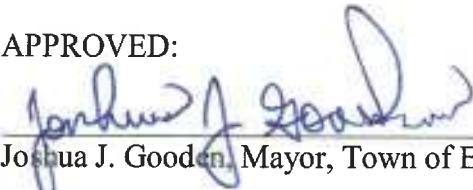
WHEREAS, the efforts of the Steering Committee, the staff of the Central Shenandoah Planning District Commission, as well as members of the public, private, and nonprofit sectors, have resulted in the development of the 2020 Update of the Central Shenandoah Hazard Mitigation Plan for the Region; and

WHEREAS, the Central Shenandoah Regional Wildfire Community Protection Plan (CSRWP) is an annex to the Central Shenandoah Hazard Mitigation Plan and is included in this resolution,

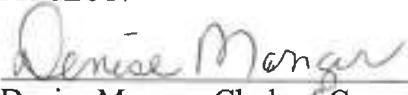
NOW THEREFORE, BE IT RESOLVED by the Elkton Town Council that the Central Shenandoah Hazard Mitigation Plan 2020 Update is hereby approved and adopted for the Town of Elkton.

Adopted by the Elkton Town Council this 18th day of December, 2023.

APPROVED:

  
Joshua J. Gooden, Mayor, Town of Elkton

ATTEST:

  
Denise Monger, Clerk of Council

RESOLUTION 2024-2

**Adoption of the Central Shenandoah Hazard Mitigation Plan 2020 Update**

WHEREAS, the **Town of Glasgow** recognizes the threat that natural and man-made hazards pose to people within the **Town of Glasgow**, and

WHEREAS, the Disaster Mitigation Act of 2000, as amended, requires that local governments develop and adopt natural hazard mitigation plans to receive certain federal assistance and update these plans; and

WHEREAS, the Central Shenandoah Hazard Mitigation Plan (CSHMP) identifies mitigation measures and strategies to reduce or eliminate long-term risk to people and property in our community and in the Central Shenandoah Region from the impacts of future hazards and disasters; and

WHEREAS, the CSHMP Steering Committee representing 21 local jurisdictions of the Central Shenandoah Planning District convened in order to review the original Plan and study the Region's risk from and vulnerability to natural hazard, and to make recommendations on mitigating the effects of such hazards on the Region; and

WHEREAS, the steering committee was provided staff support by the Central Shenandoah Planning District Commission; and

WHEREAS, the effort of the Steering Committee, the staff of the Central Shenandoah Planning District Commission, as well as members of the public, private and nonprofit sectors, have resulted in the development of the 2020 Update of the Central Shenandoah Hazard Mitigation Plan for the Region; and

WHEREAS, the Central Shenandoah Regional Wildfire Community Protection Plan (CSRWP) is an annex to the Central Shenandoah Hazard Mitigation Plan and is included in this resolution,

NOW THEREFORE, BE IT RESOLVED by the **Town of Glasgow, Virginia**, that the Central Shenandoah Hazard Mitigation Plan 2020 update is hereby approved and adopted for the **Town of Glasgow**.

Adopted by the Town of Glasgow this 9 day of January, 2024.

APPROVED: Paul K. Hill

ATTEST:

Jon Ellerstad, Clerk

## RESOLUTION

### **Adoption of the Central Shenandoah Hazard Mitigation Plan 2020 Update**

WHEREAS, the Town Of Goshen recognizes the threat that natural and man-made hazards pose to people within the Town Of Goshen, and

WHEREAS, the Disaster Mitigation Act of 2000, as amended, requires that local governments develop and adopt natural hazard mitigation plans in order to receive certain federal assistance and update these plans; and

WHEREAS, the Central Shenandoah Hazard Mitigation Plan (CSHMP) identifies mitigation strategies to reduce or eliminate long-term risk to people and property in our community and in the Central Shenandoah Region from the impacts of future hazards and disasters; and

WHEREAS, the CSHMP Steering Committee representing the 21 local jurisdictions of the Central Shenandoah Planning District convened in order to review the original Plan and study the Region's risks from and vulnerability to natural hazards, and to make recommendations on mitigating the effects of such hazards on the Region; and

WHEREAS, the Steering Committee was provided staff support by the Central Shenandoah Planning District Commission; and

WHEREAS, the efforts of the Steering Committee, the staff of the Central Shenandoah Planning District Commission, as well as members of the public, private, and nonprofit sectors, have resulted in the development of the 2020 Update of the Central Shenandoah Hazard Mitigation Plan for the Region; and

WHEREAS, the Central Shenandoah Regional Wildfire Community Protection Plan (CSRWP) is an annex to the Central Shenandoah Hazard Mitigation Plan and is included in this resolution,

NOW THEREFORE, BE IT RESOLVED by the Town Of Goshen, VA, that the Central Shenandoah Hazard Mitigation Plan 2020 Update is hereby approved and adopted for the Town Of Goshen.

Adopted by the Town of Goshen this 4<sup>th</sup> day of May, 2021.

APPROVED:

Tommy Carr - Mayor

ATTEST:

Shila Sampson, Clerk

**THE COUNCIL OF THE TOWN OF GROTOES, VIRGINIA**  
**RESOLUTION ADOPTING THE CENTRAL SHENANDOAH HAZARD MITIGATION**  
**PLAN 2020 UPDATE**

WHEREAS, the Town recognizes the threat that natural and man-made hazards pose to people within Grottoes and

WHEREAS, the Disaster Mitigation Act of 2000, as amended, requires that local governments develop and adopt natural hazard mitigation plans in order to receive certain federal assistance and update these plans; and

WHEREAS, the Central Shenandoah Hazard Mitigation Plan (CSHMP) identifies mitigation strategies to reduce or eliminate long-term risk to people and property in our community and in the Central Shenandoah Region from the impacts of future hazards and disasters; and

WHEREAS, the CSHMP Steering Committee representing the 21 local jurisdictions of the Central Shenandoah Planning District convened in order to review the original Plan and study the Region's risks from and vulnerability to natural hazards, and to make recommendations on mitigating the effects of such hazards on the Region; and

WHEREAS, the Steering Committee was provided staff support by the Central Shenandoah Planning District Commission; and

WHEREAS, the efforts of the Steering Committee, the staff of the Central Shenandoah Planning District Commission, as well as members of the public, private, and nonprofit sectors, have resulted in the development of the 2020 Update of the Central Shenandoah Hazard Mitigation Plan for the Region; and

WHEREAS, the Central Shenandoah Regional Wildfire Community Protection Plan (CSRWP) is an annex to the Central Shenandoah Hazard Mitigation Plan and is included in this resolution,

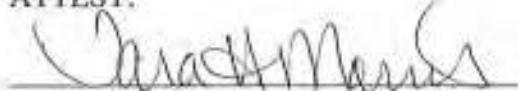
NOW THEREFORE, BE IT RESOLVED by the Town Council that the Central Shenandoah Hazard Mitigation Plan 2020 Update is hereby approved and adopted for the Town of Grottoes.

Adopted by the Town Council this 12 day of July, 2021.

APPROVED:



ATTEST:



## RESOLUTION

### **Adoption of the Central Shenandoah Hazard Mitigation Plan 2020 Update**

WHEREAS, the Town of Monterey, Virginia recognizes the threat that natural and man-made hazards pose to people within the Town, and

WHEREAS, the Disaster Mitigation Act of 2000, as amended, requires that local governments develop and adopt natural hazard mitigation plans in order to receive certain federal assistance and update these plans; and

WHEREAS, the Central Shenandoah Hazard Mitigation Plan (CSHMP) identifies mitigation strategies to reduce or eliminate long-term risk to people and property in our community and in the Central Shenandoah Region from the impacts of future hazards and disasters; and

WHEREAS, the CSHMP Steering Committee representing the 21 local jurisdictions of the Central Shenandoah Planning District convened in order to review the original Plan and study the Region's risks from and vulnerability to natural hazards, and to make recommendations on mitigating the effects of such hazards on the Region; and

WHEREAS, the Steering Committee was provided staff support by the Central Shenandoah Planning District Commission; and

WHEREAS, the efforts of the Steering Committee, the staff of the Central Shenandoah Planning District Commission, as well as members of the public, private, and nonprofit sectors, have resulted in the development of the 2020 Update of the Central Shenandoah Hazard Mitigation Plan for the Region; and

WHEREAS, the Central Shenandoah Regional Wildfire Community Protection Plan (CSRWP) is an annex to the Central Shenandoah Hazard Mitigation Plan and is included in this resolution,

NOW THEREFORE, BE IT RESOLVED by the Monterey Town Council that the Central Shenandoah Hazard Mitigation Plan 2020 Update is hereby approved and adopted for the Town of Monterey.

Adopted by the Town Council this 3<sup>rd</sup> day of June, 2021.

APPROVED:



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Ronald Wimer, Mayor

ATTEST:



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Alice Shumate, Town Clerk

## RESOLUTION

### **Adoption of the Central Shenandoah Hazard Mitigation Plan 2020 Update**

WHEREAS, the Mount Crawford Town Council recognizes the threat that natural and man-made hazards pose to people within the Town of Mount Crawford, and

WHEREAS, the Disaster Mitigation Act of 2000, as amended, requires that local governments develop and adopt natural hazard mitigation plans in order to receive certain federal assistance and update these plans; and

WHEREAS, the Central Shenandoah Hazard Mitigation Plan (CSHMP) identifies mitigation strategies to reduce or eliminate long-term risk to people and property in our community and in the Central Shenandoah Region from the impacts of future hazards and disasters; and

WHEREAS, the CSHMP Steering Committee representing the 21 local jurisdictions of the Central Shenandoah Planning District convened in order to review the original Plan and study the Region's risks from and vulnerability to natural hazards, and to make recommendations on mitigating the effects of such hazards on the Region; and

WHEREAS, the Steering Committee was provided staff support by the Central Shenandoah Planning District Commission; and

WHEREAS, the efforts of the Steering Committee, the staff of the Central Shenandoah Planning District Commission, as well as members of the public, private, and nonprofit sectors, have resulted in the development of the 2020 Update of the Central Shenandoah Hazard Mitigation Plan for the Region; and

WHEREAS, the Central Shenandoah Regional Wildfire Community Protection Plan (CSRWP) is an annex to the Central Shenandoah Hazard Mitigation Plan and is included in this resolution,

NOW THEREFORE, BE IT RESOLVED by the Mount Crawford Town Council that the Central Shenandoah Hazard Mitigation Plan 2020 Update is hereby approved and adopted for the Town of Mount Crawford.

Adopted by the Mount Crawford Town Council this 12<sup>th</sup> day of July, 2021.

APPROVED:

ATTEST:



**A RESOLUTION  
FOR THE TOWN OF TIMBERVILLE**

**Adoption of the Central Shenandoah Hazard Mitigation Plan 2020 Update**

WHEREAS, the Timberville Town Council recognizes the threat that natural and man-made hazards pose to people within the Town of Timberville, and

WHEREAS, the Disaster Mitigation Act of 2000, as amended, requires that local governments develop and adopt natural hazard mitigation plans in order to receive certain federal assistance and update these plans; and

WHEREAS, the Central Shenandoah Hazard Mitigation Plan (CSHMP) identifies mitigation strategies to reduce or eliminate long-term risk to people and property in our community and in the Central Shenandoah Region from the impacts of future hazards and disasters; and

WHEREAS, the CSHMP Steering Committee representing the 21 local jurisdictions of the Central Shenandoah Planning District convened in order to review the original Plan and study the Region's risks from and vulnerability to natural hazards, and to make recommendations on mitigating the effects of such hazards on the Region; and

WHEREAS, the Steering Committee was provided staff support by the Central Shenandoah Planning District Commission; and

WHEREAS, the efforts of the Steering Committee, the staff of the Central Shenandoah Planning District Commission, as well as members of the public, private, and nonprofit sectors, have resulted in the development of the 2020 Update of the Central Shenandoah Hazard Mitigation Plan for the Region; and

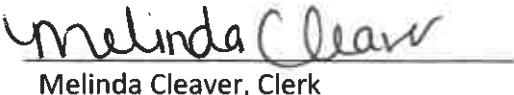
WHEREAS, the Central Shenandoah Regional Wildfire Community Protection Plan (CSRWP) is an annex to the Central Shenandoah Hazard Mitigation Plan and is included in this resolution,

NOW THEREFORE, BE IT RESOLVED by the Timberville Town Council that the Central Shenandoah Hazard Mitigation Plan 2020 Update is hereby approved and adopted for the Town of Timberville.

Adopted by the Timberville Town Council this 8<sup>th</sup> day of July, 2021.

APPROVED:  
  
Don Delaughter, Mayor

ATTEST:

  
Melinda Cleaver, Clerk



## RESOLUTION

### **Adoption of the Central Shenandoah Hazard Mitigation Plan 2020 Update**

WHEREAS, the Central Shenandoah Planning District Commission recognizes the threat that natural and man-made hazards pose to people within the Region and

WHEREAS, the Disaster Mitigation Act of 2000, as amended, requires that local governments develop and adopt natural hazard mitigation plans in order to receive certain federal assistance and update these plans; and

WHEREAS, the Central Shenandoah Hazard Mitigation Plan (CSHMP) identifies mitigation strategies to reduce or eliminate long-term risk to people and property in our community and in the Central Shenandoah Region from the impacts of future hazards and disasters; and

WHEREAS, the CSHMP Steering Committee representing the 21 local jurisdictions of the Central Shenandoah Planning District convened in order to review the original Plan and study the Region's risks from and vulnerability to natural hazards, and to make recommendations on mitigating the effects of such hazards on the Region; and

WHEREAS, the Steering Committee was provided staff support by the Central Shenandoah Planning District Commission; and

WHEREAS, the efforts of the Steering Committee, the staff of the Central Shenandoah Planning District Commission, as well as members of the public, private, and nonprofit sectors, have resulted in the development of the 2020 Update of the Central Shenandoah Hazard Mitigation Plan for the Region; and

WHEREAS, the Central Shenandoah Regional Wildfire Community Protection Plan (CSRWPP) is an annex to the Central Shenandoah Hazard Mitigation Plan and is included in this resolution,

NOW THEREFORE, BE IT RESOLVED by the Central Shenandoah Planning District Commission that the Central Shenandoah Hazard Mitigation Plan 2020 Update is hereby approved and adopted.

Adopted by the CSPDC this 21st day of June 2021.

APPROVED:



Frank Friedman  
CSPDC Chairperson

ATTEST:



Rita Whisler



January 24, 2025

Wendy C. Howard-Cooper  
Division Director, Dam Safety & Floodplain Management  
Virginia Department of Conservation and Recreation  
600 East Main Street, 24th Floor  
Richmond, VA 23219

Re: Community Flood Preparedness Fund Match Funding Confirmation

Ms. Howard-Cooper:

The CSPDC is pleased to submit a Community Flood Preparedness Fund (CFPF) Planning and Capacity Building application to develop a Central Shenandoah Planning District Commission (CSPDC) Regional Flood and Stormwater Resilience Plan on behalf of the 19 participating localities in our region.

Localities continue to express a strong need to identify, develop, and prioritize specific flood and stormwater best management practice (BMP) projects, and the CFPF grant is a unique opportunity to provide much-needed environmental planning and engineering assistance to small, unregulated communities.

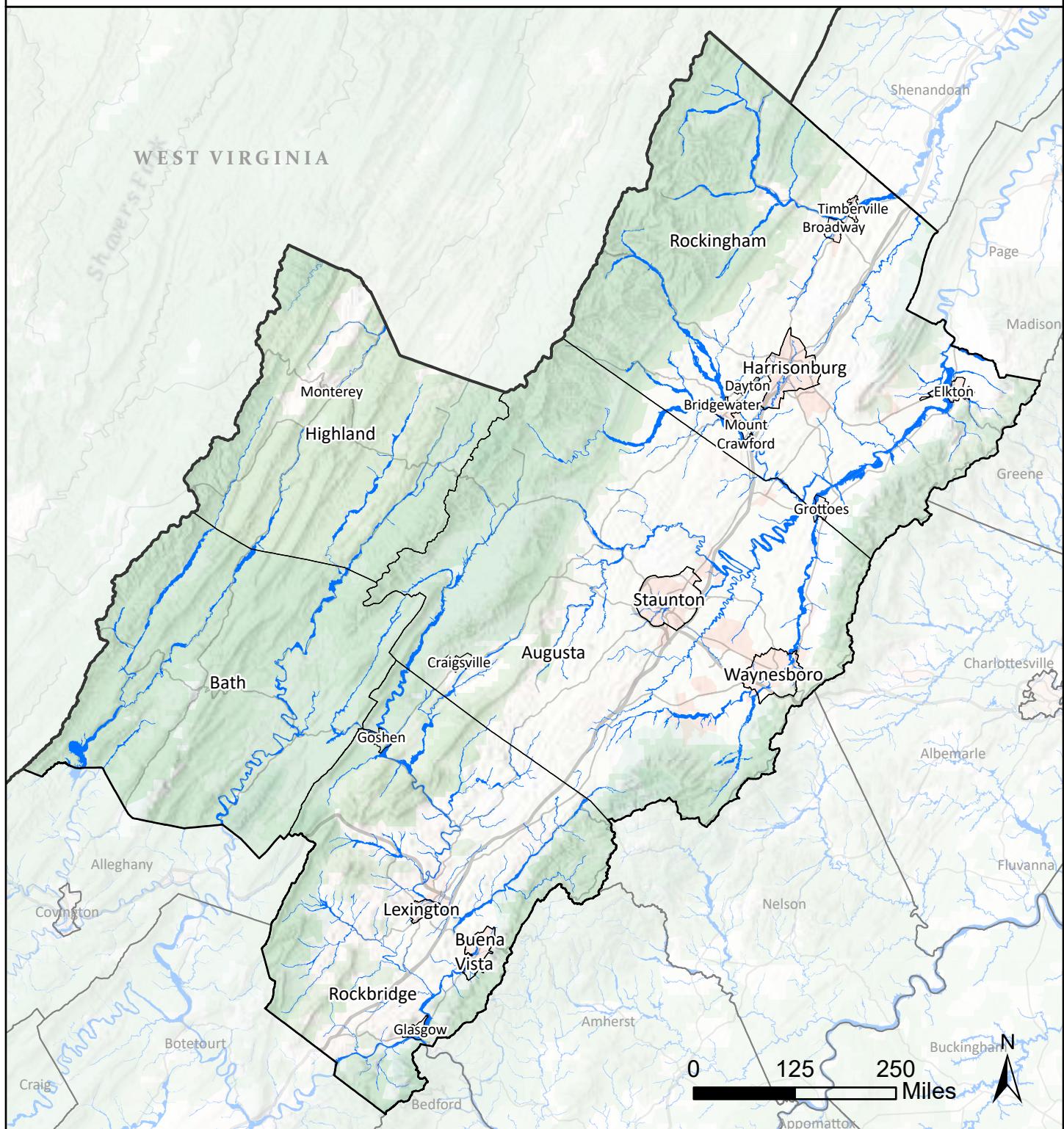
The CSPDC is committed to funding the full 10% match of \$30,000 on behalf of our region's participating localities through in-kind staff time funded through our Watershed Implementation Plan (WIP) program. We also acknowledge the CFPF's reimbursement structure and confirm our financial capacity to cover all costs prior to grant disbursement.

Thank you for your consideration of the funding request.

Sincerely,

Ann Cundy  
Executive Director

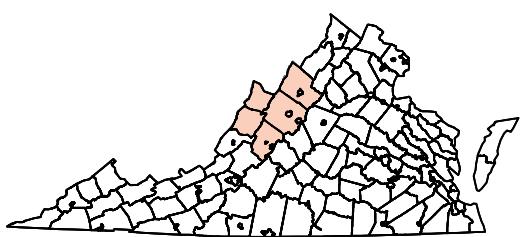
## Special Flood Hazard Areas



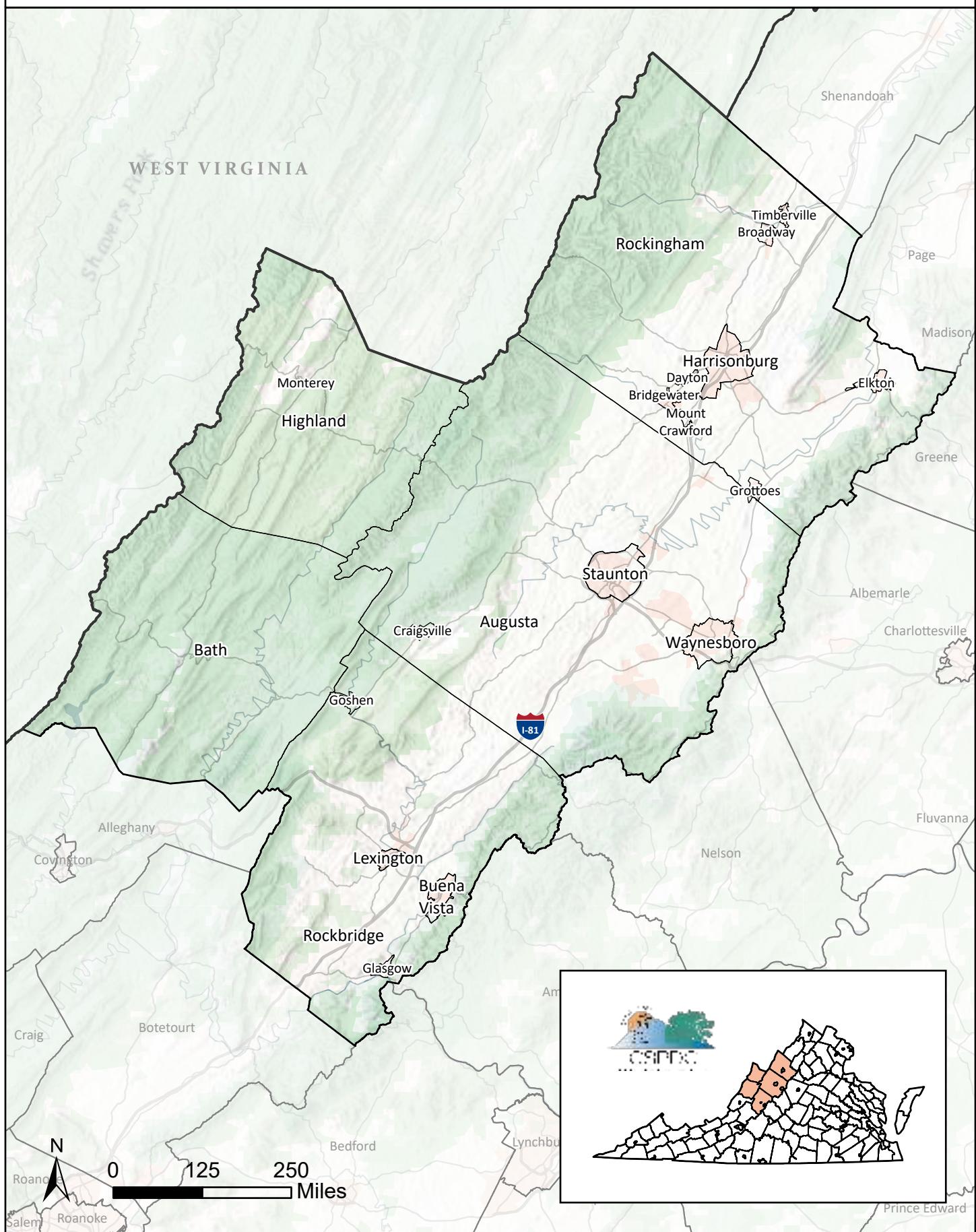
### Legend

Special Flood Hazard Areas (A, AE, AO, AH)

Source: FEMA National Flood Hazard Layer (NFHL), 2024



## Central Shenandoah Planning District Commission (District 6)



**2025 CSPDC Resilience Plan FIRM Numbers for Localities**

**Source:** [FEMA's National Flood Hazard Layer \(NFHL\) Viewer](#)

Non-MS4 Localities		
Locality	FIRM Number(s)	Effective Date
<b>Bath County</b>	51017C0025B	4/2/2009
	51017C0050B	4/2/2009
	51017C0075B	4/2/2009
	51017C0100B	4/2/2009
	51017C0125B	4/2/2009
	51017C0150B	4/2/2009
	51017C0175B	4/2/2009
	51017C0200B	4/2/2009
	51017C0225B	4/2/2009
	51017C0250B	4/2/2009
	51017C0275B	4/2/2009
	51017C0300B	4/2/2009
	51017C0325B	4/2/2009
	51017C0350B	4/2/2009
	51017C0375B	4/2/2009
<b>Broadway</b>	51165C0280D	2/6/2008
	51165C0281D	2/6/2008
	51165C0285D	2/6/2008
<b>Buena Vista</b>	51163C0290C	4/6/2000
	51163C0385C	4/6/2000
	51163C0401C	4/6/2000
	51163C0405C	4/6/2000
<b>Craigsville</b>	51015C0433D	9/28/2007
	51015C0434D	9/28/2007
	51015C0451D	9/28/2007
	51015C0453D	9/28/2007
<b>Dayton</b>	51165C0387D	2/6/2008
	51165C0391D	2/6/2008

MS4 Localities		
Locality	FIRM Number(s)	Effective Date
<b>Augusta County</b>	51015C0025D	9/28/2007
	51015C0050D	9/28/2007
	51015C0065D	9/28/2007
	51015C0070D	9/28/2007
	51015C0125D	9/28/2007
	51015C0130D	9/28/2007
	51015C0135D	9/28/2007
	51015C0140D	9/28/2007
	51015C0145D	9/28/2007
	51015C0155D	9/28/2007
	51015C0160D	9/28/2007
	51015C0165D	9/28/2007
	51015C0170D	9/28/2007
	51015C0190D	9/28/2007
	51015C0191D	9/28/2007
	51015C0193D	9/28/2007
	51015C0194D	9/28/2007
	51015C0200D	9/28/2007
	51015C0215D	9/28/2007
	51015C0250D	9/28/2007
	51015C0260D	9/28/2007
	51015C0270D	9/28/2007
	51015C0275D	9/28/2007
	51015C0300D	9/28/2007
	51015C0305D	9/28/2007
	51015C0310D	9/28/2007
	51015C0315D	9/28/2007
	51015C0320D	9/28/2007
	51015C0330D	9/28/2007
	51015C0331D	9/28/2007

<b>Elkton</b>	51165C0442D	2/6/2008
	51165C0444D	2/6/2008
	51165C0561D	2/6/2008
	51165C0563D	2/6/2008
<b>Glasgow</b>	51163C0390C	4/6/2000
	51163C0389C	4/6/2000
	51163C0393C	4/6/2000
	51163C0452C	4/6/2000
<b>Goshen</b>	51163C0107C	4/6/2000
	51163C0126C	4/6/2000
<b>Grottoes</b>	51165C0562D	2/6/2008
	51165C0564D	2/6/2008
<b>Highland County</b>	51091C0025C	4/2/2009
	51091C0050C	4/2/2009
	51091C0075C	4/2/2009
	51091C0087C	4/2/2009
	51091C0100C	4/2/2009
	51091C0125C	4/2/2009
	51091C0150C	4/2/2009
	51091C0175C	4/2/2009
	51091C0200C	4/2/2009
	51091C0225C	4/2/2009
	51091C0250C	4/2/2009
	51091C0275C	4/2/2009
	51091C0300C	4/2/2009
	51091C0325C	4/2/2009
	51091C0350C	4/2/2009
	51091C0375C	4/2/2009
<b>Lexington</b>	51163C0262C	4/6/2000
	51163C0264C	4/6/2000
	51163C0266C	4/6/2000
	51163C0270C	4/6/2000
<b>Monterey</b>	51091C0087C	4/2/2009
<b>Mount Crawford</b>	51165C0527E	8/18/2014
	51165C0531E	8/18/2014

51015C0332D	9/28/2007
51015C0333D	9/28/2007
51015C0334D	9/28/2007
51015C0336D	9/28/2007
51015C0337D	9/28/2007
51015C0338D	9/28/2007
51015C0339E	9/28/2007
51015C0341D	9/28/2007
51015C0342D	9/28/2007
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51015C0435D	9/28/2007
51015C0445D	9/28/2007
51015C0451D	9/28/2007
51015C0453D	9/28/2007
51015C0455D	9/28/2007
51015C0460D	9/28/2007
51015C0465D	9/28/2007
51015C0470D	9/28/2007

Rockbridge County	51163C0025C	4/6/2000		51015C0485D	9/28/2007
	51163C0050C	4/6/2000		51015C0493D	9/28/2007
	51163C0075C	4/6/2000		51015C0494D	9/28/2007
	51163C0100C	4/6/2000		51015C0495D	9/28/2007
	51163C0107C	4/6/2000		51015C0500D	9/28/2007
	51163C0125C	4/6/2000		51015C0505D	9/28/2007
	51163C0126C	4/6/2000		51015C0506D	9/28/2007
	51163C0130C	4/6/2000		51015C0507D	9/28/2007
	51163C0135C	4/6/2000		51015C0508D	9/28/2007
	51163C0140C	4/6/2000		51015C0509D	9/28/2007
	51163C0145C	4/6/2000		51015C0511D	9/28/2007
	51163C0175C	4/6/2000		51015C0512D	9/28/2007
	51163C0190C	4/6/2000		51015C0513D	9/28/2007
	51163C0200C	4/6/2000		51015C0514D	9/28/2007
	51163C0225C	4/6/2000		51015C0518D	9/28/2007
	51163C0250C	4/6/2000		51015C0519D	9/28/2007
	51163C0262C	4/6/2000		51015C0520D	9/28/2007
	51163C0264C	4/6/2000		51015C0526D	9/28/2007
	51163C0266C	4/6/2000		51015C0527D	9/28/2007
	51163C0270C	4/6/2000		51015C0528D	9/28/2007
	51163C0275C	4/6/2000		51015C0529D	9/28/2007
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	51163C0350C	4/6/2000		51015C0538D	9/28/2007
	51163C0375C	4/6/2000		51015C0539F	8/3/2015
	51163C0380C	4/6/2000		51015C0541F	8/3/2015
	51163C0385C	4/6/2000		51015C0542D	9/28/2007
	51163C0389C	4/6/2000		51015C0543F	8/3/2015
	51163C0390C	4/6/2000		51015C0544D	9/28/2007
	51163C0393C	4/6/2000		51015C0551D	9/28/2007
	51163C0395C	4/6/2000		51015C0553D	9/28/2007

	51163C0401C	4/6/2000
	51163C0405C	4/6/2000
	51163C0415C	4/6/2000
	51163C0430C	4/6/2000
	51163C0435C	4/6/2000
	51163C0445C	4/6/2000
	51163C0452C	4/6/2000
	51163C0455C	4/6/2000
	51163C0460C	4/6/2000
	51163C0465C	4/6/2000
<b>Rockingham County</b>	51165C0020D	2/6/2008
	51165C0025D	2/6/2008
	51165C0029D	2/6/2008
	51165C0030D	2/6/2008
	51165C0040D	2/6/2008
	51165C0045D	2/6/2008
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	51165C0169D	2/6/2008
	51165C0170D	2/6/2008
	51165C0190D	2/6/2008
	51165C0200D	2/6/2008
	51165C0225D	2/6/2008

<b>Bridgewater</b>	51015C0555D	9/28/2007
	51015C0561D	9/28/2007
	51015C0575D	9/28/2007
	51015C0600D	9/28/2007
	51015C0610D	9/28/2007
	51015C0625D	9/28/2007
	51015C0630D	9/28/2007
	51015C0635D	9/28/2007
	51015C0640D	9/28/2007
	51015C0645E	8/3/2015
<b>Harrisonburg</b>	51015C0652F	8/3/2015
	51015C0654F	8/3/2015
	51015C0655E	8/3/2015
	51015C0660E	8/3/2015
	51015C0665E	8/3/2015
	51165C0388E	8/18/2014
	51165C0389E	8/18/2014
	51165C0526E	8/18/2014
	51165C0527E	8/18/2014
	51165C0382D	2/6/2008
<b>Staunton</b>	51165C0383D	2/6/2008
	51165C0384D	2/6/2008
	51165C0391D	2/6/2008
	51165C0392D	2/6/2008
	51165C0393D	2/6/2008
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	51165C0401D	2/6/2008
	51165C0403D	2/6/2008
	51165C0404D	2/6/2008
	51165C0411D	2/6/2008
<b>Staunton</b>	51165C0412D	2/6/2008
	51015C0333D	9/28/2007
	51015C0334D	9/28/2007
	51015C0336D	9/28/2007
<b>Staunton</b>	51015C0337D	9/28/2007

51165C0245D	2/6/2008
51165C0250D	2/6/2008
51165C0255D	2/6/2008
51165C0260D	2/6/2008
51165C0265D	2/6/2008
51165C0270D	2/6/2008
51165C0280D	2/6/2008
51165C0281D	2/6/2008
51165C0285D	2/6/2008
51165C0290D	2/6/2008
51165C0295D	2/6/2008
51165C0305D	2/6/2008
51165C0310D	2/6/2008
51165C0315D	2/6/2008
51165C0320D	2/6/2008
51165C0334D	2/6/2008
51165C0342D	2/6/2008
51165C0350D	2/6/2008
51165C0355D	2/6/2008
51165C0360D	2/6/2008
51165C0365D	2/6/2008
51165C0370D	2/6/2008
51165C0380D	2/6/2008
51165C0381D	2/6/2008
51165C0382D	2/6/2008
51165C0383D	2/6/2008
51165C0384D	2/6/2008
51165C0386D	2/6/2008
51165C0387D	2/6/2008
51165C0388E	8/18/2014
51165C0389E	8/18/2014
51165C0391D	2/6/2008
51165C0392D	2/6/2008
51165C0393D	2/6/2008
51165C0394D	2/6/2008

	51015C0338D	9/28/2007
	51015C0339E	9/28/2007
	51015C0341D	9/28/2007
	51015C0342D	9/28/2007
	51015C0343D	9/28/2007
	51015C0344D	9/28/2007
	51015C0506D	9/28/2007
Waynesboro	51015C0529D	9/28/2007
	51015C0531D	9/28/2007
	51015C0532D	9/28/2007
	51015C0533D	9/28/2007
	51015C0534D	9/28/2007
	51015C0537D	9/28/2007
	51015C0541F	8/3/2015
	51015C0542D	9/28/2007
	51015C0551D	9/28/2007
	51015C0553D	9/28/2007

51165C0401D	2/6/2008
51165C0402D	2/6/2008
51165C0403D	2/6/2008
51165C0404D	2/6/2008
51165C0410D	2/6/2008
51165C0411D	2/6/2008
51165C0412D	2/6/2008
51165C0415D	2/6/2008
51165C0420D	2/6/2008
51165C0430D	2/6/2008
51165C0435D	2/6/2008
51165C0440D	2/6/2008
51165C0442D	2/6/2008
51165C0444D	2/6/2008
51165C0445D	2/6/2008
51165C0455D	2/6/2008
51165C0458D	2/6/2008
51165C0470D	2/6/2008
51165C0500D	2/6/2008
51165C0507D	2/6/2008
51165C0525D	2/6/2008
51165C0526E	8/18/2014
51165C0527E	8/18/2014
51165C0529D	2/6/2008
51165C0531D	2/6/2008
51165C0535D	2/6/2008
51165C0545D	2/6/2008
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51165C0565D	2/6/2008
51165C0570D	2/6/2008
51165C0580D	2/6/2008

	51165C0585D	2/6/2008
	51165C0600D	2/6/2008
	51165C0605D	2/6/2008
	51165C0625D	2/6/2008
	51165C0650D	2/6/2008
	51165C0675D	2/6/2008
Timberville	51165C0168D	2/6/2008
	51165C0169D	2/6/2008
	51165C0285D	2/6/2008

## 2025 CSPDC Resilience Plan Comprehensive Plans and Floodplain Ordinances

Non-MS4 Localities		
Locality	Comprehensive Plan	NFIP Numbers
Bath County	<a href="#">Bath County Comprehensive Plan, 2024</a>	510196#
Broadway	<a href="#">Town of Broadway Comprehensive Plan, 2024</a>	510135#
Craigsville	<a href="#">Augusta County Comprehensive Plan, 2015</a>	510014#
Dayton	<a href="#">Town of Dayton Comprehensive Plan, 2023</a>	510136#
Elkton	<a href="#">Town of Elkton Comprehensive Plan, 2024</a>	510137#
Glasgow	<a href="#">Town of Glasgow Comprehensive Plan, 2024</a>	515526#
Goshen	<a href="#">Augusta County Comprehensive Plan, 2015</a>	510217#
Grottoes	<a href="#">Town of Grottoes Comprehensive Plan, 2017</a>	510138#
Highland County	<a href="#">Highland County &amp; the Town of Monterey Comprehensive Plan, 2021</a>	510311#
Lexington	<a href="#">City of Lexington Comprehensive Plan, 2024</a>	510089#
Mount Crawford	<a href="#">Town of Mount Crawford Comprehensive Plan, 2023</a>	510224#
Rockbridge County	<a href="#">Rockbridge County Comprehensive Plan, 2024</a>	510205#
Rockingham County	<a href="#">Rockingham County Comprehensive Plan, 2024</a>	510133#
Timberville	<a href="#">Town of Timberville Comprehensive Plan, 2023</a>	510139#
MS4		
Augusta County	<a href="#">Augusta County Comprehensive Plan, 2015</a>	510013D

<b>Bridgewater</b>	<a href="#">Town of Bridgewater Comprehensive Plan, 2024</a>	510134#
<b>Harrisonburg</b>	<a href="#">City of Harrisonburg Comprehensive Plan, 2018</a>	510076#
<b>Staunton</b>	<a href="#">City of Staunton Comprehensive Plan, 2019</a>	510155#
<b>Waynesboro</b>	<a href="#">City of Waynesboro Comprehensive Plan, 2018</a>	515532D

**2025 CSPDC Resilience Plan Comprehensive Plans and Floodplain Ordinances**

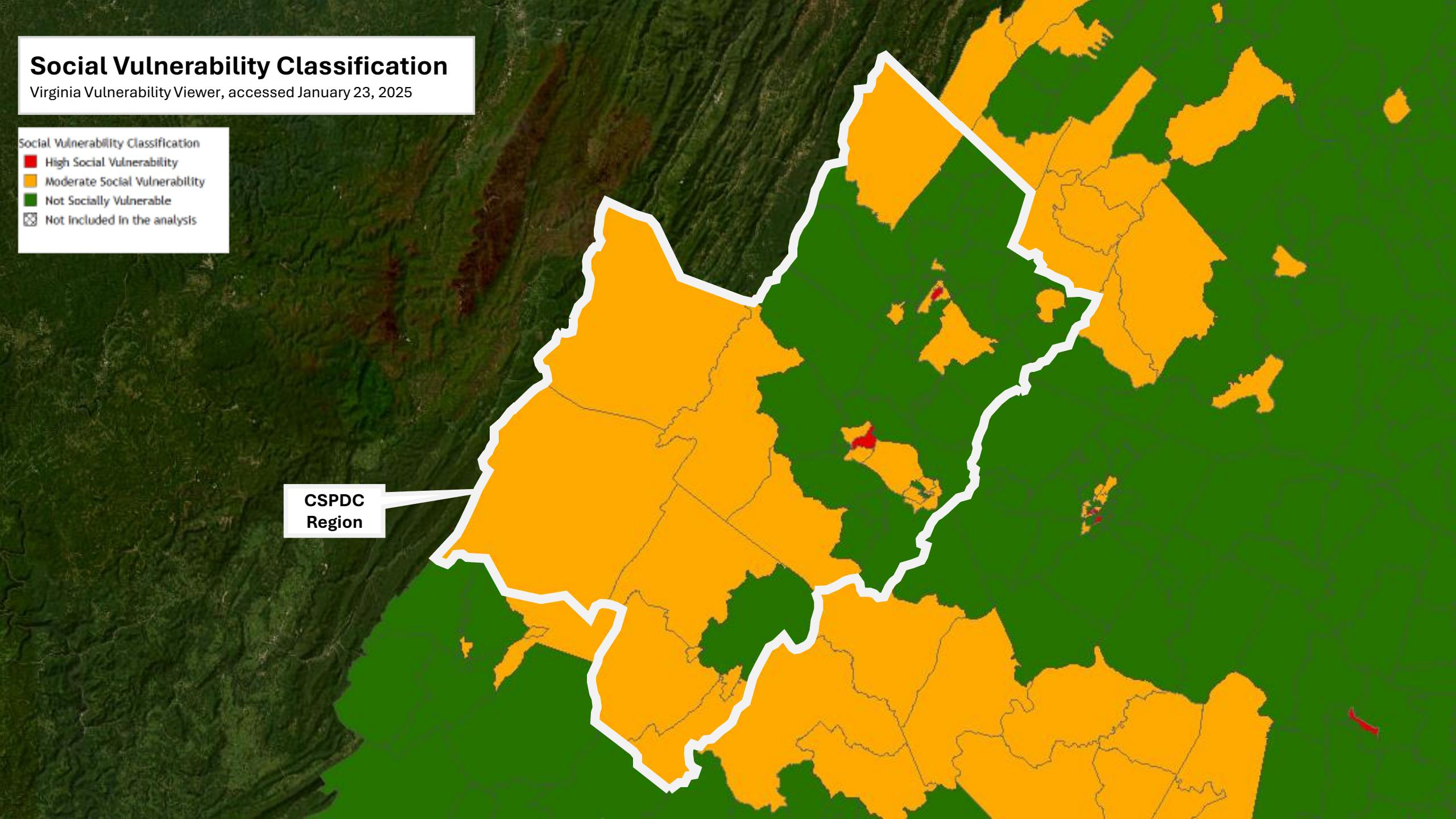
<b>Non-MS4 Localities</b>			
<b>Locality</b>	<b>Comprehensive Plan</b>	<b>Floodplain Ordinance</b>	<b>NFIP Numbers</b>
<b>Bath County</b>	<a href="#">Bath County Comprehensive Plan, 2024</a>	<a href="#">Chapter 12. Floodplain Management Ordinance</a>	510196#
<b>Broadway</b>	<a href="#">Town of Broadway Comprehensive Plan, 2024</a>	<a href="#">Sec. 640.00 Flood Hazard Districts</a>	510135#
<b>Craigsville</b>	<a href="#">Augusta County Comprehensive Plan, 2015</a>	<a href="#">Augusta County Comprehensive Plan, 2015</a>	510014#
<b>Dayton</b>	<a href="#">Town of Dayton Comprehensive Plan, 2023</a>	<a href="#">Sec. 30-576. Flood Plain District</a>	510136#
<b>Elkton</b>	<a href="#">Town of Elkton Comprehensive Plan, 2024</a>	<a href="#">Sec. 100-615 Flood Hazard District FH-1</a>	510137#
<b>Glasgow</b>	<a href="#">Town of Glasgow Comprehensive Plan, 2024</a>	<a href="#">Chapter 18. Article V-A. Flood Plain District F-1</a>	515526#
<b>Goshen</b>	<a href="#">Augusta County Comprehensive Plan, 2015</a>	<a href="#">Augusta County Comprehensive Plan, 2015</a>	510217#
<b>Grottoes</b>	<a href="#">Town of Grottoes Comprehensive Plan, 2017</a>	<a href="#">Chapter 100. Article XIX. Flood Hazard Districts</a>	510138#
<b>Highland County</b>	<a href="#">Highland County &amp; the Town of Monterey Comprehensive Plan, 2021</a>	<a href="#">Sec. 614.00 Flood Hazard Overlay District</a>	510311#
<b>Lexington</b>	<a href="#">City of Lexington Comprehensive Plan, 2024</a>	<a href="#">Chapter 420. Article X. General Floodplain District (FP)</a>	510089#
<b>Mount Crawford</b>	<a href="#">Town of Mount Crawford Comprehensive Plan, 2023</a>	<a href="#">Chapter 171 Floodplain Ordinance</a>	510224#
<b>Rockbridge County</b>	<a href="#">Rockbridge County Comprehensive Plan, 2024</a>	<a href="#">Sec. 608.00 Flood Hazard District - FH-1</a>	510205#
<b>Rockingham County</b>	<a href="#">Rockingham County Comprehensive Plan, 2024</a>	<a href="#">Chapter 6D - Floodplain Management</a>	510133#
<b>Timberville</b>	<a href="#">Town of Timberville Comprehensive Plan, 2023</a>	<a href="#">Article 6. Title 611. Flood Hazard District FH-1</a>	510139#
<b>MS4</b>			
<b>Augusta County</b>	<a href="#">Augusta County Comprehensive Plan, 2015</a>	<a href="#">Augusta County Comprehensive Plan, 2015</a>	510013D
<b>Bridgewater</b>	<a href="#">Town of Bridgewater Comprehensive Plan, 2024</a>	<a href="#">Sec. 6-14. Flood Plain Districts and Regulations</a>	510134#
<b>Harrisonburg</b>	<a href="#">City of Harrisonburg Comprehensive Plan, 2018</a>	<a href="#">Title 10. Chapter 3. Article Y. Floodplain Zoning District</a>	510076#
<b>Staunton</b>	<a href="#">City of Staunton Comprehensive Plan, 2019</a>	<a href="#">Chapter 18.170 Floodplain Districts and Regulations</a>	510155#
<b>Waynesboro</b>	<a href="#">City of Waynesboro Comprehensive Plan, 2018</a>	<a href="#">Sec. 98-3.3.5. - Floodplain Overlay (FO)</a>	515532D

# Social Vulnerability Classification

Virginia Vulnerability Viewer, accessed January 23, 2025

- Social Vulnerability Classification
- High Social Vulnerability
  - Moderate Social Vulnerability
  - Not Socially Vulnerable
  - Not Included in the analysis

CSPDC  
Region





## County of Augusta, Virginia

Timothy K. Fitzgerald  
County Administrator

Augusta County Government Center  
P.O. Box 590, Verona, VA 24482-0590  
540.245.5610  
[www.AugustaCountyVA.gov](http://www.AugustaCountyVA.gov)

October 24, 2024

Ann Cundy, Executive Director  
Central Shenandoah Planning District Commission  
112 MacTanly Place, Staunton VA 24401

Dear Ann:

We understand and support the Central Shenandoah Planning District Commission's (CSPDC) application for the Department of Conservation and Recreation's Community Flood Preparedness Fund (CFPF) grant to develop a Regional Flood Resilience Plan to address flooding and stormwater issues for our region.

The plan will enable a more detailed assessment of flooding needs – which is one of our region's main hazard-related issues – and improve our ability to identify specific, actionable projects to enhance flood resilience. The strategies and projects included in the plan will also assist with supporting the state's Chesapeake Bay watershed pollution reduction goals for nutrient and sediment runoff in the Shenandoah Valley.

Moreover, the document would serve as a worthwhile companion to the region's draft 2026 Hazard Mitigation Plan, which identifies flooding as the region's number one hazard priority based on locality input.

We acknowledge that the Regional Flood Resilience Plan must meet the criteria outlined in Appendix F of the DCR CFPF Funding Manual, and that the plan must be formally adopted to be considered for future rounds of DCR CFPF implementation funding. We further recognize and support that the CSPDC is prepared to fund the full required grant match through funding secured through the CSPDC Watershed Implementation Plan (WIP) program.

Augusta County hereby authorizes the CSPDC to submit this regional proposal on our behalf.

Sincerely,

A handwritten signature in black ink, appearing to read "Timothy K. Fitzgerald".

Timothy K. Fitzgerald, ICMA-CM  
County Administrator

Building, Planning & Zoning  
P.O. BOX 216  
WARM SPRINGS, VIRGINIA  
24484



PHONE: 540.839.7236  
FAX: 540.839.7222

October 25, 2024

Ann Cundy, Executive Director  
Central Shenandoah Planning District Commission  
112 MacTanly Place, Staunton VA 24401

Dear Ann:

We understand and support the Central Shenandoah Planning District Commission's (CSPDC) application for the Department of Conservation and Recreation's Community Flood Preparedness Fund (CFPF) grant to develop a Regional Flood Resilience Plan to address flooding and stormwater issues for our region.

The plan will enable a more detailed assessment of flooding needs – which is one of our region's main hazard-related issues – and improve our ability to identify specific, actionable projects to enhance flood resilience. The strategies and projects included in the plan will also assist with supporting the state's Chesapeake Bay watershed pollution reduction goals for nutrient and sediment runoff in the Shenandoah Valley.

Moreover, the document would serve as a worthwhile companion to the region's draft 2026 Hazard Mitigation Plan, which identifies flooding as the region's number one hazard priority based on locality input.

We acknowledge that the Regional Flood Resilience Plan must meet the criteria outlined in Appendix F of the DCR CFPF Funding Manual, and that the plan must be formally adopted to be considered for future rounds of DCR CFPF implementation funding. We further recognize and support that the CSPDC is prepared to fund the full required grant match through funding secured through the CSPDC Watershed Implementation Plan (WIP) program.

Bath County hereby authorizes the CSPDC to submit this regional proposal on our behalf.

Sincerely,

  
Sherry Ryder

Planner/Zoning Administrator/Floodplain Administrator



January 22, 2025

Ann Cundy, Executive Director  
Central Shenandoah Planning District Commission  
112 MacTanly Place  
Staunton, Virginia 24401

Dear Ann:

We understand and support the Central Shenandoah Planning District Commission's (CSPDC) application for the Department of Conservation and Recreation's Community Flood Preparedness Fund (CFPF) grant to develop a Regional Flood Resilience Plan to address flooding and stormwater issues for our region.

The plan will enable a more detailed assessment of flooding needs – which is one of our region's main hazard-related issues – and improve our ability to identify specific, actionable projects to enhance flood resilience. The strategies and projects included in the plan will also assist with supporting the state's Chesapeake Bay watershed pollution reduction goals for nutrient and sediment runoff in the Shenandoah Valley.

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We acknowledge that the Regional Flood Resilience Plan must meet the criteria outlined in Appendix F of the DCR CFPF Funding Manual, and that the plan must be formally adopted to be considered for future rounds of DCR CFPF implementation funding. We further recognize and support that the CSPDC is prepared to fund the full required grant match through funding secured through the CSPDC Watershed Implementation Plan (WIP) program.

The Town of Bridgewater hereby authorizes the CSPDC to submit this regional proposal on our behalf.

Sincerely,



J. Jay Litten, Esquire  
Town Manager



P.O. Box 156 • 116 BROADWAY AVENUE • BROADWAY, VA

PHONE (540) 896-5152 • FAX (540) 896-6460

October 30, 2024

Ann Cundy, Executive Director  
Central Shenandoah Planning District Commission  
112 MacTanly Place, Staunton VA 24401

Dear Ann:

We understand and support the Central Shenandoah Planning District Commission's (CSPDC) application for the Department of Conservation and Recreation's Community Flood Preparedness Fund (CFPF) grant to develop a Regional Flood Resilience Plan to address flooding and stormwater issues for our region.

The plan will enable a more detailed assessment of flooding needs – which is one of our region's main hazard-related issues – and improve our ability to identify specific, actionable projects to enhance flood resilience. The strategies and projects included in the plan will also assist with supporting the state's Chesapeake Bay watershed pollution reduction goals for nutrient and sediment runoff in the Shenandoah Valley.

Moreover, the document would serve as a worthwhile companion to the region's draft 2026 Hazard Mitigation Plan, which identifies flooding as the region's number one hazard priority based on locality input.

We acknowledge that the Regional Flood Resilience Plan must meet the criteria outlined in Appendix F of the DCR CFPF Funding Manual, and that the plan must be formally adopted to be considered for future rounds of DCR CFPF implementation funding. We further recognize and support that the CSPDC is prepared to fund the full required grant match through funding secured through the CSPDC Watershed Implementation Plan (WIP) program.

Town of Broadway hereby authorizes the CSPDC to submit this regional proposal on our behalf.

Sincerely,

A handwritten signature in black ink that reads "Stefanie McAlister".

Stefanie McAlister  
Town Manager  
Town of Broadway



Cary Jackson, Mayor  
Brian J. Borne, Town Manager  
Christa Hall, Treasurer  
Justin Trout, Police Chief  
Jordan Bowman, Town Attorney  
125 Eastview Street  
Dayton, VA 22821  
540-879-2241  
[www.daytonva.us](http://www.daytonva.us)

October 24, 2024

Ann Cundy, Executive Director  
Central Shenandoah Planning District Commission  
112 MacTanly Place, Staunton VA 24401

Dear Ann:

We understand and support the Central Shenandoah Planning District Commission's (CSPDC) application for the Department of Conservation and Recreation's Community Flood Preparedness Fund (CFPF) grant to develop a Regional Flood Resilience Plan to address flooding and stormwater issues for our region.

The plan will enable a more detailed assessment of flooding needs – which is one of our region's main hazard-related issues – and improve our ability to identify specific, actionable projects to enhance flood resilience. The strategies and projects included in the plan will also assist with supporting the state's Chesapeake Bay watershed pollution reduction goals for nutrient and sediment runoff in the Shenandoah Valley.

Moreover, the document would serve as a worthwhile companion to the region's draft 2026 Hazard Mitigation Plan, which identifies flooding as the region's number one hazard priority based on locality input.

We acknowledge that the Regional Flood Resilience Plan must meet the criteria outlined in Appendix F of the DCR CFPF Funding Manual, and that the plan must be formally adopted to be considered for future rounds of DCR CFPF implementation funding. We further recognize and support that the CSPDC is prepared to fund the full required grant match through funding secured through the CSPDC Watershed Implementation Plan (WIP) program.

Town of Dayton hereby authorizes the CSPDC to submit this regional proposal on our behalf.

Sincerely,



Brian J. Borne  
Town Manager  
Town of Dayton, VA



October 25, 2024

Ann Cundy, Executive Director  
Central Shenandoah Planning District Commission  
112 MacTanly Place, Staunton VA 24401

Dear Ann:

We understand and support the Central Shenandoah Planning District Commission's (CSPDC) application for the Department of Conservation and Recreation's Community Flood Preparedness Fund (CFPF) grant to develop a Regional Flood Resilience Plan to address flooding and stormwater issues for our region.

The plan will enable a more detailed assessment of flooding needs – which is one of our region's main hazard-related issues – and improve our ability to identify specific, actionable projects to enhance flood resilience. The strategies and projects included in the plan will also assist with supporting the state's Chesapeake Bay watershed pollution reduction goals for nutrient and sediment runoff in the Shenandoah Valley.

Moreover, the document would serve as a worthwhile companion to the region's draft 2026 Hazard Mitigation Plan, which identifies flooding as the region's number one hazard priority based on locality input.

We acknowledge that the Regional Flood Resilience Plan must meet the criteria outlined in Appendix F of the DCR CFPF Funding Manual, and that the plan must be formally adopted to be considered for future rounds of DCR CFPF implementation funding. We further recognize and support that the CSPDC is prepared to fund the full required grant match through funding secured through the CSPDC Watershed Implementation Plan (WIP) program.

Town of Elkton hereby authorizes the CSPDC to submit this regional proposal on our behalf.

Sincerely,

A handwritten signature in black ink that reads "Delores Hammer".

Delores Hammer  
Director of Community Development  
Town of Elkton



October 22, 2024

Ann Cundy, Executive Director  
Central Shenandoah Planning District Commission  
112 MacTanly Place, Staunton VA 24401

Dear Ann:

We understand and support the Central Shenandoah Planning District Commission's (CSPDC) application for the Department of Conservation and Recreation's Community Flood Preparedness Fund (CFPF) grant to develop a Regional Flood Resilience Plan to address flooding and stormwater issues for our region.

The plan will enable a more detailed assessment of flooding needs – which is one of our region's main hazard-related issues – and improve our ability to identify specific, actionable projects to enhance flood resilience. The strategies and projects included in the plan will also assist with supporting the state's Chesapeake Bay watershed pollution reduction goals for nutrient and sediment runoff in the Shenandoah Valley.

Moreover, the document would serve as a worthwhile companion to the region's draft 2026 Hazard Mitigation Plan, which identifies flooding as the region's number one hazard priority based on locality input.

We acknowledge that the Regional Flood Resilience Plan must meet the criteria outlined in Appendix F of the DCR CFPF Funding Manual, and that the plan must be formally adopted to be considered for future rounds of DCR CFPF implementation funding. We further recognize and support that the CSPDC is prepared to fund the full required grant match through funding secured through the CSPDC Watershed Implementation Plan (WIP) program.

The Town of Glasgow hereby authorizes the CSPDC to submit this regional proposal on our behalf.

Sincerely,

Allyson Finchum  
Town Manager  
Town of Glasgow, Virginia



THE TOWN OF GOSHEN

P.O. BOX 08

GOSHEN, VA 24439

Phone: 540-997-5545

\*\*\*\*\*

Fax: 540-997-9495

email: townofgoshen\_va@yahoo.com

web: <https://goshenvirginia.com>

October 21, 2024

Ann Cundy, Executive Director

Central Shenandoah Planning District Commission

112 MacTarny Place, Staunton VA 24401

Dear Ann:

We understand and support the Central Shenandoah Planning District Commission's (CSPDC) application for the Department of Conservation and Recreation's Community Flood Preparedness Fund (CFPF) grant to develop a Regional Flood Resilience Plan to address flooding and stormwater issues for our region.

The plan will enable a more detailed assessment of flooding needs – which is one of our region's main hazard-related issues – and improve our ability to identify specific, actionable projects to enhance flood resilience. The strategies and projects included in the plan will also assist with supporting the state's Chesapeake Bay watershed pollution reduction goals for nutrient and sediment runoff in the Shenandoah Valley.

Moreover, the document would serve as a worthwhile companion to the region's draft 2026 Hazard Mitigation Plan, which identifies flooding as the region's number one hazard priority based on locality input.

We acknowledge that the Regional Flood Resilience Plan must meet the criteria outlined in Appendix F of the DCR CFPF Funding Manual, and that the plan must be formally adopted to be considered for future rounds of DCR CFPF implementation funding. We further recognize and support that the CSPDC is prepared to fund the full required grant match through funding secured through the CSPDC Watershed Implementation Plan (WIP) program.

Town of Goshen hereby authorizes the CSPDC to submit this regional proposal on our behalf.

Sincerely,

*Tom O. McCraw* *ss*

Thomas O. McCraw  
Mayor  
Town of Goshen



# CITY OF HARRISONBURG OFFICE OF THE CITY MANAGER

ALEXANDER "ANDE" BANKS, VI, CITY MANAGER  
409 SOUTH MAIN STREET, HARRISONBURG, VA 22801  
OFFICE (540) 432-7701 • FAX (540) 432-7778

October 21, 2024

Ann Cundy, Executive Director  
Central Shenandoah Planning District Commission  
112 MacTanly Place, Staunton VA 24401

Dear Ann:

We understand and support the Central Shenandoah Planning District Commission's (CSPDC) application for the Department of Conservation and Recreation's Community Flood Preparedness Fund (CFPF) grant to develop a Regional Flood Resilience Plan to address flooding and stormwater issues for our region.

The plan will enable a more detailed assessment of flooding needs – which is one of our region's main hazard-related issues – and improve our ability to identify specific, actionable projects to enhance flood resilience. The strategies and projects included in the plan will also assist with supporting the state's Chesapeake Bay watershed pollution reduction goals for nutrient and sediment runoff in the Shenandoah Valley.

Moreover, the document would serve as a worthwhile companion to the region's draft 2026 Hazard Mitigation Plan, which identifies flooding as the region's number one hazard priority based on locality input.

We acknowledge that the Regional Flood Resilience Plan must meet the criteria outlined in Appendix F of the DCR CFPF Funding Manual, and that the plan must be formally adopted to be considered for future rounds of DCR CFPF implementation funding. We further recognize and support that the CSPDC is prepared to fund the full required grant match through funding secured through the CSPDC Watershed Implementation Plan (WIP) program.

The City of Harrisonburg hereby authorizes the CSPDC to submit this regional proposal on our behalf.

Sincerely,

A handwritten signature in blue ink, appearing to read "Ande Banks".  
Ande Banks,  
City Manager  
City of Harrisonburg



## HIGHLAND COUNTY BOARD OF SUPERVISORS

165 W. Main Street, P.O. BOX 130  
MONTEREY, VA 24465  
PHONE: 540-468-2347  
Email: [hcboard@highlandcova.org](mailto:hcboard@highlandcova.org)  
Website: [www.highlandcova.org](http://www.highlandcova.org)

### BOARD MEMBERS

HENRY A. BUDZINSKI, JR.  
HARRY B. SPONAUGLE  
PAUL S. TRIBLE

November 6, 2024

Ann Cundy, Executive Director  
Central Shenandoah Planning District Commission  
112 MacTanly Place, Staunton VA 24401

Dear Ann:

We understand and support the Central Shenandoah Planning District Commission's (CSPDC) application for the Department of Conservation and Recreation's Community Flood Preparedness Fund (CFPF) grant to develop a Regional Flood Resilience Plan to address flooding and stormwater issues for our region.

The plan will enable a more detailed assessment of flooding needs – which is one of our region's main hazard-related issues – and improve our ability to identify specific, actionable projects to enhance flood resilience. The strategies and projects included in the plan will also assist with supporting the state's Chesapeake Bay watershed pollution reduction goals for nutrient and sediment runoff in the Shenandoah Valley.

Moreover, the document would serve as a worthwhile companion to the region's draft 2026 Hazard Mitigation Plan, which identifies flooding as the region's number one hazard priority based on locality input.

We acknowledge that the Regional Flood Resilience Plan must meet the criteria outlined in Appendix F of the DCR CFPF Funding Manual, and that the plan must be formally adopted to be considered for future rounds of DCR CFPF implementation funding. We further recognize and support that the CSPDC is prepared to fund the fully required grant match through funding secured through the CSPDC Watershed Implementation Plan (WIP) program.

The County of Highland hereby authorizes CSPDC to submit this regional proposal on our behalf.

Sincerely,

A handwritten signature in black ink, appearing to read "Henry A. Budzinski, Jr."

Henry A. Budzinski, Jr.  
Chairman, Highland County Board of Supervisors  
County of Highland





Department of Public Works

October 25, 2024

Patrick J. Madigan Sr.  
City of Lexington, VA  
Public Works Department  
890 Shop Road  
Lexington, Va. 24450  
[pmadigan@lexingtonva.gov](mailto:pmadigan@lexingtonva.gov)  
(540) 463-3154

Ann Cundy, Executive Director  
Central Shenandoah Planning District Commission  
112 MacTally Place, Staunton, VA 24401

Dear Ann:

We understand and support the Central Shenandoah Planning District Commission's (CSPDC) application for the Department of Conservation and Recreation's Community Flood Preparedness Fund (CFPF) grant to develop a Regional Flood Resilience Plan to address flooding and stormwater issues for our region.

The plan will enable a more detailed assessment of flooding needs—one of our region's main hazard-related issues—and improve our ability to identify specific, actionable projects to enhance flood resilience. The strategies and projects included in the plan will also support the state's Chesapeake Bay watershed pollution reduction goals for nutrient and sediment runoff in the Shenandoah Valley.

Moreover, the document would serve as a worthwhile companion to the region's draft 2026 Hazard Mitigation Plan, which, based on locality input, identifies flooding as the region's number one hazard priority.

We acknowledge that the Regional Flood Resilience Plan must meet the criteria outlined in Appendix F of the DCR CFPF Funding Manual and be formally adopted to be considered for future rounds of DCR CFPF implementation funding. We further recognize and support the fact that the CSPDC is prepared to fund the full required grant match through funding secured through the CSPDC Watershed Implementation Plan (WIP) program.

The City of Lexington hereby authorizes the CSPDC to submit this regional proposal on our behalf.

Respectfully,

*Patrick J. Madigan Sr.*

Patrick J. Madigan, Sr.  
Director of Public Works  
City of Lexington, VA



**Town of Mt. Crawford**  
**779 S. Main Street**  
**P.O. Box 187**  
**Mount Crawford, Virginia 22841**  
**(540) 421-0856**  
**[townofmountcrawford@gmail.com](mailto:townofmountcrawford@gmail.com)**

October 24, 2024

Ann Cundy, Executive Director  
Central Shenandoah Planning District Commission  
112 MacTanly Place, Staunton, VA 24401

Dear Ann:

We understand and support the Central Shenandoah Planning District Commission's (CSPDC) application for the Department of Conservation and Recreation's Community Flood Preparedness Fund (CFPF) grant to develop a Regional Flood Resilience Plan to address flooding and stormwater issues for our region.

The plan will enable a more detailed assessment of flooding needs, one of our region's main hazard-related issues, and improve our ability to identify specific, actionable projects to enhance flood resilience. The strategies and projects included in the plan will also assist with supporting the state's Chesapeake Bay watershed pollution reduction goals for nutrient and sediment runoff in the Shenandoah Valley.

Moreover, the document would serve as a worthwhile companion to the region's draft 2026 Hazard Mitigation Plan, which, based on locality input, identifies flooding as the region's number one hazard priority.

We acknowledge that the Regional Flood Resilience Plan must meet the criteria outlined in Appendix F of the DCR CFPF Funding Manual and must be formally adopted to be considered for future rounds of DCR CFPF implementation funding. We further recognize and support the fact that the CSPDC is prepared to fund the full required grant match through funding secured through the CSPDC Watershed Implementation Plan (WIP) program.

The Town of Mount Crawford, Virginia, hereby authorizes the CSPDC to submit this regional proposal on our behalf.

Sincerely,

Libby Clark  
Town Manager  
Town of Mount Crawford, Virginia

**Office of the County Administrator**

Spencer H. Suter, County Administrator

540) 463-1460 | 540) 463-4346

ssuter@rockbridgecountyva.gov

[www.co.rockbridge.va.us](http://www.co.rockbridge.va.us)

150 S. Main St. Lexington, VA 24450

**Rockbridge County Board of Supervisors:**

Buffalo District	South River District	Walkers Creek District	Natural Bridge District	Kerrs Creek District
Leslie E. Ayers	Robert W. Day	A.J. Lewis, II	David B. McDaniel	Daniel E. Lyons

October 22, 2024

Ann Cundly, Executive Director  
Central Shenandoah Planning District Commission  
112 MacFarlan Place, Staunton VA 24401

Dear Ann:

We understand and support the Central Shenandoah Planning District Commission's (CSPDC) application for the Department of Conservation and Recreation's Community Flood Preparedness Fund (CFPF) grant to develop a Regional Flood Resilience Plan to address flooding and stormwater issues for our region.

The plan will enable a more detailed assessment of flooding needs – which is one of our region's main hazard-related issues – and improve our ability to identify specific, actionable projects to enhance flood resilience. The strategies and projects included in the plan will also assist with supporting the state's Chesapeake Bay watershed pollution reduction goals for nutrient and sediment runoff in the Shenandoah Valley.

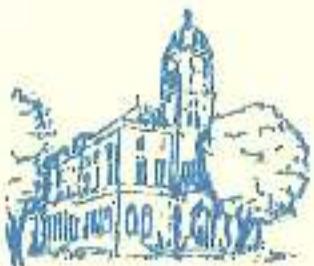
Moreover, the document would serve as a worthwhile companion to the region's draft 2026 Hazard Mitigation Plan, which identifies flooding as the region's number one hazard priority based on locality input.

We acknowledge that the Regional Flood Resilience Plan must meet the criteria outlined in Appendix F of the DCR CFPF Funding Manual, and that the plan must be formally adopted to be considered for future rounds of DCR CFPF implementation funding. We further recognize and support that the CSPDC is prepared to fund the full required grant match through funding secured through the CSPDC Watershed Implementation Plan (WIP) program.

Rockbridge County hereby authorizes the CSPDC to submit this regional proposal on our behalf.

Sincerely,

Spencer H. Suter  
County Administrator



STEPHEN G. KING  
County Administrator



## ROCKINGHAM COUNTY

October 21, 2024

BOARD OF SUPERVISORS  
DEWEY L. RITCHIE  
Section Chair of No. 1  
SALLIE WOLFE-GARRISON  
Section Chair of No. 2  
RICK L. CHANDLER  
Section Chair of No. 3  
LEILA C. LONGCOR  
Section Chair of No. 4  
JOEL L. HENSLEY  
Section Chair of No. 5

Ann Cundy, Executive Director  
Central Shenandoah Planning District Commission  
112 MacTanly Place, Staunton VA 24401

Dear Ann:

We understand and support the Central Shenandoah Planning District Commission's (CSPDC) application for the Department of Conservation and Recreation's Community Flood Preparedness Fund (CFPF) grant to develop a Regional Flood Resilience Plan to address flooding and stormwater issues for our region.

The plan will enable a more detailed assessment of flooding needs – which is one of our region's main hazard-related issues – and improve our ability to identify specific, actionable projects to enhance flood resilience. The strategies and projects included in the plan will also assist with supporting the state's Chesapeake Bay watershed pollution reduction goals for nutrient and sediment runoff in the Shenandoah Valley.

Moreover, the document would serve as a worthwhile companion to the region's draft 2026 Hazard Mitigation Plan, which identifies flooding as the region's number one hazard priority based on locality input.

We acknowledge that the Regional Flood Resilience Plan must meet the criteria outlined in Appendix F of the DCR CFPF Funding Manual, and that the plan must be formally adopted to be considered for future rounds of DCR CFPF implementation funding. We further recognize and support that the CSPDC is prepared to fund the full required grant match through funding secured through the CSPDC Watershed Implementation Plan (WIP) program.

Rockingham County hereby authorizes the CSPDC to submit this regional proposal on our behalf.

Sincerely,

A handwritten signature in blue ink, appearing to read "Stephen G. King".

Stephen G. King  
County Administrator  
Rockingham County

RODNEY S. RHODES, DIRECTOR

BUILDING SERVICES  
ENVIRONMENTAL PROGRAMS  
HOUSING PROGRAMS  
PLANNING AND ZONING



COMMUNITY DEVELOPMENT DEPT.

P. O. BOX 58  
STAUNTON, VA 24402-0058  
540-332-3862 (office)  
[WWW.CI.STAUNTON.VA.US](http://WWW.CI.STAUNTON.VA.US)

October 25, 2024

Ann Cundy, Executive Director  
Central Shenandoah Planning District Commission  
112 MacTanly Place, Staunton VA 24401

Dear Ann:

We understand and support the Central Shenandoah Planning District Commission's (CSPDC) application for the Department of Conservation and Recreation's Community Flood Preparedness Fund (CFPF) grant to develop a Regional Flood Resilience Plan to address flooding and stormwater issues for our region.

The plan will enable a more detailed assessment of flooding needs – which is one of our region's main hazard-related issues – and improve our ability to identify specific, actionable projects to enhance flood resilience. The strategies and projects included in the plan will also assist with supporting the state's Chesapeake Bay watershed pollution reduction goals for nutrient and sediment runoff in the Shenandoah Valley.

Moreover, the document would serve as a worthwhile companion to the region's draft 2026 Hazard Mitigation Plan, which identifies flooding as the region's number one hazard priority based on locality input.

We acknowledge that the Regional Flood Resilience Plan must meet the criteria outlined in Appendix F of the DCR CFPF Funding Manual, and that the plan must be formally adopted to be considered for future rounds of DCR CFPF implementation funding. We further recognize and support that the CSPDC is prepared to fund the full required grant match through funding secured through the CSPDC Watershed Implementation Plan (WIP) program.

City of Staunton hereby authorizes the CSPDC to submit this regional proposal on our behalf.

Sincerely,

A handwritten signature in black ink, appearing to read "Rodney Rhodes".

Rodney Rhodes  
Director of Community Development Department  
City of Staunton



# Town of Timberville

392 S. Main Street  
Timberville, VA 22853  
540-896-7058  
Fax 540-896-7055  
[www.towntimberville.com](http://www.towntimberville.com)



November 1, 2024

Ann Cundy, Executive Director  
Central Shenandoah Planning District Commission  
112 MacTanly Place, Staunton VA 24401

Dear Ann:

We understand and support the Central Shenandoah Planning District Commission's (CSPDC) application for the Department of Conservation and Recreation's Community Flood Preparedness Fund (CFPF) grant to develop a Regional Flood Resilience Plan to address flooding and stormwater issues for our region.

The plan will enable a more detailed assessment of flooding needs – which is one of our region's main hazard-related issues – and improve our ability to identify specific, actionable projects to enhance flood resilience. The strategies and projects included in the plan will also assist with supporting the state's Chesapeake Bay watershed pollution reduction goals for nutrient and sediment runoff in the Shenandoah Valley.

Moreover, the document would serve as a worthwhile companion to the region's draft 2026 Hazard Mitigation Plan, which identifies flooding as the region's number one hazard priority based on locality input.

We acknowledge that the Regional Flood Resilience Plan must meet the criteria outlined in Appendix F of the DCR CFPF Funding Manual, and that the plan must be formally adopted to be considered for future rounds of DCR CFPF implementation funding. We further recognize and support that the CSPDC is prepared to fund the full required grant match through funding secured through the CSPDC Watershed Implementation Plan (WIP) program.

The Town of Timberville hereby authorizes the CSPDC to submit this regional proposal on our behalf.

Sincerely,

Austin C. Garber II  
Town Manager  
Town of Timberville

# Central Virginia Planning District Commission Flood Resilience Plan

## 2024



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# Executive Summary

## Purpose and Introduction

This CVPDC Flood Resilience Plan seeks to increase resiliency across the CVPDC region by addressing threats to human life and property from flooding, as well as extreme heat. While the main purpose of this plan focuses on flood resilience, the CVPDC localities wanted to add resilience to Heat as well, which is an important climatic condition to consider. The CVPDC Flood Resilience meets the nine (9) criteria for resilience plans identified as part of the Virginia Department of Conservation and Recreation's Community Flood Preparedness Fund (CFPF) grant program:

*It is project-based with projects focused on flood control and resilience.*

The Potential Projects and Solutions section of this Plan (Appendix A) describes specific flood and/or heat mitigation projects related to issues developed through conversations with locality staff and mitigation strategies from the CVPDC Hazard Mitigation Plan.

*It incorporates nature-based infrastructure to the maximum extent possible.*

The solutions and planning principles outlined in this Resilience Plan incorporate nature-based strategies as much as possible. Additionally, each locality contains a section in the plan highlighting existing protected areas and ecological cores, overlaid on floodplains and intermittent streams. This information can be used to prioritize land acquisition for flood mitigation.

*It includes considerations of all parts of a locality regardless of socioeconomic or race and addresses flood resilience needs of underserved populations within the community.*

This Plan understands that flooding anywhere in the CVPDC region affects everyone. It considers solutions that involve every member of the community at every step of the process and seeks to identify and target the County's most vulnerable communities. See the Community Assets section of each plan for more information.

*It identifies and includes all flooding occurring in all areas of the community, not just within the SFHAs, and provides the number and location of repetitive loss and severe repetitive loss properties. Repetitive loss and/or severe repetitive loss often occurs outside of the SFHA and to properties not captured in NFIP reporting. All flooding should be tracked and addressed by the community.*

The flooding issues expounded upon in this resilience plan are not restricted to FEMA special flood hazard areas. This Plan seeks to address all forms of flooding (including but not limited to riverine, pluvial, stormwater, nuisance, infrastructure-related, residential, commercial, etc.) Building upon the 2020 CVPDC Hazard Mitigation Plan and through community interviews localized flooding events were captured and included in a map for each locality. As of 2023, all the CVPDC localities are enrolled in NFIP; and have been since the 1970's. There are a total of 27 repetitive loss properties in the region, with 19 of those within the City of Lynchburg. There are a total of 11 severe repetitive loss properties in the region, with 7 being in the City of Lynchburg.

*If property acquisition and/or relocation guidelines are included, the guidelines include equitable relocation strategies for all affected and where land is acquired. Property acquisitions must remain undeveloped, as permanent open space and under ownership or easement by the locality in perpetuity, except that flood control structures may be built on the property.*

This plan does not specifically address property acquisition and/or relocation guidelines, however several community's prioritized resilience strategies include a study and/or further efforts to do so.

*It includes a strategy for debris management.*

Debris management was specifically discussed with each locality and determined to be either a part of their Emergency Operations Plan, another local plan, or a part of day-to-day operations. If not memorialized in a written plan, a strategy is included to do so.

*It includes administrative procedures for substantial development/substantial improvement of structures within the SFHA.*

See Appendix D, which lists each locality's ordinance section for detailed administrative procedures for development and improvement of structures within the "Floodplain Management Overlay District" which encompasses the special flood hazard area.

*It includes coordination with other local and inter-jurisdictional projects, plans, and activities and has a clearly articulated timeline or phasing for plan implementation.*

This Plan relies on and synergizes with other regional plans, especially the 2020 CVPDC Hazard Mitigation Plan Update, as well as other locally based plans. See Appendix C of this Plan for other regionally important plans and sources of information. See the Project Implementation Sheets section of this Plan for timelines for project implementation.

*Is based on the best available science, and incorporates climate change, sea level rise, storm surge (where appropriate), and current flood maps.*

This plan seeks to recognize climate change impacts using the best available data and science.

## **Definition of Resilience**

Flood resilience generally refers to the ability of communities, infrastructure, and ecosystems to withstand, adapt to, and quickly recover from floods while minimizing damage and disruption.

According to FEMA, resilience is “the ability of individuals, businesses, communities, institutions, and governments to adapt to changing conditions and to prepare for, withstand, and rapidly recover from disruptions to everyday life, such as hazard events.”

The State of Virginia defines resilience as “the capability to anticipate, prepare for, respond to, and recover from significant multi-hazard threats with minimum damage to social well-being, health, the economy, and the environment.”

## **Community Input and Participation**

A key aspect of the CVPDC Flood Resilience Plan is local input. Throughout the plan process, locality staff were engaged at multiple points. Specifically, virtual interviews were conducted at the beginning of the project, at the mid-point of the project, and at the end to get feedback on the final plan and prioritized actions. Discussions with local staff enriched the planning process by providing diverse perspectives, local knowledge, ownership, support, priority identification, and innovation. See Appendix D for the notes from the community staff interviews. Through the 2020 CVPDC HMP update, input from the general public was solicited and used to guide the overall document and mitigation strategies. This CVPDC Flood Resilience Plan relied on the recent public engagement efforts associated with the HMP update.

## **Resilience Action Prioritization Matrix**

A key output of the CVPDC Flood Resilience Plan is the prioritized flood and heat actions matrix. This table contains flood and heat mitigation strategies that were identified as part of the 2020 CVPDC HMP update. These were further prioritized for each locality as well as the overall CVPDC region. For more information on the prioritization strategy and the prioritization matrix table please see Appendix A.

# The Central Virginia Planning District Commission

The Central Virginia Planning District Commission (CVPDC) is an organization that plays a vital role in coordinating collaborative efforts relating to development and planning across the region's member localities. The CVPDC is one of twenty-one regional planning districts within the Commonwealth of Virginia and encompasses a region of over 2,000 square miles. This region, located in the heart of Virginia, is situated 115 miles west of Richmond, Virginia and roughly 180 miles south of Washington, DC. Defining geographic features of the region include the James River, Staunton River, Smith Mountain Lake, and the Blue Ridge Mountains. Climate wise, the Central Virginia Region is referred to as a humid subtropical region. This area of Virginia is generally humid and typically experiences very warm summers and mildly cold winters.

The Central Virginia Planning District Commission is made up of ten (10) member localities. These local governments include the Counties of Amherst, Appomattox, Bedford, and Campbell, and the Towns of Amherst, Appomattox, Altavista, Bedford, Brookneal, and the City of Lynchburg. Together, these localities have worked towards planning for a more resilient region through their efforts associated with the CVPDC Resilience Plan development process.

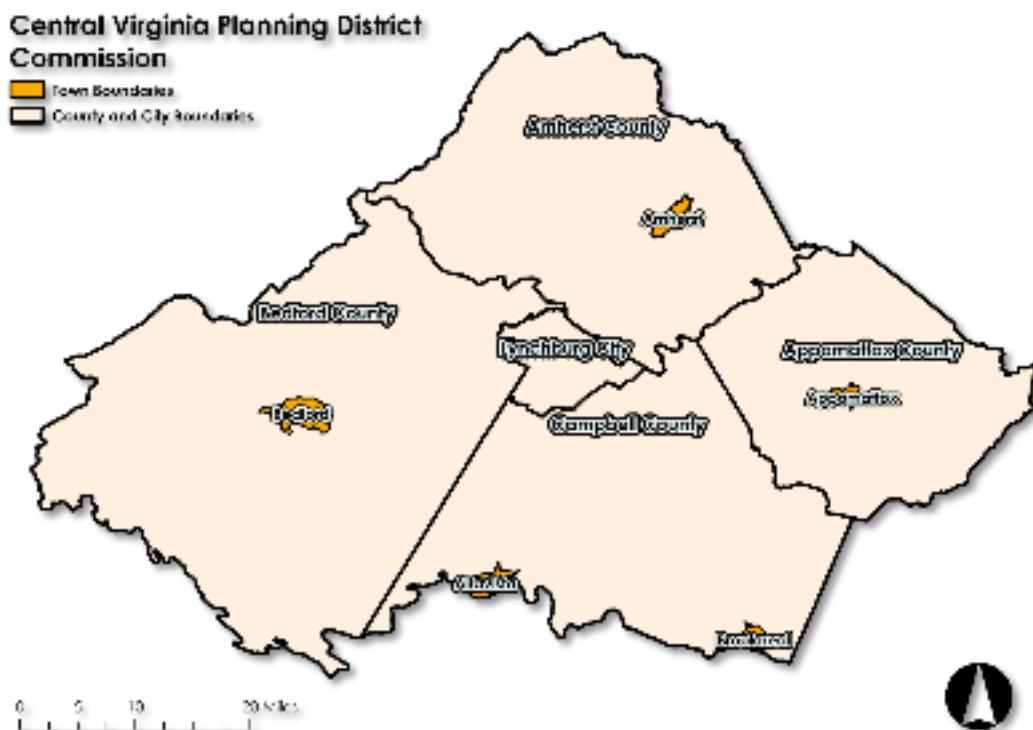


Figure 1 The Central Virginia Planning Commission District

These ten (10) members localities have varying populations and demographics. It is important that the unique makeup and needs of each be considered in a successful effort to provide resiliency from flood and heat related threats. This effort also builds upon the CVPDC 2020 Hazard Mitigation Plan update, which contains detailed demographic information for each locality. Please see Table 1 below for more information.

Locality	Approx. Population	2020 HMP Hazard Mitigation Plan Profile Reference
Amherst County	31,307	Page 2-2
Appomattox County	16,119	Page 2-3
Bedford County	79,462	Page 2-3, 2-4
Campbell County	55,696	Page 2-4
Town of Amherst	2,504 (Data USA)	Page 2-5
Town of Appomattox	1,919	Page 2-6
Town of Altavista	3,378	Page 2-5
Town of Bedford	6,657 (ACS)	Page 2-6
Town of Brookneal	1,090	Page 2-7
City of Lynchburg	79,009	Page 2-4
Comparison		
United States	331,449,281	
Virginia	8,631,393	

Table 1 Demographics for CVPDC communities, 2020 US Census data

## Vulnerable Populations

According to ADAPT VA's Social Vulnerability Index<sup>1</sup>, social vulnerability is the ability of an individual or group to anticipate, cope with, and resist and recover from natural or human-caused hazards. Vulnerable populations tend to be groups of people who are at a higher risk of poor physical and social health status. This CVPDC Flood Resilience Plan considers vulnerability and provides specific examples to align with the Virginia Department of Conservation and Recreation's Community Flood Preparedness Fund criteria. The plan will also identify areas of economic stress by the low to moderate income designation metrics.<sup>2</sup> The chart below summarizes the annual median income as well as the areas that are considered vulnerable based on their designation as a low-income geographic area.

<sup>1</sup> ADAPT VA's Social Vulnerability Index Score ([http://cmap2.vims.edu/SocialVulnerability/SocioVul\\_SS.html](http://cmap2.vims.edu/SocialVulnerability/SocioVul_SS.html)) (VA, n.d.)

<sup>2</sup> LMI 2020 US Census Data

Locality	Annual Median Income (AMI)	80% AMI ≤	Low-Income Geographic Areas	2020 HMP Hazard Mitigation Vulnerable Communities Reference
Amherst County	\$60,876	\$48,700.80	Yes	Page 4-36
Appomattox County	\$55,268	\$44,214.40	Yes	Page 4-48
Bedford County	\$71,751	\$57,400.80	Yes	Page 4-58
Campbell County	\$53,918	\$43,134.40	Yes	Page 4-76
Town of Amherst	\$46,316 (Data USA)	\$37,052.80	Yes	Page 4-36
Town of Appomattox	\$35,083	\$28,066.40	Yes	Page 4-48
Town of Altavista	\$35,438	\$28,350.40	Yes	Page 4-31
Town of Bedford	\$36,971 (ACS)	\$29,576.80	Yes	Page 4-58
Town of Brookneal	\$50,313	\$40,250.40	Yes	Page 4-76
City of Lynchburg	\$49,076	\$39,260.80	Yes	Page 4-90

Table 2 Income Information for CVPDC communities, 2020 US Census

## Central Virginia Planning District Commission

- County and City Boundaries
- Town Boundaries
- LMI Census Tracts
- Floodplain

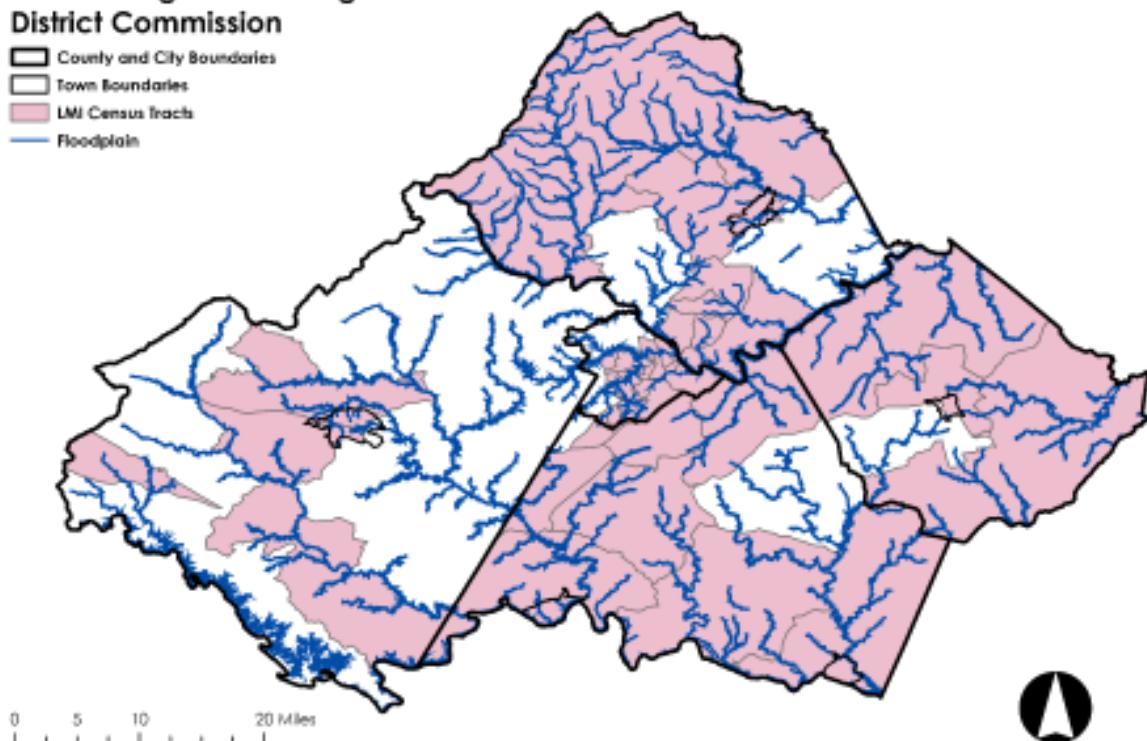


Figure 2 Low to Moderate Income Census Tracts with designated income levels at or below 80% of Area Median Income Levels.

## Regional Plans

### CVPDC 2020 Hazard Mitigation Plan (HMP)

The 2020 CVPDC Hazard Mitigation Plan,<sup>3</sup> (HMP) adopted in October 2020, defines the hazards relevant to the region and identifies vulnerabilities to such hazards. The identified hazards range from natural, technological, and human-caused concerns. Drought, flooding, and urban fire hazards were ranked as the highest hazard risks in the CVPDC region. The purpose of the HMP is to better prepare the region, including its citizens, visitors, communities, local governments, and businesses, for hazards and the risks associated with them. The HMP is a vital tool for these groups to lessen their vulnerability to hazards through strategies such as hazard risk assessments, floodplain management, additional grant program applications, and mitigation policy embedded in local and regional planning activities. The Federal Emergency Management Agency (FEMA) requires local governments to update their HMP every five years in order to maintain eligibility for pre- and post-disaster planning, mitigation, and recovery funding.

<sup>3</sup> <https://www.cvhmp.com/static/pdf-viewer/web/viewer.html?file=/static/files/Central-Virginia-Planning-District-Hazard-Mitigation-Plan-2020.pdf>

## Brownfields Assessment Program

The Central Virginia Planning District Commission was awarded a \$500,000 Brownfields Assessment Grant from the United States Environmental Protection Agency (USEPA) Region 3. The 3-year grant has EPA funding committed to September 2025. This grant will be used by the CVPDC and its member partners to conduct Phase I and Phase II Environmental Site Assessments (ESAs), to support property reuse and remediation planning and economic development and revitalization in the region.

EPA's Brownfields Program empowers communities and property owners to work together to assess, characterize and develop a foundation with which to plan redevelopment and reuse of properties that may have a complicated condition or history preventing use. Any property owners in the CVPDC planning area that own underutilized parcels with environmental concerns are eligible for funding Phase I and II evaluation.

## Regional Programs

### Watershed Implementation Plan (WIP)

The State of Virginia developed a Watershed Implementation Plan in ongoing phases (2010, 2012, and 2019) to incorporate strategies to reduce nutrient pollution in our waterways. The Chesapeake Bay Total Maximum Daily Load (TMDL) is designed to ensure that all pollution control measures needed to fully restore the Bay and its tidal rivers are in place by 2025. Specifically in Virginia, TMDL calls for a 20.5% reduction in Sediment delivered to the Bay. This will be achieved through stormwater Best Management Practice (BMPs). CVPDC and other communities across Virginia, in cooperation with the Virginia Department of Environmental Quality (DEQ), have been developing strategies to reduce nutrient pollution in our waterways through the Chesapeake Bay TMDL Phase III WIPs

## Regional Assets

### Natural Assets

#### *Conservation Areas*

The CVPDC contains numerous greenways that traverse the region. A greenway is a natural linear corridor that can play a vital role in water quality protection, minimizing stormwater impact, and mitigating stormwater flood damage in low lying areas.

Comprised of natural habitats or landscaped areas, greenways located along a river corridor and other ecologically valuable land systems filter runoff from adjacent land uses, thus assisting in the removal of sediment, nutrients and chemicals that negatively impact water systems and organisms. Additionally, greenways can serve as approved best management practice for controlling and mitigating stormwater quality and quantity thus assisting CVPDC localities in meeting new stormwater control requirements. Further, these green systems provide storage of the water and allow natural recharge of groundwater systems.



*Photo 1 Ivy Creek Greenway, Lynchburg, VA; photo credit: Lynchburg Tourism*

In addition to greenways, conservation areas are protected lands that are owned, managed, and generally held for purposes of safeguarding ecological richness, and in most cases, offering recreational opportunities for the general public. In addition to protecting wildlife and plant species, these areas offer benefits related to flooding and heat mitigation. Intact forests are a part of the natural water cycle, and function to absorb, filter, and recharge groundwater. They also prevent sediment, nutrients, and chemicals from getting into streams and rivers, which can negatively affect communities downstream. In addition to proper management of these areas, it is imperative to understand what intact or ecologically rich lands are still unprotected and take action to protect them for perpetuity. These lands stretch across County lines, generally. Regional Conservation Areas include, the Federally owned Priest National Forest Wilderness Area, George Washington National Forest, James River Face National Forest Wilderness Area, and Thunder Ridge National and Forest Wilderness Area. Numerous State Forest Areas, State Parks and State Wildlife Management Areas also dot the region. Another method for protecting land is through conservation easements on privately held land. As seen in the map below, there are conservation easements in the region, many adjacent to waterways offering various flood related benefits while keeping further built infrastructure out of the floodway. These areas can also protect biodiversity and offer linkages and corridors for wildlife. Lastly, these areas allow for public access and recreational opportunities for hiking, biking, boating, and fishing.

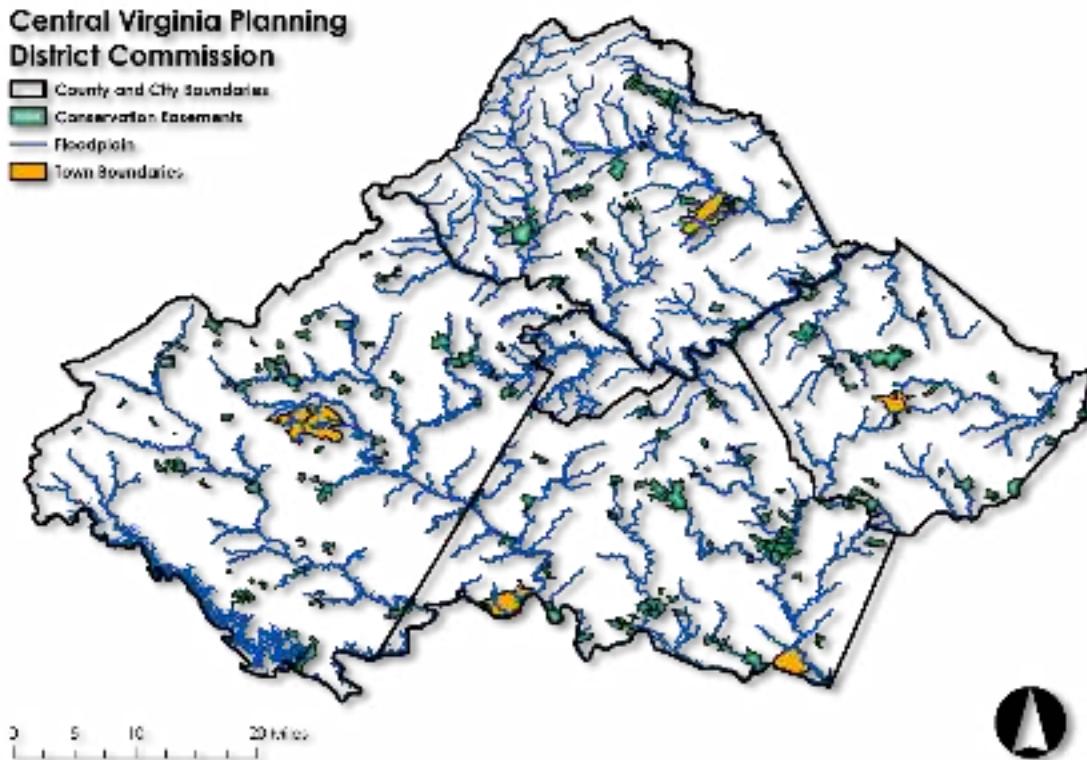


Figure 3 Conservation Lands overlaid on the regulatory floodplain, and intermittent streams, VADCR Natural Areas Inventory.

#### *Ecological Cores*

Ecological cores are patches of natural land with at least 100 acres of interior cover which provide habitat for a large variety of species, including forest, marsh, and maritime dependent species. Using satellite data, the Virginia Natural Landscape Assessment (VaNLA) provides an analysis that has identified, prioritized, and linked the important land networks throughout Virginia. The CVPDC region should have strategies to preserve ecological cores, such as using them as park lands for low-impact recreation (hiking, bird watching, etc.) and other conservation efforts.

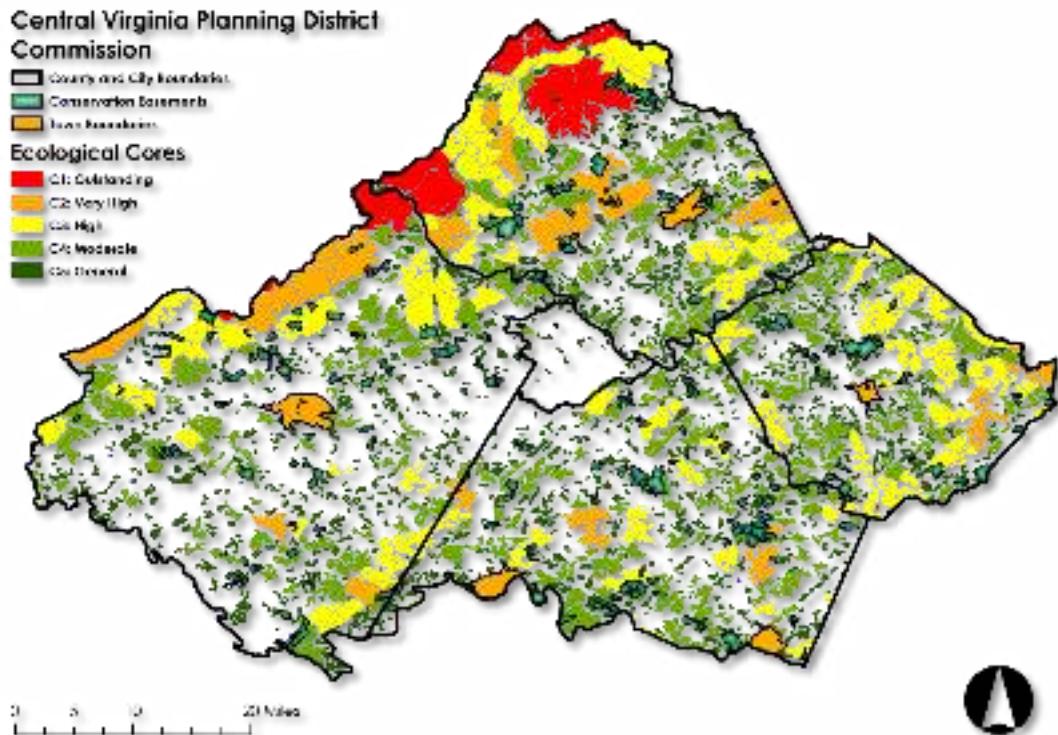


Figure 4 Ecological Cores overlaid on the regulatory floodplain, and intermittent streams, VADCR Natural Areas Inventory.

## Built Assets

Most of the built infrastructure in the region consists of roadways and bridges maintained by the Virginia Department of Transportation (VDOT). While the CVPDC 2020 Hazard Mitigation Plan contains detailed lists of vulnerable roads and bridges within the 1% and 2% Annual Chance Flood Area, it was also noted in community interviews that there are flood events that occur region wide that may not be in a designated flood hazard area and are associated with standing water from precipitation events. There may also be complications to addressing infrastructure improvements as many of the localities do not own or operate the roads and associated stormwater infrastructure.

Figure 5, below, provides an inventory of the Virginia Department of Transportation (VDOT) identified bridges and culvert conditions. The VDOT assessment ranking is helpful for prioritization of infrastructure

needs. The CVPDC can work closely with VDOT to advance projects in the region and focus on the specific infrastructure needs in poor condition. This will be discussed in more detail for each locality.

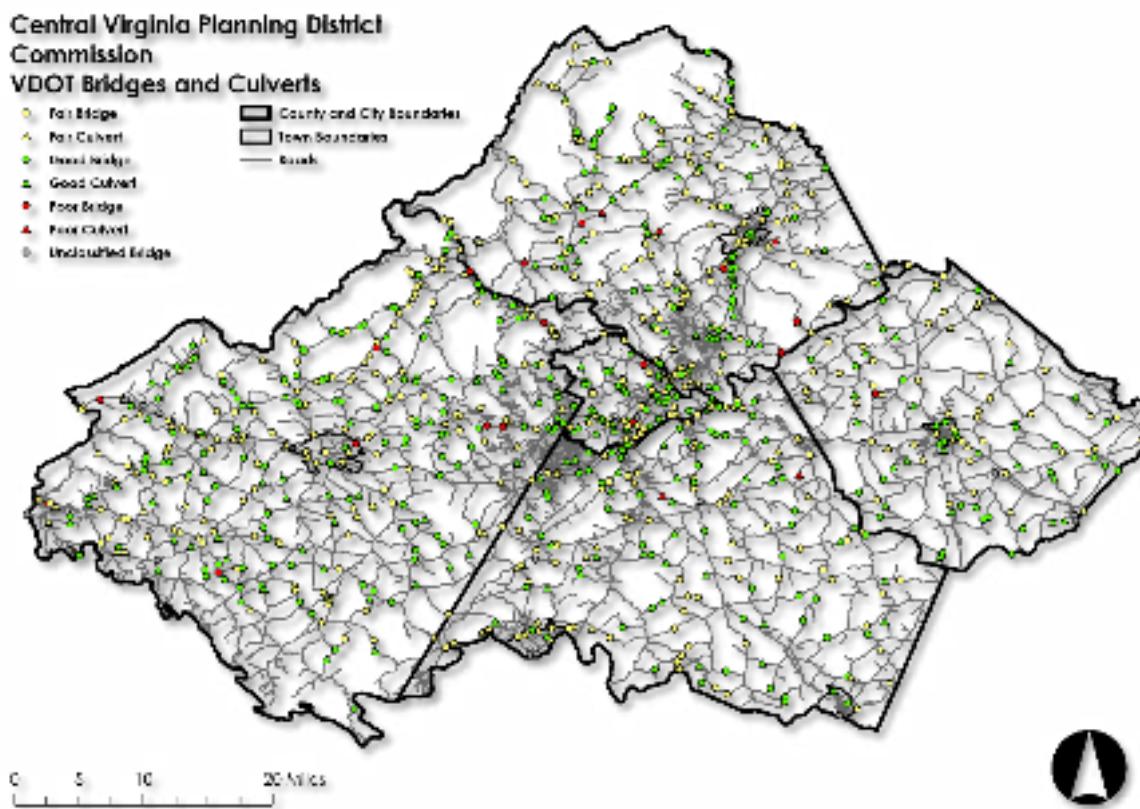


Figure 5 Bridge and culvert condition assessment within the CVPDC (VDOT).

## Regional Hazards

### Flooding and Related Hazards

#### *Precipitation Flooding*

The most frequent and most costly natural hazard throughout the United States is flooding. Excess water from snowmelt, rainfall, or riverbank flow accumulates and overflows onto adjacent floodplains. There are four basic types of floods that affect Virginia's communities, depending on the region of the state examined: coastal flooding, urban flooding, flash flooding, and riverine flooding. The CVPDC region is most susceptible to **riverine flooding** and **flash flooding**. A riverine flood occurs when water levels overtop the banks of a river. Low-lying areas adjacent to rivers, streams, or creeks are susceptible to riverine flooding, and such flooding occurs as result of excessive rainfall and/or snowmelt. A flash flood usually contains

two important elements; rainfall intensity and duration. These factors, combined with geophysical conditions, such as soils, topography, and ground cover, affect the direction and intensity of water flow. Flash floods are distinguished from regular floods by having a timescale of less than six hours between rainfall and onset of flooding.

### *Storm events*

Hurricanes and tropical storms, as well as tropical depressions, are all tropical cyclones. Hurricanes and tropical storms bring heavy rainfall, tornados, and high winds, all of which can cause significant damage. These storms can last for several days, and therefore have the potential to cause sustained flooding and high wind conditions. Numerous hurricanes and tropical storms occur along the eastern seaboard each year, with direct landfall occurring somewhere along the eastern United States approximately once every three years. While the region is protected from the full strength of a hurricane, its expansive nature makes the region vulnerable to high winds, flooding, and tornadoes that often accompany these other extreme weather events. VDEM rates Virginia's overall wind risk as high and the CVPDC communities are no exception. Historical occurrences of high winds generated by hurricanes and tropical storms are a strong indication of future events.

Thunderstorms are defined as localized storms, always accompanied by lightning, and often having strong wind gusts, heavy rain and sometimes hail or tornadoes. Thunderstorms can produce a strong out-rush of wind known as a downburst or microburst, or straight-line winds which may exceed 120mph. The entire CVPDC region is at risk of thunderstorm damage. There have been seven people injured and well over \$100,000 in property damage caused by lightning strikes in the CVPDC since 1993.

### *Dam Inundation*

Dam inundation refers to the process in which an area or land located downstream from a dam is submerged or flooded due to the release of water from the dam. This process can occur naturally after periods of heavy rainfall or snowmelt, or it can result from human-related actions such as the deliberate release of water from a dam to prevent dam failure or dam infrastructure damage. Dam inundation can have major consequences for the communities located downstream including flooding of property, agricultural land, and infrastructure. There are several mapped Dam Break Inundation Zones (DBIZs) located within the CVPDC region associated with the College Lake Dam, Reusens Dam, Ivy Lake Dam, and the Lake Summit Dam, among others.

### *Extreme Heat*

According to FEMA, extreme heat often results in the highest number of weather-related deaths in the United States each year. Extreme heat is characterized as a period of time in which temperatures and humidity are higher than the average temperatures for that time of year in a specific area. These periods of time are also often referenced to as heat waves. Extreme heat can be severely damaging to the human body and can result in many heat-related illnesses such as heat exhaustion or heat stroke. Extreme heat also has negative consequences on infrastructure and built assets within communities. Specifically, extreme heat directly impacts infrastructure such as roads and bridges that were not built to withstand such high temperatures. Additionally, extreme heat can have consequences on the agricultural industry including the health of workers and crops.

## Regional Future Conditions

One of the guiding principles of the CFPF program is to acknowledge climate change and its consequences, and base decision making on the best available science.<sup>4</sup> Considering this, the CVPDC region will endeavor to incorporate climate change data where appropriate, into proposed initiatives.

When considering a changing climate, it is important to understand the modelling variability that exists based on future conditions of emissions that affect the warming of the atmosphere. Generally, scientists must also make assumptions about future greenhouse gas emissions, which include a variety of gases, including; Carbon dioxide, Methane, Nitrous oxide, and Fluorinated gases. Worldwide, net emissions of greenhouse gases from human activities increased by 43 percent from 1990 to 2015. Emissions of carbon dioxide, which account for about three-fourths of total emissions, increased by 51 percent over this period. As with the United States, the majority of the world's emissions result from transportation, electricity generation, and other forms of energy production and use.<sup>5</sup>

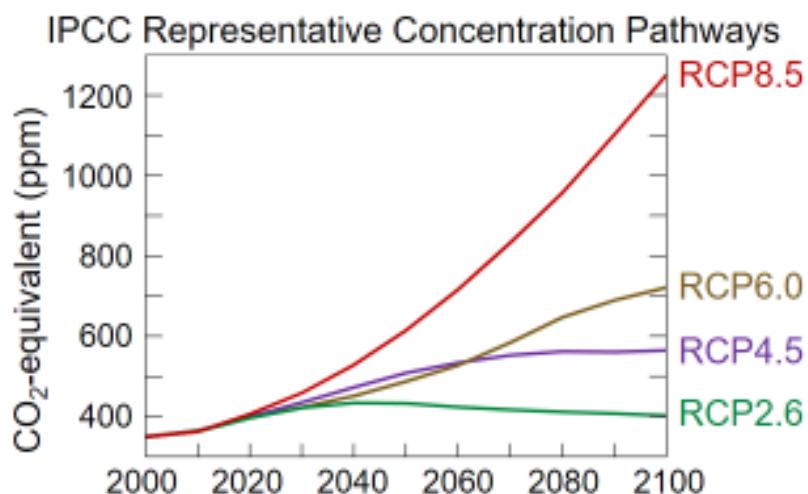


Figure 6 Representative Concentration Pathways, or RCPs, are greenhouse gas concentration trajectories adopted by the IPCC. (Source: IPCC)

Looking to the future, if emissions continue to rise, the earth will warm more quickly, and climate change impacts will be more severe. If emissions fall, the earth may not warm as much. Thus, evaluating a range of climate scenarios may assist in understanding how the climate may change in the future. For the purposes of this plan, the scenarios will generally refer to the RCP 2.6 scenario, which represents the lowest amounts of future greenhouse gas emissions; the RCP 4.5 scenario which accounts for a moderate

level of greenhouse gas emissions reductions; and the RCP 8.5 steady state scenario. The RCP 8.5 steady state scenario represents a scenario wherein little effort is made to reduce emissions, resulting in large atmospheric greenhouse gas concentrations<sup>6</sup>. Figure 4 shows a representation of the concentration of Carbon dioxide in the atmosphere, based on various levels of emissions in the future.

## Precipitation Flooding

In general, future precipitation projections in the region are expected to increase. By midcentury, (2041-2060) annual average precipitation is projected to increase from 41-47 inches to 44-53 inches statewide.<sup>7</sup> In order to provide a quantifiable amount of impact, the National Oceanographic and Atmospheric Administration's (NOAA) Mid Atlantic Regional Integrated Sciences and Assessments (MARISA) tool can

<sup>4</sup> VA Community Flood Preparedness Fund

<sup>5</sup> US EPA Climate Indicators

<sup>6</sup> Fourth National Climate Assessment, Chapter 19, Southeast

<sup>7</sup> US EPA

be used to predict rainfall for future design storms. The design storms can predict rainfall based on two planning horizons, year 2070 or 2100, and two climate change action scenarios, RCP 8.5 and RCP 4.5.

Rainfall Duration	Current Rainfall	Projected 2070		Projected 2100	
		Rainfall (in.)	Change from Current (in.)	Rainfall (in.)	Change from Current (in.)
<b>10 Year Return Period (10 Year Storm)</b>					
10 min	0.83	0.93	0.1	0.98	0.09
1 hour	1.98	2.22	0.24	2.34	0.36
24 hours	4.97	5.57	0.6	5.86	0.89
<b>25 Year Return Period ( 25 Year Storm)</b>					
10 min	0.93	1.03	0.1	1.14	0.21
1 hour	2.33	2.59	0.26	2.87	0.54
24 hours	6.1	6.77	0.67	7.5	1.4

Table 3: Rainfall duration and projected totals, MARISA <sup>8</sup>

While this data is now available, it is still difficult to predict the impacts of changes in rainfall patterns to infrastructure. This is largely due to the variety of factors that comprise the relationship between rainfall and runoff and that this relationship is generally non-linear. For example, a 5% increase in rainfall does not equal a 5% increase in runoff. The complexity leads to the necessity for additional study, and the incorporation of new information into updated standards in the design and construction of stormwater and flood infrastructure. With this in mind, a best practice to begin now, in order to plan for increases in precipitation and intensity, includes adaptation actions. An example of this is instead of building flood walls and levees, create or protect a riparian buffer with native vegetation and open spaces which will not be subject to costly damages, and which allows for passive recreation. This concept will be discussed more throughout the community sections of this plan.

Even though most of the climate models suggest rainfall increase, there is a possibility that climate change will result in less rainfall. Such a decline, particularly during the spring or summer months, could impact agriculture production and the amount of water available in rivers and streams. This could stress the agricultural industry and negatively impact natural waterways in the region.

#### *Storm Events*

Since the 1980s, the hurricane record has shown a more active period in the North Atlantic Ocean. On average, there have been more storms, stronger hurricanes, and an increase in hurricanes that rapidly intensify. Thus far, most of these increases are from natural climate variations. However, a recent study in the journal, Nature Communications, suggests that the latest increase in the proportion of North Atlantic hurricanes undergoing rapid intensification cannot be explained by natural variability alone. This could be the beginning of detecting the impact of climate change on hurricanes. In contrast, the frequency of hurricanes making U.S. landfall (a subset of North Atlantic hurricanes) has not increased since 1900, despite significant global warming and the heating of the tropical Atlantic Ocean.

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<sup>8</sup> Mid-Atlantic Regional Integrated Sciences and Assessments (MARISA)

In the future, warming ocean temperatures are expected, and this will likely play a role in the continuation of rapid intensification of hurricanes that may bring heavy rainfall and wind to the region, while providing less advance notice of a life-threatening flood and wind situation.

#### *Dam Inundation*

Dam inundation zones are likely to be impacted by both climate change and future development trends. As rainfall increases, the likelihood of hydrologic failure (water overtopping the dam) increases; dams, in general, are built to withstand a certain annual percent chance rainfall event depending on how many human lives would be affected downstream in the event of a failure. For instance, a high hazard dam would be constructed to withstand a rainfall event larger than any previously seen or predicted, whereas a significant hazard dam may be constructed to withstand an event that is predicted to occur only once every 1,000 years (a 0.1% annual chance). Likewise, less rainfall or prolonged drought could lead to lower (and thus safer) dam levels or even complete removal of a dam.

Development downstream of a dam triggers a review per [§ 10.1-606.3](#) of the Code of Virginia, requiring that DCR examine whether the extra structures and inhabitants would require a new classification for the dam which would impact them. Although development upstream of a dam would rarely require a review of any sort unless the characteristics of the watercourse were changed enough to warrant informing FEMA for floodplain review; it should be noted in general that creating new impervious surface and development in general may impact the characteristics of impounded lakes and reservoirs. Strategies to minimize runoff such as incentivizing stormwater management on site via green infrastructure or working with localities to develop local regulations to require the management of stormwater runoff onsite are viable options.

#### **Extreme Heat**

Even though climate models project different changes in temperature in the future, they all agree that temperatures will increase. The amount of warming depends on the simulated emissions scenario, and it is important to note that future warming will not be uniform across the entire year. However, more hot days are coming to Virginia. The first decade of this century was the warmest on record, and an increasing number of summer days are expected to exceed 95°F (Third National Climate Assessment for the SE and Caribbean).

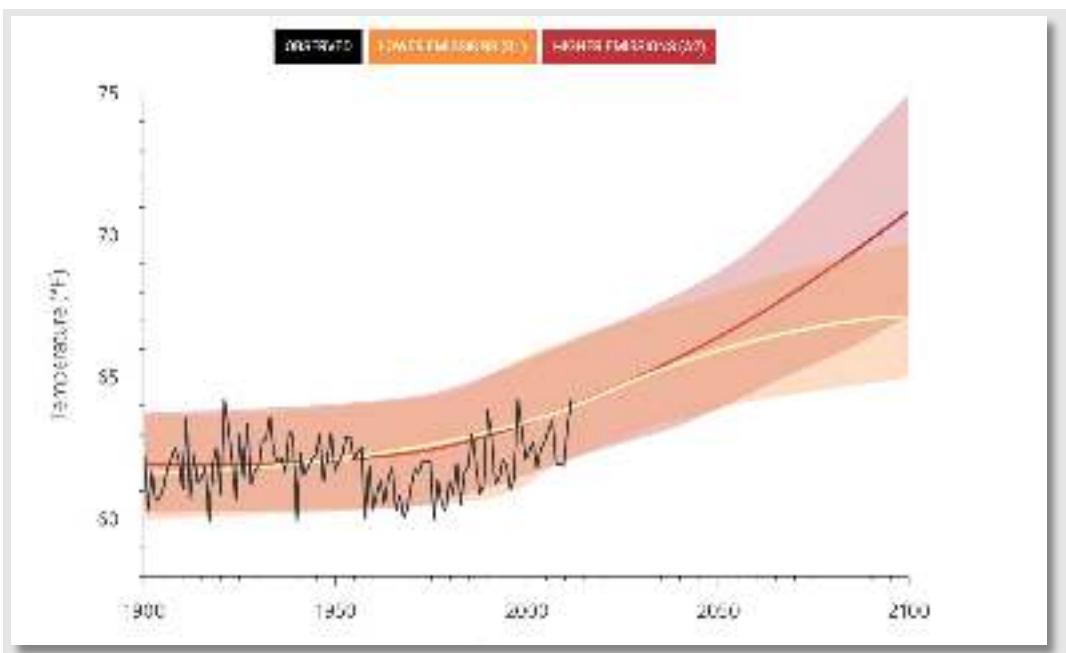


Figure 7 Observed annual temperature for the SE USA and Projected, Kunkel et al 2013

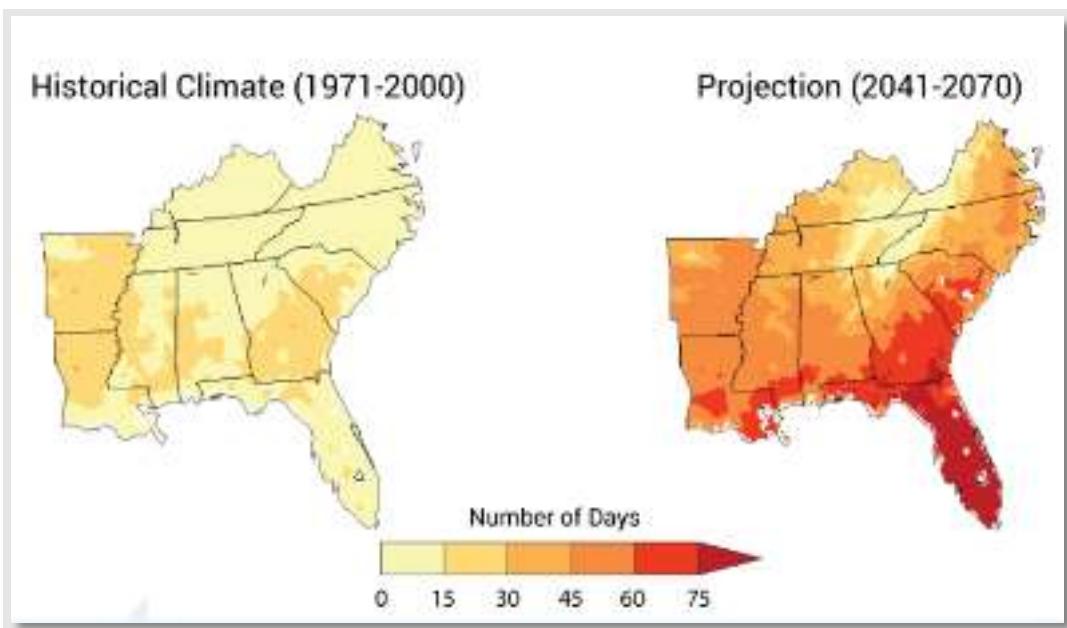


Figure 8 Projected Change in Number of Days Over 95 degrees F, assuming higher emissions (Figure source: NOAA NCDC / CICS-NC)

## Potential Regional Resilience Policies

To prepare for future conditions, the CVPDC can function as a catalyst for the region, keeping communication lines open, coordinating regional initiatives and projects, and assisting localities with identification of funding for mitigation projects.

1. Create a Resiliency Advisory Committee, representative of the communities being served, to provide community engagement and input on current and future initiatives and projects.
2. Identification of ecosystems, wetlands, and floodplains that are suitable for permanent protection or acquisition.
3. Partnering with other agencies to incentivize agricultural best management practices.
4. Coordination with VDOT on maintaining and improving stormwater infrastructure on State roads.
5. Targeted community outreach for predominately minority, low-income, or other vulnerable communities or communities that are not always included in the planning process.
6. Increased education on residential and private property green infrastructure projects.

## Prioritized Strategy

- ❖ Create a regional watershed hydraulic and hydrologic model to better understand flooding issues, stormwater system capacity, and stream conditions under future climate projections. Using the model, create a priority action plan of flood mitigation actions. (Score 65)

*For a full explanation of the Prioritized Resilience Strategy Matrix, see Page 36, Prioritizing Resilience Projects. For the full suite of resilience strategies and rankings by locality, see Appendix A.*

# Regional Action

65 Action Score

## Regional Watershed Model



### Action Description

Create a regional watershed hydraulic and hydrologic model to better understand flooding issues, stormwater system capacity, and stream conditions under future climate projections. Using the model, create a priority action plan of flood mitigation actions..

1. Conduct outreach to localities in the watershed to collect data on past flood events and impacts.
2. Develop hydraulic and hydrologic model.
3. Use model outputs to inform flood mitigation plan.



### Key Steps for Implementation



### Action Lead

DPW Directors and Staff



### Supporting Partners

- Virginia Lakes and Watersheds Association
- CVPDC
- VA DEQ Watershed Roundtables



### Ease of Implementation

- Locality can complete in-house.
- Requires locality to hire a staff person.
- Requires hiring a technical consultant.



### Measures of Success

- Meaningful input from localities on past flood events for model input.
- Consensus on priority actions in the flood mitigation plan.
- Robust outreach campaign demonstrating model results and future climate projections.

This Project Implementation Sheet is apart of a Flood Resilience Plan funded by the Virginia Community Flood Preparedness Fund (CFPF) on behalf of the Central Virginia Planning District Commission (CVPDC). For more detailed information please see the complete flood resilience report and its appendices.

### :bulb: Legend

#### Action Initiation Timeframe

Short: 0-2 years  
Medium: 3-6 years  
Long: 7+ years

#### Cost\*

\$: less than 10k  
\$\$: 10-50k  
\$\$\$: 50-500k  
\$\$\$\$: 500k-2mill  
\$\$\$\$\$: 2 mill+

\*Cost associated with the actions refers to how much it is expected to cost the Town to implement. This does not include costs for ongoing maintenance.



### Action Initiation Timeframe



Short

Medium

Long



### Resilience Considerations

A regional watershed model helps determine the areas with the highest likelihood of impacts in the region. Localities can use the shared model to make joint decision on projects that will reduce flooding not only in one locality but in multiple/the region.



### Co-Benefits & Equity Considerations

The model helps identify upstream interventions to reduce downstream flooding. There are economic efficiencies in developing a regional model because the cost of development is shared amongst localities.



### Cost

\$\$\$\$

1. Development of Hydraulic and Hydrologic Model: 250,000-500,000
2. Community Engagement: 30,000-75,000
3. Development of Flood Mitigation Plan: 100,000-200,000



### Possible Funding Sources

VA DCR Community Flood Preparedness Fund, VA DEQ

Central Virginia Planning District Commission, VA

# The Town of Amherst and Amherst County, VA

## Introduction

Amherst County encompasses a land area of 474.0 square miles and is located in the northern most portion of the CVPDC region. This diamond-shaped County is bounded to the northwest by Rockbridge County, to the northeast by Nelson County, to the southwest by Bedford County and the City of Lynchburg, and to the southeast by Appomattox County and Campbell County. Notable geographic features include the James River which borders the County to the south and east as well as the Blue Ridge Mountains along the western boundary. There is a higher education institution, Sweet Briar College, located in the southern region of the County; this is an all-female college, enrolling close to 500 students per year. Top employment sectors among Amherst County residents include Health Care and Social Assistance, Manufacturing, and the Educational Services sector.<sup>9</sup>

## Community Profile and Social Assets

Amherst County, Virginia, is home to a population that reflects a mix of rural and suburban demographics. The County's population includes a combination of individuals residing in small towns and rural areas, contributing to a unique blend of lifestyles. The demographic composition encompasses various age groups, from young families to retirees, creating a rich tapestry of experiences and perspectives. The County's economic landscape involves a mix of agriculture, local businesses, and, to some extent, commuting professionals. The racial makeup is as follows: 77.67% White, 19.79% Black or African American, 0.81% Native American, 0.35% Asian, 0.02% Pacific Islander, 0.41% from other races, and 0.94% from two or more races.<sup>10</sup>

## Vulnerable Populations

While resilience is important throughout the County and region, there are several census tracts in Amherst County that qualify as Low to Moderate Income based on 2020 census data. The definition of Low-to-Moderate Income (LMI) means any census tract (or equivalent geographic area defined by the Bureau of the Census) in which at least 50% of households have an income less than 60 percent of the Area Median Gross Income (AMGI), or which has a poverty rate of at least 25%. Amherst County contains multiple LMI census tracts which can be seen in Figure X below.

As defined in the 2023 CFPF Manual, "Low-income geographic area" means any locality, or community within a locality, that has a median household income that is not greater than 80 percent of the local median household income or any area in the Commonwealth designated as a qualified opportunity zone by the U.S. Secretary of the Treasury via his delegation of authority to the Internal Revenue Service. These areas are eligible to apply for CFPF funding with as little as 10% matching funds.

Another factor in measuring vulnerability is the Social Vulnerability Index. SVI indicates the relative vulnerability of every U.S. Census tract. Census tracts are subdivisions of counties for which the Census collects statistical data. SVI ranks the tracts on 15 social factors, including unemployment, minority

<sup>9</sup> <https://datausa.io/profile/geo/amherst-county-va>

<sup>10</sup> U.S. Census Bureau, Population Estimates Program (PEP), updated annually. [Population and Housing Unit Estimates](#)

status, and disability, and further groups them into four related themes. Thus, each tract receives a ranking for each Census variable and for each of the four themes, as well as an overall ranking. Projects and studies in areas with a higher SVI will receive prioritized rankings for CFPF funding. SVI Maps can be found in Appendix E.

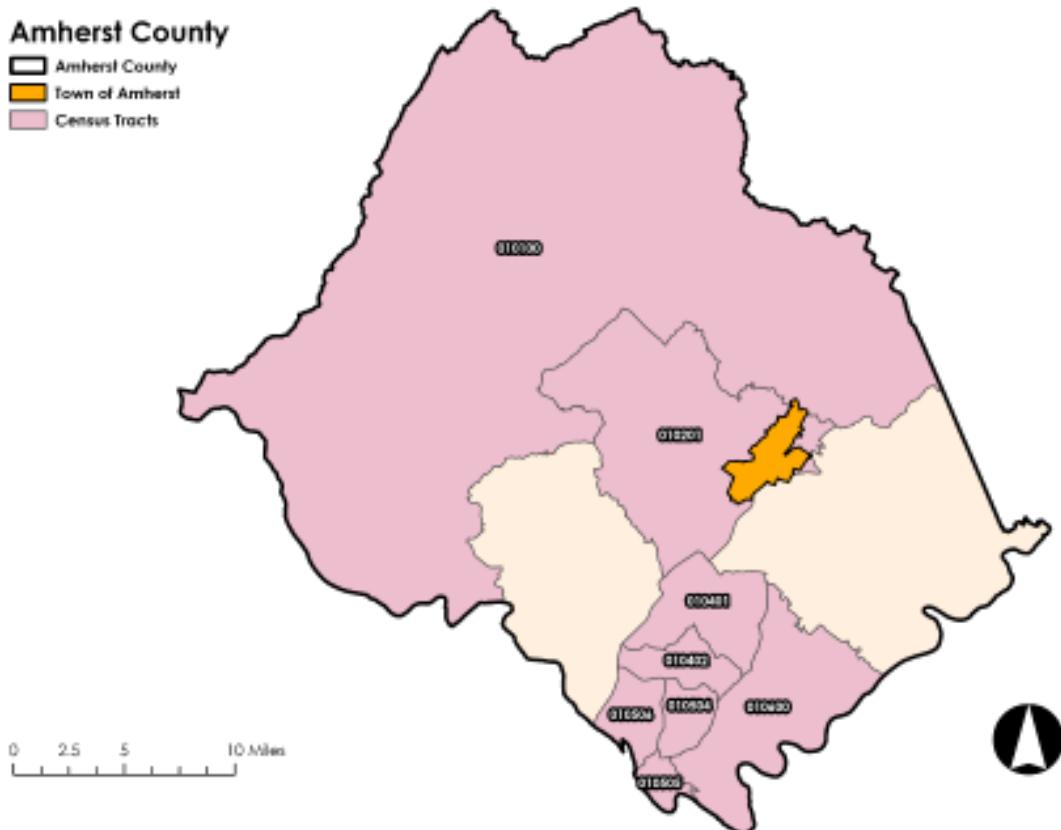


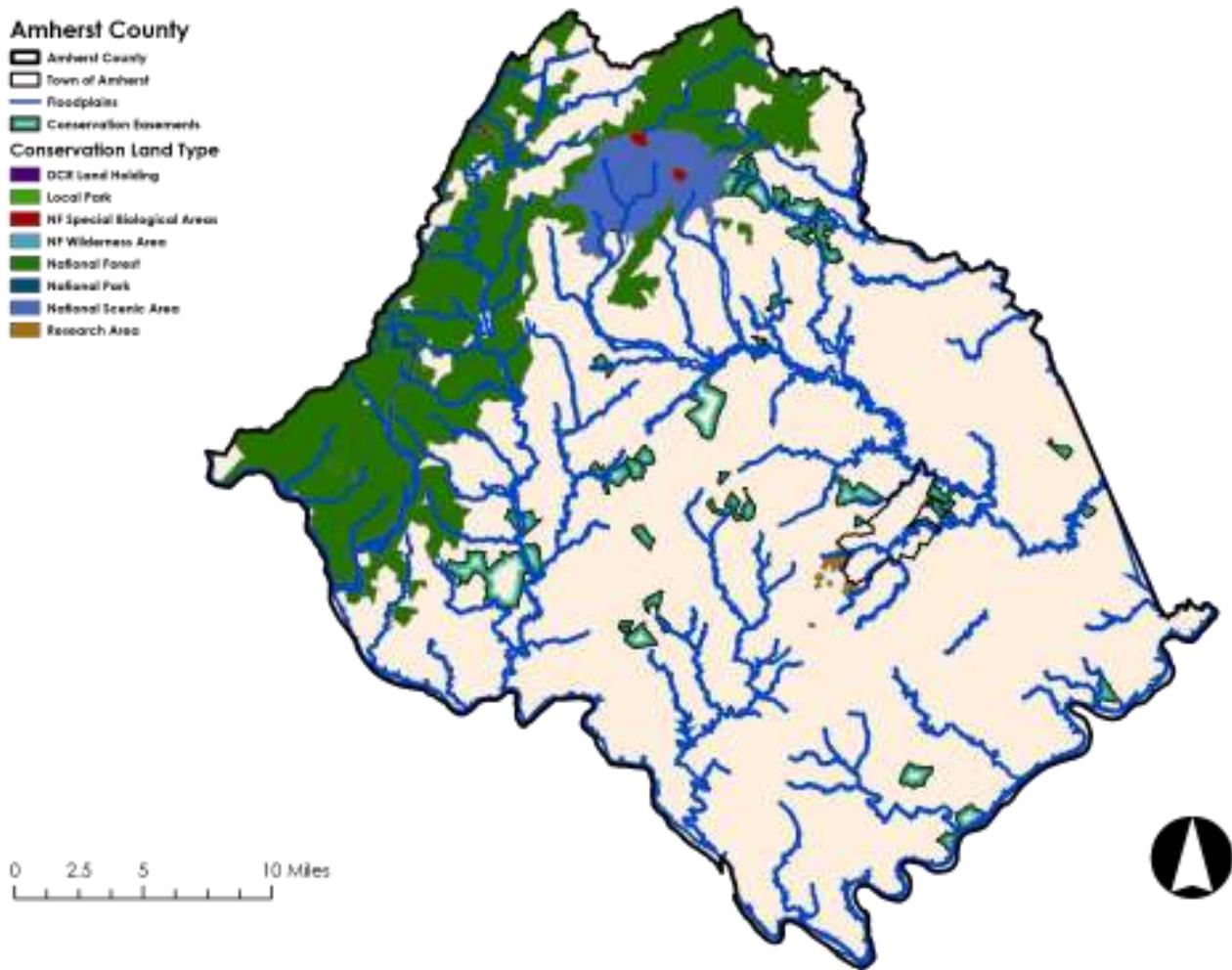
Figure 9 Low to Moderate Income Census Tracts with designated income levels at or below 80% of Area Median Income Levels. All but two Census tracts are considered Low to Moderate Income according to DCR: 010300 and 010202, Census Data, 2020.

## Natural Assets

### Conservation Lands:

Amherst County contains numerous trails and greenways including portions of the Appalachian Trail, the James River Heritage Trail, and the Virginia Blue Ridge Railway Trail, a seven-mile, crushed gravel recreation trail used for biking, hiking, and horseback riding that traverses Amherst and Nelson counties along the Piney and Tye rivers. The Piney and Tye Rivers represent a valuable resource protection greenway corridor initiative, as this portion of the County drains into the James River and is a component of the Chesapeake Bay watershed.

The largest percentage of land in conservation lies within the George Washington National Forest in the western portion of the County. There are numerous other smaller parks and conservation easements in the County. Some of these easements are riparian easements, which are specifically identified in the Amherst County Comprehensive Plan as being a tool to direct development away from flood prone areas. Recognizing this as an important step, there are several ways to do this; to purchase the land outright and use it as open space or purchase a conservation easement. There may be opportunities to collaborate

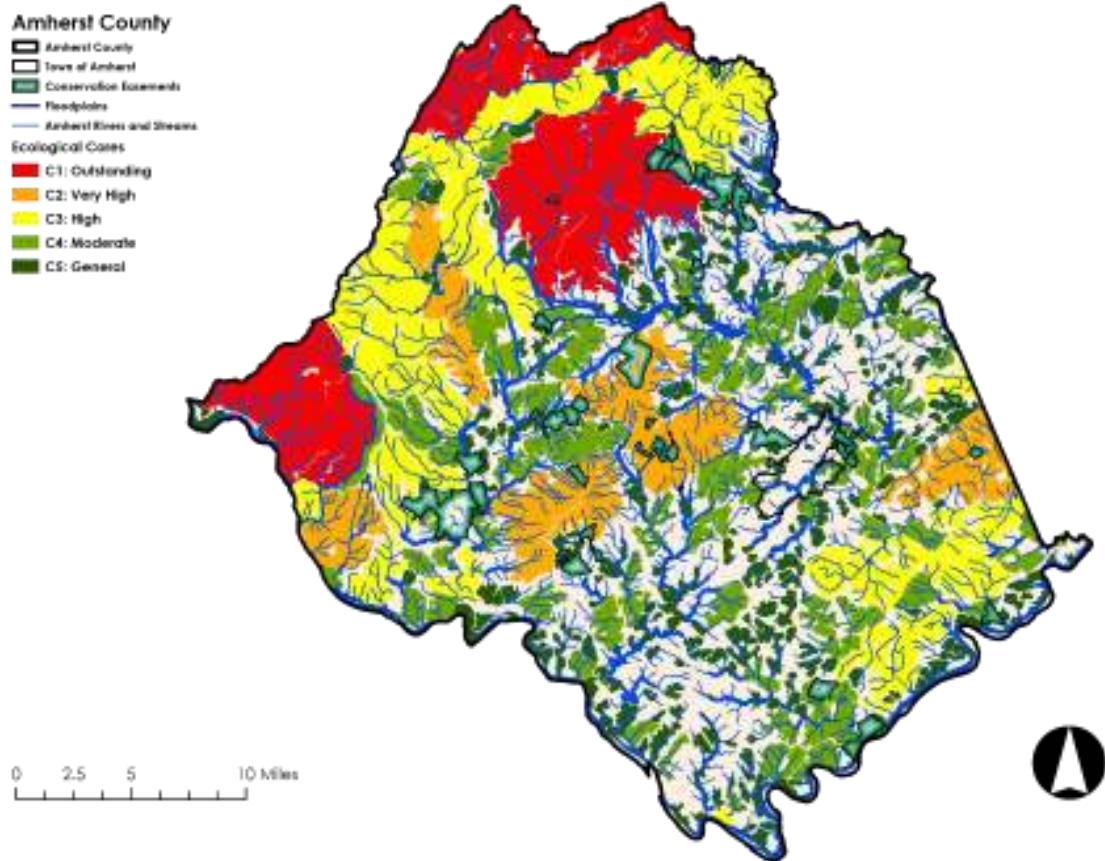


with landowners to expand conservation easements in the floodplain and further this valuable strategy for flood protection in the County.

Figure 10 Conservation Lands overlaid on the regulatory floodplain, and intermittent streams, VADCR Natural Areas Inventory

## **Ecological Cores:**

Ecological cores are patches of natural land with at least 100 acres of interior cover which provide habitat for a large variety of species, including forest, marsh, and maritime dependent species. Using satellite data, the Virginia Natural Landscape Assessment (VaNLA) provides an analysis that has identified, prioritized, and linked the important land networks throughout Virginia. Preserving and maintaining these landscapes can help ensure they continue to provide ecosystem services such as cleaner air and water filtration. Ecological cores can also provide recreational opportunities and open space resources. The following map shows which areas of the counties and cities within Amherst County contain ecological cores. A higher rating (with red being the highest) indicates the amount of ecosystem services that ecological core provides. Examples of ecological services that cores provide include wildlife and plant habitat, biodiversity conservation, water resource protection, erosion control, and carbon sequestration. Amherst County should have strategies to preserve ecological cores, such as using them as park lands for low-impact recreation (hiking, bird watching, etc.) and other conservation efforts.



*Figure 11 Ecological Cores overlaid on the regulatory floodplain, and intermittent streams, VADCR Natural Areas Inventory*

## Flooding and Built Assets - Critical Facilities and Infrastructure

Section 4.3, Flooding, of the 2020 CVPDC Hazard Mitigation Plan, contains a thorough evaluation of FEMA floodplains, critical infrastructure, roads and bridges in the floodplain, repetitive loss properties and severe repetitive loss properties for each locality in the CVPDC region. For specific lists, maps, and related information for Amherst County, see Appendix B, 2020 CVPDC HMP Maps and Data.

There are numerous critical pieces of infrastructure that are in the floodplain and susceptible to flooding. According to the local staff, there are numerous high priority critical pieces of infrastructure that need to be upgraded, including the Rutledge Creek Wastewater Treatment Plant, and the sewer pump station

along the Buffalo River. It is also known that the headworks of the wastewater treatment plant is not in a high elevation area. Further, the Town of Amherst's raw water intake is in the flood zone.

There have been recent projects and grant funds to address some of the infrastructure along the James River. Overall, master planning and prioritizing these critical components of the County is a logical next step to move from reactive management to proactive management in the future. Below is a list of infrastructure and landmarks that are currently in the floodplain.

<b>Facility Name</b>	<b>Address</b>	<b>Facility Type</b>	<b>Coordinates</b>	<b>Flood Zone *</b>
Monacan Ancestral Museum	2009 Kenmore Rd, Amherst	Attractions	37.5729, -79.1270	1%; 0.2%
Oronoco Campground	Jordan Rd, Vesuvius	Campground	37.7488, -79.2653	1%; 0.2%
Otter Creek Campground	60851 Blue Ridge Pkwy, Monroe	Campground	37.5760, -79.3379	1%; 0.2%
Cushaw Hydro Power Plant	Mt Grove Cr-01 600 N., Warm Springs	Energy Facility	37.5929, -79.3813	1%; 0.2%
Snowden Hydro Power Plant	7443 Elon Road, Big Island	Energy Facility	37.5736, -79.3715	1%; 0.2%
Pedlar Volunteer Fire and Rescue	4893 Lexington Turnpike, Amherst	Fire Stations	37.6725, -79.2171	1%; 0.2%
Lynchburg Steel & Specialty Co Inc	275 Francis Avenue, Monroe	HazMat Facility	37.5075, -79.1230	1%; 0.2%
Sewer Pump Station	Route 718 / Buffalo River, Amherst	Sewer Pump Station	37.6091, -79.0384	1%; 0.2%
Rutledge Creek WWTP **	731 Industrial Dr, Amherst	Wastewater Treatment Plant	37.5844, -79.0304	1%; 0.2%
ACSA Henry L. Lanum Water Filtration Plant	1355 Elon Road, Madison Heights	Water Treatment	37.4846, -79.166	1%; 0.2%
ACSA Williams Run Sewage Station	101 Carolina Avenue, Madison Heights	Sewage Pump Station	37.4053, -79.1004	1%; 0.2%
ACSA Madison Heights Trunk Sanitary Sewer	North bank, James River	Sanitary Sewer	37.3992, -791157	1%; 0.2%

Table 4 Critical facility and infrastructure in the floodplain of Amherst County, 2020 CVPDC HMP

The top five most susceptible roads to flooding are all US or State of Virginia primary roads, including the Blue Ridge Pkwy, Lexington Tpke, N. Fork Rd, Galts Mill Rd, and Woodson Rd. Stormwater infrastructure maintenance and repair should be a priority for these roads and can be prioritized for future funding and coordination with the Virginia Department of Transportation. *For a complete list of roads and bridges most susceptible to flooding see CVPDC Hazard Mitigation Plan 2020 Update Flooding; Page 4-39 – 3-40.* The map below illustrates real time data from the Virginia Department of Transportation on the condition of bridges and culverts. Amherst County, CVPDC and VDOT can work together to upgrade the “Poor” infrastructure first to avoid flood related damage and impacts to the surrounding areas.

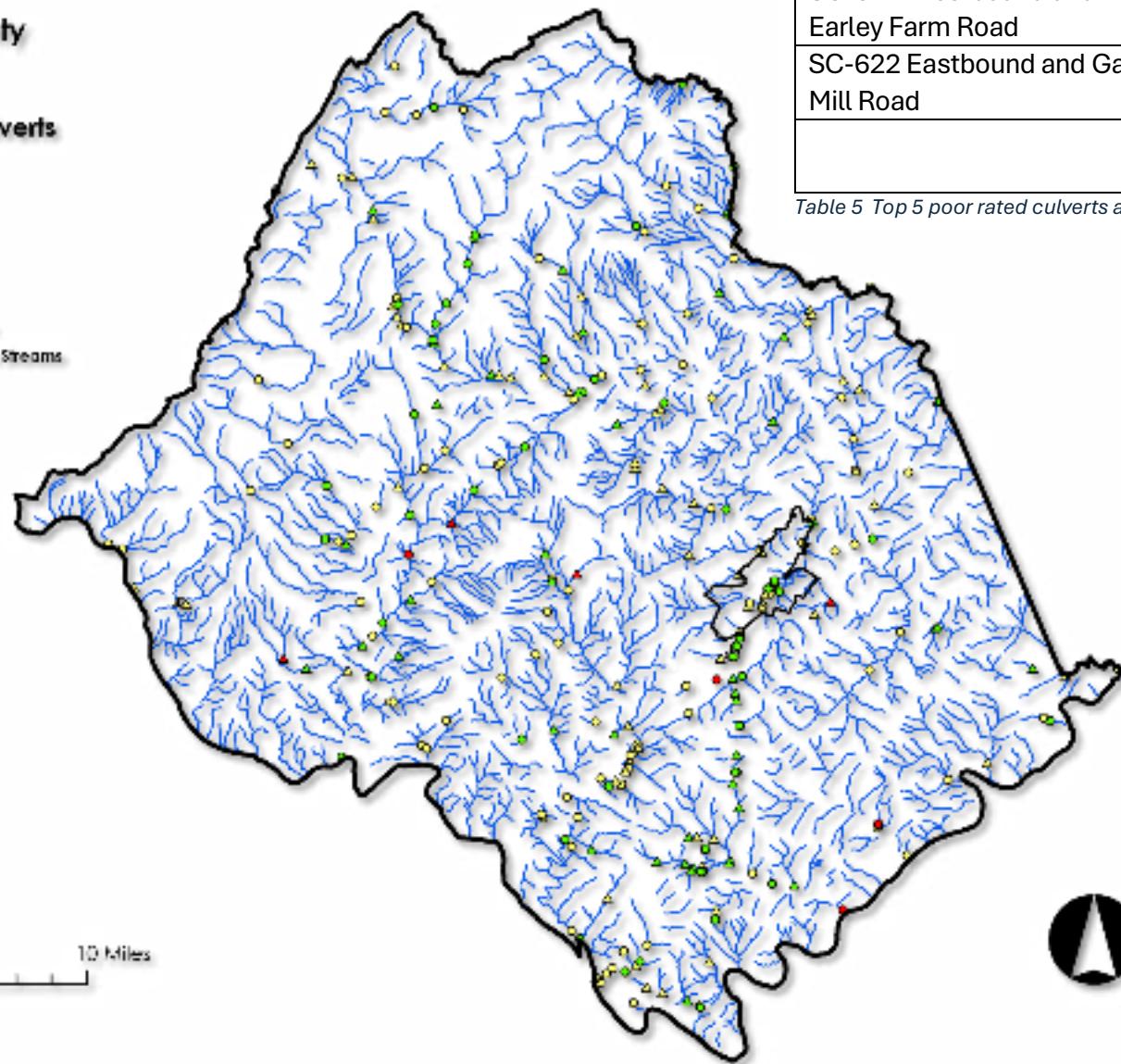
## Amherst County

Amherst County  
Town of Amherst

## Bridges and Culverts

- Fair Bridge
- △ Fair Culvert
- Good Bridge
- ▲ Good Culvert
- Poor Bridge
- ▲ Poor Culvert
- Unclassified Bridge
- Amherst Rivers and Streams

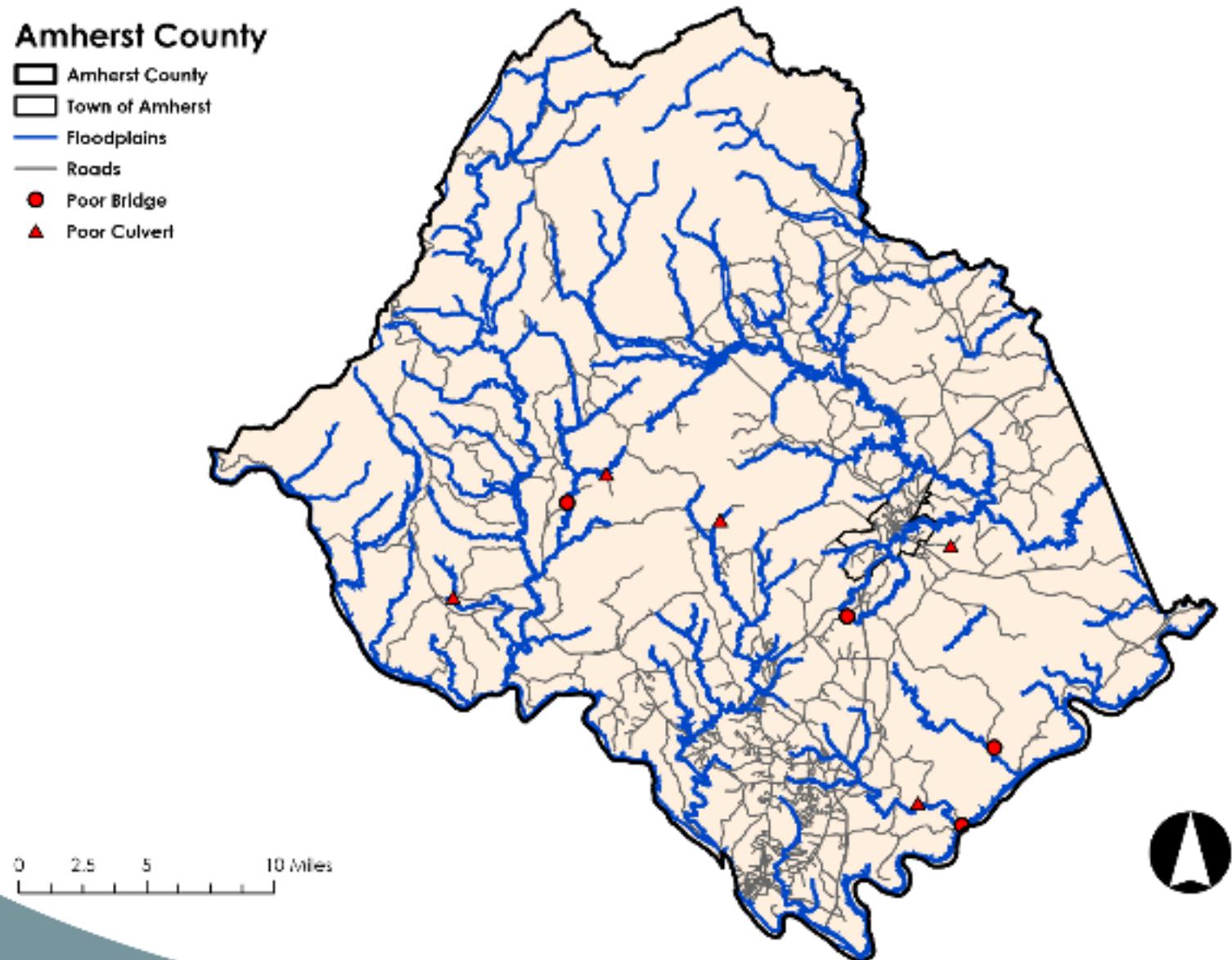
0 2.5 5 10 Miles



Top Poor Rated Bridges	Top 5 Poor Rated Culverts
SC-642 Eastbound and Meadow Hollow Road	SC-647 Eastbound and Maple Creek Road
SC-661 Northbound and Old Stage Road	SC-754 Southbound and Pryors Creek Road
SC-624 Westbound and Earley Farm Road	SC-615 Northbound and Peter's Hollow Road
SC-622 Eastbound and Galts Mill Road	SC-606 Northbound and Fox Hill Drive
	SC-648 Southbound and Beck Creek Road

Table 5 Top 5 poor rated culverts and bridges.

*Figure 12 Bridge and culvert condition assessment within Bedford County (VDOT)*



*Figure 13 Poor Rated Bridges and Culverts (VDOT) overlaid on Floodplains*

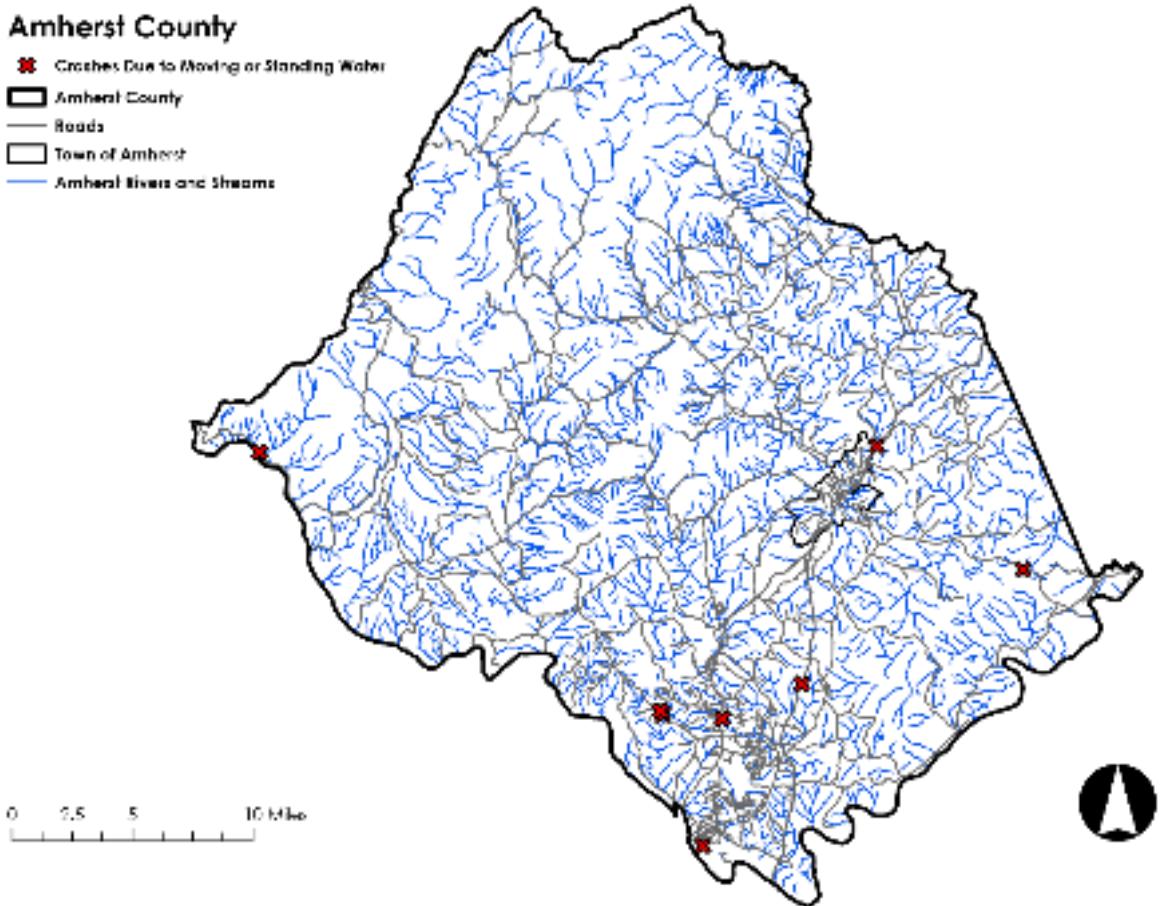


Figure 14 Vehicle crashes due to standing water on roadways (VDOT)

Crashes Due to Standing Water	Roads or Location	Date
1	3824-3860 South Amherst Highway	1/3/2017
2	Route 29 South	9/1/2017
3	Route 501	5/5/2017
4	Route 130	7/4/2019
5	Route 130 and Elon Road	11/30/2020
6	1225 Riverville Road	4/13/2020
7	29 Bypass	4/28/2023
8	29 Business	4/28/2023

Table 6 Recent vehicle crashes due to standing water, VDOT

Amherst County is generally affected most by precipitation that results in streams and rivers overtopping banks (riverine flooding) and rainfall events that leave standing water in areas that are dangerous. The map above illustrates where standing water is a problem and has resulted in a motor vehicle accident. Four of these incidents appear in the Madison Heights area, one just outside the Town of Amherst, and one in the

Eastern portion of the County. Upgrading roads and stormwater infrastructure should be prioritized in these areas to lessen the potential for further accidents.

## Flooding and Related Hazards

### Areas of Known Flooding

The CVPDC Flood Resilience Plan builds on the flood risk assessment performed in the 2020 CVPDC HMP update and adds more localized information mainly heard through community interviews and available data sets. Repetitive loss properties and severe repetitive loss properties as stated in the HMP, “*The identification of repetitive loss properties is an important element to conducting a local flood risk assessment, as the inherent characteristics of properties with multiple flood losses strongly suggest that they will be threatened by continual losses. Repetitive loss properties are also important to the NFIP, since structures that flood frequently put a strain on the National Flood Insurance Fund.*”<sup>11</sup> Amherst County currently has one repetitive loss property and one severe repetitive loss property. The Community Flood Preparedness Fund also requests that this analysis be considered in the overall flood resilience plan.

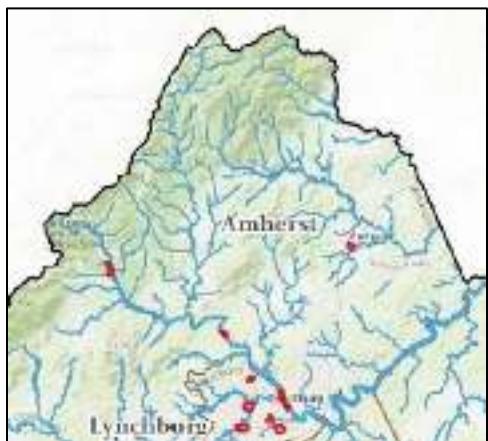


Figure 15 Amherst County repetitive loss areas (2020 CVPDC HMP)

Amherst County contains several areas that are known to have flooding and standing water issues. Most of these areas were identified during community interviews with County staff.

The Williams Run Area was identified as problematic. This area sees standing water on roads and residential yards after rainstorms. The increased development in this area is changing watershed parameters and could cause more severe flooding in the future (FEMA, 2019). Another area identified in community interviews is the nearby Sycamore Lane and Shady Oak Drive, in the Stratford Place subdivision. This is part of a natural drainage channel which can flood private property, and eventually drain into Williams run creek. The homeowner's association (HOA) may hold an easement and could be a partner in a potential stormwater management project for homeowners who would allow access. The Shady Oak Drive area and nearby streets were built prior to stormwater regulations (2004). While some drainage easements exist, generally they are not adequate and are not able to manage a 10-year storm, which is the commonly designed storm when sizing stormwater infrastructure. The Fernwood and Stratford Place subdivisions behind Wal-Mart are also in a similar situation. Further studies can be initiated in these areas to understand the underlying hydrology and identify potential solutions to recurrent flooding. To summarize, the following areas see flooding issues frequently and are shown in Figure 16 below:

- Williams Run Area
- Sycamore Lane
- Shady Oak Drive
- Fernwood Subdivision
- Stratford Place Subdivision

<sup>11</sup> The 2020 CVPDC Hazard Mitigation Plan Update

## Amherst County

- Amherst County
- Floodplains
- LMI Census Tracts
- Known Areas of Flooding

010100

010201

010401

010402

010504

010600

010506

010505

0 2.5 5 10 Miles



Figure 16 Areas of known flooding overlaid on Low Income Geographic Areas with up to 80% of Area Mean Income levels.  
(Qualified tracts for 10% match CFPF)

## Dam Inundation

The largest concern with the several dams in Amherst County (46 total, with 5 high-hazard and 23 of unknown hazard potential) are the homes, businesses, important thoroughfares and other transportation assets, and critical infrastructure assets in the Dam Break Inundation Zone (DBIZ). These include impacts to the pump station on Rt. 718, the Henry L. Lanum Water Treatment Plant, an electric substation, some portions of the Norfolk Southern Railroad, and numerous roads and road-stream crossings such as bridges and culverts. In addition, not all DBIZs are mapped for

significant-hazard dams. The Thrasher and Stonehouse Dams would impact flows downstream on the Buffalo River, Graham Creek Reservoir Dam the Graham Creek tributary to the James, the Pedlar River Dam would impact the Pedlar River as well as drinking water supplies for the City of Lynchburg, and the Reusens Dam would impact the James River. In addition to other flooding problems caused by the hypothetical historical rain event that would cause hydrologic failure of these dams, several buildings would be inundated, and numerous roads would need to be closed. While not predicted as likely, as shown by the 2018 hydrologic failure of College Lake Dam in Lynchburg, a mere 4-6 inches of rain over a short enough time span could cause an overtopping necessitating evacuation.

## Extreme Heat

Using an existing weather station along the Tye River just over the County Line (TYE River 1SE), it is possible to view observed temperature averages from 1950 – 2013 for Amherst County. Years when bars extend above the line were higher than the long-term average; years with bars that extend below the line were lower than average. While the range of exceedance events is variable, you can see a trend, especially from the year 2000 onwards, where observed temperatures clearly exceeded the average.

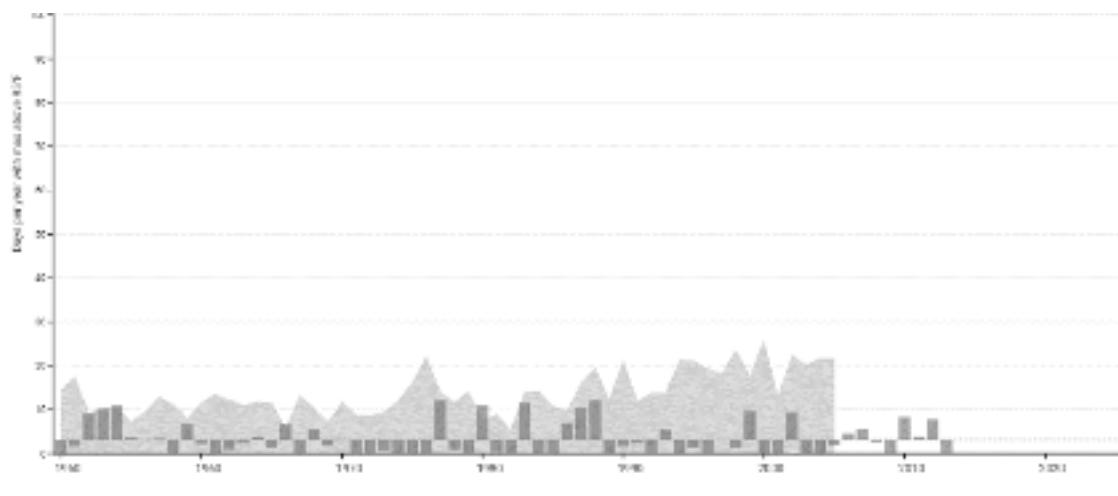


Figure 17 Days per year with temperature > 95 degree F observed average, US Climate Resilience Toolkit<sup>12</sup>

## Future Community Conditions

### Flood

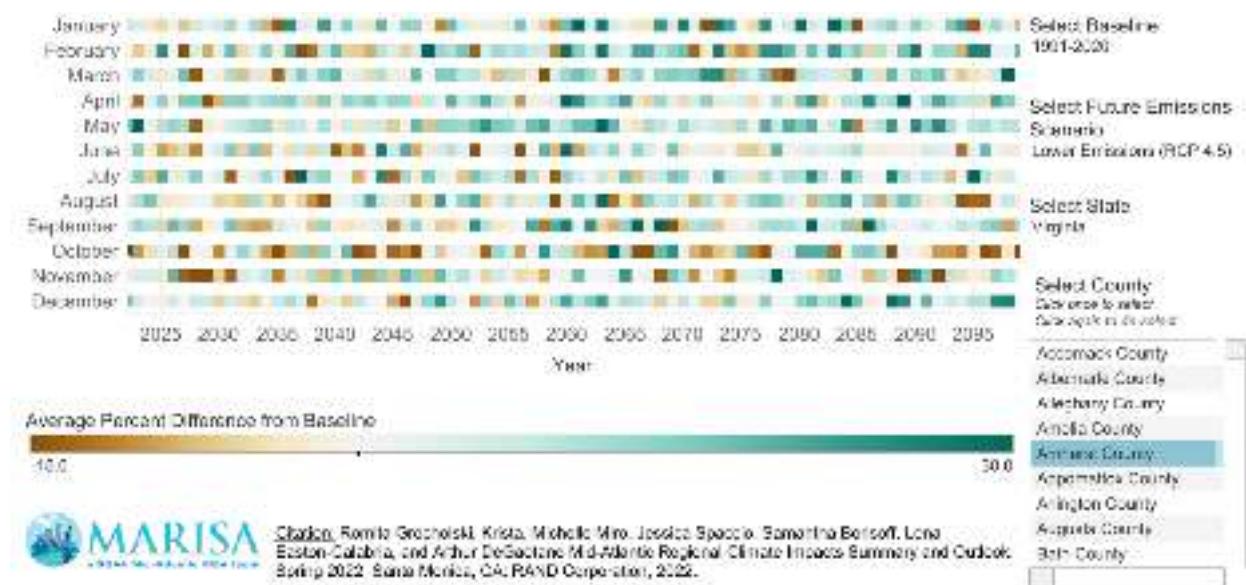
The potential risks of climate change can have broad effects on communities in Amherst County, including on its public health, infrastructure, agriculture, tourism, and emergency services. The County (and the CVPDC region in general) should expect the following in the future:

- More frequent, and more intense, precipitation events punctuated by deeper episodes of drought.

<sup>12</sup> <https://toolkit.climate.gov/#climate-explorer>

- Drier winter and summer seasons, which could deplete reservoirs and challenge drinking water supplies and agricultural production.
- Stronger storms at a greater frequency, which may threaten lives, damage infrastructure, and cause significant power outages.
- Increasing summer heat waves could threaten public health.

According to the NOAA Mid-Atlantic RISA projections,<sup>13</sup> Amherst County can expect to see some more extreme variability in precipitation over the next 50 years, with some months seeing 15% less and other months seeing up to 30% more compared to the average from the years 1991-2020. In general, the entire Appalachian and Piedmont regions can expect mild 1-2% average increases in rainfall compared to the past 40 years' average.<sup>14</sup> While it is difficult to know exactly how the County will be impacted, it is strongly encouraged to build in redundancy and extra capacity for stormwater and other water infrastructure to account for higher precipitation scenarios.



*Figure 18 Projected percent difference in total monthly precipitation compared to 1991-2020 Baseline, MARISA*

<sup>13</sup> <https://www.midatlanticrisa.org/data-tools/climate-data-tools/projected-changes-in-total-monthly-precipitation.html>

<sup>14</sup> <https://www.midatlanticrisa.org/data-tools/climate-data-tools/difference-from-normal-total-annual-precipitation.html>

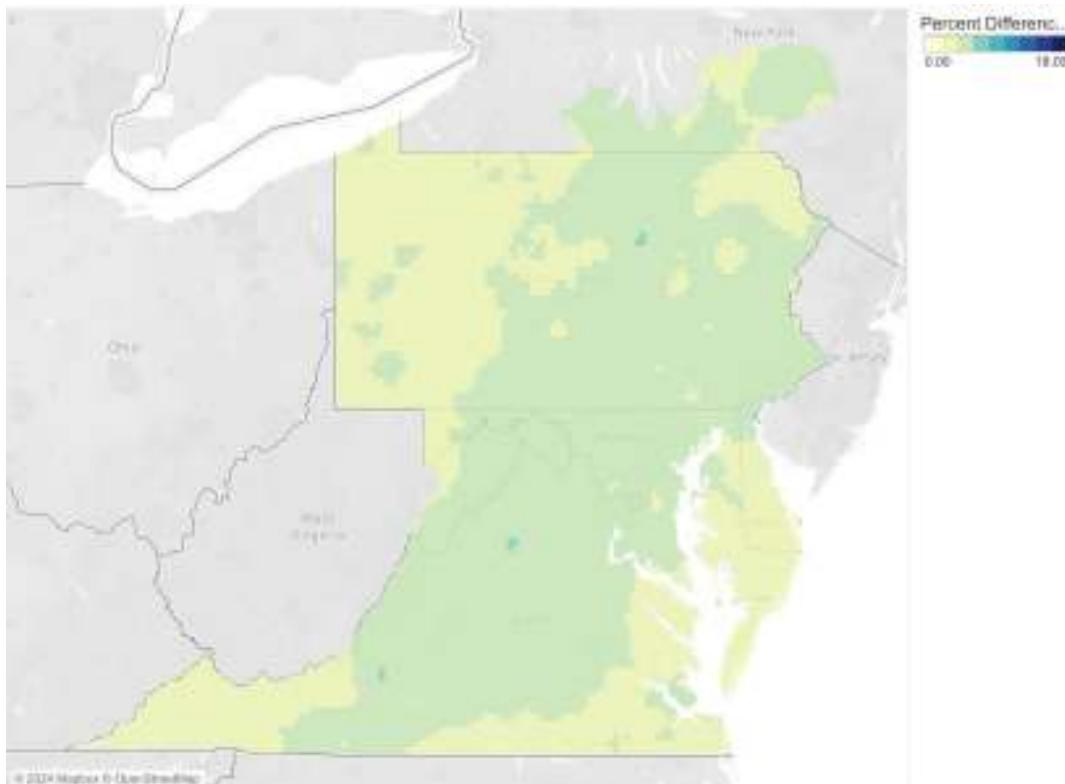


Figure 19 1981-2010 "Normal" Total Annual Precipitation, MARISA

## Heat

In Amherst County, the average daily temperature is expected to increase, as well as extreme temperatures on the hottest days of the year. This excess heat for longer periods may stress critical infrastructure such as roads and bridges. More hot days may also stress the electrical grid and the use of potable water may increase as people may need more irrigation for crops and landscaping. This type of heat may affect public health and may lead to economic impacts through disruptions in agriculture and manufacturing. Human health, stream and river health, and infrastructure are all threatened by higher temperatures.

At 95°F, it is hard to keep indoor areas and our bodies cool. Amherst County's summers are getting hotter. On average, Amherst County sees 4 days per year in excess of 95°F.<sup>1</sup> Within the next 50 years (by 2070), Amherst County can expect a yearly average of 25 to 47 days above 95°F, with associated increases in cooling costs, reduced air quality, and heat-related illnesses. It is imperative that the County begin planning for more days of extreme heat and look for ways to lessen the public health effects, especially on vulnerable populations.

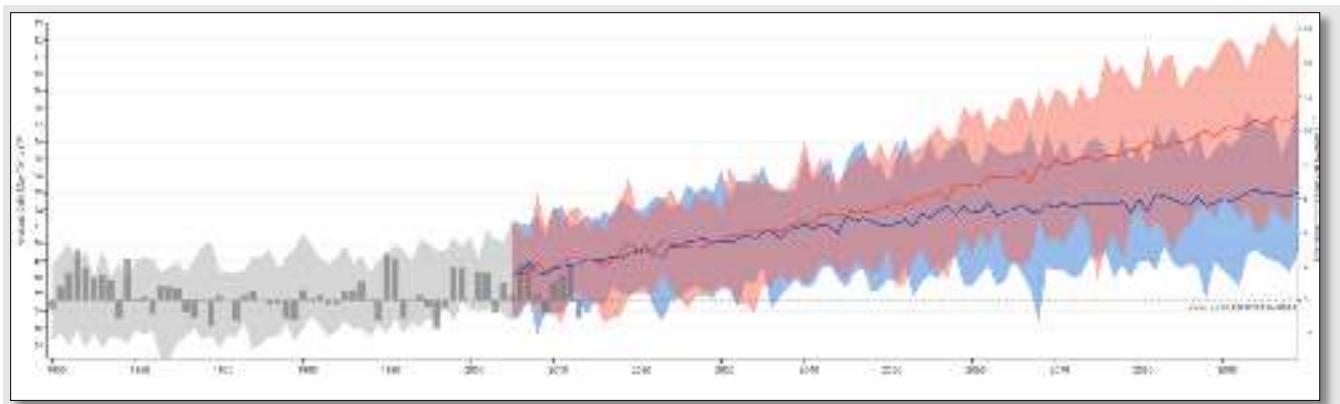


Figure 20 Days w/ maximum temp > 95°F (U.S. Climate Resilience Toolkit Climate Explorer)

Legend:  
 Observations  
  Modeled History  
  Lower Emissions  
  Higher Emissions

## General Flood and Heat Resilience Policies and Actions

- Prioritize vacant tracts of land for conservation and recreational open space in the James River floodplain and apply for grant funding to acquire these properties. (See Appendix A for more detail on grant funding)
- Create stormwater management incentives for new subdivisions and single-family residences.
- Develop targeted outreach in flood prone areas before and after a flood event that identify options for mitigation and grant funding to assist.
- Continue County wide tree planting initiatives; especially in the Madison Heights area.
- Develop targeted outreach before and during the summer months to inform the public of anticipated heat waves and ways to stay safe.

## Town of Amherst Prioritized Flood Resilience Strategy

- Assess opportunities to elevate or acquire repetitive loss properties to mitigate flood impacts including loss of life, property, and financial damage. Conduct outreach to homeowners of repetitive loss properties loss properties and owners within the dam hazard inundation area to understand their potential interest in relocation via buyouts. (Score 65)

## Amherst County Prioritized Flood Resilience Strategy

- Evaluate stream conditions and implement streambank stabilization and green infrastructure to promote natural function and mitigate riverine flooding, impacts of dam failure, and stormwater at the following locations: Lowesville, Monacan Park, Peddlar River at Buffalo Spring, Ware's Gap Road near Puppy Creek. (Score 75)

## Adapt Repetitive Loss Properties

Action  
Description

Assess opportunities to elevate or acquire repetitive loss properties to mitigate flood impacts including loss of life, property, and financial damage. Conduct outreach to homeowners of repetitive loss properties and owners within the dam hazard inundation area to understand their potential interest in relocation via buyouts.

- 1. Determine number of local repetitive loss properties and conduct outreach to property owners to better understand their concerns.
- 2. Develop a Town-VDEM partnership program/or coordinate with VDEM to streamline applications for home elevations or buyouts.
- 3. Prepare applications to FEMA for funding to support elevation or buyouts.
- 4. Support property owners as they elevate their homes or relocate by providing technical, financial, or relocation assistance.

Key Steps for  
Implementation

## Action Lead

Community Development Department

Supporting  
Partners

- Private property owners
- Virginia Department of Emergency Management (VDEM)
- CVPDC
- Amherst County

Ease of  
Implementation

- Locality can complete in-house.
- Requires locality to hire a staff person.
- Requires hiring a technical consultant.

Measures of  
Success

- Number of property owners the Town engages.
- Successful coordination or establishment of working relationship with VDEM staff who support FEMA application development.
- Number of funded applications by FEMA.
- Positive resident feedback regarding options for adaptation (without feelings of displacement or pressure).

This Project Implementation Sheet is apart of a Flood Resilience Plan funded by the Virginia Community Flood Preparedness Fund (CFPF) on behalf of the Central Virginia Planning District Commission (CVPDC). For more detailed information please see the complete flood resilience report and its appendices.



## Action Initiation Timeframe

Short: 0-2 years  
Medium: 3-6 years  
Long: 7+ years

## Cost\*

\$: less than 10k  
\$\$: 10-50k  
\$\$\$: 50-500k  
\$\$\$\$: 500k-2mill  
\$\$\$\$\$: 2 mill+

\*Cost associated with the actions refers to how much it is expected to cost the Town to implement. This does not include costs for ongoing maintenance.

Action Initiation  
Timeframe

Short

Medium

Long

Resilience  
Considerations

Home elevations can mitigate flood impacts, reducing damage to private property or loss of life.

Buyouts can permanently remove structures from vulnerable areas and create opportunities to restore properties to areas of ecological function and open space.

Co-Benefits  
& Equity  
Considerations

Matters related to home elevation or potential buyouts and relocation can be very sensitive topics. The Town should aim to engage with residents in a way that is respectful and empowering to provide property owners with options.

Cost  
\$\$\$\$

1. Property owner outreach: 5,000-10,000 (dependent on number of properties)
2. VDEM Coordination or Program Development: 30,000-150,000
3. Help Prepare FEMA Applications 35,000-100,000 (dependent on number of applications)
4. (Optional) Technical and Financial Assistance for Property Owners Pursuing Home Elevations or Buyouts: 250,000-1,000,000 (dependent on number of applications, not a requirement of FEMA)

Possible  
Funding  
Sources

Virginia Department of Emergency Management  
Federal Emergency Management Agency



Amherst, VA

# Amherst County

75 Action Score

## Stream Restoration and Nature-Based Solutions



### Action Description

Evaluate stream conditions and implement streambank stabilization and green infrastructure to promote natural function and mitigate riverine flooding, impacts of dam failure, and stormwater at the following locations: Williams Run, Lowesville, Monacan Park, Peddler river at Buffalo Spring, Ware's Gap Road near Puppy Creek.



### Key Steps for Implementation

1. Field investigation of current stream conditions
2. Assessment of stream and riverine capacity and flooding under future climate conditions.
3. Identification of priority project areas and coordination with private owners.
4. Implementation of restoration and green infrastructure solutions along stream and areas of known flooding



### Action Lead

Department of Public Works



### Supporting Partners

- Private property owners abutting waterways
- CVPDC
- Amherst Watershed Coordinator for the Robert E. Lee Soil and Water Conservation District



### Ease of Implementation

- Locality can complete in-house.
- Requires locality to hire a staff person.
- Requires hiring a technical consultant.



### Measures of Success

- Reduction of stormwater and riverine flooding
- Monitored and improved water quality and stream health
- Restoration of riverine vegetative buffer zones
- More agreements with private property owners to create conservation easements

This Project Implementation Sheet is apart of a Flood Resilience Plan funded by the Virginia Community Flood Preparedness Fund (CFPF) on behalf of the Central Virginia Planning District Commission (CVPDC). For more detailed information please see the complete flood resilience report and its appendices.



### Action Initiation Timeframe

Short: 0-2 years  
Medium: 3-6 years  
Long: 7+ years

### Cost\*

\$: less than 10k  
\$\$: 10-50k  
\$\$\$: 50-500k  
\$\$\$\$: 500k-2mill  
\$\$\$\$\$: 2 mill+

\*Cost associated with the actions refers to how much it is expected to cost the Town to implement. This does not include costs for ongoing maintenance.



### Action Initiation Timeframe

Short Medium Long



### Resilience Considerations

Stream restoration and nature-based solutions will be located and implemented based on information from a hydraulic and hydrologic model that shows impact on reducing flooding.

Nature-based solutions can also help reduce urban heat island impacts.



### Co-Benefits & Equity Considerations

Cost-sharing with private property owners to help improve their properties and reduce flooding through conservation measures.

Prioritized flood-prone areas in which socially vulnerable populations also live.



### Cost

\$\$\$\$-\$\$\$\$\$

1. Field Investigations: 30,000 - 100,000 (dependent on total acreage investigated)
2. Hydraulic and Hydrologic Modeling: 50,000-150,000 (dependent on total acreage investigated)
3. Identify Priority Projects: 50,000-100,000 (dependent on number of projects)
4. Design of Nature-Based Solutions: 150,000-250,000 (dependent on number of designs)
5. Construction and Implementation: 250,000-1,000,000 (dependent on scope of projects)



### Possible Funding Sources

Virginia Department of Environmental Quality Local Stormwater Assistance Fund, Virginia Community Flood Preparedness Fund



# The Town of Appomattox and Appomattox County, VA

## Introduction

Appomattox County is roughly 334 square miles and is situated on the eastern side of the CVPDC region, in the piedmont region. This County is bounded to the north by Nelson County, to the northwest by Amherst County, to the northeast by Buckingham County, to the southeast by Prince Edward County and Charlotte County, and to the southwest by Campbell County. The County is known for and takes pride in its rural charm and sense of place. The Town of Appomattox is the county seat of Appomattox County. Major transportation routes through and around this town include Highway 460, Confederate Boulevard, Church Street, and Court Street. A major attraction includes the Appomattox Court House National Historical Park. This site signifies the end of the Civil War and marks Appomattox as a culturally and historically significant place in the United States. The largest employment sectors for those living in the County are Office and Administrative Support Occupations, Management Occupations, and Sales and Related Occupations sector.<sup>15</sup>

## Community Profile and Social Assets

As of the 2020 census, the population of Appomattox County was 16,119, and the population within the Town of Appomattox limits was 2,157.<sup>16</sup> The median age was 48.1 years. The racial and ethnic makeup of the County was 78.4% White, 18.3% Black or African American, 0.4% Native American, 0.4% Asian, 0.0% Pacific Islander, 0.9% from other races, and 1.6% from two or more races. Hispanic or Latino of any race were 2.4% of the population. The median household income in the County was \$49,924, and the per capita income was \$27,057. About 13.7% of the population was below the poverty line. The 2020 CVPDC HMP specifically mentions lower income population located in the floodplain as a concern and this will be explored further in the flooding sections below.

## Vulnerable Populations

While resilience is important throughout the County and region, there are several census tracts in Appomattox County that qualify as Low to Moderate Income based on 2020 census data. The definition of Low-to-Moderate Income (LMI) means any census tract (or equivalent geographic area defined by the Bureau of the Census) in which at least 50% of households have an income less than 60 percent of the Area Median Gross Income (AMGI), or which has a poverty rate of at least 25%. Appomattox County contains multiple LMI census tracts which can be seen in Figure 21 below.

As defined in the 2023 CFPF Manual, "Low-income geographic area" means any locality, or community within a locality, that has a median household income that is not greater than 80 percent of the local median household income or any area in the Commonwealth designated as a qualified opportunity zone by the U.S. Secretary of the Treasury via his delegation of authority to the Internal Revenue Service. These areas are eligible to apply for CFPF funding with as little as 10% matching funds.

Another factor in measuring vulnerability is the Social Vulnerability Index. SVI indicates the relative vulnerability of every U.S. Census tract. Census tracts are subdivisions of counties for which the Census

<sup>15</sup> <https://datausa.io/profile/geo/appomattox-county-va>

<sup>16</sup> 2020 Census Data

collects statistical data. SVI ranks the tracts on 15 social factors, including unemployment, minority status, and disability, and further groups them into four related themes. Thus, each tract receives a ranking for each Census variable and for each of the four themes, as well as an overall ranking. Projects and studies in areas with a higher SVI will receive prioritized rankings for CFPF funding. SVI and related maps can be found in Appendix E.

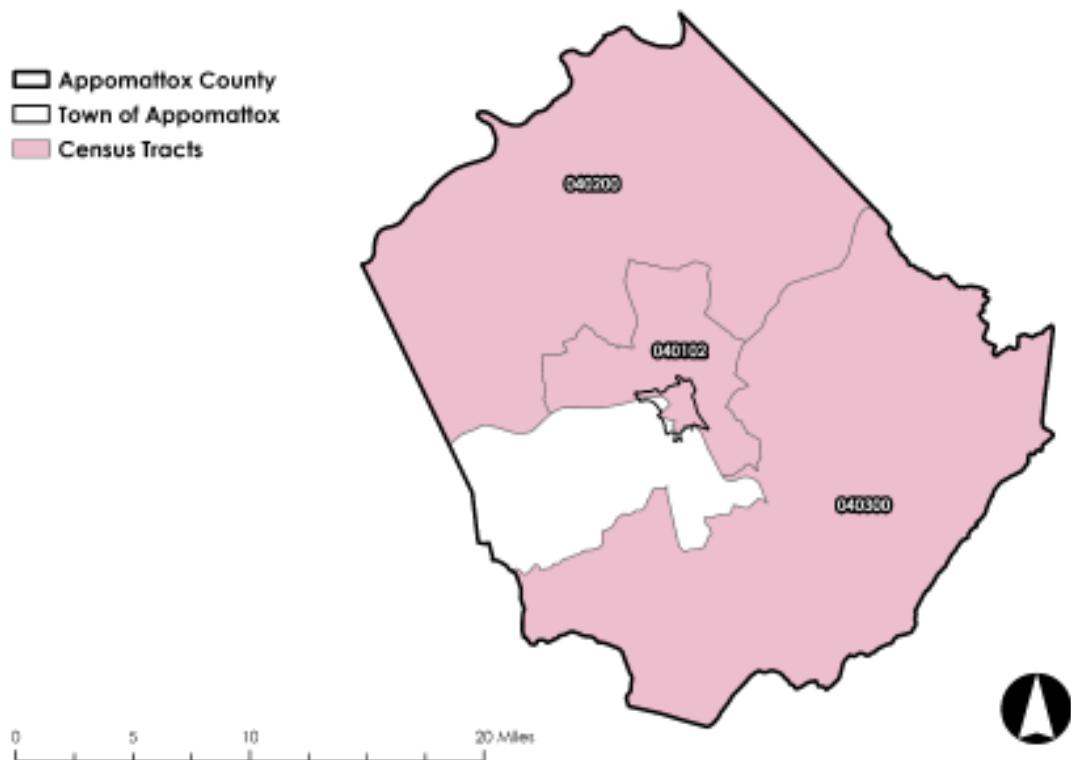
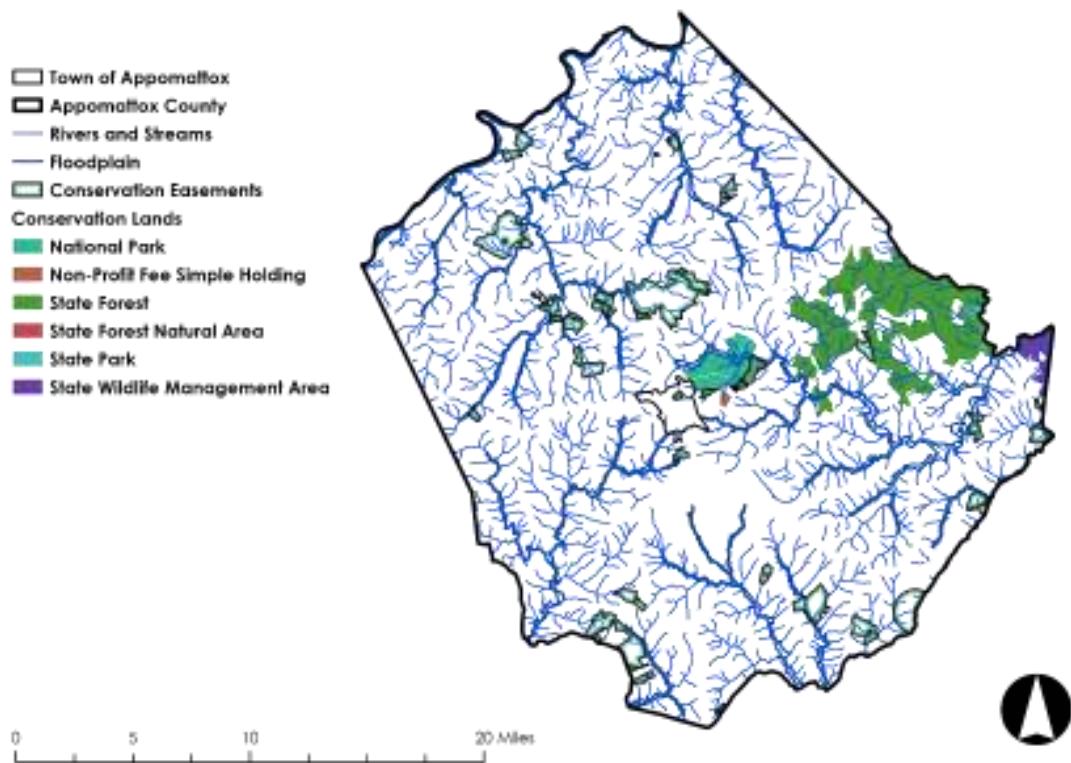


Figure 21 Low to Moderate Income Census Tracts with designated income levels at or below 80% of Area Median Income Levels.

## Natural Assets

### Conservation Lands:

Appomattox County contains numerous notable geographic features including the James River, which borders the County to the north, and the Appomattox-Buckingham State Forest positioned within the northeast portion of the County. Various other state forest and natural areas exist in the County along with private conservation easements. Some of these easements are riparian easements, which are a practical tool to direct development away from flood prone areas. Recognizing this as an important step, there are several ways to do this; to purchase the land outright and use it as open space or purchase a conservation easement. There may be opportunities to collaborate with landowners to expand conservation easements in the floodplain and further this valuable strategy for flood.



*Figure 22 Conservation Lands overlaid on the regulatory floodplain, and intermittent streams, VADCR Natural Areas Inventory.*

## Ecological Cores

Ecological cores are patches of natural land with at least 100 acres of interior cover which provide habitat for a large variety of species, including forest, marsh, and maritime dependent species. Utilizing satellite data, the Virginia Natural Landscape Assessment (VaNLA) provides an analysis that has identified, prioritized, and linked the important land networks throughout Virginia. Preserving and maintaining these landscapes can help ensure they continue to provide ecosystem services such as cleaner air and water filtration. Ecological cores can also provide recreational opportunities and open space resources. The following map shows which areas of the County and Town contain ecological cores. A higher rating (with red being the highest) indicates the amount of ecosystem services that ecological core provides. Examples of ecological services that cores provide include wildlife and plant habitat, biodiversity conservation, water resource protection, erosion control, and carbon sequestration. Appomattox County should have strategies to preserve ecological cores, such as using them as park lands for low-impact recreation (hiking, bird watching, etc.) and other conservation efforts.

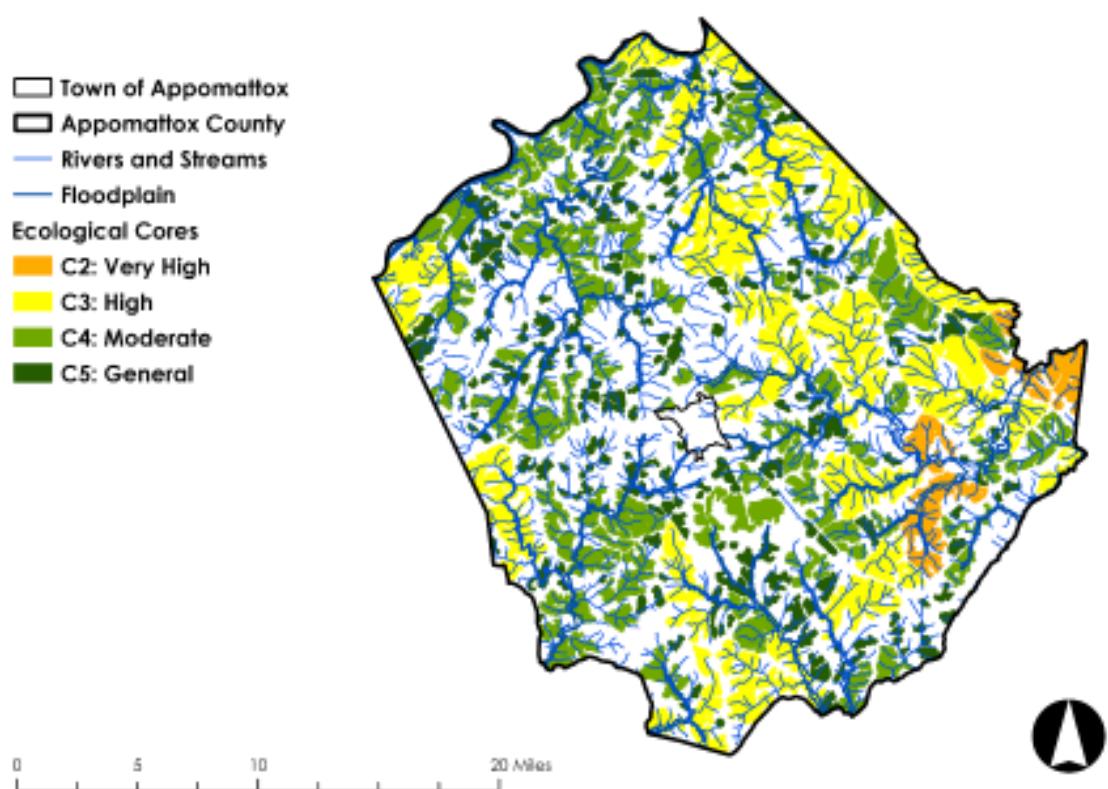


Figure 23 Ecological Cores overlaid on the regulatory floodplain, and intermittent streams, VADCR Natural Areas Inventory

## Flooding and Built Assets - Critical Facilities and Infrastructure

Section 4.3, Flooding, of the 2020 CVPDC Hazard Mitigation Plan, contains a thorough evaluation of FEMA floodplains, critical infrastructure, roads and bridges in the floodplain, repetitive loss properties and severe repetitive loss properties for each locality in the CVPDC region. For specific lists, maps and related information for the County and Town of Appomattox, see Appendix B, 2020 CVPDC HMP Maps and Data. There are critical pieces of infrastructure that are in the floodplain and susceptible to flooding, namely a natural gas line, a sewer pump station located on the southern end of the Town of Appomattox, and roads and bridges. The top five most susceptible roads to flooding are all US or State of Virginia primary roads; these are roads located along the James River, Chase Trail Ln, Dreaming Creek Rd, Stone Ridge Rd, Oakville Rd, Riverside Dr, and Mill Pond Rd.<sup>17</sup> Stormwater infrastructure maintenance and repair should be a priority for these roads and can be prioritized for future funding and coordination with

<sup>17</sup> 2020 CVPDC Hazard Mitigation Plan

the Virginia Department of Transportation. For a complete list of roads and bridges most susceptible to flooding see CVPDC Hazard Mitigation Plan 2020 Update Flooding; Page 4-50 – 4-51. Figure 24 below illustrates real time data from the Virginia Department of Transportation on the condition of bridges and culverts. Overlaid on the rivers and streams, Appomattox County, CVPDC and VDOT can work together to upgrade the “Poor” infrastructure first to avoid flood related damages and impacts to the surrounding areas.

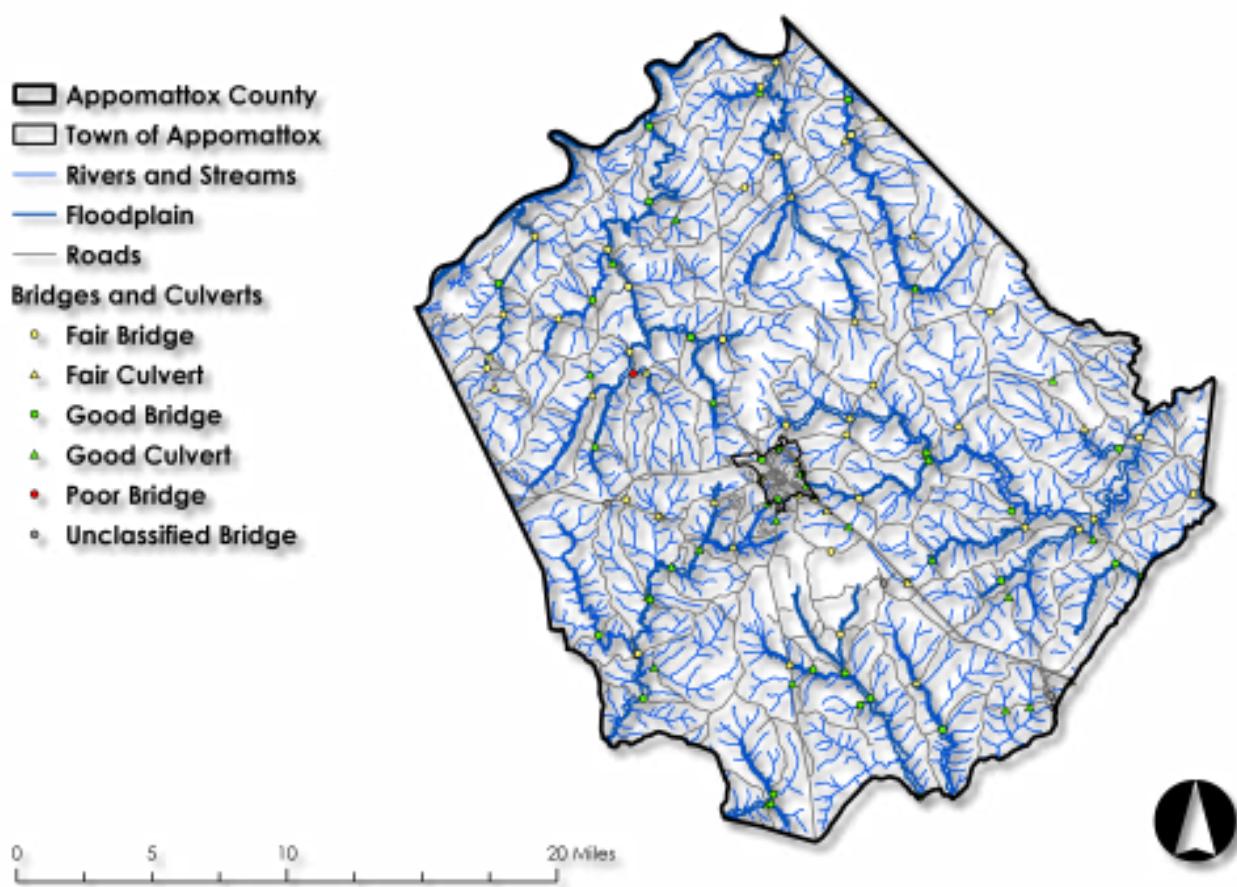


Figure 24 VDOT Bridges and Culverts Condition Assessment

Poor Rated Bridge
SC-613 E/W and Spring Grove Road

Table 7 Bridge Condition Assessment (VDOT)

# Flooding and Related Hazards

## Areas of Known Flooding

Appomattox County contains several areas that are known to have flooding and standing water issues. Most of these areas were identified during community interviews with County staff, in addition to information in the CVPDC 2020 HMP. Specifically identified were low areas near the James River, Bent Creek, Appomattox River, (“washout gap” in central Appomattox), Blackberry

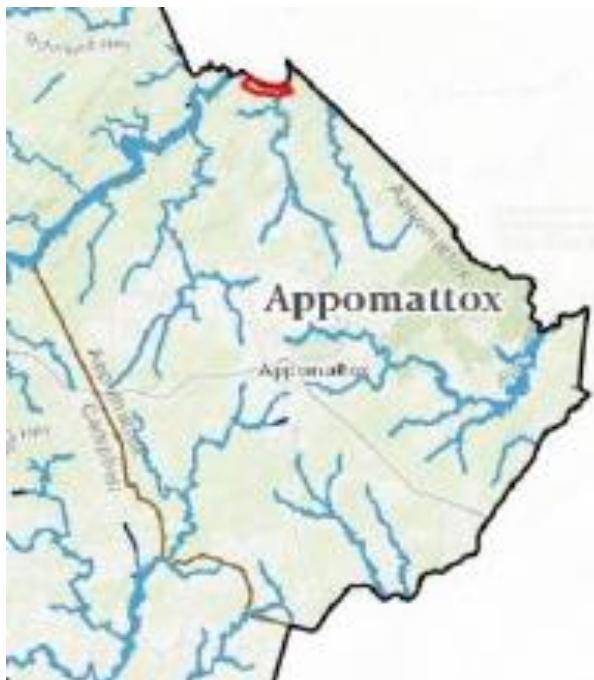


Figure 25 Repetitive Loss Area in red for Appomattox County, 2020 CVPDC HMP

Lane near the intersection with the Appomattox River, and Wreck Island Creek (west Appomattox) flood often. Mill Pond Rd (parallel to the creek) also commonly floods. In addition, lower ground along smaller streams is sometimes damaged by flooding of crops, deposition of silt on crops, and by channels silting up and preventing proper drainage. Many of the identified flood areas are located in low to moderate income census tracts. (See Figure 25) Further studies can be initiated in the area to understand the underlying hydrology and identify potential solutions to recurrent flooding.

The County has only 2 repetitive loss properties and 1 severe repetitive loss property. These are located in the Northern portion of the County in the James River floodplain. The Town of Appomattox does not contain any repetitive loss properties.

- Appomattox County
- Town of Appomattox
- Rivers and Streams
- Floodplain
- Roads
- ✖ Crashes Due to Moving or Standing Water



Figure 26 Motor Vehicle Crashes due to Standing Water, VDOT

Crashes Due to Standing Water	Roads or Location	Date
1	Route 460E	6/6/2015
2	Route 460W	6/19/2023

Table 8 Recent vehicle crashes due to standing water

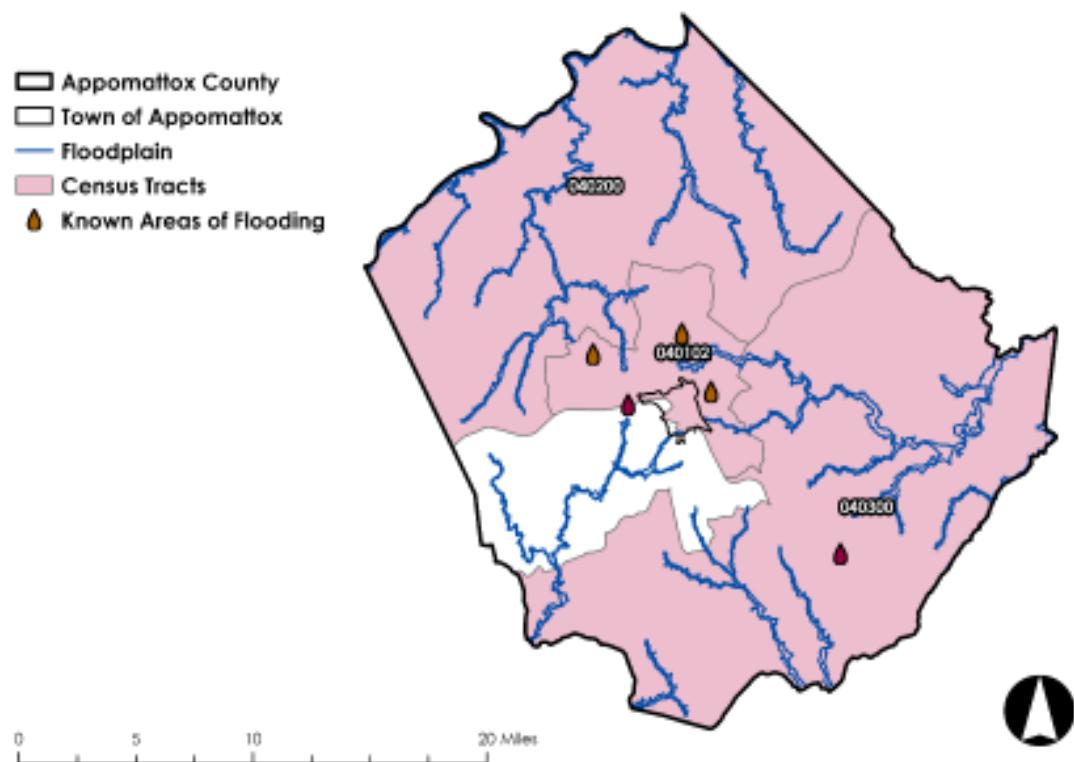


Figure 27 Area of Known Flooding identified in community interviews, overlaid on Low to Moderate Income Census Tracts, Census Data 2020

## Dam Inundation

The largest concern with the few dams in Appomattox County (17 total, with none classified as high or high-special hazard potential and 11 unknown) are the homes, businesses, important thoroughfares and other transportation assets, and critical infrastructure assets in the Dam Break Inundation Zone (DBIZ). The main potential impacts are those to bridges, culverts, and other transportation infrastructure, as well as flooding caused by Caldwell Lake Dam (a significant hazard dam) which has overtopped and caused flooding in the past. There are no dams in the Town of Appomattox, although it could see minor issues downstream of some unknown-hazard dams.

It is unknown whether significant vulnerable and minority populations would be affected by dam spillovers in Appomattox County, but many critical roads would need to be closed or might be

washed away entirely, impeding travel and egress. The map of dams of known and unknown hazard potential are shown in the map below.

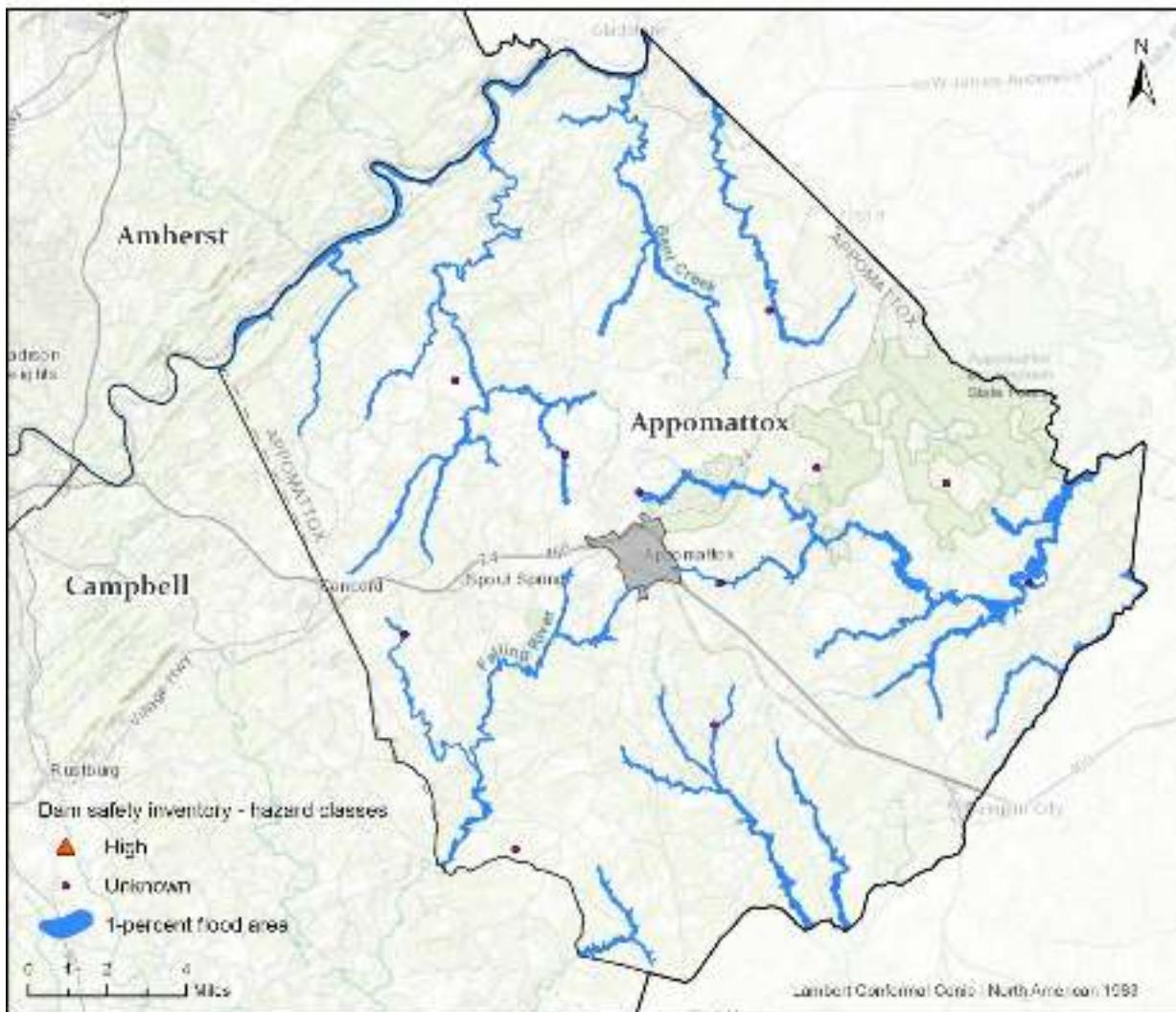


Figure 28 High and Unknown Hazard Dams in Appomattox County, VA, VA Dam Safety Inventory System, VA Tech, 2020, CVPDC 2020 HMP

## Extreme Heat

Using an existing weather station located in Appomattox County (APPOMATTOX), it is possible to view observed days per year exceeding 95 degrees Fahrenheit from 1950 – 2013 for Appomattox County. In the graph below, the bars are representative of the observed days, either a positive or negative number, above 95 degrees. Generally, while the range of exceedance events is variable, a trend can be seen, especially from the year 2000 onwards where average temperatures clearly exceeded the average.



Figure 29, 1961-2013 days per year with temperature > 95 degree F observed average, US Climate Explorer Toolkit

## Future Community Conditions

### Flood

The potential risks of climate change can have broad effects on communities in Appomattox County, including on its public health, infrastructure, agriculture, tourism, and emergency services. Appomattox County (and the CVPDC region in general) should expect the following in the future:

- More frequent and more intense precipitation events punctuated by deeper episodes of drought.
- Drier winter and summer seasons, which could deplete reservoirs and challenge drinking water supplies and agricultural production.
- Stronger storms at a greater frequency, which may threaten lives, damage infrastructure, and cause significant power outages.
- Increasing summer heat waves could threaten public health.

According to the NOAA Mid-Atlantic RISA projections,<sup>18</sup> Appomattox County can expect to see some more extreme variability in precipitation over the next 50 years, with some months seeing 15% less and other months seeing up to 30% more compared to the average from the years 1991-2020. In general, the entire Appalachian and Piedmont regions can expect mild 1-2% average increases in rainfall compared to the past 30 years' average.<sup>19</sup> While it is difficult to know exactly how the County will be impacted, it is strongly encouraged to build in redundancy and extra capacity for stormwater and other water infrastructure to account for higher precipitation scenarios.

<sup>18</sup> <https://www.midatlanticrisa.org/data-tools/climate-data-tools/projected-changes-in-total-monthly-precipitation.html>, MARISA

<sup>19</sup> <https://www.midatlanticrisa.org/data-tools/climate-data-tools/difference-from-normal-total-annual-precipitation.html>, MARISA

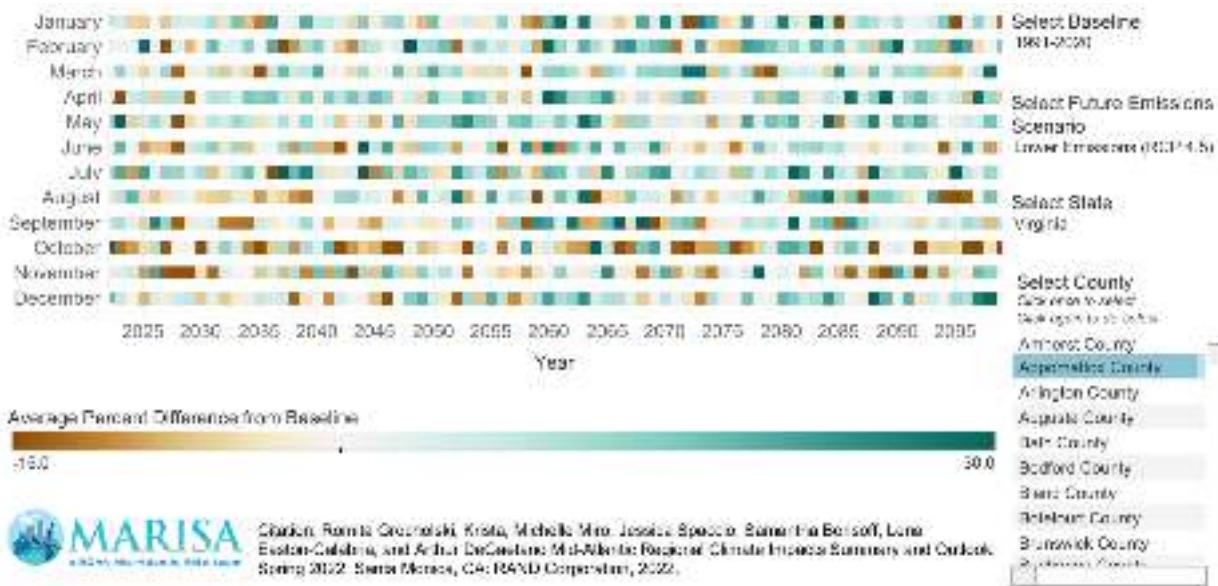
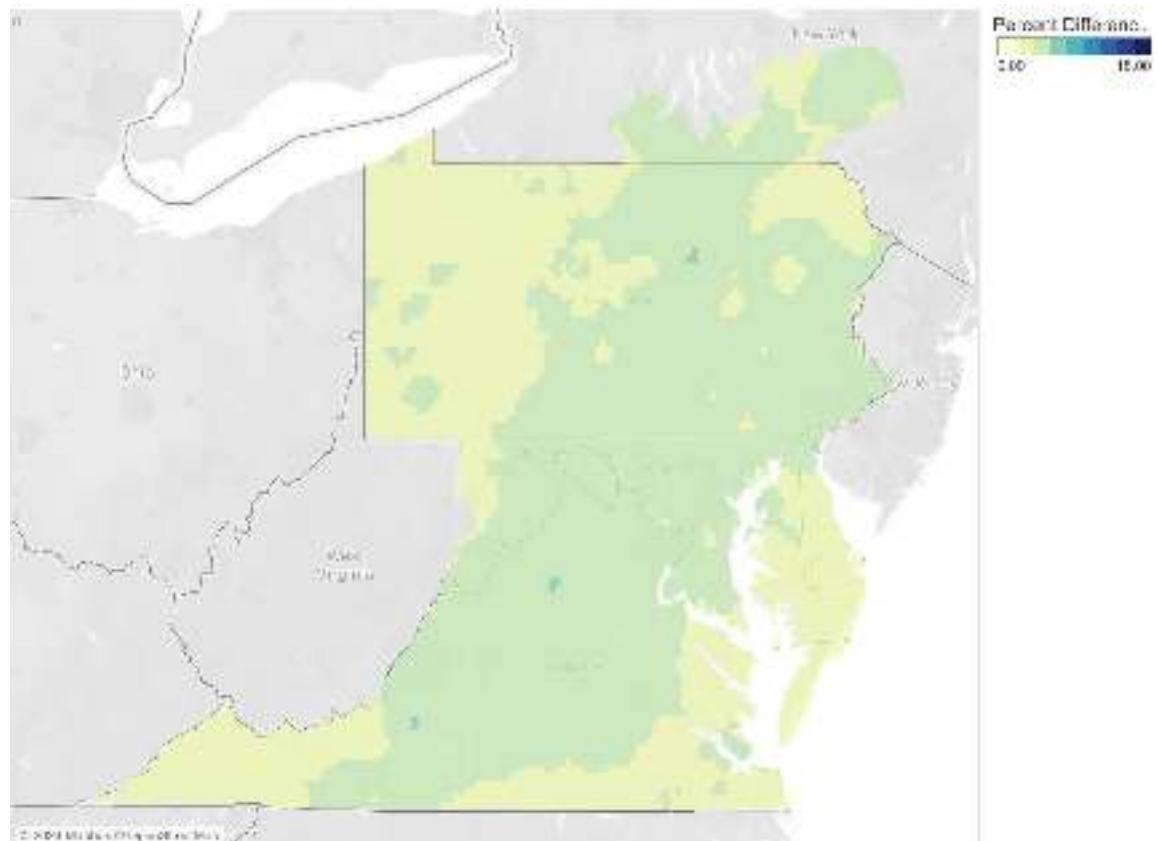


Figure 30 Projected percent difference in total monthly precipitation compared to 1991-2020 Baseline, MARISA



**Figure 31 1981-2010 "Normal" Total Annual Precipitation and Projected Percent Difference, MARISA**

## Heat

In Appomattox County, the average daily temperature is expected to increase, as well as extreme temperatures on the hottest days of the year. This excess heat for longer periods may stress critical infrastructure such as roads and bridges. More hot days may also stress the electrical grid and the use of potable water may increase as people may need more irrigation for crops and landscaping. This type of heat may affect public health and may lead to economic impacts through disruptions in agriculture and manufacturing. Human health, stream and river health, and infrastructure are all threatened by higher temperatures.

At 95°F, it is hard to keep indoor areas and our bodies cool. Appomattox County's summers are getting hotter. On average, Appomattox County sees 4 days per year in excess of 95°F.<sup>1</sup> Within the next 50 years (by 2070), Appomattox County can expect a yearly average of 34 to 60 days above 95°F, with associated increases in cooling costs, reduced air quality, and heat-related illnesses. It is imperative that the County begin planning for more days of extreme heat and look for ways to lessen the public health effects, especially on vulnerable populations.

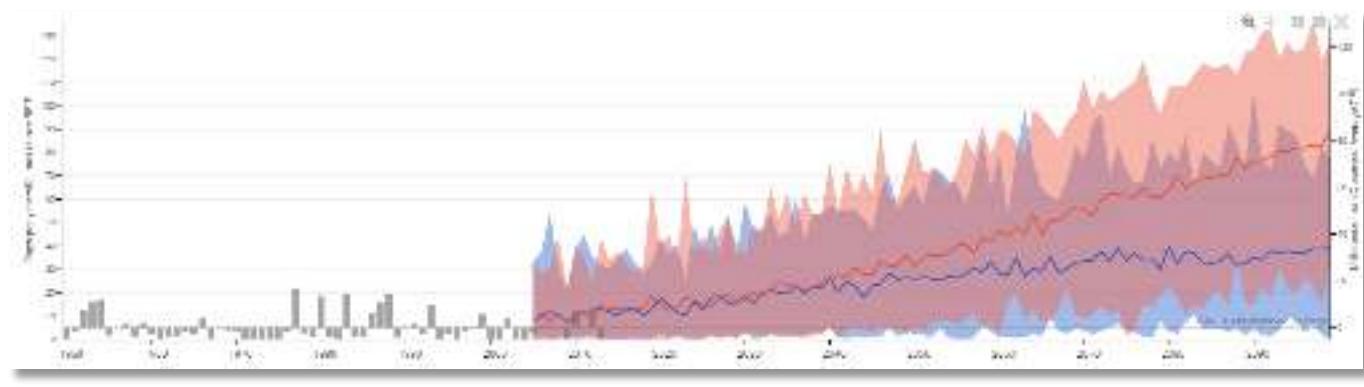


Figure 32 Days w/ maximum temp > 95°F Appomattox County (U.S. Climate Resilience Toolkit Climate Explorer)

## General Flood and Heat Resilience Policies and Actions

1. Prioritize vacant tracts of land for conservation and recreational open space in floodplains and apply for grant funding to acquire these properties. (See Appendix A for more detail on grant funding)
2. Create stormwater management incentives for new subdivisions and single-family residences. (Town)
3. Develop a debris management strategy or management plan.
4. Incentivize the use of green infrastructure for commercial and residential projects.
5. Work with County extension agents to promote agricultural best management practices.
6. Develop targeted outreach before and during the summer months to inform the public of anticipated heat waves and ways to stay safe.

## Prioritized Flood Resilience Strategy Appomattox County

- ❖ Assess opportunities to elevate or acquire repetitive loss properties to mitigate flood impacts including loss of life, property, and financial damage. Conduct outreach to homeowners of repetitive loss properties and owners within the dam hazard inundation area to understand their potential interest in relocation via buyouts.

## Prioritized Flood Resilience Strategy Town of Appomattox

- ❖ Evaluate and implement stream restoration, through green infrastructure, streambank stabilization or other appropriate practices, along the stream in the Sunnydale, South Church Street area to address stormwater impacts.

*For a full explanation of the Prioritized Resilience Strategy Matrix, see Page 36, Prioritizing Resilience Projects. For the full suite of resilience strategies and rankings by locality, see Appendix A.*

# Appomattox County

65 Action Score

## Adapt Repetitive Loss Properties



### Action Description

Assess opportunities to elevate or acquire repetitive loss properties to mitigate flood impacts including loss of life, property, and financial damage. Conduct outreach to homeowners of repetitive loss properties and owners within the dam hazard inundation area to understand their potential interest in relocation via buyouts.

1. Determine number of local repetitive loss properties and conduct outreach to property owners to better understand their concerns.
2. Develop a County-VDEM partnership program/or coordinate with VDEM to streamline applications for home elevations or buyouts.
3. Prepare applications to FEMA for funding to support elevation or buyouts.
4. Support property owners as they elevate their homes or relocate by providing technical, financial, or relocation assistance.



### Key Steps for Implementation



### Action Lead

Community Development Department



### Supporting Partners

- Private property owners
- Virginia Department of Emergency Management (VDEM)
- CVPDC
- 



### Ease of Implementation

- Locality can complete in-house.
- Requires locality to hire a staff person.
- Requires hiring a technical consultant.



### Measures of Success

- Number of property owners the County engages.
- Successful coordination or establishment of working relationship with VDEM staff who support FEMA application development.
- Number of funded applications by FEMA.
- Positive resident feedback regarding options for adaptation (without feelings of displacement or pressure).

This Project Implementation Sheet is apart of a Flood Resilience Plan funded by the Virginia Community Flood Preparedness Fund (CFPF) on behalf of the Central Virginia Planning District Commission (CVPDC). For more detailed information please see the complete flood resilience report and its appendices.



### Action Initiation Timeframe

Short: 0-2 years  
Medium: 3-6 years  
Long: 7+ years

### Cost\*

\$: less than 10k  
\$\$: 10-50k  
\$\$\$ 50-500k  
\$\$\$\$: 500k-2mill  
\$\$\$\$\$: 2 mill+

\*Cost associated with the actions refers to how much it is expected to cost the Town to implement. This does not include costs for ongoing maintenance.



### Action Initiation Timeframe

Short

Medium

Long



### Resilience Considerations

Home elevations can mitigate flood impacts, reducing damage to private property or loss of life.

Buyouts can permanently remove structures from vulnerable areas and create opportunities to restore properties to areas of ecological function and open space.



### Co-Benefits & Equity Considerations

Matters related to home elevation or potential buyouts and relocation can be very sensitive topics. The County should aim to engage with residents in a way that is respectful and empowering to provide property owners with options.

The County should provide technical or financial assistance when possible to support residents while they temporarily relocate (during home elevation construction) or permanently relocate



### Cost

\$\$\$\$

1. Property owner outreach: 5,000-10,000 (dependent on number of properties)
2. VDEM Coordination or Program Development: 30,000-150,000
3. Help Prepare FEMA Applications 35,000-100,000 (dependent on number of applications)
4. (Optional) Technical and Financial Assistance for Property Owners Pursuing Home Elevations or Buyouts: 250,000-1,000,000 (dependent on number of applications, not a requirement of FEMA)



### Possible Funding Sources

Virginia Department of Emergency Management  
Federal Emergency Management Agency



# Town of Appomattox

**63** Action Score

## Stream Restoration and Nature-Based Solutions



### Action Description

Evaluate and implement stream restoration, through green infrastructure, streambank stabilization or other appropriate practices, along the stream in the Sunnydale, South Church Street area to address stormwater impacts.



### Key Steps for Implementation

1. Field investigation of current stream conditions
2. Assessment of stream and riverine capacity and flooding under future climate conditions.
3. Identification of priority project areas and coordination with private owners.
4. Implementation of restoration and green infrastructure solutions along stream and areas of known flooding



### Action Lead

Department of Public Works



### Supporting Partners

- Private property owners abutting waterways
- CVPDC
- Appomattox County



### Ease of Implementation

- Locality can complete in-house.
- Requires locality to hire a staff person.
- Requires hiring a technical consultant.



### Measures of Success

- Reduction of stormwater and riverine flooding
- Monitored and improved water quality and stream health
- Restoration of riverine vegetative buffer zones
- More agreements with private property owners to create conservation easements

This Project Implementation Sheet is apart of a Flood Resilience Plan funded by the Virginia Community Flood Preparedness Fund (CFPF) on behalf of the Central Virginia Planning District Commission (CVPDC). For more detailed information please see the complete flood resilience report and its appendices.



### Action Initiation Timeframe

Short: 0-2 years  
Medium: 3-6 years  
Long: 7+ years

### Cost\*

\$: less than 10k  
\$\$: 10-50k  
\$\$\$: 50-500k  
\$\$\$\$: 500k-2mill  
\$\$\$\$\$: 2 mill+

\*Cost associated with the actions refers to how much it is expected to cost the Town to implement. This does not include costs for ongoing maintenance.



### Action Initiation Timeframe

Short Medium Long



### Resilience Considerations

Stream restoration and nature-based solutions will be located and implemented based on information from a hydraulic and hydrologic model that shows impact on reducing flooding.  
Nature-based solutions can also help reduce urban heat island impacts.



### Co-Benefits & Equity Considerations

Cost-sharing with private property owners to help improve their properties and reduce flooding through conservation measures.  
Prioritized flood-prone areas in which socially vulnerable populations also live.



### Cost \$\$\$\$

1. Field Investigations: 30,000 - 100,000 (dependent on total acreage investigated)  
2. Hydraulic and Hydrologic Modeling: 50,000-150,000 (dependent on total acreage investigated)  
3. Identify Priority Projects: 50,000-100,000 (dependent on number of projects)  
4. Design of Nature-Based Solutions: 150,000-250,000 (dependent on number of designs)  
5. Construction and implementation: 250,000-1,000,000 (dependent on scope of projects)



### Possible Funding Sources

Virginia Department of Environmental Quality Local Stormwater Assistance Fund, Virginia Community Flood Preparedness Fund

Appomattox, VA



## Town of Altavista, VA

The Town of Altavista is nestled in the scenic landscapes of Campbell County, offering a unique blend of historical charm and natural beauty. Founded in the late 19th century as a company town by the Lane Company, a prominent furniture manufacturer, Altavista retains remnants of its industrial past, providing a glimpse into its rich history. The Town's small-town atmosphere fosters a powerful sense of community, with residents enjoying the benefits of a close-knit environment and a more relaxed pace of life. Surrounded by picturesque vistas, Altavista boasts opportunities for outdoor activities, from hiking to fishing, allowing residents and visitors alike to connect with the beauty of the natural surroundings.

### Community Profile and Social Assets

The Town of Altavista is a relatively new town, incorporated in 1905, and built as a stop on the railroad network. The Town has a somewhat diverse demographic profile with racial makeup: 83.24% White, 14.71% Black or African American, 0.19% Native American, 0.62% Asian, 0.01% Pacific Islander, 0.33% from other races, and 0.90% from two or more race.<sup>20</sup> There may also be a significant portion of elderly or mobility limited persons in the Town. While resilience is important throughout the Town and region, there are several census tracts in the Town that qualify as Low to Moderate Income based upon 2020 census data. The definition of Low-to-Moderate Income (LMI) means any census tract (or equivalent geographic area defined by the Bureau of the Census) in which at least 50% of households have an income less than 60 percent of the Area Median Gross Income (AMGI), or which has a poverty rate of at least 25%. The entirety of the incorporated Town of Altavista is designated as LMI census tracts, which can be seen in Figure X below.

### Vulnerable Populations

As defined in the 2023 CFPF Manual, "Low-income geographic area" means any locality, or community within a locality, that has a median household income that is not greater than 80 percent of the local median household income or any area in the Commonwealth designated as a qualified opportunity zone by the U.S. Secretary of the Treasury via his delegation of authority to the Internal Revenue Service. These areas are eligible to apply for CFPF funding with as little as 10% matching funds.

Another factor in measuring vulnerability is the Social Vulnerability Index. SVI indicates the relative vulnerability of every U.S. Census tract. Census tracts are subdivisions of counties for which the Census collects statistical data. SVI ranks the tracts on 15 social factors, including unemployment, minority status, and disability, and further groups them into four related themes. Thus, each tract receives a ranking for each Census variable and for each of the four themes, as well as an overall ranking. Projects and studies in areas with a higher SVI will receive prioritized rankings for CFPF funding. The SVI maps can be found in Appendix E.

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<sup>20</sup> 2020 US Census Data

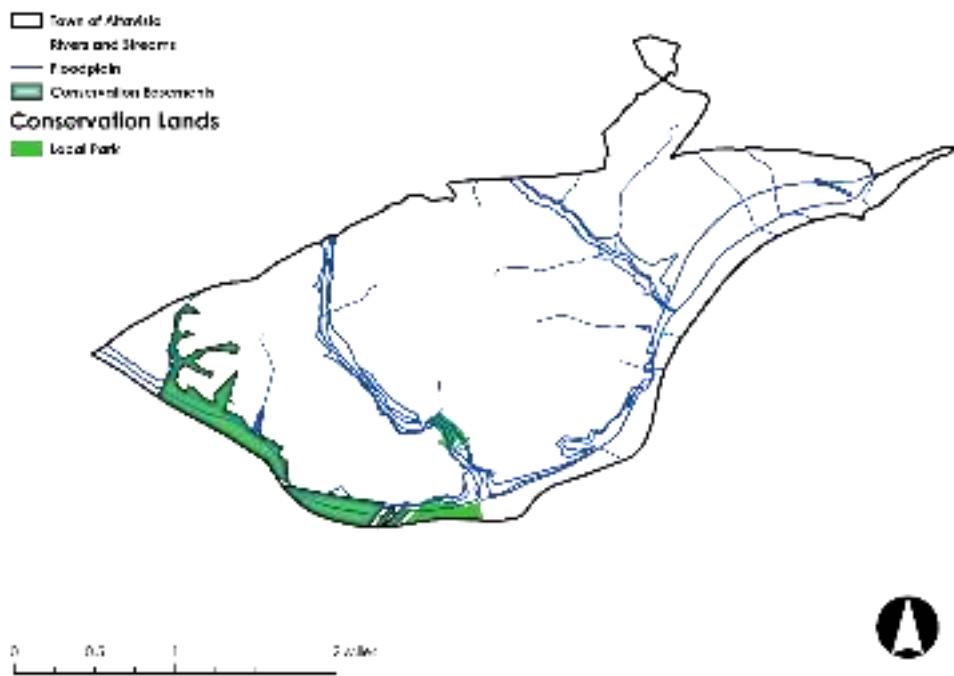


*Figure 33 Census tracts with designated income levels at or below 80% of Area Median Income Levels, 2020 US Census Data.*

## Natural Assets

### Conservation Lands

English Park is situated along the Roanoke/Staunton River within the Town of Altavista and includes roughly 160 acres of protected and public space. Overall, English Park serves as a valuable community asset in Altavista, offering a range of recreational opportunities, natural beauty, and spaces for community



*Figure 34 Conservation Lands overlaid on the regulatory floodplain, and intermittent streams, VADCR Natural Areas Inventory.*

engagement and enjoyment. Its location along the Staunton River and its diverse amenities makes it a popular destination for outdoor enthusiasts of all ages.

## Ecological Cores

Ecological cores are patches of natural land with at least 100 acres of interior cover which provide habitat for a large variety of species, including forest, marsh, and maritime dependent species. The Virginia Natural Landscape Assessment (VaNLA) provides an analysis that has identified, prioritized, and linked, using satellite data, the important land networks throughout Virginia. Preserving and maintaining these landscapes can help ensure they continue to provide ecosystem services such as cleaner air and water filtration. Ecological cores can also provide recreational opportunities and open space resources. The following map shows which areas of the Town contain ecological cores. A higher rating (with red being the highest) indicates the amount of ecosystem services that ecological core provides. Examples of ecological services that cores provide include wildlife and plant habitat, biodiversity conservation, water resource protection, erosion control, and carbon sequestration. The Town of Altavista should have strategies to preserve ecological cores, such as using them as park lands for low-impact recreation (hiking, bird watching, etc.) and other conservation efforts.

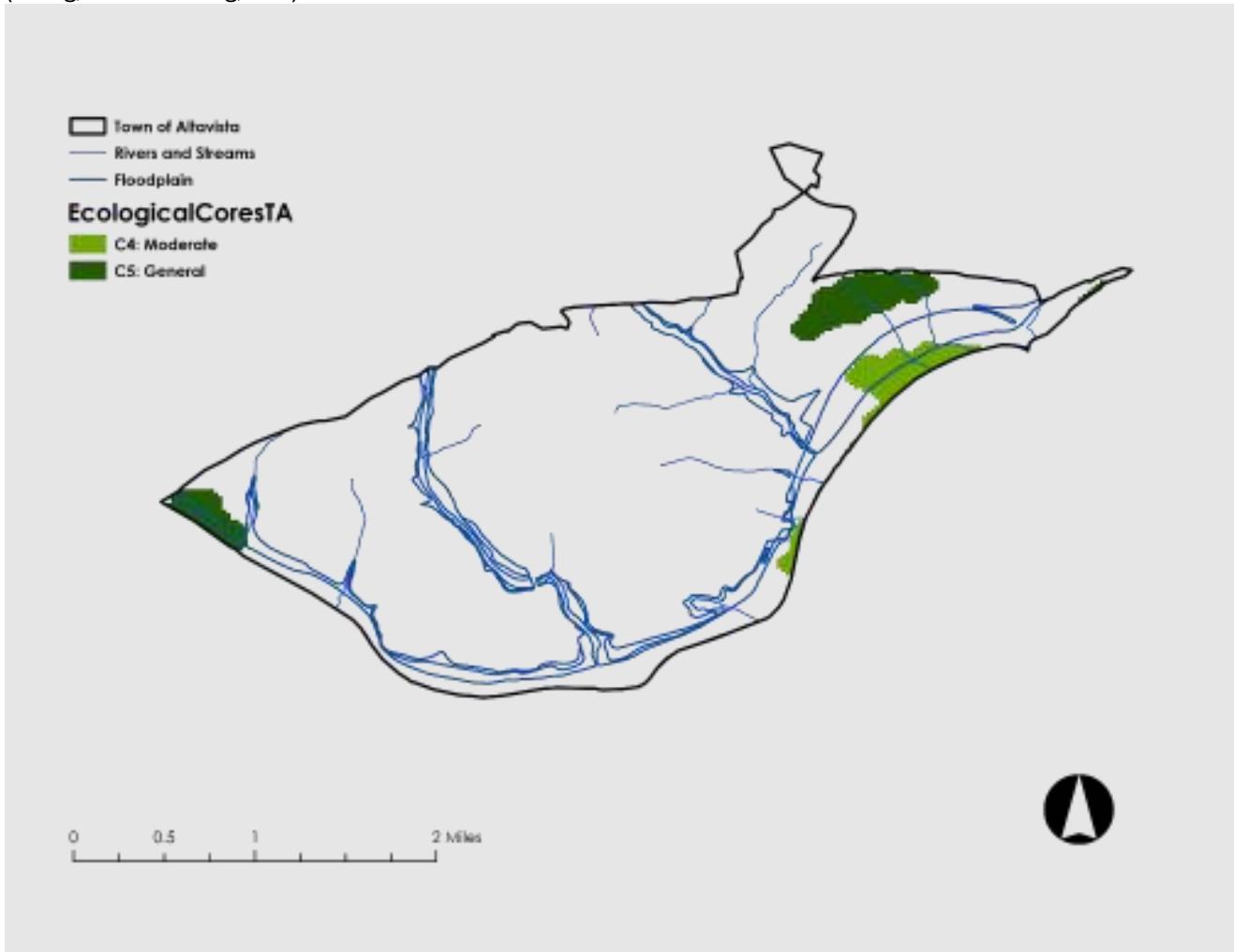


Figure 35 Ecological Cores overlaid on the regulatory floodplain, and intermittent streams, VADCR Natural Areas Inventory

## Flooding and Related Hazards

### Precipitation Flooding

The Town of Altavista contains several areas that are known to have flooding and standing water issues. Most of these areas were identified during community interviews with Town staff, in addition to information in the 2020 HMP. Areas along Pittsylvania (changes name) Ave have standing water issues. Additionally, Reed Creek overflows onto Grit Rd quite frequently. Areas along Franklin Ave experience flooding, specifically at the YMCA near Pittsylvania Avenue; Lynch Creek traverses this area and causes flooding. Another area that floods is 7<sup>th</sup> Street. There are also streambank erosion issues at Lynch Creek and Goose Creek, which both flow into the Staunton River. The increase in sedimentation has a negative effect on water quality and water infrastructure in the area.

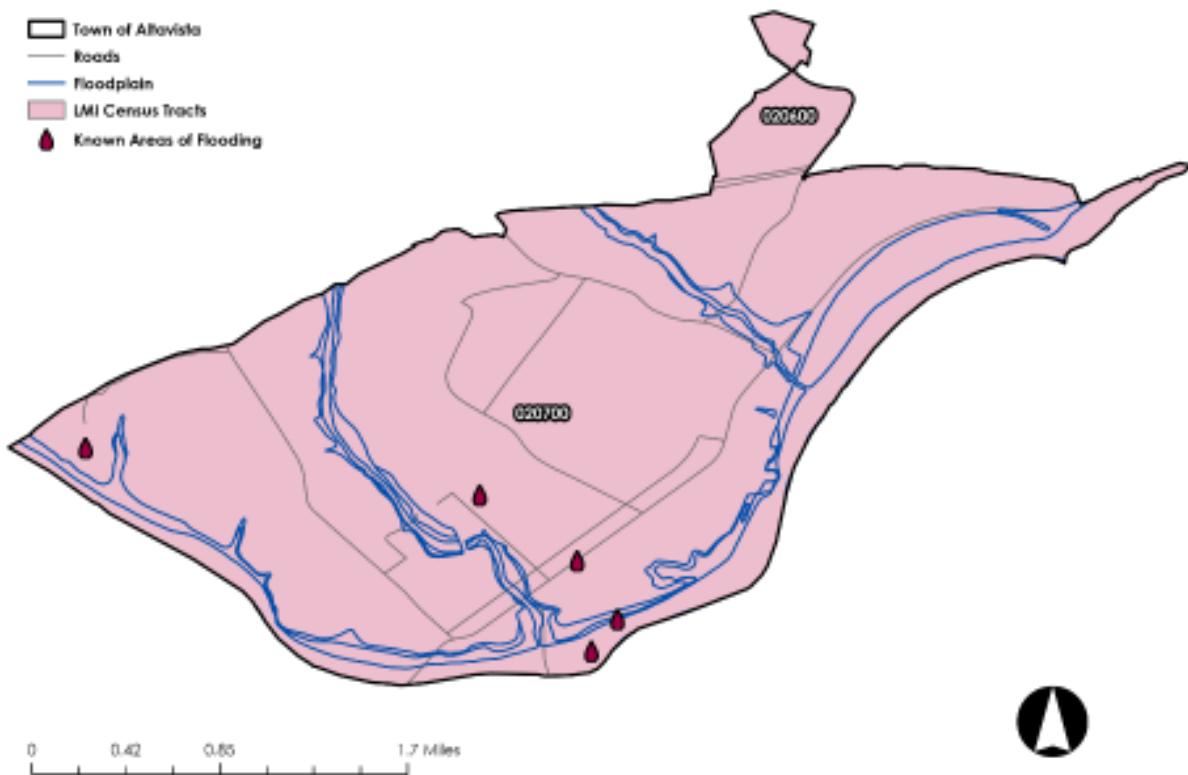


Figure 36 Areas of known flooding overlaid on Low Income Geographic Areas with up to 80% of Area Mean Income levels (Qualified tracts for 10% match CFPF)

### Dam Inundation

The largest concern with the few dams near the Town of Altavista (34 total, with 3 classified as high or high-special hazard potential and 22 unknown) are the homes, businesses, important thoroughfares and other transportation assets, and critical infrastructure assets in the Dam Break Inundation Zone (DBIZ). In

the Town of Altavista potential impacts include the Altavista Power Station, Altavista Fire Company, Altavista Area YMCA Family Center, Altavista Wastewater Plant, Altavista Water Treatment Plant, and several hazmat facilities.

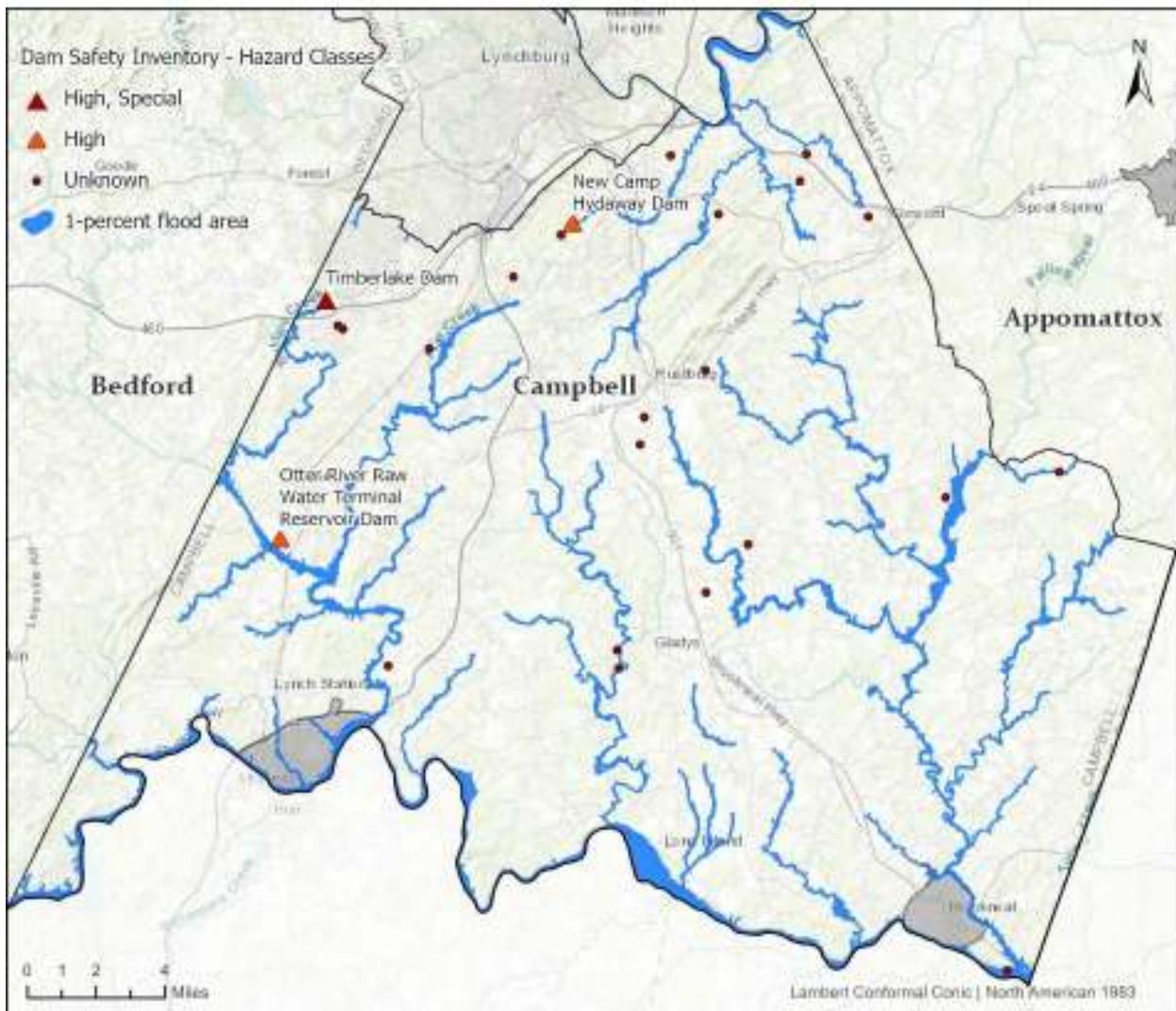


Figure 37 Dams in Campbell County, VA, VA Dam Safety Inventory System, Center For Geospatial Technology at Virginia Tech, CVPDC HMP 2020

## Extreme Heat

Using an existing weather station at the Lynchburg Regional Airport (LYNCHBURG REG AP), it is possible to view observed temperature averages from 1950 – 2013 for the area. In the graph below, it is possible to view observed days per year exceeding 95 degrees Fahrenheit from 1950 – 2013 for Campbell County. In the graph below, the bars are representative of the observed days, either a positive or negative number, above 95 degrees. Generally, while the range of exceedance events is variable, a trend can be seen, especially from the year 2000 onwards where average temperatures clearly exceeded the average.



Figure 38 Days per year with maximum temperature above 95 degrees Fahrenheit, Observed Temperatures 1950 - 2013, The Climate Explorer, US Climate Toolkit.<sup>21</sup>

## Future Community Conditions

### Flood

The potential risks of climate change can have broad effects on communities in the Town, including on its public health, infrastructure, agriculture, tourism, and emergency services. The Town of Altavista (and the CVPDC region in general) should expect the following in the future:

- More frequent, and more intense, precipitation events punctuated by deeper episodes of drought.
- Drier winter and summer seasons, which could deplete reservoirs and challenge drinking water supplies and agricultural production.
- Stronger storms at a greater frequency, which may threaten lives, damage infrastructure, and cause significant power outages.
- Increasing summer heat waves could threaten public health.

According to the NOAA Mid-Atlantic RISA projections,<sup>22</sup> The Town of Altavista can expect to see some more extreme variability in precipitation over the next 50 years, with some months seeing 15% less and other months seeing up to 40% more compared to the average from the years 1950-2000. In general, the entire Appalachian and Piedmont regions can expect mild 1-2% average increases in rainfall compared to

<sup>21</sup> U.S. Federal Government, 2023: U.S. Climate Resilience Toolkit Climate Explorer. [Online] <https://crt-climate-explorer.nemac.org/> Accessed {April 15, 2024}.

<sup>22</sup> <https://www.midatlanticrisa.org/data-tools/climate-data-tools/projected-changes-in-total-monthly-precipitation.html>

the past 30 years' average.<sup>23</sup> While it is difficult to know exactly how the Town will be impacted, it is strongly encouraged to build in redundancy and extra capacity for stormwater and other water infrastructure to account for higher precipitation scenarios.

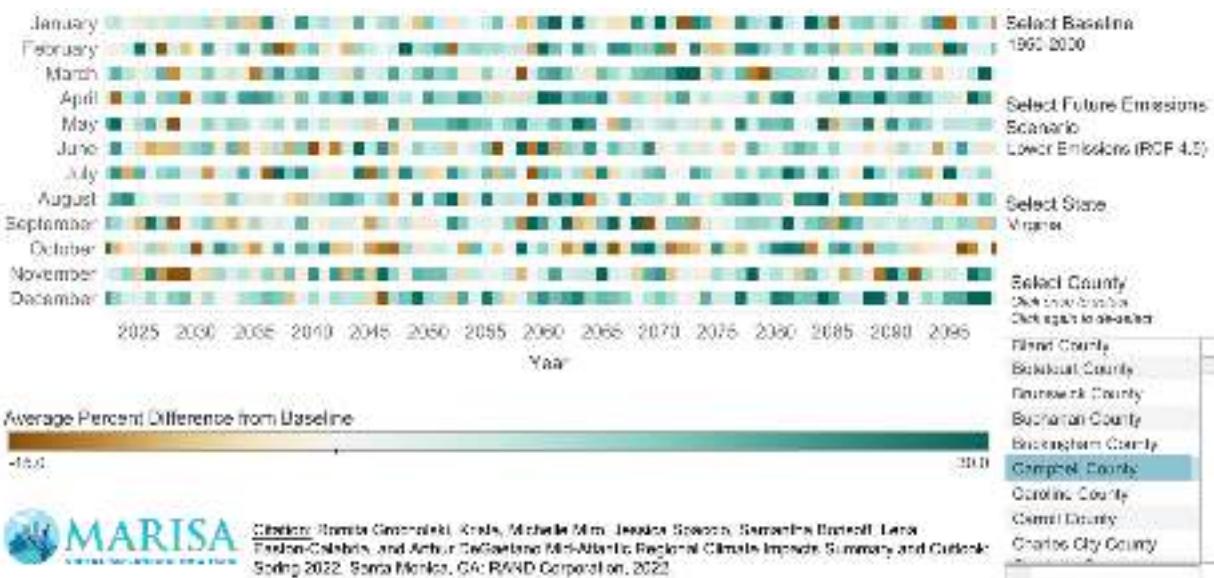


Figure 39 Projected percent difference in total monthly precipitation compared to 1991-2020 Baseline, MARISA

<sup>23</sup> <https://www.midatlanticrisa.org/data-tools/climate-data-tools/difference-from-normal-total-annual-precipitation.html>

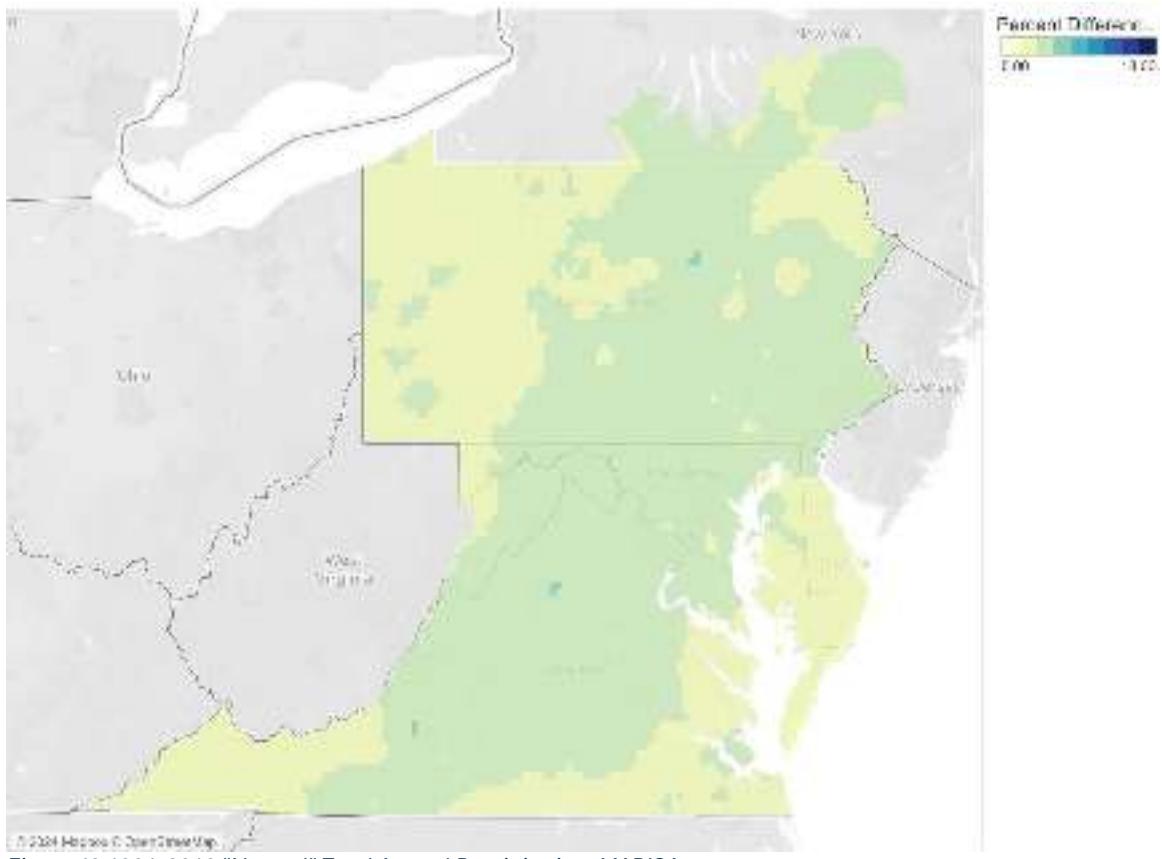


Figure 40 1981-2010 "Normal" Total Annual Precipitation, MARISA

## Heat

In the Town of Altavista the average daily temperature is expected to increase, as well as extreme temperatures on the hottest days of the year. This excess heat for longer periods may stress critical infrastructure such as roads and bridges. More hot days may also stress the electrical grid and the use of potable water may increase as people may need more irrigation for crops and landscaping. This type of heat may affect public health and may lead to economic impacts through disruptions in agriculture and manufacturing. Human health, stream and river health, and infrastructure are all threatened by higher temperatures.

At 95°F, it is hard to keep indoor areas and our bodies cool. Altavista's summers are getting hotter. On average, the Town sees 4 days per year in excess of 95°F. Within the next 50 years (by 2070), the Town can expect a yearly average of 25 to 47 days above 95°F, with associated increases in cooling costs, reduced air quality, and heat-related illnesses. It is imperative that the Town begin planning for more days of extreme heat and look for ways to lessen the public health effects, especially on vulnerable populations.

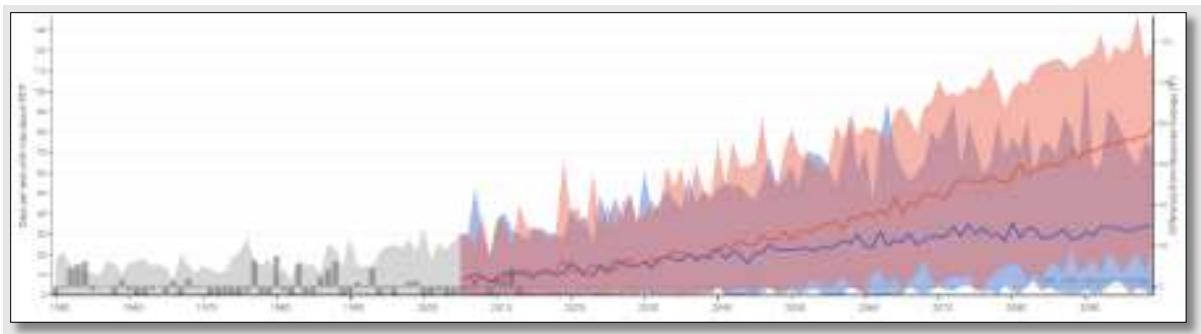


Figure 41 Table 3. Days w/ maximum temp > 95°F (U.S. Climate Resilience Toolkit Climate Explorer)

## General Flood and Heat Resilience Policies and Actions

1. Prioritize vacant tracts of land for conservation and recreational open space in floodplains and apply for grant funding to acquire these properties or work with partners who can acquire them. (See Appendix A for more detail on grant funding)
2. Work with VDOT, CVPDC and others to develop a debris management strategy for the Town.
3. Work with VDOT and CVPDC to identify stormwater infrastructure priorities on state roads.
4. Develop targeted outreach before and during the summer months to inform the public of anticipated heat waves and ways to stay safe.

## Prioritized Flood Resilience Strategy

- ❖ Create a watershed management plan that includes the following: Assess streambank conditions and restore stream beds along the Staunton River and its tributaries to mitigate flood impacts on the town's sewer system. Restoration and mitigation measures may include green infrastructure, erosion controls, cleaning debris from streams, and bank stabilization. (Score 68)

*For a full explanation of the Prioritized Resilience Strategy Matrix, see Page 36, Prioritizing Resilience Projects. For the full suite of resilience strategies and rankings by locality, see Appendix A.*

## Create a Watershed Management Plan



## Action Description

Create a watershed management plan that includes the following: Assess streambank conditions and restore stream beds along the Staunton River and its tributaries to mitigate flood impacts on the town's sewer system. Restoration and mitigation measures may include green infrastructure, erosion controls, cleaning debris from streams, and bank stabilization.



## Key Steps for Implementation

- 1. Field investigation of current stream conditions.
- 2. Develop a watershed scale hydraulic and hydrologic model to assess stream and riverine capacity and flooding under future climate conditions.
- 3. Identification of priority project areas and coordination with private owners.
- 4. Implementation of restoration and green infrastructure solutions along stream and areas of known flooding.



## Action Lead

Department of Public Services



## Supporting Partners

- Private property owners abutting waterways
- CVPDC
- Campbell County
- VA DEQ



## Ease of Implementation

- Locality can complete in-house.  
 Requires locality to hire a staff person.  
 Requires hiring a technical consultant.



## Measures of Success

- Reduction of stormwater and riverine flooding in watershed
- Monitored and improved water quality and stream health
- Restoration of riverine vegetative buffer zones
- More agreements with private property owners to create conservation easements



## Action Initiation Timeframe

Short: 0-2 years  
 Medium: 3-6 years  
 Long: 7+ years

## Cost\*

\$: less than 10k  
 \$\$: 10-50k  
 \$\$\$: 50-500k  
 \$\$\$\$: 500k-2mill  
 \$\$\$\$\$: 2 mill+

\*Cost associated with the actions refers to how much it is expected to cost the Town to implement. This does not include costs for ongoing maintenance.



## Action Initiation Timeframe

Short                    Medium                    Long



## Resilience Considerations

Stream restoration and nature-based solutions will be located and implemented based on information from a hydraulic and hydrologic model that shows impact on reducing flooding throughout the watershed.

Nature-based solutions can also help reduce urban heat island impacts.



## Co-Benefits &amp; Equity Considerations

Cost-sharing with private property owners to help improve their properties and reduce flooding through conservation measures.

Prioritized flood-prone areas in which socially vulnerable populations also live.

Coordination with County to maximize benefits throughout watershed.

Cost  
\$\$\$\$

1. Field Investigations: 30,000 - 100,000 (dependent on total acreage investigated)
2. Hydraulic and Hydrologic Modeling: 50,000-150,000 (dependent on total acreage investigated)
3. Identify Priority Projects: 50,000-100,000 (dependent on number of projects)
4. Design of Nature-Based Solutions: 150,000-250,000 (dependent on number of designs)
5. Construction and Implementation: 250,000-1,000,000 (dependent on scope of projects)



## Possible Funding Sources

Virginia Department of Environmental Quality Local Stormwater Assistance Fund, Virginia Community Flood Preparedness Fund



## The Town of Bedford and Bedford County, VA

Bedford County is located on the western side of the CVPDC region and consists of 764 square miles of land area. The County is home to the Town of Bedford, which is situated in the center of the County and serves as the county seat. In 2013, the Town of Bedford abandoned its status as an independent city and became a town; this reversion added approximately 6,222 residents (2010 Census) and nearly seven square miles to Bedford County. Additionally, it increased the Town's boundaries by 1.5 square miles. The reversion brought changes to the tax structure, utility provision, public safety, schools, representation, election districts, etc.

Bedford County is bounded to the west by Franklin, Roanoke, and Botetourt Counties, to the north by Rockbridge County, to the east by Campbell County and the City of Lynchburg, and to the south by Pittsylvania County. Bedford County is well-known for having great access to the Blue Ridge Mountains which are located along the County's western border. Other geographic features in the County include the Peaks of Otter, Smith Mountain Lake, and the James River. Additional recreational features include the Appalachian Trail and the Blue Ridge Parkway, both of which run along the northwest border of the County.

The most common job groups among those living in Bedford County include the Management Occupations, Office and Administrative Support Occupations, and Sales and Related Occupations sectors ([source](#)).

## Community Background and Social Assets

The Town of Bedford and Bedford County are characterized by a community that values its rich history and natural beauty. Nestled in the scenic Blue Ridge Mountains of Virginia, the community fosters a sense of camaraderie and neighborly support. Residents often participate in local events, community gatherings, and civic activities, contributing to a strong sense of unity. The County's commitment to preserving its rural heritage, coupled with a focus on economic development and education, reflects the community's dedication to ensuring a high quality of life for its residents. As of the 2020 census, there are 86.8% White (Non-Hispanic), 6.18% Black or African American (Non-Hispanic), 2.85% Two+ (Non-Hispanic), 1.34% White (Hispanic), and 1.18% Asian (Non-Hispanic). About 5.20% of families and 7.10% of the population were below the poverty line, including 8.30% of those under age 18 and 10.50% of those age 65 or over.<sup>24</sup>

## Vulnerable Populations

While resilience is important throughout the County and region, there are several census tracts in Bedford County that qualify as Low to Moderate Income based on 2020 census data. The definition of Low-to-Moderate Income (LMI) means any census tract (or equivalent geographic area defined by the Bureau of the Census) in which at least 50% of households have an income less than 60 percent of the Area Median Gross Income (AMGI), or which has a poverty rate of at least 25%. Bedford County contains multiple LMI census tracts which can be seen in Figure 1 below.

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<sup>24</sup> [United States Census Bureau](#). Retrieved 2011-05-14

As defined in the 2023 CFPF Manual, "Low-income geographic area" means any locality, or community within a locality, that has a median household income that is not greater than 80 percent of the local median household income or any area in the Commonwealth designated as a qualified opportunity zone by the U.S. Secretary of the Treasury via his delegation of authority to the Internal Revenue Service. These areas are eligible to apply for CFPF funding with as little as 10% matching funds.

Another factor in measuring vulnerability is the Social Vulnerability Index. SVI indicates the relative vulnerability of every U.S. Census tract. Census tracts are subdivisions of counties for which the Census collects statistical data. SVI ranks the tracts on 15 social factors, including unemployment, minority status, and disability, and further groups them into four related themes. Thus, each tract receives a ranking for each Census variable and for each of the four themes, as well as an overall ranking. Projects and studies in areas with a higher SVI will receive prioritized rankings for CFPF funding. Please see Appendix E for the social vulnerability and other information and related data.

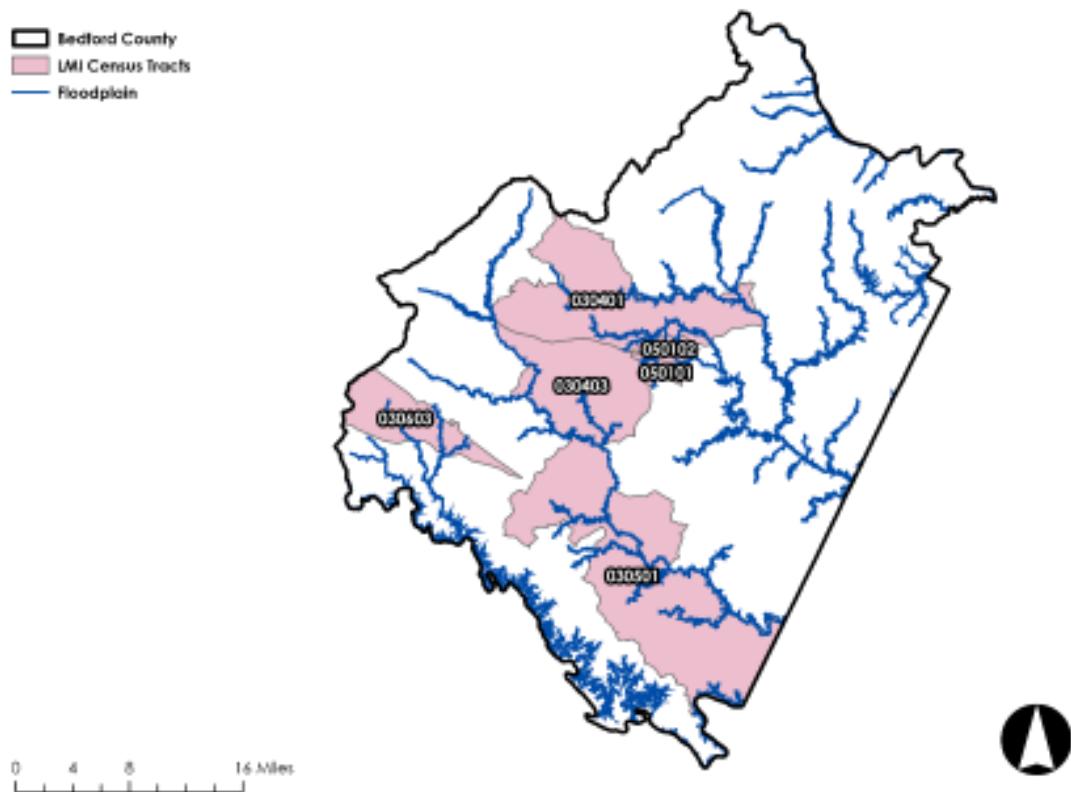
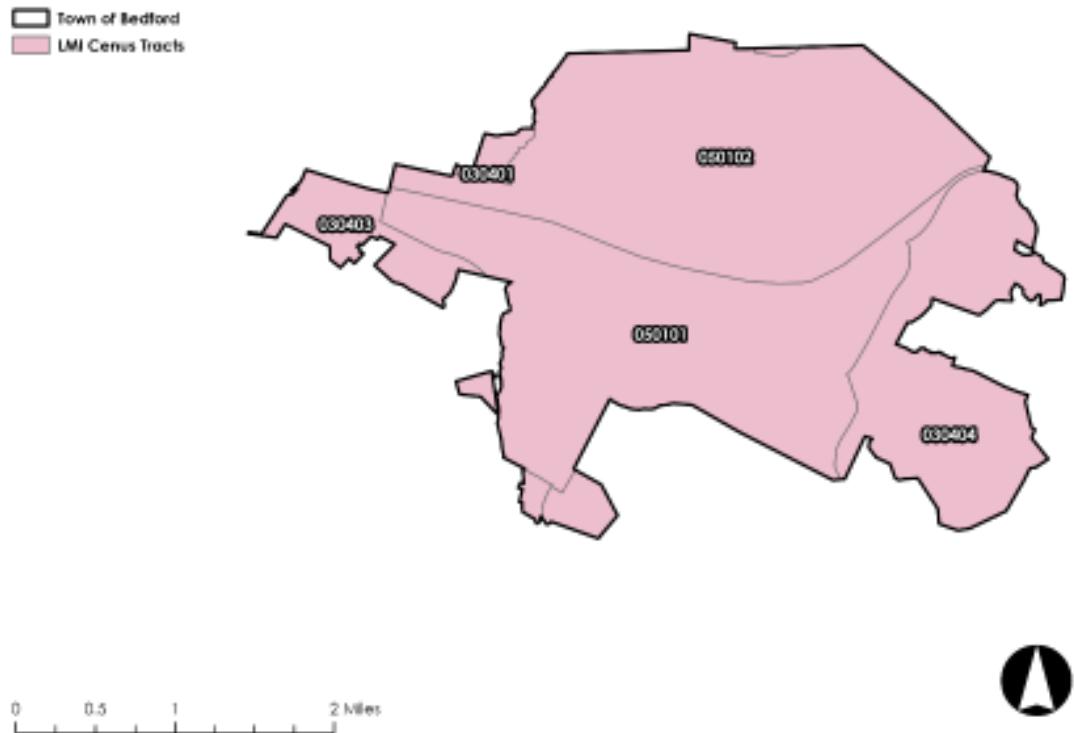


Figure 42 Bedford County Low to Moderate Income Census tracts with designated income levels at or below 80% of Area Median Income Levels, 2020 US Census Data.



*Figure 43 Town of Bedford Low to Moderate Income Census tracts with designated income levels at or below 80% of Area Median Income Levels (2020 US Census Data)*

## Natural Assets

### Conservation Lands

There are four regional parks located in Bedford County. These parks include Falling Creek Park, Moneta Park, Montvale Park, and New London Park. Falling Creek Park is located just outside of the Town of Bedford and contains roughly 10 miles of trails suitable for hikers, trail runners, and mountain bikers. Other local parks include Bike Park, Independence Park, and Liberty Lake Park.

Bedford County is known for its scenic landscapes and outdoor recreational opportunities. The County boasts several parks and open spaces that cater to the diverse interests of residents and visitors alike. One notable park is the Smith Mountain Lake State Park, situated along the shores of the picturesque Smith Mountain Lake. This park offers various amenities, including hiking trails, picnic areas, and water-based activities like boating and fishing.

Another noteworthy outdoor destination is the Peaks of Otter, part of the Blue Ridge Parkway. This area encompasses Sharp Top and Flat Top mountains, providing hiking trails with breathtaking views of the

surrounding mountains and valleys. Residents and visitors can enjoy outdoor activities like hiking, bird watching, and photography. Bedford County also values its agricultural heritage, and there are areas with open spaces and farmlands that contribute to the rural charm of the County.

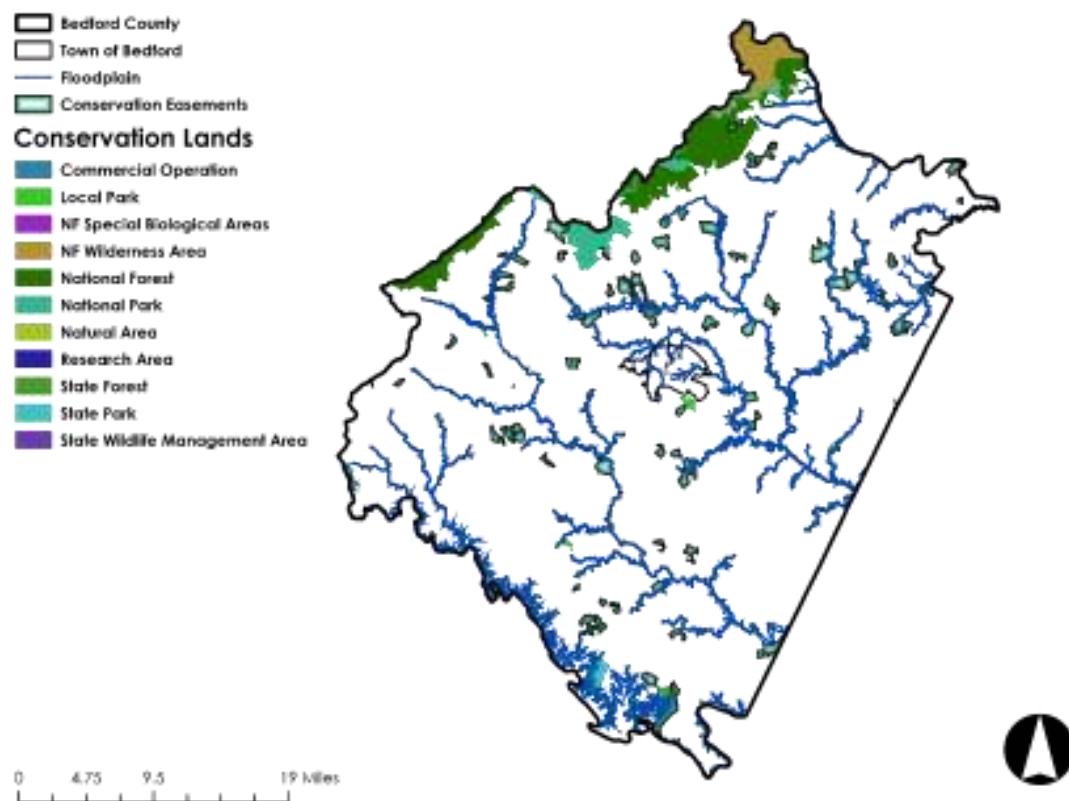


Figure 44 Bedford County Conservation Lands overlaid on the regulatory floodplain, and intermittent streams, VADCR Natural Areas Inventory.

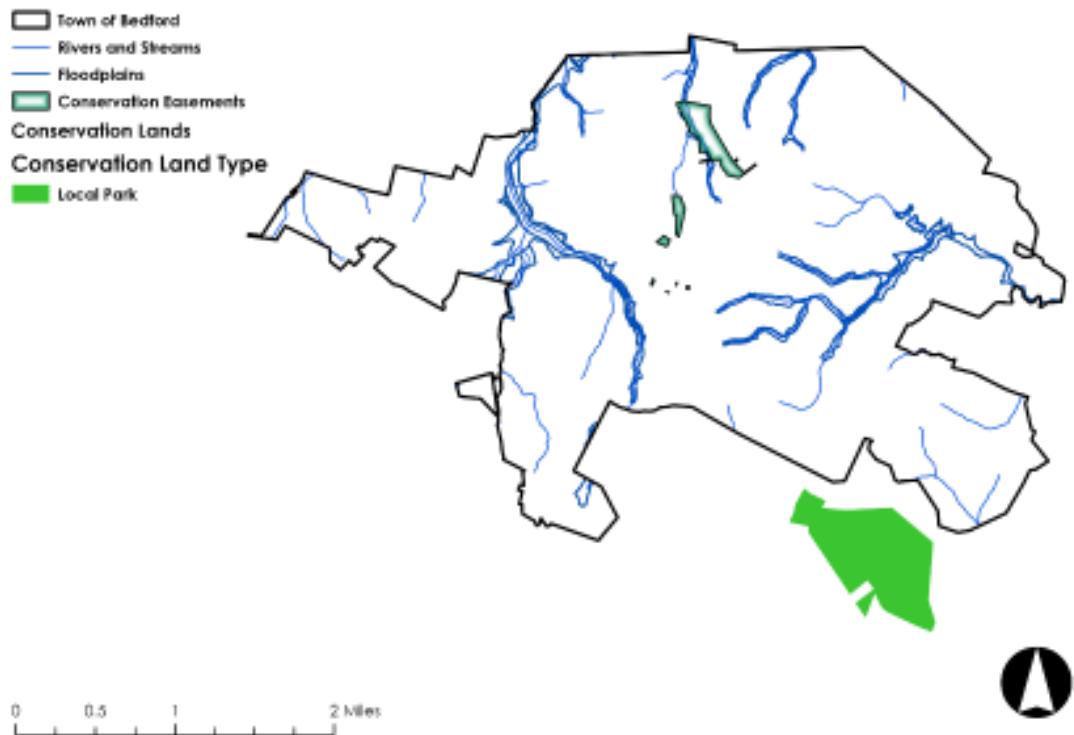


Figure 45 Town of Bedford Conservation Lands overlaid on the regulatory floodplain, and intermittent streams, VADCR Natural Areas Inventory.

## Ecological Cores

Ecological cores are patches of natural land with at least 100 acres of interior cover which provide habitat for a large variety of species, including forest, marsh, and maritime dependent species. Using satellite data, the Virginia Natural Landscape Assessment (VaNLA) provides an analysis that has identified, prioritized, and linked the important land networks throughout Virginia. Preserving and maintaining these landscapes can help ensure they continue to provide ecosystem services such as cleaner air and water filtration. Ecological cores can also provide recreational opportunities and open space resources. The following map shows which areas of the counties and cities within Bedford County contain ecological cores. A higher rating (with red being the highest) indicates the amount of ecosystem services that ecological core provides. Examples of ecological services that cores provide include wildlife and plant habitat, biodiversity conservation, water resource protection, erosion control, and carbon sequestration. The Town of Bedford and Bedford County should have strategies to preserve ecological cores, such as using them as park lands for low-impact recreation (hiking, bird watching, etc.) and other conservation effor

Bedford County  
Town of Bedford  
Floodplain  
Rivers and Streams

### Ecological Cores

C1: Outstanding  
C2: Very High  
C3: High  
C4: Moderate  
C5: General

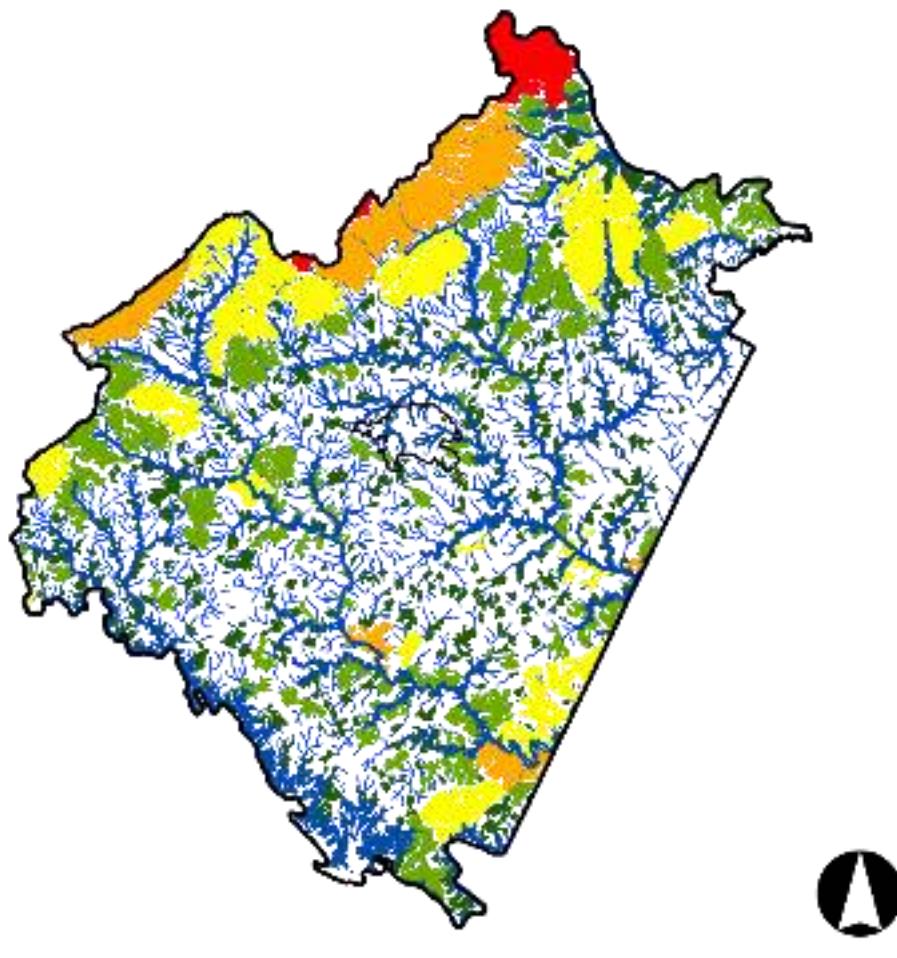
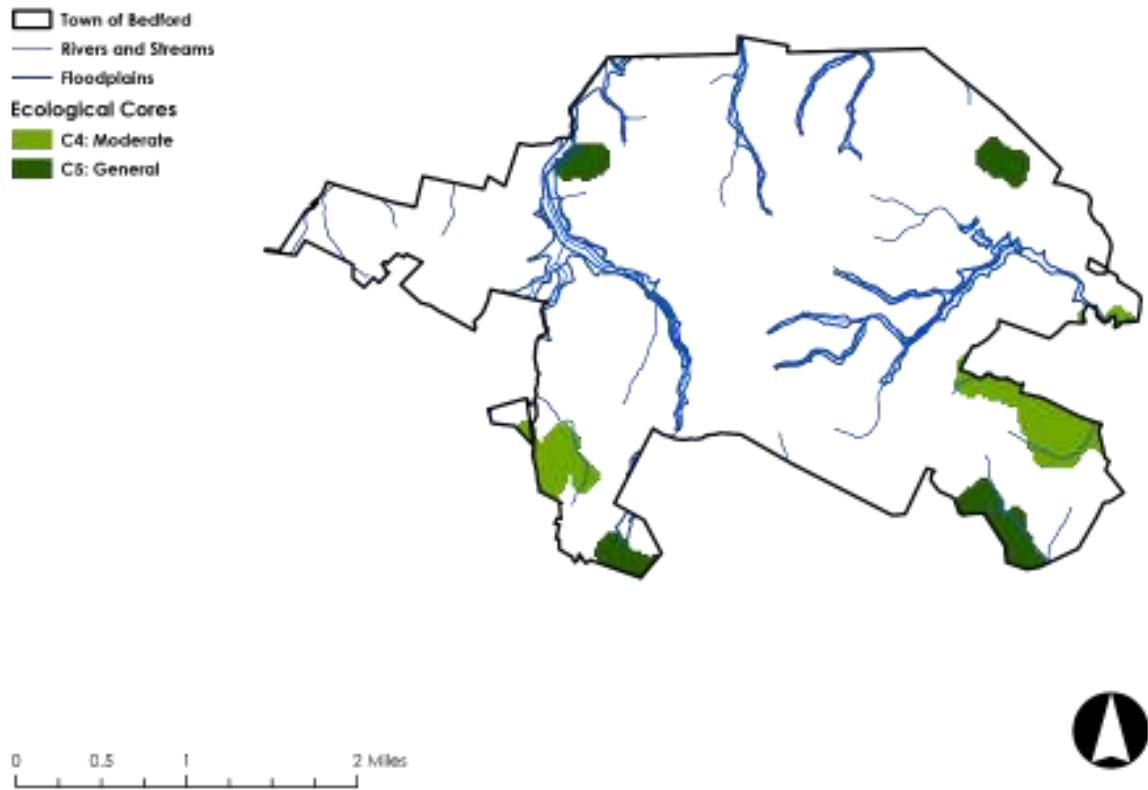


Figure 46 Bedford County Ecological Cores overlaid on the regulatory floodplain, and intermittent streams, VADCR Natural Areas Inventory



*Figure 47 Town of Bedford Ecological Cores overlaid on the regulatory floodplain, and intermittent streams, VADCR Natural Areas Inventory*

## Flooding and Built Assets – Critical Facilities and Infrastructure

Section 4.3, Flooding, of the 2020 CVPDC Hazard Mitigation Plan Section 4.3 Flooding, contains a thorough evaluation of FEMA floodplains, critical infrastructure, roads and bridges in the floodplain, repetitive loss properties and severe repetitive loss properties for each locality in the CVPDC region. For specific lists, maps, and related information for Bedford County, see Appendix B, 2020 CVPDC HMP Maps and Data.

Taken from the HMP, the table below provides the vulnerable critical facilities and infrastructures of Bedford County and the Town. Within the Bedford County unincorporated areas, there are 6 campgrounds, 2 electrical substations, 4 energy facilities, 6 sewer pump stations, 1 water booster pumpstation, and 2 wastewater treatment plants situated in the floodplain. The Town of Bedford contains two Electrical substations.

Facility Name	Address	Facility Type	Coordinates	Flood Zone*
Halesford Harbour Rv Park Resort	1336 Campers Paradise Trl, Moneta	Campground	37.1583, -79.6617	1%; 0.2%
Hannabass-Crouch Campground	1241 Hannabass Dr, Goodview	Campground	37.1548, -79.6994	1%; 0.2%
Mitchell'S Point Marina & Campground	3553 Trading Post Rd, Huddleston	Campground	37.0622, -79.5601	1%; 0.2%
Moorman Marina	1510 Moorman Rd, Goodview	Campground	37.2232, -79.7753	1%; 0.2%
Tri-County Marina	1261 Sunrise Loop, Lynch Station	Campground	37.0595, -79.4468	1%; 0.2%
Waterfront Park Campground	1000 Waterfront Dr, Moneta	Campground	37.1397, -79.6464	1%; 0.2%
Electrical Substation **	678 Orange St, Bedford	Electrical Substation	37.3334, -79.5123	1%; 0.2%
Electrical Substation **	Macon St, Bedford	Electrical Substation	37.3393, -79.5414	1%; 0.2%
Electrical Substation	Big Island Hwy / North Otter Creek	Electrical Substation	37.4599, -79.4651	1%; 0.2%
Electrical Substation	1026 Churchill Rd, Big Island	Electrical Substation	37.5411, -79.3978	1%; 0.2%
Coleman Falls Dam Hydro	6007 Lee Jackson Hwy,	Energy	37.5021,	1%; 0.2%

Table 9 Critical facility and infrastructure in the floodplain of Bedford County and Town (2020 CVPDC HMP)

Bedford County has 339 (or 749) primary structures and 19 (or 22) critical facilities and infrastructures identified in the 1-percent (or 0.2-percent) floodplain (shown in Figure 4-24. Most vulnerable structures are located in the following areas.<sup>25</sup>

- ❖ Smith Mountain Lake / Roanoke River
- ❖ Major / Powells Store area
- ❖ Forest area
- ❖ Montvale area

<sup>25</sup> 2020 CVPDC Hazard Mitigation Plan Update

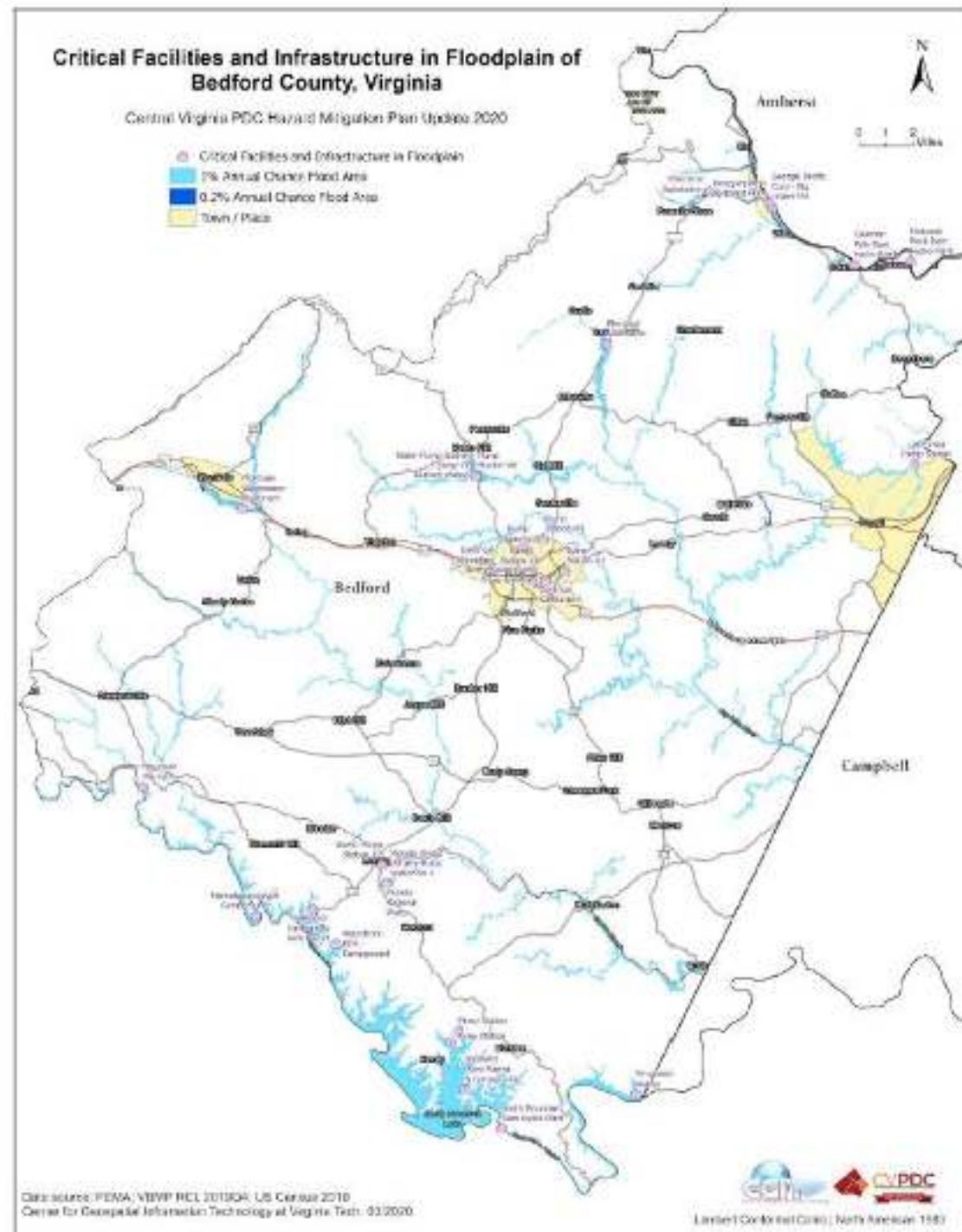


Figure 48 Critical Facilities and Infrastructure in the Floodplain, CVPDC HMP 2020

The five most susceptible roads to flooding are all US or State of Virginia primary roads:  
Rt 706 Bells Mill Rd at Elk Creek, Rt 643 Otterville Rd at North Otter Creek, Rt 644 at North Otter Creek  
(due to a bridge barely above water level), Rt 221 at Grant Rd due to a stream, and Rt 811 Thomas Jefferson Rd between Rt 643 Bellevue Rd and 6007 Thomas Jefferson Rd due to natural channel from the hayfield.

Figure 32 below illustrates real time data from the Virginia Department of Transportation on the condition of bridges and culverts. Overlaid on the rivers and streams, Bedford County, CVPDC and VDOT can work together to upgrade the “Poor” infrastructure first to avoid flood related damages and impacts to the surrounding areas.

<b>Top Poor Rated Bridges</b>	<b>Top Poor Rated Culverts</b>
SC-698E and Villamont Road	SC-635N Eastbound and Beagle Club Road
SC-639S and Hurricane Drive	SC-635N Southbound and Falling Creek
SC-666E and Elkton Farm Road	SC-1460E and Village Drive
SC-666E and Elkton Farm Road	SC-1460W and Village Drive
Sc-691E and Shepherds Street	

Table 10 Bedford County Bridge and Culvert Condition, VDOT

 Bedford County  
 Town of Bedford  
— Roads  
— Floodplain

## Bridges and Culverts

- Fair Bridge
- △ Fair Culvert
- Good Bridge
- ▲ Good Culvert
- Poor Bridge
- ▲ Poor Culvert
- Unclassified Bridge

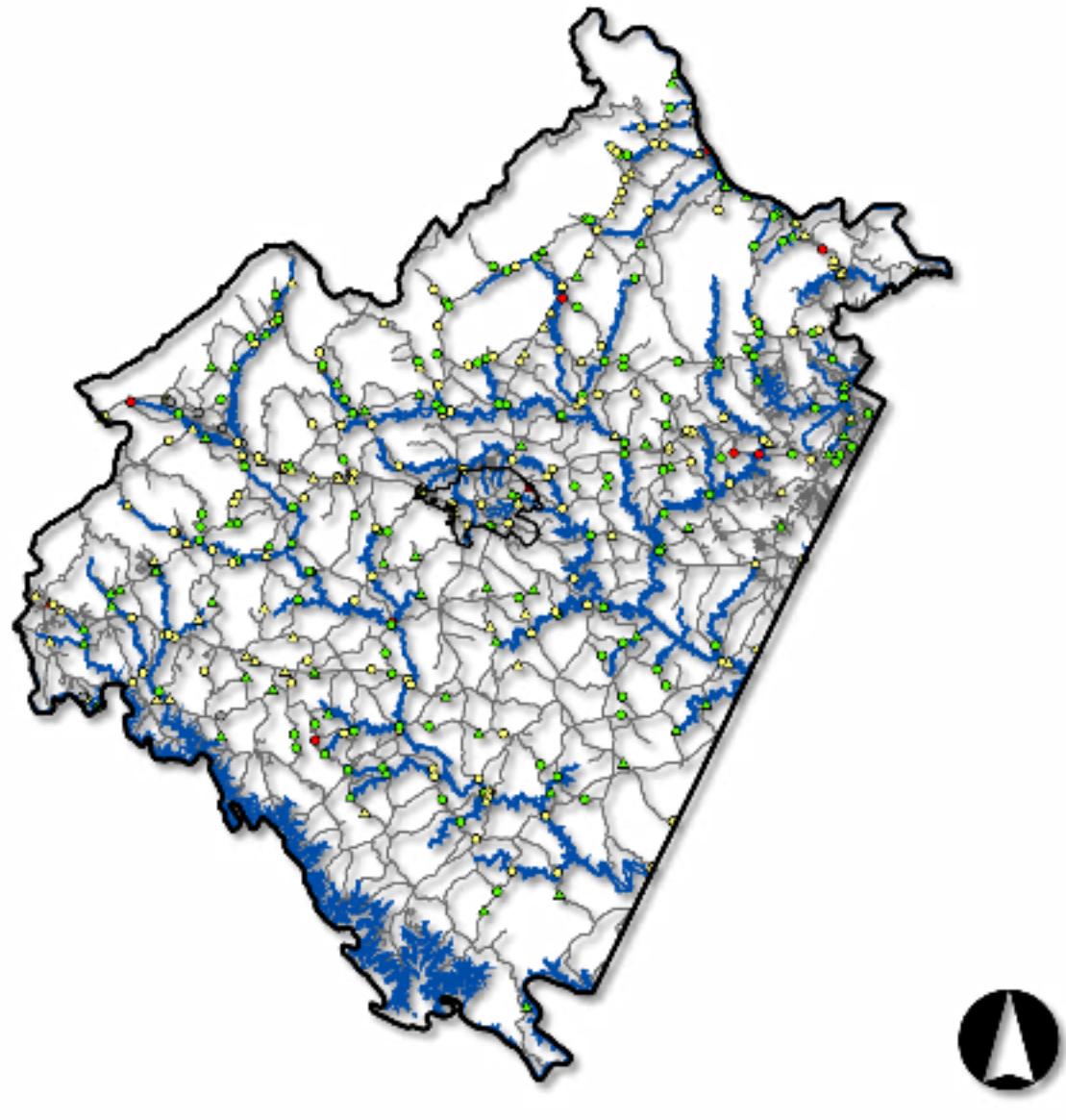


Figure 49 Bridge and culvert condition assessment within Bedford County (VDOT)

Looking at recent data and information from VDOT on vehicle crashes due to standing water on roadways, with the floodplain areas and waterways, it is possible to see the most common areas of known flooding heard from community interviews and standing water where vehicle crashes have occurred due to standing water on the road.

<b>Crashes Due to Standing Water</b>	<b>Roads or Location</b>	<b>Date</b>
1	Route 460	7/25/2018
2	Route 460 W	4/14/2019
3	Route 460 W	4/13/2020
4	Route 460 W	6/19/2020
5	Route 626	6/22/2021
6	Route 460 E	5/28/2021
7	Tolers Ferry	8/20/2021

Table 11 Vehicle Crashes Due to Standing Water, VDOT April 2024

# Flooding and Related Hazards

## Areas of Known Flooding

Flooding is most often associated with storm events that bring large amounts of rainfall to the area, swelling rivers and tributaries beyond their banks. Topographical features, soils, and development patterns also play a part in flooding; and the interaction between these geophysical elements can affect how water moves through the landscape. This flood resilience plan builds on the flood risk assessment performed in the 2020 CVPDC HMP update and adds more localized information mainly heard through community interviews and available data sets. Repetitive loss properties and severe repetitive loss

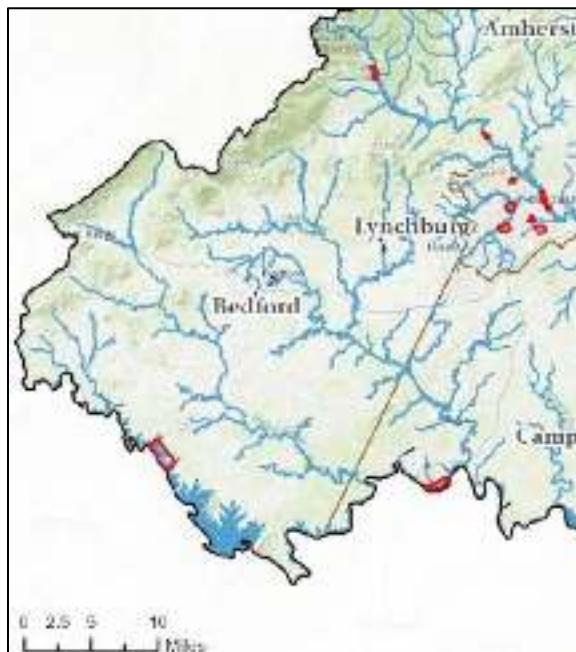


Figure 50 Bedford County repetitive loss areas (2020 CVPDC HMP)

identify potential solutions to recurrent flooding.

properties as stated in the CVPDC 2020 HMP, “*The identification of repetitive loss properties is an important element to conducting a local flood risk assessment, as the inherent characteristics of properties with multiple flood losses strongly suggest that they will be threatened by continual losses.*

*Repetitive loss properties are also important to the NFIP, since structures that flood frequently put a strain on the National Flood Insurance Fund.*”<sup>26</sup>

Bedford County currently has three repetitive loss properties and one severe repetitive loss property.

In addition to repetitive loss area data, Figures 51 and 52 draw on additional data sets to identify known areas of flooding and potential flooding. Figure 51 (below) represents vehicle crashes due to standing water on roadways from VDOT. Additionally, Figure 52 shows the NFIP floodplain areas, and the census tracts identified as low to moderate income. These areas should be considered for future studies and projects to understand the underlying hydrology and

<sup>26</sup> The 2020 CVPDC Hazard Mitigation Plan Update

- Bedford County
- Town of Bedford
- Roads
- Floodplain
- Crashes Due to Moving or Standing Water

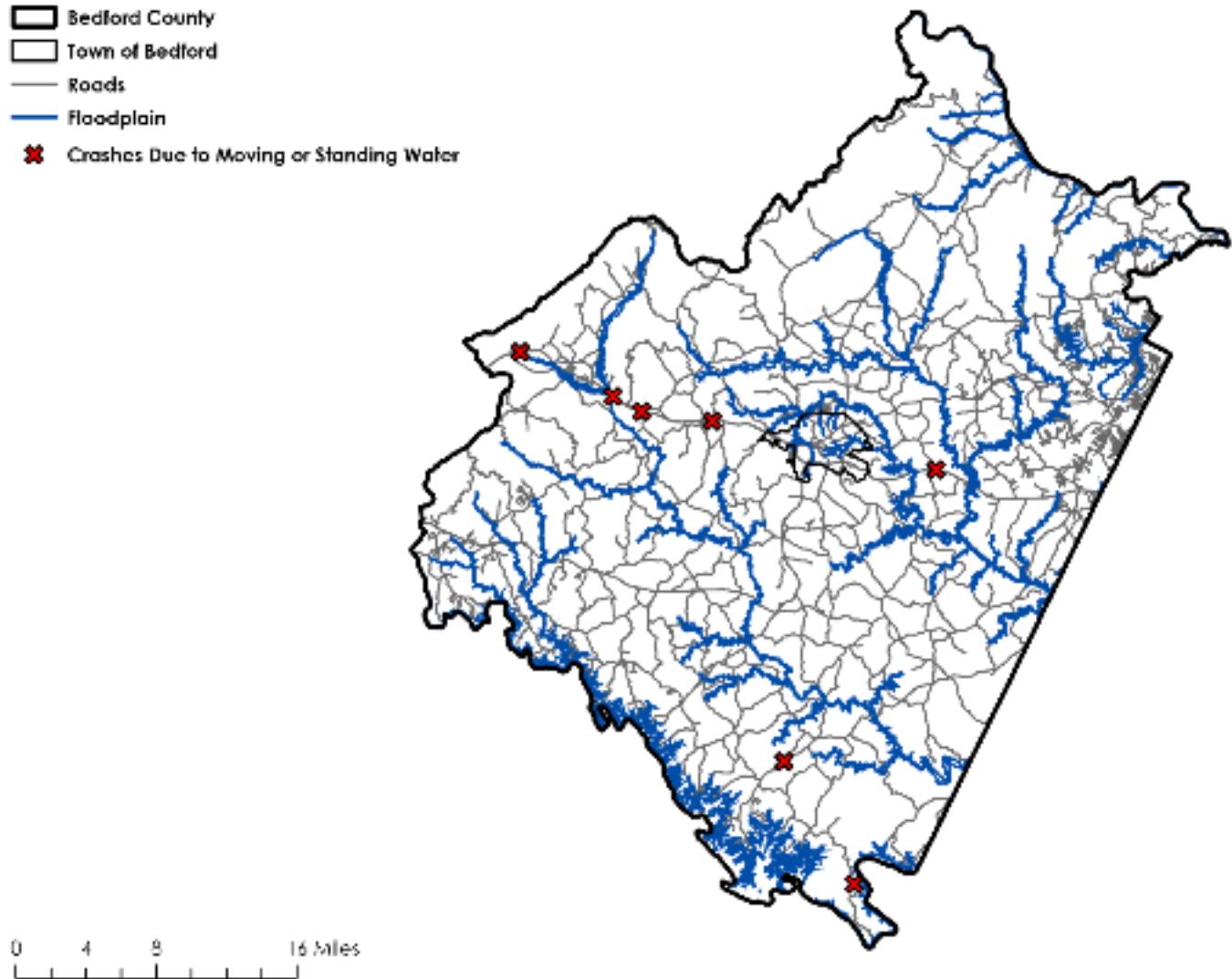


Figure 51 Vehicle crashes due to standing water on roadways, VDOT April 2024

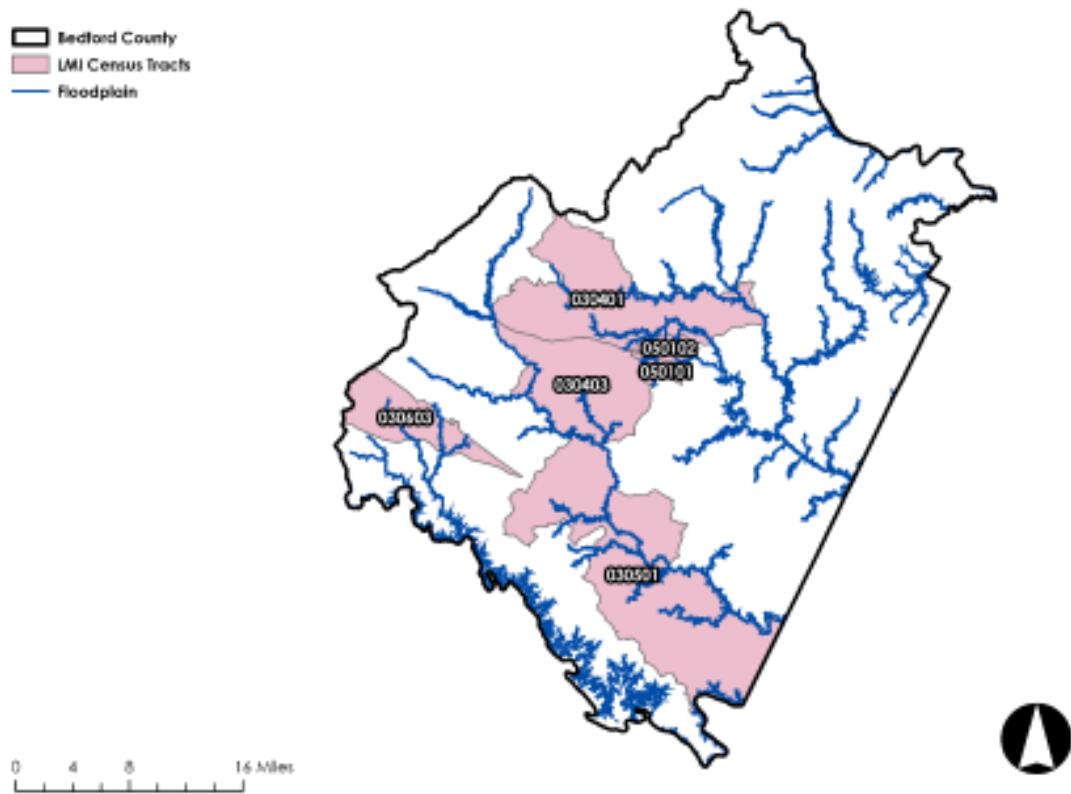


Figure 52 LMI Census Tracts Overlaid on FEMA Floodplains, NFIP and Census Data 2020

## Dam Inundation

The largest concern with the number of dams in Bedford County (152 total, with 12 classified as high or high-special hazard potential and 129 unknown) are the homes, businesses, important thoroughfares and other transportation assets, and critical infrastructure assets in the Dam Break Inundation Zone (DBIZ). These include potential impacts to electric substations, two pump stations and two water storage facilities, CSX and Norfolk Southern Railroad, major highways such as Rt.

122 and Lee Jackson Highway, several residences and businesses within the maximum inundation area, and many roads and road-stream crossings such as bridges and culverts. Some of these facilities are listed in the table below.<sup>27</sup>

Facility Name	Facility Type	Address	Coordinates	Floodplain	Inundation Zone
Tri-County Marina	Campground	1261 Sunrise Loop, Lynch Station	37.0595, -79.4468	1%, 0.2%	Smith Mountain Dam
Tuck-A-Way Campground	Campground	1312 Sunrise Loop, Lynch Station	37.0605, -79.4484	No	Smith Mountain Dam
Electrical Substation	Electrical Substation	Big Island Hwy / North Otter Creek	37.4599, -79.4651	1%, 0.2%	Bedford Lake Dam
Smith Mountain Dam Hydro Plant	Energy Facility	Route 1, Penhook	37.0413, -79.5356	1%, 0.2%	Smith Mountain Dam
Coleman Falls Dam Hydro Plant	Energy Facility	6007 Lee Jackson Hwy, Coleman Falls	37.5021, -79.3006	1%, 0.2%	Pedlar River Dam
Holcomb Rock Dam Hydro Plant	Energy Facility	4839 Holcomb Rock Road	37.5036, -79.2628	1%, 0.2%	Pedlar River Dam
Mineral Springs Christian School	Schools	1030 Bible Ln, Vinton	37.2865, -79.8352	No	Falling Creek Reservoir Dam
Pump Station #6	Sewer Pump Station	Peaks Rd / Woods Rd, Bedford	37.3894, -79.5516	1%, 0.2%	Stoney Creek Reservoir Dam
Lake Vista Pump Station	Sewer Pump Station	2474 Cottontown Rd, Forest	37.3953, -79.2606	1%, 0.2%	Ivy Lake Dam
Farmington Pump Station	Sewer Pump Station	1715 Helmsdale Dr, Forest	37.3845, -79.3008	No	Ivy Lake Dam
Water Pump Station - 5 (Town Of Bedford Water)	Water Booster Pump Station	4690 Peaks Rd, Bedford	37.3897, -79.5531	1%, 0.2%	Stoney Creek Reservoir Dam
Well Lot Ridgeview Sc 1	Water Storage Facility	Ridgeview Dr, Lynchburg	37.3976, -79.2588	No	Ivy Lake Dam

Table 12 Bedford County and Town Critical Infrastructure in the Dam Inundation Zone, CVPDC 2020 HMP

Not all DBIZs are mapped for the high hazard dams or are not in GIS format (*digitization of these maps would be a helpful tool*). It is unknown whether significant vulnerable and minority populations would be affected by dam spillovers in Bedford County, but many critical roads would

<sup>27</sup> Source: CVPDC 2020 HMP

need to be closed or might be washed away entirely, impeding travel and egress. The map of dams of known and unknown hazard potential are shown in the map below.

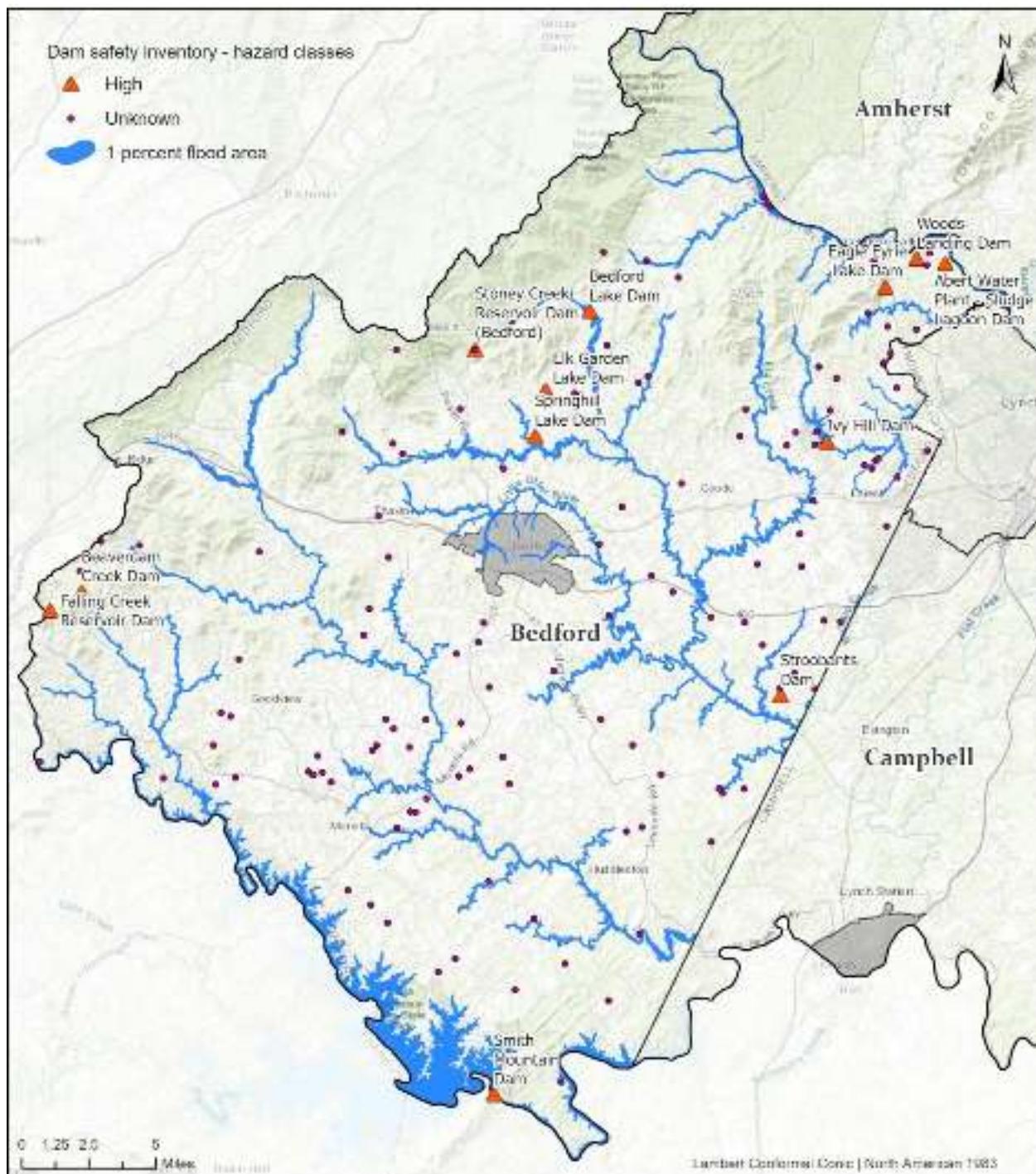


Figure 53 Virginia Dam Safety Inventory System (as of 2/7/2020), Center for Geospatial Technology, Virginia Tech, CVPDC 2020 HMP.

*For a more thorough evaluation of the impacted geographies, structures, and critical assets in Bedford County and the Town of Bedford, and for the dam inundation zone maps for the referenced dams, refer to pp. 4-158 – 4-167 of the CVPDC 2020 Hazard Mitigation Plan Update.*

## Extreme Heat

Using an existing weather station at Lynchburg Airport it is possible to view observed temperature averages from 1950 – 2013 for Bedford County. In the graph below, the horizontal line from which the bars extend up or down is the long-term average of days per year that exceed 95 degrees Fahrenheit. Years when bars extend above the line were higher than the long-term average; years with bars that extend below the line were lower than average. While the range of exceedance events is variable, you can see a trend, especially from the year 2000 onwards, where average temperatures clearly exceeded the average.



Figure 549 Days per year with temperature > 95 degree F observed average, US National Climate Toolkit<sup>28</sup>

<sup>28</sup> U.S. Federal Government, 2023: U.S. Climate Resilience Toolkit Climate Explorer. [Online] <https://crt-climate-explorer.nemac.org/> Accessed {April 15, 2024}.

## Future Community Conditions

### Flood

The potential risks of climate change can have broad effects on communities in Bedford County, including on its public health, infrastructure, agriculture, tourism, and emergency services. Bedford County (and the CVPDC region in general) should expect the following in the future:

- More frequent, and more intense, precipitation events punctuated by deeper episodes of drought.
- Drier winter and summer seasons, which could deplete reservoirs and challenge drinking water supplies and agricultural production.
- Stronger storms at a greater frequency, which may threaten lives, damage infrastructure, and cause significant power outages.
- Increasing summer heat waves, which could threaten public health.

According to the NOAA Mid-Atlantic RISA projections,<sup>29</sup> Bedford County can expect to see some more extreme variability in precipitation over the next 50 years, with some months seeing 15% less and some months seeing up to 40% more compared to the average from the years 1950-2000. In general, the entire Appalachian and Piedmont regions can expect mild 1-2% average increases in rainfall compared to the past 30 years' average.<sup>30</sup> While it is difficult to know exactly how the County will be impacted, it is strongly encouraged to build in redundancy and extra capacity for stormwater and other water infrastructure to account for higher precipitation scenarios.

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<sup>29</sup>Mid Atlantic Regional Integrative Assessment, <https://www.midatlanticrisa.org/data-tools/climate-data-tools/projected-changes-in-total-monthly-precipitation.html>

<sup>30</sup> Mid Atlantic Regional Integrative Assessment, <https://www.midatlanticrisa.org/data-tools/climate-data-tools/difference-from-normal-total-annual-precipitation.html>

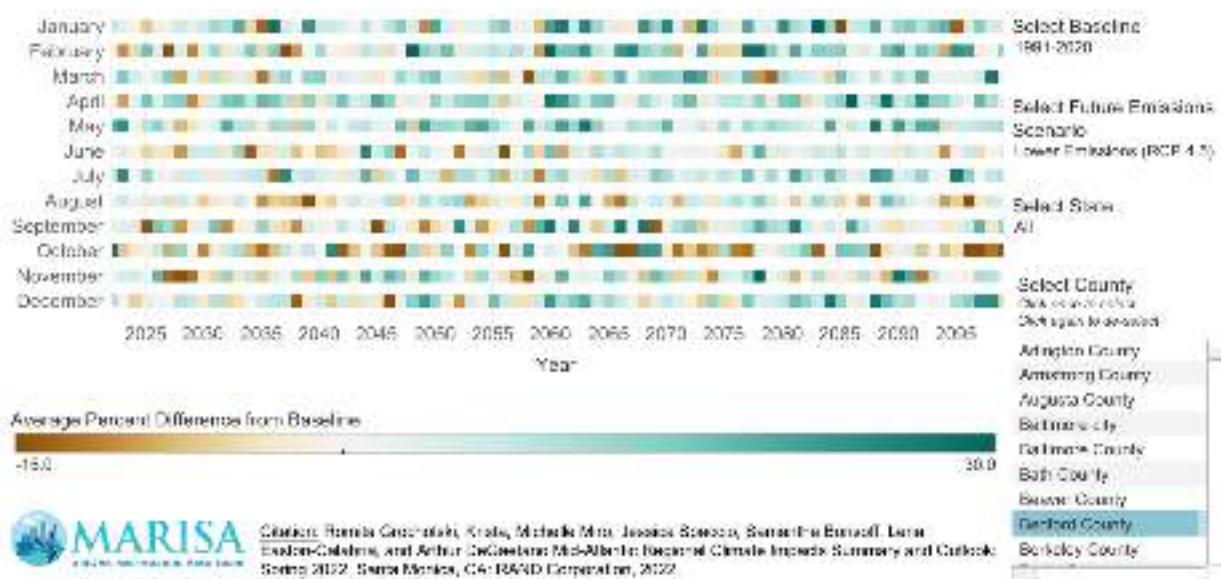


Figure 5510 Projected percent difference in total monthly precipitation compared to 1991-2020 Baseline, MARISA

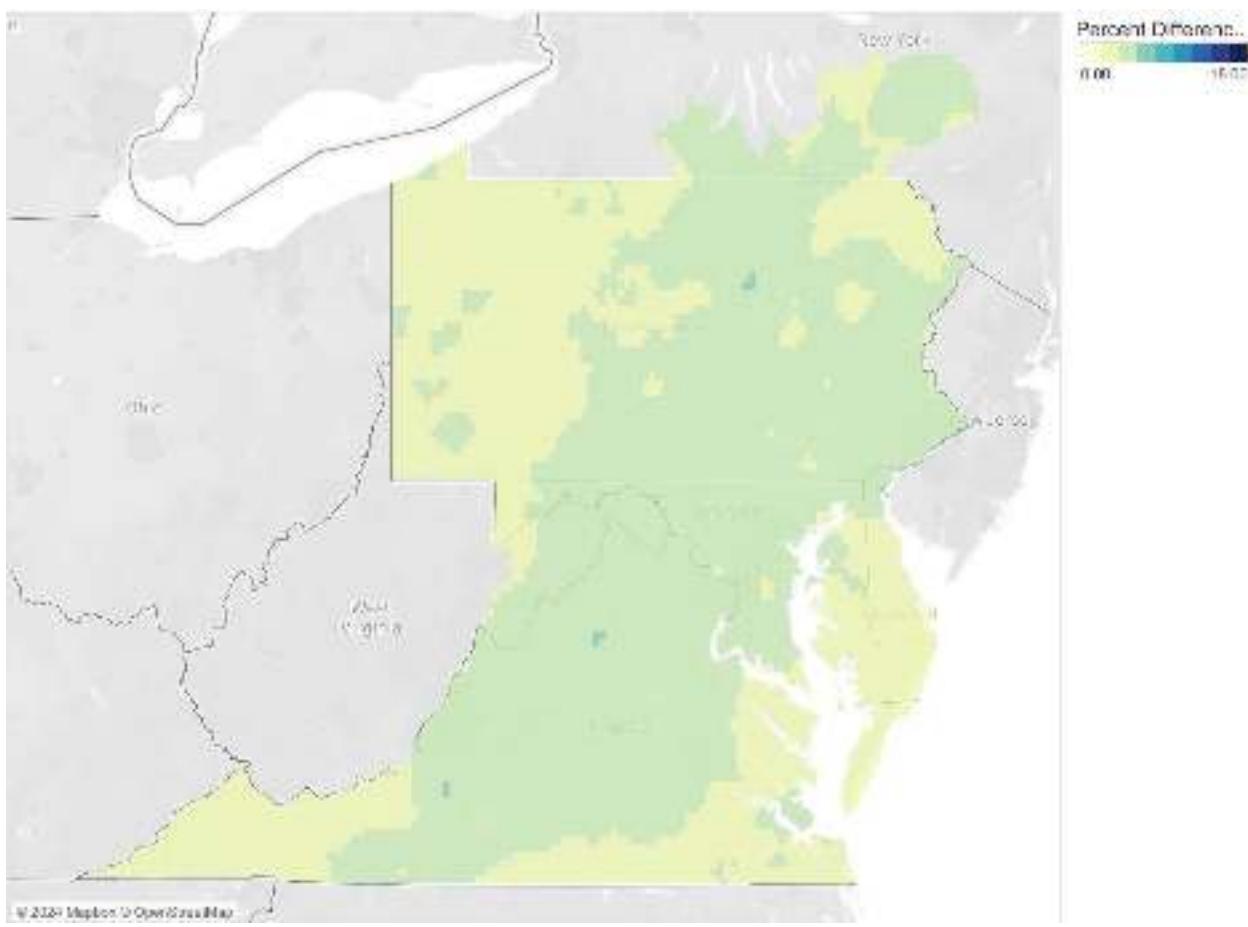


Figure 56 1981-2010 "Normal" Total Annual Precipitation, MARISA

## Heat

In Bedford County, the average daily temperature is expected to increase, as well as extreme temperatures on the hottest days of the year. This excess heat for longer periods may stress critical infrastructure such as roads and bridges. More hot days may also stress the electrical grid and the use of potable water may increase as people may need more irrigation for crops and landscaping. This type of heat may affect public health and may lead to economic impacts through disruptions in agriculture and manufacturing. Human health, stream and river health, and infrastructure are all threatened by higher temperatures.

At 95°F, it is hard to keep indoor areas and our bodies cool. Bedford County's summers are getting hotter. On average, Bedford County sees 4 days per year in excess of 95°F.<sup>1</sup> Within the next 50 years (by 2070), Bedford County can expect a yearly average of 25 to 47 days above 95°F, with associated increases in cooling costs, reduced air quality, and heat-related illnesses. It is imperative that the County begin

planning for more days of extreme heat and look for ways to lessen the public health effects, especially on vulnerable populations.

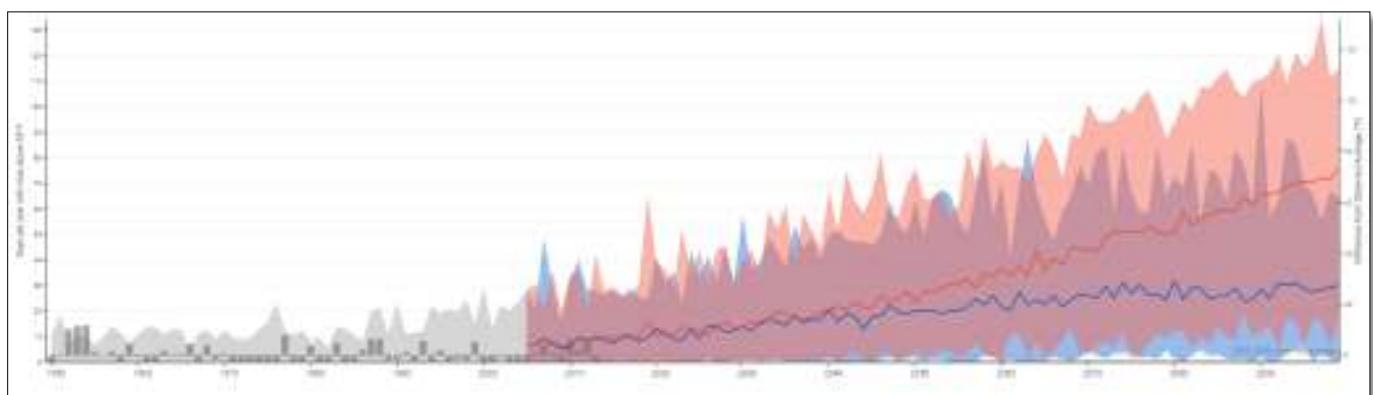


Figure 57 Table 3. Days w/ maximum temp > 95°F (U.S. Climate Resilience Toolkit Climate Explorer)



## General Flood and Heat Resilience Policies and Actions

1. Prioritize vacant tracts of land for recreational open space in floodplains and apply for grant funding to acquire these properties (See Appendix A for more detail on grant funding);
2. Incentivize and/or develop stormwater regulations and the use of green infrastructure in residential areas;
3. Work with VDOT, CVPDC and others to develop a debris management for the county;
4. Work with VDOT and CVPDC to identify stormwater infrastructure priorities on state roads;
5. Develop targeted outreach before and during the summer months to inform the public of anticipated heat waves and ways to stay safe; and
6. Develop a debris management strategy or plan.

## Prioritized Flood Resilience Strategy for Bedford County

- ❖ Assess the vulnerability of roadways and identify priority projects to improve drainage through grey and green infrastructure upgrades. Upgrades will help continuity of access to critical facilities and to physically isolated residents. (Score 70)

*For a full explanation of the Prioritized Resilience Strategy Matrix, see Page 36, Prioritizing Resilience Projects. For the full suite of resilience strategies and rankings by locality, see Appendix A.*

# Bedford County

70 Action Score

## Roadway Vulnerability Assessment and Improvements



### Action Description

Assess the vulnerability of roadways and identify priority projects to improve drainage through grey and green infrastructure upgrades. Upgrades will help continuity of access to critical facilities and to physically isolated residents.



### Key Steps for Implementation

1. Assess the vulnerability of roadways with stakeholder input on flood problem areas and using climate projections to understand potential future impacts.
2. Determine priority areas for roadways upgrades to enhance drainage.
3. Evaluate whether grey or green infrastructure projects are most appropriate or effective for each priority location.
4. Design and construct drainage improvements.



### Action Lead

Department of Public Works, VDOT



### Supporting Partners

- VDOT
- CVPDC
- Town of Bedford



### Ease of Implementation

- Locality can complete in-house.
- Requires locality to hire a staff person.
- Requires hiring a technical consultant.



### Measures of Success

- Reduction of stormwater and riverine flooding
- Monitored and improved water quality and stream health
- Restoration of riverine vegetative buffer zones
- More agreements with private property owners to create conservation easements



### Action Initiation Timeframe



Short

Medium

Long



### Resilience Considerations

- Enhancing drainage to reduce flood impacts will help with emergency response and access.
- Driving through flooded roadways is a primary cause of injury or loss of life.
- Green infrastructure solutions can also help improve water quality and reduce heat impacts.



### Co-Benefits & Equity Considerations

Prioritize flood-prone areas in which socially vulnerable populations also live, or where critical assets are located and continuous access if necessary.



### Cost

\$\$\$\$

1. Roadway Vulnerability Assessment: 100,000-125,000 (dependent on total footage assessed)
2. Determine Priority Areas: 20,000-35,000
3. Identify Priority Projects: 50,000-100,000 (dependent on number of projects)
4. Design of Drainage Solutions: 150,000-250,000 (dependent on number of designs)
5. Construction and Implementation: 250,000-1,000,000 (dependent on scope of projects)



FEMA BRIC, Inflation Reduction Act, DEQ Stormwater Assistance Fund

This Project Implementation Sheet is apart of a Flood Resilience Plan funded by the Virginia Community Flood Preparedness Fund (CFPF) on behalf of the Central Virginia Planning District Commission (CVPDC). For more detailed information please see the complete flood resilience report and its appendices.  
CVPDC Flood Resilience Plan

Bedford County, VA



## Prioritized Flood Resilience Strategy for the Town of Bedford

- ❖ Assess opportunities to elevate or acquire repetitive loss properties to mitigate flood impacts including loss of life, property, and financial damage. Conduct outreach to homeowners of repetitive loss properties and owners within the dam hazard inundation area to understand their potential interest in relocation via buyouts.

*For a full explanation of the Prioritized Resilience Strategy Matrix, see Page 36, Prioritizing Resilience Projects. For the full suite of resilience strategies and rankings by locality, see Appendix A.*

## Adapt Repetitive Loss Properties



## Action Description

Assess opportunities to elevate or acquire repetitive loss properties to mitigate flood impacts including loss of life, property, and financial damage. Conduct outreach to homeowners of repetitive loss properties and owners within the dam hazard inundation area to understand their potential interest in relocation via buyouts.

1. Determine number of local repetitive loss properties and conduct outreach to property owners to better understand their concerns.
2. Develop a Town-VDEM partnership program/or coordinate with VDEM to streamline applications for home elevations or buyouts.
3. Prepare applications to FEMA for funding to support elevation or buyouts.
4. Support property owners as they elevate their homes or relocate by providing technical, financial, or relocation assistance.



## Key Steps for Implementation



## Action Lead

Community Development Department



## Supporting Partners

- Private property owners
- Virginia Department of Emergency Management (VDEM)
- CVPDC
- Bedford County



## Ease of Implementation

- Locality can complete in-house.  
 Requires locality to hire a staff person.  
 Requires hiring a technical consultant.

- Number of property owners the Town engages.
- Successful coordination or establishment of working relationship with VDEM staff who support FEMA application development.
- Number of funded applications by FEMA.
- Positive resident feedback regarding options for adaptation (without feelings of displacement or pressure).



## Measures of Success

This Project Implementation Sheet is apart of a Flood Resilience Plan funded by the Virginia Community Flood Preparedness Fund (CFPF) on behalf of the Central Virginia Planning District Commission (CVPDC). For more detailed information please see the complete flood resilience report and its appendices.



## Action Initiation Timeframe

Short: 0-2 years  
Medium: 3-6 years  
Long: 7+ years

## Cost\*

\$: less than 10k  
\$\$: 10-50k  
\$\$\$ 50-500k  
\$\$\$\$: 500k-2mill  
\$\$\$\$\$: 2 mill+

\*Cost associated with the actions refers to how much it is expected to cost the Town to implement. This does not include costs for ongoing maintenance.



## Action Initiation Timeframe

Short

Medium

Long



## Resilience Considerations

Home elevations can mitigate flood impacts, reducing damage to private property or loss of life.

Buyouts can permanently remove structures from vulnerable areas and create opportunities to restore properties to areas of ecological function and open space.



## Co-Benefits &amp; Equity Considerations

Matters related to home elevation or potential buyouts and relocation can be very sensitive topics. The Town should aim to engage with residents in a way that is respectful and empowering to provide property owners with options.

The Town should provide technical or financial assistance when possible to support residents while they temporarily relocate (during home elevation construction) or permanently relocate

Cost  
\$\$\$\$

1. Property owner outreach: 5,000-10,000 (dependent on number of properties)
2. VDEM CoordWination or Program Development: 30,000-150,000
3. Help Prepare FEMA Applications 35,000-100,000 (dependent on number of applications)
4. (Optional) Technical and Financial Assistance for Property Owners Pursuing Home Elevations or Buyouts: 250,000-1,000,000 (dependent on number of applications, not a requirement of FEMA)



## Possible Funding Sources

Virginia Department of Emergency Management  
Federal Emergency Management Agency



## Town of Brookneal, VA

The Town of Brookneal is nestled in the scenic landscapes of Campbell County. The Town was incorporated, and a charter issued in 1908. Later to become the smallest incorporated town in the Central Virginia region, Brookneal served as the closest center of commerce for portions of Campbell, Charlotte, and Halifax counties. As transportation modes developed, Brookneal's location offered proximity to waterways, roads, and railroads. Founded amidst the verdant valleys and rolling hills, the Town's inception is intertwined with the pioneering spirit of its early settlers, who sought to carve out a community in the heart of Virginia's rural landscape.

### Community and Social Assets

The Town of Brookneal is situated in the southwest portion of Campbell County. The Town has a somewhat diverse demographic profile; with racial makeup: 63.7% White, 34.71%, African American, 0.56% from other races, and 0.95% from two or more races.<sup>31</sup> There is a significant portion of elderly or mobility limited persons in the Town.

### Vulnerable Populations

While resilience is important throughout the Town and region, the entirety of the Town of Brookneal qualifies as Low to Moderate Income based on 2020 census data. The definition of Low-to-Moderate Income (LMI) means any census tract (or equivalent geographic area defined by the Bureau of the Census) in which at least 50% of households have an income less than 60 percent of the Area Median Gross Income (AMGI), or which has a poverty rate of at least 25%. The Town of Brookneal contains multiple LMI census tracts which can be seen in Figure 1 below.

As defined in the 2023 CFPF Manual, "Low-income geographic area" means any locality, or community within a locality, that has a median household income that is not greater than 80 percent of the local median household income or any area in the Commonwealth designated as a qualified opportunity zone by the U.S. Secretary of the Treasury via his delegation of authority to the Internal Revenue Service. These areas are eligible to apply for CFPF funding with as little as 10% matching funds.

Another factor in measuring vulnerability is the Social Vulnerability Index. SVI indicates the relative vulnerability of every U.S. Census tract. Census tracts are subdivisions of counties for which the Census collects statistical data. SVI ranks the tracts on 15 social factors, including unemployment, minority

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<sup>31</sup> 2020 US Census Data

status, and disability, and further groups them into four related themes. Thus, each tract receives a ranking for each Census variable and for each of the four themes, as well as an overall ranking. Projects and studies in areas with a higher SVI will receive prioritized rankings for CFPF funding. See Appendix X for more information on vulnerable communities.

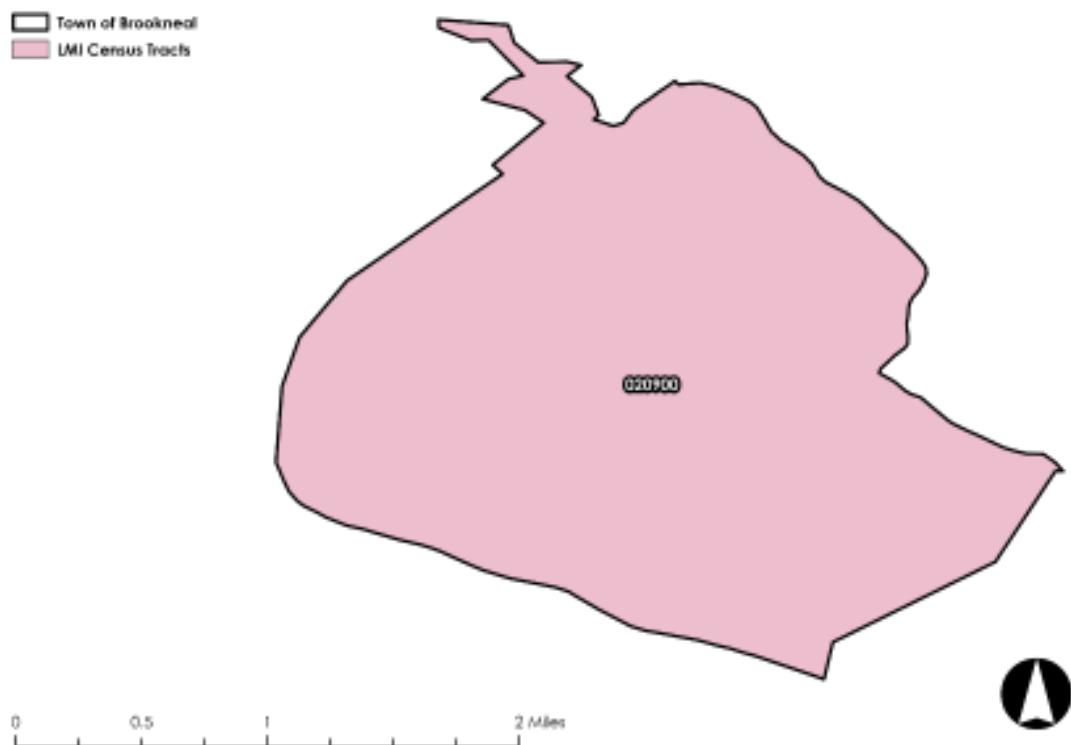


Figure 58 Town of Brookneal Census tracts with designated income levels at or below 80% of Area Median Income Levels (2020 US Census Data)

# Natural Assets

## Conservation Lands

The Town of Brookneal contains two major protected areas, the Brookneal Recreation Park, offering softball and baseball fields, tennis courts, and hiking trails, and the Vic Thomas Striped Bass Hatchery Wildlife Conservation Site. These areas are both in or near rivers and creeks and are a great example of passive flood mitigation. The areas are kept generally free of development and if and when a flood occurs, the low areas of the site are able to hold water and naturally drain back into the soil.

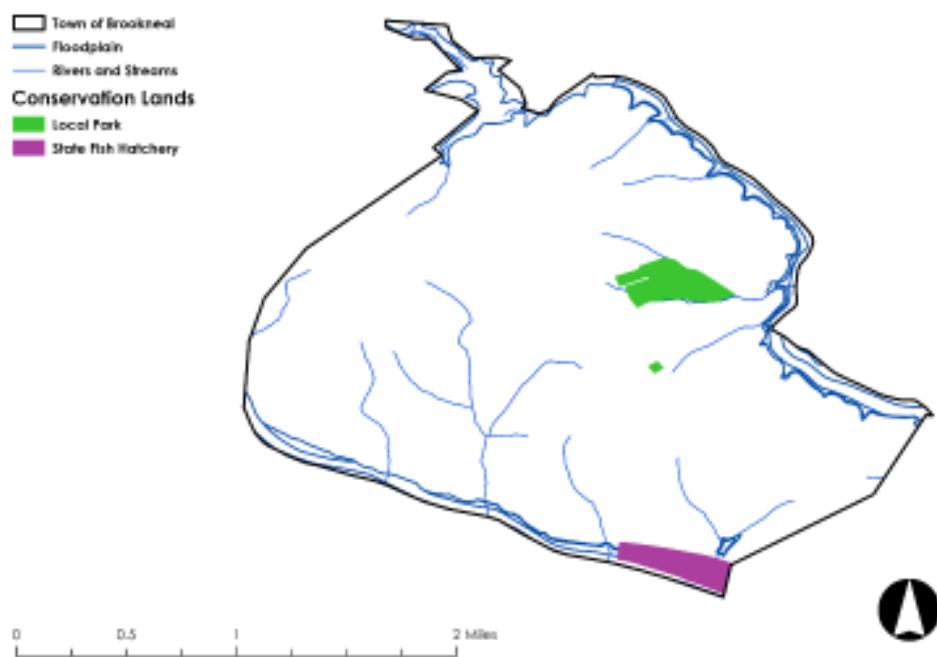
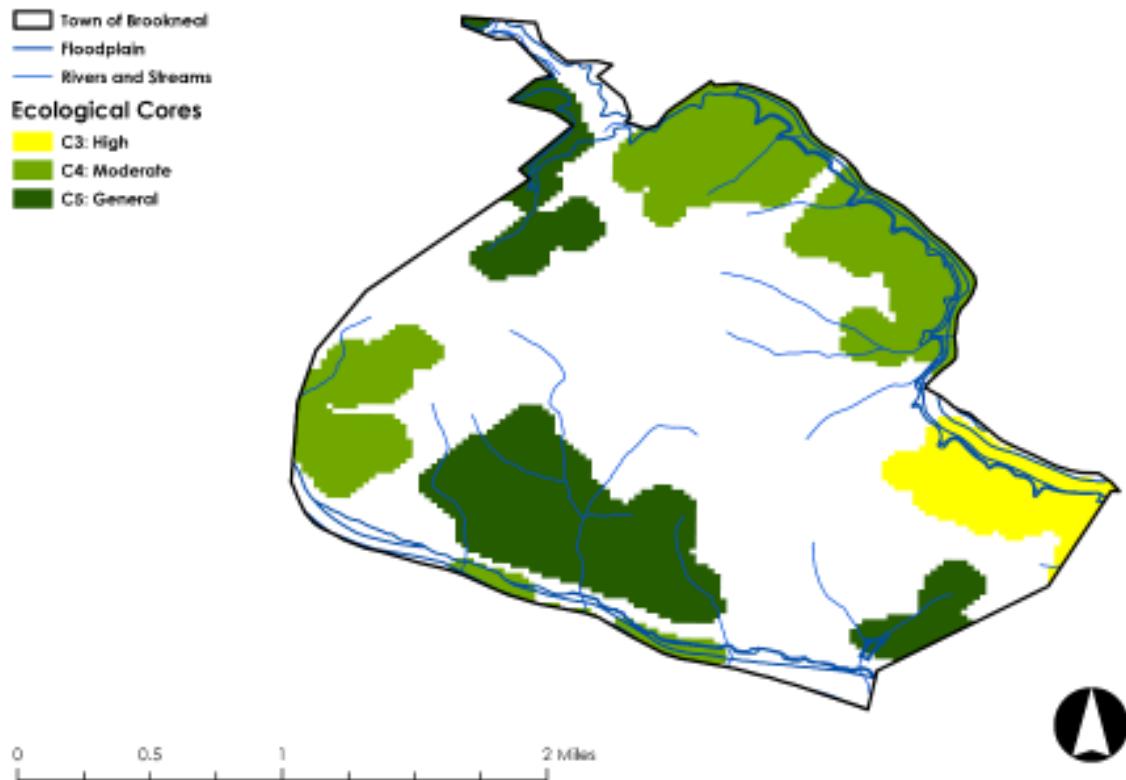


Figure 59 Conservation Lands overlaid on the regulatory floodplain, and intermittent streams, VADCR Natural Areas Inventory.

## Ecological Cores

Ecological cores are patches of natural land with at least 100 acres of interior cover which provide habitat for a large variety of species, including forest, marsh, and maritime dependent species. The Virginia Natural Landscape Assessment (VaNLA) provides an analysis that has identified, prioritized, and linked, using satellite data, the important land networks throughout Virginia. Preserving and maintaining these landscapes can help ensure they continue to provide ecosystem services such as cleaner air and water filtration. Ecological cores can also provide recreational opportunities and open space resources. The following map shows which areas of the Town contain ecological cores. A higher rating (with red being the

highest) indicates the amount of ecosystem services that ecological core provides. Examples of ecological services that cores provide include wildlife and plant habitat, biodiversity conservation, water



resource protection, erosion control, and carbon sequestration. The Town of Brookneal should have strategies to preserve ecological cores, such as using them as park lands for low-impact recreation (hiking, bird watching, etc.) and other conservation efforts.

*Figure 60 Ecological Cores overlaid on the regulatory floodplain, and intermittent streams, VADCR Natural Areas Inventory*

## Flooding and Built Assets – Critical Facilities and Infrastructure

The Town of Brookneal contains several areas that are known to have flooding and standing water issues. Most of these areas were identified during community interviews with Town staff, in addition to

information in the 2020 HMP. The total length of road segments in the floodplain within the Town is 0.9 miles; these include Dog Creek Rd, Radio Rd, Wickliffe Ave, Lusardi Dr, and Juniper Cliff Rd. No high-risk bridges are identified in the Town.<sup>32</sup> Standing water on roads can result in hazardous travel conditions and damage to infrastructure. It is important that the town prioritizes upgrading and maintaining stormwater infrastructure in these areas, which would all qualify for reduced match for grant funding from the Community Flood Preparedness Fund.



Figure 61 Floodplain areas overlaid on Low Income Geographic Areas with up to 80% of Area Mean Income levels. (Qualified tracts for 10% match CFPF)

For a complete list of roads and bridges most susceptible to flooding see CVPDC Hazard Mitigation Plan 2020 Update Flooding; Page 4-39 – 3-40. The map below illustrates real time data from the Virginia Department of Transportation on the condition of bridges and culverts. The Town of

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<sup>32</sup> 2020 CVPDC HMP Update

Brookneal does not currently have any poor or fairly rated roads or bridges, only those classified in good condition. However, the Town should continue to monitor the status and can do so through VDOT online road conditions portal.<sup>33</sup> There are currently no repetitive loss or severe repetitive loss properties within the Town of Brookneal.



Figure 62 Town of Bedford Culvert and Bridge Assessment (VDOT)

## Dam Inundation

The largest concern with the few dams near the Town of Brookneal (34 total, with 3 classified as high or high-special hazard potential and 22 unknown) are the homes, businesses, important thoroughfares and other transportation assets, and critical infrastructure assets in the Dam Break Inundation Zone (DBIZ).

<sup>33</sup> VDOT Condition Portal Data

These include potential impacts to several historic sites, water treatment plants with associated pump stations in the Town's incorporated area, nuclear facility property in dam breach maximum inundation area, several residences and businesses within the maximum inundation area, and many roads and road-stream crossings such as bridges and culverts. In the Town of Brookneal, potential impacts include two historical sites, a communications facility, and water treatment plants with associated pump stations. Some of these facilities are listed in the table below.<sup>34</sup>

<b>Facility Name</b>	<b>Address</b>	<b>Facility Type</b>	<b>Flood Zone</b>
WODI - AM - The Rain Broadcasting, Inc.	1230 Radio Road Brookneal	Communication Facility	1%; 0.2%
Cat Rock Sluice	General Location, Brookneal	Historic Site	1%; 0.2%
Brookneal Town - Falling River	Wickliffe Ave, Brookneal	Wastewater Treatment Plant	1%; 0.2%
Brookneal Town - Staunton River ***	Radio Rd, Brookneal	Wastewater Treatment Plant	1%; 0.2%

Table 13 Critical facility and infrastructure in floodplain of Brookneal CVPDC HMP Update

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<sup>34</sup> Source: CVPDC 2020 HMP

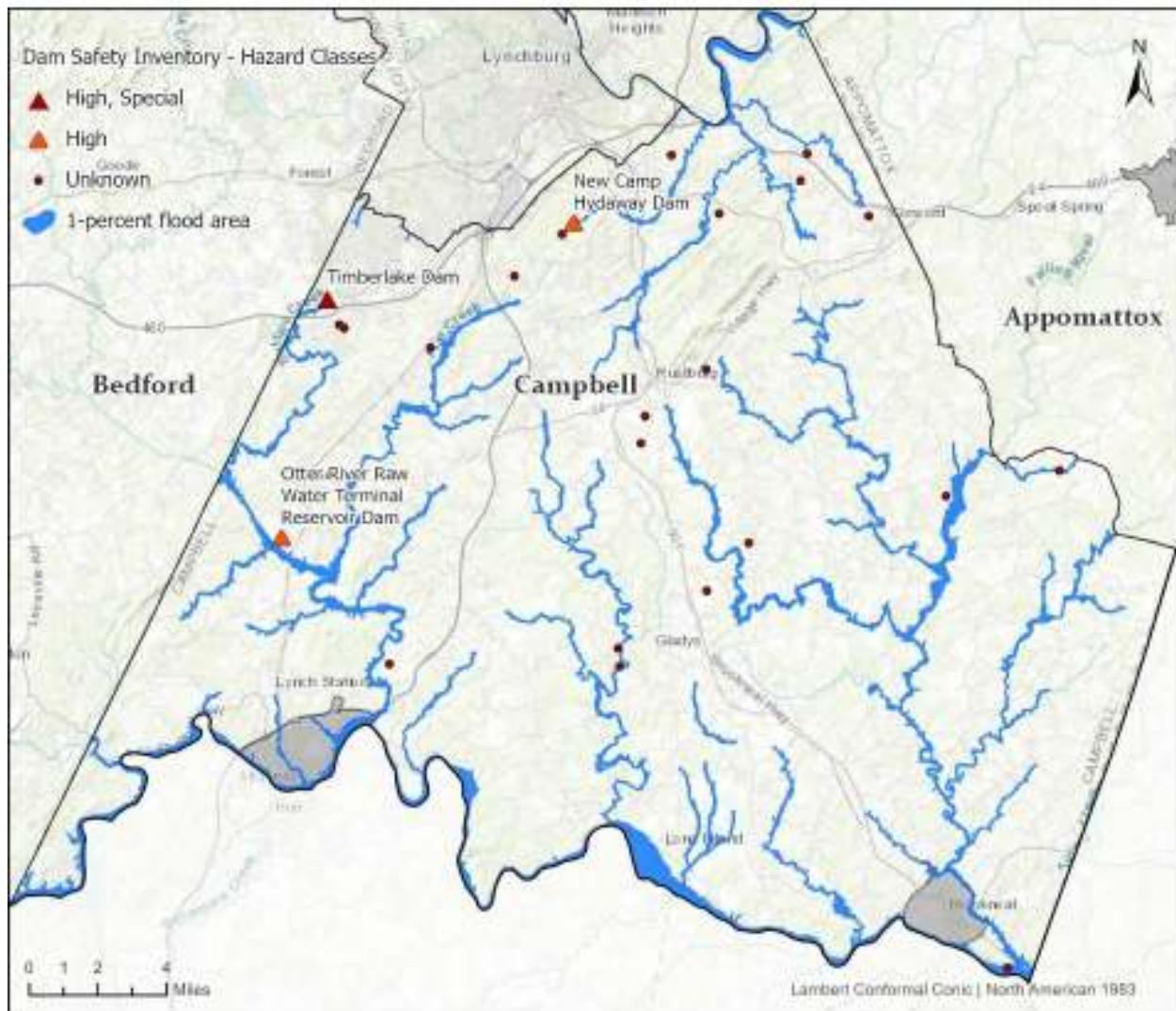


Figure 63 Dams in Campbell County, VA, VA Dam Safety Inventory System, Center For Geospatial Technology at Virginia Tech, CVPDC HMP 2020

## Extreme Heat

Using an existing weather station at the Lynchburg Regional Airport (LYNCHBURG REG AP), it is possible to view observed temperature averages from 1950 – 2013 for the area.

In the graph below, it is possible to view observed days per year exceeding 95 degrees Fahrenheit from 1950 – 2013 for Campbell County. The bars are representative of the observed days, either a positive or negative number, above 95 degrees. Generally, while the range of exceedance events is variable, a trend can be seen, especially from the year 2000 onwards where average temperatures clearly exceeded the average.



Figure 64 Campbell County Days per year with temperature > 95 degree F observed average, US National Climate Toolkit

## Future Community Conditions

### Flood

The potential risks of climate change can have broad effects on communities in Community, including on its public health, infrastructure, agriculture, tourism, and emergency services. The Town of Brookneal (and the CVPDC region in general) should expect the following in the future:

- More frequent, and more intense, precipitation events punctuated by deeper episodes of drought.
- Drier winter and summer seasons, which could deplete reservoirs and challenge drinking water supplies and agricultural production.
- Stronger storms at a greater frequency, which may threaten lives, damage infrastructure, and cause significant power outages.
- Increasing summer heat waves, which could threaten public health.

According to the NOAA Mid-Atlantic RISA projections,<sup>35</sup> The Town of Brookneal can expect to see some more extreme variability in precipitation over the next 50 years, with some months seeing 15% less and some months seeing up to 40% more compared to the average from the years 1950-2000. In general, the entire Appalachian and Piedmont regions can expect mild 1-2% average increases in rainfall compared to the past 30 years' average.<sup>36</sup>

<sup>35</sup> Mid Atlantic Regional Assessment, <https://www.midatlanticrisa.org/data-tools/climate-data-tools/projected-changes-in-total-monthly-precipitation.html>

<sup>36</sup> Mid Atlantic Regional Assessment, <https://www.midatlanticrisa.org/data-tools/climate-data-tools/difference-from-normal-total-annual-precipitation.html>

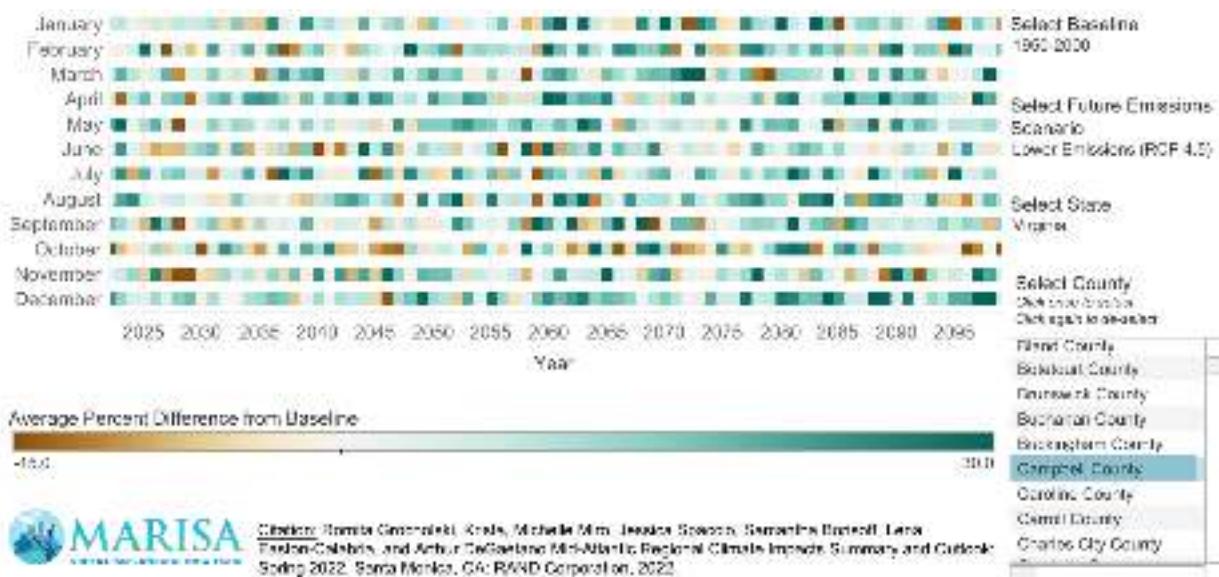


Figure 65 Projected percent difference in total monthly precipitation compared to 1991-2020 Baseline, MARISA

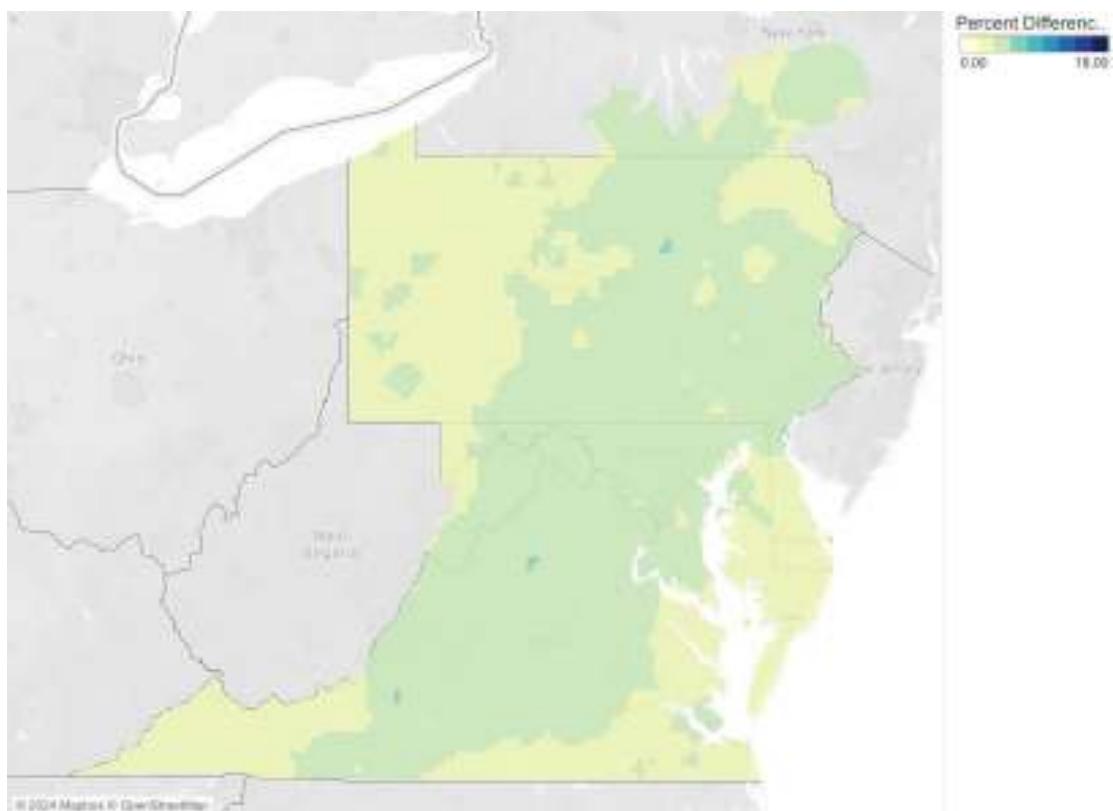


Figure 66 1981-2010 "Normal" Total Annual Precipitation, MARISA

## Heat

In The Town of Brookneal , the average daily temperature is expected to increase, as well as extreme temperatures on the hottest days of the year. This excess heat for longer periods may stress critical infrastructure such as roads and bridges. More hot days may also stress the electrical grid and the use of potable water may increase as people may need more irrigation for crops and landscaping. This type of heat may affect public health and may lead to economic impacts through disruptions in agriculture and manufacturing. Human health, stream and river health, and infrastructure are all threatened by higher temperatures.

At 95°F, it is hard to keep indoor areas and our bodies cool. Altavista's summers are getting hotter. On average, the Town sees 4 days per year in excess of 95°F.<sup>1</sup> Within the next 50 years (by 2070), the Town of Brookneal can expect a yearly average of 25 to 47 days above 95°F, with associated increases in cooling costs, reduced air quality, and heat-related illnesses. It is imperative that the Town begin planning for more days of extreme heat and look for ways to lessen the public health effects, especially on vulnerable populations.

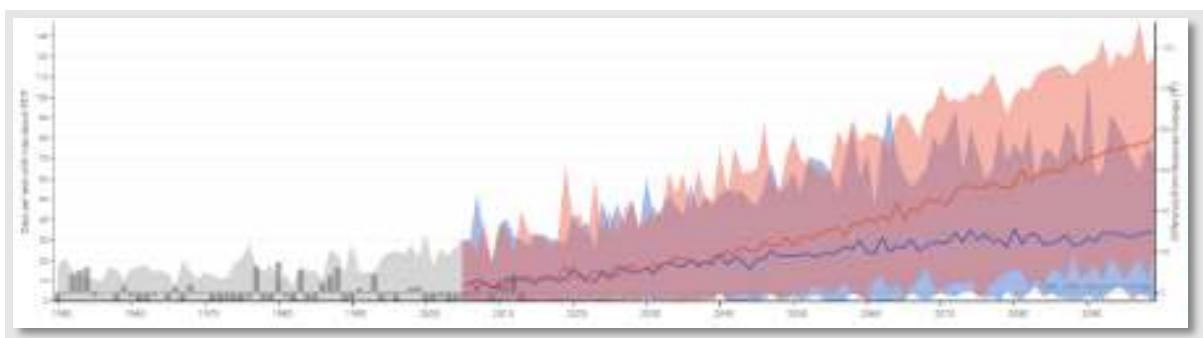


Figure 67 Days w/ maximum temp > 95°F (U.S. Climate Resilience Toolkit Climate Explorer)



## General Flood and Heat Resilience Policies and Actions

1. Prioritize vacant tracts of land for conservation and recreational open space in floodplains and apply for grant funding to acquire these properties or work with partners who can acquire them. (See Appendix A for more detail on grant funding)
2. Incentivize and/or develop stormwater regulations and the use of green infrastructure in residential areas.
3. Work with VDOT, CVPDC and others to develop a debris management strategy for the Town.
4. Work with VDOT and CVPDC to identify stormwater infrastructure priorities on state roads.
5. Develop targeted outreach before and during the summer months to inform the public of anticipated heat waves and ways to stay safe.
6. Develop a debris management strategy or plan with Campbell County.

## Prioritized Flood Resilience Strategy

- ❖ Evaluate and execute retrofit measures to reduce service disruption and facility damage to the Town's water and sanitary sewage systems (Score 65)

*For a full explanation of the Prioritized Resilience Strategy Matrix, see Page 36, Prioritizing Resilience Projects. For the full suite of resilience strategies and rankings by locality, see Appendix A.*

# Town of Brookneal

65 Action Score

## Retrofit water and sanitary sewage facilities



### Action Description

Evaluate and execute retrofit measures to reduce service disruption and facility damage to the Town's water and sanitary sewage systems.



### Key Steps for Implementation

1. Conduct a site scale vulnerability assessment of water and sewer facilities and systems.
2. Determine priority needs for facility and infrastructure upgrades to enhance resilience.
3. Design adaptation measures to retrofit facilities.
4. Construct and implement adaptation measures.



### Action Lead

Town of Brookneal Water and Sewer



### Supporting Partners

- Virginia Department of Emergency Management (VDEM)
- CVPDC



### Ease of Implementation

- Locality can complete in-house.
- Requires locality to hire a staff person.
- Requires hiring a technical consultant.

- Minimize utility service disruptions during and after climate-related events.
- Minimize damage at facilities due to climate-related impacts.
- Support continuity of services including operations and maintenance planning and power (back-up generator) at facilities.



### Measures of Success

This Project Implementation Sheet is apart of a Flood Resilience Plan funded by the Virginia Community Flood Preparedness Fund (CFPF) on behalf of the Central Virginia Planning District Commission (CVPDC). For more detailed information please see the complete flood resilience report and its appendices.

65 Action Score



### Action Initiation Timeframe

Short: 0-2 years  
Medium: 3-6 years  
Long: 7+ years

### Cost\*

\$: less than 10k  
\$\$: 10-50k  
\$\$\$: 50-500k  
\$\$\$\$: 500k-2mill  
\$\$\$\$\$: 2 mill+

\*Cost associated with the actions refers to how much it is expected to cost the Town to implement. This does not include costs for ongoing maintenance.



### Action Initiation Timeframe

Short

Medium

Long



### Resilience Considerations

Resilience considerations for vertical infrastructure (facilities, buildings, above-ground assets) will differ from horizontal infrastructure (utility lines, sewer and water mains, sub-surface assets)



### Co-Benefits & Equity Considerations

Considerations for continuity of services should include helping low-income residents keep their utilities on during the winter months or during heat waves if they have difficulty paying utility bills.



### Cost

\$\$\$\$

1. Vulnerability Assessment: 75,000-200,000 (dependent on number of assets)
2. Development of retrofit and adaptation measures: 100,000-200,000 (dependent on number of assets)
3. Design of retrofit or adaptation measures: 175,000-300,000 (dependent on scope of designs)
4. Construction of adaptation measures: 1,000,000-2,000,000 (dependent on extent of construction)



### Possible Funding Sources

VA DCR, Dam Safety and Flood Prevention and Protection Assistance  
Federal Emergency Management Agency



Brookneal, VA



## Campbell County, VA

Campbell County sits at the foothills of the Blue Ridge Mountains and is located within the southern portion of the CVPDC region. This county, which is just over 500 square miles in size, is bounded to the north by the City of Lynchburg, to the east by Appomattox and Charlotte Counties, to the south by Pittsylvania and Halifax Counties, and to the west by Bedford County. Within Campbell County are the Towns of Altavista and Brookneal, which are included as separate sections in the CVPD Flood Resilience Plan. Besides the Blue Ridge Mountain foothills, other notable geographic features of the County include the James River and the Roanoke (Staunton) River.

The most common job sectors worked by residents of Campbell County include Production Occupations, Office and Administrative Support Occupations, and Management Occupations ([source](#)).

## Community and Social Assets

Campbell County, situated in the central part of the state, encompasses a mix of rural and suburban areas. Historically, agriculture has played a significant role in the local economy, but over the years, there has been a gradual shift towards a more diversified economic landscape. The county seat is the town of Rustburg, which serves as a hub for local government and administrative functions. The County has a somewhat diverse demographic profile; with racial makeup: 83.24% White, 14.71% Black or African American, 0.19% Native American, 0.62% Asian, 0.01% Pacific Islander, 0.33% from other races, and 0.90% from two or more race.<sup>37</sup>

## Vulnerable Populations

While resilience is important throughout the County and region, there are several census tracts in Campbell County that qualify as Low to Moderate Income based on 2020 census data. The definition of Low-to-Moderate Income (LMI) means any census tract (or equivalent geographic area defined by the Bureau of the Census) in which at least 50% of households have an income less than 60 percent of the Area Median Gross Income (AMGI), or which has a poverty rate of at least 25%. Campbell County contains multiple LMI census tracts which can be seen in Figure X below. There may also be a significant portion of elderly or mobility limited persons in the County, especially in the more rural area.

As defined in the 2023 CFPF Manual, "Low-income geographic area" means any locality, or community within a locality, that has a median household income that is not greater than 80 percent of the local median household income or any area in the Commonwealth designated as a qualified opportunity zone by the U.S. Secretary of the Treasury via his delegation of authority to the Internal Revenue Service. These areas are eligible to apply for CFPF funding with as little as 10% matching funds.

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<sup>37</sup> 2020 US Census Data

Another factor in measuring vulnerability is the Social Vulnerability Index. SVI indicates the relative vulnerability of every U.S. Census tract. Census tracts are subdivisions of counties for which the Census collects statistical data. SVI ranks the tracts on 15 social factors, including unemployment, minority status, and disability, and further groups them into four related themes. Thus, each tract receives a ranking for each Census variable and for each of the four themes, as well as an overall ranking. Projects and studies in areas with a higher SVI will receive prioritized rankings for CFPF funding. See Appendix E for more information on the Social Vulnerability Index and other information related to vulnerable communities.

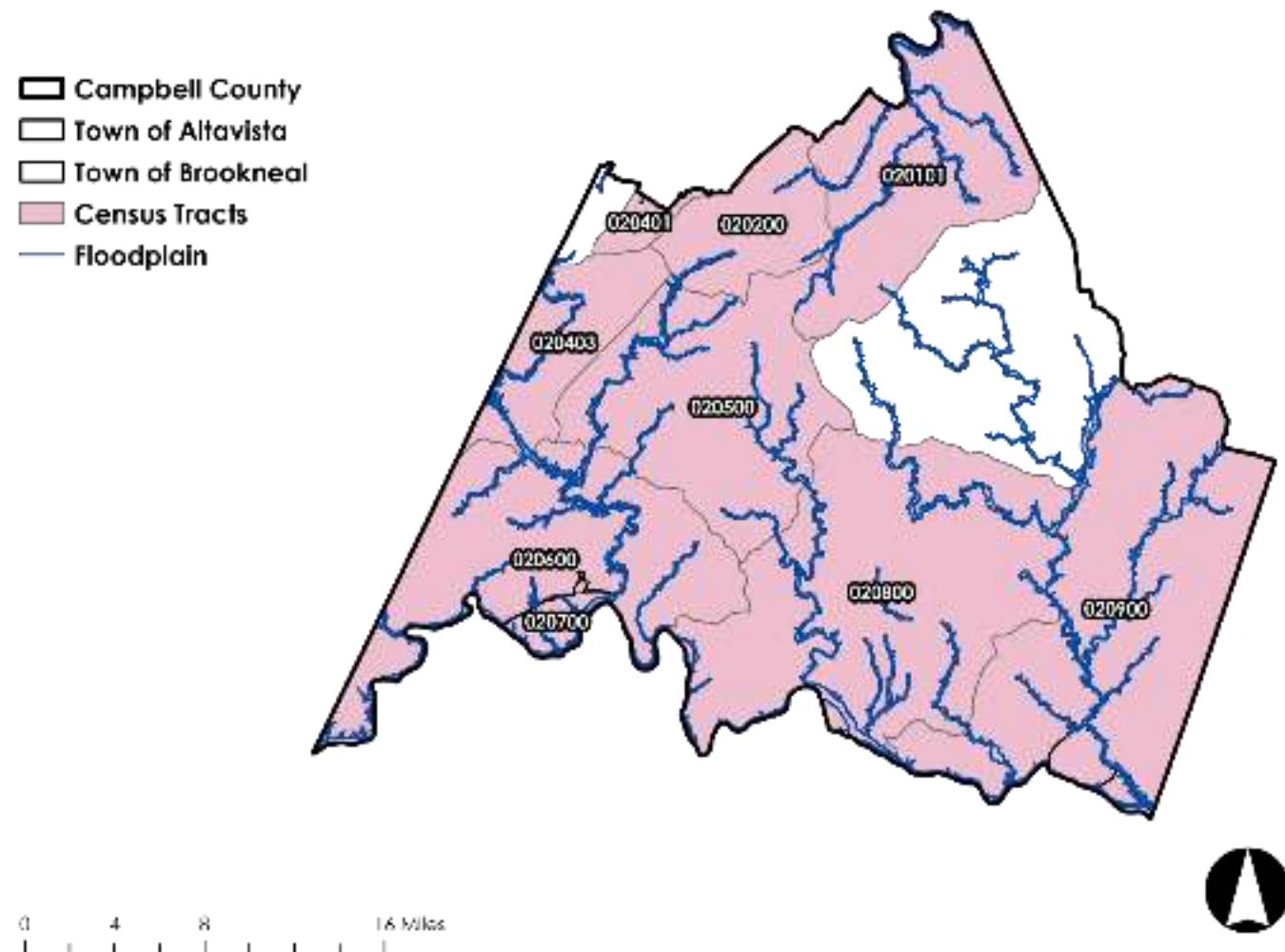


Figure 68. Census tracts with designated income levels at or below 80% of Area Median Income Levels (2020 US Census Data)

## Natural Assets

### Conservation Lands

Campbell County is home to several conservation and park areas that showcase the region's environmental diversity and offer a variety of outdoor experiences. English Park is situated along the Roanoke River within the Town of Altavista and includes roughly 160 acres of protected and public space. Other notable parks and protected lands include the Abbott Duncan Recreation Fields, Countywide Park, Long Island Park, Long Mountain Park, S.R. Bryant Memorial Greenway, and Timbrook Park. These conservation efforts reflect Campbell County's commitment to maintaining a delicate balance between recreation, education, and environmental preservation.

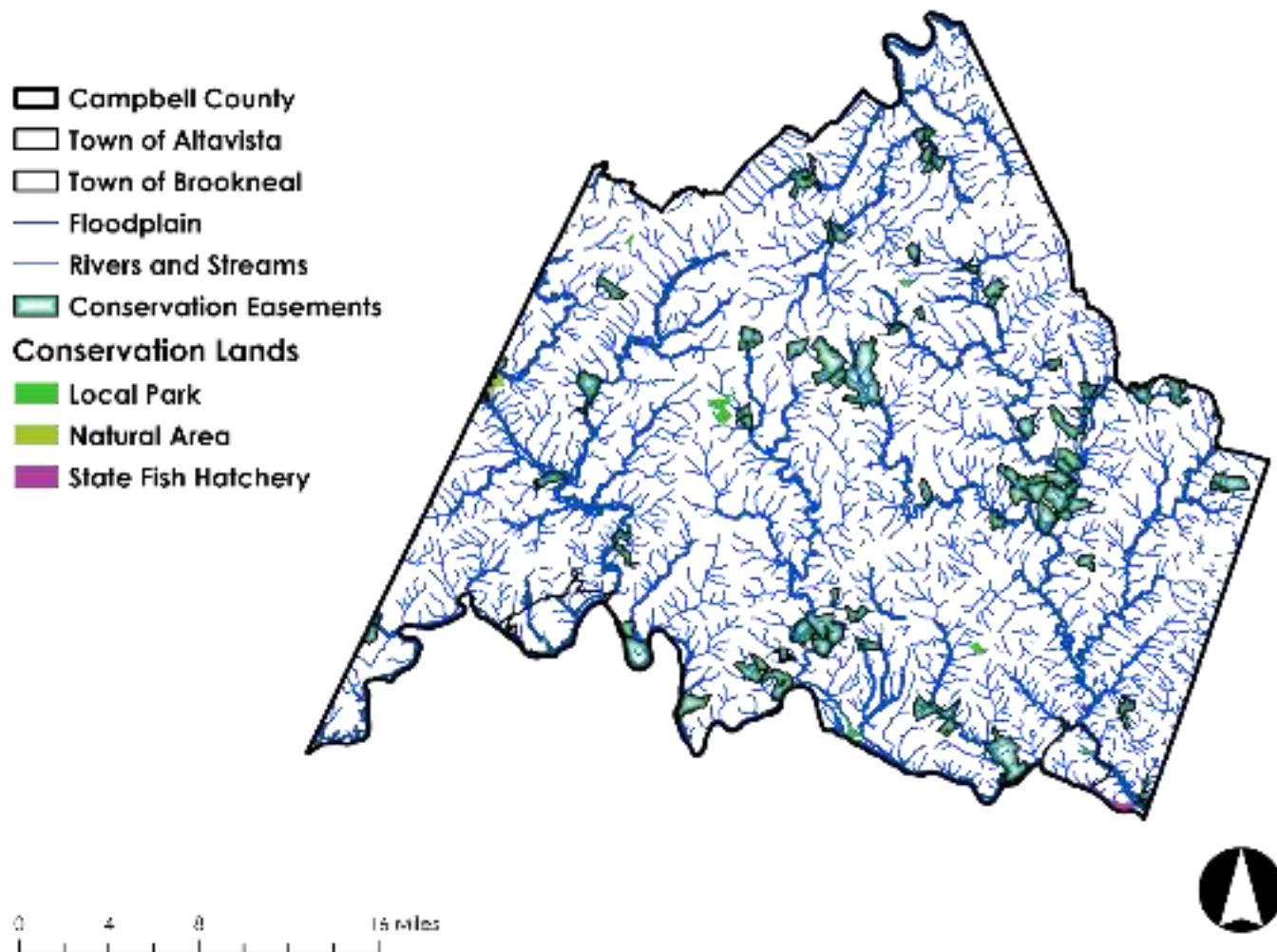


Figure 69 Conservation Lands overlaid on the regulatory floodplain, and intermittent streams, VADCR Natural Areas Inventory.

## Ecological Cores

Ecological cores are patches of natural land with at least 100 acres of interior cover which provide habitat for a large variety of species, including forest, marsh, and maritime dependent species. The Virginia Natural Landscape Assessment (VaNLA) provides an analysis that has identified, prioritized, and linked, using satellite data, the important land networks throughout Virginia. Preserving and maintaining these landscapes can help ensure they continue to provide ecosystem services such as cleaner air and water filtration. Ecological cores can also provide recreational opportunities and open space resources. The following map shows which areas of the counties and cities within Campbell County contain ecological cores. A higher rating (with red being the highest) indicates the amount of ecosystem services that ecological core provides. Examples of ecosystem services that cores provide include wildlife and plant habitat, biodiversity conservation, water resource protection, erosion control, and carbon sequestration. Campbell County should have strategies to preserve ecological cores, such as using them as park lands for low-impact recreation (hiking, bird watching, etc.) and other conservation efforts. These areas have been overlaid on the Campbell County floodplain to understand where conservation lands may also offer flood reduction benefits. The acquisition of these areas should be a priority for flood reduction.

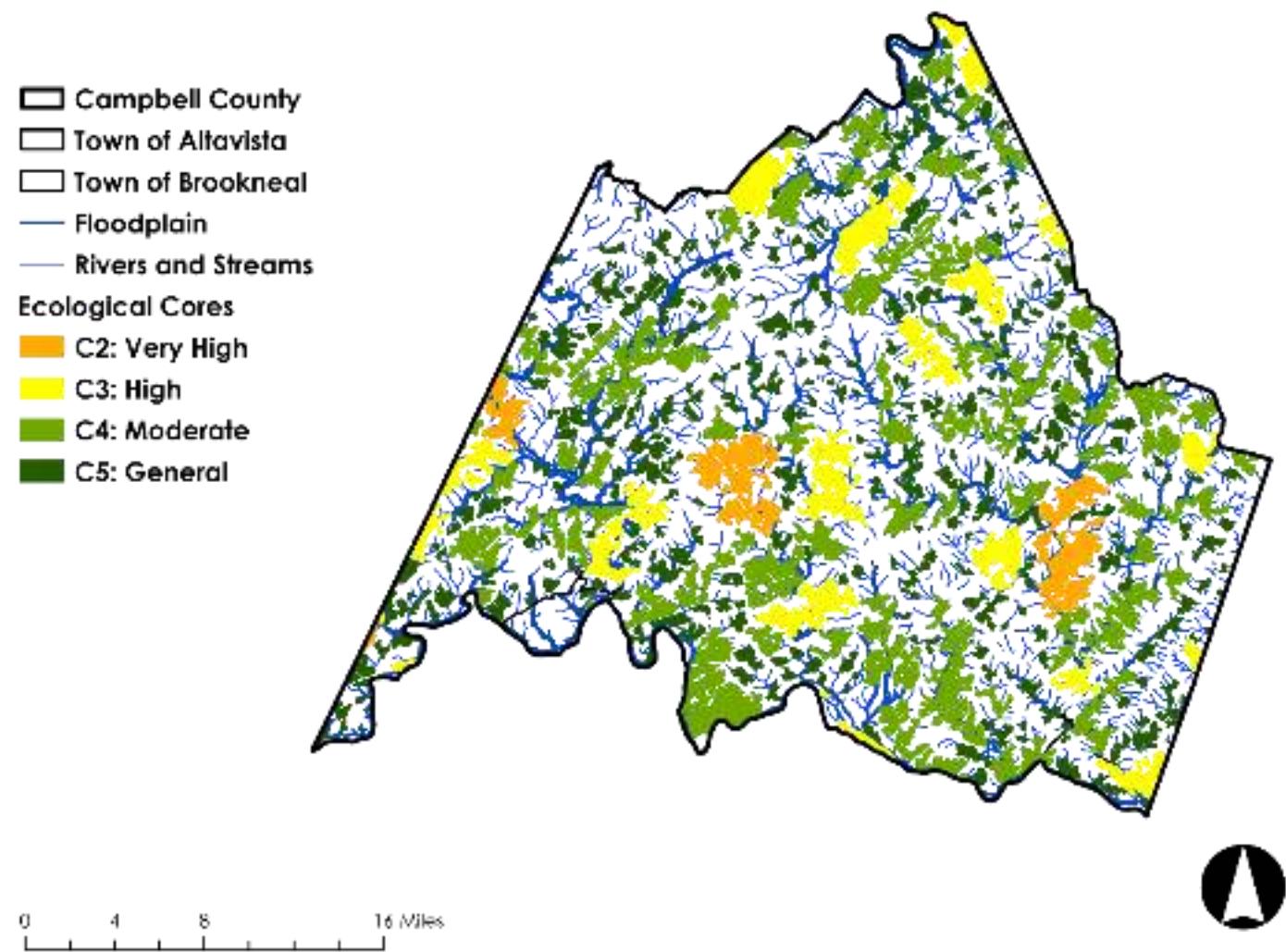


Figure 70 Ecological Cores overlaid on the regulatory floodplain, and intermittent streams, VADCR Natural Areas Inventory.

## Flooding and Built Assets - Critical Facilities and Infrastructure

Critical facilities encompass a range of infrastructure components that are essential for the functioning of a society, economy, or community. These facilities are vital for maintaining public health, safety, and well-being. Some types of infrastructure that occur in Campbell County and are commonly considered critical include energy Infrastructure, transportation Infrastructure, water, and wastewater Infrastructure, hospitals and healthcare facilities, police stations, fire stations, and emergency response centers. The 2020 CVPDC Hazard Mitigation Plan Section 4.3 Flooding, contains a thorough evaluation of FEMA floodplains, critical infrastructure, roads, and bridges in the floodplain for each locality in the CVPDC region. For specific lists, maps, and related information for Campbell County, see *Appendix B, 2020 CVPDC HMP Maps and Data*.

Building on the information generated, and through locality interviews, there are numerous critical pieces of infrastructure that are in the floodplain and therefore susceptible to flooding. The following critical facilities are located in the floodplain and were specifically mentioned in the 2020 CVPDC HMP

Facility Name	Address	Facility Type	Coordinates	Flood Zone
Leesville Hydro Plant	Rt. 754, Hurt	Energy Facility	37.0931, -79.4022	1%; 0.2%
Lynchburg Casting Industries	1132 Mt Athos Rd, Lynchburg	HazMat Facility	37.4027, -79.0595	1%
Harpers Mill	General Location, Brookneal	Historic Site	37.0436, -78.9599	1%; 0.2%
Six Mile Bridge	Mount Athos Rd & James River, Lynchburg	Historic Site	37.3932, -79.0612	1%; 0.2%
Campbell Co Util And Serv Auth/Sewer Pump Station	9625 Leesville Rd, Evington	Sewer Pump Station		1%; 0.2%
Flat Creek Pump Station	13238 Wards Rd N, Lynchburg	Sewer Pump Station	37.3096, -79.1831	1%; 0.2%

Table 14 Critical facility and infrastructure in the floodplain of Campbell County (2020 CVPDC HMP)

The Campbell County Utility and Service Authority and Flat Creek Pump Station were specially mentioned in community interviews. According to the locality staff, the most critical piece of infrastructure located in the floodplain, the Campbell County Utility and Service Authority Plant (Rustburg Wastewater Treatment Plant), is the most vulnerable to flood events. The plant is associated with several retention ponds which lie in close proximity to the creek. During intense rainfall, the creek will overflow its banks, fill the ponds, and potentially contaminate the creek, and cause excess water treatment. This is also the main plant operated in the County and serves the entire village of Rustburg.

Transportation infrastructure is composed of Virginia Department of Transportation managed roads and bridges, a major railroad traversing North/South, and the Lynchburg International Airport. The 2020 HMP contains a thorough list of roads and bridges most susceptible to flooding. *For a complete list of roads and bridges most susceptible to flooding see CVPDC Hazard Mitigation Plan 2020 Update Flooding; Page 4-39 – 3-40.* Stormwater infrastructure maintenance and repair should be a priority for these roads and can be prioritized for future funding and coordination with the Virginia Department of Transportation. The map below illustrates real time data from the Virginia Department of Transportation. on the condition of bridges and culverts. Overlaid on the floodplain, rivers and streams, Campbell County, CVPDC and VDOT can work together to upgrade the “Poor” infrastructure first to avoid flood related damages and impacts to the surrounding areas.

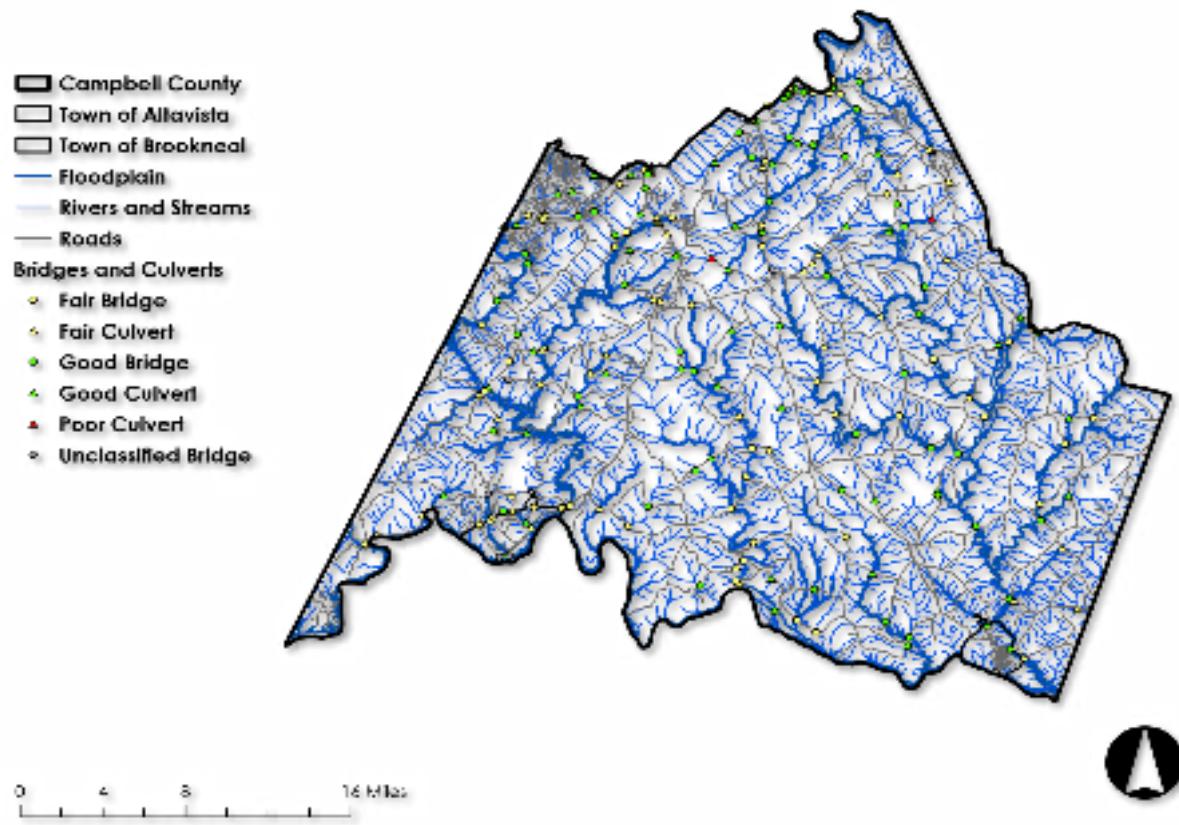


Figure 71 Bridge and culvert condition assessment (VADOT) as of March 2024

Top Poor Rated Bridges	Top Poor Rated Culverts
N/A	SC-622E/W and Depot Road
	SC-658N/S and Toll Gate Road

Table 15 Top Poor Rated Culverts in Campbell County

Campbell County is generally affected most by precipitation that results in streams and rivers overtopping banks (riverine flooding) and rainfall events that leave standing water in areas that are dangerous. The map above illustrates where standing water is a problem and has resulted in a motor vehicle accident. Upgrading roads and stormwater infrastructure should be prioritized in these areas to prevent further accidents.

## Flooding and Related Hazards

### Areas of Known Flooding

Repetitive loss properties and severe repetitive loss properties are important to understand as part of a community's overall flood resilience. As stated in the HMP, "*The identification of repetitive loss properties is an important element to conducting a local flood risk assessment, as the inherent characteristics of properties with multiple flood losses strongly suggest that they will be threatened by continual losses. Repetitive loss properties are also important to the NFIP, since structures that flood frequently put a strain on the National Flood Insurance Fund.*"<sup>38</sup> Campbell County unincorporated does not have any repetitive

loss properties as they are identified in the Town of Altavista.

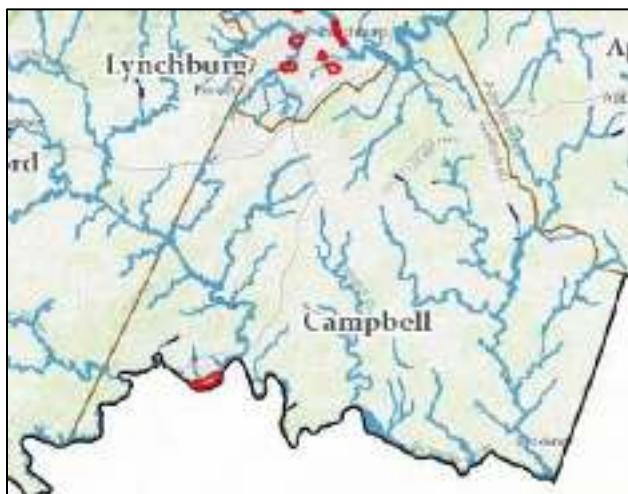


Figure 72 Campbell County repetitive loss areas (2020 CVPDC HMP)

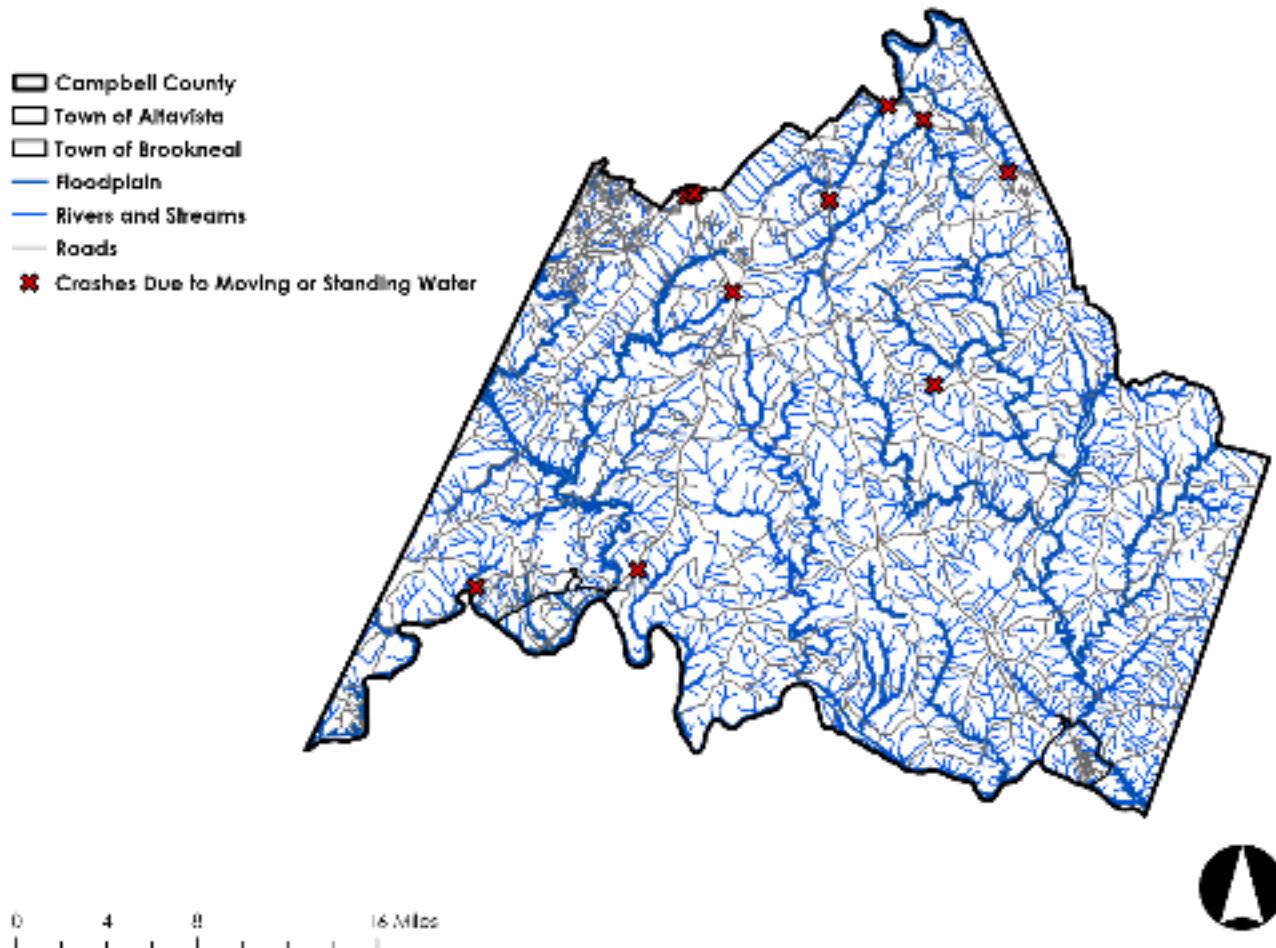
landscape.

This flood resilience plan builds on the flood risk assessment performed in the CVPDC HMP update and adds more localized information mainly heard through community interviews and available public data sets. Flooding is most often associated with storm events that bring large amounts of rainfall to the area, swelling rivers and tributaries beyond their banks. Topographical features, soils, and development patterns also play a part in flooding; and the interaction between these geophysical elements can affect how water moves through the

Figure 73 (below) represents vehicle crashes due to standing water on roadways reported from VDOT. Figure 74 combines this crash data with information received through community interviews about known

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<sup>38</sup> The 2020 CVPDC Hazard Mitigation Plan Update



locations of flooding in the community. Specifically, there are areas off Waterlick Road in the neighborhood containing Brooklawn Drive and Woodlawn Circle, that flood frequently. The increased development in this area is changing watershed parameters and could cause more severe flooding in the future <sup>39</sup>. Further studies can be initiated in the area to understand the underlying hydrology and identify potential solutions to recurrent flooding.

*Figure 73 Vehicle crashes on roadways with standing water, VDOT as of March 2024*

<sup>39</sup> FEMA, 2019

5 Most Recent Crashes Due to Standing Water	Roads or Location	Date
1	Route 460	12/17/2015
2	Route 460	10/11/2018
3	Route 43	11/15/2018
4	Route 460 Richmond Highway	4/13/2020
5	Route 29	8/10/2021

Table 16 Most recent vehicle crashed due to standing water, VDOT, April 2024

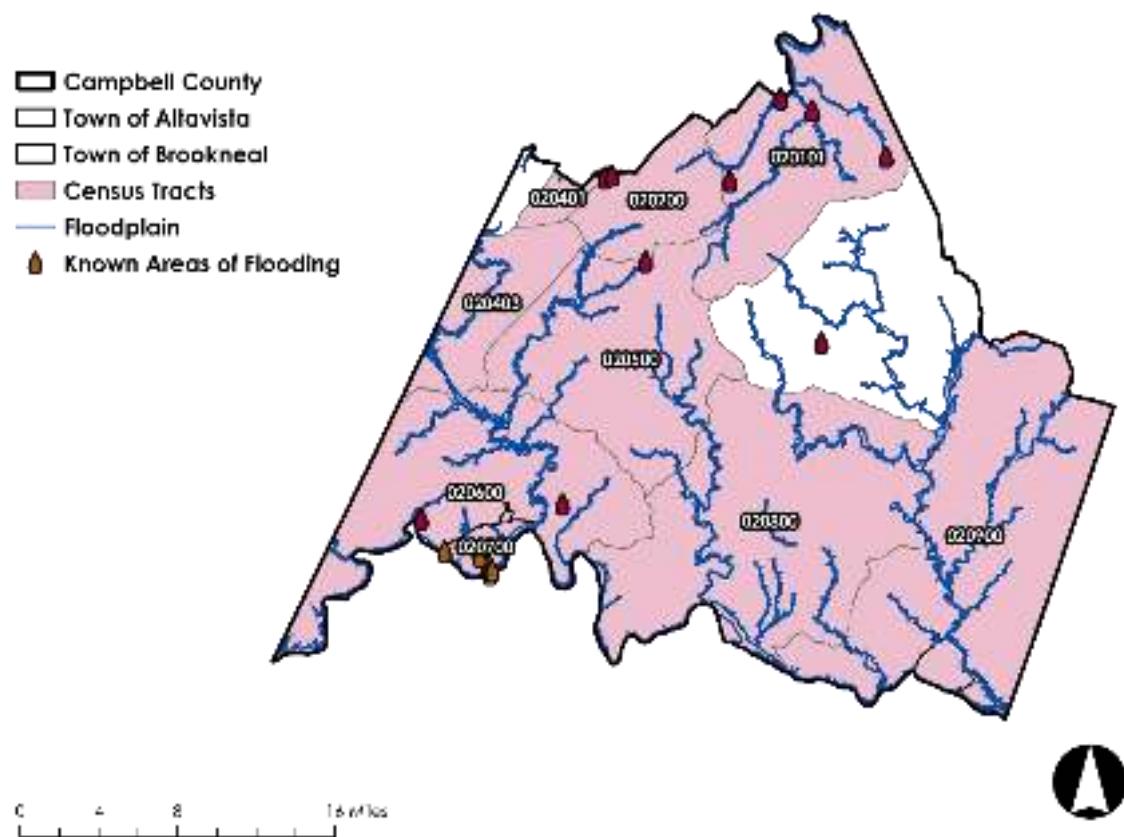


Figure 74 Areas of known flooding as heard through community interviews, March 2024. overlaid on Low to Moderate Income census tracts, Census data 2020.

## Dam Inundation

The largest concern with the dams in Campbell County (34 total, with 3 classified as high or high-special hazard potential and 22 unknown) are the homes, businesses, important thoroughfares and other transportation assets, and critical infrastructure assets in the Dam Break Inundation Zone (DBIZ). These include potential impacts to several historic sites, water treatment plants with associated pump stations in the county's incorporated area, nuclear facility property in dam breach maximum inundation area, several residences and businesses within the maximum inundation area, and many roads and road-stream crossings such as bridges and culverts. Many of the County's assets are located in the Town of Altavista and the Town of Brookneal. While these are discussed in more detail in those sections associated with the Towns, it is relevant to include them here. Potential impacts include the Altavista Power Station, Altavista Fire Company, Altavista Area YMCA Family Center, Altavista Wastewater Plant, the Altavista Power Station, and several hazmat facilities. In the Town of Brookneal, potential impacts include two historical sites, a communications facility, and water treatment plants with associated pump stations. Some of these facilities are listed in the table below.<sup>40</sup>

Facility Name	Facility Type	Address	Coordinates	Floodplain	Inundation Zone
Avoca Museum	Attractions	1514 Main St, Altavista	37.1300, -79.2697	No	Smith Mountain Dam
WODI - AM - The Rain Broadcasting, Inc.	Communication Facility	1230 Radio Road Brookneal, VA 24528	37.0384, -78.9420	1%, 0.2%	Smith Mountain Dam
Altavista Power Station	Energy Facility	104 Wood Lane, Altavista	37.1188, -79.2735	No	Smith Mountain Dam
Leesville Hydro Plant	Energy Facility	Rt. 754, Hurt	37.0931, -79.4022	1%, 0.2%	Smith Mountain Dam
Altavista Fire Company	Fire Stations	1280 Main Street, Altavista	37.1199, -79.2755	No	Smith Mountain Dam
Lane Home Furnishings	HazMat Facility	701 5Th St, Altavista	37.1097, -79.2855	1%, 0.2%	Smith Mountain Dam
Abbott Laboratories - Ross Products Division	HazMat Facility	1516 Main St, Altavista	37.1333, -79.2658	No	Smith Mountain Dam
BGF Industries	HazMat Facility	401 Amherst Avenue, Altavista	37.1122, -79.2782	1%, 0.2%	Smith Mountain Dam

<sup>40</sup> Source: CVPDC 2020 HMP

Dominion - Altavista Power Station	HazMat Facility	104 Wood Lane, Altavista	37.1187, -79.2734	No	Smith Mountain Dam
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Table 17 Critical facilities in the floodplain of Campbell County, VA, CVPDC 2020 HMP

The DBIZs are mapped for the high-hazard dams: New Camp Hydaway Dam, the Otter River Dam, and the Timberlake Dam. It is unknown whether significant vulnerable and minority populations would be affected by dam spillovers in Campbell County, but many critical roads would need to be closed or might be washed away entirely, impeding travel and egress. The map of dams of known and unknown hazard potential are shown in the map below.

Importantly, the New Camp Hydaway Dam is now operational. During the development of this resilience plan, in August 2023, the Timberlake Dam went into stage 2 and was flowing at 24" above the dam for approximately 24 hours. At 16" above dam level, VDOT closes Route 460, rerouting must then occur which has impacts on the community. There are other relevant downstream issues related to the Timberlake Dam that need to be addressed and coordinated. Some of them are:

- Sediment flows into Timberlake via the 460 Timberlake Rd Interchange;
- Clogging and failure of stormwater infrastructure; especially the box culvert under Old Plantation Road;
- Streambank erosion downstream from the 460 Timberlake Road interchange, taking down trees and adding sediment loads in the stream and also to Timberlake.

**On the ground projects that address ongoing flooding, erosion and sedimentation issues near Timberlake and the 460 interchange need to be identified and funded for construction.**

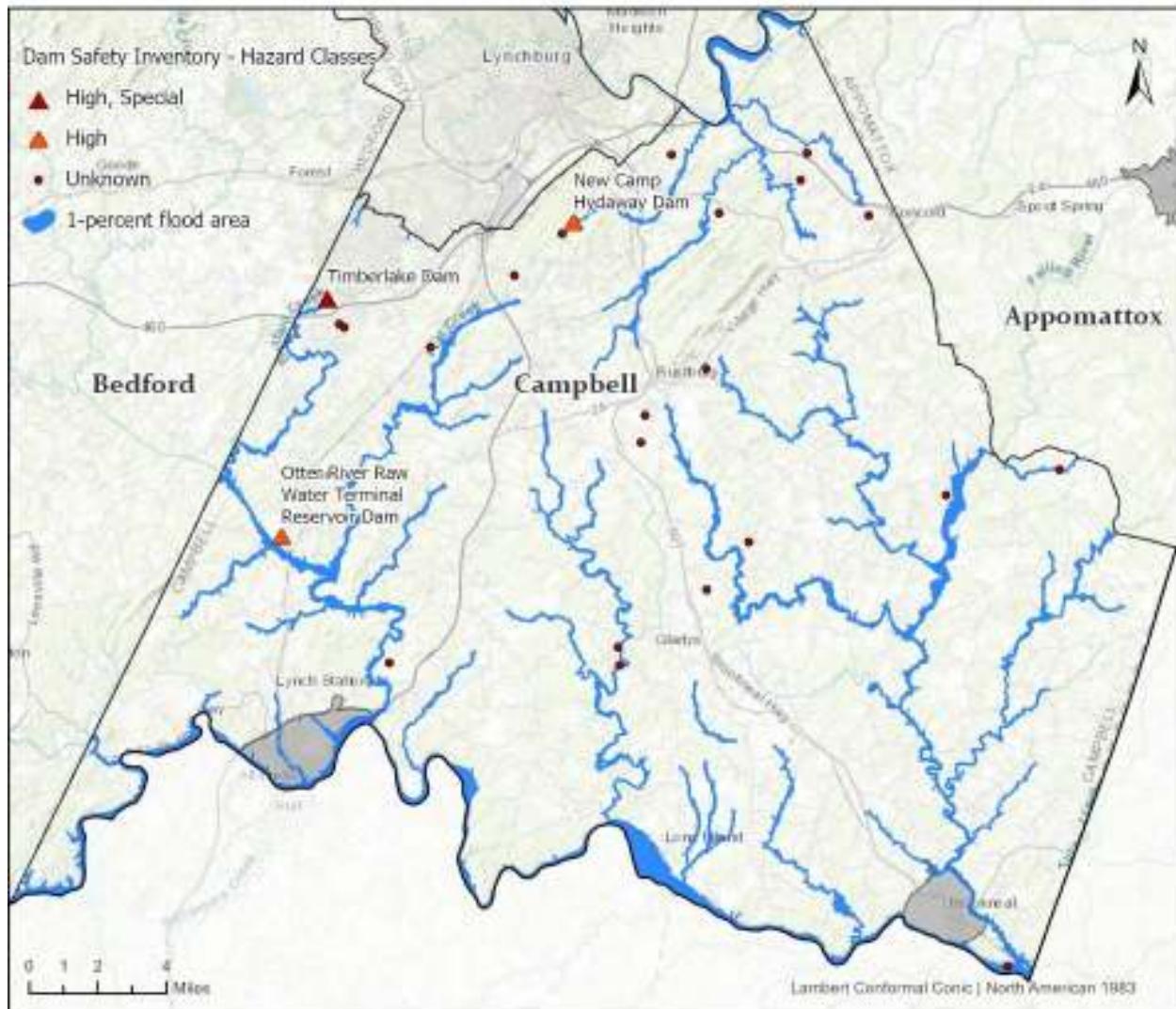


Figure 75 High and Unknown Hazard Dams in Campbell County, VA Dam Safety Inventory System, Va Tech Center for Geospatial Information Technology 2/2020

For a more thorough evaluation of the impacted geographies, structures, and critical assets in the Campbell County, and for the dam inundation zone maps for the referenced dams, refer to pp. 4-158 – 4-167 of the Central Virginia PDC 2020 Hazard Mitigation Plan Update.

## Extreme Heat

Using an existing weather station at the Lynchburg Regional Airport (LYNCHBURG REG AP), it is possible to view observed temperature averages from 1950 – 2013 for the area. In the graph below, the horizontal line from which the bars extend up or down is the average observed temperature from 1961-

1990. Years when bars extend above the line were higher than the long-term average; years with bars that extend below the line were lower than average. While the range of exceedance events is variable, you can see a trend, especially from the year 2000 onwards, where average temperatures clearly exceeded the average.

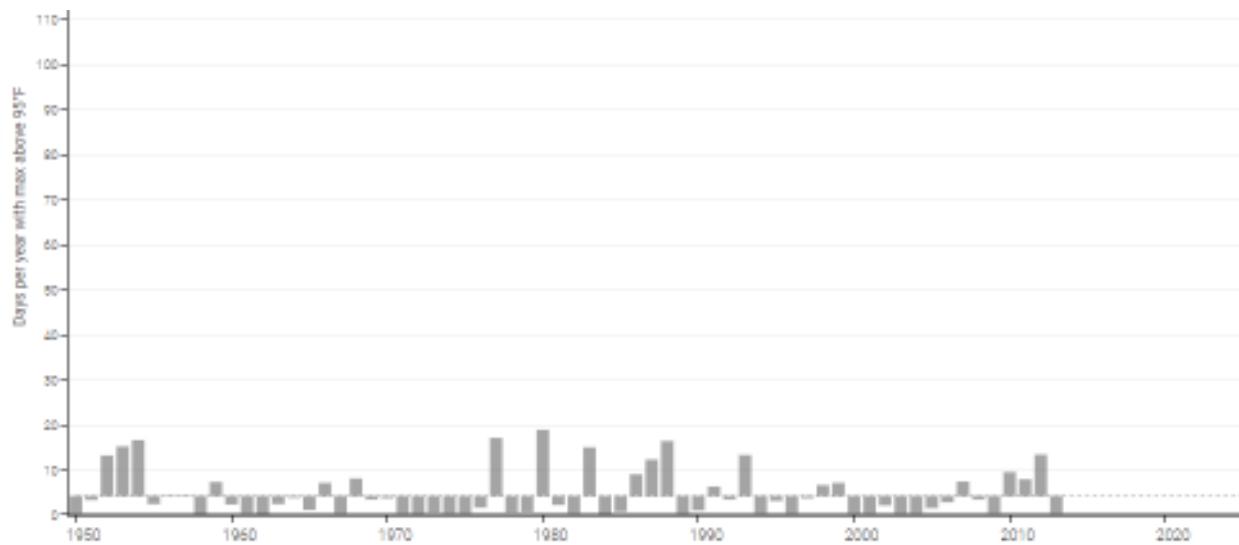


Figure 76 Days per year with temperature > 95 degree F observed average 1950-2013, US National Climate Toolkit

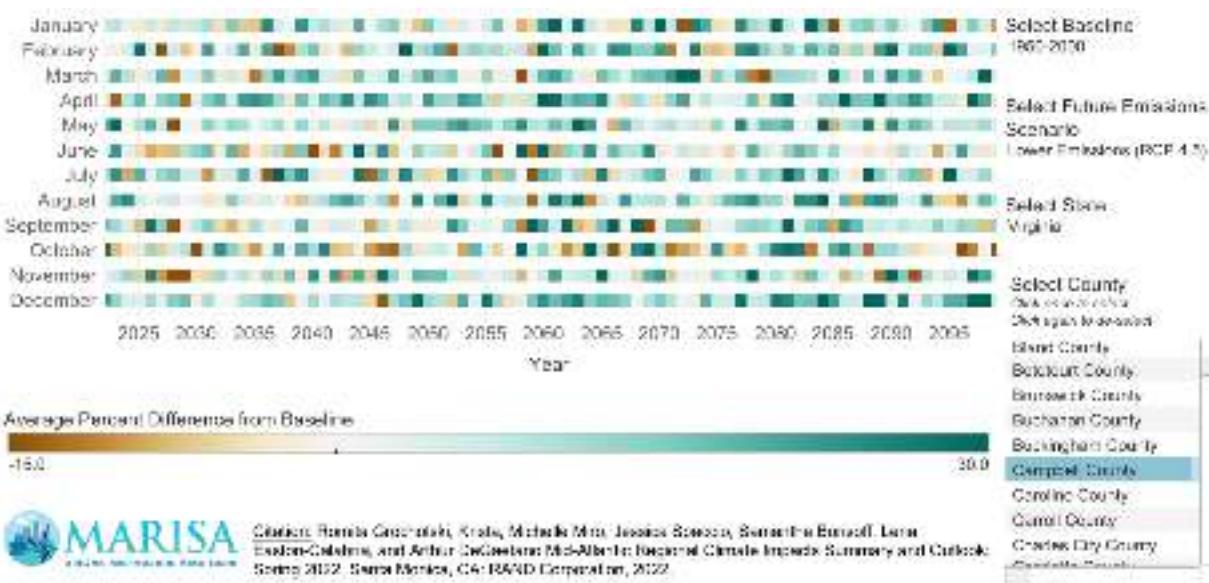
## Future Community Conditions

### Flood

The potential risks of climate change can have broad effects on communities in Community, including on its public health, infrastructure, agriculture, tourism, and emergency services. Campbell County (and the CVPDC region in general) should expect the following in the future:

- More frequent, and more intense, precipitation events punctuated by deeper episodes of drought.
- Drier winter and summer seasons, which could deplete reservoirs and challenge drinking water supplies and agricultural production.
- Stronger storms at a greater frequency, which may threaten lives, damage infrastructure, and cause significant power outages.
- Increasing summer heat waves, which could threaten public health.

According to the NOAA Mid-Atlantic RISA projections,<sup>41</sup> Campbell County can expect to see some more extreme variability in precipitation over the next 50 years, with some months seeing 15% less and some months seeing up to 40% more compared to the average from the years 1950-2000. In general, the entire Appalachian and Piedmont regions can expect mild 1-2% average increases in rainfall compared to the past 30 years' average.<sup>42</sup> While it is difficult to know exactly how the County will be impacted, it is strongly encouraged to build in redundancy and extra capacity for stormwater and other water infrastructure to account for higher precipitation scenarios.



*Figure 77 Projected changes in monthly precipitation compared to 1991-2020 Baseline, MARISA*

<sup>41</sup>Mid Atlantic Regional Integrated Science Assessment, <https://www.midatlanticrisa.org/data-tools/climate-data-tools/projected-changes-in-total-monthly-precipitation.html>

<sup>42</sup> Mid Atlantic Regional Integrated Science Assessment, <https://www.midatlanticrisa.org/data-tools/climate-data-tools/difference-from-normal-total-annual-precipitation.html>

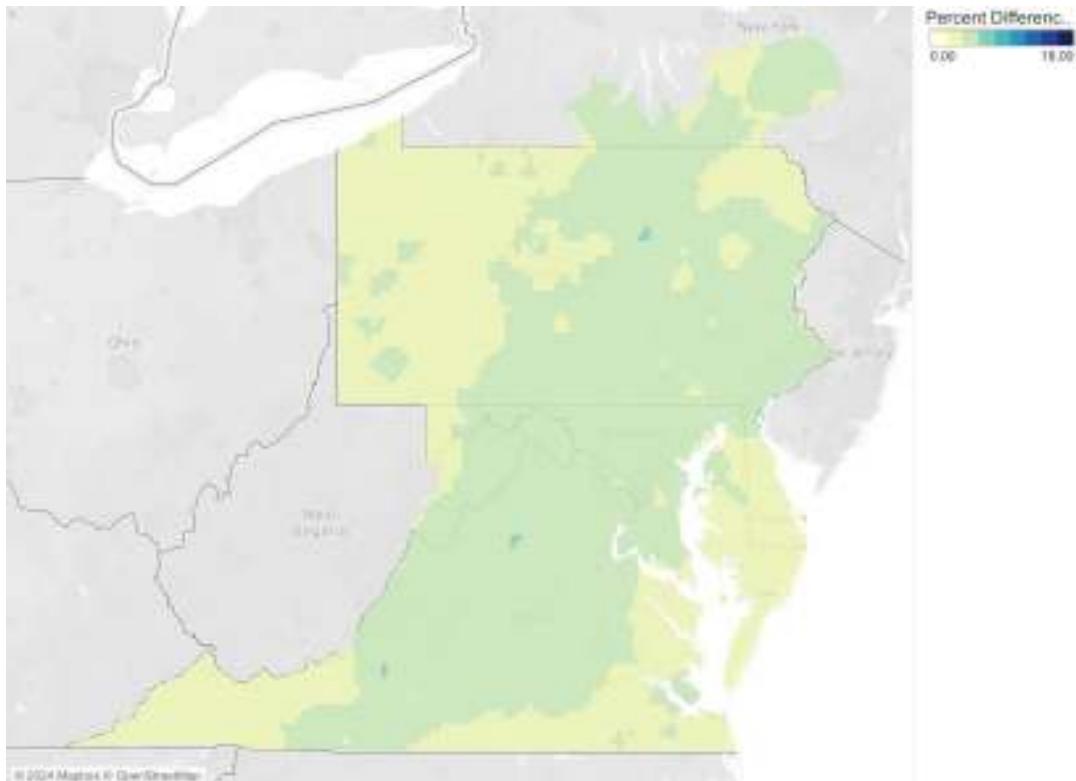


Figure 78 Projected percent difference in total monthly precipitation compared to 1991-2020 Baseline, MARISA

## Heat

In Campbell County the average daily temperature is expected to increase, as well as extreme temperatures on the hottest days of the year. This excess heat for longer periods may stress critical infrastructure such as roads and bridges. More hot days may also stress the electrical grid and the use of potable water may increase as people may need more irrigation for crops and landscaping. This type of heat may affect public health and may lead to economic impacts through disruptions in agriculture and manufacturing. Human health, stream and river health, and infrastructure are all threatened by higher temperatures.

At 95°F, it is hard to keep indoor areas and our bodies cool. Campbell County's summers are getting hotter. On average, Campbell County sees 4 days per year in excess of 95°F (observed average). Within the next 50 years (by 2070), Campbell County can expect a yearly average of 30 to 54 days above 95°F, with associated increases in cooling costs, reduced air quality, and heat-related illnesses. It is imperative that the County begin planning for more days of extreme heat and look for ways to lessen the public health effects, especially on vulnerable populations.

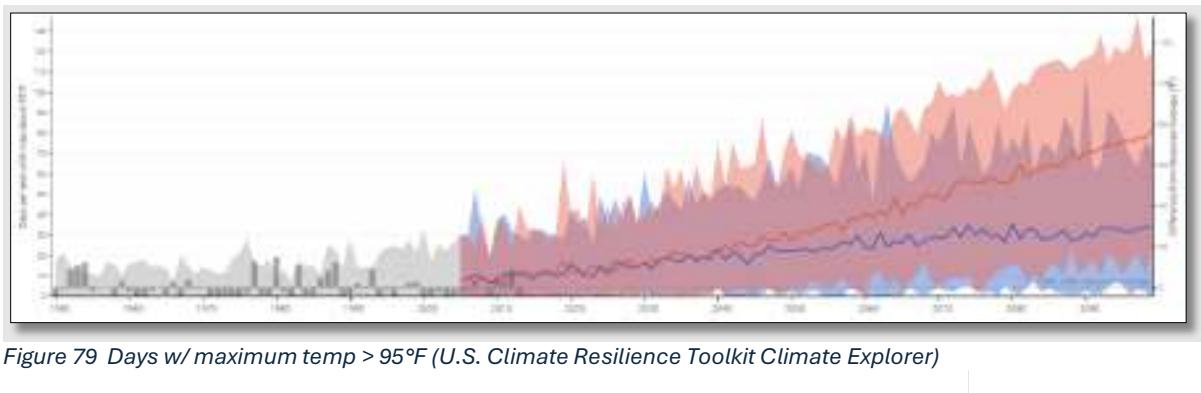


Figure 79 Days w/ maximum temp > 95°F (U.S. Climate Resilience Toolkit Climate Explorer)

## Recommended General Flood and Heat Resilience Policies and Actions

1. Prioritize vacant tracts of land for conservation and recreational open space in floodplains and apply for grant funding to acquire these properties or work with partners who can acquire them; (See Appendix A for more detail on grant funding);
2. Incentivize and/or develop stormwater regulations and the use of green infrastructure in residential areas;
3. Work with VDOT, CVPDC and others to develop a debris management strategy for the county;
4. Work with VDOT and CVPDC to identify stormwater infrastructure priorities on state roads; and
5. Develop targeted outreach before and during the summer months to inform the public of anticipated heat waves and ways to stay safe.
6. Seek opportunities to reduce sedimentation into the Timberlake Dam and reduce flood impacts secure safety and access onto Route 460 as well as Old Plantation Rd.

## Prioritized Flood Resilience Strategy

- ❖ Assess the vulnerability of critical assets, facilities, and private property in the high hazard dam inundation area. Determine needed improvements and adaptations to make these assets more resilient to flooding and in the case of dam overtopping. (Score 70)

*For a full explanation of the Prioritized Resilience Strategy Matrix, see Page 36, Prioritizing Resilience Projects. For the full suite of resilience strategies and rankings by locality, see Appendix A.*

# Campbell County

70 Action Score

## Vulnerability Assessment and Adaptation Measures



### Action Description

Assess the vulnerability of critical assets, facilities, and private property in the high hazard dam inundation area and known areas of impact that may be in proximity. Determine needed improvements and adaptations to make these assets more resilient to flooding and in the case of dam overtopping.

1. Conduct a local-level vulnerability assessment of properties and assets in the high hazard dam inundation area.
2. Determine priority assets or properties to adapt to potential flood impacts.
3. Conduct outreach to key stakeholders
4. Construct and implement adaptation measures.



### Key Steps for Implementation



### Action Lead

Multi-Departmental



### Supporting Partners

- Virginia Department of Emergency Management (VDEM)
- CVPDC



### Ease of Implementation

- Locality can complete in-house.
- Requires locality to hire a staff person.
- Requires hiring a technical consultant.



### Measures of Success

- Minimize utility service disruptions during and after climate-related events.
- Minimize damage to private properties and facilities due to climate-related impacts and dam inundation.
- Help protect lives and livelihoods by mitigating flood impacts.

This Project Implementation Sheet is apart of a Flood Resilience Plan funded by the Virginia Community Flood Preparedness Fund (CFFP) on behalf of the Central Virginia Planning District Commission (CVPDC). For more detailed information please see the complete flood resilience report and its appendices.



### Action Initiation Timeframe

Short: 0-2 years  
Medium: 3-6 years  
Long: 7+ years

### Cost\*

\$: less than 10k  
\$\$: 10-50k  
\$\$\$: 50-500k  
\$\$\$\$: 500k-2mill  
\$\$\$\$\$: 2 mill+

\*Cost associated with the actions refers to how much it is expected to cost the Town to implement. This does not include costs for



### Action Initiation Timeframe

Short

Medium

Long



### Resilience Considerations

Resilience considerations for vertical infrastructure (facilities, buildings, above-ground assets) will differ from horizontal infrastructure (utility lines, sewer and water mains, sub-surface assets)  
Actions should not be limited to adaptation strategies but also include emergency response protocols and communication warning systems if the chance of inundation is high.



### Co-Benefits & Equity Considerations

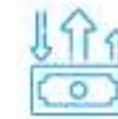
Residents should be engaged throughout the vulnerability assessment and during the identification of potential actions. Residents concerns and life safety is paramount.



### Cost

\$\$\$\$\$

1. Vulnerability Assessment: 75,000-200,000 (dependent on number of assets)
2. Development of retrofit and adaptation measures: 100,000-200,000 (dependent on number of assets)
3. Design of retrofit or adaptation measures: 175,000-300,000 (dependent on scope of designs)
4. Construction of adaptation measures: 1,000,000-2,000,000 (dependent on extent of construction)



### Possible Funding Sources

Virginia Department of Emergency Management  
Federal Emergency Management Agency



Campbell County, VA

# City of Lynchburg, VA

The City of Lynchburg, which is recognized as an independent city in the Commonwealth of Virginia, is located in the middle of the CVPDC region. Lynchburg is home to nearly 80,000 residents and is just under 50 square miles in size. Lynchburg is a riverfront community located on the James River and is bounded to the northeast by Amherst County, to the southeast by Campbell County, and to the west by Bedford County. Lynchburg is positioned 115 miles west of Richmond, the state capital; 52 miles east of Roanoke; 180 miles southwest of Washington, D.C.; and 200 miles west of the Port of Hampton Roads. Home to Liberty University, a private coeducational Christian institution, the university hosts over 7,000 residential students and a substantial number engaged in distance learning. Established in 1971, the university spans 4,400 acres nestled in the foothills of the Blue Ridge Mountains and south of the James River. The city is also home to the University of Lynchburg, Randolph College, and Virginia University of Lynchburg, making the city well-known across the state as an educational hub.

## Community Background and Social Assets

Lynchburg, Virginia, is home to a diverse population, comprising a mix of students, professionals, and long-time residents. The presence of two prominent universities, Liberty University, and the University of Lynchburg, contributes to a significant student population, infusing the city with youthful energy and cultural diversity. Beyond the academic community, Lynchburg attracts professionals from various fields, thanks to its growing job market and business opportunities. The City also hosts a community of long-time residents who take pride in the area's history and traditions, contributing to a sense of continuity and stability. Additionally, Lynchburg is known for its welcoming atmosphere, making it a popular choice for families looking for a friendly and supportive community to raise children. This blend of students, professionals, and long-standing residents creates a unique and vibrant tapestry that defines Lynchburg's community spirit. The City's African American community, in particular, has played a vital role in shaping its cultural landscape, contributing to the vibrant set of traditions, arts, and history. Lynchburg has witnessed efforts to promote inclusivity and celebrate diversity, with various cultural events, festivals, and organizations fostering connections among different ethnic and racial groups. Additionally, the city's Hispanic and Latino population has been growing, adding to the cultural richness of Lynchburg.

## Vulnerable Populations

Lynchburg, like many communities, has its share of disadvantaged populations facing economic challenges and social disparities. While resilience to flood and heat events is important throughout the City, there are several areas that qualify as Low to Moderate Income based on 2020 census data. Moreover, as defined in the 2023 CFPF Manual, "Low-income geographic area" means any locality, or community within a locality, that has a median household income that is not greater than 80 percent of the local median household income or any area in the Commonwealth designated as a qualified opportunity zone by the U.S. Secretary of the Treasury via his delegation of authority to the Internal Revenue Service.

These areas are eligible to apply for CFPF funding with as little as 10% matching funds. The City of Lynchburg contains multiple Low-income geographic areas via census tracts which can be seen in Figure 1 below.

Another factor in measuring vulnerability is the Social Vulnerability Index. SVI indicates the relative vulnerability of every U.S. Census tract. Census tracts are subdivisions of counties for which the Census collects statistical data. SVI ranks the tracts on 15 social factors, including unemployment, minority status, and disability, and further groups them into four related themes. Thus, each tract receives a ranking for each Census variable and for each of the four themes, as well as an overall ranking. Please see Appendix E for more information on vulnerable populations, including SVI data.

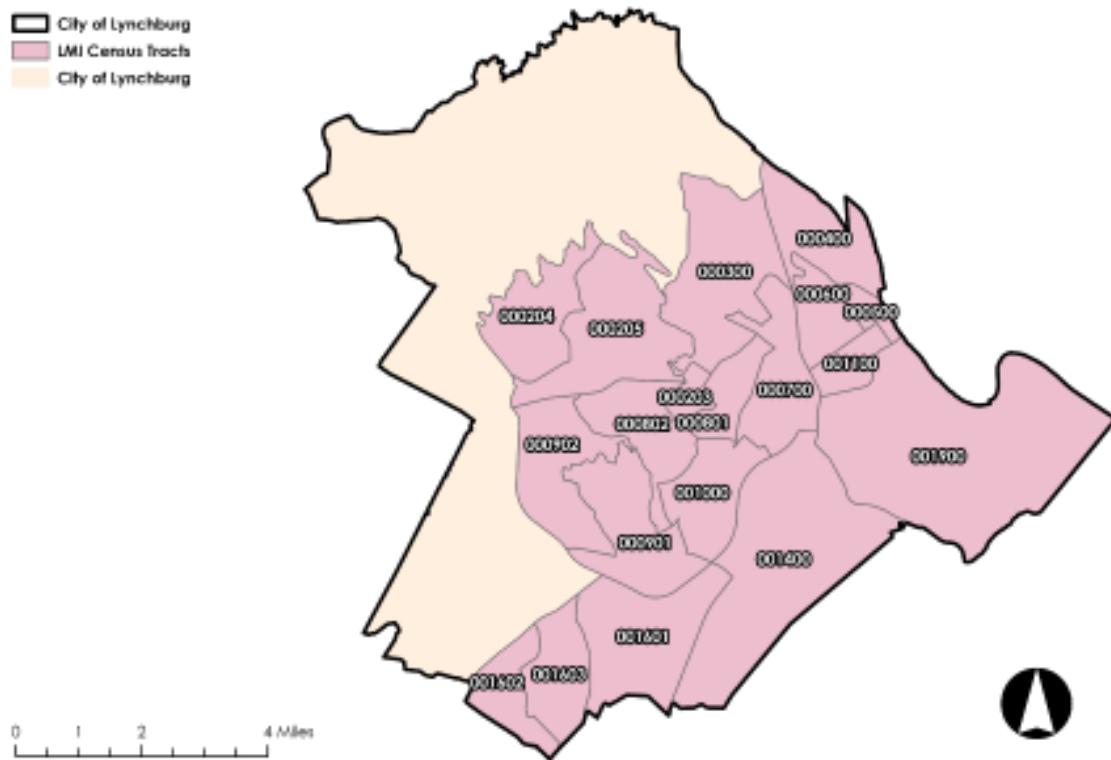
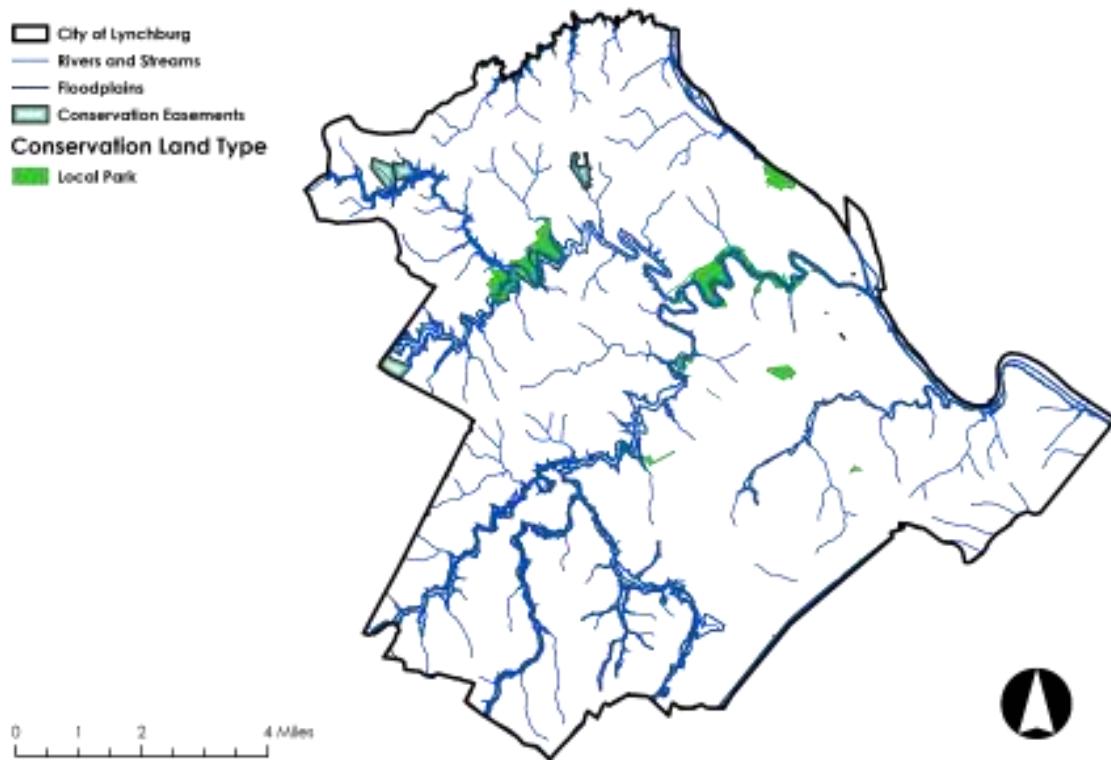


Figure 80 Census tracts with designated income levels at or below 80% of Area Median Income Levels (2020 US Census Data)

## Natural Assets

### Conservation Areas

Because Lynchburg is situated within the foothills of the Blueridge Mountains, it is well known for the seven hills surrounding the City. The seven hills also provide Lynchburg with its nicknames of the City of Seven Hills or Hill City. The city takes advantage of its picturesque location in the foothills of the Blue Ridge Mountains, providing residents and visitors with many opportunities to explore the great outdoors. The Blackwater Creek Natural Area features a well-maintained trail system that winds alongside the Blackwater Creek and James River, offering breathtaking views of waterfalls, lush forests, and historic landmarks. Ivy Creek Park, which provides a tranquil retreat with hiking trails, fishing spots, and open spaces for picnics. These parks not only serve as recreational havens but also contribute to the community's well-being by fostering a sense of connection with nature.



*Figure 81 11 Conservation Lands overlaid on the regulatory floodplain, and intermittent streams, VADCR Natural Areas Inventory.*

## Ecological Cores

Ecological cores are patches of natural land with at least 100 acres of interior cover which provide habitat for a large variety of species, including forest, marsh, and maritime dependent species. The Virginia Natural Landscape Assessment (VaNLA) provides an analysis that has identified, prioritized, and linked, using satellite data, the important land networks throughout Virginia. Preserving and maintaining these landscapes can help ensure they continue to provide ecosystem services such as cleaner air and water filtration. Ecological cores can also provide recreational opportunities and open space resources. The following map shows which areas of the City consist of ecological cores. A higher rating (with red being the highest) indicates the amount of ecosystem services that ecological core provides. Examples of ecological services that cores provide include wildlife and plant habitat, biodiversity conservation, water

resource protection, erosion control, and carbon sequestration. The City of Lynchburg should have strategies to preserve ecological cores, such as using them as park lands for low-impact recreation (hiking, bird watching, etc.) and other conservation efforts. The City of Lynchburg's comprehensive plan and parks and recreation master plan illustrate the dedication the city has to providing open space in the City. See Appendix C for links to the plans where more information can be found.

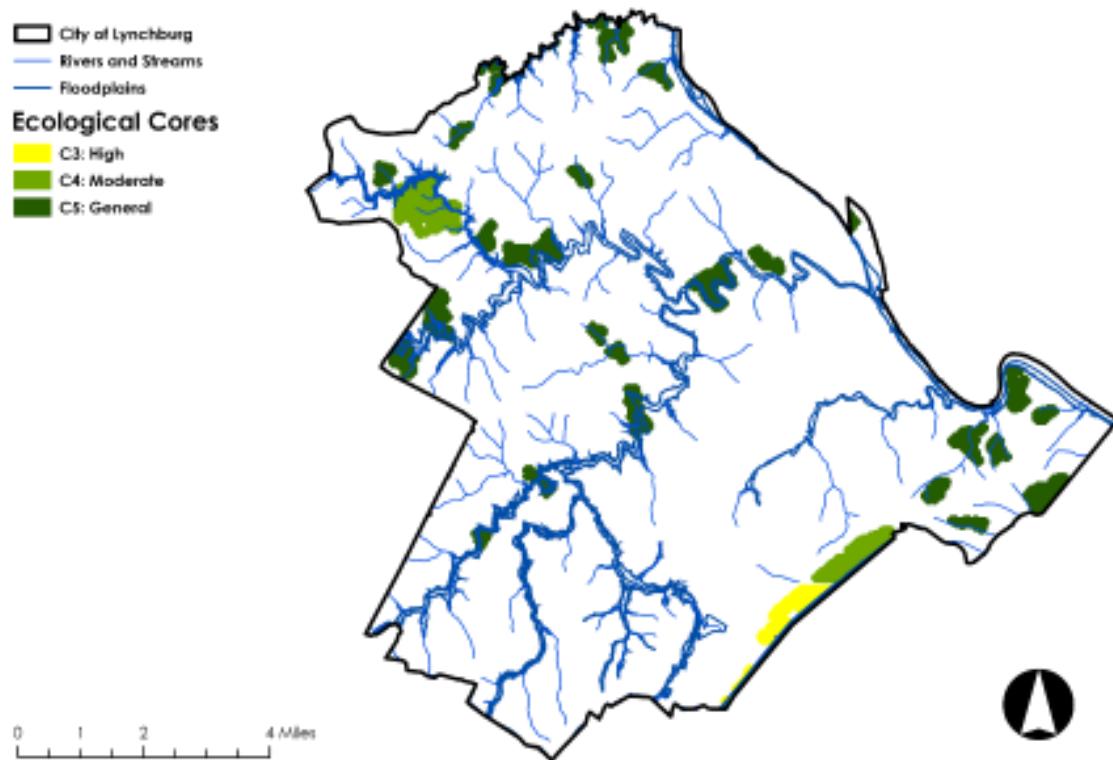


Figure 82 Ecological Cores overlaid on the regulatory floodplain, and intermittent streams, VADCR Natural Areas Inventory

## Built Assets - Critical Facilities and Infrastructure

Critical infrastructure refers to the essential systems, services, and assets that are vital for the functioning of a community. These elements play a crucial role in maintaining public safety, national security, and overall well-being. Critical infrastructure can be found in various sectors, including energy, transportation, water supply, telecommunications, healthcare, and financial services. The City of Lynchburg contains numerous critical facilities and infrastructure that are a part of the day-to-day function of the City. For the

purposes of this flood resilience plan, the focus will be on infrastructure susceptible to flood related hazards. Section 4.3, Flooding, of the 2020 CVPDC Hazard Mitigation Plan, contains a thorough evaluation of FEMA floodplains, critical infrastructure, roads, and bridges in the floodplain, for each locality in the CVPDC region.

The floodplains of the James River near Lynchburg contain commercial development, including warehouses, factories, businesses, and the necessary rail, highway, and utility services for the City. As seen in Figure 4 below, other numerous critical pieces of infrastructure lie in other floodplains throughout the City. The Reusens area contains flood prone facilities and train warehouses of CSX Railroad. Two facilities, the Reusens Dam Hydro Plant, and an electrical substation, are also located here.

Facility Name	Address	Facility Type	Coordinates	Flood Zone*
Amazement Square Child Museum	27 9Th St, Lynchburg	Attractions	37.4162, -79.1403	1%; 0.2%
Electrical Substation		Electrical Substation	37.4622, -79.1872	1%; 0.2%
Reusens Dam Hydro Plant	4300 Hydro Street, Lynchburg	Energy Facility	37.4630, -79.1867	1%; 0.2%
U.S. Pipe (Former Griffin Pipe Products Co Inc)	10 Adams Street, Lynchburg	HazMat Facility	37.4208, -79.1413	1%; 0.2%
Lynchburg Foundry Co Lower Basin Plant	Garnet Street And Concord Turnpike, Lynchburg	HazMat Facility	37.4071, -79.1318	1%; 0.2%
Westrock Converting Company	1801 Concord Turnpike, Lynchburg	HazMat Facility	37.4034, -79.1281	1%; 0.2%
Lynchburg City Sewage Treatment	2301 Concord Tpke, Lynchburg	Wastewater Treatment Plant	37.3968, -79.1141	1%; 0.2%

Note: 1% (or 0.2%) indicates 1 percent (or 0.2 percent) annual chance flood zone

Table 18 Critical facilities and infrastructure in the floodplain of Lynchburg, CVPDC 2020 HMP Update

Roads and Bridges are also critical pieces of transportation infrastructure. The top 5 identified roads prone to flooding are Blackwater Creek Trail, Concord Turnpike, Wards Road, 5th Street, and Hydro Street.<sup>43</sup> All these roads together with Lynchburg Expressway, Evergreen Road, and Graves Mill Road have multiple flood-prone locations along their route. Stormwater infrastructure maintenance and repair should be a priority for these roads and can be prioritized for future funding.

The map below illustrates real time data from the Virginia Department of Transportation on the condition of bridges and culverts. Overlaid on the rivers and streams, City of Lynchburg, CVPDC and VDOT can work

<sup>43</sup> 2020 CVPDC HMP Update;4-93

together to upgrade the “Poor” infrastructure first to avoid flood related damages and impacts to the surrounding areas.

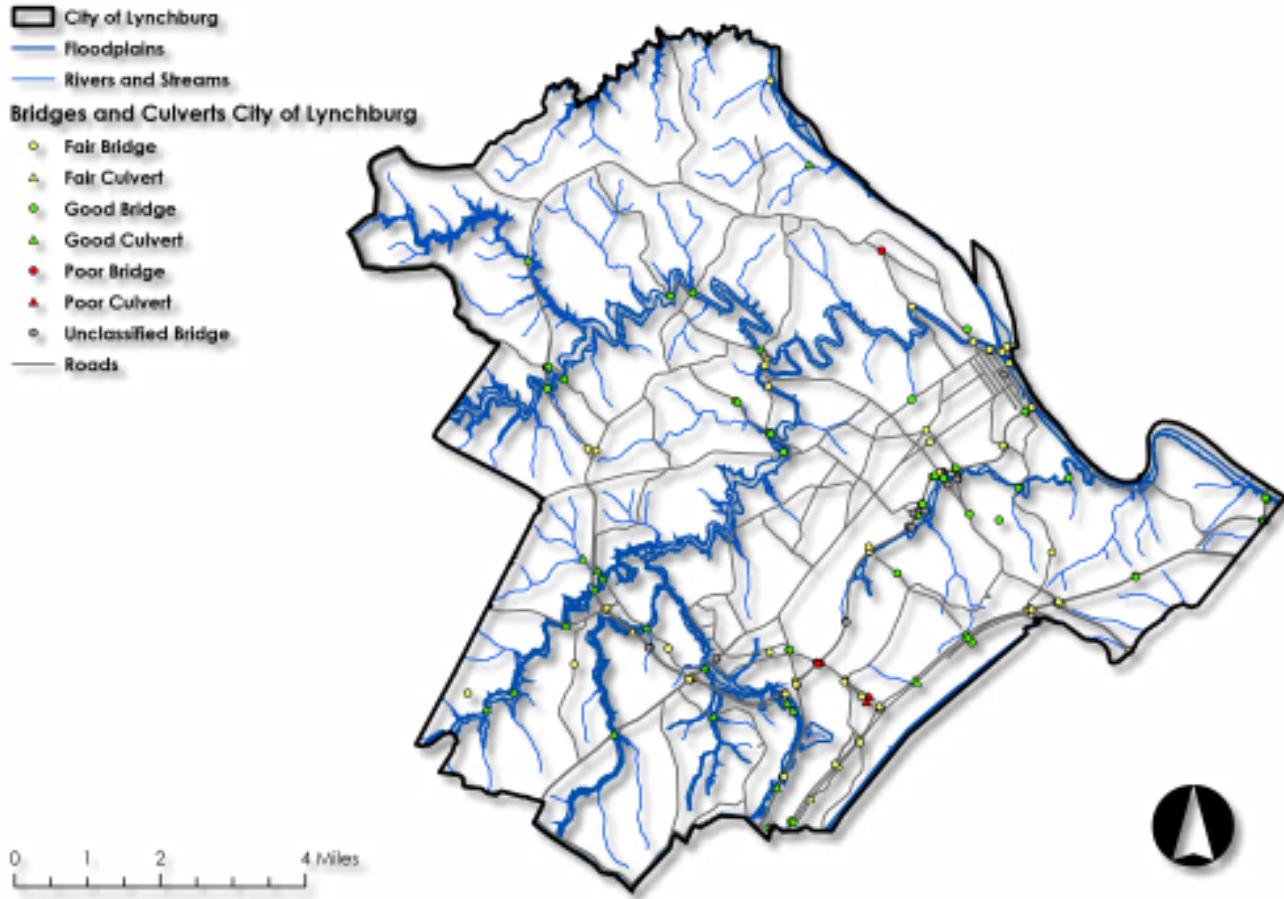


Figure 83 Bridge and culvert condition assessment within the City of Lynchburg

Top Poor Rated Bridges	Top Poor Rated Culverts
VA-128E and Candlers Mtn Rd	US-501N and Candlers Mtn. Road
BUS US 29NCandlers Mtn Rd	US-501S Ramp 71A
Bedford Avenue	

US-501N and Candlers Mtn Rd	
Bedford Avenue	
BUS US 29S and Candlers Mtn Rd	

Table 19 Rated Bridges and Culvert, VDOT, March 2024

## Flooding and Related Hazards

### Areas of Known Flooding

Repetitive loss properties and severe repetitive loss properties as stated in the HMP, “*The identification of repetitive loss properties is an important element to conducting a local flood risk assessment, as the inherent characteristics of properties with multiple flood losses strongly suggest that they will be threatened by continual losses. Repetitive loss properties are also important to the NFIP, since structures that flood frequently put a strain on the National Flood Insurance Fund.*”<sup>44</sup> The City of Lynchburg contains

19 repetitive loss properties and 7 severe repetitive loss properties, more than any other locality in the CVPDC region. Figure 84 (left) shows the general areas of these properties as mapped for the HMP update. While the exact locations are not displayed due to privacy concerns, the areas are useful to identify for prioritizing mitigation actions.

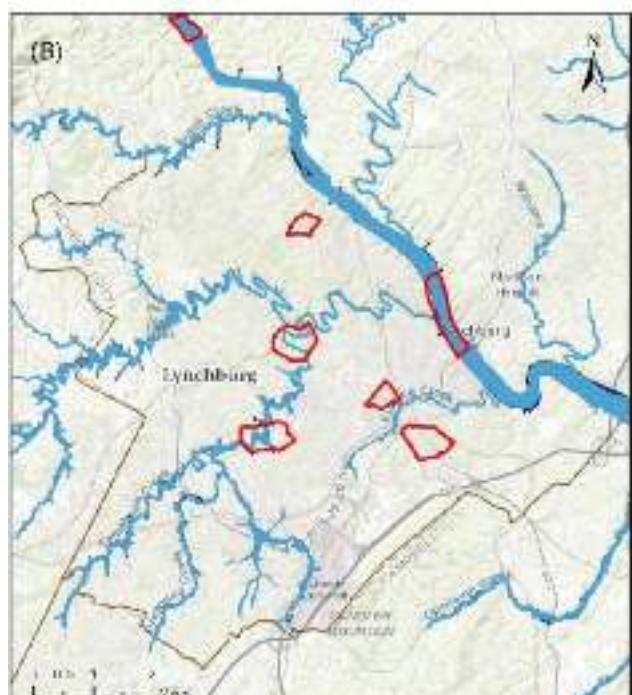


Figure 84 Repetitive Loss Areas in the City of Lynchburg Area (2020 CVPDC HMP)

Flooding is most often associated with storm events that bring large amounts of rainfall to the area, swelling rivers and tributaries beyond their banks. Topographical features, soils, and development patterns also play a part in flooding; and the interaction between these geophysical elements can affect how water moves through the landscape. This CVPDC Flood Resilience Plan builds on the flood risk assessment performed in the 2020 CVPDC HMP update and adds more localized information mainly heard through community interviews and available data

<sup>44</sup> The 2020 CVPDC Hazard Mitigation Plan Update

sets. Figure 85 (below) shows information from VDOT on locations of vehicle crashes due to standing water on roadways.

In Figure 86, (Pg. 126), areas of known flooding heard from community interviews are combined with the DOT vehicle crashes are overlaid on census tracts designated as low to moderate income. These areas can be prioritized for studies and projects to potentially alleviate standing water issues,

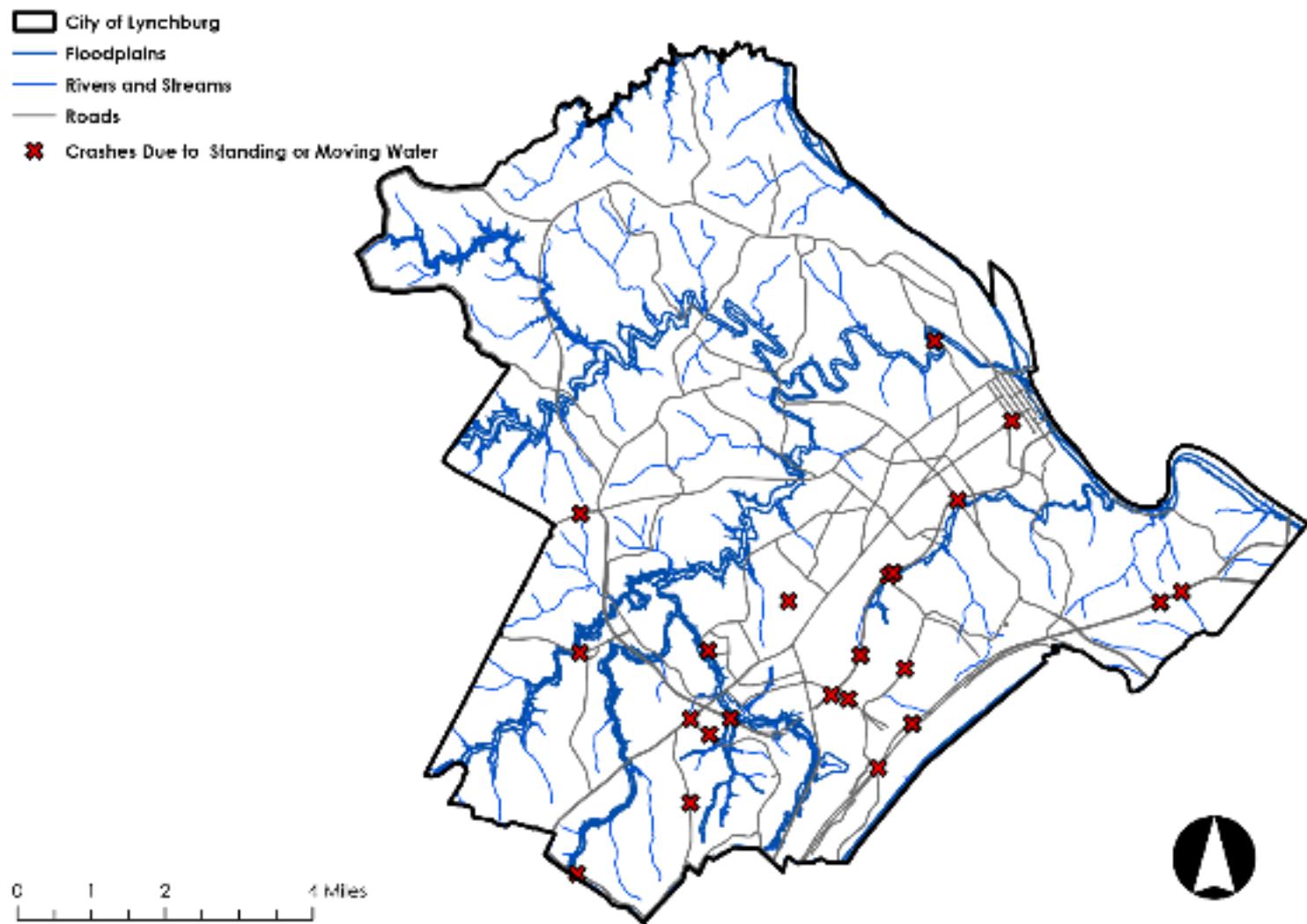


Figure 85 12 Vehicle crashes due to standing water on roadways (VDOT)

<b>5 Most Recent Crashes Due to Standing Water</b>	<b>Roads or Location</b>	<b>Date</b>
1	29 South	8/6/2020
2	29 South	8/19/2020
3	460 Byway	12/14/2020
4	Mayflower Drive	12/31/2022
5	Pawnee Drive	7/11/2023

*Table 20 The most recent vehicle crashes as of March 2024*

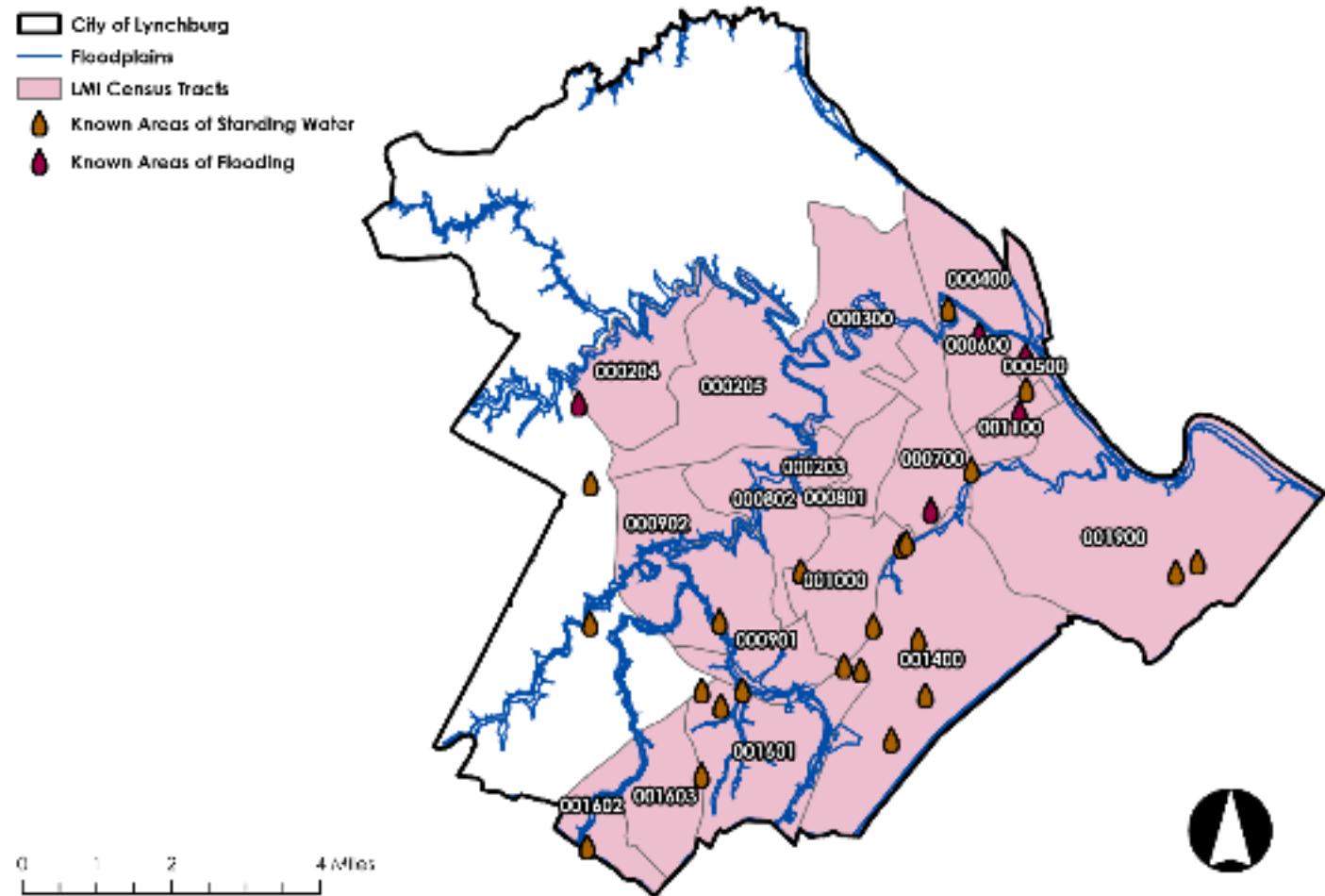


Figure 86 Areas of known flooding documented in community interviews and roadways with standing water (VDOT)

## Dam Inundation

The largest concern with the few dams in the City of Lynchburg's jurisdiction (6 total, with 3 classified as high hazard potential and 2 unknown) are the homes, businesses, important thoroughfares and other transportation assets, and critical infrastructure assets in the Dam Break Inundation Zone (DBIZ). These include potential impacts to four electrical substations, a water treatment plant, the Children's Museum, several roads including the Lynchburg Expressway, Lakeside Drive, and Timberlake Rd, the CSX Transportation Railroad and Norfolk Southern Railroad, several residences and businesses within the maximum inundation area (some of which are outside the 100-year SFHA), and many roads and road-stream crossings such as bridges and culverts.

College Lake Dam was breached in the summer of 2018, threatening around 120 homes with flooding, and causing the need for evacuation, with a fear of imminent collapse which would put many areas in its inundation zone under 15 feet of water. The dam is currently scheduled to be drained and removed for safety reasons. The DBIZs are mapped for the other high-hazard dam. The City is also threatened by dams near the border, including Ivy Lake Dam and Reusens Dam. Significant vulnerable and minority populations would be affected by dam spillovers in Lynchburg, including impacts to specific neighborhoods. The map of dams of known and unknown hazard potential are shown in the map below.

## High and Unknown Hazard Dams in Lynchburg City, Virginia

Central Virginia PDC Hazard Mitigation Plan Update 2020

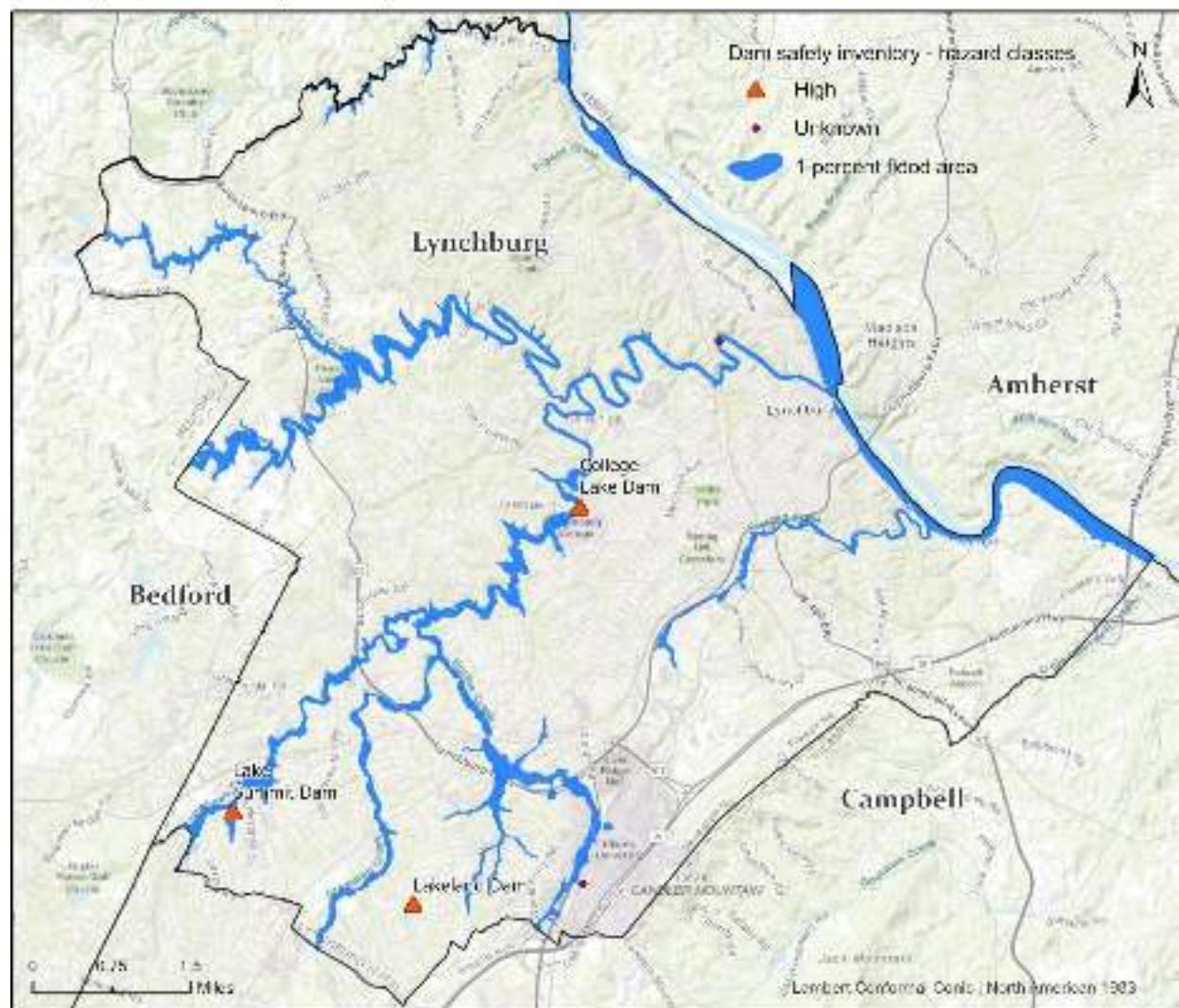


Figure 87 Virginia Dam Safety Inventory System (as of 2/7/2020), Center for GeoSpatial Technology, Virginia Tech, CVPDC 2020 HMP

For a more thorough evaluation of the impacted geographies, structures, and critical assets in the City of Lynchburg, and for the dam inundation zone maps for the referenced dams, refer to pp. 4-168 – 4-186 of the Central Virginia PDC 2020 Hazard Mitigation Plan Update.

## Extreme Heat

Using an existing weather station located at the Lynchburg International Airport (LYNCHBURG REG AP), it is possible to view observed temperature averages from 1950 – 2013 for the City of Lynchburg. Years when bars extend above the line were higher than the long-term average; years with bars that extend below the line were lower than average. While the range of exceedance events is variable, you can see a trend, especially from the year 2000 onwards, where the average number of days per year that exceed 95 degrees increases.

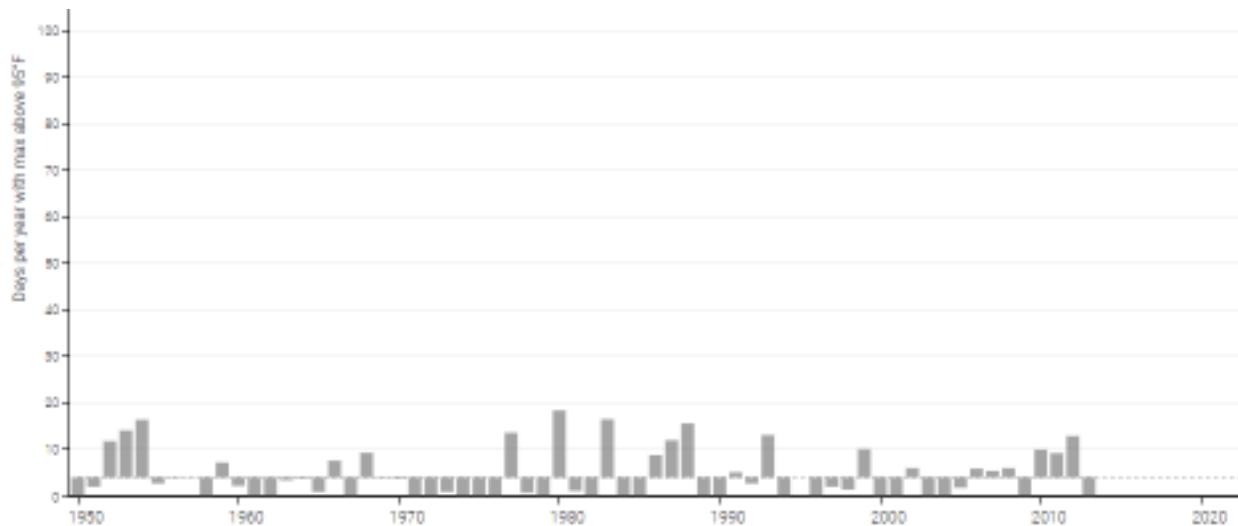


Figure 88 Days per year with temperature > 95 degree F observed average 1950 – 2013; US Climate Resilience Toolkit, The Climate Explorer

## Future Community Conditions

### Flood

The potential risks of climate change can have broad effects on communities in Community, including on its public health, infrastructure, agriculture, tourism, and emergency services. The City of Lynchburg (and the CVPDC region in general) should expect the following in the future:

- More frequent, and more intense, precipitation events punctuated by deeper episodes of drought;
- Drier winter and summer seasons, which could deplete reservoirs and challenge drinking water supplies and agricultural production;
- Stronger storms at a greater frequency, which may threaten lives, damage infrastructure, and cause significant power outages; and
- Increasing summer heat waves could threaten public health.

According to the NOAA Mid-Atlantic RISA projections,<sup>45</sup> the City of Lynchburg can expect to see some more extreme variability in precipitation over the next 50 years, with some months seeing 15% less and some months seeing up to 40% more compared to the average from the years 1950-2000. In general, the entire Appalachian region can expect mild 1-2% average increases in rainfall compared to the past 30 years' average.<sup>46</sup>

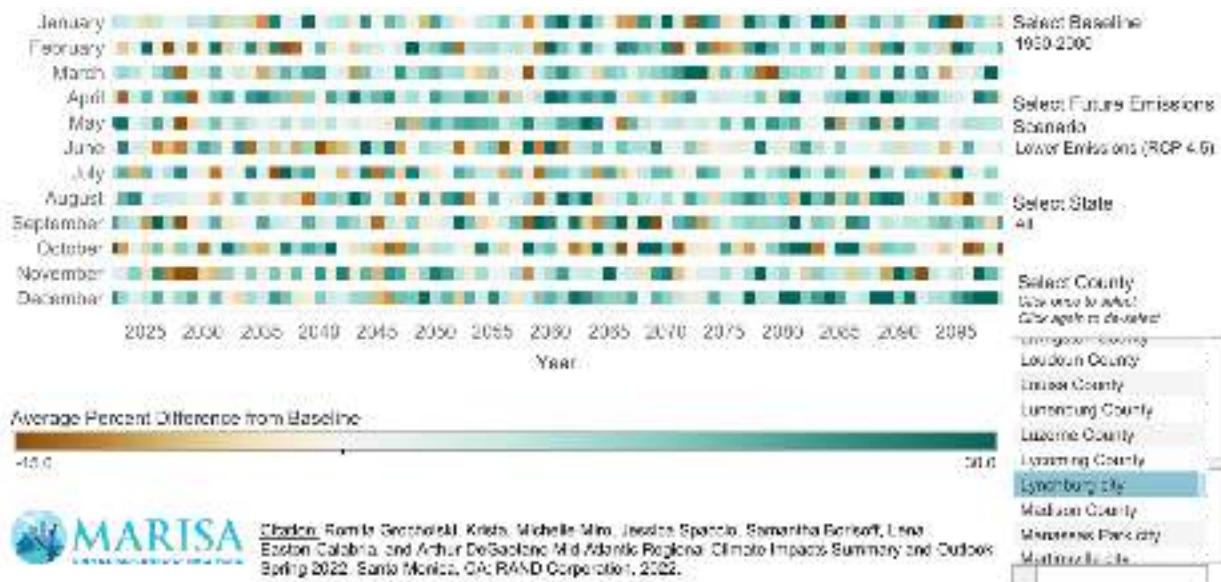


Figure 89 Projected Percent Difference in Total Monthly Precipitation, MARISA

<sup>45</sup> <https://www.midatlanticrisa.org/data-tools/climate-data-tools/projected-changes-in-total-monthly-precipitation.html>

<sup>46</sup> <https://www.midatlanticrisa.org/data-tools/climate-data-tools/difference-from-normal-total-annual-precipitation.html>

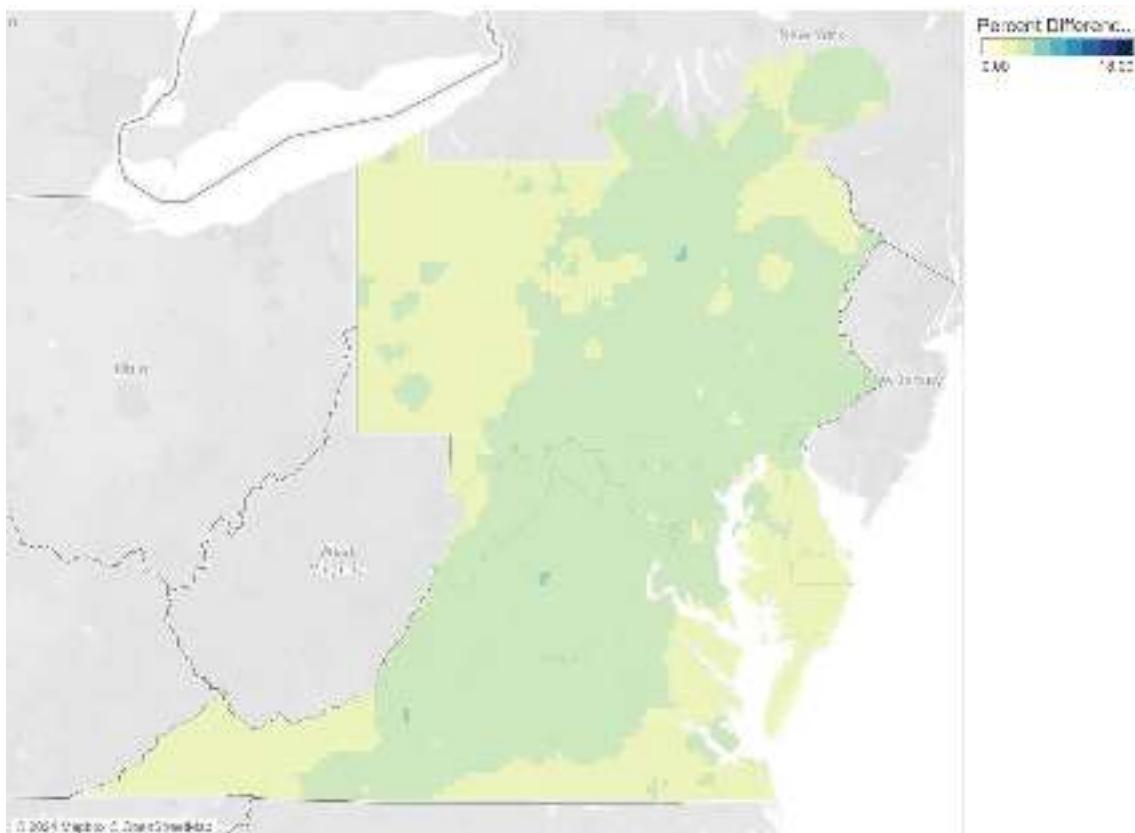


Figure 90 1981-2010 "Normal" Total Annual Precipitation with Percentage Difference Anticipated, MARISA

## Heat

In the City of Lynchburg, the average daily temperature is expected to increase, as well as extreme temperatures on the hottest days of the year. This excess heat for longer periods may stress critical infrastructure such as roads and bridges. More hot days may also stress the electrical grid and the use of potable water may increase as people may need more irrigation for crops and landscaping. This type of heat may affect public health and may lead to economic impacts through disruptions in agriculture and manufacturing. Human health, stream and river health, and infrastructure are all threatened by higher temperatures.

At 95°F, it is hard to keep indoor areas and our bodies cool. The City of Lynchburg's summers are getting hotter. On average, City of Lynchburg sees 4 days per year in excess of 95°F.<sup>1</sup> Within the next 50 years (by 2070), City of Lynchburg can expect a yearly average of 25 to 47 days above 95°F, with associated

increases in cooling costs, reduced air quality, and heat-related illnesses.<sup>47</sup> It is imperative that the County begin planning for more days of extreme heat and look for ways to lessen the public health effects, especially on vulnerable populations.

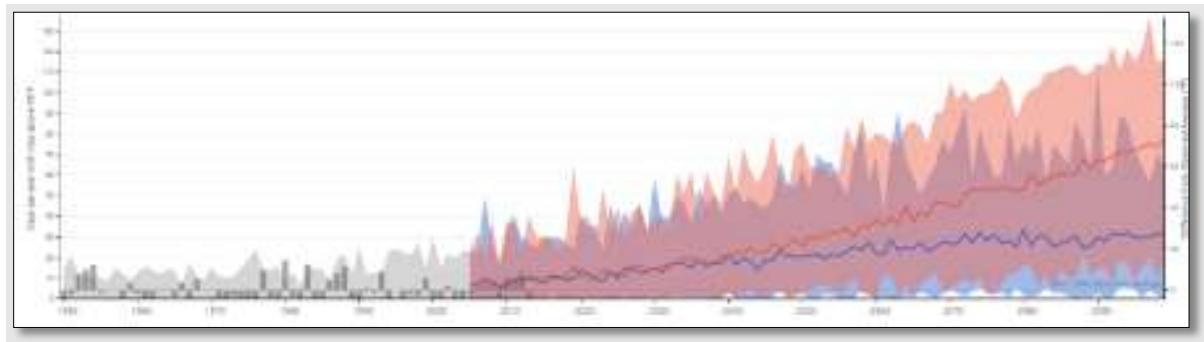


Figure 9113 Table 3. Days w/ maximum temp > 95°F (U.S. Climate Resilience Toolkit Climate Explorer)

■ Observations ■ Modeled History ■ Lower Emissions ■ Higher Emissions

## General Flood and Heat Resilience Policies and Actions

1. Prioritize vacant tracts of land for conservation and recreational open space in floodplains and apply for grant funding to acquire these properties; (See Appendix A for more detail on grant funding);
2. Identify outcomes of the Diamond Hill Neighborhood plan with concurrent flood related benefits and prioritize these actions;
3. Incentivize the use of green infrastructure for commercial and residential development projects;
4. Continue city wide tree planting initiatives; especially in identified low to moderate income areas; and
5. Develop targeted outreach before and during the summer months to inform the public of anticipated heat waves and ways to stay safe;

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<sup>47</sup> US Climate Resilience Toolkit Climate Explorer

## Prioritized Flood Resilience Strategy

- ❖ Create a resilient riverfront plan that promotes and supports sustainable and resilient development of the City's riverfront. (Score 70)

*For a full explanation of the Prioritized Resilience Strategy Matrix, See Appendix E, Prioritizing Resilience Projects. For the full suite of resilience strategies and rankings by locality, see Appendix A.*

## Resilient Riverfront Plan



## Action Description

Create a resilient riverfront plan along the James River that creates a flood mitigation system while also promoting climate adapted development or redevelopment. Integrate recreational activities and resilient open spaces that can be enjoyed by residents.



## Key Steps for Implementation

1. Complete an existing conditions and climate vulnerability assessment of parcels or lands abutting the riverfront.
2. Complete a programming and development study to determine potential future uses.
3. Engage with residents, property owners, businesses, and agencies.
4. Develop site plans and schematic sections of flood mitigation system and tie-in locations.



## Action Lead

City of Lynchburg Community Development Department, and Public Services Departments



## Supporting Partners

- City of Lynchburg Economic Development Authority
- James River Arts and Cultural District
- CVPDC



## Ease of Implementation

- Locality can complete in-house.  
 Requires locality to hire a staff person.  
 Requires hiring a technical consultant.
- Development of a plan that is celebrated by residents and has buy-in from property owners abutting the river.
  - Successful analysis of where a flood mitigation system might tie-in given constraints such as topography, utility lines, property ownership.
  - Alignment of a resilient riverfront plan with the goals of the Economic Development Department, Arts and Cultural District, and zoning.



## Measures of Success

This Project Implementation Sheet is apart of a Flood Resilience Plan funded by the Virginia Community Flood Preparedness Fund (VCFPF) on behalf of the Central Virginia Planning District Commission (CVPDC). For more detailed information please see the complete flood resilience report and its appendices.



## Action Initiation Timeframe

Short: 0-2 years  
Medium: 3-6 years  
Long: 7+ years

\$: less than 10k  
\$\$: 10-50k  
\$\$\$: 50-500k

\$\$\$\$: 500k-2mill  
\$\$\$\$\$: 2 mill+

\*Cost associated with the actions refers to how much it is expected to cost the Town to implement. This does not include costs for ongoing maintenance.



## Action Initiation Timeframe



Short

Medium

Long



## Resilience Considerations

Creation of a resilient riverfront plan should not only include strategies and visions related to riverine flooding, but also stormwater flooding, extreme heat, and impacts from winter storms.



## Co-Benefits &amp; Equity Considerations

Residents should be engaged throughout the vulnerability assessment and during the development of the resilient riverfront vision.

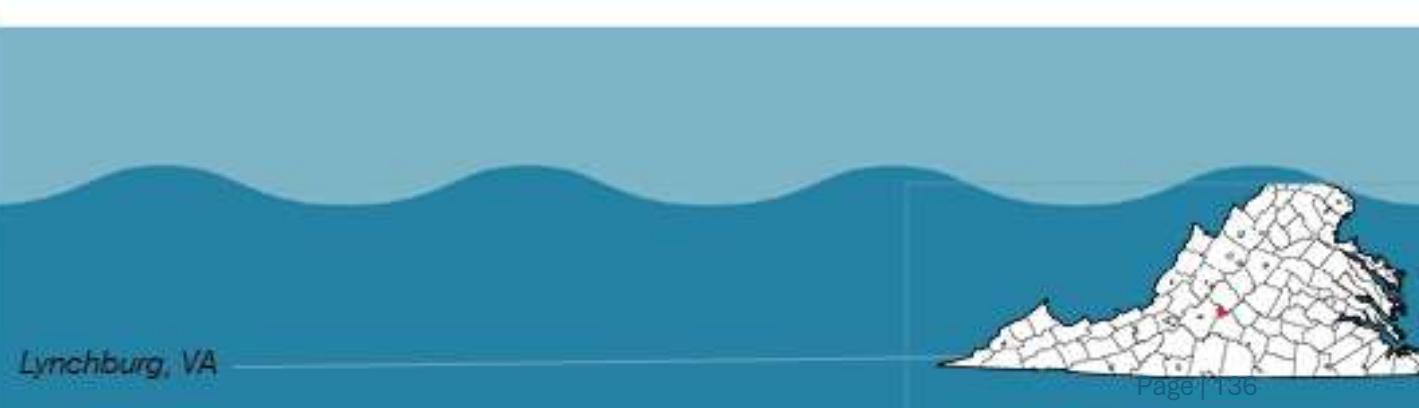
The plan should include ways that small businesses can prosper from development of such a plan.

Cost  
\$\$\$

1. Vulnerability and Existing Conditions Assessment: 50,000-75,000
2. Programming and Development Study: 50,000-100,000
3. Community Engagement: 30,000-75,000
4. Development of Resilient Riverfront Plan - including vision, site plan, and sections: 125,000-200,000



FEMA BRIC, VA DCR Community Flood Preparedness Fund



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## APPENDIX A Project Prioritization Matrix

	Lead Department	Current/Future Cost	Potential Funding	Action Is in a FEMA Flood Zone			Location in Flood Problem Areas	Effectiveness in Mitigating Climate Impacts				Action Provides Co-Benefits	Feasibility			Covered Priority (2023-2025 Initiatives)	Risk Score		
				No.	Community Flood Protection Act (CFPA) Status	Yardine's Annual Change Score (YACS)		Action Is Flood Problem Area (Flood Zone)	Effectiveness in Mitigating Flood Impacts	Effectiveness in Mitigating Windstorm Impacts	Effectiveness in Mitigating Water Shortage Impacts		Action Supports Socially Vulnerable Populations	Action's Value to Previous HES	Proposed Impacted Public (M) HES (S) Element (T) Priority (W)	Maintenance Required (M) Status (S) Progress (P)			
		\$1 - Up to \$50,000 \$51 - \$250,000 up to \$500,000 \$501 - \$1,000,000 up to \$500,000 \$500,001 - \$1,000,000 up to \$1,000,000 \$1,000,001 and greater		0	5	0	0.50	1.00	1.00	0.50	0.50	1.00	0.50	0.50	0.250	0.5/1	0.10		
1	Conduct an environmental audit of assets and develop a reporting procedure related to assets.	Public Safety - Emergency Preparedness (Emergency Services)	4	DCPA (Dam Safety, Flood Prevention and Protection Assistance Fund)	0	0	0	0	1	1	1	0	1	0	0	0	0	85	Locally Led or Partnered
2	Join the County's public information system and create a specific hazard communication protocol.	Public Safety - Emergency Preparedness (Emergency Services)	9	VA DEM/DOPR (Dam Safety, Flood Prevention and Protection Assistance Fund)	0	0	0	0	1	1	1	0	1	0	0	0	0	70	HMP High Priority
2	Conduct an environmental assessment of the Town's critical facilities, infrastructure, and assets to understand potential risks, resources, and lead operational plans for vulnerable assets.	Department of Public Works (DPW)	100	FEMA/VA DOOR (Flood Prevention and Protection Assistance Fund)	0	5	0	5	1	1	1	5	1	0	0	0	5	10	HMP High Priority
4	Design a健在的 flood protection system for the town and enhance new facilities to protect them from future flooding due to climate impacts.	Department of Public Works (DPW)	100	FEMA/VA DOOR (Flood Prevention and Protection Assistance Fund)	0	5	0	5	1	1	1	5	0	0	0	0	10	HMP High Priority	
5	Conduct a watershed management plan that includes the following: Assess streambank conditions and evaluate areas along the Gwynedd River and its tributaries to mitigate flood impacts on the riverine system. Reduce non-point source runoff by including green infrastructure controls, diversing flows from stream, and bank stabilization.	Department of Public Works	215	Capital Improvement Plan, VCBM Streambank Restoration or VA DOOR Streamside Local Assistance Fund	0	0	1	5	0	1	1	5	0	1	0	0	10	HMP High Priority	
6	Evaluate regular repetitive loss properties to encourage flood insurance, including loss of life, property, and financial damage. Consider back to back occurrences of repetitive loss properties to understand their potential losses from location of buildings.	Community Development Department	42500	FEMA/VA DOOR (Flood Prevention and Protection Assistance Fund)	0	0	0	0	0	0	1	5	0	0	0	0	0	55	HMP High Priority
7	Advocate and coordinate with FIRM to update Flood Insurance Rate Maps to include up-to-date data on specific flood hazard areas to expand flood insurance coverage to include areas of known flooding and the dam failure zone.	Community Development Department	240	FEMA	0	0	0	0	1	1	1	0	1	0	0	0	0	10	HMP Priority Action Discussed in Stakeholder Review
1	Conduct an environmental assessment of the watershed treatment plan and determine adaptation options to either relocate the building or design and implement alternative treatments/treatments.	DPW / Utility User	40	DOE Community Flood Preparation Fund (HMP)	0	0	0	0	0	1	1	5	0	1	0	0	5	10	Locally Led or Partnered
2	Conduct an environmental assessment of the Town's critical facilities, infrastructure, and assets to understand potential risks and lead operational plans for vulnerable assets.	Public Safety (Emergency Services)	45	FEMA	0	0	0	0	1	1	1	5	0	1	0	0	0	25	HMP High Priority
3	Conduct an environmental assessment of the Town's critical facilities, infrastructure, and assets to understand potential risks and lead operational plans for vulnerable assets.	DPW / Utility User	540	FEMA/VA DOOR (Flood Prevention and Protection Assistance Fund)	0	5	0	5	1	1	1	5	0	1	0	0	0	45	HMP High Priority
4	Assess opportunities to elevate or move repetitive loss properties to mitigate flood impacts including loss of life, property, and financial damage. Conduct research to implement best practices for properties and areas within the dam hazard inundation zones to understand the potential impact of elevation or relocation.	Community Development Department	58550	FEMA/DOOR (Dam Safety, Flood Prevention and Protection Assistance Fund)	0	0	0	0	0	0	0	0	0	0	0	0	0	85	HMP Priority Action Discussed in Stakeholder Review
6	Identify critical equipment and systems that require backup power by identifying facilities such as the Police Dept, City Hall, Parks, etc. to ensure reliable backup generation for continuous power and identify backup supply (e.g. Quick Connect).	DPW / Utility User	425	AUA	0	5	0	5	0	0	1	5	0	0	0	0	0	40	HMP Priority Action Discussed in Stakeholder Review
6	Assess water availability in households and develop water storage options through gray and green infrastructure upgrades. Upgrade local continuity of access to critical facilities and to residents.	VOOT/DPW	425	FEMA/VADOF/CPFF	0	0	0	0	0	0	0	0	0	0	0	0	0	80	HMP Priority Action Discussed in Stakeholder Review
7	Inquire about and evaluate options for National Flood Insurance Program (NFIP) to include information on the county's risk.	Public Safety (Emergency Services)	4	FEMA/VADOF/CPFF	0	0	0	0	0	0	0	0	0	0	0	0	0	30	HMP High Priority
8	Produce stormwater design and construction guidelines, and implement mitigation practices to mitigate flooding.	DPW	24	VADOF/CPFF	0	0	0	0	0	0	0	0	0	0	0	0	0	45	HMP High Priority
9	Create response protocols for prolonged drought and high temperatures to address fire hazards and community needs, as well as potential strain on water resources.	Public Safety (Emergency Services)	54	VOEM	0	0	0	0	1	0	0	0	0	0	0	0	0	30	HMP High Priority
1	Improve the county's public announcement system/bulletin board to include notices regarding emergency events, preparedness measures, and shelter-in-place orders.	Public Safety	4	VOEM	0	0	0	1	0	0	0	0	0	0	0	0	0	40	HMP Priority Action Discussed in Stakeholder Review
2	Update the county's website to include informational pages on severe weather, flooding, and the management of household water storage, hurricane preparedness, including mobile water sources and filter kits.	Public Safety	4	Local Funding	0	0	0	1	0	0	0	0	0	0	0	0	0	40	HMP Priority Action Discussed in Stakeholder Review
3	Conduct an environmental assessment of the county's critical facilities, develop emergency response plans, adapt early warning systems to natural and human-made threats, and have a continuity of operations plan.	Community Development Department/DPW	425	DOE Community Flood Preparation Fund (CPFF) or FEMA/DOOR	0	0	0	0	0	0	0	0	0	0	0	0	0	45	HMP Priority Action Discussed in Stakeholder Review
4	Evaluate current conditions and implement streambank stabilization and green infrastructure to promote natural water and reduce flooding impacts of dam failure, and prioritize at the following locations: Laramie, Monagan Park, Pecanwood at Blue Springs, Wink Gap Roadwest, Puppy Creek.	Public Works	425	VA DOOR Stormwater Local Assistance Fund	0	0	0	0	0	0	0	0	0	0	0	0	0	70	HMP Priority Action Discussed in Stakeholder Review
5	Assess stream conditions and implement streambank stabilization and green infrastructure to promote natural water and reduce flooding impacts of dam failure, and prioritize at the following locations: Laramie, Monagan Park, Pecanwood at Blue Springs, Wink Gap Roadwest, Puppy Creek.	Public Works	425	VA DOOR Stormwater Local Assistance Fund	0	0	0	0	0	0	0	0	0	0	0	0	0	75	HMP Priority Action Discussed in Stakeholder Review

	<p>Analyze opportunities to elevate or acquire repetitive loss properties to mitigate flood impacts including loss of life, property, and financial damage. Conduct outreach to homeowners of repetitive loss properties and owners/renters in the dam hazard inundation area to understand their potential interest in relocation/dislocation.</p>	Community Development Department	\$4448	FEMA/DOE (Don Bois), Flood Prevention and Protection Assistance Fund	0	0	10	10	10	5	5	0	10	0	0	0	5	10	45	HMP Priority Action Discussed in Stakeholder Interview
7	<p>Create programs with funding and resources to adapt private property in flood hazard areas to reduce risk and mitigate impacts from stormwater and dam failures. Focus programs areas with most vulnerable residents and hardest hit areas such as the Meadow Anne and Mill Run.</p>	Community Development Department	\$1242	FEMA/HCDM	0	0	10	10	10	5	5	0	10	5	0	0	5	10	70	HMP Priority Action Discussed in Stakeholder Interview
8	<p>Create programs to expand preparedness resources, especially for people in remote areas such as Louisa, Lexington, Goochland, and Powhatan, components of the Virginia Avenue Minimum.</p>	Community Development Department	\$8	FEMA/HCDM	0	5	0	0	10	5	5	5	5	5	0	5	10	45	HMP Priority Action Discussed in Stakeholder Interview	
9	<p>Develop educational outreach materials on a MyVA website for flood-related topics to highlight preparedness.</p> <p>Participating and coordinating with agricultural producers to respond to drought, high temperatures, or other environmental factors that may impact crop or livestock production and harvests.</p>	Public Works	\$5	VDOT/VDEM	0	0	0	0	5	1	0	0	0	0	0	0	0	0	35	HMP Priority Action
10	<p>Develop drainage capacity and improve conditions along roadway to support emergency access to critical facilities and residents who are more isolated.</p> <p>Build conditions of dams and flood mitigation measures and make improvements to and maintain Army Corps managed dams to meet federal and state minimum precipitation and requirement and high hazard dams under the Army Corps' Floodplain and Levee</p>	Agricultural Committee	\$288	VDEM	0	0	0	0	0	1	0	0	5	5	0	0	5	0	30	HMP Priority Action
11	<p>Develop drainage capacity and improve conditions along roadway to support emergency access to critical facilities and residents who are more isolated.</p> <p>Build conditions of dams and flood mitigation measures and make improvements to and maintain Army Corps managed dams to meet federal and state minimum precipitation and requirement and high hazard dams under the Army Corps' Floodplain and Levee</p>	VDOT/Public Works	\$288	VDOT/VDEM	0	0	10	10	10	1	5	0	10	5	5	5	0	0	30	HMP Priority Action
12	<p>Join the HMP Community Rating System and complete ratings to reduce HMP premiums. Update Severe Weather Alerting system to include HMP enrollment and coverage.</p>	Public Safety	\$54	FEMA	0	0	0	5	5	1	0	0	5	5	0	5	0	0	45	HMP High Priority
13	<p>Develop a complaint to alert more residents in the County to public information system so that more residents receive emergency updates about severe weather and hazards.</p>	Public Safety	\$8	Local Pending	0	0	0	0	5	1	0	5	5	5	0	0	0	0	45	HMP High Priority
14	<p>Coordinate with VDOT to install high water warning systems and signage along roads to prevent flooding through standing water areas and back ditches.</p>	VDOT/Public Works	\$5	VDOT	0	5	0	10	5	1	5	0	0	0	0	5	5	0	25	HMP High Priority
15	<p>Update cellular alert system to include back-up generators on the county's communication network for continuity of service during emergency events.</p>	Public Safety	\$8	DDOT	0	5	0	5	5	1	5	5	0	0	0	5	5	0	40	HMP High Priority
16	<p>Identify drainage improvement opportunities along the following roadways: Black Creek at Route 338 and North Creek, Route 61 near Route 655 (Wickham and Creek) and Blackberry Lane (No street).</p>	VDOT/DPW	\$54	VA DEQ Stormwater Local Assistance Fund	0	5	0	0	10	1	0	0	0	0	0	0	1	0	40	HMP High Priority
	<p>Analyze opportunities to elevate or acquire repetitive loss properties to mitigate flood impacts including loss of life, property, and financial damage. Conduct outreach to homeowners of repetitive loss properties and owners/renters in the dam hazard inundation area to understand their potential interest in relocation/dislocation.</p>	Community Development Department	\$5252	FEMA/DCR (Dam Safety, Flood Prevention and Protection Assistance Fund)	0	1	0	10	10	5	5	0	10	0	0	0	5	10	85	HMP Priority Action Discussed in Stakeholder Interview
7	<p>Conduct outreach to property owners to secure voluntary to create secondary emergency access along Blackberry Lane using local or other emergency routes.</p>	Public Safety	\$54	FEMA/HMGP	0	1	0	10	0	6	6	0	0	0	0	0	0	0	60	HMP Priority Action Discussed in Stakeholder Interview
8	<p>Coordinate with VDOT to install high water warning systems at Route 655/McCoy Creek to support emergency access.</p>	VDOT/DPW	\$559	VDEM/VDOT	0	1	0	10	10	0	9	0	0	0	0	5	9	1	45	HMP High Priority
9	<p>Develop process of emergency response for emergency situations with a special focus on water rescue during drought and public health concerns.</p>	Public Safety	\$54	VDEM	0	1	0	0	0	0	0	10	10	0	0	0	0	0	35	HMP High Priority
10	<p>Participate and coordinate with agricultural producers to respond to drought, high temperatures, or other environmental factors that may impact crop or livestock production and harvests.</p>	Agricultural Committee	\$454	VDEM	0	1	0	0	0	0	0	0	10	0	0	0	0	0	30	HMP High Priority
	<p>Conduct a Dam and Flood Risk Assessment of the Town's drinking water supply. Evaluate demands based on population size for emergency storage. Identify secondary water resources or partnerships with adjacent communities to assess water connection or supply agreements for emergency situations.</p>	Community Development Department	\$5	AWRA	0	1	0	0	0	0	0	0	5	5	0	5	5	30	HMP Priority Action Discussed in Stakeholder Interview	
2	<p>Create a public outreach campaign designed to build preparedness among individuals, residents, and organizations and information on the HMP.</p>	Public Safety (Emergency Planning)	\$2	Local Pending	0	1	0	0	5	5	5	5	5	5	0	10	10	45	HMP High Priority	
3	<p>Analyze the vulnerability of the Town's water and wastewater systems. Develop measures to adapt or build to known climate-related events to minimize system disruptions. Create emergency response plans for facilities including back-up power, such as generator and emergency lighting, and emergency supplies.</p>	DPW	\$18	FEMA/HMGP/VADOT CTPP	0	1	0	5	5	5	5	0	0	0	0	0	5	5	35	HMP High Priority
4	<p>Conduct a vulnerability assessment of the Town's water and wastewater systems to identify natural, climate, and other related hazards. Create emergency response plans for facilities including back-up power, such as generator and emergency lighting, and emergency supplies.</p> <p>Work with the local department to understand current building regulations and how permits are issued.</p> <p>Develop contingency plans for staff and services. Seek necessary funding for equipment or technologies to enhance the</p>	Department of Public Works	\$35	VA DEQ Stormwater Local Assistance Fund	0	1	0	10	10	0	9	5	5	0	0	5	9	1	65	HMP High Priority
5	<p>Analyze opportunities to elevate or acquire repetitive loss properties to mitigate flood impacts including loss of life, property, and financial damage. Conduct outreach to homeowners of repetitive loss properties and owners/renters in the dam hazard inundation area to understand their potential interest in relocation/dislocation.</p>	Community Development Department	\$5252	FEMA/DCR (Dam Safety, Flood Prevention and Protection Assistance Fund)	0	1	0	10	10	5	5	0	10	0	0	0	5	10	85	HMP High Priority
6	<p>Conduct a vulnerability assessment of the Town's water and wastewater systems to identify natural, climate, and other related hazards. Create emergency response plans for facilities including back-up power, such as generator and emergency lighting, and emergency supplies.</p>	DPW/Community Development Department	\$35	FEMA/VADOT CTPP	0	1	0	5	5	5	5	5	0	0	0	0	5	10	45	HMP High Priority
7	<p>Mult Deparmental Action</p>	Mult Deparmental Action	\$5	FEMA/DOE	0	1	0	0	5	5	5	5	0	0	0	0	0	0	40	HMP High Priority
8	<p>Join the HMP Community Rating System and complete ratings to reduce HMP premiums. Update the town's flood insurance availability information on HMP enrollment and coverage.</p>	Public Safety (Emergency Planning)	\$35	FEMA	0	1	0	5	5	0	0	0	5	5	0	0	0	0	45	HMP High Priority

Bedford County																				
1	Expand the county's public announcement system to include notices regarding emergency events, preparedness measures, and shelter-in-place orders.	Public Safety	\$	LocalFunding	0	0	0	0	5	5	5	5	5	0	10	10	0	45	HMP High Priority	
2	<i>Azerr opportunities to elevate or acquire repetitive loss properties to mitigate flooding impacts including loss of life, property, and financial damage. Conduct outreach to homeowners of repetitive loss properties and owners within the dam hazard inundation area to understand their potential interest in relocation via buyouts.</i>	Community Development Department	\$\$\$\$	FEMA/DCR (Dam Safety, Flood Prevention and Protection Assistance Fund)	0	0	10	10	10	5	5	0	10	0	0	5	0	55	HMP High Priority	
3	<i>Azerr the vulnerability of the Woodfield Pump Station, Mantville Treatment Plan, and electrical substations. Determine needed improvements and adaptations to make these assets more resilient to natural and climate hazards as well as human-made hazards such as cybersecurity, hazardous waste, etc.</i>	DPW	\$\$	VADeQ,VADEQ,DOE	0	5	0	5	10	5	5	5	0	0	5	10	0	50	HMP High Priority	
4	<i>Azerr the vulnerability of roadways and identify priority projects to improve drainage through grey and green infrastructure upgrades. Upgrades will help continuity of access to critical facilities and to physically isolate residents.</i>	VDOT/DPW	\$\$	VADEQ,Stormwater Local Assistance Fund	0	0	10	10	10	0	5	5	0	10	5	5	10	70	HMP Priority Action Discussed in Stakeholder Interview	
5	Develop procedural emergency response for extreme heat events with a special focus on water resources during drought and public health concerns.	Public Safety	\$\$	VDEM	0	0	0	0	0	0	0	0	10	10	0	10	5	0	35	HMP High Priority
6	Coordinate with AEP to develop communication protocols and emergency response measures for flooding and dam inundation/failure events.	Public Safety	\$	VDEM, DCR (Dam Safety, Flood Prevention and Protection Assistance Fund)	0	0	10	10	10	0	5	0	5	0	0	5	0	45	HMP High Priority	
7	Implement facility improvements to adapt County public schools to provide for continuous operation. Evaluation and improvements considerations include secondary generator to drive secondary public water source for Mantville; address electrical service capabilities/interruptions at Big Island; stormwater/flood retrofits to Huddleston and Staunton River to protect walls and campus buildings.	Multi-Departmental Action	\$\$\$	FEMA,VDEM	0	0	10	10	10	10	10	10	10	5	10	5	0	90	HMP High Priority	
8	Study and implement flood & dam structural improvements at existing Bedford, BRWA managed dams to meet all federal and state maximum precipitation rules and high hazard dam regulations.	BRWA	\$\$\$\$	VADeQ Dam Safety	0	0	10	10	10	0	5	0	0	0	10	0	0	45	HMP High Priority	
9	Find funding and coordinate with agricultural producers to respond to drought, high temperature, or other environmental factors that may impact crop or livestock production and harvest.	Agricultural Committee	\$\$\$	VDEM	0	0	0	0	0	0	0	0	10	5	10	0	5	0	30	HMP High Priority
10	Join the NFIP Community Rating System and complete strategies to reduce NFIP premiums. Update the county website with readily available information on NFIP enrollment and insurance.	Public Safety	\$\$	FEMA	0	0	10	5	5	0	0	0	5	5	10	5	0	45		

Issues of Bedard																				
1	Conduct site-level assessment of the Bedford Memorial Hospital. Identify upgrades, climate adaptations, and emergency response measures and protocols to support service continuity. Install back-up power, such as a generator system.	Bedford Memorial Hospital	\$\$	FEMABRIC	0	0	0	0	5	5	5	5	10	5	0	5	0	40	HMP High Priority	
2	Evaluate Taul emergency response system, identify and make repairs, or install new system if necessary.	Public Safety (Bedford County)	\$	LocalFunding or FEMA	0	0	0	0	5	5	5	5	5	0	10	10	0	45	HMP High Priority	
3	<i>Azerr opportunities to elevate or acquire repetitive loss properties to mitigate flooding impacts including loss of life, property, and financial damage. Conduct outreach to homeowners of repetitive loss properties and owners within the dam hazard inundation area to understand their potential interest in relocation via buyouts.</i>	Community Development Department/DPW	\$\$\$\$	FEMA/DCR (Dam Safety, Flood Prevention and Protection Assistance Fund)	0	0	10	10	10	5	5	0	10	0	0	5	10	65	HMP Priority Action Discussed in Stakeholder Interview	
4	Develop emergency response plans and service continuity contingency strategies for public utilities.	DPW	\$	FEMA	0	0	0	0	5	5	5	5	5	0	5	10	0	40	HMP High Priority	
5	<i>Azerr the vulnerability of critical assets and facilities. Determine needed improvements and adaptations to make these assets more resilient to natural and climate hazards as well as human-made hazards such as cybersecurity, hazardous waste, etc.</i>	DPW/Community Development Department	\$\$	FEMA,VADeQ,DOE	0	5	0	5	5	5	5	5	0	0	10	5	0	45	HMP High Priority	
6	Develop and maintain emergency response protocols related to public health and extreme heat. Explore options for cooling centers and programs to subsidize air conditioning units. Identify nature-based solutions for heat relief.	Public Safety (Bedford County)	\$	DOE/NOAA	0	0	0	0	0	0	0	0	10	10	10	10	10	60	HMP Priority Action Discussed in Stakeholder Interview	
7	Create a public outreach campaign with specific hazard preparedness toolkits for businesses, residents, and organizations and information on the NFIP.	Public Safety (Bedford County)	\$	LocalFunding	0	0	0	0	5	5	5	5	5	0	10	10	0	45	HMP High Priority	
8	Evaluate and improve drainage along roadways to ensure emergency access and safe movement; target areas of Taul with recurring flooding: South Bridge St., West Gate/Blue Ridge Ave., Summit & 4th St/Train Tracks. Develop high water driving/safety education.	VDOT/DPW	\$\$	VDOT,VDEM,VADEQ, Stormwater Local Assistance Fund	0	0	10	10	10	0	5	5	0	10	5	5	0	60	HMP High Priority	
9	Evaluate and implement streambank restoration, through green infrastructure, streambank stabilization or other appropriate practices, to lessen stormwater impacts to BRWA Woodfield Pump Station, other water and sanitary facilities. (Natural resource conservation plan).	DPW	\$\$\$	VADeQ,DOE,VADEQ, Stormwater Local Assistance Fund	0	0	10	10	10	0	5	5	5	10	3	5	0	62	HMP High Priority	
10	Evaluate needs to adopt or relocate Taul's electrical substations from flood and high hazard dam failure zones.	Electrical Department	\$\$\$	DOE,VDEM	0	0	10	10	10	0	5	0	0	0	0	10	5	0	50	HMP High Priority
	Expand outreach about NFIP coverage. Join the NFIP Community Rating System and complete strategies to reduce NFIP premiums. Update the Taul website with readily available information on NFIP enrollment and insurance.	Public Safety	\$\$	FEMA	0	0	10	5	5	0	0	0	5	5	10	5	0	45	HMP High Priority	

Town of Brookneal																		
	Actions opportunity to elevate or acquire repetitive loss properties to mitigate flooding impacts including loss of life, property, and financial damage. Conduct outreach to homeowners of repetitive loss properties and owners within the dam hazard inundation area to understand their potential interest in relocation via buyouts.																	
1	Community Development Department/DPW	\$\$\$\$	FEMA/DCR (Dam Safety, Flood Prevention and Protection Assistance Fund)	0	0	10	10	10	5	5	0	10	0	0	5	0	55	HMP High Priority
2	DPW/Community Development Department	\$\$\$	FEMA, VADCR CFPF	0	5	0	5	5	5	5	5	0	0	10	5	0	45	HMP High Priority
3	Public Safety	\$\$\$	FEMA	0	0	10	5	5	0	0	0	5	5	10	5	0	45	HMP High Priority
4	DPW	\$\$\$\$	FEMA, VDEM	0	5	0	10	10	5	5	5	5	0	10	10	0	65	HMP High Priority
5	Public Safety	\$\$	VDEM, DCR (Dam Safety, Flood Prevention and Protection Assistance Fund)	0	0	10	10	10	0	5	0	5	0	0	5	0	45	HMP High Priority
6	DPW	\$\$\$\$	VADCR CFPF, VADER Starmwaster Local Assistance Fund	0	0	10	10	10	0	5	5	5	10	3	5	0	63	HMP High Priority
7	Public Safety	\$\$	VDEM	0	0	0	0	0	0	0	10	10	0	10	5	0	35	HMP High Priority
8	Public Safety	\$	Local Funding	0	0	0	0	5	5	5	5	5	0	10	10	0	45	HMP High Priority

Campbell County																		
	Actions opportunity to elevate or acquire repetitive loss properties to mitigate flooding impacts including loss of life, property, and financial damage. Conduct outreach to homeowners of repetitive loss properties and owners within the dam hazard inundation area to understand their potential interest in relocation via buyouts.																	
1	Public Safety	\$	Locality Funding, FEMA	0	0	0	0	5	5	5	5	5	0	10	10	0	45	HMP High Priority
2	Public Safety	\$\$	FEMA, DCR Community Flood Preparedness Fund (CFPF)	0	5	0	0	5	5	5	0	0	0	10	10	0	40	HMP High Priority
3	DPW/Waste Water	\$\$	AWIA	0	0	0	0	0	0	0	0	0	0	10	5	0	15	HMP High Priority
4	DPW	\$\$	DCR Community Flood Preparedness Fund (CFPF)	0	0	0	5	10	5	5	5	0	5	10	5	10	60	HMP Priority Action Discussed in Stakeholder Interview
5	DPW	\$\$	FEMA/DCR (Dam Safety, Flood Prevention and Protection Assistance Fund)	0	0	10	10	10	5	5	0	0	0	10	10	10	70	HMP Priority Action Discussed in Stakeholder Interview
6	Community Development Department/DPW	\$\$\$\$	FEMA/DCR (Dam Safety, Flood Prevention and Protection Assistance Fund)	0	0	10	10	10	5	5	0	10	0	0	5	0	55	HMP High Priority
7	Public Safety	\$\$	VDEM	0	0	0	0	0	0	0	10	10	0	10	5	0	35	HMP High Priority
8	Multi-Departmental Action	\$\$\$\$	DOE, VDEM	0	5	0	10	0	10	10	0	0	0	5	10	0	50	HMP High Priority
9	VDOT/DPW	\$\$	VDOT, VDEM, VADER Starmwaster Local Assistance Fund	0	0	10	10	10	0	5	5	0	10	5	5	0	60	HMP High Priority
10	DPW	\$\$\$\$	VADCR CFPF, VADER Starmwaster Local Assistance Fund	0	0	10	10	10	0	5	5	5	10	3	5	10	73	HMP Priority Action Discussed in Stakeholder Interview

City of Lynchburg																			
1	Introduce regulatory requirements to reduce impervious area in new development. Encourage pervious areas, vegetation, and stormwater controls (best management practices) to mitigate stormwater erosion, and heating impacts.	Community Development Department	\$\$	DCR Community Flood Preparedness Fund (CFPF)	0	5	0	10	10	0	0	10	0	10	0	5	10	60	Locality Kick-off Meeting
2	Update the city's floodplain zoning ordinance based on FEMA updated NFIP maps. Include standards that support flood mitigation and resilience throughout buildings and infrastructure.	Community Development Department	\$\$	DCR Community Flood Preparedness Fund (CFPF), FEMA	0	0	10	10	5	0	5	5	0	5	0	10	10	60	Locality Kick-off Meeting
3	Create a retrofit program with funding opportunities and incentives for private property owners to adapt their buildings to better withstand flooding or storm events.	Community Development Department	\$\$\$\$	FEMABRIC	0	5	0	5	10	0	5	0	0	0	0	5	10	40	Locality Kick-off Meeting
4	Assess the current conditions of culverts and four-through pipes, and replace underpasses or aqueducts to better accommodate increased streamflow during storm events.	DPW/VDOT	\$\$\$\$	VADEQ Stormwater Local Assistance Fund	0	5	0	10	10	0	5	0	0	0	5	5	10	50	Locality Kick-off Meeting
5	Assess opportunities to elevate or acquire repetitive loss properties to mitigate flood impacts including loss of life, property, and financial damage. Conduct outreach to homeowners of repetitive loss properties to understand their potential interest in relocation via buyouts.	Community Development Department/DPW	\$\$\$\$	FEMA/DCR (Dam Safety, Flood Prevention and Protection Assistance Fund)	0	0	10	10	10	5	5	0	10	0	0	5	10	65	Locality Kick-off Meeting
6	Assess the vulnerability of utility systems and infrastructure to make systems resilient during storm and flood events.	DPW	\$\$\$	DOE	0	5	0	0	10	5	5	5	0	0	10	5	10	55	Locality Kick-off Meeting
7	Implement green infrastructure and plant trees in urban heat island hot spots where low-to-moderate income populations live. Hotspots were identified through the University of Lynchburg's mapping study.	Community Development Department	\$\$	Department of Forestry	0	0	0	0	5	0	0	10	10	10	5	5	10	55	Locality Kick-off Meeting
8	Assess the conditions of stream banks and implement stream bank stabilization measures to mitigate erosion and scour.	DPW/Waterworks	\$\$	VADEQ Stormwater Local Assistance Fund	0	5	0	5	10	0	5	0	0	10	5	5	10	55	Locality Kick-off Meeting
9	Enroll in the Community Rating System (CRS). Complete a strategy to reduce NFIP premiums through the CRS. Update the team website with readily available information on NFIP enrollment and coverage. Create a public outreach campaign with specific hazard preparedness toolkits for businesses, residents, and organizations.	Public Safety/Community Development Department	\$\$	Locality Funding, FEMA HMPG	0	0	10	0	5	0	0	0	5	0	10	10	0	40	HMP High Priority
10	Promote sustainable and resilient development of the City's riverfront.	Community Development Department	\$\$	FEMA/DCR (Dam Safety, Flood Prevention and Protection Assistance Fund (CFPF))	0	0	10	10	10	0	5	5	5	10	10	5	0	70	HMP High Priority
11	Create a public outreach campaign with specific hazard preparedness toolkits for businesses, residents, and organizations. Educational information will focus on how to prepare for flood events, what to do when high water is on roadways, or when there is dam overtopping and inundation.	Community Development Department/Public Safety	\$	FEMA/DCR (Dam Safety, Flood Prevention and Protection Assistance Fund)	0	5	0	0	5	0	0	0	0	0	10	10	0	30	HMP High Priority
12	Install a back-up power generator for DWR facilities, at emergency shelters, and at city buildings.	Public Safety/Community Development Department	\$\$\$\$	Capital Improvement Plan (CIP)	0	0	10	0	5	5	5	0	0	0	10	10	0	45	HMP High Priority
13	Develop an emergency response plan for the high hazard dam inundation area. Complete a high hazard dam breach evaluation and studies to determine which areas are inundated areas of multiple high hazard dams breaching stance.	Public Safety	\$\$	FEMA/DCR (Dam Safety, Flood Prevention and Protection Assistance Fund)	0	0	10	10	5	0	0	0	5	0	10	10	10	60	HMP Priority Action Discussed in Stakeholder Interview
14	Initiate tree canopy analysis or condition study; selectively remove dead or diseased trees that have the potential to impact structures or block ROW during weather events.	DPW	\$\$\$\$	Department of Forestry	0	0	0	0	5	5	5	5	5	10	5	5	0	45	HMP High Priority
15	Create a resilient stormwater masterplan. Assess the current and future conditions of the stormwater system under climate change. Identify priority green and gray infrastructure projects. Design and implement stormwater best management practices to help mitigate flood impacts and contribute to better water quality.	DPW	\$\$	VADEQ Stormwater Local Assistance Fund	0	0	10	10	10	0	5	5	0	5	5	5	10	65	HMP Priority Action Discussed in Stakeholder Interview
16	Develop and publicize heat-resilience plan which includes the use of cooling centers and public health considerations.	Community Development Department/Public Safety	\$\$	VDEM	0	0	0	0	0	0	0	10	10	10	5	10	55	HMP Priority Action Discussed in Stakeholder Interview	
17	Study land use and cover in the sensitive areas (i.e., floodplain, high hazard dam inundation zones, streams, and steep slopes) to identify areas for conservation and open space.	Community Development Department	\$\$	VACPPF	0	0	10	10	5	0	0	5	0	10	0	10	0	50	HMP High Priority
Regional																			
1	Implement nature-based solutions in historically redlined areas that also suffer from urban heat island and stormwater flooding. Target NBS along transportation corridor.	VDOT, CIPDC, Locality DPW	\$\$	DCR Community Flood Preparedness Fund (CFPF)	0	5	0	5	5	0	5	10	10	10	5	5	60	Locality Kick-off Meeting	
2	Develop a regional emergency response plan that involves town, city, and county public safety officers.	Community Development Department	\$\$	FEMA	0	0	0	5	5	5	5	0	5	0	10	0	10	45	Locality Kick-off Meeting
3	Create a regional watershed hydrodynamic and hydrologic model to better understand flooding issues, stormwater system capacity, and stream conditions under future climate projections. Using the model, create a priority action plan of flood mitigation actions.	CIPDC, Locality DPW/Planning Department	\$\$	DCR Community Flood Preparedness Fund (CFPF)	0	0	10	10	10	0	5	5	10	5	5	10	65	Watershed & Sanjour	
4	Apply for funding and update the HMP in November 2024.	Community Development Department	\$\$	FEMA, VDEM	0	0	10	5	5	5	5	5	10	5	10	5	10	75	Locality Kick-off Meeting
5	Conduct a regional water supply study. Evaluate risks to resources and redundancy opportunities. Execute interconnection resource agreements between communities. Create conservation strategies and drought management plans.	Regional Multi-Departmental Action	\$\$	AWIA, Locality Cost-Share	0	0	0	0	0	0	0	0	0	0	5	5	10	20	Locality Kick-off Meeting
6	Evaluate risks associated with buried pipe crossings or streams and flood impacts (e.g., pipeline risk).	DPW	\$	Stormwater Local Assistance Fund	0	0	0	0	5	0	0	0	0	0	5	10	30	Locality Kick-off Meeting	
7	Develop an educational program for private property owners with optic systems on water quality, conservation, and flood mitigation.	Community Development Department	\$\$	VDEM	0	0	0	5	5	0	5	0	5	0	0	10	30	Locality Kick-off Meeting	
8	Develop a VDOT regional vulnerability assessment of the road and highway network.	VDOT	\$\$	VDOT	0	5	0	10	5	5	5	5	0	0	5	5	10	55	Berkley Group and Localities their 10 million-dollar "wish list"
9	Establish HMP Technical Advisory Committee, include locality, citizen, business, agency representation, that meets at least twice per year to review HMP mitigation strategy progress, evaluate changes, review regional projects.	CIPDC, Emergency Management/Public Safety, Multi-Departmental Action	\$\$	FEMA, VDEM	0	0	0	0	0	0	0	0	0	10	5	0	15	HMP High Priority	
10	Purchase equipment and execute agreement for a regional Public Safety Answering Point (PSAP) generator(s) to facilitate rapid and efficient emergency communication and response capabilities between the region's emergency response departments.	Public Safety Departments	\$\$	VDEM	0	0	0	0	5	5	5	5	5	0	10	10	0	45	HMP High Priority

## Scoring Criteria Definitions for Action Prioritization Matrix

This document provides the basis for the action prioritization scoring criteria for the Central Virginia Regional Resilience Plan. These criteria were developed to guide which actions the localities within the planning district commission geographic area prioritize moving forward.

### Implementation Details

Each action includes implementation details. While this information is not included in the scoring criteria, it does impact how the action will be implemented, who will implement it, and with what funding.

**Lead Department** - Department that could be the champion of planning and implementing the action, maintaining the action, or coordinating with other departments to implement or maintain the action.

**Opinion of Probable Cost** – The opinion of probable cost is an order of magnitude estimate of the cost of completing the action. Potential order of magnitude costs associated with the proposed actions are provided for planning studies, assessments, engineering or other design projects, and programs. Costs are not included for ongoing maintenance, but this should be a consideration when choosing which actions to implement. Operations and maintenance are key factors in the success of an action.

\$ - Up to \$50,000

\$\$ - \$50,000 up to \$150,000

\$\$\$ - \$150,000 up to \$500,000

\$\$\$\$ - \$500,000 up to \$1,000,000

\$\$\$\$\$ - \$1,000,000 and greater

**Potential Funding** – Potential eligibility for funding the action based on existing grant programs (such as the DCR Community Flood Preparedness Fund) or local programs or funds (such a stormwater utility).

### Location of Actions in Flood-Problem Areas

Each action is scored based on its location or proximity to a flood problem area. Criteria that relate to this category of scoring include FEMA Flood Zones and flood problem areas that were identified by localities during stakeholder interviews conducted by the Berkley Group in September 2023.

*Actions that pertain to the whole locality, such as locality wide plan or a local ordinance, should receive a “5” – a proxy intermediate score – because the action may apply to FEMA Zones, flood-prone areas, non-identified flood prone areas, or areas not currently vulnerable to flooding.*

Criteria	Points	Definitions
<b>Action is in a FEMA designated flood zone</b>	<b>0</b>	This action is not in any FEMA designated flood zones (such as a location specific project that is in a flood-problem area that <i>has not</i> been designated a FEMA flood zone).
	<b>5</b>	This action is not specifically within a FEMA designated flood zone; however, it pertains to areas within flood zones (such as locality-wide ordinances, plans, programs, or policies).
	<b>10</b>	This action is in a FEMA designated 1% annual chance flood zone.
<b>Action is in a flooding problem area (As ID by locality)</b>	<b>0</b>	This action is not in a flooding problem area as ID by locality.
	<b>5</b>	This action partially pertains to flooding problem areas as ID by locality (such as locality-wide ordinances, plans, programs, or policies).
	<b>10</b>	This action is in a flooding problem area as ID by locality.

## Effectiveness in Mitigating Flooding or Other Climate Impacts

Each action is scored based on its effectiveness in mitigating flood or other climate impacts. Effectiveness is determined based on knowledge of best practices, local understanding of what has worked in the past, or the scale of the action.

*The consultant team realizes that "effectiveness" may vary based on the physical conditions of the action location, the unique climate vulnerabilities of that geographic location, and the standards by which the action is planned, designed, implemented, and maintained. This criterium is based on a planning level expert opinion.*

- **Effectiveness in Mitigating Flooding** - Potential risk reduction from proposed alternative, either through reducing likelihood or consequence of flooding. This may be related to extreme precipitation flooding, riverine flooding, or erosion.
- **Effectiveness in Mitigating Other Climate Impacts** - Potential risk reduction from proposed alternative, either through reducing likelihood or consequence of climate impacts such as windstorm, urban heat island, or winter weather.

Section	Points	Definitions
Action Mitigates Flooding Impacts	<b>0</b>	This action has limited risk reduction.
	<b>5</b>	This action has some risk reduction.
	<b>10</b>	This action substantially reduces risk.
Action helps mitigate windstorm impacts	<b>0</b>	This action will not help mitigate windstorm impacts.
	<b>5</b>	This action will somewhat help mitigate windstorm impacts.
	<b>10</b>	This action will help mitigate windstorm impacts.
Action helps mitigate the urban heat island (UHI) effect	<b>0</b>	This action will not help mitigate the UHI effect.
	<b>5</b>	This action will somewhat help mitigate the UHI effect.
	<b>10</b>	This action will help mitigate the UHI effect.
Action helps mitigate winter storm impacts (snow or ice)	<b>0</b>	This action will not help mitigate winter storm impacts.
	<b>5</b>	This action will somewhat help mitigate winter storm impacts.
	<b>10</b>	This action will help mitigate winter storm impacts.

## Action Provides Co-Benefits

Each action is scored based on the co-benefits it may provide residents and community members. For the purposes of this Resilience Strategy, co-benefits include support for priority populations (defined below) or inclusion of nature-based solutions.

- **Supports Socially Vulnerable Populations (as identified in the AdaptVA Tool)**— Action supports socially vulnerable populations: “Social vulnerability refers to the characteristics of an individual or group that impacts their ability to anticipate, cope with, resist and recover from a physical hazard. The level of social vulnerability is dependent on physical, social, economic, and environmental factors.” These can include low-income residents, older adults, individuals with limited English proficiency, individuals with limited educational attainment (less than a high school degree), individuals with self-identified disabilities, minority populations, and residents who are undocumented.
- **Nature-based solutions** — Nature-based solutions are a priority project type in the Virginia Community Flood Preparedness Program, meaning that they are more likely to be funded. Additionally, nature-based solutions can improve air and water quality, green the public realm, provide shade and reduce urban heat islands, and help mitigate erosion. Nature-based solutions can also improve public spaces and provide aesthetic value.

Section	Points	Definitions
Action is in Area with Socially Vulnerable Populations	<b>0</b>	This action will not impact priority populations.
	<b>5</b>	This action will somewhat impact priority populations.
	<b>10</b>	This action will impact priority populations.
Action is a Nature-Based Solution	<b>0</b>	This action is not a nature-based solution.
	<b>5</b>	This action promotes or facilitates the creation of nature-based solutions (such as a plan, policy, ordinance, or program).
	<b>10</b>	This action is a nature-based solution or site-scale open space project (such as bioswales, tree box filters, green roofs, green facades, bioretention ponds, rain gardens, buffers to waterways, park spaces).

## Feasibility of Implementation

Each action is scored based on the feasibility of implementing the action. Feasibility is evaluated using several criteria.

- **Action was Identified in the FEMA Hazard Mitigation Plan** - The HMP was recently updated and included engagement with the localities to develop a comprehensive set of actions. Therefore, actions have already been approved and adopted by the localities that relate to hazard mitigation and resilience. While this Resilience Plan is a distinct effort from the HMP, actions that are included in both plans should be recognized as being a high priority.
- **Properties Implicated** – Property ownership directly impacts the feasibility of implementing an action. Actions that are located on public property will be more easily implemented by the localities than actions that are specific to private property. Some actions are located on public rights of ways or locality easements, which may require coordination with private property owners, but are within the domain of the local government.
- **Maintenance Required** – The success of an action is dependent on how well it is upheld and maintained. Therefore, when planning and implementing priority actions, localities should consider their capacity for operations and maintenance in the future. Although maintenance needs should not be a deterrent to implementing effective flood mitigation actions, low-maintenance actions receive a higher score since they are more feasible to *successfully* implement, maximizing their effectiveness.
- **Action was Identified in Stakeholder Interviews (2023)** – Actions that were specifically mentioned or identified by locality stakeholders during interviews with the Berkley Group, receive a higher score, as they are considered actions most relevant to localities today (at the time of resilience plan development).

<b>Section</b>	<b>Points</b>	<b>Definitions</b>
<b>Action was ID in Hazard Mitigation Plan (HMP)</b>	<b>0</b>	This action was not identified in the HMP.
	<b>5</b>	This action may have some of the components identified in the HMP.
	<b>10</b>	This action is directly identified in the HMP.
<b>Action Aligns with Community Flood Preparedness Fund (CFPF) Principles</b>	<b>0</b>	This action does not align with any CFPF Principles.
	<b>5</b>	This action aligns with 1-3 CFPF Principle.
	<b>10</b>	This action aligns with 3 or more CFPF Principles.
<b>Properties Implicated (Public, PROW, Easement, Private)</b>	<b>0</b>	This action will take place on public property.
	<b>3</b>	This action will take place on public right-of-way (PROW).
	<b>5</b>	This action will take place on an easement.
	<b>10</b>	This action will take place on private property.
<b>Maintenance Required</b>	<b>0</b>	This action will require frequent maintenance once implemented.
	<b>5</b>	This action will require some on-going maintenance once implemented.
	<b>10</b>	This action will not require on-going maintenance once implemented.
<b>Action was Identified in a Stakeholder Interview (2023) as a Priority Action</b>	<b>0</b>	This action was not mentioned in the Resilience Plan stakeholder engagement.
	<b>10</b>	This action was mentioned in the Resilience Plan stakeholder engagement.

## APPENDIX B – 2020 CVPDC HMP Data and Maps

\*same link/document for all

Community	Page Numbers	Topic	Downloadable	Link:
CVPDC	4-20,21	Existing Floodplains	Yes	<a href="https://www.cvhmp.com/static/files/flooding.pdf*">https://www.cvhmp.com/static/files/flooding.pdf*</a>
CVPDC	4-20,4-21	Existing Floodplains	Yes	
CVPDC	4-24,4-25	Repetitive Loss Properties	Yes	
CVPDC	4-26	Repetitive Loss Areas	Yes	
Amherst County	4-20,4-21	Existing Floodplains	Yes	
Amherst County	4-24,4-25	Repetitive Loss Properties	Yes	
Amherst County	4-26	Repetitive Loss Areas	Yes	
Amherst County	4-34, 4-35	NFIP Dashboard	Yes	
Amherst County	4-35, 4-36	Principal Flood Problems	Yes	
Amherst County	4-36-41	Vulnerable Populations and Structures	Yes	
Amherst County	4-42-45	Map of Vulnerable Structures in the Floodplain	Yes	
Amherst County	4-46	Map of Community Growth Areas	Yes	
Appomattox County	4-20,4-21	Existing Floodplains	Yes	
Appomattox County	4-24,4-25	Repetitive Loss Properties	Yes	
Appomattox County	4-26	Repetitive Loss Areas	Yes	

Community	Page Numbers	Topic	Downloadable	Link:
<b>Appomattox County</b>	4-34, 4-35	NFIP Dashboard	Yes	
<b>Appomattox County</b>	4-35, 4-36	Principal Flood Problems	Yes	
<b>Appomattox County</b>	4-36-41	Vulnerable Populations and Structures	Yes	
<b>Appomattox County</b>	4-42-45	Map of Vulnerable Structures in the Floodplain	Yes	
<b>Appomattox County</b>	4-46	Map of Community Growth Areas	Yes	
<b>Town of Appomattox</b>	4-20,4-21	Existing Floodplains	Yes	
<b>Town of Appomattox</b>	4-24,4-25	Repetitive Loss Properties	Yes	
<b>Town of Appomattox</b>	4-26	Repetitive Loss Areas	Yes	
<b>Town of Appomattox</b>	4-34, 4-35	NFIP Dashboard	Yes	
<b>Town of Appomattox</b>	4-35, 4-36	Principal Flood Problems	Yes	
<b>Town of Appomattox</b>	4-36-41	Vulnerable Populations and Structures	Yes	
<b>Town of Appomattox</b>	4-42-45	Map of Vulnerable Structures in the Floodplain	Yes	
<b>Town of Appomattox</b>	4-46	Map of Community Growth Areas	Yes	
<b>Bedford County</b>	4-20,4-21	Existing Floodplains	Yes	

Community	Page Numbers	Topic	Downloadable	Link:
<b>Bedford County</b>	4-24,4-25	Repetitive Loss Properties	Yes	
<b>Bedford County</b>	4-26	Repetitive Loss Areas	Yes	
<b>Bedford County</b>	4-34, 4-35	NFIP Dashboard	Yes	
<b>Bedford County</b>	4-35, 4-36	Principal Flood Problems	Yes	
<b>Bedford County</b>	4-36-41	Vulnerable Populations and Structures	Yes	
<b>Bedford County</b>	4-42-45	Map of Vulnerable Structures in the Floodplain	Yes	
<b>Bedford County</b>	4-46	Map of Community Growth Areas	Yes	
<b>Town of Bedford</b>	4-20,4-21	Existing Floodplains	Yes	
<b>Town of Bedford</b>	4-24,4-25	Repetitive Loss Properties	Yes	
<b>Town of Bedford</b>	4-26	Repetitive Loss Areas	Yes	
<b>Town of Bedford</b>	4-34, 4-35	NFIP Dashboard	Yes	
<b>Town of Bedford</b>	4-35, 4-36	Principal Flood Problems	Yes	
<b>Town of Bedford</b>	4-36-41	Vulnerable Populations and Structures	Yes	
<b>Town of Bedford</b>	4-42-45	Map of Vulnerable Structures in the Floodplain	Yes	
<b>Town of Bedford</b>	4-46	Map of Community Growth Areas	Yes	
<b>Campbell County</b>	4-20,4-21	Existing Floodplains	Yes	
<b>Campbell County</b>	4-24,4-25	Repetitive Loss Properties	Yes	
<b>Campbell County</b>	4-26	Repetitive Loss Areas	Yes	

Community	Page Numbers	Topic	Downloadable	Link:
Campbell County	4-34, 4-35	NFIP Dashboard	Yes	
Campbell County	4-35, 4-36	Principal Flood Problems	Yes	
Campbell County	4-36-41	Vulnerable Populations and Structures	Yes	
Campbell County	4-42-45	Map of Vulnerable Structures in the Floodplain	Yes	
Campbell County	4-46	Map of Community Growth Areas	Yes	
City of Lynchburg	4-20,4-21	Existing Floodplains	Yes	
City of Lynchburg	4-24,4-25	Repetitive Loss Properties	Yes	
City of Lynchburg	4-26	Repetitive Loss Areas	Yes	
City of Lynchburg	4-34, 4-35	NFIP Dashboard	Yes	
City of Lynchburg	4-35, 4-36	Principal Flood Problems	Yes	
City of Lynchburg	4-36-41	Vulnerable Populations and Structures	Yes	
City of Lynchburg	4-42-45	Map of Vulnerable Structures in the Floodplain	Yes	
City of Lynchburg	4-46	Map of Community Growth Areas	Yes	
Town of Altavista	4-20,4-21	Existing Floodplains	Yes	
Town of Altavista	4-24,4-25	Repetitive Loss Properties	Yes	
Town of Altavista	4-26	Repetitive Loss Areas	Yes	
Town of Altavista	4-34, 4-35	NFIP Dashboard	Yes	
Town of Altavista	4-35, 4-36	Principal Flood Problems	Yes	

Community	Page Numbers	Topic	Downloadable	Link:
<b>Town of Altavista</b>	4-36-41	Vulnerable Populations and Structures	Yes	
<b>Town of Altavista</b>	4-42-45	Map of Vulnerable Structures in the Floodplain	Yes	
<b>Town of Altavista</b>	4-46	Map of Community Growth Areas	Yes	
<b>Town of Brookneal</b>	4-20,4-21	Existing Floodplains	Yes	
<b>Town of Brookneal</b>	4-24,4-25	Repetitive Loss Properties	Yes	
<b>Town of Brookneal</b>	4-26	Repetitive Loss Areas	Yes	
<b>Town of Brookneal</b>	4-34, 4-35	NFIP Dashboard	Yes	
<b>Town of Brookneal</b>	4-35, 4-36	Principal Flood Problems	Yes	
<b>Town of Brookneal</b>	4-36-41	Vulnerable Populations and Structures	Yes	
<b>Town of Brookneal</b>	4-42-45	Map of Vulnerable Structures in the Floodplain	Yes	
<b>Town of Brookneal</b>	4-46	Map of Community Growth Areas	Yes	

## APPENDIX C – Community Plan/Project Criteria Matrix

Community	Plan Name	Purpose	Downloadable	Link
CVPDC	2020 Hazard Mitigation Plan Update	A plan that examines the risk and impact of natural disasters and establishes strategies to mitigate, or lessen, human and property impacts.	Yes	<a href="#">Link</a>
CVPDC	Brownfields Assessment Program	Phase I and Phase II Environmental Site Assessments (ESAs), to support property reuse and remediation planning and economic development and revitalization in the region.	Yes	<a href="#">Link</a>
CVPDC	Housing Study	A compilation of data, maps, and visualizations describing local demographics and measures of housing affordability, housing stock and characteristics.	No	
CVPDC	Transportation Plan	A long-range vision of anticipated transportation needs and regional goals and objectives over a 30-year timeframe.	No	
CVPDC	Comprehensive Economic Development Strategy	Tool to diversify and strengthen the region's economic vitality	Yes	<a href="#">Link</a>
Amherst County	Comprehensive Plan	The County's plan regarding growth, development, and future change for the next five (5) years.	Yes	<a href="#">Link</a>
Amherst County	Madison Heights Master Plan	A masterplan for the Madison Heights area that will provide a guide for growth and development, and what the area could look like in the future.	No	

Community	Plan Name	Purpose	Downloadable	Link
Appomattox County	Comprehensive Plan	The County's plan on future growth and development that local leaders and citizens envision for their community.	Yes	<a href="#">Link</a>
Town of Appomattox	Comprehensive Plan	A plan that guides Town Council members in assessing the strengths and weaknesses as well as the potential opportunities for their community.	Yes	<a href="#">Link</a>
Bedford County	Comprehensive Plan	The plan provides a general basis for assisting the County in optimal economic development, land use, and a plan to achieve what citizens of the community.	Yes	<a href="#">Link</a>
Town of Bedford	Comprehensive Plan	A plan where local government officials and citizens express their voices on issues and what they envision for the Town.	Yes	<a href="#">Link</a>
Town of Bedford	Bike/Walk Plan	Prioritized guide for improving bicycling and walking in the Town.	Yes	<a href="#">Link</a>
Campbell County	Comprehensive Plan	The plan that examines the past trends of economic development, citizen input of issues of the County, and guides development that suites the wants or needs of the County.	Yes	<a href="#">Link</a>
City of Lynchburg	Comprehensive Plan	The City's plan for future development and policy guidance that includes several smaller plans including the Parks and Recreation Master Plan, Downtown 2040 Master Plan, and the Diamond Hill Neighborhood Plan.	Yes	<a href="#">Link</a>
City of Lynchburg	Parks and Recreation Master Plan	The City's current and future plan for the development of parks and recreational areas.	Yes	<a href="#">Link</a>

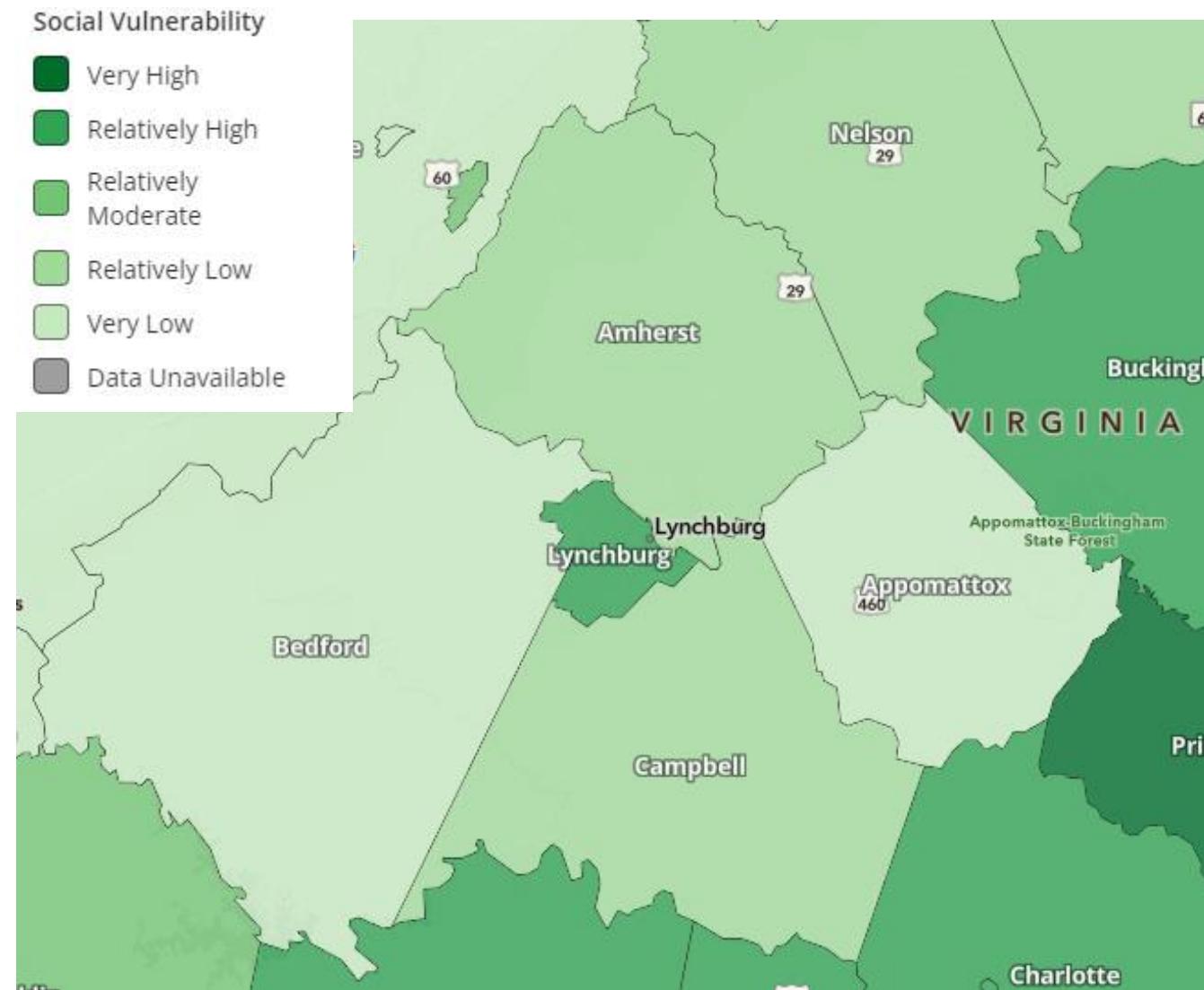
<b>Community</b>	<b>Plan Name</b>	<b>Purpose</b>	<b>Downloadable</b>	<b>Link</b>
City of Lynchburg	Downtown 2040 Master Plan	Address the future growth and development of Downtown.	Yes	<a href="#">Link</a>
Town of Altavista	Comprehensive Plan	A plan that serves as a policy guide for the Town's vision of redevelopment and creating an economic resurgence for its community.	Yes	<a href="#">Link</a>

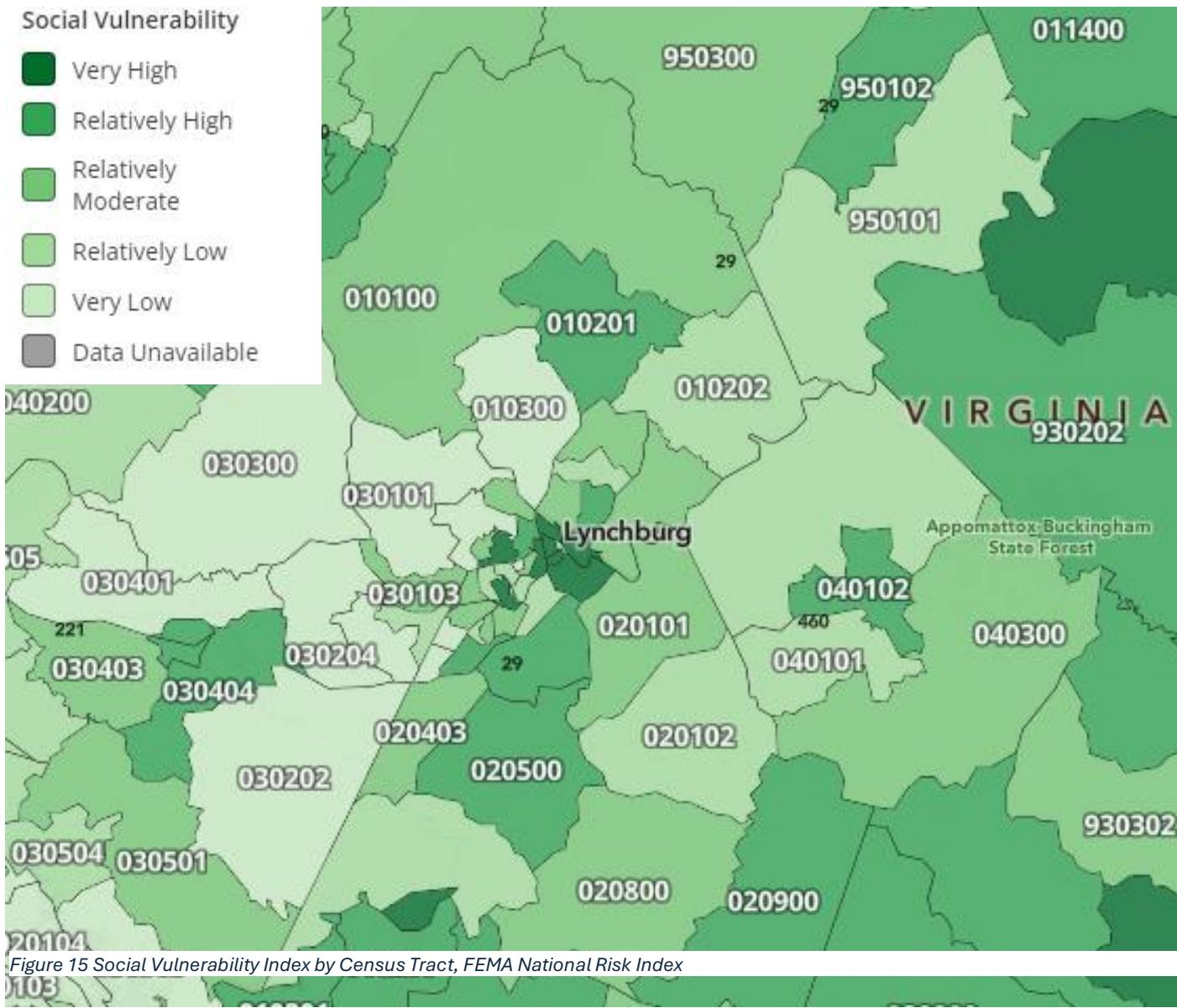
## APPENDIX D – Administrative procedures for regulating the development and substantial improvement of structures in the floodplain by Locality.

Locality	Floodplain Ordinance	Link
<b>Amherst County</b>	Floodplain Overlay District	<a href="#">Article VII, Section 714, Flood Hazard Overlay District (FH)</a>
<b>Town of Altavista</b>	Flood Control	<a href="#">Flood Control Regulations</a>
<b>Appomattox County</b>	Floodplain Overlay District	<a href="#">Section 11 Floodplain Overlay FPO</a>
<b>Town of Appomattox</b>	Floodplain District	<a href="#">Article XIV Floodplain District</a>
<b>Town of Brookneal</b>	Floodplain Regulations	<a href="#">Chapter 154: Floodplain Regulations</a>
<b>Town of Bedford</b>	Flood Hazard District	<a href="#">Sec. 611. Flood Hazard District (FH)</a>
<b>Bedford County</b>	Floodplain Regulations	<a href="#">Article II. – Floodplain Management</a>
<b>Campbell County</b>	Floodplain Management	<a href="#">Chapter 11 Floodplain Management</a>
<b>City of Lynchburg</b>	Floodplain Management	<a href="#">Section 16.2-22 Floodplain Management</a>



## APPENDIX E – Social Vulnerability Index and Related Maps





# APPENDIX F – Community Interview Notes

CVPDC Resilience Plan Request for Information

July 31, 2023

Amherst County

<b>Primary Hazards – Please share any first-hand information concerning the events that have impacted your community, and the infrastructure that helps manage and recover from an event.</b>	
1.	<p>Known areas of flooding and/or photos of past flood events;</p> <ul style="list-style-type: none"><li>• Big concern – fernwood, stratford palce subdivisions behind wal-mart. Went through stormwater mgmt, but shady oak dr. and others were built prior to regulations (2004). Drainage easement aren't adequate, can't handle 10-year storms. Inspected yesterday, channel inadequate, easement isn't dedicated, so it's on the property owner.</li><li>• Business – cooper steel in floodzone on corner of 5 forks. Pond/lake upstream – if levee breaks, entire area floods.</li><li>• James River bank.</li></ul>
2.	<p>Stormwater system inventory and/or assessments (and whether there are GIS files available);</p> <ul style="list-style-type: none"><li>• Ditches &amp; culverts, too. Not readily available – each new development has BMPs written in permit. Most BMPs assct. With subdivisions over acre/10,000sqft.</li><li>• After 2018 these are digitized.</li><li>• GIS site is great – available for download for public use? Public site we send them an email and they can give us shapefiles.</li></ul>
3.	<p>Resident or community focused information or programs on emergency response and preparedness for extreme weather events.</p> <ul style="list-style-type: none"><li>• Beyond HMP? Public safety has system where if there's an issue or hazard they can send out signal/message reverse 911 to given radius.</li><li>• Primary hazard ID'd is flooding.</li><li>• Ob Howard was looking into stabilization on the James for sewer</li><li>• EPA plans required for water utilities. Authority plan submitted to EPA – we'd love to have that.</li></ul>
<b>Demographics/Community Info – Please share information about your community and the populations that are most vulnerable/less able to recover from hazards.</b>	
1.	<p>Plans, reports, or programs that specifically support priority and/or underserved populations(there may be elements of this in disparate sources, such as housing or transportation plans);</p> <ul style="list-style-type: none"><li>• Comp Plan best source – breaks down different districts and can look at LMI districts that way. Broken down by voting districts – average house and incomes.</li><li>• Emergency plan might too, but for specific communities?</li><li>• Monacan Nation</li></ul>

July 31, 2023

2.	Zoning, housing, land use data sets for your locality if not publicly available; <ul style="list-style-type: none"> <li>• GIS downloadable. Ahead of a lot of other communities about having their data online.</li> </ul>
3.	Names of neighborhoods in your community commonly used by residents that you would like used in this plan (such as voting districts) and any GIS maps that delineate these boundaries (if available). <ul style="list-style-type: none"> <li>• </li> </ul>
<b>Funding – How does your community fund services and/or projects that contribute to hazard preparedness and recovery?</b>	
1.	Does your community have a Capital Improvement Plan? If so, please provide the sections that related to stormwater, flooding, or heat mitigation; <ul style="list-style-type: none"> <li>• Do not maintain their own roads – VDOT or private properties</li> <li>• Not an MS4 – DEQ maintains stormwater</li> <li>• Wastewater treatment plant – partially in floodzone. Tim found 331 page document ID'ing all resiliency and threats for plant.</li> <li>• \$2MM to stabilize James – threatening to encroach on sewer trunk.</li> <li>• Last week submitted joint work application to protect sewer gravity main.</li> <li>• \$2MM to improve emergency spillway on anne french (?) reservoir.</li> <li>• They need to do some master planning – these are more reactive projects. #1 project right now.</li> </ul>
2.	Other sources of funding for stormwater, flooding or heat mitigation activities or projects; <ul style="list-style-type: none"> <li>• CVPDC block grant.</li> <li>• James River Assoc. VCAP funding.</li> </ul>
3.	Beyond what is in the HMP (2020), specific information on staff capacity or staffing needs to support flood mitigation and preparedness; <ul style="list-style-type: none"> <li>• Enough manpower for inspections? Nate has data showing what workload of inspectors should be, well over that.</li> <li>• Jarred in EM doesn't have staffing to deal with flood mitigation.</li> <li>• DEQ deals with stormwater, so they inspect plans throughout the course of the project but they don't have their own staff to do that.</li> </ul>
4.	Beyond what is in the HMP (2020), needs for critical facility upgrades and continuity of essential services. <ul style="list-style-type: none"> <li>• Cooper Steel, Ferwood and woodland</li> <li>• Fire department might be in floodplain – area along seminole Dr. is lower income area, private utility system there that ties into County's faces storm and sewer issues.</li> <li>• Dixie Girls softball field of lakeview drive floods frequently and affects nonprofit.</li> </ul>
<b>FEMA NFIP CRS Program – Many of the actions for hazard preparedness your community undertakes may be considered a credit for the CRS program and can save residents money on their NFIP flood insurance policies.</b>	

July 31, 2023

1.	What barriers exist for entry in the NFIP CRS program? <ul style="list-style-type: none"><li>• Gravel in roadway covered plant.</li></ul>
<b>Conservation/Recreation – Recreation and open space areas can have multiple benefits, including flood and heat mitigation.</b>	
1.	Areas/parcels currently being protected as open space, and especially those owned by your locality; <ul style="list-style-type: none"><li>• Seminole area; PDC already doing some work in that area. (Peddler fire station)</li></ul>
2.	Current or planned recreation areas, greenways and parks (and GIS data if it exists); <ul style="list-style-type: none"><li>• Procurement process to hire 3<sup>rd</sup> party to do parks master plan. Pull up GIS for layer for trails.</li><li>• Any with flooding or erosion issues? Tyler: “oh yeah” <b>get back to them</b><ul style="list-style-type: none"><li>○ Coordination – send to Sara</li></ul></li></ul>
3.	Tree protection plans and/or tree inventories.

- Roads? Coordination between this plan and VDOT between flooding roads would be good.
- Other resilience? Code enforcement aspects – resilience in model building codes. Building closer to model codes the more resilient that communities become.
- [need to think about policy and regulations and ordinances]
  - Public safety – installing two new rain gauges with NWS
    - Monitoring is important
    - Thrasher’s, Buffalo Springs Turnpike

**Amherst County**

**Interview Follow up: October 11, 2023**

Evaluate and implement streambank stabilization along the James River at Madison Heights to protect ACSA trunk sanitary sewer line and provide sediment reduction and environmental protection to the James River.	Amherst County	Flood	N/A	High	Interview Discussion - looking for funding	Received grant funding/ Federal funding requested*
Initiate program and studies to execute elevation, relocation, or acquisition measures, especially in area of repetitive flooding, to reduce or eliminate flooding and high hazard dam failure impacts to lives, property and financial impacts to families and communities.	Amherst County	Flood	N/A	High	Interview Discussion - looking for funding	Private Dams
Provide hardening or preparedness best practices to private property owners, especially if in the flood zone, high hazard dam inundation zone, or known for repetitive stormwater impacts, to reduce or eliminate flooding and dam failure impacts; include information on roadway highwater safety. Target communication with historical areas (e.g. Monacan Ancestral Museum), isolated and vulnerable communities.	Amherst County	Flood	N/A	Medium	Interview Discussion - looking for funding	Most issues are on Private property associated with subdivisions

## **Meeting Notes: Amherst Resilience Plan Review**

**Wednesday, February 21, 2024, 10:00AM – 11:00AM**

**EST Prepared by Luke Peters**

*In attendance (#):*

<b>First</b>	<b>Last</b>	<b>Organization/Affiliation</b>	<b>Position</b>
Luke	Peters	Berkley Group	Planner II
Kate	Jones	Berkley Group	Principal Planner
Nate	Young	Amherst	
Tyler	Creasy	Amherst	
Kelly	Hitchcock	CVPDC	

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### **Meeting Notes**

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Preview of individual locality sections of the CVPDC Resilience Plan.

#### **Debris Management Plan:**

- *EOP is on the website, otherwise reach out to Brad.*

#### **Critical infrastructure:**

- *Public safety might be interested in the VDOT crash data.*

#### **Dams:**

- *Tyler interested in developing DBIZ maps, using plan for that (definitely mention this).*

#### **Future Conditions:**

**Recommended Policies:**

- *DEQ handles commercial development over a certain size – over an acre, and they account for quantity and quality.*
  - *Smaller lot sizes in subdivisions and future development could be looked at, though.*
- *Might not control the land in Madison Heights needed for increased tree planting – try for incentives for private property owners.*

**Project Prioritization:**

- *How'd they get to “action lead” on which department should take it on?*
  - *Probably just from HMP – okay if so.*

**Prioritized Flood Resilience Strategy:****Other Notes:**

- *Amherst is interested in having the data from the maps, packaged easy.*
- *Tyler wanted to make sure County admin knows what's going on, but they should be set.*

Subdivision behind Madison Heights Walmart (Shadey Oaks Dr)

**Cooper Steel (in a flood zone)** – privately own dam

James River bank along county

Trunk line for the public sewer serving half of **Madison Heights**, also a vulnerable area, the County's commercial hub and largest town, is on the north bank of James River and threatened by river bank erosion. Some of

the water lines and many of the sewer lines follow the streams. A pump station is also in the base floodplain and other pump stations are inaccessible during flood events.

#### **Sycamore Ln (In Madison heights)**

- Area of existing private sewer line
- Manholes take in water during floods: runs into sewer systems
- Sewer systems become backed up during floods
- Runs into resident properties

Trying to public/private project – funding with DEQ? Underserved area? Lower income area. Facilities are not up to current authority standards. Current owner has to pay up. Older neighborhood. May be opportunities.

Williams Run – precip flooding

Sewer lines and water lines through there, pp or non profit. A portion of that. Main drainage area, in the floodway.

180 acre development starting upstream. Stormwater will increase. All SW is private.

**Madison Heights conceptual master plan**

Multiple census tracks, 80% of LMI

Disadvantaged Communities –

**Old Town Madison Heights**

29 B, everything E of 29, LMI/Disadvantaged.

Stormwater scenario – Shady Oak drive, near stratford Place, Natural drainage channel, floods all the backyards, and goes into Williams run. HOA holds the easement.

Yes, the owners would provide access.

James river association.

Debris Management Plan – NO. Raw water intake. Debris Management Plan,

Public owned dams, study at Winton farms, dam inspection studies and further analysis.

VDEM – private roads in the county, NW area, topographiy is steep, all private owned bridges, for access purposes. Study funded by FEMA. District roads.

- Johnnie

**Primary Hazards – Please share any first-hand information concerning the events that have impacted your community, and the infrastructure that helps manage and recover from an event.**

1.	Known areas of flooding and/or photos of past flood events; <ul style="list-style-type: none"> <li>• [missed this]</li> </ul>
2.	Stormwater system inventory and/or assessments (and whether there are GIS files available); <ul style="list-style-type: none"> <li>• Might have contact with the town to see if there's an inventory. Town public works guy holds GIS close to the vest.</li> </ul>
3.	Resident or community focused information or programs on emergency response and preparedness for extreme weather events. <ul style="list-style-type: none"> <li>• They have severe weather alert code red system. Town has a siren.</li> </ul>

**Demographics/Community Info – Please share information about your community and the populations that are most vulnerable/less able to recover from hazards.**

1.	Plans, reports, or programs that specifically support priority and/or underserved populations (there may be elements of this in disparate sources, such as housing or transportation plans); <ul style="list-style-type: none"> <li>• LMIs and neighborhoods aren't in distinct places – there's little strips. Town of Pamplin is the most distressed, but doesn't flood. Town of Appomattox has a couple neighborhoods. Metalark/Steven's street has some, but also not very susceptible to flooding.</li> </ul>
2.	Zoning, housing, land use data sets for your locality if not publicly available; <ul style="list-style-type: none"> <li>• They have town and county zoning. Send Johnnie an email to download it – send it to Timmons guy.</li> </ul>
3.	Names of neighborhoods in your community commonly used by residents that you would like used in this plan (such as voting districts) and any GIS maps that delineate these boundaries (if available). <ul style="list-style-type: none"> <li>• Just use historical crossroads – like Oakville. Used to have old schools (use school districts). Promiseland, Aveera, Stonewall, etc.</li> </ul>

**Funding – How does your community fund services and/or projects that contribute to hazard preparedness and recovery?**

1.	Does your community have a Capital Improvement Plan? If so, please provide the sections that related to stormwater, flooding, or heat mitigation; <ul style="list-style-type: none"> <li>• They have one, but getting a stormwater project on there is highly difficult. Nothing on the list right now – dealing with schools and old courthouse buildings. Community center on police tire rd. \$1.8MM project for industrial park has been on list for 4-5 years now.</li> </ul>
2.	Other sources of funding for stormwater, flooding or heat mitigation activities or projects; <ul style="list-style-type: none"> <li>• Nope. No flooding projects ever.</li> </ul>

CVPDC Resilience Plan Request for Information

July 31, 2023

3.	Beyond what is in the HMP (2020), specific information on staff capacity or staffing needs to support flood mitigation and preparedness; <ul style="list-style-type: none"><li>• Interested in training? Johnnie is a floodplain manager but doesn't have a ton of knowledge or official CFM. Inspector in the field doesn't have too much training either.</li></ul>
4.	Beyond what is in the HMP (2020), needs for critical facility upgrades and continuity of essential services. <ul style="list-style-type: none"><li>• Get their water from Campbell County, source is CCUSA hooked into Town system.</li></ul>
<p><b>FEMA NFIP CRS Program</b> – <i>Many of the actions for hazard preparedness your community undertakes may be considered a credit for the CRS program and can save residents money on their NFIP flood insurance policies.</i></p>	
1.	What barriers exist for entry in the NFIP CRS program? <ul style="list-style-type: none"><li>• Nope</li></ul>
<p><b>Conservation/Recreation</b> – <i>Recreation and open space areas can have multiple benefits, including flood and heat mitigation.</i></p>	
1.	Areas/parcels currently being protected as open space, and especially those owned by your locality; <ul style="list-style-type: none"><li>• 100 acres on police <b>tower</b> rd (recreation park). Phil's branch runs along the border and there's a walking trail across the stream, goes into industrial park a little. There are some issues right at the bridge. On the industrial park side there's wetlands, they did permitting to get 100' of trail there. When it floods though it wipes the trail out.</li></ul>
2.	Current or planned recreation areas, greenways and parks (and GIS data if it exists);
3.	Tree protection plans and/or tree inventories.

- *No other real resilience concerns. Maybe tornadoes?*
- *Roads? They're all VDOT. They have some that flood but VDOT handles it. Done a good job in recent years replacing lower bridges and adding box culverts. They don't do anything with roads.*

CVPDC Regional Resilience Plan – Bedford County/Town Data & Interview Session

Thursday, August 17<sup>th</sup>, 2023

Atendees

- Luke Peters - Berkley Group Environmental Planner
- Kate Jones - Berkley Group Principal Planner
- Kelly Hitchcock - CVPDC Deputy Director of Planning
- Sara Oakley - CVPDC Regional Planner
- Jordan Mitchell – Director of Community Development
- Kevin Leamy – Natural Resources Engineer
- Mary Zirkle – Economic Development Coordinator
- Kent Robey – Director of Emergency Management
- Jared Thompson – Project Administrator

Primary Hazards

- 1. Known areas of flooding and/or photos of past flood events.**
  - Just created emergency operation plan – addresses flooding
  - VDOT is making list of areas prone to flooding (will be emailed to us)
- 2. Stormwater system inventory and/or assessments (and whether there are GIS files available);**
  - Town uses VDOT funding?
- 3. Resident or community focused information or programs on emergency response and preparedness for extreme weather events.**
  - Social media, local news,

radio Demographics/ Community Info

- 1. Plans, reports, or programs that specifically support priority and/or underserved populations (there may be elements of this in disparate sources, such as housing or transportation plans);**
  - Use census tract data
  - Hilltop community low/moderate income, Town: south of Main St., trailer parks in county
- 2. Zoning, housing, land use data sets for your locality if not publicly available**
  -
- 3. Names of neighborhoods in your community commonly used by residents that you would like used in this plan (such as voting districts) and any GIS maps that delineate these boundaries (if available).**

## Funding

- 1. Does your community have a Capital Improvement Plan? If so, please provide the sections that are related to stormwater, flooding, or heat mitigation.**
  -
- 2. Other sources of funding for stormwater, flooding or heat mitigation activities or projects.**
  -
- 3. Beyond what is in the 2020 HMP specific information on staff capacity or staffing needs to support flood mitigation and preparedness.**
  - County is interested in more training
- 4. Beyond what is in the 2020 HMP, needs for critical facility upgrades and continuity of essential services.**
  - None

## FEMA NFIP CRS

### Program

- 1. What barriers exist for entry in the NFIP CRS program?**
  - Haven't seen a real need (flooding related)
  - May want to participate as a town (HMP has number of flood insurance policies) Conservation/Recreation
    - GIS layer of town park
    - Green infrastructure project from UVA
    - Updating parks masterplan

- Kent Robey, new director of EM
- Jared Thompson, project admin from town of bedford
- Kevin
- Jordan Mitchell, dir. Commdev (with two others from nat. res.) Bedford County
- Mary, Town of Bedford

**Primary Hazards – Please share any first-hand information concerning the events that have impacted your community, and the infrastructure that helps manage and recover from an event.**

1.	<p>Known areas of flooding and/or photos of past flood events;</p> <ul style="list-style-type: none"> <li>• Kent: Brand new plan being voted on in 28<sup>th</sup> meeting addresses flooding. VDOT working on rds that flood often (not a lot of them); mostly concerned about flooding that traps residents, have ID'd a few places. Kent will try and find a way for them to escape when flash floods occur.</li> <li>• Couple bridges and roads have been wiped out in the past.</li> <li>• They'll email us the list.</li> </ul>
2.	<p>Stormwater system inventory and/or assessments (and whether there are GIS files available);</p> <ul style="list-style-type: none"> <li>• Don't have extra data from what you'd get from the state.</li> <li>• Town – not sure where drain inlet layer comes from but they have it. VDOT maintains town streets.</li> </ul>
3.	<p>Resident or community focused information or programs on emergency response and preparedness for extreme weather events.</p> <ul style="list-style-type: none"> <li>• Algae blooms? Went on social media, went to HOAs down there, signage at boat ramps, heavily publicized Town Hall on local news and radio, + real estate agents. Some residents canceled vacations because of algae blooms. 7 people got sick (gastral stuff) who took transit down there. Have EM website up and running.</li> </ul>

**Demographics/Community Info – Please share information about your community and the populations that are most vulnerable/less able to recover from hazards.**

1.	<p>Plans, reports, or programs that specifically support priority and/or underserved populations (there may be elements of this in disparate sources, such as housing or transportation plans);</p> <ul style="list-style-type: none"> <li>• Town – just uses Census tract data. Very clear where LMI areas are, see where they coincide with flood plain</li> <li>• County – census is the same thing. They have generalized areas (can email to us).</li> <li>• </li> </ul>
2.	<p>Zoning, housing, land use data sets for your locality if not publicly available;</p> <ul style="list-style-type: none"> <li>• Trailer parks (generally R-3) are on maps they can email us.</li> </ul>

July 31, 2023

3.	<p>Names of neighborhoods in your community commonly used by residents that you would like used in this plan (such as voting districts) and any GIS maps that delineate these boundaries (if available).</p> <ul style="list-style-type: none"> <li>• Town – hilltop area CBDG funds for housing.</li> <li>• Also look specifically at mobile home parks. (High ridge trailer park).</li> </ul>
<b>Funding – How does your community fund services and/or projects that contribute to hazard preparedness and recovery?</b>	
1.	<p>Does your community have a Capital Improvement Plan? If so, please provide the sections that related to stormwater, flooding, or heat mitigation;</p> <ul style="list-style-type: none"> <li>• </li> </ul>
2.	<p>Other sources of funding for stormwater, flooding or heat mitigation activities or projects;</p> <ul style="list-style-type: none"> <li>• Fining folks for stormwater control ordinance – can dedicate the funds to improving stormwater measures.</li> <li>• Town – VDOT funding earmarked for stormdrain projects.</li> <li>• Town – wants to map existing stormwater structures (wasn't aware there even was a GIS overlay).</li> </ul>
3.	<p>Beyond what is in the HMP (2020), specific information on staff capacity or staffing needs to support flood mitigation and preparedness;</p> <ul style="list-style-type: none"> <li>• County and Town both looking to get CFMs</li> </ul>
4.	<p>Beyond what is in the HMP (2020), needs for critical facility upgrades and continuity of essential services.</p> <ul style="list-style-type: none"> <li>• Heat mitigation/cooling stations; come out of general fund when they need to open them up, generally done at churches (set up by red cross). <ul style="list-style-type: none"> <li>○ Had 100 degree heat and power knocked out for a long time from derecho. State steps in with water and ice.</li> </ul> </li> <li>• </li> </ul>
<b>FEMA NFIP CRS Program – Many of the actions for hazard preparedness your community undertakes may be considered a credit for the CRS program and can save residents money on their NFIP flood insurance policies.</b>	
1.	<p>What barriers exist for entry in the NFIP CRS program?</p> <ul style="list-style-type: none"> <li>• Not a huge flooding need in Town.</li> <li>• </li> </ul>
<b>Conservation/Recreation – Recreation and open space areas can have multiple benefits, including flood and heat mitigation.</b>	
1.	<p>Areas/parcels currently being protected as open space, and especially those owned by your locality;</p> <ul style="list-style-type: none"> <li>• Town has isolated the park layers. In county comp plan as well.</li> <li>• County GIS open data portal probably has it.</li> </ul>

CVPDC Resilience Plan Request for Information

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2.	Current or planned recreation areas, greenways and parks (and GIS data if it exists); <ul style="list-style-type: none"><li>• Greenway plan for trail going through little otter bottom.</li></ul>
3.	Tree protection plans and/or tree inventories. <ul style="list-style-type: none"><li>• 2021 UVA from green infrastructure center did canopy assessemnt in Town.</li></ul>

*Jeff Wells, director, Campbell utilities,*

*Josh Gribel, [pribble, operations superintendent] Sean Fitzgibbons,  
Austin Mitchell,*

**Primary Hazards – Please share any first-hand information concerning the events that have impacted your community, and the infrastructure that helps manage and recover from an event.**

1.	<p>Known areas of flooding and/or photos of past flood events;</p> <ul style="list-style-type: none"> <li>• Wastewater treatment plant in Rustberg behind cit. services – raw water lagoons have creek running beside it, and creek during intense rainfall will fill lagoons which they then have to treat along with sewage. Main plant operated in the County. Serves entire village of rustberg.</li> <li>• </li> </ul>
2.	<p>Stormwater system inventory and/or assessments (and whether there are GIS files available);</p> <ul style="list-style-type: none"> <li>• Austin: they have dataset but it's not exhaustive, has 30-40 points. 5 years ago there was push to map inventory. Stormwater features mapped in GIS and linked to original plans for post-construction BMP inspection.</li> <li>• </li> </ul>
3.	<p>Resident or community focused information or programs on emergency response and preparedness for extreme weather events.</p> <ul style="list-style-type: none"> <li>• HMP is the guiding document.</li> </ul>

**Demographics/Community Info – Please share information about your community and the populations that are most vulnerable/less able to recover from hazards.**

1.	<p>Plans, reports, or programs that specifically support priority and/or underserved populations(there may be elements of this in disparate sources, such as housing or transportation plans);</p> <ul style="list-style-type: none"> <li>• Nothing specific to certain areas, but broad statements in Comprehensive plan.</li> </ul>
2.	<p>Zoning, housing, land use data sets for your locality if not publicly available;</p> <ul style="list-style-type: none"> <li>• Zoning is on the publicly available site. Future land use. Can be downloaded – two separate sites.</li> </ul>
3.	<p>Names of neighborhoods in your community commonly used by residents that you would like used in this plan (such as voting districts) and any GIS maps that delineate these boundaries (if available).</p> <ul style="list-style-type: none"> <li>• Voting districts. Just redone in the past couple years – available on GIS download site.</li> </ul>

**Funding – How does your community fund services and/or projects that contribute to hazard preparedness and recovery?**

1.	<p>Does your community have a Capital Improvement Plan? If so, please provide the sections that related to stormwater, flooding, or heat mitigation;</p> <ul style="list-style-type: none"> <li>• They have CIP but nothing in next 5 years related to stormwater.</li> </ul>
2.	<p>Other sources of funding for stormwater, flooding or heat mitigation activities or projects;</p> <ul style="list-style-type: none"> <li>• </li> </ul>

a

3.	<p>Beyond what is in the HMP (2020), specific information on staff capacity or staffing needs to support flood mitigation and preparedness;</p> <ul style="list-style-type: none"> <li>• Have CFM – public works director. Also the environmental manager. Bryan Stokes</li> </ul>
4.	<p>Beyond what is in the HMP (2020), needs for critical facility upgrades and continuity of essential services.</p> <ul style="list-style-type: none"> <li>• Raw water pump station on big otter river – flooded once in past 20-30 years (1995) hurricane and dam breach.</li> <li>• About to spend \$40MM refitting school. Sean working on it now. Brookneal High School. Gym flooded from overflow.</li> <li>• Waterlick Rd brookline drive/woodlawn cricle neighborhood, get flooding complaints pretty frequently.</li> <li>• 460 just flooded near Moore's country store (ID'd in HMP)</li> <li>• Sunnymead Rd closed currently, Town Fork rd</li> <li>• </li> </ul>
<p><b>FEMA NFIP CRS Program</b> – <i>Many of the actions for hazard preparedness your community undertakes may be considered a credit for the CRS program and can save residents money on their NFIP flood insurance policies.</i></p>	
1.	<p>What barriers exist for entry in the NFIP CRS program?</p> <ul style="list-style-type: none"> <li>• Not a lot of policies in town, but have they ever thought about it?</li> </ul>
<p><b>Conservation/Recreation</b> – <i>Recreation and open space areas can have multiple benefits, including flood and heat mitigation.</i></p>	
1.	<p>Areas/parcels currently being protected as open space, and especially those owned by your locality;</p> <ul style="list-style-type: none"> <li>• County-owned parcels? They have a layer with park facilities.</li> <li>• Conservation easements are private.</li> </ul>
2.	<p>Current or planned recreation areas, greenways and parks (and GIS data if it exists);</p>
3.	<p>Tree protection plans and/or tree inventories.</p>

- *Right around treatment plant is a mixed-use village*
- *Immediate vicinity is primarily wooded.*
- *Trail? Rustberg trail along creek.*
- *Sidewalks being built – underserved communities – plant trees to prevent flood.*

**Campbell County**

**Interview Follow up: October 12, 2023**

1. *Wastewater treatment plant in Rustberg behind cit. services – raw water lagoons have creek running beside it, and creek during intense rainfall will fill lagoons which they then have to treat along with sewage. Main plant operated in the County. Serves entire village of rustberg.*

*Any further progress on this we should know about? Any more incidents since we last spoke?*

*No more events. Prolonged rainfall events cause it to come out of the banks. Once that water gets in the basin, must be treated. Concrete barriers put up.*

*Funding to be able to evaluate solutions that may be appropriate. Conceptual design studies.*

*Picnic table across from county public works buildings. Wooded area maybe a park County land.*

2. *Sidewalks being built – underserved communities – plant trees to prevent flood. What is the status of this project? Where are the sidewalks being planned and built? Altavista Town.*

3. Is stormwater inventory completed? Have some [GIS layers](#)

Need for stormwater modelling/analysis to determine potential needs and project areas?

**Modelling not needed. Not at this time.**

4. Private Property Flooding:

Waterlick Rd brookline drive/woodlawn circle neighborhood, get flooding complaints pretty frequently.

Old neighborhood, headwaters of a creek, possibly stream restoration here? Private property.

Are there opportunities for projects here? Are there drainage easements in place if private property? BMPS.

5. Repetitive Loss Area is Alta Vista Town –

HMP High priority : Initiate program and studies to execute elevation, relocation, or acquisition measures, especially in area of repetitive flooding, to reduce or eliminate flooding and high hazard dam failure impacts to lives, property and financial impacts to families and communities. Also a low income community.

6. 34 Dams in Campbell County – any known projects of interest? HMP identified 3 dams as high hazard. Timberlake, New Camp Hydaway and Otter River Reservoir. More are unknown status. Further studies needed?

DCR Dams management – inspection reports. Second part of the question, unknown not at this time.

- *Erin Hawkins, MS4 manager*
- *Kevin Henry*
- *Epiphany Vandebogart*
- *Timothy Mitchell*

**Primary Hazards – Please share any first-hand information concerning the events that have impacted your community, and the infrastructure that helps manage and recover from an event.**

	Known areas of flooding and/or photos of past flood events; <ul style="list-style-type: none"> <li>• Basement flooding (Kevin)</li> <li>• Riverine flooding – issues with that throughout the year. Increased storm events (two 100yr in the past 4-5 years).</li> </ul>
1.	<ul style="list-style-type: none"> <li>• Current FEMA mapping is awaiting upgrade. Haven't gotten the official determination, but they have access to preliminary data.</li> <li>• Particular persistent issue on __wood Dr.</li> <li>• Few more overland flooding areas have become worse over the years – Wythe Rd, Fort Avenue block, old toyota dealership on woodge (words?) rd on Rt 29 business (river and stormwater issue; floodplain at bottom and floodplain at top).</li> </ul>
2.	Stormwater system inventory and/or assessments (and whether there are GIS files available); <ul style="list-style-type: none"> <li>• In past 5 years have updated inventory from as-built plans. In 2013 they started inventory for MS4, can all be requested through water resources, city-wide or particular areas. Kathleen Feinen can request it.</li> <li>• Public culverts and railroad culverts are also listed on there.</li> </ul>
3.	Resident or community focused information or programs on emergency response and preparedness for extreme weather events. <ul style="list-style-type: none"> <li>• Emergency Action Plan for 3 high hazard dams, 1 which will be removed. Aber water plant lagoon (technically in bedford), peddler reservoir (amherst in the national forest).</li> <li>• [should be available on open portal] there's some inundation maps for privately owned lakes.</li> <li>• Also have "know your zone" mapping available to public. Add Melissa and Amy to conversations.</li> <li>• Situations with last dam flood events – EM services didn't have copy of EAP that dam owners were activating.</li> </ul>

**Demographics/Community Info – Please share information about your community and the populations that are most vulnerable/less able to recover from hazards.**

	Plans, reports, or programs that specifically support priority and/or underserved populations (there may be elements of this in disparate sources, such as housing or transportation plans); <ul style="list-style-type: none"> <li>• Look in the Housing White Paper from 3-4 years ago. BG is doing Lynchburg's Comp Plan but there might not be anything too useful in there.</li> <li>• Neighborhoods are laid out on their GIS(!)</li> <li>• Any specific areas or neighborhoods that are particularly susceptible? College Hill Timber Park Diamond Hill (might be worst one)</li> <li>• Census info available on open portal too.</li> <li>• Not all areas of the city are considered in neighborhoods. Don't exclude anyone.</li> </ul>
1.	Zoning, housing, land use data sets for your locality if not publicly available;
2.	
3.	Names of neighborhoods in your community commonly used by residents that you would like used in this plan (such as voting districts) and any GIS maps that delineate these boundaries (if available).
<b>Funding – How does your community fund services and/or projects that contribute to hazard preparedness and recovery?</b>	
1.	Does your community have a Capital Improvement Plan? If so, please provide the sections that related to stormwater, flooding, or heat mitigation; <ul style="list-style-type: none"> <li>• CIP is online, but specific flood actions?</li> <li>• Looking at outfall rehab</li> <li>• Gravity sewers located near streams – they're eroding and meandering more.</li> <li>• Fort Avenue event in July caused them to look into capacity.</li> </ul>
2.	Other sources of funding for stormwater, flooding or heat mitigation activities or projects; <ul style="list-style-type: none"> <li>• Three enterprise funds – water, wastewater, stormwater. Applied for SLAF and VRA loans. Want to be open for CFPF.</li> </ul>
3.	Beyond what is in the HMP (2020), specific information on staff capacity or staffing needs to support flood mitigation and preparedness;
4.	Beyond what is in the HMP (2020), needs for critical facility upgrades and continuity of essential services.
<b>FEMA NFIP CRS Program – Many of the actions for hazard preparedness your community undertakes may be considered a credit for the CRS program and can save residents money on their NFIP flood insurance policies.</b>	
1.	What barriers exist for entry in the NFIP CRS program? <ul style="list-style-type: none"> <li>• Looking into it.</li> </ul>

<b>Conservation/Recreation</b> – <i>Recreation and open space areas can have multiple benefits, including flood and heat mitigation.</i>	
1.	Areas/parcels currently being protected as open space, and especially those owned by your locality; <ul style="list-style-type: none"><li>• Have to sort by ownership (Lynchburg).</li></ul>
2.	Current or planned recreation areas, greenways and parks (and GIS data if it exists);
3.	Tree protection plans and/or tree inventories.

- *Lynchburg handles all their own roads*

Lynchburg City

Follow up Interview.

10/11/23

- Are there FY 2024 CIP projects related to flooding or extreme heat that went unfunded?  
CIP - *Ford Ave* looking to upsize SW infras. but there are adjacent areas, Studies tdml purposes but could correlate, need areas studied.
- Are there opportunities to expand FY2024 CIP projects to improve flood and/or extreme heat resilience? Perhaps Phase II?
- Neighborhoods close to downtown were discussed as being underserved : College Hill, Diamond Hill area. We would like to ask a few more questions about these areas and their needs.

Diamond Hill neighborhood plan – greenway trail system and street trees. Charlotte Lester

- Potential projects along the James River waterfront – two; first project is public works nearing construction, Jefferson park project off the ground. Park infrastructure, no green yet.

Along the james – funded by water resources, bank stabilization, sanitary sewer projects, gets uncovered and bank needs stabilization.

Two projects in river bank stabilization design: Norfolk southern crosses the, WWTP discharges.

Walk sanitary sewer line along the James.

Sanitary Sewer Fund. Funding the design, what about construction-yes.

Center of Lynchburg, issues with

Blackwater Creek bank stabilization -

From HMP:

- Reusens area. Over 30 homes and train warehouses of CSX Railroad sit in this floodplain. Two facilities, the Reusens Dam Hydro Plant and an electrical substation, are located here (Figure 4-46, panel B).
  - Forest Hill / Blue Ridge Farms area. Some homes and buildings of Peak View Park are in the floodplain (Figure 4-47, Panel C).
  - Lynchburg Expressway (Route 460) / Timberlake Rd (Route 501) interchange. Several clusters of townhouses, single family houses, and duplexes are in the floodplain near this interchange along

- Burton Creek (Figure 4-48, Panel

D). Incorporate

Stormwater analysis studies – neighborhood level?

CSO project there or around there.

Ongoing Sewer projects – piggy backing on top of with stormwater.

Public works projects – add SW. Open would like to add green infrastructure,

Na~~o~~nwide drive, city road, office park, no sidewalks no\$ for stormwater, can we

Neighborhood needs but need further analysis, needs direc~~o~~n

Modelling of stormwater

Data driven inventory already done. Rough idea of sizes.

## **Meeting Notes: Altavista Resilience Plan Review**

**Thursday, February 22, 2024, 10:00AM – 11:00AM EST**

**Prepared by Luke Peters**

*In attendance (#):*

First	Last	Organization/Affiliation	Position
Luke	Peters	Berkley Group	Planner II
Kate	Jones	Berkley Group	Principal Planner
Gary		Altavista	
Mathew	Perkins	Altavista	
Tom	Fore	Altavista	

## **Meeting Notes**

Preview of individual locality sections of the CVPDC Resilience Plan.

### **Debris Management Plan:**

- *Town calls in all staff needed when trees fall – knuckleboom trucks that go out, haul to wwtf (stockpile of debris), then bring in a firm to chip it all.*
  - *Also assist VDOT with areas immediately around Town for debris that might end up on bypass, etc.*
  - *EOP is being worked on currently, not complete, but will include this.*
  - *WWT has their own EOPs (these aren't publicly released). VDEM wants these on file, especially the drinking water facility, and want it by 2025. (can mention this in the Plan as well).*

### **Ecological Cores/Natural Assets:**

- *There are some incorrect assets (like Abbot-Duncan recreation field)*

### **Critical infrastructure:**

- Gary Shanaberger, town manager altavista
- Tom Fore, public services director (sharon williams was there too)
- Mathew perkins, asst. town manager

**Primary Hazards – Please share any first-hand information concerning the events that have impacted your community, and the infrastructure that helps manage and recover from an event.**

	Known areas of flooding and/or photos of past flood events; <ul style="list-style-type: none"> <li>• Pittsylvania ave (primary business 29 main st corridor) is a downward incline when first make the turn, water level has been up to the bottom of the railroad bridge that you go under. Stops all ingress/egress. Assistance at water plant is cut off. Stream behidn water plant floods Grit Rd (continuation of ricky abys-shelton). If the water isn't in the plant, you can't get to it.</li> </ul>
1.	<ul style="list-style-type: none"> <li>• Same thing occurring at wastewater treatment plant.</li> <li>• Release from leesvile and smith mt lake – can't control flow coming down. Have to release controls on reservoir dams. If dams overflowed altavista would be gone.</li> <li>• Altavista flooding pictures on google. Had 37-year flood which created problem with treatment (halicidics and trilomethanes, lot of organixs) had to violate standard</li> <li>• </li> </ul>
2.	Stormwater system inventory and/or assessments (and whether there are GIS files available); <ul style="list-style-type: none"> <li>• (incl. ditches and culverts). No Inv. Of drop inlets. There <i>should</i> be an inventory of easements. Tom would like to inventory every asset. Would like funding to get that done.</li> <li>• </li> </ul>
3.	Resident or community focused information or programs on emergency response and preparedness for extreme weather events. <ul style="list-style-type: none"> <li>• </li> </ul>

**Demographics/Community Info – Please share information about your community and the populations that are most vulnerable/less able to recover from hazards.**

	Plans, reports, or programs that specifically support priority and/or underserved populations(there may be elements of this in disparate sources, such as housing or transportation plans); <ul style="list-style-type: none"> <li>• Mosely heights community – were trying to improve quality of life, pretty much on Franklin Ave up to Eudora semicircle. From 10<sup>th</sup> to 16<sup>th</sup>, and ties back into Avendale. Beginning of community is YMCA family center in flood area.</li> <li>• Not a lot of asst. living senior places, but there's a nursing home.</li> <li>• Large hispanic community, playing soccer in english park.</li> <li>• Derelict homes inventory - %-wise are 5-10%. Look at housing.</li> <li>• Look to comprehensive plan and <b>transit dev. elopment plan</b></li> </ul>
1.	

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2.	Zoning, housing, land use data sets for your locality if not publicly available; <ul style="list-style-type: none"> <li>• Campbell County GIS has their info. If you look at it on CC site – go to planning layer; uncheck zoning districts for county they'll show just altavista.</li> </ul>
3.	Names of neighborhoods in your community commonly used by residents that you would like used in this plan (such as voting districts) and any GIS maps that delineate these boundaries (if available).
<b>Funding – How does your community fund services and/or projects that contribute to hazard preparedness and recovery?</b>	
1.	Does your community have a Capital Improvement Plan? If so, please provide the sections that related to stormwater, flooding, or heat mitigation; <ul style="list-style-type: none"> <li>• Recently Sharon reapplied with DCR about stream bank restoration. Town owns large portion of bank that's in the Town from WWTP to area owned by Isaac Grotto (couple miles).</li> <li>• Creek coming down from Pittsylvania Ave (Lynch Creek) has been targeted for improvement for bank restoration.</li> <li>• Raw water line supplying to water plant going under bridge need to be bored under river and upgraded in size.</li> <li>• In English park, working at edge of the river trying to create trail.</li> <li>• Can't raise water or sewer plant up, but can protect them.</li> <li>• Some streambank restoration has already been done on Franklin behind YMCA. Stream was flooding play area behind the building. Creek is TMDL on DEQ's list for improvement.</li> <li>• Asked DEQ to look at Gose Creek that dumps into Staunton river – when it rains there's runoff and erosion coming off it it affects the quality of water.</li> </ul>
2.	Other sources of funding for stormwater, flooding or heat mitigation activities or projects; <ul style="list-style-type: none"> <li>• Utility fee? Town has agreement with VDOT to maintain roadways throughout the town (all except alleyways and Main St and Bedford) – mowing grass, guardrails, stormwater (drop inlet on Pittsylvania Ave, e.g.).</li> <li>• Washout on Lynch creek tree fell off and is going to cause \$90k</li> <li>• Prioritize redoing asphalt on highways every 2 years, but otherwise Tom sends Kelly <b>water assessment plan</b> broken down over 25 year period (last done 2017-2018).</li> <li>• Rainfall coming through private property (town easement) got 55 gallon drums to act as culvert that drops under Frasier Rd. Barrels deteriorated and sinkholes through property – Town's responsibility. Can use VDOT highway fund to fix, but then takes away from paving.</li> </ul>
3.	Beyond what is in the HMP (2020), specific information on staff capacity or staffing needs to support flood mitigation and preparedness; <ul style="list-style-type: none"> <li>• Can get CFM certified.</li> </ul>

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	Beyond what is in the HMP (2020), needs for critical facility upgrades and continuity of essential services. <ul style="list-style-type: none"> <li>• Public works facility – houses salt for roads, staff, etc. Equipment.</li> <li>• YMCA daycare belongs to Altavista, just used by YMCA</li> <li>• Just redid raw water intake facility – put it above 500-year floodplain and added generator. That's taken care of. ID'd in HMP and completed through FEMA grant.</li> </ul>
<b>FEMA NFIP CRS Program</b> – <i>Many of the actions for hazard preparedness your community undertakes may be considered a credit for the CRS program and can save residents money on their NFIP flood insurance policies.</i>	
1.	What barriers exist for entry in the NFIP CRS program? <ul style="list-style-type: none"> <li>• Would like to learn more about it. Gary slightly familiar from Appomattox. Would like to know their responsibility in administrating it.</li> </ul>
<b>Conservation/Recreation</b> – <i>Recreation and open space areas can have multiple benefits, including flood and heat mitigation.</i>	
1.	Areas/parcels currently being protected as open space, and especially those owned by your locality; <ul style="list-style-type: none"> <li>• Create public zoning district in Altavista just to distinguish between public facilities like English Park and High School – currently in R-1 district.</li> </ul>
2.	Current or planned recreation areas, greenways and parks (and GIS data if it exists); <ul style="list-style-type: none"> <li>• They've got more parks than Lynchburg. Off 7<sup>th</sup> street they have war emmorial ball field and tree park with picnic tables and grist mill and parking lot folks use for car shows and farmers markets, etc.           <ul style="list-style-type: none"> <li>○ Mosely Heights park (Leonard Coleman)</li> <li>○ Bedford ave. park (tennis/basketball)</li> <li>○ Also own industrial area down by walmart – 120 acres.</li> <li>○ Railroad with caboose, etc.</li> </ul> </li> <li>• They do have parks and recs plan (2018)</li> <li>• Booker Building in English park – looking into BRIC grant for getting air conditioning.</li> </ul>
3.	Tree protection plans and/or tree inventories.

- Roads?
- Other Resilience? Heat. When it's really hot folks ride the bus just to get out of the heat.
  - Comp Plan talks about 7<sup>th</sup> st is used a lot but there are no trees.
- Monitoring?
- 

Type text here

- 

#### **Repetitive Loss Properties:**

- 

#### **Motor Vehicle Crashes Due to Standing Water:**

- *They do manage some roads in the town, and we don't have condition data for their owned culverts.*
  - *Throw Franklin Ave into the mix – at the YMCA near Penn. Ave. Lynch Creek comes down through their and causes flooding.*
  - *Include 7<sup>th</sup> St as well.*
  - *[Road] doesn't change names until you get to Grit Rd (and has 3 names)*

#### **Dams:**

- *Leesville and Smith Mt. Lake dam getting more attention because App. Power gives them annual EAP report – Altavista is responsible for evacuation. If Leesville breaks they have 54 minutes.*
- *Spoke with Tracey Fairchild (County EMS coord.) to have sit-down; don't really have evacuation plan, especially for people without cellphones.*
  - *Tornado/dam break warning alarm.*

#### **Extreme Heat:**

- 

#### **Future Conditions:**

- 

#### **Recommended Policies:**

- 

#### **Project Prioritization:**

- 

#### **Prioritized Flood Resilience Strategy:**

- *Everything up to Leesville Dam needs a watershed management plan. Doesn't preclude anyone from using water for agriculture but do need to stop erosion + sediment.*
  - *Staunton + Roanoke river are one in the same in the area around Altavista.*
  - *Have 4 points in key steps, then cost has 5 points, though 4 and 5 are going to be together.*
  - *Discuss drinking water reservoir for droughts?*
  - *Or in flood event, if extra water is too muddy to treat, still have good water from reservoir.*

**Other Notes:**

- 

**Follow-up/To-do/Future Meetings/Links:**

-

- Sara McGuffin

**Primary Hazards – Please share any first-hand information concerning the events that have impacted your community, and the infrastructure that helps manage and recover from an event.**

1.	<p>Known areas of flooding and/or photos of past flood events;</p> <ul style="list-style-type: none"> <li>• Significant portion of wastewater plant is in the floodplain, but haven't had an issue for several years. Pipes going along streams might not get undermined, but a tree falling might impact it. How do you secure and stabilize sewer lines open to the outside?</li> <li>• Bypass gets flooded when it rains, and people are going fast. Not exactly in Town.</li> <li>• Old Mill Trapezium brewing</li> </ul>
2.	<p>Stormwater system inventory and/or assessments (and whether there are GIS files available);</p> <ul style="list-style-type: none"> <li>• Don't have a stormwater plan, and between County and DEQ don't want anything to do with it.</li> </ul>
3.	<p>Resident or community focused information or programs on emergency response and preparedness for extreme weather events.</p> <ul style="list-style-type: none"> <li>• Social media, code red system</li> </ul>

**Demographics/Community Info – Please share information about your community and the populations that are most vulnerable/less able to recover from hazards.**

1.	<p>Plans, reports, or programs that specifically support priority and/or underserved populations (there may be elements of this in disparate sources, such as housing or transportation plans);</p> <ul style="list-style-type: none"> <li>• Have some low-income and historically black neighborhoods – but it's very intermingled. Hot housing market has flipped some houses in old neighborhoods and brought values back up. They don't have any plans that speak specifically to it or any special neighborhood delineations.</li> </ul>
2.	<p>Zoning, housing, land use data sets for your locality if not publicly available;</p> <ul style="list-style-type: none"> <li>• PDC has most recent map.</li> </ul>
3.	<p>Names of neighborhoods in your community commonly used by residents that you would like used in this plan (such as voting districts) and any GIS maps that delineate these boundaries (if available).</p>

**Funding – How does your community fund services and/or projects that contribute to hazard preparedness and recovery?**

1.	<p>Does your community have a Capital Improvement Plan? If so, please provide the sections that related to stormwater, flooding, or heat mitigation;</p> <ul style="list-style-type: none"> <li>• Have CIP, but probably not flood hazards.</li> </ul>
2.	<p>Other sources of funding for stormwater, flooding or heat mitigation activities or projects;</p>

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3.	Beyond what is in the HMP (2020), specific information on staff capacity or staffing needs to support flood mitigation and preparedness; <ul style="list-style-type: none"> <li>• Not aware of staff issues.</li> </ul>
4.	Beyond what is in the HMP (2020), needs for critical facility upgrades and continuity of essential services. <ul style="list-style-type: none"> <li>• Hardening projects down at wastewater, esp. the headworks. Upper and lower plant, everything from lower plant has to get pumped up to upper, all wastewater through headworks gets pumped up, and it's in the floodplain. Two digesters in the floodplain. Hasn't been flooded in many years, but if they were, all the sludge would be in rutledge creek.</li> <li>• Operate a water plant as well. Raw water pump station is right on edge of floodplain.</li> </ul>
<b>FEMA NFIP CRS Program</b> – <i>Many of the actions for hazard preparedness your community undertakes may be considered a credit for the CRS program and can save residents money on their NFIP flood insurance policies.</i>	
1.	What barriers exist for entry in the NFIP CRS program?
<b>Conservation/Recreation</b> – <i>Recreation and open space areas can have multiple benefits, including flood and heat mitigation.</i>	
1.	Areas/parcels currently being protected as open space, and especially those owned by your locality; <ul style="list-style-type: none"> <li>• Park with couple creeks that go through that floods and is flood plain. Park master plan resides in mcguffin's brain.</li> </ul>
2.	Current or planned recreation areas, greenways and parks (and GIS data if it exists); <ul style="list-style-type: none"> <li>• No separate layer</li> </ul>
3.	Tree protection plans and/or tree inventories.

- All roads are VDOT
- Other resilience? Can't think of anything.

- Gary Shanaberger, town manager altavista
- Tom Fore, public services director (sharon williams was there too)
- Mathew perkins, asst. town manager

**Primary Hazards – Please share any first-hand information concerning the events that have impacted your community, and the infrastructure that helps manage and recover from an event.**

	Known areas of flooding and/or photos of past flood events; <ul style="list-style-type: none"> <li>• Pittsylvania ave (primary business 29 main st corridor) is a downward incline when first make the turn, water level has been up to the bottom of the railroad bridge that you go under. Stops all ingress/egress. Assistance at water plant is cut off. Stream behidn water plant floods Grit Rd (continuation of ricky abys-shelton). If the water isn't in the plant, you can't get to it.</li> </ul>
1.	<ul style="list-style-type: none"> <li>• Same thing occurring at wastewater treatment plant.</li> <li>• Release from leesvile and smith mt lake – can't control flow coming down. Have to release controls on reservoir dams. If dams overflowed altavista would be gone.</li> <li>• Altavista flooding pictures on google. Had 37-year flood which created problem with treatment (halicidics and trilomethanes, lot of organixs) had to violate standard</li> <li>• </li> </ul>
2.	Stormwater system inventory and/or assessments (and whether there are GIS files available); <ul style="list-style-type: none"> <li>• (incl. ditches and culverts). No Inv. Of drop inlets. There <i>should</i> be an inventory of easements. Tom would like to inventory every asset. Would like funding to get that done.</li> <li>• </li> </ul>
3.	Resident or community focused information or programs on emergency response and preparedness for extreme weather events. <ul style="list-style-type: none"> <li>• </li> </ul>

**Demographics/Community Info – Please share information about your community and the populations that are most vulnerable/less able to recover from hazards.**

	Plans, reports, or programs that specifically support priority and/or underserved populations(there may be elements of this in disparate sources, such as housing or transportation plans); <ul style="list-style-type: none"> <li>• Mosely heights community – were trying to improve quality of life, pretty much on Franklin Ave up to Eudora semicircle. From 10<sup>th</sup> to 16<sup>th</sup>, and ties back into Avendale. Beginning of community is YMCA family center in flood area.</li> <li>• Not a lot of asst. living senior places, but there's a nursing home.</li> <li>• Large hispanic community, playing soccer in english park.</li> <li>• Derelict homes inventory - %-wise are 5-10%. Look at housing.</li> <li>• Look to comprehensive plan and <b>transit development plan</b>.</li> </ul>
1.	

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2.	Zoning, housing, land use data sets for your locality if not publicly available; <ul style="list-style-type: none"> <li>• Campbell County GIS has their info. If you look at it on CC site – go to planning layer; uncheck zoning districts for county they'll show just altavista.</li> </ul>
3.	Names of neighborhoods in your community commonly used by residents that you would like used in this plan (such as voting districts) and any GIS maps that delineate these boundaries (if available).
<b>Funding – How does your community fund services and/or projects that contribute to hazard preparedness and recovery?</b>	
1.	Does your community have a Capital Improvement Plan? If so, please provide the sections that related to stormwater, flooding, or heat mitigation; <ul style="list-style-type: none"> <li>• Recently Sharon reapplied with DCR about stream bank restoration. Town owns large portion of bank that's in the Town from WWTP to area owned by Isaac Grotto (couple miles).</li> <li>• Creek coming down from Pittsylvania Ave (Lynch Creek) has been targeted for improvement for bank restoration.</li> <li>• Raw water line supplying to water plant going under bridge need to be bored under river and upgraded in size.</li> <li>• In English park, working at edge of the river trying to create trail.</li> <li>• Can't raise water or sewer plant up, but can protect them.</li> <li>• Some streambank restoration has already been done on Franklin behind YMCA. Stream was flooding play area behind the building. Creek is TMDL on DEQ's list for improvement.</li> <li>• Asked DEQ to look at Gose Creek that dumps into Staunton river – when it rains there's runoff and erosion coming off it it affects the quality of water.</li> </ul>
2.	Other sources of funding for stormwater, flooding or heat mitigation activities or projects; <ul style="list-style-type: none"> <li>• Utility fee? Town has agreement with VDOT to maintain roadways throughout the town (all except alleyways and Main St and Bedford) – mowing grass, guardrails, stormwater (drop inlet on Pittsylvania Ave, e.g.).</li> <li>• Washout on Lynch creek tree fell off and is going to cause \$90k</li> <li>• Prioritize redoing asphalt on highways every 2 years, but otherwise Tom sends Kelly <b>water assessment plan</b> broken down over 25 year period (last done 2017-2018).</li> <li>• Rainfall coming through private property (town easement) got 55 gallon drums to act as culvert that drops under Frasier Rd. Barrels deteriorated and sinkholes through property – Town's responsibility. Can use VDOT highway fund to fix, but then takes away from paving.</li> </ul>
3.	Beyond what is in the HMP (2020), specific information on staff capacity or staffing needs to support flood mitigation and preparedness; <ul style="list-style-type: none"> <li>• Can get CFM certified.</li> </ul>

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4.	<p>Beyond what is in the HMP (2020), needs for critical facility upgrades and continuity of essential services.</p> <ul style="list-style-type: none"><li>• Public works facility – houses salt for roads, staff, etc. Equipment.</li><li>• YMCA daycare belongs to Altavista, just used by YMCA</li><li>• Just redid raw water intake facility – put it above 500-year floodplain and added generator. That's taken care of. ID'd in HMP and completed through FEMA grant.</li></ul>
<p><b>FEMA NFIP CRS Program</b> – <i>Many of the actions for hazard preparedness your community undertakes may be considered a credit for the CRS program and can save residents money on their NFIP flood insurance policies.</i></p>	
1.	<p>What barriers exist for entry in the NFIP CRS program?</p> <ul style="list-style-type: none"><li>• Would like to learn more about it. Gary slightly familiar from Appomattox. Would like to know their responsibility in administrating it.</li></ul>
<p><b>Conservation/Recreation</b> – <i>Recreation and open space areas can have multiple benefits, including flood and heat mitigation.</i></p>	
1.	<p>Areas/parcels currently being protected as open space, and especially those owned by your locality;</p> <ul style="list-style-type: none"><li>• Create public zoning district in Altavista just to distinguish between public facilities like English Park and High School – currently in R-1 district.</li></ul>
2.	<p>Current or planned recreation areas, greenways and parks (and GIS data if it exists);</p> <ul style="list-style-type: none"><li>• They've got more parks than Lynchburg. Off 7<sup>th</sup> street they have war memorial ball field and tree park with picnic tables and grist mill and parking lot folks use for car shows and farmers markets, etc.<ul style="list-style-type: none"><li>○ Mosely Heights park (Leonard Coleman)</li><li>○ Bedford ave. park (tennis/basketball)</li><li>○ Also own industrial area down by walmart – 120 acres.</li><li>○ Railroad with caboose, etc.</li></ul></li><li>• They do have parks and recs plan (2018)</li><li>• Booker Building in English park – looking into BRIC grant for getting air conditioning.</li></ul>
3.	<p>Tree protection plans and/or tree inventories.</p>

- Roads?
- Other Resilience? Heat. When it's really hot folks ride the bus just to get out of the heat.
  - Comp Plan talks about 7<sup>th</sup> st is used a lot but there are no trees.
- Monitoring?
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