2739 - Floodplain Data Digitization Initiative

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 3:06 PM
Initially Submitted By:	Matthew Lindsay
Last Submit Date:	
Last Submitted By:	

Contact Information

Primary Contact Information

Active User*:	Yes
Type:	External User
Name*:	Mr. (Salutation) Matthew (First Name) Middle Name Lindsay (Last Name)
Title:	Planner II
Email*:	MLindsay@botetourtva.gov
Address*:	57 S Center Drive
	Daleville (City) Virginia (State/Province) 24083 (Postal Code/Zip)
Phone*:	540-928-2080 (Phone) 2072 (Ext.) ###-###-####
Fax:	###-###-####
Comments:	

Organization Information

Status*:	Approved
Name*:	Botetourt County
Organization Type*:	Local Government
Tax ID*:	54-6001153
Unique Entity Identifier (UEI)*:	SXWDD87FVNV9
Organization Website:	https://www.botetourtva.gov/

Address*: 57 S Center Drive

Daleville Virginia 24083-
City State/Province Postal Code/Zip

Phone*: (540) 254-1212 Ext.
###-###-####

Fax: ###-###-####

Benefactor:

Vendor ID:

Comments:

VCFPF Applicant Information

Project Description

Name of Local Government*: Botetourt County

Your locality's CID number can be found at the following link: Community Status Book Report

NFIP/DCR Community Identification Number (CID)*: 510018

If a state or federally recognized Indian tribe,

Name of Tribe:

Authorized Individual*: Matthew Lindsay
First Name Last Name

Mailing Address*: 57 S Center Drive
Address Line 1

Address Line 2

Daleville Virginia 24083
City State Zip Code

Telephone Number*: 540-928-2072

Cell Phone Number*: 540-928-2072

Email*: MLindsay@botetourtva.gov

Is the contact person different than the authorized individual?

Contact Person*: No

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

Project Description*:

This project seeks to digitize legacy floodplain maps, flood elevation certificates, and other floodplain related documents to ensure compliance with FEMA record keeping regulations and provide better internal and community access to paper floodplain documents moving forward. We seek to digitize roughly 50,000 documents by having these documents professionally scanned and uploaded to our county database

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*: No

Information regarding your census block(s) can be found at census.gov

Census Block(s) Where Project will Occur*: 403.03

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

Is Project Located in a Special Flood Hazard Area?*: No

Flood Zone(s) (if applicable):

Flood Insurance Rate Map Number(s) (if applicable):

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*: N/A

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*: Other Capacity Building and Planning Activities

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*: Low Social Vulnerability (-1.0 to 0.0)

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*: No

Does this project provide ?community scale? benefits?

Community Scale Benefits*: More than one census block

Comments:

The documents include information across Botetourt County and will impact all Census Blocks in the county

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*: Scope of Work - Floodplain Documents Digitiation Initative.docx

Comments:

Budget Narrative

Budget Narrative Attachment*: Budget Narative Chart - Floodplain Documents Digitization Initative.pdf

Comments:

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*:

As part of this capacity building project, we seek to work with a private contractor to increase our capacity to digitize upwards of 50,000 documents. As noted elsewhere in our application, we are limited both financially and staff-wise to tackle this large project and therefore seek to outsource this important work to a company who is familiar with the digitization and disposal process of floodplain, stormwater, and E&S documentation.

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*:

We intend to hire an outside contractor to transport, digitize, and dispose of documents in line with industry standards.

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*:

We intend to secure funding in order to facilitate the digitization process through grants

Describe policy management and/or development plans

Policy management and/or development*:

N/A

Describe plans for stakeholder identification, outreach, and education strategies

Stakeholder identification, outreach, and education strategies*:

N/A

Budget

Budget Summary

Grant Matching Requirement*:

Planning and Capacity Building - Fund 75%/Match 25%

*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.

*:

Total Project Amount (Request + Match)*: $80,000.00

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

REQUIRED Match Percentage Amount: $20,000.00

BUDGET TOTALS

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

Match Percentage: 25.00%

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

Total Requested Fund Amount: $60,000.00

Total Match Amount: $20,000.00

TOTAL: $80,000.00

Personnel

Description	Requested Fund Amount	Match Amount	Match Source
Grant Administration	$0.00	$8,000.00	
	$0.00	**$8,000.00**	

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
Contractor - Transportation, Digitization, Disposal of Documents	$60,000.00	$12,000.00	
	$60,000.00	**$12,000.00**	

Pre-Award and Startup Costs

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

Other Direct Costs

Description	Requested Fun 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)						
FIRMette of the project area(s) (Projects/Studies)						
Historic flood damage data and/or images (Projects/Studies)						
A link to or a copy of the current floodplain ordinance		Link: https://library.municode.com/va/botetourt_county/codes/code_of_ordinances?nodeId=COCO_CH25ZO_ARTIIIOVDI_DIV1FLHAOVDI	Botetourt County VA Code of Ordinances - Flood Hazard Overlay District.pdf	pdf	5 MB	01/23/202 03:49 PM
Maintenance and management plan for project						
A link to or a copy of the current hazard mitigation plan		https://rvarc.org/what-we-do/resiliency/emergency-management-disaster-mitigation/	RVAR_Hazard_Mitigation_Plan_2019.pdf	pdf	6 MB	01/23/202 03:49 PM
A link to or a copy of the current comprehensive plan		https://www.botetourtva.gov/361/Comprehensive-Plan	2010 Comprehensive Plan.pdf	pdf	2 MB	01/23/202 03:49 PM
Social vulnerability index score(s) for the project area		SVIS for Botetourt County	VA Social Vulnerability - Botetourt County.pdf	pdf	607 KB	01/23/202 03:49 PM
Authorization to request funding from the Fund from governing body or chief executive of the local government		Authorization Letter signed by County Administrator	Authorization Letter - Floodplain Documents Digitization Initative.pdf	pdf	42 KB	01/23/202 03:49 PM
Signed pledge agreement from each contributing organization						
Maintenance Plan						

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 i cost-effectiveness.

Benefit Cost Analysis					
Other Relevant Attachments	Budget Chart		Budget Narative Chart - Floodplain Documents Digitization Initative.pdf	pdf	345 KB 01/24/202 02:06 PM

Letters of Support

Description	File Name	Type	Size	Upload Date
No files attached.				

Appendix B: Budget Narrative Template

Applicant Botetourt County
Name: Community Flood
Preparedness Fund &
Resilient Virginia
Revolving Loan Fund
Detailed Budget Narrative
Period of Performance: 2025 through 2027
Submission Date: January 24, 2025

Grand Total State Funding Request	$60,000
Grand Total Local Share of Project	$ 20,000
Federal Funding (if applicable)	$ 0
Project Grand Total	$80,000
Locality Cost Match	% 25

Breakout By Cost Type	Personnel	Fringe	Travel	Equipment	Supplies	Contracts	Indirect Costs	Other Costs	Total
Federal Share (if applicable)									
Local Share	8,000					12,500			20,000
State Share – CFPF Grant						60,000			60,000
State Share – RVRF Match Loan									
Pre-Award/Startup									
Maintenance									
Total	$	$	$	$	$	$	$	$	$ 80,000

COUNTY ADMINISTRATION
botetourtva.gov

57 S. Center Drive, Suite 200
Daleville, VA 24083

P: (540) 928-2006
F: (540) 473-8225

BOTETOURT COUNTY
VIRGINIA

January 23, 2025

Virginia Department of Conservation and Recreation
Virginia Community Flood Preparedness Fund Application
Funding Opportunity Number: 2725
Submitted by Botetourt County Community Development Department

Re: Fund Request Authorization – Botetourt County, Virginia

To Whom It May Concern,:

Botetourt County, Virginia, will oversee the Floodplain Document Digitization Initiative for the transportation, digitization, disposal, and cataloging of historic floodplain, stormwater, erosion and sediment control, and other related documents.

We understand the estimated amounts to be as follows, and the County will meet the match as shown for the local amount of $80,000 total.

Total - $80,000
Federal - $0
State - $60,000
Local - $20,000

Sincerely,

Gary Larrowe
County Administrator

Appendix B: Budget Narrative Template

Applicant Botetourt County
Name: Community Flood
Preparedness Fund &
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Breakout By Cost Type	Personnel	Fringe	Travel	Equipment	Supplies	Contracts	Indirect Costs	Other Costs	Total
Federal Share (if applicable)									
Local Share	8,000					12,000			20,000
State Share – CFPF Grant						60,000			60,000
State Share – RVRF Match Loan									
Pre-Award/Startup									
Maintenance									
Total	$	$	$	$	$	$	$	$	$ 80,000

ROANOKE VALLEY - ALLEGHANY REGIONAL
Hazard Mitigation Plan
2019 Update

Alleghany County
Botetourt County
Craig County
Roanoke County
City of Covington
City of Roanoke
City of Salem
Town of Buchanan
Town of Clifton Forge
Town of Fincastle
Town of Iron Gate
Town of New Castle
Town of Troutville
Town of Vinton

FEMA Approved _____

August 15, 2019

Coordinated by the
Roanoke Valley - Alleghany Regional Hazard Mitigation Committee

Prepared by the
Roanoke Valley - Alleghany Regional Commission

Table of Contents

Hazard Mitigation Plan Committee

Ryan D. Muterspaugh Director of Public Safety Alleghany County	David Henderson, CFM, PE County Engineer Roanoke County
Daniel Murray Deputy Emergency Management Coordinator Botetourt County	Butch Workman, CFM Stormwater Operations Manager CRS Coordinator Roanoke County
Jennifer Morris Director of Community Development / Assistant Town Manager Town of Clifton Forge	Charles Grant, CFM, GISP GIS Coordinator City of Salem
Dan Collins County Administrator Craig County	Chris Linkous Emergency Services Coordinator Town of Vinton
Jim Cady Emergency Services Coordinator Craig County	Anita McMillan Planning & Zoning Director CRS Coordinator Town of Vinton
Eric Tyree Director of Development Services City of Covington	Nathan S. McClung Principal Planner Town of Vinton
Wendy Biggs Town Clerk Town of Iron Gate	Jonathan T. Simmons All-Hazards Planner VDEM Region 6
Trevor Shannon Battalion Chief Emergency Management Roanoke Fire-EMS	Dennis McCarthy Area Forester Virginia Department of Forestry
Marci Stone Deputy Chief Roanoke Fire-EMS	Marc Davis Community Services Manager Blue Ridge Independent Living Center
Dwayne D'Ardenne Regional Stormwater Advisory Committee (Chair) VAMSA Board Member Stormwater Utility Manager City of Roanoke	Phil Hysell Warning Coordination Meteorologist National Weather Service
Danielle DeHart CRS Coordinator City of Roanoke	Peter Corrigan Hydrologist National Weather Service
Leigh Anne Weitzenfeld, CFM Water Quality Administrator City of Roanoke	Bill Tanger Friends of the Rivers of Virginia / Roanoke River Blueway Committee
Dustin Campbell Deputy Chief County of Roanoke Fire & Rescue Roanoke County	Hal Cone Realtor Lichtenstein Rowan Realtors
Tarek Moneir Acting Director of Development Services Roanoke County	Robert Humphreys Insurance Agent Allstate

Acronym Descriptions

BFE	Base Flood Elevation
BRILC	Blue Ridge Independent Living Center
CFR	Code of Federal Regulations
CFS	Cubic Feet per Second
CRS	Community Rating System
CTP	Cooperating Technical Partners
DCR	Department of Conservation and Recreation
DEQ	Department of Environmental Quality
DFIRM	Digital Flood Insurance Rate Map
DSIS	Dam Safety Inventory System
EMS	Emergency Medical Services
FEMA	Federal Emergency Management Agency
FIRM	Flood Insurance Rate Map
FMA	Flood Mitigation Assistance
HAZUS-MH	Hazards U.S. Multi-Hazard
HMGP	Hazard Mitigation Grant Program
ICC	International Code Council
IFLOWS	Integrated Flood Observing and Warning System
NCEI	National Center for Environmental Information
NFIP	National Flood Insurance Program
NFPA	National Fire Prevention Association
NID	National Inventory of Dams
NOAA	National Oceanic and Atmospheric Administration
NRCS	Natural Resources Conservation Service
NWS	National Weather Service
RFC	Repetitive Flood Claims
RVARC	Roanoke Valley-Alleghany Regional Commission
RVTPO	Roanoke Valley Area Transportation Planning Organization
SAME	Specific Area Message Encoding
SFHA	Special Flood Hazard Area
SRL	Severe Repetitive Loss
SWCB	Virginia Soil and Water Conservation Board
SWRP	State Water Resources Plan
USACE	United States Army Corps of Engineers
USBC	Uniform Statewide Building Code
USDA	United States Department of Agriculture
USFS	United States Forest Service
USGS	United States Geological Survey
USNSN	U.S. National Seismic Network
VDEM	Virginia Department of Emergency Management
VDOF	Virginia Department of Forestry
VDOT	Virginia Department of Transportation
VESCP	Virginia Erosion and Sediment Control Program
VSMP	Virginia Stormwater Management Program
VTSO	Virginia Tech Seismological Observatory
WVRWA	Western Virginia Regional Water Authority

Chapter 1 Introduction

1.1 Natural Hazards Mitigation Planning Process

The Disaster Mitigation Act of 2000 (DMA 2000) requires that local governments, as a condition of receiving federal disaster mitigation funds, have a mitigation plan that describes the process for identifying hazards, risks and vulnerabilities, identifies and prioritizes mitigation actions, encourages the development of local mitigation and provide technical support for those efforts.

The Federal Emergency Management Agency (FEMA) defines Mitigation as any sustained action taken to reduce or eliminate long-term risk to life and property from a hazard event. Mitigation, also known as prevention, encourages long-term reduction of hazard vulnerability. The goal of mitigation is to save lives and reduce property damage. Mitigation can accomplish this and should be cost-effective and environmentally sound. This, in turn, can reduce the enormous cost of disasters to property owners and all levels of government. In addition, mitigation can protect critical community facilities, reduce exposure to liability, and minimize community disruption resulting from natural disasters. Examples include land use planning, adoption of building codes, elevation of homes, or acquisition and relocation of homes away from floodway and floodplain areas.

It has been demonstrated time after time that hazard mitigation is most effective when based on an inclusive, comprehensive, long-term plan that is developed before a disaster actually occurs. However, in the past, many communities have undertaken mitigation actions with good intentions but with little advance planning. In some of these cases, decisions have been made "on the fly" in the wake of a disaster. In other cases, decisions may have been made in advance but without careful consideration of all options, effects, and/or contributing factors. The results have been mixed at best, leading to less than optimal use of limited resources.

1.2 Purpose of the Plan

The purpose of this plan is to fulfill the Federal requirements for the Disaster Mitigation Act of 2000. The plan identifies hazards; establishes community goals and objectives and mitigation activities that are appropriate for the Roanoke Valley-Alleghany region.

1.3 Planning Region

The 2018 Regional Pre-Disaster Mitigation Plan affects unincorporated areas, towns, cities and counties within the Roanoke Valley-Alleghany Regional Commission service area except the localities of Franklin County and towns of Boones Mill and Rocky Mount which are covered by the West Piedmont PDC Plan. These are the same localities that participated in the 2006 and 2013 plans. While the plan does not establish any legal requirements for the localities, it does provide a framework for natural hazard mitigation planning.

1.4 Plan Update Process

The plan update process is similar to the process used to develop the original 2013 plan. Local governments and Pre-Disaster Mitigation Plan Committee members felt that following a similar process would be the most efficient method for gathering information, reviewing priorities and updating the plan.

The Mitigation Plan was evaluated to review progress that has been made on implementing the projects and to identify new or updated information that could affect mitigation priorities. The convener, Roanoke Valley-Alleghany Regional Commission, was responsible for contacting the Pre-Disaster Mitigation Plan Committee members and organizing meetings to review the plan. Committee members representing their respective local governments and agencies provided guidance for the plan update.

The committee reviewed the hazard information, risk and loss data, goals and strategies and proposed mitigation projects to determine if they are addressing current and expected conditions. The review also considered state and Federal legislation that could affect the implementation of the plan.

Several towns in the region requested that their interests in the planning process be represented by the county in which they are located. The towns of Fincastle and Troutville were represented on the Committee by the Botetourt County Deputy Emergency Management Coordinator. The Town of New Castle was represented by Craig County Director of Emergency Services. These representatives served as the liaison between the Committee and the town's staff and/or elected officials.

1.5 Plan Review

In addition to the local government participants, adjoining regional planning organizations were asked to comment on the plan. The planning process included an opportunity for adjacent localities and regional commissions to review the draft plan.

1.6 Committee Meetings

Committee meetings were held on an as needed basis at critical times in the document's development and for review of the draft and final versions of the Plan. Committee meeting agendas and attendance sheets are included in Appendix A.

Localities, state and federal agencies, and other local groups were invited to serve on the Roanoke Valley-Alleghany Regional Commission Pre-Disaster Mitigation Plan Committee. Local governments were asked to appoint the staff and/or citizens that would be the most appropriate representative(s) to the Committee and responded with a wide range of appointees: Emergency Service Coordinators, engineers, planners, public works and stormwater staff, law enforcement officers, and fire and rescue personnel. Locality representatives attended the Committee

meetings on a regular basis. RVARC staff also worked directly with local governments during development of local goals/projects.

As in the pervious two versions of this plan, some rural communities requested to be represented in the planning process by their respective county governments due to the fact that the towns do not have full-time staff or those that do are unable to attend. The Town of New Castle was represented on the plan committee by the Craig County Emergency Services director who worked with the town to identify necessary changes to the plan and revise the town's project listing. The draft plan was reviewed by the Town of New Castle. The Town of Buchanan and Town of Troutville were represented on the plan committee by the Botetourt County Deputy Emergency Management Coordinator who met with the towns and helped in identifying updates to the town's sections of the project listings. The Town of Buchanan removed two projects from their project listing – generator purchase for the sewer plant and purchase of a portable generator. The Town of Troutville did not make any changes to the plan. The town of Fincastle, while not attending committee meetings, did review the draft plan and did not make any changes or additions.

In addition, the following agencies/groups participated on the Committee: the Virginia Department of Forestry, Blue Ridge Independent Living Center, Virginia Department of Emergency Management, Friends of the Rivers of Virginia, local insurance and real estate agents, and the National Weather Service. Input was also provided by the Virginia Department of Transportation and the Western Virginia Regional Water Authority.

A group of Committee members met with FEMA Regional 3 Community Planning Lead staff on October 31, 2018 to review the progress on the plan update and learn more about new FEMA initiatives and requirements for the plan.

Table 1: Pre-Disaster Mitigation Plan Committee Meetings

Date	Location
03/14/18	Roanoke Valley-Alleghany Regional Commission, Roanoke, VA
04/11/18	Roanoke Valley-Alleghany Regional Commission, Roanoke, VA
05/09/18	Roanoke Valley-Alleghany Regional Commission, Roanoke, VA
07/11/18	Roanoke Valley-Alleghany Regional Commission, Roanoke, VA
08/08/18	Roanoke Valley-Alleghany Regional Commission, Roanoke, VA
09/12/18	Roanoke Valley-Alleghany Regional Commission, Roanoke, VA
10/10/18	Roanoke Valley-Alleghany Regional Commission, Roanoke, VA
11/14/18	Roanoke Valley-Alleghany Regional Commission, Roanoke, VA
12/12/18	Roanoke Valley-Alleghany Regional Commission, Roanoke, VA
02/13/19	Roanoke Valley-Alleghany Regional Commission, Roanoke, VA
03/13/19	Roanoke Valley-Alleghany Regional Commission, Roanoke, VA
04/10/19	Roanoke Valley-Alleghany Regional Commission, Roanoke, VA
05/08/19	Roanoke Valley-Alleghany Regional Commission, Roanoke, VA

1.7 Public Participation

1.7.1 Public Meetings

The public was invited to attend two meetings that were held to seek input about the updated hazard mitigation plan. Participants were given the opportunity to review maps, historical hazard data, damage estimates, and information about the Disaster Mitigation Act and the pre-disaster planning requirements. Information gathered at the meetings was used in developing strategies to mitigate natural hazards in the region.

Three public input meetings were held in the early evening from 5 p.m. to 7 p.m. on April 22 at Dabney S. Lancaster Community College in Clifton Forge and April 24 at the Roanoke Higher Education Center in Roanoke. The meeting announcement was sent to 34 media outlets in the region, through Facebook postings, multiple government websites, and direct emails. A draft copy of the plan, sign-in sheets, news articles, brochures, and hazard mitigation handout materials - in English and Spanish - were available at the meetings. The meetings were covered by WDBJ 7, WSLS 10, and WFXR 27. Documentation is included in Appendix C

1.7.2 Survey

The Roanoke Valley-Alleghany Regional Commission conducted two online surveys – one for the general public and one for local government staff - with the goal of gauging the level of knowledge and opinions about hazard mitigation. The survey resulted from discussions of the Hazard Mitigation Committee about differing levels of knowledge and familiarity of natural disasters between the public and local government staff. Perception of levels of risk from natural disasters also differs between the public and government. There was also the issue that all local government departments are not familiar with the mitigation of natural disasters and additional training or outreach could be beneficial.

The Committee felt that everyone should have a good basic understanding of natural disaster mitigation activities and the resources that support them (PDM, HMGP, NFIP, etc.). The gaps identified in the survey results of different levels of familiarity and perception of risk, along with outreach preferences, can help guide future education and training activities at the local and regional level.

The surveys were open from August 16, 2018 to October 1, 2018. Press releases were sent out on social media, websites, local newspapers, and local government newsletters. There were 122 responses to the Public Survey and 50 responses to the Local Government Staff Survey.

Survey forms and detailed results can be found in Appendix C.

An example of the differing levels of impact from natural disasters can be seen in Figure 1 below. While the winter storm events seemed to impact the general public and government staff equally, flooding showed a large difference in responses, likely because only certain properties are impacted by any given flood. The local governments however respond to every flood event. This implies that all local governments should provide information about flooding and that it should be focused on properties directly impacted.

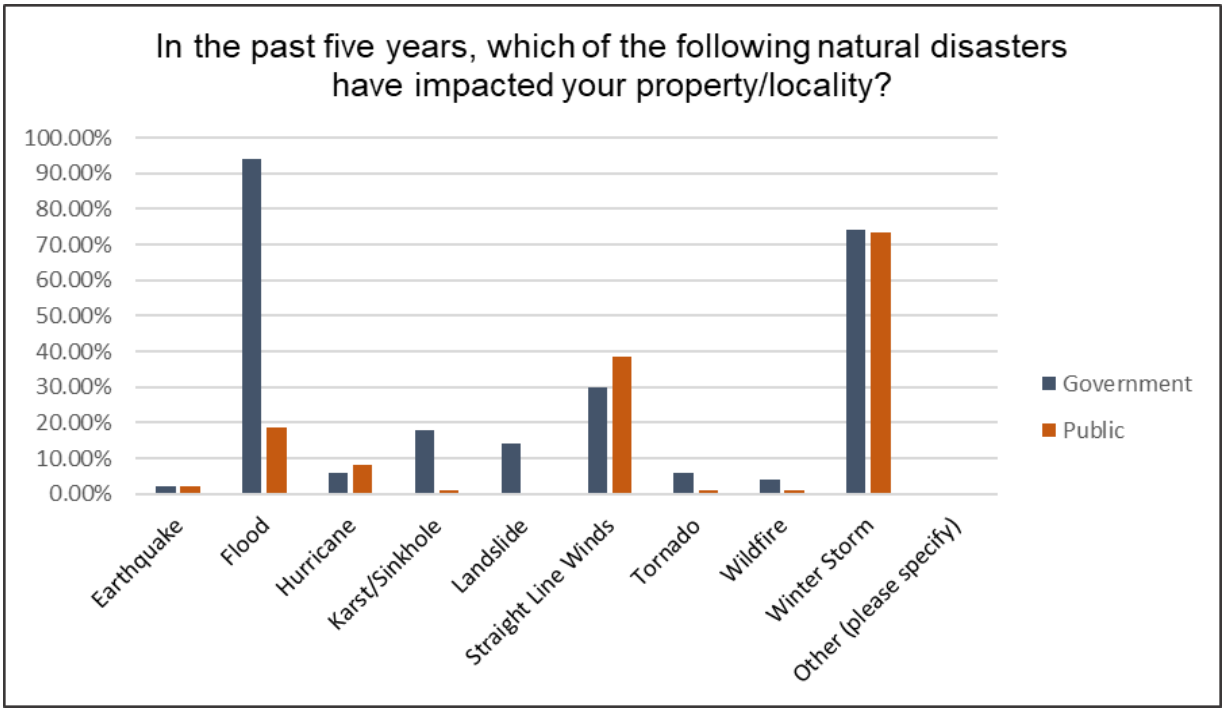


Figure 1

Some questions in the surveys attempt to answer ongoing questions or efforts such as how to motivate property owners to take additional steps to better mitigate the impact of natural disasters. When both survey groups were asked about incentives - tax breaks, insurance discount, etc. – government staff showed more support for incentives than the general public (Figure 2).

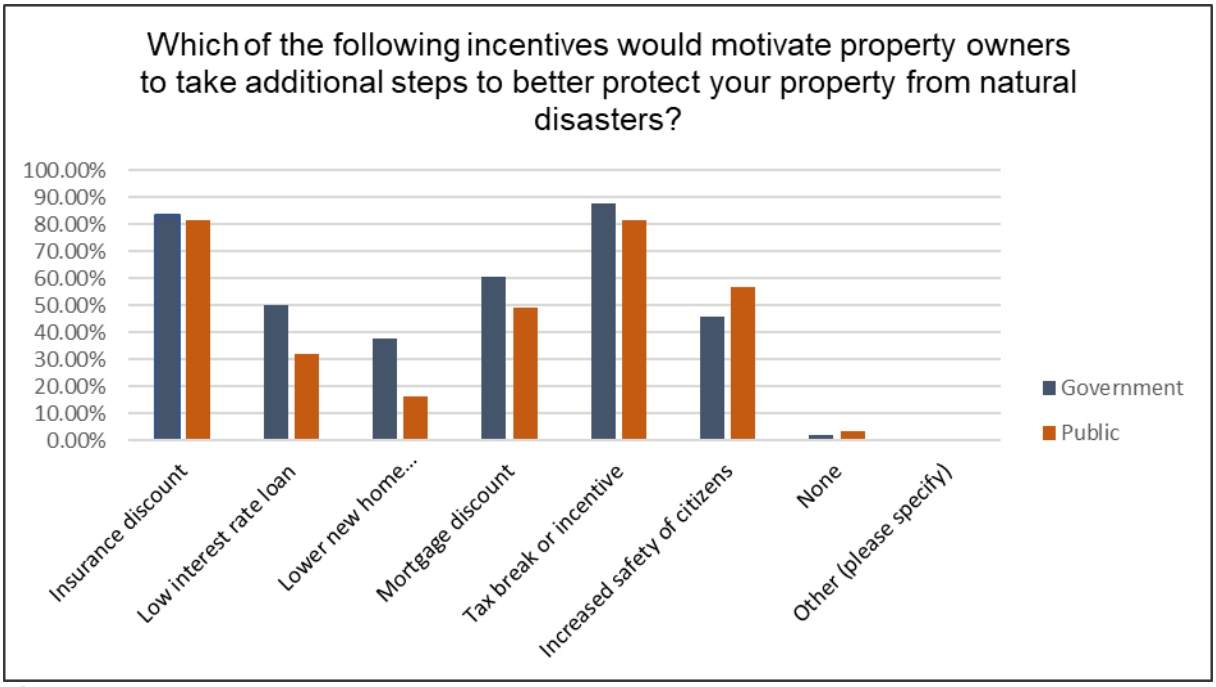


Figure 2

1.7.2.1 Public Survey

This survey is designed to help gauge household preparedness for disasters and knowledge of methods to reduce risk and loss from natural hazards. 20 questions covering a range of items including past events, outreach methodology, willingness to spend additional money – including higher taxes - to mitigate hazards, and flood insurance.

A majority of respondents were from the urban area (62% from City of Roanoke and 23% from Roanoke County) with 97% being residential properties and 19% being rental properties.

The natural disasters that have impacted the largest percentage of respondents were: winter storm at 73%; straight-line winds at 38% and flood at 19%.

When asked if the respondent had ever received information about how to make property safe from natural disasters 43% said yes, with 39% receiving information within the past 6 months. Respondents received disaster mitigation information from a wide variety of sources including: Local Government (51%), VDEM (11%), VA DEQ (2%), FEMA (16%), News media (55%), Insurance agent (38%), Utility company (36%), and American Red Cross (15%).

One of the questions that was important for guiding future outreach efforts was “How do you, as a private property owner, prefer to receive information about how to prepare for natural disasters?” While social media ranked highest at 46%, with mail a close second place at 42%, television, internet, and factsheet/brochure also selected by more than a third of respondents as

their preference. This indicates that outreach efforts should utilize a wide variety of media in future efforts.

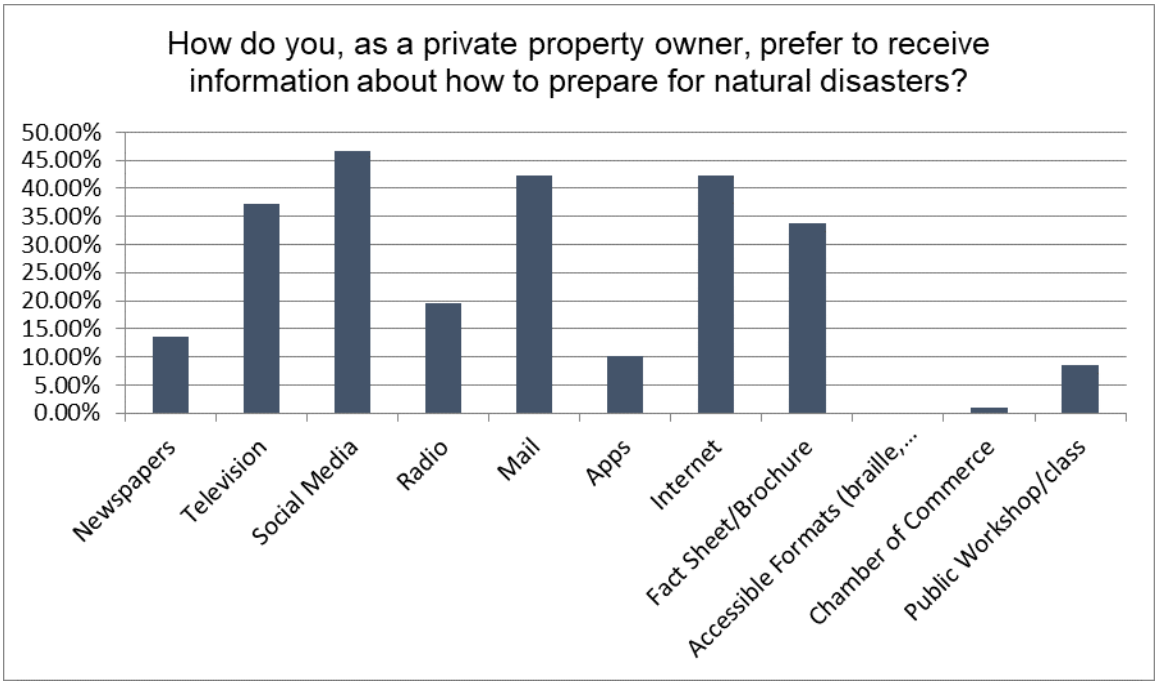


Figure 3

Responses to one question raised concerns about the level of preparedness of the general public. When asked if the respondent had taken any actions to prepare for a disaster the results showed that less than half had taken any action to prepare for a natural disaster – no supply kit, designation of a family meeting place, discussed location of utility shutoff valves, etc. Another concern was that other than emergency services, less than half of the respondents were familiar with natural hazard prevention activities such as property protection, natural resource protection and structural projects.

Looking at some of the questions that gauged the public's knowledge about natural disaster mitigation programs, 16% of respondents did not know if their property was in the floodplain and 14% did not know if the property had flood insurance. For those in the floodplain that choose not to have flood insurance, the reasons given were that it was too expensive (9%) and the deductibles were too high (4%) or that they had not considered coverage (6%) or they were not familiar with the program (9%). Respondents with flood insurance were either unsure if they received a CRS discount or stated that they did not receive a discount.

Only half of the respondents had considered the possible occurrence of a natural hazard when purchasing their property. Seventy percent of respondents said they would be willing to spend more money on a property to make it more disaster resistant (elevated HVAC, tornado safe room, flood vents, etc., and 13% of those willing to spend more than $5,000.

Incentives were popular with respondents when asked about taking additional steps to protect property and are shown in Figure 2 along with local government responses on what would motivate property owners to act.

1.7.2.2 Government Staff Survey

This 16-question survey was designed to help gauge local government staff knowledge and familiarity with preparedness for disasters and of methods to reduce risk and loss from natural hazards. The information provided in the survey responses will help improve public/private coordination of preparedness and risk reduction activities. This survey was more focused on local government staff knowledge and activities related to hazard mitigation including department, familiarity of past hazard events, outreach, hazard plan implementation, NFIP and CRS participation, and incentivizing property owners to take additional actions to mitigate hazard impacts.

Again, a majority of respondents from the urban are: 43% from City of Roanoke, 24% from City of Salem and 18% from Town of Vinton. Responses were from across various departments: 35% from stormwater, 17% from administration, 15% from planning/zoning, 10% from fire & rescue, 10% from transportation, 7.5% from building inspections, and 2.5 % from both water/wastewater and parks and recreation.

Sixty-eight percent said that they had received information about natural disasters, with 37% with the past 6 months and 29% within 6-12 months from a wide variety of sources (Figure 4).

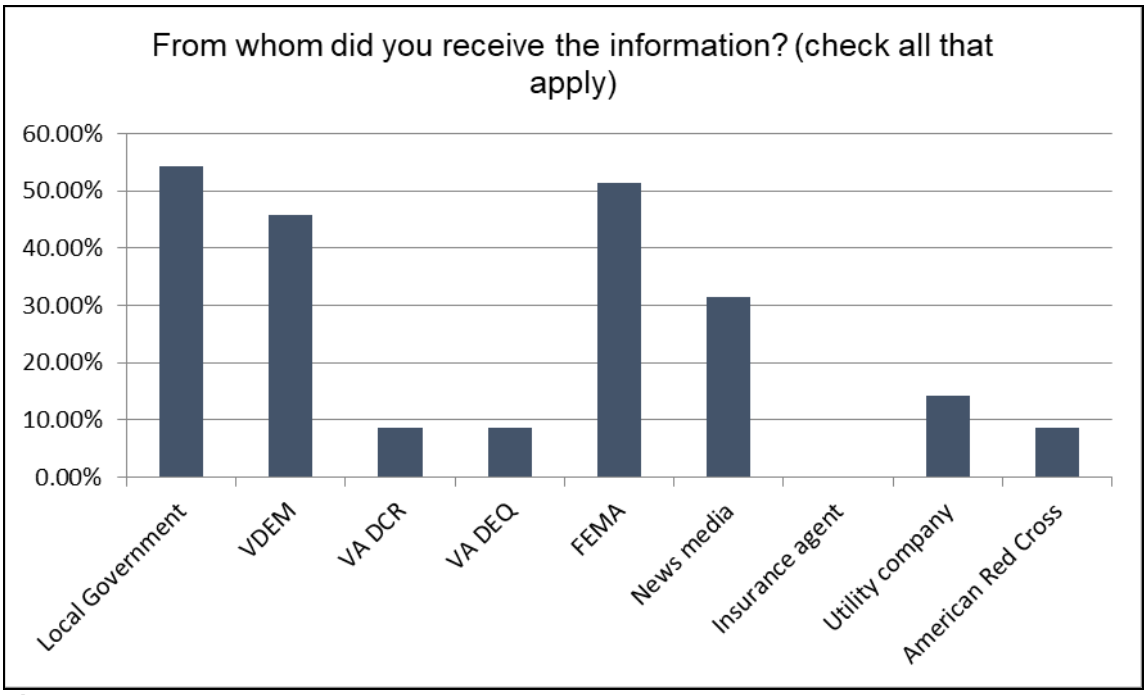


Figure 4

We can contrast graph of government staff's preferred ways to receive information (Figure 5) with that of the general public (Figure 3). The government staff respondents had a clear preference for the internet as a source of information at 80% with social media (42%) and public workshops/classes (36%) a distant second and third preference.

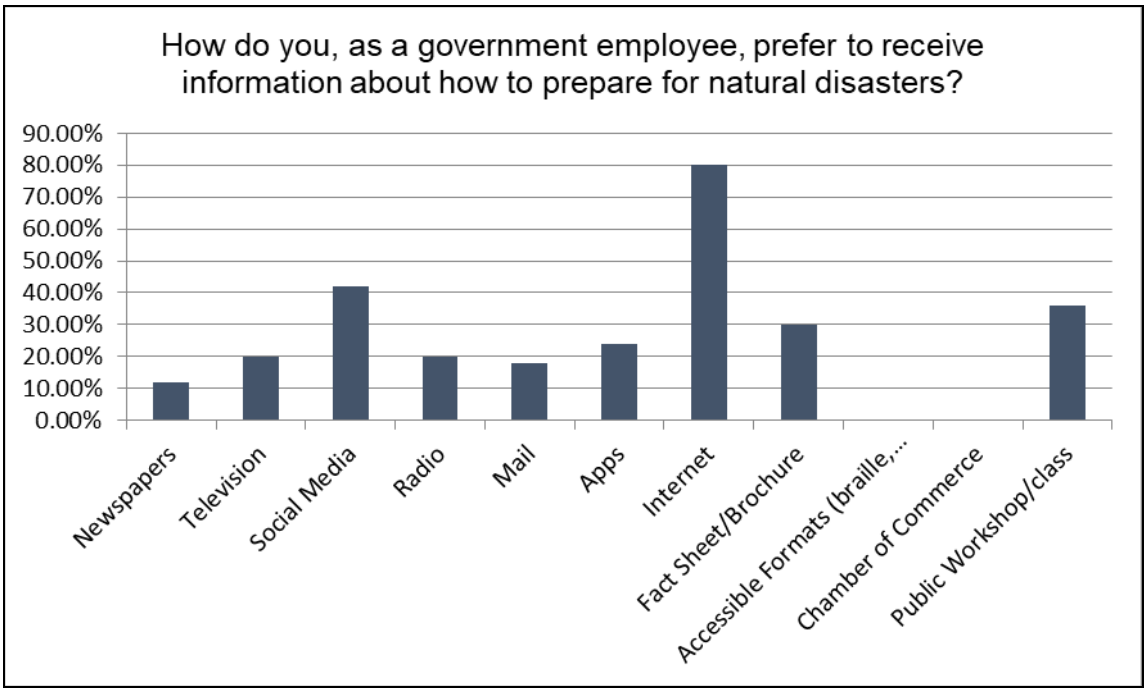


Figure 5

When asked how natural hazard mitigation should be implemented through local government documents and actions, respondents answered the floodplain ordinance (85%), stormwater ordinance (77%) and comprehensive plan (79%).

Looking at existing local government participation in ongoing programs, 36% were not sure if the local government participated in the NFIP, and 52% were not sure if it participated in CRS.

When asked about participation in other programs related to natural disaster mitigation, staff were more aware of programs that required direct participation such as the Local Emergency Planning Committee than they were of federal government sponsored activities (Figure 6).

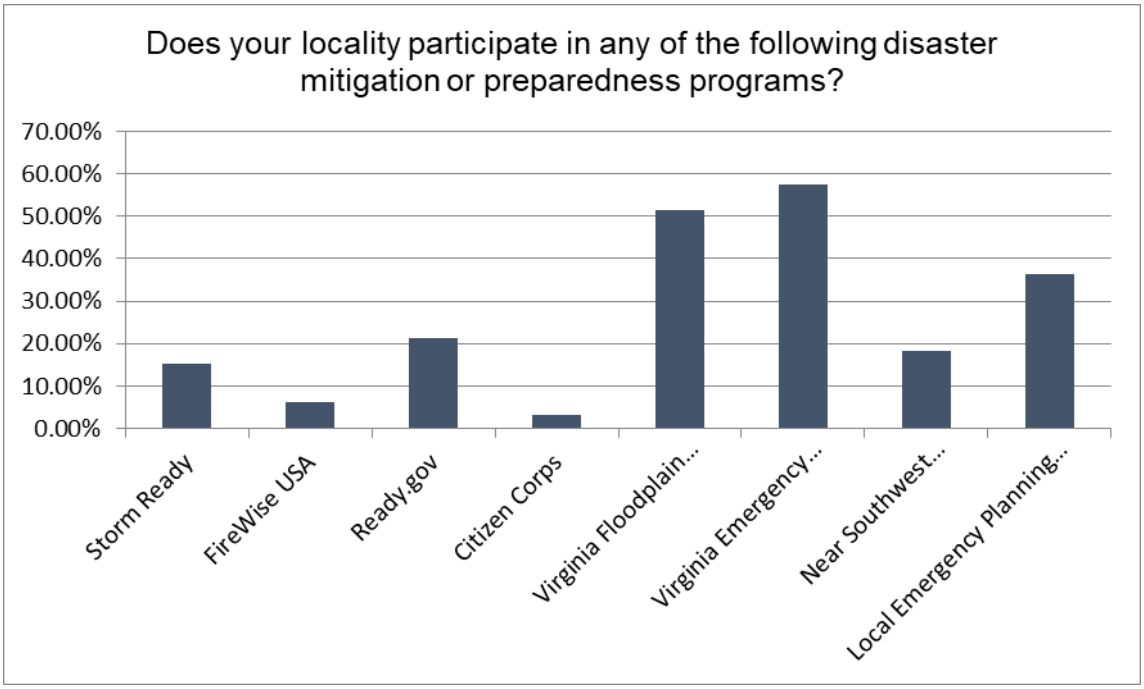


Figure 6

Recommendations

Recommendations based on the survey responses include the following:

1. Outreach for flood mitigation and flood insurance should be undertaken by all local governments and should be targeted at properties directly impacted by flooding
2. Local governments should use multiple media formats for outreach to the general public including television, social media, internet, mail, and factsheets/brochures.
3. Local, state, and federal government should explore ways to offer additional incentives to property owners to encourage them to act to protect their property.
4. Local governments should offer training and workshops to staff in all departments that have a role in hazard mitigation.
5. Local, state, and federal governments should utilize and work with other organization and agencies to improve and expand outreach.

1.8 Regional Profile

The Roanoke Valley-Alleghany Regional Commission service area lies in western Virginia and includes the counties of Alleghany, Botetourt, Craig, Franklin and Roanoke; the cities of Covington, Roanoke and Salem; and the towns of Boones Mill, Buchanan, Clifton Forge, Fincastle, Iron Gate, New Castle, Rocky Mount, Troutville, and Vinton.

The planning area for the Hazard Mitigation Plan includes only the counties of Alleghany, Botetourt, Craig, and Roanoke; the cities of Covington, Roanoke and Salem; and the towns of Buchanan, Clifton Forge, Fincastle, Iron Gate, New Castle, Troutville, and Vinton.

1.9 Location

The region is on the eastern border of the Appalachian Plateau and the western slope of the Blue Ridge Mountains. The James River flowing east through Botetourt County ultimately reaches the Chesapeake Bay and Atlantic Ocean. The Roanoke River flows through the district in a southeasterly direction to North Carolina before reaching the Atlantic. Both river basins serve as development corridors. Although the planning area includes the Roanoke metropolitan area, much of the region is rural. Approximately 212,039 acres of federal land lies within the National Forest and Blue Ridge Parkway system.

1.10 Physiography

The predominant physical characteristic of the region is the mountainous terrain. Forty-eight percent of the land area has slopes of 25 percent or greater. Within the region, mountain ridges run southwest to northeast. There are large concentrations of steep land in northern Botetourt County and Alleghany County. A broken ring of steep lands surrounds the Roanoke metropolitan area. Past development has been influenced greatly by topographic characteristics. The higher elevations have remained in open or forest use while the more moderate foothills and river valleys have been developed.

Flood plains impose considerable restraints on land development activities. In the past, heavy flooding has caused considerable property damage to existing development in flood plains. The region has several major flood plain areas along the Roanoke, James and Jackson Rivers, Peters, Mason, Carvin, Tinker, Glade, Mud Lick and Smith Creeks.

1.11 Transportation

Interstate 64 bisects Alleghany County in an east-west direction while passing through the City of Covington and Town of Clifton Forge. Interstate 81 crosses Botetourt and Roanoke counties in a northeast-southwest direction and includes an urban connector I-581 that links I-81 to the central business district of the City of Roanoke. Other arterial routes in the area include US 11 in Botetourt and Roanoke counties; US 60 in Alleghany County; US 220 passing through Alleghany, Botetourt, and Roanoke counties; US 221 and 460 in Roanoke County; and State

Primary Route 311 in Alleghany and Craig counties. Air service is available at the Roanoke Regional Airport that provides nonstop service from Roanoke, Virginia to nine major cities. Rail service for freight is provided by the Buckingham Branch Railroad, CSX Transportation and Norfolk Southern Railway. Passenger train service is available from Amtrak at station in the Town of Clifton Forge and City of Roanoke.

1.12 Climate

The climate of the region is mild and characterized by warm summers and moderately cool winters. Average monthly temperatures range from a low of 36°F in January to a high of 73°F in July. The average annual temperature is 54°F. Annual precipitation is 43 inches and proportionate throughout the year. The highest monthly rainfalls occur between May and September. Snowfall amounts average 20 inches per year.

1.13 Population

The planning area has an area of 1,636 square miles and a 2010 population of 272,452 according to the US Census Bureau. The region's population is projected to increase to 296,212 by 2045 based on estimates from University of Virginia Weldon Cooper Center, Demographics Research Group. There are 120,679 occupied housing units in the planning area. The existing population of the region is concentrated within the Roanoke Valley. The two population centers in the region are the Roanoke Valley area and the Covington/Clifton Forge area.

Several localities within the Roanoke region experienced an increase in their respective populations since 2010. As can be seen in Table 2 below, most localities gained population except for Alleghany County, City of Covington, and the Town of Clifton Forge. Craig County and Town of Vinton population remained stable with little change. The population for the region increased 2.0% compared to a 6.7% increase in the Commonwealth over the same period.

Table 2: Population Trends

Locality	2010	2017
Alleghany County	16,406	15,489
Town of Clifton Forge	3,946	3,668
Town of Iron Gate	439	276
Botetourt County	32,867	33,149
Town of Buchanan	1,350	1,101
Town of Fincastle	371	464
Town of Troutville	573	527
City of Covington	5,989	5,675
Craig County	5,173	5,131
Town of New Castle	151	149
City of Roanoke	95,793	99,572
Roanoke County	91,583	93,419
Town of Vinton	8,074	8,069
City of Salem	24,641	25,521
Plan Area	272,452	277,956

Source: U.S. Census Bureau, 2010 and American Community Survey, 2018.

The population of most of the localities within the region is older than that of the Commonwealth. Table 3 displays the median age of each of the jurisdictions and disaggregates the population by age.

The region's population is older by comparison to the Commonwealth. Based on recent demographic trends in the region, it appears that the older population in the region will continue to expand. Data suggests that potential labor force issues related to a large percentage of retirees and declining number of people in the workforce are likely if the current population trends continue.

Table 3: Percent of Population by Age Group

Locality	Median Age	Under 5	5 to 19	20 to 34	35 to 54	55 to 64	65 and older
Alleghany County	45.8	4.8	18.6	13.0	27.9	15.4	20.3
Botetourt County	44.9	4.9	19.6	12.2	31.0	16.0	16.4
Craig County	44.8	5.0	18.7	13.8	30.1	15.5	17.1
Roanoke County	43.3	5.0	19.3	14.7	29.3	14.6	17.2
City of Covington	42.9	5.8	17.9	16.7	27.8	13.1	18.8
City of Roanoke	38.5	7.2	16.9	21.5	27.5	12.7	14.2
City of Salem	40.5	4.8	19.7	19.1	26.3	13.0	17.1
Town of Clifton Forge	45.8	4.9	18.7	13.3	26.7	13.6	22.6
Town of Vinton	39.0	6.3	19.4	19.1	27.0	12.4	15.9
Virginia	37.5	6.4	19.7	20.9	29.0	11.9	12.2

Source: 2013-2017 5-Year Estimates, American Community Survey Demographic and Housing Estimates, 2019.

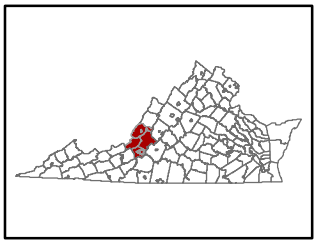
Table 4 shows the most recent population projections from the Weldon Cooper Center out through 2045. The rural areas all are projected to lose population, while the urban areas experience small gains and the region gains almost 10,000 people from 2025 to 2045.

Table 4: Population Projections

Locality	2025	2035	2045
Alleghany County	14,237	12,927	11,535
Botetourt County	34,604	36,086	37,306
Craig County	5,200	5,194	5,152
Roanoke County	97,199	101,099	104,266
City of Covington	6,352	6,195	5,997
City of Roanoke	103,175	104,878	105,836
City of Salem	26,117	26,210	26,119
RVAR CEDS Region	286,884	292,590	296,212
Virginia	9,145,616	9,874,244	10,528,817

Source: Virginia Population Projections, University of Virginia Weldon Cooper Center, Demographics Research Group. 2017.

Map 1: Roanoke Valley - Alleghany Planning Region



Scale 1:500,000

Source: Roanoke Valley-Alleghany Regional Commission, 2012.

Content may not reflect National Geographic's current map policy.
Sources: National Geographic, Esri, DeLorme, HERE, UNEP-WCMC, USGS, NASA, ESA, METI, NRCAN, GEBCO, NOAA, increment P Corp.

1.14 Development Trends

It is important to examine new development that has occurred in the area and how this could influence the impact of future natural hazard events. While localities are trying to prevent new construction in floodways through local ordinances, development occurring in the rest of the region remains at risk from other natural disaster such as hurricanes, straight line winds, wildfires and winter storms. Each additional residential unit constructed, or commercial investment made is another potential loss. The plan looks at residential development trends and major new investments in commercial, mixed-use, and industrial sites.

1.14.1 Major New Commercial, Mixed-Use, and Industrial Development

In addition to reviewing new residential development, major new commercial and industrial development was also examined. New commercial and industrial development increases the potential for loss of life and property caused by natural disasters. Localities have been managing growth by encouraging redevelopment of existing properties or expansion of existing sites which helps to prevent sprawl and expansion of development into “greenfield” areas. This practice also tends to create a higher concentrate of development, and therefore potential losses.

Since adoption of the previous plan, several major commercial, mixed-use, and industrial developments have occurred or are currently underway in the region. Some are single use sites while others are mixed use developments that include residential and commercial properties. The region has had over 70 new industrial announcements since the adoption of the last hazard mitigation plan worth over $1.1 billion and creating almost 4,000 new jobs.

Ongoing downtown revitalization efforts in the City of Covington, and towns of Buchanan, Fincastle, Clifton Forge and Vinton are bringing new businesses and development to these communities. The revitalization of the downtowns focuses primarily on improving the conditions of existing buildings and repairs to infrastructure in an effort to improve the local economy by attracting investment to the localities. While the efforts are to be applauded, however when looking at the work from the point of view of natural disaster risk this leads to increased concentrations of people and higher property values which could result in greater losses. Each of the downtowns, except Fincastle, is susceptible to flooding.

WestRock (formerly MeadWestvaco) in Covington has made a $285 million investment to construct a new, state-of-the-art biomass boiler and upgrade associated power infrastructure at its Covington facility. Announced in June 2007, the boiler is expected to went online in late 2013. The new boiler and related 75-megawatt steam turbine generator system will replace two older and less efficient units allowing the mill to become self-sufficient in electrical power. Schaefer Rolls, a producer of polymer-based materials, invested $12.1 million in Covington creating 31 new jobs on a former industrial site adjacent to the Jackson River but well above the floodplain. The City of Covington has also been working in partnership with Alleghany County to

redevelop a former elementary school site into an unmanned aerial vehicle research and commercialization site.

A new medical clinic was constructed in 2008 in the downtown New Castle. The Craig County Health Center is the only medical facility in the county. The center is a critical facility and has been outfitted with a generator for emergency power. A new community center and library in downtown are in the planning and design phases in 2019.

The Daleville Town Center, a new pedestrian-friendly and lifestyle-oriented community in the Botetourt County community of Daleville, is under development. The town center consists of commercial, medical, restaurants, single-family homes and apartments as well as recreation spaces. The town center has a projected build-out of 10 years and will be comprised of 300 residences around the town center. There will be a total of 120 single-family homes. The rest will be town homes and apartment homes. Botetourt County completed a housing study in 2016 that looked at the need for market rate housing in the county. The market for new housing is being driven by new commercial and industrial development. Botetourt County is expecting almost 1,000 new manufacturing jobs alone over the next 5 to 6 years. A wide variety of new firms have located in Botetourt County such as Altec utility truck manufacturing, Canatal Steel, Eldor ignition coil manufacturing, Ballast Point Brewing and the Virginia Community College System.

Carilion Clinic has established the Carilion Biomedical Institute in Roanoke in association with Virginia Tech. The partnership, announced in 2007, has a campus that includes the Virginia Tech Carilion School of Medicine, Research Institute, and Riverside Center office complex. The Research Institute, comprised of 21 major research teams with more than 150 faculty and staff, is a business incubator designed to introduce advanced medical devices into the marketplace. The Virginia Tech Carilion School of Medicine is located on the campus, adjacent to Carilion Roanoke Memorial Hospital and the Carilion Clinic on South Jefferson Street in Roanoke. The site was designed to mitigate any flooding impact from the nearby Roanoke River by elevating the buildings out of the floodplain and the incorporation of berms and other floodproofing and stormwater management BMPS into the site. A hotel was constructed adjacent to the campus in 2011 at a value of more than $10 million and utilized a similar floodproofing strategy. Two new buildings have been added in the past few years on the site.

The Bridges mixed use redevelopment is a $100 million, 20-year effort to develop apartments, offices, stores and restaurants across from the Virginia Tech Carilion School of Medicine and Research Institute in the City of Roanoke adjacent to the Roanoke River. The first phase of the project was a $12 million, 150-unit apartment building on the site.

Downtown housing in the City of Roanoke has grown at a rapid pace since adoption of the previous plan increasing the number of residents that could be impacted by a natural disaster in the central urban area. Several hundred new condo/apartment units are available in downtown Roanoke. According to Downtown Roanoke, Inc., there has been an increase in the number of people living downtown and is now estimated at 2,500. Demand for downtown housing remains

strong and renovation of additional buildings for apartments is underway. A new $17 million Hampton Inn with 127 rooms opened in 2016 in downtown and a new 125 room Marriott was proposed in 2019.

In 2017, Amtrak passenger rail returned to Roanoke following construction of a $13 million passenger platform along with a $5.5 million facility for crew members and service area for the train itself. The station is in downtown near the Taubman Art Museum and Hotel Roanoke and serves over 32,000 riders a year. In January 2019, the city proposed moving the existing public transit facility that serves as Valley Metro's main transfer center, two blocks west and redeveloping the existing site as a $25 million multi-use project for shops, offices and apartments. The move also included plans for an open-air bus station and a new Amtrak station.

A new 324-unit apartment complex is under construction on Orange Avenue in the City of Roanoke. The complex would be built on an 18-acre site on the eastern side of the city. At the Roanoke Center for Industry and Technology, also nearby on Orange Avenue, Deschutes Brewery has proposed a new manufacturing site. RCIT is also home to other large manufacturers including: Advance Auto Parts, AT&T, Eaton, Elizabeth Arden, FedEX, Orvis, and Wholesome Harvest Baking.

Planning for the Countryside site redevelopment in the City of Roanoke located near Hershberger Road and Interstate 581, just west of the Roanoke Regional Airport, took place from 2010 to 2012. The City of Roanoke purchased the Countryside Golf Course property in November 2005. The golf course was closed in winter 2010 and City planning staff initiated a public participation process to identify potential reuse options. This plan recommends the property be developed as a new mixed-use neighborhood. The challenge was to plan an infill development within an existing neighborhood context, street patterns, and environmental constraints. Over half of the property's 139 acres will be dedicated to open space uses such as recreation, preservation, and natural areas. An additional 71 acres owned by the Roanoke Regional Airport Commission, though not publicly accessible, will be open space. The Central area features a cluster of mixed residential development with a wide variety of housing types bracketed by a neighborhood park, a community park, and preservation areas.

The Evans Spring Area land comprises approximately 130 acres of vacant land along the southern side of Interstate 581 opposite Valley View Mall. It is the largest assembly of privately owned developable vacant land left in the City. In 2011 the General Assembly provided funding for completion of the interchange at this site. Construction was completed in 2016 for the eastern portion of the interchange with remaining work expected to be done by 2021. The City's plan for the area addresses these anticipated changes by establishing standards and guidelines that will enable this land to be a productive and mutually beneficial part of the City. This plan recommends Evans Spring be developed as a mixed-use neighborhood a framework for development within the context of surrounding neighborhoods, a regional commercial shopping corridor, a major interstate highway frontage and a significant environmental feature, the Lick Run watershed and its floodplain. Proposed development would include residential, commercial, mixed-use and environmental preservation.

The Valley View area in the northern part of the City of Roanoke continues to expand and has had several new hotels and restaurants constructed over the past 5 years. Expansion of the mall property itself has occurred with the opening of “The District” adding two new restaurants and several retail properties. Outparcels also continue to be developed with new restaurants and retailers.

Roanoke County has had several companies to expand employment over the past five years including Harris Corporation that makes night vision devices, Ardaugh Metal Packaging, and Integrity Windows. Office park jobs have also seen many expansions by companies such as Metis Holdings, a risk management and insurance company, Wells Fargo financial services, Allstate insurance, Tectron fiberglass and Optical Cable Corporation. The South Peak community in Roanoke County developed dense residential condominiums (34 units in Phase I) along with commercial buildings, a restaurant, and a hotel on a hilltop near the intersection of Route 220 and Franklin Road. Nearby in the Clearbrook Village area, a Super Walmart with over 350 employees opened in 2011.

Roanoke County has three major land use planning initiatives underway in 2019; Hollins Area Plan, Oak Grove Community Plan and the Route 419 Town Center Plan. The 419 Town Center Plan is expected to spur redevelopment of a major commercial center in the county that would include redevelopment of Tanglewood Mall, highway improvements and new housing, all in an area that has experienced stormwater issues in the past.

Salem developed a new Downtown Plan in 2015 and has been very successful in implementing the documents recommendations. Streetscapes, lighting, parking, and a façade program have been underway since adoption of the plan in 2016. Two new boutique hotels and three new restaurants have opened or are under development in 2019. The city has had several industrial development announcements over the past five years totaling over $20 million including: Parkway Brewing Company, Old Salem Brewery, Lake Region Medical, Yokohama Tire, and RCS Industrial.

The Town of Vinton undertook a Downtown Revitalization project from 2011 to 2015 that addressed utilities, streetscape, farmers market, and new economic development initiatives. The town has seen two former school buildings be renovated into apartments, expanding housing units by 85 units at the former William Byrd High School and 20 units at the former Roland E. Cook Elementary School. A new 23,000 square-foot library was constructed in downtown in 2015. Two sites are in the planning phase for redevelopment: the former Holdren’s Country Store, a possible retail or restaurant, and the former Vinton Motor Company car dealership slated to be a mixed-use development called Vinyard Station.

The Western Virginia Regional Industrial Facility Authority was formed in 2013 to bring local governments together to jointly acquire property for a new industrial park. A 100-acre site on Wood Haven Road at the junction of I-81 and I-581 is under development and is expected to be home to several new businesses over the next five years.

Chapter 2 Hazard Specific Information

2.1 Regional Hazards

The region has experienced nearly all types of natural disasters, the major ones being flooding, straight-line winds, winter storms, and wildfires. Other disasters that might occur in the region include earthquakes, hurricanes, landslides and tornados. Based on past occurrences and probability, the Pre-Disaster Mitigation Plan Committee selected the following disasters for inclusion in this Plan: earthquakes, flooding, hurricanes, straight line wind, karst, landslides, tornados, wildfires, and winter storms. There were no locality specific unique hazards identified during the planning process.

Widespread flooding or flash flooding impacts a large portion of the region. Watersheds in the region are typical of the Blue Ridge region in which smaller streams collect water which then flows through steep terrain, picking up velocity, and into the valleys and flatlands along major rivers where development has occurred. Sudden downpours can cause stormwater systems in urbanized areas to overflow and cause localized flooding. Downpours in 2016 on May 11, July 12 and August 15 dumped 2.26 inches on downtown in under an hour in downtown Roanoke flooding several businesses. A July 2013 cloudburst caused a localized flash flood event northern and northwestern sections of Roanoke and adjacent Roanoke County when 3.35 inches of rain fell in an hour; similar to a 200-year and 500-year event. Route 220 Northbound at Ashley Way was flooded by a quick storm in May 2018, blocking entrances to Ashely Plantation subdivision and Botetourt Center at Greenfield.

Floods are not the only weather-related disasters the region faces. The area is frequently subjected to weather events such as winter storms, heavy thunderstorms, tropical storms, hurricane remnants, straight line winds and rare tornados. Meteorological events have the potential to impact all communities and structures in the region. In addition, geologic hazards including karst, landslides and earthquakes can impact the region.

In the Roanoke Valley wildfires are a recurring natural hazard. In 1999, Fort Lewis Mountain in the western part of Roanoke County burned out of control for a week, destroying land and endangering homes before it was brought under control. Other fires have occurred on Brushy Mountain, Poor Mountain, Twelve O'clock Knob, Yellow Mountain, and even portions of Mill Mountain that lies within the heart of the City of Roanoke. The Purgatory Mountain fire in Botetourt County burned 1,285 acres and cost over $166,000 to contain.

Hurricanes or tropical storms occur when their track inland from the Atlantic or Gulf Coast brings them into the surrounding Blue Ridge Mountains. The long periods of rain result in mountain streams overflowing and urban stormwater facilities exceeding their capacities. Thunderstorms often can create flash flooding in the area. Several neighborhoods throughout the region experience flash flooding every year due to runoff resulting from strong thunderstorms. These flash floods can damage homes, washout roads and overflow stormwater systems. In 2018, the region was impacted by Hurricane Florence and Hurricane Michael. Hurricane Florence reached

western Virginia on September 16th. The slow-moving storm dumped rainfall amounts across the area varied from less than 1 inch in Eagle Rock, 2.6 inches at the Roanoke Regional Airport to 5.6 inches on Bent Mountain. Winds were from 38mph at the Roanoke Regional Airport to 13 mph at Springwood in Botetourt County. The Roanoke River crested at 11.14 feet (0.5 feet above flood stage) and the James River in Buchanan crested at 14.7 feet (2.3 feet below flood stage). Hurricane Michael came into southside Virginia on October 11th causing flooding. Rainfall amounts ranged from 1.97 inches at Gathright Dam, 3.3 inches at Daleville, 3.15 inches at the Roanoke Regional Airport to 7.16 inches in the Cave Spring area of Roanoke County. The Roanoke River at Glenvar crested at 17.1 feet (8.1 feet above flood stage) and in Roanoke at 16.4 feet (6.4 feet above flood stage).

Thunderstorms bring large amounts of rain, lightning and damaging straight line winds. Thunderstorm season in the region is spring to late fall. Straight-line winds and flooding are responsible for most thunderstorm damage. Severe thunderstorms have produced tornados in the region. The last verified tornado in the region occurred in Craig County in 2018. Classified as an EF-1, estimated windspeeds reached 105 mph and had a path length of 0.5 miles. The tornado damaged 6 homes, several outbuildings and garages, and approximately 50 trees in the vicinity. Three cars and a double axel trailer were moved including one truck that was flipped over. The tornado was part of a wide regional outbreak made up of several supercells on April 15, 2018 impacting communities in Virginia and North Carolina.

Landslides and sinkholes can occur during or following intense thunderstorms or prolonged rain events such as hurricanes. Landslides can damage buildings located on steep slopes and block roadways. A rockslide in Eagle Rock in April 2017 blocked Route 43 for a week and a slide in Alleghany County blocked Rt. 220 for two weeks in February 2019. In May 2018, a home in Roanoke County was partially collapsed and pushed off its foundation by a slide and in January 2019 a slide in the City of Roanoke broke a sewer line in a residential area near the base of Mill Mountain.

Winter Storms are the most likely natural hazard to occur in the region. Arctic blasts and gulf moisture have historically combined to deliver serious winter weather to the region. There is potential for dangerous winter weather from November to May. The regions greatest snowfalls occur from January to March. In 1966, the Roanoke Valley received 41.2 inches of snow. The City of Roanoke's snowiest single day in December occurred in 2018 with 15.2 inches. The biggest snowstorm on record for the City was December 18-19, 2009 with 17.8 inches. When heavy snowfalls occur, highway crews, emergency personnel and citizens can quickly become overwhelmed - roads close, rescue personnel are pushed to the limit, and citizens can be stranded at work or at home. Heavy snow and ice accumulation can knock down trees, power and telephone lines, and collapse roofs. Winter ice storms are frequent in the region. Even modest accumulations of ice can knock down trees, power lines, and communication towers that are critical for emergency services.

The NOAA National Center for Environmental Information (NCEI) reports on past storm damage with a focus on property and crop damage. NCEI receives Storm Data from the National Weather Service. The National Weather service receives their information from a variety of sources, which include but are not limited to county, state and federal emergency management officials, local law enforcement officials, Skywarn spotters, NWS damage surveys, newspaper clipping services, the insurance industry and the general public, among others.

NCEI's Storm Data is an official publication of the National Oceanic and Atmospheric Administration (NOAA) which documents the occurrence of storms and other significant weather phenomena having enough intensity to cause loss of life, injuries, significant property damage, and/or disruption to commerce. In addition, it is a partial record of other significant meteorological events, such as record maximum or minimum temperatures or precipitation that occurs in connection with another event. Some information appearing in Storm Data may be provided by or gathered from sources outside the National Weather Service (NWS), such as the media, law enforcement and/or other government agencies, private companies, individuals, etc. An effort is made to use the best available information but because of time and resource constraints, information from these sources may be unverified by the NWS. NCEI data contained in this plan update is the best available version of the best data available.

NCEI is known to have spotty recording of geological hazards (i.e. earthquake, landslide, karst) and no longer includes earthquake events. In the absence of better data, it was determined to proceed with the records available in NCEI for these events, as in all cases NCEI records for these events are severe under-representations of what has happened in Virginia. To date, no comprehensive digital databases exist for these hazards.

The National Weather Service makes a best guess using all available data at the time of the publication. Property and crop damage should be considered as broad estimates. See the NOAA Storm Events FAQ at https://www.ncdc.noaa.gov/stormevents/faq.jsp for more information.

Storm event data for the past 20 years, from 1998 to 2018 which is similar to the Virginia Plan's 20-year summary of 1996-2016. Table 5 is the sum of all the jurisdictions, by hazard, for the NCEI parameters of interest. In this table, the damages, injuries, and deaths due to each hazard type have not been annualized to account for their varying periods of record. Each event in this table represents a storm event affecting a single jurisdiction. The damages entered into the NCEI Storm Events Database portray how much estimated damage was incurred in the year of the event. These amounts have not been adjusted for inflation over the 20-year period.

Table 5 Regional Analysis of NCEI Data
Cumulative Damage in Localities 1998-2018

Hazard Type	Number of Events	Property Damage ($)	Crop Damage ($)	Injuries	Fatalities
Avalanche/Landslide	1	0	0	0	0
Drought	24	0	70,000	0	0
Extreme Cold	1	0	0	0	0
Flash Flood	133	14,878,730	500	3	0
Flood	80	3,936,150	0	1	4
Frost/Freeze	17	0	4,169,000	0	0
Hail	239	1,815,600	0	0	0
Heat	1	0	0	0	0
Heavy Snow	120	1,120,000	0	0	0
High Wind	136	983,750	0	50	0
Ice Storm	76	124,000	0	0	0
Strong Wind	9	96,500	0	0	0
Thunderstorm Wind	320	6,849,350	346,700	0	0
Tornado	4	579,000	0	0	0
Tropical Storm	0	0	0	0	0
Wildfire	4	3,410,000	0	0	0
Winter Storm	78	59,000	0	0	0
Winter Weather	16	10,000	0	0	0
Regional Total	1,259	33,862,080	4,586,200	54	4

Source: Storm Events Database, NOAA National Center for Environmental Information, 2018.

Based on the estimates from NCEI, flooding continues to be the most dangerous natural hazard and caused 4 deaths in the past 20 years. High wind events caused the most injuries with one event in Alleghany County accounting for an estimated 50 injuries.

Flash floods and floods caused the most damage with $18.8 million in property damage. Recurring events such as thunderstorms and strong winds caused almost $7 million in damages and winter related weather caused over $3 million, almost as much as wildfires at $3.4 million. Crop damage was mostly caused by frost/freeze events that accounted for over $4 million in damages along with almost $350,000 in damage from thunderstorm winds.

2.1.1 Drought

Five major droughts affected Virginia in the 20th century, during 1930-32, 1938-42, 1962-71, 1980-82, and from 1998 to 2002. Following the 2002 drought, the Local and Regional Water Supply Planning Regulation was established in Virginia, which required each locality to develop and submit a plan by 2011, either alone or in collaboration with other localities.

The Virginia State Water Resources Plan (SWRP) was finalized and released to the public in October 2015. The SWRP identified some potential areas of concern as well as challenges for future water resources management and recommendations for action to address water supplies and drought. This State Plan is a compilation of the 48 local and regional water supply plans developed by local governments to assess their water supply needs 2010 to 2040. Each water supply plan includes information concerning community water systems and self-supplied users, existing and potential sources of water supply, existing use, and anticipated future water demand.

The regulations guiding this plan detail the information to be included in a region's/locality's water supply plan, including a drought response plan (9VAC25-780-120 Drought Response and Contingency Plans). The regulation requires a locality to specify how a drought or low water condition is declared, what actions they will implement to conserve water under such a condition, and how they will enforce water conservation actions. The water supply planning program was designed as a statewide partnership with localities having the lead role in identifying their future demands and the state providing technical support and oversight. For many regions public service authorities play a major role in drought response planning (see the Western Virginia Water Authority's Drought Contingency Plan).

The Roanoke Valley - Alleghany Regional Commission coordinates the state mandated regional water supply plans required of its member localities. There are three water supply plans which overlap the Roanoke Valley - Alleghany region. All of them were adopted and reviewed by the Virginia Department of Environmental Quality in 2013. A 5-year update to these plans was submitted in December of 2018 and will be reviewed by the Virginia Department of Environmental Quality (DEQ).

There are 48 regional water supply plans that cover the Commonwealth. The three that cover the RVARC region are:

- The Upper James Water Supply Plan covers Alleghany, Bath, and Highland Counties, as well as Lexington, Buena Vista, Covington, Clifton Forge and Iron Gate.
- The Roanoke River Water Supply Plan covers Roanoke, Bedford, Botetourt, and Franklin Counties as well as the cities of Roanoke and Salem, and the Towns of Boones Mill, Buchanan, Fincastle, Rocky Mount, Troutville and Vinton.
- The Craig County – Town of New Castle Regional Water Supply Plan covers Craig County and the Town of New Castle.

All localities within the Hazard Mitigation Plan area except the Town of Troutville have adopted their appropriate water supply plan including the required drought response ordinance. Copies of the locality adoption resolutions as well as “locality snapshots” describing existing water supply, customer base, and usage can be found in Appendix F.

Since the adoption of the Virginia Drought Assessment and Response Plan in 2003, drought watch declarations have been issued for various regions nearly every year, but drought warning declarations have occurred less frequently. A Drought Emergency declaration has not been issued in the region since the 2002 drought, however statewide drought watches have been issued as have local water restrictions due to drought. Drought was not selected as a natural hazard that would be addressed in this plan since it is addressed in other planning documents.

More information about the state water supply plan requirements and outcomes can be found in DEQ’s October 2018 report Status of Virginia’s Water Resources and at the DEQ’s website (https://www.deq.virginia.gov/Programs/Water/WaterSupplyWaterQuantity/WaterSupplyPlanning.aspx).

2.2 Earthquake

An earthquake is a sudden, rapid shaking of the Earth caused by the breaking and shifting of rock beneath the Earth's surface. Ground shaking from earthquakes can collapse buildings and bridges; disrupt gas, electric, and phone service; and sometimes trigger landslides, avalanches, flash floods, fires, and huge, destructive ocean waves (tsunamis). Buildings with foundations resting on unconsolidated landfill and other unstable soil, trailers and homes not tied to their foundations are at risk because they can be shaken off their mountings during an earthquake. When an earthquake occurs in a populated area, it may cause deaths and injuries and extensive property damage.

Ground movement during an earthquake is seldom the direct cause of death or injury. Most earthquake-related injuries result from collapsing walls, flying glass, and falling objects as a result of the ground shaking, or people trying to move more than a few feet during the shaking. Much of the damage in earthquakes is predictable and preventable. We must all work together in our communities to apply our knowledge to building codes, retrofitting programs, hazard hunts, and neighborhood and family emergency plans.

2.2.1 Past Events

Virginia, like most states on the eastern seaboard, has a moderate level of risk from earthquakes. The largest earthquake known to have impacted the region was the 1886 Charleston, South Carolina, earthquake (estimated magnitude 6.6-6.9). That quake was felt as far north as Canada, as far west as Missouri, and as far south as Cuba. Although earthquakes outside Virginia have caused damage in the Commonwealth in the past, the most likely sources for future damaging shaking in Virginia are the local active areas within the state like Central Virginia and Giles County.

Since 1774, the year of the earliest documented Virginia earthquake, there have been over 300 earthquakes in or near the Commonwealth. Of those, 18 earthquakes had reports of intensity VI or higher. The largest earthquake in Virginia was the 1897 Giles County shock. The maximum intensity was VIII in Giles County, and it was felt over 11 states (approximately 280,000 square miles). The estimated magnitude for this event was 5.8, making it the third largest earthquake in the eastern United States in the last 200 years (second largest in the southeastern U.S.).

From 1978 through 1993, over 160 earthquakes were detected in and around the Commonwealth. On May 16, 2009 a magnitude 3.0 earthquake, with an epicenter located in the Cave Spring area of Roanoke County, shook buildings from Salem to Vinton but did not cause any significant property damage. A magnitude 2.8 earthquake occurred on February 20, 2011 approximately a mile northwest of Potts Creek near the Alleghany and Craig County line. On August 23, 2011, a magnitude 5.8 earthquake occurred 5 miles south-southwest of Mineral, Virginia (150 miles northeast of Roanoke). The Mineral event was Virginia’s strongest earthquake in over a century. While several small quakes have occurred, no major earthquakes

have occurred in Virginia since 2011. There has not been a Presidential or State Disaster Declaration in the planning region for earthquakes.

Although numerous intensity scales have been developed over the last several hundred years to evaluate the effects of earthquakes, the one currently recommended for use in the United States is the Modified Mercalli (MM) Intensity Scale. This scale, composed of 12 increasing levels of intensity that range from imperceptible shaking to catastrophic destruction, is designated by Roman numerals. It does not have a mathematical basis; instead it is an arbitrary ranking based on observed effects.

The Modified Mercalli Intensity value assigned to a specific site after an earthquake has a more meaningful measure of severity to the nonscientist than the magnitude because intensity refers to the effects experienced at that place. The lower numbers of the intensity scale generally deal with the way the earthquake is felt by people. The higher numbers of the scale are based on observed structural damage. Structural engineers usually contribute information for assigning intensity values of VIII or above.

Table 6: Modified Mercalli Intensity Levels

I. Not felt except by a very few under especially favorable conditions.
II. Felt only by a few persons 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 cars 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 awakened. Dishes, windows, doors disturbed; walls make cracking sound. Sensation like heavy truck striking building. Standing motor cars 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.

The more common Richter Scale is shown below and compared to the Modified Mercalli Intensity Scale.

Table 7: Comparison of Earthquake Intensity Measurement Scales

Richter Magnitude Scale	Modified Mercalli Intensity Scale
1.0 to 3.0	I
3.0 to 3.9	II to III
4.0 to 4.9	IV to V
5.0 to 5.9	VI to VII
6.0 to 6.9	VII to IX
7.0 and Higher	VIII or Higher

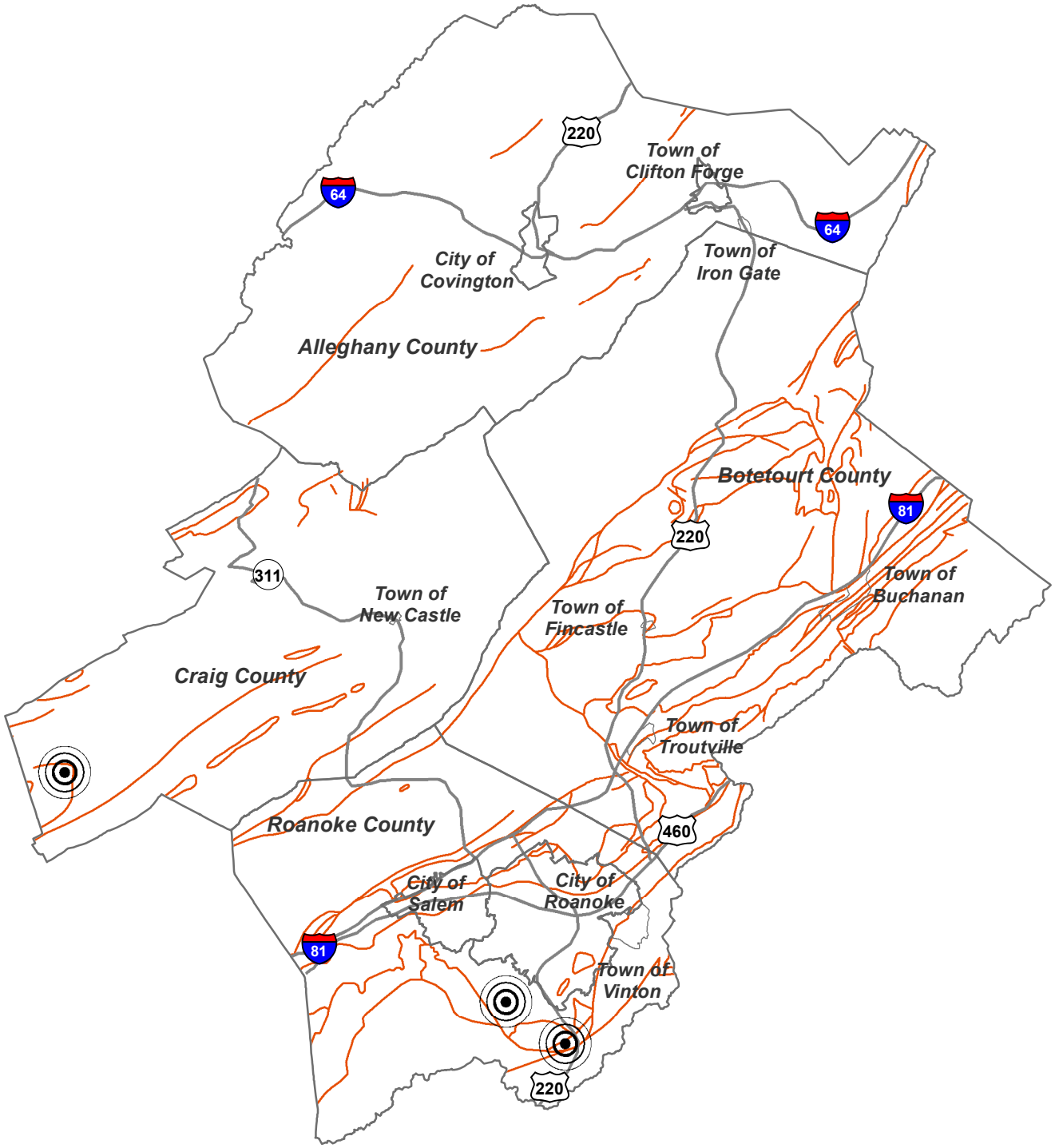
Current mitigation in the region consists of monitoring for seismic activity by several agencies. In 1963, as part of the Worldwide Standard Seismograph Network program, seismographs were installed at Georgetown University in Washington, DC, and at Blacksburg, Virginia. In 1977, several more seismographs were installed and operated by Virginia Tech and the Virginia Department of Mines, Minerals, and Energy - Division of Mineral Resources. Initially, the recording was purely analog, but in 1985 digital recording was added. In 1995, a US National Seismic Network broadband, high dynamic range seismograph was installed in Blacksburg. In 1997 the Giles County network was upgraded to digital telemetry.

The Virginia Tech Seismological Observatory (VTSO) operates a digital seismic network with stations in Virginia and southern West Virginia. Along with other southeastern regional seismic networks and the U.S. National Seismic Network (USNSN), VTSO contributes to earthquake monitoring, information dissemination and seismic hazard assessment objectives in the southeastern United States. In 1991, Virginia Tech combined with other institutions in North Carolina and Tennessee to form the Southern Appalachian Cooperative Seismic Network to coordinate earthquake monitoring and data exchange.

Map 2 summarizes two and a third centuries of earthquake activity in the region as compiled by the U.S. Geological Survey. The seismic history consists of letters, journals, diaries, and newspaper and scholarly articles that supplement seismograph recordings (seismograms) dating from the early twentieth century to the present. All of the pre- instrumental (historical) earthquakes were large enough to be felt by people or to cause shaking damage to buildings and their contents. Later, widespread use of seismographs meant that tremors too small or distant to be felt could be detected and accurately located.

Earthquakes are a legitimate concern in Virginia and parts of adjacent states. Moderate earthquakes cause slight local damage somewhere in the map area about twice a decade on the average. Additionally, many buildings in the map area were constructed before earthquake protection was added to local building codes. The large map shows all historical and instrumentally located earthquakes from 1774 through 2004.

Map 2: Earthquake Epicenters and Faults



Scale 1:500,000

Source: Roanoke Valley-Alleghany Regional Commission, 2019, Virginia Department of Conservation and Recreation 2012, and Virginia Department of Mines, Minerals and Energy 2018.

Legend

Epicenters

Fault Lines

References:

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2.3 Flood

Widespread flooding or flash flooding impacts a large portion of the region. Watersheds in the Roanoke Valley-Alleghany region are typical of the Blue Ridge region in which smaller streams collect water which then flows through steep terrain, picking up velocity, and into the valleys and flatlands along major rivers where development has occurred. The flood plains throughout these mountainous areas are narrow, averaging less than 250 feet in most areas. These are also the only flat areas where development could take place in this mountainous region. Most flood-producing storms generally occur in the winter and spring. However, flooding due to intense local thunderstorms or from tropical disturbances can occur in any season.

Flood hazard areas, along with repetitive loss clusters, dams, flood prone roads, IFLOWS and rain gauges, for each jurisdiction participating in the plan are shown on the maps in Appendix D.

2.3.1 Review of Past Events and Studies

A review of past flood related research and documentation indicates that there are an estimated 5,400 structures that could be impacted by flooding in the Roanoke Valley Alleghany Region. The following documents chronicle flood events in the Roanoke Valley-Alleghany Regional Commission region: Flood Plain Information reports developed by the U.S. Army Corps of Engineers (COE) in the 1968-1971 covering the Roanoke River (City of Roanoke, Roanoke County, City of Salem, and Town of Vinton), Mason Creek (Salem), James River (Alleghany County, Covington, Clifton Forge, and Botetourt County), Jackson River (Alleghany County, Covington and Clifton Forge), Smith Creek (Alleghany County and Clifton Forge); Flood Control Study for Covington, U.S. Army Corps of Engineers 1987; Flood Insurance Study, Alleghany County, Virginia, unincorporated areas, FEMA, 1992; Flood Insurance Study, Botetourt County, Virginia unincorporated areas, 1977; Roanoke Valley Regional Stormwater Management Plan, 1977; and Hazard Analysis, Project Impact Roanoke Valley, 2000; Preliminary Flood Insurance Study, Alleghany County, Virginia, unincorporated areas, FEMA, 2009; and Preliminary Flood Insurance Study, Botetourt County, Virginia unincorporated areas, 2009.

Alleghany County has experienced floods since its original settlement. Large floods occurred in 1877, 1913, 1936, 1969, 1972, 1973 and 1985. Hurricane Jeanne caused severe storms and flooding in October 2004. Flood damage in the area is typically concentrated in and near Covington and Clifton Forge. Because of the rural nature of the county, damages from flooding are widespread. Damage occurs to roads and bridges and public facilities such as schools.

The Jackson River flows through the City of Covington, towns of Clifton Forge and Iron Gate and the communities of Low Moor and Selma. Gathright Dam, constructed in 1974, partially controls flooding along the Jackson River. However, many structures will continue to be in harm's way in the event of a US Army Corps of Engineers projected Standard Project Flood. The water and sewer treatment plants located adjacent to the Jackson could be damaged as well as most of the river's bridges.

Covington has experienced large floods on November 1877, March 1913, March 1936, March 1967, August 1969 (Hurricane Camille), 1972 (Tropical Storm Agnes), March and December 1973, and November 1985. Tropical Storm Agnes was the most severe of the events with as much as one-third of the city under water. In all, one church, three public buildings, two industrial plants, 8 commercial buildings, and 490 private residences were damaged. In November 1985, a 100-year frequency rainstorm caused a reported $17 million in damages in the City of Covington. This indicates that even with flood control provided by the dam, the city is still vulnerable to flooding.

The US Army Corps of Engineers, 1986 report titled Flood Control Study, Jackson River, Lower Jackson Street Residential Area, Covington, provides information about the major flood that occurred in November 1985. An approximate 90-year flood event resulted in residential, commercial, and municipal damage in the lower Jackson Street / Rayon Terrace neighborhood. Residential losses included yard, basement, and first floor damage in sixty-four (64) homes and four (4) businesses. Municipal damage included debris in the city park, a sewage pump station and damage to a storm sewer. Total residential, commercial and municipal damage were estimated at $544,000. Structural and non-structural alternatives for this section of the city were explored in a cost-benefit analysis and found to be infeasible.

The Army Corps of Engineers 1986 Flood Control Study, Harmon's Run at Industrial Park, Covington, Virginia, reports that the 1985 flood caused inundation of the industrial park's southern edge and affected nothing of value at the site. The study concluded that no benefits would be realized for a flood-proofing project due to the lack of damage from the flood.

Floods used in the 1978 Federal Insurance Administration study to describe the impact on the town of Clifton Forge include the Flood of 1950 and Flood of 1969 - both of which occurred prior to construction of Gathright Dam. The 1950 flood brought on the flooding of basements, a lumberyard and the armory, and the town's water supply was cut off when two water mains were washed away.

Smith Creek flows north to south though the residential and commercial center of the Town of Clifton Forge. In Clifton Forge, residential, public, and commercial development are concentrated on both sides of Smith Creek. A number of large commercial buildings in the downtown area have been constructed directly over Smith Creek. Floods have inundated portions of this land in the past, and a substantially greater area is within reach of larger floods in the future. The 1969 Smith Creek flooding caused evacuation of 40 families; a water main was broken, damaged the Matthews Woodworking Mill and caused over $200,000 in damage to town owned property.

A water supply dam is located on Smith Creek about 3.4 miles above the mouth (approximately 1,500 feet above the corporate limits of the Town of Clifton Forge). Built in 1949, the dam is a concrete gravity type structure and is the source of raw water for the Town of Clifton Forge's water treatment plant. The dam's reservoir receives runoff from approximately 12.6 square miles of drainage area and can store approximately 57 million gallons of water below the

spillway crest. However, the amount of water that can be stored by the dam is small compared to the total volume of runoff which would occur during a large flood. Therefore, the reservoir has no significant effects on floods at the City of Clifton Forge. Little data is available to document the flood events along Smith Creek. Because of the watershed's steep slopes with the town, flood velocities could be dangerously high and cause substantial damage.

Numerous flood events have been recorded in the Upper James River Basin in the counties of Alleghany, Botetourt and Craig. The following water bodies in the basin have flooded: Dunlap Creek, Potts Creek, Cowpasture River, Johns Creek, Craig Creek, and Catawba Creek. Records show a history of major and frequent flooding. One of the worst floods to occur in Tinker Creek in Botetourt County was in 1940. Another large flood occurred in 1961 along Buffalo Creek and is considered to be one of the worst storms of record. The unincorporated communities of Eagle Rock, Glen Wilton, and Gala located in Botetourt County along the James River have all experienced flooding. Glen Wilton was isolated in 1972 due to floodwaters covering the only road access to the community. The Botetourt Communities of Strom, Lithia, Cloverdale, and Coyner have also been victims of floodwaters.

A lack of flood plain information studies for Craig County prevents damages within this locality from being quantified at this time. The county should work with the Corps of Engineers, Virginia Department of Emergency Management, and FEMA to develop a Flood Insurance Study for the major watersheds of Johns Creek, Craig Creek, Potts Creek, Sinking Creek and Barbours Creek.

The Flood Insurance Study, Botetourt County, Virginia Unincorporated Areas, was performed by the US Department of Housing and Urban Development and Federal Insurance Administration in 1977 and updated in 2009. This flood insurance study covers the unincorporated area of Botetourt County, areas within the incorporated towns of Buchanan, Fincastle, and Troutville were not included. The report studied Back Creek, Buffalo Creek, Craig Creek, Eagle Rock Creek, Ellis Run, Glade Creek, Jackson River, James River, Laurel Run, Laymantown Creek, Long Run, Looney Mill Creek, Mill Creek, Roaring Run, Sinking Creek, and Tinker Creek. One of the worst floods for the James River occurred as a result of Tropical Storm Agnes in 1972. A 1940 event caused severe damage in the Tinker Creek basin. Buffalo Creek was impacted by a flood in 1961. The communities of Eagle Rock, Glen Wilton, and Gala have been in the paths of flood waters associated with both intense summer rainfall and frontal system storms during the winter months. Glen Wilton was isolated in June 1972 due to floodwaters overtopping Route 663. The communities of Strom, Lithia, Cloverdale and Coyner Springs have also been victims of damaging floodwaters.

The updated 2009 Flood Insurance Study briefly describes flooding that has taken place in the towns. In the Town of Buchanan, several businesses, and many homes within the study area would be flooded by both the 1-percent annual chance and 0.2-percent annual chance floods. U.S. Highway 11 crosses the James River in Buchanan. The bridge, itself, does not produce any major backwater effects for the 1-percent annual chance flood; however, the approaches would be inundated causing delays and detours.

The Town of Fincastle has experienced flooding. Two of the most severe floods occurred in 1969 and 1972, with the most extensive occurring as a result of tropical storm Agnes in 1972. Town Branch overflowed its banks and, due largely to insufficient bridge capacity at Highway 606, flooded the area between U.S. Highway 220 and Factory Street. Neither discharges nor frequencies are currently available. The bridge on Highway 630 is of sufficient capacity to pass all floods studied except for the 0.2-percent annual chance event.

The Town of Troutville has been damaged by flooding from Buffalo Creek several times in the past. One of the worst floods occurred during August 1961 when “after two hours of intense downpour, Buffalo Creek overflowed its banks. Several homes and basements were flooded and travel on Highway 11 was hazardous due to excessive water. Also, there was about 2 feet of water around Rader Funeral Chapel in the major commercial area of the town” (Roanoke Times, 1961).

The James River in Botetourt County has experienced large floods in 1877, 1913, 1936, and 1969. The remains of hurricane Camille in 1969 caused flooding that destroyed homes, roads, railroads, and bridges along the James River.

River stages and discharges on the James River at Buchanan have been recorded since 1895 by the USGS. Since 1877, the bank at full stage of 15 feet has been exceeded at least 60 times. The greatest flood known to have occurred in Buchanan was in November 1877 and measured 34.9 feet at the USGS gage. Other large floods occurred in April 1886, March 1889, March 1902, March 1913, January 1935, March 1936, March 1963, and August 1969. Tropical Storm Agnes in 1972 was the second highest storm of record. Few flood related problems have occurred on Purgatory Creek in the Town of Buchanan because of lack of development in its watershed.

The Town of Buchanan has a primary sewage treatment plant on the James River. The plant is subject to flooding and during the November 1985 flood was out of operation for 6 months. The historic flood of record in Buchanan occurred in November 1985 (after completion of Gathright Dam). The Town of Buchanan was devastated during the November 1985 storm which produced the Flood of Record with an exceedance of 600 years. The river caused water damage and structural damage to numerous buildings. Some buildings were completely washed away. The railroad station was washed off its foundation and the historic footbridge was washed downstream. People who expected their basements to be flooded had water up to their ceilings.

Historic floods in the community of Eagle Rock occurred in November 1985, November 1877, March 1913, June 1972, April 1978, March 1936, and August 1969. The November 1985 and April 1978 floods were the only two significant flood events to affect the Eagle Rock area since the completion of Gathright Dam. The community of Eagle Rock was severely flooded during the November 1985 storm causing substantial damage to the commercial district and to many residences. The 1985 storm was the storm of record with an exceedance frequency of 460

years. Seventeen commercial properties and about 16 residences were damaged during the November 1985 flood.

The history of flooding in the Roanoke Valley has been well documented since records were kept. Since 1877 over 17 large floods have occurred in the Roanoke Valley with four of the largest in the past 20 years. Dates of significant floods include the following: 1877, August 1892, October 1893, October 1906, Spring 1913, August 1928, October 1932, January 1935, August 1939, August 1940, July 1947, August 1961, July 1962, June 1972, April 1978, November 1985, April 1992, and June 1995. The flood of record was the November 1985 event.

In the past 20 years, four of the largest floods on record have occurred including June 1972, April 1978, November 1985, and April 1992. Based on rainfall amounts and durations which resulted in these events, the June 1972, April 1978, and November 1985 flood events have recurrence intervals, respectively of approximately 50-, 10-years, and 130-years. In this period of flood activity, damages have been estimated exceeding $200 million with over 12,000 impacted residential structures and over 1,000 businesses.

In November of 1985 when rains from Hurricane Juan caused the Roanoke River to rise and crest at a level of 23.4 feet from the bottom of the River, as measured from Walnut Street. The result of that single weather event created floodwaters in downtown Roanoke that rose over five feet inside some businesses. Ten lives were lost and damage to property cost $520,000,000 (source: The Roanoke Times, November 1985). While this was the Flood of Record, is not the only significant flood the Roanoke Valley has experienced over the past 100 years. On August 16, 1928, the Roanoke River crested at 18.1 feet; twelve years later, on August 14, 1940, the Valley's river crested at 18.3 feet. On June 21, 1972, the Roanoke Valley was hit with the effects of Hurricane Agnes, causing the Roanoke River to crest at 19.6 feet. On April 22, 1992, the river once again exceeded its banks and spread floodwaters in the Valley when it crested at 18.1 for the second time during the century.

The most severe flooding on the Roanoke River is usually the result of heavy rains associated with tropical storms, while tributary stream flooding is usually the result of local thunderstorms or frontal systems. Flooding along tributaries is compounded when the streams in lower elevations back-up into feeder streams.

Major floods in the area have occurred in 1940 and 1972 with discharges of 24,400 and 28,800 cfs, respectively, as measured at the USGS gage on the Roanoke River at Niagara Dam. On Tinker Creek at Dale Avenue, the August 1940 storm produced a discharge of 9,000 cfs. The flood damage from the August 1940 event was extensive and resulted in major damage to buildings, roads, bridges, and agricultural crops. The 1972 flood on the Roanoke River, which was the result of Tropical Storm Agnes, was estimated as a 50-year flood. Approximately 400 homes were damaged by flooding from Hurricane Agnes in the Roanoke-Salem area.

On November 5, 1985, a 130-year flood event inundated the study area. This flood was caused by the remnants of Hurricane Juan. The flooding inundated much of the downtown area of

Roanoke and resulted in 10 deaths. A total of 11 inches of rain fell between Thursday October 31 and the following Monday. The last six inches fell during the last 24 hours of that five-day period.

Flood Plain Information Glade Creek, Vinton, Virginia, U.S. Army Corps of Engineers, 1971. The report covers the areas subject to flooding by Glade Creek from the Botetourt County line through the Town of Vinton to its confluence with Tinker Creek. The width of the flood plain within the study limits of Glade Creek ranges from 300 feet in width to 1,400 feet. Past floods have occurred at an estimated rate of nearly one every three years.

According to the Flood Plain Management Study, Roanoke River, Roanoke County, Cities of Roanoke and Salem, performed by the US Army Corps of Engineers in 1978, the most severe flooding on the Roanoke River usually results from heavy rains associated with tropical storms. The flood of June 1972, resulting from rains associated with Hurricane Agnes, produced the highest stage of record and approximated the 50-year flood level. This floodplain encompasses about 2,000 acres of flat land where more than 40 industrial plants, along with approximately 2,630 homes and 1,260 businesses are subject to flooding according to the 1978 report. The report states that although severe flash floods have occurred on the Roanoke River in the past, it is reasonable to assume that even greater floods can occur. Studies show that the 100-year frequency flood would inundate most of the floodplain to a depth of 5 to 7 feet, with some areas covered by as much as 12 feet of water.

The main flood season for the creeks is spring and summer, with most of the higher floods resulting from intense thunderstorms. Floods above bankfull level have occurred in August 1940, September 1960, August 1961, August 1962, August 1964, July 1965, February 1966 and March 1967.

The 1985 FEMA Flood Insurance Study, Roanoke County, Virginia, Unincorporated Areas, covers the unincorporated areas of Roanoke County. In all, selected segments of 19 streams were studied in detail, these include the Roanoke River, Back Creek, Tinker Creek, Glade Creek, Carvin Creek, Mason Creek, Mudlick Creek, West Fork Carvin Creek, Jumping Run, Dry Branch, Cook Creek, Stypes Branch, Barnhardt Creek, Peters Creek, Ore Branch, Glade Creek, Murray Run, Mudlick Creek Tributary 1 and Mudlick Creek Tributary 2. Low lying areas adjacent to the streams are subject to periodic flooding. The most severe flooding is usually the result of heavy rains associated with tropical storms, while creek flooding is the result of local thunder storms or frontal systems. Major floods have occurred several times in the study area including the 1972 50-year flood event and the 1985 flood of record.

Flood Plain Information, Mud Lick Creek at Roanoke, Virginia, U.S. Army Corps of Engineers, 1971. Mud Lick Creek flows along the western corporate limits of the City of Roanoke. Past floods have occurred at an estimated rate of nearly one every three years.

Special Flood Plain Information, Upper Mason Creek at Roanoke County, Virginia, by the U.S. Army Corps of Engineers and Hayes, Seay, Mattern and Mattern, addresses the flood situation

along Mason Creek upstream from the Virginia Route 116 bridge northward and includes the communities of Bennett Springs, Mason Cove and Hanging Rock. The properties along the creek are primarily residential and agricultural and have been inundated by the flood of 1942, 1972 and 1988.

Flood Plain Information, Peters Creek and Lick Run, Roanoke, Virginia, (U.S. Army Corps of Engineers, 1968) addresses flooding along Peters Creek. Peters Creek flows along the western corporate limits of the City of Roanoke and empties into the Roanoke River. Lick Run flows parallel to Interstate 581 through the downtown and empties into Tinker Creek at the eastern corporate limits. The study addresses only the "rural" portion of Lick Run north of the downtown area. Past floods have occurred at an estimated rate of nearly one every three years.

2.3.2 Flood Insurance Studies and FIRM

All localities within the planning region have been issued new flood insurance studies along with new FIRMs since the previous plan was adopted.

In 2009, the Flood Insurance Study for Alleghany County was updated along with the Flood Insurance Rate maps (FIRM). The new FIRMs went into effect in December 2010. This study was prepared to include all Alleghany County and unincorporated areas, the independent City of Covington, and the Towns of Clifton Forge and Iron Gate into a countywide format.

In 2009, the Flood Insurance Study for Botetourt County was updated along with the Flood Insurance Rate maps. The new FIRMs went into effect in December 2010. This study was prepared to include all of Botetourt County and unincorporated areas and the Towns of Buchanan, Fincastle and Troutville into a countywide format.

In 2009, the Flood Insurance Study for Craig County was updated along with the Flood Insurance Rate maps. The new FIRMs went into effect in December 2010. This study does not include all of Craig County.

In 2007, the Flood Insurance Study for Roanoke County was updated along with the Flood Insurance Rate maps. The new FIRMs went into effect in December 2010. This study was prepared to include all of Roanoke County and unincorporated areas, the cities of Roanoke and Salem, and the Town of Vinton into a countywide format.

2.3.3 Community Rating System

Community Rating System - The Community Rating System (CRS) is a voluntary program for NFIP-participating communities. The goals of the CRS are to reduce flood damages to insurable property, strengthen and support the insurance aspects of the NFIP, and encourage a comprehensive approach to floodplain management. The CRS has been developed to provide incentives in the form of flood insurance premium discounts for communities to go beyond the

minimum floodplain management requirements to develop extra measures to provide protection from flooding.

Roanoke County entered the CRS program in October 1991 and has a rating of 8 (10% discount). The Town of Vinton entered the CRS program in October 1, 2016 and has a class 8 rating. The City of Roanoke entered the CRS program in 1996 and maintains a class 7 rating (15% discount on flood insurance premiums for parcel owners within City limits). While other localities in the region have considered participation in the CRS program, they have not had the available staff or budget to do so at this time.

2.3.4 Repetitive Flood Claims

The Repetitive Flood Claims (RFC) grant program was authorized by the Flood Insurance Reform Act of 2004, which amended the National Flood Insurance Act of 1968.

The Severe Repetitive Loss (SRL) grant program was authorized by the Bunning-Bereuter-Blumenauer Flood Insurance Reform Act of 2004, which amended the National Flood Insurance Act of 1968 to provide funding to reduce or eliminate the long-term risk of flood damage to severe repetitive loss (SRL) structures insured under the National Flood Insurance Program (NFIP). The purpose of the SRL program was to reduce or eliminate claims under the NFIP through project activities that will result in the greatest savings to the National Flood Insurance Fund. These programs have been rolled into the Flood Mitigation Assistance Program.

The NFIP defines a repetitive loss property as any insurable building for which two or more claims of more than $1,000 were paid by the NFIP within any rolling 10-year period since 1978. At least two of the claims must be more than 10 days apart but within 10 years of each other. A repetitive loss property may or may not be currently insured by the NFIP.

Properties must meet one of the definitions below (consistent with the legislative changes made in the Biggert-Waters Flood Insurance Reform Act of 2012):

A severe repetitive loss property is a structure that:

(a) Is covered under a contract for flood insurance made available under the NFIP; and

(b) Has incurred flood related damage –

(i) For which 4 or more separate claims payments have been made under flood insurance coverage with the amount of each such claim exceeding $5,000, and with the cumulative amount of such claims payments exceeding $20,000; or

(ii) For which at least 2 separate claims payments have been made under such coverage, with the cumulative amount of such claims exceeding the market value of the insured structure.

A repetitive loss property is a structure covered by a contract for flood insurance made available under the NFIP that:

(a) Has 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
(b) At the time of the second incidence of flood-related damage, the contract for flood insurance contains increased cost of compliance coverage.

The region has had $28,962,295.86 in repetitive loss claims with an average claim of $31,722.12 (see tables 8 to 18). Repetitive loss and severe repetitive loss properties are shown on each locality's flood map in Appendix D.

2.3.4.1 Repetitive Loss Strategy

A repetitive loss strategy to verify the geographic location of each repetitive loss property and determine if that property has been mitigated and by what means was developed during the 2011 update of this plan. The strategy was developed in part to meet a FEMA requirement, qualifying the State as having a FEMA approved repetitive loss strategy. Putting this strategy in place allows the State (and sub-grantees such as local governments) to qualify for the 90/10 federal-nonfederal share allocation instead of the 75/25 for funding from the Severe Repetitive Loss grant program and in the Flood Mitigation Assistance grant program (when used for SRL property mitigation). This reduced nonfederal share requirement can help in implementing mitigation projects for repetitive loss and severe repetitive loss properties. The strategy also provides local governments and citizens with information about repetitive loss "hot spots" in the region that should be targeted for mitigation.

The activities to maintain an accurate database and map of repetitive loss properties are outlined below:

- Localities will work with VDEM and FEMA to update list of repetitive loss properties annually.
- Localities will obtain updated list of repetitive loss properties annually from VDEM/FEMA.
- Localities will review property addresses for accuracy and make necessary corrections.
- Localities will determine if and by what means each property has been mitigated.
- Localities will map properties to show general site locations (not parcel specific in order to maintain anonymity of the property owners).
- Localities will determine if properties have been mitigated and inform FEMA/VDEM through submission of an updated list/database and mapping.

Table 8: Repetitive Loss Statistics Alleghany County

Number of Properties	24
Number of Losses	61
Total Payments	$904,984.46
Total Building Payments	$581,655.31
Total Contents Payments	$313,319.15
Average Claim	$14,835.81

Note: Unincorporated area only.
Source: FEMA, 2019.

Table 9: Repetitive Loss Statistics Botetourt County

Number of Properties	29
Number of Losses	76
Total Payments	$1,144,875.62
Total Building Payments	$926,736.89
Total Contents Payments	$218,138.73
Average Claim	$15,064.15

Note: Unincorporated area only.
Source: FEMA, 2019.

Table 10: Repetitive Loss Statistics Town of Buchanan

Number of Properties	6
Number of Losses	19
Total Payments	$1,189,972.47
Total Building Payments	$364,264.82
Total Contents Payments	$825,707.65
Average Claim	$62,630.13

Source: FEMA, 2019.

Table 11: Repetitive Loss Statistics Town of Clifton Forge

Number of Properties	3
Number of Losses	7
Total Payments	$102,073.97
Total Building Payments	$69,203.62
Total Contents Payments	$32,870.35
Average Claim	$14,582.00

Source: FEMA, 2019.

Table 12: Repetitive Loss Statistics City of Covington

Number of Properties	6
Number of Losses	16
Total Payments	$196,675.92
Total Building Payments	$122,174.32
Total Contents Payments	$74,501.60
Average Claim	$12,292.25

Source: FEMA, 2019.

Table 13: Repetitive Loss Statistics Craig County

Number of Properties	6
Number of Losses	13
Total Payments	$476,515.94
Total Building Payments	$291,170.33
Total Contents Payments	$185,345.61
Average Claim	$36,655.07

Note: Unincorporated area only.
Source: FEMA, 2019.

Table 14: Repetitive Loss Statistics City of Roanoke

Number of Properties	85
Number of Losses	267
Total Payments	$7,140,602.57
Total Building Payments	$5,130,375.16
Total Contents Payments	$2,010,227.41
Average Claim	$26,743.83

Source: FEMA, 2019.

Table 15: Repetitive Loss Statistics Roanoke County

Number of Properties	35
Number of Losses	103
Total Payments	$1,598,666.69
Total Building Payments	$1,263,025.08
Total Contents Payments	$335,641.61
Average Claim	$15,521.04

Note: Unincorporated area only.
Source: FEMA, 2019.

Table 16: Repetitive Loss Statistics City of Salem

Number of Properties	87
Number of Losses	341
Total Payments	$15,713,165.47
Total Building Payments	$14,367,997.83
Total Contents Payments	$1,345,167.64
Average Claim	$46,079.66

Source: FEMA, 2019.

Table 17: Repetitive Loss Statistics Town of Vinton

Number of Properties	4
Number of Losses	10
Total Payments	$494,762.75
Total Building Payments	$270,306.59
Total Contents Payments	$224,456.16
Average Claim	$49,476.28

Source: FEMA, 2019.

Table 18: Repetitive Loss Statistics Region Total

Number of Properties	285
Number of Losses	913
Total Payments	$28,962,295.86
Total Building Payments	$23,386,909.95
Total Contents Payments	$5,575,385.91
Average Claim	$31,722.12

Source: FEMA, 2019.

Table 19: Severe Repetitive Loss Statistics City of Roanoke

Number of Properties	1
Number of Losses	5
Total Payments	$115,574.93
Total Building Payments	$98,974.93
Total Contents Payments	$16,600.00
Average Claim	$23,114.99

Source: FEMA, 2019.

Table 20: Severe Repetitive Loss Statistics Roanoke County

Number of Properties	2
Number of Losses	11
Total Payments	$393,787.03
Total Building Payments	$308,458.97
Total Contents Payments	$85,328.06
Average Claim	$35,798.82

Source: FEMA, 2019.

Table 21: Severe Repetitive Loss Statistics City of Salem

Number of Properties	17
Number of Losses	109
Total Payments	$11,578,940.03
Total Building Payments	$10,931,904.78
Total Contents Payments	$647,035.25
Average Claim	$106,228.81

Source: FEMA, 2019.

Table 22: Repetitive Loss Statistics Region Total

Number of Properties	20
Number of Losses	125
Total Payments	12,088,301.99
Total Building Payments	11,339,338.68
Total Contents Payments	748,963.31
Average Claim	96,706.42

Source: FEMA, 2019.

2.3.5 Disaster Declarations for Flooding

The Governor of Virginia declares a state of emergency when he believes a disaster has occurred or may be imminent that is severe enough to require state aid to supplement local resources in preventing or alleviating damages, loss, hardship or suffering. Once a local state of emergency has been declared, the Governor may then ask for an emergency declaration, which makes federal resources available for immediate response missions. In the event of a Presidential Disaster Declaration, Virginia Department of Emergency Management (VDEM) is further empowered to coordinate federal agency assets that become available. An emergency declaration preempts generally approved administrative purchasing and procurement procedures to make resources immediately available to rescue, evacuate, shelter, provide essential commodities (i.e., heating fuel, food, etc.) and quell disturbances in affected localities.

There have been nine (9) Presidential Disaster Declarations related to flooding in the region since 1969. All the declarations impacted multiple localities in the region.

Table 23: Presidential Disaster Declarations for Flooding, 1969 to 2018

Locality	Declaration Number	Designation Date	Disaster Description
Alleghany County Botetourt County	274	08/23/1969	Severe storms and flooding
Alleghany County Botetourt County Clifton Forge City of Covington Craig County Roanoke County City of Roanoke City of Salem	755	11/09/1985	Severe storms and flooding
Botetourt County Craig County Roanoke County City of Roanoke City of Salem	944	05/19/1992	Severe storms and flooding
Alleghany County Botetourt County Craig County Roanoke County City of Roanoke	1014	03/10/1994	Severe ice storms, flooding
Roanoke County City of Roanoke	1059	07/31/1995	Severe storms and flooding
Alleghany County Botetourt County Clifton Forge City of Covington	1098	02/02/1996	Flooding, high winds, and wind driven rain
Craig County Roanoke County City of Roanoke City of Salem	1458	04/28/2003	Severe winter storm, record/near record snowfall, heavy rain, flooding, and mudslide
Alleghany County Botetourt County Craig County Roanoke County City of Roanoke City of Salem	1570	10/18/2004	Hurricane Jeanne caused severe storms and flooding
Alleghany County Botetourt County Craig County	1655	07/13/2006	Severe storms, tornados and flooding

Source: Virginia Department of Emergency Management, 2018 and FEMA 2018.

There have been eight (8) State Emergency Declarations for flooding in the Region since 1985.

Table 24: State Emergency Declarations for Flooding, 1985 to 2018

Type of Disaster	Declaration Date	Type	Description
Flash Flooding, Landslides		Continuing Declaration	Executive Order 65 (85)
Flash Flooding, Landslides		Continuing Declaration	Executive Order 15 (86)
Flooding	9/18/87	State of Emergency	Unusually heavy rains
Flash Flooding	4/24/92	State of Emergency	Heavy rains occurred in southwest Virginia and continued up the Roanoke Valley and then to the Shenandoah Valley and other affected parts of the state, at least one life was lost, National Guard was called out
Storm	6/23/93	State of Emergency	Summer storm system crossed the Commonwealth with hail, high winds, and torrential rains, the City of Lynchburg, City of Bedford, Appomattox County and Campbell County were particularly affected
Flash Flooding, Landslides, Dam Failure	6/23/95 with extension of area on 6/26/95	State of Emergency	Heavy rains resulted in flash floods, mudslides and dam failure in the western and central portions of the state, later other portions of the state, northern and south central) were added, the Virginia National Guard was called out
Tropical Storm	11/11/2009	State of Emergency	Severe weather from prolonged periods of wet and windy weather from the remnants of Tropical Storm Ida and a coastal Nor'easter causing widespread power outages, flooding and transportation difficulties throughout the State.
Flooding and Severe Thunderstorms	06/08/2018	State of Emergency	Storms produced damaging winds and resulted in severe flooding, downed trees, large-scale power outages, and loss of life

Note: All disaster declarations in Virginia are Executive Orders issued by the Governor. Disasters without a description in the Virginia Department of Emergency Management file are described by Executive Order number only.
Source: Virginia Department of Emergency Management, 2003, Library of Virginia, 2010, Office of the Governor, 2018.

2.4 Hurricane

A hurricane is a tropical storm with winds that have reached a constant speed of 74 miles per hour or more. Hurricane winds blow in a large spiral around a relative calm center known as the "eye." The eye is generally 20 to 30 miles wide, and the storm may extend outward 400 miles. As a hurricane approaches, the skies will begin to darken and winds will grow in strength. As a hurricane nears land, it can bring torrential rains, high winds, and storm surges. A single hurricane can last for more than two weeks over open waters and can run a path across the entire length of the eastern seaboard. August and September are the peak months during the hurricane season that lasts from June 1 through November 30.

Some of the greatest rainfall amounts associated with tropical systems occurs from weaker Tropical Storms that have a slow forward speed (one to 10 mph) or stall over an area. Due to the amount of rainfall a Tropical Storm can produce, they are capable of causing as much damage as a Category 2 hurricane.

Widespread rainfall of six to 12 inches or more is common during landfall, frequently producing deadly and destructive floods. Such floods have been the primary cause for tropical cyclone-related fatalities over the past 30 years. The risk from flooding depends on a number of factors: the speed of the storm, its interactions with other weather systems, the terrain it encounters, and ground saturation.

Large amounts of rain can occur more than 100 miles inland where flash floods are typically the major threat along with mudslides in mountainous regions. Tornadoes and high winds generally become less of a threat the farther inland a hurricane moves (although there have been several exceptions), but the heavy rains frequently continue and even intensify as the dying, but still powerful, hurricane is forced up higher terrain or merges with other storm systems in the area. For example, Hurricane Camille (1969) devastated the Gulf Coast, but weakened quickly as it moved northeast. The storm combined with a cold front in the mountains of central Virginia to produce an unexpected 30 inches of rain. As a result, 109 people died.

The Saffir-Simpson Hurricane Wind Scale is a 1 to 5 rating based on a hurricane's sustained wind speed. This scale estimates potential property damage. Hurricanes reaching Category 3 and higher are considered major hurricanes because of their potential for significant loss of life and damage. Category 1 and 2 storms are still dangerous, however, and require preventative measures. In the western North Pacific, the term "super typhoon" is used for tropical cyclones with sustained winds exceeding 150 mph.

Table 25: Saffir-Simpson Hurricane Damage Scale

Category	Sustained Winds	Types of Damage Due to Hurricane Winds
1	74-95 mph 64-82 kt 119-153 km/h	Very dangerous winds will produce some damage: 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 mph 83-95 kt 154-177 km/h	Extremely dangerous winds will cause extensive damage: 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 (major)	111-129 mph 96-112 kt 178-208 km/h	Devastating damage will occur: 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 (major)	130-156 mph 113-136 kt 209-251 km/h	Catastrophic damage will occur: 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 (major)	157 mph or higher137 kt or higher252 km/h or higher	Catastrophic damage will occur: 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 Hurricane Center, National Weather Service, http://www.nhc.noaa.gov/aboutsshws.php, 2013.

2.4.1 Review of Past Events and Reports

Virginia has been struck by 48 hurricanes from 1900 to 2018 according to records from the National Hurricane Center. The Roanoke Valley – Alleghany region has not experienced a direct hurricane in over 100 years. The region is impacted by the remnants of the hurricanes as tropical depressions and subtropical storms bringing heavy rains and winds.

August 12-16, 1928: Two tropical storms moved across the Florida panhandle and then turned northeast and moved up the Appalachians weakening into depressions. The depressions passed over Virginia just four days apart bringing heavy rain, flash flooding and significant rises on the larger rivers. Major flooding occurred on the Roanoke River through Roanoke and Brookneal. The river crested on the 16th at 18.1 ft (8 ft above flood stage) in Roanoke.

October 18, 1932: Tropical storm made landfall on the Gulf Coast moved northeast weakening to a depression. The center passed over the Virginia-Kentucky border into West Virginia. Heavy rains to the east of the storm impacted the Appalachians. It caused major flooding on the Roanoke River through Alta Vista where it crested at 29 feet (11 feet over flood stage) and moderate flooding in South Boston on the Dan River.

August 19, 1939: A hurricane made landfall on the Florida coast and then again on the Gulf Coast. The storm turned northeast and moved up across Virginia as a tropical depression on the 19th. The storm produced heavy rains and flash flooding particularly along the eastern slopes of the southern Blue Ridge. Major flooding occurred on the Roanoke River through Alta Vista (11.5 feet over flood stage).

October 15, 1954, Hurricane Hazel: Hazel maintained hurricane force winds up the East Coast and produced a number of record wind gusts. Lynchburg, Roanoke, and Danville recorded five to six inches of rain causing flooding of small streams.

August 17, 1955, Hurricane Diane. Hurricane Diane made landfall near Wilmington, NC as a Category 1 storm on August 17 and moved north across central Virginia. Rain spread north up to 250 miles ahead of the storm's eye. On the evening of the 17th, the Blue Ridge saw rainfall amounts of five to 10 inches along the southern and eastern slopes. The Skyline Drive area was hardest hit. Severe flooding followed on the Rappahannock River with some flooding also on the James, Potomac and Shenandoah Rivers. Roanoke saw winds gusts to 62 mph and Lynchburg 56 mph out of the north.

August 20, 1969, Hurricane Camille: Camille made landfall as a Category 5 hurricane smashing the Mississippi Coast with 200 mph winds on August 17. Camille was the strongest hurricane to make landfall on the U.S. this century. The hurricane maintained force for 10 hours as it moved 150 miles inland. The storm tracked northward weakening and becoming less defined. It moved toward Virginia on the 19th and was only a tropical depression. Moisture from the warm Gulf Stream waters moved northwest toward the storm and new feeder bands formed. These thunderstorms "trained" (one followed the other), into the Blue Ridge south of Charlottesville. In

just 12 hours, up to 31 inches of rain fell with devastating results (153 killed, most in Nelson County). Major flooding followed as the bulge of water moved down the James River into Richmond. Waynesboro on the South River saw eight feet of water in its downtown and Buena Vista had five and one-half feet in its business section. Damage was estimated at 113 million dollars (1969 dollars).

June 21, 1972, Hurricane Agnes. Agnes originated in the Gulf of Mexico and was downgraded to a tropical storm by the time it reached Virginia, yet still caused 13 deaths in the Commonwealth. The storm impacted the entire region. Tropical Storm Agnes was a severe event and resulted in as much as one-third of the City of Covington under water where one church, three public buildings, two industrial plants, 8 commercial buildings, and 490 private residences were damaged. During the event, Glen Wilton was isolated due to floodwaters covering the only road access to the community. The storm impacted communities along the James and Roanoke Rivers. Tropical Storm Agnes was the second highest storm of record along the James River in Buchanan. The storm caused a 50-year flood. The Roanoke Valley was hit with the effects of Agnes, causing the Roanoke River to crest at 19.6 feet and approximately 400 homes were damaged by flooding in the Roanoke-Salem area.

September 18, 2003, Hurricane Isabel. Hurricane Isabel struck the North Carolina coast at midday and moved north-northeast through the evening hours and following day. Hurricane Isabel's 29 hours of tropical storm force winds carved a wide swath of damage and left behind major flooding across the commonwealth. The Roanoke Valley-Alleghany area received rain amounts varying from 0.5 to 5.5 inches and 50 mph winds causing light damage.

Sept. 8, 2004, Hurricane Frances. The hurricane made landfall over east central Florida as a Category 2 hurricane. It then moved northeast into the northern Gulf of Mexico, eventually turning north, making a second landfall in the Panhandle of Florida, and then weakening into a tropical depression. It tracked through western Virginia, then northeast and offshore the mid-Atlantic coast. A total of six tornadoes were observed in central and eastern Virginia, the strongest producing F1 damage.

Sept. 17, 2004, Hurricane Ivan. The hurricane made landfall near the Florida/Alabama border as a Category 3 hurricane. It weakened to a tropical depression and moved northeast, tracking along the Appalachian Mountains through western Virginia, then northeast and offshore the mid-Atlantic coast. A total of 40 tornadoes were produced in Virginia, most in central and northern Virginia. This was a record single day outbreak for Virginia and exceeded the previous annual tornado record of 31. Most of these tornadoes were F0 or F1 in intensity, although 10 F2 tornadoes and one F3 tornado touched down in south central, west central and northern Virginia.

Sept. 28, 2004, Hurricane Jeanne. The remnants of Hurricane Jeanne, in the form of a tropical depression, moved through the vicinities of Greenville, SC, Roanoke, VA and Washington, DC and finally to the New Jersey coast on Tuesday, Sept. 28. Maximum sustained wind speeds ranged from 25 mph to 30 mph near the storm's center. The primary impact on the

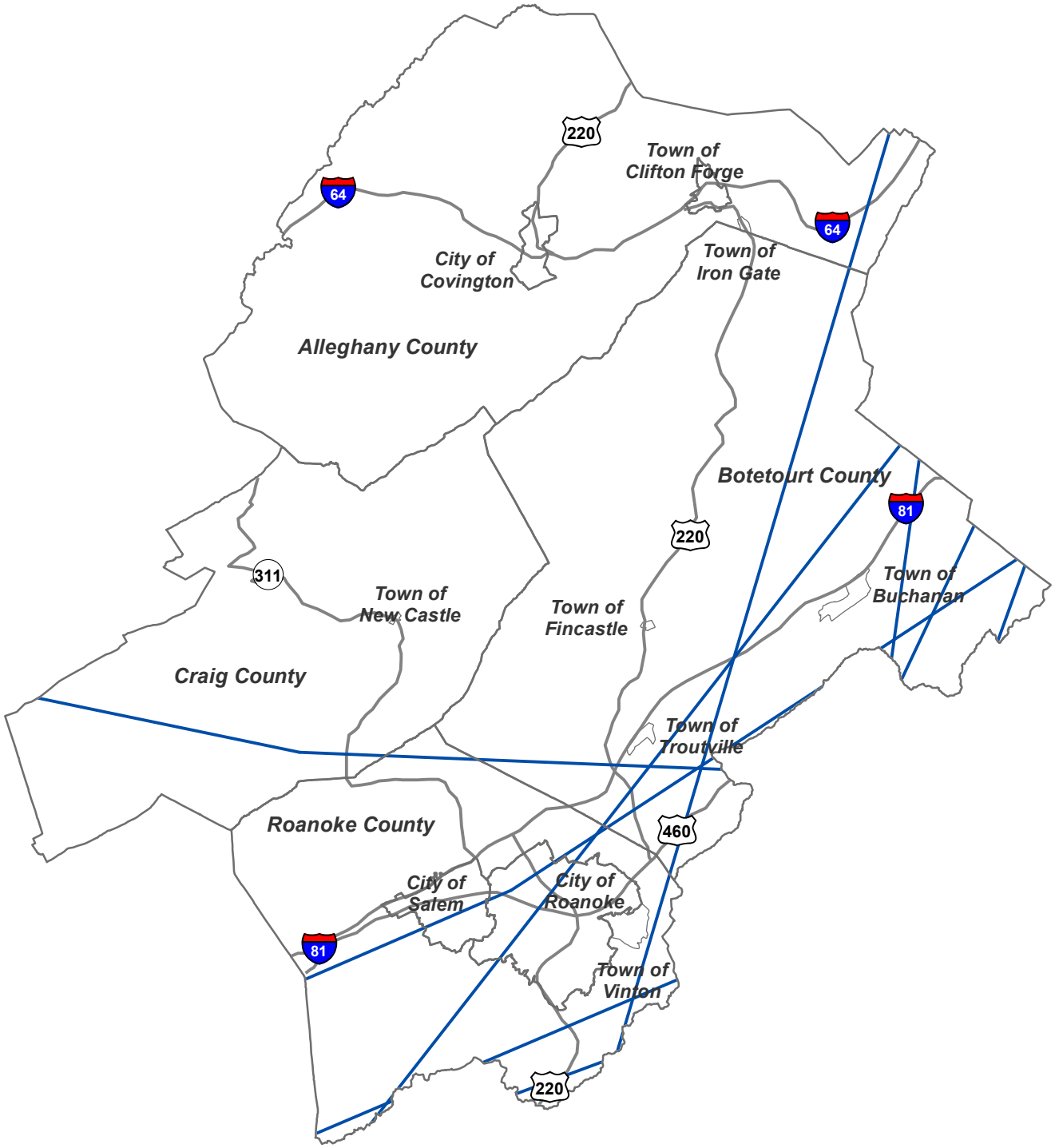
Commonwealth was flooding, although one F1 tornado touched down in Pittsylvania County. The heaviest rainfall occurred from the New River Valley to the Southern Shenandoah Valley. Rainfall in this region ranged from 3 inches to 7 inches, with the highest amounts falling in Patrick, eastern Floyd, eastern Montgomery, Giles, Roanoke, Botetourt and Rockbridge counties.

October 26, 2012, Hurricane Sandy caused heavy rainfall and flooding along Virginia's Eastern Shore. Severe coastal flooding and storm surge inundated many areas along the coast as the storm moved north, causing millions of dollars in damages to residences and businesses. Hurricane Sandy was declared a major disaster in Virginia on November 26, 2012.

September 14-16, 2018, Hurricane Florence. Hurricane Florence made landfall along the North Carolina coast on September 14, and after slowly tracking westward through South Carolina, the remnants of Florence did not reach western Virginia until September 16, accelerating again by that time. The track of the remnant circulation through the southern Appalachians resulted in heavy rain and flooding, and at least one landslide, over a large part of the NWS Blacksburg forecast area, with especially heavy rain along portions of the Blue Ridge due to enhanced upslope easterly flow. In addition to the heavy rain and flooding, gusty winds (although below tropical storm force) combined with saturated ground to cause numerous uprooted trees and some scattered power outages. Rainfall amounts across the area varied form less than 1 inch in Eagle Rock, 2.6 inches at the Roanoke Regional Airport to 5.6 inches on Bent Mountain. Winds were from 38 mph at the Roanoke Regional Airport to 13 mph at Springwood in Botetourt County. The Roanoke River crested at 11.14 feet (0.5 feet above flood stage) and the James River in Buchanan crested at 14.7 feet (2.3 feet below flood stage).

October 10-11, 2018, Hurricane Michael. Hurricane Michael made landfall along the Florida panhandle as Category 4 hurricane on October 10, 2018, then tracked northeastward with the northern portion of the storm circulation tracking across portions of Southside Virginia, Thursday afternoon, the 11th. As the storm circulation approached on October 11th a cold front moving in from the west and interacted with the storm and enhanced rainfall especially east of Interstate 81. Widespread rainfall amounts of 4 to 8 inches were reported, along with local amounts over 10 inches, mainly from the mountains of North Carolina up through Southside Virginia. This resulted in significant flash flooding with flash flood emergencies issued for the city of Roanoke, as well as Roanoke County. Rainfall amounts ranged from 1.97 inches at Gathright Dam, 3.3 inches at Daleville, 3.15 at the Roanoke Regional Airport to 7.16 inches in the Cave Spring area of Roanoke County. The Roanoke River at Glenvar crested at 17.1 feet (8.1 feet above flood stage) and in Roanoke at 16.4 feet (6.4 feet above flood stage).

Map 3: Hurricane Tracks



Scale 1:500,000

Legend

Hurricane Tracks

Source: Roanoke Valley-Alleghany Regional Commission, 2019,

2.4.2 Disaster Declarations for Hurricanes

There have been three (3) Presidential Disaster Declarations related to hurricanes in the region. There have been ten (10) State Emergency Declarations for hurricanes in the Region since 1987.

Table 26: Presidential Disaster Declarations for Hurricanes, 1972 to 2018

Locality	Declaration Number	Designation Date	Disaster Description
Alleghany County Botetourt County Clifton Forge City of Covington Craig County Roanoke County City of Salem	339	06/29/1972	Tropical storm Agnes
Alleghany County Botetourt County Roanoke County	1135	09/16/1996	Hurricane Fran and associated severe storm conditions
Alleghany County Botetourt County City of Covington Craig County Roanoke County City of Salem	3240	09/10/2005	Hurricane Katrina; evacuation, emergency protective measures
Craig County	4092	01/03/2013	Hurricane Sandy
Craig County	4401	10/15/2018	Hurricane Florence
Roanoke County	4411	12/18/2018	Tropical Storm Michael

Source: Virginia Department of Emergency Management, 2018 and FEMA 2018.

Table 27: State Emergency Declarations for Hurricanes, 1987 to 2018

Type of Disaster	Declaration Date	Type	Description
Hurricane	9/22/89	State of Emergency	Hurricane Hugo, on September 21, 1989 Hugo made landfall on the Carolinas and flooding was expected, the Virginia National Guard was called out
Hurricane	7/11/96	State of Emergency	Hurricane Bertha, predictions of storm surge, heavy rains, flooding and high winds in localities east of I-95, inland areas could also be impacted, the Virginia National Guard was called out
Hurricane	9/6/96	State of Emergency	Hurricane Fran, predictions of heavy rains that could cause flash and riverine flooding, predicted landfall is between North and South Carolina, the Virginia National Guard was called out
Hurricane	8/25/98	State of Emergency	Hurricane Bonnie, predictions of storm surge, heavy rains and high winds, predicted landfall south of the Virginia coast in North Carolina, the Virginia National Guard was called out
Hurricane	9/14/99	State of Emergency	Hurricane Floyd, predictions of storm surge, heavy rains, high winds and tornadoes, predicted, the Virginia National Guard was called out
Hurricane	9/04/2008	State of Emergency	Declared based on forecasts that indicate that Hurricane Hanna could cause damaging high winds, flash flooding, and possible tornadoes throughout the eastern and southeastern portion of the state.
Hurricane	9/01/2010	State of Emergency	Based on National Hurricane Center and National Weather Service forecasts projecting impacts from Hurricane Earl that could cause damaging high winds, coastal and lowland flooding throughout the eastern portion of the Commonwealth.
Hurricane	10/29/2012	State of Emergency	Hurricane Sandy
Hurricane	11/26/2012	Major Disaster	Hurricane Sandy
Hurricane	09/12/2018	State of Emergency	Hurricane Florence
Hurricane	10/11/2018	State of Emergency	Hurricane Michael

Source: Virginia Department of Emergency Management, 2018, Office of the Governor, 2018, and Library of Virginia, 2010.

References:

Inland Flooding, National Weather Service, http://www.nws.noaa.gov/oh/hurricane/inland_flooding.html, 2001.

Hurricane Basics, NOAA, http://www.nws.noaa.gov/oh/hurricane, 2002.

StormReady, National Weather Service, http://www.nws.noaa.gov/stormready.

Virginia Hurricanes, National Weather Service, http://165.176.249.147/library/vahurr/va-hurr.htm.

U.S. Mainland Hurricane Strikes by State, 1900-1996, National Hurricane Center, http:/www.nhc.noaa.gov/paststate.html.

Hurricane Isabel Situation Reports #1 through #7, Virginia Emergency Operations Center, 2003.

Preliminary Local Storm Report, September 19, 2003, National Weather Service Blacksburg, Virginia, 2003.

Virginia's Weather History, Virginia Hurricanes, Virginia Department of Emergency Management, http://www.vaemergency.com/newsroom/history/hurricane.cfm

Executive Actions, Virginia Office of the Governor, https://www.governor.virginia.gov/executive-actions/ 2018.

2.5 Karst

Karst is defined as a landscape with sinkholes, springs, and streams that sink into subsurface caverns. In karst areas, the fractured limestone rock formations have been dissolved by flowing groundwater to form cavities, pipes, and conduits. Sinkholes, caves, sinking streams, and springs signal the presence of underground drainage systems in karst areas.

Sinkholes are natural depressions on the land surface that are shaped like a bowl or cone. They are common in regions of karst, where mildly acidic groundwater has dissolved rock such as limestone, dolostone, marble, or gypsum. Sinkholes are subsidence or collapse features that form at points of local instability. Their presence indicates that additional sinkholes may develop in the future. The probability for karst hazards cannot be determined as easily as other hazards due to lack of accurate mapping and historical data.

The most notable karst related event in the region was a sinkhole in Botetourt County that occurred on Route 670 in 2005. That hole eventually expanded to 50 feet deep and 75 feet wide. Several smaller sinkholes have damaged Interstate 81 to the north in Augusta, Rockbridge and Shenandoah counties and south in Washington County in the past along with damage to Route 460 in Bedford County to the east. To date, there have been no federal disaster declarations or NCEI recorded events for karst related sinkhole events. Currently, there is no comprehensive long-term record of past events in Virginia.

References

Living on Karst: A Reference Guide for Landowners in Limestone Regions, Cave Conservancy of the Virginias, 1997.

Living With Sinkholes, Virginia Cave Board, Virginia Department of Conservation and Recreation.

2.6 Landslide

The term “landslide” describes many types of downhill earth movements, ranging from rapidly moving catastrophic rock avalanches and debris flows in mountainous regions to more slowly moving earth slides and other ground failures.

Though most landslide losses in the United States accrue from many widely distributed events, landslides can be triggered by severe storms and earthquakes, causing spectacular damage in a short time over a wide area. Some landslides move slowly and cause gradual damage, whereas others move so rapidly that they can destroy property and take lives. Debris flows are a common type of fast-moving landslide that generally occurs during intense rainfall on saturated soil. Their consistency ranges from watery mud to thick, rocky mud (like wet cement) which is dense enough to carry boulders, trees, and cars. Debris flows from many different sources can combine in channels, where their destructive power may be greatly increased. (Debris Flow Hazards in the Blue Ridge of Virginia, USGS Fact Sheet 159-96P. L. Gori and W. C. Burton, 1996).

Landslides can be triggered by both natural changes in the environment and human activities. Inherent weaknesses in the rock or soil often combine with one or more triggering events, such as heavy rain, snowmelt, and changes in groundwater level, or seismic activity. Erosion may remove the toe and lateral slope support of potential landslides. Human activities triggering landslides are usually associated with construction and changes in slope and surface water and groundwater levels. Changes in irrigation, runoff and drainage can increase erosion and change groundwater levels and ground saturation.

2.6.1 Review of Past Events and Reports

Historical records tell us that destructive landslides and debris flows in the Appalachian Mountains occur when unusually heavy rain from hurricanes and intense storms soaks the ground, reducing the ability of steep slopes to resist the downslope pull of gravity. For example, during Hurricane Camille in 1969, such conditions generated debris flows in Nelson County, Virginia. The storm caused 150 deaths, mostly attributed to debris flows, and more than $100 million in property damage. Likewise, 72 hours of storms in Virginia and West Virginia during early November 1985 caused debris flows and flooding in the Potomac and Cheat River basins that were responsible for 70 deaths and $1.3 billion in damage to homes, businesses, roads, and farmlands.

Most localities of the RVARC region have experienced small localized landslide events, especially areas in the valleys. The mountain slopes are characterized by the USGS as having a high susceptibility but a low incidence, indicating that few events have occurred on the higher slopes.

The only documented concentration of landslides in the planning region has been along Smith Creek in the Town of Clifton Forge. A State Emergency Declaration was issued in November of

1987 for the area. Heavy rains caused landslides along Smith Creek in Clifton Forge, the third occurrence in the past decade. The area is landslide prone and structures are at risk from further landslides. A study is warranted to determine scope of the problem and a method to stabilize the area. In 2008, a rockslide occurred on Route 220 just north of the City of Covington. No property damage estimates were reported. In 2019, another event on Route 220 closed a section of the road north of Covington for a two-week period. Small landslides just outside of Eagle Rock have closed Route 43 multiple times. Landslides on Route 220 south in the Bent Mountain area of Roanoke County have resulted in closures of that road multiple times.

2.6.2 Disaster Declarations for Landslides

There has been only one Presidential Disaster Declaration related to landslides in the region and it was related to a severe winter storm event that caused mudslides. The declaration impacted multiple localities in the region. There have been three (3) State Emergency Declarations for landslides in the Region since 1987.

Table 28: Presidential Disaster Declarations for Landslides, 1965 to 2010

Locality	Declaration Number	Designation Date	Disaster Description
Craig County Roanoke County City of Roanoke City of Salem	1458	04/28/2003	Severe winter storm, record/near record snowfall, heavy rain, flooding, and mudslide

Source: Virginia Department of Emergency Management, 2003 and FEMA 2010.

Table 29: State Emergency Declarations for Landslides, 1987 to 2010

Type of Disaster	Localities Affected	Declaration Date	Type	Description	Noted Damage
Landslides	Town of Clifton Forge	11/30/87	Declaration of State of Emergency	Heavy rains caused landslides along Smith Creek in Clifton Forge, third occurrence in the past decade, area is landslide prone and structures are at risk from further landslides, study is warranted to determine scope of the problem and stabilize the area	Property damage, residences at risk
Flash Flooding, Landslides, Dam Failure	Western, Central, Northern, South central Virginia	6/23/95 with extension of area on 6/26/95	Declaration of State of Emergency	Heavy rains resulted in flash floods, mudslides and dam failure in the western and central portions of the state.	Dam failure
Winter Emergency, Landslide	Entire State	2/11/94	Declaration of State of Emergency	Severe winter storm across the Commonwealth, large accumulations of ice, sleet and snow and moderate rain throughout the state, the southwestern portion of the state had heavy rains, mudslides and flooding occurred, 28 localities opened shelters, Virginia National Guard called out	More than 235,000 homes had no power, trees were downed and some roads were blocked by mudslides

Source: Virginia Department of Emergency Management, 2003 and Library of Virginia 2010.

References:

National Landslide Hazards Mitigation Strategy: A Framework for Loss Reduction, USGS Open-File Report 00-450, E. C. Spiker and P. L. Gori, 2000.

Debris Flow Hazards in the Blue Ridge of Virginia, USGS Fact Sheet 159-96P. L. Gori and W. C. Burton, 1996.

2.7 Straight Line Winds

Straight line wind is a term used to define any thunderstorm wind that is not associated with rotation and is used mainly to differentiate from tornadic winds. Most straight-line winds are a result of outflow generated by a thunderstorm downdraft. High winds are also associated with hurricanes, with two significant effects: widespread debris due to damaged and downed trees and building debris; and power outages. Half of all severe weather reports in the lower 48 states are due to damaging winds. Since most thunderstorms produce some straight-line winds as a result of outflow generated by the thunderstorm downdraft, anyone living in thunderstorm-prone areas is at risk for experiencing straight line winds.

2.7.1 Past Events

According to the National Climatic Data Center, there have been over 350 events reported in the planning region for high winds and thunderstorm winds 1950 and 2011. The most recent large-scale event was the derecho on June 29, 2012 that arrived with 80 mph winds and left over a million people without power and caused extensive wind damage throughout Virginia. The event was caused by a series of days with high temperatures in excess of 100 degrees created by a heat dome over the central and eastern US followed by a line of strong thunderstorms that moved quickly from the Chicago area to the east on the afternoon of June 29th. Emergency services personnel dealt with fires caused by downed powerlines, collapsed roofs, and wrecked vehicles. Many businesses in the area remained closed for an extended time and lost revenue due to the power outages while hardware stores experienced a run on generators and propane fueled grills. It took more than two weeks for utility companies to restore power to all residents in the region. Recovery, including the clean-up of hundreds of downed trees, roofs and building repairs lasted throughout July and August.

Straight line wind events can occur anywhere in the planning region and have the potential to impact all types of buildings, power and telecommunication transmission lines, and transportation services.

Table 30: Presidential Disaster Declarations for Straight Line Winds, 1965 to 2018

Locality	Declaration Number	Designation Date	Disaster Description
Alleghany County Botetourt County City of Covington Craig County Roanoke County City of Salem	4072	07/27/2012	Virginia Severe Storms and Straight-line Winds

Source: Virginia Department of Emergency Management, 2018.

Table 31: State Emergency Declarations for Straight Line Winds, 1987 to 2018

Type of Disaster	Localities Affected	Declaration Date	Type	Description	Noted Damage
Derecho	Craig County Roanoke County City of Salem	07/01/2012	Declaration of State of Emergency	Severe storms and winds in excess of 60 mph	Extensive wind damage
Derecho	Craig County Roanoke County City of Salem	07/27/2012	Major Disaster	Severe storms and winds in excess of 60 mph	Extensive wind damage

Source: Virginia Department of Emergency Management, 2018.

References:

Damaging Winds Basics, NOAA National Severe Storms Laboratory, http://www.nssl.noaa.gov/primer/wind/wind_basics.html, 2011.

Storm Events 2011, NOAA National Climatic Data Center, http://www.ncdc.noaa.gov/oa/ncdc.html, 2011.

2.8 Tornados

A tornado is a violent windstorm characterized by a twisting, funnel-shaped cloud. It is spawned by a thunderstorm (or sometimes as a result of a hurricane) and produced when cool air overrides a layer of warm air, forcing the warm air to rise rapidly. The damage from a tornado is a result of the high wind velocity and wind-blown debris. Tornado season is generally April through September, although tornadoes can occur at any time of year. Low-intensity tornadoes appear to occur most frequently; tornadoes rated EF2 or higher are very rare in Virginia, although EF2, EF3, and a few EF4 storms have occurred.

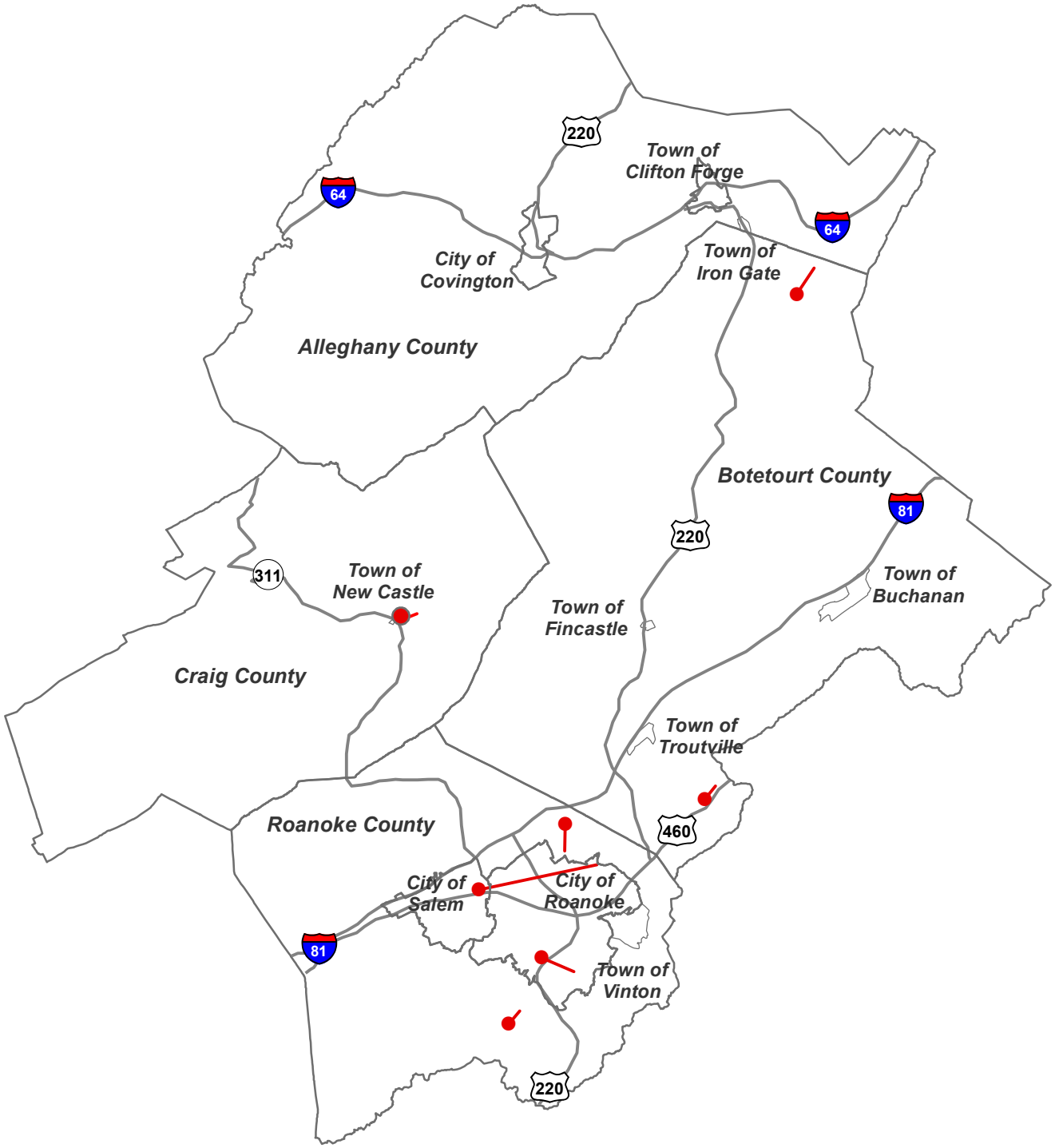
In February 2007, the National Weather Service adopted the Enhanced Fujita scale to measure tornadoes. The EF scale replaces the original Fujita scale that led to inconsistent tornado ratings due to a lack of damage indicators, no account of construction quality and variability, and no definitive correlation between damage and wind speed. For example, a weak structure combined with a slow-moving storm could lead to a tornado's rating being higher than it should be. The EF scale accounts for these and other variables for a more accurate measurement.

Table 32: Enhanced Fujita (EF) scale definition

F Scale	Class	MPH	Damage	EF Scale	Class	MPH
F0	Weak	40-72	Light damage. Tree branches snapped; antennas and signs damaged.	EF0	Weak	65-85
F1	Moderate	73-112	Moderate damage. Roofs off; trees snapped; trailers moved or overturned.	EF1	Moderate	86-110
F2	Strong	113-157	Considerable damage. Weak structures and trailers demolished; cars blown off road.	EF2	Strong	111-135
F3	Severe	158-206	Roofs and some walls torn off well-constructed buildings; some rural buildings demolished; cars lifted and tumbled.	EF3	Severe	136-165
F4	Devastating	207-260	Houses leveled leaving piles of debris; cars thrown some distance.	EF4	Devastating	166-200
F5	Incredible	261-318	Well built houses lifted off foundation and disintegrated with debris carried some distance.	EF5	Incredible	>200

Source: Virginia Department of Emergency Management, 2010.

Map 4: Tornado Tracks



Scale 1:500,000

Legend

- Initial Touchdown Point
- Tornado Path

Source: Roanoke Valley-Alleghany Regional Commission, 2019,
NOAA Storm Prediction Center, 2019.

2.8.1 Review of Past Events and Reports

Numerous tornados occur in Virginia each year. While a tornado in the Roanoke Valley-Alleghany region is rare, several had touched down in the past as described below.

April 24, 1896: Around 4:30 pm, a tornado moved northeast from Salem into Roanoke destroying a bowling alley and several other buildings. A framed home near the bowling alley was leveled, killing three of the eight-member family in the house. The five others were injured.

May 2, 1929: "Virginia's Deadliest Tornado Outbreak": It has been said that tornadoes do not occur in mountainous areas. This is false. In Bath and Alleghany counties, the Cowpasture Valley is at an elevation of 1,500 feet and lies between two ridges that rise 1,000 feet above the valley. On May 2, 1929, a tornado struck around 6 pm. Property losses in the communities of Coronation and Sitlington were great. At least 10 people were injured, but none were killed. There were five tornadoes reported on that day. More may have struck remote areas. Twenty-two people were killed and over 150 injured with at least half a million dollars in damage in Alleghany and Bath counties.

April 4, 1974: "Super Outbreak": It was before sunrise when the severe thunderstorms rolled into southwest Virginia. The storms were part of a squall line ahead of a cold front, and they had a history of being deadly. It was the worst tornado outbreak in U.S. history. April 3-4, 1974 is known as the "Super Outbreak" with 148 tornadoes, 315 people killed and 5,484 injured. It was the most tornadoes ever in recorded in a 24-hour period and it was the worst tornado outbreak since February 19, 1884. In Virginia, eight tornadoes hit. One person was killed and 15 injured, all in mobile homes. Over 200 homes and barns and over 40 mobile homes and trailers were damaged or destroyed. The Saltville area and Roanoke were the hardest hit. An F3 tornado touched down on the west edge of Roanoke, near Salem around 5 a.m., and moved through the north part of Roanoke to Bonsack and into Botetourt County to the Blue Ridge area. The path was initially a mile wide, but it continued to narrow to 75 yards across near the end of its track of damage. It hit four schools (two lost portions of their roof and two had windows broken out) and two apartment complexes, Grandview Village Apartments (18 buildings damaged) and Ferncliff Apartments (lost roof). The Red Cross reported 120 homes damaged or destroyed in the Roanoke area. Trees were down on buildings and cars. Carports, garages, and porches were flattened. Roofs were partly blown off several houses in Botetourt.

August 5, 2003: A small tornado struck northern Roanoke County. The storm had winds of 110-113 miles per hour and caused damage to ITT Industries and Sunnybrook Garage on Plantation Road in addition to damaging roofs, fences and a car in the area. No injuries were reported as a result of the tornado.

June 4, 2008: A small tornado touched down in the City of Roanoke. The tornado was rated EF-0 on the Enhanced Fujita Scale of tornado intensity. The National Weather Service reported that the storm knocked down power lines and trees, including on houses along a 1.4-mile path. Appalachian Power stated that the storm knocked out power to 4,000 customers.

April 15, 2018: A tornado touched down just east of the Town of New Castle. Classified as an EF-1, estimated windspeeds reached 105 mph and had a path length of 0.5 miles. The tornado damaged 6 homes, several outbuildings and garages, and approximately 50 trees in the vicinity. Three cars and a double axel trailer were moved including one truck that was flipped over. The tornado was part of a wide regional outbreak made up of several supercells on April 15th impacting communities in Virginia and North Carolina.

There have not been any Presidential Disaster Declarations for tornados in the planning area and only one State Emergency Declaration.

Table 33: State Emergency Declarations for Tornados, 1987 to 2018

Type of Disaster	Localities Affected	Declaration Date	Type	Description	Noted Damage
Tornados	Craig County	04/16/2018	Declaration of State of Emergency	EF-1 Tornado touched down in Craig County	Multiple homes, garages and vehicles damaged

Source: Virginia Department of Emergency Management, 2018.

At this time NOAA, the National Weather Service and other agencies are unable to predict the occurrence and location of future tornadoes. Based on past events it is likely that tornados will continue to impact the Roanoke Valley – Alleghany Region.

References:

Yes, Roanoke was Hit by a Tornado, Roanoke Times, http://www.roanoke.com/news/wb/164601, 2008.

Tornados, NOAA, http://www.outlook.noaa.gov/tornadoes.

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Virginia Tornados, B. M. Watson, NOAA, http://www.vdem.state.va.us/library/vatorn/va-tors.htm, 2002.

Virginia Weather History, Virginia Tornados, Virginia Department of Emergency Management, http://www.vaemergency.com/newsroom/history/tornado.cfm, 2008.

The April 15th, 2018 Tornadoes Event Summary, National Weather Service, https://www.weather.gov/rnk/2018_04_15_Tornado, 2018.

2.9 Wildfire

Wildfires are a natural part of the ecosystem in the Roanoke Valley and Alleghany Highlands; however, wildfires also present a substantial hazard to life and property.

2.9.1 Review of Past Events and Reports

According to the Virginia Department of Forestry, Virginia experiences forest fire seasons in the spring and fall. The spring fire season begins in mid-February and extends through April. The fall fire season usually covers a period of a few weeks in late October through November. Wildfire events are highly dependent on weather conditions and can occur any time of year in the planning region.

In 1999, Fort Lewis Mountain in the western part of Roanoke County burned out of control for a week, endangering multiple homes before it was brought under control. Other fires have occurred on Brushy Mountain, Purgatory Mountain, Poor Mountain, Twelve O'Clock Knob, Yellow Mountain, and even portions of Mill Mountain that lies within the heart of the City of Roanoke.

In April 2012, a series of wildfires burned more than 38,000 acres in western Virginia. One of the largest fires impacting the region was in a remote area in Alleghany County 10 miles west of Covington. The U.S. Forest Service reported the Alleghany Tunnel Fire burned 11,381 acres and resulted in temporary closure of sections of routes 770 and 850. The largest fire originated in Rich Hole Wilderness area of Alleghany County. This fire spread to private lands, grew to 15,454 acres, and closed parts of Interstate 64 in both directions. 7,351 acres burned in the Barbers Creek Fire in Alleghany and Craig counties. All fires posed threats to structures on private lands. Fires also occurred in Page and Shenandoah counties.

On the first weekend of March 2018, VDOF responded to 127 wildfires spread by high winds. Statewide, these fires burned a total of 690 acres. These fires impacted Botetourt County and multiple other localities across the state. A month later in Roanoke County, several fires ignited along the shoulder of Virginia Highway 311 on Catawba Mountain, near the highway's intersection with the Appalachian Trail. The fires grew quickly in dry and windy conditions. Several of these fires merged into one fire which grew to 165 acres and threatened the safety of dozens of hikers who were on the trail to McAfee Knob.

The main causes of wildfires in the region are: debris burning; powerlines; lightning; campfires; and arson.

Table 34: Regional Wildfire Statistics 2000-2016

Locality*	Total Number of Wildfires
Alleghany County	84
Botetourt County	99
Craig County	49
Roanoke County	35

* Data includes cities and towns located within each county. Data is a compilation of fires on private land, local or state government land, and National Forest.
Source: Virginia Department of Forestry, 2019.

2.9.2 Disaster Declarations for Wildfires

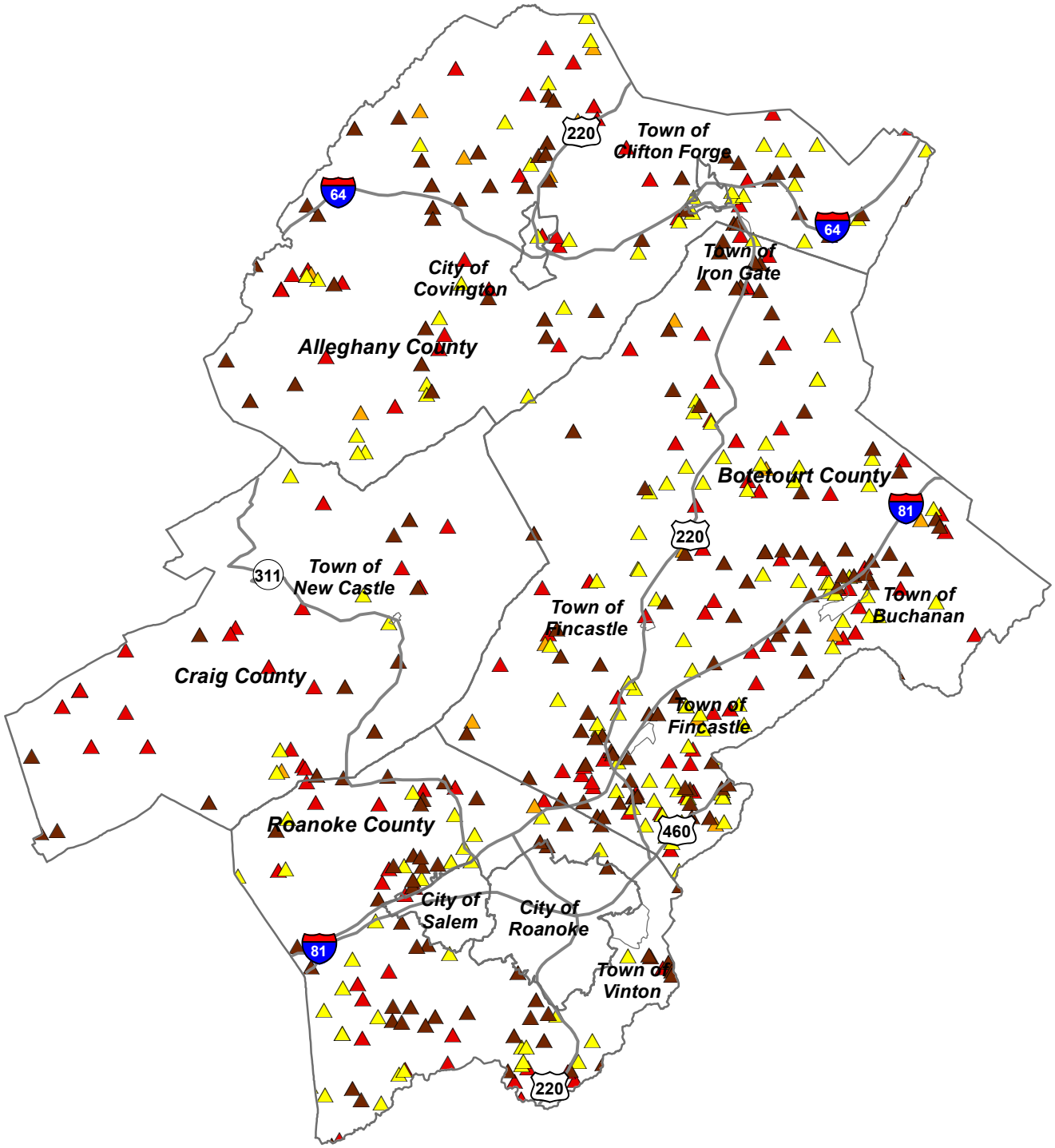
There have not been any Presidential Disaster Declarations related to wildfire in the region. There have been three (3) State Emergency Declarations for wildfire in the Region since 1995.

Table 35: State Emergency Declarations for Wildfires, 1987 to 2018

Type of Disaster	Localities Affected	Declaration Date	Type	Description
Forest Fires	Entire State	04/09/1995	Declaration of State of Emergency	Due to extreme dry conditions in the Commonwealth has forest fires in existence and other potential for forest fires, the Virginia National Guard was called out.
Forest Fires, Plant Disease Risk, Insect Infestation	Entire State	09/06/1996	Declaration of State of Emergency	Amendment to EO 66 (96), due to damage done to the Commonwealth by Hurricane Fran there was a risk of forest fires, spread of plant diseases and undesirable insect increase.
Forest Fires, Drought	Entire State	10/26/2001	Declaration of State of Emergency	Existence of drought conditions caused a greater potential for forest fires, the Virginia National Guard was called out, a statewide ban on open burning was announced.

Source: Virginia Department of Emergency Management, 2018 and Office of the Governor of Virginia 2018.

Map 5: Wildfire Incidents



Legend

- Incidents 1995-2001
- Incidents 2002-2008
- Incidents 2009
- Incidents 2010- 2016

Scale 1:500,000

Source: Roanoke Valley-Alleghany Regional Commission, 2018.

2.10 Winter Storms

Winter Storms have the greatest chance of impacting the region. Virginia's biggest winter storms are the great Nor'easters. In order for these storms to form, several things need to occur. High pressure builds over New England. Arctic air flows south from the high center into Virginia. The colder and drier the air is, the denser and heavier it becomes. This cold, dry air is unable to move west over the Appalachian Mountains. Instead, it remains trapped to the east side, funneling down the valleys and along the coastal plain toward North Carolina. To the east of the arctic air is the warm water of the Gulf Stream. The contrast of cold air sinking into the Carolinas and the warm air sitting over the Gulf Stream creates a breeding ground for storms. Combine this with the right meteorological conditions such as the position of the jet stream and storm development may become "explosive" (sudden, rapid intensification; dramatic drop in the central pressure of the storm).

2.10.1 Review of Past Events and Reports

The region's greatest snowfall totals have occurred in January, February, and March. In January of 1966, the area received a total of 41.2 inches of snow. February of 1960 found the area blanketed with 27.6 inches and March delivered 30.3 inches that same year. The second greatest official snow accumulation in a single 24-hour period occurred on February 11th and 12th of 1983 when 18.6 inches covered the region. The storm resulted in snowdrifts of up to three feet in height. This was the third heaviest snowfall in over 100 years. The "Storm of the Century" hit the valley in March 1993. With blizzard-like conditions and nearly 30 inches of snow, this was the biggest winter storm in 10 years. Localities in the region received a Presidential Declaration of Emergency and the National Guard was mobilized to help with emergency transportation needs. Shelters were open for those without electricity.

A devastating storm struck the region and surrounding jurisdictions in February 1994, with one to three inches of solid ice from freezing rain and sleet. Roads were blocked, electric and phone lines were damaged, and a large portion of the valley was without electricity. The "Blizzard of '96" dropped 22.2 inches officially in 24 hours in early January of 1996 that is the current record 24-hour snowfall. Many areas of the region received more than 36 inches during the same period.

In March 2009 snowfall reports in the region ranged from 6 to 9 inches and were the largest snow event since 2005. The Winter of 2009-2010 brought three major winter storms to the area. On December 18th, with areas of Craig and Alleghany County reporting up to 23 inches, snow continued to fall for the next 11 days. The first week of February 2010, saw another 8-10 inches fall on top of an event in late January that had already dropped 10-12 inches causing power outages, and dangerous driving conditions. The City of Roanoke's snowiest single day in December occurred in 2018 with 15.2 inches. The biggest snowstorm on record for the City was December 18-19, 2009 with 17.8 inches.

2.10.2 Disaster Declarations for Winter Storms

There have been seven (7) Presidential Disaster Declarations related to winter storms in the region. The declarations impacted multiple localities in the region. There have been sixteen (16) State Emergency Declarations for winter storms in the Region since 1993

Table 36: Presidential Disaster Declarations for Winter Storms, 1965 to June 2003

Locality	Declaration Number	Designation Date	Disaster Description
Alleghany County Botetourt County Craig County Roanoke County City of Roanoke	1014	03/10/1994	Severe ice storms, flooding
Craig County Roanoke County	1021	04/11/1994	Severe winter ice storm
Alleghany County Botetourt County Clifton Forge City of Covington Craig County Roanoke County City of Roanoke City of Salem	1086	02/02/1996	Blizzard of 96 (severe snow storm)
Alleghany County Botetourt County Craig County Roanoke County	1318	02/28/2000	Severe winter storms
Craig County Roanoke County City of Roanoke City of Salem	1458	04/28/2003	Severe winter storm, record/near record snowfall, heavy rain, flooding, and mudslide
Alleghany County Botetourt County Clifton Forge City of Covington Craig County Roanoke County City of Roanoke City of Salem	1874	02/16/2010	Severe winter storms
Craig County	1905	04/27/2010	Severe winter storms

Source: Virginia Department of Emergency Management, 2018 and FEMA, 2018.

Table 37: State Emergency Declarations for Winter Storms, 1987 to 2003

Type of Disaster	Localities Affected	Declaration Date	Type	Description
Winter Emergency	Entire State	03/12/1993	Declaration of State of Emergency	Extremely low temperatures and heavy snowfall accompanied by high velocity winds, sleet and freezing rain fell over the Commonwealth, hundreds of motorists were stranded, thousands of people were without power or heat, shelters were opened, the Virginia National Guard was called out.
Winter Emergency	Western Virginia	01/3/1994	Declaration of State of Emergency	An unusually severe winter storm was expected to impact the western portion of Virginia shortly after January 3, 1994, the conditions did not materialize although two feet of snow had been predicted, the Virginia National Guard was called out.
Winter Emergency	Entire State	01/19/1994	Declaration of State of Emergency	Due to severe winter weather (extremely low temperatures, heavy snowfall, high winds, sleet and freezing rains) winter fuel was being used faster than homes and agribusiness could be supplied, exemptions were granted to haulers delivering heating fuels.
Winter Emergency, Landslide	Entire State	02/11/1994	Declaration of State of Emergency	Severe winter storm across the Commonwealth, large accumulations of ice, sleet and snow and moderate rain throughout the state, the southwestern portion of the state had heavy rains, mudslides and flooding occurred, 28 localities opened shelters, Virginia National Guard was called out.
Winter Emergency	Entire State	03/2/1994	Declaration of State of Emergency	Severe winter weather buried the Commonwealth with snow to depths of 1 and one-half to two feet of snow, drifts occurred in the Shenandoah Valley and Northern Virginia due to 25 mile per hour winds, ice condition existed on the roads and torrential rains caused flooding in the coastal and western regions of the state, the ground was saturated by previous winter storms and this exacerbated the storm's effects, Virginia National Guard was called out.
Winter Emergency	Entire State	01/6/1996	Declaration of State of Emergency	Predicted winter storm with blizzard conditions, snowfall of 12-24 inches expected throughout the Commonwealth

Type of Disaster	Localities Affected	Declaration Date	Type	Description
Winter Emergency	Entire State	02/2/1996	Declaration of State of Emergency	A storm system moved through Virginia February 1-4, 1996, an Arctic air mass from Canada moved across the state, it had the potential to cause widespread power outages, and fuel and other resource shortages, it had the potential to cause severe economic losses including the agricultural community and livestock operations, the Virginia National Guard was called out.
Winter Emergency	Entire State	01/28/1998	Declaration of State of Emergency	Severe winter storm causing heavy snowfall in the western section of the state causing riverine flooding, coastal flooding and high winds on the coast, the Virginia National Guard, EO was extended for second storm predicted shortly after.
Winter Emergency	Entire State	01/25/2000	Declaration of State of Emergency	Winter storm with high winds dumped up to 18 inches of snow across much of the state, there were drifting and blizzard conditions, the Virginia National Guard was called out, the EO was extended to cover a predicted storm on January 28-31, 2000.
Winter Emergency	Entire State	12/11/2002	Declaration of State of Emergency	Icy conditions caused massive power outage.
Winter Emergency	Entire State	02/17/2003	Declaration of State of Emergency	SW Virginia received more than 4 inches of rain that caused flooding and mudslides.
Winter Emergency	Entire State	03/02/2009	Declaration of State of Emergency	Severe weather from a winter weather event causing widespread power outages and transportation difficulties throughout the State.
Winter Emergency	Entire State	12/18/2009	Declaration of State of Emergency	Severe winter storm from prolonged periods of snow and windy weather from the remnants of a winter storm causing widespread power outages, flooding and transportation difficulties throughout the State.
Winter Emergency	Entire State	01/28/2010	Declaration of State of Emergency	Severe winter storm with significant snow accumulations ranging from 4 to 12 inches and temperatures below freezing that could cause transportation difficulties and power outages.
Winter Emergency	Entire State	02/03/2010	Declaration of State of Emergency	Severe winter storms with significant snow and ice accumulations and excessive rain that could impact the Commonwealth between February 5 and 10, 2010, creating the potential for transportation difficulties and power outages.

Type of Disaster	Localities Affected	Declaration Date	Type	Description
Winter Emergency	Entire State	02/26/2010	Declaration of State of Emergency	Winter storm with damaging high winds, continuous snow showers and blowing snow that reduced visibility to near zero creating the potential for transportation difficulties and power outages.
Severe Winter Storm	Entire State	04/27/2010	Major	
Severe Winter Storm	Entire State	09/25/2010	Declaration of State of Emergency	
Winter Storm	Entire State	02/03/2014	Declaration of State of Emergency	
Winter Storm	Entire State	02/11/2014	Declaration of State of Emergency	
Winter Storm	Entire State	02/24/2015	Declaration of State of Emergency	
Winter Storm	Entire State	01/21/2016	Declaration of State of Emergency	
Severe Winter Storm	Entire State	03/07/2016	Declaration of State of Emergency	
Winter Storm	Entire State	01/06/2017	Declaration of State of Emergency	
Severe Winter Storm	Entire State	03/13/2017	Declaration of State of Emergency	
Severe Winter Storm	Entire State	01/03/2018	Declaration of State of Emergency	
Winter Storm	Entire State	03/02/2018	Declaration of State of Emergency	Snow and ice
Winter storm	Entire State	12/08/2018	Declaration of State of Emergency	Need to prepare and coordinate response to winter weather forecast. Resulted in snow and ice accumulations, transportation issues, and power outages.
Winter Storm	Entire State	01/12/2019	Declaration of State of Emergency	Need to prepare and coordinate response to winter weather forecasted to impact Commonwealth.

Source: Virginia Department of Emergency Management, 2018, Library of Virginia, 2010, Office of the Governor Office, 2018.

References:

Hazard Analysis, Project Impact Roanoke Valley, (no date).

StormReady, National Weather Service, http://www.stormready.noaa.gov, 2003.

Chapter 3 Vulnerability Assessment

The vulnerability assessment of the region's localities to specific hazards is based on a combination of the probability, extent and past occurrences of hazard events. Probability is based on the number of past documented occurrences of a hazard. A higher number of occurrences resulted in the disaster being given a higher ranking. Extent is based on the hazards area of impact- either localized or jurisdiction wide. Hazards with a wider area of impact were given a higher ranking. Past occurrences are based on whether or not a specific hazard has occurred in a locality. Disasters that have actually occurred in a locality were given a higher ranking.

Based on past probability, extent and past occurrences, the Hazard Mitigation Plan Committee selected the following disasters for inclusion in this Plan: earthquakes, flooding, hurricanes, landslides, tornados, straight-line winds, wildfires, and winter storms.

3.1 Disaster Rankings

Tables 38 to 40 show rankings for disasters in each locality based on: probability of occurrence; extent of disaster; past occurrence; and overall vulnerability. The ranking system is similar to the one used by VDEM in the State HIRA. A semi-quantitative scoring system was used to compare all of the hazards. This method prioritizes hazard risk based on a blend of quantitative factors from the available data.

Probability of Occurrence is the probability that a specific type of disaster will occur in a jurisdiction. Some of the hazards assessed in this plan did not have precisely quantifiable probability or impact data, therefore a qualitative ranking based on local knowledge and historical record was used.

Earthquake probability is taken from the history of past occurrences (Section 2.2.1), seismic activity documented on Map 2 Seismic Activity, and the USGS Earthquake Hazards Program data and mapping (Section 3.3 and Map 6 Seismic Hazards).

Flood probability is taken from the history of past occurrences (Section 2.3.1), Flood Insurance Studies and FIRM (Section 2.3.2), vulnerability assessments for flooding(Section 3.4), flood prone roads (Section 3.5), and risk of dam failure (Section 3.6), along with flood hazard mapping in Appendix D.

Hurricane probability is based on past occurrences (Section 2.4) and minimal knowledge about predicting hurricanes from NOAA in Section 3.7.

Straight Line Winds probability is based on past occurrences (Section 2.7) and a vulnerability assessment (Section 3.11) using past event extent magnitude (Map 9).

Landslide probability is based on past occurrences (Section 2.6) and a vulnerability assessment based on USGS landslide susceptibility (Map 8).

Tornado probability is based on past occurrences (Section 2.8) and Map 4 Tornado Tracks based on data from the NOAA Storm Prediction Center.

Wildfire probability is based on past occurrences (Section 2.9.1) and Map 5 Wildfire Incidences from the Virginia Department of Forestry and the wildfire vulnerability assessment information in Section 3.13 Wildfire which included a national wildfire risk assessment model (Section 3.13.2 and Map 10).

Winter Storm probability is taken from past occurrences (Section 2.10) and Section 3.14 in the vulnerability assessment along with mapping based on information from the national Climate Data Center.

Probable Extent of Disaster is the probable geographic extent of the disasters impact. The available data sources vary widely in their depiction of hazard geography. As a result, one uniform ranking system could not be accomplished. Each hazard has been assigned a category of localized such as the path of a tornado or jurisdiction-wide such as a winter storm.

Past Occurrence is simply whether the disaster has occurred in a locality.

Overall Vulnerability is a combination of the rankings of the other three matrixes to obtain an overall ranking for each type of disaster in each jurisdiction and in the region.

Table 38: Probability of Hazard Occurrence

Locality	Earthquake	Flood	Hurricane	Straight Line Winds	Landslide	Tornado	Wildfire	Winter Storm
Alleghany County	1	3	1	2	3	1	3	3
Botetourt County	1	3	1	2	3	1	3	3
Town of Buchanan	1	3	1	2	3	1	2	3
Town of Clifton Forge	1	3	1	2	3	1	2	3
City of Covington	1	3	1	2	3	1	1	3
Craig County	1	3	1	2	3	1	3	3
Town of Fincastle	1	1	1	2	3	1	1	3
Town of Iron Gate	1	1	1	2	3	1	2	3
Town of New Castle	1	2	1	2	3	1	1	3
City of Roanoke	1	3	1	2	2	1	1	3
Roanoke County	1	3	1	2	3	1	3	3
City of Salem	1	3	1	2	2	1	1	3
Town of Troutville	1	3	1	2	3	1	2	3
Town of Vinton	1	3	1	2	3	1	1	3

Source: Roanoke Valley-Alleghany Regional Hazard Mitigation Plan Committee, 2018.
Note: Rankings are defined as: 1 - Low; 2 - Medium; and 3 - High.

Table 39: Probable Extent of Disaster

Locality	Earthquake	Flood	Hurricane	Straight Line Winds	Landslide	Tornado	Wildfire	Winter Storm
Alleghany County	Localized	Localized	Jurisdiction-wide	Localized	Localized	Localized	Localized	Jurisdiction-wide
Botetourt County	Localized	Localized	Jurisdiction-wide	Localized	Localized	Localized	Localized	Jurisdiction-wide
Town of Buchanan	Localized	Localized	Jurisdiction-wide	Localized	Localized	Localized	Localized	Jurisdiction-wide
Town of Clifton Forge	Localized	Localized	Jurisdiction-wide	Localized	Localized	Localized	Localized	Jurisdiction-wide
City of Covington	Localized	Localized	Jurisdiction-wide	Localized	Localized	Localized	Localized	Jurisdiction-wide
Craig County	Localized	Localized	Jurisdiction-wide	Localized	Localized	Localized	Localized	Jurisdiction-wide
Town of Fincastle	Localized	Localized	Jurisdiction-wide	Localized	Localized	Localized	Localized	Jurisdiction-wide
Town of Iron Gate	Localized	Localized	Jurisdiction-wide	Localized	Localized	Localized	Localized	Jurisdiction-wide
Town of New Castle	Localized	Localized	Jurisdiction-wide	Localized	Localized	Localized	Localized	Jurisdiction-wide
City of Roanoke	Localized	Localized	Jurisdiction-wide	Localized	Localized	Localized	Localized	Jurisdiction-wide
Roanoke County	Localized	Localized	Jurisdiction-wide	Localized	Localized	Localized	Localized	Jurisdiction-wide
City of Salem	Localized	Localized	Jurisdiction-wide	Localized	Localized	Localized	Localized	Jurisdiction-wide
Town of Troutville	Localized	Localized	Jurisdiction-wide	Localized	Localized	Localized	Localized	Jurisdiction-wide
Town of Vinton	Localized	Localized	Jurisdiction-wide	Localized	Localized	Localized	Localized	Jurisdiction-wide

Source: Roanoke Valley-Alleghany Regional Hazard Mitigation Plan Committee, 2018.

Table 40: Past Hazard Occurrences

Locality	Earthquake	Flood	Hurricane	Straight Line Winds	Landslide	Tornado	Wildfire	Winter Storm
Alleghany County	No	Yes	Yes	Yes	Yes	No	Yes	Yes
Botetourt County	No	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Town of Buchanan	No	Yes	Yes	Yes	No	No	No	Yes
Town of Clifton Forge	No	Yes	Yes	Yes	Yes	No	No	Yes
City of Covington	No	Yes	Yes	Yes	No	No	No	Yes
Craig County	No	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Town of Fincastle	No	Yes	Yes	Yes	No	No	No	Yes
Town of Iron Gate	No	Yes	Yes	Yes	No	No	Yes	Yes
Town of New Castle	No	Yes	Yes	Yes	No	No	No	Yes
City of Roanoke	Yes	Yes	Yes	Yes	No	Yes	Yes	Yes
Roanoke County	No	Yes	Yes	Yes	Yes	Yes	Yes	Yes
City of Salem	No	Yes	Yes	Yes	No	Yes	No	Yes
Town of Troutville	No	Yes	Yes	Yes	No	No	No	Yes
Town of Vinton	No	Yes	Yes	Yes	No	No	No	Yes

Source: Roanoke Valley-Alleghany Regional Hazard Mitigation Plan Committee, 2018.

Table 41: Overall Hazard Vulnerability Rankings

Locality	Earthquake	Flood	Hurricane	Straight Line Winds	Landslide	Tornado	Wildfire	Winter Storm
Alleghany County	2	5	4	4	3	2	5	6
Botetourt County	2	5	4	4	3	3	5	6
Town of Buchanan	2	5	4	4	2	2	3	6
Town of Clifton Forge	2	5	4	4	3	2	3	6
City of Covington	2	5	4	4	2	2	2	6
Craig County	2	5	4	4	3	3	5	6
Town of Fincastle	2	3	4	4	2	2	2	6
Town of Iron Gate	2	3	4	4	2	2	4	6
Town of New Castle	2	4	4	4	2	2	2	6
City of Roanoke	3	5	4	4	2	3	3	6
Roanoke County	2	5	4	4	3	3	5	6
City of Salem	2	5	4	4	2	3	2	6
Town of Troutville	2	5	4	4	2	2	3	6
Town of Vinton	2	5	4	4	2	2	2	6
Regional Average	2.1	4.6	4.0	4.0	2.4	2.4	3.3	6.0

Source: Roanoke Valley-Alleghany Regional Hazard Mitigation Plan Committee, 2018.

Note: Rankings are defined as: 1 - Very Low; 2 - Low; 3 - Medium; 4 - Medium High; 5 - High; and 6 - Very High.

3.3 Earthquake

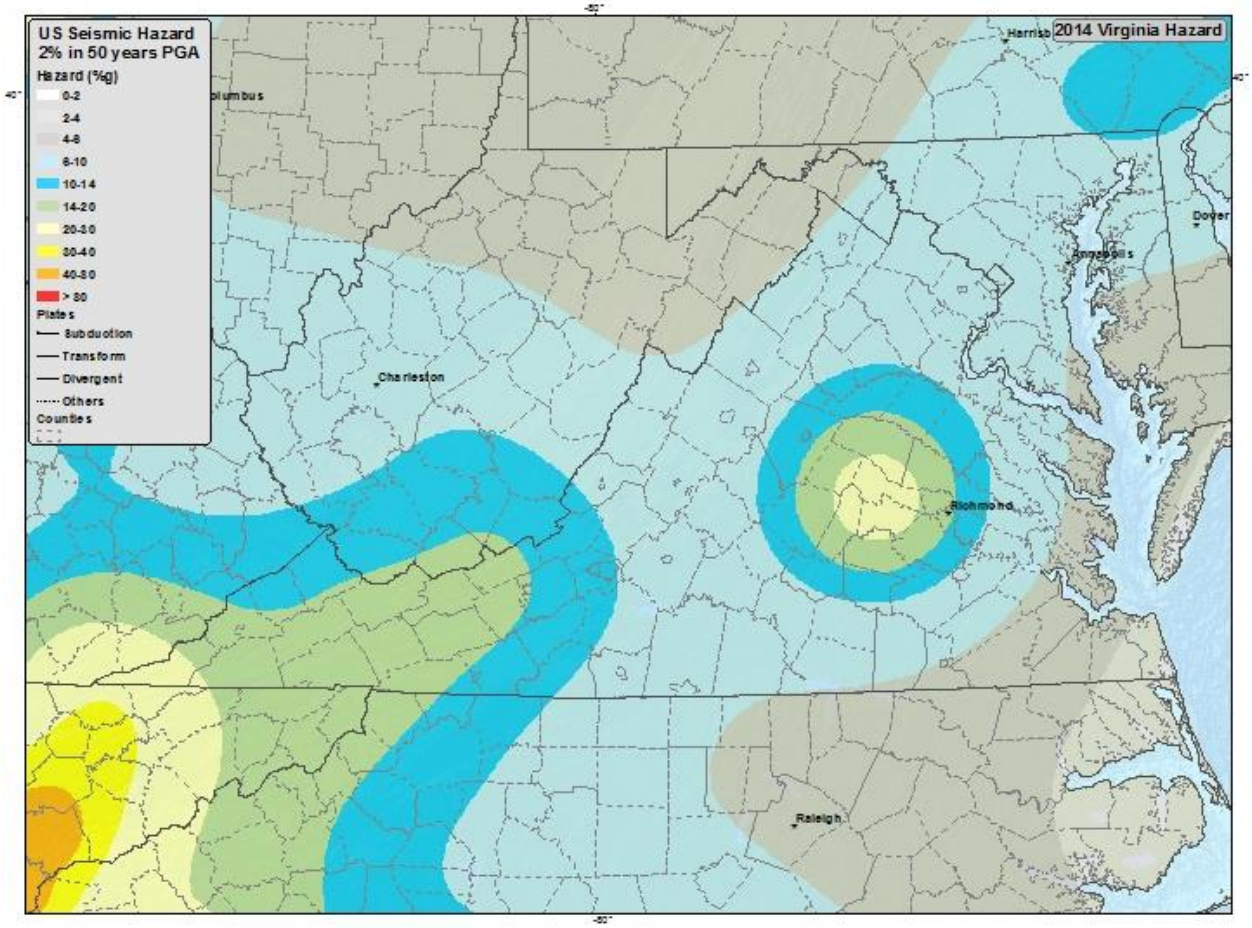
While rarely occurring, earthquakes do impact the region. The map below illustrates the severity of horizontal shaking that has a 10% probability of occurring within a 50-year period for the Commonwealth of Virginia. The %g value, an index indicating the severity of horizontal shaking that has a 10% chance of occurring within a 50-year period, for the Roanoke Valley-Alleghany region ranges from 4 to 5. An area in southwest Craig County has a %g value of 5, which indicates the likelihood of increased severity in earthquake events. Overall, earthquake events in the region will most likely be minor or, at most, moderate events with little or no structural damage.

The most recent long-term Seismicity Model shown on the 2014 U.S. Geological Survey National Seismic Hazard Maps displays earthquake ground motions for various probability levels across the United States and are applied in seismic provisions of building codes, insurance rate structures, risk assessments, and other public policy. The maps represent an assessment of the best available science in earthquake hazards and incorporate findings on earthquake ground shaking, faults, seismicity, and geodesy.

The USGS National Seismic Hazard Mapping Project developed these maps by incorporating information on potential earthquakes and associated ground shaking obtained from interaction in science and engineering workshops involving hundreds of participants, review by several science organizations and State surveys, and advice from expert panels and a Steering Committee. The probabilistic hazard maps represent an update of the seismic hazard maps.

The National Seismic Hazard Maps are derived from seismic hazard curves calculated on a grid of sites across the United States that describe the annual frequency of exceeding a set of ground motions. Maps for available periods (0.2 s, 1 s, Peak Ground Acceleration) and specified annual frequencies of exceedance were calculated from the hazard curves. Figures depict probabilistic ground motions with a 2 percent probability of exceedance. Spectral accelerations are calculated for 5 percent damped linear elastic oscillators. All ground motions are calculated for site conditions with Vs30=760 m/s, corresponding to NEHRP B/C site class boundary.

Map 6
Seismic Hazards



Source: USGS Earthquake Hazards Program, https://earthquake.usgs.gov/hazards/hazmaps/ , 2018

3.4 Flood

Widespread flooding or isolated flash flooding impact a large portion of the region. The Roanoke Valley has historically proven susceptible to flooding. The main contributing factor to sustained flooding and flash flooding is the intensity of the rainfall and its duration. The mountains surrounding the valley make the region prone to runoff from heavy rain. Much of this rainfall is absorbed into the ground, replenishing groundwater. Pavement, concrete, and buildings limit the amount of ground cover available for the absorption of water. Water runoff in urbanized areas is increased two to six times over what would occur in natural terrain. The result is swollen streams overflowing their banks and ending with dangerous widespread flooding of the Roanoke Valley. The probability of an occurrence of a flood event has remained unchanged since the adoption of the 2013 Regional Pre-Disaster Mitigation Plan. There have been no significant regional flooding events since the previous edition of the plan.

3.4.1 National Flood Insurance Program

Many localities participate in, and are in good standing with, the National Flood Insurance Program (NFIP) by enforcing floodplain management regulations that meet federal requirements. This program allows property owners to purchase flood insurance from NFIP. The number of active flood insurance policies is an indicator of flood risk in the region.

Many residents have purchased flood insurance to help recover from flood losses. Flood insurance covers only the improved land or the actual building structure. Although it is helpful to those who have suffered losses, it may also provide a false sense of security and discourage people and businesses from relocating to a more appropriate site. Many residents that experience flood loss rebuild in the same location, only to be flooded again. These repetitive loss properties expose lives and property to flood hazards. FEMA and local governments recognize this problem and attempt to remove repetitive loss properties through land acquisition, structure relocation or by elevating the structure. Continued repetitive loss claims lead to increased damage by floods, higher insurance rates, and increasing amounts of tax dollars being spent on disaster relief.

Table 42: National Flood Insurance Program Communities

Community Name	Date of Entry	Current Effective Map
Alleghany County	07/16/87	12/17/10
Botetourt County	06/15/78	12/17/10
Buchanan, Town of	11/02/77	12/17/10
Clifton Forge, Town of	09/01/78	12/17/10
Covington, City of	01/03/79	12/17/10
Craig County	02/02/90	04/02/09
Fincastle, Town of	05/15/78	12/17/10
Iron Gate, Town of	01/16/87	12/17/10
New Castle, Town of	02/02/90	04/02/09
Roanoke County	10/17/78	09/28/07
Roanoke, City of	11/04/81	09/28/07
Salem, City of	09/02/81	09/28/07
Troutville, Town of	10/14/77	12/17/10
Vinton, Town of	03/15/78	09/28/07

Source: FEMA, Federal Insurance Administration, 2018.

Table 43: NFIP Policy Statistics (as of 08/31/2018)

Community Name	Policies In-force	Insurance In-force (dollars)	Written Premiums In-force
Alleghany County*	194	32,429,100	155,269
Clifton Forge, Town of	10	1,495,000	17,828
Iron Gate, Town of	1	23,100	722
Botetourt County *	170	29,138,200	152,223
Buchanan, Town of	31	6,519,300	46,810
Fincastle, Town of	1	148,000	508
Troutville, Town of	19	2,037,300	19,188
Craig County *	61	7,591,100	50,747
New Castle, City of	1	210,000	351
Covington, City of	109	15,642,700	92,345
Roanoke, City of	547	138,278,300	1,249,712
Salem, City of	376	89,479,800	907,106
Roanoke County *	379	83,654,200	420,703
Vinton, Town of	33	7,950,200	60,631
Virginia	105,931	27,930,765,500	77,956,689

Source: FEMA, National Flood Insurance Program, Bureau Net Reporting, 2018
Note: Policies in Force = Number of policies on the "as of" date of the report.
Insurance in Force = The coverage amounts for the policies in force.
Written Premium in Force = The premiums paid for the policies in force.
* Town data not included in county data.

Table 44: NFIP Loss Statistics (as of 08/31/2018)

Community Name	Total Number of Losses	Closed Losses	Open Losses	CWOP Losses	Total Payments (dollars)
Alleghany County*	220	192	0	28	3,211,107.52
Clifton Forge, Town of	10	9	0	1	79,507.87
Iron Gate, Town of	1	0	0	1	0.00
Botetourt County *	227	194	1	32	2,837,571.86
Buchanan, Town of	63	60	0	3	1,777,294.28
Fincastle	0	0	0	0	0.00
Troutville, Town of	9	5	0	4	9,534.03
Craig County *	95	73	0	22	1,310,440.53
New Castle, City of	4	4	0	0	32,441.48
Covington, City of	207	182	0	25	1,782,132.63
Roanoke, City of	1,130	903	1	226	19,898,855.13
Salem, City of	714	592	0	122	16,421,037.10
Roanoke County *	458	366	1	91	4,151,218.43
Vinton, Town of	83	62	0	21	1,269,049.22
Virginia	47,951	38,233	124	9,594	721,950,658.88

Source: FEMA, National Flood Insurance Program, Bureau Net Reporting, 2018
Note: Total losses = All losses submitted regardless of the status; Closed losses = Losses that have been paid; Open losses = Losses that have not been paid in full; CWOP losses = Losses that have been closed without payment; Total Payments = Total amount paid on losses.

3.4.2 Flood Mitigation Assistance (FMA) Program

The FMA program is authorized by Section 1366 of the National Flood Insurance Act of 1968, as amended with the goal of reducing or eliminating claims under the National Flood Insurance Program (NFIP). The FMA Grant Program was created as part of the National Flood Insurance Reform Act of 1994 with the goal of reducing or eliminating claims under the NFIP. Consistent with Biggert-Waters Flood Insurance Reform Act of 2012 (Public Law 112-141), the FMA Grant Program is focused on mitigating repetitive loss properties and severe repetitive loss properties.

Funding is appropriated by Congress annually. The total amount of funds available under the FY 2018 FMA grant program was $160,000,000. Of this, a total of $70,000,000 was prioritized for community flood mitigation proposals leaving an estimated $90,000,000 available for other FMA priorities.

FEMA requires state, tribal, and local governments to develop and adopt hazard mitigation plans as a condition for receiving certain types of non-emergency disaster assistance, including funding for HMA mitigation projects. Generally, local communities will sponsor applications on behalf of homeowners and then submit the applications to their State. All FMA grant applications must be submitted to FEMA by a State, U.S. Territory, or federally-recognized tribe.

3.4.3 Riverine Flooding

Riverine flooding impacts all localities within the region. Rainfall on the steep watersheds floods small streams, raise river levels and overwhelms stormwater systems. The prevention of losses of life and property due to flooding is a priority for the local governments in the region.

3.4.3.1 Alleghany Highlands Communities

The main flooding problem in Alleghany County is along the Jackson River. Gathright Dam is the only dedicated flood protection structure in the County. Since the completion of the dam, there has been widespread belief that flooding should not occur. This belief helps lead to increased pressure for development along the floodplain of the Jackson River. Although the reduction in flood stages provided by the dam is substantial, it does not completely eliminate the flood hazards downstream of Potts Creek and Dunlap Creek. Gathright Dam only controls approximately 38 percent of the Jackson River watershed and has no control over the watersheds of Potts and Dunlap Creeks.

The USGS has recorded stages of area streams. Records of river stages and discharges on the Jackson River at Falling Spring gage, located approximately 10 miles upstream from Covington, have been maintained since April 1925. To supplement the Falling Springs records, data is recorded from the USGS gauging stations at Dunlap Creek and Potts Creek. The Dunlap gage, located 4.3 miles above its confluence with the Jackson River, has been recording data since October 1928. Records of river stages and discharges on Potts Creek, 7.5 miles upstream of its mouth, have been maintained from October 1928 to September 1956, and October 1965 to present. There is also a USGS stream gage on the Cowpasture River.

In 1986, the Federal Emergency Management Agency (FEMA) completed a *Flood Insurance Study for Alleghany County*. In 1992, the study was updated and provided detailed data on Wilson Creek and its tributaries. The floodplains along the Jackson River are areas of intensive development and should be noted as possible hazardous areas.

The U.S. Department of Housing and Urban Development (HUD), Federal Insurance Administration (FIA), 1978 *Flood Insurance Study of Clifton Forge, Virginia*, provides details on the effects of flooding along the Jackson River and Smith Creek. Flooding on the smaller streams Hazel Run, Dry Creek, and East Branch were studied by approximate methods. The Jackson River flows easterly through the town with a relatively well-defined channel and banks covered with vegetation and trees. CSX Railroad parallels the river along its length in town. The steep banks of the river prevent development on the flood plain. Smith Creek flows in a southerly direction from its headwaters in Bath County, through Clifton Forge to the Jackson River. Development, consisting primarily of residences, public buildings and businesses is concentrated along both sides of the stream throughout its entire reach.

Floods have occurred and can be expected to occur on the Jackson River and Smith Creek in Clifton Forge during all seasons of the year. During all major floods, high velocity flood flows

and hazardous conditions would exist in the main stream channel and in some parts of the flood plain. Intense rainfall from local thunderstorms or by tropical disturbances will most likely be the source of the more severe floods on the Jackson River. Flooding at the mouth of Smith Creek can be caused by rainfall runoff from the watershed or by backwater from the Jackson River when it floods.

Damage from past floods along the Jackson River has been minor due to the topography and physical characteristics of the floodplain. However, this is not true on Smith Creek. At a number of locations, the floodplain is severely restricted by buildings that have been constructed on opposite sides of the stream. Near the center of town, flow is confined for a distance of approximately 400 feet by a maze of culverts of varying sizes and capacities. Due to the numerous buildings that have been constructed over this section of the creek, potential for serious flood losses exists. If the culvert system becomes clogged, floodwaters would travel over the streets and a large portion of the business district would be flooded.

The US Department of Housing and Urban Development and Federal Insurance Administration 1978 *Flood Insurance Study of the City of Covington, Virginia* details the effects of fluvial flooding from the Jackson River. Mill Branch, Harmon's Run, and Dry Run Branch by approximate methods. The study does take into consideration the storage effects of Gathright Dam. The Jackson River flood plain contains a mixture of residential and commercial development with some light industry located in the area. The flood plains of the tributaries of the Jackson contain most of the residential development with occasional commercial development. The Jackson River flows in a southerly direction through the City of Covington with a well-defined bank covered with vegetation and trees. Dry Branch flows in a northwesterly direction to the Jackson. Floods have occurred and can be expected to occur on the Jackson River in Covington during all seasons of the year. During all major floods, high velocity flood flows and hazardous conditions would exist in the main stream channel and in some parts of the flood plain.

In 2009 the *Flood Insurance Study for Alleghany County* was updated along with the Flood Insurance Rate maps (FIRM). The new FIRMs went into effect in December 2010. This study was prepared to include all Alleghany County and unincorporated areas, the independent City of Covington, and the Towns of Clifton Forge and Iron Gate into a countywide format. For this FIS, the floodplains for all detailed study, unrevised streams and approximately 80 miles of effective Zone A floodplains have been redelineated using updated topographic data provided to FEMA by the Virginia Department of Conservation and Resources (DCR) on October 2, 2008. All floodplain boundaries were updated, based on new digital topographic data; supplied by the Commonwealth of Virginia, dated Spring 2005. Also, all approximate Zone A Special Flood Hazard Areas were delineated based on the aforementioned elevation data. This work was completed in April 2009. New FIRM were developed and went into effect in December 2017. The updated study and maps were used in determining risk and potential loss caused by flooding.

3.4.3.2 Botetourt County Communities

The *Flood Insurance Study, Town of Buchanan, Virginia*, performed by the US Department of Housing and Urban Development and Federal Insurance Administration in 1977 documented the impact of the James River and Purgatory Creek on the Town of Buchanan. Purgatory Creek flows into the James River within the corporate limits of Buchanan and forms the eastern town limit. Most of the residential and business areas of the town are above the flood plain. However, there are many residential, commercial, and industrial properties subject to flooding, many of which have been damaged by flooding in the past. The CSX Railroad parallels the James River on the south bank and the Norfolk Southern Railroad parallels the north bank throughout the Buchanan study area. During the 100-year flood portions of both tracks would be flooded according to the Flood Insurance Study. The high school, the sewage treatment plant, several businesses, and many homes would be flooded by the 100-year flood. US Highway 11 crosses the James River at Buchanan. While the bridge does not produce backwater, the approaches to the structure would be flooded.

The *1988 Reconnaissance Report, James River, Buchanan, Virginia, Section 205 Flood Control Study*, by the US Army Corps of Engineers provides information about potential flooding along Looney, Purgatory and Bearwallow creeks. Entering the James River from the west of Buchanan is Looney Creek. Bearwallow Creek flows into the James just east of town. Purgatory Creek flows east into the James River at the eastern corporate limits of Buchanan. The Study did not predict flood losses. The Section 205 Flood Control Study prepared and reviewed two alternatives for reducing flood loss in Buchanan: a 600-year levee and a 100-year levee. Due to the cost involved and low benefits of the alternatives, the Corps of Engineers determined that further study of developing local flood control measures was not appropriate at the time.

The *1989 Reconnaissance Report, James River, Eagle Rock, Virginia, Section 205 Flood Control Study*, by the US Army Corps of Engineers, study area included the entire community of Eagle Rock and its immediate vicinity just downstream from the confluence of Craig Creek with the James River. The study estimates that the damages for a 100-year flood would be $605,000 (1989 dollars). Field reconnaissance performed for the Reconnaissance Report indicated that there would be a minimal amount of commercial and residential flooding below the 100-year event. This would be limited to the old mill, railroad station, and railways. Due to the cost involved and low benefits of the alternatives, the Corps determined that further study of developing local flood control measures for the community of Eagle Rock was not appropriate at the time.

In 2009 the Flood Insurance Study for Botetourt County was updated along with the Flood Insurance Rate maps (FIRM). This study was prepared to include all of Botetourt County and unincorporated areas and the Towns of Buchanan, Fincastle and Troutville into a countywide format. All detailed streams within Botetourt County and Incorporated Areas were redelineated based on new digital topographic data; supplied by the Commonwealth of Virginia, dated 2006 to 2007. Also, all approximate Zone A floodplains were delineated, based on the aforementioned elevation data. The updated study and maps were used in determining risk and

potential loss caused by flooding. Additional updates were made in 2017 with the new FIRMs going into effect in December 2017.

3.4.3.4 Craig County Communities

A lack of flood plain information studies for Craig County prevents a risk assessment within this locality from being quantified at this time. The county should work with the Corps of Engineers, Virginia Department of Emergency Management, and FEMA to develop a Flood Insurance Study for the major watersheds of Johns Creek, Craig Creek, Potts Creek, Sinking Creek and Barbours Creek. FIRM for Craig County went into effect in April 2009.

3.4.3.5 Roanoke Valley Communities

In 1997, the Roanoke Valley Regional Stormwater Management Plan was prepared by Dewberry & Davis under contract to the Fifth Planning District Commission (now the Roanoke Valley-Alleghany Regional Commission). Localities participating in this study include only the Cities of Roanoke and Salem, the County of Roanoke and the Town of Vinton. The project is funded by the City of Roanoke, the City of Salem, the County of Roanoke, the Town of Vinton, and a stormwater mitigation grant from the Federal Emergency Management Agency.

The overall focus of the Regional Stormwater Management Plan was the implementation of policies and procedures for mitigation of floods in the Roanoke Valley. The plan focused on 16 major watersheds. To accomplish this task, the report includes components that are designed to assist jurisdictions in making decisions about stormwater management and related flooding.

Following hydraulic (HEC-2) and hydrologic (HEC-1) analysis of the 16 watersheds, development of flood profiles and floodplains, flood hazards in the study area were identified. Residential structures located in the floodplains were identified and a determination was made as to the cause of the flooding. Possible solutions to reduce or eliminate flooding at residential structures were screened to determine those that would reduce the severity of the flooding. Roads that were inundated by storms with a 10-year or more frequent recurrence interval were also identified.

The following section describes the 16 watersheds and vulnerability to flooding identified in the Roanoke Valley Regional Stormwater Management Plan.

Back Creek

Located in Southeast Roanoke County, the Back Creek watershed encompasses a 58.7 square mile drainage basin that originates in the Blue Ridge Mountains on Poor Mountain at an elevation of 3,600 feet above sea level. It flows in a northeasterly direction for about 25 miles until it joins the Roanoke River near the borders of Roanoke, Bedford, and Franklin Counties.

Flooding problems along Back Creek (running west to east through southern Roanoke County), Martins Creek (southwest Roanoke County along Rt. 696), Little Back Creek (southwest Roanoke County along Rt. 695 and Rt. 221) and Back Creek Tributaries A & B (southern Roanoke County) were identified for flood events ranging from the 2-year recurrence interval to the 100-year recurrence interval storms. Buildings located in the floodplain were identified as well as overtopped roads.

On Back Creek, flooding is scattered throughout the length of the stream. Two areas that experience house flooding are between Merriman Road (southern Roanoke County along Rt. 613) and Coleman Road (Rt. 735) and between Cotton Hill Road (Rt. 688) and Old Mill Road (Rt. 752) in southern Roanoke County. The tributaries to Back Creek also experience scattered house flooding.

The Roanoke Valley Regional Stormwater Management Plan estimated that 165 houses in the watershed would be flooded by a 100-year storm event.

Barnhardt Creek

With an origin on Poor Mountain at 2,700 feet above sea level in southwestern Roanoke County, the Barnhardt Creek watershed is a 4.2 square mile drainage basin located in south central Roanoke County, southern Salem, and the southwestern portion of the City of Roanoke.

Flooding problems along Barnhardt Creek for both existing and developed land use conditions, were identified for flood events ranging from the 2-year recurrence interval to the 100-year recurrence interval storms. Buildings located in the floodplain were identified as well as overtopped roads.

The existing conditions 100-year storm floods about 30 homes along Barnhardt Creek including more than 20 that are inundated by a 10-year storm. One of the major flooding problems on Barnhardt Creek is upstream of Cravens Creek Road (located in the westernmost part of Roanoke City at the border with the City of Salem). Another is upstream of Electric Road - State Route 419 in the Farmingdale subdivision (located between Rt. 685 and Rt. 419 at the junction of Roanoke County, the City of Salem and City of Roanoke) along Lakemont Drive. The Meadow Creek subdivision located in southwest Roanoke County, also experiences house flooding both upstream and downstream of Meadow Creek Drive (off of Rt. 686).

The Roanoke Valley Regional Stormwater Management Plan estimated that 36 houses in the watershed would be flooded by a 100-year storm event

Butt Hollow Creek

Located wholly within central Roanoke County and the western portion of the City of Salem, Butt Hollow Creek watershed is a 2.7 square mile fan-shaped drainage basin. Butt Hollow Creek

originates on Fort Lewis Mountain at an elevation of 3,260 feet above sea level. It flows southeasterly for about three miles to its confluence with the Roanoke River.

Flooding problems along Butt Hollow Creek for both existing and developed land use conditions were identified for flood events ranging from the 2-year recurrence interval to the 100-year recurrence interval storms. Buildings located in the floodplain were identified as well as overtopped roads.

The existing conditions 100-year storm floods about 30 homes along Butt Hollow Creek including more than 10 that are also inundated by a 10-year storm. The major flooding problems on Butt Hollow Creek are at Routes 11/460 and Butt Hollow Road (Rt. 640) at the western corporate limits of the City of Salem.

The Roanoke Valley Regional Stormwater Management Plan estimated that 29 houses in the watershed would be flooded by a 100-year storm event.

Carvin Creek

The Carvin Creek watershed originates on Tinker Mountain in southeastern Botetourt County at an elevation of 3,200 feet above sea level. It flows in a northeasterly direction for about 3 miles to the Carvin Cove Reservoir, which is a public drinking water supply for the City of Roanoke. Located in northeast Roanoke County, northern City of Roanoke, and the western portion of Botetourt County, the Carvin Creek watershed is a 28 square mile fan-shaped drainage basin.

Flooding problems along Carvin Creek, West Fork Carvin Creek, and Deer Branch, for both existing and developed land use conditions, were identified for flood events ranging from the 2-year recurrence interval to the 100-year recurrence interval storms. Buildings located in the floodplain were identified as well as overtopped roads. Problems with debris blockage were also identified.

The major flooding problem in the Carvin Creek watershed is in the Sun Valley subdivision located on the main stem of Carvin Creek (Verndale Drive and Rt. 623 in northeastern Roanoke County). Approximately 100 houses are located in the 100-year floodplain including more than 25 that are inundated by a 10-year storm. Another problem in the Carvin Creek watershed is in the Summerdean subdivision in northeastern Roanoke County south of Rt. 11 where debris blockage problems at Plantation Road and Peyton Street increase the flood elevations enough to inundate several more houses. The major flooding problem on West Fork Carvin Creek is in the Captains Grove subdivision in Roanoke County (near the intersection of Rt. 623 and Rt. 11 / 220, just east of the Roanoke Regional Airport) where seven houses are located in the 100-year floodplain. On Deer Branch in northern Roanoke County near the intersection of Peters Creek Road and Williamson Road (Rt. 11), the worst flooding problem is on U.S. Route 11 just upstream of the confluence of Deer Branch with West Fork Carvin Creek. At this location U.S. Route 11 is flooded by the 2-year storm for approximately 1,000 feet of the road.

The Roanoke Valley Regional Stormwater Management Plan estimated that 160 houses in the watershed would be flooded by a 100-year storm event.

Cole Hollow Brook

From 3,020 feet above sea level on Fort Lewis Mountain, Cole Hollow Brook flows southwesterly and then southeasterly for about 4 miles until its confluence with the Roanoke River in Salem. The Cole Hollow Brook watershed is a 5.9 square mile drainage basin. This oblong watershed is located primarily in Roanoke County (paralleling Rt. 618), but the southern portion is in the City of Salem at Rt. 618 and Rt. 11.

Flooding problems along Cole Hollow Brook for both existing and developed land use conditions, were identified for flood events ranging from the 2-year recurrence interval to the 100-year recurrence interval storms. Buildings located in the floodplain were identified as well as overtopped roads.

The existing conditions 100-year storm floods about 45 buildings/homes in west Salem along Cole Hollow Brook including more than 10 that are inundated by a 10-year storm. One of the major flooding problems on Cole Hollow Brook is upstream of West Main Street in the City of Salem at Horner Lane. Another is downstream of Interstate 81 in the Mitchell subdivision in west Salem along Windsor Avenue.

The Roanoke Valley Regional Stormwater Management Plan estimated that 43 houses in the watershed would be flooded by a 100-year storm event.

Dry Branch

Lying within Roanoke County and the City of Salem, the Dry Branch watershed is a 4.5 square mile drainage basin located primarily in north central Roanoke County that parallels Rt. 619 and 733. The southern portion of the watershed is in northern Salem. With a width of about two miles near its center, the watershed is fan shaped and has a length of 4.5 miles.

Flooding problems along Dry Branch for both existing and developed land use conditions, were identified for flood events ranging from the 2-year recurrence interval to the 100-year recurrence interval storms. Buildings located in the floodplain were identified as well as overtopped roads. The major flooding problems on are in the Hockman Subdivision at Dry Branch's crossing of East Main Street (Rt. 11) and Burwell Street and at the Cameron Court subdivision at Dry Branch's crossing of Carrollton Avenue in Salem.

The Roanoke Valley Regional Stormwater Management Plan estimated that 149 houses in the watershed would be flooded by a 100-year storm event.

Gish Branch

Originating on Fort Lewis Mountain in north Roanoke County, the Gish Branch watershed descends from 3,080 feet above sea level. It flows in a southeasterly direction for about 3.5 miles until its confluence with Mason Creek in the City of Salem. Gish Branch lays wholly within north central Roanoke County and the north central portion of the City of Salem.

Flooding problems along Gish Branch for both existing and developed land use conditions were identified for flood events ranging from the 2-year recurrence interval to the 100-year recurrence interval storms. Buildings located in the floodplain were identified as well as overtopped roads.

The existing conditions 100-year storm floods about 11 homes along Gish Branch on North Mill Road (Rt. 631) including more than 8 that are inundated by a 10-year storm. One of the major flooding problems on Gish Branch is upstream of Kessler Mill Road (Rt. 630) in east Salem where several homes and a commercial building are inundated by a 10-year storm.

The Roanoke Valley Regional Stormwater Management Plan estimated that 12 houses in the watershed would be flooded by a 100-year storm event.

Glade Creek

The Glade Creek watershed is a 33 square mile drainage basin located in northeast Roanoke County, northeast City of Roanoke, and northwest Vinton with the northern portion of the watershed located in Botetourt County. Glade Creek originates in the Blue Ridge Mountains near Curry Gap at an elevation of 2,500 feet above sea level. It flows in a southwesterly direction for about 11 miles to its confluence with Tinker Creek at the border of the City of Roanoke and Vinton.

Flooding problems for both existing and developed land use conditions along Glade Creek, Cook Creek, and Glade Creek Tributaries A and B, were identified for flood events ranging from the 2-year recurrence interval to the 100-year recurrence interval storms. Buildings located in the floodplain were identified as well as overtopped roads. Problems with debris blockage were also identified.

The major flooding problem on Glade Creek is in the Town of Vinton upstream of the confluence of Glade Creek with Tinker Creek. From just upstream of Gus W. Nicks Boulevard to the confluence there are approximately 100 houses in the developed conditions (Year 2020) 100-year floodplain and 50 of which are inundated by the 10-year storm in the Town of Vinton. The May 1985, Feasibility Study by Camp Dresser and McKee states that the intersection of Walnut Avenue and Fifth Street located near the confluence of Glade Creek with Tinker Creek is the most severe flooding problem in the Town of Vinton.

The Roanoke Valley Regional Stormwater Management Plan estimated that 122 houses in the watershed would be flooded by a 100-year storm event.

Lick Run

The Lick Run watershed is located primarily in north central City of Roanoke with the northern portion in north central Roanoke County. It is a 7.8 square mile drainage basin that is narrow and has a maximum width of about two miles near its mouth. It is approximately 5.5 miles long. Lick Run originates at the interchange of Interstate 81 and Route 11 at an elevation of approximately 1,200 feet above sea level. Lick Run flows in a southeasterly direction for about 7.5 miles until its confluence with Tinker Creek immediately north of Norfolk Avenue and the Norfolk Southern Railyard.

Much of the central business district of Roanoke is subject to flooding by Lick Run. The Williamson Road area has exhibited some of the most severe and continuing local flooding problems in the City of Roanoke. Areas upstream of Washington Park (Lick Run north of Orange Avenue) have also been subject to flooding. High water marks along Lick Run were used by the consultants to verify the computed flood elevations

Flooding problems along Lick Run and Trout Run, for both existing and developed land use conditions, were identified for flood events ranging from the 2-year recurrence interval to the 100-year recurrence interval storms. Buildings located in the floodplain were identified as well as overtopped roads. Problems with debris blockage were also identified.

The major flooding problem in the Lick Run watershed is overland flooding of residential neighborhoods (10th Street, Norris Drive and Andrews Road) and the central business district along Lick Run and Trout Run in the City of Roanoke where both streams are contained underground in the storm sewer system for the City of Roanoke.

The Roanoke Valley Regional Stormwater Management Plan estimated that 207 houses in the watershed would be flooded by a 100-year storm event.

Mason Creek

Originating at an elevation of 3,260 feet above sea level on Fort Lewis Mountain in northern Roanoke County near Big Bear Rock Gap, the Mason Creek watershed is a 29.6 square mile drainage basin. It includes the Gish Branch watershed and is in north central Roanoke County, eastern Salem, and western City of Roanoke. The watershed is fan-shaped and has a length of about 8.5 miles and a maximum width of 9 miles near its headwaters. From Fort Lewis Mountain, Mason Creek flows northeasterly for about seven miles to Mason Cove where it turns and flows southeasterly 7.5 miles to its confluence with the Roanoke River in the City of Salem.

Flooding problems along Mason Creek and Jumping Run Creek, for both existing and developed land use conditions, were identified for flood events ranging from the 2-year recurrence interval to the 100-year recurrence interval storms. Buildings located in the floodplain were identified as well as overtopped roads. Problems with debris blockage were also identified.

In the downstream portion of Mason Creek, the major flooding problems are at two trailer parks, the Salem Village Trailer Park (south of the intersection of Rt. 460 and Kessler Mill Road in Salem) and a trailer park located along Schrader Street in eastern Salem, south of the Salem Turnpike (Rt. 460). These trailer parks are subject to flooding in the 2-year storm. Another major problem in the Mason Creek watershed is in the vicinity of East Main Street where several buildings and houses are inundated by a 10-year storm including the Lakeside Plaza Shopping Center. Other areas subject to flooding include North Electric Road to Janee Drive (north of Interstate 81), Janee Drive to Carvins Cove Road, Carvins Cove Road to Catawba Valley Road, and Catawba Valley Road to Plunkett Road (all sections parallel Mason Creek and Kessler Mill Road from the City of Salem and then north along Catawba Road, Rt. 311, into Roanoke County).

The Roanoke Valley Regional Stormwater Management Plan estimated that 519 houses in the watershed would be flooded by a 100-year storm event.

Mud Lick Creek

Mudlick Creek watershed is a 9.6 square mile drainage basin. It is located in east central Roanoke County and southeast City of Roanoke. The watershed is fan shaped with a length of about 4.5 miles and a maximum width of 3.5 miles near its headwaters. Mudlick Creek flows northeasterly for about 4.5 miles until its confluence with the Roanoke River in Roanoke.

Flooding problems along Mudlick Creek for both existing and developed land use conditions, were identified for flood events ranging from the 2-year recurrence interval to the 100-year recurrence interval. Buildings located in the floodplain were identified as well as overtopped roads.

There are several areas of house flooding on Mudlick Creek which are scattered along the stream. The major flooding areas on Mudlick Creek are located downstream of Brandon Avenue in the western part of Roanoke City, downstream of Grandin Road (Rt. 11) in the Westhampton/Rosalind Hills subdivisions (Brandon Avenue and Langdon Road in Roanoke City) and along South Park Circle in the Southwoods subdivision (northwest of the intersection of Garst Mill Road and Halevan Road in Roanoke County). There are approximately 60 houses in the 100-year floodplain of Mudlick Creek of which 40 are also inundated by the 10-year storm.

The Roanoke Valley Regional Stormwater Management Plan estimated that 60 houses in the watershed would be flooded by a 100-year storm event.

Murray Run

The Murray Run watershed lies wholly within Roanoke County and the City of Roanoke. It is an oblong shaped watershed consisting of a 2.9 square mile drainage basin located in south central Roanoke County and southeast City of Roanoke. Originating from nearly 1,400 feet

above sea level just south of Roanoke and north of Starkey Road, Murray Run flows northeasterly for about four miles to its confluence with the Roanoke River in Roanoke.

Flooding problems along Murray Run for both existing and developed land use conditions were identified for flood events ranging from the 2-year recurrence interval to the 100-year recurrence interval storms. Buildings located in the floodplain were identified as well as overtopped roads.

One of the major flooding problems on Murray Run is upstream of Brandon Avenue in the City of Roanoke along Ross Lane where 17 houses are in the 100-year floodplain including 13 that are inundated by a 10-year storm. Another is located both upstream and downstream of West Road in the Lakewood subdivision in the City of Roanoke where 12 houses are in the 100-year floodplain including 10 that are inundated by a 10-year storm. Several of the Pebble Creek Apartments (Circle Brook Drive in Roanoke County) located upstream of Ogden Road are also located in the 10 and 100-year floodplain. Upstream of Crawford Road near its intersection with Janney Lane in the Green Valley subdivision in Roanoke County, five houses are flooded by a 100-year storm and four of these are also flooded by a 10-year storm.

The Roanoke Valley Regional Stormwater Management Plan estimated that 52 houses in the watershed would be flooded by a 100-year storm event.

Ore Branch

With an origin near Chestnut Ridge south of Roanoke, the Ore Branch watershed begins at an elevation of almost 1,700 feet above sea level. From Chestnut Ridge, it flows northeasterly for about 2.5 miles along Route 220 in Roanoke County and Franklin Road in the City of Roanoke to its confluence with the Roanoke River at Wiley Drive in the City of Roanoke.

Flooding problems along Ore Branch for both existing and developed land use conditions were identified for flood events ranging from the 2-year recurrence interval to the 100-year recurrence interval storms. Buildings located in the floodplain were identified as well as overtopped roads. The major flooding problem in the Ore Branch watershed is downstream of the Cycle Systems recycling yard near the confluence of Ore Branch with the Roanoke River at Wonju Street and Franklin Road in the City of Roanoke. This area is heavily developed with commercial and industrial buildings.

The Roanoke Valley Regional Stormwater Management Plan estimated that 62 houses in the watershed would be flooded by a 100-year storm event.

Peters Creek

The Peters Creek watershed originates at an elevation of 2,380 feet above sea level on Brushy Mountain in Roanoke County. This nine square mile drainage basin is in central Roanoke County, northwest City of Roanoke, and northeast Salem. The watershed has a length of about

six miles and a maximum width of two miles near the center. From Brushy Mountain, it flows southeasterly for about six miles to its confluence with the Roanoke River in Roanoke.

Flooding problems along Peters Creek and Peters Creek Tributaries A, B and C were identified for flood events. ranging from the 2-year recurrence interval to the 100-year recurrence interval storms. Buildings located in the floodplain were identified as well as overtopped roads. The major flooding problem in the Peters Creek watershed are upstream of Westside Boulevard (near Rolling Hill Avenue), downstream of Westside Boulevard (Laurel Ridge Apartments at Westside and Shenandoah Avenue), upstream of Melrose Avenue (intersection of Melrose and Peters Creek Road in the City of Roanoke) and near Northwood Drive (including Bermuda Road and Laura Road) in the City of Roanoke. All the Peters Creek watershed streams have adjacent scattered buildings and residences subject to flooding. Several specific areas for concern within the Peters Creek watershed in the City of Roanoke are: Westside Boulevard to Shenandoah Avenue, Shenandoah Avenue to Salem Turnpike in the Washington Heights region, Salem Turnpike to Melrose Avenue, Melrose Avenue to Peters Creek Road, Peters Creek Road to Shenandoah Bible College Access Road, Shenandoah Bible College Access Road to Peach Tree Drive, Peach Tree Drive to Northwood Drive, and Northwood Drive to Green Ridge Road.

The Roanoke Valley Regional Stormwater Management Plan estimated that 214 houses in the watershed would be flooded by a 100-year storm event.

Tinker Creek

Located in northeast Roanoke County, northeast City of Roanoke, northwest Vinton, and southeast Botetourt County, the Tinker Creek watershed is a 112 square mile drainage basin. Tinker Creek watershed originates at an elevation of 2,400 feet above sea level on Tinker Mountain near in Botetourt County, Virginia. It flows in a southerly direction about 11 miles until its confluence with the Roanoke River at the border between the City of Roanoke and Vinton.

Along Tinker Creek, the major flooding problem is located upstream of Dale Avenue (Rt. 24/364) near the confluence of Glade Creek on the boarder of the City of Roanoke and Town of Vinton. A substantial number of houses and buildings lie within the Tinker Creek floodplain. Some areas of specific concern in the City of Roanoke are: Mouth of Tinker Creek to Dale Avenue, Dale Avenue to Wise Avenue, Wise Avenue to Orange Avenue, Orange Avenue to 13th Street, 13th Street to Old Mountain Road, Old Mountain Road to Preston Avenue, Preston Avenue to the City limit. Areas of specific concern in the County of Roanoke are: the Roanoke City limit to Hollins Road, Hollins Road to Clearwater Avenue, Clearwater Avenue to Ardmore Avenue, and Ardmore Avenue to Williamson Road (at this point Tinker Creek is in Botetourt County and outside of the Stormwater Study).

The Roanoke Valley Regional Stormwater Management Plan estimated that 134 houses in the watershed would be flooded by a 100-year storm event.

Wolf Creek

Originating in the Blue Ridge Mountains at Stewart Knob at an elevation above sea level of 2,435 feet, the Wolf Creek watershed is a 4.9 square mile drainage basin. It is located in eastern Roanoke County and east Vinton. The watershed flows in a southeasterly direction for about 4 miles until its confluence with the Roanoke River in Vinton.

No significant areas of flooding were identified on Wolf Creek. Presently, the main risk associated with Wolf Creek is the overtopping of roadways by floodwaters. Three roadways are identified: Niagara Road is subject to 5-year storms, and Hardy Road and Mountain View Road are overtopped by 10-year storms. Flooding of these roadways prevents access to some residential areas.

The Roanoke Valley Regional Stormwater Management Plan estimated that there would not be any houses in the watershed flooded by a 100-year storm event.

The remaining localities in the Roanoke Valley-Alleghany Region have not performed studies as detailed as that of the Roanoke Valley Regional Stormwater Management Plan. For these areas, past studies performed by the USGS, FEMA and HUD were used in combination with GIS and FIRMs to document vulnerability to flooding.

3.5 Flood Prone Roadways

A flood prone roadway is defined as any public road that has a history of being covered by enough water in a manner that the road surface, markings and edges are not visible. Such conditions could be caused by stream/river flooding, poor drainage along roadways or normal surface runoff. Water on the roadway could be either standing or moving, and could also leave debris such as gravel, leaves and branches on the roadway.

About 40 percent of flood related deaths occur to people traveling in motor vehicles. Suddenly changing water depths, water currents and road damage make crossing a flooded roadway very dangerous for both motor vehicles and pedestrians. Rural areas are particularly vulnerable because roads are lightly traveled and often not closed to traffic as quickly as urban roadways.

The 2007 *Flood Prone Roadway Study* is an update and expansion of the Rural Flood Prone Roadway Study developed by the Fifth Planning District Commission in 1999. The Rural Flood Prone Roadway Study covered the portions of the region outside of the Roanoke Valley Area Transportation Planning Organization (RVATPO) study area. The 2007 Flood Prone Roadway Study includes the entire Roanoke Valley-Alleghany Regional Commission's service area except Franklin County which is not part of the Roanoke-Valley Alleghany Regional Pre-Disaster Mitigation Plan.

The purpose of this study was to identify, compile, and map flood prone roadways in the region and to provide information on how to mitigate the loss of life and property, especially as associated with flooded roadways in the region. In this study, a flood prone roadway is defined as any public road that has a history of being covered by enough water to render road surface, markings, and edges not visible to motor vehicle operators, bicyclists, and pedestrians. The flood prone roadways listed in this study include those identified as having a history of being flooded based on information from the Virginia Department of Transportation, National Weather Service, and/or local government staff.

There is little written documentation on flooded roadways in the region, and often the knowledge is distributed among the employees of several state and local organizations. A central and structured reporting and inventory system would provide better documentation on problem areas. By maintaining an inventory of flood prone roadways, officials will have documentation to help evaluate possible solutions to mitigate the impact of flooded roadways in the future. While some flooding from streams and runoff can be expected, standing water in roadways indicates improper drainage that should be remedied if the problem is reoccurring. While the blockage of regular traffic is mostly an inconvenience, emergency service personnel should have easy access to written documentation on flood prone roadways so that they can research alternate routes before emergencies occur. In some heavily affected areas, evacuation plans could be developed for larger flood events.

Table 45: Flood Prone Roadways Alleghany County

Road	Route	Description
Douthat Road	629	Just before the Buckhorn Store
Indian Draft Road	600	I-64 bridge
Indian Draft Road	600	Humpback Bridge
Rich Patch Road	616	Just below Rich Patch Union Church near the intersection of Routes 616 and 621(Roaring Run Road)
White Gap Road	623	About 2 miles from Route 616 at the creek intersection just past Bryant Farm
	634	Along the Cowpasture River below Sharon School

Source: Flood Prone Roadway Study, Roanoke Valley – Alleghany Regional Commission, 2007.

Table 46: Flood Prone Roadways Botetourt County

Road	Route	Description
Ball Park Road	685	South side of Craig Creek
Barger Drive	819	Confluence of Little Patterson Creek & Patterson Creek
Breckinridge Mill Road	600	Two miles west of Fincastle
Nace Road	640	Spec, Lithia, and Pico areas
Country Club Road	665	Intersection of SR 600 Haymakertown
Craig Creek Road	615	Several spots from the James River to Roaring Run
Craig Creek Road	615	Just west of Oriskany near Silent Dell, and at Roaring Run
Ellis Run Lane	644	Spec, Lithia, and Pico areas
Fringer Trail	645	Spec, Lithia, and Pico areas
Goode Lane	643	Spec, Lithia, and Pico areas
Greyledge Road	611	Several spots where Purgatory Creek crosses
Haymakertown Road	600	Intersection of 665 near Haymakertown
Jennings Creek Road	614	From Arcadia to the dead end
Lake Catherine Drive	649	Four miles northwest of Buchanan
Lapsley Run Road	726	James River to the intersection with SR 687
Lee Highway	US 11	Near intersection with Hardbarger Road (Route 636)
Middle Creek Road	618	Middle Creek
Middle Creek Road	620	Middle Creek
Mt. Joy Road	625	Near intersection with Park Vista Drive
Patterson Trail	683	To US 220
Plank Road	610	Near I-81 in the extreme northeast portion of the county
Poor Farm Road	681	Between SR 679 and 630 just northeast of Fincastle
Pulaski Mine Road	689	Spec, Lithia, and Pico areas
Springwood Road	630	Between Timber Ridge Road (635) and Thrasher Road (625)
Sugar Tree Hollow	684	Area adjacent to Little Patterson Creek
Tinker Mill Road	674	Daleville area 0.5 miles west of US 220
Willowbrook Lane	US 460	Glade Creek near Willow Brook Mobile Home Park

Source: Flood Prone Roadway Study, Roanoke Valley – Alleghany Regional Commission, 2007.

Table 47: Flood Prone Roadways Town of Clifton Forge

Route	Description
Commercial Street	Upper end in an area referred to as "Neddleton Addition"
Rose Street	Small bridge above the 900 Block
Rose Street	Parking lot bordering Dry Creek
West Main Street	Downtown area

Source: Flood Prone Roadway Study, Roanoke Valley – Alleghany Regional Commission, 2007.

Table 48: Flood Prone Roadways City of Covington

Route	Description
Court Street	Downtown area
Dalton Avenue	Sunnydale area
Dry Run Road	North Alleghany Drive to Hillcrest Drive
Gilliam Street	Rayon View area
Gordon Street	Parrish Court Avenue
Gum Avenue	Rayon View area
Lyman Avenue	Sunnydale area
Maple Avenue	Downtown area
Marshall Street	Idlewilde area
Michigan Avenue	Idlewilde area
North Alleghany Drive	Dry Run to Hillcrest Drive
North Craig Avenue	Downtown area
North Lexington Avenue	Downtown area
Parrish Court Avenue	Parrish St, Phillip St, Gordon St
Parrish Street	Parrish Court Avenue
Phillip Street	Parrish Court Avenue
Plum Street	Rayon View area
Riverside Avenue	Downtown area
Royal Avenue	Downtown area
South Carpenter Drive	Idlewilde area
SR 18	Bridge over Jackson River
Trout Street	Idlewilde area
West Chestnut Street	Downtown area
West Jackson Street	Lower end
Wood Street	Rayon View area

Source: Flood Prone Roadway Study, Roanoke Valley – Alleghany Regional Commission, 2007.

Table 49: Flood Prone Roadways Craig County

Route	Description
311	Broad Run bridge - confluence of Craig Creek and Broad Run approximately three miles south of New Castle
611	Portions along Craig Creek
612	Craig Creek
614	Low water bridge
614	Intersection of Route 681
618	From about 0.75 miles north of Route 311to 4 miles north.
623	About 4 miles southwest of New Castle
627	One mile southeast of the town of Simmonsville at a low water bridge
647	Near the end of state maintenance
651	About five miles southwest of Abbott
681	Intersection of Route 614

Source: Flood Prone Roadway Study, Roanoke Valley – Alleghany Regional Commission, 2007.

Table 50: Flood Prone Roadways City of Roanoke

Route	Description
10th Street	Intersection of Shadelawn Avenue
13th Street	Intersection with Eastern Avenue and Tinker Creek
Arbor Avenue	Riverview Area
Arbutus Avenue	Riverview Area
Baldwin Avenue	Intersection with Tuck Street
Bennington Street	Jamestown Area
Boulevard Street	Intersection with Salem Ave. (Shaffers Crossing)
Brambleton Avenue	Crossing of Murray Run Creek
Campbell Avenue	Near intersection of 10th Street
Cravens Creek Road	Intersection with Deyerle Road
Deyerle Road	Intersection with Valentine Road
Edgewood Street	Near intersection with Brandon Road
Franklin Road	Intersection with Brandon Road
Franklin Road	Intersection with Broadway Avenue
Jefferson Street	Intersection with Reserve Avenue
King Street	Intersection of Berkeley Ave and Richards Ave
Piedmont Street	Intersection with Hamilton Terrace
Wiley Drive	Various spots
Wise Avenue	Crossing of Tinker Creek

Source: Flood Prone Roadway Study, Roanoke Valley – Alleghany Regional Commission, 2007.

Table 51: Flood Prone Roadways Roanoke County

Road	Route	Description
Back Creek Road	676	Between US 220 and 615
Bandy Road	666	Middle Back Creek Bridge
Bandy Road	666	5000 Bandy Road
Barley Drive	646	Various spots near River
Bendermere Road	699	Masons Creek Bridge
Bent Mountain Road	US 221	Intersection of Twelve O'clock Knob Road (694)
Bottom Creek Lane	637	Various spots
Bottom Creek Road	607	1.5 miles west of intersection with Route 711
Bottom Creek Road	607	724 Bottom Creek Road
Bradshaw Road	622	Various spots near Creek
Carson Road	758	Near intersection with Lake Back O Beyond Dr.
Cartwright Road	1726	Near Crystal Creek
Carvins Cove Road	740	Bennet Springs to Carvins Cove
Carvins Cove Road	740	Above Carvins Cove reservoir near Bennett Springs
Clearwater Avenue	1861	Various spots near Creek
Coleman Road	735	Various points
Cotton Hill Road	688	West of Intersection with Route 613
Crawford Road	1736	400 block
Creekwood Drive	1124	Near intersection with Beaverbrook
Cresthill Drive	1658	Garst Mill Bridge
Dent Road	623	From Williamson Road to Brookside
Dutch Oven Road	863	Various spots near Creek
Electric Road	419	Near intersection with Cordell Dr
Electric Road	419	Intersection with McVitty Road
Electric Road	419	Ogden Road to Rt 220
Ferguson Valley Road	721	Various spots along Creek
Five Oaks Road	6512	Intersection with Bent Mountain Road
Florist Road	623	Near intersection with Verndale Drive
Garst Mill Road	682	Near Intersection with Halevan Road
Glade Creek Road	636	Near intersection with Bonsack Road
Grandin Road Extension	686	West of Meadow Creek Drive
Green Ridge Road	628	3000 Block of Green Ridge Road
Halevan Road	1361	At Garst Mill Park Road
Harwick Drive	769	Various spots
Hershberger Road	101	East of intersection with Plantation Road
Indian Head/Bohon Hollow Rd.	734	Various spots
John Richardson Road	743	Near Hershberger Dr. and Plantation Road
Keagy Road	685	4400 Keagy Road
Kessler Mill Road	630	Various spots
Lakemont Drive	1446	Various locations
LaMarre Drive	1815	Various spots near Creek
Little Bear Road	680	Various spots
Loch Haven Road	1894	2 miles east of Route 419

Road	Route	Description
McVitty Road	1662	Intersection with Castle Rock Rd
McVitty Road	1662	3100 McVitty Road
Merriman Road	613	Near Penn Forest Elementary
Ogden Road	681	At Pebble Creek
Old Mountain Road	864	Various spots near Creek
Palm Valley Road	1897	Sun Valley Subdivision
Plymouth Street	836	Near Brookside
Ran Lyn Drive	745	Near Intersection with South Roselawn
River Road		Various places near river
Rocky Road	744	635 Rocky Road
Shadwell Road	601	Near intersection of Ashton Rd. and Summerview
South Campus Drive	6081	Various spots near Creek
Starkey Road	904	At Back Creek Tributary B
Starlight Lane	615	Boones Chapel Rd. to Blue Ridge Parkway
Sugarloaf Mountain Road	692	Near Mud Lick Creek
Texas Hollow Road	641	Various spots
Tinsley Lane	711	Near intersection with Bottom Creek Road
Tree Top Camp Road	871	Various spots
Twelve O'clock Knob Road	694	Various locations
Verndale Drive	1867	Sun Valley Subdivision
West River Road	639	Various places
West Riverside Drive	639	Various spots near River
Willow Branch Road	677	Various spots near Creek
Wood Haven Road	628	Near intersection with Willow Creek Drive
Yellow Mountain Road	668	Near intersection with US 220

Source: Flood Prone Roadway Study, Roanoke Valley – Alleghany Regional Commission, 2007.

Table 52: Flood Prone Roadways City of Salem

Route	Description
Apperson Drive	Between Orchard Drive and Riverside
Colorado Street	Between Rowan Street and Riverside Dr
East Main Street	Intersection with Kessler Mill
East Riverside Drive	Between Apperson and McVitty
Electric Road	Near intersection with Apperson Drive
Epperly Lane	Kessler Mill Road to Terminus
Front Street	Between Riverside Drive and Riverside Dr
Horner Lane	Near Wildwood Road
Lancing Drive	Salem Ridge Apartments, aka Willow River
Mill Lane	Between W Main Street and Riverside Dr
Pine Bluff	Kessler Mill Road to Sycamore
River Side Drive	Apperson Drive to Colorado Street
Sycamore Drive	Pine Bluff to Terminus
Union Street	Between Fourth Street and Eddy Street
West Main Street	Intersection with Wildwood Road
West Main Street	Between Poplar Street and Turner Street
Wildwood Road	Intersection with West Main Street

Source: Flood Prone Roadway Study, Roanoke Valley – Alleghany Regional Commission, 2007.

Table 53: Flood Prone Roadways Town of Vinton

Road	Description
Hardy Road	Town of Vinton / Roanoke County CL
Virginia Avenue	Town of Vinton / City of Roanoke CL
Walnut Avenue	From 4th Street to 8th Street

Source: Flood Prone Roadway Study, Roanoke Valley – Alleghany Regional Commission, 2007.

3.6 Potential Flooding Due to Dam Failure

Flooding due to dam failure refers to a collapse, overtopping, breaching, 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. Intense storms may produce a flood in a few hours or even minutes from upstream locations. Dam failure may occur within hours of the first signs of breaching. Other failures and breeches can take much longer to occur, from days to weeks, as a result of debris jams or the accumulation of melting snow.

DCR's Division of Dam Safety and Floodplain Management administers the Virginia Dam Safety Program, under the authority of the Virginia Soil and Water Conservation Board. The dam safety division regulates impounding structures in the Commonwealth to ensure that they are "properly and safely constructed, maintained and operated." The regulations promulgated to achieve these ends are recorded in the Virginia Administrative Code. Ongoing dam inspections and Virginia's participation in the National Dam Safety Program maintained by FEMA and the U.S. 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 compliant with the National Flood Insurance Program regulations.

3.6.1 Dam Classifications

In 2001, Virginia's legislature broadened the definitions of "impounding structure" to bring more dams under regulatory oversight. On February 1, 2008, the Virginia Soil and Water Conservation Board approved major revisions to the Impounding Structure Regulations in the Virginia Administrative Code, changing the dam hazard potential classification system, modifying spillway requirements, requiring dam break inundation zone modeling, expanding emergency action plan requirements, and making a variety of other regulatory changes.

On June 28, 2018, the Virginia Soil and Water Conservation Board approved the initiation of a review of dam regulations as required under §§2.2-4007.1 and 2.2-4017 of the Code of Virginia and Executive Order 14 (2018). The review's purpose is to determine if the regulations should be repealed, amended or retained.

Dams are classified with a hazard potential depending on the downstream losses estimated in event of failure. The recent regulatory revisions (4VAC50-20-40) bring Virginia's classification system into alignment with the system already used in the National Inventory of Dams maintained by the U.S. Army Corps of Engineers. Hazard potential is not related to the structural integrity of a dam 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 the extent of emergency operations plans, are dependent upon the dam classification.

Table 54: Virginia Dam Classification System

Potential	Description	Inspection
High	Failure will cause probable loss of life or serious economic damage (to buildings, facilities, major roadways, etc.)	Annual, with inspection by a professional engineer every 2 years.
Significant	Failure may cause loss of human life or appreciable economic damage (to buildings, secondary roadways, etc.)	Annual, with inspection by a professional engineer every 3 years.
Low	Failure would result in no expected loss of human life, and cause no more than minimal economic damage	Annual, with inspection by a professional engineer every 6 years.

Source: Dam Safety and Floodplains Department, Virginia Department of Conservation and Recreation.

The owner of each regulated high, significant, or low hazard dam is required to apply to the board for an Operation and Maintenance Certificate. The application must include an assessment of the dam by a licensed professional, an Emergency Action Plan and the appropriate fee(s), submitted separately. An executed copy of the Emergency Action Plan or Emergency Preparedness Plan must be filed with the appropriate local emergency official and the Virginia Department of Emergency Management.

The Virginia Soil and Water Conservation Board (VSWCB) 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, the board may issue a Conditional Operation and Maintenance Certificate, during which time the dam owner is to correct the deficiency. After a dam is certified by the board, annual inspections are required either by a professional engineer or the dam owner, and the Annual Inspection Report is submitted to the regional dam safety engineer.

There are no comprehensive databases of historical dam failures or flooding following a dam failure in Virginia. Most failures occur due to lack of maintenance of dam facilities in combination with major precipitation events, such as hurricanes and thunderstorms.

Although flood inundation maps are a requirement of the current Impounding Structure Regulations, Virginia DCR does not currently have this information available in a digital form. Were these maps available, they would illustrate the probable area of flooding downstream of a dam in the event of failure.

In 1972, Congress authorized the U.S. Army Corps of Engineers to inventory dams located in the United States through the National Dam Inspection Act. The Water Resources Development Act of 1986 authorized USACE to maintain and periodically publish an updated National Inventory of Dams (NID). The Water Resources Development Act of 1996 re-authorized periodic

update of the NID by USACE and continued a funding mechanism. Most recently, the NID was reauthorized as part of the Water Resources Reform and Development Act of 2014.

The NID consists of dams meeting at least one of the following criteria;

1. High hazard potential classification - loss of human life is likely if the dam fails,
2. Significant hazard potential classification - no probable loss of human life but can cause economic loss, environmental damage, disruption of lifeline facilities, or impact other concerns,
3. Equal or exceed 25 feet in height and exceed 15 acre-feet in storage,
4. Equal or exceed 50 acre-feet storage and exceed 6 feet in height.

The goal of the NID is to include all dams in the United States that meet these criteria, however it is limited to information that can be gathered and properly interpreted with the given funding. The NID initially consisted of approximately 45,000 dams, which were gathered from extensive record searches and some feature extraction from aerial imagery. Since continued and methodical updates have been conducted, data collection has been focused on the most reliable data sources, which are the many federal and state government dam construction and regulation offices. In most cases, dams within the NID criteria are regulated (construction permit, inspection, and/or enforcement) by federal or state agencies, who have basic information on the dams within their jurisdiction.

Data for the NID is partially supplied by the Virginia Department of Conservation and Recreation's Dam Safety program and related Dam Safety Inventory System (DSIS). The DSIS application enables users to access information about all dams in Virginia that DCR tracks. Depending on the level of access granted, users may use DSIS to view, edit, download, upload and enter information related to the dams. Users with a "participant role" can even apply for key regulatory documents online. Those now having a participant role can apply for and submit certificates, permits, emergency plans and inspections. They may also update contact information and view dam details maintained by DCR. Any member of the public may also apply for read-only access to information about individual dams and sets of dams.

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, or from geotechnical or operational factors. The data and time necessary to perform a probabilistic failure analysis for each dam in the region is beyond the scope of this plan.

3.6.2 Identified Dam Deficiencies

Rainbow Forest Lake Dam

Rainbow Forest Recreation Association (RFRA) in Botetourt County was ordered to drain Rainbow Forest Lake by the Virginia Department of Conservation and Recreation in May 2011. The association must comply with required maintenance. The RFRA has been working with the

state to address concerns about the structure since 1997. Additional development has occurred downstream since the impoundment was built almost 50 years ago. RFRA did not have the funds (estimated at $300,000) to upgrade the dam to meet state standards. The state has designated the dam as high hazard meaning that if the dam failed there could be loss of life and property downstream.

Gathright Dam

In May 2009, the U.S. Army Corps of Engineers (USACE) inspected the Gathright Dam as part of Screening Portfolio Risk Analysis and routine inspections. Later in the year on September 2, the USACE assigned the dam a Safety Action Classification (DSAC) II which is defined as "Urgent (Unsafe or Potentially Unsafe)". The rating is attributed to concerns about possible increased seepage at the toe of the dam, and an undetermined flow rate at the river spring a quarter mile downstream, and potential flow channels through limestone below the spillway during pool events above 1,600 feet. Because of this rating, the USACE has implemented risk reduction measures which include increased monitoring, updating emergency operation plans and reducing the water level in the reservoir. As of early 2010, the USACE has reduced and continues to maintain the reservoir at an elevation of 1,562 ft above sea level compared to the normal level of 1,582 feet. Throughout 2010, the USACE conducted safety exercises with local/state officials, conduct a series of investigations on the dam, update inundation mapping and reevaluate the DSAC status. In November 2010, Lake Moomaw was restored to a level of 1,582 ft. and the DSAC will be reevaluated in the future.

Clifton Forge Dam

Clifton Forge Dam impounds a 12.5 square mile drainage area of Smith Creek with an 11.5-acre normal pool. The dam is classified as a High Hazard Dam by DCR and operates under a conditional 2-year, renewable, Operation and Maintenance Certificate. It has been issued an alteration permit by DCR that will be used during upgrades in 2018-19. A Dam Breach Inundation Zone Analysis was done in 2013 that showed a failure would impact 650 residential units, 1,400 people and downtown commercial, retail, public administration and infrastructure. An Emergency Action Plan was completed in 2014 and a preliminary engineering report for proposed improvements was done in 2016. Major improvements proposed include raising crest of non-overflow sections; raise concrete core wall and surrounding earthfill; seal a leaking concrete joint; remove spillway piers to expand spillway capacity; anchor the principal spillway; replace spillway bridge; and repair the deteriorated concrete face. The estimated cost for this work was approximately $4.3 million. The town worked with its consulting engineers to develop a funding package from USDA Rural Development in cooperation with Alleghany County. The proposed schedule anticipates construction to be complete by December 2019.

Johns Creek Watershed Dam #1 (McDaniel's Lake)

Craig County Board of Supervisors and Mountain Castles Soil and Water Conservation District own and operate the Johns Creek watershed Dam #1. Four floodwater-retarding structures were built in the Johns Creek Watershed between 1966 and 1967.

The dam has a drainage area of 12,241 acres and a normal pool surface area of 28 acres. It was designed to store runoff of 50-year storm. The dam was originally designed as "Significant" hazard and later reclassified to "High" hazard due to downstream development that was allowed to occur. The dam operates under a conditional Operation and Maintenance Certificate from DCR that expired in September 2018.

A breach inundation study for the dam was done in 2009 which concluded the dam is a High Hazard Potential dam. The study found 68 occupied structures and 16 bridges within the inundation zone below the dam. An additional study by URS Group completed in 2010 found the population at risk to be 150 people.

NRCS received funding for planning assistance for the dam in 2014. NRCS funding will provide 65% Federal Cost-Share for improvements and 100% of the cost of NRCS technical assistance for planning, design, contracting and construction. Planning and design underway with a final plan expected by April 2019.

Table 55: Inventory of Dams

Dam Name	Waterbody	Location (City/County)	Hazard Class	Dam Type	Size
Gathright Dam	Jackson River	Alleghany County	Unknown	Rockfill	S
Pond Lick Branch Dam	Pond Lick Branch, Potts Creek	Alleghany County	Low, Special	Earth	S
Clifton Forge Dam	Smith Creek	Alleghany County	High	Gravity	U
Landfill No. 2 Dam	Dunlap Creek	Alleghany County	High	Earth	L
Wright Dam	Dunlap Creek	Alleghany County	Unknown	Earth	S
Casteel Hunt Club Dam	Cast Steel Run, Jackson River	Alleghany County	Unknown	Earth	S
Hanna Dam	Jerrys Run, Dunlap Creek	Alleghany County	Unknown	Earth	S
Jeremy Thomas Dam	Smith Creek	Alleghany County	Unknown	Earth	S
West Virginia Pulp Dam B	Jackson River	Alleghany County	Unknown	Earth	S
West Virginia Pulp Dam A	Jackson River	Alleghany County	Unknown	Earth	S
Falling Creek Reservoir Dam	Falling Creek	Bedford County	High	Earth	S
Jetters Chapel Mountain Dam	Glade Creek / Tinker Creek	Bedford County	Unknown	Earth	S
Carvin Cove Dam	Carvins Creek	Botetourt County	High	Masonry	M
Orchard Lake Dam	Tinker Creek tributary	Botetourt County	Unknown	Earth	S
Rainbow Forest Dam	Laymantown Creek	Botetourt County	High	Earth	S
Blue Ridge Estates Dam	Laymantown Creek	Botetourt County	High	Earth	S
Botetourt Country Club Dam	Tinker Creek	Botetourt County	Unknown	Earth	S
Fairview Pond Dam	Tinker Creek / Buffalo Creek	Botetourt County	Unknown	Earth	U
Greenfield Lake Dam	Tinker Creek / Buffalo Creek	Botetourt County	Unknown	Earth	S
Greenwood Sediment Pond Dam	Tinker Creek / Glade Creek	Botetourt County	Unknown	Earth	S
Hancock Dam	Tinker Creek / Buffalo Creek	Botetourt County	Unknown	Earth	S
Wilburn Dam	Spec Mine Branch / Looney Creek	Botetourt County	Unknown	Earth	S
Goldberg Beaver Dam	Lick Run, James River	Botetourt County	Unknown	Earth	U
Roanoke Cement Holdings Dam	Catawba Creek	Botetourt County	Unknown	Earth	S
Stokes Dam	Catawba Creek / Town Branch	Botetourt County	Unknown	Earth	S
Lake Catherine Hunt Club Dam	Hickory Hollow / James River	Botetourt County	Unknown	Earth	S
Bayne Dam	Craig Creek / Roaring Run	Botetourt County	Unknown	Earth	S
Grandview Dam	Black Lick / James River	Botetourt County	Unknown	Earth	S
Atherholt Dam	Big Creek / James River	Botetourt County	Unknown	Earth	S

Dam Name	Waterbody	Location (City/County)	Hazard Class	Dam Type	Size
Deming Dam	Purgatory Creek	Botetourt County	Unknown	Earth	S
Johns Creek Dam #2	Johns Creek	Craig County	High	Earth	M
Johns Creek Dam #1	Little Oregon Creek / Johns Creek	Craig County	High	Earth	M
Johns Creek Dam #3	Mudlick Branch / Johns Creek	Craig County	High	Earth	U
Johns Creek Dam #4	Dicks Creek / Johns Creek	Craig County	High	Earth	U
Craig County Dam #5	Broad Run / Craig Creek	Craig County	Unknown		S
Craig County Dam #6	Potts Creek / Mill Branch	Craig County	Unknown		S
Craig County Dam #7	Barbours Creek / Wrights Branch	Craig County	Unknown		S
Niagara Dam	Roanoke River	Roanoke County	Unknown	Gravity	U
Loch Haven Lake Dam	Deer Branch Creek / Carvin Creek	Roanoke County	High	Gravity	S
Orchard Dam	Glade Creek	Roanoke County	Unknown	Earth	U
Clifford D. Craig Memorial Dam	Mill Branch / Roanoke River	Roanoke County	High	Concrete	L
Woods End Dam	Mud Lick Creek / Peters Creek	Roanoke County	High	Earth	S
Cotton Hills Dam	Back Creek	Roanoke County	Unknown	Earth	U
Amrhein Dam	Bottom Creek	Roanoke County	Unknown		S
Hudick Dam	Back Creek	Roanoke County	Unknown		S
Gustafson Dam	Roanoke River	Roanoke County	Unknown		S
Salem Stone Dam	Saw Mill Hollow	Roanoke County	Unknown		S
Lewis Jamison Dam	Barnhardt Creek	Roanoke County	Unknown		S
Charles Ray Cox Dam	Glade Creek	Roanoke County	Unknown		S
Roanoke College Dam	Dry Creek / Saw Mill Hollow	City of Salem	Unknown		S
Linda Howell Dam	Masons Creek	Roanoke County	Unknown		S
Windsor Lake Dam	Barnhardt Creek	City of Roanoke	High	Earth	S
Spring Valley Lake Dam	Roanoke River	City of Roanoke	High	Earth	S
City of Roanoke Dam #1	Roanoke River	City of Roanoke	Unknown		S
City of Roanoke Dam #2	Roanoke River	City of Roanoke	Unknown		S
Masons Mill Dam	Tinker Creek	City of Roanoke	Unknown	Masonry	S

Source: Virginia Dam Safety Inventory System, 2018 and City or Roanoke, 2019.

1. Rainbow Forest Lake was ordered by the VA Department of Conservation and Recreation to be drained by July 2011 due to concerns about the dam.

Dam sizes: Large - 50,000 ac. ft. or 100 ft. height; Medium - 1,000 to 50,000 ac. ft. or 40 to 100 ft. height; Small - 15 to 1,000 ac. ft. or 6 to 40 ft. height

References:

Gathright Dam Action Plan Update, U.S. Army Corps of Engineers, 2010.

Flood Prone Roadway Study, Roanoke Valley – Alleghany Regional Commission, 2007.

Dam Failure, FEMA, http://www.fema.gov/hazard/damfailure/index.shtm

National Inventory of Dams, Water Control Infrastructure, U.S. Army Corps of Engineers in cooperation with FEMA's National Dam Safety Program, 2003

Virginia Dam Safety Inventory System, 2018 https://consapps.dcr.virginia.gov/DSIS/#/dams

3.7 Hurricane

Since 1871, 123 hurricanes and tropical storms have affected Virginia taking 228 lives and costing the commonwealth over a billion dollars in damages. The eye of 69 tropical cyclones has tracked directly across Virginia. Eleven have made landfall on or close (within 60 miles) to the Virginia Coast. Virginia averages one hurricane a year. Some years go by with no storms while other years threaten the Commonwealth with multiple storms sometimes, just days or weeks apart. The planning region has not experienced any significant damage from hurricanes since the adoption of the previous plan.

The majority of hurricanes (61 percent) and tropical storms that have affected Virginia have originated in the Atlantic Ocean. The storm begins as a disturbance moving off the west coast of Africa near the Cape Verde Islands. It gains strength over the very warm equatorial waters. Twenty-six percent of the tropical cyclones that affect Virginia originate in the Caribbean waters and eight percent in the Gulf of Mexico. Three storms (2.5%) originated in the eastern Pacific. They traversed Central America into the Gulf of Mexico before moving northeast toward Virginia.

Hurricanes often spawn tornadoes across Mid-Atlantic region that have, at times, been strong and deadly. This century, 15 hurricanes, tropical storms or their remnants have spawned tornadoes in Virginia. Hurricane David in 1979 spawned 34 tornadoes, of which, eight were in Virginia. Tornadoes struck five counties and three cities from Norfolk in the southeast to near Leesburg in the far north. One person was killed, 25 were injured and damages were close to $14 million.

At this time NOAA, the National Weather Service and other agencies are unable to predict the occurrence and location of future hurricanes. Based on past events it is likely that hurricanes will continue to impact the Roanoke Valley - Alleghany Region in the future. The probability of an occurrence of a hurricane event has remained unchanged since the adoption of the 2013 Regional Pre-Disaster Mitigation Plan.

3.8 Karst

Karst and sinkholes were identified as a natural hazard of concern by the localities participating in the regional pre-disaster mitigation plan process due to the localized nature of hazards caused by sinkholes – typically impacting only one structure or a short section of road. Lack of adequate historical data on sinkhole hazard events and lack of complete, detailed mapping of karst/sinkholes also makes it difficult to determine the level of risk for these geologic features.

The areas at risk from karst in Virginia, as shown in Map 7, are primarily limited to the mountainous regions of the state. Because land subsidence caused by karst is very site-specific and often occurs in undeveloped areas, there is no existing long-term record for Virginia. There have not been any known karst events since the previous plan was adopted.

Table 56: Karst Areas

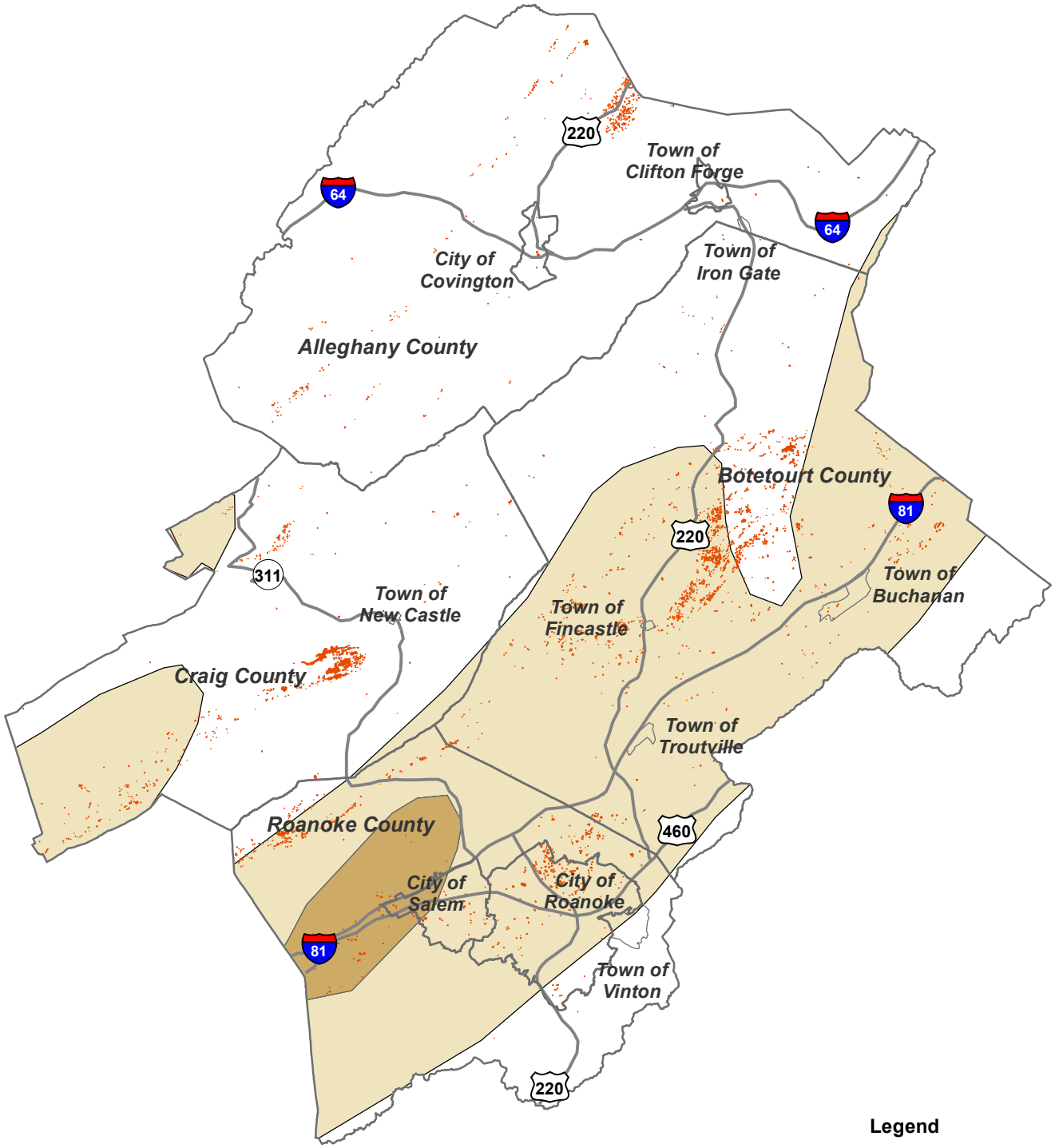
Locality	Estimated % Karst Terrain	Major Karst Development Areas
Alleghany County (incl. City of Covington, and Towns of Clifton Forge and Iron Gate)	30	Jackson River Valley Potts Creek Valley Warm Springs Valley
Botetourt County (incl. Towns of Buchanan, Fincastle and Troutville)	20	Catawba Creek Valley Timber Ridge
Craig County (incl. Town of New Castle)	30	Sinking Creek Valley Potts Creek Valley
Roanoke County (incl. cities of Roanoke and Salem and Town of Vinton)	20	Roanoke Valley Minor Valleys

Source: Virginia Speleological Survey, http://www.virginiacaves.org, 2005.

Localities should be aware of how environmentally sensitive karstlands can be. Sinkholes, in particular, pose several problems that ultimately affect groundwater in karstic terrain and delicate cave ecosystems. Environmental concerns included: (1) introduction of contaminants and pollutants into the groundwater, (2) catastrophic collapse and gradual subsidence of the land surface, and (3) flooding during or following intense storms.

Karst terrain, particularly that of moderate to high sinkhole density, thus imposes constraints on land use. Mismanagement of karstlands, whether through unsupervised development, poor farming practices, improper waste disposal, or other means, will often damage groundwater resources, cave ecosystems, or man-made structures built on karst.

Map 7: Karst and Sinkholes



Legend

Sinkholes

Karst Types

Fissures, tubes, and caves over 1,000 ft (300 m) long; 50 ft (15 m) to over 250 ft (75 m) vertical extent

No Karst

Scale 1:500,000

Source: Roanoke Valley-Alleghany Regional Commission, 2019, Virginia Department of Conservation and Recreation 2012, and Virginia Department of Mines, Minerals and Energy 2018.

In the report Natural Hazard Mitigation Planning for Karst Terrains in Virginia, the researcher found that despite an extensive amount of karst terrain in many communities in western Virginia, few communities use comprehensive land use planning and management approaches for development on karst terrain. A survey of local governments, conducted for the Cave Conservancy of the Virginias by the Urban Affairs and Planning Department at Virginia Tech in 2003, indicated that few communities in western Virginia have adopted land use planning and management tools to minimize karst terrain hazard risks. This statement is also true of the localities within the Roanoke Valley-Alleghany Regional Commission.

One of the first steps in the development of any natural hazard mitigation plan is the identification and mapping of natural hazards. Many jurisdictions identify karst features using 7-1/2 minute USGS topographic maps (map scale of 1:24,000 and a contour interval of 20-feet) and/or Natural Resource Conservation Service county soil surveys (map scales generally range from 1:12,000 to 1:63,360 (Natural Resources Conservation Service, 2003). Both of these map scales prove too large to correctly identify many karst features present on the landscape. The Virginia Department of Conservation and Recreation estimates that in some parts of Virginia standard 1:24,000 topographic maps show less than 50% of the karst features present on the landscape. For these reasons, a smaller, more detailed mapping scale is necessary for appropriate consideration of karst terrain hazards on individual parcels of land.

Localities within the RVARC should work with Virginia Karst Mapping Project, Virginia Speleological Survey, the USGS and other appropriate agencies to identify karst areas and sinkholes, maps these sites, and provide this information to local governments to use as a land use and natural hazards planning tool.

By combining karst GIS spatial and attribute data from state, regional, and local sources, including karst feature buffers and overlay areas, local governments could create a valuable natural hazard planning tool. *Natural Hazard Mitigation Planning for Karst Terrains in Virginia* recommends that including GIS data for abandoned wells, active wells and springs, septic systems, source water protection boundaries, hazardous waste storage sites, ground water dye tracings, streams, etc. to enhance this planning tool.

The four-step planning process proposed in *Natural Hazard Mitigation Planning for Karst Terrains in Virginia*, serves as an example for local governments to follow in the development of local karst hazard mitigation plans. The process starts with community education and partnership building to develop community support and commitment for the subsequent steps in the planning process. The karst terrain risk assessment and vulnerability analysis clarify the hazards that local karst terrain poses to a community. In the final two steps, local governments develop both regulatory and non-regulatory mitigation strategies to minimize community exposure to local karst terrain natural hazards. By using a karst terrain buffer and overlay hierarchy local governments can target regulatory and non-regulatory mitigation strategies to those karst areas that pose the highest natural hazard risks.

Karst Hazard Mitigation Planning

I. Community Education and Partnership Building
II. Karst Terrain Hazard Assessment
    A. Develop a karst feature classification system
    B. Develop a karst buffer and overlay hierarchy system
    C. Develop geographic information system capabilities for karst terrain hazard planning
III. Develop Regulatory Karst Terrain Hazard Mitigation Strategies
    A. Update the subdivision ordinance to reflect community goals and objectives for development on karst terrain
    B. Develop a karst terrain zoning overlay district requiring:
        i. effective karst feature buffers
        ii. geotechnical studies for development on karst terrain
        iii. karst terrain related performance standards
    C. Enforce Virginia stormwater management regulations
    D. Enforce Virginia erosion and sediment control regulations
    E. Enhance Virginia septic system regulations to better address the unique geo-hydrology of karst terrain
    F. Develop spring and wellhead protection policies that reflect the unique geo-hydrology of karst terrain
IV. Develop Non-Regulatory Karst Terrain Hazard Mitigation Strategies
    A. Use capital improvements programming to steer development away from high-risk karst terrain
    B. Encourage voluntary land use restrictions in karst terrains through the use of:
        i. Conservation easements
        ii. Purchase of development rights
        iii. Agricultural and forestal districts
        iv. Land use assessment and taxation programs

Source: Natural Hazard Mitigation Planning For Karst Terrains in Virginia, B. P. Belo, 2003.

References:

Natural Hazard Mitigation Planning for Karst Terrains in Virginia, Bradley Paul Belo, 2003.

Virginia Speleological Survey, Project Areas, http://www.virginiacaves.org, 2005.

Living on Karst: A Reference Guide for Landowners in Limestone Regions, Cave Conservancy of the Virginias, 1997.

Living with Sinkholes, Virginia Cave Board, Virginia Department of Conservation and Recreation.

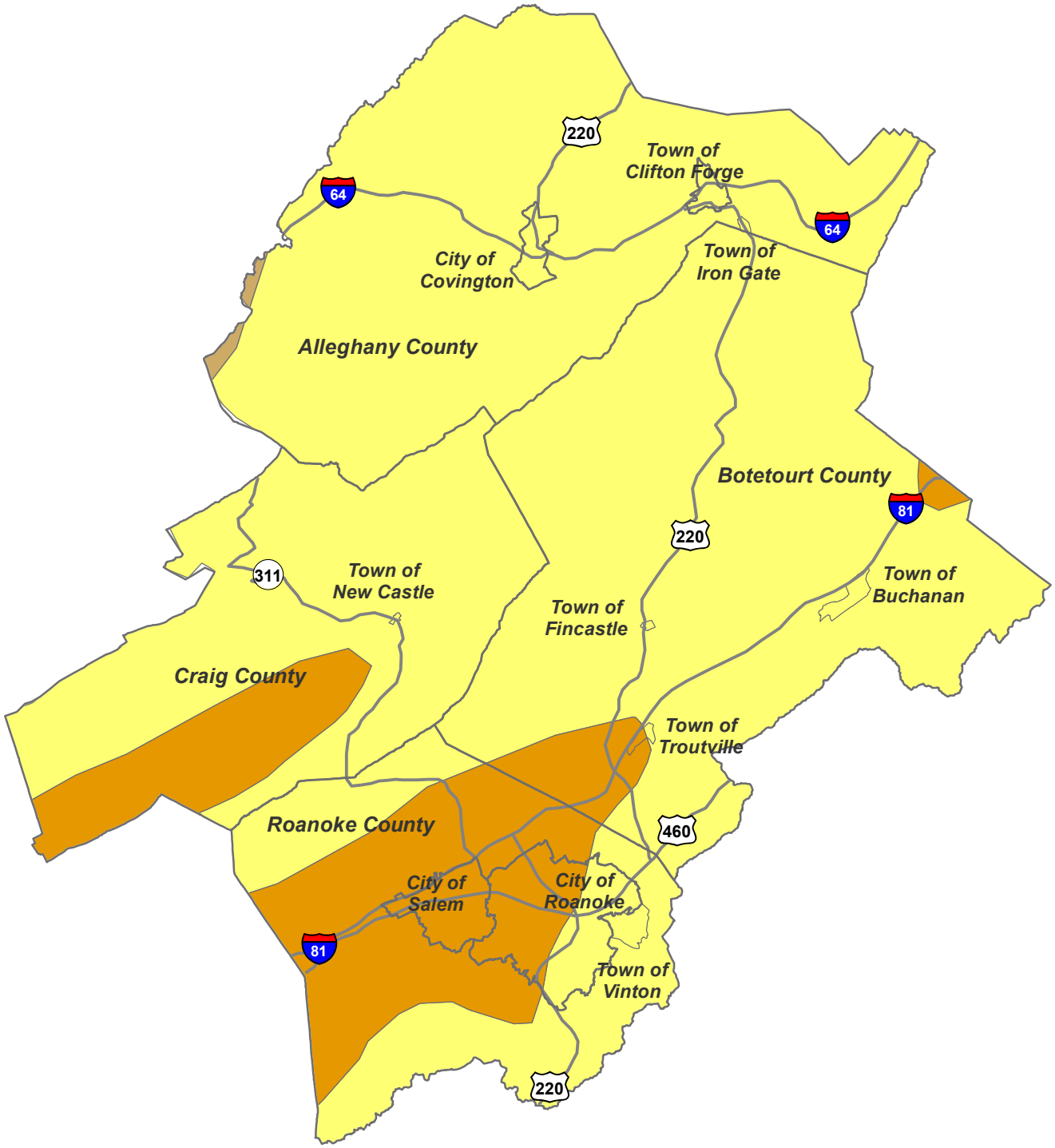
Interactive Geologic Map, Division of Geology and Mineral Resources, Virginia Department of Mines, Minerals, and Energy, 2018.

3.10 Landslide

All 50 states and the U.S. Territories experience landslides and other ground failure problems; 36 states have moderate to highly severe landslide hazards. The greatest landslide damage occurs in the Appalachian, Rocky Mountain, and Pacific Coast regions and Puerto Rico.

The Blue Ridge region of Virginia has experienced landslides throughout its history. Boulders, uprooted trees and tallis are all evidence of these events that can be found throughout the region. Records show that landslides and debris flows in the Appalachian Mountains occur when unusually heavy rain from hurricanes and intense storms soaks the ground, reducing the ability of steep slopes to resist the downslope pull of gravity. Scientists have documented 51 historical debris-flow events between 1844 and 1985 in the Appalachians – most of them in the Blue Ridge region. (Debris Flow Hazards in the Blue Ridge of Virginia, USGS Fact Sheet 159-96P. L. Gori and W. C. Burton, 1996). There have been no known significant landslide events since the previous plan was adopted.

Map 8: Landslide Susceptibility



Scale 1:500,000

Legend

- High Susceptibility
- Moderate Susceptibility
- Low Susceptibility

Source: Roanoke Valley-Alleghany Regional Commission, 2019,

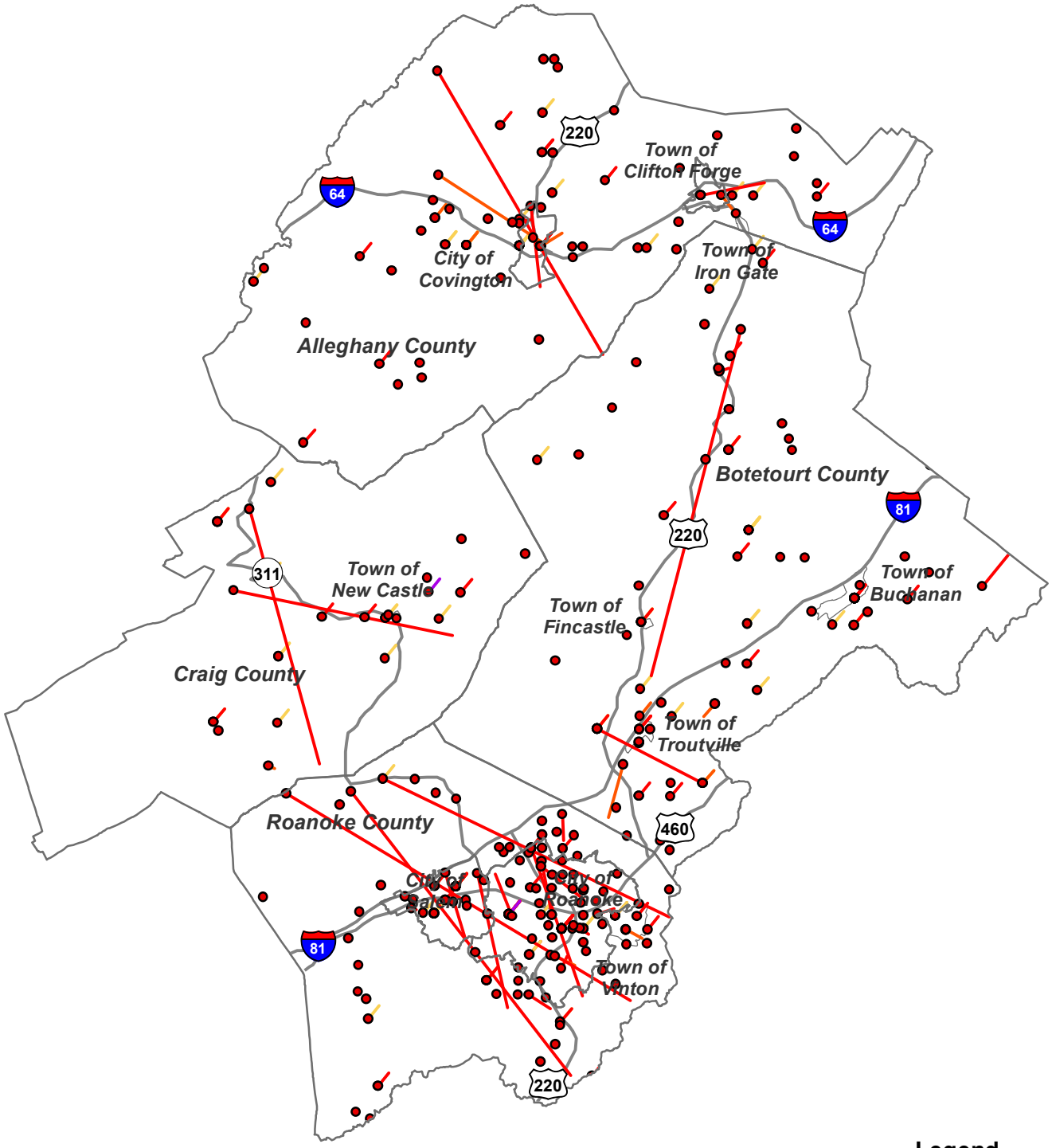
3.11 Straight-Line Wind

Damaging wind events can develop with little advanced warning and straight-line wind events can occur anywhere in the planning region. People outside may not have access to warning information, so boaters and campers are very susceptible. Those in cars and trucks also are vulnerable to being hit by falling trees and utility poles. High profile vehicles such as semi-trailer trucks, buses, and sport utility vehicles may be blown over. At outside events such as fairs and festivals, people may be killed or injured by collapsing tents and flying debris. Typical impacts from straight line winds include damage to roofs, siding, and carports from winds as well as damage caused by falling trees to buildings and electric power lines. Even those indoors may be at risk for death or injury. Mobile homes, in particular, may be overturned or destroyed, while barns and similar buildings can collapse. People inside homes, businesses, and schools are sometimes victims of falling trees and branches that crash through walls and roofs; they also may be injured by flying glass from broken windows or structural damage to the building itself.

According to the State HIRA, tropical weather patterns are the source of the strongest winds to impact most jurisdictions. While stronger winds may occasionally occur due to thunderstorm events, or as a result of local topographic conditions, sources of information on the probability and impact of these winds are not as well-developed as the sources of information related to hurricanes. Therefore, the probabilistic models of hurricane wind speeds were used for an analysis of the non-rotational wind hazard in the State HIRA.

The Straight-Line Winds hazard was added to the Regional Pre-Disaster Mitigation Plan during the 2012 update of the document based on past occurrences and potential future impacts from this type of weather event.

Map 9: Straight Line Wind Events



Scale 1:500,000

Source: Roanoke Valley-Alleghany Regional Commission, 2019,
NOAA Storm Prediction Center, 2019.

3.12 Tornado

A number of factors were considered in the tornado risk assessment map to be able to compare between jurisdictions and hazards. The risk in the planning region ranges from in Craig County and the Alleghany Highlands to medium high in the City of Roanoke and Roanoke County. Factors were combined to come up with the overall total ranking for each hazard for the State HIRA. Some factors were weighted based on input from the State HIRA sub-committee. Weighting factors are: Population Vulnerability & Density 0.5 weighting; Injuries & Deaths 1.0 weighting; Crop & Property Damage 1.0 weighting; Annualized Events 1.0 weighting; and Geographic Extent 1.5 weighting.

3.13 Wildfire

In order to determine the base hazard factor of specific wildfire hazard sites and interface regions between structures and forest, the following factors must be considered: topographic location, site/building construction and design, fuel profile, defensible space, accessibility, and water availability.

The Department of Forestry utilizes a Geographic Information System (GIS) - based Wildfire Risk Assessment of the entire state. Agency Firewise Specialists are now actively working to better assess the level of wildfire risk for the more than 4,000 individuals at risk in Wildland Urban Interface communities identified in the Commonwealth, however, this is only the first step in the process. Once communities have been visited and assessed for their level of wildfire risk, positive actions need to be taken to help reduce or mitigate the hazards identified.

3.13.1 Wildfire Risk

Using GIS, the Virginia Department of Forestry has recently identified areas of high, medium and low risk from wildfire. The Wildfire Risk Assessment Map illustrates these areas on a regional level.

VDOF has developed the Wildfire Risk Assessment to more objectively reflect the potential for wildfire across Virginia. By building a GIS model that assigns relative weights and ranks to input layers, VDOF has produced a map of Wildfire Risk that will help the agency perform community Firewise outreach, better allocate resources, and increase response preparedness. Input layers include slope, slope aspect, landcover, distance to railroads, distance to roads, population density, and historical fire occurrence. Maps of the model output were sent to each DOF field office for verification. Changes were made to the model weights to better reflect the conditions at the local scale. This Wildfire Risk Assessment is meant to be used at county or regional scales; it is not as reliable at the site scale.

The information in the analysis and the GIS is provided by the Virginia Department of Forestry with the understanding that it is not guaranteed to be correct or complete and conclusions

drawn from such information are the sole responsibility of the user. While the Virginia Department of Forestry has attempted to ensure that this documentation is accurate and reliable, DOF does not assume liability for any damages caused by inaccuracies in these data or documentation, or as a result of the failure of the data or software to function in a particular manner. DOF makes no warranty, express or implied, as to the accuracy, completeness, or utility of this information, nor does the fact of distribution constitute a warranty. For more detailed information about modeling methodology, go to the GIS Data Downloads page and read the Info file (metadata) for the Wildfire Risk Assessment at the Virginia Department of Forestry at http://www.dof.virginia.gov/gis/dwnld-Statewide-faq.shtml.

Risk is defined as the probability of an event occurring. The wildfire hazard-risk assessment consists of six inputs described above. These six inputs are weighted according to their importance and geographical location (coastal plain, piedmont and mountain regions). For example, homes within or adjacent to wildland fuels and in areas of high fire occurrence, on steep slopes may have a higher risk of burning. Homes that are not located near wildland fuels, in areas of low fire occurrence and in relatively flat terrain may have a low risk of burning. State, county and local governments or communities need to know where their high-risk areas are, the factors that make those areas at risk and what can be done to mitigate this risk.

The areas at greatest risk for forest fire are those at the urban-wildland interface, or where people and forests meet. A wildfire mitigation project is currently underway that will update and refine the wildfire risk analysis described above. Another goal of this project is to improve decision-making capabilities for fire suppression and prevention activities by adding to the GIS database. Data are being collected on locations and attributes of wildfire suppression resources, woodland home communities, and historical fire incidents. Understanding the spatial relationship of these and other features will help VDOF concentrate their prevention education, resource allocation, and emergency response efforts where fire poses the greatest risk.

3.13.2 Model Inputs and Analysis Development

Due to the importance wildfire risk in the region and the need for local governments and citizens to have a better understanding of this risk, a detailed description of the Virginia Department of Forestry’s model inputs and analysis development is described below.

The Virginia Department of Forestry used GIS to develop a statewide spatial Wildfire Risk Assessment model that aims to: (1) identify areas where conditions are more conducive and favorable to wildfire occurrence and wildfire advancement; (2) identify areas that require closer scrutiny at larger scales; and (3) examine the spatial relationships between areas of relatively high risk and other geographic features of concern such as woodland home communities, fire stations and fire hydrants. This model incorporates data from several other state and federal agencies including land cover, demographics, transportation corridors and topography. Differences in the relative importance of model variables necessitated the use of three individual analyses broken along Virginia's mountain, piedmont and coastal plain physiographical regions. The three model results were merged to produce the statewide Wildfire Risk Assessment.

3.13.3 Woodland Home Communities

Not only are we at risk from naturally occurring wildfires but we are also responsible for wildfire ignition through deliberate actions or carelessness. In the past low rural population levels plus adequate suppression resources have kept the loss of life and property low.

A first concern about wildland fire is the rapidly growing number of woodland home communities that are evident across Virginia. In the past, rural communities were typically scattered agricultural operations. Today, new rural communities are more likely to be residential communities whose residents commute to urban jobs. These rural communities are becoming increasingly attractive to the urban populations.

Fire organizations, which have found their roots in rural America, evolved into two separate groups, the more rural volunteer organization and the professional urban fire organizations each with its own distinct philosophy. Fires within or threatening the wildland-urban interface have elements of both wildland and urban fires. For this reason, both organizations become involved in protection and suppression of wildfires.

The woodland home communities are shown on Map 11. Resources are mapped at a regional scale due to the nature of rural emergency services that are not limited by governmental boundaries; for example, the Buchanan Volunteer Fire Department would respond to a fire on Purgatory Mountain which is located outside of the town limits in Botetourt County. The number of homes located in woodland communities and their level of risk are shown in the following tables.

Table 57: Woodland Home Community Fire Risk, Alleghany County

Community	Number of Homes	Risk Level
Horseshoe Blvd	100	High
Woodland Road	50	High
Ridgevue	30	High
Longdale Furnace Road	25	Moderate
Cline Meadow Road	20	Moderate
Lukes Mountain	10	High
Lakewood Lane	10	High
Dunbrach Road	10	High
County Road	10	High
Bens	10	Moderate
Tucker Road	10	Moderate
Jackson River	10	Moderate
Total	295	

Source: Virginia Department of Forestry, 2018.

Table 58: Woodland Home Community Fire Risk, Town of Clifton Forge

Community	Number of Homes	Risk Level
Richmond Avenue	120	High
Roxbury Street	20	High
Verge Street	15	High
Total	155	

Source: Virginia Department of Forestry, 2018.

Table 59: Woodland Home Community Fire Risk, City of Covington

Community	Number of Homes	Risk Level
Sally Ann Drive	100	Low
Detroit St	30	High
Total	130	-

Source: Virginia Department of Forestry, 2018.

Table 60: Woodland Home Community Fire Risk, Botetourt County

Community	Number of Homes	Risk Level
Applewood	95	High
Ball Park Road - Eagle Rock	57	Moderate
Andrew Drive	49	High
Lakeridge Circle	45	High
Longwood Lane	45	High
White Oak Drive	37	High
Leonard Farm	35	High
Sherwood Drive	35	High
Grandview Drive	32	High
Brookfield Road	30	High
Stratford Drive	28	High
Blue Ridge Drive	27	High
Brunswick Forge Road	15	High
Four Seasons Drive	14	High
Oakwood Road	12	High
Laurel Lane	11	High
Archway Road	11	High
Blackberry Lane	10	High
Stone Coal Road	10	Moderate
Slim Road	10	Moderate
Total	608	

Source: Virginia Department of Forestry, 2018.

Table 61: Woodland Home Community Fire Risk, Craig County

Community	Number of Homes	Risk Level
Route 694	30	High
Route 311	22	Moderate
Route 311	15	Moderate
Route 676	12	Moderate
Route 658	10	High
Route 311	10	High
Route 311	10	High
Route 620	10	High
Route 42	10	Moderate
Route 621	10	Moderate
Route 617	10	Moderate
Total	149	

Source: Virginia Department of Forestry, 2018.

Table 62: Woodland Home Community Fire Risk, Roanoke County

Community	Number of Homes	Risk Level
Chaparral	300	Low
Whipple Tree	200	Low
Puritan / Summit Ridge	200	High
Twin Mountains	200	High
Carriage Hills	150	High
Remington Road	150	High
Flintlock	75	Moderate
Fort Mason	70	High
Cherokee Hills	60	High
Shawnee/ Apache	50	High
Skyview Road	50	High
Glenvar Heights	45	High
Mountain Heights	40	High
Forest Acre	35	High
Brandy Run off Wildwood Rd	30	High
Timberview Road East	30	High
Laurel Mountain Road	20	High
Bradshaw Road	20	Moderate
Cove Hollow	17	Moderate
Sagewood Circle	16	High
Laurel Woods	16	High
Timberview Road	16	High
Bryant Lane	10	High
Elizabeth Drive	200	High
Total	1800	

Source: Virginia Department of Forestry, 2018.

Table 63: Woodland Home Community Fire Risk, City of Roanoke

Community	Number of Homes	Risk Level
Robin Hood Road	500	Low
Cassell Lane	200	Low
Estates / Hartsock Road	100	High
Total	800	

Source: Virginia Department of Forestry, 2018.

Table 64: Woodland Home Community Fire Risk, City of Salem

Community	Number of Homes	Risk Level
Niblick/ Bent Ridge	100	High
Total	100	-

Source: Virginia Department of Forestry, 2018.

Table 65: Woodland Home Community Fire Risk, Town of Vinton

Community	Number of Homes	Risk Level
Total	0	-

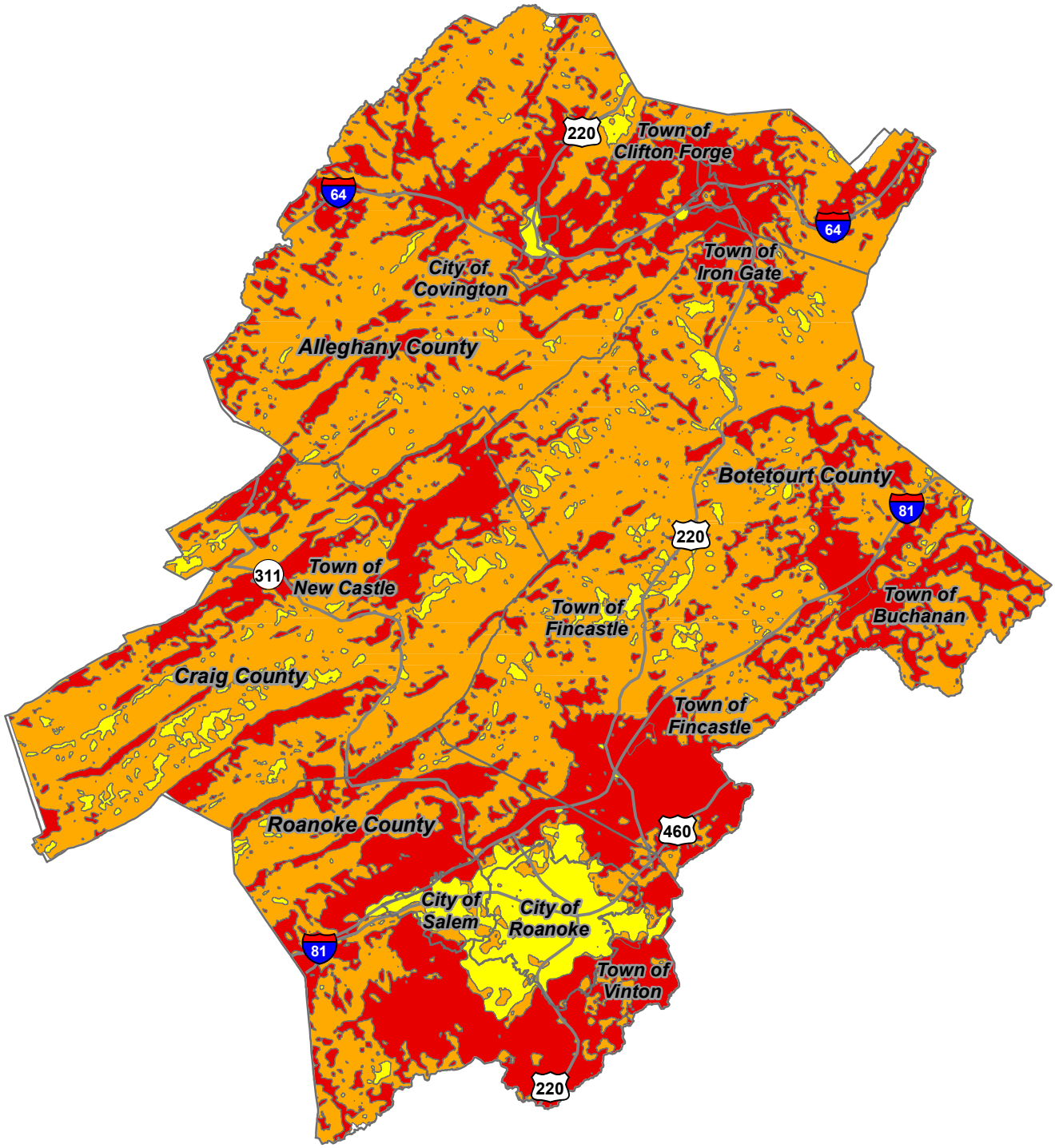
Source: Virginia Department of Forestry, 2018.

The localities of Buchanan, Fincastle, Iron Gate, New Castle, and Troutville do not have any Woodland Home Communities listed in the Virginia Department of Forestry analysis; however, this does not necessarily mean that those localities are not at risk from wildfire.

The total number of homes in the region for each Risk Level is: low risk, 1,300; moderate risk, 343; and high risk, 2,594. The total number of homes at risk from wildfire for the region is 4,237.

Based on past events it is likely that wildfires will continue to impact the Roanoke Valley – Alleghany Region in the future. The probability of an occurrence of a wildfire event has remained unchanged since the adoption of the 2013 Regional Pre-Disaster Mitigation Plan.

Map 10: Wildfire Risk Assessment



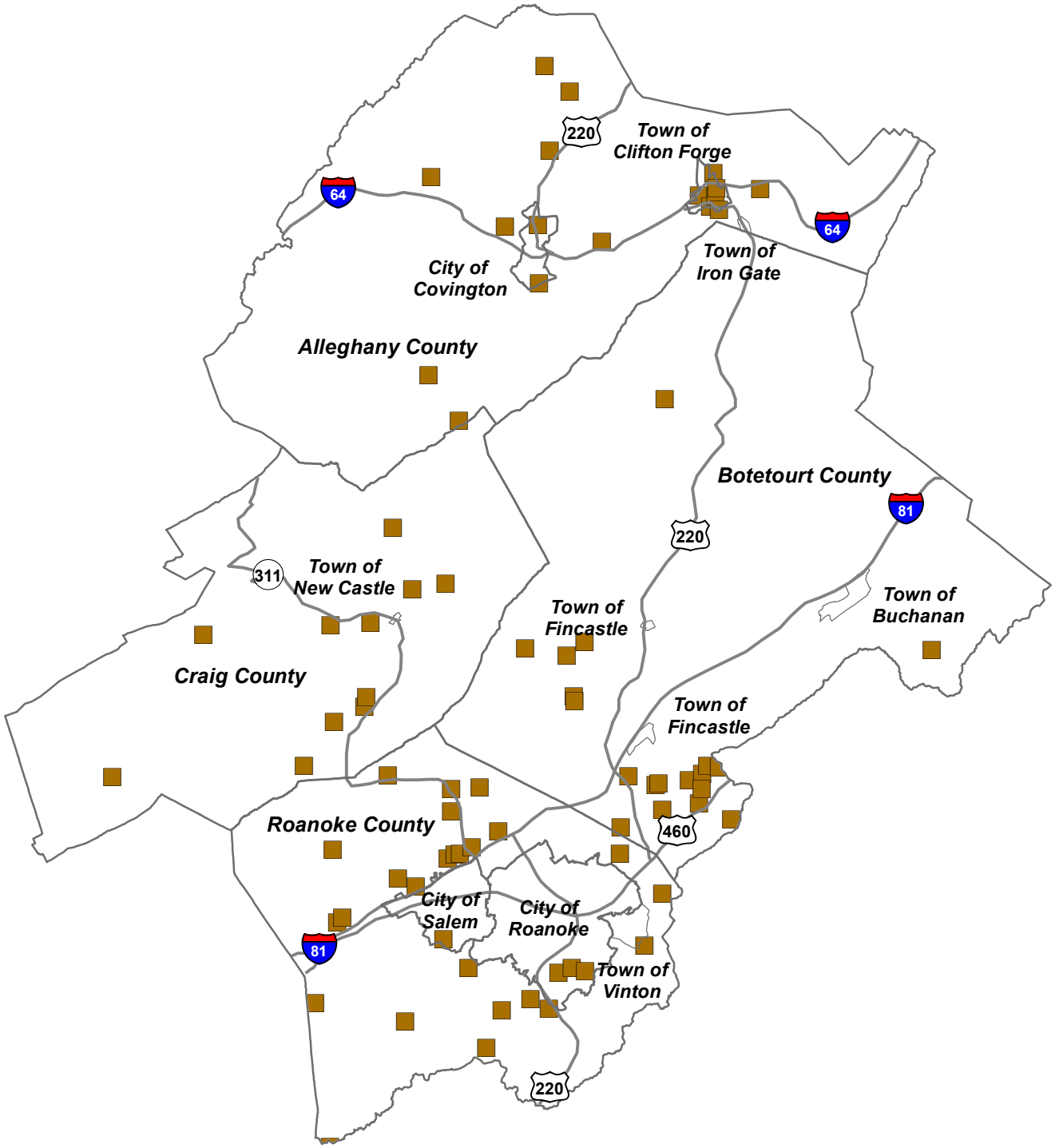
Scale 1:500,000

Legend

- Low Risk
- Moderate Risk
- High Risk

Source: Roanoke Valley-Alleghany Regional Commission, 2018.

Map 11: Woodland Home Communities



Scale 1:500,000

Legend

Woodland Home Community

Source: Roanoke Valley-Alleghany Regional Commission, 2018.

3.14 Winter Storm

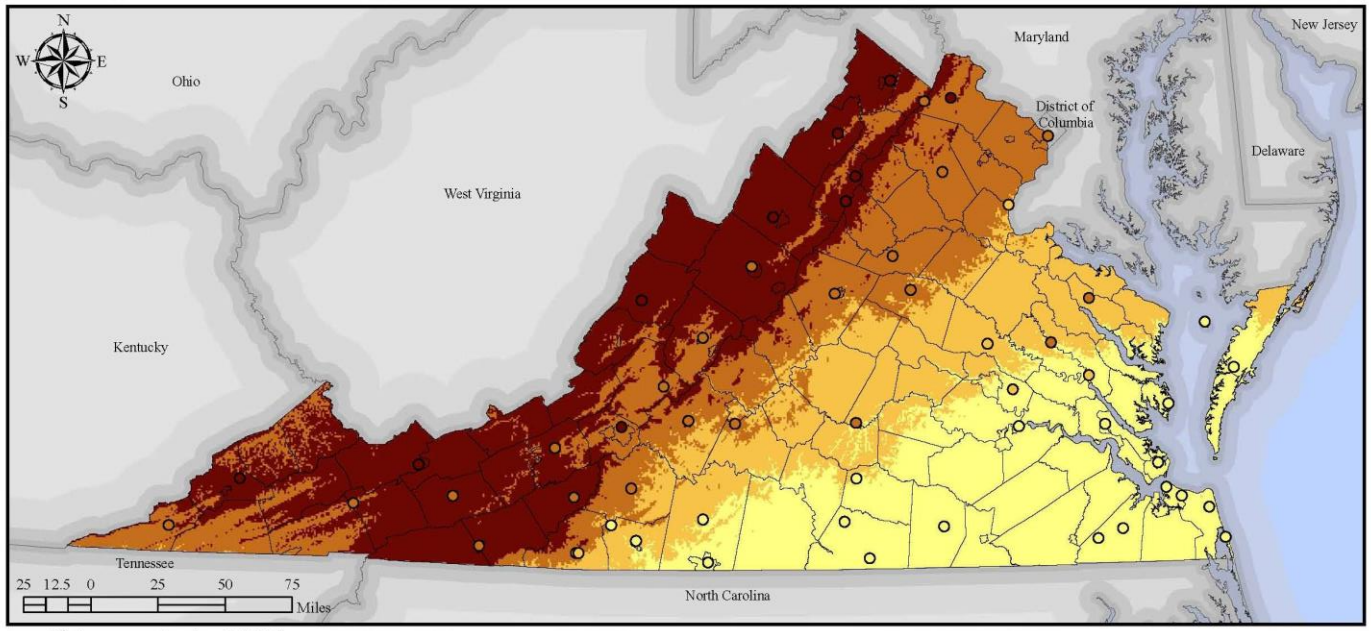
The entire region is vulnerable to winter storms based on the evidence of past events. Winter storms impact entire jurisdictions. The Virginia Department of Emergency Management ranks all of the localities within the RVARC regions as being at risk for “high severity” winter storms. A typical winter in the Roanoke Valley-Alleghany region is relatively mild, but Arctic blasts and Gulf moisture or coastal storms driven inland have historically combined to deliver serious winter weather. There is potential for dangerous winter weather from November to as late as May. Severe winter weather might come in the form of snow, ice, sleet and freezing rain, or blustery cold temperatures and winds.

When heavy snow falls quickly, commuters are often stranded, the delivery of essential goods and supplies stopped, and emergency responses delayed. Heavy snow can knock down trees, power and telephone lines, and collapse roofs. In rural areas, livestock and pets can die while homes are isolated for days. Additionally, the costs of snow removal, damage repair, and lost business can have a serious economic impact. The dangers of winter are intensified when extremely cold temperatures accompany a winter storm. Extremely cold weather is most dangerous to infants and the elderly. Additionally, freezing temperatures can cause damage to vegetation, wildlife, pets, and even homes and businesses as pipes freeze and burst. Streams can freeze; creating ice jams that can cause flooding. When snow is driven by the wind, the result is blizzard conditions that are often blinding and deadly.

Winter ice storms are frequent in the region. When rain falls onto a surface that is below freezing, it freezes to that surface. Anything the freezing rains contact becomes glazed with accumulating ice. Even modest accumulations of ice can quickly down trees, electrical and telephone wires, communications towers and antennas critical for emergency communications. Repair of these utilities can take days, leaving citizens without power or telephone service. Light accumulations of ice are hazardous to motorists and pedestrians.

Based on past events it is likely that winter storms will continue to impact the Roanoke Valley – Alleghany Region in the future. The probability of an occurrence of a winter storm event has remained unchanged since the adoption of the 2006 Regional Pre-Disaster Mitigation Plan.

Map 12 Average Number of Days Per Year with 3 or More Inches of Snow



DATA SOURCES:
CGIT analysis of NCDC data
VGIN Jurisdictional Boundaries
ESRI State Boundaries

LEGEND:
Avg. Number of Days per Year
- 1.5 or lower
- 1.51 - 2.0
- 2.01 - 3.0
- 3.01 - 6.72

HAZARD IDENTIFICATION:
Winter weather statistics were estimated from daily NCDC weather station reports from 1960 - 2000; the values at the weather stations are symbolized with small round dots, and a statewide regression fit depicts the overall trend in the weather station statistics.

These results depict general trends, and local conditions may vary widely.

PROJECTION: *VA Lambert Conformal Conic North American Datum 1983*

DISCLAIMER: Majority of available hazard data is intended to be used at national or regional scales. The purpose of the data sets are to give general indication of areas that may be susceptible to hazards. In order to identify potential risk in the Commonwealth available data has been used beyond the original intent.

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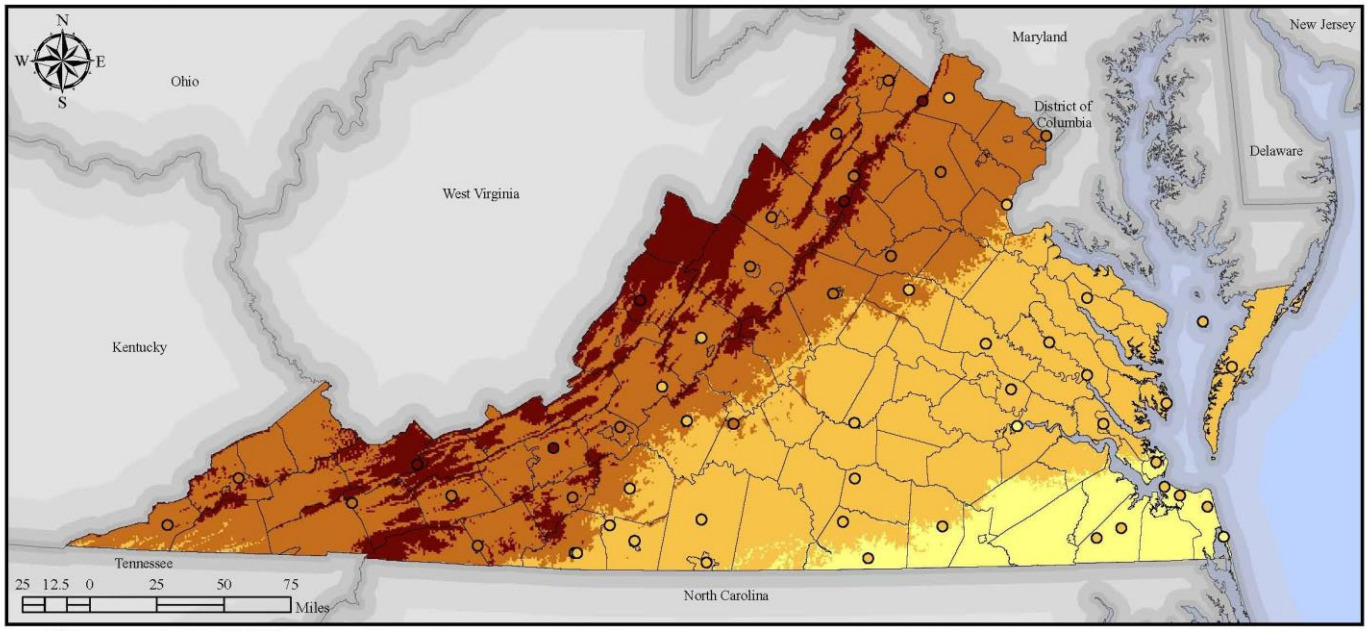
Map 13 Average Number of Days Per Year at or Below 32° F



DATA SOURCES:
CGIT analysis of NCDC data
VGIN Jurisdictional Boundaries
ESRI State Boundaries

LEGEND:
Avg. Number of Days per Year
- 3 or lower
- 3.1 - 9
- 9.1 - 18
- 18.1 - 40

HAZARD IDENTIFICATION:
Winter weather statistics were estimated from daily NCDC weather station reports from 1960 - 2000; the values at the weather stations are symbolized with small round dots, and a statewide regression fit depicts the overall trend in the weather station statistics.

These results depict general trends, and local conditions may vary widely.

PROJECTION: *VA Lambert Conformal Conic*
North American Datum 1983

DISCLAIMER: Majority of available hazard data is intended to be used at national or regional scales. The purpose of the data sets are to give general indication of areas that may be susceptible to hazards. In order to identify potential risk in the Commonwealth available data has been used beyond the original intent.

3.15 Historic Resources Vulnerability

Historic properties and cultural resources are valuable, economic assets in communities throughout the Roanoke Valley-Alleghany region. For many communities, historic and cultural resources are a catalyst for economic development and source of pride for residents. Historic properties can be located throughout a locality and the number of structures varies widely. The potentially devastating effects that flooding and other disasters can have on historic properties are not always considered in mitigation planning.

Historically, people often built their homes on the highest ground that provided the best protection from flooding. As cities and towns grew, what once was considered undesirable land - floodplains, steep slopes - became the only affordable option for new development. These lands are in turn some of the hardest hit areas by natural disasters.

FEMA has made a special effort to work with the National Park Service National Center for Preservation and state preservation offices to create guidance for dealing with the mitigation of natural disasters on historic structures. One such document, Historic Structures, (FEMA P-467-2), addresses how the National Flood Insurance Program treats historic structures. This bulletin also identifies mitigation measures that can be taken to protect historic structures from floods.

The National Flood Insurance Program gives special consideration to the unique value of historic buildings, landmarks, and sites. It does so in two ways.

First, the NFIP floodplain management regulations provide significant relief to historic structures. Historic structures do not have to meet the floodplain management requirements of the program as long as they maintain their historic structure designation. They do not have to meet the new construction, substantial improvement, or substantial damage requirements of the program. This exclusion from these requirements serves as an incentive for property owners to maintain the historic character of the designated structure (44 CFR §60.3). It may also serve as an incentive for an owner to obtain historic designation of a structure.

Second, a designated historic structure can obtain the benefit of subsidized flood insurance through the NFIP even if it has been substantially improved or substantially damaged so long as the building maintains its historic designation. The amount of insurance premium charged the historic structure may be considerably less than what the NFIP would charge a new non-elevated structure built at the same level.

Although the NFIP provides relief to historic structures from having to comply with NFIP floodplain management requirements for new construction, communities and owners of historic structures should give consideration to mitigation measures that can reduce the impacts of flooding on historic structures located in Special Flood Hazard Areas (44 CFR §60.3). Mitigation measures to minimize future flood damages should be considered when historic structures are rehabilitated or are repaired following a flood or other hazard event.

In addition to the relief from the NFIP floodplain management requirements described above, owners of “historic structures” can obtain and maintain flood insurance at subsidized rates. Flood insurance coverage is required for most mortgage loans and for obtaining Federal grants and other financial assistance. The ability to obtain flood insurance coverage is also important to ensuring that historic structures can be repaired and restored after a flood event.

Local governments can play a role in preserving historic structures through identification and implementation of hazard mitigation projects. Mitigation measures can take a variety of forms from simple low-cost improvements such as elevating utilities and mechanical equipment to structural measures such as elevation, dry floodproofing, or relocating the building to a site outside the Special Flood Hazard Area. Even the more costly measures can have significant benefits relative to their cost.

By adhering to the Secretary of the Interior’s Standards for the Treatment of Historic Properties and by seeking the help of an architect or engineering professional experienced in rehabilitating historic structures, a structure’s original historic setting, scale, and distinctive features can be preserved.

Local governments should work with state Department of Historic Resources, VDEM, and local preservation groups to identify historic buildings and sites in need of hazard mitigation. It is suggested that these efforts follow the guidance in the FEMA publication titled Integrating Historic Property and Cultural Resource Considerations into Hazard Mitigation Planning (FEMA 386-6).

This plan begins that process by identifying historic properties that could be impacted by flooding. The National Register of Historic Places lists historic buildings, archeological sites, and landscapes recognized by the American people for their significance. State and local preservation groups also maintain lists of sites important to their histories. Virginia’s Department of Historic Resources DHR administers two programs designed to recognize Virginia’s historic resources and to encourage their continued preservation: the Virginia Landmarks Register and the National Register of Historic Places. Table 66 lists historic sites and historic districts that could be impacted by flooding, one of the region’s most likely and most damaging natural hazards.

Table 66: Historic Structures Potentially Impacted by Flooding

ID	Name	Locality	Register*
003-0098	Australia Furnace	Alleghany	V/N
003-0019	Clifton Furnace	Alleghany	V/N
003-0011	H.R. Massie House	Alleghany	V/N
003-0002	Humpback Bridge (Covered)	Alleghany	V/N
003-0338	Longdale Furnace Historic District	Alleghany	V/N
003-5006	Luke's Mountain Historic District	Alleghany	V/N
003-0018	Persinger-Wright House	Alleghany	V/N
003-0348	Rosedale Historic District	Alleghany	V/N
003-0006	Sweet Chalybeate Springs Lodge	Alleghany	V/N
008-0136	Douthat State Park Historic District	Alleghany/Bath	V/N
105-0017	Clifton Forge Commercial Historic District	Clifton Forge	V/N
011-0041	Annandale (Lock on James River-Kanawha Canal)	Botetourt	V/N
011-0187	Breckenridge Mill Historic District and Extension	Botetourt	V/N/E
011-0040	Catawba Furnace	Botetourt	V
011-0056	Dr. William Anderson House	Botetourt	V/N/E
011-5155	Gala Site	Botetourt	V/
011-0010	Greyledge	Botetourt	V/N
127-0171	James River/Kanawha Canal Historic District (incl. Locks)	Botetourt	V/N
011-0048	Lauderdale	Botetourt	V/N
011-0184	Looney Mill Creek Site	Botetourt	V/N
011-0057	Niningers Mill	Botetourt	V/N
011-0095	Phoenix Bridge	Botetourt	V/N
011-0185	Prospect Hill	Botetourt	V/N/E
011-0063	Roaring Run Furnace	Botetourt	V/N
011-0032	Santillane	Botetourt	V/N
011-5034	Thomas D. Kinzie House	Botetourt	V/N
011-0068	Varneys Falls Dam & Lock	Botetourt	V/N
011-0039	Wiloma	Botetourt	V/N
180-0028	Buchanan Historic District	Buchanan	V/N
180-0006	Wilson Warehouse	Buchanan	V/N
107-0023	Conrad Fudge House	Covington	V/N
107-0025	Covington Historic District	Covington	V/N
022-5003	Huffman House/Creekside Farm	Craig	V/N
268-0016	New Castle Historic District Expansion	New Castle	V/N
128-0052	Belle Aire (Bell-Air)	Roanoke	V/N
128-0044	Colonial National Bank	Roanoke	V/N
128-5455	Heironimus Warehouse	Roanoke	V/N
128-0039	Crystal Spring Steam Pumping Station	Roanoke	V/N
128-0040	First National Bank	Roanoke	V/N
128-5762	Gainesboro Historic District	Roanoke	V/N
128-0025	Hotel Roanoke	Roanoke	V/N
128-0010	Lone Oaks	Roanoke	V/N
128-0035	Monterey (Belmont)	Roanoke	V/N/E
128-5432	N & W Railway Company Historic District	Roanoke	V/N
128-0045	Roanoke City Market Historic District and Extension	Roanoke	V/N

ID	Name	Locality	Register*
128-5761	Roanoke Downtown Historic District and Expansion	Roanoke	V/N
128-0046	Roanoke Warehouse Historic District (Wholesale Row)	Roanoke	V/N
080-0013	Samuel Harshbarger House	Roanoke	V/N
128-0049	Southwest Historic District	Roanoke	V/N
080-0348	Starkey Elementary School	Roanoke	V/N
128-5461	Virginian Railway Passenger Station/Depot	Roanoke	V/N
128-6269	Wasena Historic District	Roanoke	V/N
128-6261	Melrose-Rugby Historic District	Roanoke	V/N
128-5476	Riverland/Walnut Hill Historic District	Roanoke	V/N
-	Southeast Roanoke Historic District (eligible)	Roanoke	-
-	Norwich Neighborhood (eligible)	Roanoke	-
129-0075	Downtown Salem Historic District	Salem	V/N
129-0012	Monterey	Salem	V/N
129-5018	Preston House	Salem	V/N/E
129-0009	Salem Presbyterian Church	Salem	V/N
129-5023	Valley Railroad Bridge (Gish Branch Railroad Bridge)	Salem	V/N

Source: Virginia Landmarks Register, Virginia Department of Historic Resources, 2018
* Register: N=national, V=Virginia, and E=Eligible

References:

Resilient Heritage, Protecting Your Historic Home from Natural Disasters, Louisiana Department of Historic Preservation and National Park Service's National Center for Preservation Technology & Training, 2015.

Historic Structures, Floodplain Management Bulletin, FEMA P-467-2, May 2008

Virginia Landmarks Register, Virginia Department of Historic Resources, 2018.

3.16 Critical Facilities

There is currently no standard critical facility dataset for the Commonwealth; various plans have used different datasets, based upon the geographic and subject-matter scope of each regional plan. At the time, critical facilities were grouped into six broad categories: law enforcement facilities, educational facilities, emergency response, transportation, and public health. These groupings along with FEMA Fact Sheet Critical Facilities and Higher Standards were used to guide the selection of critical facilities.

Many privately-owned buildings and structures (e.g., hospitals, power plants, certain industrial facilities, etc.) may be considered critical during certain natural disasters. The critical facilities data collection represents a broad array of critical facilities identified by each participating local government.

The Committee struggled with defining "critical facility" as each locality had its own idea of what this term meant. The main question was does this mean a facility critical to the community at large, such as a daycare center or library, or is it a facility that is necessary for the day-to-day operation of the government when a disaster strikes such as a 911 dispatch center or hospital. As a compromise, each locality was asked to submit its own individual critical facilities list. In almost all cases this was limited to public facilities and did not include private utilities (gas/oil lines, electrical supply, communications, fuel storage), or state and Federal facilities. The omission of state and Federal facilities meant that highways and their associated infrastructure, including bridges, were not included.

Additional types of linear infrastructure may also qualify as critical facilities but were not assessed in this plan due to data and scope limitations. Historical road closure and condition reports were considered for use in this plan but are in need of updates and more complete risk and loss estimates.

Most localities did not include hazard materials sites (Tier II reporting facilities) due to concerns about releasing this data in a widely used public document. For those that did, the sites are included in their individual local critical facilities list.

The critical facilities list is in Appendix E. These listings vary from locality to locality depending what each of them identified as critical to their communities. The critical facilities data collection is a work-in-progress that will be maintained and expanded upon during plan implementation. Although not a complete representation of all the possible types of critical facilities, this data is a good representation of facility locations in the region. The listing contains over 600 critical facilities.

3.17 Capabilities Assessment

The capabilities assessment reviews the ability of each jurisdiction to implement future mitigation projects. The assessments are ratings of localities in the region for the technical, fiscal, and administrative capacity to implement hazard mitigation strategies. Technical expertise and mitigation experience of staff (engineers, public works technicians), administrative ability (in particular availability of enough staff to manage multiple projects) and financial constraints were key considerations in the assessment. Each locality in the region was considered separately although many of the towns are served by county services.

Table 67: Capabilities Assessment

Locality	Technical	Administrative	Financial
Alleghany County	High	High	Low
Town of Clifton Forge	Moderate	Moderate	Low
Town of Iron Gate	Low	Low	Low
Botetourt County	High	High	Moderate
Town of Buchanan	Low	Low	Low
Town of Fincastle	Low	Low	Low
Town of Troutville	Low	Low	Low
City of Covington	Moderate	Moderate	Low
Craig County	Low	Low	Low
Town of New Castle	Low	Low	Low
City of Roanoke	High	High	Moderate
Roanoke County	High	High	Moderate
Town of Vinton	Moderate	Moderate	Low
City of Salem	High	Moderate	Low

General descriptions of the capabilities rating are described below.

Technical

High – Locality has multiple departments with staff that have adequate training and experience, including at least one engineer, a public works department, and a full-time emergency services coordinator.

Moderate – Locality has only one or two experienced and trained staff, lacking key department such as engineering or public works, emergency services coordinator is part-time or a shared position (such as fire chief, planner, town manager, etc.).

Low – Locality is lacking adequate staff to manage a disaster event and will be dependent on the state or perhaps the surrounding county to provide response and coordination.

Administrative

High – Locality has multiple departments with staff that have adequate training and experience, including accounting, a full-time county administrator or city or town manager, and a full-time emergency services coordinator.

Moderate – Locality has only one or two experienced and trained staff, full-time county administrator or city or town manager but lacking key departments such as accounting and emergency services coordinator is part-time or a shared position (such as fire chief, planner, town manager, etc.).

Low – Locality is lacking adequate staff to manage a disaster event and will be dependent on the state or perhaps the surrounding county to provide response and coordination.

Financial

High – Locality has either budgeted for disaster response, related capital improvements, or rainy-day fund for emergencies. Funding is available for preventative disaster mitigation projects and planning.

Moderate – Locality could make emergency budget revisions to respond to a disaster or to undertake minor emergency mitigation activities such as stormwater system repairs, landslide clean-up, road repairs. Funds are not generally available for mitigation or addressing large disasters.

Low – Locality does not have adequate funding available to address a disaster event nor complete disaster mitigation activities on its own. Locality would be almost total dependent on outside or government funding.

Chapter 4 Loss Estimation

Loss estimates were calculated by the staff of the Roanoke Valley-Alleghany Region Commission and done for flooding only. Other disasters are too variable and widespread to determine any useful loss estimates.

4.1 Methodology for Flood Damage Estimates

The methodology for determining flood losses varied depending on the data available for each locality. Estimates were calculated for residential and commercial structures only. In most cases, 911-addressed structure data was available for each locality in a digital format. In Craig County, structures in the floodplain were identified by viewing aerial photos. Using the most recent version of the FEMA Digital Flood Insurance Rate Maps and local tax parcel maps, staff identified parcels associated with each structure in the 100-year floodplain. For most localities, the value of the structure was then calculated based on information from the local tax parcel database.

In the Craig County and the City of Covington, estimated structure values were used. No structures were found in the Town of New Castle. Structures were separated by commercial and residential uses based on land use codes in the digital real estate databases, or by visual inspection on air photos. The top values in each locality were reviewed to identify any anomalies that needed adjustment. For example, the parcel for Hollins University lists the value of all structures on campus when only two or three buildings are in the flood plain. Residential structure damage is based on a split level or two-story home with a basement at a flood depth of 3 feet which equates to a 33% of the structure value.

Residential content damage is based on a two story or split-level home with a basement at a flood depth of 3 feet which equates to an 18% of structure value. Commercial Structure Damage is estimated at 33% and contents loss is estimated at 20% of structure value. In the City of Roanoke, adjustments were made to multi-story buildings in downtown and large buildings valued over $5 million. These structures were adjusted to 10 percent of their overall value based on the assumption only one level would be flooded. A handful of residential units in downtown were removed because they are more likely on upper floors. The water treatment plant in the City of Roanoke was not included in the analysis.

Damage estimates are for a county-wide event. They also assume a standard flood depth for each structure, which is an unknown variable unless a flood elevation is determined for each building based on topography and structure height. Likewise, the estimates include generalizations about the structure type and the contents. Furthermore, estimates do not include damage to other features such as roads, fences, public and private utilities, stormwater features, dams, sheds, barns, livestock, and crops; nor do they include loss of use estimates. Each locality was given an opportunity to review and adjust the estimates.

4.2 Loss Estimates

Table 68: Alleghany County Flood Loss Estimate (unincorporated areas)

	Parcels/Structures in Floodplain	Value of Structures in Floodplain	Structure Damage at 3 ft Flood depth	Contents Damage at 3 ft Flood Depth	Total Estimated Damage
Residential	630	$38,966,900	$12,859,077	$7,014,142	$19,873,119
Commercial	34	$7,342,600	$2,423,058	$1,468,520	$3,891,578
Total	664	$46,309,500	$15,282,135	$8,482,562	$23,764,697

Average Damage per Residential Structure in Floodplain:	$31,545
Average Value per Residential Structure in Floodplain:	$61,852
Average Damage per Commercial Structure in Floodplain:	$114,458
Average Value per Commercial Structure in Floodplain:	$215,959

Table 69: Town of Clifton Forge Flood Loss Estimate

	Parcels/Structures in Floodplain	Value of Structures in Floodplain	Structure Damage at 3 ft Flood depth	Contents Damage at 3 ft Flood Depth	Total Estimated Damage
Residential	57	$2,624,700	$866,151	$472,446	$1,338,597
Commercial	16	$2,661,300	$878,229	$532,260	$1,410,489
Total	73	$5,286,000	$1,744,380	$1,004,706	$2,749,086

Average Damage per Residential Structure in Floodplain:	$23,484
Average Value per Residential Structure in Floodplain:	$46,047
Average Damage per Commercial Structure in Floodplain:	$88,156
Average Value per Commercial Structure in Floodplain:	$166,331

Table 70: Town of Iron Gate Flood Loss Estimate

	Parcels/Structures in Floodplain	Value of Structures in Floodplain	Structure Damage at 3 ft Flood depth	Contents Damage at 3 ft Flood Depth	Total Estimated Damage
Residential	1	$254,000	$83,820	$45,720	$129,540
Commercial	0	$0	$0	$0	$0
Total	1	$254,000	$83,820	$45,720	$129,540

Average Damage per Residential Structure in Floodplain:	$129,540
Average Value per Residential Structure in Floodplain:	$254,000
Average Damage per Commercial Structure in Floodplain:	NA
Average Value per Commercial Structure in Floodplain:	NA

Table 71: City of Covington Flood Loss Estimate

	Parcels/Structures in Floodplain	Value of Structures in Floodplain	Structure Damage at 3 ft Flood depth	Contents Damage at 3 ft Flood Depth	Total Estimated Damage
Residential	305	$33,550,000	$11,071,500	$6,039,000	$17,110,500
Commercial	52	$13,000,000	$4,290,000	$2,600,000	$6,890,000
Total	357	$46,550,000	$15,361,500	$8,639,000	$24,000,500

Average Damage per Residential Structure in Floodplain: $56,100
Average Value per Residential Structure in Floodplain: $110,000
Average Damage per Commercial Structure in Floodplain: $132,500
Average Value per Commercial Structure in Floodplain: $250,000

Table 72: Botetourt County Flood Loss Estimate (unincorporated areas)

	Parcels/Structures in Floodplain	Value of Structures in Floodplain	Structure Damage at 3 ft Flood depth	Contents Damage at 3 ft Flood Depth	Total Estimated Damage
Residential	422	$31,863,000	$10,514,790	$5,735,340	$16,250,130
Commercial	36	$11,627,500	$3,837,075	$2,325,500	$6,162,575
Total	458	$43,490,500	$14,351,865	$8,060,840	$22,412,705

Average Damage per Residential Structure in Floodplain: $38,507
Average Value per Residential Structure in Floodplain: $75,505
Average Damage per Commercial Structure in Floodplain: $171,183
Average Value per Commercial Structure in Floodplain: $322,986

Table 73: Town of Buchanan Flood Loss Estimate

	Parcels/Structures in Floodplain	Value of Structures in Floodplain	Structure Damage at 3 ft Flood depth	Contents Damage at 3 ft Flood Depth	Total Estimated Damage
Residential	52	$3,842,900	$1,268,157	$691,722	$1,959,879
Commercial	11	$883,100	$291,423	$176,620	$468,043
Total	63	$4,726,000	$1,559,580	$868,342	$2,427,922

Average Damage per Residential Structure in Floodplain: $37,690
Average Value per Residential Structure in Floodplain: $73,902
Average Damage per Commercial Structure in Floodplain: $42,549
Average Value per Commercial Structure in Floodplain: $80,282

Table 74: Town of Fincastle Flood Loss Estimate

	Parcels/Structures in Floodplain	Value of Structures in Floodplain	Structure Damage at 3 ft Flood depth	Contents Damage at 3 ft Flood Depth	Total Estimated Damage
Residential	2	$189,600	$62,568	$34,128	$96,696
Commercial	2	$410,100	$135,333	$82,020	$217,353
Total	4	$599,700	$197,901	$116,148	$314,049

Average Damage per Residential Structure in Floodplain: $48,348
Average Value per Residential Structure in Floodplain: $94,800
Average Damage per Commercial Structure in Floodplain: $108,677
Average Value per Commercial Structure in Floodplain: $205,050

Table 75: Town of Troutville Flood Loss Estimate

	Parcels/Structures in Floodplain	Value of Structures in Floodplain	Structure Damage at 3 ft Flood depth	Contents Damage at 3 ft Flood Depth	Total Estimated Damage
Residential	51	$4,283,300	$1,413,489	$770,994	$2,184,483
Commercial	9	$2,352,300	$776,259	$470,460	$1,246,719
Total	60	$6,635,600	$2,189,748	$1,241,454	$3,431,202

Average Damage per Residential Structure in Floodplain: $42,833
Average Value per Residential Structure in Floodplain: $83,986
Average Damage per Commercial Structure in Floodplain: $138,524
Average Value per Commercial Structure in Floodplain: $261,367

Table 76: Craig County Flood Loss Estimate (including New Castle*)

	Parcels/Structures in Floodplain	Value of Structures in Floodplain	Structure Damage at 3 ft Flood depth	Contents Damage at 3 ft Flood Depth	Total Estimated Damage
Residential	93	$6,170,000	$2,036,100	$1,110,600	$3,146,700
Mobile Homes	27	$270,000	$270,000	$270,000	$540,000
Commercial	6	$600,000	$198,000	$120,000	$318,000
Total	126	$7,040,000	$2,504,100	$1,500,600	$4,004,700

Average Damage per Residential Structure in Floodplain: $33,835
Average Value per Residential Structure in Floodplain: $66,344
Average Damage per Commercial Structure in Floodplain: $53,000
Average Value per Commercial Structure in Floodplain: $100,000
*No structures in the Town of New Castle appeared to be in the floodplain.

Roanoke County buildings in floodplain were delineated by viewing aerial photos. Buildings greater than 750 sq. ft. were selected for review. Parcels with structures were then selected. Dropped parcels with no dwelling value-even if the building was shown on building layer. Separated parcels based on land use into residential and commercial units. Dropped high value parcels from commercial selection. This included a few schools on large parcels, parcels not in the floodplain, Hollins University, and the Regional Fire Training Facility.

Table 77: Roanoke County Flood Loss Estimate (unincorporated area)

	Parcels/Structures in Floodplain	Value of Structures in Floodplain	Structure Damage at 3 ft Flood depth	Contents Damage at 3 ft Flood Depth	Total Estimated Damage
Residential	683	$85,935,200	$28,358,616	$15,468,336	$43,826,952
Commercial	80	$20,930,100	$6,906,933	$4,186,020	$11,092,953
Total	763	$106,865,300	$35,265,549	$19,654,356	$54,919,905

Average Damage per Residential Structure in Floodplain:	$64,168
Average Value per Residential Structure in Floodplain:	$125,820
Average Damage per Commercial Structure in Floodplain:	$138,662
Average Value per Commercial Structure in Floodplain:	$261,626

Town of Vinton buildings in floodplain were delineated by viewing aerial photos. Buildings greater than 750 sq. ft. were selected for review. Parcels with structures were then selected. Dropped parcels with no dwelling value-even if the building was shown on building layer. Separated parcels based on land use into residential and commercial units. Dropped high value parcels from commercial selection. Separated parcels based on land use into residential and commercial units.

Table 78: Town of Vinton Flood Loss Estimate

	Parcels/Structures in Floodplain	Value of Structures in Floodplain	Structure Damage at 3 ft Flood depth	Contents Damage at 3 ft Flood Depth	Total Estimated Damage
Residential	58	$5,613,100	$1,852,323	$1,010,358	$2,862,681
Commercial	36	$7,064,400	$2,331,252	$1,412,880	$3,744,132
Total	94	$12,677,500	$4,183,575	$2,423,238	$6,606,813

Average Damage per Residential Structure in Floodplain:	$49,357
Average Value per Residential Structure in Floodplain:	$96,778
Average Damage per Commercial Structure in Floodplain:	$104,004
Average Value per Commercial Structure in Floodplain:	$196,233

City of Roanoke buildings in the floodplain were delineated by viewing aerial photos. Buildings greater than 750 sq. ft. and less than 3000 sq. ft. for residential areas were selected for review. All structures over 3,000 sq. ft. were considered commercial for the loss estimates calculations. Some commercial was picked up in the residential selection based on land use-transferred to commercial (i.e. house that was changed to office use). Some residential was picked up in commercial areas based on land use-transferred to residential (office/warehouse conversion to condominium or apartment). Dropped parcels with no dwelling value-even if the building was shown on building layer. Dropped high value parcels from commercial selection. This included a few schools on large parcels, parcels not in the floodplain, hospitals, parking garages, Ivy Market, and the Regional Waste Water Treatment Plant.

Table 79: City of Roanoke Flood Loss Estimate

	Parcels/Structures in Floodplain	Value of Structures in Floodplain	Structure Damage at 3 ft Flood depth	Contents Damage at 3 ft Flood Depth	Total Estimated Damage
Residential	598	$80,439,700	$26,545,101	$14,479,146	$41,024,247
Commercial	434	$218,931,100	$72,247,263	$43,786,220	$116,033,483
Total	1,032	$299,370,800	$98,792,364	$58,265,366	$157,057,730

Average Damage per Residential Structure in Floodplain:	$68,602
Average Value per Residential Structure in Floodplain:	$134,515
Average Damage per Commercial Structure in Floodplain:	$267,358
Average Value per Commercial Structure in Floodplain:	$504,450

City of Salem buildings in floodplain were delineated by viewing aerial photos. Buildings greater than 750 sq. ft. were selected for review. Parcels with structures were selected for review. Dropped parcels with no dwelling value-even if the building was shown on building layer. Separated parcels based on land use into residential and commercial units. Dropped high value parcels from commercial selection. This included schools on large parcels, parcels not in the floodplain, and Roanoke College upper campus.

Table 80: City of Salem Flood Loss Estimate

	Parcels/Structures in Floodplain	Value of Structures in Floodplain	Structure Damage at 3 ft Flood depth	Contents Damage at 3 ft Flood Depth	Total Estimated Damage
Residential	641	$70,479,300	$23,258,169	$12,686,274	$35,944,443
Commercial	329	$141,183,100	$46,590,423	$28,236,620	$74,827,043
Total	970	$211,662,400	$69,848,592	$40,922,894	$110,771,486

Average Damage per Residential Structure in Floodplain:	$56,076
Average Value per Residential Structure in Floodplain:	$109,952
Average Damage per Commercial Structure in Floodplain:	$227,438
Average Value per Commercial Structure in Floodplain:	$429,128

Chapter 5 Regional Mitigation Goals and Strategies

5.1 Project Prioritization and Benefit to Cost Consideration

In developing mitigation strategies for the region and each locality, a wide range of activities were considered in order to achieve the goals and to lessen the vulnerability of the area to the impact of natural hazards. All goals, strategies and projects are dependent on the availability and timeliness of non-local funding.

Goals and Strategies were prioritized by each individual locality. Prioritization was completed in order of relative priority – high, medium or low – based on the benefit to cost criteria and the strategy's potential to mitigate the impact from natural hazards. Consideration was also given to availability of funding, the department/agency responsible for implementation, and the ability of the locality to implement the project. Under each identified pre-disaster, applicable local government departments will be the lead in making sure that each project or action will be implemented in timely manner with other departments, other local government representatives and/or other regional agencies.

Project priorities are ranked as high, medium or low. In general, a high ranking indicates an immediate need – within the next year – and that the locality is actively planning for the project. A medium ranking indicates a short-term need – within 2-5 years – that is being planned. A low priority indicates either a long-term need – more than 5 years out – or an activity that would be of benefit but might not be a necessity, for example new mapping or additional outreach programs.

The anticipated level of cost effectiveness of each measure was a primary consideration when developing the list of proposed projects. Since the mitigation projects are an investment of public funds to reduce damages, localities have selected, and prioritized projects based on the benefit to cost of each project in hopes of obtaining the maximum benefit. Projects were categorized as high, medium or low benefit to cost based on the available information for each proposed project. Reduced damages over the lifespan of the projects, the benefits, are likely to be greater than the project cost in all cases. Although detailed cost and benefit analysis was not conducted during the mitigation action development process, these factors were of primary concern when prioritizing and selecting the proposed projects.

5.2 Regional Climate Considerations

Climate scientists are in agreement that weather trends are demonstrating that southwest Virginia is experiencing rising temperatures and increased precipitation. Based on data available from the NOAA Climate Explorer Tool, the average temperature in Southwest Virginia has increased in by 2 degrees in the last 50 years and by maintaining current conditions is expected rise 8 more degrees by the end of the century. Within the same timeframe, precipitation is also expected to increase by up to 5 inches, setting the stage for unpredictable and violent weather events.

In Governor Northam recently issued Executive Order Number Twenty-Four titled, Increasing Virginia's Resilience to Sea Level Rise a Natural Hazards, which states:

> *"Sea level, land subsidence, higher average temperatures, more frequent and intense weather events, severe droughts and increased development, has increased the risk from natural hazards across the Commonwealth of Virginia. The number of federally declared disasters has steadily increased in nationally and in Virginia. The number has experienced a 250 percent increase in federally declared disasters over the past 20 years, including declaration for flooding, hurricanes, severe storms and wildfire. The best available science predicts that this trend will continue to worsen …This increase in extreme weather events and natural disasters will continue to have a profound impact on Virginia. It threatens public health and safety, our environment and natural resources and the economic wellbeing of the Commonwealth …"*

With the ever-present risk that is associated with the changes in the climate, this document attempts to include important mitigation and adaptation strategies to avert extreme weather events.

Mitigation Goals could include the following:

- Protect sites with high ecological value and/or add a buffer
- Riparian buffer protection
- Mitigation on site to compensate for impacts
- Protection of wetlands and surface water with managed vegetative zones and natural zones
- Preserve undeveloped land
- Brownfields
- Hold 90% of a 10-year event onsite
- Floodplain avoid of 95% or total floodplain protection
- Emissions reduction
- Vulnerability assessment
- Climate Change considerations
- Integration and redundancy
- Reducing impervious
- Green Infrastructure – promote infiltration
- Pervious alleys
- Settling pools and channels
- Personal property at site, community education

5.3 Regional Mitigation Goals and Strategies

Regional mitigation goals and strategies are those that could apply to the entire region (e.g., mitigation of the impact of flooding) or can be accomplished in a more efficient manner by two or more localities working cooperatively (e.g., hazard outreach and education campaigns).

5.3.1 Earthquake

Mitigation measures for earthquakes are region-wide recommendations for all localities adopting the Regional Pre-Disaster Mitigation Plan.

Goal: Increase public awareness of the probability and potential impact of earthquakes.
Responsible Departments: Emergency Management, Public Information Office
Strategy:

1. Publish a special section in local newspaper with emergency information on earthquakes. Localize the information by printing the phone numbers of local emergency services offices, the American Red Cross, and hospitals.

5.3.2 Flood

Mitigation measures for floods are region-wide recommendations for all localities adopting the Roanoke Valley-Alleghany Regional Hazard Mitigation Plan. Localities have also developed locality specific goals and activities for this disaster that are listed in Chapter 7 Local Mitigation Strategies in this document.

Goal: Mitigation of loss of life and property from flooding and flood related disasters.
Responsible Departments: Community Development, Engineering, Public Information Office, Public Works, Transportation
Strategies:

1. In cooperation with Federal and State governments, support a comprehensive public information and education program on all hazards addressed in the Regional Hazard Mitigation Plan. This can be accomplished through regional workshops and educational materials for citizens, business, local staff, and elected officials.
2. Develop and maintain an inventory of flood prone roadways in cooperation with local governments and the Virginia Department of Transportation.
3. Develop and maintain an inventory of flood prone critical regional facilities such as hospitals, public utility sites, airports, etc.

Goal: Update existing GIS data layers related to natural hazards.
Responsible Departments: Engineering, Public Works
Strategies:

1. Consider seeking funding and support programs that update FEMA's Flood Insurance Rate Maps (FIRM). Consider participation in FEMA's Cooperating Technical Partners

(CTP) program that establishes partners with local jurisdictions to develop and maintain up-to-date flood maps.
2. In cooperation with local governments, utilize GIS to inventory at risk infrastructure and public and private structures within flood prone areas.
3. Participate in FEMA's Digital Flood Insurance Rate Maps (DFIRM) program.
4. Support FIRM remapping projects that address areas in the region that have the most serious mapping problems and where flooding is a repetitive problem.

Goal: Provide early warning of flooding
Responsible Department(s): Emergency Management, Engineering, Public Works, Transportation
Strategy:

1. Identify areas with recurring flood problems and request additional IFLOW stream/rain gauges as appropriate to ensure that these areas are adequately covered and monitored.

Goal: Identify structural projects that could mitigate the impact of flooding.
Responsible Departments: Engineering, Public Works, Transportation
Strategies:

1. Consider seeking funding to prepare site-specific hydrologic and hydraulic studies that look at areas that have chronic and repetitive flooding problems.
2. Support Virginia Department of Transportation projects that call for improved ditching, replacement of inadequate and undersized culverts, enlargements of bridge openings and drainage piping needed to minimize flooding.

Goal: Maintain an accurate database and map of repetitive loss properties
Responsible Departments: Emergency Management, Engineering, Public Works
Strategies:

1. Localities will work with RVARC, VDEM and FEMA to update list of repetitive loss properties annually.
2. Localities will obtain updated list of repetitive loss properties annually from VDEM/FEMA.
3. Localities will review property addresses for accuracy and make necessary corrections.
4. Localities will determine if and by what means each property has been mitigated.
5. Localities will map properties to show general site locations (not parcel specific in order to maintain anonymity of the property owners).
6. Localities will determine if properties have been mitigated and inform FEMA/VDEM through submission of an updated list/database and mapping.

5.3.3 Hurricane

Mitigation measures for hurricanes are region-wide recommendations for all localities adopting the Regional Hazard Mitigation Plan.

Goal: Mitigate the impact of hurricanes in the Roanoke Valley-Alleghany Region.

Responsible Department: Emergency Management
Strategy:

1. Provide information about the “StormReady” program to each locality.

5.3.4 Karst

Mitigation measures for karst are region-wide recommendations for all localities adopting the Regional Hazard Mitigation Plan.

Goal: Improved Hazard Mapping and Assessments for karst areas and sinkholes.
Responsible Departments: Engineering, Public Works
Strategy:

1. Encourage the delineation of karst areas and areas susceptible to sinkholes through a cooperative effort with the Virginia Karst Mapping Project, Virginia Speleological Survey, and Virginia Department of Conservation and Recreation (Virginia Cave Board).

5.3.5 Landslide

Mitigation measures for landslides are region-wide recommendations for all localities adopting the Regional Hazard Mitigation Plan.

Goal: Improved Hazard Mapping and Assessments for landslides.
Responsible Departments: Engineering, Public Works, Transportation
Strategies:

1. Encourage the delineation of susceptible areas and different types of landslide hazards at a scale useful for planning and decision-making, led by USGS and State geological surveys.
2. Work with state and Federal agencies to develop data that will assist in reducing and eliminating impacts from landslides.

5.3.6 Straight Line Winds

Mitigation measures for straight line winds are region-wide recommendations for all localities adopting the Regional Hazard Mitigation Plan.

Goal: Mitigation of the impact of Straight Line Winds.
Responsible Departments: Emergency Management, Public Information Office
Strategy:

1. In cooperation with Federal and State governments, support a comprehensive public information and education program on Straight Line Winds. This can be accomplished through regional workshops and educational materials for citizens, business, local staff, and elected officials.

5.3.7 Tornado

Mitigation measures for tornados are region-wide recommendations for all localities adopting the Regional Hazard Mitigation Plan.

Goal: Mitigation of the impact of Tornados.
Responsible Departments: Emergency Management, Public Information Office
Strategy:

1. In cooperation with Federal and State governments, support a comprehensive public information and education program on Tornados. This can be accomplished through regional workshops and educational materials for citizens, business, local staff, and elected officials.

5.3.8 Wildfire

Mitigation measures for wildfires are region-wide recommendations for all localities adopting the Regional Hazard Mitigation Plan.

Goal: Mitigation of the impacts of wildfire to life and property.
Responsible Departments: Community Development, Emergency Management, Engineering
Strategies:

1. Encourage residents and developers to use NFPA Firewise USA ™ building design, siting, and materials for construction.
2. Encourage VDOF to continue its Community Wildfire Assessments.
3. Identify buildings or locations vital to the emergency response effort and buildings or locations that, if damaged, would create secondary disasters in forested areas.

5.3.9 Winter Storms

Mitigation measures for winter storms are region-wide recommendations for all localities adopting the Regional Hazard Mitigation Plan.

Goal: Mitigation of the effects of extreme winter weather.
Responsible Departments: Emergency Services, Public Information Office
Strategies:

1. Research and consider participating in the National Weather Service “Storm Ready” program.
2. Participate in special statewide outreach/awareness activities, such as Winter Weather Awareness Week, Flood Awareness Week, etc.

5.3.10 All Hazards

Mitigation measures for the all hazards classification are region-wide recommendations for all localities adopting the Regional Hazard Mitigation Plan.

Goal: Improve general preparedness of the local government for all hazards.
Responsible Departments: Emergency Services, Public Information Office
Strategies:

1. In cooperation with Federal and State governments, support a comprehensive public information and education program on Tornados. This can be accomplished through regional workshops and educational materials for citizens, business, local staff, and elected officials.
2. Participate in statewide disaster mitigation outreach and awareness activities.

Table 81: Regional Hazard Mitigation Projects

Project	Hazard Mitigated	Benefit	Cost Estimate	Benefit-to-Cost	Priority	Funding Partners	Implementation/ Lead Agency	Status	Proposed Schedule
Publish a special section in local newspaper with emergency information on earthquakes	Earthquake	Increased level of knowledge and awareness in citizens	$5,000	High	Low	FEMA, VDEM Local governments	Local government	Not started; lack of funding	2020
Maintain an accurate database and map of repetitive loss properties	Flooding	Identification of repetitive loss properties that should be mitigated	$5,000	High	High	FEMA, VDEM	Local government RVARC, VDEM, FEMA	Ongoing	Ongoing
Utilize GIS to inventory at risk infrastructure and public and private structures within flood prone areas	Flooding	Available inventory of structures that need additional or unique protection from flooding.	$30,000	Medium	Medium	FEMA, VDEM Local governments	Local government	Not started; lack of funding	Ongoing
Participate in FEMA's Digital Flood Insurance Rate Maps (DFIRM) program	Flooding	Increased accuracy of flood hazard areas through sharing of local knowledge.	$10,000	Medium	Medium	FEMA, Local governments	Local government	In progress; depends on the locality's ability to provide GIS information	Ongoing
Support FIRM remapping projects in repetitive loss areas	Flooding	Increased accuracy of flood hazard areas through sharing of local knowledge.	unknown	unknown	Medium	FEMA, VDEM Local governments	Local government	In progress; advocating for flood studies by localities	Ongoing

Project	Hazard Mitigated	Benefit	Cost Estimate	Benefit-to-Cost	Priority	Funding Partners	Implementation/ Lead Agency	Status	Proposed Schedule
Seek funding to prepare site-specific hydrologic and hydraulic studies of areas that have chronic and repetitive flooding	Flooding	Possible determination of solutions to repetitive loss properties.	$5,000	High	Medium	Local governments	Local government	Ongoing	Ongoing
Support Virginia Department of Transportation projects that minimize flooding	Flooding	Safer transportation system and reduction in flooding of private properties.	$0	High	Medium	Local governments, VDOT	Local government	In progress; localities advocating for drainage improvements.	Ongoing
Provide information about the "StormReady" program to each locality	All Hazards	Increased knowledge of local officials about the StormReady program; possible applicants to the program.	$1,000	High	Medium	FEMA, VDEM, NWS, Local governments	RVARC	Ongoing	Annual reminder to localities that have not applied to the program
Encourage residents and developers to use FireWise building design, siting, and materials for construction	Wildfire	Reduction in wildfire damage.	$5,000	High	Medium	VA Dept. of Forestry, USFS, Local governments	Local government	Ongoing	Ongoing
Identify buildings or locations vital to the emergency response effort and buildings or locations that, if damaged, would create secondary disasters in forested areas	Wildfire	Available inventory of structures that need additional or unique protection from wildfires.	$10,000	Medium	Medium	VA Dept. of Forestry, US Forest Service, Local governments	Local government	Not started; lack of funding	2020

Project	Hazard Mitigated	Benefit	Cost Estimate	Benefit-to-Cost	Priority	Funding Partners	Implementation/ Lead Agency	Status	Proposed Schedule
Develop and maintain an inventory of flood prone critical regional facilities	Flooding	Available inventory of critical structures that need additional or unique protection from flooding.	$10,000	Medium	Medium	FEMA, VDEM Local governments	Local government	Ongoing	Ongoing
Flood prone roadway study / database	Flooding	Inventory of flood prone roadways for planning purposes (road improvements, limitation of development)	$10,000	Medium	Medium	FEMA, VDEM VDOT	RVARC	In progress	2-year updates
Participate in FEMA's Cooperating Technical Partners (CTP) program and Digital Flood Insurance Rate Maps (DFIRM) program	Flooding	Increased accuracy of flood maps and more effective regulation and enforcement of regulations	$5,000	High	Medium	FEMA, VDEM	Local government	Ongoing; not all localities participate	Ongoing
Identify funding and resources for delineating landslide hazards	Landslide	Tool for planning and decision-making; limitation of new development.	$5,000	Medium	Low	FEMA, VDEM USGS VDOT	Local government VA DCR	Not started; lack of funding	2020
Public information and education program	All Hazards	Increased level of knowledge and awareness in citizens of natural hazards.	$5,000	Medium	Medium	FEMA, VDEM Local governments	Local government	Ongoing local efforts	Ongoing
Participate in special statewide outreach/awareness activities	All Hazards	Increased level of knowledge and awareness in citizens of natural hazards.	$5,000	Medium	Low	FEMA, VDEM	Local government	Ongoing local efforts	Ongoing

Chapter 6 Local Mitigation Activities, Goals and Strategies, and Proposed Project Listings

In developing mitigation strategies for the region and each locality, a wide range of activities were considered in order to achieve the goals and to lessen the vulnerability of the area to the impact of natural hazards. All goals, strategies and projects are dependent on the availability and timeliness of non-local funding.

Goals and Strategies were prioritized by each individual locality. Prioritization was completed in order of relative priority – high, medium or low – based on the benefit to cost criteria and the strategy's potential to mitigate the impact from natural hazards. Consideration was also given to availability of funding, the department/agency responsible for implementation, and the ability of the locality to implement the project. Under each identified pre-disaster, applicable local government departments will be the lead in making sure that each project or action will be implemented in timely manner with other departments, other local government representatives and/or other regional agencies.

Project priorities are ranked by localities as high, medium or low. In general, a high ranking indicates an immediate need – within the next year – and that the locality is actively planning for the project. A medium ranking indicates a short-term need – within 2-5 years – that is being planned. A low priority indicates either a long-term need – more than 5 years out – or an activity that would be of benefit but might not be a necessity, for example new mapping or additional outreach programs.

The anticipated level of cost effectiveness of each measure was a primary consideration when developing the list of proposed projects. Since the mitigation projects are an investment of public funds to reduce damages, localities have selected, and prioritized projects based on the benefit to cost of each project in hopes of obtaining the maximum benefit. Projects were categorized as high, medium or low benefit to cost based on the available information for each proposed project. Reduced damages over the lifespan of the projects, the benefits, are likely to be greater than the project cost in all cases. Although detailed cost and benefit analysis was not conducted during the mitigation action development process, these factors were of primary concern when prioritizing and selecting the proposed projects.

6.1 Alleghany County

6.1.1 Current and Past Mitigation Measures

Floodplain Management – Alleghany County adopted its most recent Floodplain District in December 2010 that requires new residential buildings to be elevated to or above the base flood elevation. The floodplain district is an overlay that applies to all other zoning districts. Additional requirements prevent the obstruction of the floodway. In addition to Federal Regulations, the County has established guidelines for development within flood hazard areas. They can be

found in Chapter 66-Zoning, of the Code of the County of Alleghany, Virginia. No construction or development, including fill, can be done in a designated floodway. Development can occur in the 100-year floodplain, however the first-floor elevation of a structure must be at least one foot above the designated flood elevations shown on the Flood Insurance Rate Maps. Also, structures in the 100-year floodplain must be in compliance with building code requirements for structures in flood hazard areas. Development can occur in the 500-year floodplain with compliance of building code requirements for structures in flood hazard areas.

Erosion and Sediment Control – The County has an Erosion and Sediment Control Ordinance that is part of the County Code. Pursuant to Code of Virginia, §10.1-562, the Alleghany County adopted the regulations, references, guidelines, standards and specifications promulgated by the state soil and water conservation board for the effective control of soil erosion and sediment deposition to prevent the unreasonable degradation of properties, stream channels, waters and other natural resources. Such regulations, references, guidelines, standards and specifications for erosion and sediment control are included in but not limited to the Virginia Erosion and Sediment Control Regulations and the Virginia Erosion and Sediment Control Handbook, as amended from time to time.

National Flood Insurance Program – The County participates in, and is in good standing with, the National Flood Insurance Program (NFIP) by enforcing floodplain management regulations that meet federal requirements. This program allows property owners to purchase flood insurance from NFIP. There were 194 NFIP policies in force in the County as of August 2018.

Dam Safety – There are four dams in Alleghany County. These are the Clifton Forge Dam (owned and maintained by the Town of Clifton Forge), Gathwright Dam (owned and maintained by US Army Corps of Engineers), Pond Lick Branch Dam (privately owned) and WestRock #2 Flyash Lagoon Dam (owned and maintained by WestRock).

Gathright Dam was completed in 1979 and is operated for flood control. The facility is managed by the Army Corps of Engineers. The dam controls the runoff from a 345 square mile drainage area and reduces the effects of flooding along the Jackson and James Rivers. The Corps of Engineers estimates that the project has prevented more than $70 million in flood damages. In May 2009, the U.S. Army Corps of Engineers (USACE) inspected the Gathright Dam as part of Screening Portfolio Risk Analysis and routine inspections. Later in the year on September 2, the USACE assigned the dam a Safety Action Classification (DSAC) II which is defined as "Urgent (Unsafe or Potentially Unsafe)". The rating is attributed to concerns about possible increased seepage at the toe of the dam, and an undetermined flow rate at the river spring a quarter mile downstream, and potential flow channels through limestone below the spillway during pool events above 1600 feet. Because of this rating, the USACE has implemented risk reduction measures which include increased monitoring, updating emergency operation plans and reducing the water level in the reservoir. As of early 2010, the USACE has reduced and continues to maintain the reservoir at an elevation of 1,562 ft above sea level compared to the normal level of 1,582 feet. Throughout 2010, the USACE conducted safety exercises with local/state officials, conduct a series of investigations on the dam, update inundation mapping

and reevaluate the DSAC status. In November 2010, Lake Moomaw was restored to a level of 1,582 feet and the DSAC will be reevaluated in the future.

All of these dams are subject to the National Dam Safety Program Act of 1996 and the resulting 1998 Federal Guidelines for Dam Safety. FEMA requires all dam owners to develop an Emergency Action Plan for warning, evacuation and post-flood actions. The dams are also subject to the Virginia Dam Safety Act that is administered by the by the Department of Conservation and Recreation and Dam Safety Regulations enacted by the Virginia Soil and Water Conservation Board. All dams in the County are in good standing with State and Federal regulatory agencies at this time.

IFLOWS – The County participates in a flood warning system developed by the National Weather Service called Integrated Flood Observing and Warning System (IFLOWS). Through the use of radio-transmitted information, this system provides advanced flood forecasting to the County Emergency Operation Center. There are eight (8) IFLOW stations located in the County.

6.1.2 Alleghany County Mitigation Goals and Strategies

In developing mitigation strategies for the region and each locality, a wide range of activities were considered in order to achieve the goals and to lessen the vulnerability of the area to the impact of natural hazards. All goals, strategies and projects are dependent on the availability and timeliness of non-local funding.

Goals and Strategies were prioritized by each locality. Prioritization was completed in order of relative priority – high, medium or low – based on the benefit to cost criteria and the strategy's potential to mitigate the impact from natural hazards. Consideration was also given to availability of funding, the department/agency responsible for implementation, and the ability of the locality to implement the project. Under each identified pre-disaster, applicable local government departments will be the lead in making sure that each project or action will be implemented in a timely manner with other departments, other local government representatives and/or other regional agencies.

The anticipated level of cost effectiveness of each measure was a primary consideration when developing the list of proposed projects. Since the mitigation projects are an investment of public funds to reduce damages, localities have selected and prioritized projects based on the benefit to cost of each project in hopes of obtaining the maximum benefit. Projects were categorized as high, medium or low benefit to cost based on the available information for each proposed project. Reduced damages over the lifespan of the projects, the benefits, are likely to be greater than the project cost in all cases. Although detailed cost and benefit analysis was not conducted during the mitigation action development process, these factors were of primary concern when prioritizing and selecting the proposed projects.

6.1.2.1 Flood

Goal: Mitigation of loss of life and property from flooding and flood related disasters.
Responsible Departments: Emergency Services, Public Works, Planning/Zoning
Strategies:

1. In cooperation with Federal and State governments, support a comprehensive public information and education program on all hazards addressed in the Regional Hazard Mitigation Plan. This can be accomplished through regional workshops and educational materials for citizens, business, local staff, and elected officials.
2. Develop and maintain an inventory of flood prone roadways in cooperation with local residents and the Virginia Department of Transportation.
3. Develop and maintain an inventory of flood prone critical facilities and public utilities and evaluate measures for flood proofing.
4. Identify households in flood hazard areas and work to remove them to reduce repetitive loss, loss of life, and loss of property.
5. Identify areas with recurring flood problems and request additional IFLOW stream/rain gauges as appropriate to ensure that these areas are adequately covered and monitored.
6. Participate in, and remain in good standing with, the National Flood Insurance Program (NFIP) by enforcing floodplain management regulations that meet federal requirements.
7. Acquisition of flood prone properties followed by the appropriate mitigation action of demolition or relocation.

Goal: Identify structural projects that could mitigate the impact of flooding.
Responsible Department: Public Works, Planning/Zoning
Strategies:

1. Consider seeking funding to prepare site-specific hydrologic and hydraulic studies that look at areas that have chronic and repetitive flooding problems caused by rivers, creeks, streams, and/or drainage/runoff.
2. Support Virginia Department of Transportation projects that call for improved ditching, replacement of inadequate and undersized culverts, enlargements of bridge openings and drainage piping needed to minimize flooding.

Goal: Update existing GIS data layers related to natural hazards.
Responsible Department: Public Works, Planning/Zoning
Strategies:

1. Consider seeking funding and support programs that update FEMA's Flood Insurance Rate Maps (FIRM). Consider participation in FEMA's Cooperating Technical Partners (CTP) program that establishes partners with local jurisdictions to develop and maintain up-to-date flood maps.
2. Continue to participate in FEMA's Digital Flood Insurance Rate Maps (DFIRM) program.
3. Support FIRM re-mapping projects that address areas that have the most serious mapping problems and where flooding is a repetitive problem.

4. Develop and utilize GIS to inventory at risk infrastructure and public and private structures to increase accuracy and improve hazard mitigation planning.

Goal: Maintain an accurate database and map of repetitive loss properties
Responsible Department: GIS
Strategies:

1. Work with VDEM and FEMA to update list of repetitive loss properties annually.
2. Obtain updated list of repetitive loss properties annually from VDEM/FEMA.
3. Review property addresses for accuracy and make necessary corrections.
4. Determine if and by what means each property has been mitigated.
5. Map properties to show general site locations (not parcel specific in order to maintain anonymity of the property owners).
6. Determine if properties have been mitigated and inform FEMA/VDEM through submission of an updated list/database and mapping.

6.1.2.2 All Hazards

Goal: Improve general preparedness of the local government for all hazards.
Responsible Department: Emergency Services
Strategies:

1. Improve interoperability with surrounding jurisdictions by improving existing radio equipment and acquiring additional/alternate methods by which to communicate.
2. Work with local officials and emergency volunteers to evaluate the necessity of placing generators at emergency facilities.
3. Work to evaluate local development codes that would improve disaster mitigation.

6.1.2.3 Wildfire

Goal: Mitigation of the impacts of wildfire to life and property.
Responsible Department: Emergency Services
Strategies:

1. Encourage residents and developers to use Fire-Wise building design, siting, and materials for construction.
2. Encourage VDOF to continue it program of Community Wildfire Assessments.
3. Identify buildings or locations vital to the emergency response effort and buildings or locations that, if damaged, would create secondary disasters in forested areas.

Table 82: Alleghany County Hazard Mitigation Projects

Project	Hazard Mitigated	Benefit	Cost Estimate	Benefit-to-Cost	Priority	Funding Partners	Implementation/ Lead Agency	Status	Proposed Schedule
Develop and maintain an inventory of flood prone roadways	Flooding	Inventory of flood prone roadways for planning purposes (road improvements, limitation of development)	$25,000	Medium	Medium	FEMA, VDEM, RVARC, VDOT, Local government	RVARC	In progress	Ongoing updates
Acquisition of flood prone properties	Flooding	Removal of households from flood hazard areas; reduce repetitive loss; reduce loss of life and property	Unknown	High	High	FEMA, VDEM, Local government	Local government, Engineering & Building Inspections	Not started; lack of funding	2018-2023
Participate in, and remain in good standing with, the National Flood Insurance Program (NFIP)	Flooding	Reduction of future flood damage through enforcement of floodplain ordinances and availability of discounted flood insurance for property owners	N/A	High	High	FEMA	Local government	In progress	Ongoing
Maintain an accurate database and map of repetitive loss properties	Flooding	Identification of repetitive loss properties that should be mitigated	Unknown	High	High	FEMA, VDEM	Local government, RVARC, VDEM	Ongoing	Ongoing
Identify areas with recurring flood problems and request additional IFLOW stream/rain gauges	Flooding	Improved early warning of flooding; ensure that these areas are adequately covered and monitored	$12,500	High	Medium	FEMA, VDEM	RVARC	In progress	2019

Project	Hazard Mitigated	Benefit	Cost Estimate	Benefit-to-Cost	Priority	Funding Partners	Implementation/ Lead Agency	Status	Proposed Schedule
Seek funding to prepare site-specific hydrologic and hydraulic studies that look at areas that have chronic and repetitive flooding problems	Flooding	Possible determination of solutions to repetitive loss properties.	$5,000	High	Medium	Local governments	Local government	Not started; lack of funding	Unknown
Continue participation in FEMA DFIRM program	Flooding	Increased accuracy of flood hazard areas through sharing of local knowledge.	$10,000	Medium	Medium	FEMA, local governments	Local government	In progress	Ongoing
Support FIRM re-mapping projects	Flooding	Increased accuracy of flood hazard areas through sharing of local knowledge.	Unknown	unknown	Medium	FEMA, local governments	Local government	In progress	Ongoing
Encourage residents and developers to use Fire-Wise building design, siting, and materials for construction	Wildfire	Reduction in damages from wildfire	$5,000	High	Medium	VA Dept. of Forestry, Local governments	Local government	Not started; lack of funding	Unknown
Identify buildings or locations vital to the emergency response effort and buildings or locations that, if damaged, would create secondary disasters in forested areas	Wildfire	Available inventory of structures that need additional or unique protection from wildfires.	$10,000	Medium	Medium	VA Dept. of Forestry, US Forest Service, Local governments	Local government, VDOF, USFS	Not started; lack of funding	Unknown

Project	Hazard Mitigated	Benefit	Cost Estimate	Benefit-to-Cost	Priority	Funding Partners	Implementation/ Lead Agency	Status	Proposed Schedule
Flood hazard mapping update/ modernization	Flooding	Increased accuracy of flood maps and more effective regulation and enforcement of regulations	$50,000	N/A	High	FEMA, VDEM	Local government	Complete	Completed in 2010
Support Virginia Department of Transportation projects that minimize flooding	Flooding	Clear debris and repair banks to prevent backup, erosion and flooding of existing drainage systems	$500,000	N/A	Medium	FEMA, VDEM, VDOT	Local government or VDOT	Not started; lack of funding	Unknown
Evaluate critical facilities and public utilities for flood-proofing	Flooding	Evaluation of critical facilities and public utilities for retrofitting or flood-proofing to prevent failure during disasters	$250,000	N/A	Medium	FEMA, Local government	Local government	In progress; need funds for flood-proofing	Ongoing
Communication equipment interoperability	All hazards	Improved coordination among jurisdictions; improved response times	$7,000,000	N/A	High	FEMA, Local government	Local government	In progress	Current / Ongoing
Public education	All hazards	Inform public about hazards and mitigation options	$25,000	N/A	High	FEMA, VDEM, Local government	Local government	In progress	Current - Ongoing
Determine the need for generators at public emergency facilities	All hazards	Ensure that emergency facilities can be operational during hazard events	$250,000	N/A	Medium	FEMA, Local government	Local government	In progress	2019
Local codes review	All hazards	Review of development codes to evaluate need for changes that would improve disaster mitigation	$10,000	N/A	Medium	FEMA, Local government	Local government	Not started; lack of funding	Unknown
Community wildfire assessments	Wildfire	Reduction of loss to wildfire	$25,000	N/A	Medium	VDOF	Local government	Not started; lack of funding	Unknown

6.2 Town of Clifton Forge

6.2.1 Current and Past Mitigation Measures

Floodplain Management – Clifton Forge has adopted a Floodplain Management Ordinance (1992) which requires new residential buildings to be elevated to or above the base flood elevation. Additional requirements prevent the obstruction of the floodway. The Town has a Floodplain Overlay in its Zoning Ordinance. Clifton Forge worked with FEMA to appeal and revise the 2010 FIRM changes that dealt primarily with the downtown and Smith Creek corridor.

National Flood Insurance Program – The Town participates in, and is in good standing with, the National Flood Insurance Program (NFIP) by enforcing floodplain management regulations that meet federal requirements. This program allows property owners to purchase flood insurance from NFIP. There were 11 NFIP policies in force in the Town as of August 2018.

Dam Safety – There is one dam on Smith Creek that could impact the Town of Clifton Forge. The dam, along with the associated Smith Creek Reservoir is owned and maintained by the Town of Clifton Forge and serves as the water supply for the Town of Clifton Forge, portions of Alleghany County, and the Town of Iron Gate. The Town of Clifton Forge is responsible for the maintenance of the dams. Improvement to the dam will begin once the necessary land transfer from the US Forest Service to the Town is complete. Construction is expected to begin in March 2019 and be complete by early 2020.

The dam is subject to the National Dam Safety Program Act of 1996 and the resulting 1998 Federal Guidelines for Dam Safety. The Town has developed the required FEMA Emergency Action Plan for warning, evacuation and post-flood actions. The dam is also subject to the Virginia Dam Safety Act that is administered by the by the Department of Conservation and Recreation and Dam Safety Regulations enacted by the Virginia Soil and Water Conservation Board. The Smith Creek dam is in good standing with State and Federal regulatory agencies at this time.

IFLOWS – The Town participates in a flood warning system developed by the National Weather Service called Integrated Flood Observing and Warning System (IFLOWS). Through the use of radio-transmitted information, this system provides advanced flood forecasting to the Town Emergency Operation Center. There are no IFLOW stations located in the Town. The nearest gauges are on the Jackson River in Covington and in Sharon along with gauges on Fore Mountain and Low Moor.

Erosion and Sediment Control – The Town of Clifton Forge has adopted the regulations, references, guidelines, standards and specifications promulgated by the State Water Control Board for the effective control of soil erosion and sediment deposition to prevent the unreasonable degradation of properties, stream channels, waters and other natural resources. Such regulations, references, guidelines, standards and specifications for erosion and sediment control are included in but not limited to the Virginia Erosion and Sediment Control Regulations

and the Virginia Erosion and Sediment Control Handbook, as amended. The Town contracts with a private engineering firm for erosion and sediment control services.

6.2.2 Clifton Forge Mitigation Goals and Strategies

In developing mitigation strategies for the region and each locality, a wide range of activities were considered in order to achieve the goals and to lessen the vulnerability of the area to the impact of natural hazards. All goals, strategies and projects are dependent on the availability and timeliness of non-local funding.

Goals and Strategies were prioritized by each locality. Prioritization was completed in order of relative priority – high, medium or low – based on the benefit to cost criteria and the strategy's potential to mitigate the impact from natural hazards. Consideration was also given to availability of funding, the department/agency responsible for implementation, and the ability of the locality to implement the project. Under each identified pre-disaster, applicable local government departments will be the lead in making sure that each project or action will be implemented in a timely manner with other departments, other local government representatives and/or other regional agencies.

The anticipated level of cost effectiveness of each measure was a primary consideration when developing the list of proposed projects. Since the mitigation projects are an investment of public funds to reduce damages, localities have selected and prioritized projects based on the benefit to cost of each project in hopes of obtaining the maximum benefit. Projects were categorized as high, medium or low benefit to cost based on the available information for each proposed project. Reduced damages over the lifespan of the projects, the benefits, are likely to be greater than the project cost in all cases. Although detailed cost and benefit analysis was not conducted during the mitigation action development process, these factors were of primary concern when prioritizing and selecting the proposed projects.

6.2.2.1 Flooding

Goal: Mitigation of loss of life and property from flooding and flood related disasters.
Responsible Departments: Public Works, Community Development
Strategies:

1. In cooperation with Federal and State governments, support a comprehensive public information and education program on all hazards addressed in the Regional Hazard Mitigation Plan. This can be accomplished through regional workshops and educational materials for citizens, business, local staff, and elected officials.
2. Develop and maintain an inventory of flood prone roadways in cooperation with local residents and the Virginia Department of Transportation.
3. Develop and maintain an inventory of flood prone critical facilities and public utilities and evaluate measures for flood proofing.

4. Identify areas with recurring flood problems and request additional IFLOW stream/rain gauges as appropriate to ensure that these areas are adequately covered and monitored.
5. Participate in, and remain in good standing with, the National Flood Insurance Program (NFIP) by enforcing floodplain management regulations that meet federal requirements.

Goal: Identify structural projects that could mitigate the impact of flooding.
Responsible Department: Public Works
Strategies:

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.

Goal: Update existing GIS data layers related to natural hazards.
Responsible Department: Public Works
Strategies:

1. Consider seeking funding and support programs that update FEMA's Flood Insurance Rate Maps (FIRM). Consider participation in FEMA's Cooperating Technical Partners (CTP) program that establishes partners with local jurisdictions to develop and maintain up-to-date flood maps.
2. Participate in FEMA's Digital Flood Insurance Rate Maps (DFIRM) program.
3. Support FIRM re-mapping projects that address areas that have the most serious mapping problems and where flooding is a repetitive problem.
4. Develop and utilize GIS to inventory at risk infrastructure and public and private structures to increase accuracy and improve hazard mitigation planning.

6.2.2.2 All Hazards

Goal: Improve general preparedness of the local government for all hazards.
Responsible Department: Police Department and Town Manager
Strategies:

1. Improve interoperability with surrounding jurisdictions by improving existing radio equipment and acquiring additional/alternate methods by which to communicate.
2. Work to evaluate local development codes that would improve disaster mitigation.

6.2.2.3 Wildfire

Goal: Mitigation of the impacts of wildfire to life and property.
Responsible Department: Emergency Services
Strategies:

1. Encourage residents and developers to use Fire-Wise building design, siting, and materials for construction.
2. Encourage VDOF to continue its program of Community Wildfire Assessments.

3. Identify buildings or locations vital to the emergency response effort and buildings or locations that, if damaged, would create secondary disasters in forested areas.

Table 83: Town of Clifton Forge Hazard Mitigation Projects

Project	Hazard Mitigated	Benefit	Cost	Benefit-to-Cost	Priority	Funding Partners	Implementation/ Lead Agency	Status	Proposed Schedule
Town Mapping by Degree of Urgency	Flooding	Identify Problem Areas	$25,000	High	Medium	Local Government	Local Government; Public works	Not started; lack of funding	12 months
Participate in, and remain in good standing with, the National Flood Insurance Program (NFIP)	Flooding	Reduction of future flood damage through enforcement of floodplain ordinances and availability of discounted flood insurance for property owners	0	High	High	FEMA	Local government; Community Development	Ongoing	Ongoing
Maintain an accurate database and map of repetitive loss properties	Flooding	Identification of repetitive loss properties that should be mitigated	Unknown	High	High	FEMA, VDEM	Local government, RVARC, VDEM	Ongoing	Ongoing
Identify areas with recurring flood problems and request additional IFLOW stream/rain gauges	Flooding	Improved early warning of flooding; ensure that these areas are adequately covered and monitored	$12,500	High	Medium	FEMA, VDEM	Local Government, Public Works, RVARC	In progress	2013
Continue participation in FEMA DFIRM program	Flooding	Increased accuracy of flood hazard areas through sharing of local knowledge.	$10,000	Medium	Medium	FEMA, local governments	Local governments	In progress	Ongoing
Support FIRM re-mapping projects	Flooding	Increased accuracy of flood hazard areas through sharing of local knowledge.	Unknown	unknown	High	FEMA, local governments	Local government	In progress	Ongoing

Project	Hazard Mitigated	Benefit	Cost	Benefit-to-Cost	Priority	Funding Partners	Implementation/ Lead Agency	Status	Proposed Schedule
Encourage residents and developers to use Fire-Wise building design, siting, and materials for construction	Wildfire	Reduction in damages from wildfire	$5,000	High	Medium	VA Dept. of Forestry, Local governments	Local government, Building Official	Not started; lack of funding	Unknown
Identify buildings or locations vital to the emergency response effort and buildings or locations that, if damaged, would create secondary disasters in forested areas	Wildfire	Available inventory of structures that need additional or unique protection from wildfires.	$10,000	Medium	Medium	VA Dept. of Forestry, US Forest Service, Local governments	Local government, VDOF, USFS	Not started; lack of funding	Unknown
Support local street projects that minimize flooding	Flooding	Clear debris and repair banks to prevent backup, erosion and flooding of existing drainage systems	$500,000	N/A	Medium	FEMA, VDEM	Local government, Public Works	Not started; lack of funding	Unknown
Evaluate critical facilities and public utilities for flood-proofing	Flooding	Evaluation of critical facilities and public utilities for retrofitting or flood-proofing to prevent failure during disasters	$250,000	N/A	Medium	FEMA, Local government	Local government, Public Works	In progress; need funds for flood-proofing	Ongoing
Communication equipment interoperability	All hazards	Improved coordination among jurisdictions; improved response times	$1,000,000	N/A	High	FEMA, Local government	Local government, Police Department	In progress	Current / Ongoing
Public education	All hazards	Inform public about hazards and mitigation options	$25,000	N/A	High	FEMA, VDEM, Local government	Local government, Community Development	In progress	Current - Ongoing

Project	Hazard Mitigated	Benefit	Cost	Benefit-to-Cost	Priority	Funding Partners	Implementation/ Lead Agency	Status	Proposed Schedule
Determine the need for generators at public emergency facilities	All hazards	Ensure that emergency facilities can be operational during hazard events	$250,000	N/A	Medium	FEMA, Local government	Local government, Public Works	In progress	2013
Local codes review	All hazards	Review of development codes to evaluate need for changes that would improve disaster mitigation	$10,000	N/A	Medium	FEMA, Local government	Local government, Community Development, Building Official	Not started; lack of funding	Unknown
Community wildfire assessments	Wildfire	Reduction of loss to wildfire	$25,000	N/A	Medium	VDOF	Local government, Community Development	Not started; lack of funding	Unknown
Local Flood Profile	Flood	Identify Hazards	$100,000	High	High	USDA	VA Soil and Water Conservation Board	Not started; lack of funding	2014-15
Stream Bed Survey	Flood	Identify Repairs Required	$25,000	Medium	Medium	RWA, Local Government	Local Government Public Works	Not started; lack of funding	Unknown
Identify Geologic Hazard Areas	Earthquake, Landslide and Karst	Identify Hazards	$75,000	Medium	Medium	Local Government	FEMA, Local Government, Community Development	Not started; lack of funding	12 months
Communications Plan	All Hazards	Improved Communication and Response	$5,000	Medium	High	Local Government	FEMA, Local Government, Police Department	In progress	Ongoing
Water Reservoir Hazard Plan	All Hazards	Protection of Town Water Supply	$125,000	High	High	VA Dept of Health, FEMA	Local Government, VA Department of Health	Not started; lack of funding	12 months

6.3 Town of Iron Gate

6.3.1 Current and Past Mitigation Measures

Floodplain Management – Town of Iron Gate has chosen to adopt the Alleghany County Zoning Ordinance that includes a Floodplain District that requires new residential buildings to be elevated to or above the base flood elevation.

National Flood Insurance Program – The Town participates in, and is in good standing with, the National Flood Insurance Program (NFIP) by enforcing floodplain management regulations that meet federal requirements. This program allows property owners to purchase flood insurance from NFIP. There was one (1) NFIP policies in force in the Town as of August 2018.

Dam Safety – There is one dam on Smith Creek that could impact the Town of Clifton Forge. The dam, along with the associated Smith Creek Reservoir is owned and maintained by the Town of Clifton Forge and serves as the water supply for the Town of Clifton Forge, portions of Alleghany County, and the Town of Iron Gate. The Town of Clifton Forge is responsible for the maintenance of the dams. Improvement to the dam will begin once the necessary land transfer from the US Forest Service to the Town is complete. Construction is expected to begin in March 2019 and be complete by early 2020.

The dam is subject to the National Dam Safety Program Act of 1996 and the resulting 1998 Federal Guidelines for Dam Safety. The Town has developed the required FEMA Emergency Action Plan for warning, evacuation and post-flood actions. The dam is also subject to the Virginia Dam Safety Act that is administered by the by the Department of Conservation and Recreation and Dam Safety Regulations enacted by the Virginia Soil and Water Conservation Board. The Smith Creek dam is in good standing with State and Federal regulatory agencies at this time.

IFLOWS – The Town participates in a flood warning system developed by the National Weather Service called Integrated Flood Observing and Warning System (IFLOWS). Through the use of radio-transmitted information, this system provides advanced flood forecasting to the Town Emergency Operation Center. There are no IFLOW stations located in the Town.

Erosion and Sediment Control – The Town utilizes the E&S Control services of Alleghany County. Alleghany County adopted the regulations, references, guidelines, standards and specifications promulgated by the State Water Control Board for the effective control of soil erosion and sediment deposition to prevent the unreasonable degradation of properties, stream channels, waters and other natural resources. Such regulations, references, guidelines, standards and specifications for erosion and sediment control are included in but not limited to the Virginia Erosion and Sediment Control Regulations and the Virginia Erosion and Sediment Control Handbook, as amended from time to time.

6.3.2 Iron Gate Mitigation Goals and Strategies

In developing mitigation strategies for the region and each locality, a wide range of activities were considered in order to achieve the goals and to lessen the vulnerability of the area to the impact of natural hazards. All goals, strategies and projects are dependent on the availability and timeliness of non-local funding.

Goals and Strategies were prioritized by each locality. Prioritization was completed in order of relative priority – high, medium or low – based on the benefit to cost criteria and the strategy's potential to mitigate the impact from natural hazards. Consideration was also given to availability of funding, the department/agency responsible for implementation, and the ability of the locality to implement the project. Under each identified pre-disaster, applicable local government departments will be the lead in making sure that each project or action will be implemented in a timely manner with other departments, other local government representatives and/or other regional agencies.

The anticipated level of cost effectiveness of each measure was a primary consideration when developing the list of proposed projects. Since the mitigation projects are an investment of public funds to reduce damages, localities have selected and prioritized projects based on the benefit to cost of each project in hopes of obtaining the maximum benefit. Projects were categorized as high, medium or low benefit to cost based on the available information for each proposed project. Reduced damages over the lifespan of the projects, the benefits, are likely to be greater than the project cost in all cases. Although detailed cost and benefit analysis was not conducted during the mitigation action development process, these factors were of primary concern when prioritizing and selecting the proposed projects.

6.3.2.1 Flood

Goal: Mitigation of loss of life and property from flooding and flood related disasters.
Responsible Department: Administration
Strategies:

1. Develop and maintain an inventory of flood prone roadways in cooperation with local residents and the Virginia Department of Transportation.
2. Develop and maintain an inventory of flood prone critical facilities and public utilities and evaluate measures for flood proofing.
3. Identify repetitive loss properties for acquisition and/or elevation projects.
4. Participate in, and remain in good standing with, the National Flood Insurance Program (NFIP) by enforcing floodplain management regulations that meet federal requirements.
5. Acquisition of flood prone properties followed by the appropriate mitigation action of demolition or relocation.

Goal: Identification of structural projects to mitigate flooding
Responsible Departments: Administration, Public Works
Strategies:

1. Consider seeking funding to prepare site-specific hydrologic and hydraulic studies that address areas that have chronic and repetitive flooding problems caused by streams, inadequate road drainage, failing stormwater drains, and natural runoff.
2. Encourage Virginia Department of Transportation projects that call for improved ditching, replacement of inadequate and undersized culverts, and drainage piping needed to minimize flooding.

Goal: Maintain an accurate database and map of repetitive loss properties
Responsible Department:
Strategies:

1. Work with VDEM and FEMA to update list of repetitive loss properties annually.
2. Obtain updated list of repetitive loss properties annually from VDEM/FEMA.
3. Review property addresses for accuracy and make necessary corrections.
4. Determine if and by what means each property has been mitigated.
5. Map properties to show general site locations (not parcel specific in order to maintain anonymity of the property owners).
6. Determine if properties have been mitigated and inform FEMA/VDEM through submission of an updated list/database and mapping.

6.3.2.2 All Hazards

Goal: Improve general preparedness of the local government and emergency service providers for all hazards.
Responsible Departments: Administration, Police Department
Strategies:

1. Expand the existing Volunteer Fire Department facility to create a disaster shelter for use by local residents (expected completion in 2019).
2. Improve interoperability with surrounding jurisdictions by improving existing radio equipment and acquiring additional/alternate methods by which to communicate.
3. Work with local officials and emergency volunteers to evaluate the necessity of placing generators at emergency facilities. Purchase and install generators.
4. Work to evaluate local development codes (subdivision, zoning, etc.) that would improve disaster mitigation.

Table 84: Town of Iron Gate Hazard Mitigation Projects

Project	Hazard Mitigated	Benefit	Cost Estimate	Benefit-to-Cost	Priority	Funding Partners	Implementation/ Lead Agency	Status	Proposed Schedule
Communication equipment interoperability	All hazards	Improved coordination among jurisdictions; improved response times	$250,000	High	High	FEMA, Local government	Local government, Sheriff Dept., Police Dept.	In progress	2014
Acquisition of flood prone properties	Flooding	Removal of households from flood hazard areas; reduce repetitive loss; reduce loss of life and property	$500,000	High	High	FEMA, VDEM, Local government	Local government, Engineering & Building Inspections	Not started; lack of funding	2013-2018
Participate in, and remain in good standing with, the National Flood Insurance Program (NFIP)	Flooding	Reduction of future flood damage through enforcement of floodplain ordinances and availability of discounted flood insurance for property owners	$2,000	High	High	FEMA	Local government	Ongoing	Ongoing
Maintain an accurate database and map of repetitive loss properties	Flooding	Identification of repetitive loss properties that should be mitigated	$2,500	High	High	FEMA, VDEM	Local government, RVARC, VDEM	Ongoing	Ongoing
Develop and maintain an inventory of flood prone roadways	Flooding	Inventory of flood prone roadways for planning purposes (road improvements, limitation of development)	$25,000	Medium	Medium	FEMA, VDEM, RVARC, VDOT, Local government	RVARC	In progress	Ongoing updates
Evaluate critical facilities and public utilities for flood-proofing	Flooding	Evaluation of critical facilities and public utilities for retrofitting or flood-proofing to prevent failure during disasters	$25,000	N/A	Medium	FEMA, Local government	Local government	In progress	2014

Project	Hazard Mitigated	Benefit	Cost Estimate	Benefit-to-Cost	Priority	Funding Partners	Implementation/ Lead Agency	Status	Proposed Schedule
Seek funding to prepare site-specific hydrologic and hydraulic studies that look at areas that have chronic and repetitive flooding problems	Flooding	Possible determination of solutions to repetitive loss properties.	$50,000	High	Medium	Local governments	Local government	Not started; lack of funding	
Communication equipment interoperability	All hazards	Improved coordination among jurisdictions; improved response times	$1,000,000	N/A	High	FEMA, Local government	Local government	In progress	Current / Ongoing
Identify repetitive loss properties for acquisition/elevation projects	Flooding	Removal of structures from flood hazard areas; reduce repetitive loss; reduce loss of life and property	unknown	NA	High	FEMA, VDEM, Local government	Local government, Police Dept.	In progress	Ongoing
Public education	All hazards	Inform public about hazards and mitigation options	$4,000	Medium	Medium	FEMA, VDEM, Local government	Local government; RVARC	In progress	ongoing
Identify needed upgrade/repairs to stormwater system	Flooding	Reduce frequency and impact of flooding	$100,000	High	High	FEMA, VDEM, VDOT	Local government, Pubic Works Dept, VDOT	In progress	Ongoing
VDOT Drainage system maintenance	Flooding	Clear debris and repair banks to prevent backup, erosion and flooding of existing drainage	Unknown	Unknown	High	FEMA, VDEM, VDOT	Local government, Pubic Works Dept, VDOT	In progress	Annual review of projects with VDOT
Evaluate public utilities for floodproofing	Flooding	Evaluation of public utilities for retrofitting or floodproofing to prevent failure during disasters	$10,000	High	High	FEMA, Local government	Local government, Public Works Dept	Not started; lack of funding	Annually
Expand Volunteer Fire Dept. Building for use as Public Shelter	All Hazards	Provide shelter for the public to use during disasters (Town does not have a shelter)	$500,000	High	High	FEMA, USDA, Local government	Local government, Iron Gate VFD	Complete in 2019	2018-2019

Project	Hazard Mitigated	Benefit	Cost Estimate	Benefit-to-Cost	Priority	Funding Partners	Implementation/ Lead Agency	Status	Proposed Schedule
Flood hazard mapping update/ modernization	Flooding	Increased accuracy of flood maps and more effective regulation and enforcement of regulation	$50,000	High	High	FEMA	Local government, FEMA	Complete	Completed in 2010
Determine the need for generators at public facilities; purchase generators	All hazards	Ensure that emergency services, Town Hall/Police Dept. and water and sewer service (pumps) can be operational during hazard events	$75,000	Medium	Medium	FEMA, Local government	Local government	In progress; need funds for generators	2014
Local codes review	All hazards	Review of development codes to evaluate need for changes that would improve disaster mitigation	$5,000	High	Medium	FEMA, Local government	Local government	Not started; lack of funding	2014

6.4 City of Covington

6.4.1 Current and Past Mitigation Measures

Floodplain Management – City of Covington has adopted a Floodplain Management Ordinance that requires new residential buildings to be elevated to or above the base flood elevation. Additional requirements prevent the obstruction of the floodway.

National Flood Insurance Program – The City participates in, and is in good standing with, the National Flood Insurance Program (NFIP) by enforcing floodplain management regulations that meet federal requirements. This program allows property owners to purchase flood insurance from NFIP. There were 109 NFIP policies in force in the City as of August 2018.

Dam Safety – There are three dams in that could impact the City of Covington. These are the Gathwright Dam (owned and maintained by US Army Corps of Engineers), Pond Lick Branch Dam (privately owned) and Mead Westvaco #2 Fly Ash Lagoon Dam (owned and maintained by Mead Westvaco).

Gathright Dam was completed in 1979 and is operated for flood control. The facility is managed by the Army Corps of Engineers. The dam controls the runoff from a 345 square mile drainage area and reduces the effects of flooding along the Jackson and James Rivers. The Corps of Engineers estimates that the project has prevented more than $70 million in flood damages. In May 2009, the U.S. Army Corps of Engineers (USACE) inspected the Gathright Dam as part of Screening Portfolio Risk Analysis and routine inspections. Later in the year on September 2, the USACE assigned the dam a Safety Action Classification (DSAC) II which is defined as "Urgent (Unsafe or Potentially Unsafe)". The rating is attributed to concerns about possible increased seepage at the toe of the dam, and an undetermined flow rate at the river spring a quarter mile downstream, and potential flow channels through limestone below the spillway during pool events above 1600 feet. Because of this rating, the USACE has implemented risk reduction measures which include increased monitoring, updating emergency operation plans and reducing the water level in the reservoir. As of early 2010, the USACE has reduced and continues to maintain the reservoir at an elevation of 1,562 ft above sea level compared to the normal level of 1,582 feet. Throughout 2010, the USACE conducted safety exercises with local/state officials, conduct a series of investigations on the dam, update inundation mapping and reevaluate the DSAC status. In November 2010, Lake Moomaw was restored to a level of 1,582 ft. and the DSAC will be reevaluated in the future.

All of these dams are subject to the National Dam Safety Program Act of 1996 and the resulting 1998 Federal Guidelines for Dam Safety. FEMA requires all dam owners to develop an Emergency Action Plan for warning, evacuation and post-flood actions. The dams are also subject to the Virginia Dam Safety Act that is administered by the by the Department of Conservation and Recreation and Dam Safety Regulations enacted by the Virginia Soil and Water Conservation Board. All dams in the County are in good standing with State and Federal regulatory agencies at this time.

IFLOWS – The City participates in a flood warning system developed by the National Weather Service called Integrated Flood Observing and Warning System (IFLOWS). Through the use of radio-transmitted information, this system provides advanced flood forecasting to the City Emergency Operation Center. There is one IFLOW station located in the City.

Erosion and Sediment Control – The City has adopted the regulations, references, guidelines, standards and specifications promulgated by the State Water Control Board for the effective control of soil erosion and sediment deposition to prevent the unreasonable degradation of properties, stream channels, waters and other natural resources. Such regulations, references, guidelines, standards and specifications for erosion and sediment control are included in but not limited to the Virginia Erosion and Sediment Control Regulations and the Virginia Erosion and Sediment Control Handbook, as amended from time to time.

6.4.2 City of Covington Mitigation Goals and Strategies

In developing mitigation strategies for the region and each locality, a wide range of activities were considered in order to achieve the goals and to lessen the vulnerability of the area to the impact of natural hazards. All goals, strategies and projects are dependent on the availability and timeliness of non-local funding.

Goals and Strategies were prioritized by each locality. Prioritization was completed in order of relative priority – high, medium or low – based on the benefit to cost criteria and the strategy's potential to mitigate the impact from natural hazards. Consideration was also given to availability of funding, the department/agency responsible for implementation, and the ability of the locality to implement the project. Under each identified pre-disaster, applicable local government departments will be the lead in making sure that each project or action will be implemented in a timely manner with other departments, other local government representatives and/or other regional agencies.

The anticipated level of cost effectiveness of each measure was a primary consideration when developing the list of proposed projects. Since the mitigation projects are an investment of public funds to reduce damages, localities have selected and prioritized projects based on the benefit to cost of each project in hopes of obtaining the maximum benefit. Projects were categorized as high, medium or low benefit to cost based on the available information for each proposed project. Reduced damages over the lifespan of the projects, the benefits, are likely to be greater than the project cost in all cases. Although detailed cost and benefit analysis was not conducted during the mitigation action development process, these factors were of primary concern when prioritizing and selecting the proposed projects.

6.4.2.1 Flood

Goal: Mitigation of Property Damage from Flooding.
Responsible Department: Public Works
Strategies:

1. Acquisitions of Residential and Commercial properties in the Flood Plain. Acquisition of properties in the flood plain and their removal would eliminate the danger of damage to these residences, the danger to the residents and first responders during their evacuation or rescue. As some of these residences have had previous damage on several occasions, the repetitive loss would be eliminated.
2. Evaluation of Public Utilities and Building. The evaluation of public facilities for the delivery of services to the citizens would enable the planning of actions to allow these facilities to be better utilized during emergency situations and also prevent damage to them.
3. Elevation of Structures at the City Playground & Pool. The elevation of the bathhouse and pool at the City Park would allow these structures to withstand flooding without damage.
4. Drainage Improvements - Parrish Court, Marshall Street, Rayon View Area, and West Jackson Street Area. The improvement of the drainage systems in these areas would lessen the damage in these areas due to drainage off adjoining areas and drain backups.
5. Participate in, and remain in good standing with, the National Flood Insurance Program (NFIP) by enforcing floodplain management regulations that meet federal requirements.
6. Acquisition of flood prone properties followed by the appropriate mitigation action of demolition or relocation.
7. Drainage Improvements – Craig Avenue and Royal Avenue. The improvement of the drainage systems in these areas would lessen the damage in these areas due to drainage off adjoining areas and drain backups.

Goal: The Development of Information Systems for Better Planning, Regulation, and Response.
Responsible Department: Emergency Services
Strategies:

1. Flood Hazard Mapping Update & Modernization. Conversion of the flood insurance maps to digital form and the updating of these maps to reflect needed changes (complete 2010).
2. Hazard Related “GIS” Layers. The development of layers for the City of Covington GIS System which indicate areas of flooding, road closures, man-made hazards, hazardous material sites, landslide sites, transportation hazards, shelter sites, and any other information related to emergency operations and planning.
3. Additional Flood Hazard Data. The addition of additional data on previous flooding, elevation data, and flood insurance requirements would allow the plotting of residence which require elevation certificates and recording of these residences.

Goal: The addition of local IFLOWS monitoring stations and additional stream gauges.
Responsible Department: Emergency Services
Strategy:

1. The addition of local IFLOWS monitoring and the addition of any needed stream gauges. Project would allow the emergency responders of the City of Covington, Virginia to have more timely access to the water levels in the streams which affect the City. This would allow them to take action sooner with better information than they can at present.

Goal: Maintain an accurate database and map of repetitive loss properties
Responsible Department:
Strategies:

1. Work with VDEM and FEMA to update list of repetitive loss properties annually.
2. Obtain updated list of repetitive loss properties annually from VDEM/FEMA.
3. Review property addresses for accuracy and make necessary corrections.
4. Determine if and by what means each property has been mitigated.
5. Map properties to show general site locations (not parcel specific in order to maintain anonymity of the property owners).
6. Determine if properties have been mitigated and inform FEMA/VDEM through submission of an updated list/database and mapping.

6.4.2.2 All Hazards

Goal: Mitigation of the impacts of natural hazards.
Responsible Department: Emergency Services
Strategy:

1. Public Education. The public education function of emergency management is an on-going activity. It comes into play anytime an emergency is foreseen or actually occurs. An intensive program is needed to inform all citizens of the hazards in the area, the actions being taken to protect them, and the things that they can do to protect themselves.

Goal: The Improvement of Response Capabilities for All Hazards.
Responsible Department: Emergency Services
Strategies:

1. Communications Interoperability. The City of Covington, Virginia has the capability to talk to City agencies on our 450 MHz System. An interface is in place to allow County agencies on their 800 MHz System to talk to City agencies on Our 450 MHz System. The modernization of the Alleghany County fire, rescue, public works, and law enforcement communications system would allow the interoperability of communications between the City of Covington, Alleghany County, and the towns of Clifton Forge and Iron Gate. The 450 MHz System of the City of Covington will be completed by the acquisition of 450 MHz pagers for the Covington Fire Department and Covington Rescue Squad and the establishment of a new transmitter site specifically constructed for this system for better antenna separation and better radio coverage.

2. Add / Replace Generators at emergency facilities. The addition of generators to the designated shelters in the City of Covington (old Armory, Edgemont School, Jeter-Watson School, and Covington High School), the public works facility on South Maple Avenue, and the former Rivermont School would allow these facilities to be utilized at any time and under almost any conditions to house and feed residents of the City and adjoining Alleghany County. The replacement of the generators at Covington Fire & Rescue - Station One and Covington Fire & Rescue - Station Two would allow the evaluation of these facilities to determine the proper size generator for the facility and after it's installation, the facility would be much more valuable to the emergency personnel manning them and the citizen of the City of Covington, Virginia during emergencies. The generator at the City Hall should be upgraded to provide service to the entire building.
3. Upgrade the Weather Terminal at the Covington EOC. This upgrade will provide better weather warnings and have alarms which warn City personnel when storms approach the City at a pre-determined distance. The alarms could be set at a specific distance or specific storm intensity.

Goal: Local Codes and Regulations that assist in the mitigation of impacts from natural disasters.
Responsible Department: Administration, Planning
Strategy:

1. Local Code and Regulation Review. The review of the local codes, ordinances, regulations, policies, and procedures is an activity which needs to be done on a regular basis in order to keep these essential texts up-to-date, in proper legal form, and in line with the needs of the community. These instruments can prevent the use of property in inappropriate manners, inappropriate location of buildings, and regulate many other hazards and dangerous situations.

Table 85: City of Covington Hazard Mitigation Projects

Project	Hazard Mitigated	Benefit	Cost Estimate	Benefit-to-Cost	Priority	Funding Partners	Implementation/ Lead Agency	Status	Proposed Schedule
Communications Equipment Interoperability	All Hazards	Improved coordination between City, County, and State responders	$325,000	High	High	VDEM / FEMA / LOCAL GOVT	Local Government	In progress with Alleghany County	2012
Acquisition of flood prone properties	Flooding	Removal of households from flood hazard areas; reduce repetitive loss; reduce loss of life and property	Unknown	High	High	FEMA, VDEM, Local government	Local government, Engineering & Building Inspections	Not started; lack of funding	2013-2018
Participate in, and remain in good standing with, the National Flood Insurance Program (NFIP)	Flooding	Reduction of future flood damage through enforcement of floodplain ordinances and availability of discounted flood insurance for property owners	$5,000	High	High	FEMA	Local government	Ongoing	Ongoing
Maintain an accurate database and map of repetitive loss properties	Flooding	Identification of repetitive loss properties that should be mitigated	$5,000	High	High	FEMA, VDEM	Local government, RVARC, VDEM	Ongoing	Ongoing
Additional Hazard Field Data	Flooding	Elevation Certificates for residential, business, and critical facilities. Increased accuracy of hazard mitigation planning	$25,000	High	Medium	VDEM / FEMA / LOCAL GOVT	Local Government	Not started; lack of funding	
Structure Acquisition – residential and commercial	Flooding	Removal of structures from flood hazard areas; reduce repetitive losses; reduce the loss of life and property	$3,800,000	Medium	Medium	VDEM / FEMA / LOCAL GOVT	Local Government	Not started; lack of funding	
Public Education	All Hazards	Inform the public about hazards, mitigation options, flood insurance, NFIP, and protective actions	$12,500	High	High	VDEM / FEMA / LOCAL GOVT	Local Government	In progress	2012 - Ongoing

Project	Hazard Mitigated	Benefit	Cost Estimate	Benefit-to-Cost	Priority	Funding Partners	Implementation/ Lead Agency	Status	Proposed Schedule
Evaluate Public Utilities for Flood proofing	Flooding	Evaluation of public utilities for retrofitting or flood proofing to prevent failures and lessen damages during disasters	$25,000	High	High	VDEM / FEMA / LOCAL GOVT	Local Government	Not started; lack of funding	
Local code and regulation review	All Hazards	Reduction in flood insurance rates; reduction in flood losses	$2,500	Medium	Medium	VDEM / FEMA / LOCAL GOVT	Local Government	Not started; lack of funding	
Add / Replace Generators at emergency facilities, public utilities and City Hall	All Hazards	Evaluate the facilities and install appropriate generating equipment and controls to allow them to be better utilized during disasters and severe events	$220,000	High	High	VDEM / FEMA / LOCAL GOVT	Local Government	Not started; lack of funding	
Add local IFLOWS monitoring and additional stream gauges	Flooding / Heavy Rains	Provide better, more timely information to allow faster, more accurate warnings to be issued to the public	$18,500	High	Medium	VDEM / FEMA / LOCAL GOVT	Local Government	Not started; lack of funding	
Elevation of Structures - City Pool and Playground	Flooding	Reduced damages and repair costs	$100,000	Medium	Medium	VDEM / FEMA / LOCAL GOVT	Local Government	Not started; lack of funding	
Drainage Improvements - West Jackson Street Area	Flooding	Reduced damages and repair costs	$600,000	High	High	VDEM / FEMA / LOCAL GOVT	Local Government	Engineering/ design underway	2020-22
Drainage Improvements - Parrish Court, Marshall Street, and Rayon View Area	Flooding	Reduced damages and repair costs	$500,000	High	High	VDEM / FEMA / LOCAL GOVT	Local Government	Engineering/ design underway	2020-22

Project	Hazard Mitigated	Benefit	Cost Estimate	Benefit-to-Cost	Priority	Funding Partners	Implementation/ Lead Agency	Status	Proposed Schedule
Drainage Improvements – Craig Avenue and Royal Avenue	Flooding	Reduced damages and repair costs	$500,000	High	High	VDEM / FEMA / LOCAL GOVT	Local Government	Engineering/ design underway	2020-22
The upgrading of the present weather terminal at the Covington EOC	Flooding and Other Severe Weather Occurrences	Better and more timely weather information will allow first responders to make better decision about actions to take, evacuations, and the possibility of flooding and other severe weather	$10,000	Medium	High	VDEM / FEMA / LOCAL GOVT	Local Government	Not started; lack of funding	

6.5 Botetourt County and the Towns of Buchanan, Fincastle and Troutville

6.5.1 Current and Past Mitigation Measures

Floodplain Management – Botetourt County has adopted a Flood Hazard Overlay District as part of its Zoning Ordinance (2002). The boundaries of the floodplain district are established as shown on the flood boundary and floodway and/or Flood Insurance Rate Maps. The towns of Buchanan, Fincastle, and Troutville have each adopted a Floodplain Management Ordinance that requires new residential buildings to be elevated to or above the base flood elevation. Additional requirements prevent the obstruction of the floodway.

National Flood Insurance Program – The County participates in, and is in good standing with, the National Flood Insurance Program (NFIP) by enforcing floodplain management regulations that meet federal requirements. The towns of Buchanan, Fincastle and Troutville all participate in the NFIP and are in good standing. This program allows property owners to purchase flood insurance from NFIP. There were 221 NFIP policies in force in the County (including the towns of Buchanan, Fincastle and Troutville) as of August 2018.

Erosion and Sediment Control Ordinance – Botetourt County adopted its most current Erosion and Sediment Control ordinance in 1996. The County utilizes the regulations, references, guidelines, standards and specifications promulgated by the Virginia Soil and Water Conservation Board (and any local handbook or publication of the board) for the effective control of soil erosion and sediment deposition to prevent the unreasonable degradation of properties, stream channels, waters and other natural resources. Such regulations, references, guidelines, standards and specifications for erosion and sediment control are included in, but not limited to, the Virginia Erosion and Sediment Control Regulations and the Virginia Erosion and Sediment Control Handbook, as amended from time to time. The towns of Buchanan, Fincastle and Troutville utilize Botetourt County's E&S staff for erosion and sediment control monitoring.

Dam Safety – Botetourt County adopted a Drainage and Flood Control Ordinance in 1987. Division 2 Dam Safety, in Sec. 8.5-31 addresses issues concerning impoundment construction, inspection and maintenance stating "No one shall have a right to build or maintain an impoundment structure which unreasonably threatens the life or property of another. The [county] administrator shall cause safety inspections to be made of impounding structures on such schedule, as he deems appropriate. The time of the initial inspection and the frequency of reinspection shall be established depending on such factors as the condition of the structure and its size, type, location and downstream hazard potential. The owners of impounding structures found to have deficiencies which could threaten life or property if uncorrected, shall take the corrective actions needed to remove such deficiencies within the time limits established by this article, or if no time limit is established, within a reasonable time."

There are five dams of significance in Botetourt County. These are the Blue Ridge Estates Dam on Laymantown Creek, Carvin Cove Dam on Carvin Creek, Orchard Lake Dam on Glade Creek,

Rainbow Forest Dam on Laymantown Creek and Greenfield dam on an unnamed creek. Gathright Dam, located on the Jackson River in Alleghany County, was completed in 1979 and is operated for flood control of the Jackson and James Rivers. The facility is managed by the Army Corps of Engineers. The dam controls the runoff from a 345 square mile drainage area and reduces the effects of flooding along the Jackson and James Rivers. The Corps of Engineers estimates that the project has prevented more than $70 million in flood damages. The James River passes through the northern part of Botetourt County and impacts the communities of Eagle Rock and Glen Wilton and the Town of Buchanan. All of these dams are subject to the National Dam Safety Program Act of 1996 and the resulting 1998 Federal Guidelines for Dam Safety. FEMA requires all dam owners to develop an Emergency Action Plan for warning, evacuation and post-flood actions. The dams are also subject to the Virginia Dam Safety Act that is administered by the by the Department of Conservation and Recreation and Dam Safety Regulations enacted by the Virginia Soil and Water Conservation Board. All operational dams in the County are in good standing with State and Federal regulatory agencies at this time. Rainbow Forest Dam is currently drained pending state-mandated repair. The Rainbow Forest Recreation Association (owner) estimates that it would take $200,000 to make the necessary improvements.

IFLOWS – The County participates in a flood warning system developed by the National Weather Service called Integrated Flood Observing and Warning System (IFLOWS). Through the use of radio-transmitted information, this system provides advanced flood forecasting to the County Emergency Operation Center. There are twelve (12) IFLOW stations located in Botetourt County (including the towns of Buchanan, Fincastle and Troutville.

6.5.2 Mitigation Goals and Strategies

In developing mitigation strategies for the region and each locality, a wide range of activities were considered in order to achieve the goals and to lessen the vulnerability of the area to the impact of natural hazards. All goals, strategies and projects are dependent on the availability and timeliness of non-local funding.

Goals and Strategies were prioritized by each locality. Prioritization was completed in order of relative priority – high, medium or low – based on the benefit to cost criteria and the strategy's potential to mitigate the impact from natural hazards. Consideration was also given to availability of funding, the department/agency responsible for implementation, and the ability of the locality to implement the project. Under each identified pre-disaster, applicable local government departments will be the lead in making sure that each project or action will be implemented in a timely manner with other departments, other local government representatives and/or other regional agencies.

The anticipated level of cost effectiveness of each measure was a primary consideration when developing the list of proposed projects. Since the mitigation projects are an investment of public funds to reduce damages, localities have selected and prioritized projects based on the benefit to cost of each project in hopes of obtaining the maximum benefit. Projects were

categorized as high, medium or low benefit to cost based on the available information for each proposed project. Reduced damages over the lifespan of the projects, the benefits, are likely to be greater than the project cost in all cases. Although detailed cost and benefit analysis was not conducted during the mitigation action development process, these factors were of primary concern when prioritizing and selecting the proposed projects.

It is important to note that the majority of Goals and Strategies listed for Botetourt County would also benefit its three incorporated towns by extension of overall services / mitigation activities.

6.5.2.1 Flood

Goal: Mitigation of loss of life and property from flooding and flood related disasters.
Responsible Department: Fire and EMS, Community Development
Strategies:

1. Develop and maintain an inventory of flood prone roadways in cooperation with local governments and the Virginia Department of Transportation.
2. Develop and maintain an inventory of flood prone critical regional facilities such as public utility sites, shelters, etc.
3. In cooperation with local governments, support a comprehensive public information and education program on flooding, living in the floodplain, flood risks, low cost simple flood mitigation measures, flood insurance, stream remediation, hydrology, floodplain ordinances, and NFIP. This can be accomplished through regional workshops and educational materials for citizens, business, local staff, and elected officials.
4. Participate in, and remain in good standing with, the National Flood Insurance Program (NFIP) by enforcing floodplain management regulations that meet federal requirements.
5. Acquisition of flood prone properties followed by the appropriate mitigation action of demolition or relocation.

Goal: Update existing GIS data layers related to natural hazards.
Responsible Department: Technology Services, Community Development
Strategies:

1. Participate in FEMA's Cooperating Technical Partners (CTP) program that establishes partners with local jurisdictions to develop and maintain up-to-date flood maps.
2. In cooperation with local governments, utilize GIS to inventory at risk infrastructure and public and private structures within flood prone areas.
3. Participate in FEMA's Digital Flood Insurance Rate Maps (DFIRM) program.
4. Support FIRM remapping projects that address areas in the region that have the most serious mapping problems and where flooding is a repetitive problem.

Goal: Provide early warning of flooding.
Responsible Department: Fire and EMS
Strategies:

1. Identify areas with recurring flood problems and request additional IFLOW stream/rain gauges as appropriate to ensure that these areas are adequately covered and monitored.
2. Expand existing 911 capacities to include social media communication for warnings and disasters.
3. Review Emergency Operation Plan annexes for effectiveness of early flood warnings.

Goal: Maintain an accurate database and map of repetitive loss properties
Responsible Department: Technology Services, Fire and EMS
Strategies:

1. Work with VDEM and FEMA to update list of repetitive loss properties annually.
2. Obtain updated list of repetitive loss properties annually from VDEM/FEMA.
3. Review property addresses for accuracy and make necessary corrections.
4. Determine if and by what means each property has been mitigated.
5. Map properties to show general site locations (not parcel specific in order to maintain anonymity of the property owners).
6. Determine if properties have been mitigated and inform FEMA/VDEM through submission of an updated list/database and mapping.

6.5.2.2 Hurricane

Mitigation measures for hurricanes are region-wide recommendations for all localities adopting the Regional Pre-Disaster Hazard Mitigation Plan.

Goal: Mitigate the impact of hurricanes.
Responsible Department: Fire and EMS, County Administration
Strategy:

1. Participate in the “StormReady” program.

6.5.2.3 Tornado / Severe Thunderstorm

Mitigation measures for tornados are region-wide recommendations for all localities adopting the Regional Pre-Disaster Hazard Mitigation Plan.

Goal: Mitigate the impact of tornados.
Responsible Department: Fire and EMS, County Administration
Strategies:

1. Conduct a series of public workshops about how to protect yourself during a tornado in case you are at home, in a car, at the office, or outside.

2. Coordinate with local schools to ensure existence, effectiveness, and practice of Tornado drills.
3. Continue improvements to automated citizen alert system to include social media or other means.

6.5.2.4 Wildfire

Mitigation measures for wildfires are region-wide recommendations for all localities adopting the Regional Pre-Disaster Hazard Mitigation Plan.

Goal: Mitigation of the impacts of wildfire to life and property.
Responsible Department: Fire and EMS, County Administration
Strategies:

1. Encourage residents and developers to use FireWise building design, siting, and materials for construction.
2. Conduct Community Wildfire Assessments in cooperation with VDoF staff using the Wildland Urban Interface Fire Protection Program's Woodland Community Wildfire Hazard Assessment form.
3. Identify buildings or locations vital to the emergency response effort and buildings or locations that, if damaged, would create secondary disasters in forested areas.

6.5.2.5 Winter Storms

Mitigation measures for winter storms are region-wide recommendations for all localities adopting the Regional Pre-Disaster Hazard Mitigation Plan.

Goal: Mitigate the effects of extreme winter weather by implementing programs that provide early warning and preparation.
Responsible Department: Fire and EMS, County Administration
Strategy:

1. Participate in special statewide outreach/awareness activities, such as Winter Weather Awareness Week, Flood Awareness Week, etc.

Table 86: Botetourt County Hazard Mitigation Projects

Project	Hazard Mitigated	Benefit	Cost Estimate	Benefit-to-Cost	Priority	Funding Partners	Implementation/ Lead Agency	Status	Proposed Schedule
Participate in, and remain in good standing with, the National Flood Insurance Program (NFIP)	Flooding	Reduction of future flood damage through enforcement of floodplain ordinances and availability of discounted flood insurance for property owners	$5,000	High	High	FEMA	Local government	Ongoing	Ongoing
Maintain an accurate database and map of repetitive loss properties	Flooding	Identification of repetitive loss properties that should be mitigated	Unknown	High	High	FEMA, VDEM	Local government, RVARC, VDEM	Ongoing	Ongoing
Develop and maintain an inventory of flood prone roadways	Flooding	Inventory of flood prone roadways for planning purposes (road improvements, limitation of development)	$25,000	Medium	Medium	FEMA, VDEM, RVARC, VDOT, Local government	RVARC	In progress	Ongoing updates
Evaluate critical facilities and public utilities for flood-proofing	Flooding	Evaluation of critical facilities and public utilities for retrofitting or flood-proofing to prevent failure during disasters	$50,000	N/A	Medium	FEMA, Local government	Local government	In progress	2026
Participate in the “StormReady” program	All Hazards	Community is better prepared through planning and education	$1,000	High	Medium	FEMA, VDEM, NWS, Local governments	Local government	Accepted to program in 2011	Ongoing Renewals every 4 years
Community notification system	All hazards	Reduced loss through improved warning system	$55,000	High	Low	FEMA, VDEM, ODP, Local Government	Local government, ESC, Sheriff Dept.	Ongoing	2026
Communication equipment interoperability	All hazards	Improved coordination among jurisdictions; improved response times	$250,000	Medium	High	FEMA, Local government	Local government, ESC, Sheriff Dept.	In progress	Ongoing
Public education	All hazards	Inform public about hazard mitigation options	$5,000	High	High	FEMA, VDEM, Local government	Local government	In progress	Ongoing

Project	Hazard Mitigated	Benefit	Cost Estimate	Benefit-to-Cost	Priority	Funding Partners	Implementation/ Lead Agency	Status	Proposed Schedule
Public education workshops for tornado drills (public, businesses and schools)	Tornado	Public informed about how to protect yourself during a tornado in case you are at home, in a car, at the office, or outside	$5,000	High	Medium	Local government	Local government	Not started; lack of funding	Ongoing
Evaluate and Participate in FEMA's Cooperating Technical Partners (CTP) program	Flooding	Continuing updates to flood hazard maps	$15,000	High	High	FEMA, local government	Local government	Not started; lack of funding	Ongoing
Encourage residents and developers to use Fire-Wise building design, siting, and materials for construction	Wildfire	Reduction in damages from wildfire	$5,000	High	Medium	VA Dept. of Forestry, Local governments	Local government	Not started; lack of funding	Ongoing
Local codes review	All hazards	Review of development codes to evaluate need for changes that would improve disaster mitigation	$50,000	Unsure	Medium	FEMA, Local government	Local government, Emergency Services, Planning Dept	In progress	Ongoing
Identification and tracking of special needs populations	All hazards	Preparation for assisting special needs populations to prevent loss of life and property	$25,000	Unsure	Medium	Local government	Local government	In progress	Ongoing
Identification and installation of generator quick-connect locations for critical public service facilities, shelter facilities, and other critical infrastructure	All Hazards	Continuity of critical services during disasters	$150,000	High	High	FEMA, VDEM, Local	Local government	In progress	2025
Obtain more up-to-date and comprehensive GIS system	All hazards	Increased information for better incident response	$350,000	High	High	Local Government	Local Government	Not Started; Lack of Funding	2026

Project	Hazard Mitigated	Benefit	Cost Estimate	Benefit-to-Cost	Priority	Funding Partners	Implementation/ Lead Agency	Status	Proposed Schedule
Obtain portable generators to be used on various infrastructure components as needed during incidents	All Hazards	Would allow deployment of generator to critical infrastructure when power fails to certain facilities		Medium	Medium	Local Government	Local Government	Not Started; Lack of Funding	2026
Construct an Emergency Operations Center for use during disasters to support response and recovery efforts	All hazards	Allow for central location to coordinate all response and recovery resources during and after an event.	$1,000,000	Medium	Medium	Local Government	Local Government	Not Started; Lack of Funding	2026

Table 87: Town of Buchanan Hazard Mitigation Projects

Project	Hazard Mitigated	Benefit	Cost Estimate	Benefit-to-Cost	Priority	Funding Partners	Implementation/ Lead Agency	Status	Proposed Schedule
Evaluate public utilities for floodproofing	Flooding	Evaluation of public utilities for retrofitting or floodproofing to prevent failure during disasters	$10,000	Low	High	FEMA, Local government	Local government, Public Works Dept	Not started; lack of funding	Ongoing
Participate in, and remain in good standing with, the National Flood Insurance Program (NFIP)	Flooding	Reduction of future flood damage through enforcement of floodplain ordinances and availability of discounted flood insurance for property owners	$2,500	High	High	FEMA	Local government	Ongoing	Ongoing
Maintain an accurate database and map of repetitive loss properties	Flooding	Identification of repetitive loss properties that should be mitigated	$2,500	High	High	FEMA, VDEM	Local government, RVARC, VDEM	Ongoing	Ongoing
Local Code Review	All Hazards	Review of development codes to evaluate need for changes that would improve disaster mitigation	$5,000	Medium	High	FEMA, VDEM	Local government	Not started; lack of funding	Ongoing
Identification of appropriate properties for acquisition and/or elevation out of flood area	Flooding	Reduction of flood loss	Unsure	Medium	Low	FEMA, VDEM, Local	Local government	Not started; lack of funding	2026
Public education	All hazards	Inform public about hazards and mitigation options	$5,000	High	High	FEMA, VDEM, Local	Local government	In progress	Ongoing
Protection of the Town Lift Station on Parkway Drive	Flooding	Continuation of sewer service during disasters	unknown	High	High	FEMA, VDEM, Local	Local government	Not started; lack of funding	2026
Protection of the Town Sewage Treatment Plant on Parkway Drive	Flooding	Continuation of sewer service during disasters	unknown	High	High	FEMA, VDEM, Local	Local government	Not started; lack of funding	2026

Project	Hazard Mitigated	Benefit	Cost Estimate	Benefit-to-Cost	Priority	Funding Partners	Implementation/ Lead Agency	Status	Proposed Schedule
Mitigation of culvert at intersection of 19th Street and New Town Road	Flooding	Elimination of street and business flooding	unknown	Medium	High	FEMA, VDEM, VDOT, Local	Local government	Not started; lack of funding	2026
Mitigation of culvert at Main Street and 19th Street	Flooding	Elimination of street and business flooding	unknown	Medium	High	FEMA, VDEM, VDOT, Local	Local government	Not started; lack of funding	2026
Mitigation of culvert between Main Street and Lowe Street near Alley.	Flooding	Elimination of street, business and residential flooding downtown	unknown	Medium	High	FEMA, VDEM, VDOT, Local	Local government	Not started; lack of funding	2026
Flood Wall to protect Lowe Street and Main Street	Flooding	Elimination of street, business and residential flooding downtown	unknown	High	High	FEMA, VDEM, Local	Local government	Not started; lack of funding	2026

Table 88: Town of Fincastle Hazard Mitigation Projects

Project	Hazard Mitigated	Benefit	Cost Estimate	Benefit-to-Cost	Priority	Funding Partners	Implementation/ Lead Agency	Status	Proposed Schedule
Local codes review	All hazards	Review of development codes to evaluate need for changes that would improve disaster mitigation	$5,000	Medium	High	FEMA, Local government	Local government	Not started; lack of funding	Ongoing
Participate in, and remain in good standing with, the National Flood Insurance Program (NFIP)	Flooding	Reduction of future flood damage through enforcement of floodplain ordinances and availability of discounted flood insurance for property owners	$2,500	High	High	FEMA	Local government	Ongoing	Ongoing
Maintain an accurate database and map of repetitive loss properties	Flooding	Identification of repetitive loss properties that should be mitigated	$2,500	High	High	FEMA, VDEM	Local government, RVARC, VDEM	Ongoing	Ongoing
Evaluate public utilities for floodproofing	Flooding	Evaluation of public utilities for retrofitting or floodproofing to prevent failure during disasters	$10,000	Low	High	FEMA, Local government	Local government, Public Works Dept	Not started; lack of funding	Ongoing
Public Education	All hazards	Inform public about hazards and mitigation options	$5,000	High	High	FEMA, VDEM, Local government	Local government	In progress	Ongoing

Table 89: Town of Troutville Hazard Mitigation Projects

Project	Hazard Mitigated	Benefit	Cost Estimate	Benefit-to-Cost	Priority	Funding Partners	Implementation/ Lead Agency	Status	Proposed Schedule
Evaluate public utilities for floodproofing	Flooding	Evaluation of public utilities for retrofitting or floodproofing to prevent failure during disasters	$10,000	Low	High	FEMA, Local government	Local Government, Public Works Dept.	Not started; lack of funding	Ongoing
Participate in, and remain in good standing with, the National Flood Insurance Program (NFIP)	Flooding	Reduction of future flood damage through enforcement of floodplain ordinances and availability of discounted flood insurance for property owners	$2,500	High	High	FEMA	Local government	Ongoing	Ongoing
Maintain an accurate database and map of repetitive loss properties	Flooding	Identification of repetitive loss properties that should be mitigated	$2,500	High	High	FEMA, VDEM	Local government, RVARC, VDEM	Ongoing	Ongoing
Local Code Review	All Hazards	Review of development codes to evaluate need for changes that would improve disaster mitigation	$5,000	Medium	High	FEMA, VDEM	Local government	Not started; lack of funding	Ongoing
Public education	All hazards	Inform public about hazard mitigation options	$10,000	High	High	FEMA, VDEM, Local government	Local government	In progress	Ongoing

6.6 Craig County and the Town of New Castle

6.6.1 Current and Past Mitigation

Floodplain Management – Craig County has adopted a Floodplain Management Ordinance (1996) as part of its Zoning Ordinance. The Town of New Castle has adopted a Floodplain Management Ordinance that requires new residential buildings to be elevated to or above the base flood elevation. Additional requirements prevent the obstruction of the floodway.

National Flood Insurance Program – The County and Town of New Castle participate in, and are in good standing with, the National Flood Insurance Program (NFIP) by enforcing floodplain management regulations that meet federal requirements. This program allows property owners to purchase flood insurance from NFIP. There were 61 NFIP policies in force in the County and 3 in the Town of New Castle as of August 2018.

Dam Safety – There are four dams in Craig County. The Mountain Castles Soil and Water Conservation District has responsibility for the operation and maintenance of these dams. The dams are located on Johns Creek, Little Oregon Creek, Mudlick Branch, and Dicks Creek. The dams were constructed during the period of 1966 to 1968 for the purpose of flood control in the Johns Creek watershed.

IFLOWS – The County participates in a flood warning system developed by the National Weather Service called Integrated Flood Observing and Warning System (IFLOWS). Through the use of radio-transmitted information, this system provides advanced flood forecasting to the Craig County Emergency Operation Center. There are seven (7) IFLOW stations located in the County.

Erosion and Sediment Control – Craig County adopted the regulations, references, guidelines, standards and specifications promulgated by the State Water Control Board for the effective control of soil erosion and sediment deposition to prevent the unreasonable degradation of properties, stream channels, waters and other natural resources. Such regulations, references, guidelines, standards and specifications for erosion and sediment control are included in but not limited to the Virginia Erosion and Sediment Control Regulations and the Virginia Erosion and Sediment Control Handbook, as amended from time to time. The Town of New Castle utilizes the E&S Control services of Craig County.

6.6.2 Craig County and the Town of New Castle Mitigation Goals and Strategies

In developing mitigation strategies for the region and each locality, a wide range of activities were considered in order to achieve the goals and to lessen the vulnerability of the area to the impact of natural hazards. All goals, strategies and projects are dependent on the availability and timeliness of non-local funding.

Goals and Strategies were prioritized by each locality. Prioritization was completed in order of relative priority – high, medium or low – based on the benefit to cost criteria and the strategy's potential to mitigate the impact from natural hazards. Consideration was also given to availability of funding, the department/agency responsible for implementation, and the ability of the locality to implement the project. Under each identified pre-disaster, applicable local government departments will be the lead in making sure that each project or action will be implemented in a timely manner with other departments, other local government representatives and/or other regional agencies.

The anticipated level of cost effectiveness of each measure was a primary consideration when developing the list of proposed projects. Since the mitigation projects are an investment of public funds to reduce damages, localities have selected, and prioritized projects based on the benefit to cost of each project in hopes of obtaining the maximum benefit. Projects were categorized as high, medium or low benefit to cost based on the available information for each proposed project. Reduced damages over the lifespan of the projects, the benefits, are likely to be greater than the project cost in all cases. Although detailed cost and benefit analysis was not conducted during the mitigation action development process, these factors were of primary concern when prioritizing and selecting the proposed projects.

6.6.2.1 Earthquake

Goal: Increase public awareness of the probability and potential impact of earthquakes.
Responsible Department: Administration
Strategy:

1. Publish a special section in local newspaper with emergency information on earthquakes. Localize the information by printing the phone numbers of local emergency services offices, the American Red Cross, and hospitals.

6.6.2.2 Flood

Goal: Mitigation of loss of life and property from flooding and flood related disasters.
Responsible Department: Emergency Services
Strategies:

1. Develop and maintain an inventory of flood prone roadways in cooperation with local governments and the Virginia Department of Transportation.
2. Develop and maintain an inventory of flood prone critical facilities such as hospitals, public utility sites, schools, etc.

3. In cooperation with local governments, support a comprehensive public information and education program on flooding, living in the floodplain, flood risks, low cost simple flood mitigation measures, flood insurance, stream remediation, hydrology, floodplain ordinances, and NFIP. This can be accomplished through regional workshops and educational materials for citizens, business, local staff, and elected officials.
4. Participate in, and remain in good standing with, the National Flood Insurance Program (NFIP) by enforcing floodplain management regulations that meet federal requirements.
5. Acquisition of flood prone properties followed by the appropriate mitigation action of demolition or relocation.

Goal: Update existing GIS data layers related to natural hazards.
Responsible Department: Emergency Services, Building Inspector
Strategies:

1. Consider seeking funding and support programs that update FEMA's Flood Insurance Rate Maps (FIRM). Consider participation in FEMA's Cooperating Technical Partners (CTP) program that establishes partners with local jurisdictions to develop and maintain up-to-date flood maps.
2. In cooperation with local governments, utilize GIS to inventory at risk infrastructure and public and private structures within flood prone areas.
3. Participate in FEMA's Digital Flood Insurance Rate Maps (DFIRM) program.
4. Support FIRM remapping projects that address areas in the region that have the most serious mapping problems and where flooding is a repetitive problem.

Goal: Provide early warning of flooding.
Responsible Department: Emergency Services
Strategies:

1. Identify areas with recurring flood problems and request additional IFLOW stream/rain gauges to ensure that these areas are adequately covered and monitored.
2. Seek assistance to fund reverse E 911 to provide early warning to flood prone areas.

Goal: Identification of structural projects that could mitigate the impact of flooding.
Responsible Department: Administration
Strategies:

1. Consider seeking funding to prepare site-specific hydrologic and hydraulic studies that look at areas that have chronic and repetitive flooding problems.
2. Support Virginia Department of Transportation projects that call for improved ditching, replacement of inadequate and undersized culverts, enlargements of bridge openings and drainage piping needed to minimize flooding.
3. Improvements to Johns Creek Dam #1, #2, #3, and #4.

Goal: Maintain an accurate database and map of repetitive loss properties
Responsible Department: Emergency Services
Strategies:

1. Work with VDEM and FEMA to update list of repetitive loss properties annually.

2. Obtain updated list of repetitive loss properties annually from VDEM/FEMA.
3. Review property addresses for accuracy and make necessary corrections.
4. Determine if and by what means each property has been mitigated.
5. Map properties to show general site locations (not parcel specific in order to maintain anonymity of the property owners).
6. Determine if properties have been mitigated and inform FEMA/VDEM through submission of an updated list/database and mapping.

6.6.2.3 Hurricane

Goal: Mitigate the impact of hurricanes in the Roanoke Valley-Alleghany Region.
Responsible Department: Administration
Strategy:

1. Research and consider participating in the National Weather Service "Storm Ready" program.

6.6.2.4 Landslide

Goal: Improved Hazard Mapping and Assessments for landslides.
Responsible Department: Emergency Services
Strategy:

1. Encourage delineation of susceptible areas and different types of landslide hazards at a scale useful for planning and decision-making by USGS and State geological surveys.
2. Work with state and Federal agencies to develop data that will assist in reducing and eliminating impacts from landslides.

6.6.2.5 Tornado

Goal: Mitigate the impact of tornados.
Responsible Department: Emergency Services
Strategy:

1. Conduct a series of public workshops about how to protect yourself during a tornado in case you are at home, in a car, at the office, or outside.

6.6.2.6 Wildfire

Goal: Mitigation of the impacts of wildfire to life and property.
Responsible Department: Emergency Services
Strategy:

1. Encourage residents and developers to use Firewise building design, siting, and materials for construction.
2. Conduct Community Wildfire Assessments in cooperation with VDOF staff using the Wildland Urban Interface Fire Protection Program's Woodland Community Wildfire Hazard Assessment form.

3. Identify buildings or locations vital to the emergency response effort and buildings or locations that, if damaged, would create secondary disasters in forested areas.

6.6.2.7 Winter Storms

Goal: Mitigate the effects of extreme weather by implementing programs that provide early warning and preparation.
Responsible Department: Emergency Services
Strategy:

1. Continue participating in the National Weather Service “Storm Ready” program.
2. Participate in special statewide outreach/awareness activities, such as Winter Weather Awareness Week, Flood Awareness Week, etc.

Table 90: Craig County Hazard Mitigation Projects

Project	Hazard Mitigated	Benefit	Cost Estimate	Benefit-to-Cost	Priority	Funding Partners	Implementation/ Lead Agency	Status	Proposed Schedule
Reverse 911	All hazards	Reduced loss through improved warning system	$38,000	High	High	FEMA, VDEM, Local Government	Local government, ESC, Sheriff Dept.	Not started; lack of funding	2020-22
Communication equipment interoperability	All hazards	Improved coordination among jurisdictions; improved response times	$150,000	High	High	FEMA, Local government	Local government, ESC, Sheriff Dept.	Not started; lack of funding	2020-22
Publish a special section in local newspaper with emergency information on earthquakes	Earthquake	Increased level of knowledge and awareness in citizens	$2,500	High	Low	FEMA, VDEM	Local government	Not started; lack of funding	2020
Acquisition of flood prone properties	Flooding	Removal of households from flood hazard areas; reduce repetitive loss; reduce loss of life and property	Unknown	High	High	FEMA, VDEM, Local government	Local government, Engineering & Building Inspections	Not started; lack of funding	As needed
Participate in, and remain in good standing with, the National Flood Insurance Program (NFIP)	Flooding	Reduction of future flood damage through enforcement of floodplain ordinances and availability of discounted flood insurance for property owners	$2,500	High	High	FEMA	Local government	Ongoing	Ongoing
Maintain an accurate database and map of repetitive loss properties	Flooding	Identification of repetitive loss properties that should be mitigated	$2,500	High	High	FEMA, VDEM	Local government, RVARC, VDEM	Ongoing	Ongoing
Develop and maintain an inventory of flood prone roadways	Flooding	Inventory of flood prone roadways for planning purposes (road improvements, limitation of development)	$25,000	Medium	Medium	FEMA, VDEM, RVARC, VDOT, Local government	RVARC	In progress	Ongoing updates

Project	Hazard Mitigated	Benefit	Cost Estimate	Benefit-to-Cost	Priority	Funding Partners	Implementation/ Lead Agency	Status	Proposed Schedule
Support Virginia Department of Transportation projects that minimize flooding	Flooding	Clear debris and repair banks along roads to prevent backup, erosion and flooding of existing drainage systems	$700,000	N/A	Medium	FEMA, VDEM, VDOT	Local government or VDOT	Not started; lack of funding	
Seek funding to prepare site-specific hydrologic and hydraulic studies that look at areas that have chronic and repetitive flooding problems	Flooding	Possible determination of solutions to repetitive loss properties.	$5,000	High	Medium	Local governments	Local governments	Not started; lack of funding	
Add local IFLOWS monitoring and additional stream gauges	Flooding / Heavy Rains	Provide better, more timely information to allow faster, more accurate warnings to be issued to the public	$25,000	High	Medium	VDEM / FEMA / LOCAL GOVT	Local Government	Not started; lack of funding	
Seek funding and support programs that update FEMA's Flood Insurance Rate Maps	Flooding	Updated flood hazard mapping	unknown	NA	High	FEMA	Local government	Not started; lack of funding	
Identify projects that would mitigate or eliminate repetitive loss properties	Flooding	Reduction and/or elimination of repetitive loss properties	unknown	Unknown	High	FEMA, VDEM	Local government	Not started; lack of funding	
Participate in FEMA's Cooperating Technical Partners (CTP) program	Flooding	Continuing updates to flood hazard maps	$12,000	High	High	FEMA, local government	Local government,	Not started; lack of funding	
Continue participation in FEMA's DFIRM program	Flooding	Updated flood hazard mapping	$5,000	High	High	FEMA, local government	Local government	In progress	Ongoing

Project	Hazard Mitigated	Benefit	Cost Estimate	Benefit-to-Cost	Priority	Funding Partners	Implementation/ Lead Agency	Status	Proposed Schedule
Develop and maintain an inventory of flood prone critical facilities	Flooding	Available inventory of critical structures that need additional or unique protection from flooding.	$1,000	Medium	Medium	FEMA, VDEM	Local government	Not started; lack of funding	
Safety improvements to Johns Creek dams #1, #2, #3, and #4	Flooding	Protection of life and property downstream from the dams.	Unknown	Unknown	High	FEMA, DCR, USDA, SWCD	Mountain Castle SWCD	Structural Study to be completed in 2019	2020-25
Identify funding and resources for delineating landslide hazards	Landslide	Landslide Tool for planning and decision-making; limitation of new development.	$5,000	Low	Medium	VDEM, DCR	DCR	Not started; lack of funding	
Public education workshops for tornado drills (public, businesses and schools)	Tornado	Public informed about how to protect yourself during a tornado in case you are at home, in a car, at the office, or outside	$5,000	High	Medium	Local government	Local government	Not started; lack of funding	
Identify buildings or locations vital to the emergency response effort and buildings or locations that, if damaged, would create secondary disasters in forested areas	Wildfire	Available inventory of structures that need additional or unique protection from wildfires.	$10,000	Medium	Medium	VA Dept. of Forestry, US Forest Service, Local governments	Local government, VDOF, USFS	Not started; lack of funding	
Encourage residents and developers to use Fire-Wise building design, siting, and materials for construction	Wildfire	Reduction in damages from wildfire	$5,000	High	Medium	VA Dept. of Forestry, Local government	Local government	Not started; lack of funding	
Community wildfire assessments	Wildfire	Reduction of loss to wildfire	$25,000	N/A	Medium	VA Dept. of Forestry, Local government	VA Dept. of Forestry, Local government	Not started; lack of funding	

Project	Hazard Mitigated	Benefit	Cost Estimate	Benefit-to-Cost	Priority	Funding Partners	Implementation/ Lead Agency	Status	Proposed Schedule
Participate in special statewide outreach/awareness activities, such as Winter Weather Awareness Week, Flood Awareness Week, etc	All Hazards	Inform public about hazards and mitigation options	$5,000	High	High	VDEM, FEMA, NWS	Local government	In progress	Ongoing events
Public education	All hazards	Inform public about hazards and mitigation options	$12,000	Medium	Medium	FEMA, VDEM, Local government	Local government, ESC	Not started; lack of funding	

Table 91: Town of New Castle Hazard Mitigation Projects

Project	Hazard Mitigated	Benefit	Cost Estimate	Benefit-to-Cost	Priority	Funding Partners	Implementation/ Lead Agency	Status	Proposed Schedule
Acquisition of flood prone properties	Flooding	Removal of households from flood hazard areas; reduce repetitive loss; reduce loss of life and property	Unknown	High	High	FEMA, VDEM, Local government	Local government, Engineering & Building Inspections	Not started; lack of funding	As needed
Downtown Flooding	Flooding	Work with VDOT to address downtown stormwater drainage problems	$400,000	High	High	FEMA, VDOT, VA DHCD	Local government and VDOT	Planning and design underway	
Reverse 911	All hazards	Reduced loss through improved warning system	$10,000	High	High	FEMA, VDEM, Local Government	Local government, ESC, Sheriff Dept.	Not started; lack of funding	
Public education	All hazards	Inform public about hazards and mitigation options	$2,000	Medium	Medium	FEMA, VDEM, Local government	Local government, ESC	Not started; lack of funding	

6.7 Roanoke County

6.7.1 Current and Past Mitigation Measures

Floodplain Management – Roanoke County has adopted a new Stormwater Management Ordinance and Design Manual (2008) that require new residential buildings to be elevated two feet and new commercial buildings one foot above the 100-year base flood elevation. The County has a floodplain overlay district, corresponding to areas identified on Flood Insurance Rate Maps (FIRM) prepared by FEMA. Roanoke County also has up to date DFIRMS of all FEMA studied streams. Additionally, the County has adopted regulations for development in areas that contain more than 100 acres of drainage area that require flood studies for elevations of additions or new construction.

Roanoke River Corridor Conservation and Overlay District – Roanoke County has adopted a Roanoke River Corridor Conservation and Overlay District. Although primarily designed to protect water quality, it also helps reduce siltation, which in turn protects the channel that is carrying floodwaters. In this overlay district, smaller sites (2,500 square feet in lieu of standard 10,000 square feet minimum) must meet erosion and sediment controls standards. Roanoke County has completed over 1 mile of stream restoration. Project goals were aimed at reducing streambank erosion, improving channel stability during high flow events, storing flood waters, and supporting aquatic and other life.

Roanoke Valley Regional Stormwater Management Plan – All four Roanoke Valley jurisdictions participated in the development of the plan that was coordinated through the efforts of the Fifth Planning District Commission (Roanoke Valley-Alleghany Regional Commission). It offers alternative solutions for both flooding and flash flooding problems. These alternatives include clearing stream channels, enlarging drainage openings, constructing regional detention facilities, and flood proofing individual structures. The plan presents a total of 138 individual projects to address flooding in the 16 watersheds. These are ranked in order of priority within each watershed but no overall ranking within the valley is presented. Cost estimates are presented for each project, but neither individual project benefits, nor cumulative benefits are discussed. It would be essential to analyze the benefits of these projects before the plan can be used as a guideline for specific activities. The identified projects would cost a total of $66 million in 2001 dollars, not including land acquisition or efforts to flood proof or move over 2,200 buildings. A formal quantification of the corresponding benefits would go a long way toward justifying this cost, which can initially seem overwhelming to both citizens and community officials. For example, the 1997 plan reports that between 1972 and 1992, floods caused over $200 million in damages in the valley, and resulted in 10 deaths. The plan's Financing Options Report recommends creation of a regional stormwater utility as a means of funding the identified work.

Stormwater Management – The County has a Stormwater Management Ordinance that is part of the County Code. It was developed to bring the County into compliance with state laws on stormwater management and erosion and sedimentation control. In addition to using the Virginia

Erosion and Sediment Control Handbook, Roanoke County publishes a separate Stormwater Management Design Manual that specifies acceptable methodologies, design events for a wide variety of facilities, and administrative requirements such as submittal checklists. Appendices provide a wide variety of charts and tables to be used in applying the approved methodologies.

National Flood Insurance Program – The County participates in, and is in good standing with, the National Flood Insurance Program (NFIP) by enforcing floodplain management regulations that meet federal requirements. This program allows property owners to purchase flood insurance from NFIP. There were 379 NFIP policies in force in the County as of August 2018.

Storm Ready – The County of Roanoke was designated a Storm Ready community in May 2019 by the National Weather Service.

Community Rating System - The Community Rating System (CRS) is a voluntary program for NFIP-participating communities. The goals of the CRS are to reduce flood damages to insurable property, strengthen and support the insurance aspects of the NFIP, and encourage a comprehensive approach to floodplain management. The CRS has been developed to provide incentives in the form of flood insurance premium discounts for communities to go beyond the minimum floodplain management requirements to develop extra measures to provide protection from flooding. Roanoke County entered the CRS program in October 1991 and has a rating of 8 (10% discount).

Dam Safety – There are eight regulated dams that could impact properties in Roanoke County: Privately owned Loch Haven Lake Dam located on a tributary of Deer Branch Creek; Appalachian Electric Power owned Niagara Dam located on the Roanoke River; privately owned Orchard Dam on a tributary of Glade Creek; Carvin Cove Reservoir Dam, located on a tributary of the Carvin Creek and owned by the Western Virginia Water Authority, Spring Hollow Reservoir Dam located on a tributary of the Roanoke River and owned by the Western Virginia Water Authority, Montclair Dam and North lakes Dam in the Peters Creek watershed managed by Roanoke City, and Hidden Valley Dam in southwest county managed by Roanoke County.

Erosion and Sediment Control – Roanoke County has adopted the regulations, references, guidelines, standards and specifications promulgated by the Virginia Soil and Water Conservation Board (and any local handbook or publication of the board) for the effective control of soil erosion and sediment deposition to prevent the unreasonable degradation of properties, stream channels, waters and other natural resources. Such regulations, references, guidelines, standards and specifications for erosion and sediment control are included in, but not limited to, the Virginia Erosion and Sediment Control Regulations and the Virginia Erosion and Sediment Control Handbook, as amended from time to time. Roanoke County administers the Town of Vinton program under the handbook guidelines.

IFLOWS – The County participates in a flood warning system developed by the National Weather Service called Integrated Flood Observing and Warning System (IFLOWS). Through the use of radio-transmitted information, this system provides advanced flood forecasting to the

County Emergency Operation Center. There are eleven (11) IFLOW stations located in the County.

Project Impact Roanoke Valley – Project Impact Roanoke Valley was a partnership of FEMA, Roanoke County, the cities of Roanoke and Salem and the Town of Vinton to reduce destruction to life and property during disasters through planning and mitigation. The Project Impact Roanoke Valley Steering Committee and its work groups evaluated hazard mitigation needs from 1998 to 2001. The four work groups were: Hazard Mitigation, Public Information and Community Education, Stormwater Management and Partnership and Resource group. The Stormwater Management group was responsible for the preparation of over 1,500 floodplain elevation certificates in the participating localities. The Public Information and Community Education and Partnership and Resource groups met with community organizations, civic groups, businesses and the general public to promote hazard mitigation activities. The Land Use group focused on the how local plans and ordinances relate to hazard mitigation and published Hazard Mitigation through Land Use Planning in 2001. The Hazard Mitigation group addressed flooding, wildfire, meteorological events, and hazardous materials incidents in its report Hazard Analysis.

6.7.2 Roanoke County Mitigation Goals and Strategies

In developing mitigation strategies for the region and each locality, a wide range of activities were considered in order to achieve the goals and to lessen the vulnerability of the area to the impact of natural hazards. All goals, strategies and projects are dependent on the availability and timeliness of non-local funding.

Goals and Strategies were prioritized by each locality. Prioritization was completed in order of relative priority – high, medium or low – based on the benefit to cost criteria and the strategy's potential to mitigate the impact from natural hazards. Consideration was also given to availability of funding, the department/agency responsible for implementation, and the ability of the locality to implement the project. Under each identified pre-disaster, applicable local government departments will be the lead in making sure that each project or action will be implemented in a timely manner with other departments, other local government representatives and/or other regional agencies.

The anticipated level of cost effectiveness of each measure was a primary consideration when developing the list of proposed projects. Since the mitigation projects are an investment of public funds to reduce damages, localities have selected, and prioritized projects based on the benefit to cost of each project in hopes of obtaining the maximum benefit. Projects were categorized as high, medium or low benefit to cost based on the available information for each proposed project. Reduced damages over the lifespan of the projects, the benefits, are likely to be greater than the project cost in all cases. Although detailed cost and benefit analysis was not conducted during the mitigation action development process, these factors were of primary concern when prioritizing and selecting the proposed projects.

6.7.2.1 Earthquake

Goal: Increase public awareness of the probability and potential impact of earthquakes.
Responsible Departments: Engineering, Public Information, Emergency Services
Strategy:

1. Publish a special section in local newspaper with emergency information on earthquakes. Localize the information by printing the phone numbers of local emergency services offices, the American Red Cross, and hospitals.

6.7.2.2 Flood

Goal: Mitigation of loss of life and property from flooding and flood related disasters.
Responsible Department: Engineering, Emergency Services
Strategies:

1. Support a comprehensive, regional public information and education program on flooding, living in the floodplain, flood risks, low cost simple flood mitigation measures, flood insurance, stream remediation, hydrology, floodplain ordinances, and NFIP. This can be accomplished through regional workshops and educational materials for citizens, business, local staff, and elected officials.
2. Develop and maintain an inventory of flood prone roadways in cooperation with local governments and the Virginia Department of Transportation.
3. Develop and maintain an inventory of flood prone critical regional facilities such as hospitals, public utility sites, airports, etc.
4. Maintain an inventory of flood prone residential properties and repetitive loss properties.
5. Develop and maintain damage assessment information.
6. Continue the acquisition of elevation certificates for flood prone properties.
7. Continue the flood proofing/acquisition of flood prone properties.
8. Revise stormwater management and floodplain management ordinances.
9. Participate in, and remain in good standing with, the National Flood Insurance Program (NFIP) by enforcing floodplain management regulations that meet federal requirements.
10. Acquisition of flood prone properties followed by the appropriate mitigation action of demolition or relocation.

Goal: Update existing GIS data layers related to natural hazards.
Responsible Department: Engineering
Strategies:

1. Consider seeking funding and support programs that update FEMA's Flood Insurance Rate Maps (FIRM). Continue participation in FEMA's Cooperating Technical Partners (CTP) program that establishes partners with local jurisdictions to develop and maintain up-to-date flood maps.
2. Utilize GIS to inventory at risk infrastructure and public and private structures within flood prone areas.
3. Continue participate in FEMA's Digital Flood Insurance Rate Maps (DFIRM) program.

4. Support FIRM remapping projects that address areas in the region that have the most serious mapping problems and where flooding is a repetitive problem.

Goal: Provide early warning of flooding.
Responsible Department(s): Engineering, Emergency Services
Strategies:

1. Identify areas with recurring flood problems and request additional IFLOW stream/rain gauges as appropriate to ensure that these areas are adequately covered and monitored.
2. Consider a reverse 911 early warning system.
3. Consider on-site notification of flood prone properties.

Goal: Identification of structural projects that could mitigate the impact of flooding.
Responsible Department: Engineering
Strategies:

1. Consider seeking funding to prepare site-specific hydrologic and hydraulic studies that look at areas that have chronic and repetitive flooding problems.
2. Support Virginia Department of Transportation projects that call for improved ditching, replacement of inadequate and undersized culverts, enlargements of bridge openings and drainage piping needed to minimize flooding.
3. Update the Roanoke Valley Regional Stormwater Master Plan.
4. Expand the number of watersheds studied in the master plan and develop watershed plans for each.

Goal: Maintain an accurate database and map of repetitive loss properties
Responsible Department: Engineering
Strategies:

1. Work with VDEM and FEMA to update list of repetitive loss properties annually.
2. Obtain updated list of repetitive loss properties annually from VDEM/FEMA.
3. Review property addresses for accuracy and make necessary corrections.
4. Determine if and by what means each property has been mitigated.
5. Map properties to show general site locations (not parcel specific in order to maintain anonymity of the property owners).
6. Determine if properties have been mitigated and inform FEMA/VDEM through submission of an updated list/database and mapping.

6.7.2.3 Hurricane

Goal: Mitigate the impact of hurricanes.
Responsible Department: Emergency Services
Strategy:

1. Research and consider participating in the National Weather Service “Storm Ready” program.

6.7.2.4 Landslide

Goal: Improved Hazard Mapping and Assessments for landslides.
Responsible Department: Engineering
Strategies:

1. Delineating susceptible areas and different types of landslide hazards at a scale useful for planning and decision-making, led by USGS and State geological surveys.
2. Work with state and Federal agencies to develop data that will assist in reducing and eliminating impacts from landslides.
3. Continue enforcing steep slope ordinance/guidelines for development in steep slope/marginal soils areas.

6.7.2.5 Tornado

Goal: Mitigation of the impact of tornados.
Responsible Department: Emergency Services
Strategy:

1. Conduct a series of public workshops about how to protect yourself during a tornado in case you are at home, in a car, at the office, or outside.

6.7.2.6 Wildfire

Goal: Mitigation of the impacts of wildfire to life and property.
Responsible Department: Emergency Services
Strategies:

1. Encourage residents and developers to use Firewise building design, siting, and materials for construction.
2. Conduct Community Wildfire Assessments in cooperation with VDOF staff using the Wildland Urban Interface Fire Protection Program's Woodland Community Wildfire Hazard Assessment form.
3. Identify buildings or locations vital to the emergency response effort and buildings or locations that, if damaged, would create secondary disasters in forested areas.

6.7.2.7 Winter Storms

Goal: Mitigate the effects of extreme weather by implementing programs that provide early warning and preparation.
Responsible Department: Emergency Services
Strategy:

1. Research and consider participating in the National Weather Service "Storm Ready" program.
2. Participate in special statewide outreach/awareness activities, such as Winter Weather Awareness Week, Flood Awareness Week, etc.

Table 92: Roanoke County Hazard Mitigation Projects

Project	Hazard Mitigated	Benefit	Cost	Benefit-to-Cost	Priority	Funding Partners	Implementation/ Lead Agency	Status	Proposed Schedule
Publish a special section in local newspaper with emergency information on earthquakes	Earthquake	Increased level of knowledge and awareness in citizens	$2,500	High	Low	FEMA, VDEM	Local government	Ongoing	
Research and consider participating in the National Weather Service “Storm Ready” program	All Hazards	Community will be better prepared through planning and education about hazards	$2,000	Medium	Medium	NWS	Local government	May 2019	Ongoing
Public education workshops for tornado drills (public, businesses and schools)	Tornado	Public informed about how to protect yourself during a tornado in case you are at home, in a car, at the office, or outside	$5,000	High	Medium	Local government	Local government	Ongoing	
Participate in, and remain in good standing with, the National Flood Insurance Program (NFIP)	Flooding	Reduction of future flood damage through enforcement of floodplain ordinances and availability of discounted flood insurance for property owners	Unknown		High	FEMA	Local government	Ongoing	Ongoing
Maintain an accurate database and map of repetitive loss properties	Flooding	Identification of repetitive loss properties that should be mitigated	Unknown		High	FEMA, VDEM	Local government	Ongoing	Ongoing
Develop and maintain an inventory of flood prone roadways	Flooding	Inventory of flood prone roadways for planning purposes (road improvements, limitation of development)	$25,000	Medium	Medium	FEMA, VDEM, RVARC, VDOT, Local government	RVARC	In progress	Ongoing updates

Project	Hazard Mitigated	Benefit	Cost	Benefit-to-Cost	Priority	Funding Partners	Implementation/ Lead Agency	Status	Proposed Schedule
Support Virginia Department of Transportation projects that minimize flooding	Flooding	Clear debris and repair banks along roads to prevent backup, erosion and flooding of existing drainage systems	$1,400,000	N/A	Medium	FEMA, VDEM, VDOT	Local government or VDOT	Ongoing	Ongoing
Seek funding to prepare site-specific hydrologic and hydraulic studies that look at areas that have chronic and repetitive flooding problems	Flooding	Possible determination of solutions to repetitive loss properties.	$100,000	High	Medium	Local governments	Local governments	Pending funding	
Identify locations for additional IFLOWS monitoring and additional stream gauges	Flooding / Heavy Rains	Provide better, more timely information to allow faster, more accurate warnings to be issued to the public	$25,000	High	Medium	VDEM / FEMA / LOCAL GOVT	Local Government	Not started; lack of funding	
Develop and maintain an inventory of flood prone critical facilities	Flooding	Available inventory of critical structures that need additional or unique protection from flooding.	$1,000	Medium	Medium	FEMA, VDEM	Local government	Inventory complete	Ongoing
Maintain an inventory of flood prone residential properties and repetitive loss properties.	Flooding	Available inventory of repetitive loss properties that could be used for planning purposes				VDEM	Local government	Ongoing	
Repetitive Loss Property Acquisition	Flooding	Mitigation of repetitive loss properties	Unknown	High	High	FEMA, VDEM	Local government	Ongoing	Ongoing
Develop and maintain damage assessment information	Flooding	Knowledge of hazard caused damage for planning and disaster recovery efforts	Unknown			VDEM	Local government	Not started; lack of funding	

Project	Hazard Mitigated	Benefit	Cost	Benefit-to-Cost	Priority	Funding Partners	Implementation/ Lead Agency	Status	Proposed Schedule
Revise stormwater management and floodplain management ordinances	Flooding	Up to date hazard related ordinances to provide guidance for planning and development	Unknown	High	High	Local government, DCR	Local government	Ongoing	Complete in 2019
Flood hazard mapping update/ modernization	Flooding	Increased accuracy of flood maps and more effective regulation and enforcement of regulations	$50,000	High	High	FEMA, VDEM	Local government	Ongoing	Ongoing
Citizen Warning and Alert	All hazards	Reduced loss through improved warning system	$50,000/ $20,000 annually	High	Medium	FEMA, VDEM, Local Government	CommIT12	Ongoing	Ongoing
Communication equipment interoperability	All hazards	Improved coordination among jurisdictions; improved response times	unknown	High	High	FEMA, Local government	FEMA, Local government	Ongoing	Ongoing
Additional hazard related GIS layers/data	All hazards	Increased accuracy of hazard mitigation planning	$100,000	High	High	USGS, NOAA, FEMA, VDEM, VDOT, VDOF	Local government, Engineering Dept.	Ongoing	Ongoing
Additional hazard field data	Flooding	Elevation certificates for residential, business and critical facilities; increased accuracy of hazard mitigation planning	$75,000	High	High	FEMA, VDEM, Local government	Local government, Engineering Dept.	Ongoing	Ongoing
Residential and Commercial Structure acquisition	Flooding	Removal of structures from flood hazard areas; reduce repetitive loss; reduce loss of life and property	$15,000,000	High	High	FEMA, VDEM	Local government, Engineering Dept	Ongoing	Ongoing
Identify funding and resources for delineating landslide hazards	Landslide	Landslide Tool for planning and decision-making; limitation of new development.	$15,000	Low	Medium	VDEM, DCR	DCR	Not started; lack of funding	
Develop steep slope ordinance/guidelines for development in steep slope/marginal soils areas	Landslide	Landslide Tool for planning and decision-making; limitation of new development.	$10,000	Medium	Medium	DCR	Local government	Completed	

Project	Hazard Mitigated	Benefit	Cost	Benefit-to-Cost	Priority	Funding Partners	Implementation/ Lead Agency	Status	Proposed Schedule
Public education	All hazards	Inform public about hazards and mitigation options	$50,000	High	High	FEMA, VDEM, Local government	Local government	In progress	Ongoing
Participate in special statewide outreach/awareness activities, such as Winter Weather Awareness Week, Flood Awareness Week, etc	All Hazards	Inform public about hazards and mitigation options	$10,000	High	High	VDEM, FEMA, NWS	Local government	In progress	Ongoing events
Stormwater facilities construction	Flooding	Reduce frequency and impact of flooding	$15,000,000	High	High	FEMA, VDEM	Local government, Engineering Dept.	Ongoing	Ongoing
Upgrade/repairs to stormwater system	Flooding	Reduce frequency and impact of flooding	$10,000,000	High	High	FEMA, VDEM, VDOT	Local government, Engineering Dept.	Ongoing	Ongoing
Drainage system maintenance	Flooding	Clear debris and repair banks to prevent backup, erosion and flooding of existing drainage systems	$1,000,000 annually	High	High	FEMA, VDEM, VDOT	Local government, Engineering Dept.	Ongoing	Ongoing
Update Regional Stormwater Management Master Plan	Flooding	Watershed/mitigation planning and project identification	$750,000	High	High	FEMA, Local government, PDC	Local government, Engineering Dept.	Ongoing	Ongoing
Encourage residents and developers to use Fire-Wise building design, siting, and materials for construction	Wildfire	Reduction in damages from wildfire	$5,000	High	Medium	VA Dept. of Forestry, Local government	Local government	Not started; lack of funding	
Community wildfire assessments	Wildfire	Reduction of loss to wildfire	$25,000	N/A	Medium	VA Dept. of Forestry, Local government	VA Dept. of Forestry, Local government	Not started; lack of funding	

Project	Hazard Mitigated	Benefit	Cost	Benefit-to-Cost	Priority	Funding Partners	Implementation/ Lead Agency	Status	Proposed Schedule
Identify buildings or locations vital to the emergency response effort and buildings or locations that, if damaged, would create secondary disasters in forested areas	Wildfire	Available inventory of structures that need additional or unique protection from wildfires.	$10,000	Medium	Medium	VA Dept. of Forestry, US Forest Service, Local governments	Local government, VDOF, USFS	Not started; lack of funding	

6.8 Town of Vinton

6.8.1 Current and Past Mitigation Measures

Emergency Communications Center (ECC) Services – In January 2010, the Town of Vinton and Roanoke County entered a Memorandum of Understanding (MOU) for Operations, Oversight, and Management of the Merged Emergency Communications Center. By the agreement, the Roanoke County Emergency Communications Center shall provide emergency and non-emergency dispatch services for the Town of Vinton, including the Vinton Police Department, the Vinton Fire and Rescue Department, and the Vinton Public Works Department. Services delivery procedures will be documented in General Orders (GO) Standard Operating Procedures (SOPs), and Directives, with input provided by the Inter-Agency Operational Team, and the Advisory Board.

Floodplain Management – The Town of Vinton floodplain management regulations were originally adopted in 1982. These regulations are designed as an overlay district and adopted as part of the 1995 Zoning Ordinance. The regulations have been amended subsequently in 2007 and 2014 and comply with the Federal Emergency Management Agency (FEMA) floodplain regulations. The Floodplain Overlay District applies to properties that have been identified on a Flood Insurance Rate Map (FIRM) as being in a Special Flood Hazard Area (SFHA). The land area covered by the floodwaters of the base flood is the SFHA.

There are two (2) flood zones in the Town:

1. Floodway – The land immediately adjoining the watercourse channel that is the natural conduit for floodwaters; and
2. 100-year Floodplain – Any area of land that is susceptible to a one percent (1%) chance of flooding annually. The most recent FIRM for the Town of Vinton was completed in 2007.

The Town’s floodplain management regulations ordinance requires that new residential structures be at least two (2) feet above flood elevation, and that new non-residential structures be at least one (1) foot above flood elevation.

The Federal Emergency Management Agency's (FEMA) Community Rating System (CRS) is a voluntary program for recognizing and encouraging community floodplain management activities that exceed the minimum standards set up for the National Flood Insurance Program (NFIP). In exchange for a community's proactive efforts to reduce flood risk, policyholders can receive reduced flood insurance premiums for buildings in the community. These reduced premiums reflect the reduced flood risk resulting from community efforts toward achieving the three CRS goals:

1. Reduce flood damage to insurable property;
2. Strengthen and support the insurance aspects of the NFIP; and

3. Encourage a comprehensive approach to floodplain management.

As of October 1, 2016, the Town is one of the few communities in Virginia that have been accepted into the Community Rating System (CRS) program. Due to the continuing efforts of Town administration, every Town of Vinton property owner – residential or commercial – whose property is located within the Special Hazard Flood Area (SHFA), may be eligible for a 10% discount on their annual flood insurance premium due to the Town's CRS Classification of 8.

National Flood Insurance Program – The Town participates in, and is in good standing with, the National Flood Insurance Program (NFIP) by enforcing floodplain management regulations that meet federal requirements. This program allows property owners to purchase flood insurance from NFIP. There are currently 33 NFIP policies in force in the Town.

The Town obtained two FEMA Hazard Mitigation Grant Program (HMGP) grant funding in April 1998 and July 2004. Through these two grant programs, 19 properties that were either developed with residential structures or vacant lots located in the SFHA were acquired. Eleven structures that were located in the floodway were demolished and the occupants and/or tenants were relocated from the SFHA and the properties were rezoned to public/open space district.

Stormwater Management – On April 5, 2016, a resolution was adopted by the Vinton Town Council for the establishment of a Memorandum of Understanding (MOU) agreement between the County of Roanoke Board of Supervisors and the Vinton Town Council for the County to continue to administer the Virginia Erosion and Sediment Control Program (VESCP) and to administer the Virginia Stormwater Management Program (VSMP) for the Town of Vinton. The County became the Town of Vinton VSMP administrator as of June 1, 2016, with the approval of the State Water Control Board.

Roanoke Valley Regional Stormwater Management Plan – All four Roanoke Valley jurisdictions participated in the development of the plan that was coordinated through the efforts of the Fifth Planning District Commission (Roanoke Valley-Alleghany Regional Commission). It offers alternative solutions for both flooding and flash flooding problems. These alternatives include clearing stream channels, enlarging drainage openings, constructing regional detention facilities, and flood proofing individual structures. The plan presents a total of 138 individual projects to address flooding in the 16 watersheds. These are ranked in order of priority within each watershed but no overall ranking within the valley is presented. Cost estimates are presented for each project, but neither individual project benefits, nor cumulative benefits are discussed.

It would be essential to analyze the benefits of these projects before the plan can be used as a guideline for specific activities. The identified projects would cost a total of $66 million in 2001 dollars, not including land acquisition or efforts to flood proof or move over 2,200 buildings. A formal quantification of the corresponding benefits would go a long way toward justifying this cost, which can initially seem overwhelming to both citizens and community officials. For example, the 1997 plan reports that between 1972 and 1992, floods caused over $200 million in

damages in the valley, and resulted in 10 deaths. The plan's Financing Options Report recommends creation of a regional stormwater utility as a means of funding the identified work.

IFLOWS – The Town participates in a flood warning system developed by the National Weather Service called Integrated Flood Observing and Warning System (IFLOWS). Through the use of radio-transmitted information, this system provides advanced flood forecasting to the Roanoke County/Town of Vinton Communications Center. There are no IFLOW stations located in the Town.

Project Impact Roanoke Valley – Project Impact Roanoke Valley was a partnership of FEMA, Roanoke County, the cities of Roanoke and Salem and the Town of Vinton to reduce destruction to life and property during disasters through planning and mitigation. The Project Impact Roanoke Valley Steering Committee and its work groups evaluated hazard mitigation needs from 1998 to 2001. The four work groups were: Hazard Mitigation, Public Information and Community Education, Stormwater Management and Partnership and Resource group. The Stormwater Management group was responsible for the preparation of over 1,500 floodplain elevation certificates in these four jurisdictions. The Public Information and Community Education and Partnership and Resource groups met with community organization, civic groups, businesses and the general public to promote hazard mitigation activities. The Land Use group focused on how local plans and ordinances relate to hazard mitigation and published Hazard Mitigation through Land Use Planning in 2001. The Hazard Mitigation group addressed flooding, wildfire, meteorological events, and hazardous materials incidents in its report Hazard Analysis.

Dam Safety – Carvins Cove Reservoir Dam, located on a tributary of the Carvin Creek and owned by the Western Virginia Water Authority could impact the western side of the Town of Vinton.

Erosion and Sediment Control – Since February 14, 1984, the County of Roanoke has been responsible for the Erosion and Sediment Control program for the entire County area, including the Town of Vinton. The County and the Town have adopted the regulations, references, guidelines, standards and specifications promulgated by the Virginia Soil and Water Conservation Board (and any local handbook or publication of the board) for the effective control of soil erosion and sediment deposition to prevent the unreasonable degradation of properties, stream channels, waters and other natural resources. Such regulations, references, guidelines, standards and specifications for erosion and sediment control are included in, but not limited to, the Virginia Erosion and Sediment Control Regulations and the Virginia Erosion and Sediment Control Handbook, as amended from time to time. The County and the Town continue to maintain an Erosion and Sediment Control (ESC) Ordinance to require erosion and sediment controls during construction activities, as well as sanctions, to ensure compliance, under local law, for all land disturbances of 2,500 square feet or more. In February 2016, Roanoke County amended its ESC ordinance to incorporate steep slope development requirements.

Virginia Uniform Statewide Building Code – In September 1989, the Town of Vinton entered an agreement with Roanoke County for Roanoke County Office of Building Safety to administer and enforce the Virginia USBC within the Town Limits. Roanoke County, along with all other localities in the State of Virginia, utilizes the Virginia Uniform Statewide Building Code (USBC). This is a document produced by the Virginia Board of Housing and Community Development. It is based upon the model codes published by The International Code Council (ICC) and the National Fire Prevention Association.

As of January 2012, VA USBC requires the building official of any locality which has identifiable soils of expensive, compressible, shifting or unknown characteristics, to make a determination as to when soils testing shall be required. Generally, expansive or "shrink-swell" type soils are those that are high in clay content and change volume with variations in moisture content. Each year in the United States, expansive soils cause billions of dollars in damage to buildings, roads, pipelines, and other structures.

Such areas are identified in Roanoke County which include the Town of Vinton, by the current soil survey performed by the United States Department of Agriculture. Under Roanoke County Expensive Soils Policy and Procedures, parcels located in the Town Limits with tax identification number begins with 63-74 are considered to be located in a potential expansive soil area and are required to submit a soils test report from a qualified testing agency prior to the issuance of a permit involving new construction or an expansion of existing construction.

6.8.2 Town of Vinton Mitigation Goals and Strategies

During the late 1990s, under the Project Impact initiatives, the Roanoke Valley Project Impact Steering Committee and its work groups actively addressed hazard mitigation needs. The Steering Committee and the work groups were composed of representatives from the Cities of Roanoke and Salem, County of Roanoke, and Town of Vinton. The Hazard Mitigation work group prepared a report identifying potential hazards including wildfires and flooding, and maps identifying hazard areas from the report were distributed through the local newspaper. The Public Information and Community Education work group and the Partnership and Resource Development work group met with community organizations, businesses, and decision makers to promote cooperative hazard mitigation activities. The Land Use work group focused on the analysis of how local plans and ordinances relate to hazard mitigation and how these documents might be changed to protect the community more effectively. The goal of the work group was to ensure that local land use, development, and building codes minimize the potential impact of floods and other disasters on the natural and built environment.

In developing mitigation strategies for the region and each locality, a wide range of activities were considered in order to achieve the goals and to lessen the vulnerability of the area to the impact of natural hazards. **All goals, strategies and projects are dependent on the availability and timeliness of non-local funding.**

Goals and Strategies were prioritized by each locality. Prioritization was completed in order of relative priority – high, medium or low – based on the benefit to cost criteria and the strategy's potential to mitigate the impact from natural hazards. Consideration was also given to availability of funding, the department/agency responsible for implementation, and the ability of the locality to implement the project. Under each identified hazard, applicable local government departments will be the lead in making sure that each project or action will be implemented in a timely manner with other departments, other local government's representatives and/or other regional agencies.

The anticipated level of cost effectiveness of each measure was a primary consideration when developing the list of proposed projects. Since mitigation projects are an investment of public funds to reduce damages, localities selected and prioritized projects based on the benefit to cost of each project in hopes of obtaining the maximum benefit. Projects were categorized as high, medium or low benefit to cost based on the available information for each proposed project. Reduced damages over the lifespan of the projects, the benefits, are likely to be greater than the project cost in all cases. Although detailed cost and benefit analysis was not conducted during the mitigation action development process, these factors were of primary concern when prioritizing and selecting the proposed projects.

6.8.2.1 Earthquake

Goal: Increase public awareness of the probability and potential impact of earthquakes.
Responsible Department(s): Administration, Planning and Zoning, Emergency Services Coordinator, ECC, Roanoke County Department of Community Development and CommIT.
Strategies:

1. Publish a special section in local newspaper with emergency information on earthquakes. Localize the information by printing the phone numbers of local emergency services offices, the American Red Cross, and hospitals.
2. Develop "critical area" maps based on geotechnical information to identify locations where damage potential is high.

6.8.2.2 Flood

Goal: Mitigation of loss of life and property from flooding and flood related disasters.
Responsible Department(s): Administration, Public Works, Planning and Zoning, Emergency Services Coordinator, ECC, and Roanoke County Department of Community Development and CommIT.
Strategies:

1. Support a comprehensive, regional public information and education program on flooding, living in the Special Flood Hazard Areas (SFHA), flood risks, low cost simple flood mitigation measures, flood insurance, stream remediation, hydrology, floodplain ordinances, and NFIP. This can be accomplished through regional workshops and

educational materials for property owners, citizens, business, local staff, and elected officials.
2. Utilize existing documents and programs from FEMA, NFIP, VDEM, and the National Weather Service to educate the public about hazards and mitigation opportunities.
3. Coordinate with and support Community Emergency Response Team (CERT) information distribution activities in the community.
4. Develop and maintain an inventory of flood prone roadways in cooperation with local governments and the Virginia Department of Transportation.
5. Develop and maintain an inventory of flood prone critical regional facilities such as hospitals, public utility sites, airports, etc.
6. Maintain an inventory of flood prone residential properties and repetitive loss properties.
7. Develop and maintain damage assessment information.
8. Continue to seek funding opportunities for the completion the acquisition of elevation certificates for flood prone properties.
9. Continue to seek funding opportunities for the flood proofing of structures and/or acquisition of flood prone properties to mitigate the loss of life and properties from flooding.
10. Continue to stay informed with Roanoke County with any update of the ESC, stormwater management, and floodplain management ordinances.
11. Continue to maintain the Town's Community Rating System (CRS) Class 8 classification, which will allow residents and business owners to receive a 10% discount on their flood insurance premiums.
12. Continue to find ways and/or increase mitigation activities to earn additional CRS points to lower the CRS Classification from Class 8 to Class 7.
13. Participate in, and remain in good standing with, the National Flood Insurance Program (NFIP) by enforcing floodplain management regulations that meet federal requirements.
14. Acquisition of flood prone properties followed by the appropriate mitigation action of demolition or relocation of the structures.

Goal: Update existing GIS data layers related to natural hazards.
Responsible Department(s): Planning and Zoning, Roanoke County Department of Community Development and CommIT.
Strategies:

1. Consider seeking funding and support programs that update FEMA's Flood Insurance Rate Maps (FIRM). Continue participation in FEMA's Cooperating Technical Partners (CTP) program that establishes partners with local jurisdictions to develop and maintain up-to-date flood maps.
2. Utilize GIS to inventory at risk infrastructure and public and private structures within flood prone areas.
3. Continue participate in FEMA's Digital Flood Insurance Rate Maps (DFIRM) program.
4. Support FIRM remapping projects that address areas in the region that have the most serious mapping problems and where flooding is a repetitive problem.

Goal: Provide flood early warning system.
Responsible Department(s): Planning and Zoning, Emergency Services Coordinator, Roanoke County Department of Community Development and CommIT, ECC, and Social Media Administrators.
Strategies:

1. Identify areas with recurring flood problems and request additional IFLOW stream/rain gauges as appropriate to ensure that these areas are adequately covered and monitored.
2. Consider a reverse 911 early warning system.
3. Consider on-site notification of flood prone properties.
4. Implement early warning system using social media (webpage, Facebook, Twitter, etc.). (Strategy completed)

Goal: Identification of structural projects that could mitigate the impact of flooding.
Responsible Department(s): Administration, Planning and Zoning, Public Works, Roanoke County Department of Community Development and CommIT.
Strategies:

1. Consider seeking funding to prepare site-specific hydrologic and hydraulic studies that look at areas that have chronic and repetitive flooding problems.
2. Support Virginia Department of Transportation and adjoining jurisdictions projects that call for improved ditching, replacement of inadequate and undersized culverts, enlargements of bridge openings and drainage piping needed to minimize flooding.
3. Update the Roanoke Valley Regional Stormwater Master Plan.
4. Expand the number of watersheds studied in the master plan and develop watershed plans for each.

Goal: Maintain an accurate database and map of repetitive loss properties
Responsible Department(s): Planning and Zoning, Emergency Services Coordinator, Roanoke County Department of Community Development and CommIT.
Strategies:

1. Work with VDEM and FEMA to update list of repetitive loss properties annually.
2. Obtain updated list of repetitive loss properties annually from VDEM/FEMA.
3. Review property addresses for accuracy and make necessary corrections.
4. Determine if and by what means each property has been mitigated.
5. Map properties to show general site locations (not parcel specific in order to maintain anonymity of the property owners).
6. Determine if properties have been mitigated and inform FEMA/VDEM through submission of an updated list/database and mapping.

6.8.2.3 Hurricane

Goal: Mitigate the impact of hurricanes in the Roanoke Valley-Alleghany Region.
Responsible Department(s): Planning and Zoning, Emergency Services Coordinator, Social Media Administrators, ECC.
Strategies:

1. Research and consider participating in the National Weather Service "Storm Ready" program.
2. Encourage voluntary use of the National Weather Service or private warning mechanisms, such as The Weather Channel NOTIFY! and the Specific Area Message Encoding (SAME).
3. Develop reverse 911 warning systems to activate by National Weather Service.
4. Educate the public regarding the need to pre-plan for weather emergencies.
5. Continue to post early warning notice using social media (webpage, Facebook, Twitter, etc.).

6.8.2.4 Landslide

Goal: Improved Hazard Mapping and Assessments for landslides.
Responsible Department(s): Planning and Zoning, and Roanoke County Department of Community Development and CommIT.
Strategies:

1. Encourage the delineation of susceptible areas and different types of landslide hazards at a scale useful for planning and decision-making by USGS and State geological surveys.
2. Work with state and Federal agencies to develop data that will assist in reducing and eliminating impacts from landslides risk to life and property.
3. Continue to enforce and/or update the steep slope development for development in steep slope/marginal soils areas.

6.8.2.5 Tornado

Goal: Mitigate the impact of tornados.
Responsible Department(s): Administration, Emergency Services Coordinator, Social Media Administrators, ECC.
Strategies:

1. Involve in regional effort to conduct a series of public workshops about how to protect yourself during a tornado in case you are at home, in a car, at the office, or outside.
2. Educate the public regarding the need to pre-plan for weather emergencies and provide an informational brochure or handout on emergency planning.
3. Encourage voluntary use of the National Weather Service or private warning mechanisms, such as The Weather Channel NOTIFY! and the Specific Area Message Encoding (SAME).

4. Continue to post early warning notice using social media (webpage, Facebook, Twitter, etc.).

6.8.2.6 Wildfire

Goal: Mitigation of the impacts of wildfire to life and property.
Responsible Department(s): Emergency Services Coordinator, Planning and Zoning, and Roanoke County Department of Community Development and CommIT, Social Media Administrators, and ECC.
Strategies:

1. Encourage residents and developers to use FireWise building design, siting, and materials for construction.
2. Conduct Community Wildfire Assessments in cooperation with VDOF staff using the Wildland Urban Interface Fire Protection Program's Woodland Community Wildfire Hazard Assessment form.
3. Identify buildings or locations vital to the emergency response effort and buildings or locations that, if damaged, would create secondary disasters in forested areas.
4. Continue to post early warning notice using social media (webpage, Facebook, Twitter, etc.).

6.8.2.7 Winter Storms

Goal: Mitigate the effects of extreme weather by implementing programs that provide early warning and preparation.
Responsible Department(s): Emergency Services Coordinator, Planning and Zoning, and Roanoke County Department of Community Development and CommIT, Social Media Administrators, and ECC.
Strategies:

1. Research and consider participating in the National Weather Service "Storm Ready" program.
2. Develop reverse 911 warning systems to be activated by National Weather Service input.
3. Participate in special statewide outreach/awareness activities, such as Winter Weather Awareness Week, Flood Awareness Week, etc.
4. Provide an informational brochure or handout on emergency for weather events.
5. Encourage voluntary use of the National Weather Service or private warning mechanisms, such as The Weather Channel NOTIFY! and the Specific Area Message Encoding (SAME).
6. Continue to post early warning notice using social media (webpage, Facebook, Twitter, etc.).

Table 93: Town of Vinton Hazard Mitigation Projects

Project	Hazard Mitigated	Benefit	Cost Estimate	Benefit-to-Cost	Priority	Funding Partners	Implementation/ Lead Agency	Status	Proposed Schedule
Implement early warning system using social media	All Hazards	Public made aware of impending danger	Unknown	High	High	RVARC Localities	RVARC and Local government	In progress	Ongoing
Encourage voluntary use of the National Weather Service or private warning mechanisms, such as The Weather Channel NOTIFY! and the Specific Area Message Encoding (SAME)	All Hazards	Public able to receive warnings from appropriate sources	Unknown	High	High	RVARC Localities	RVARC and Local government	In progress	Ongoing
Participate in special statewide outreach/awareness activities, such as Winter Weather Awareness Week, Flood Awareness Week, etc.	All Hazards	Inform public about hazards and mitigation options	$10,000	High	High	VDEM, FEMA, NWS, RVARC Localities	RVARC and Local government	In progress	Ongoing events
Provide an informational brochure or handout on emergency for weather events	All Hazards	Public better informed about hazards.	Unknown	Medium	Medium	VDEM FEMA, RVARC Localities	Town of Vinton	Not started; lack of funding	As funding becomes available
Reverse 911	All Hazards	Reduced loss through improved warning system	$100,000	High	Middle	FEMA, VDEM, Local Governments	Town of Vinton, Roanoke County, and RVARC	In progress	2020-2024
Communication equipment interoperability	All Hazards	Improved coordination among jurisdictions; improved response times	$100,000	High	High	FEMA, RVARC Localities	Town of Vinton Emergency Coordinator, Roanoke County/Vinton ECC	In progress	Ongoing
Additional hazard related GIS layers/data	All Hazards	Increased accuracy of hazard mitigation planning	$100,000	Medium	High	USGS, NOAA, FEMA, VDEM, VDOT, VDOF, RVARC Localities	RVARC, County of Roanoke CommIT, and Town of Vinton	Ongoing	Ongoing

Project	Hazard Mitigated	Benefit	Cost Estimate	Benefit-to-Cost	Priority	Funding Partners	Implementation/ Lead Agency	Status	Proposed Schedule
Coordinate with and support Community Emergency Response Team (CERT)	All Hazards	Coordinated information distribution	Unknown	Unknown	Unknown	Unknown	Unknown	Ongoing	Ongoing
Public education	All hazards	Inform public about hazards and mitigation options	$50,000	Medium	High	FEMA, VDEM, RVARC Localities	Town of Vinton and RVARC	Ongoing	Ongoing
Determine the need for generators at public infrastructure facilities, emergency shelters, and public buildings	All hazards	Ensure that water and sewer service can be operational during hazard events. Needed services can be provided during emergency events.	$20,000	High	High	FEMA, Local government	Town of Vinton Public Works and Police Departments	Ongoing	As funding becomes available
Local codes review	All hazards	Review development codes to evaluate need for changes that would improve disaster mitigation	$100,000	Medium	High	FEMA, Roanoke County and Town of Vinton	Town of Vinton Planning and Zoning Department	Ongoing	Ongoing
Publish a special section in local newspaper with emergency information on earthquakes	Earthquake	Increased level of knowledge and awareness in citizens	$2,500	High	Low	FEMA, VDEM, and RVARC Localities	RVARC and participating local government	Not started; lack of funding	As funding becomes available
Develop “critical area” maps for earthquake zones	Earthquake	Identification of earthquake hazard locations	$75,000	Medium	Medium	FEMA	Local government	Not started; lack of funding	As funding becomes available
Participate in, and remain in good standing with, the National Flood Insurance Program (NFIP)	Flooding	Reduction of future flood damage through enforcement of floodplain ordinances and availability of discounted flood insurance for property owners	Unknown	High	High	FEMA, VA DCR, VDEM	Town of Vinton and Roanoke County	Ongoing	Ongoing
Maintain an accurate database and map of repetitive loss properties	Flooding	Identification of repetitive loss properties that should be mitigated	Unknown	High	High	FEMA, VDEM, VA DCR, Roanoke County and Town of Vinton	Roanoke County and Town of Vinton	Ongoing	Annual update

Project	Hazard Mitigated	Benefit	Cost Estimate	Benefit-to-Cost	Priority	Funding Partners	Implementation/ Lead Agency	Status	Proposed Schedule
Seek funding to prepare site-specific hydrologic and hydraulic studies that look at areas that have chronic and repetitive flooding problems	Flooding	Possible determination of solutions to repetitive loss properties.	Unknown	High	Medium	FEMA, VDEM, and RVARC Localities	Local governments	Not started; lack of funding	As funding becomes available
Flood hazard mapping update/ modernization	Flooding	Increased accuracy of flood maps and more effective regulation and enforcement of regulations	$50,000	Medium	High	FEMA, VDEM	RVARC, County of Roanoke, and Town of Vinton	Ongoing	Ongoing
Develop and maintain an inventory of flood prone roadways	Flooding	Inventory of flood prone roadways for planning purposes (road improvements, limitation of development)	$25,000	Medium	Medium	FEMA, VDEM, RVARC Localities, VDOT	RVARC	Ongoing	Annual update
Support Virginia Department of Transportation projects that minimize flooding	Flooding	Clear debris and repair banks along roads to prevent backup, erosion and flooding of existing drainage systems	$1,400,000	N/A	Medium	FEMA, VDEM, VDOT	RVARC, VDOT, and participating local governments	Not started; lack of funding	As funding becomes available
Maintain an inventory of flood prone residential properties and repetitive loss properties	Flooding	Available inventory of repetitive loss properties that could be used for planning purposes	Unknown	Unknown	Unknown	VDEM, RVARC	RVARC, Roanoke County and Town of Vinton	Ongoing	Ongoing
Develop and maintain damage assessment information	Flooding	Knowledge of hazard caused damage for planning and disaster recovery efforts	Unknown	High	Medium	VDEM	Town of Vinton	Ongoing	Ongoing
Additional hazard field data	Flooding	Elevation certificates for residential, business and critical facilities; increased accuracy of hazard mitigation planning	$50,000	Medium	High	FEMA, VDEM, RVARC Localities	Town of Vinton and Roanoke County	Ongoing	Ongoing, as funding becomes available
Property acquisition – single-family and commercial structures	Flooding	Removal of households from flood hazard areas; reduce repetitive loss; reduce loss of life and property	$10,000,000	High	High	FEMA, VDEM, Town of Vinton	Town of Vinton Planning and Zoning Department	Ongoing	2020-2024, as funding becomes available

Project	Hazard Mitigated	Benefit	Cost Estimate	Benefit-to-Cost	Priority	Funding Partners	Implementation/ Lead Agency	Status	Proposed Schedule
Update Regional Stormwater	Flooding	Watershed/mitigation planning and project identification	$500,000	Medium	High	FEMA, VDEM, RVARC Localities	Town of Vinton and other Valley governments	Not started	As funding becomes available
Stormwater facilities construction	Flooding	Reduce frequency and impact of flooding	$10,000,000	Medium	High	FEMA, VDEM, Town of Vinton,	Town of Vinton	Not started, lack of funding	2020-2024, as funding becomes available
Upgrade/repairs to stormwater system	Flooding	Reduce frequency and impact of flooding	$20,000,000	Medium	High	FEMA, VDEM, VDOT	Town of Vinton Public Works Department	Ongoing	2020-2024, as funding becomes available
Drainage system maintenance	Flooding	Clear debris and repair banks to prevent backup, erosion and flooding of existing drainage systems	$100,000, Annually	Medium	High	FEMA, VDEM, VDOT, Town of Vinton	Town of Vinton Public Works Department	Ongoing	Ongoing
Evaluate public utilities for floodproofing	Flooding	Evaluation of public utilities for retrofitting or floodproofing to prevent failure during disasters	$50,000	High	Medium	FEMA, VDEM, Town of Vinton	Town of Vinton Public Works Department	Ongoing	Additional projects as funding becomes available.
Maintain and/or upgrade CRS Classification Rating	Flooding	Reduction in flood insurance rates; reduction in flood loss	$10,000, Annually	Medium	High	FEMA, RVARC Localities, Town of Vinton	Town of Vinton Planning and Zoning Department	Ongoing	Ongoing
Identify locations for additional IFLOWS monitoring and additional stream gauges	Flooding / Heavy Rains	Provide better, more timely information to allow faster, more accurate warnings to be issued to the public	$25,000	High	Medium	FEMA, VDEM, and RVARC Localities	Town of Vinton and Roanoke County	Not started; lack of funding	As funding becomes available
Identify funding and resources for delineating landslide hazards	Landslide	Landslide Tool for planning and decision-making; limitation of new development.	$15,000	Low	Medium	VDEM, VA DCR, RVARC Localities	VA DCR	Not started; lack of funding	As funding becomes available
Continue to enforce steep slope ordinance/guidelines for development in steep slope/marginal soils areas	Landslide	Landslide Tool for planning and decision-making; limitation of new development.	$10,000	Medium	Medium	VA DCR, Roanoke County, Town of Vinton	Roanoke County, Town of Vinton	Completed in 2016	Ongoing/Update when needed

Project	Hazard Mitigated	Benefit	Cost Estimate	Benefit-to-Cost	Priority	Funding Partners	Implementation/ Lead Agency	Status	Proposed Schedule
Public education workshops for tornado drills (public, businesses and schools)	Tornado	Public informed about how to protect yourself during a tornado in case you are at home, in a car, at the office, or outside	$5,000	High	Medium	RVARC Localities	RVARC	Not started; lack of funding	As funding becomes available
Encourage residents and developers to use Fire-Wise building design, siting, and materials for construction	Wildfire	Reduction in damages from wildfire	$5,000	High	Medium	VA DOF, RVARC Localities	Roanoke County, Town of Vinton	Not started; lack of funding	As funding becomes available
Community Wildfire assessments	Wildfire	Reduction of loss to wildfire	$50,000	Medium	Medium	VA DOF, RVARC Localities	Roanoke County and Town of Vinton	Ongoing	As funding becomes available

6.9 City of Roanoke

6.9.1 Current and Past Mitigation Measures

Floodplain Management – The City of Roanoke has adopted a Floodplain Management Ordinance that requires new residential buildings to be elevated 2 feet above the base flood elevation. The City has a floodplain overlay district corresponding to areas identified on Flood Insurance Rate Maps prepared by FEMA.

National Flood Insurance Program – The City participates in, and is in good standing with, the National Flood Insurance Program (NFIP) by enforcing floodplain management regulations that meet federal requirements. This program allows property owners to purchase flood insurance from NFIP. As of 2018, there are 549 NFIP policies in force in the City with a total of 1,132 structures in the floodplain.

Community Rating System - The Community Rating System (CRS) is a voluntary program for NFIP-participating communities. The goals of the CRS are to reduce flood damages to insurable property, strengthen and support the insurance aspects of the NFIP, and encourage a comprehensive approach to floodplain management. The CRS has been developed to provide incentives in the form of flood insurance premium discounts for communities to go beyond the minimum floodplain management requirements to develop extra measures to provide protection from flooding. The City of Roanoke entered the CRS program in 1996 and maintains a class 7 rating (15% discount on flood insurance premiums for parcel owners within City limits).

River & Creek Corridors Overlay District – The City has adopted the River and Creek Corridors Overlay District (RCC) to recognize the Roanoke River and its tributaries as valuable water resources in the City and to designate certain areas along their banks as being critical to their protection in order to ensure that such streams and adjacent lands will fulfill their natural functions. Streams have the primary natural functions of conveying storm and ground water, storing floodwater, and supporting aquatic and other life. Vegetated lands adjacent to the stream channel in the drainage basin serve as a buffer to protect the stream system's ability to fulfill its' natural functions. Primary natural functions of the buffer include protection of water quality by filtering pollutants, provision of storage for floodwaters, and provision of suitable habitats for wildlife. Within the River and Creek Overlay District, riparian buffers shall be established and shall consist of all land adjacent to, and fifty (50) feet landward from, the top of the banks of the Roanoke River or the applicable tributary. Further, riparian buffers shall be retained and maintained if present, and where it does not exist, shall be established and maintained upon any land disturbing activity. To retain ecological functional value, native vegetation shall be preserved to the maximum extent possible.

Stormwater Management – As part of the state VSMP program, the City has a Stormwater Management Ordinance to address stormwater runoff quantity and quality from development

activities that is part of the City Code. It was developed to bring the City into compliance with state laws on stormwater management and erosion and sedimentation control.

Erosion and Sediment Control – The City of Roanoke has adopted more stringent regulations, references, guidelines, standards and specifications than promulgated by the Virginia Soil and Water Conservation Board (and any local handbook or publication of the board) for the effective control of soil erosion and sediment deposition to prevent the unreasonable degradation of properties, stream channels, waters and other natural resources. Such regulations, references, guidelines, standards and specifications for erosion and sediment control are included in, but not limited to, the Virginia Erosion and Sediment Control Regulations and the Virginia Erosion and Sediment Control Handbook, as amended from time to time.

Stormwater Utility – In 2014, the Stormwater Utility was created to provide an adequate, sustainable source of revenue for stormwater management activities that are necessary to protect the general health, safety, and welfare of the residents of the city. The Stormwater Utility fee is based on a parcel's impervious surface. These funds are used for projects that protect and restore the City's watersheds and improve water quality. Project examples include:

- Planning, design, engineering, construction, and debt retirement for new facilities and enlargement or improvement of existing facilities, including the enlargement or improvement of dams, levees, and floodwalls, whether publicly or privately owned, that serve to control stormwater;
- Water Quality Projects including stream restorations and other green infrastructure to reduce pollutants and erosion and to enhance runoff infiltration;
- Facility operation and maintenance, including the maintenance of dams, levees, floodwalls, whether publicly or privately owned, that serve to control stormwater;
- Monitoring of stormwater control devices and ambient water quality monitoring; and
- Other activities consistent with the state or federal regulations or permits governing stormwater management, including, but not limited to, public education, watershed planning, inspection and enforcement activities, and pollution prevention planning and implementation.
- Creation of a Stormwater Utility Flood Mitigation Program as a supplement to nationally competitive FEMA grants, especially for substantially damaged homes in the floodway.
- Outreach and Education on water quality, stream health, floodplain natural functions, flood insurance and substantial damage and substantial improvement requirements.

Storm Ready – The City of Roanoke was designated a Storm Ready community in February 2010 by the National Weather Service. The City was certified based on it level of emergency preparedness including: a 24-hour warning point and emergency operations center; development of at least four methods by which weather warnings can be received and disseminated; creation of a system to monitor local weather conditions; conducting community seminars to promote disaster readiness; and development of a formal hazardous weather plan,

including spotter training and emergency exercises. An additional benefit of the designation to the residents and business owners in the City is reduced rate for flood insurance.

Dam Safety – Spring Hollow Reservoir Dam, located on a tributary of the Roanoke River and owned by the Western Virginia Water Authority, could impact properties in the City of Roanoke if it failed. Carvins Cove Reservoir Dam, located on a tributary of the Carvin Creek and owned by the Western Virginia Water Authority, could impact properties in the City if it failed. Two other smaller private lakes in the City are designated high hazard by the DCR; Windsor Lake and Spring Lake, both in SW City.

IFLOWS – The City participates in a flood warning system developed by the National Weather Service called Integrated Flood Observing and Warning System (IFLOWS). Through the use of radio-transmitted information, this system provides advanced flood forecasting to the City Emergency Operation Center. There are five IFLOW stations located in the City.

USGS Stream Flow Monitoring – The City has partnered with the USGS to install a water quality monitoring station that is located in the Lick Run Watershed adjacent to the greenway. The goal of this monitoring program is to characterize streamflow and sediment transport in Lick Run prior to, during, and after BMPs are implemented throughout the watershed. The monitoring objectives include continual stream levels, water temperature, pH, conductivity, dissolved oxygen and turbidity. Data will also be used to determine annual loads of suspended sediment.

USGS Precipitation Gauges – The City has also partnered with the USGS to install 9 precipitation monitoring gauges in a selected spatial distribution pattern to optimize data capture. This robust precipitation monitoring network can provide many benefits to a variety of stakeholders within the city, including stormwater and other utilities, first responders, educational programs, and others. The monitoring network can provide critical data to aid the management and modeling of the stormwater infrastructure and first responders could utilize the real-time monitoring to better allocate resources during extreme precipitation events. The network could also be used as an outreach tool to educate residents and students about precipitation and potential risks of precipitation and flooding.

6.9.2 Past Mitigation Measures

Roanoke Valley Regional Stormwater Management Plan - All four Roanoke Valley jurisdictions participated in the development of the plan that was coordinated through the efforts of the Fifth Planning District Commission (Roanoke Valley-Alleghany Regional Commission). It offers alternative solutions for both flooding and flash flooding problems. These alternatives include clearing stream channels, enlarging drainage openings, constructing regional detention facilities, and flood proofing individual structures. The plan presents a total of 138 individual projects to address flooding in the 16 watersheds. These are ranked in order of priority within each watershed but no overall ranking within the valley is presented. Cost estimates are presented for each project, but neither individual project benefits, nor cumulative benefits are

discussed. It would be essential to analyze the benefits of these projects before the plan can be used as a guideline for specific activities. The identified projects would cost a total of $66 million in 2001 dollars, not including land acquisition or efforts to flood proof or move over 2,200 buildings. A formal quantification of the corresponding benefits would go a long way toward justifying this cost, which can initially seem overwhelming to both citizens and community officials. For example, the 1997 plan reports that between 1972 and 1992, floods caused over $200 million in damages in the valley, and resulted in 10 deaths. The plan's Financing Options Report recommends creation of a regional stormwater utility as a means of funding the identified work.

Project Impact Roanoke Valley – Project Impact Roanoke Valley was a partnership of FEMA, Roanoke County, the cities of Roanoke and Salem and the Town of Vinton to reduce destruction to life and property during disasters through planning and mitigation. The Project Impact Roanoke Valley Steering Committee and its work groups evaluated hazard mitigation needs from 1998 to 2001. The four work groups were: Hazard Mitigation, Public Information and Community Education, Stormwater Management and Partnership and Resource group.

Stormwater Management group – This group that originated with the Project Impact Roanoke Valley initiative was responsible for the preparation of over 1,500 floodplain elevation certificates. The Public Information and Community Education and Partnership and Resource groups met with community organization, civic groups, businesses and the general public to promote hazard mitigation activities. The Land Use group focused on the how local plans and ordinances relate to hazard mitigation and published Hazard Mitigation through Land.

6.9.3 City of Roanoke Mitigation Goals and Strategies

In developing mitigation strategies for the region and each locality, a wide range of activities were considered in order to achieve the goals and to lessen the vulnerability of the area to the impact of natural hazards. All goals, strategies and projects are dependent on the availability and timeliness of non-local funding.

Goals and Strategies were prioritized by each locality. Prioritization was completed in order of relative priority – high, medium or low – based on the benefit to cost criteria and the strategy's potential to mitigate the impact from natural hazards. Consideration was also given to availability of funding, the department/agency responsible for implementation, and the ability of the locality to implement the project. Under each identified pre-disaster, applicable local government departments will be the lead in making sure that each project or action will be implemented in a timely manner with other departments, other local government representatives and/or other regional agencies.

The anticipated level of cost effectiveness of each measure was a primary consideration when developing the list of proposed projects. Since the mitigation projects are an investment of public funds to reduce damages, localities have selected, and prioritized projects based on the

benefit to cost of each project in hopes of obtaining the maximum benefit. Projects were categorized as high, medium or low benefit to cost based on the available information for each proposed project. Reduced damages over the lifespan of the projects, the benefits, are likely to be greater than the project cost in all cases. Although detailed cost and benefit analysis was not conducted during the mitigation action development process, these factors were of primary concern when prioritizing and selecting the proposed projects.

6.9.3.1 Flooding

Goal: Minimize Watershed Hazard to Public Health, Safety, and Property
Responsible Departments: Stormwater Utility, Emergency Management
Strategies:

1. Participate in, and remain in good standing with, the National Flood Insurance Program (NFIP) by enforcing floodplain management regulations that meet federal requirements.
2. Participate in The Community Rating System.
    a. Acquisition of flood prone properties followed by the appropriate mitigation action of demolition or relocation. Increased outreach, community involvement in events such as the Preparation, and stream channel maintenance will move the City towards its goal of a Class 6 designation. Additionally, the Class 6 designation would allow citizens a 20% discount of floodplain insurance.
3. Prioritize and construct capital improvement projects that both mitigate city-wide flood hazards and improve downstream water quality.
4. In collaboration with local governments, support a comprehensive public information and education program on flooding, living in the floodplain, flood risks, low cost simple flood mitigation measures, flood insurance, stream remediation, hydrology, floodplain ordinances, and NFIP. This can be accomplished through regional workshops, neighborhood meetings, events such as the Preparathon, educational materials, and social media for citizens, business, local staff, and elected officials.
5. Maintain an inventory and map of flood prone roadways.
6. Maintain an inventory and map of flood prone critical facilities such as hospitals, public utility sites, airports, etc.
7. Share information and collaborate with other City Departments and Municipalities prior to and during a natural disaster.

Goal: Update existing GIS data layers related to natural hazards.
Responsible Department: Stormwater Utility
Strategies:

1. Consider seeking funding and support programs that update FEMA's Flood Insurance Rate Maps (FIRM). Consider participation in FEMA's Cooperating Technical Partners

(CTP) program that establishes partners with local jurisdictions to develop and maintain up-to-date flood maps.
2. Utilize GIS to inventory at risk infrastructure and public and private structures within flood prone areas.
3. Participate in FEMA's Digital Flood Insurance Rate Maps (DFIRM) program.
4. Support FIRM remapping projects that address areas in the region that have the most serious mapping problems and where flooding is a repetitive problem.

Goal: Maintain an accurate database and map of repetitive loss properties
Responsible Department: Stormwater Utility
Strategies:

1. Work with VDEM and FEMA to update list of repetitive loss properties annually.
2. Review property addresses for accuracy and make necessary corrections.
4. Determine if and by what means each property has been mitigated.
5. Map properties to show general site locations (not parcel specific in order to maintain anonymity of the property owners).
6. Determine if properties have been mitigated and inform FEMA/VDEM through submission of an updated list/database and mapping.

Goal: Reduce impervious surfaces to improve infiltration, to deter run-off and reduce flooding
Responsible Departments: Stormwater Utility, Transportation Division, Planning and Development
Strategies:

1. Consider using pervious surfaces whenever possible, including but not limited to, alleys, walkways and parking surfaces.
    a. Add Stormwater Utility Fee estimation to all proposed development plan sets to determine long-term costs of impervious areas vs. green infrastructure costs.
2. Promote the use of green roofs and rainwater harvesting systems.

Goal: Promote green infrastructure to prevent flooding, manage excess runoff, and increase infiltration
Responsible Departments: Stormwater Utility, Transportation Division, Planning and Development
Strategies:

1. Consider using strategies and best practices identified in programs such as the Envision Rating System to optimize decision making on and prioritization of Capital Improvement Projects.
    a. Consider adding the Envision Rating Certification as a contract requirement for consultant-designed projects.
2. Consider an increase of pipe conveyance standards to handle more intense precipitation (such as the 4% chance or 25-year event vs. current 10% chance or 10-

year event design standard) as long as this doesn't cause more streambank erosion in downstream channels.

3. Encourage and incentivize Green Infrastructure.

Goal: Utilize and protect wetlands and natural infrastructure to offset impervious surfaces
Responsible Department: Stormwater Utility, Transportation Division, Planning and Development
Strategies:

1. Restore and protect riparian areas.
    a. Add River and Creek Corridor Overlay boundaries to all development plan sets. Enforce riparian buffer re-establishment as per City Code.
2. Restore waterways that have been covered or buried to natural conditions.

Goal: Consider Benefit Cost and Life Cycle Cost Analysis when designing and planning stormwater mitigation and adaptation strategies
Responsible Department: Stormwater Utility
Strategies:

1. Rate Green Infrastructure and Capital Improvement Projects via the ISI Envision Rating System to ensure the right project is being prioritized and implemented.

Goal: Conduct a community Climate Vulnerability & Risk Assessment to identify, and prepare for, potential threats, health hazards and high-risk impacts and establish resilience guidelines.
Responsible Department: Stormwater Utility
Strategies:

1. Consider securing grant funding to evaluate the City's Vulnerability to Hazards and Climate Change through the Resiliency Scorecard methodology.

Goal: Acknowledge value of Natural Floodplain Function when planning for future development and in Neighborhood Plans.
Responsible Department: Stormwater Utility
Strategies:

1. Consider securing grant funding to study economic valuation of the Roanoke River and priority tributaries that are more prone to flooding.

Goal: Identification of structural projects that could mitigate the impact of flooding.
Responsible Department: Stormwater Utility
Strategies:

1. Consider seeking funding to prepare site-specific hydrologic and hydraulic studies that look at areas that have chronic and repetitive flooding problems.

6.9.3.2 All Hazards

Goal: Provide early warning for terrorism events and natural disasters and emergencies.
Responsible Department: Emergency Management
Strategies:

1. Maintain the Reverse 911 system. Fund annual maintenance and upgrade costs. Identify likely targets and develop call out list for quick activation. Identify flood prone areas and incorporate those numbers in a flood notification database.
2. In cooperation with VDEM, FEMA, the Red Cross and other localities support comprehensive public information and education program dealing with citizen preparedness for acts of terrorism as well as manmade disasters.

Goal: Develop Disaster Pet Sheltering capabilities through equipment procurement, plans, and Community Animal Response Team (CART) development.
Responsible Department: Emergency Management, Animal Control
Strategies:

1. Re-engage Roanoke Community Animal Response Team to support outreach, staffing, registration, and care of animals during pet shelter activation.

Goal: Develop Disaster Family Assistance Center capabilities through planning, and volunteer outreach and development, and exercise.
Responsible Departments: Emergency Management, Health Department
Strategies:

1. Develop Family Assistance Center Plan, Standard Operating Guidelines for Family Assistance Center deployment, and identify staffing needs.
2. Identify personnel for staffing and develop guidelines that identify skill set, training, and requirements.

Table 94: City of Roanoke Hazard Mitigation Projects

Project	Hazard Mitigated	Benefit	Cost Estimate	Benefit-to-Cost	Priority	Funding Partners	Implementation/ Lead Agency	Status	Proposed Schedule	
Reverse 911	All Hazards	Reduced loss of life and property through improved warning system.	$50,000	High	High	FEMA, VDEM, Local Government	Local Government, Emergency Management	Online registration portal available.	Ongoing	Continuing to utilize hazard response operations
Structure acquisition	Flooding	Removal of structures from flood hazard areas; reduce repetitive loss; reduce loss of life and property.	$50,000 per year	High	High	FEMA, VDEM, Local Government	Local government, Stormwater Utility	Ongoing; To date $6.3M has been spent to mitigate 118 homes/structures thereby returning 41 acres to natural floodplain open space.	Ongoing	Continuing to achieve property protection measures. Created City of Roanoke Flooding Mitigation Program in 2019.
Acquisition of flood prone properties	Flooding	Removal of households from flood hazard areas; reduce repetitive loss; reduce loss of life and property	Unknown	High	High	FEMA, VDEM, Local government	Local government, Stormwater Utility	Ongoing; To date $6.3M has been spent to mitigate 118 homes/structures thereby returning 41 Acres to natural floodplain open space	Ongoing	Continuing to achieve property protection measures. Created City of Roanoke Flooding Mitigation Program in 2019.
Public Education	All Hazards	Inform public about hazards and mitigation options and NFIP	$50,000	Medium	Medium	FEMA, VDEM, Local Government	Local government, Stormwater Utility, Emergency Management	Ongoing – Direct mailer sent each year and Flooding Brochure inserted in Roanoke Times each year.	Ongoing; The first Preparathon will be held in August 2019.	Advise property owners, potential property owners, and visitors about hazards.
Flood Hazard mapping update / modernization	Flooding	Increased accuracy of flood maps and more effective regulation and enforcement of regulations	$100,000	High	High	FEMA, VDEM	Local government, Stormwater Utility, Planning Division	Ongoing; Flood prone roads and critical facilities have been mapped. Roanoke River Flood Reduction LOMR in progress.	Ongoing, Roanoke River Flood Reduction LOMR in progress.	Work with organizations to improve flood hazard mapping. Look to develop flood models.

Additional Hazard related GIS layers / data	All hazards	Increased accuracy of hazard mitigation planning.	$100,000	High	Medium	USGS, NOAA, FEMA, VDEM, VDOT	Local government, Stormwater Utility, Department of Technology	Ongoing	Ongoing	Update City of Roanoke Real Estate GIS to reflect flood zones on FEMA Map Center.
Participate in, and remain in good standing with, the National Flood Insurance Program (NFIP)	Flooding	Reduction of future flood damage through enforcement of floodplain ordinances and availability of discounted flood insurance for property owners.	$0	High	High	FEMA	Local government, Stormwater Utility	Ongoing	Ongoing	Reflect City Codes to match NFIP Standards.
Elevation Certificate Updates	Flooding	Once the LOMR is updated as a result of the Roanoke River Flood Reduction Project, new elevation certificates along the river corridor may be needed.	Unknown	Med	Med	Silver Jackets, VDEM, FEMA	Local government, Stormwater Utility	Pending LOMR and FIRM updates	Pending LOMR, FIRM, and grant funding availability	Revised Elevation Certificates with updated Base Flood Elevations
Inundation Mapping	Flooding	City will be able to understand what flooding depths will be based on RR stream gauge heights.	Unknown	High	High	Silver Jackets, local governments	Stormwater Utility	Pending LOMR updates and Silver Jacket proposal approval and funding.	Pending LOMR updates and Silver Jacket proposal approval and funding.	Ability to provide road closures and needed evacuation zones at certain gauges levels of the Roanoke River.
Economic Valuation of Floodplain	Flooding	Strategic development decision making will be improved.	$60,000	High	High	DCR, VDEM, FEMA	Stormwater Utility	Pending funding.	Project may be broken into smaller components over several years.	Can inform mitigation strategies and policy.

Resiliency Scorecard	All Hazards	Assessment of readiness and specific areas of vulnerability to hazards and climate change.	unknown	High	High	DCR, VDEM, FEMA	Stormwater Utility	Pending funding.	Pending funding.	Can inform mitigation strategies and policy.
Urban GI Lab	Flooding	Bringing together local partners to increase capacity of local green infrastructure projects to bring long-term water quality and flood reduction benefits.	No Cost	High	High	Earth Economics	Stormwater Utility	Pending Application Approval	May be incorporated into or combined with Economic Valuation Study of the floodplain.	Increased knowledge and stakeholder engagement.
Maintain an accurate database and map of repetitive loss properties	Flooding	Identification of repetitive loss properties that should be mitigated	Unknown	High	High	FEMA, VDEM	Stormwater Utility, VDEM	Ongoing;	Ongoing; annual updates	Continue to update Repetitive Loss list.
Participate in CRS	Flooding	Reduction in flood insurance rates; reduction in flood loss	$10,000	High	High	VDEM	Local government; Stormwater Utility	Participating Community – Currently Class 7	Ongoing; Class 6 projected by 2021.	Continue to work with departments in the City of Roanoke to achieve CRS credit.
Develop and maintain an inventory of flood prone critical facilities	Flooding	Available inventory of critical structures that need additional or unique protection from flooding.	$10,000	Medium	Medium	FEMA, VDEM	Local government, Stormwater Utility, Emergency Management	Completed	Ongoing; updates as needed	Plan for emergency services. Advise emergency response, citizens, and visitors.
Continue participation in FEMA's DFIRM program	Flooding	Updated flood hazard mapping	$15,000	High	High	FEMA, local government	Local government	In progress	Ongoing	Property protection.
Develop Family Assistance Center Plan, Standard Operating Guidelines for Family Assistance Center deployment, and identify staffing needs	All Hazards	Supporting government and private employers in Roanoke by developing SOGs to implement Family Assistance Center	$0	High	Medium	City & private partner agencies	City of Roanoke Emergency Management	Developed	Ongoing	Plan for emergency response and protection to public safety.

Secure grants to purchase and maintain Volunteer Management and Reception capabilities	All Hazards	Supporting spontaneous volunteers in a disaster	$25,000 (100% grant funded)	High	Medium	City/FEMA	Roanoke Valley governments	Implemented	Ongoing	Plan for emergency response and protection to public safety.
Standard Operating Guidelines for pet Volunteer Reception deployment	All Hazards	Supporting spontaneous volunteers in a disaster	$0	High	Medium	City Emergency Management	City EM & Police Department	Developed	Ongoing	Plan for emergency response and protection to public safety.
Develop Disaster Pet Sheltering capabilities	All Hazards	Supporting Pets in Disaster by developing Community Animal Response Team	$25,000 (100% grant funded)	High	Medium	City Emergency Management	City EM & Police Department	Developed	Ongoing	Plan for emergency response and protection to public safety.
Upgrade / repairs to storm water system	Flooding	Reduce frequency and impact of flooding	$140,000,000	High	High	FEMA, VDEM, Local government	Local government	Ongoing	Ongoing	Preventative maintenance.
Drainage System Maintenance	Flooding	Clear debris and repair banks to prevent backup, erosion and flooding of existing drainage systems.	$500,000	High	High	FEMA, VDEM, Local government	Local government	Ongoing	Annually	Preventative maintenance.
Stream Restorations	Flooding	Improved stream flow and sediment transport, reduction of stream bank erosion, increase in water quality benefits	Variable $300,000 to $2 million	High	High	VADEQ, potentially FEMA	Local government	Ongoing	Ongoing based on Watershed Master Plans	Natural Resource Protection
Update Regional Storm Water Management Master Plan	Flooding	Watershed / mitigation planning and project identification	$750,000	High	High	FEMA, Local government, PDC	Local government	Not started, lack of funding	Unknown	Actively keeping flood problems from getting worse.

6.10 City of Salem

6.10.1 Current and Past Mitigation Measures

Floodplain Management – The City of Salem adopted a Floodplain Management Ordinance in 1993 (revised in 2007) that requires new residential buildings to be elevated to a minimum of one foot (1') above the base flood elevation. The City has a floodplain overlay district corresponding to areas identified on Flood Insurance Rate Maps prepared by FEMA.

Roanoke Valley Regional Stormwater Management Plan – All four Roanoke Valley jurisdictions participated in the development of the plan that was coordinated through the efforts of the Fifth Planning District Commission (Roanoke Valley-Alleghany Regional Commission). It offers alternative solutions for both flooding and flash flooding problems. These alternatives include clearing stream channels, enlarging drainage openings, constructing regional detention facilities, and flood proofing individual structures. The plan presents a total of 138 individual projects to address flooding in the 16 watersheds. These are ranked in order of priority within each watershed but no overall ranking within the valley is presented. Cost estimates are presented for each project, but neither individual project benefits, nor cumulative benefits are discussed. It would be essential to analyze the benefits of these projects before the plan can be used as a guideline for specific activities. The identified projects would cost a total of $66 million in 2001 dollars, not including land acquisition or efforts to flood proof or move over 2,200 buildings. A formal quantification of the corresponding benefits would go a long way toward justifying this cost, which can initially seem overwhelming to both citizens and community officials. For example, the 1997 plan reports that between 1972 and 1992, floods caused over $200 million in damages in the valley, and resulted in 10 deaths. The plan's Financing Options Report recommends creation of a regional stormwater utility as a means of funding the identified work.

Stormwater Management – The City has a Stormwater Management Ordinance that is part of the City Code. It was developed to bring the City into compliance with state laws on stormwater management and is consistent with the statewide Stormwater Management Model Ordinance.

National Flood Insurance Program – The City participates in, and is in good standing with, the National Flood Insurance Program (NFIP) by enforcing floodplain management regulations that meet federal requirements. This program allows property owners to purchase flood insurance from NFIP. There are currently 523 NFIP policies in force in the City.

Dam Safety – Spring Hollow Reservoir Dam, located on a tributary of the Roanoke River and owned by the Western Virginia Water Authority, could impact properties in the City of Salem if it failed.

Erosion and Sediment Control – The City of Salem has adopted the regulations, references, guidelines, standards and specifications promulgated by the Virginia Soil and Water Conservation Board (and any local handbook or publication of the board) for the effective

control of soil erosion and sediment deposition to prevent the unreasonable degradation of properties, stream channels, waters and other natural resources. Such regulations, references, guidelines, standards and specifications for erosion and sediment control are included in, but not limited to, the Virginia Erosion and Sediment Control Regulations and the Virginia Erosion and Sediment Control Handbook, as amended from time to time. Salem's ordinance, in addition to referencing the handbook, states in Section 30-117 that the erosion and sediment control plan must consider "Peak runoff from a ten year or 100-year frequency storm, based on present and future developed conditions …" and "If the watershed is greater than one square mile in area, a peak runoff study of the 100-year frequency storm shall be prepared."

IFLOWS – The City participates in a flood warning system developed by the National Weather Service called Integrated Flood Observing and Warning System (IFLOWS). Through the use of radio-transmitted information, this system provides advanced flood forecasting to the City Emergency Operation Center. There is one IFLOW station located in the City.

Project Impact Roanoke Valley – Project Impact Roanoke Valley was a partnership of FEMA, Roanoke County, the cities of Roanoke and Salem and the Town of Vinton to reduce destruction to life and property during disasters through planning and mitigation. The Project Impact Roanoke Valley Steering Committee and its work groups evaluated hazard mitigation needs from 1998 to 2001. The four work groups were: Hazard Mitigation, Public Information and Community Education, Stormwater Management and Partnership and Resource group. The Stormwater Management group was responsible for the preparation of over 1,500 floodplain elevation certificates. The Public Information and Community Education and Partnership and Resource groups met with community organization, civic groups, businesses and the general public to promote hazard mitigation activities. The Land Use group focused on the how local plans and ordinances relate to hazard mitigation and published Hazard Mitigation through Land Use Planning in 2001. The Hazard Mitigation group addressed flooding, wildfire, meteorological events, and hazardous materials incidents in its report Hazard Analysis.

6.10.2 City of Salem Mitigation Goals and Strategies

In developing mitigation strategies for the region and each locality, a wide range of activities were considered in order to achieve the goals and to lessen the vulnerability of the area to the impact of natural hazards. **All goals, strategies and projects are dependent on the availability and timeliness of non-local funding**.

Goals and Strategies were prioritized by each locality. Prioritization was completed in order of relative priority – high, medium or low – based on the benefit to cost criteria and the strategy's potential to mitigate the impact from natural hazards. Consideration was also given to availability of funding, the department/agency responsible for implementation, and the ability of the locality to implement the project. Under each identified pre-disaster, applicable local government departments will be the lead in making sure that each project or action will be implemented in a timely manner with other departments, other local governments' representatives and/or other regional agencies.

The anticipated level of cost effectiveness of each measure was a primary consideration when developing the list of proposed projects. Since the mitigation projects are an investment of public funds to reduce damages, localities have selected and prioritized projects based on the benefit to cost of each project in hopes of obtaining the maximum benefit. Projects were categorized as high, medium or low benefit to cost based on the available information for each proposed project. Reduced damages over the lifespan of the projects, the benefits, are likely to be greater than the project cost in all cases. Although detailed cost and benefit analysis was not conducted during the mitigation action development process, these factors were of primary concern when prioritizing and selecting the proposed projects.

6.10.2.1 Flooding

Goal: Mitigation of loss of life and property from flooding and flood related disasters.
Responsible Departments: Community Development, Emergency Services
Strategies:

1. In cooperation with local governments, support a comprehensive public information and education program on flooding, living in the floodplain, flood risks, low cost simple flood mitigation measures, flood insurance, stream remediation, hydrology, floodplain ordinances, and NFIP. This can be accomplished through regional workshops and educational materials for citizens, businesses, local staff, and elected officials.
2. Develop and maintain an inventory of flood prone roadways in cooperation with the Virginia Department of Transportation.
3. Develop and maintain an inventory of flood prone critical facilities such as hospitals, public utility sites, airports, etc.
4. Participate in FEMA Hazard Mitigation Programs such as SRL, FMA, PDM, RCL, and HMGP for acquisition/demolition projects, structure elevation, relocation, mitigation reconstruction, flood-proofing critical facilities, flood-proofing commercial facilities, infrastructure upgrades, and technology upgrades.
5. Participate in, and remain in good standing with, the National Flood Insurance Program (NFIP) by enforcing floodplain management regulations that meet federal requirements.
6. Acquisition of flood prone properties followed by the appropriate mitigation action of flood-proofing, demolition or relocation.
7. Soil stabilization along rivers, creeks, and streams to prevent undercutting of roads from erosion due to flooding.

Goal: Update existing GIS data layers related to natural hazards.
Responsible Department: Community Development
Strategies:

1. Consider seeking funding and support programs that update FEMA's Flood Insurance Rate Maps (FIRM). Consider participation in FEMA's Cooperating Technical Partners (CTP) program that establishes partners with local jurisdictions to develop and maintain up-to-date flood maps.

2. Utilize GIS to inventory at risk infrastructure and public and private structures within flood prone areas.
3. Participate in FEMA's Digital Flood Insurance Rate Maps (DFIRM) program.
4. Support FIRM remapping projects that address areas in the region that have the most serious mapping problems and where flooding is a repetitive problem.
5. Use HEC-GeoRAS, HEC-GeoHMS, and HAZUS software to model potential flood scenarios and identify high-hazard areas.
6. Annual review of floodplain ordinances and make any necessary changes to remain in compliance with NFIP regulations.

Goal: Provide early warning of flooding.
Responsible Departments: Emergency Services, Department of Technology
Strategies:

1. Identify areas with recurring flood problems and request additional IFLOW stream/rain gauges as appropriate to ensure that these areas are adequately covered and monitored.
2. Identify areas with recurring flood problems and incorporate the addresses and phone numbers into an early warning database, specifically the Reverse 911 system.

Goal: Identification of structural projects that could mitigate the impact of flooding.
Responsible Departments: Community Development
Strategies:

1. Consider seeking funding to prepare site-specific hydrologic and hydraulic studies that look at areas that have chronic and repetitive flooding problems.
2. Support Virginia Department of Transportation projects that call for improved ditching, replacement of inadequate and undersized culverts, enlargements of bridge openings and drainage piping needed to minimize flooding.
3. Identify congested streams and remove debris to enhance flow and mitigate flooding.

Goal: Maintain an accurate database and map of repetitive loss properties
Responsible Departments: Community Development
Strategies:

1. Work with VDEM and FEMA to update list of repetitive loss properties annually.
2. Obtain updated list of repetitive loss properties annually from VDEM/FEMA.
3. Review property addresses for accuracy and make necessary corrections.
4. Determine if and by what means each property has been mitigated.
5. Map properties to show general site locations (not parcel specific in order to maintain anonymity of the property owners).
6. Determine if properties have been mitigated and inform FEMA/VDEM through submission of an updated list/database and mapping.

6.10.2.2 All Hazards

Goal: Provide early warning for terrorism events and natural disasters and emergencies.
Responsible Department(s): Emergency Services, Department of Technology
Strategies:

1. In cooperation with VDEM, FEMA, the Red Cross and other localities support comprehensive public information and education programs dealing with citizen preparedness for acts of terrorism as well as manmade disasters.
2. Prepare for NextGen 911. Review, update, and correct data (i.e.,GIS data: road centerlines and address points) for NextGen 911 compliance

6.10.2.3 Wildfire

Goal: Mitigation of loss of life and property from wildfires.
Responsible Departments: Community Development, Emergency Services, Streets and General Maintenance
Strategies:

1. Defensible Space for Wildfire – Create perimeters around homes, structures, and critical facilities through the removal or reduction of flammable vegetation.
2. Application of Ignition-resistant Construction – Apply ignition-resistant techniques and/or non-combustible materials on new and existing homes, structures, and critical facilities.
3. Hazardous Fuels Reduction – Remove vegetative fuels proximate to the at-risk structures and critical facilities that pose a significant threat to human life and property.

Table 95: City of Salem Hazard Mitigation Projects in Need of State and Federal Assistance

Project	Hazard Mitigated	Benefit	Cost	Benefit-to-Cost	Priority	Funding Partners	Implementation/ Lead Agency	Status	Proposed Schedule
Communication equipment interoperability	All hazards	Improved coordination among jurisdictions; improved response times; citizen alerts	$1,000,000 to 3,000,000	N/A	High	FEMA, Local government	Local government, Fire & Emergency Services, Police, IT	In progress; to be completed by April 2019	2018-2019
Flood hazard mapping update/ modernization/ Additional hazard related GIS layers/data	All hazards/ flooding	Increased accuracy of flood maps and increased accuracy of hazard mitigation planning	N/A	High	Medium	FEMA, VDEM	Local government	Ongoing	Ongoing
Soil Stabilization	All hazards/ flooding	Repair headwall and riverbank stabilization to reduce road undercutting	$500,000	High	Medium	FEMA, VDEM, Local government	Local government	Potential project within next 5 years	2017-2022
Public education	All hazards	Develop web application(s) for informing public about hazards and mitigation options	N/A	High	Low	FEMA, VDEM, Local government	Local government	Ongoing	Ongoing
Reverse 911	All hazards	Reduced loss through improved warning system	N/A	N/A	N/A	FEMA, VDEM, Local Government	Local government, Fire & Emergency Services, Police, IT	N/A	N/A
Participate in FEMA Hazard Mitigation Programs such as FMA, PDM, and HMGP for acquisition of flood prone properties or flood-proofing projects	Flooding	Possible sources of funding for acquisition/demolition projects, structure elevation, mitigation reconstruction project, flood-proofing critical facilities, flood-proofing commercial structure, infrastructure upgrades, and technology upgrades	$500,000	High	High	FEMA, VDEM, Local government	Local government, Community Development	Determined when VDEM grants become available; Two potential projects 2019-2022	2017-2022

Project	Hazard Mitigated	Benefit	Cost	Benefit-to-Cost	Priority	Funding Partners	Implementation/ Lead Agency	Status	Proposed Schedule
Maintain an accurate database and map of repetitive loss properties	Flooding	Identification of repetitive loss properties that should be mitigated	N/A	High	High	FEMA, VDEM	Local government, Community Development	Ongoing	Ongoing
Seek funding to prepare site-specific hydrologic and hydraulic studies that look at areas that have chronic and repetitive flooding problems	Flooding	Possible determination of solutions to repetitive loss properties.	$15,000	Medium	Medium	FEMA, VDEM, Local government	Local government, Community Development	Not started; lack of funding	N/A
Open Drainage system maintenance;	Flooding	Improved stream flow and mitigation of flooding; Clear debris and repair banks to prevent backup, erosion and flooding of existing drainage systems	$100,000	Medium	Medium	FEMA, VDEM, Local government	Local government, Community Development, Street Department	Ongoing	Ongoing
Closed Stormwater system construction, upgrades or repairs	Flooding	Reduce frequency and impact of flooding	$1,000,000	Medium	Medium	FEMA, VDEM, local match	Local government, Community Development.	Not started; lack of funding	2017-2022
Additional hazard field data	Flooding	Elevation certificates for residential, business and critical facilities; increased accuracy of hazard mitigation planning	$25,000	Medium	Medium	FEMA, VDEM, Local government	Local government, Community Development.	As needed per project	Ongoing
Develop and maintain an inventory of flood prone critical facilities	Flooding	Available inventory of critical structures that need additional or unique protection from flooding.	N/A	Medium	Medium	FEMA, VDEM	Local government, Community Development, Fire & Emergency Services	Completed	N/A

Project	Hazard Mitigated	Benefit	Cost	Benefit-to-Cost	Priority	Funding Partners	Implementation/ Lead Agency	Status	Proposed Schedule
Continue participation in FEMA's DFIRM program	Flooding	Updated flood hazard mapping	N/A	Medium	Low	FEMA, local government	Local government, Community Development	Ongoing	Ongoing
Use HEC-GeoRAS, HEC-GeoHMS, or HAZUS software to model potential flood scenarios and identify high-hazard areas	Flooding	Use software to model potential flood areas and identify high risk areas to help mitigate flooding	$10,000	Medium	Low	FEMA, VDEM, Local government	Local government, Community Development	Not started; lack of funding	N/A
Participate in CRS	Flooding	Reduction in flood insurance rates; reduction in flood loss	$20,000	Medium	Low	VDEM	Local government, Community Development	Not started; lack of funding	N/A
Annual review of floodplain ordinance	Flooding	Up to date floodplain ordinance to provide guidance for development	N/A	N/A	Low	Local government	Local government, Community Development	In progress	Yearly Review
Defensible Space	Wildfire	Project to remove combustible material near structures	N/A	High	Low	FEMA, VDEM, Local government	Local government, Community Development, Fire & Emergency Services, Streets and General Maintenance	Not started; lack of funding	2017-2022
Application of Ignition-resistant Construction	Wildfire	Apply ignition resistant techniques to new or existing structures and critical facilities	N/A	High	Low	FEMA, VDEM, Local government	Local government, Community Development, Fire & Emergency Services, Streets and General Maintenance	Not started; lack of funding	2017-2022

Project	Hazard Mitigated	Benefit	Cost	Benefit-to-Cost	Priority	Funding Partners	Implementation/ Lead Agency	Status	Proposed Schedule
Hazardous Fuels Reduction	Wildfire	Removal of vegetative fuels in proximity to at-risk structures and critical facilities	N/A	High	Low	FEMA, VDEM, Local government	Local government, Community Development, Fire & Emergency Services, Streets and General Maintenance	Not started; lack of funding	2017-2022

Chapter 7 Plan Maintenance

The Plan Maintenance section of this document details the process that will ensure that the Mitigation Plan remains an active and relevant document. The process includes a schedule for monitoring the Plan on an annual basis and producing the required plan revision every five years. This section describes how the localities will integrate the plan into their overall planning efforts.

7.1 Evaluating and Updating the Plan

The Mitigation Plan will be evaluated on an annual basis to review progress that has been made on implementing the projects and to identify changes that could affect mitigation priorities. The convener, Roanoke Valley-Alleghany Regional Commission, will be responsible for contacting the Mitigation Advisory Committee members and organizing the annual meeting. Committee members will be responsible for monitoring and evaluating the progress of the mitigation strategies in the Plan. The Committee will determine at the annual meeting if an update of the plan is needed. At a minimum, the plan will be updated every five years.

The committee will review the projects to determine if they are addressing current and expected conditions. The review will also consider state and Federal legislation that could affect the implementation of the plan. The committee will also review the risk assessment portion of the Plan to determine if this information should be updated or modified, given any new available data. The coordinating organizations responsible for the various action items will report on the status of their projects, the success of various implementation processes, difficulties encountered, success of coordination efforts, and which strategies should be revised.

Monitoring activities will include periodic reports by agencies involved in implementing projects or activities; site visits, phone calls, and meetings conducted by the Roanoke Valley-Alleghany Regional Commission; and the preparation of an annual report that captures the highlights of the previously mentioned activities.

The evaluation will utilize the following criteria:

1. That goals and objectives address current and expected conditions.
2. Changes in the nature, magnitude, and/or type of risks.
3. That resources were appropriate for implementing the plan.
4. Existence of implementation problems, such as technical, political, legal, or coordination issues with other agencies.
5. That outcomes have occurred as expected.
6. That agencies and other partners have participated as originally proposed.

The Hazard Mitigation Advisory Committee will also notify all holders of the regional plan when changes have been made. Every five years the updated plan will be submitted to the Virginia Department of Emergency Management and the Federal Emergency Management Agency for review.

As part of the HMP Committee's desire to be proactive in addressing mitigation activities, future plan updates will be initiated on the three-year anniversary of the plan's adoption. Due to the complicated nature of applying for HMGP funding – including the release of available funds and getting under contract – it is imperative that the participating localities and the Regional Commission get an early start on the plan update process.

Beginning with this 2019, VDEM will require completion of a Virginia Hazard Mitigation Plan Annual Report Form that will be completed by the Roanoke Valley-Alleghany Regional Commission. The report form covers items such as how many projects have been completed, how were the projects funded, number of people and properties protected, success stories and challenges to implementation.

7.2 Public Involvement

Roanoke Valley-Alleghany Regional Commission and the local governments of the region are dedicated to involving the public directly in the review and updates of the Hazard Mitigation Plan. The public will also have the opportunity to provide feedback about the Plan. Copies of the Plan will be catalogued and kept at all of the appropriate agencies.

In addition, copies of the plan and any proposed changes will be posted on the Roanoke Valley-Alleghany Regional Commission website. This site will also contain an email address and phone number to which people can direct their comments and concerns. Public meetings will also be held in conjunction with each annual evaluation or when deemed necessary by the Hazard Mitigation Advisory Committee. The meetings will provide the public a forum for which they can express its concerns, opinions, or ideas about the Plan. Local Public Information Officers will be responsible for publicizing the annual public meetings and maintaining public involvement through the public access channel, web page, and newspapers.

7.3 Coordinating Body

The Regional Hazard Mitigation Committee will be responsible for coordinating the undertaking of the formal annual and five-year review and update process. Each locality will designate the appropriate representatives to the committee.

In order to make this committee as broad and useful as possible, the Roanoke Valley-Alleghany Regional Commission will encourage other organizations and agencies to become involved in hazard mitigation. Possible additional representatives include: elected officials, insurance representative, Home Builders Association, Virginia Department of Transportation, railroad industry, gas and electrical utilities, and a local Red Cross representative.

The Hazard Mitigation Advisory Committee will meet on an annual basis. These meetings will provide an opportunity to discuss the progress of projects and identify updates that may need to be made. The Roanoke Valley-Alleghany Regional Commission will serve as coordinator for the Committee.

7.4 Plan Adoption

The governing body of each locality will be responsible for adopting the Mitigation Plan. Each governing body has the statutory authority to promote actions to prevent the loss of life and property from natural hazards. The Roanoke Valley-Alleghany Regional Commission will be responsible for submitting the document to the VDEM. The VDEM will then submit the plan to the FEMA for review and approval. The review will be based on the federal criteria outlined in FEMA Interim Final Rule 44 CFR Part 201. Following FEMA review and approval, each participating jurisdiction will be required by FEMA and VDEM to formally adopt the plan.

7.5 Implementation through Existing Programs

Local governments have the statutory authority to implement many planning and mitigation goals through the comprehensive plan, capital improvement plan, and building and zoning codes. The Hazard Mitigation Plan provides a series of recommendations, which could be incorporated into the goals, and objectives of existing planning programs.

Upon adoption of the mitigation plan, localities will be able to utilize the Hazard Mitigation Plan as a baseline of information on the natural hazards that impact the region. These projects and action items identified in the Plan will help local governments develop planning documents that assist in protecting life and property from natural disasters. Local jurisdictions can use the annual Plan review as an avenue to update relevant sections of the capital improvements plan and incorporate mitigation activities.

The local building officials are responsible for administering the building codes. The Hazard Mitigation Plan Committee will work with other agencies at the state level to review, develop and ensure building codes that are adequate to mitigate or prevent damage by natural hazards.

Local governments should incorporate the relevant data, goals, actions and projects into their comprehensive plans. This can be accomplished through development of a hazard mitigation chapter for the plan or a series of sections in the plan that addresses specific hazards. A separate hazard mitigation chapter in the plan would provide a readily accessible source of hazard information for citizens and officials. Addressing hazards in each relevant section of the plan, such as flood prone roadways in the transportation chapter, would also be an effective method for documenting risk, potential loss and projects relating to hazard mitigation.

In the planning region, several localities have either utilized or discussed the information in the Regional Hazard Mitigation Plan as part of their local comprehensive plans. Alleghany County included loss estimates and mitigation project listings in their 2007 and 2013 Comprehensive Plan updates. The Town of Clifton Forge mentions its participation in the Regional Hazard Mitigation Plan efforts in its 2012 Comprehensive Plan. The City of Covington has included mitigation goals, projects and loss estimates in its 2013 Comprehensive Plan update. Other

localities in the region address flooding in various ways in their comprehensive plans and development ordinances but do not address every natural hazard.

Botetourt County
2010 Comprehensive Plan Update

Prepared By: RENAISSANCE PLANNING GROUP

Adopted: March 22, 2011

Acknowledgement

Botetourt County would like to thank the many people and residents who contributed to the preparation of the 2010 Comprehensive Plan Update. The Comprehensive Plan Steering Committee and county staff spent many hours attending meetings, reviewing materials, and providing recommendations for this plan. Their contributions significantly shaped the plan update and their participation helped assure that the broad views of the county residents were represented.

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Botetourt County would also like to thank those residents of Botetourt who participated in the community survey, public meetings, and hearings. The purpose of this plan is to serve the future needs of Botetourt County residents and input from Residents is important.

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1 POLICY PLAN

INTRODUCTION

A Vision for Botetourt County:
"Envision a community where County residents are attaining higher educational and economic goals; are enjoying a quality of life marked by safety and security, environmental protection, quality business and residential development, and a variety of recreational and cultural opportunities; and are pleased with the value and cost of government services."

Board of Supervisors

This document is the Comprehensive Plan for the County of Botetourt Virginia. It was prepared as an update to Botetourt County's current comprehensive plan adopted in 2004. The plan update was adopted on March 22, 2011.

A comprehensive plan is one of the most important long range-planning tools that Virginia communities use to guide development, manage change and implement a community vision. Communities naturally go through changes over time. A well thought out comprehensive plan which evaluates local trends and conditions and presents a shared vision for the future implemented through targeted goals, objectives and action strategies can help guide public and private decision making and investment to the benefit of the whole community. To be effective and useful, the plan must reflect the knowledge, values and aspirations of a community's citizens and be embraced and implemented by elected and appointed representatives.

Community involvement is one of the guiding principles that governed the preparation of this plan. Many citizens contributed to its development, as either participants in the community workshops, or as members of the Steering Committee. Stakeholder interviews, a citizen survey, community meetings, Planning Commission work sessions, and public hearings were just some of the techniques used to effectively engage Botetourt citizens in the development of this important document.

AUTHORITY TO PLAN

Authority for local government planning in Virginia is contained in Section 15.2-2223 through 15.2-2232 of the Code of Virginia. This plan was prepared in accordance with these provisions. By law, the Botetourt County Planning Commission is charged with the responsibility of preparing and recommending a comprehensive plan to the Botetourt County Board of Supervisors for adoption. This update was undertaken in part to fulfill code provisions that require local planning commissions to review the adopted comprehensive plan at least once every five years.

Comprehensive Plan Purpose: "It is the purpose of the Botetourt Comprehensive Plan to promote balanced growth and development while protecting the County's natural environment and cultural resources. This shall be accomplished through the application of sound planning principals and the implementation of complementary development controls"

Planning Commission,
August 2003

The Code of Virginia requires that the Commission base the preparation of a comprehensive plan on "careful and comprehensive surveys and studies of the existing conditions and trends of growth," and of the probable future requirements of Botetourt County's citizens. It also specifies that the plan should include all unincorporated areas of the County and that it shall be general in nature. The Code further requires that a comprehensive plan "shall designate the general or approximate location, character, and extent of each feature including any road improvement and any transportation improvement, shown on the plan and shall indicate where existing lands or facilities are proposed to be extended, widened, removed, relocated, vacated, narrowed, abandoned, or changed in use…."

The Comprehensive Plan, with accompanying maps, charts, and descriptive matter, may include, but need not be limited to:

- The designation of various types of public and private development and use, such as different kinds of residential, including age-restricted housing, business; industrial; agricultural; mineral resources; conservation; active and passive recreation; public service; floodplain and drainage; and other areas;
- The designation of a system of community service facilities such as parks, sports playing fields, forests, schools, playgrounds, public buildings and institutions, hospitals, nursing homes, assisted living facilities, community centers, waterworks, sewage disposal or waste disposal areas, and the like;
- The designation of historical areas and areas for urban renewal or other treatment;
- The designation of areas for the implementation of reasonable ground water protection measures;
- An official map, a capital improvement program, a subdivision ordinance, a zoning ordinance and zoning district maps, mineral resource district maps and agricultural and forestal district maps, where applicable;
- The location of existing or proposed recycling centers;
- The location of military bases, military installations, and military airports and their adjacent safety areas;
- The designation of corridors or routes for electric transmission lines of 138 kilovolts or higher.

The Comprehensive Plan shall include:

- The designation of areas for the implementation of measures to promote the construction and maintenance of affordable housing, sufficient to meet the current and future needs of residents of all levels of income in the locality while considering the current and future needs of the planning district within which the locality is situated.
- A map that shall show road improvements and transportation improvements, including the cost estimates of such road and transportation improvements as available from the Virginia Department of Transportation, taking into account the current and future needs of residents in the locality while considering the current and future needs of the planning district within which the locality is situated.

PURPOSE AND PLAN ELEMENTS

Botetourt County has a thirty-five year history of formal comprehensive planning initiatives. The County Board of Supervisors adopted its first Comprehensive Plan in February 1975. That plan, entitled the *Botetourt County Land Use Plan,* was intended to manage land development and population growth.

Five additional plans have been adopted since 1975, with updates occurring generally every five years. These planning efforts incorporated information from each decennial census and responded to land development trends and the need for improvements to County infrastructure. The plans developed from 1975 through 1998 were prepared with the assistance of the staff of the Roanoke Valley Alleghany Regional Commission (RVARC). Subsequent plans have been prepared by staff with the assistance of outside planning consultants through a process that included public involvement, followed by Planning Commission review and recommendation with ultimate review and adoption by the Board of Supervisors.

Relationship to the 2004 Comprehensive Plan

The 2004 Comprehensive Plan was prepared using a facilitated visioning process. The 2004 plan included discussion, analysis and recommendations that emerged from the community planning process. This Comprehensive Plan Update, which was also based on extensive community and stakeholder input, builds upon that information, further examining growth trends, planning initiatives, and affirming the county's goals and vision for Botetourt County's future growth. Some of the information included in the 2004 Comprehensive Plan has been incorporated into this plan update.

Vision for Botetourt County

This Comprehensive Plan sets out goals and policies that will be used by public officials to make decisions that will greatly influence the County's future. Most successful, thriving communities have a vision for the future that guides day-to-day decision-making. Stated or unstated, an ultimate vision sets a framework for incremental decisions that lead toward creating the future. The long term vision for Botetourt, adopted by the Board of Supervisors in 2002 and reviewed and affirmed as part of this update, is the foundation for more specific goals and policies that are included in later chapters of this plan. If the goals and policies of the plan are upheld and implemented, the following vision for Botetourt should be realized:

"Envision a community where County residents are attaining higher educational and economic goals; are enjoying a quality of life marked by safety and security, environmental protection, quality business and residential development, and a variety of recreational and cultural opportunities; and are pleased with the value and cost of government services."

Plan Elements

The 2010 Comprehensive Plan is organized into six elements, or major topics, of countywide significance. Immediately following this introductory chapter is a discussion about key countywide issues and influences driving the need to update the plan. This Trends chapter provides an overview of growth forecasts, defines the vision and themes that serve as the overarching goals for this Plan, and describes the role of the Future Land Use Map.

The subsequent chapters of the plan contain a summary overview providing the context and defining issues for each element, followed by policies and actions to address these issues. Tables, images, text boxes, and maps supplement the narrative content. One chapter of the plan is dedicated to each countywide element listed below:

Trends: The Trends Element provides base information for understanding the short and long-term growth trends related to people, jobs, race, income, housing, mobility, and agricultural activity.

Land Use: The Land Use Element provides a framework for all land use and development-related decisions. It is the critical foundation upon which all other elements are based, and includes the Future Land Use Map and related policies to guide growth in a more compact and efficient pattern over the next 20 years.

Transportation: The Transportation Element guides development of the County's transportation network. It includes highways, public transit systems, and bike and pedestrian networks to support the County's desired land uses and form. The proposed transportation system seeks to reduce the growth of vehicle miles traveled and provide transportation options that provide alternatives to single occupancy vehicles. The aim is to achieve a balanced and efficient transportation system for Botetourt County's expanding populations and their corresponding needs.

Cultural and Environmental: The Cultural and Environmental Element contains the policies and actions required for Botetourt County to preserve its natural resources and address the challenges inherent with retaining these resources as growth occurs. This element addresses park and recreation planning, greenway and trail planning and connectivity, open space conservation, and the preservation of special landscapes and historic resources, among other issues. The element also identifies all natural features of the County, including soils, topography, and floodplains.

Community Services and Facilities: The Community Services and Facilities Element provides direction for the location of government buildings, solid waste services, emergency services, schools, and libraries. This element also includes recommendations to ensure the adequacy and safety of the drinking water supply, distribution system, and the wastewater system.

Economic Development: The Economic Development Element provides recommendations to enhance Botetourt County's competitive advantages and economic viability. In May 2010, the Botetourt County Board of Supervisors adopted the Botetourt County Economic Development Study, which serves to update this section of the plan. That study addresses two main objectives; 1) Identify opportunities that can potentially expand quality jobs, build tax base, and enhance tourism activity within the County; and 2) define the strategy and plan for implementing those efforts required to achieve specific actions derived from the first objective.

This plan is intended to be accessible and easily understood by all users. Key issues are described with data to make the purpose of policies more apparent. Graphics, maps, photos, and charts have been used to illustrate major points and improve the legibility of the text. The Comprehensive Plan's Future Land Use Map is incorporated as part of the document and provides the foundation for future decisions regarding land use and zoning.

PLANNING HORIZON

Typical planning horizons for comprehensive plans range from approximately 20 - 50 years with 20 years being the most common. The year 2030 is the planning horizon for this comprehensive planning initiative. This comprehensive plan shall be reviewed by the Botetourt County Planning Commission at least once every five years, as required by State Code. Each review will serve as the basis to evaluate the continued appropriateness of the plans' goals, objectives and policies, and progress made toward achieving the Board's vision for the community.

RELATIONSHIP TO OTHER DOCUMENTS

There are several key documents that are available to Virginia localities to implement the goals, policies and vision of the comprehensive plan. These documents include the zoning ordinance, subdivision ordinance, and the capital improvements plan. County officials and staff use these tools on a day to day basis to guide development of individual properties and to plan for public improvements. Further, there are numerous other planning documents that guide the decision making processes. The County's recreation strategic plan provides information on the needs and future implementation of recreation services, the emergency service strategic plan provides direction of how to best provide safety and security, the economic development study report provides a new direction of how the County can best attract and promote economic growth, and the county-wide water and wastewater plan is critical to providing direction of where existing and planned infrastructure can accommodate new growth. All of these plans have been consulted and referenced in this plan. Consistency between all of these documents and the comprehensive plan ensures that the long term vision for the County is considered as part of the many incremental decisions that shape a community.

Zoning Ordinance

The Botetourt County Zoning Ordinance is perhaps the most significant of the three primary implementation tools that guide development and land use in the county. It includes regulations intended to protect and promote the health, safety and general welfare of current and future county residents by providing specific standards for uses, lots, building size, location and other related issues that encourage and ensure appropriate development in the County. The provisions for various zoning districts and zoning regulations included in the ordinance should be consistent with the goals, objectives and policies of the adopted comprehensive plan to ensure that the vision for Botetourt is fully realized.

Subdivision Ordinance

The second regulatory document that helps implement the comprehensive plan is the Botetourt County Subdivision Ordinance. It provides for the orderly, efficient division of land into parcels or lots for development and for the coordinated construction of streets, highways and public facilities within proposed subdivisions. Like the zoning ordinance, the subdivision ordinance directly influences development in the County and the character of the community. Subdivision regulations should be in sync with the goals, objectives and policies of the comprehensive plan if the County is to be developed consistently with the adopted vision. Botetourt County's subdivision Ordinance adheres to the Virginia State Code.

Capital Improvements Plan

The Comprehensive Plan provides direction for managing growth and development and guiding continued investment in the County's physical infrastructure and facilities. The plan can enhance the capital improvement planning and budgeting process by implementing more explicit ties between the Comprehensive Plan and the development of the Capital Improvement Program (CIP) and by helping establish priorities among competing potential capital investments. The Botetourt County Capital Improvement Plan (CIP) is reviewed and adopted annually by the Board of Supervisors to provide fiscal guidance for capital investments over a five year period. As the third primary implementation tool of the comprehensive plan, the CIP should reflect the recommendations and priorities of the plan to support the pattern of development envisioned for the future.

USE OF THE COMPREHENSIVE PLAN

This document is intended for use by elected and appointed officials, County government administration and staff, residents, businesses and developers, and others with an interest in the future of Botetourt. This Comprehensive Plan will:

- Establish the vision for what Botetourt County can achieve and aspires to be by 2030;
- Consolidate and coordinate policies that relate to the County's physical and economic growth and development into one document for use by all County departments;
- Guide decision-making and evaluation of zoning map and text amendments and discretionary development approvals;
- Guide public investment by coordinating the Capital Improvement Program with the policies of the Comprehensive Plan; and
- Identify short to long-term strategic actions for the County to undertake.

As the County's primary policy and planning document addressing the physical development of the County, the Comprehensive Plan will be used by elected and appointed officials who make land use and fiscal decisions related to the CIP. It will also be used by County staff that will be charged with implementing policies contained in the plan through departmental programs, strategic initiatives and by coordinating updates to related documents.

The Comprehensive Plan is also an important source of information and guidance for businesses, potential investors or employers, and members of the development community. The plan's Land Use Element and Future Land Use Map provides clear guidance on preferred land uses for each area of the County that will assist in guiding property owners in decisions about their property. Several policies describe the desired character of future development and will ideally be used as a factor in evaluating discretionary development applications, such as Special Exception Permits, rezoning applications and, to some extent, site plans and subdivisions.

The plan lays out a strategy for public improvements that reflect public investment priorities and that may promote concurrent and compatible private sector development. It also has the potential to improve the predictability of the development review and approval process for developers, property owners, and concerned citizens alike when the Future Land Use Map is used as a foundation for land use and zoning decisions. Finally, the Comprehensive Plan is also a resource for those who seek general information about how the County may evolve over the next 20 years, as well as those who seek to understand how the County will respond to key issues in the future.

Interpretation of Policies

Policies provide direction for decision-makers regarding particular courses of action to pursue. They are also intended to guide decisions regarding the review and approval of development proposals, and provide a consistent basis for decisions relating to land use, such as amendments to the County's official zoning map. Policy language may be written to apply exclusively to County actions, or it may set forth an expectation regarding private sector activities.

The policies are typically worded as an ongoing aspiration or intent, using active words such as "encourage", "promote", and "provide". The latter such policies are typically worded as a statement expressing a desired state or outcome, using the word "should" to distinguish the policy statements in the plan from the legal requirements found in the County's codes, where the word "shall" is the norm.

DEVELOPING THE PLAN

Public participation is possibly the most important part of any planning process and this may be especially true for a countywide comprehensive plan. Botetourt County undertook this plan update with a solid commitment to public participation. The public participation process began with the formation of a Steering Committee, comprised of a range of stakeholders in the county, to provide input throughout the planning process.

The public at large was also involved at critical points in the plan update process to ensure that the most accurate information was available, that goals and implementation steps were feasible, and most importantly, reflected the vision of the general public, Steering Committee members and municipal officials. Surveys, newsletters, a website and open house forums were used to involve the public in identifying and prioritizing key issues and initiatives deemed important by the community. These efforts are discussed in greater detail later in this plan. The information gathered through these efforts was a key component in developing goals and policies included in the plan.

Three-phase public input process was used to identify priorities, develop goals and objectives, and craft plan recommendations. The initial phase was aimed at identifying regional concerns and issues including potential areas for development, preservation and addressing specific issues such as infrastructure. The second phase of public involvement was designed to assist in identifying expectations and opinions about growth and development, and the overall future of the County. And the third phase served to present the final vision to the public. Community members were given an opportunity to review the plan's goals and objectives for a wide range of planning topics, including housing, transportation, community facilities, historic preservation, natural resources, agriculture, and land use. Final comments were received regarding the plan's recommendations and future land use plan. These comments were considered in the final revisions of the plan.

Role of Steering Committee

Botetourt County initiated the public input component of the Comprehensive Plan update process by appointing a Steering Committee. A list of Steering Committee Members can be found at the beginning of this document within the Acknowledgement page. The Steering Committee embodied a cross-section of citizens representing businesses and industry, civic and social organizations, human service agencies, governmental bodies, and residents. Their mission was to engage the residents of Botetourt County to identify and articulate a vision and set of goals for the County. Steering Committee members also served as a liaison to their respective organizations to share and receive information about the plan update process. Additionally, members provided valuable information in their particular fields of expertise when appropriate during development of the plan.

The work of the Steering Committee assisted in identifying both local and regional concerns to develop a consensus for plan recommendations. This group of over 25 individuals was surveyed early in the plan process to help identify issues of importance and values that shape community opinion and aspirations. In those areas where the questions related to development patterns, there was a clear consensus: plan growth and infrastructure to provide for jobs, but do it in such a way as to ensure the preservation of the rural character of the county.

Website Development

In October 2009, the County launched a project specific website to provide steering committee members, officials and the general public with easy access to the most current information related to the plan. Initially, the website provided an overview of the comprehensive planning process, the planning team, and Botetourt County data and resources. As the plan evolved, the website was used to conduct an electronic survey, provide press releases and news articles, post draft development objectives and goals, and summaries of public involvement meetings. Contact information was provided on the website so that any member of the public could address the planning team with questions related to the plan update.

Public Workshops

The Botetourt County Comprehensive Plan Update began with advertised public workshops designed to solicit community input on issues of concern to citizens and to get a sense of their visions for the future of the County. The first public meetings were held on October 24, 2009; one at Lord Botetourt High School, and the other at James River High School, to target different geographic areas of the County. Between twelve and forty participants attended each workshop. At each of these meetings, participants were asked to affirm the current vision as adopted in the 2004 Comprehensive Plan and to identify what residents valued the most in relation to the county's future growth. Participants provided feedback needed to develop recommendations for the 2010 Comprehensive Plan update.

These meetings were designed as open house forums and displayed information on growth trends for the public review and comment. Stations provided information about population and housing growth, transportation issues, employment and economics, agricultural and environmental features, land use, and public facilities. A questionnaire was provided to solicit responses from attendees about topics such as: What is best about the county? What are the top challenges? What are its opportunities? What is the vision for the next 20 years? Where should growth go, or not go? County and consultant team members were at the meetings to address questions and to listen to the public comments.

A second round of meetings was held on December 5, 2009 and on January 5, 2010. These meetings were held at Lord Botetourt High School and Central Academy Middle School, respectively. The purpose of these meetings was for participants to review and affirm the community values and priorities that evolved from the information and input gathered at the previous public forums. A total of 23 participants attended the second set of forums. Twelve people attend the December 5th meeting and 11 attended the January 5th meeting.

SUMMARY OF PUBLIC INPUT

Major Themes

Citizen Survey participants identified "managing growth and development," "economic development" and "protection of farm and rural land" as the top three issues that the County will face in the next 20 years. Strong concerns about these three issues also emerged from the community-input meetings, along with more specific concerns about the pace and pattern of development, community design, preservation of natural and cultural resources, retaining traditional industries such as agriculture as a cornerstone for economic development, in addition to controlling commercial development along U.S. Route 220 and around Exit 150.

Population Growth and Pace of Development

Botetourt County's population has grown substantially in the past decade, and surveyed residents perceive population growth as "somewhat too fast" or "much too fast." Growth management received the highest average score (8.35 out of 10) relative to areas of importance to residents.

At the public forums, participants expressed their perception that change is on its way and that the County's future is somewhat threatened by factors beyond the control of local residents and local government. The high quality of life in Botetourt County has attracted retirees and new families, stimulating recent growth.

Citizens expressed concern that the attractive character of Botetourt County creates growth pressures that will overwhelm it and compromise the rural quality of life for those who currently live here. Comments received at the public forums also emphasized preserving rural land and allocating growth to areas that are already designated to support future growth. Residents would like to see commercial growth occur where capacity exists and ensure future commercial growth is designed well to minimize the impact on the rural character. Overall, most comments focused on how to maintain the rural character and related land uses. Workshop participants felt that one of the best ways to address these issues in the future is to direct new development to appropriate locations and ensure that the County's Comprehensive Plan goals and policies are reflected and supported in its Zoning Ordinance.

Local Economy and Economic Development

Residents expressed concern that young people are leaving the area for jobs elsewhere, wages are too low, and local workforce skills are not adequate. Botetourt County's residents also voiced concerns about the future vitality of the County's traditional economic engines – agriculture and manufacturing.

The general sense among workshop participants was that Botetourt County is fortunate to have some of the most fertile and productive agricultural soils in Virginia. However, outside influences, such as nationwide changes in farming practices, loss of local farm laborers, increased agricultural regulations, and changes in food merchandising, have meant that family farming is gradually giving way to larger, corporate-owned farm entities, or have increased pressure to sell family farms for conversion to residential development.

In addition, citizens in the workshops commented on Botetourt County's strong tourism potential and highlighted assets that would be attractive to the tourism industry, including pristine natural areas, historic buildings and settlements, and recreational activities. Agriculture-based, nature-based, and cultural and heritage-based tourism were identified as key industries that the County should pursue and plan for in the coming years.

Citizens voiced a strong interest in finding ways to strengthen agriculture and tourism for economic development purposes, but also as a crucial part of maintaining the County's rural character and traditional development pattern of towns and villages.

Community Character and Development Pattern

Participants in the community meetings expressed fears that without appropriate land-use policies and regulations, regional growth pressures will lead to the conversion of farmland to residential and commercial use, loss of affordable housing and loss of rural character. There was also a concern that towns will lose their identities and significance or be indistinguishable from surrounding suburban development. Most community workshop participants favored directing new development to existing incorporated towns where public services are already available as a way of revitalizing existing incorporated towns and promoting compact development.

Workshop participants also suggested that historic districts, design guidelines and maintaining a clear separation between incorporated towns and encroaching development would reinforce the fabric and sense of community in the existing incorporated towns and improve the compatibility of new development.

Natural Resources

It was evident from comments made at the public-input meetings that Botetourt County residents take pride in the unique natural resources that make the County a desirable and beautiful place to live, including the ecologically and environmentally significant feature of the Blue Ridge Parkway. Citizens supported promoting Botetourt County's unique natural features as a means to attract tourists, encourage eco-tourism, market Blue Ridge products and goods, and to attract innovative and ecologically compatible business and industry.

Community Facilities and Infrastructure

While local residents expressed pride in local community facilities such as schools and libraries, the lack of water and waste water facilities needed to serve existing and future residents was a topic of concern during the public forums. The potential for development at higher densities and adjacent to the incorporated towns is limited due to a lack of utility capacity. Citizens also noted that new development brings demands for services that may stretch the County's financial capabilities. Citizens identified Town and County cooperation and coordination, improvements to existing systems, and development proffers garnered through conditional zoning as ways to address future infrastructure needs.

The U.S. Route 220 Corridor

U.S. Route 220 is not only the major local roadway connecting Botetourt County's incorporated towns to regional destinations; it is the only north-south connector road in the County. It is a vital transportation artery for both local residents and the many travelers who pass through the area each year. For this reason, residents expressed concerns about the level of commercial development occurring on U.S. Route 220 and at key intersections. U.S. Route 220 has been a typical location for commercial uses that serve through travelers. Residents are concerned that too much commercial development along U.S. Route 220 would create congestion, compete with commercial activities in the incorporated towns and fundamentally alter the character of the rural "view from the road" valued by residents and a factor in attracting potential tourists to the area. Stakeholders interviewed during the plan update process focused on the need to control commercial development along U.S. Route 220 and focus growth around existing incorporated towns to promote nodes of development.

SUMMARY OF 2008 CITIZEN SURVEY

Another source of input for the Comprehensive Plan Update was the third county-wide "Botetourt County Citizen Satisfaction Survey" conducted in 2008. The telephone survey was a comprehensive citizen survey conducted by *The Center for Community Research at Roanoke College*. A summary of the survey as it relates to the Comprehensive Plan is provided below.

Table 1 – Citizen Survey Summary

1. Top three areas of importance scored 1 to 10, with 10 being extremely important *(mean score of respondents)*	A. Ensure carefully managed growth – 8.35 B. Improve quality of schools – 8.07 C. Improve job creation and business investment – 7.90
2. What are the three things that have changed for the better in Botetourt County?	A. More shopping/restaurants B. More people/population growth C. Better schools
3. What are the three things that have changed for the worse in Botetourt County?	A. Too many people/population growth B. Traffic/roads C. Taxes too high
4. Top three aspects rated best of Botetourt County *(mean score provided)*	A. As a place to raise children – 8.77 B. Public safety – 7.79 C. Quality of housing – 7.49
5. Top three aspects rated worst of Botetourt County *(mean score provided)*	A. Cultural amenities – 5.53 B. Cost of housing – 5.88 C. Availability of recreational activities – 6.21

Source: Botetourt County Citizen Satisfaction Survey, May 2008.

Conflicts and Contradictions of the Public Input Process

It is an inherent part of any community planning process that conflicts and contradictions occur. When discussing with residents certain aspects of the community in isolation, they form opinions based on the context of the discussion. As a result, desires and needs will conflict, for a single individual as well as between residents of a diverse community like Botetourt County. For example, based on the input received during the public workshops and information from the 2008 Citizen Survey, there is consensus that more people moving to Botetourt County is a change for the better (Table 1, 2B). But, this directly conflicts with the consensus that the population growth is a change for the worse (Table 1, 3A). Further, residents have concerns that taxes are too high, but there is a desire for more recreation facilities and more commercial growth, both require expenditure of County funds.

There exists a fine balance of what resources and infrastructure are critically implemented, and what resources are critical for the sense of livability. Through the use of the comprehensive plan, and continued community input, the county can prioritize the investments of its resources to best meet the needs, and expectations of the residents. It is only through the use of this plan that the County can ensure appropriately planned growth while minimizing unnecessary investments in infrastructure.

INVENTORY, ANALYSIS AND PEER COUNTY COMPARISON

Research and Analysis

Based on the preliminary comments and opinions researched and received, an analysis of several topic areas have been conducted to provide a basis for understanding how Botetourt County has grown and how it is projected to grow. The following data and information has been reviewed and evaluated to provide a basis for informed decisions during the Comprehensive Plan Update process:

- *Demographics*: Provides information about local and regional growth, age groups, income, persons per dwelling units (measure of average household size), and population forecasts.

- *Employment:* Includes a trend analysis of the labor force, commuting patterns, types of jobs, types of businesses, and location/density of employment.

- *Land Use*: Includes information about current zoning and the use of land throughout the county; trends of building permitting, residential dwelling units; population distribution, and anticipates future land use demands based on population forecasts (these projections are based on current trends and not planned development or existing development approvals).

- *Public Facilities:* Includes an inventory of existing public facility capacity, projected capacity, future demands based on projected population growth, fire and rescue inventory, recreation plans, and water and sewer service.

- *Housing*: Includes an analysis of the current housing stock, the availability of housing, density of residential dwelling units, owner occupied versus rental units, home values, and the relation of home values to income levels.

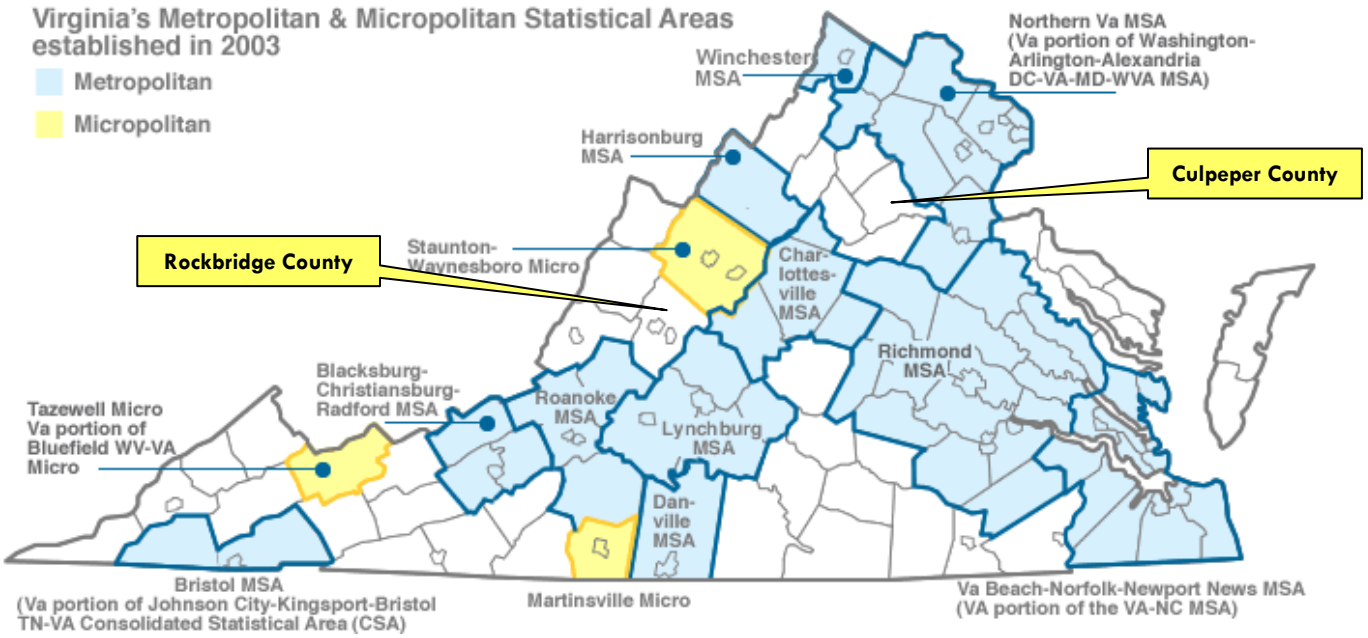
- *Environmental and Historic Resources:* Shows an inventory of environmental and historic resources.

- *Transportation:* Presents a summary of the existing travel demand analysis, an assessment of future transportation demands, and current studies related to I-81 interchanges 150 and 162.

Regional and Peer Comparison

Botetourt County is one of six localities in the Roanoke Metropolitan Statistical Area (MSA). To provide a sense of Botetourt County's role in the region, most of the analysis in this document is based on a comparison of Botetourt County relative to the other communities in the Roanoke MSA. Additionally, two counties were selected for peer evaluation since they share some characteristics with Botetourt County; Culpeper County and Rockbridge County. Comparisons to these counties provide a means of evaluating Botetourt County relative to other predominantly rural communities of different sizes in other regions of the State.

Figure 1 – Map identifying Roanoke MSA, Culpeper County, and Rockbridge County



2 TRENDS

INTRODUCTION

This chapter provides an overview and analysis of selected trends that may shape the future of the County. An analysis of demographic data is a helpful comprehensive planning tool. Evaluating changes in a community's population over time helps a locality better understand current needs and can help the community anticipate future needs that should be addressed in the plan's goals, objectives and policies.

An analysis of population, income, housing, and education data is presented below. This analysis also includes information comparing local and regional growth, age groups, persons per dwelling units (measure of average household size), and population forecasts. This data was presented to Botetourt County residents at a Public Workshop on October 24, 2009. Residents reviewed the data and analysis, and offered comments about the significance of this information for the future.

PEOPLE & JOBS

Population growth is an indicator of existing demand for services and can be used to predict future demand for public services such as education, recreation, and public safety. The 2008 American Community Survey estimates the population of Botetourt County to be 32,261. In contrast, the 2003 comprehensive plan estimated the County population to the reach 32,200 in 2005. This comparison represents a slower rate of growth than anticipated in the last Comprehensive Plan update process. The Virginia Employment Commission projects Botetourt County's population to be 38,437 in 2030. Table 2 – Population Estimates & Forecasts for Botetourt County and Figure 2 – Alternative Population Forecasts, show three population projections that were considered for use in development of Comprehensive Plan.

The population projections labeled as "long term growth trend" are based on the rate of growth experienced in the County from 1900 to 2008 and includes periods of rapid growth and long periods of relatively small change. Population projections labeled as "short term growth trends" are based on the County's rate of growth from 1990 to 2008, a period which includes rapid population growth, particularly between 1990 and 2000. Population projections based on the long term and short term growth trends present widely varying projections that reflect the difference between rates of growth that may not be typical in the future; one includes growth periods when the County grew very little and the other places too much emphasis on the County's most rapid period of growth.

The population projections deemed most appropriate for use in this plan update were prepared by the Virginia Employment Commission (VEC) (Table 3– Virginia Employment Commission Population Forecast). The VEC population forecasts take into account anticipated growth rates and projected job growth in the region and state, as well as actual growth rates experienced by the county in the past and therefore are expected to provide the best representation of future growth in Botetourt County. The VEC projects that the County's population will increase by approximately 6,000 residents by 2030.

Table 2 – Population Estimates & Forecasts for Botetourt County

Alternative Population Forecasts (2000 to 2030)					
	2000 (actual)	2008 (estimate)	2010 (estimate)	2020 (projected)	2030 (projected)
VEC	30,496	32,261	33,156	35,756	38,437
Long Term Growth	30,496	32,261	32,445	34,518	36,724
Short Term Growth	30,496	32,261	34,075	38,075	42,543
2004 Comprehensive Plan Figures (estimates after year 2000)	30,496	33,250	34,300	38,500	N/A

Figure 2 – Alternative Population Forecasts

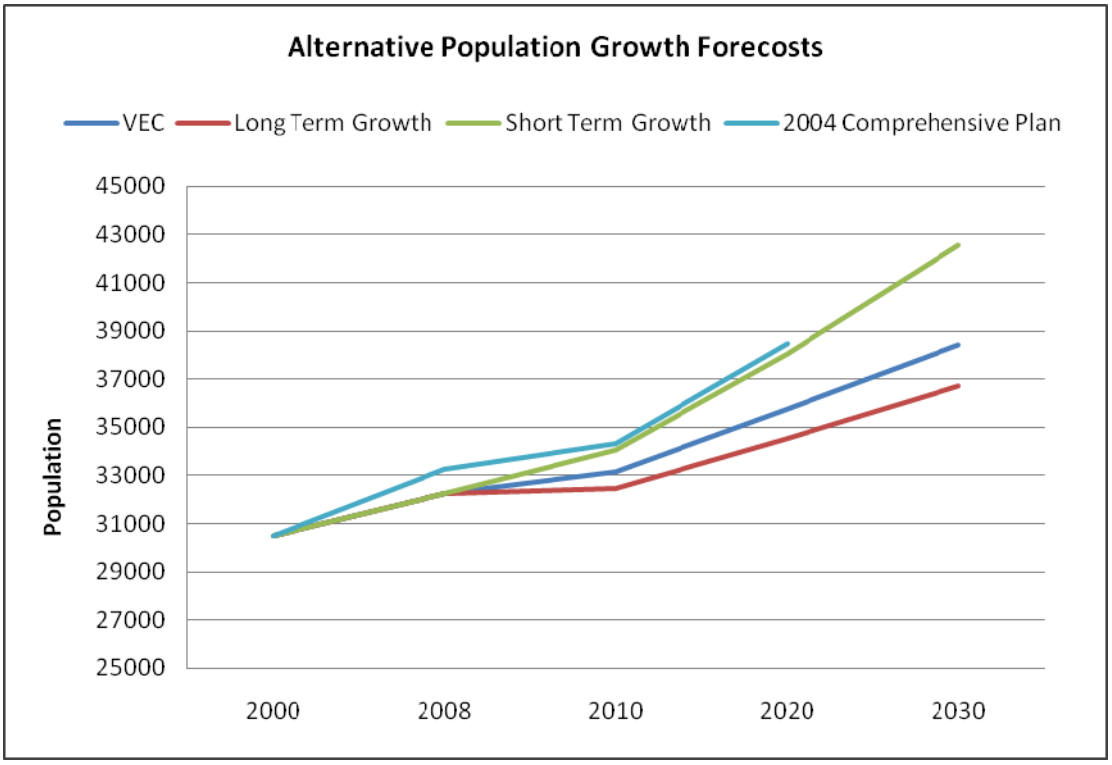


Table 3– Virginia Employment Commission Population Forecast

	Botetourt County	(% change)	Virginia	(% change)
1990	24,992		6,187,358	
2000	30,496	22.02 %	7,078,515	14.40 %
2010	33,156	8.72 %	8,010,239	13.16 %
2020	35,756	7.84 %	8,917,396	11.32 %
2030	38,437	7.50 %	9,825,019	10.18 %

Source: Virginia Employment Commission, Botetourt Community Profile

Botetourt County's population experienced relatively minor fluctuations between 1900 and 1970 (Table 4 – Historical Population Trends). After 1970, the county experienced significant population growth. Table 4 illustrates the growth of Botetourt County compared to the Roanoke MSA and the peer communities of Culpeper County and Rockbridge County. Between 1970 and 2008, the County grew over 77% with significant increases between 1970 and 1980 and between 1990 and 2000, while the Roanoke MSA and Rockbridge County grew only by 28.1% and 28.83% respectively during the same timeframe. While Botetourt County's growth outpaced that of the MSA as a whole, it did not outpace growth in Culpeper County, which grew by 148.64% between 1970 and 2008.

While Botetourt continues to grow at a faster rate compared to regional trends, the most recent data suggests a much slower rate of growth this decade than the previous decade. From 2000 to 2008, growth occurred at a rate of 5.0%, compared to a 22% increase in the previous decade of 1990 to 2000. The growth rate for the Roanoke MSA during this same time period (2000-2008) was 2.8%, as compared to 32.2% for Culpeper County and 3.0% for Rockbridge County.

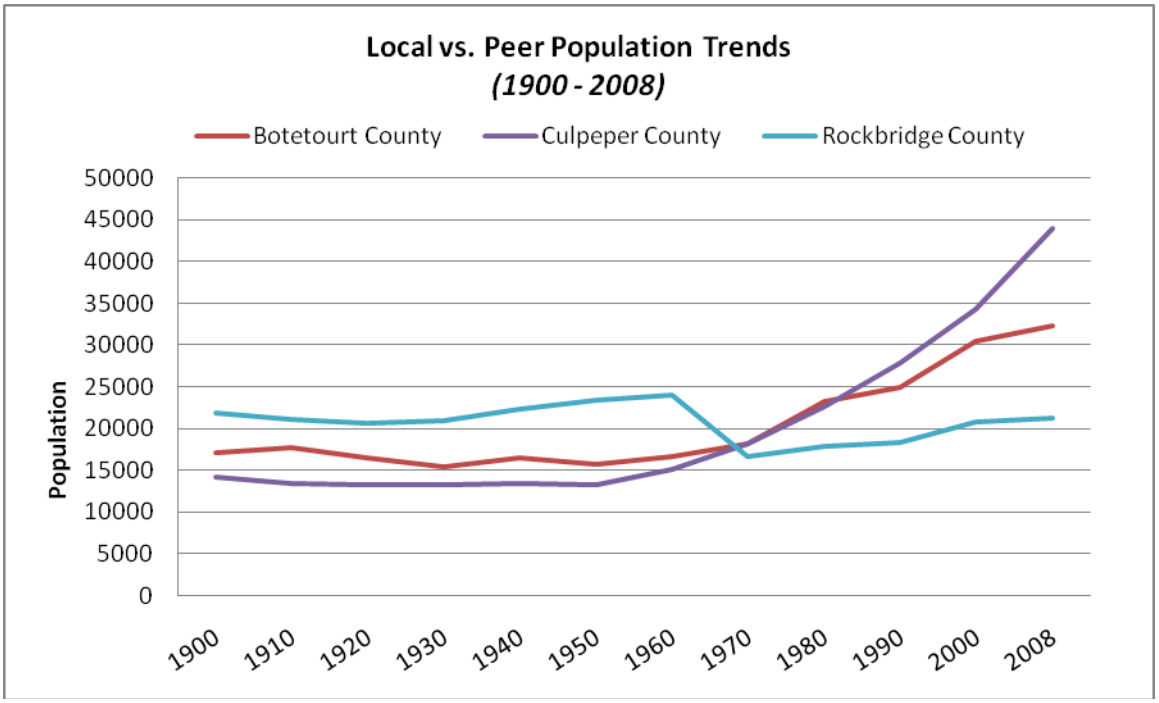
Table 4 – Historical Population Trends

LOCAL, PEER AND REGIONAL POPULATION TRENDS (1900 – 2008)								
Year	**Botetourt County**	*Percent Change*	**Roanoke MSA Population***	*Percent Change*	**Culpeper County**	*Percent Change*	**Rockbridge County**	*Percent Change*
1900	**17,161**		**84,739**		**14,123**		**21,799**	
1910	**17,727**	*3.3%*	**103,415**	*22.0%*	**13,472**	*-4.6%*	**21,171**	*-2.9%*
1920	**16,557**	*-6.6%*	**120,177**	*16.2%*	**13,292**	*-1.3%*	**20,626**	*-2.6%*
1930	**15,457**	*-6.6%*	**147,851**	*23.0%*	**13,306**	*0.1%*	**20,902**	*1.3%*
1940	**16,447**	*6.4%*	**158,264**	*7.0%*	**13,365**	*0.4%*	**22,384**	*7.1%*
1950	**15,766**	*-4.1%*	**177,185**	*12.0%*	**13,242**	*-0.9%*	**23,359**	*4.4%*
1960	**16,715**	*6.0%*	**204,799**	*15.6%*	**15,088**	*13.9%*	**24,039**	*2.9%*
1970	**18,193**	*8.8%*	**231,316**	*12.9%*	**18,218**	*20.7%*	**16,637**	*-30.8%*
1980	**23,270**	*27.9%*	**260,081**	*12.4%*	**22,620**	*24.2%*	**17,911**	*7.7%*
1990	**24,992**	*7.4%*	**268,513**	*3.2%*	**27,791**	*22.9%*	**18,350**	*2.5%*
2000	**30,496**	*22.0%*	**288,309**	*7.4%*	**34,262**	*23.3%*	**20,808**	*13.4%*
2008	**32,261**	*5.8%*	**297,029**	*3.0%*	**43,945**	*28.3%*	**21,312**	*2.4%*

Sources: US Bureau of the Census; American Community Survey, 2008

**MSA Population adjusted to reflect sum population of all counties within existing MSA boundaries*

Figure 3 - Peer County Comparison of Population Growth Trends



As population expanded during the 1980s and 1990s, population density for the entire County increased from 42 persons per square mile in 1980, to 56 persons per square mile in 2000, a 33% increase. Table 5 and Map 2 (Population Distribution – 2000 US Census Data) show total population and density in the year 2000 by U.S. Census Blocks. The majority of the population is concentrated in the southern part of the County, specifically in Census Tracts 403, 404, and 405. Table 5 shows that in 2000, 75% of County residents lived in those three Census Tracts, as compared to 72% in 1990, and only 66% in 1980. Map 2 and Map 4 (Population Distribution – Estimated 2009) provide a geographic analysis of population distribution and growth. Map 4 illustrates a more recent population distribution estimate based on the location of dwelling units and using an estimated average of 2.4 persons per dwelling unit.

Table 5 – Population Density by Census Tract (2000)

	401	402	403	404	405	Total
Square Miles	239	132	121	31	24	547
Population	3,415	4,213	8,258	7,112	7,498	30,496
Population/sq.mi.	14	32	68	229	312	56

Source: U.S. Bureau of the Census.

POPULATION AND AGE CHARACTERISTICS

In general, Botetourt County's population is aging; a trend that is occurring nationwide as the baby boom generation ages and the average lifespan increases. The median age of Botetourt County residents was 42.7 in 2007 and the rate of population growth is higher in older age groups (over 45) than in younger groups (Table 6 and Table 7).

Population increases in Botetourt County between 1980 and 1990 were primarily due to growth in age groups over 18. However, between 1990 and 2000, a different growth pattern emerged as evidence by three significant demographic trends. First, the five and under age group kept up with overall population growth, unlike the previous decade. Second, growth rates for the 45-64 year olds and 65 years and older were quite high, 54% and over 30% respectively, while the number of young adults 18-24 years declined 9% and the 24-44 year old age group failed to keep up with the overall population growth. Table 8 provides a more detailed growth projection per age group.

An aging population may bring an increased interest in mixed use and walkable communities as people live and work longer, either by choice or necessity. Walkable communities with a mix of uses are highly desirable for aging adults, as they provide employment opportunities, needed services, and housing without dependence upon an automobile. Reduced mobility among older residents often increases the demand for transportation services and the potential for transit; making a mix of land use highly desirable, as traveling long distances becomes more difficult. The provision of adequate public transportation increases the ability for seniors to remain independent longer. An aging population may also increase the demand for certain public services such as facilities that provide health care services, senior programs and police, fire and EMS services, as well as educational facilities for lifelong learning. Demands for senior housing, nursing homes and age restricted communities may also increase.

Table 6 –Age Group Trends Botetourt County (1990 to 2008)

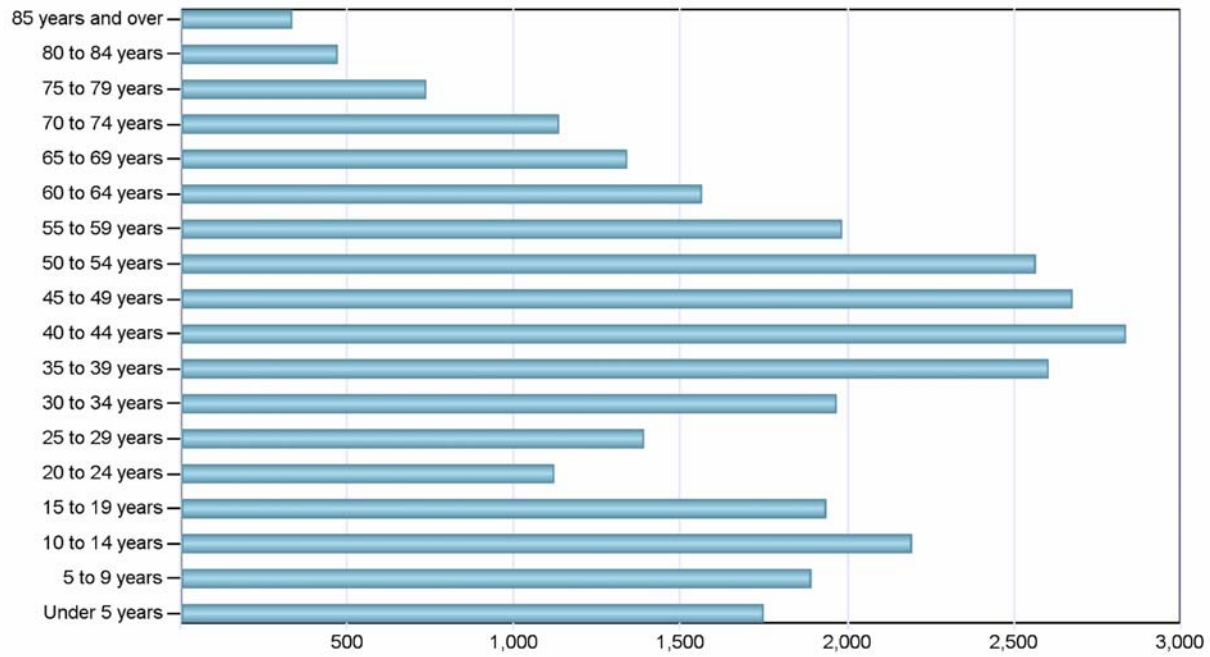
Population Age Groups (1990 - 2008)			
Age Group	1990	2000	2008
Total Population	24992	30496	31801
5 and under	1423	1749	1521
18 years and over	19184	23499	25217
65 years and over	3073	4012	4454

Sources: US Bureau of the Census; American Community Survey, 2008

Table 7 – Median Age, Peer County Comparison

Median Age of County Residents		
	2000	**2007**
Botetourt County	40.7	42.7
Roanoke MSA	39.2	40.7
Culpeper County	36.5	35.6
Rockbridge County	40.4	42.4

Figure 4 – 2000 Census Population Age Groups



Source: Virginia Employment Commission, Botetourt Community Profile, 2000 Census

Figure 5 - Age Group Growth Trends for Botetourt County (1990 to 2008)

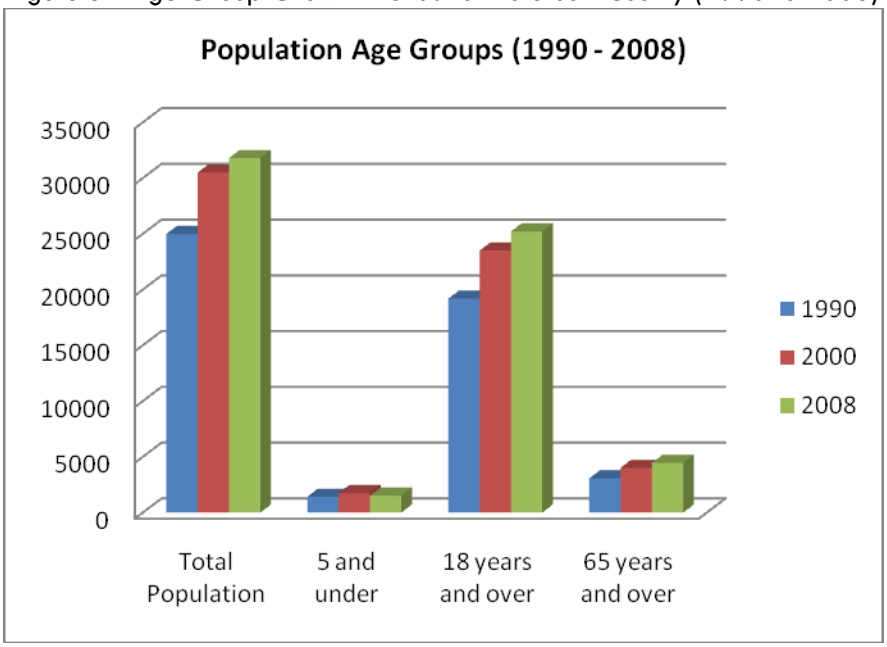


Table 8 – Population Projections by Age and Gender, Botetourt

	2010		2020		2030	
	Female	Male	Female	Male	Female	Male
Under 5 years	792	770	868	849	916	899
5 to 9 years	830	781	897	865	1,012	985
10 to 14 years	916	897	919	852	1,039	980
15 to 19 years	910	1,007	825	816	920	929
20 to 24 years	858	974	693	796	724	766
25 to 29 years	975	1,185	908	1,028	857	851
30 to 34 years	926	999	1,128	1,240	966	1,051
35 to 39 years	854	845	1,142	1,386	1,103	1,240
40 to 44 years	1,098	1,102	1,059	1,116	1,309	1,405
45 to 49 years	1,471	1,312	958	923	1,309	1,536
50 to 54 years	1,467	1,489	1,206	1,164	1,205	1,226
55 to 59 years	1,336	1,382	1,554	1,368	1,055	1,004
60 to 64 years	1,294	1,303	1,535	1,560	1,301	1,252
65 to 69 years	958	931	1,336	1,393	1,613	1,415
70 to 74 years	748	674	1,305	1,200	1,578	1,465
75 to 79 years	556	415	826	620	1,193	956
80 to 84 years	375	273	511	349	920	645
85 years and over	302	151	369	192	528	284
	16,666	**16,490**	**18,039**	**17,717**	**19,548**	**18,889**
	33,156		**35,756**		**38,437**	

Source: Virginia Employment Commission, Botetourt Community Profile

RACIAL AND CULTURAL COMPOSITION

The racial and cultural composition of the Botetourt County population has not changed greatly since 1990 see (Table 9). The County is mostly white, with other racial and cultural groups making up approximately 5% of the total population. As in other regions of Virginia, the percentages of Hispanic and Asian residents, though small in terms of total population, grew significantly, 69.2% and 46.5%, respectively, over the past ten years in the County. The African-American population increased only slightly by 3.7% during the same timeframe.

Table 9 – Racial and Cultural Composition Botetourt County (1990 – 2000)

Group	1990	2000	Percent Change
Total Population	24,992	30,496	22.0%
White	23,818	28,944	21.5%
White Hispanic	82	111	35.3%
White-Non-Hispanic	23,736	28,833	21.5%
Black	1,035	1,073	3.7%
American Indian, Eskimo or Aleut	22	66	200%
Asian or Pacific Islander	97	145	49.5%
Total Hispanic (any race)	107	181	69.2%
Other Race	20	59	195%
Two or More Races	N/A	209	N/A

Source: U.S. Bureau of the Census.

HOUSEHOLD CHARACTERISTICS

Changes in population characteristics and lifestyles have created greater diversity in household types throughout the United States over the past 20 years. There are more single heads of households, extended family households, and multigenerational households than in previous decades. Demand for a variety of housing types and sizes have grown in response to these demographic and social changes.

Table 10 – Household Type by Census Tract, Botetourt County (2000)

Household Type	401	402	403	404	405	Total	Percent
1 Person:	324	396	524	614	379	2,237	19%
Male Householder	166	191	264	296	103	1020	9%
Female Householder	158	205	260	318	276	1,217	10%
2+ Persons:	1,052	1,318	2,596	2,108	2,351	9,425	81%
Married Couple Family	913	1,072	2,292	1,688	2,120	8,085	69%
Other Family	125	198	257	328	179	1,087	9%
Male HH-no wife	50	33	85	87	56	311	3%
Female HH-no husband.	75	165	172	241	123	776	7%
Non-Family Household:	14	48	47	92	52	253	2%
Male Householder	14	31	16	77	31	169	1%
Female Householder	0	17	31	15	21	84	<1%
Total	1,376	3,120	2,722	2,722	2,730	11,662	100%

Source: U.S. Bureau of the Census. Note: HH – householder

Table 11 – Botetourt County Household Type by Census Tract: Persons Under Age 18

Household Type	401	402	403	404	405	Total	Percent
Family Households:	381	496	972	900	1,060	3,809	94 %
Married-Couple Family	324	419	876	706	955	3,280	81 %
Other Family:	57	77	96	194	105	529	13 %
Male HH-no wife	31	15	44	55	30	175	4 %
Female HH-no husb.	26	62	52	139	75	354	9 %
Non-Family Household:	14	48	47	92	52	253	6 %
Total	395	544	1,019	992	1,112	4,062	100%

Source: U.S. Bureau of the Census. Note: HH - householder.

HOUSING CHARACTERISTICS

The majority of County residents and homes (also known as dwelling units) are located in the southern end of the County. In 2007, owner occupied dwelling units accounted for 11,398, or 81.7 percent dwelling units. According to the 2000 Census, approximately 81.6 percent of the County's housing stock was also owner occupied. This indicates that housing characteristics remained consistent over time and the County has not yet experienced significant demand for alternative housing styles. The tables below summarize the distribution of new dwelling types and type of construction and structural characteristics of the County's housing stock.

According to the 2007 data, the median value of housing in Botetourt County was $177,700; a significant increase over previous years. Increased housing values were likely based on recent trends that affected the County and most regions of the country: a rapid rise in housing values due the competitive housing market and availability of easy credit and a movement toward larger houses over the last two to three decades. These trends may not be sustained long term given recent changes in the national economy. Table 13, Table 14, and Table 15 compare the median value of housing for Botetourt County from 1980 to 2007 and to peer communities and the MSA.

Table 12 – Total Housing Units Botetourt County

Total Housing Units (1970-2007)		
Year	**Units**	**Change**
1970	6,133	-
1980	8,467	38.1%
1990	9,785	15.6%
2000	12,571	28.5%
2007	13,954	11.0%

Sources: US Bureau of the Census; American Community Survey, 2008

Table 13 – Botetourt Housing Tenure and Characteristics, Trend

Housing Tenure and Characteristics (1980 to 2007)				
	1980	**1990**	**2000**	**2007**
Total Population	23,270	24,992	30,496	31,801
Housing Units	8,467	9,785	12,571	13,954
Persons Per Housing Unit	2.92	2.73	2.61	2.49
Occupied Units	7,972	9,148	11,700	12,772
Owner Occupied	6,605	7,842	10,268	11,398
Renter Occupied	1,367	1,306	1,432	1,374
Median Value	$43,300	$73,400	$130,500	$177,700
Median Rent	$125	$249	$475	$603
Vacant Housing	1,862	1,943	2,303	2,556
Vacancy Rate	22.0%	19.9%	18.3%	18.3%

Sources: US Bureau of the Census; American Community Survey, 2008

Table 14 – Housing Unit Values, Peer Comparison

Distribution of Housing Unit Value, Peer Comparison								
	Botetourt	**Percent of Total**	**Culpeper**	**Percent of Total**	**Rockbridge**	**Percent of Total**	**Roanoke MSA**	**Percent of Total**
Owner-occupied units	**11,398**		**11,419**		**6,885**		**90,612**	
Less than $50,000	574	5.0%	307	2.7%	641	9.3%	4,679	5.2%
$50,000 to $99,999	1,598	14.0%	253	2.2%	1,077	15.6%	16,661	18.4%
$100,000 to $149,999	2,291	20.1%	907	7.9%	1,239	18.0%	26,418	29.2%
$150,000 to $199,999	2,532	22.2%	836	7.3%	977	14.2%	17,029	18.8%
$200,000 to $299,999	2,263	19.9%	2,578	22.6%	1,342	19.5%	14,299	15.8%
$300,000 to $499,999	1,860	16.3%	4,880	42.7%	923	13.4%	8,135	9.0%
$500,000 to $999,999	264	2.3%	1,520	13.3%	535	7.8%	2,948	3.3%
$1,000,000 or more	16	0.1%	138	1.2%	151	2.2%	443	0.5%
Median (dollars)	177,700		331,900		173,900		145,300	

Sources: US Bureau of the Census; American Community Survey, 2008

Table 15 – 2007 Housing Tenure and Characteristics, Peer Comparison

2007 Housing Tenure and Characteristics, Peer County Comparison							
	Total population: Total	**Persons Per Housing Units**	**Housing units: Total**	**Occupied**	**Owner Occupied**	**Renter Occupied**	**Vacant housing units: Total**
Botetourt County, Virginia	31,801	2.48	13,954	12,772	11,398	1,374	1182
Culpeper County, Virginia	43,945	2.56	17,496	16,344	11,419	4,925	1152
Rockbridge County, Virginia	21,312	2.29	10,694	9,296	6885	2,411	1,398
Roanoke, VA MSA	294,422	2.31	138,148	123,888	90,612	33,276	14,260

The quality of housing has improved in Botetourt County over the past few decades as evidenced by a decline in the number of housing units that lack plumbing facilities as illustrated in Table 16. As indicated in Table 17, Botetourt County had more percentage of its housing lacking facilities than peer communities or the MSA.

Table 16 – Botetourt County Total Housing Units Lacking Plumbing

Historical Trend of Housing Units Lacking Plumbing	
2007	175
2000	248
1990	393

Sources: US Bureau of the Census; American Community Survey, 2008

Table 17 - Total Housing Units Lacking Plumbing, Peer Comparison

Housing Units Lacking Plumbing, Peer Comparison				
	Botetourt	**Culpeper**	**Rockbridge**	**Roanoke MSA**
Occupied housing units	**12,772**	**16,344**	**9,296**	**123,888**
Lacking complete plumbing facilities	175	0	112	512

Sources: US Bureau of the Census; American Community Survey, 2008

Table 18 –Housing Unit Density, Peer Comparison

Housing Units Per Density, Peer Comparison				
	Botetourt	**Culpeper**	**Rockbridge**	**Roanoke MSA**
Total housing units	**13,954**	**17,496**	**10,694**	**138,148**
1-unit, detached	11,722	12,833	8,576	99,625
1-unit, attached	325	1,306	4	3,230
2 units	124	429	185	4,262
3 or 4 units	71	331	141	2,761
5 to 9 units	172	509	266	4,753
10 to 19 units	96	1,180	116	10,376
20 or more units	38	208	34	4,824
Mobile home	1,406	700	1,372	8,244

Sources: US Bureau of the Census; American Community Survey, 2008

Table 19 – Housing Units Year Built, Peer Comparison

Distribution of Housing Units Per Year Built, Peer Comparison				
	Botetourt	**Culpeper**	**Rockbridge**	**Roanoke MSA**
Total housing units	**13,954**	**17,496**	**10,694**	**138,148**
Built 2005 or later	116	1,044	89	1,280
Built 2000 to 2004	1,189	2,811	313	7,732
Built 1990 to 1999	3,333	3,215	2,215	19,976
Built 1980 to 1989	2,010	3,224	1,647	19,337
Built 1970 to 1979	3,105	2,198	1,594	25,560
Built 1960 to 1969	1,256	1,423	930	17,856
Built 1950 to 1959	782	1,053	1,061	19,137
Built 1940 to 1949	692	638	482	8,566
Built 1939 or earlier	1,471	1,890	2,363	18,704

Sources: US Bureau of the Census; American Community Survey, 2008

The cost of housing was one item of concern to residents who participated in the Citizen Survey conducted in 2008. However, at least in terms of rental housing, Botetourt County is generally more affordable than peer counties and the Roanoke MSA. Table 13 and Table 20 provide a comparison of home values and rents, respectively.

Table 20 – Median Rent, Peer County Comparison

2007 Median Rent, Peer Comparison				
	Botetourt	**Culpeper**	**Rockbridge**	**Roanoke MSA**
Median Rent	$603	$882	$579	$625

Sources: US Bureau of the Census; American Community Survey, 2008

Table 21 – Rent as Percentage of Income, Peer Comparison

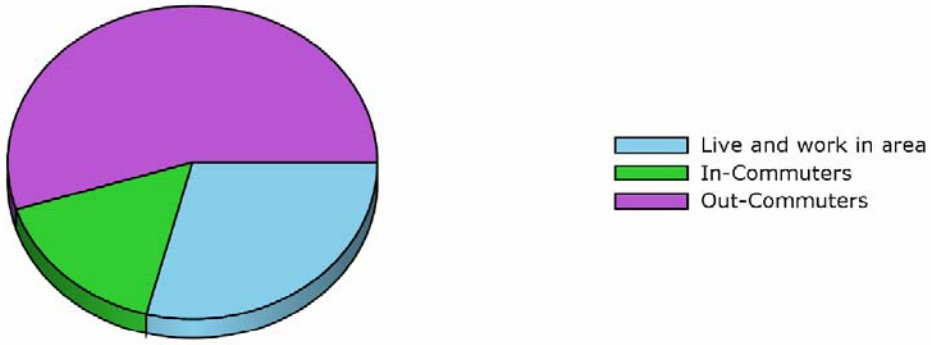
Gross Rent as Percentage of Income, Peer Comparison								
	Botetourt	**Percent of Total**	**Culpeper**	**Percent of Total**	**Rockbridge**	**Percent of Total**	**Roanoke MSA**	**Percent of Total**
Renter-occupied units	**1,374**		**4,925**		**2,411**		**33,276**	
Less than 15.0 percent	296	2.6%	317	2.8%	556	8.1%	5,041	5.6%
15.0 to 19.9 percent	228	2.0%	589	5.2%	172	2.5%	4,971	5.5%
20.0 to 24.9 percent	183	1.6%	421	3.7%	292	4.2%	4,791	5.3%
25.0 to 29.9 percent	79	0.7%	858	7.5%	77	1.1%	3,307	3.6%
30.0 to 34.9 percent	20	0.2%	370	3.2%	26	0.4%	2,316	2.6%
35.0 percent or more	370	3.2%	1,849	16.2%	995	14.5%	10,272	11.3%
Not computed	198	1.7%	521	4.6%	293	4.3%	2,578	2.8%

Sources: US Bureau of the Census; American Community Survey, 2008

REGIONAL MOBILITY

Botetourt County's transportation system is heavily auto-dependant with few options for public transit. Figure 6, Table 22, and Table 23 present commuting data for Botetourt County derived from Virginia Employment Commission information. The data highlights the net "journey to work" migration of daily commuters to and from the County. In 2007, 2,990 residents of other jurisdictions commuted into the County to their place of employment (also known as in-commuters). Conversely, 10,150 Botetourt residents commuted to other jurisdictions to their place of employment (out-commuters). Approximately 78% of these out-commuters traveled to Roanoke City or Roanoke County for employment. Thus, on an average, there is a net out-migration of 7,160 residents each day. This compares to a 1990 net out-migration of 6,757. The net outmigration from the County can be attributed to the increase in housing and population over the past two decades and the high number of employment opportunities found in the more urban portions of the Roanoke Valley. Most commuters coming into the County to work are from Roanoke City and Roanoke County.

Figure 6 – Botetourt County Commuting Patterns



Commuting Patterns	
People who live and work in the area	5,369
In-Commuters	2,990
Out-Commuters	10,150
Net In-Commuters (In-Commuters minus Out-Commuters)	-7,160

Source: Virginia Employment Commission, Botetourt Community Profile

Table 22 – Top 10 Places Residents are Commuting TO and FROM

Commuting TO

Area	Workers
Roanoke city, VA	5,563
Roanoke County, VA	2,387
Salem city, VA	1,006
Alleghany County, VA	240
Rockbridge County, VA	149
Clifton Forge city, VA	105
Bedford County, VA	95
Montgomery County, VA	82
Covington city, VA	58
Bedford city, VA	50

Commuting FROM

Area	Workers
Roanoke County, VA	831
Roanoke city, VA	768
Bedford County, VA	487
Franklin County, VA	163
Salem city, VA	109
Rockbridge County, VA	90
Clifton Forge city, VA	61
Alleghany County, VA	59
Montgomery County, VA	55
Covington city, VA	39
Craig County, VA	39

Table 23 – Commuting to Work Comparison

Peer Comparisons of Commuting to Work				
	Roanoke MSA	**Botetourt**	**Culpeper**	**Rockbridge**
Workers 16 years and over	**138,731**	**15,852**	**21,110**	**10,207**
Car, truck, or van -- drove alone	116,272	13,604	16,263	7,782
Car, truck, or van -- carpooled	13,342	1,242	2,994	1,546
Public transportation (excluding taxicab)	1,299	11	146	24
Walked	2,183	221	334	310
Other means	1,033	88	284	92
Worked at home	4,602	686	1,089	453
Mean travel time to work (minutes)	21.5	25.7	37.4	22.9

INCOME

Income distribution is a helpful tool for evaluating the economic vitality of a community. Income data can be an indicator of the types of services and needs that County residents may require. Table 24 shows that the median annual gross income of $42,883 in Botetourt County was estimated to be higher than comparable median gross incomes the Roanoke MSA and peer communities. This may be attributed to the fact that the number of people in age groups that are typically at their peak earning power has increased in the County over the last decade and there has been an increase in the number of professional and/or higher-paying jobs in the County. By 2008, median annual gross income levels were about 30% higher than the Roanoke region, while median household income in Botetourt County, $58,187, was approximately 26% higher than the regional median income.

Table 24 – Median Annual Gross Income Trend, Peer County Comparison

Median Annual Gross Income (1996 to 2008)								
	Botetourt	Percent Change	Culpeper	Percent Change	Rockbridge	Percent Change	Roanoke	Percent Change
1996	$26,731		$23,241		$19,759		$21,637	
1997	$28,441	6.4%	$24,380	4.9%	$21,390	8.3%	$22,823	5.5%
1998	$29,423	3.5%	$25,802	5.8%	$22,462	5.0%	$23,847	4.5%
1999	$30,527	3.8%	$27,099	5.0%	$23,015	2.5%	$24,492	2.7%
2000	$32,141	5.3%	$28,434	4.9%	$24,477	6.4%	$25,518	4.2%
2001	$32,266	0.4%	$29,469	3.6%	$24,416	-0.2%	$25,621	0.4%
2002	$32,467	0.6%	$30,466	3.4%	$24,310	-0.4%	$25,568	-0.2%
2003	$33,189	2.2%	$30,935	1.5%	$24,219	-0.4%	$25,444	-0.5%
2004	$35,017	5.5%	$33,241	7.5%	$25,934	7.1%	$26,433	3.9%
2005	$38,440	9.8%	$37,299	12.2%	$29,251	12.8%	$29,963	13.4%
2006	$39,929	3.9%	$38,158	2.3%	$30,196	3.2%	$30,999	3.5%
2007	$41,345	3.5%	$39,873	4.5%	$31,430	4.1%	$31,857	2.8%
2008	$42,883	3.7%	$41,741	4.7%	$32,745	4.2%	$32,832	3.1%

Sources: US Bureau of the Census

Table 25 – Income Distribution, Peer Comparison

Peer Comparison of Income (in 2007 inflation-adjusted collars)				
	Roanoke MSA	**Botetourt**	**Culpeper**	**Rockbridge**
Total households	**123,888**	**12,772**	**16,344**	**9,296**
Less than $10,000	9,347	659	835	729
$10,000 to $14,999	7,189	481	903	576
$15,000 to $24,999	13,629	1,237	1,498	1,346
$25,000 to $34,999	16,955	1,278	1,478	1,299
$35,000 to $49,999	19,687	1,831	2,266	1,451
$50,000 to $74,999	24,829	2,722	3,606	1,889
$75,000 to $99,999	14,569	1,953	2,037	1,034
$100,000 to $149,999	11,472	1,610	2,406	568
$150,000 to $199,999	3,206	478	921	234
$200,000 or more	3,005	523	394	170
Median household income (dollars)	46,103	58,187	59,138	41,298
Mean household income (dollars)	59,183	71,499	69,619	53,849
Families	**79,873**	**9,675**	**12,091**	**6,439**
Less than $10,000	3,111	237	263	129
$10,000 to $14,999	2,081	249	667	249
$15,000 to $24,999	5,749	633	603	556
$25,000 to $34,999	9,488	815	935	1,052
$35,000 to $49,999	12,901	1,244	1,794	1,093
$50,000 to $74,999	18,833	2,373	2,723	1,532
$75,000 to $99,999	12,654	1,846	1,806	952
$100,000 to $149,999	9,720	1,393	2,154	511
$150,000 to $199,999	2,810	448	795	234
$200,000 or more	2,526	437	351	131
Median family income (dollars)	57,517	68,085	65,671	54,052
Mean family income (dollars)	70,499	80,335	77,430	63,223
Per capita income (dollars)	25,347	28,811	25,516	23,256

Sources: US Bureau of the Census; American Community Survey, 2008

EDUCATION

The general education statistics presented in Table 26 highlight significant overall improvements in educational attainment among Botetourt County residents. In 1970, only 38.3% of the residents 25 years or older had completed high school. By 2008, the percentage of graduates had increased to 88.3%. The percentage of college graduates increased from 2.9% to 23.2% between 1970 and 2008. The median school years completed increased from 10.4 years in 1970 to 12.2 in 1980. Statistics on median school years completed in 1990, 2000, 2008 were not available; however, the positive changes in the high school and college graduation rates and the change in employment types indicate that they continue to increase.

Table 26 – General Education Statistics 1970 – 2000

People 25 years old and older	1970	1980	1990	2000
Percent High School Graduates	38.3%	57.7%	72.9%	81.1%
Percent College Graduates	2.9%	10.9%	13.6%	19.5%
Median School Years Completed	10.4	12.2	NA	N/A

Source: U.S. Bureau of the Census. NA - Not available.

WORK FORCE

Employment levels in the County have fluctuated over the last 30 years. During the economic boom period of the late 1960s and early 1970s, unemployment was very low (1.6%). However, by 1982, unemployment had reached 8.4%. Between 1987 and 1992, unemployment in Botetourt County decreased to 3.5% in 1990, but peaked in 1992 at 5.8%. Since 1994, unemployment for the region has remained at or below 3% and has been consistently lower than comparable periods for Virginia and the whole country. Growth in employment kept up with population growth in the period between 1990 and 2000. In 2008, unemployment spiked to 3.8%, but still remained lower than surrounding localities (Table 27 and Table 28).

Table 27 – Labor Force, Region and Peer Counties

Peer Comparison of Labor Force				
	Roanoke MSA	**Botetourt**	**Culpeper**	**Rockbridge**
Population 16 years and over	**238,367**	**26,042**	**34,185**	**17,336**
In labor force	151,482	16,858	22,865	10,892
Civilian labor force	151,343	16,858	22,754	10,888
Employed	143,915	16,210	21,737	10,432
Unemployed	7,428	648	1,017	456
Armed Forces	139	0	111	4
Not in labor force	86,885	9,184	11,320	6,444
Civilian labor force	**151,343**	**16,858**	**22,754**	**10,888**
Unemployed	4.9%	3.8%	4.5%	4.2%

Sources: US Bureau of the Census; American Community Survey, 2008

Table 28 – Ratio of Employment to Population, Botetourt (1990 to 2008)

	1990	2000	2008
Population	24,992	30,496	31,801
Employment	12,895	16,488	16,210
Ratio	51.6%	54.1%	51.0%

Sources: US Bureau of the Census; American Community Survey, 2008

The County has seen significant changes in the occupations of its residents with a shift toward professional and service employment. In 1980, "technicians, sales, and administrative support" was the dominant occupation of County residents (27%), followed by "operators, fabricators, and laborers" (24%). In 1990, the major occupation of County residents was also "technicians, sales, and administrative support" (30%), followed by "managerial and professional" (22%), and "operators, fabricators, and laborers" (20%). By 2008, the "manufacturing" category had become the largest, reflecting a shift in the County's economy towards this industry. At the same time, natural resource oriented jobs of "farming, forestry, and fishing" continued to suffer significant declines. Current occupations by age groups of Botetourt County residents during 2008 are shown in Table 29.

Table 29 – Age of Work Force by Industry – 2008

	14 - 18	19 - 21	22 - 24	25 - 34	35 - 44	45 - 54	55 - 64	65+
Total, All Industries	343	514	614	2,051	2,665	2,691	1,725	471
Agriculture, Forestry, Fishing & Hunting	4			19	16	24	11	11
Mining			5	17	24	35	23	6
Utilities								
Construction	7	50	62	220	243	220	125	30
Manufacturing	6	55	100	487	672	605	324	25
Wholesale Trade	6	20	51	194	242	232	125	55
Retail Trade	67	122	101	269	328	319	270	61
Transportation and Warehousing	5	15	28	124	167	219	121	28
Information			4	21	25	25	18	3
Finance and Insurance		3	7	29	35	34	24	7
Real Estate and Rental and Leasing		5	9	12	19	18	10	5
Professional and Technical Services	9	14	18	51	62	88	33	12
Management of Companies and Enterprises		3	6	30	44	45	34	4
Administrative and Waste Services	3	11	29	58	73	94	48	20
Educational Services		8	28	114	218	238	214	57
Health Care and Social Assistance	42	53	61	164	210	220	162	70
Arts, Entertainment, and Recreation	13	6	4	8	23	13	16	7
Accommodation and Food Services	163	123	68	134	127	106	56	33
Other Services, Ex. Public Admin	11	9	16	32	34	51	37	15
Public Administration		12	16	65	102	105	72	20

Source: U.S. Census Bureau,
Local Employment Dynamics (LED) Program, 2nd Quarter (April, May, June) 2008, all ownerships.

**Some data for age distribution related to employment type not provided.*

AGRICULTURAL ACTIVITY

Table 30 traces changes in the characteristics of agriculture in Botetourt from 1982 to 2007. These statistics were obtained from the Census of Agriculture for the years 1982, 1987, 1992, 1997, 2002, and 2007 as published by the U.S. Bureau of the Census. In general, these statistics show a diminishing role for agriculture as a part of the Botetourt County economy. Concerns about the potential conversion of farmland to other uses were raised at public workshops on the plan.

The number of farms in Botetourt County has been declining over the years (13.8 percent between 1982 and 1997), but has recently rebounded to 638 in 2007. While the number of farms has increased, the total acreage devoted to farming has declined, with a decrease of average farm size from 167 acres to 138 acres. This is likely due either to farm diversification, or medium sized farms being sold for other uses, leaving large and small farms intact. Although the number of farm acres has declined, the average value of farms has increased 75 percent from 1997 to 2007, reflecting an overall trend of increasing land values in the County as a whole; farm value may decline in the future given the recent collapse of the real estate market.

Table 30 – Agricultural Statistics

Agricultural Statistics (1982 to 2007)						
	1982	1987	1992	1997	2002	2007
Number of Farms	586	532	512	505	610	638
Land in Farms (acres)	97,835	97,523	96,833	90,502	97,091	87,913
Average Farm Size (acres)	167	183	189	179	159	138
Estimated market value of land and buildings						
Average per farm ..... dollars	$179,118	$202,592	$259,284	$332,893	$496,590	$584,921
Average per acre ..... dollars	$1,007	$1,070	$1,459	$1,870	$2,732	$4,245
Total Cropland (acres)	46,236	40,465	41,373	40,662	44,393	27,662
Harvested Cropland (acres)	19,193	19,397	18,689	20,023	23,458	21,005
Market value of agricultural products sold $1,000	$10,580	$11,934	$12,549	$10,773	$9,982	$13,548
Average per farm ..... dollars	$17,983	$22,432	$25,410	$21,253	$16,365	$21,234
Crops, including nursery and greenhouse crops $1,000	$2,011	$2,086	$2,138	$1,772	$1,850	$2,488
Livestock, poultry, and their products $1,000	$8,527	$9,848	$10,411	$8,961	$8,133	$11,059

PLANNING FOR GROWTH AND CHANGE

Change is usually inevitable, but not entirely unpredictable. As the children of the baby boom generation age and graduate from the County school system, they often leave the County to pursue higher education, job opportunities, or a greater diversity of housing options. Those same boomer children may gravitate back to the area with young families because of the quality of life and superior education system. Seniors are increasingly choosing to "age in place" rather than migrate away from familiar communities for their retirement years. To remain attractive, competitive and stable, the County needs to anticipate changes that will affect the future and anticipate local, regional and national trends that will influence future land use patterns and drive public facility and utility needs. This comprehensive plan is designed to respond to the driving forces that will affect the County's future through policies that will maintain the county's quality of life and economic vitality.

3 LAND USE

INTRODUCTION

The Land Use Element of the Comprehensive Plan establishes the framework for the physical growth and development of the county over the life of the plan. It provides direction and guidance on a range of development, conservation and land use compatibility issues. It also describes the competing priorities that must be taken into account when planning for the future of the County.

The Land Use Element lays out policies to improve economic strength and security, enhance the built and natural environment, and build livable communities. Land use policies seek to accommodate growth and change by enhancing development in existing areas while preserving natural areas. The Land Use Element objectives and policies directly tie to the objectives and policies of all other plan elements. Transportation, economic development, cultural and environmental resources, and community facilities policies must be compatible with the overarching land use policies to ensure that the County develops as envisioned. The Land Use Element establishes policies for the physical development of appropriate uses at appropriate densities in appropriate locations and includes guidelines that describe the character and quality of future development and the preferred future development pattern.

BACKGROUND

This section of the Land Use Element provides background information, analysis, and discussion of challenges and opportunities.

Challenges

Botetourt County is fortunate to have plentiful natural resources that have fueled its agricultural economy and attracted residential growth. While the County has historically been a rural community with its roots in farming, it has become an increasingly attractive location for residential development over the last 10 to 20 years. Recent trends indicate that residential growth is shifting from large lot rural residential growth to low-to-medium density, more suburban style development and increasing pressure for the conversion of farmland to residential use.

The increase in residential development is anticipated to play a major role in the County's economy as there is an expectation that the demand for service-related businesses will increase to serve the growing residential population. Botetourt County recently initiated an *Economic Development Study* to evaluate future demands and provide direction for the County's economic development policies. The information gathered for that study will provide important input to help identify future land use needs and appropriate patterns of development throughout the County.

Transportation has long influenced the development pattern of Botetourt County. Current development patterns in Botetourt County are heavily influenced by existing transportation routes: U.S. Route 220, U.S. Route 11, U.S. Route 460 and I-81. The James River, railroads, and U.S. Route 220 were significant influences that shaped historic settlement patterns. The construction of I-81 provided access to new lands within the County, attracting development around the interchanges, specifically at Exit 150. During the Comprehensive Plan process, residents and stakeholders expressed their views that the County should develop plans to mitigate the rapid growth along U.S. Route 220; to preserve the rural character north of Daleville Town Center and promote more growth around the incorporated towns.

Land Use Analysis

In addition to public input, several factors must be evaluated to prepare appropriate Land Use goals, objectives and policies of this plan and a Future Land Use Map for Botetourt County. These include review of the existing land use pattern, current zoning, existing development densities, population distribution and recent development activity. Additionally, a capacity analysis based on population projections provides an indication of whether or not there is sufficient development capacity to accommodate projected growth.

Existing Land Use

Draft existing land use, zoning and future land use maps were reviewed by the general citizenry of Botetourt County at community meetings held on December 5, 2009 and January 5, 2010 (Map 5 - Existing Land Use, Map 6 - Zoning, and Map 9 – Future Land Use). The final existing land use map, a generalized zoning map, and a future land use map are incorporated into this plan.

The existing land use map indicates that current residential and commercial land uses are clustered in the southern end of the county, where sufficient infrastructure and facilities exist to support development of this intensity. The map (Map 5) depicts seven general land use categories:

Agricultural/Forest Land

This is the largest land use category in the County, comprising approximately 69.1 percent of the County's land area. Agricultural uses in Botetourt are generally located in the central and northern sections of the County. These areas are typically used as cropland and orchards, and raising and grazing of livestock. Buildings associated with these activities (single family dwellings, barns, grain storage, etc.) are considered agricultural uses for the purposes of this map. Forest land consists of privately, corporately owned, or National Forest. Forested areas are typically found in the more mountainous regions of the County, particularly in northern Botetourt and the area along the Blue Ridge Parkway.

Federal Lands
This category consists of George Washington National Forest land that is publicly owned and managed by the Federal government. Public forest land comprises approximately 25.9 percent of the total land area in the County. Currently, the Jefferson and George Washington National Forests encompass approximately 90,000 acres of land in Botetourt County, some of which is along the Blue Ridge Parkway.

Rural Residential
This category includes clusters of rural residential development in the County, which are typically single family housing. This type of development is located in very rural portions of the county, typically on land previously used for agricultural or forestry. Most of these homes have no public water and sewer service.

Low Density Residential
This category generally represents areas of single family homes in large lot suburban patterns of development. Low-density residential land uses are concentrated in the southern portion of the County. These areas may be served by public water and sewer, but are normally served by individual wells or private water systems and septic systems.

Medium Density Residential
This residential category comprises a small portion of the County's total land area. Medium density areas include all apartment and townhouse developments and small lot single family developments. All medium density residential areas are served by public or private water and public sewer. Most of these medium density residential land uses are found in southern Botetourt; however, this land use category also exists within the incorporated towns and unincorporated communities in other areas of the County, such as Iron Gate, Glen Wilton, and Eagle Rock.

Commercial/Office
The commercial/office land use category consists of areas where the wholesale and retail sale of goods and services is the primary activity. Commercial and office development in the County has historically occurred at Interstate 81 interchanges and along main transportation corridors where public water and sewer are available in proximity to existing and anticipated residential development.

Industrial
The industrial land use category indicates those areas where manufacturing is the primary activity. This includes quarrying, industrial parks, and for the purpose of this plan, sanitary landfilling. The major areas of industrial activity in Botetourt County are the EastPark Commerce Center, the Jack C. Smith Industrial Park, the Roanoke Cement Company, the Botetourt Center at Greenfield and Vista Park, all of which are located in the southern region of the County. Other smaller industrial uses and areas can be found on scattered sites and along highway corridors such as U.S. Route 11and U.S. Route 220 North.

Existing Zoning

The existing zoning map (Map 6) shows how parcels are currently zoned with respect to the 13 zoning districts included in Botetourt County's Zoning Ordinance. Table 31 provides more specific zoning information about parcels that are currently developed with at least one dwelling unit. Based on this information, 6,433 dwelling units are located in areas of the zoned Agricultural A-1, and 3,962 dwellings are located in areas zoned Residential R-1.

Table 31 – Land Use Analysis (Parcels With Dwelling Units – DU > 0)

Current land use per zoning (parcels with dwelling units)				
ZONING	Number of Parcels	Dwelling Units (DU)	Total Acres	Average of DU/Gross Acres
A1	6242	6433	75,814	0.0849
B1	34	35	47	0.7475
B2	37	39	62	0.6305
B3	10	10	31	0.3242
FC	360	371	16,250	0.0228
M1	7	7	93	0.0754
M2	2	2	3	0.7198
M3	9	10	242	0.0414
R1	3948	3962	3,601	1.1001
R2	211	213	124	1.7192
R3	260	262	64	4.1202
RR	1260	1280	2259	0.5666
SC	1	1	2	0.6474
TOWN	986	1002	789	1.2703
Total	13,367	13,627	99,379	

Source: Botetourt County GIS Parcel Information, 2009

Table 32 provides information about parcels that are either undeveloped or not developed with a residential dwelling. These tables indicate that most of the land in the County is zoned A-1, agricultural, followed by Forest Conservation (FC) and that there are areas zoned for residential development that have not been improved to date.

Table 32 - Land Use Analysis (Parcels With Dwelling Units – DU < 0)

Current land use per zoning (parcels with no dwelling units)			
ZONING	Number of Parcels	Average Acres	Total Acres
A1	5333	31	164,189
B1	78	2	178
B2	190	2	469
B3	52	2	115
FC	471	156	73,540
M1	80	7	527
M2	75	13	988
M3	92	45	4,109
POP	2	152	304
R1	931	1	1,235
R2	153	0	70
R3	71	1	71
RR	899	1	959
SC	28	4	102
TND	1	118	118
TOWN	929	1	1,006
Total	**9,385**		**247,980**

Source: Botetourt County GIS Parcel Information, 2009

Implications of Existing Zoning

The following tables and graph (Table 33, Table 34, Table 35, and Table 36) describe how the current population of the County is distributed by zoning category and provide an assessment as to whether or not the County can accommodate projected population growth based on current zoning patterns. This assessment is based on three assumptions: the current number of persons per household of 2.4 is maintained in the future, the average number of dwelling units per acre remains consistent with current development patterns and existing densities in each zoning category, and that no additional land is zoned for residential use. The estimated persons per household figure is based on the most recent estimate of population available from the Weldon Cooper Center, divided by the County's estimate of total dwellings based on GIS and tax assessment information. Table 33 provides the analysis of how the person per dwelling unit has been estimated.

The 2.4 persons per dwelling unit figure and the zoning information included in Table 34 can be used to develop a rough estimate of population distribution by zoning category (Table 34 and Table 35). Table 35 demonstrates the capacity of the County to accommodate projected population increases based on existing zoning. This simplified capacity analysis indicates that Botetourt County has sufficient amounts of residentially zoned land to accommodate the additional 6,000 anticipated by VEC forecasts by the year 2030. Table 36 provides an estimate of total population distribution in each residential zoning category by decade to the year 2030.

Table 33 – Population Per Dwelling Unit Estimation Method

Estimation of Population Per Dwelling Unit (DU)	
Population 2008 (provisional Weldon Cooper Center/US Census)	32,261
Percent Change 2007-2008	1.5%
2009 Estimated Population	32,745
Current Dwelling Units (Source: Botetourt GIS Parcel Database)	13,689
Average persons per household (DU) 2009	2.39

Sources: US Bureau of the Census; American Community Survey, 2008

Figure 7 – Current population distribution per zoning (based on 2.4 Persons/DU)

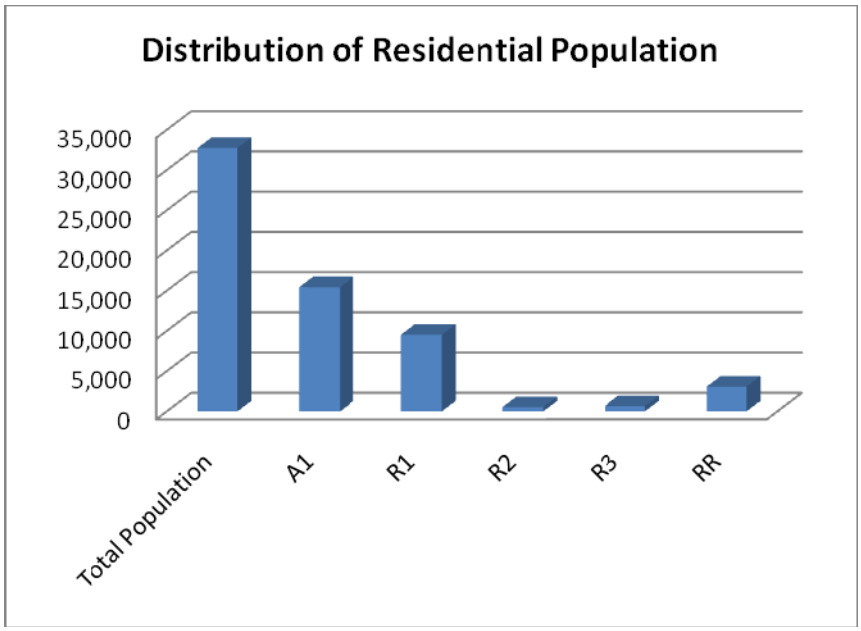


Table 34 - Current Distribution of Population per Zoning Category

Current Distribution of Population Relative to Residential Zoning Categories *(based on 2.4 Persons/DU)*		
Zoning District	Population	Percentage
Total Population	32,745	100.0%
A1	15,439	47.1%
R1	9,509	29.0%
R2	511	1.6%
R3	629	1.9%
RR	3,072	9.4%

Source: Botetourt County GIS Parcel Information, 2009

Table 35 - Available Population Growth Capacity per Zoning Category

Potential Population Capacity based on existing Zoning *(based on 2.4 Persons/DU)*		
Zoning	Available Population Capacity	Percentage
A1	N/A*	N/A*
R1	2,963	9.0%
R2	167	0.5%
R3	169	0.5%
RR	2,302	7.0%

**While still allowed where appropriate, it is assumed that if the policies set forth in this plan are implemented, that little or no additional growth would occur in the Agricultural zoning category.*

Table 36 – Population Forecast Per Zoning Category, VEC Forecasts

Projected Population by Zoning District – Virginia Employment Commission Projection						
	Total Population	A1	R1	R2	R3	RR
2009*	32,745	18,676	9, 525	125	2,926	1,494
2010	33,156	18,910	9,644	126	2,963	1,513
2020	35,756	20,393	10,401	136	3,195	1,631
2030	38,437	21,922	11,180	146	3,434	1,754

Based on housing growth trends during past five years
**Estimate based on 2008 census estimate and growth from 2007 to 2008*

Residential Development Activities

The following tables provide an overview of housing activity since 1999. The information is divided into three tables: residential development between 1999 and 2004, residential development after 2005 and residential development for the entire period from 1999 to 2009. Growth since 2005 has shifted slightly to Residential R-1 which might indicate a preference for a conventional suburban development pattern. Whether this trend will continue in the future will depend on factors that are beyond the County's control such as land values, the economy, lending regulations, and the price of gas as well as factors such as whether or not the County wants to implement policies that encourage other development patterns.

Table 37 – Housing Units Built Per Zoning Category (1999 to 2004)

Housing Units Built Per Zoning (1999 to 2004)					
Zoning	Number of Parcels	Total Acres	DUs	Average DU/Acre	Percentage of Growth
A1	885	7,693	900	0.12	61.3%
R1	368	2,574	375	0.15	25.5%
R2	16	1,077	16	0.01	1.1%
R3	76	52	76	1.46	5.2%
RR	102	576	102	0.18	6.9%

Table 38 – Housing Units Built Per Zoning Category (2005 to 2009)

Housing Units Built Per Zoning (2005 to 2009)					
Zoning	Number of Parcels	Total Acres	DUs	Average DU/Acre	Percentage of Growth
A1	277	2,458	300	0.12	57.0%
R1	153	127	153	1.20	29.1%
R2	2	5	2	0.38	0.4%
R3	47	11	47	4.17	8.9%
RR	24	42	24	0.58	4.6%

Table 39 – Housing Units Built Per Zoning Category (1999 to 2009)

Housing Units Built Per Zoning (1999 to 2009)					
Zoning	Number of Parcels	Total Acres	DUs	Average DU/Acre	Percentage of Growth
A1	1,162	10,151	1,200	0.12	60.2%
R1	521	2,702	528	0.20	26.5%
R2	18	1,082	18	0.02	0.9%
R3	123	64	123	1.94	6.2%
RR	126	617	126	0.20	6.3%

Map 7 (Recent Residential Growth Since 1999) and Map 8 (Residential Densities) provide information about where residential development has occurred over the past 10 years. Generally, new residential development has been scattered along rural roads and in some instances, adjacent to areas of existing development.

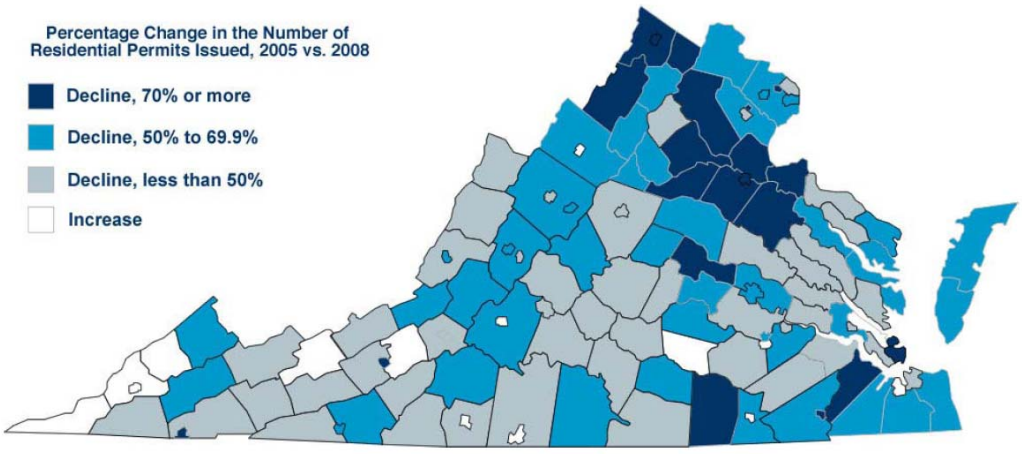
Building permit data for the County (Table 40) indicates that there has been a decline in residential construction activity since 2005, and that development levels in 2009 were at a 20 year low. This trend was evident Statewide as shown in Figure 8.

Table 40 – Annual Building Permits, Botetourt County

Number of Annual Building Permits							
Year	New Res. Const. Units	Commercial Incl. Add. & Alter.	Residential Add. & Alter.	Misc.	Electric, Plumbing & Mech.	Number Inspections	Const. Costs $$$$ Value
1984	169	8	124	123	952	2002	$ 11,444,426
1985	176	14	169	95	1033	2704	$ 12,881,769
1986	205	19	215	125	1576	3679	$ 17,563,823
1987	189	57	119	231	1318	3245	$ 21,219,672
1988	201	38	173	366	1396	3755	$ 21,127,164
1989	156	43	250	229	2075	3529	$ 19,523,163
1990	230	42	335	269	2289	3825	$ 24,300,130
1991	235	55	321	215	2324	4160	$ 28,533,244
1992	257	45	315	191	2292	3893	$ 28,677,924
1993	281	27	387	236	2486	4503	$ 30,555,162
1994	290	13	361	341	2608	5446	$ 39,633,084
1995	249	20	348	336	2525	4874	$ 49,205,658
1996	226	46	282	355	2306	4814	$ 50,321,772
1997	216	21	341	326	2428	5119	$ 45,149,167
1998	228	43	360	269	2374	5858	$ 43,877,716
1999	230	26	404	223	2377	6058	$ 76,217,138
2000	253	45	390	93	1401	5911	$ 53,015,291
2001	275	79	304	31	1288	5636	$ 53,499,117
2002	208	84	281	77	1238	6697	$ 41,761,938
2003	276	66	232	140	1477	6302	$ 71,541,928
2004	237	85	175	239	1840	7536	$ 88,126,958
2005*	277/32	59	191	119	1819	7791	$ 84,644,900
2006	194/33	82	201	165	1813	7735	$ 89,191,822
2007	142/33	90	142	177	1405	6867	$ 48,594,897
2008	102/25	109	184	131	1131	5826	$ 58,311,790
2009	63/19	76	170	118	942	4885	$ 25,595,941

**Starting 2005 the tabulations depict new residential units/manufactured units*
Source: Botetourt County Building Department, 2009

Figure 8 – Building Permit Percentage Change Statewide (2005 vs 2009)



Future Land Use Map

The Future Land Use Map (Map 9) depicts areas of the County that have been designated for future residential and commercial growth as well as areas for agriculture and conservation. The Future Land Use Map serves as a general guide for both public and private sector decision-makers who will shape future development of Botetourt County. The map serves as a guide for the Planning Commission and Board of Supervisors when planning public facilities, or evaluating land development applications. The map also serves as a guide to investors, businesses and citizens to indicate what areas of the County are appropriate for development.

This map presents a generalized overview of desired land use patterns within the County. The map is not intended to be parcel specific. The specific location of future land uses and the appropriate mix of uses in any given area will be determined as part of the development review process, subject to the standards of the Zoning Ordinance, at such time as the Planning Commission and Board of Supervisors review specific land use requests. Such review will consider the compatibility and benefits of the use, and the land use impacts of a specific use on the surrounding neighborhood and larger community.

Seven future land use categories are shown on this map. They are:

Federal Lands
This category designates National Forest lands.

Conservation/100 Year Floodplains
This category includes steep slopes, lands protected by conservation easements, 100-year floodplains, and properties that are within the Carvins Cove watershed. Future development in these areas should be prohibited or extremely limited.

Agricultural
This category includes land areas in the rural portions of the County where agricultural and forestal uses are the dominant land use. Large lot single family development may now exist within some of these areas. Future development of these properties at densities higher than allowed by the current agricultural zoning is not encouraged.

Rural Low Density Residential
This category includes areas where larger lot residential development is encouraged, as a transition between the County's agricultural and medium density residential areas. Such development generally lacks public water and/or sewer.

Medium Density Residential
This category includes areas where suburban patterns of residential development have occurred and are encouraged to occur in the future. Although single family homes are the predominant land use in this category, higher density residential development such as townhomes and apartments may also be suitable. Allowable future densities in these areas should be based upon the availability and adequacy of public facilities and the compatibility of the proposed land use with surrounding properties. Public water and/or sewer typically serve or are planned for these areas. Most of these areas are and will be located in the southern portions of the county.

Commercial
This category designates areas where commercial developments have occurred and where future commercial developments are encouraged. Public water and sewer is generally available or planned for these areas.

Industrial
The industrial land use category is designated to show those areas where major industrial activities exist and/or are planned.

GOALS, OBJECTIVES AND POLICIES

Land Use Goals

- To achieve a balanced land use system that provides sufficient and compatible land areas for all community land use needs, while protecting sensitive natural environments, and important local historic and cultural resources.
- To promote Urban Development Areas in the place or places where a variety of land uses, facilities, and services exist and are planned to support the County's future growth, with emphasis placed on infill development.
- To enable well-planned, coordinated, and sustainable development to occur throughout the county.

Land Use Objectives

- Minimize adverse impacts of growth on rural character.
- Promote a strong and diversified tax base through diverse zoning.
- Protect rural residential areas and prime agricultural lands from future growth.
- Protect sensitive environmental areas and historic and cultural resources.
- Discourage scattered development patterns which are incompatible with the County's ability to provide adequate and cost effective public services and facilities.
- Enhance the rural character of the County through the preservation of agricultural and forestal lands.
- Implement appropriate policies and procedures to provide reasonable protection to the Blue Ridge Parkway and Appalachian Trail.
- Adopt and maintain appropriate land use ordinances and voluntary programs designed to guide and implement the provisions of this comprehensive plan.
- Coordinate review of joint development plans and concepts with incorporated towns.
- Promote and encourage commercial, residential and limited light and small industrial growth in areas in close proximity to the towns, where appropriate services and infrastructure are available.

Land Use Policies

- Consider the intent and policies contained in this comprehensive plan, and the plan's future land use map when evaluating development proposals requiring a public hearing.
- Continue to develop the County's economic base so that tax rates can be maintained and desired services can continue to be provided to all property owners.
- Zone appropriate areas for industrial, commercial and office growth.
- Large residential, commercial and industrial development proposals should only locate in areas planned for such use, where there are adequate public facilities, and where the transportation system can accommodate the demands of the new development.
- Encourage commercial and office uses around existing incorporated towns and villages.
- Infill development should be encouraged in south County areas, so that existing infrastructure can be more efficiently used, and rural and agricultural lands can be deferred from development.
- Encourage infill development where infrastructure exists, as well as in and around incorporated towns.
- Direct growth toward areas designed to accommodate such growth.
- Periodically review the County's zoning and subdivision ordinances to ensure that they are relevant tools to achieve local land use objectives and are in conformance with policies contained in this plan.
- Work with the National Park Service and Blue Ridge Parkway staff to develop local procedures and standards to protect critical Parkway viewsheds and achieve an appropriate development character at Parkway interchanges.

- Encourage the conservation and preservation of major historic and archeological sites. Continue to provide comment on potential new sites within the County.
- Continue to incorporate innovative development techniques into zoning and subdivision ordinances, such as cluster developments and conservation subdivision design.
- Discourage scattered development patterns through zoning incentives.
- Review existing and potential incentives and development standards to ensure that opportunities for rural preservation and compact development are used effectively.
- Encourage the use of conservation easement programs at the discretion of private land owners to promote preservation of key rural areas in perpetuity.
- Allow and encourage residential cluster development to maintain larger tracts of open space in rural areas; amend the county's current subdivision and zoning ordinances to provide incentives for clustering in rural areas. A common incentive for clustering is a density bonus or bonuses (residential and non-residential) which provide an increase in density correlating to the amount of open space set aside.
- Encourage mixed-use centers that should be comprised of well-mixed and integrated developments that avoid segregated uses and have well planned public spaces that bring people together and provide opportunities for active living and interaction.
- Promote the development of mixed-use activity centers with multi-modal transportation connections to provide convenient and accessible residential and employment areas.
- Coordinate with the towns to create more uniform zoning regulations in the towns and surrounding county areas.

IMPLEMENTATION STRATEGIES

The land use policies of this plan are based on two key strategies: directing growth to appropriate areas and reducing development pressures to convert farmland to higher intensity uses. The County's desire to maintain a balance between development and preservation objectives is obvious in the way the Future Land Use Map has been drawn.

The Future Land Use Map should be used as a general guide for future county development patterns. More specific guidelines for development or programs and strategies for encouraging alternative development types, encouraging preservation of farmland and managing the timing and location of growth can be pursued by the County as deemed appropriate subject to the framework of this Comprehensive Plan. Some examples of programs that the County might wish to explore after adoption of this plan include:

Farm Land Protection and Environmental Preservation Initiatives

Purchase of Development Rights (PDR's)

A purchase of development rights (PDR) program enables a locality to purchase conservation easements from property owners to promote limited development. PDR programs offer key advantages to both the landowner and the community. The landowner gets to keep the land, and receive financial compensation for foregoing development. The advantage to the community is reduced development in priority preservation areas.

The goal of the program is to preserve and protect farm and forested lands through perpetual easements. The protected land base will help to ensure that farm and forested lands will be available for future generations to maintain a viable agricultural industry for Botetourt County. By preventing development in the rural areas of the County, tremendous savings are realized by offsetting infrastructure costs. PDR prevents the need for new roads and improvements, public services such as police, fire and EMS, new schools, libraries, and trash collection. The American Farmland Trust Cost of Community Services studies conducted over the past two decades show working lands generate more public revenues than they receive back in public services. Their impact on community general funds is similar to that of other commercial and industrial land uses. Agricultural lands require very few city services and generate positive tax revenue, thus they actually subsidize the residential development. Several localities in Virginia have adopted PDR programs.

A local PDR program can be funded through a variety of mechanisms. These include a line item in the local budget, general revenue, roll-back taxes, a specific local tax, grants, and dedication of a particular windfall.

Agricultural/Forestal Districts

An Agricultural and Forestal District (AFD) is enabled by State law and subject to provisions of the State Code. An AFD is a voluntary agreement between farmers and the local government to maintain land in farming for a set term. When a district is established, landowners agree not to convert their farm or forest land to development for a period of between 4 and 10 years. In return, the locality offers reduced tax rates, protection from nuisance suits, and consideration of the district in local land-use planning. The Commonwealth also agrees not to take actions or make infrastructure investments that will place increased pressure on landowners to convert land.

Basic criteria for AFD's are as follows: 1) they are initiated by landowners voluntarily; 2) a district must have a core of at least 200 acres in one or more contiguous parcels, 3) parcels can be included in the district if their closest boundary is within one mile of the core, or if they are adjacent to a parcel that is in the district, and 4) part or all of a parcel can be enrolled.

Conservation Reserve Program (CRP)

Although not well known to many local government officials, this program is the federal government's single largest environmental improvement program. It is administered by the United State's Department of Agriculture's (USDA) commodity credit corporation (CCC) through the Farm Service Agency (FSA). Established in 1985, the CRP encourages farmers to voluntarily plant permanent areas of grass and trees on land that needs protection from erosion, to act as windbreaks, or in places where vegetation can improve water quality or provide food and habitat for wildlife. The farmers must enter into contracts with the CCC lasting between 10 and 15 years. In return, they receive annual rental payments, incentive payments for certain activities, and cost share assistance to establish this protective vegetation.

Riparian Easements

A riparian easement is a special type of conservation easement that applies only to a streamside or riparian zone mutually agreed upon by the landowner and the easement holder(s). Like all easements, a riparian easement is a legal agreement in which the landowner retains ownership and full control of the property, yet conveys certain specified rights to the easement holder(s). Specifically, the landowner agrees to restrict uses that would harm the riparian zone and works with the easement holder to develop a management plan to ensure riparian zone protection. Typically this is done by establishing and maintaining vegetation and limiting livestock access to the stream. Each easement is tailored to the property and the desires of the individual landowner. Again, depending upon the terms and timing of the riparian easement, significant tax savings can accrue to the owner granting the easement.

Conservation Reserve Enhancement Program (CREP)

CREP is a voluntary initiative using state, federal, and non-governmental funding to help solve environmental problems. The objective is to share costs and resources to address specific local environmental problems in a designated target area. Specific financial incentives encourage farmers to enroll land in targeted areas in CREP contracts for designated environmental practices such as riparian buffers, grass filter strips, or wildlife habitat. Incentives can include cost-share assistance for establishing the designated practices, special rental rates, or one-time payments. A landowner may establish both a CREP contract and a riparian easement on his/her property, reaping the benefits of both programs.

Voluntary Conservation Easements

In 2010, over 15,423 acres of land in Botetourt County were protected by voluntary conservation easements (Map 10 – Conservation Easements). A conservation easement is a legal agreement by which a landowner retains ownership of property while conveying certain specified rights to the easement holder. Conservation easements are usually given to a non-profit, charitable land conservation organization or a public entity. Easements can be tailored to meet the owner's wishes regarding the future use of his/her land. They can be for a specific time period, or can be granted in perpetuity. Typically a conservation easement restricts development or uses that would destroy natural, scenic, or historic areas while at the same time allowing other traditional uses such as farming. Depending upon the terms and timing of the easement, significant tax savings can accrue to the property owner granting the easement. The County should continue to develop its easement program in conjunction with other rural land preservation efforts.

Design and Development Patterns Initiative

1. Land Use and Transportation Coordination

Outside of the town cores, the majority of Botetourt County population lives, works, and socializes within an auto-dependent land use framework. To reduce vehicle miles traveled and improve the quality of land development, Botetourt County should implement land use and transportation coordination policies that focus on shortening trips and encouraging more pedestrian, bicycle, and transit-friendly communities within and adjacent to mixed-use centers and corridors or accessible to them via sidewalks, trails, or transit. It also directs growth to areas with development capacities that are less congested.

- **Coordinate Transportation Investments with Land Use**
  Ensure that transportation decisions, strategies, and investments are coordinated with and support the County's land use objectives.

- **Transportation in Support of Walkable Neighborhoods**
  Make the design and scale of transportation facilities compatible with planned land uses and with consideration for the character anticipated by this Comprehensive Plan for the surrounding neighborhood.

- **Directing Transportation Investments**
  Target transportation facilities, services, and investments to promote and accommodate the growth this Comprehensive Plan anticipates in mixed-use centers, commercial corridors, and residential neighborhoods while reducing reliance on single occupancy vehicles.

- **Reducing VMT Through Mixed Use**
  Promote mixed-use development that provides a range of services within a short distance of residences as a way to reduce the growth of vehicle miles traveled (VMT).

- **Connectivity**
  New development and redevelopment should provide pedestrian and vehicular connectivity between individual development sites to provide alternative means of access along corridors.

Growth Areas and Urban Development Areas

The key to Botetourt County's future growth management will be accommodating population growth in a way that avoids sprawl. Growth areas are a way that the County can address reducing low-density development, both residential and commercial. Identifying growth areas helps a locality align both its development regulations and its capital improvements program toward guiding new development into specific locations. The underlying principle is to limit infrastructure improvements to growth areas. This lessens the likelihood of sprawl and increases demand for the land that the locality is prepared to serve with utilities. Growth areas may be jointly designated by a town and county in the form of joint development areas. Potential detriments to Growth Areas involve artificial escalation of property values in targeted areas while prices fall elsewhere. Keys to delineating successful growth areas include:

- Water and sewer limited to designated boundaries
- Zoned for density
- Priority for infrastructure funding
- Detailed plan for growth (i.e., streetscapes, parks, roads, joint developments plans)

As part of the Transportation Act of 2007, Section 15.2-2223 of the Code of Virginia was expanded to include new requirements that certain fast growing localities, including Botetourt County, must include at least one Urban Development Area (UDA) within their boundaries. According to the new legislation, a UDA is an area located close to a city, town or other developed area that is designated as appropriate for higher density development due to its proximity to transportation facilities and to public or community

sewer and water systems. The language further states that development within the UDA shall provide for reasonably compact development with residential densities of "at least" four units per gross acre and commercial densities of "not less than" 0.4 F.A.R (floor area ratio) per gross acre. Finally, the UDA or UDAs must be of sufficient size to accommodate projected commercial and residential growth for at least 10 years but not more than 20 years.

The State code allows comprehensive plans to include incentives for development in UDAs and state and local funding for transportation improvements, housing and economic development shall be directed to UDAs to the extent possible. Localities subject to the new legislation are now also required to incorporate new urbanism design principles such as pedestrian friendly roads, interconnected road and pedestrian networks, stormwater management, preservation of natural areas, mixed use neighborhoods with a mix of housing types and reduced yard setbacks and street widths in their comprehensive plans.

Design Standards

Many localities are moving toward comprehensive plans and zoning ordinances that emphasize the physical form of development over use, reflecting planning trends like Neo-traditional design and New Urbanism. This approach incorporates traditional land use concepts like use type, density and intensity but relates them to physical form and character. Virginia has even embraced and mandated the use of these principles in the new UDA legislation described above. These concepts may be beneficial to Botetourt County as a means of further refining the Future Land Use Map included in the Comprehensive Plan and to ensure that the County satisfies the new UDA legislation.

Good design ensures attractive, usable, durable, and adaptable places and is a key element in achieving sustainable development. Good design is indivisible from good planning. Design standards influence the physical form of the County and how residents experience public spaces such as streets, parks, or civic spaces. While individual buildings may be attractive in themselves, there are numerous other design elements that contribute to the organization of a space including architectural design, building placement, height, scale, and open space. The cumulative interaction of these design elements and adjacent buildings in organizing public space is vital for achieving an environment that supports and promotes social interaction and protection of community character. As discussed throughout this plan, Botetourt County has many of the physical components that contribute to a successful and vibrant community, but it continues to grapple with issues of maintaining its identity and attractiveness. General design guidelines that help promote coordinated and high quality development and enhance the public realm and the County's image. Listed below are some strategies that the County and private developers can implement to largely determine the physical form of the County.

- **Identity through corridors:** Ensure community identity by enhancing the aesthetic qualities of Botetourt County's corridors with a high-quality built environment, greenway network, and preserving its natural landscapes and scenic resources.

- **Identity through places:** Eagle Rock, Town of Fincastle, Town of Troutville, and the Town of Buchanan are just some examples of communities with unique identities that are impacted by growth of the County. The recent historic survey contains many buildings that offer a window into the architectural heritage of the County's various communities. By identifying characteristics that make the communities distinctive could help in establishing Botetourt County's identity.

- **Creating Attractive Facades:** Well-designed building facades, storefront windows, and attractive signage and lighting should be used to create visual interest. Monolithic or box-like facades should be avoided to promote the human quality of the place and street.

- **County Gateways:** Create more distinctive and memorable gateways at points of entry to the County, and points of entry to incorporated towns, individual neighborhoods and neighborhood centers. Gateways should provide a sense of transition and arrival, and should be designed to make a strong and positive visual impact. This type of approach is exemplified by the need for a more designed and attractive gateway at I-81 Exit 150.

- **Zoning to Achieve Design Goals:** Explore zoning and other regulatory techniques to promote excellence in the design of new buildings and public spaces. Zoning should include incentives or requirements for facade features, buffering, and other exterior architectural elements that improve the compatibility of structures, while promoting a consistent architectural character.

- **Mixed Use:** Mixed-use developments are the future of dense planning in rural communities. They are efficient in terms of land use and service delivery. There are several design standards associated with promoting mixed use land development.

    - **Building Orientation:** Buildings in mixed-use developments should be oriented along streets, plazas, and pedestrian ways. Their facades should create an active and engaging public realm.

    - **Multi-modal Design:** Mixed-use developments should accommodate all modes of transportation to the greatest extent possible.

    - **Parking Location and Design:** New single purpose surface parking lots should be avoided within mixed-use centers. Instead, shared parking facilities with landscaping visible from a public right-of-way should be used.

    - **Public Open Space:** Usable and well-appointed public open space should be provided within mixed-use centers to serve as focal points and community gathering spots.

- **Corridors:** The appearance of Botetourt County's commercial corridors, specifically U.S Route 220 (including U.S. Route 220 Alternate), U.S. Route 460 and Route 11, has been detrimental to the larger community's image. As primary entry corridors for visitors to the County, it is essential that these roadways convey a positive impression. At many points along these corridors, there is also a need to mitigate air and noise pollution. The creation of boulevards with landscaped medians, street trees, and sidewalks will greatly improve the appearance of Botetourt County's corridors, mitigate air and noise pollution, and address the needs of users.

    - **Gateway Corridor Design Quality:** Promote high quality development along gateway corridors to improve aesthetics and encourage higher levels of investment. Design of new development should contribute to the overall visual quality of the corridor and define the street space.

    - **Highlighting Important Intersections:** Promote the use of gateways and landmarks to highlight access points and important intersections along key corridors.

    - **Strip Shopping Centers:** Ensure that zoning and parking standards discourage strip commercial shopping centers and auto-oriented building designs (designs that encourage use of automobile as the only possible mode of access).

    - **Screening of Unsightly Uses:** The visibility of trash storage, loading, and truck parking areas from the street, sidewalk, building entrances and corridors should be minimized.

    - **Parking Lot Design:** Encourage efficient site design, shared parking between complementary uses, and reduced amounts of impervious surface in parking lot design.

    - **Planting Requirements:** Enhance and expand the required planting and tree coverage for parking lots by incorporating design standards that promote long term tree growth and health. Planting standards should improve permeability and reduce the heat island effect.

Streetscape Design Standards

Streetscape design refers to those elements of roadway design that affect street users and nearby residents. Streetscapes can have a significant effect on how people perceive and interact with their community. If streetscapes are designed in a way that is safe and inviting to pedestrians, people are more likely to walk, which can help reduce automobile traffic, improve public health, stimulate local economic activity, and attract residents and visitors to a community. Applied to I-81, at Exit 150, streetscape design standards can greatly improve the aesthetics and sense of safety for the area surrounding the interchange. This would improve the gateway into the Botetourt community from the south, and help change the overall character of land uses. Visually cohesive streetscapes use a variety of techniques including landscaping, undergrounding of utilities, and other streetscape improvements along street frontages that reflect adjacent land uses.

Residential Cluster Development

Cluster development promotes the preservation of open space by allowing smaller lots to be grouped on a portion of a larger parcel. The remainder is set aside as 'open space.' For example, a 100-acre parcel at a base density of 1 dwelling unit per 5 acres and a minimum lot size of 1½ acres would result in 30 developed acres (putting 20 residences on 1½ acre lots) and leaving an undeveloped residual of 70 acres. The residual acreage can be available for continued farming, or it can be incorporated into the development as common open space.

Localities can set different standards to achieve goals through cluster development. For example, in agricultural zones, the emphasis might be on maintaining a sizeable contiguous area to enable continued farming or forestry. Other ordinances may specify that environmental features be protected. Also, provisions might address the suitability of the reserved open space to ensure that it is usable and appealing for common open space. All of these strategies recognize that the open space and key vistas on-site should be 'designed' in their own right, to serve specific purposes, rather than merely be the 'leftover' portion after house sites are chosen.

One variation for open space design involves instituting minimum open space requirements. Some communities have varying minimum open space requirements for various zoning districts, including multi-family and commercial. The benefits of clustering include the opportunity to protect natural areas, scenic views, and other assets during development as well as somewhat reduced land consumption.

Scenic Resource Initiatives

Preserving scenic views and vistas is particularly important for Botetourt County. The County's scenery is critical to the rural character and is one of its most distinguishing features. The Blue Ridge Mountains are a national attraction and derive their popularity from spectacular views. Tourism and nature-based leisure draw on the beauty of the region and have significant economic impact. Furthermore, County residents value the beauty of their natural surroundings on a daily basis.

Keys to Preserving Scenic Views

- Maintain farmland and forestland
- Develop corridor plans and overlay districts
- Minimize the visibility of wireless communication towers and other tall structures
- Use scenic designations (like Virginia Byways and Virginia Scenic Rivers)
- Site rural buildings to their context
- Use viewshed easements around particularly important sites
- Limit ridgeline development
- Use open space development designs

Mixed Use

The resurgence of mixed-use downtowns, employment centers, and retail centers is a national development trend that is evident in recent developments like Daleville Town Center. Mixed-use centers bring together medium- to high-density residential and non-residential uses within a walkable, bicycle-friendly, and/or transit-accessible development framework. Uses can be mixed vertically, within buildings; or horizontally, when tightly clustered in a pedestrian-friendly arrangement. Due to the diversity of uses and activities, mixed-use centers are typically vibrant destinations that attract attention due to their level of activity. Fundamentally, a mixed-use center should provide a full service environment and diverse land uses (residences, offices, retail, service, entertainment, civic, and open space) for residents, employees, and visitors. Further, mixed-use developments and mixed-use target areas (Map 11- Future Mixed Use Target Areas) should be coordinated with the implementation of water and waste water infrastructure. While mixed-use developments help reduce overall infrastructure costs, such as less demand of daily traffic on the road network, the demand for water resources does not change with a diversity of land uses. Botetourt County should coordinate the approval of mixed-use developments with the provision of water resources.

Some effective mixed use aspects are listed below.

- **Composition of Mixed-Use Centers**
  Mixed-use centers should be comprised of well-mixed and integrated developments that avoid segregated uses and have well planned public spaces that bring people together and provide opportunities for active living and interaction.

- **Complementary Uses and Urban Vitality**
  A complementary integration and mixture of land uses should be provided within regional, county, and community mixed-use centers to maintain the County's livability, manage future growth, and provide walkable and transit accessible destinations. An example of this is the potential future development of I-81 Exit 150.

- **Mixed-Use and Multi-Modal Transportation**
  Promote the development of mixed-use activity centers with multi-modal transportation connections to provide convenient and accessible residential and employment areas.

- **Zoning Standards for Mixed-Use**
  Revise the Zoning Ordinance to modify setback and buffering to the site design requirements within designated mixed-use centers and mixed-use zoning districts to ensure compatibility and encourage dynamic communities.

<u>Future Mixed Use Target Areas Mapping Categories</u>

Listed below are some possible future mixed use categories that may be identified on a future land use map (Map 11- Future Mixed Use Target Areas) that indicate areas desirable for mixed use development.

Town Edge Mixed Use
This category applies to shopping and pedestrian-oriented retail districts located near at the edge of existing incorporated towns, such as commercial growth just south and north of Fincastle. The service area of these districts is generally about a two-mile radius or less. Typical uses would include corner stores or convenience stores, restaurants, bakeries, supermarkets (other than super-stores/centers), drug stores, dry cleaners, small professional offices, retail banking, limited light industries and similar uses that serve the immediately surrounding neighborhood. While this is primarily a commercial category, mixed-use projects with mixed residential types are also supported by this designation.

Multiple zoning districts could be developed for this category in the future, recognizing that some of the designated areas are connected with established "main streets" and others are auto-oriented shopping plazas or strip centers.

Mixed use centers have not been identified for the town edges of Buchanan and Troutville. Because this plan only identifies land use strategies for the areas within the county boundaries, it does not include recommendations for the incorporated towns. If the county was to identify mixed use target areas at the town-county edge of Buchanan and Troutville it would encourage a form of "leap frog" development that skips developing within the town limits. This would create a disconnection within the incorporated towns, as well as be counterintuitive to the purpose of mixed use. Mixed use at the edge of these towns should only occur once the towns believe they have reached development capacity within the town limits. Further, each town should consider including mixed use target areas within the town limits that encourages similar mixed-use development encouraged in the county.

Community Mixed Use
This category applies to medium-sized shopping centers and larger pedestrian-oriented retail districts, such as the Daleville Town Center. Typical commercial uses include supermarkets, medium sized department stores and variety stores, clothing stores, banks, offices, restaurants, and similar uses that draw from multiple neighborhoods. Development intensities could be higher than in Town Edge areas, with mid-rise buildings as well as low rise buildings. Where residential development occurs, ground floor retail would be encouraged and minimum density standards might be applied. Multiple zoning districts could be developed for this category in the future, recognizing that some of the designated areas are established neighborhood "main streets" and others are corridor auto-oriented shopping plazas or strip centers. Although housing would be allowed in all cases, there could be greater incentives for "vertical mixed use" that adjoin future transit nodes (such as service from an express route), or are on traditional "walking" streets.

Regional Mixed Use
This category applies to potential regional nodes, like I-81 Exit 150, where future land development targets regional retail markets. The intent is to identify the major retail and service hubs that draw customers from across the county and adjoining counties. These areas may include high-density housing, office development, hotels, movie theaters, and region-serving retail uses such as department stores and specialty stores.

Railroad and Land Use Access Study

The cost-effective movements of incoming material to be processed and the outgoing finished products destined for domestic and international markets are vital to the industries in Botetourt County. A key component to providing manufacturers with low cost freight transportation access is rail service. A study of the potential land available for industrial use and railroad access would offer a general assessment of a rail line connection between the mainline track and potential or existing industrial locations. The study should include three main goals: (1) Identify feasible industrial land use locations that can be served by active railroad alignments; (2) an estimate of potential rail shipment capacity; and (3) infrastructure considerations for land uses not yet identified in the comprehensive plan for industrial purposes. Some steps to be considered for the study include:

1. Property Study – Perform a traffic and business development study of the entire railroad alignment in Botetourt County. This includes existing industries and the potential for new railroad traffic development with those industries.
2. Industrial Site Locations – Develop a list of industrial sites, reload/transload sites and industrial buildings on and near the railroad alignments. This list will include local zoning assessment, water and waste water infrastructure assessment, and proximity to highways and rail access.
3. Transload/Reload – Identify and prepare a study of transload/reload operators and/or potential distribution clients.
4. Non-Rail Users - Perform traffic and business development study of area non-rail users. Included would be a detailed breakdown of the existing inbound/outbound traffic, existing rail structure and the potential for rail traffic development opportunities.

4 TRANSPORTATION

INTRODUCTION

A community's transportation system is comprised of more than just highways. Air transportation, rail facilities, bikeways, and sidewalks are all elements of an efficient transportation network. Together these elements allow for the efficient movement of people and goods. It is essential that communities continually plan for the construction and enhancement of these transportation elements. Doing so allows for the economic viability of communities to be retained and enhanced.

In addition, it is important to remember the strong reciprocal linkage between land use planning and transportation planning. Transportation planning decisions directly affect community growth patterns and may influence the availability and adequacy of public facilities.

Alternative development patterns, particularly those that promote compact development, can directly influence future transportation needs. For example, development density is a factor in determining which transit modes can be supported to potentially reduce vehicular trips in a community. Similarly, diversity of use – having a mix of different land use types in the same area or site – can reduce vehicle trips by increasing opportunities for walking and biking to nearby destinations. Broader elements of site and community design, such as greenways and increased street connections, also contribute to reduced vehicle travel, reduced congestion on main roads, and relate to the environmental and quality of life goals of the comprehensive plan.

This chapter establishes the framework for coordinating transportation with land use, economic development, the environment and other elements essential to developing a sustainable county plan.

BACKGROUND

Botetourt County's transportation infrastructure provides opportunities for future development and to attract and support economic development because it offers multiple options for moving people and goods. However, the County's ability to invest in necessary transportation improvements will continue to be a challenge over the lifetime of this plan. Developments along primary corridors and on the periphery of the County's developed area will strain existing infrastructure; VDOT funding is limited, and many of the roads in the County are not a priority for expansion or repair. Existing corridors, many of which are moderate-to-high traffic roadways with two to four lanes and no shoulders, cannot adequately handle forecasted travel demand at build-out. Botetourt County's traditional, low-density development pattern has resulted in an auto-dependent transportation pattern that if allowed to continue unchecked, will produce an unsustainable growth in travel demand.

Challenges

Road Network

Botetourt County has an efficient road network design. Interstate 81, U.S. Route 11, U.S. Route 220, and U.S. Route 460 provide excellent access and allow for the efficient movement of people and goods within and through the County. Maintaining and improving roads to keep pace with development as well as keeping roads operating at an acceptable level of service will be challenges the County will face during the timeframe of this plan. Map 12 (Botetourt County Transportation Map) shows the major components of the County's highway network within the region. Map 13 (2005 Level of Service), and Map 14 (2035 Level of Service) show the current and projected Levels of Service for the major corridors in Botetourt County. Levels of Services (LOS) are qualitative measures describing operating conditions of roadways and are given designations from A through F, with A representing the best operating conditions and F the worst. Level of Service C is the generally accepted minimum operating standard for rural primary roadways. Under LOS C conditions, a driver is able to maintain the set speed limit, stopping only for stop signs or signals. When proceeding through a stop sign or green light, the driver is able to return to the set speed limit without delay. A driver may occasionally slow down for cars entering the roadway from intersecting streets or driveways. However, the majority of the trip can be completed without impediment. Maintaining and improving roads to keep pace with development while keeping roads operating at an acceptable level of service will be challenges the County will face during the timeframe of this plan.

Primary Highways

The County's major primary highways, U.S. Route 220, Alternate U.S. Route 220/604, U.S. Route 11, and U.S. Route 460 are critical transportation corridors within the County. These corridors allow for the efficient movement of people and goods, and thus are critical to the County's economic health and quality of life.

These corridors are also gateways into Botetourt County and surrounding communities. Visitors' first impressions of the County are developed partly on the basis of how these corridors function, and how they look. Maintaining and enhancing traffic flow within these corridors is of critical importance to the County. Future development along these corridors should be designed to ensure that it does not impede or further restrict traffic flow, and where allowed by law, new development should be responsible for contributing a fair share toward improvement costs required to maintain or enhance the functionality of the corridor. Generally, future development along Botetourt County's primary highways should increasingly be a mixture of land uses conditioned upon the provision or existence of adequate public facilities, the preservation of highway capacity, and improvements to access control. Specific corridors are discussed below. For each, there is a brief description of the corridor, discussion of desired future corridor development patterns, and policy recommendations for future corridor development. The development recommendations contained in this section are more refined than those found on the Future Land Use Map, and can serve as a more specific and refined guide for decision making.

I-81 Interchanges

Five interchanges are located on Interstate 81 (I-81) within Botetourt County. These interchanges provide ease of access to/from I-81 and, to varying degrees, create opportunities for economic and residential development. The future development potential near each of these interchanges is highly dependent upon natural features such as soils and slope and upon other factors such as zoning, availability of water and sewer, and VDOT access policies.

Exit 150

Exit 150 is the primary interchange of concern in the community. This exit is in southern Botetourt County and is located at the convergence of I-81, U.S. Route 220 North, Alternate U.S. Route 220/604 and Route 11. The exit is the location of a considerable portion of the County's commercial economic base. Traffic congestion occurs daily at this interchange. The existing design, very intense commercial development, minimal access control and high volumes of traffic contribute to the congestion.

Planned improvements to I-81 through the Roanoke Valley will result in significant design changes at this interchange. A recently completed study of this interchange has resulted in a recommendation for operations mitigation, new roadway development, and the acquisition of land that presents new opportunities for Botetourt County to change one of its primary gateways and commercial hubs. As one of the main access points to the County, it will be critical to develop a clear vision for the future land development of the area. A new land use vision will minimize the negative traffic and aesthetic impact of inevitable, future land development.

Maintenance of Road Networks

Although Botetourt County has a well-maintained primary roadway network, secondary roadways are often only in fair condition which can put a strain on safety. The maintenance of acceptable levels of service (LOS) on roadways is essential to preserving and enhancing interregional mobility, increasing transportation efficiency, and coordinating transportation and land development.

Based on the most recent counts supplied by the Virginia Department of Transportation (VDOT) and level of service guidelines provided by the Planning District Commission (PDC), the existing roadway network in Botetourt County provides a generally good level of service for motor vehicle transport. There are, however, three roadway segments in the County that are operating at Level of Service D, where LOS C is considered to be the generally accepted minimum operating standard for rural primary roadways. These segments are U.S. Route 220 from north County line to Fincastle, Fincastle to Daleville Town Center, and Daleville Town Center to I-81 Exit 150. Although these segments are not operating at a failing level of service, minor increases in daily traffic would result in failures.

Transportation and Land Use Coordination

Like many growing counties, Botetourt is experiencing extensive low density suburban growth that has had a negative impact on the overall transportation system. Projects exclusively designed to address automobile congestion are not feasible solutions to the County's mounting congestion and long commutes. Roadway investments must be balanced with investments in other transportation modes, such as public transportation and greenways. In addition, within and surrounding small town nodes it is important to link development to sidewalks and greenways, as well as provide adequate connections to transit.

Public Transportation

Botetourt County is predominantly rural with residents living in small communities or isolated rural areas. The rural nature of the County increases the difficulty of providing adequate transportation alternatives for all residents. Because of the auto-dependant nature of the development pattern, there is an unmet need among elderly, disabled, or economically disadvantaged residents without access to personal vehicles for some mode of transport to medical facilities, jobs, shopping, and other locations. Although countywide public transportation services do not currently exist within Botetourt County, a shuttle bus service for some elderly residents and the senior center is in operation.

Access Management

Traffic congestion has steadily increased over the past five years along U.S. Route 220, south of Fincastle. This increase in congestion is directly related to the level of new development that has occurred, generating more and more automobile trips, some of which are considered local with short connections between destinations. The number of commercial entrances and intersections along U.S. Route 220 exacerbates the issue by creating many conflict points, which in turn cause delays in traffic flow. Designed as an arterial road, U.S. Route 220 was meant for mobility – moving people and goods from one destination to another as efficiently as possible – it was never meant to be a commercial corridor. Without improvements such as access management, mobility along the corridor will continue to deteriorate.

Transportation Analysis

Air Transportation

The Roanoke Regional Airport provides passenger and general aviation facilities for Botetourt County residents and businesses. The airport is located within ten minutes of the southern portions of the County. Currently, four major airlines (Allegiant Air, Delta, United Airlines and US Airways) provide passenger services. The airport is a key element of the County's transportation system and an important County economic development tool. The County's proximity to the airport, via I-81 and I-581 allows convenient access for business travel.

Rail Transportation

Portions of Botetourt County and the Town of Buchanan are served by two railroads: Norfolk Southern and CSX. The Norfolk Southern line provides freight service between Hagerstown, Maryland and Winston-Salem, North Carolina, passing through and serving Buchanan and Southeastern Botetourt County. The CSX freight line follows the north bank of the James River through the County. There are no passenger rail services in Botetourt County or the Roanoke Valley. A variety of passenger rail assessments have been undertaken in the past; however, there are no current plans to provide passenger services to the Roanoke Valley. The closest passenger rail terminal for Botetourt residents is located in Clifton Forge in Alleghany County.

Bikeways

As previously noted, much of the southern portion of Botetourt County is located in the RVAMPO study area (i.e., urbanized area), thus covered in the 2005 *Bikeway Plan for the Roanoke Valley Area MPO*. While much of the growth and development is concentrated in the southern portion of the county, many areas of Botetourt remain rural in nature with low-density development. Growth will likely continue along the rural-urban interface, as the urbanized area expands. However, this growth offers the opportunity to coordinate the provision of bicycle and pedestrian accommodations with development in the area. Botetourt County also has an abundance of outdoor recreation, as well as cultural tourism opportunities. The Appalachian Trail, Blue Ridge Parkway, Bike Route 76, and the James River pass through the county.

Roadways

Interstate 81

Botetourt County is traversed by Interstate 81 from the Rockbridge County line on the north to the Roanoke County line on the south, a distance of 28 miles of interstate highway. Five interchanges serve Botetourt County, providing a major personal travel route and trucking access to areas outside the region and throughout the nation. The Commonwealth of Virginia is currently evaluating improvement options for Interstate 81. Although preliminary or final designs for I-81 have not been determined, all improvement options will likely involve circulation and land use changes at the interchanges within the County, in particular Exit 150.

Future development potential in proximity to each of these interchanges is highly dependent upon natural features such as soils and slope and upon other factors such as zoning, availability of water and sewer, and VDOT access management policies. A considerable portion of the County's commercial economic base is located around Exit 150, located in southern Botetourt County at the convergence of I-81, U.S. Route 220 North, Alternate U.S. Route 220/604 and U.S. Route 11. Design of the interchange itself, combined with very intense commercial development, minimal access control and high volumes of traffic all contribute to daily congestion around the interchange. A recently completed study of Exit 150 resulted in recommendations for operations mitigation and new construction that will transform the character and use of the area, while still maintaining, and hopefully improving, the economic impact.

Primary and Arterial Routes

Arterial routes or primary roads comprise over 110 miles of Botetourt County's transportation network. U.S. Route 460 provides an important east - west connection from Botetourt County, through the City of Lynchburg, to the Hampton Roads region that is vital to commerce within the County. Other primary routes include U.S. Route 11(north - south) which runs parallel to I- 81, U.S. Route 220 North, which provides access to the Town of Fincastle and links I-81 at Daleville to I-64 at Clifton Forge, and Alternate 220/604 linking U.S. Route 460 to I-81 and U.S. Route 220 North. In addition to moving people and goods, the County's primary highways are also gateways into Botetourt County and surrounding communities; visitors' first impressions of the County are developed partly on the basis of how these corridors function, and how they look. Maintaining and enhancing traffic flow within these corridors is of critical importance to the County's economic health and quality of life.

Route 11

Route 11 between the Roanoke County and Rockbridge County lines has three distinct segments:

1. Roanoke County Line to Exit 150
2. Exit 150 to Town of Troutville, and
3. Town of Troutville to the Rockbridge County line.

Roanoke County Line to Exit 150

This segment of U.S. Route 11 is characterized by a combination of commercial and industrial uses. The road design is currently inadequate and needs to be improved. Some large undeveloped parcels also exist in the corridor. Many of the commercial uses/buildings predate the construction of I-81, and lack access control. Multiple curb cuts are present at these commercial properties, creating opportunities for multiple uncontrolled turning movements.

Exit 150 to Town of Troutville

Land uses along this corridor segment transition from commercial (near Exit 150) to residential (near Town of Troutville). Some of the existing commercial development is interstate oriented, while other commercial development has a more rural character, i.e., antique shops and other small businesses. Future development opportunities exist in the corridor, but are limited on one side of the corridor due to the presence of the railroad.

Town of Troutville North to Buchanan and Beyond

North of Town of Troutville, the corridor segment is characterized by low density residential and agricultural land uses. Commercial and industrial uses are very minimal and found in locations around the Town of Buchanan and the interchanges. North of Exit 168 the landscape is even more rural with no commercial or industrial development present.

Alternate U.S. Route 220 from U.S. Route 460 to Route 11

Alternate U.S. Route 220 is a critical transportation corridor connecting U.S. Route 460 traffic to I-81 and U.S. Route 220 North. Land uses in the corridor are characterized by sporadic commercial and industrial development and low density large lot residential development. Current commercial development in the corridor has generally been designed to minimize strip commercial characteristics. Emphasis has been placed on architectural design, landscaping, and signage control, resulting in a pleasing corridor aesthetic. Traffic within the corridor is free flowing, with minimal flow disruption from traffic signals or turning movements. A median currently restricts left hand turning movements except at controlled intersections.

U.S. Route 220 North

This corridor segment begins at Exit 150, extends northward to Fincastle and beyond to the Alleghany County line. A mixture of industrial, commercial, residential and agricultural land uses are found in the corridor, with the heaviest concentration of commercial development located between Exit 150 north to Glebe Road near Daleville. Multiple curb cuts, uncontrolled turning movements, significant commercial signage and minimal landscaping characterize this older commercial area.

A significant amount of vacant land exists in this corridor north of Route 779. Recent developments in the corridor include the Botetourt Center at Greenfield, Ashley Plantation, and other suburban-style residential developments near Fincastle. Greenfield currently defines the northern limit of more intensive development in the corridor. Most of the vacant land in the corridor is zoned agricultural. North of Fincastle, a rural/agricultural land use pattern dominates the landscape with sporadic rural residential development. Commercial uses are few, and rural in scale.

U.S. Route 460

U.S. Route 460 is a four lane median divided highway that traverses southeast Botetourt County from the Roanoke County line to the Bedford County line. It is a major east to west corridor connecting the Virginia coalfields region to Tidewater. Commercial and industrial developments in the corridor, primarily within Roanoke County and Bedford County, have significantly increased traffic in the corridor in recent years. Traffic has also increased due to suburban residential developments in Botetourt County east of Alternate 220.

In Botetourt County, a mixture of land uses can be found along the Botetourt County segment of the corridor, with industrial uses bracketing both ends, at the Roanoke County and Bedford County lines. Commercial nodes exist in the Rainbow Forest and Blue Ridge areas, and multiple residential subdivisions exist off of the corridor, principally north of U.S. Route 460. As previously discussed, a major entrance to the Blue Ridge Parkway is located in this corridor. Land uses around the Parkway interchange are generally either vacant or currently rural in character.

Secondary and Collector Roads

In addition to the primary route network there are over 530 miles of secondary roads within the County. The purpose of these roads is to provide access to adjoining properties and serve as an internal circulation system for residential, commercial, or industrial areas. These routes also are meant to feed into the primary system to provide access to regional facilities. Collectors carry a variety of traffic volumes, but generally carry less traffic than minor arterial routes. On-street parking may be permitted and usually all abutting properties have access to the road.

Transportation Studies

A number of transportation planning studies have been completed that include information and recommendations pertinent to this plan. They are summarized below.

I-81 Interchange Study

Prepared by Roanoke Valley Alleghany Regional Commission - 2008

This study reviewed traffic capacity factors that will influence future land use at Interstate 81 Exits 156, 162, 167 and 168. The study describes existing conditions at each interchange and recommends future land uses, generally. Based on the information provided in the study, Exits 156 and 162 are projected to experience significant increase in traffic volumes by 2020; Exit 167 is being considered for closure and Exit 168 will experience minor increases. For the purpose of the Comprehensive Plan, this information allows Botetourt County to further consider land use planning around each interchange. Conclusions of the study indicate that as development reduces the amount of land available in southern Botetourt County, growth can be expected to move along Routes 220, 11 and Interstate 81.

Exit 156

- Only a slight decrease in LOS, from A to B is projected at this interchange by 2020.
- The VDOT study is projecting no decrease in LOS for the interchange ramps and State Route 640.
- Route 640 traffic volumes on the south side of the interchange - coming from U.S. Route 11- is projected to increase 100% while traffic on the north side is projected to increase 75% by 2020.
- Traffic volumes on the northbound entrance ramp and southbound exit ramp are projected to increase by 100% while the northbound exit ramp and southbound entrance ramp are projected to increase 71% by 2020.

Exit 162

- While Interstate 81 Average Annual Daily Traffic (AADT) is projected to increase 93%, the AADT for the ramps at this interchange are projected to increase from 129% to 140% from 1997 to 2020.
- U.S. Route 11AADT north of the interchange is projected to increase 131% from 1997 to 2020 while still maintaining a LOS of A.
- U.S. Route 11southbound, south of the interchange has a projected AADT increase of 117% and peak hour increase of 280% from 1997 to 2020.
- U.S. Route 11northbound, south of the interchange has a projected AADT increase of only 65% and peak hour increase of 58% for the same time period.

Exit 167

- The VDOT Interstate 81 Improvement Study discusses the potential closing of Exit 167.
- This consideration shows that the elimination of Exit 167 ramps improves operation of traffic on this section of Interstate 81 while having no negative impact on traffic flow at Exit 168.
- Traffic on Interstate 81 in this area is expected to increase 25% by 2010 and almost double by 2020 with or without truck lane restrictions.
- The southbound exit ramp peak hour traffic is projected to increase by 400% from 1997 to 2020 and AADT has a projected increase of 117%.

Exit 168

- The Interstate 81 Improvement Study projects a significant decrease in the level of service (LOS) on Interstate 81 for this section.
- The I-81 northbound LOS drops to D south of the interchange and to F north by 2010.
- There is a projected 20% decrease in percentage of truck traffic on northbound entrance ramp. This is the only interchange in the study area with a projected change in truck traffic.
- The southbound entrance ramp has an AADT projected increase of 80%.
- The opposite effect occurs on Route 614 northbound, from a projected decrease of 7% in 2020 without truck lane restrictions to a 78% increase with truck lane restrictions.

U.S. 220 Corridor Review
Prepared by Roanoke Valley Alleghany Regional Commission – June 2008

This study examines the capacity, safety (measured by level of accidents), and infrastructure conditions of U.S. Route 220 within Botetourt County. The information provided examines Level of Service projections to 2035, indicating the furthest southern and northern segments will reach capacity by 2035 (Map 15 - U.S. Route 220 - Traffic Information). VDOT is using this information to prioritize roadway expansion and improvements, but with limited state budgets Botetourt County may need to explore other initiatives to slow the projected LOS declines as growth occurs. For the purpose of the Comprehensive Plan, this information provides an indication that alternative modes of transportation should be considered, as should means of mitigating local travel impacts, such as access management planning. Map 13 and Map 14 also show the Level of Service for all major corridors in Botetourt County. Table 41 provides a snapshot of the roadway characteristics along U.S. Route 220. There are fewer lanes on the northern end of the corridor, which contributes to the lower Level of Service projections. Table 42 indicates the number of accidents at each major intersection along the corridor. There has been a steady increase in accidents at Wesley Road, which can be correlated to the increase in commercial development.

Table 41 – Road Characteristics – U.S. Route 220 Corridor Review

From	To	Lanes	Lane Width (ft.)	Shoulder Surface	Speed Limit (mph)	Median
I-81	RTE 779 North	4 to 6	11 to 12	Gravel	35 to 45	Depressed
RTE 779 North	RTE 1211	4	11 to 12	Gravel	55	Depressed
RTE 1211	RTE 1204	4	12	Curb and Gutter	45	None
RTE 1204	RTE 43Y	4	11 to 12	Gravel	55	Depressed
RTE 43Y	1.14 Mi N RTE 696N	2	10 to 12	Gravel	55	None
1.14 Mi N RTE 696N	Alleghany CL	2	12	Gravel	40	None

Source: Statewide Planning System. Virginia Transportation and Mobility Planning Division. Richmond, 2007.

Table 42 – Accident Data – U.S. Route 220 Corridor Review

		Accidents			People Injured	
Intersection	2004	2005	2006	2004	2005	2006
I-81 SB Exit Ramp		1	1		3	
Tinker Mountain Rd.	2	2	3	2	3	
Stonedale Dr.		1	6			5
Valley Rd.	4	3	3		3	1
Catawba Rd.	1	1	1		4	
Greenfield St.	4	1	2	3		1
Ashley Rd.		1	2			4
Country Club Rd.		1	1			4
Vine St.			2			3
Roanoke St.			1			3
Prices Bluff Rd.	2		1	1		2
10th St.	1		1			3

Source: Statewide Planning System. Virginia Transportation and Mobility Planning Division. Richmond, 2007.

Rural Regional Long-Range Plans
Prepared by Virginia Department of Transportation – On-Going

Improving the transportation system remains vital to improving the quality of life and continued economic growth and prosperity in Virginia. The Virginia Department of Transportation (VDOT) and 20 planning district commissions (PDC) throughout the Commonwealth are partnering to evaluate the state's rural transportation system and to recommend a range of transportation improvements that best satisfy existing and future needs. This partnership will result in a regional plan that identifies needs based upon goals and objectives established by each region. This plan will provide Botetourt County with the opportunity to further identify and assess the community's transportation priorities and needs. Additional benefits may include:

- Identification of transportation deficiencies and recommendations of remedies
- Assistance with comprehensive plan updates and traffic impact studies (per Chapter 527 of the State Code)
- Programming of transportation improvements
- Effects of land use and development

Rural Bikeway Plan
Prepared by Roanoke Valley Alleghany Regional Commission - 2006

The *Rural Bikeway Plan* (2006) is part of the Roanoke Valley – Alleghany Regional Commission's FY 2006 *Rural Transportation Planning Program* (http://rvarc.org/work/rural06.pdf). The *Rural Bikeway Plan* covers the rural portions of the Regional Commission's service area, including areas outside of the Roanoke Valley Area Metropolitan Planning Organization study area.

The *Rural Bikeway Plan* provides information and guidance on the planning and provision of bike facilities at local and regional levels, to enhance and encourage bicycling in the rural portions of the Regional Commission's service area. The *Rural Bikeway Plan* also briefly considers the relationship between bicycling and tourism and the potential economic benefits of a bicycle-friendly environment. The plan is currently being implemented as roadway improvements are made. Map 16 (Rural Bikeway Plan Study Area) provides the regional context of the bikeway alignment and Map 17 (Botetourt County Rural Bikeway) indicates the alignment within Botetourt County.

GOALS, OBJECTIVES AND POLICIES

The following transportation goals, objectives and policies were developed in conjunction with citizens, the Steering Committee, stakeholders, and elected and appointed officials to guide future decisions about Botetourt County transportation systems.

Transportation Goals

- To provide for an adequate and safe transportation network designed to serve residents, businesses, industry, and the general public.
- To promote safe and efficient accessibility by all modes of transportation including personal automobile, transit, walking, and bicycling by designing a pedestrian-scale, well-connected street network.

Transportation Objectives

- Develop a well coordinated, publicly supported comprehensive transportation system.
- Continue local long range transportation planning efforts for the County's interstate, primary and secondary road system.
- Support alternative modes of transportation for the population such as car-pooling, van pooling, and bicycle routes.
- Monitor state program requirements and seek sources of state funding for specialized road construction needs.
- Ensure that new development proposals do not negatively impact traffic safety, or traffic flow on the County's primary highways.

Transportation Policies

- Continue to participate in the Roanoke Valley Metropolitan Planning Organization (MPO), working closely with MPO partners on local and regional transportation matters affecting the County.
- Clearly define Botetourt County transportation goals within the regional Rural Long Range Transportation Planning process.
- Prepare annual updates to the County's Six Year Secondary Road Construction Plan in conjunction with VDOT.
- Use VDOT's Industrial and Recreational Access Road programs to strengthen the County's economic development and recreational programs, as the need arises.
- Actively support the widening of I-81 and improvements to existing interchanges.
- Work closely with VDOT on the design and implementation of plans for improvements to Exit 150 to ensure that business disruption is minimal, and that the new interchange provides opportunities for business relocations and additional accessible business locations.
- Evaluate current VDOT primary and secondary road access standards and consider adopting more stringent local access standards.
- Support multimodal transportation by developing land use plans and policies that encourage mixed-use land use patterns and pedestrian-oriented site design, and direct higher density development toward designated development areas.
- Continue to identify additional dedicated funding sources to finance the cost of proposed multimodal transportation improvements.
- Include consideration for bicycle and pedestrian accommodations in the planning and design of all major road projects, consistent with VDOT policy.
- Include bicycle and pedestrian accommodations, including ancillary facilities such as bicycle racks, benches, water fountains, rest areas, signage, etc., in conjunction with all new development.

IMPLEMENTATION STRATEGIES

This section indentifies more detailed implementation strategies for transportation planning improvements, which include access management, a corridor study, continued bikeway planning, park and ride initiatives, carpooling and transit, continued support of the Blue Ridge parkway, transportation and land use planning for primary highways, considerations for I-81 interchanges, transportation and land use planning and implementation of a Rustic Rural Road Program.

Transportation and Land Use Coordination

Land use patterns have a significant effect on trip generation and travel behavior. Compact, mixed-use and walkable developments mitigate traffic generation and thoroughfare impacts by shortening trip distances, capturing a greater share of trips internally, and facilitating transit and non-motorized trip-making. Successful mixed-use areas with multi-modal access can thrive with lower parking ratios, freeing up land and capital for open space amenities and productive, revenue-producing uses. Some implementation strategies listed below may be used to develop and maintain a sustainable multi-modal transportation system that supports new and existing residential, commercial and recreational areas, preserves and enhances neighborhood livability and the quality of life for Botetourt County residents, and provides for the safe and efficient movement of people and goods.

- **Coordination with Land Use Map:** Transportation planning, development, expansion, and investment in transportation facilities should be coordinated with the Future Land Use Map.

- **Right-of-Way Reservation:** Support the early identification and acquisition of land for future transportation corridors through land use planning and development permitting.

- **Multi-modal Transportation Design:** Where appropriate, offer residents safe and attractive choices among modes including pedestrian walkways, bikeways, public transportation, roadways, and railways. The street patterns of newly developed areas should provide multi-modal transportation alternatives for access to and circulation between adjacent neighborhoods, parks, shopping centers, and employment areas.

- **Increasing Mobility Choice:** Diversify the mobility choices for work trips by targeting transit support along corridors that connect concentrations of office, retail, and residential uses.

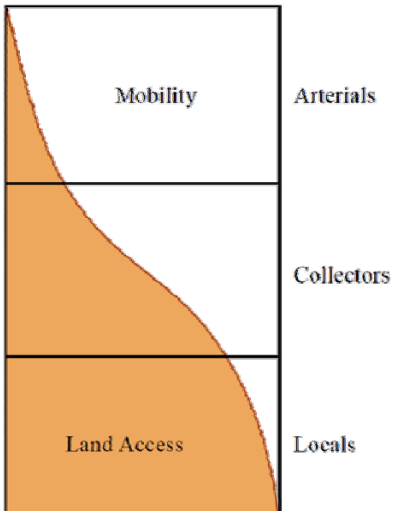
- **Context Sensitive Road Design:** "Context Sensitive" approaches can be used or new roadways or widening of existing roads to minimize impacts to historic areas and neighborhoods, and sensitive natural areas (particularly in watershed protection, conservation management and rural protection areas)

- **Transportation Impacts:** Identify and address transportation impacts before a development is implemented.

Access Management

The primary objective of access management is to improve traffic flow, a concept that may seem at odds with the concept of creating a pedestrian-friendly environment. However, access management is not just about moving traffic as quickly and safely as possible. Access management can be used to create an attractive roadway environment as well; one that is safer for pedestrians who aren't able to avoid driveways and driveway traffic, by using median refuge areas that allow them to cross roadways in increments.

An effective local access management program can play an important role in preserving highway capacity, reducing crashes, and avoiding or minimizing costly remedial roadway improvements. The traveling public would then benefit from faster and safer travel. The great majority of businesses also benefit from increased economic vitality along a well managed corridor. Taxpayers benefit from more efficient use of existing facilities, and public agencies benefit from the relatively low cost of access management, freeing resources for other needs.



This diagram shows the relationship of road design (Access versus Mobility) and road types.

Botetourt County should work with VDOT to develop an access management plan for U.S. Route 220. This plan should be developed in conjunction with a corridor study to determine the potential of future growth along the corridor and the best means of accessing that growth.

Corridor Studies

Corridor planning determines the best way to serve existing and future travel demand, bringing together the goals and expectations of all stakeholders involved in the project. Corridor studies are typically initiated in response to a specific problem (high accident locations and corridors, high levels of existing or future congestion, significant land-use changes, etc.) and often involve more than one mode of transportation. However the benefits of corridor planning reach beyond engineering solutions: resolution of major planning issues prior to the initiation of project development, identification and possibly preservation of transportation right-of-way, protection of transportation investments, and partnerships with diverse public and private agencies and organizations are all positive results of corridor planning efforts. Specific recommendations for corridor studies are identified by route number below.

Botetourt County should develop a corridor study for U.S. Route 220 that examines potential build-out for the corridor, determines travel and traffic implications, and promotes proactive growth management. Additional studies could be conducted for the U.S. Route 460 and U.S. Route 11 corridors. Both the U.S. Route 220 and U.S. Route 11 corridor studies should focus on the I-81 Exit 150 interchange as a gateway into the community. Funding sources for the corridor studies could include grants from VDOT or the local PDC.

Bikeway Planning

Developing safe bikeways is a strategy typically used to diversify modes of transportation and increase the safety and number of bicyclists. Used by both commuters and recreational users, bikeways contribute to a community's quality of life. A common goal of a bikeway plan is to include consideration of the needs of bicyclists in the design and construction of roadways. Typically, road improvements that consider bikeways involve either a wider travel lane, or a wider shoulder. Previous bikeway plans for Botetourt County identified Routes 11, 220, 460, 601, 651, 654, 738, 779 and a portion of the Blue Ridge Parkway as suitable bikeway locations (see Table 43); however, currently there are no bikeways under construction in the County.

Botetourt County should actively pursue implementation of bikeway plans as public roads are improved under VDOT Primary and Secondary funding programs, consistent with *VDOT's Policy for Integrating Bicycle and Pedestrian Accommodations*.

Table 43 – Corridors for Bicycle Accommodations

Roadway	From	To
US Route 11	Buchanan	Troutville
Frontage Road 55 (Old US 11)*	Rockbridge County CL	US Route 11*
Route 43	Buchanan	Blue Ridge Parkway
Route 43	Eagle Rock	Buchanan
Route 43	Eagle Rock CL	US Route 220
US Route 220	Route 43	Route 615 (Craigs Creek Road)
Route 615 (Craigs Creek Road)	US Route 220	Craig County CL
Route 640 (Lithia Road)*	US Route 11	Nace Road (also Route 640)*
Nace Road (Route 640)*	Route 640 (Lithia Road)	US Route 11
Route 651 (Stoney Battery Road)*	US Route 11	US Route 220
Route 740	Roanoke County CL	Carvins Cove Road
Route 779 (Valley Road)*	US Route 220	Catawba Road (also Route 779)
Route 779 (Catawba Road)*	US Route 220	Roanoke County CL
Blue Ridge Parkway**	Roanoke County CL	Rockbridge County CL

* Part of the Virginia Interstate Bike Route 76 (Note: All portions of Bike Route 76 are included in the Rural Bikeway Plan. Portions of US Route 11, Route 651, Route 779 are within the MPO study area, thus also included in the Bikeway Plan RVAMPO).
** Managed by the United State National Park Service

Park and Ride Facilities and/or Locations

Park & Ride transportation facilities facilitate transit and rideshare use by providing parking facilities at transit stations, bus stops and highway entrance ramps, particularly at the urban fringe. By encouraging commuter shifts between single occupancy vehicles, transit and ridesharing, Park & Ride facilities can reduce urban highway traffic congestion and worksite parking demand. There is one facility located on U.S. Route 220 near the I-81 southbound on-ramp. Some additional ad-hoc locations might be used, but sufficient data is not available for an inventory.

Botetourt County should explore working with developers and business owners to create new park and ride lots in appropriate locations that allow users access to park-n-ride facilities and retail services. Such facilities could include minimal efforts such as designation of unused parking spaces during non-peak retail times during the day. Similar approaches can be taken with churches, where parking goes unused during typical work hours. These options could also be pursued in conjunction with a commuter transit service and/or vanpool program.

Rideshare, Commuter Transit, and Car/Van Pooling Options

Public transportation is not just for urban areas. Rural transit services can provide an essential link for Botetourt County residents living in small towns and rural areas with limited access to personal vehicles. Employees, students, the elderly and disabled, and single parents caring for children are all examples of population groups that would benefit from the availability of public transit to commute to work, go shopping, attend school, get to medical appointments and travel to recreational activities.

Botetourt County should work with Roanoke on a continuous basis to reevaluate the potential of a fixed bus route that provides express service to key locations within the county. Eventually, parts of the County may reach transit supportive densities which would trigger the need for services based on location and

commuter demand. On-going conversations will ensure further development and redevelopment meets the operational needs of transit, increasing the efficiency of potential services. Further, Botetourt County should consider the implementation of a Rural Transit Program, which is mostly federally funded for capital and operations assistance. The County currently provides limited elderly and disabled services, which can evolve into a rural transit program. These types of programs are widely used in rural areas like Botetourt County. Proper coordination with human service transportation needs could minimize the County's financial responsibility.

Blue Ridge Parkway Enhancements

Designed as a 469 mile-long national scenic linear park, the Blue Ridge Parkway is a significant recreational resource for over twenty-one million travelers per year. The Parkway is also a significant economic resource for communities located along its length. Conservation of the Parkway's scenic environment benefits from a partnership between the National Park Service (NPS) which manages the park, and localities through which the Parkway passes. The visual impact of new development on the Parkway is an extremely critical issue in the Roanoke Valley and Botetourt County due to the high degree of suburbanization that has occurred in proximity to the Parkway in the past 30 years.

Five miles of the Blue Ridge Parkway are located within the southeast section of Botetourt County, accessible from three interchanges leading to local and regional roads: Route 43 east of Buchanan, U.S. Route 460 in Blue Ridge, and Route 618 near the Peaks of Otter. Although most of the Botetourt segment of the Parkway lies within National Forest Land, including the interchanges that provide access to Route 43 and 618, a highly visible and susceptible portion of the Parkway lies is in proximity to the interchange serving U.S. Route 460. Currently, land near this interchange is largely undeveloped; however, future development in this corridor has the potential to be visible from the Parkway. In addition, future development along U.S. Route 460 at or near the Parkway interchange has the potential to be inconsistent with the rural, scenic character of the Parkway.

Botetourt County can assist with the conservation of the Parkway's scenic environment through local action in two areas:

1. Evaluation of the visual impact of new development that is proposed within the Parkway's viewsheds, and
2. Consideration of the scale, character and design of new development proposed to be located in proximity to the Parkway Interchanges.

Primary Highway Strategies

Route 11 Corridor

Future land uses in the U.S. Route 11corridor should be a combination of commercial and industrial development. Development of these land uses should be limited in scale until road improvements are made. Future road improvements in this corridor should emphasize access management. For example, if a four-lane design is proposed, a median should be considered as a strategy to control turning movements and improve the aesthetics of the corridor.

Access for all new development in the corridor should be controlled, minimizing new curb cuts and emphasizing the shared use of existing curb cuts, and utilizing frontage roads or a reverse frontage access, where feasible. New development should be responsible for installing deceleration/acceleration lanes, as required by VDOT. As redevelopment occurs along the corridor, existing curb cuts should be combined, where appropriate.

Segment 1 – Roanoke County Line to Exit 150

This segment of the U.S. Route 11Corridor serves as a gateway to both Botetourt County and Roanoke County and would benefit from a corridor planning effort or an urban design strategy to improve the look, feel and mobility through this area. The Botetourt County Planning Commission should initiate discussions with the Roanoke County Planning Commission concerning the development of strategies to improve mutual gateways at this location.

Segment 2 - Exit 150 to Town of Troutville

As indicated on the Future Land Use Map, development along this segment of road should be commercial from Exit 150 North to State Road 653. From State Road 653 North to Town of Troutville a mixture of commercial and office uses are desirable.

Access for all new development in the corridor should be controlled, minimizing new curb cuts and emphasizing the shared use of existing curb cuts, and utilizing frontage roads or a reverse frontage access, where feasible. New development should be responsible for installing deceleration/acceleration lanes, as required by VDOT. As redevelopment occurs along the corridor, existing curb cuts should be combined, where appropriate.

Signage in the corridor should be strictly controlled, extensive landscaping should be provided, and typical "strip commercial" character should be avoided for all new development within this corridor segment (see discussion of *Design Standards* in the *Implementation Section* of the *Land Use Element*, Page 58).

Segment 3 - Town of Troutville North to Buchanan and Beyond

North of Town of Troutville, the corridor segment is characterized by low density residential and agricultural land uses. Commercial and industrial uses are very minimal and found in locations around Buchanan and the interchanges. North of Exit 168 the landscape is even more rural with no commercial or industrial development present.

As indicated on the Future Land Use Map, desired land uses in this corridor segment are primarily agriculture, or very low density residential. Future commercial and industrial development is not appropriate along this corridor, with the exception of commercial and small scale industrial development around the town, commercial development located at I-81 interchanges. Any commercial and/or industrial development proposed near the Town of Buchanan should be evaluated with consideration of the impact of the development on the town, and, to the extent feasible, such development should be encouraged to locate within the Town consistent with the Town's land use plan and zoning.

Alternate U.S. Route 220 from 460 to Route 11

A corridor access study should be undertaken for this corridor, focusing on the characteristics of vacant land and developed property within the corridor and recommending specific opportunities for future signalization, shared access, median cuts, and frontage roads. Traffic flow is a top priority for this corridor. Strategies for future development include minimizing the number of new traffic signals and discouraging new median cuts, only allowing them for new public roads. Frontage roads and reverse frontage site designs are also a preferred access alternative. For smaller developments, shared access easements should be required to reduce the number of new curb cuts.

Additional commercial uses should be allowed on both the east and west side of this corridor, with a priority for larger scale, planned commercial developments so that access can be controlled through new public roads, or through the use of shared access for multiple properties and uses. New development in the corridor should reflect the highest standards of architectural quality and should incorporate significant landscaping (see discussion of *Design Standards* in the *Implementation Section* of the *Land Use Element*, Page 58). Freestanding signage should be well designed, but limited in height and number. Lighting should be effective for security purposes, but subdued to avoid spillover into the road corridor or adjoining properties.

U.S. Route 220

Botetourt County should develop a corridor study for U.S. Route 220 that examines potential build-out for the corridor, determines travel and traffic implications, and promotes proactive growth management. Funding sources for the corridor study could include grants from VDOT or the local PDC.

U.S. Route 220 North

The key to the appropriate future development of the U.S. Route 220 corridor is development of the frontage parcels with consideration of access control, signage, landscaping, and lighting. Strip commercial development patterns that exist south of Route 779 should not be allowed to extend northward towards Fincastle. Although additional commercial development between Route 779 and Greenfield is appropriate, it should be clustered in nodes at selected intersections, and should not be allowed to develop into a strip commercial pattern of development. Development north of Greenfield should be limited to agricultural and low density residential uses due to lack of public facilities in this area. Higher residential densities may be appropriate for properties near Fincastle if, in the future, the town has the capacity and willingness to extend water and sewer to serve new residential areas. No commercial development should be encouraged north of Greenfield; instead, commercial needs in this area of the County should be met within the Town of Fincastle consistent with the Town's land use plan and zoning.

Access control in this corridor is extremely important to preserve traffic capacity and flow. Left hand turning movements should be limited to existing median cuts, or to new cuts designed to serve new public roads. The number of new traffic signals should be minimized.

U.S. Route 460

Similar to other corridors, access control in the U.S. Route 460 corridor is extremely important to preserve traffic capacity and flow. Left hand turning movements should be limited to existing median cuts, or to new cuts designed to serve new public roads. The number of new traffic signals should be minimized. Shared access between adjoining properties should be required, as should frontage or reverse access roads.

Future commercial development within the corridor should be limited in scale and located within the existing commercial nodes near Laymantown Road and the Blue Ridge community. Future land uses in the corridor should be evaluated with consideration to their impact on the Blue Ridge Parkway viewsheds and interchange character. Parkway staff should be consulted when new developments are proposed. Densities of future residential development in the corridor should be a factor of public utility and facility capacities.

I-81 Interchanges

The character of the I-81 interchanges are discussed elsewhere in the transportation section. The following strategies are recommended:

1. Site specific soil and geologic evaluations should be performed prior to development at I-81 interchanges. If a rezoning is required, the results of these evaluations should be included as one of the factors considered by the Planning Commission and Board of Supervisors as they make their decisions.

2. Exits 156, 162 and 168 are best suited for additional development. However, no new intense residential, commercial, or industrial development should be approved at these intersections unless and until public water and sewer services are available. The previously referenced water and wastewater analysis plan projected a 20-year time frame for County utility improvements. Small scale commercial and low density residential development may be suitable at these interchanges based upon site specific review and analysis.

3. Future interchange development should be required to demonstrate adequate access design to ensure development will not negatively impact traffic flow or impede interchange improvements.

4. The Development Suitability Maps (Map 40, Map 41, and Map 42) for each interchange designate Primary, Secondary, and Restricted development areas. More intensive development should be encouraged/allowed in the Primary areas if public water and sewer are available. Secondary areas do not preclude development, but require more detailed site suitability studies prior to development or zoning approvals. Restricted areas should not be further developed due to their slope, geologic and soil limitations. If proposed for development, extensive site studies should be required within restricted areas.

5. Future development at these interchanges should reflect and respect their predominantly rural setting. Although future commercial development may be oriented to the highway traveler, it should be designed in character with its environs. In evaluating development or rezoning proposals, the Commission and Board of Supervisors should consider design elements such as architectural character and scale, lighting, signage, landscaping and shared access between parcels to reduce curb cuts and provide adequate turning lanes.

6. Commercial development at these interchanges should be restricted to "nodes" around each interchange, and should not be allowed to extend along the U.S. Route 11corridor to create a strip commercial land use pattern.

Transportation and Land Use Coordination

Land use patterns have a significant effect on trip generation and travel behavior. Compact, mixed-use and walkable developments mitigate traffic generation and thoroughfare impacts by shortening trip distances, capturing a greater share of trips internally, and facilitating transit and non-motorized trip-making. Successful mixed-use areas with multi-modal access can thrive with lower parking ratios, thus freeing up land and capital for open space amenities and productive, revenue-producing uses. The County should evaluate its existing Zoning Ordinance, Subdivision Ordinance and site plan requirements to refine guidelines and regulations to encourage mixed use developments, interconnected streets, sidewalks, streets, adjusted parking standards and other mechanisms that reduce vehicular trips.

Rural Rustic Roads

The Virginia Department of Transportation's Local Assistance Division established *Guidelines for Rural Rustic Roads,* working with the Rural Rustic Road Policy Committee. This concept, first enacted by the 2002 Session of the General Assembly of Virginia, is a practical approach to paving Virginia's Low Volume Unpaved Roads. A pilot program, implemented in July 2002, demonstrated the success of this program concept. The program ensures that the County will practice environmental and financial stewardship while providing basic paved access to more of its rural countryside. Table 44 provides an overview of the options for the rustic road program.

The following eligibility criteria apply to the Rural Rustic Road Program:

- Must be an unpaved road already within the State Secondary System.
- Must carry no more than 1500 vehicles per day (VPD).
- Must be a priority (line item) in an approved Secondary Six-Year Plan, even if the funding source is not from normal, secondary construction allocations.
- Must be designated as a Rural Rustic Road by the County Board of Supervisors, in consultation with VDOT's Residency Administrator or designee.
- Must be a road predominately used for local traffic. The local nature of the road means that most motorists using the road have traveled it before and are familiar with its features.
- Must have minimal anticipated traffic growth. The County Board of Supervisors must attempt to limit growth on roads improved under the Rural Rustic Road program and cooperate with VDOT on the development of adjacent lands consistent with rural rustic road concepts through the comprehensive planning process.
- Must have a special Resolution designating the road as a Rural Rustic Road by the County Board of Supervisors for each individual road.

The maximum speed limit on any highway designated a Rural Rustic Road pursuant to § 33.1-70.1 of the Code of Virginia is 35 miles per hour; however, all speed limits on rural rustic roads in effect on July 1, 2008, may remain in effect unless and until it is changed as a result of a traffic engineering study.

Botetourt County should continue to implement this program on selected, qualified roads. This approach would help minimize the maintenance costs associated with the secondary roads. Because the program limits future improvements, careful consideration should be given to those roads that might have increased development, creating the need for expansion or improvements.

Table 44 – Rural Rustic Road Program Guidelines

Unpaved Road Improvement Program Options

	Unpaved Road	Pave-In-Place	Rural Rustic Road
Roadway Status	The road must already be a state maintained road in the secondary system of state highways. These programs do not apply to the addition and improvement of roads that are privately maintained.		
Traffic Volume VPD = vehicles per day Limitations are based on funding (see below).	50 vpd minimum for unpaved road funds, otherwise no minimum for normal secondary construction funding.	less than 750 vpd	less than 1500 vpd
County Government Action and Funding	Project must be in the County's Secondary Six-Year Plan (SSYP) of improvements.	Project must be in the County's Secondary Six-Year Plan (SSYP) of improvements.	Project must be in the County's Secondary Six-Year Plan (SSYP) of improvements. Board must also request the Rural Rustic Road Program be used, by passing a special resolution declaring the road a "Rural Rustic Road."
Land Use Growth Factor	No restrictions.	No restrictions.	The County Board indicates growth and traffic generated by the land are not expected to increase significantly over the next 10 years.
Safety	Safety factors are addressed as part of the project.	Safety factors are addressed as part of the project.	Specific identified safety issues that cannot be addressed through signing should be corrected.
Alignment	Reconstruct as necessary to improve alignment and grade.	Minor changes in alignment may be necessary to address issues.	Ideally, a candidate road can be paved without alignment improvements. For higher traffic volume roads (>400vpd), 18 foot pavement is desirable and some typical section improvements may be necessary.
Drainage	Roadway drainage will be improved, if needed.	Roadway drainage will be improved, if needed.	Existing drainage provisions should be sufficient with minimal improvement. Improvements should be made as necessary to ensure positive drainage.
Right of Way	Abutting property owners will need to provide additional right of way, normally 50 feet in width.	Paving may be done within the existing right of way, but abutting property owners are normally expected to donate additional right-of-way for spot widening, if necessary for safety.	Paving may be done within the existing right of way, which may be a minimum of 30 feet prescriptive R/W.

Source: Virginia Department of Transportation – Rural Rustic Road Program, July 2008

5 CULTURAL AND ENVIRONMENTAL RESOURCES

INTRODUCTION

Botetourt County was founded in 1770 and is historically unique. It was initially formed from the County of Augusta and derived its name from Lord Botetourt, who was then Governor of Virginia. The County's jurisdiction originally reached to the Mississippi River, encompassing what are now West Virginia, Kentucky, Ohio, Indiana, and part of Illinois.

Early County settlers were primarily Scots-Irish pioneers who journeyed from Pennsylvania seeking homesteads. In the early years of the County's development, the economy was predominantly agricultural. In later years, mining gained some prominence. In the late 1700s and early 1800s, trade centers began to develop in the County.

The Town of Buchanan, founded in 1742, became an important regional distribution center in the mid-1860s. The Town was the western terminus of the Kanawha Canal. This Canal, tied to the James River, linked the urban centers in eastern Virginia with the developing commercial areas in western Virginia. Buchanan began losing its prominence as a major center in the late 1800s and early 1900s as railroad expansion reduced the amount of shipping on the Canal.

The Town of Fincastle, the County seat of Botetourt, was once the governmental center of an area stretching to the Mississippi River. Fincastle is still the hub of government activity in the County and also serves as a minor, yet important commercial center for central Botetourt.

As a result of this long history, Botetourt County is rich in historical, cultural, and natural landmarks that enhance the County's cultural traditions and is an attraction for new residents and tourists visiting the region.

Agriculture remains an important component of the County's economy, and continues to support and define the rural character of Botetourt. The County's many mountains and national forest areas also are critical to defining the County's rural character. However, the economy and character of Botetourt has changed significantly over the past thirty years. Agriculture has lost its dominance over the local economy, and a very successful County economic development program, which includes the development of a tourism program, has contributed significantly to the fiscal health of the community.

Currently, the southern portion of the County is the most urbanized part of the community. It has higher population, housing, and commercial densities when compared to the central and northern sections of the County. The County's continued commitment to a high quality of life, educational attainment, environmental protection, efficient and cost effective governmental services, and with sensible, sustainable development patterns will ensure that future generations will enjoy the same benefits of "Botetourt Living" that residents enjoy today.

BACKGROUND

Botetourt County's natural and cultural environment is characterized by many factors that both promote and impede the development of land. The attractiveness of the County promotes growth as the area continues to attract new residents, many who retreat to the area for retirement. The geographical dynamics of the area impede some growth, displacing it to either dense areas along main corridors, around existing incorporated towns, or dispersing it across the rural landscape. Dispersed residential growth is the top threat to preserving the existing rural character of the County in the future. More often than not, agricultural land is lost to new residential development, with some agricultural land converting to commercial uses. The historic, environmental, and even the agricultural quality of Botetourt County creates a nexus of loss and gain that must be addressed through various land use and growth policies that influence development and preserve the rural landscape.

Agricultural/Rural/Mountain Preservation

Over the years, the industry of agriculture has been affected by shifts in population and loss of traditional farming lands. Land trends across Virginia reflect a shifting in population from traditional urban areas to rural lands. Much of the development occurs as land intensive forms of development such as residential subdivisions and commercial development in patterns that are typically auto-dependant. When new development occurs on farms that have been sold to developers, these traditionally agricultural areas are caught in a conflict between new and old land uses. The resulting patchwork of development creates conflicts between agricultural and new land uses, generating traffic and future development pressures. Even though Botetourt County has seen a recent slow-down of residential, commercial and industrial growth, when the economy recovers, there will likely be renewed pressure on the County's agricultural and forested areas to be rezoned and developed. Agricultural statistics contained in the Land Use section of this plan show a continuing trend towards the loss of agricultural land uses and farms. Of equal concern are inappropriate patterns of development on environmentally sensitive lands such as the steep sloped properties located at higher elevations at or near mountain ridge tops.

Historic Preservation

Preserving historic resources is vital to maintaining the County's cultural heritage and also represents a significant opportunity for development of tourism as an economic resource. The three main steps to historic preservation are 1) identification, 2) recognition, and 3) protection of historic resources. Identification means inventorying the historic resources in a community and understanding their importance; this was completed recently prior to initiation of this plan update. Historic designation provides recognition for particularly significant sites, but does not protect them. Protection comes primarily through local historic districts implemented through the zoning ordinance or by a property owner placing a site or structure under an historic easement.

Currently, there is little control of the effect of development on historic resources. While there is a historic state designation program, it is up to the County to further determine incentives for maintaining historic properties. The lack of adequate protection mechanisms makes existing historic resources susceptible to negative impacts of development, including demolition.

Cultural and Environmental Resource Analysis

Historic Resources

Botetourt County continues to be a community rich in history. This history is evident through the numbers of structures and sites that have been identified as worthy of preservation for future generations. A listing on the Virginia Landmarks Register or the National Register of Historic Places is an honor but not a guarantee that these historically significant properties are protected from demolition or degradation. This is particularly true in rapidly growing jurisdictions where new development can significantly impact historic properties and their character.

Properties Listed on the National Register

Properties and districts in Botetourt County that are currently listed on the Virginia Landmarks Register and the National Register of Historic Places include the following (Map 18 – Historic Resources):

Anderson House (011-0056)
Annandale (011-0041)
Breckenridge Mill Historic District (011-0187)
Buchanan Historic District (180-0028)
Callie Furnace (011-0065)
Catawba Furnace (011-0040)
Fincastle Historic District (218-0051)
Greyledge (011-0010)
Hawthorne Hall (011-0037)
Lauderdale (011-0048)
Nininger's Mill (011-0057)
Phoenix Bridge (011-0095)
Prospect Hill (011-0185)
Santillane (011-0032)
Thomas D. Kinzie House (011-5034)
Varney's Falls Dam (011-0068)
Wheatland Manor (011-0038)
Wiloma (011-0039)
Wilson Warehouse (180-0006)

Properties Evaluated by Virginia Department of Historic Resources (VDHR) National Register Evaluation Team and Determined Eligible for National Register Listing

The following properties have been evaluated by the VDHR National Register Team and determined eligible for listing on the state and national registers.

Bryan McDonald, Jr. Farm House (011-0021)
Bowyer-Holladay House, Lewis Holladay House (011-0028)
George Botetourt Rader House (011-0058)
Roaring Run Furnace (011-0063)
Henry Stair House (011-0082)
Emanuel Episcopal Church (011-0109)
Camper/Cronise House (011-0116)
James River & Kanawha Canal Tunnel (011-0144)
Jeter Barn (011-0176)
Fort Fauquier, Lipes Site, Looney Mill Creek Site (011-0184)
Bessemer Archaeological Site (011-0188)
Bridge # 6100, Route 817, Craig Creek Bridge (011-0404)
Daleville College Historic District (011-5095)
Blue Ridge Hall (011-5096)
The Iron Industry of Virginia (011-5116)
Gala Site (011-5155)

Properties Potentially Eligible for National Register Listing

As a result of a field survey, the following properties and districts are identified as being potentially eligible for listing on the state and national registers and recommended for further investigation and/or intensive-level survey so that they can be formally evaluated by the VDHR National Register Evaluation Team:

Eagle Rock Historic District
Fox Folly Farm (011-5403)
Glen Wilton Historic District
Glencoe (011-0034)
Hammit House (011-5216)
Mill Creek Manor (011-0020)
Mulberry Bottom (011-0049)
Oakland (011-0050)
Shadowlands (011-5203)
"Soldier's Retreat" (011-0181)
Spec Mine Facilities (011-5143)
Springwood Historic District
Stonelea (011-0035)
Town of Troutville Historic District
William Booze Farmstead (011-5171)
Greenfield Plantation Site (011-0026)

Owners of historic properties have significant control over their condition and long-term viability. A variety of state and federal programs have been established to provide incentives to owners to maintain, restore and preserve historic properties. Botetourt County can also play an important role in the long-term preservation of these sites. Specific public actions could include directing property owners to available preservation incentive programs and considering the impact on historic resources when evaluating development proposals.

Natural Environment

Notwithstanding public investment in roads and utilities, and public policies pertaining to zoning and other development standards, the development potential for land is dependent in large part on its natural characteristics such as slope, elevation and soil types. These natural characteristics should be a major factor for consideration when land is proposed for development in the County. Development proposals should respect the natural features of a site. Natural resources, that are economically valuable and that are susceptible to damage or reduction in value by other land uses, should be protected. Prime agricultural lands, significant geologic formations, surface and ground waters and air quality are examples of such natural resources.

Geology and Soils

Subsurface geology, soil characteristics and topography are three highly interrelated factors that can influence the development potential of property. Igneous, metamorphic, and sedimentary rocks that range from Mississippian to Precambrian in age underlie Botetourt County. Along the Blue Ridge, granite, granodiorite, diorite, unakite, quartzite and phyllite are found. Sedimentary shale, limestone, and dolomite are dominant in the valleys. The Appalachian Mountains are comprised of sedimentary sandstone and shales. The characteristics of limestone yield good wells and free flowing springs for many County property owners; however, the valley regions of the County are likewise susceptible to groundwater pollution. Limestone geology can also present significant challenges to property development including sinkhole formation and long term reliability of groundwater supplies due to multiple developments using and drawing down a single ground water source.

Soils can also play a role in the development potential of property. The United States Department of Agriculture completed a detailed soil survey of the County in 1994. There are 12 general soil classifications for the County (Map 19 – Soils). The 1994 Botetourt Soil Survey provides general information for these classifications as well as detailed information on more specific types of soils.

Topography

Topography is another important aspect in planning for land development. Steep slopes often preclude intensive land development due in part to their natural erosive tendencies, but also because of necessary increases in development costs. It is imperative that any type of steep slope development be undertaken with the highest sensitivity for environmental considerations, including soil stability. The general topography of Botetourt County was mapped and discussed as part of the RVARC's 1977 report entitled Regional Inventory of the Fifth Planning District Commission (Map 20 - Slopes). The report presented four slope classifications and the constraints associated with each.

Classification 1 -- level land (0-8 percent slope): this land is flat to moderate and capable of many types of development. Areas in this classification include central Botetourt (north to Fincastle), lands along the James River, Craig Creek, and the land surrounding Cloverdale and Daleville.

Classification 2 -- rolling land (8-15 percent slope): this land can be developed for residential use with larger lots. Development of intensive residential, commercial and public uses would require different types of foundations than land in Classification 1. Classification 2 lands are well suited for pastures and certain other agricultural uses. Areas in this classification are scattered throughout the County.

Classification 3 -- hilly land (15-25 percent slope): the lands in this classification may be suitable for residential uses provided lot size and careful site planning is used to fit the development to the topography. This slope classification limits intensive development, as well as placement of public facilities. Agricultural activities would be limited to passive activities, such as pastureland. Areas in this classification include lands along the foothills of mountains.

Classification 4 -- steep slopes (25 percent slope and greater): this land is generally considered unsuitable for any type of intensive development or cultivation. The best use of this land is for limited outdoor recreation, wildlife management, and watershed maintenance. Areas in this classification include lands adjacent to the Blue Ridge Parkway; lands bordering Craig and Alleghany Counties; and the land northeast of Eagle Rock to the Rockbridge County border and north of Buchanan.

Any efforts to guide future development to locations that are topographically suitable must be done with an understanding of the significant environmental benefits that will accrue. Such efforts must also respect and address legitimate property right interests. A programmatic approach based upon both public regulation and private incentives has the potential to be an effective strategy to ensure both appropriate development locations and appropriate development techniques. It is also important to remember programs that discourage or limit development on steep slopes will likely redirect development demand and will most likely channel development to the south central portion of the County where land is in high demand based upon its topography, access and presence of utility services.

Air Quality

Air quality is an important factor in local land use planning as indicated in the Federal Clean Air Act (CAA) of 1970 and subsequent amendments. The CAA requires the U.S. Environmental Protection Agency to develop and issue criteria for local air quality to protect the public health and welfare. Both mobile and stationary sources contribute pollutants to the natural air environment. These pollutants influence air quality in Botetourt County and across the Roanoke Valley. Due to prevailing wind patterns and topographic considerations, discharged air pollutants can, and do, travel hundreds of miles, affecting communities far from their source.

In recent years, air quality readings in the Roanoke Valley have indicated that the Valley occasionally exceeds federal standards for ozone. If formally declared to be in violation of these federal standards, Roanoke Valley jurisdictions, including Botetourt, would be formally designated a "nonattainment area" and would be subject to more stringent Clean Air Act requirements. Communities with nonattainment status would be subject to a four-part federal compliance plan requiring that (1) long range transportation plans not negatively impact air quality, (2) new or expanded industrial operations be subject to stringent source reviews, (3) local pollutants be reduced on a yearly basis, and (4) a ten-year air quality maintenance plan be prepared to ensure continued air quality compliance.

As a proactive strategy to avoid formal non-attainment status, Botetourt County and other Valley jurisdictions agreed in 2002 to form an "Early Action Compact" to develop a formal Ozone Early Action Plan (OEAP) to address air quality issues. This OEAP does not mitigate or reduce the Valley's responsibility to improve air quality. Rather, the preparation of the OEAP is a local, state and federal partnership to improve air quality. The OEAP (1) gives more local control in the selection of emission reduction measures, (2) avoids the local stigma of becoming a nonattainment community, and (3) allows a faster cleanup of air quality.

Botetourt County's air quality situation increases the importance of considering air quality impacts when evaluating long-range transportation improvements, economic development opportunities, and major land use decisions. Long range transportation planning should consider the benefits of mass transit and other alternative forms of transportation other than the automobile. Local economic development programs should continue their long-term historic emphasis on encouraging "clean industries". Finally, intensive land use development proposals in the more rural portions of the County should be evaluated partially on the basis of required commuting distances for residents or employees.

Surface Water Resources

As Map 22 (Watershed Basins) indicates, the southernmost portion of Botetourt County lies in the Roanoke River Basin. However, the majority of the County is in the James River Basin, the major source of drinking water for the County. The James River begins near the Botetourt-Alleghany County line where the Jackson and Cowpasture Rivers merge. Several important tributaries (Craig Creek, Catawba Creek, and Looney Creek) feed into the James. Other major creeks also contribute to the County's surface water resources. These include Back Creek, Mill Creek, and Little Patterson Creek, all within the James River Basin, and Tinker Creek which lies within and contributes to the Roanoke River Basin.

The County's surface water resources are significant environmental features, enhancing and contributing to the County's quality of life and recreational opportunities. They also are a source of periodic surface flooding within the County. Map 23 (100 Year Floodplain) shows the approximate location of 100-year floodplains in the County as designated by the Federal Emergency Management Agency (FEMA). The County participates in the federal flood insurance program and restricts the design and location of new development within 100-year floodplain areas. In exchange, County residents within flood-prone areas are eligible for subsidized federal flood insurance.

The James River flows into the Chesapeake Bay, and a majority of the County lies within the Chesapeake Bay watershed. Because of the County's location in western Virginia, the County is not currently subject to the land use and water quality guidelines of the Chesapeake Bay Preservation Act (CBPA). To date, the County's administration of Virginia's erosion and sedimentation control laws represent the extent to which the County regulates the quality and quantity of surface water runoff. However, should future amendments to the CBPA or the federal National Pollution Discharge Elimination System (NPDES) program occur, Botetourt County may be required take additional programmatic and regulatory steps to manage the quality and quantity of surface water runoff. In anticipation of these requirements, some Virginia localities have voluntarily adopted environmental quality standards similar to the requirements of the Chesapeake Bay Act. Others communities are adopting Low Impact Development (LID) design standards as a strategy to achieve more environmentally sensitive development without the burden of additional development regulation.

Groundwater Resources

Though there is an abundance of surface water flowing through Botetourt County, the majority of County residents and businesses use groundwater resources as their primary drinking water. These resources are available either through (1) individual wells, (2) private water provision and distribution systems that meet State Health Department standards, or (3) public water systems that are owned and maintained by Botetourt County.

Groundwater is that part of the subsurface water supply located within aquifers. The amount of water that an aquifer will yield depends on the porosity and permeability of the material at surface and subsurface levels. The yield of an aquifer is determined by the average annual recharge (influenced by climate and precipitation). Vegetation and slope of the land also affect perennial yield.

Groundwater is an important County water source for the foreseeable future. Although groundwater supplies are currently meeting the demands of Botetourt County residents and businesses, this source of water should not be taken for granted. All County citizens need to be aware of the competing demands on this resource, so that contamination and overuse do not occur. Wise management and control of this resource can ensure an adequate supply of clean water for years to come.

GOALS, OBJECTIVES AND POLICIES

Cultural and Environmental Resource Goals

- To maintain and enhance the County's high standard of environmental quality.
- To ensure the preservation of areas and properties of natural, historic and cultural significance.
- To maintain and promote unique aspects and resources of the rural community.

Cultural and Environmental Resource Objectives

- Enhance and protect Botetourt County's environment from adverse environmental impacts of land development through implementation and enforcement of local, state and federal environmental regulatory requirements.
- Enhance, preserve and protect areas of natural and rural significance.
- Enhance, preserve and protect historic features and buildings.
- Promote the County's proximity to the Appalachian Trail, National Forests, Blue Ridge Parkway and the James River.
- Maintain the County's predominantly rural character by ensuring that farming remains a viable livelihood and that farmland continues to be an available resource.

Cultural and Environmental Resource Policies

- Continue implementation of the County's floodplain management regulations.
- Encourage new development to be connected to public water and sewer whenever feasible. If public facilities are not available, thoroughly evaluate the impact of the new development on groundwater supply and quality.
- Continue to enforce the County-wide erosion and sedimentation control laws.
- Cooperate with the Department of Forestry in the monitoring of timbering operations to ensure compliance with environmental requirements.
- Continue to participate in the regional Early Action Compact as a strategy to avoid an EPA designation as an Ozone Non-Attainment area.
- Continue to support the Department of Environmental Quality (DEQ) in its efforts to investigate pollution and maintain and improve water quality standards.
- Discourage land uses which would have a detrimental effect on the environment.
- Enforce standards for site development, construction and maintenance to minimize adverse impacts to the environment.
- Promote protection of the environment by identifying potential areas for low-impact county owned park and recreation development.
- Promote protection of the environment through the continued implementation of the County's solid waste management plan.
- Review and comment on proposed National Forest Plans to ensure a coordinated effort in the protection and management of forest resources in the County.
- Coordinate with Department of Forestry and the National Park Service in the protection and management of forest resources.
- Pursue programmatic and incentive-based regulatory approaches to the protection of mountain ridgelines and critical mountain viewsheds.
- Identify and protect critical viewsheds for their environmental, aesthetic, cultural, agricultural/forestal and recreational value.
- Define and identify priority areas for forestal, agricultural and open space conservation.
- Develop farmland and forestry retention programs, such as agricultural and forestal districts, to support open space protection efforts in Conservation and Agricultural areas.
- Continue the implementation and promotion of County's Conservation Easement Program
- Board of Supervisors should consider recommendations of the historic structures survey and implement as appropriate.

- Develop and adopt land-use practices and regulations under the zoning ordinance that protect historic sites and structures and their gateways and provide adequate buffer areas.
- Encourage efforts to maintain and repair historic structures in the County, and support the donation of historic easements.
- Support local, regional and state efforts to develop and promote heritage tourism and eco-tourism opportunities in the County.
- Cooperate with the National Park Service, Department of Forestry and National Forest Service in the protection of the Blue Ridge Parkway and the Appalachian Trail.
- Encourage all future development at Blue Ridge Parkway interchanges and along the Upper James to be designed consistent with the character, culture and history of these valuable resources.
- Support local, regional and state efforts to develop and promote heritage tourism and eco-tourism opportunities in the County such as the Upper James River and Appalachian Trail.
- Provide support to working farms.
- Support the farmer's markets; continue to support the Daleville farmer's market.
- Develop farmland protection programs, such as agricultural and forestal districts, to support open space protection efforts.

IMPLEMENTATION STRATEGIES

Environmental Considerations

Botetourt County should consider many environmental factors when reviewing for new development. The following are some recommendations for consideration:

- Consider the slope and general topographic characteristics of a property when evaluating proposals for the development of Class 3 and 4 properties. (Greater than 14% slope), encouraging and requiring appropriate design techniques that address the challenges of developing in steep terrain.
- Require the preparation of a groundwater impact analysis when major subdivisions and other large-scale developments are proposed.
- Consider and encourage the development of a broad range of programmatic and voluntary activities and incentives that address the appropriate development of Class 3 and Class 4 properties. Enhanced development guidelines and regulations for these properties should also be considered.
- Continue to participate in the Regional Early Action Compact as a way of proactively planning for air quality. In addition, the air quality characteristics of new development should be a factor considered when reviewing the impacts of new development.
- Explore creative ways to encourage the management of stormwater quality including the development of mandatory and/or voluntary low impact development design standards.

Historic Preservation Planning

Preserving the physical reminders of our past creates a sense of place and community pride. Historic preservation also generates a wide range of economic benefits including those associated with the rehabilitation and adaptive reuse of historic buildings and heritage tourism, as well as the impacts that historic designation has on neighborhood character and property values. Other benefits include the role that historic preservation plays in economic development and downtown revitalization.

The County can further implement a historic preservation planning program by the following actions:

- Link survey data to the planning process (i.e. mapping properties or districts that are or are eligible for National Register designation).
- Consider nominating local, state or national historic districts for protection.
- Consider amending the Zoning Ordinance to include a historic overlay district.
- Provide the Planning Commission and/or the Board of Supervisors with information concerning historic properties within proximity of development applications during the review process, so that potential adverse impacts to historic properties can be considered as a factor in their decision making.
- Advise applicants of potential adverse impacts of proposed projects on historic properties, and work cooperatively to achieve a site design that minimizes the impacts on historic resources.

- Work cooperatively with the owner and local historic preservation organizations to fully document historic properties and sites prior to demolition.
- Use the requirements of the building code as a resource to deter or slow demolition by neglect of historic properties.
- Provide information about state and federal historic preservation programs and incentives to local historic property owners.
- Lend support to private initiatives that preserve historic properties through acquisition, conservation easements or other preservation techniques.

Conservation Easements

Conservation Easements are further discussed in the Land Use Element of this plan. Not only are they a tool for land use planning, they assist with mitigating adverse impacts of land development on environmental and agricultural resources. A conservation easement is a deed restriction landowners voluntarily place on their property to permanently protect resources, such as productive agricultural land, ground and surface water, wildlife habitat, historic sites or scenic views. Conservation easements are flexible, and can be tailored to meet the needs of individual farmers and ranchers, and unique properties. They also provide farmers with several tax benefits including income, estate, and property tax reductions.

Botetourt County should continue to implement and administer its Conservation Easement program.

Agricultural Preservation

It is important to maintain a balance between development and preservation objectives throughout the County. When development applications are filed to convert agricultural lands to other uses, the economic and quality of life benefits of agricultural and forested land uses should be considered as significantly as the adequacy of public facilities and services available to serve new development in the area. Environmental impacts of development proposals - particularly those at higher, steep slope elevations - should also be heavily weighted.

The Future Land Use Map should be used as a general guide for future County development patterns and Zoning Ordinance revisions. Future residential, commercial and industrial development should be encouraged to locate in areas of the County where adequate public services are available or planned. For example, short term and ten-year timeframe plans for water and wastewater expansions are largely confined to the developed southern portions of the County.

6 COMMUNITY FACILITIES AND SERVICES

INTRODUCTION

Community facilities play a significant role in the dynamic of growth in Botetourt County. Well-timed and strategically located public facilities are necessary to promote and sustain the growth pattern proposed on the Future Land Use Map. They are also critical to achieving and maintaining the high quality of life that Botetourt County residents admire and have come to expect. Community facilities include both the utility infrastructure and the public services provided for the benefit of residents. For the purposes of this Comprehensive Plan, the Community Facilities Element addresses the following topics:

- Water and wastewater
- Solid waste management
- Public safety (police, fire, and emergency services)
- Schools
- Library services
- Recreation facilities

Community facilities and services are critical to quality of life and can directly affect a community's potential for growth. As Botetourt County's population continues to increase and change in character, demand for facilities and services will also increase and change -- more classroom space, police protection, social services, recreation facilities, etc., will be needed. Community facilities and services in the County are provided on several levels; the provision of these facilities and services is dependent on tax dollars, whether in the form of state aid, County supported programs or locally funded facilities and services.

Community facilities and services can also serve as a tool, or as an unexpected trigger, to guide or stimulate community growth and development. Availability of a public water supply or wastewater disposal system can be used as an economic development tool to attract business and industry. It can also attract associated commercial and residential development, for which the County must plan. The construction or improvement of roads can have a similar effect, resulting in changes to community character. In short, the planning and provision of community facilities and services must be undertaken within the overall context of the County's C*omprehensive Plan* and a public discussion of the community's long-term growth and development goals.

BACKGROUND

Community Facilities and Services Analysis

Recreation Services and Facilities

The active and passive recreational needs of Botetourt County residents and visitors are met through services and facilities that are provided by a broad cross-section of local, state, federal, and private sector entities. The Botetourt County Parks, Recreation, and Tourism, and its associated Advisory Parks and Recreation Commission were created by the Board of Supervisors in 1975 to address County recreational needs and to provide recreational opportunities for County residents. Today, the Botetourt County Recreation Department, with the assistance and guidance of the Advisory Commission, provides a wide variety of team and non-team and leisure programming for County residents. To provide these opportunities, the Department relies heavily on County schools to provide space for programming.

In May 2010, the Botetourt County Parks, Recreation, and Tourism prepared a *Five-Year Parks and Recreation Plan*. The plan provides an inventory of the wide variety of local, state, federal, and private recreational facilities that serve area residents and visitors. Map 24 (Recreation Sites) shows the recreational sites within Botetourt County. The plan also discusses the need to consider the financial constraints of limited local funding with specific emphasis on the County's Capital Improvement Incentive Fund and the County's Five Year Capital Improvement Planning process as a means to finance local recreational improvements. The plan concludes with a list of park and recreation projects, also included in the 2011-2015 Capital Improvements Plan, and outlines nine departmental objectives. Objectives address the issue of coordinating the development of recreation facilities with future school development and expansion of the County's on-going efforts to cooperate with local residents and interest groups, such as booster clubs, in the parks and recreation planning process. Objectives also stress the need to address ADA compliance, completion of regional recreation facilities at the Blue Ridge, Buchanan, Greenfield and North County Parks, and continued efforts to work with the County school system and local community colleges to expand the range of adult and youth recreation courses, and the strong role and active utilization of the Capital Improvements Incentive Fund Program.

Projects highlighted in the 2011-2015 Capital Improvement Plan include:

1. *Park Community Centers* - Construction of community recreation centers in Blue Ridge, Buchanan, Greenfield and North County Parks. (2014-2015)
2. *Botetourt Sports Complex* - Development of additional athletic fields, storage and locker room facilities. (2012-2014)
3. *Boxley Park* - Implementation of Boxley Fields Master Plan. Includes infield and fencing replacement for two instructional baseball fields, parking and field access upgrades, and installation of athletic field lighting. (2012-2014)
4. *Buchanan Park* – Complete parking and access routes for park (2012) and construct picnic pavilion and park amenities. (2013)
5. *Greenfield Historic Resources* - Historic preservation/relocation and initial planning of visitor center. (2011-2013)
6. *Greenfield Recreation Park* - Construct a concession/restroom building (2012), improve parking area with the installation of grass paver system (2013), and construct for tennis courts for recreation and high school play. (2013)
7. *Incentive Fund* - Grant to provide matching funds for community based park improvement projects. (2010-2015)
8. *ADA Compliance* - Provide for necessary improvements to become ADA compliant at county athletic facilities. (2010-2015)

Outdoor Recreation Opportunities

Outdoor recreation facilities are numerous within the County. The James River, the George Washington and Jefferson National Forests, the Blue Ridge Parkway, the Appalachian Trail, and the Carvins Cove Reservoir are just some of the many natural and scenic areas that contribute to the County's recreational amenities. These areas provide excellent opportunities for fishing, hiking, horseback riding, hunting, biking, boating, birding, kayaking, camping and general sightseeing. In addition to the recreational benefits, use of these areas by residents and visitors also provides an economic benefit to the County.

The James River

The James River, 14 miles of which is designated as a Virginia Scenic River, provides opportunities for freshwater fishing as do Craig, McFalls, Jennings, Middle, and Roaring Run Creeks. The James River is popular with smallmouth bass fishermen and has gained recognition for Muskie fishing. Rock bass, bream and catfish are also plentiful. The James River is also popular with rafters, canoeists and kayakers. There are five public boat access areas along the James River in Botetourt County. These are located near Arcadia, Buchanan, Horseshoe Bend, Springwood, and Iron Gate. Parking is available at each of the public boat launch sites. The Virginia Department of Game and Inland Fisheries maintains the public boat launch access points.

The *Upper James River Water Trail Strategic Plan* was produced in 2009 by the Botetourt County Office of Tourism and provides greater detail of plans to enhance the recreational use of the James River. The plan envisions a water-based trail system that will provide opportunities for recreation, conservation, tourism and education while preserving the natural, historic and cultural resources along the river. Goals and objectives of the plan include increasing public access to the James River, developing an identity for the Upper James River, and developing a sustainable tourism based economy along the corridor. Map 25 (James River Trail – Public Access Points) provides a geographic overview of the trail alignment. The plan emphasizes that Trail development should focus on increasing public (local and non-local) access to the river while working to preserve the natural state of the Upper James. By involving all sectors of the community and working collaboratively to identify and implement needed infrastructure, services and marketing improvements, the Upper James Trail can become a premier outdoor recreation destination.

George Washington and Jefferson National Forests

The Jefferson and George Washington National Forests offer excellent fishing, hunting and nature study opportunities. Together, the Forests have over 80,000 acres in the County and comprise over twenty-two percent of the County's land area. The U.S. Forest Service maintains four major recreation areas in Botetourt County: Craig Creek Recreation Area, Middle Creek Picnic Area, North Creek Campground and Roaring Run Furnace and Picnic Area. Craig Creek Recreation Area offers picnicking, primitive camping, space for trailers and horses, a loop trail and access to Craig Creek. Middle Creek Picnic Area located near Arcadia, has a large picnic area with shelters, a pavilion, water and restroom facilities. North Creek Campground (3 miles from Arcadia) includes 15 camping units with parking, picnic table, tent pad and fireplace. Water and restroom facilities are available. Roaring Run Furnace and Picnic Area is located 8 miles northwest of Eagle Rock and includes 15 picnic units and restroom facilities. Attractions include the Roaring Run Iron Furnace, a pre-Civil War iron ore furnace, Roaring Run Falls, and the Iron Ore National Recreational Trail.

The U.S. Forest Service also manages and maintains several trails that provide residents and visitors with hiking, equestrian and off-road opportunities. The Patterson Mountain Off-Road Vehicle Trail offers opportunities for all-terrain vehicles and dirt-bike enthusiasts. The trail is approximately 15 miles in length. The U.S. Forest Service maintains the 65-mile Glenwood Horse Trail that extends from Natural Bridge Station to Montvale. There are a series of trailheads dispersed along the trail, which offer parking and entry to the trail. Bearwallow Gap Horse Trail is located near Buchanan; primitive camping is permitted along the trail as well.

Appalachian Trail

The Country's premiere hiking trail passes through Botetourt County on its way from Maine to Georgia. The Appalachian Trail enters southwestern Botetourt County on Tinker Mountain, and then crosses the valley at Daleville, before heading into the Blue Ridge Mountains. The trail has numerous access points in the County. US 220 at I-81 near Exit 150 is the most popular. Other access is possible along Mountain Pass Road, and at numerous points along the Blue Ridge Parkway.

Blue Ridge Parkway

The Blue Ridge Parkway links the Shenandoah National Park in Virginia to the Great Smokey Mountains National Park in North Carolina. The parkway follows the Blue Ridge Mountains for 469 miles and passes through thirty-five miles of the southeast section of Botetourt County. The Parkway provides scenic vistas, areas for picnicking, overlooks and trailheads. The Parkway is accessible in Botetourt County from Route 43 east of Buchanan, from Route 618 near the Peaks of Otter, and from U.S. Route 460 in Blue Ridge.

Carvins Cove Reservoir

Carvins Cove Reservoir and its twenty square mile watershed lie within Botetourt and Roanoke Counties. Recreation opportunities of off-road bike, hiking, and horseback riding trails are located in the Carvins Cove. It is owned by the City of Roanoke and serves as a public water source for area residents. The City of Roanoke charges visitors a fee to access the property and for public boat rental. Carvins Cove is regulated by a series of policies set forth by the City of Roanoke to protect water quality. In recent years, access to the watershed has been further restricted due to public health and safety concerns.

Libraries

A public library is an important community facility, the use of which expands with increasing population, land development, and higher educational goals. Botetourt County provides public library services to the residents of Botetourt County and the Roanoke Valley. The library system has nearly 165,000 items including books, DVDs, audiobooks and magazine collections. There are four library buildings including the headquarters library, known as the Blue Ridge Library, on U.S. 460 East, the Fincastle Branch Library, the Buchanan Branch Library, and the new Eagle Rock Library (Map 26 – Schools and Libraries). Internet access is available at all four library locations. The library also operates a bookmobile, which serves populations in predominantly rural areas. Botetourt County Library patrons borrowed 261,213 items in FY10 as well as recording 195,265 visits to library facilities. Children's services are provided at all libraries, including preschool story hour and an annual summer reading program. The Botetourt library system is part of the Roanoke Area Libraries consortium, whose members share a common borrower's card and computer catalog. Botetourt patrons may also obtain books and other materials from the collections of the City of Roanoke, Roanoke County, and Salem libraries at no charge.

Electric Services

Botetourt County residents and businesses obtain their electric services from one of three utility companies. The Craig-Botetourt Electric Cooperative provides electric service in the western part of the County. Virginia Power Company serves customers in the Eagle Rock and Buchanan areas. Finally, American Electric Power serves the remainder of the County and has the largest service area and customer base.

Education

Currently, the Botetourt County School System operates seven elementary schools, two middle schools, two high schools, and a County-wide vocational school (Map 26 – Schools and Libraries). The elementary schools serve grades K-5; the middle schools serve grades 6-8; and the high schools serve grades 9-12. Several local institutions, including Dabney S. Lancaster Community College, Virginia Western Community College, Hollins University, Roanoke College, Radford University, and Virginia Polytechnic Institute and State University serve the regional higher education needs of Botetourt County residents. Finally, the Greenfield Education and Training Center provides extended learning and workforce training opportunities. All of these institutions are within a 50-mile radius of Fincastle.

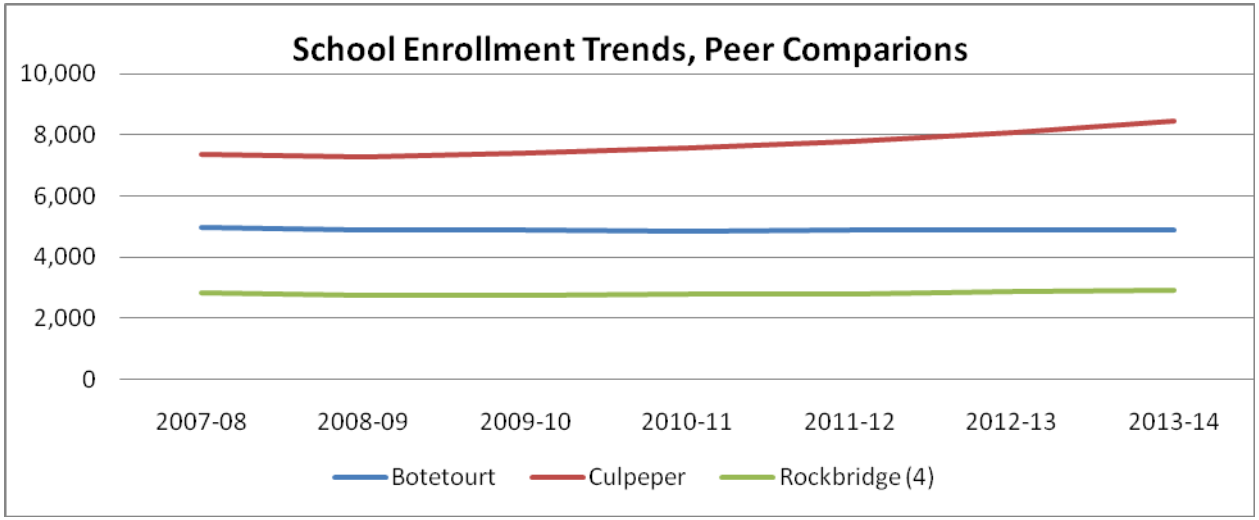
Fall enrollment in Botetourt County schools has been decreasing since 2007, and projections indicate membership will remain stable through 2013 (Table 45). When compared to peer counties, enrollment in the County schools has not kept up with population growth. This suggests that the new population growth is in the older, possibly retiree, age groups that do not have children at grade school age.

Table 45 – Historic & Projected Botetourt School Enrollment

HISTORIC & PROJECTED FALL MEMBERSHIP FOR VIRGINIA'S SCHOOL DIVISIONS: 2007-08 TO 2013-14													
School Division	Historic Membership* Fall Grades K-12:		Projected Fall Membership Grades K-12:					Numerical Change			Percentage Change		
								Historic	Forecast		Historic	Forecast	
	2007-08	2008-09	2009-10	2010-11	2011-12	2012-13	2013-14	2007-08 to 2008-09	2008-09 to 2009-10	2008-09 to 2013-14	2007-08 to 2008-09	2008-09 to 2009-10	2008-09 to 2013-14
Virginia**	1,202,342	1,205,169	1,208,994	1,214,286	1,221,361	1,233,113	1,246,869	2,827	3,825	41,700	0.2%	0.3%	3.5%
Botetourt	4,956	4894	4,880	4,865	4,872	4,889	4,901	-62	-14	7	-1.3	-0.3	0.2
Culpeper	7,368	7276	7,392	7,568	7,809	8,074	8,452	-92	116	1,176	-1.2	1.6	16.2
Rockbridge (4)	2,827	2772	2,768	2,805	2,796	2,886	2,939	-55	-4	167	-1.9	-0.1	6.0
Roanoke MSA	39,250	39036	38,871	38,624	38,655	38,784	39,040	-214	-165	4	-0.5	-0.4	0.0

Source: Demographics & Workforce Group, Weldon Cooper Center: www.coopercenter.org/demographics/SCHOOL%20FORECASTS/

Figure 9 – School Enrollment Forecast, Peer Comparison



Law Enforcement

The Botetourt County Sheriff's Department provides law enforcement services to Botetourt County and to the Towns of Buchanan, Fincastle and Town of Troutville. With offices located in Fincastle, the Department provides court security, civil process, law enforcement, criminal confinement, crime prevention, D.A.R.E., and animal control services as part of its departmental mission. Approximately twenty-four patrol officers and six investigators provide 24-hour services to County and town residents. An additional five sworn officers provide crime prevention programs and activities to residents.

Fire and Rescue Services

Seven volunteer fire departments and seven volunteer rescue squads located at a total of eight facilities provide fire and rescue services in Botetourt County (Map 27 – Fire and Rescue Stations). Map 33 (Fire Service Areas) and Map 34 (Rescue Service Areas) show the locations of these fire and rescue facilities and the service areas.

Additionally, Botetourt County operates career Emergency Medical Services from two locations:

1 – 24x7 Advanced Life Support (ALS) ambulance unit, based in Fincastle
1 – 12x7 (daytime) Advanced Life Support (ALS) ambulance based in Troutville
1 – 24x7 Advanced Life Support (ALS) response vehicle, based in Troutville.*
** - This unit is staffed with one Paramedic who responds to meet any available volunteer ambulances at the scene of a call, thus providing advanced life support services.*

While EMS is the primary mission, career staff members are cross-trained as firefighters and assist with fire response as required. A primary future focus should involve tracking response rates and making adjustments where required to ensure that Fire and EMS services are being provided appropriately and equitably.

In 2008, the County undertook a staffing study and strategies plan for fire and rescue services. The following goals and recommendations are from that plan.

Service Delivery Goals

- Improve Turnout Times and Response Times
- Improve Incident Coordination
- Enhance On-Scene Service Delivery
- Operational Incident Reporting

Recruitment and Retention Recommendations

- Returning Pride and Esprit de Corps (Retention)
- Incentive Programs

Training Recommendations

- Countywide Training Coordination
- Multi-Department Operations
- Increasing Participation at Training Programs
- Leadership Development

Based on the information found in the 2008 study, Botetourt County's current populations of medium density or higher are generally located within 1,000 feet of a fire hydrant (Map 28 - Road/Hydrant Analysis, Roads within 1,000ft of Hydrant and Map 29 - Road/Hydrant Analysis, Roads within three miles of Hydrant). Based on an evaluation of the travel distance capture area (Map 30 – Fire Station Travel Distance), most of the commercial nodes and residential areas are located within a five mile zone of a first response station. More importantly, the travel times of

five and ten minutes provide fire and rescue coverage to almost all main residential and commercial areas, include most low rural residential areas (Map 31 - Fire Station Travel Time and Map 32 – Rescue Station Travel Time). Based on this information, cross referenced with the Future Land Use map, Botetourt County's areas of designated growth can be served by sufficient fire and rescue services. However, consideration should be given to staffing levels for both fire and EMS service at each location.

Solid Waste Management

Residential solid waste is collected within Botetourt County by five private companies that collect waste in franchised service areas in accordance with adopted County law. Similarly, commercial businesses contract individually with one of seven private companies franchised to collect commercial waste countywide. These private waste collectors own and operate their own equipment. Collected waste is transported to the Salem Transfer Station for loading onto truck and conveyance and disposal at Amelia Virginia. A Citizen Convenience Center has been constructed adjacent to the Botetourt County landfill located off of Route 779 in the southwest portion of the County (Map 35 – Landfills and Recycle Centers). The Citizens Convenience Center accepts residential waste from citizens that do not want to use the franchised residential collection service.

The existing landfill has capacity and is in full compliance with Virginia Department of Environmental Quality (DEQ) solid waste management regulations. Closure of the landfill is not anticipated in the near future.

Refuse Collection - Refuse collection in Botetourt County is privatized through a franchise system. The County receives proposals, interviews and selects the haulers for the franchise contracts and sets the fees that can be charged to residential and commercial customers. The private companies bill the users of the collection services directly. The County is divided into five solid waste residential collection areas (Map 36 – Solid Waste Residential Collection Areas) and three classes of customers.

Refuse Disposal - In 2008, the County determined that it is in its best interest to transfer its waste to a disposal facility outside of the County. This decision was made after careful evaluation of its options and geologic investigations of property owned by the County. The existing County-owned property was found to be unsuitable. To site a new facility is very difficult given the rough geology of the County, its growth patterns, and timing.

Recycling - The County operates ten drop off sites, nine at the schools and one at the Customer Convenience Center, (Map 35). Compartmentalized roll-off boxes are placed at each site where newspaper, plastics #1 and #2, and metal cans are collected. As of July 1, 2004 the County's recycler would no longer accept brown and green glass. A contract hauler services the sites. The County also recycles tires and white goods at the landfill.

In 2004, the County, with a population of less than 100 persons per square mile, was able to reduce its recycling goal from 25% to15%, per §10.1-1411 D of the Code of Virginia. For 2007 and 2008 the County was below this goal, and operated under a VDEQ approved Recycling Action Plan during that period. The total recycling tonnage for 2009 was 3,550 tons, or 19.1%, bring the County back into conformance with the state mandated goal.

Litter Control- Includes volunteer programs associated with the Clean Valley Council, Adopt a Highway programs, and the use of inmate labor for periodic cleanup at the landfill.

Natural Gas

Natural gas service is available in many parts of Botetourt County. Currently, Roanoke Gas Company, a division of RGC Resources provides natural gas service to the industrial parks in the County, as well as to residents in the Town of Troutville, Daleville, Fincastle and Cloverdale areas. Communities along Route 604/Alternate 220 and U.S. Route 460 East into Webster are also served.

Botetourt County and many other parts of the Roanoke Valley are served by two major gas transmission supply lines that are owned and operated by Columbia Gas Transmission Company. Roanoke Gas also owns and operates a liquefied natural gas (LNG) facility in Botetourt County. This facility is located at the base of Tinker Mountain along Interstate 81. This facility serves as a backup source of natural gas during periods of high demand.

Natural gas lines do not currently serve Buchanan and Blue Ridge. For these and other rural areas, propane can be supplied by Highland Propane and Valley Propane.

Water and Wastewater Services

Public water and wastewater services often drive growth in suburban and urban communities. The location and availability of public water and waste water facilities are key determinants of land use patterns. Similarly, the timing and location of future extensions or new systems influences the location and rate of growth in a community. For this reason, effective community planning requires strong coordination between future utility plans and future land use and transportation plans and decisions.

Botetourt County has numerous public water and wastewater systems within its borders. These systems, which are regulated by the Virginia Department of Health and/or the Virginia Department of Environmental Quality, are owned and operated by a variety of County, municipal and private entities. Botetourt County has a strong interest in ensuring that public water and wastewater services are designed to meet the future needs of the County. Of particular importance are water and wastewater services to the County's existing and planned commercial and industrial areas and businesses. To this end, the County commissioned a comprehensive countywide water and wastewater analysis. The *Countywide Water and Wastewater Systems Analysis Update,* completed in the fall of 2009, was prepared by ARCADIS. The analysis looked at existing system conditions and projections of future need over a 20 year time frame; identifying deficiencies and recommending improvements to allow the County to continue providing appropriate water and wastewater service to its customers.

The water and wastewater analysis is considered a long-range plan for the development of these facilities, and is appended to this Comprehensive Plan by reference. As a component of this plan, it can be used as a general guide for decisions of the Board of Supervisors pertaining to future capital investment in these facilities. As with all plans, the Water and Wastewater Plan is subject to periodic review and possible revision to address current community needs and the availability of fiscal resources.

Specific recommendations included in the Countywide Water and Wastewater Systems Analysis Update (December 2009) are concentrated in the first ten years and will solve nearly all capacity problems foreseen through the year 2029. Phase 1 of the wastewater system improvements include replacement of pipes that are at or over capacity, specifically in areas between I-81 and the Roanoke County line on the Tinker Creek Interceptor (TCI) and one section on the Cook's Creek Interceptor. Phase 2 improvements include pipe replacements on the entire section of TCI between Lord Botetourt High School and I-81, with additional segments along Cook's Creek Interceptor. Phase 3 improvements should address the entire section of TCI between I-81 and just south of Read Mountain Road in Cloverdale and the remaining pipes in the lower portion of Cook's Creek Interceptor. Phase 4 improvements address remaining pipes in the TCI between Read Mountain Road and Roanoke County.

Phase 1 water system improvements include interconnecting all County systems; 8-inch water main from Greenfield to HUB, 8-inch water main from HUB to Cloverdale/Vista Park, and 12-inch water main from Cloverdale/Vista Park to East Park. Adding PRV at Radars Funeral Home and PRV from Greenfield to serve parts of Tinkerview Gardens. Installing a booster pump station at HUB. And, abandoning HUB well/springs and Cloverdale/Vista Park well. Phase 2 improvements include beginning to use the Weatherwood wells and changing the operation settings for Radars Funeral Home PRV. Phase 3 water system improvements include abandoning Tinkerview well and connecting all of Tinkerview to the Greenfield system.

Water System Development

The water demands of County residents are currently met through private wells and through a combination of County, municipal and private water systems that operate within the County. Botetourt County owns and operates several water systems. These include Greenfield, Weatherwood, Williamsburg Court, Cedar Ridge, Tinkerview Gardens, HUB, Autumnwood, Cloverdale/Vista Park, and EastPark. These eight individual systems are combined into five major systems based on their water source and the elevation of their customers: Greenfield, Tinkerview Gardens, HUB, Cloverdale/Vista Park, and EastPark. EastPark is supplied by Western Virginia Water Authority. Water for these systems is supplied by wells. In addition to these County systems, there are thirteen strategic private and municipal (non-County owned) water providers in the southern portion of the County.

Map 37 (Water and Wastewater Infrastructure) presents a summary of Botetourt County water system development plans for a twenty-year time horizon. The 2009 analysis of current and future demand reveals that, in general, water mains are adequately sized, if not over sized for the present and 20-year future horizon. Three phases are anticipated. Recommended immediate improvements include the interconnection of all County systems, specifically the Greenfield, HUB, Cloverdale/Vista Park, and EastPark systems. Interconnection of these three systems will improve water supply and distribution to the areas served by these systems. It will also allow for an enhanced capability to extend these systems to interconnect with some of the privately owned subdivision systems should a future public health need arise.

Within a ten-year time frame, the plan recommends placing the Wetherwood wells into service and proposes changes to operation settings for Raders Funeral Home. The twenty-year timeframe recommends taking the Tinkerview well source off-line.

Land Use Planning Considerations

Water system improvements during this 20-year time frame are generally located within the southern portion of the County to address the needs of specific areas identified by County staff. These areas include Daleville and Williamsburg Court vicinity of Greenfield's service area and north and east of the EastPark service area. Map 38 and Map 39 provide a comparison of existing and future land uses for the water and wastewater infrastructure.

Waste Water System Development

Wastewater treatment needs within Botetourt County are met through a combination of on-site facilities, County and municipal collection and treatment, and private treatment facilities. Botetourt County operates sewer lines in the south which includes the infrastructure tributary to the Tinker Creek Interceptor sewer, Cook's Creek Interceptor sewer, and the Glade Creek Interceptor sewer, that provide wastewater flows into the Western Virginia Water Authority's wastewater treatment plant near the City of Roanoke. Map 37 shows the location of wastewater collection systems in the County.

The comprehensive analysis of wastewater needs prepared by ARCADIS indicates that there are a few pipes in the three systems that are over-capacity during existing dry weather conditions and a number of others that are over-capacity during wet weather conditions. It also reveals that currently allocated flows, those which the County has promised to existing or near future customers, will significantly stress the Tinker Creek Interceptor. Future flows from growth projections for the 20-year period will exacerbate these sewer deficiencies.

GOALS, OBJECTIVES AND POLICIES

Community Facilities and Services Goals

- Ensure that Botetourt County residents are provided adequate public facilities and community services.
- Ensure the provision of and access to comprehensive and innovative state-of-the-art educational facilities, opportunities, and programs for Botetourt County residents.
- Enhance community safety and security through the provision of efficient and effective emergency services such as fire services, emergency medical and transport services, emergency management, and law enforcement.
- Enhance and increase recreational opportunities that will serve all segments of the County citizenry and visitors while preserving open spaces.

Community Facilities and Services Objectives

- Expand the County's water and wastewater systems in accord with the 2009 *Countywide Water and Wastewater Systems Analysis Update* analysis.
- Continue to address the County's solid waste management and recycling requirements in accordance with Virginia law.
- Support an expanded countywide library services program.
- Continue to develop and maintain an integrated County information system that supports all County functions.
- Pursue additional funding for the development of additional public facilities and the provision of programs and services.
- Promote a strong and progressive county school program to properly prepare students for post-secondary education opportunities and to provide students with an array of vocational and technical skills.
- Provide appropriate resources and facilities for law enforcement, fire and rescue training and distribution of services.
- Expand and diversify the County's recreational programs and facilities.

Community Facilities and Services Policies

- Implement the recommended near term improvements to the County's water and wastewater systems.
- Expand the County's water and wastewater system within planned growth areas only.
- Coordinate future public facility expansion and provision with land use planning efforts.
- Continue to operate the County landfill in accord with DEQ guidelines.
- Continue current County recycling initiatives.
- Implement solid waste management and recycling programs.
- Continue to implement the library's five-year plan for the expansion of facilities and programs.
- Expand library programs and facilities to adequately serve existing and future residents.
- Continue with the development, expansion and maintenance of the County's GIS system, and Internet based service delivery applications.
- Continue to prepare and adopt an annual five-year Capital Improvements Plan.
- Continue to monitor and pursue State and Federal grant and loan funds to assist with programmatic and capital needs for all County departments and functions.
- Identify and pursue potential private grant and loan funding sources for programmatic and capital needs.
- Provide training opportunities for teachers and staff.
- Enhance educational facilities.
- Support the development of programs designed to enhance the quality of educational services available for all students.
- Support the efforts of the Community Colleges and other entities to provide vocational and technical workforce-development opportunities and facilities to County students.

- Evaluate the recommendations contained in the recently completed Fire – Rescue Needs Assessment, and, as resources allow, implement those recommendations that are necessary to ensure a well coordinated and well trained fire and emergency medical response function.
- Continue to implement the Recreation Department's plan for the expansion of facilities and programs.
- Identify potential areas for County owned park and recreation area development.
- Develop joint school and County recreational facilities wherever practicable and promote programs that serve the recreational needs of all County residents.
- Support development of the Upper James River by improving and increasing access points to allow a variety of recreational types such as boating, fishing, picnicking and river viewing.
- Work with private landowners and government agencies to implement system of walking and bike paths, and trails that serve both the recreational and transportation needs of residents and visitors.
- Provide additional playgrounds, tennis courts and community swimming pools.
- Continue cooperation with the National Park Service, Department of Forestry and National Forest Service in the protection of the Blue Ridge Parkway and the Appalachian Trail.
- Identify and protect critical viewsheds for their environmental, aesthetic, cultural, agricultural/forestal and recreational value.
- Encourage all future development at Blue Ridge Parkway interchanges and along the Upper James to be designed consistent with the character, culture and history of these valuable resources.

IMPLEMENTATION STRATEGIES

Water and Wastewater Management

The major recommendations are concentrated in the first ten years and will solve nearly all capacity problems foreseen through the year 2029. Improvements are to be implemented in phases. Phase 1 improvements include replacement of pipes that are at or over capacity, specifically in areas between I-81 and the Roanoke County line on the Tinker Creek Interceptor (TCI) and one section on the Cook's Creek Interceptor. Phase 2 improvements include pipe replacements on the entire section of TCI between Lord Botetourt High School and I-81, with additional segments along Cook's Creek Interceptor. Phase 3 improvements should address the entire section of TCI between I-81 and just south of Read Mountain Road in Cloverdale and the remaining pipes in the lower portion of Cook's Creek Interceptor. Phase 4 improvements should address all remaining pipes in the TCI between Read Mountain Road and the Roanoke County line.

Exploration of a Water Authority

Botetourt County and its incorporated towns should explore the formation of a water authority that would serve as an independent public agency that collects, treats, stores and distributes water and transports and treats wastewater for residents of Botetourt County, Fincastle, Troutville and Buchanan. The common arrangement in Virginia is for the authority to serve as a wholesale agency with the localities as consumers, who in turn provide direct plumbing to individual customers. Further, it is common for funding of operations to be entirely paid for by users, though local and state funding would be sought for capital improvements.

Land Use Planning Considerations

Wastewater system improvements during this ten-year time frame are generally located within the southern portion of the County. Similar to the ten-year water plans, they are consistent with the policies and future land use map contained in this plan. The 20 year projections contained in the wastewater analysis are subjective due to the extreme difficulty of projecting needs or demand over a lengthy time horizon.

The Planning Commission should be kept apprised on the status of current County wastewater improvement plans and consider the timing of the implementation of those plans when evaluating land use requests within the existing and proposed wastewater service areas. As water and sewer capital improvements are phased for expansion, it is recommended that new areas to be served by these facilities be further studied by the Planning Commission to determine, and possibly redefine, appropriate future land uses in these areas.

Evaluation of Progress

Many counties in Virginia have established ways to conduct an evaluation of the progress and effectiveness of the policies and strategies of comprehensive plans. Some counties have annual review or measures for specific areas, targeting outcomes and/or general performance. Some have more comprehensive "report cards" that bring together various measures into a comprehensive assessment of the plans implementation and progress. This approach provides a means to measure the success or changes needed for the comprehensive plan, and its goals and objectives. It is recommended that Botetourt County Board of Supervisors and the Planning Commission explore the implementation of a means to evaluate the expectations of the comprehensive plan, providing an annual assessment of its progress.

DIVISION 1. - FLOOD HAZARD OVERLAY DISTRICT

Sec. 25-401. - Authority and purpose.

This article is adopted pursuant to the authority granted to localities by Code of Virginia § 15.2-2280.

The purpose of these provisions is to prevent the loss of life and property, the creation of public health and safety hazards, the disruption of commerce and governmental services, the extraordinary and unnecessary expenditure of public funds for flood protection and relief, and the impairment of the tax base by:

(1) Regulating uses, activities, and development which, alone or in combination with other existing or future uses, activities, and development, will cause unacceptable increases in flood heights, velocities, and frequencies.

(2) Restricting or prohibiting certain uses, activities and development from locating within areas subject to flooding.

(3) Requiring all those uses, activities, and developments that do occur in flood-prone districts to be protected and/or floodproofed against flooding and flood damage; and

(4) Protecting individuals from buying lands and structures which are unsuited for intended purposes because of flood hazards.

(Res. No. 10-10-19, 10-26-10)

Sec. 25-402. - Applicability.

These provisions of the flood hazard overlay district shall apply to all lands within the jurisdiction of Botetourt County and identified as being in the 100-year floodplain as delineated by the Federal Emergency Management Agency, Federal Insurance Administration Study, dated December 17, 2010, as amended.

(Res. No. 10-10-19, 10-26-10)

Sec. 25-403. - Permitted uses.

The flood hazard district is an overlay district, and thus the underlying provisions of each base district shall continue to apply except as otherwise provided for herein. The uses permitted in the underlying zoning district shall be permitted in the flood hazard overlay district, except as restricted or prohibited by the provisions of this section. (See section 25-414.)

(Res. No. 10-10-19, 10-26-10)

Sec. 25-404. - Uses permissible by special exception.

The uses identified as being allowed by a special exception permit in the underlying zoning district, shall be allowed in the flood hazard overlay district, except as restricted or prohibited by the provisions of this section, and only by a special exception permit as provided herein. (See section 25-414.)

(Res. No. 10-10-19, 10-26-10)

Sec. 25-405. - Compliance and liability.

(a) No land shall hereafter be developed and no structure shall be located, relocated, constructed, reconstructed, enlarged, or structurally altered except in full compliance with the terms and provisions of this division and any other applicable ordinances and regulations which apply to uses within the jurisdiction of this division.

(b) The degree of flood protection sought by the provisions of this division is considered reasonable for regulatory purposes and is based on acceptable engineering methods of study. Larger floods may occur on rare occasions. Flood heights may be increased by man-made or natural causes, such as ice jams and bridge openings restricted by debris. This division does not imply that areas outside the floodplain districts, or that land uses permitted within such districts, will be free from flooding or flood damages.

(c) This division shall not create liability on the part of Botetourt County or any officer or employee thereof for any flood damages that result from reliance on this division or any administrative decision lawfully made thereunder.

(Res. No. 10-10-19, 10-26-10)

Sec. 25-406. - Abrogation and greater restrictions.

This division supersedes any ordinance regulations currently in effect in flood-prone areas. However, any underlying ordinance and all districts established in this chapter shall remain in full force and effect to the extent that its provisions are more restrictive than this division.

(Res. No. 10-10-19, 10-26-10)

Sec. 25-407. - Severability.

If any section, subsection, paragraph, sentence, clause, or phrase of this division shall be declared invalid for any reason whatever, such decision shall not affect the remaining portions of this division. The remaining portions shall remain in full force and effect; and for this purpose, the provisions of this division are hereby declared to be severable.

(Res. No. 10-10-19, 10-26-10)

Sec. 25-408. - Penalties.

(a) Any person who fails to comply with any of the requirements or provisions of this division or directions of the zoning administrator or any other authorized employee of Botetourt County shall be guilty of a misdemeanor of the first class and subject to the penalties therefore.

(b) In addition to the above penalties, all other actions are hereby reserved, including an action in equity for the proper enforcement of this division. The imposition of a fine or penalty for any violation of, or noncompliance with, this division shall not excuse the violation or noncompliance to permit it to continue; and all such persons shall be required to correct or remedy such violations or noncompliances within a reasonable time. Any structure constructed, reconstructed, enlarged, altered, or relocated in noncompliance with this division may be declared by the Botetourt County Board of Supervisors to be a public nuisance and abatable as such. Flood insurance may be withheld from structures constructed in violation of this division.

(Res. No. 10-10-19, 10-26-10)

Sec. 25-409. - Description of sub-districts.

(a) The various floodplain sub-districts shall include areas subject to inundation by waters of the one hundred-year flood. The basis for the delineation of these districts shall be the Flood Insurance Study and the Flood Insurance Rate Map (FIRM) for Botetourt County prepared by the Federal Emergency Management Agency, Federal Insurance Administration, dated December 17, 2010, as amended.

(b) Floodway sub-district is delineated, for purposes of this division, using the criterion that certain areas within the floodplain must be capable of carrying the waters of a one hundred-year flood without increasing the water surface elevation of that flood more than one (1) foot at any point. The areas included in this sub-district are specifically shown on the flood boundary and floodway map and/or flood insurance rate map.

(c) The flood-fringe sub-district shall be that area of the one hundred-year floodplain not included in the floodway sub-district. The basis for the outermost boundary of this district shall be the one hundred-year flood elevations contained in the flood profiles of the above-referenced flood insurance study and as shown on the accompanying flood boundary and floodway map and/or flood insurance rate map.

(d) The approximated floodplain sub-district shall be that floodplain area for which no detailed flood profiles or elevations are provided, but where a one hundred-year floodplain boundary has been approximated. Such areas are shown as zone A on the maps accompanying the flood insurance study. For these areas, the one hundred-year flood elevations and floodway information from federal, state, and other acceptable sources shall be used, when available.

(e) The floodplain sub-districts described above all shall be overlays to the existing underlying districts shown on the official zoning ordinance map, in accord with section 25-402, and as such, the provisions for the floodplain districts shall serve as a supplement to the underlying district provisions.

(f) Any conflict between the provisions or requirements of the floodplain districts and those of any underlying district, the more restrictive provisions and/or those pertaining to the floodplain district shall apply.

(g) In the event any provision concerning a floodplain district is declared inapplicable as a result of any legislative or administrative actions or judicial decision, the basic underlying provisions shall remain applicable.

(Res. No. 10-10-19, 10-26-10)

Sec. 25-410. - Official zoning map.

The boundaries of the floodplain district are established as shown on the flood boundary and floodway and/or flood insurance rate maps which are declared to be a part of this division and which shall be kept on file at the Botetourt County Planning office.

(Res. No. 10-10-19, 10-26-10)

Sec. 25-411. - District boundary changes.

The delineation of any of the floodplain districts may be revised by the Botetourt County Board of Supervisors as it may deem appropriate and at its sole discretion, where natural or man-made changes have occurred and/or where more detailed studies have been conducted by the U.S. Army Corps of Engineers or other qualified agency, or if an individual documents the appropriateness of such change, and where, prior to any such change, approval is obtained from the Federal Insurance Administration.

(Res. No. 10-10-19, 10-26-10)

Sec. 25-411.1. - Submitting technical data.

A community's base flood elevations may increase or decrease resulting from the physical changes affecting flooding conditions. As soon as practicable, but not later than six (6) months after the date such information becomes available, a community shall notify the Federal Insurance Administration of the changes by submitting technical or scientific data. Such submission is necessary so that upon confirmation of those physical changes affecting flooding conditions, risk premium rates and flood plain management requirements will be based upon current data.

(Res. No. 10-10-19, 10-26-10)

Sec. 25-412. - Interpretation of district boundaries.

Initial interpretations of the boundaries of the floodplain districts shall be made by the zoning administrator. Appeals of the zoning administrator's determination may be made as provided for herein.

(Res. No. 10-10-19, 10-26-10)

Sec. 25-413. - District provisions.

(a) All uses, activities, and development occurring within any floodplain district shall be undertaken only upon the issuance of a zoning permit by the county. Such development shall be undertaken only in strict compliance with the provisions of this division and with all other applicable codes and ordinances, such as the Virginia Uniform Statewide Building Code and the Botetourt County Subdivision Regulations. Prior to the issuance of any such permit, the zoning administrator shall require all applications to include compliance with all applicable state and federal laws. Under no circumstances shall any use, activity, and/or development adversely affect the capacity of the channels or floodways of any watercourse, drainage ditch, or any other drainage facility or system.

(b) Prior to any proposed alteration or relocation of any channels or of any watercourse, stream, etc., within this jurisdiction, a permit from the U.S. Corps of Engineers, the Virginia Marine Resources Commission, and certification from the Virginia Department of Environmental Quality is necessary (a joint permit application is available from any one of these organizations). Further notification of the proposal shall be given to all affected adjacent jurisdictions, the department of conservation and recreation, and the Federal Insurance Administration.

(c) All applications for development in the floodplain district and all building permits issued for the floodplain shall incorporate the following information:

(1) The elevation of the lowest floor (including basement).

(2) For structures that have been floodproofed (nonresidential only), the elevation to which the structure has been floodproofed.

(3) Topographic information showing existing and proposed ground elevations.

(4) The elevation of the one hundred-year flood.

(5) Records of actions associated with administering this ordinance shall be kept on file and maintained by the zoning administrator.

(d) All manufactured homes to be placed or substantially improved within the floodplain district shall be placed on a permanent foundation and elevated and anchored in accordance with the Virginia Uniform Statewide Building Code.

(Res. No. 10-10-19, 10-26-10)

Sec. 25-414. - Standards for the floodway district; permitted use.

(a) Encroachments, including fill, new construction, substantial improvements and other developments are prohibited unless certification such as hydrologic and hydraulic analyses (with supporting technical data) is provided demonstrating that encroachments shall not result in any increase in flood levels during occurrence of the base flood. Hydrologic and hydraulic analyses shall be undertaken only

by professional engineers or others of demonstrated qualifications, who shall certify that the technical methods used correctly reflect currently-accepted technical concepts. Studies, analyses, computations, etc., shall be submitted in sufficient detail to allow a thorough review by the zoning administrator.

Development activities which increase the water surface elevation of the base flood may be allowed, provided that the developer or applicant first applies — with the Botetourt County's endorsement — for a conditional flood insurance rate map and floodway revision, and receives the approval of the Federal Emergency Management Agency.

(b) The placement of any manufactured home (mobile home), except in an existing manufactured home (mobile home) park or subdivision, within the floodway sub-district is specifically prohibited. A replacement manufactured home (mobile home) may be placed on a lot in an existing manufactured home (mobile home) park or subdivision provided the anchoring, elevation, and encroachment standards are met.

(c) In the floodway sub-district, the following uses and activities are permitted provided that they are in compliance with the provisions of the underlying district and are not prohibited by any other ordinance and provided that they do not require structures, fill, or storage of materials and equipment:

(1) Agricultural uses, such as general farming, pasture, grazing, outdoor plant nurseries, horticulture, truck farming, forestry, sod farming, and wild crop harvesting.

(2) Public and private recreational uses and activities, such as parks, day camps, picnic grounds, golf courses, boat-launching and swimming areas, horseback riding and hiking trails, wildlife and nature preserves, game farms, fish hatcheries, trap and skeet game ranges, and hunting and fishing areas.

(3) Accessory residential uses (but not habitable structures), such as yard areas, gardens, play areas, and loading areas.

(4) Accessory industrial and commercial uses, such as yard areas, pervious parking and loading areas and airport landing strips.

(5) In the floodway sub-district, no use, structure, fill, deposit, obstruction or storage of materials or equipment will be permitted which, acting alone or in combination with existing or future uses, will result in affecting the capacity of the floodway or unduly increasing flood limits. Such limits will be those established by the federal insurance administration.

(Res. No. 10-10-19, 10-26-10)

Sec. 25-415. - Standards for the special floodplain district and approximated floodplain.

(a) The following provisions shall apply within the Special Floodplain District: Until a regulatory floodway is designated, no new construction, substantial improvements, or other development (including fill) shall be permitted within the areas of special flood hazard, designated as zones A1-30 and AE on the flood insurance rate map, unless it is demonstrated that the cumulative effect of the proposed development, when combined with all other existing and anticipated development, will not increase the water surface elevation of the base flood more than one foot at any point within the county.

Development activities in zones A1-30, and AE, on the county's flood insurance rate map which increase the water surface elevation of the base flood by more than one foot may be allowed, provided that the developer or applicant first applies — with the county's endorsement— for a conditional flood insurance rate map revision, and receives the approval of the Federal Emergency Management Agency.

(1) The following provisions shall apply with the approximate floodplain district:

a. The approximated floodplain district shall be that floodplain area for which no detailed flood profiles or elevations are provided, but where a one hundred-year floodplain boundary has been approximated. Such areas are shown as zone A on the maps accompanying the flood insurance study. For these areas, the one hundred-year flood elevations and floodway information from federal, state, and other acceptable sources shall be used, when available. It is recommended that the applicant refer to FEMA Publication 265, "Managing Floodplain Development in Approximate Zone A Areas, A Guide for Obtaining and Developing Base (100-Year) Flood Elevations."

b. Where the specific one hundred-year flood elevation cannot be determined for this area using other sources of data, such as the U. S. Army Corp of Engineers Floodplain Information Reports, U.S. Geological Survey Flood-Prone Quadrangles, etc., an applicant for a proposed use, development and/or activity greater than fifty (50) lots or five (5) acres, whichever is lesser, shall determine this elevation. For development proposed in the approximate floodplain, the applicant must use technical methods that correctly reflect currently accepted technical concepts, such as point on boundary, high water marks, or hydrologic and hydraulic analyses.

Studies, analyses, computations, etc., shall be submitted in sufficient detail to allow a thorough review by the zoning administrator.

The zoning administrator reserves the right to require hydrologic and hydraulic analyses for any development.

When such base flood elevation data is utilized, the lowest floor shall be elevated one (1) foot above the base flood elevation. During the permitting process, the zoning administrator shall obtain:

(1) The elevation of the lowest floor (including the basement) of all new and substantially improved structures; and

(2) If the structure has been flood-proofed in accordance with the requirements of this article, the elevation (in relation to mean sea level) to which the structure has been flood-proofed.

(Res. No. 10-10-19, 10-26-10; Res. No. 11-10-10, 10-25-11)

Sec. 25-416. - General standards.

In all special flood hazard areas the following provisions shall apply:

(a) New construction and substantial improvements shall be according to the VA USBC, and anchored to prevent flotation, collapse or lateral movement of the structure.

(b) Manufactured homes shall be anchored to prevent flotation, collapse, or lateral movements. Methods of anchoring may include, but are not limited to, use of over-the-top or frame ties to ground anchors. This standard shall be in addition to and consistent with applicable state requirements for resisting wind forces.

(c) New construction and substantial improvements shall be constructed with materials and utility equipment resistant to flood damage.

(d) New construction or substantial improvements shall be constructed by methods and practices that minimize flood damage.

(e) Electrical, heating, ventilation, plumbing, air conditioning equipment and other service facilities, including duct work, shall be designed and/or located so as to prevent water from entering or accumulating within the components during conditions of flooding.

(f) New and replacement water supply systems shall be designed to minimize or eliminate infiltration of flood waters into the system.

(g) New and replacement sanitary sewage systems shall be designed to minimize or eliminate infiltration of flood waters into the systems and discharges from the systems into flood waters.

(h) On-site waste disposal systems shall be located and constructed to avoid impairment to them or contamination from them during flooding.

(i) Any alteration, repair, reconstruction or improvements to a building that is in compliance with the provisions of this ordinance shall meet the requirements of "new construction" as contained in this article.

(j)

Any alteration, repair, reconstruction or improvements to a building that is not in compliance with the provisions of this article, shall be undertaken only if said nonconformity is not furthered, extended, or replaced.

(k) The flood carrying capacity within an altered or relocated portion of any watercourse shall be maintained.

(l) All new or replacement utilities and facilities shall be designed and constructed in conformance with the county's regulations for subdivision, stormwater management, erosion and sediment control and other such regulations.

(m) All storm drainage facilities shall be designed to convey the flow of surface waters without damage to persons or property. The systems shall ensure drainage away from buildings and on-site waste disposal sites. The Botetourt County Board of Supervisors may require a primarily underground system to accommodate frequent floods and a secondary surface system to accommodate larger, less frequent floods. Drainage and facility plans shall be consistent with local and regional drainage plans and with all other applicable ordinances.

(n) All utilities, such as gas lines, electrical and telephone systems being placed in flood-prone areas should be located, elevated (where possible), and constructed to minimize the chance of impairment during a flooding occurrence.

(o) Streets and sidewalks should be designed to minimize their potential for increasing and aggravating the levels of flood flow. Drainage openings shall be required to sufficiently discharge flood flows without unduly increasing flood heights.

(p) All new structures shall be constructed so that the lowest habitable elevation is at least one (1) foot above the base flood elevation.

(Res. No. 10-10-19, 10-26-10)

Sec. 25-416.1. - Specific standards.

In all special flood hazard areas where base flood elevations have been provided in the flood insurance study or generated according to article III, section 25-415 the following provisions shall apply:

(a) *Residential construction.* New construction or substantial improvement of any residential structure (including manufactured homes) shall have the lowest floor, including basement, elevated no lower than one (1) foot above the base flood elevation.

(b) *Nonresidential construction.* New construction or substantial improvement of any commercial, industrial, or nonresidential building (or manufactured home) shall have the lowest floor, including basement, elevated to no lower than one (1) foot above the base flood elevation. Buildings located in all A and AE zones may be floodproofed in lieu of being elevated provided that all areas of the building components below the elevation corresponding to the BFE plus one (1) foot are water tight with walls substantially

impermeable to the passage of water, and use structural components having the capability of resisting hydrostatic and hydrodynamic loads and the effect of buoyancy. A registered professional engineer or architect shall certify that the standards of this subsection are satisfied.

(c) *Elevated buildings.* Enclosed areas, of new construction or substantially improved structures, which are below the regulatory flood protection elevation shall:

(1) Not be designed or used for human habitation, but shall only be used for parking of vehicles, building access, or limited storage of maintenance equipment used in connection with the premises. Access to the enclosed area shall be the minimum necessary to allow for parking of vehicles (garage doors) or limited storage of maintenance equipment (standard exterior door), or entry to the living area (stairway or elevator).

(2) Be constructed entirely of flood resistant materials below the regulatory flood protection elevation;

(3) Include, in zones A and AE measures to automatically equalize hydrostatic flood forces on walls by allowing for the entry and exit of floodwater. To meet this requirement, the openings must either be certified by a professional engineer or architect or meet the following minimum design criteria:

a. Provide a minimum of two (2) openings on different sides of each enclosed area subject to flooding.

b. The total net area of all openings must be at least one (1) square inch for each square foot of enclosed area subject to flooding.

c. If a building has more than one (1) enclosed area, each area must have openings to allow floodwaters to automatically enter and exit.

d. The bottom of all required openings shall be no higher than one (1) foot above the adjacent grade.

e. Openings may be equipped with screens, louvers, or other opening coverings or devices, provided they permit the automatic flow of floodwaters in both directions.

f. Foundation enclosures made of flexible skirting are not considered enclosures for regulatory purposes, and, therefore, do not require openings. Masonry or wood underpinning, regardless of structural status, is considered an enclosure and requires openings as outlined above.

(d) *Manufactured homes.* All manufactured homes placed or substantially improved on individual lots or parcels, in expansions to existing manufactured home parks or subdivisions, in a new manufactured home park or subdivision, or in an existing manufactured home park or subdivision on which a manufactured home has incurred substantial damage as a result of a flood

must meet all the requirements for new construction, including the elevation and anchoring requirements in section 25-416(a) and (b) and section 25-416.1(a).

(e) *Recreational vehicles.* All recreational vehicles placed on sites must either be on the site for fewer than one hundred eighty (180) consecutive days; be fully licensed and ready for highway use (a recreational vehicle is ready for highway use if it is on its wheels or jacking system, is attached to the site only by quick disconnect type utilities and security devises and has no permanently attached additions); or, meet all requirements for manufactured homes in section 25-416 and section 25-416.1(d).

(Res. No. 10-10-19, 10-26-10)

Sec. 25-417. - Information to be shown on plat of proposed subdivision.

The owner or developer of any proposed subdivision or any site plan, any part of which is located within a flood hazard district, shall include the following information on the subdivision plat or site plan required by this chapter and/or by chapter 21 of this Code (subdivision ordinance):

(1) Name of engineer, surveyor or other qualified person responsible for providing the information required in this section.

(2) The location of the proposed subdivision with respect to the county's flood-prone areas, proposed lots and sites, fills, flood or erosion protection facilities and areas subject to special deed restrictions. In addition, all subdivisions shall show the limits of the floodplain and if construction or fills within the one hundred-year floodplain are required, shall include base flood elevations, and shall delineate the floodway area based on the requirement that the proposed development not increase the one hundred-year flood elevation more than one (1) foot at any one point and no fill or construction will be placed in the floodway. The engineering principle of "equal reduction of conveyance" shall be used to make the determination of increased flood heights and velocities.

(3) Where the subdivision and other new development lies partially or completely in the flood-prone areas, the plan map shall include detailed information giving the location and elevation of proposed roads, public utilities and building sites. All such maps shall also show contours, at intervals of two (2), four (4), or five (5) feet, depending upon the slope of the land, and identify accurately the boundaries of the flood-prone areas.

(4) Location of water and sewer systems (including on-site systems).

(Res. No. 10-10-19, 10-26-10)

Sec. 25-418. - Notice to be given buyer prior to sale of real estate subject to floodplain regulations.

(a) Any owner or partial owner of real estate or his agent, and any real estate broker or his agent, who sells or contracts to sell real estate subject to a floodplain regulation, without first notifying, in writing, the buyer or his agent that such real estate is subject to floodplain regulations, shall be subject to the penalties set forth in subsection (c) below.

(b) Floodplain regulations referred to in subsection (a) of this section include this chapter, subdivision regulations and building codes which impose restrictions specifically related to flooding on the whole or a portion of the land.

(c) The penalties for a violation of subsection (a) of this section may, at the discretion of the court, include:

(1) Rescission of the contract at the option of the buyer;

(2) Payment to the buyer of damages he may have suffered, whether the buyer rescinds the contract or not; or

(3) A fine of not more than two thousand dollars ($2,000.00).

(Res. No. 10-10-19, 10-26-10)

Sec. 25-419. - Prohibited development and uses in floodway sub-district generally.

(a) No development which increases flood heights and produces hazardous velocities shall be permitted in the floodway sub-district.

(b) In the floodway sub-district, no use, structure, fill, deposit, obstruction or storage of materials or equipment will be permitted which, acting alone or in combination with existing or future uses, will result in affecting the capacity of the floodway or unduly increasing flood limits. Such limits will be those established by the federal insurance administration.

(c) No new residential or commercial uses shall be permitted in the floodway sub-district.

(Res. No. 10-10-19, 10-26-10)

Sec. 25-420. - Flood protection provisions relating to variances, special exceptions, rezoning, etc.

(a) Any agent, commission or board of the county, in taking action on special exceptions, rezoning, special uses, variances and amendments to this chapter, shall consider, in addition to all pertinent provisions of other sections of this chapter, the following:

(1) The danger of life and property due to increased flood heights or velocities caused by encroachments. No variance shall be granted for any proposed use, development, or activity within the floodway district that will cause any increase in flood levels during the one hundred-year flood.

(2) The danger that materials may be swept on to other lands or downstream to the injury of others.

(3) The proposed water supply and sanitation systems and the ability of these systems to prevent disease, contamination, and unsanitary conditions.

(4) The susceptibility of the proposed facility and its contents to flood damage and the effect of such damage on the individual owners.

(5) The importance of the services provided by the proposed facility to the community.

(6) The requirements of the facility for a waterfront location.

(7) The availability of alternative locations not subject to flooding for the proposed use.

(8) The compatibility of the proposed use with existing development and development anticipated in the foreseeable future.

(9) The relationship of the proposed use to the comprehensive plan and floodplain management program for the area.

(10) The safety of access of ordinance and emergency vehicles to the property in time of flood.

(11) The expected heights, velocity, duration, rate of rise, and sediment transport of the flood waters expected at the site.

(12) The historic nature of a structure. Variances for repair or rehabilitation of historic structures may be granted upon a determination that the proposed repair or rehabilitation will not preclude the structure's continued designation as a historic structure and the variance is the minimum necessary to preserve the historic character and design of the structure.

(13) Such other factors which are relevant to the purposes of this division.

(b) The board of zoning appeals may refer any application and accompanying documentation pertaining to any request for a variance to any engineer or other qualified person or agency for technical assistance in evaluation of the proposed project in relation to flood heights and velocities, and the adequacy of the plans for flood protection and other related matters.

(c) Variances shall be issued only after the board of zoning appeals has determined that the granting of such will not result in: a) increases in flood heights, b) additional unreasonable threats to public safety, c) extraordinary public expense, and will not d) create nuisances, e) cause fraud or victimization of the public, or f) conflict with local laws or ordinances.

(d) Variances shall be issued only upon a showing of good and sufficient cause after the board of zoning appeals has determined that variance will be the minimum required to provide relief from any hardship to the applicant.

(e)

The board of zoning appeals shall notify the applicant for a variance, in writing, that the issuance of a variance to construct a structure below the one hundred-year flood elevation (a) increases the risks to life and property and (b) will result in increased premium rates for flood insurance.

(f) A record shall be maintained of the above notification as well as all variance actions, including justification for the issuance of the variances. Any variances which are issued shall be noted in the annual or biennial report submitted to the federal insurance administrator.

(Res. No. 10-10-19, 10-26-10)

Sec. 25-421. - Existing structures in floodplain district.

A structure or use of a structure or premises which lawfully existed before the enactment of these provisions, but which is not in conformity with these provisions, may be continued subject to the following conditions:

(1) Existing structures and/or uses located in the floodway district shall not be expanded or enlarged, unless it has been demonstrated through hydrologic and hydraulic analyses performed in accordance with standard engineering practices that the proposed expansion would not result in any increase in the base flood elevation.

(2) Any modification, alteration, repair, reconstruction, or improvement of any kind to a structure and/or use located in any floodplain district to an extent or amount of less than fifty (50) percent of its market value, shall be elevated and/or floodproofed in full compliance with this ordinance and the Virginia Uniform Statewide Building Code.

(3) The modification, alteration, repair, reconstruction, or improvement of any kind to a structure and/or use, regardless of its location in a floodplain district, to an extent or amount of fifty (50) percent or more of its market value shall be undertaken only in full compliance with this ordinance and shall require the entire structure to conform to the Virginia Uniform Statewide Building Code.

(4) Uses or adjuncts thereof which are, or become, nuisances shall not be permitted to continue.

(Res. No. 10-10-19, 10-26-10)

Sec. 25-422. - Definitions.

For the purpose of this flood damage prevention overlay ordinance, the following words and phrases shall have the meanings respectfully ascribed to them by this section. Any word, term or phrase used in this overlay ordinance not defined below shall have the meaning ascribed to the word in section 25-601 of the zoning ordinance or if not defined there then in the most recent edition of Webster's unabridged Dictionary, unless in the opinion of the zoning administrator established customs or practices of the County of Botetourt justify a different or additional meaning:

Base flood.* The flood having a one (1) percent chance of being equaled or exceeded in any given year.

Base flood elevation.* The Federal Emergency Management Agency designated one hundred-year water surface elevation.

Basement.* Any area of the building having its floor sub-grade (below ground level) on all sides.

Board of zoning appeals.* The board appointed to review appeals made by individuals with regard to decisions of the zoning administrator in the interpretation of this article.

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

Elevated building.* A nonbasement building built to have the lowest floor elevated above the ground level by means of fill, solid foundation perimeter walls, pilings, or columns (posts and piers).

Encroachment.* The advance or infringement of uses, plant growth, fill, excavation, buildings, permanent structures or development into a floodplain, which may impede or alter the flow capacity of a floodplain.

Existing manufactured home park or subdivision.* A manufactured home park or subdivision for which the construction of facilities for servicing the lots on which the manufactured homes are to be affixed (including, at a minimum, the installation of utilities, the construction of streets, and either final site grading or the pouring of concrete pads) is completed before the effective date of the floodplain management regulations adopted by a community.

Expansion to an existing manufactured home park or subdivision.* The preparation of additional sites by the construction of facilities for servicing the lots on which the manufacturing homes are to be affixed (including the installation of utilities, the construction of streets, and either final site grading or the pouring of concrete pads).

Fill. The placing, storage or dumping of any material, such as (by way of illustration, but not limitation) earth, clay, sand, concrete, rubble, or waste of any kind, upon the surface of the ground, which results in increasing the natural ground surface elevation.

Flood or *flooding*.*

(1) A general or temporary condition of partial or complete inundation of normally dry land areas from:

   a. The overflow of inland or tidal waters; or

   b. The unusual and rapid accumulation or runoff of surface waters from any source.

(2) The collapse or subsidence of land along the shore of a lake or other body of water as a result of erosion or undermining caused by waves or currents of water exceeding anticipated cyclical levels or suddenly caused by an unusually high water level in a natural body of water, accompanied by a severe storm, or by an unanticipated force of nature such as flash flood or an abnormal tidal surge, or by some similarly unusual and unforeseeable event which results in flooding as defined in paragraph (1)a. of this definition.

(3) Mudflows which are proximately caused by flooding as defined in paragraph (1)b. of this definition and are akin to a river of liquid and flowing mud on the surfaces of normally dry land areas, as when earth is carried by a current of water and deposited along the path of the current.

Flood insurance rate map (FIRM).* An official map of a community on which both the special hazard areas and the risk premium zones applicable to the community are delineated.

Flood insurance study (FIS). An examination, evaluation and determination of flood hazards and, if appropriate, corresponding water surface elevations, or an examination, evaluation and determination of mudflow and/or flood-related erosion hazards.

Floodplain or flood-prone area.* Any land area susceptible to being inundated by water from any source.

Floodproofing. any combination of structural and nonstructural additions, changes or adjustments to structures which reduce or eliminate flood damage to real estate or improved real property, water and sanitary facilities, structures and their contents.

Floodway.* The channel of a river or other watercourse and the adjacent land areas that must be reserved in order to discharge the base flood without cumulatively increasing the water surface elevation more than a designated height.

*Freeboard** A factor of safety usually expressed in feet above a flood level for purposes of floodplain management. "Freeboard" tends to compensate for the many unknown factors that could contribute to flood heights greater than the height calculated for a selected size flood and floodway conditions, such as wave action, bridge openings, and the hydrological effect of urbanization in the watershed.

Highest Adjacent Grade. The highest natural elevation of the ground surface prior to construction next to the proposed walls of a structure.

Historic structure.* Any structure that is:

(1) Listed individually in the National Register of Historic Places (a listing maintained by the Department of Interior) or preliminarily determined by the Secretary of the Interior as meeting the requirements for individual listing on the National Register;

(2) Certified or preliminarily determined by the Secretary of the Interior as contributing to the historical significance of a registered historic district or a district preliminarily determined by the Secretary to qualify as a registered historic district;

(3) Individually listed on a state inventory of historic places in states with historic preservation programs which have been approved by the Secretary of the Interior; or

(4) Individually listed on a local inventory of historic places in communities with historic preservation programs that have been certified either:

a. By an approved state program as determined by the Secretary of the Interior; or

b. Directly by the Secretary of the Interior in states without approved programs.

Lowest floor.* The lowest floor of the lowest enclosed area (including basement). An unfinished or flood-resistant enclosure, usable solely for parking of vehicles, building access or storage in an area other than a basement area is not considered a building's lowest floor; provided, that such enclosure is not built so as to render the structure in violation of the applicable nonelevation design requirements of Federal Code 44 CFR § 60.3.

Manufactured home.* A structure, transportable in one (1) or more sections, which is built on a permanent chassis and is designed for use with or without a permanent foundation when connected to the required utilities. For floodplain management purposes the term manufactured home also includes park trailers, travel trailers, and other similar vehicles placed on a site for greater than one hundred eighty (180) consecutive days.

Manufactured home park or subdivision.* A parcel (or contiguous parcels) of land divided into two (2) or more manufactured home lots for rent or sale.

Manufactured home park or subdivision, new.* A manufactured home park or subdivision for which the construction of facilities for servicing the lots on which the manufactured homes are to be affixed (including at a minimum, the installation of utilities, the construction of streets, and either final site grading or the pouring of concrete pads) is completed on or after the effective date of floodplain management regulations adopted by a community.

New construction.* For the purposes of determining insurance rates, structures for which the "start of construction" commenced on or after the effective date of an initial flood insurance rate map on or after June 15, 1978, whichever is later, and includes any subsequent improvements to such structures. For floodplain management purposes, new construction means structures for which start of construction commenced on or after the effective date of a floodplain management regulation adopted by a community and includes any subsequent improvements to such structures.

Recreational vehicle.* A vehicle which is:

(1) Built on a single chassis;

(2) Four hundred (400) square feet or less when measured at the largest horizontal projection;

(3) Designed to be self-propelled or permanently towable by a light duty truck; and

(4) Designed primarily not for use as a permanent dwelling but as temporary living quarters for recreational camping, travel, or seasonal use.

Shallow flooding area.* A special flood hazard area with base flood depths from one (1) to three (3) feet where a clearly defined channel does not exist, where the path of flooding is unpredictable and indeterminate, where velocity flow may be evident. Such flooding is characterized by ponding or sheet flow.

Special flood hazard area.* The land in the floodplain subject to a one (1) percent or greater chance of being flooded in any given year as determined in section 25-416 of this article.

Start of construction.* The date the building permit was issued, provided the actual start of construction, repair, reconstruction, rehabilitation, addition, placement, substantial improvement or other improvement was within one hundred eighty (180) days of the permit date. The actual start means either the first placement of permanent construction of a structure on a site, such as the pouring of slab or footings, the installation of piles, the construction of columns, or any work beyond the stage of excavation; or the placement of a manufactured home on a foundation. Permanent construction does not include land preparation, such as clearing, grading and filling; nor does it include the

installation on the property of accessory buildings, such as garages or sheds not occupied as dwelling units or not part of the main structure. For a substantial improvement, the actual start of the construction means the first alteration of any wall, ceiling, floor, or other structural part of a building, whether or not that alteration affects the external dimensions of the building.

Structure.* For flood plain management purposes a walled and roofed building, including a gas or liquid storage tank that is principally above ground, as well as a manufactured home. Structure for insurance coverage purposes means a walled and roofed building, other than a gas or liquid storage tank that is principally above and affixed to a permanent site, as well as a manufactured home on a permanent foundation. For the latter purpose, the term includes a building while in the course of construction, alteration or repair, but does not include building materials or supplies intended for use in such construction, alteration or repair, unless such materials or supplies are within an enclosed building on the premises.

Subdistrict. One of several defined areas of a flood hazard overlay district that have different probabilities for flooding.

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

Substantial improvement.* Any reconstruction, rehabilitation, addition, or other improvement of a structure, the cost of which equals or exceeds fifty (50) percent of the market value of the structure before the start of construction of the improvement. This term includes structures which have incurred substantial damage regardless of the actual repair work performed. The term does not, however, include either:

(1) Any project for improvement of a structure to correct existing violations of state or local health, sanitary, or safety code specifications which have been identified by the local code enforcement official and which are the minimum necessary to assure safe living conditions, or

(2) Any alteration of a historic structure, provided that the alteration will not preclude the structure's continued designation as a historic structure.

Violation.* The failure of a structure or other development to be fully compliant with the community's floodplain management regulations. A structure or other development without the elevation certificate, other certificates, or other evidence of compliance required by this chapter is presumed to be in violation until such time as all documentation is provided and approved by the appropriate county official(s).

Watercourse.* A lake, river, creek, stream, wash, channel or other topographic feature on or over which waters flow at least periodically. Watercourse includes specifically designated areas in which substantial flood damage may occur.

* Denotes definitions to be used only for the purpose of this flood damage prevention overlay ordinance, the words and phrases shall have the meanings respectfully ascribed to them by this section.

Virginia Vulnerability Viewer

Getting Started | Locality/Address Search | Methods | Switch Basemap | Close Print

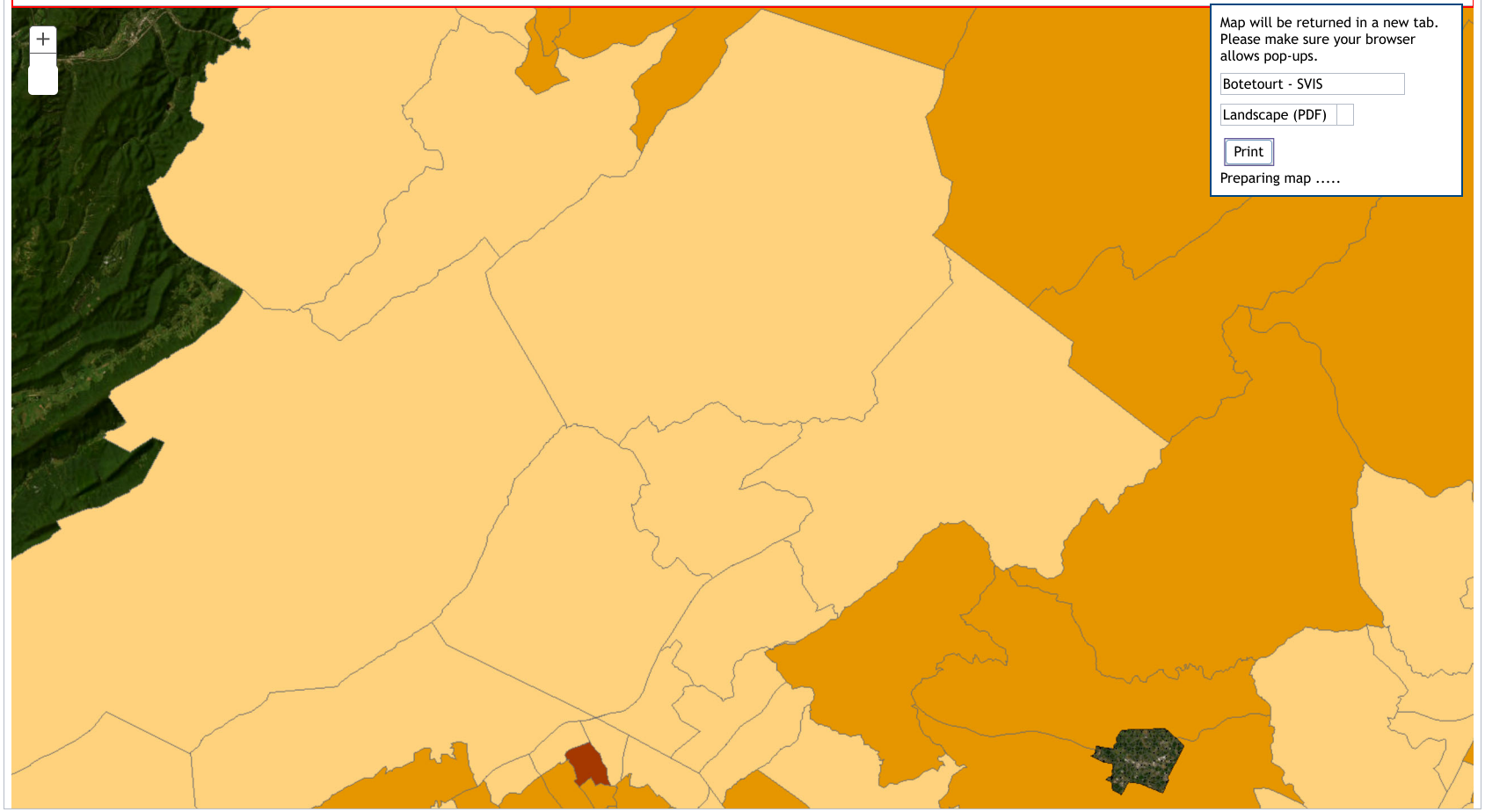
Map will be returned in a new tab. Please make sure your browser allows pop-ups.

Botetourt - SVIS

Landscape (PDF)

Print

Preparing map .....



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- Low Social Vulnerability
- Moderate Social Vulnerability
- High Social Vulnerability
- Very High Social Vulnerability
- Not inlcuded in the analysis

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