Regional Natural Hazard Mitigation Plan

2023 UPDATE

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Executive Summary

BACKGROUND

The purpose of the Regional Natural Hazard Mitigation Plan is to prepare for natural disasters before they occur, thus reducing loss of life, property damage, and disruption of commerce. The Federal Emergency Management Agency (FEMA) requires such a plan as a condition for eligibility in certain mitigation grant programs. The plan applies to all jurisdictions in the Thomas Jefferson Planning District – Albemarle County, the City of Charlottesville, Greene County, Louisa County, Fluvanna County, Nelson County, and the Towns of Stanardsville, Louisa, Mineral, Scottsville, and Columbia. The original plan was adopted by all jurisdictions in 2006; the plan was updated in 2012, with FEMA approval on March 14, 2018 and formal adoption by all localities completed in June 2018. This plan was approved by FEMA on January 17, 2023, and its official adoption date is February 1, 2023, after it was adopted by Fluvanna County.

SECTIONS OF PLAN

The following sections are included in the plan:

1. **Introduction – overview of hazard mitigation generally.**
2. **Planning Process – the process through which the plan was developed, including public input.**
3. **Community Profile – general information about communities in the planning district.**
4. **Hazard Identification and Analysis – general information about potential hazards in the planning district, the historic record of hazard events, and the probability of future events.**
5. **Vulnerability Assessment – analysis of the impact hazards could cause, with estimated potential losses for various hazard scenarios.**
6. **Capabilities Assessment – survey of current local capacity to prepare for natural hazards.**
7. **Mitigation Strategies – goals, objectives, and action items selected to mitigate hazards identified.**

PLANNING PROCESS

The lead agency in the preparation of this plan is the Thomas Jefferson Planning District Commission. A Hazard Mitigation Working Group guided the preparation of this plan and will assume responsibility for monitoring the progress of implementation on an annual basis. The Working Group consisted of at least one representative from each locality, as well as state representatives. Working Group members represented the planning department, emergency management department, and/or Administration from each locality.

TJPDC staff organized monthly meetings of the Working Group to refine multiple components of the plan. First, a review of the data needs was conducted in order to determine how TJPDC staff would update information that would be used to update the Hazard Identification and Risk Assessment (HIRA) section and to ask members to promote a public survey that would collect information about community needs. Next, TJPDC staff compiled and presented updated data about the natural hazards that would be ranked according to relative risk in the HIRA. This information was presented, refined, and then sent out to each locality's Working Group member in order to formulate a risk assessment for their respective localities. These assessments were compiled and presented to the working group as the regional HIRA matrix. The Working Group then examined, edited, and finalized the Goals and Objectives used to guide the long and short-term goals for risk mitigation in the region. A public workshop was also held to examine these Goals and Objectives, as well as the regionwide HIRA. Finally, meetings with all locality staff and presentations to Local Emergency Planning Committees (LEPC) were conducted in order to present the 2018 plan's mitigation actions for each locality, the HIRA data, and best practices and example action items for them to formulate new action items and catalogue or update old ones. Staff compiled these into the Mitigation Strategies section of the plan. Staff also presented

to all nine governing bodies that are expected to adopt the approved plan in May, June, and July 2022 to inform these bodies of the planning process, plan contents, and expectations around adoption and grant opportunities available through adoption. During these series of meetings, a public comment period that was advertised in local media and local government communication channels occurred during June 2022. After compiling feedback from elected officials and the public, the draft plan was sent to VDEM in July 2022. Full meeting agendas, sign-in sheets, meeting materials, and recordings are available in Appendix A of all Working Group meetings, public meetings, and survey.

The following sources of stakeholder input were used:

- **Regular meetings of the Hazard Mitigation Working Group.**
- **One public workshop**
- **An online survey**
- **Presentations to Local Emergency Planning Committees an work with local staff**
- **Recommendations from existing plans and documents.**
- **Public comment period of entire draft plan**

HAZARD IDENTIFICATION AND ANALYSIS/VULNERABILITY ASSESSMENT

All hazards in the region are ranked by this plan according to overall relative threat, which combines the probability of occurrence with the impact of an event. The matrix The Working Group reviewed the HIRA data and assigned values for each hazard over December 2021. The HIRA matrix, created by Kaiser Permanente, creates a template for hazards can be ranked by relative risk according to probability, human impact, property impact, and business impact. TJPDC staff created a set of data for each hazard and asked each locality to fill out an individual matrix for their locality. Localities used this data, as well as staff input, to assign values for each hazard. TJPDC staff combined these matrices into the below matrix for the region. This matrix can be viewed as the final product of staff deliberation using best available weather data, staff input, and local emergency management information.

The HIRA uses two components to determine relative risk. First, probability is represented as a numeric value (1-3) that represents the likelihood of that the associated hazard will occur in the region in the next 5 years.

Probability Definition:

0- 0% probability of occurring in the next 5 years
1- 0-33% probability of occurring in the next 5 years
2- 34-66% probability of occurring in the next 5 years
3- 67-100% probability of occurring in the next 5 years

Severity is defined as the human, economic, and property impact that a hazard will have on the region if it occurs. Severity is separated into 3 distinct types of impact: Human, Property, and Business. For each of these categories, severity is represented as a numeric value (1-3) that represents the impact that an associated hazard would have on each category in the region.

Severity Definition:

0- no loss of life, business impact, or property damage
1- No loss of life, but non-life threatening injuries, minor property damage, and slightly reduced economic activity
2- Some moderate and life-threatening injuries and potential loss of life, moderate to major property damage, moderate to significant disruption of commerce
3- Moderate to major injuries and loss of life, major and sustained property damage, major disruption to commerce

EVENT	PROBABILITY	HUMAN IMPACT	PROPERTY IMPACT	BUSINESS IMPACT	RISK
	Likelihood this will occur	Possibility of death or injury	Physical losses and damages	Interruption of services	Relative threat*
SCORE	0 = no possibility 1 = some possibility 2 = very high possibility 3 = certain possibility	0 = no possibility 1 = some possibility 2 = very high possibility 3 = certain possibility	0 = no possibility 1 = some possibility 2 = very high possibility 3 = certain possibility	0 = no possibility 1 = some possibility 2 = very high possibility 3 = certain possibility	0 - 100%
Hurricane/high wind/windstorms	3	2	2	2	74%
Flooding	3	1	2	2	65%
Winter storms/ weather	3	1	1	2	56%
Communicable Disease/Pandemic	2	2	1	2	30%
Lightning	2	1	1	1	22%
Wildfire	2	1	1	1	22%
Drought / Extreme Heat	2	1	1	1	22%
Dam Failure	1	2	2	2	22%
Tornado	2	1	1	1	22%
Earthquake	1	1	2	2	19%
Landslide	1	1	1	1	11%
AVERAGE SCORE	**1.88**	**1.37**	**1.5**	**1.58**	**33%**

RISK = PROBABILITY * SEVERITY		
0.32	0.43	0.17

**Threat increases with percentage.*

Most data on hazards are derived from federal and state government sources, and data on development and critical facilities are derived primarily from local government sources. Results are presented in a series of maps and charts.

MITIGATION STRATEGY

The following goals and objectives, grouped into five broad categories, are recommended by the plan: Education and Outreach, Infrastructure and Buildings, Whole Community, Mitigation Capacity, Information Data and Development: The five major goals of the plan have been components of all of the Regional Natural Hazard Mitigation Plans prior to this update. The Hazard Mitigation Working Group adjusted language regarding the goals and objectives under each category, in order to better guide the development of new mitigation action items, in early 2022. More information regarding these mitigation categories and their relation to mitigation activities can be found on page MS-1.

Education and Outreach (E)

- **GOAL: Increase awareness of hazards and encourage action to mitigate the impacts**
  - **OBJECTIVE: Educate families and individuals on disaster mitigation and preparedness options and promote self-sufficient buildings with multiple energy options**
  - **OBJECTIVE: Train key agency staff and volunteer groups in disaster mitigation and preparedness**
  - **OBJECTIVE: Train staff at schools and residential facilities in disaster mitigation and preparedness**
  - **OBJECTIVE: Encourage and equip employers to develop emergency action plans**

Infrastructure and Buildings (I)

- **GOAL: Reduce the short and long-term impact of hazard events on buildings and infrastructure**
  - **OBJECTIVE: Diversify the energy system to provide multiple power source and fuel supply**
  - **options and promote self-sufficient buildings with multiple energy options**
  - **OBJECTIVE: Diversity the communications system to provide alternative lines for use during loss of capacity**
  - **OBJECTIVE: Diversify the transportation system by increasing connectivity and providing modal options**
  - **OBJECTIVE: Elevate, retrofit and relocate existing structures and facilities in vulnerable locations**
  - **OBJECTIVE: Construct or upgrade drainage, retention, and diversion elements to lessen the impact of a hazard on an area**
  - **OBJECTIVE: Protect sensitive areas through conservation practices**
  - **OBJECTIVE: Ensure that each critical facility has a disaster plan in place**
  - **OBJECTIVE: Identify high hazard potential dams in the region and consider options to reduce vulnerabilities**

Whole Community (C)

- **GOAL: Prepare to meet the immediate functional and access needs of the population during natural hazards**
  - **OBJECTIVE: Effectively communicate with and transport people regardless of their language proficiency and physical needs.**
  - **OBJECTIVE: Make information available, accessible, and accurate to ensure the entire population can access emergency shelters in a timely manner and have functional needs met, in the event of a natural hazard**
  - **OBJECTIVE: Updating necessary information consistently and through multiple different outlets through the development an emergency information communication plan**

Mitigation Capacity (M)

- **GOAL: Increase mitigation and adaptation capacity through planning and project implementation**
  - **OBJECTIVE: Reduce property risks through planning, zoning, ordinances and regulations**
  - **OBJECTIVE: Incorporate mitigation planning concepts, climate resilience, and vulnerability planning into local plans and ordinances**
  - **OBJECTIVE: Pursue funding to implement identified mitigation and resilience strategies**
  - **OBJECTIVE: Encourage proactive management of hazard prone areas, environmental features, or infrastructure**

Information and Data Development (D)

- **GOAL: Build capacity with information and data development to refine hazard identification and assessment, mitigation targeting and funding identification**
  - **OBJECTIVE: Identify data and information needs and develop methods to meet these needs**
  - **OBJECTIVE: Utilize data to ensure proactive targeting of mitigation efforts**

MITIGATION ACTION ITEMS

A set of mitigation action items are designated for each locality to substantively further the objectives of the plan. The detailed list of action items includes the supporting goal, hazard to be mitigated, party responsible for implementation, timeframe of implementation, estimated cost, and potential funding sources. Furthermore, all action items are prioritized and listed in order from high, moderate, to low priority.

The following is an abridged list of action items for each jurisdiction and the Thomas Jefferson region

Activity Code / Activity Description

Thomas Jefferson Region	
RHE1	Provide a copy of the Regional Hazard Mitigation Plan to each library in the Jefferson-Madison Regional Library system
RME1	Conduct a public education program on disaster preparedness, leveraging existing materials and sharing resources regionally

RME2	Engage Working Group and leverage connections to continue mitigation preparedness throughout plan's duration, before next update
RMD1	Identify locations for deposit of debris after a hazard
RME3	Continue to research grant and funding opportunities for regionwide hazard mitigation efforts
RHI1	Promote and educate localities on high hazard dam vulnerability reduction including rehabilitating/removing dams, elevating structures in inundation zones, adding flood protection, such as berms, floodwalls or floodproofing, in inundation zones

Albemarle County	
AHE1	Increase the number of trained emergency responders, both staff and volunteers. Establish a minimum ICS/emergency management training/certification requirement for essential County staff. Train/educate 70% of identified staff to minimum qualifications. Conduct disaster tabletop and/or full-scale scenarios on an annual basis to exercise skills/processes
AHI1	Implement recommendations from the urban Community Water Supply Plan and those for all other public water supplies within the County, including drought monitoring and management
AHI2	Develop an integrated regional security and monitoring system, including access control and intrusion detection
AHI3	Establish a backup Emergency Operations Center (EOC)
AHI4	Establish an Albemarle County specific basic Emergency Operations Plan and annexes for the 3 highest risk natural disasters as defined in the HIRA.
AHM1	Incorporate this Regional Hazard Mitigation Plan into local comprehensive plans and Emergency Operations Plans
AHM2	Install fire mitigation measures, including dry hydrants, fire breaks, and fire rings.
AHM3	Develop continuity-of-operations plan to ensure critical operations are maintained during power failure.
AHD1	Continue to assess resilience of existing critical facilities to natural hazards
AHD2	Mitigate Water and Wastewater System Failure or Contamination through community coordination and information/equipment sharing. Provide planning support for operational and integrated security management (including communications plan and continuity plan, emergency exercises, coordinated committee)
AHC1	Develop a debris management plan (including emergency response access and cleanup) for removal of fallen trees, etc. following a storm, such as hurricane or tornado.
AHC2	Engage in climate resilience and adaptation planning and implement initiatives to prepare for the anticipated hazards and impacts driven by climate change.
AHC3	Implement initiatives to reduce community greenhouse gas emissions as prescribed by the Climate Action Plan adopted in 2020 in order to mitigate climate change.
AME1	Ensure that all schools have regular disaster response drills
AME2	Continue to pursue conservation practices in sensitive areas, including riparian buffers and flood-prone areas.
AME3	Conduct comprehensive residential and business disaster preparedness programs focusing on the ability of residents and businesses to sustain themselves for 72 hours post emergency.
AME4	Define Neighborhoods/communities within the County and identify (using a contact management system) key residents and Non-Governmental organizations (NGOs) within each neighborhood who may connect the County and disaster services to the neighborhood during a crisis.
AMI1	Build or repair bridges so as not to minimize impacts to floodways
AMI2	Upgrade existing bridges to support emergency vehicles
AMI3	Carry out physical security improvements to water and wastewater systems, which may include fencing, door hardening, window hardening, locks, bollards, cameras, signage, lighting, access control and intrusion detection.
AMI4	Procure technology equipment for Water/Wastewater system component inspections.
AMI5	Improve the maintenance and repair of stormwater conveyance systems – in part through better coordination and cooperation with local partners
AMC1	Improve the preparedness of public and private dams within the county to withstand extreme flood events
AMC2	Maintain and update, as needed, the regional and local sheltering plans.

AMC3	Continue to assess designated community shelters for compliance with minimum specifications and best practices.
AMC4	During Comp Plan update, consider loosening restrictions on the types of County improvements in Rural Areas to accommodate community support facilities.
AMM1	Through the development process, discourage or prohibit development in flood-prone
areas	
AMD1	Expand GIS data and other technologies for the purposes of mitigation planning, preparedness planning, and response activities
ALE1	Encourage property owners and residents to clear storm drain inlets, channels, creek beds, and other conveyances of fallen trees and debris to minimize the potential for flow restrictions and flooding.
ALE2	Ensure all houses and businesses have clear address signs that are visible during snowstorms and other emergencies
ALE3	Continue educational campaign about the benefits of open space and sensitive area protection.
ALE4	Outdoor warning sirens for public use facilities
ALC1	Increase the capacity to shelter in place in public buildings.
ALC2	Promote biodiversity and native plant communities and control invasive species to improve the resilience of native ecosystems
ALC3	Develop communications strategy and protocols (both preparedness and response) using traditional and emerging outlets (local media, social media, etc.); consider languages besides English
ALC4	Improve ability to notify public in the event of extreme storms and/or dam failure, possibly through utilizing river level sensors and a downstream notification system
ALC5	Continue and expand the use of citizen alert systems. Explore use of Social Media platform emergency alert systems. Establish backup procedures/plans for emergency notification/alert when methods relying on power & technology are inoperable
ALI1	Implement Stormwater Management programs and initiatives to reduce flood risk throughout the community
ALI2	Improve the maintenance, repair, and upgrades to public and private stormwater management facilities and impound-ments to withstand extreme storms and enhance flood control.
ALI3	Partner with utility companies to keep power lines and other utilities free of vegetation
ALI4	Implement programs and initiatives to reduce pollution discharge via stormwater systems
ALI5	Continue to upgrade security systems
ALI6	Promote increased tree canopy in urban areas to reduce heat island effect.

Town of Scottsville	
ASMM1	Update the Town's Floodplain Maps to inform decision-making.
ASMM2	Improve Riparian Buffers along parts of Mink Creek and the James River.
ASLM1	Improve Regional Transit for emergency evacuations, prevention, and resiliency.

City of Charlottesville	
CHE1	Provide training for building inspectors and code officials on mitigation techniques and hazard-resistant buildings.
CHE2	Ensure that all city schools have an emergency and disaster plan and regularly conduct disaster response drills.
CHM1	Complete Flood Resilience Plan
CHM2	Complete Climate Adaptation Plan
CHM3	Update floodplain regulations
CHM4	Incorporate hazard mitigation plan into community plans. Identify senior living/special needs residences in areas vulnerable for flooding.
CHM5	Conduct Community Emergency Response Team (CERT) classes to equip individuals and groups to assist in the event of a disaster.
CHM6	Provide incentives to institutions and homeowners for use of low-flow appliances.

CHM7	Continue to expand use of citizen alert system. (Code RED) Develop community promotion plan for Code RED.
CHM8	Inventory all shelters and public buildings to ensure emergency preparedness supplies and equipment are onsite.
CMD1	Identify vulnerable structures and apply for funding to implement acquisition and demolition, relocation, floodproofing, or structural retrofit projects
CMD2	Conduct a needs survey that identifies special needs population and residences and/or facilities needing attention in the event of emergencies or evacuations
CMI1	Ensure culverts, streams, channels, storm drains, and gutters remain clear of debris
CMI2	Build or repair roadway and pedestrian crossings so as not to impede floodwaters
CMI3	Retrofit emergency service buildings for hazard preparedness and resistance.
CMM1	Support volunteer groups and encourage collaboration on public outreach and education programs on hazard mitigation.
CMM2	Pursue conservation practices in sensitive areas (stream corridor restoration, forest management)
CMM3	Create a strategy for using existing media outlets for communications during a hazard event.
CMM4	Ensure that all critical facilities have updated shelter-in-place plans
CLE1	Provide citizens with literature about flood and drought-smart landscaping and GI. Promote VCAP.
CLE2	Create educational campaign about floodplain locations, the benefits of open space and riparian corridors.
CLI1	Improve the maintenance of stormwater infrastructure.
CLI2	Reduce pollution discharge to and erosive conditions in receiving waters.
CLI3	Increase infiltration capacity and volumetric reductions in runoff via stormwater control measures (SCMs).
CLI4	Improve capture and conveyance capacity of stormwater infrastructure.

Fluvanna County	
FHE1	Increase the number of trained emergency responders, both staff and volunteers
FHI1	Install new fire hydrants along new JRWA water line
FHC1	Conduct regular disaster response drills in schools, and with staff at Assisted Living Facilities and Nursing Homes
FHC2	Continue and expand the use of citizen alert systems
FHC3	Implement community notification protocols before, during, and after a disaster event
FHM1	Develop Continuity of Operations Plans (COOP) for locality departments and update the plans annually
FME1	Carry out a targeted educational campaign in subdivisions at high risk for fire impacts
FME2	Conduct tabletop exercises for damage assessments
FME3	Bring in experts to conduct in-house staff training in best management practices in hazard mitigation and preparedness
FME4	Offer training on post-event inspection and develop a protocol to serve as a mechanism for prioritization
FMI1	Identify vulnerable structures and apply for funding to implement acquisition and demolition, relocation, floodproofing, or structural retrofit projects
FMI2	Install warning signs and develop alternate routes for roads that flood briefly during heavy rains (e.g. Slaters Fork Road, Carysbrook, farm pond dam locations)
FMM1	Identify areas to receive debris from post-event clean-up efforts
FMD1	Expand GIS data for us in mitigation planning, preparedness planning, and response activities
FLE1	Carry out an educational campaign for businesses to develop emergency procedures and shelter-in-place plans
FLI1	Identify repetitive loss properties, develop appropriate mitigation action, and apply for funding
FLI2	Demolish and remove remains of old surface water treatment plant located on TM 58 A 26 & 27(County-owned property)
FLI3	Remove +/-20,000 gallon water storage tank from James River.
FLC1	Develop County agreements (possibly with women's prison) for food services for county-supported shelters (including high school)

FLM1	Develop evacuation plans for dam breaches from Charlottesville-area dams
FLM2	Develop a comprehensive fire safety communication strategy, addressing open space, burn permit, FireWise, and dry hydrants
FLM3	Adopt fire code
FLM4	Incorporate this Regional Hazard Mitigation Plan into local comprehensive plans and Emergency Operations Plans
FLD1	Develop a disaster plan for the Fork Union Sanitary District (FUSD)

Greene County	
GHE1	Conduct Firewise workshops
GHI1	Partner with utility companies to keep power lines free of vegetation
GHI2	Conduct structural evaluations of current and proposed shelters
GHI3	Implement recommendations from Greene County Water Supply plan
GHI4	Enhance dam safety; table tops/exercises
GHI5	Install backup generators in shelters and critical facilities
GHI6	Enhance public safety emergency communications to provides reliable, dependable coverage
GHI7	Enhance access to broadband countywide
GHC1	Assist the schools with regular disaster response drills and disaster planning
GHM1	Conduct CERT classes to equip individuals and groups to assist in the event of a disaster
GHM2	Routinely inspect public and private fire hydrants
GHM3	Ensure all critical facilities have updated shelter-in-place plans
GHM4	Increase number of trained emergency responders and establish recruitment and retention program
GME1	Develop cooperative agreements between all agencies involved in emergency management, provide methods of communication between agencies responsible for being present at the Emergency Operations Center following a disaster, and conduct joint exercises
GME2	Create a community toolbox with tools and information for local homeowners
GMI1	Add signage to roads in locations that frequently flood
GMM1	Develop and implement a drought management plan
GMM2	Create a strategy for using existing media outlets for communications during a hazard event
GMM3	Provide career fire staff
GMI2	Upgrade all area bridges to support emergency vehicles
GMD1	Conduct channel improvement study
GMD2	Create a needs survey that identifies special needs population and residences and/or facilities needing attention in the event of emergencies or evacuations
GLE1	Provide citizens with literature about flood and drought-smart landscaping
GLI1	Build and repair bridges so as not to impede floodwaters
GLI2	Ensure culverts, streams, channels, storm drains, and gutters remain clear of debris
GLI3	Install more dry hydrants in high wildfire risk areas
GLI4	Repair, replace, or relocate septic and drainage fields that leak sewage into bodies of water during flooding events
GLI5	Bury utilities in the county
GLM1	Ensure all structures have clear address signs that are visible

Town of Stanardsville	
GSHM1	Increase water capacity and pressure for the Town of Stanardsville to enable optimal emergency response

GSMM1	Ensure all houses have clear address signs that are visible
Louisa County	
LHI1	Enhance access to broadband internet in rural areas
LHI2	Install backup generators in shelters and critical facilities
LHI3	Implement recommendations from Water Supply Plan
LHC1	Ensure that all schools have regular disaster response drills
LHM1	Provide training for building inspectors and code officials on mitigation techniques and hazard-resistant building
LHM2	Continue and expand use of citizen alert systems countywide, including within Towns
LHM3	Increase number of trained emergency responders
LHM4	Develop driveway codes to allow emergency vehicle access
LHM5	Work to prevent stormwater and wastewater flooding in water bodies across the County
LMI1	Put high water marks on bridges
LMI2	Investigate, plan, and implement repairs and/or upgrades to Bowlers Mill dam to preserve flood control benefits for the historic Green Springs area.
LMM1	Investigate safety and maintenance of roads in private communities
LMM2	Conduct Community Emergency Response Team (CERT) classes to equip individuals and groups to assist in the event of a disaster
LMM3	Ensure all houses have clear address signs that are visible during storms events
LMM4	Incorporate hazard mitigation plans into community plans
LMM5	Incorporate special needs populations into Hazard Mitigation and Emergency Operations Plans
LLE1	Provide educational outreach about the burn permit process
LLE2	Create an educational program to help residents understand the benefits and costs of earthquake insurance
LLI2	Add signage to roads in locations that frequently flood
LLD1	Track and map space available for pets at local SPCA and other animal shelters. Install generator and place shelter on snow removal priority list.
Town of Louisa	
LLHI1	Install backup generators in shelters and critical facilities – the Town Hall generator will be upgraded to serve as a shelter during emergencies
LLHM1	Incorporate hazard mitigation plans into community plans
LLMM1	Ensure all houses have clear address signs that are visible during snowstorms
Town of Mineral	
LMHM1	Incorporate hazard mitigation plans into community plans
LMMM1	Ensure all houses have clear address signs that are visible during snowstorms
LMMM2	Work with the Louisa County to designate a representative for the County's Emergency Operations Committee
LMMM3	Develop a system for alerts and other communication with citizens
LMMI1	Mark the fire hydrants with reflective markers for large snow storms
LMMI2	Install emergency generator for wells
LMLI1	Bury utilities underground in town of Mineral
Nelson County	

NHM1	Continue and expand use of citizen alert systems
NHM2	Provide training for building inspectors and code officials on mitigation techniques and hazard-resistant building
NME1	Conduct Firewise Workshops
NME2	Provide educational instruction and materials to school age youth and their teachers on proper procedures for responding to natural disasters
NMI1	Investigate safety and maintenance of roads in private communities
NMM1	Ensure all houses have clear address signs that are visible during snowstorms
NLE1	Ensure that all homeowners and businesses located in areas prone to landslides are aware of the risks and appropriate responses to an event
NLI2	Maintain and add more fire rings in camping areas for controlled fires

ACTIVITY CODE KEY

R H E 1 ← **Sequential number within group**

Goal
E------ Education and Outreach
I------- Infrastructure and Buildings
C------ Whole Communities
M----- Mitigation Capacity
D ----- Information and Data Development

Priority
H ----- High
M----- Moderate
L------ Low

Place
R------ Thomas Jefferson Region
A------ Albemarle County
AS ---- Town of Scottsville (Albemarle)
C------ City of Charlottesville
F------ Fluvanna County
G------ Greene County
GS ---- Town of Stanardsville (Greene)
L------ Louisa County
LL----- Town of Louisa (Louisa)
LM --- Town of Mineral (Louisa)
N ----- Nelson County

Introduction

Hazard: *An event or physical condition that has the potential to cause fatalities, injuries, property damage, infrastructure damage, agricultural loss, damage to the environment, interruption of business, or other types of harm or loss.*

Mitigation: *Sustained action taken to reduce or eliminate the long-term risk to human life and property from natural hazards and their effects. Note that this emphasis on long-term risk distinguishes mitigation from geared primarily to emergency preparedness and short-term recovery.*

Natural hazards tend to be low-probability, high-impact events. One year could be mild with natural events scarcely interrupting communities, while the next could be literally disastrous. The purpose of hazard mitigation is to try to minimize the damage and loss of life caused by disasters when they do occur. Hazard mitigation is one component, along with emergency response and post-disaster recovery, to the larger strategy of dealing with the human impacts of natural hazard.

With more people living in areas susceptible to natural hazards, the costs associated with such hazards have been steadily increasing over time. The localities of the Thomas Jefferson Planning District (the Counties of Albemarle, Greene, Fluvanna, Louisa, and Nelson, the City of Charlottesville, and the Towns of Scottsville, Stanardsville, Louisa, and Mineral) are impacted by variety of different hazards. In order to lessen the growing cost of disaster recovery on the localities and minimize the disruption of business during a disaster, there is a growing need to mitigate the impact of known hazards. Through proper planning and the implementation of policies and projects identified in this Hazard Mitigation Plan, the region and the localities can reduce the likelihood that these events will result in costly disasters.

Hazard mitigation is any sustained action taken to reduce or eliminate the long-term risk to human life and property from natural hazards. It includes both structural measures, such as protecting buildings and infrastructure from the forces of nature and non-structural measures, such as natural resource protection and wise floodplain management. Actions may be targeted to protect existing development or could be designed to protect future development as well. It is widely accepted that the most effective mitigation measures are implemented at the local government level, where decisions on the regulation and control of development are ultimately made.

The **benefits of hazard mitigation** are numerous, including:

- **Saving lives and reducing property damage**
- **Protecting critical community facilities**
- **Reducing exposure to liability**
- **Minimizing community disruption**
- **Reducing long-term hazard vulnerability**
- **Contributing to sustainable communities**

More importantly, mitigation planning has the potential to produce long-term benefits by breaking the repetitive cycle of disaster loss. A core assumption of hazard mitigation is that a pre-disaster investment significantly reduces the demand for post-disaster assistance. Further, the adoption of mitigation practices enables local residents, businesses, and industries to more quickly recover from a disaster, getting the economy back on track sooner and with less interruption. Mitigation planning offers a great opportunity for proactive and creative planning from localities to help insulate their communities from the negative effects of natural hazards.

Critical to mitigation is discussion and emphasis on equity of outcomes, a theme of mitigation planning shared by both FEMA as a part of their "Equitable Outcomes" goal in its most recent strategic plan. VDEM has also committed to equity through the establishment of a new office of Diversity, Equity, and Inclusion, making it the first state emergency management office with this office. An understanding of not only the broader threats hazards pose to the region, but also an understanding that underserved and marginalized populations are at more risk of harm. Information about equity of outcomes can be found during discussions of hazards below.

This plan systematically identifies potential hazards and sets goals for implementation over the long-term that will result in a reduction in risk. Unlike emergency operations plans or disaster preparedness, this plan seeks to develop ways to lessen the impact of natural disasters on the region's resources through strategic, long-range planning. The overall goal of hazard mitigation is to save lives and reduce property damage.

Sections of the Plan

This Plan is designed to meet the requirements of the Disaster Mitigation Act of 2000. The Hazard Mitigation Plan includes the following sections:

1. **Planning Process**
2. **Community Profile**
3. **Hazard Identification and Analysis**
4. **Vulnerability Assessment**
5. **Capabilities Assessment**

MITIGATION STRATEGIES

The **Planning Process** section describes the process by which this plan was developed including a description of the planning team, and overall stakeholder involvement. It also outlines the ongoing process for maintaining and updating the plan.

The **Community Profile** is a narrative description of general community characteristics, such as the region's geographical, economic, and demographic profiles. Future development trends and implications for hazard vulnerability are discussed.

The **Hazard Identification and Analysis** section describes natural hazards in the order in which they pose the greatest threat to the Thomas Jefferson Planning District. Hazards are profiled in terms of prevalence, intensity, and geographical scope. The section includes a description of the hazard as well as analysis based upon historical and scientific data.

The **Vulnerability Assessment** combines the identification of hazards with both present and projected human settlement patterns to measure their human impact. Potential losses are estimated quantitatively based upon historic events scenarios or the probability of future events.

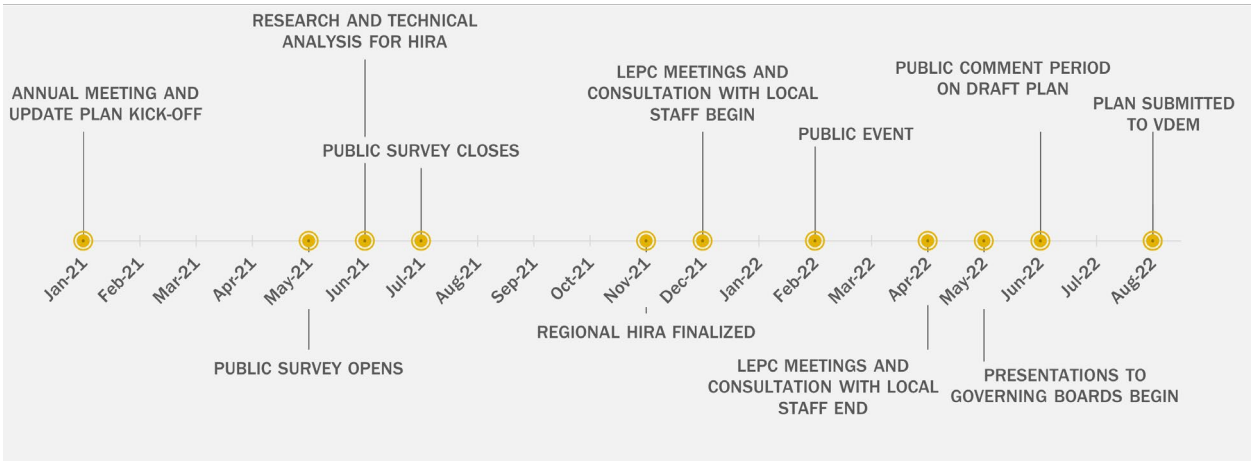
The **Capabilities Assessment** provides an examination of the region's capacity to implement meaningful mitigation actions and identify existing opportunities for program enhancement. Capabilities addressed in this section include staff and organizational capability, technical capability, policy and program capability, fiscal capability, legal authority, and political will. The purpose of this assessment is to identify any existing gaps that may hinder mitigation efforts, and to identify those activities that can facilitate risk reduction efforts.

The **Mitigation Action Plan** forms the basis for action — identifying broad policy goal statements, more specific policy objectives and specific action-oriented hazard mitigation actions. Hazard mitigation actions include both policies and projects designed to reduce the impacts of hazardous events. The section also describes four overarching strategies for mitigating high and moderate risk hazards.

Planning Process and Public Involvement

This section describes the planning process undertaken by the Thomas Jefferson Planning District Commission in preparation of the Regional Hazard Mitigation Plan, as well as the means for monitoring the plan between 2023 and 2028. An emphasis is placed on the engagement of a broad range of community stakeholders and the substantive inclusion of public input into the plan.

The following timeline depicts the major points along the process of the plan update:



A key feature of the development of the plan has been achieving participation and input from stakeholders throughout the Planning District. Documentation of the planning process including meeting notes, sign-in sheets, and complete survey results are included in the appendices.

> *201.6(b) and §201.6(c)(1): An open public involvement process is essential to the development of an effective plan. In order to develop a more comprehensive approach to reducing the effects of natural disasters, the planning process shall include:*
>
> *(1) an opportunity for the public to comment on the plan during the drafting stage and prior to plan approval;*
>
> *(2) an opportunity for neighboring communities, local and regional agencies involved in hazard mitigation activities, and agencies that have the authority to regulate development, as well as businesses, academia and other private and non-profit interests to be involved in the planning process; and*
>
> *(3) review and incorporation, if appropriate, of existing plans, studies, reports, and technical information.*

Because of the multi-jurisdictional nature of this Hazard Mitigation Plan, comprehensive and balanced representation from each jurisdiction has been practiced consistently.

> *44 CFR 201.6(a)(3): Multi-jurisdictional plans may be accepted, as appropriate, as long as each jurisdiction has participated in the process.*

There have been six primary methods for obtaining input for the plan:

1. **Regular meetings of the Hazard Mitigation Working Group.**
2. **One public workshop**
3. **An online survey and solicitation of public input from website.**
4. **Presentations to Local Emergency Planning Committees and work with locality staff**
5. **Recommendations from existing plans and documents.**
6. **Public comment period of entire draft plan.**

44 CFR 201.6(c)(1): The plan must document the planning process used to develop the plan, including how it was prepared, who was involved in the process, and how the public was involved.

1. Hazard Mitigation Working Group

The Working Group, consisting primarily of planners and emergency operations coordinators in the City and each County as well as state experts, served as the primary decision-making body guiding the plan. The Working Group as a body also provided technical input on the content of the plan at multiple points along the timeline of the update. Locality staff also completed the list of actions for their respective jurisdiction and filled out the Capabilities Assessment. There are four towns in the Planning District: Scottsville in Albemarle County, Mineral and Louisa in Louisa County, and Stanardsville in Greene County. The towns of Stanardsville, Louisa, and Mineral were represented on the Working Group by their respective Counties. TJPDC staff engaged Town of Louisa and Mineral's governing boards and town staff in the preparation of the plan through presentations and meetings outside of regular working group meetings. The Town of Scottsville was represented on the Working Group by staff. County representatives reached out to Towns during the process through invitations to meetings and contact by e-mail and phone. TJPDC also followed up with the Towns to confirm actions to be included in the HMP

The Working Group was originally formed during the creation of the 2006 Regional Hazard Mitigation Plan, and the group has reconvened on an annual basis to monitor progress toward the adopted action items in the initial plan. A roster of the Working Group is included in the appendix. There have been a number of staff changes during the development of this regional plan, which are noted on the roster.

2. Public Workshops

A public event was held on February 7, 2022.The event was widely advertised both through the TJPDC News Brief, e-mails to individuals with a special interest in hazard mitigation and emergency response and a press release was issued to local media outlets. An article was published in the Daily Progress, Greene County Record, and the Central Virginian on January 23 and January 27th, respectively.

The purpose of the first part of the meeting was to present a draft of the Hazard Identification and Risk Assessment, to provide an objective basis for any mitigation response and solicit feedback to improve the HIRA. In addition to this information, participants were provided the goals and objectives from the 2018 plan and worked to develop recommendations for additions, deletions, and revisions. The primary feedback from this public event was ensuring that functional and access needs were addressed in the Goals and Objectives, that improvements to buildings and infrastructure accommodated all ability levels, and expanding preemptive communication before major weather events. Comments were summarized and provided to the Working Group in a presentation.

3. Online Survey and Website

The TJPDC website was updated early in the planning process to announce the initiation of the plan and probe for interest among residents in the region. The website was updated regularly with drafts of various components as they were completed, along with requests for comment.

Throughout Fall 2021, an online survey was used to assess familiarity with hazard mitigation concepts, weigh the relative concern over various hazards, prioritize the goals and objectives of the plan, gauge the political will for mitigation policies, and find new ideas for effective action items. The survey received 284 responses, with participants from every locality in the Planning District.

The survey's results indicated that many of the planning district's residents were especially concerned about the damage that hurricanes/windstorms,

winter weather, earthquakes, floods, and droughts could have on life, property, and commerce in the region. Many survey responses indicated specific areas that could be involved in mitigation planning efforts, as well as specific actions localities and the TJPDC could take. The survey results were presented to the Hazard Mitigation Working Group in summary form and to all members with all responses. Locality staff were encouraged to reference the survey results in their formulation of new mitigation activities for the plan update as well as in their creation of their locality's HIRA matrix.

Because of its self-selecting nature and marketing through the Hazard Mitigation Working Group, the survey should not be considered representative of the opinions of the whole population. Nevertheless, it proved to be a useful tool for gathering input from informed and enthusiastic members of the public, and several action items were revised or added based on the results.

4. Presentations to Local Committees

Visits were paid to local committees to make them aware of the hazard mitigation plan update and incorporate the specific expertise of the group into the plan. The Working Group developed the goals and objectives for the regional plan and incorporated a list of potential actions organized under each objective. Presentations were made to the Charlottesville-UVA-Albemarle and Louisa Local Emergency Planning Committee (LEPC) on February 24, 2022. Other LEPC's are chaired by local emergency management staff, who TJPDC staff worked closely with to ensure that all localities' emergency management and hazard mitigation stakeholders were involved in updating the 2018 Mitigation Action items, as well as creating new action items. Meetings outside of LEPC's and formal presentations involved TJPDC outlining the recommended process for cataloguing process on existing mitigation action items Results from public participation (survey and event) were also shared both in the meetings and after.

5. Recommendations from Existing Plans and Documents

Locality staff reviewed various plans for their jurisdiction, to incorporate strategies and specific actions set forth in those plans into the Regional Hazard Mitigation Plan. Some specific relevant projects were taken directly from these plans and included as action items in the regional plan. More information can be found in the plan's Mitigation Action items section.

After the 10 participating jurisdictions adopt the plan formally and become eligible for various FEMA grant funding, the TJPDC has advised localities to incorporate the plan into other pertinent local plans. These include Capital Improvement Plans (CIP), Comprehensive Plans, and Emergency Operations Plans. Various portions of the plan are more applicable to other community plans than others. For example, the funding estimates included in the Mitigation Action items can be used for a locality's CIP. General emphasis on specific hazards and mitigation techniques are relevant for Emergency Operations Plans. With a wide variety of capacity, population, and area, each locality will determine how best to incorporate the Hazard Mitigation plan into other local plans. More information about each locality's capacity can be found in the Capability Assessment.

6. Public comment period

The entire draft Hazard Mitigation Plan was made available to the public for comment between June 1 and June 30, 2022. The comment period was advertised in local media on May 31, 2022. Notification of the draft plan was also included in TJPDC's News Brief on June 13. This on-line publication has a distribution of over 1,300 contacts, including adjacent PDCs and localities. Language involving specific flood-prone areas and clarification on Scottsville's flood control system and zoning ordinances were the major revisions from the public comment period.

7. Neighboring Communities and State Stakeholders

In addition to general distribution of the draft plan via the public comment process and TJPDC's News Brief, TJPDC has communicated with other Planning District Commissions in the state. Staff worked with the Central Virginia Planning District Commission to gather best practices and share information. Staff also talked with Commonwealth Regional Council in order to share process information. A variety of state experts were consulted during research for the HIRA, including the Departments of Health, Forestry, Energy, and Conservation and Recreation. Staff were also included on a Working Group for the Commonwealth of Virginia's Hazard Mitigation plan update by VDEM staff, representing the region and providing information concerning hazards, capabilities, and other pertinent information.

METHOD OF UPDATE

The 2023 Regional Hazard Mitigation Plan is an update of the 2018 Plan. The original plan Regional Hazard Mitigation Plan was adopted in 2006. As such, TJPDC staff has made efforts to maintain continuity with the original plan while making substantive revisions to reflect new data on hazards, new ideas for mitigation, and progress made toward the completion of previous action items. The Hazard Identification section kept most of the original material broadly profiling hazards, and any new information or events that affect the planning district were updated in the analysis sections of each hazard.

Goals and objectives from the 2018 Plan were reviewed in the public workshop. Comments from that workshop were presented to the Working Group, which further modified the goals and objectives. Input on potential actions was also solicited at the public workshop and from the Working Group. TJPDC Staff then developed a listing of goals and objectives, with suggested actions for inclusion under each objective. The draft was then reviewed with the Working Group, to ensure that the goals and objectives were inclusive of suggested actions. The final product was used to facilitate input from local committees, and to facilitate the review and incorporation of actions from other local plans.

Action items were developed from the master list and pulled from other local plans. Notes from annual meetings also suggested some potential actions to include. The action items were further revised through LEPC meetings, Working Group meetings, and input from locality staff and other stakeholders.

Some new action items were generated by the online survey.

Action items that were removed from the plan are documented in a table in the appendices. Changes to priority levels are also noted.

MONITORING AND MAINTENANCE

§201.6(c)(4)(i): The plan maintenance process shall include a section describing the method and schedule of monitoring, evaluating, and updating the mitigation plan within a five-year cycle.

The monitoring policy set forth in the original 2006 plan remains in place. The Hazard Mitigation Working Group, supported by TJPDC staff, will meet annually in May or following a major disaster to evaluate progress and review annual impacts or actions which may necessitate changes in the plan. TJPDC will regularly engage the working group to provide information concerning grant funding, updates to the Hazard Mitigation Plan process, and other guidance from FEMA or VDEM.

Regular evaluation of the plan will address whether:

1. **goals and objectives address current and expected conditions;**
2. **the nature, magnitude, or type of hazard affecting the region has changed;**
3. **current resources are appropriate for implementing the plan;**
4. **important problems such as technical, political, legal, or coordination issues with other agencies have occurred;**
5. **agencies and other partners are participating as originally proposed.**

The plan will undergo a comprehensive review and evaluation every five years by the Working Group and the TJPDC under the authority of the Board of Supervisors and City Council. The next update is anticipated to be submitted to VDEM in calendar year 2027 with formal adoption in 2028.

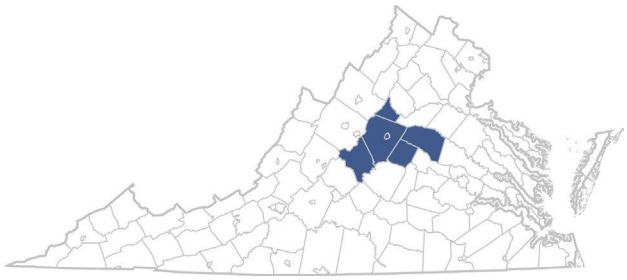
Ongoing public involvement will be critical to ensure the most accurate and up-to-date plan. Significant amendments to the plan will require a public hearing and other efforts to involve the public will be made as necessary.

Community Profile

The Thomas Jefferson Planning District is located roughly in the geographic center of the Commonwealth of Virginia. The Planning District is made up of the counties of Albemarle, Fluvanna, Greene, Louisa and Nelson, the City of Charlottesville and the incorporated towns of Scottsville, Louisa, Mineral and Stanardsville. The Planning District is home to historic resources such as Monticello and Highland, as well as the University of Virginia.

This section includes several features of the Thomas Jefferson Planning District Commission including:

1. **Geography**
2. **Land Use and Development Trends**
3. **Population and Demographics**
4. **Economic Growth and Development**
5. **Transportation**
6. **Housing**
7. **Disaster Declarations**
8. **Historic Properties and Districts**



GEOGRAPHY

The Thomas Jefferson Planning District is in the Piedmont region of Virginia. It is bounded by the Blue Ridge Mountains on the west with ridges and foothills and hollows rolling down to the James River in the east. Elevations range from more than 2,500 feet above sea level in the mountains to roughly 200 feet at Columbia on the James River. Areas of relatively flat land are found in larger river valleys and floodplains. Most of the land has a slope of some kind.

Total land area is 2,155 square miles.

The area drains west to east by six major rivers: the Tye, Rockfish, Hardware, Rivanna, Anna, and Rapidan. The headwaters of area rivers are generally located in the mountains and flow to the James River, which drains to the Chesapeake Bay. The Rapidan and Anna Rivers drain into the Rappahannock and York Rivers respectively, which also reach the Bay.

The area has a moderate climate. Average temperatures are approximately 50 degrees, and range from January lows in the mid-20s to July highs in the high 80s. Annual rainfall averages above 40 inches, supplemented with approximately 14 inches of snow.

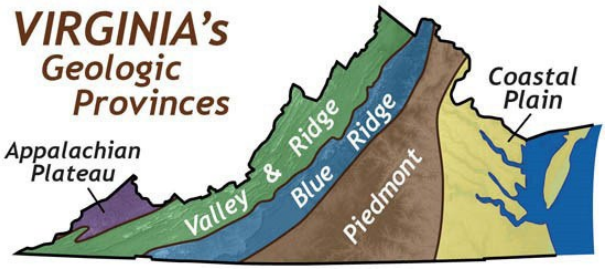
There are a few large river dams in the district: one on the Rivanna for drinking water and one at Lake Anna for the nuclear power plant. Smaller streams have been dammed to create resort lakes, such as Lake Monticello, Twin Lakes, Lake Nelson, Ruritan Lake, and Lake Louisa.

Most of the land is either field or forest, with development occupying the remainder. Crop farming is found in larger scale to the south and east, away from the mountains, where land is flatter. Hay and grains are the majority crops, with some corn and other row crops. Orchards and vineyards are prevalent in the high hills. Livestock fields are also common for cattle, horses, sheep, and a variety of other animals. Timberland can be found in all parts of the district, with large tracts in the east and James River areas. For the Rivanna Watershed, which encompasses 35% of the Planning District, tree canopies account for approximately 72% of the basin, open lands 22.8%, impervious surfaces 3.2%, and the remaining 2% is water, orchards, or golf courses. The Rivanna River Basin Commission determined these land cover classes through an analysis of 2009 aerial images.

Soils in the district are generally moderately- to well-drained, with a surface layer moderately low in organic content, and usually consisting of gravelly silt or fine sandy loam about 9-12" deep. The soils also generally have a low to moderate shrink-swell potential. Soils differ across the geographic spectrum in their slope, total depth, and permeability. Soils of Fluvanna County are predominantly silt loam and contain high clay content.

Parts of the Thomas Jefferson Planning District lie in the Blue Ridge province, while most of it is in the Piedmont province (see above). The Blue Ridge province forms a basement massif with Mesoproterozoic crystalline rock in its core and Late Neoproterozoic to Early Paleozoic cover rock on its flanks. The Blue Ridge province is allochthonous (formed in a place other than where it is found) and has been thrust to the northwest over Paleozoic rocks of the Valley and Ridge province. Although earlier deformation events are recorded in the older igneous and metamorphic rocks, the Blue Ridge is a contractional structure that experienced deformation and crustal shortening during the Paleozoic.

The Piedmont is the largest physiographic province in Virginia. It is bounded on the east by the Fall Zone, which separates the province from the Coastal Plain, and on the west by the mountains of the Blue Ridge province. The province is characterized by gently rolling topography, deeply weathered bedrock, and a relative paucity of solid outcrop.



Source: William & Mary Geology Department

Rocks are strongly weathered in the Piedmont's humid climate and bedrock is generally buried under a thick (2-20 m) blanket of saprolite. Outcrops are commonly restricted to stream valleys, where saprolite has been removed by erosion. The topography becomes somewhat more rugged with proximity to the Blue Ridge, where local monadnocks of more resistant rock occur.

Most of the ridges of the Blue Ridge are either part of the Shenandoah National Park or the Washington/ Jefferson National Forest. Regulations of the federal Department of Interior or Department of Agriculture control land use in these areas.

LAND USE AND DEVELOPMENT TRENDS

FEMA requires that the local mitigation plans provide a general description of community land uses and development trends so that mitigation options can be considered in future land use decisions to ensure safe development. Changes in urban, forest, and agricultural land cover may help to highlight areas within the region that should be considered in the long-term comprehensive plans.

The National Land Cover Dataset produced by the Multi-Resolution Land Characteristics Consortium (MRLC), was used to identify the land cover changes in the TJPDC (Thomas Jefferson Planning District Commission). The MLRC consortium is a group of federal agencies who coordinate and generate consistent and relevant land cover information at the national scale at a 30m resolution. The NLCD Enhanced Visualization and Analysis Tool mapped and analyzed land cover changes from 2008 to 2019 in each locality.

Below, changes of land use including forested area, development area, impervious surface area and agricultural land area are described for each Jurisdiction. Information on what portions of the land is changing usage, becoming developed, losing forested area, or increasing the size of wetlands, can indicate trends in the level of protection from hazards the natural landscape provides. Developed areas typically consist of more impervious surfaces than developed areas, which contribute to a lack of drainage and therefore increased flooding. Forested areas and wetlands provide protection from flooding, decrease susceptibility to landslides, help mitigate erosion and filter runoff protecting water quality.

Agricultural lands can have a high impact on surrounding areas. This can be for a variety of reasons including runoff, pesticide application, fertilizer application, etc. This can also show conversion of natural areas to more highly managed areas which relate to overall increases for local impacts. This can also include areas of hay pasture, which generally have lower impacts on the landscape, to higher production cultivated crops. Decreasing agricultural land can show habitat restoration, increased urbanization, decreasing water availability, and a host of other factors important for resource managers and local communities. As agricultural lands increase or decrease, a variety of impacts can happen. Increasing agricultural lands can sometimes identify increased water usage as well as loss of natural habitat. Decreasing agricultural lands can highlight droughts, long-term water shortages, habitat restoration, etc. Understanding how these changes are occurring and to what extent helps to identify usage and potential risks for producers and the community.

Areas with impervious surface rates approaching 12-15 percent will experience negative impacts to water quality, which is exceeded in Charlottesville. Low density and open space development can negatively impact water quality, though usually to a lesser degree than with high density development. In addition to changes in impervious surface area, there was an overall increase in Wetland cover from 2008-2019. Wetlands provide both habitat and food and help control erosion, and filter urban and agricultural runoff to maintain water quality. A regional decrease in forested land area can reflect a transitional period after a fire, other natural disaster, or logging operation, but typically can be expected to recover. Some losses, such as forests converted to development, tend to be permanent. Like wetlands, forests also help to buffer the impacts of flooding and storm surge, help mitigate erosion and landslides, and absorb, filter and store agricultural and urban runoff, protecting water quality.

Most of the change in TJPDC has occurred in forested lands and developed areas. From 2008 through 2019, forested and agricultural land cover has decreased, and developed areas increased across the region. Every county in the region saw an increase in developed land and decrease in forested land, as shown in the table below.

FEMA states that an effective way to reduce future losses in a community is to avoid development in known precarious locations and to enforce development of safe structures in other areas. Thus, a general description of population growth and development trends within the planning area are crucial factors in formulating mitigation options that influence future land use and development decisions.

Land Use Change by Locality from 2008-2019 (Square Miles)

Jurisdiction	Land Use Change	Developed Area Change	Forest Change	Agriculture Change	Impervious Surface Change	Wetland Change
Albemarle	45.89	2.67	-8.53	-1.81	1.45	0.11
Charlottesville	0.54	0.1	-0.11	-0.03	0.19	0.1
Fluvanna	40.71	0.41	-8.14	-0.1	0.24	0.08
Greene	4.82	0.28	-0.2	-0.54	0.17	0
Louisa	89.4	1.1	-5.12	0.41	0.57	0.04
Nelson	39.04	0.2	-7.15	-0.81	0.14	0.04
Region	220.4	4.76	-29.25	-2.88	2.76	0.37

Source: Multi-Resolution Land Characteristics Consortium – January 2022

Overall Land Use Area Percentage by Locality (2019)

Jurisdiction	Developed Area	Forested Area	Agricultural Area	Impervious Area	Wetland Area
Albemarle	9.02%	65.57%	20.28%	1.98%	0.35%
Charlottesville	88.12%	9.24%	1.29%	34.58%	0.50%
Fluvanna	6.98%	66.58%	13.84%	1.09%	2.19%
Greene	9.55%	65.52%	22.66%	1.63%	0.10%
Louisa	7.40%	60.16%	14.49%	1.25%	4.23%
Nelson	5.82%	75.90%	12.27%	0.92%	0.16%

Source: Multi-Resolution Land Characteristics Consortium – January 2022

Central Virginia is an attractive place to live and work, and the localities in the Thomas Jefferson Planning District are growing in population. Higher costs of living in the urban core and in Albemarle County have made growth in the rural counties attractive. Local comprehensive plans generally intend to keep denser growth limited to the city and town areas, but major roadway corridors are seeing rapid growth as well. The result is growing populations in areas lacking many services that support modern needs.

According the 2040 TJPDC's Rural Long Range Transportation Plan, over the past decade Albemarle County has absorbed much of the region's growth, which has altered the county's land use patterns. Albemarle's land use patterns have become more urban along the 29 Corridor and around the Village of Crozet. In the rural areas, the land use pattern continues to be large lot single family homes, agriculture, silviculture, and rural development. Fluvanna County is also mostly rural or forested, but the county has designated Community Planning areas to concentrate growth in specific locations. Greene County is more rural and highly forested due to the location of Shenandoah National Park. However, additional growth has moved the County to designate growth areas around existing towns. Louisa County land use has been primarily rural and rural residential in the past but is rapidly changing due to its attractive position between Richmond and Charlottesville. Finally, Nelson County is primarily rural with large tracts of forested land within the George Washington National Forest and Wintergreen Resort.

As growth occurs, more houses, roads, commercial services, communications, fire and rescue, and public facilities will be built to service the growing population. Schools are often used as shelters and should be built to meet applicable standards. New water and sewer treatment plants and infrastructure are expected and are required to be built to hazard-proof standards. There are several transportation infrastructure improvements underway, with other planned projects awaiting funding. Solid waste services and collection points may also change and grow in all areas. Fluvanna and Louisa Counties are

jointly undertaking the James River Water Project to provide to supply both counties with the projected 50-year water need as identified in their respective Long Range Water Supply Plans. Currently, there is no indication that major development is occurring in areas that are more prone to natural hazards. Most development is occurring near major thoroughfare intersections, with much less development occurring in rural areas of the planning district. Increased flooding in the planning district is the primary concern for new development, but most development incorporates flood risk in the choice of location, per each developer or per local ordinance.

Agriculture and Forestry: Land in farms and forestry is slowly being converted to residential and estate uses across the region. There is a trend toward smaller farms, niche marketing, and direct sales, and an emphasis on sustainable agriculture. The George Washington National Forest is not expected to change in size, but may be more open to timber management, depending on economic and political forces.

Open Space: Open space is defined as any land left in a completely natural, recreational park or agricultural state. The growth in population leads to land being slowly converted to residential and commercial uses, although there are a growing number of properties entering into permanent protection with conservation easements. The state purchased land for the Biscuit Run State Park south of Charlottesville in 2010, but the park has not yet been developed. The Shenandoah National Park is not expected to change in area. Some developments in rural areas use conservation design techniques to preserve open space, especially as rural land converts into residential use.

Commercial: The primary commercial areas are the US 29 Corridor, downtown Charlottesville, Pantops, and the Corner near the University of Virginia. Commercial land uses are increasing, and generally newer developments occur in strip style near existing residential areas. In recent years, new large-scale retail has been built further from Charlottesville. The Zion Crossroads area is a major development focus for Fluvanna and Louisa Counties. Route 151 holds a significant amount of commercial use, consisting of breweries and wineries, as well as access to Wintergreen Resort. The major areas of commercial and

Source: TJPDC

business growth in Greene County are along the US 29 corridor, between Ruckersville and Albemarle County, and the US 33 corridor between Ruckersville and the County seat of Stanardsville. The Shops at Stonefield at Hydraulic and Route 29 opened in 2015. Additional development in the 29 corridor is underway. Fifth Street Station near I-64 and Fifth Street opened in November 2016, bringing 470,000 square feet of retail space just south of the City of Charlottesville. Another designated growth area includes Crozet in Albemarle.

Public Space: The primary public space for the region is the Downtown Mall in Charlottesville, although other commercial centers function as public gathering spaces, including those under private ownership. The IX warehouse property just south of the downtown mall is now an Art Park: a public, non-commercial, interactive space for residents and visitors. Each county has at least one park available for public use. For example, Pleasant Grove Park in Fluvanna features over 23 miles of hiking trails, several soccer and baseball fields, and a transportation museum. Patricia Ann Byrom Forest Preserve Park in Albemarle contains over 600 acres of multi-use trails for hiking, running, mountain biking, and horseback riding. Roadways are the largest public land use by area. New subdivisions in each of the localities are required to provide some form of open space, although this space is not always open for public use. Growth and development trends specific to individual localities are discussed in the Vulnerability Assessment section.

POPULATION AND GROWTH

The region grew by approximately 18% from 2000 to 2010, and an estimated 8.9% between 2010 and 2019, based on the American Census Bureau population estimates. Relative to other regions in Virginia, this growth rate is high, although it has slowed slightly from the 19% growth rate experienced between 1990 and 2000. The City of Charlottesville's population decreased slightly between 1980 and 2000, but then grew by 8% between 2000 and 2010, and an estimated 10.9% between 2010 and 2015. The City has been encouraging infill development, since its supply of developable land is constrained. Both Greene and Louisa counties have seen high growth rates in the past decade.

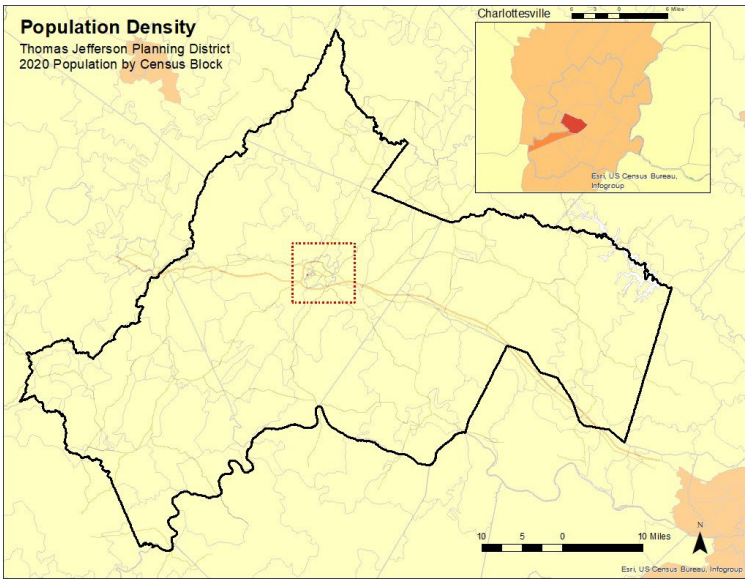
Population Change 2010-2020

Locality	2010 Population	2020 Population	% Change
Albemarle	99,204	112,395	13.3%
Charlottesville	43,461	46,553	7.1%
Fluvanna	25,791	27,249	5.6%
Greene	18,457	20,552	11.3%
Louisa	33,309	37,596	11.4%
Nelson	14,978	14,775	-0.3%
Region	235,200	256,206	8.9%

Source: US Census (2010, 2020) – January 2022

Major population centers and growth areas can be identified using census data and local comprehensive planning information. In 2015, The City of Charlottesville and the surrounding urban ring in Albemarle County was home to 38% of the region's population, down from around half of the population in 2000. Growth in Louisa, Fluvanna, and Greene has slowed slightly since the 1990s, but growth in these counties continues to outpace the rest of the region, partially due to available land and lower cost of living. The Route 29 corridor and the I-64/250 corridor, otherwise known as Pantops, are the major commercial and industrial areas outside of the city. Most localities stated in their Comprehensive Plans the goal of encouraging growth around existing centers to reduce the potential for sprawling development over time.

A density map shows concentrated population around Charlottesville and in Albemarle around Rt. 29N. While they are growing, most other counties in the planning district do not contain dense areas and preserve a rural character.



ECONOMIC GROWTH AND DEVELOPMENT

Relative to other metropolitan regions in Virginia and around the county, the overall economic growth from the Planning District has been healthy. However, the region has not been immune from the national economic downturn that occurred in 2008, with increased unemployment rates reflected in 2011 unemployment data. The unemployment rate has decreased since 2011 and now in 2021, the regional rates remain lower than the national rate of 5.2% and the slightly lower than the Virginia rate of 4.2%.

BLS Unemployment Rate

Locality	1994	2000	2011	2015	2021
Charlottesville	3.3%	1.7%	6.1%	3.7%	3.6%
Albemarle	2.4%	1.4%	4.9%	3.9%	3.4%
Fluvanna	3.5%	1.5%	5.5%	3.7%	3.4%
Greene	3.9%	1.5%	5.2%	3.7%	3.1%
Louisa	8.2%	3.0%	7.8%	5.1%	3.3%
Nelson	4.0%	2.3%	5.9%	4.0%	3.7%
VA	4.9%	2.2%	6.3%	4.4%	4.2%
National	6.1%	4.0%	9.2%	5.3%	5.2%

Source: Virginia Employment Commission, Bureau of Labor Statistics, National: CPS Annual Average, Local: LAUS Annual Average – January 2022

Reflecting national trends, the greatest increases in jobs in the Planning District have been in the service, retail, and government sectors, while farm and manufacturing jobs have been on the decline. The University of Virginia is the largest employer in the region. Other major employers in the area include the County of Albemarle, City of Charlottesville, Food Lion, State Farm, Sentara/Martha Jefferson Hospital, State Farm, Northrop Grumman, Piedmont Virginia Community College, Dominion Virginia Power, GE Intelligent Platform Systems, Wintergreen Resort, Lexis Publishing, Crutchfield Corporation, Piedmont Virginia Community College, Klockner-Pentaplast, and the Virginia Department of Corrections.

The Education and Health Care sectors are the largest in the region, comprising about a third of all employment. The University of Virginia and the UVa Health System are major drivers in the regional economy. Growth in the retail sector has occurred in the last decade, opening up more service-sector jobs. However, the wages for service-sector jobs have grown more slowly than any other sector, often matching or barely exceeding inflation.

Job placement and workforce training opportunities are available throughout the region from a number of public agencies and non-profit service providers. Piedmont Virginia Community College had 8,947 students enrolled in 2020-2021. Network2Work, a program at Piedmont Virginia Community College, is a successful job placement program. The City of Charlottesville launched its Growing Opportunity (GO) programs in 2014, providing basic literacy & workplace readiness training through the PluggedIn Virginia (PIVA) program, assistance with transportation and childcare, and jobs-driven workforce development training programs, including GO Driver, GO Clean, GO Electric, providing job-specific

The industries that provide most jobs in the region can be affected by natural disasters. For example, if a disaster were to cause temporary or permanent damage to any of the historical sites in the region, the tourism industry would be negatively impacted. Long power outages and road closures could be extremely detrimental to all employers in the region, especially tourism destinations, with long-term damage risking the overall economic outlook of the region.

The following table lists the top 50 largest employers in the region as of January 2022.

50 Largest Employers

1. University of Virginia/ Blue Ridge Hospital
2. County of Albemarle
3. Sentara Healthcare
4. UVA Health Services Foundation
5. City of Charlottesville
6. Charlottesville City School Board
7. U.S. Department of Defense
8. Sevicelink Management Com Inc
9. Food Lion
10. Wal Mart
11. State Farm Mutual Automobile Insurance
12. Fluvanna County Public School Board
13. Crutchfield Corporation
14. Greene County School Board
15. Piedmont Virginia Community College
16. Region Ten Community Services
17. Northrop Grumman Corporation
18. Wintergreen Resort
19. Assoc for Investment Management
20. Morrison Crothall Support
21. Kroger
22. Postal Service
23. Capital IQ Inc
24. Pharmaceutical Research Association
25. Fluvanna Correctional Center
26. Buckingham County School Board
27. Wegmans Store #07
28. Fresh Fields Whole Food Market
29. Nelson County School Board
30. Harris Teeter Supermarket
31. Atlantic Coast Athletic Club
32. Lowes' Home Centers, Inc.
33. Westminster Canterbury of the Blue Ridge
34. Rmc Events
35. Buckingham Correotional Center
36. VDOT
37. GE Fanuc Automation North Corporation
38. Gretna Health Care Center
39. Thomas Jefferson Memorial
40. Hanover Research Council
41. Faulconer Construction Company
42. WlllowTree Apps
43. U.P.S.
44. Labormax Staffing
45. Aramark Campus Ll..C
46. Umansky Honda Of Charlottesville
47. Dillwyn Correctional Center
48. St. Anne's Belfield School
49. Boar's Head Inn
50. Tiger Fuel Company

The following table shows the number of entities and employees in various non-farm employment sectors from the Virginia Employment Commission.

Top Industry Sectors in the Charlottesville MSA

Rank	Industry Sector	Employees
1	State Government	7,850
2	Accommodation & Food Services	3,868
3	Health Care & Social Assistance	3,361
4	Professional, Scientific, & Technical Services	3,119
5	Retail Trade	2,898
6	Local Government	2,697
7	Administrative, Support, & Waste Management Services	1,951
8	Other Services (except Public Administration	1,859
9	Finance & Insurance	1,534
10	Construction	1,470
	Total (all industries)	35,972

Source: Virginia Employment Commission Labor Market Information, derived from 2021 Quarterly Census of Employment and Wages - January 2022

TRANSPORTATION

Transportation within the planning district revolves around Interstate Route 64 on an east-west axis and Route 29, which is the primary north-south axis. Other major transportation corridors include Route 15, which travels roughly north-south through Fluvanna and Louisa counties, and Route 6, which passes through southern Fluvanna County and into northern Nelson County. Route 33 cuts through Greene County on an east-west axis and travels through Orange County into and through Louisa County. These other corridors do not have the capacity for heavier volumes of traffic as do Routes 64 and 29. Narrow roads and hilly conditions in rural areas may make it more difficult for larger trucks to travel, and occasional snow in winter can cause transportation delays of several days at times. A May 2021 mudslide in Nelson County on Route 250, which closed the section of the road down for months, demonstrated that some roads in the region can experience interruptions because of natural hazards. Both freight and passenger rail service run north-south and east-west through the region, including through Charlottesville and most small towns.

Within the narrowly defined urban area of Charlottesville and a portion of Route 29 north in Albemarle County, public transportation is available. The Charlottesville Area Transit (CAT) is the primary transit- provider, serving a large portion of the City of Charlottesville with additional stops along the U.S. Route 29 corridor and Pantops in Albemarle County. All CAT buses are accessible to people with disabilities and are wheelchair lift-equipped. In addition to CAT, demand-response and limited commuter transport services are available in the region through Jaunt. Jaunt has contracted to provide the services that Green County transit used to provide. The University of Virginia runs its own University Transit System (UTS) on and around grounds for students, staff, and faculty of the university, although it is also available to the public without charge. With new leadership at Jaunt and CAT, the area is renewing its commitment to establishing a robust transit system. Since the Covid-19 Pandemic, all UTS, CAT and Jaunt rides are fare free and CAT secured funding to continue fare free until 2024. The TJPDC, under the direction of the Regional Transit Partnership, is conducting two transit studies to improve and expand transit in the Thomas Jefferson Region. The Albemarle County Transit Expansion Study is looking at using microtransit to expand transit services in the county. The Regional Transit Vision Plan project is looking at creating a long-term vision for transit services in the entire region.

Transportation systems are key in providing effective emergency response but can also influence the impact of natural disasters. As the region's population becomes more dispersed and commute distances increase, the function of the economy is more and more vulnerable in the event of a debilitating natural disaster. In addition to more immediate needs, businesses and employees suffer economic consequences when roads are closed or otherwise impeded. Currently, transportation is one of the largest contributors to emissions in the region. Current reliance on fossil fuels and other carbon emitting mechanisms of transportation are in turn contributing to global climate change, which is accelerating and making more frequent extreme weather events in the region.

HOUSING

According to the 2020 U.S. Census, there were 115,655 housing units in the Thomas Jefferson region, with 89% of units occupied year-round.

Number of Housing Units

Locality	2010	2019	Growth Rate from 2010-2019(%)
Charlottesville	19,189	20,642	7
Albemarle	42,180	47,081	11.62
Fluvanna	10,425	11,162	7.07
Greene	7,529	8,488	12.74
Louisa	16,362	17,916	9.50
Nelson	9,938	10,240	3.04
Region	86,434	115,529	33.6

Source: US Census Bureau: Annual Estimate of Housing Units for Counties in Virginia(2010,2019) – January 2022

The following table outlines the increases in household income over a 29-year period. For most of the region, the increase in income is not keeping up with the increases in housing costs.

Median Household Income from 1990 to 2019

Locality	1990	2000	2005-2009	2010-2014	2015-2019	2014-2019 (% Change)
Charlottesville	$24,190	$31,007	$38,369	$47,218	$59,471	21%
Albemarle	$36,886	$50,749	$64,306	$67,958	$79,880	15%
Fluvanna	$31,378	$46,372	$62,163	$64,641	$76,873	16%
Greene	$29,799	$45,931	$54,153	$63,739	$67,398	5%
Louisa	$26,169	$39,402	$51,775	$57,126	$60,975	6%
Nelson	$23,705	$36,769	$44,326	$50,131	$64,313	22%

Source: Census 2000, 2014 and Census 2019 data, US Census Bureau 5-year estimates – January 2022

Self-reported median home values are highest in Charlottesville and Albemarle and lowest in Louisa and Nelson, suggesting that lower wage earners must frequently seek affordable housing far from where they work. The following figures, from the U.S. Census and American Community Survey, are self-reported, meaning that the respondents reported the value of their homes based on their own judgment.

Median Home Values: From 2009-2019

Locality	2009	2014	2009-2014 % Change	2015-2019	2014-2019 % Change
Albemarle	$336,100	$317,300	-6%	$356,100	11%
Charlottesville	$265,300	$283,100	6%	$299,600	6%
Fluvanna	$236,200	$214,000	-10%	$234,700	9%
Greene	$215,000	$244,400	12%	$236,400	-3%
Louisa	$202,300	$194,500	-4%	$223,100	13%
Nelson	$161,200	$198,500	19%	$235,000	16%

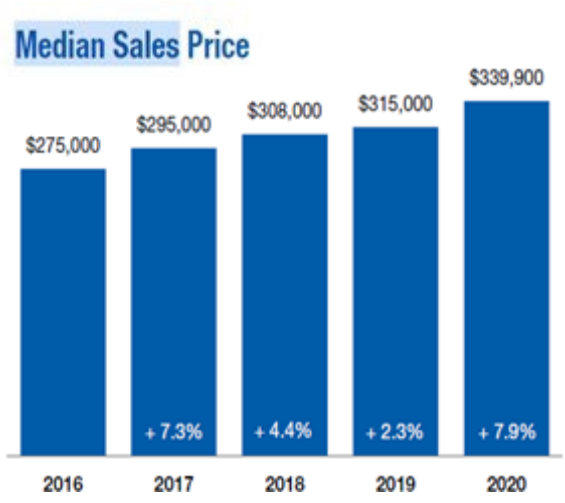
Sources: Census 2000, 2014 and Census 2019 data, American Community Survey 5-year Estimate data – January 2022

Median self-reported figures for homes in the Planning District increased significantly from the self-reported figures essentially doubled from 2000 to 2009. This increase was not fully sustained throughout the region between 2015-2019, with half of the six localities seeing a decrease in the self-reported home values over that 5-year period. The following table shows that actual sale prices increased in some localities and decreased in others.

Median Sale Price: 2018-2020

Locality	2018- Q1	2019- Q1	% Change 2018 to 2019	% Change 2019 to 2020
Albemarle	$370,000	$346,319	(-)6%	(+)8%
Charlottesville	$315,000	$350,000	(+)11%	(+)7.9%
Fluvanna	$224,000	$212,185	(-)5%	(+)10.2%
Greene	$248,500	$270,000	(+)9%	(+)7.4%
Louisa	$225,000	$221,950	(-)1%	(+)8%
Nelson	$215,000	$190,000	(-)12%	(+)19.5%

Source: Charlottesville Area Association of Realtors – January 2022



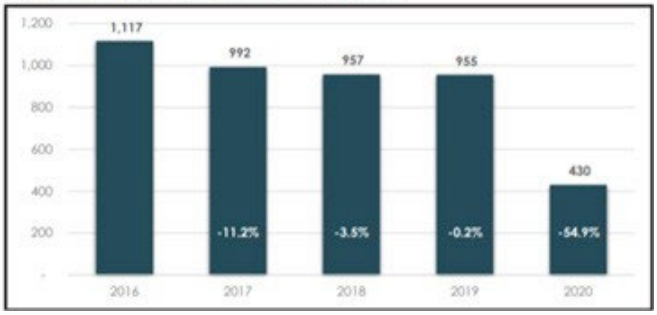
Change in Median Sales Price from 2019

Nelson County	+ 19.5%
Fluvanna County	+ 10.2%
City of Charlottesville	+ 8.5%
Louisa County	+ 8.0%
Albemarle County	+ 8.0%
Greene County	+ 7.4%

Source: Charlottesville Area Association of Realtors – January 2022

A variety of factors has affected the region's ability to construct and sell homes to most of its residents. The inventory of available homes for sale has dropped continuously from 2016-2020.

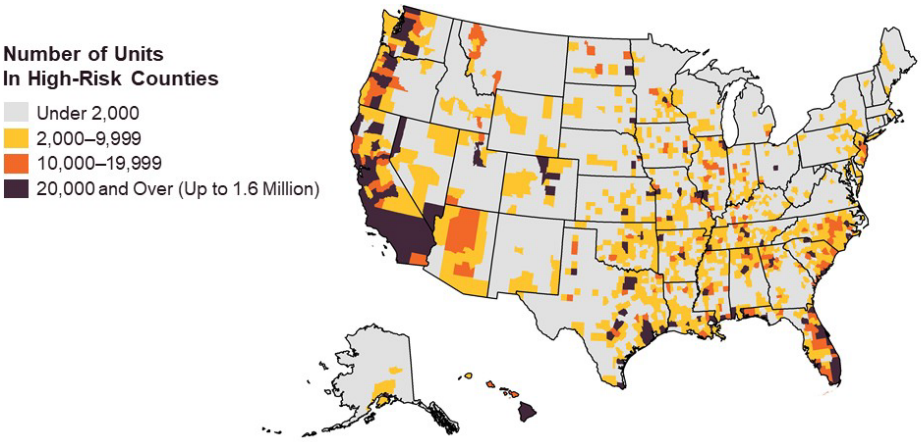
Inventory of Homes for Sale 2016 to 2020:



Source: Charlottesville Area Association of Realtors – January 2022

Low income residents are often disproportionately affected by natural disasters. Typically, the only land available to low-income families is in less desirable locations, in or near high hazard risk areas, such as along flood plains. Affordable housing may not be as well constructed as other housing, and therefore is more susceptible to damage from natural hazards. Households living in mobile homes, especially those that were built before 1978, can be at significant risk from natural disasters. Low-income families may also have less disposable income to make their homes more disaster resistant.

Figure 1: More than 17 Million Rental Units Are Under Threat from Environmental Hazards



Notes: High-risk areas have a Relatively Moderate, Relatively High, or Very High Expected Annual Loss (EAL) rating. EAL represents the average economic loss in dollars resulting from natural hazards each year. The number of units in high-risk counties are aggregated from the tract level. Rental units are occupied units only.
Source: JCHS tabulations of Federal Emergency Management Agency, November 2021 National Risk Index EAL data, and US Census Bureau, 2019 American Community Survey 5-Year Estimates.

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Joint Center for Housing Studies of Harvard University JCHS

According to Harvard University's Joint Center for Housing Studies, over 17 million rental units are under threat from environmental hazards. The accompanying analysis expects this number to continue to increase as hazardous weather events become more common and more severe. Fortunately, most of Virginia is considered to have less than 2,000 units per county at high risk. None of the planning district has more than 2,000 units that are high risk. However, it is important to keep in mind that this number may increase across the Commonwealth without effective and proactive mitigation measures. Ensuring that no particular type of housing is more dangerous than others in the planning district is an example of incorporating equity into the hazard mitigation planning process.

Certain types of housing, however, are more prone to risk than others due to their usual proximity to natural hazards and materials used in their construction. The table below illustrates the concentration of mobile homes in the Planning District. While mobile homes do not represent most homes in any of the planning district localities, they still house a significant population, especially in Nelson, Louisa, and Greene. Mobile homes are often susceptible to damage from high winds and flooding.

Mobile Home Table

Locality	Percent of Housing Units that are Mobile Homes
Charlottesville	.91%
Albemarle	4.11%
Nelson	15.03%
Louisa	12.97%
Fluvanna	6.91%
Greene	9.62%

Source: American Community Survey 2015-2019 – January 2022

Presidential Disaster Declarations

The following table lists presidential disaster declarations in the state, many of which included the localities in the Thomas Jefferson Planning District.

Presidential Disaster Declarations in Virginia Since 1969

Month	Year	Event
Aug.	1969	Hurricane Camille (flooding); 27 jurisdictions declared, All localities in PDC
June	1972	Hurricane Agnes (flooding); 106 jurisdictions declared, All localities in PDC
Sept.	1972	Storm/Flood; Hampton, Newport News, & Virginia Beach declared
Oct.	1972	Flood; Western, Central, Southeastern Virginia; 31 jurisdictions declared
April	1977	Flash Flood; Southwestern Virginia; 16 jurisdictions declared, None in the PDC
Nov.	1977	Flood; Southwestern Virginia; 8 jurisdictions declared, None in the PDC
July	1979	Flood; Buchanan County declared
Sept.	1979	Flood; Patrick County declared
May	1984	Flood; Buchanan, Dickenson & Washington Counties declared
Nov.	1985	Flood; Western, Central Virginia; 52 jurisdictions declared
Oct.	1989	Flood; Buchanan County declared
April	1992	Flood; Western Virginia; 24 jurisdictions declared, None in the PDC
March	1993	Snowstorm; 43 jurisdictions declared
Aug.	1993	Tornado; Petersburg declared
Feb.	1994	Ice Storm; Central, Western Virginia; 71 jurisdictions declared, None in the PDC
March	1994	Ice Storm; Central, Western Virginia; 29 jurisdictions declared, None in the PDC
June	1995	Flood; Central & Western Virginia; 24 jurisdictions declared
Jan.	1996	Blizzard; All counties and cities in state declared, All localities in PDC declared
Jan.	1996	Flood; 27 jurisdictions declared
Sept.	1996	Hurricane Fran (flooding); 88 jurisdictions declared
Aug.	1998	Hurricane Bonnie (flooding); 5 jurisdictions declared, None in the PDC
Sept.	1999	Hurricane Dennis; Hampton declared, None in the PDC
Sept.	1999	Hurricane Floyd (flooding); 48 jurisdictions declared, None in the PDC
Feb.	2000	Winter Storms; 107 jurisdictions declared: all except Charlottesville and Nelson
July	2001	Flood; Southwestern Virginia; 10 jurisdictions declared, None in the PDC

Sept.	2001	Pentagon Attack; 1 jurisdiction declared, None in the PDC
March	2002	Flood; Southwestern Virginia; 10 jurisdictions declared, None in the PDC
April/May	2002	Flood; Southwestern Virginia; 9 jurisdictions declared, None in the PDC
Feb.	2003	Winter Storms/Flooding; 39 jurisdictions declared, None in the PDC
Sept.	2003	Hurricane Isabel (winds, flooding); 100 jurisdictions declared, All localities in PDC
Nov.	2003	Flood; Southwestern Virginia; 6 jurisdictions declared
May	2004	Flood; Southwestern Virginia; 3 jurisdictions declared
Sept	2004	Flood; Central Virginia; 12 jurisdictions declared, None in the PDC
October	2004	Severe Storms and Flooding from the remnants of Hurricane Jeanne, None in PDC
Sept.	2005	Hurricane Katrina Evacuation
April	2006	Bull Mountain Fire
July	2006	Severe Storms, Tornadoes, and Flooding
Sept.	2006	Severe Storms and Flooding, Including Severe Storms and Flooding Associated with Tropical Depression Ernesto
Dec.	2009	Severe Storms and Flooding Associated with Tropical Depression Ida and a Nor'easter
Feb.	2010	Severe Winter Storm and Snowstorm
April	2010	Severe Winter Storms and Snowstorms
Feb.	2011	Smith Fire
Feb.	2011	Coffman Fire
Sep	2011	Hurricane Irene
Nov	2011	Earthquake in Louisa County
Nov	2011	Remnants of Tropical Storm Lee
July	2012	Severe Storms and Straight-line Winds
Nov	2012	Hurricane Sandy
Mar	2016	Severe Winter Storm and Snowstorm
Nov	2016	Hurricane Matthew
Sept	2018	Hurricane Florence
October	2018	Tropical Storm Michael
Jan	2020 and continuing	Virginia Covid 19 Pandemic
Feb.	2021	Severe Winter Storms
Aug	2021	Flooding, Landslides, Mudslides

Source: FEMA, VDEM – January 2022

HISTORIC DISTRICTS

The Thomas Jefferson Planning District is home to a number of historic districts (HD) and properties, and the UNESCO World Heritage Site of Monticello and the University of Virginia's Academical Village. The region's history is a significant contributor to the area's character and supports a robust tourism industry. The Historic Downtown Mall in Charlottesville is considered one of the finest urban parks in the country. This pedestrian mall is home to a vibrant collection of more than 120 shops and 30 restaurants located in the historic buildings on and around old Main Street Charlottesville. Historic

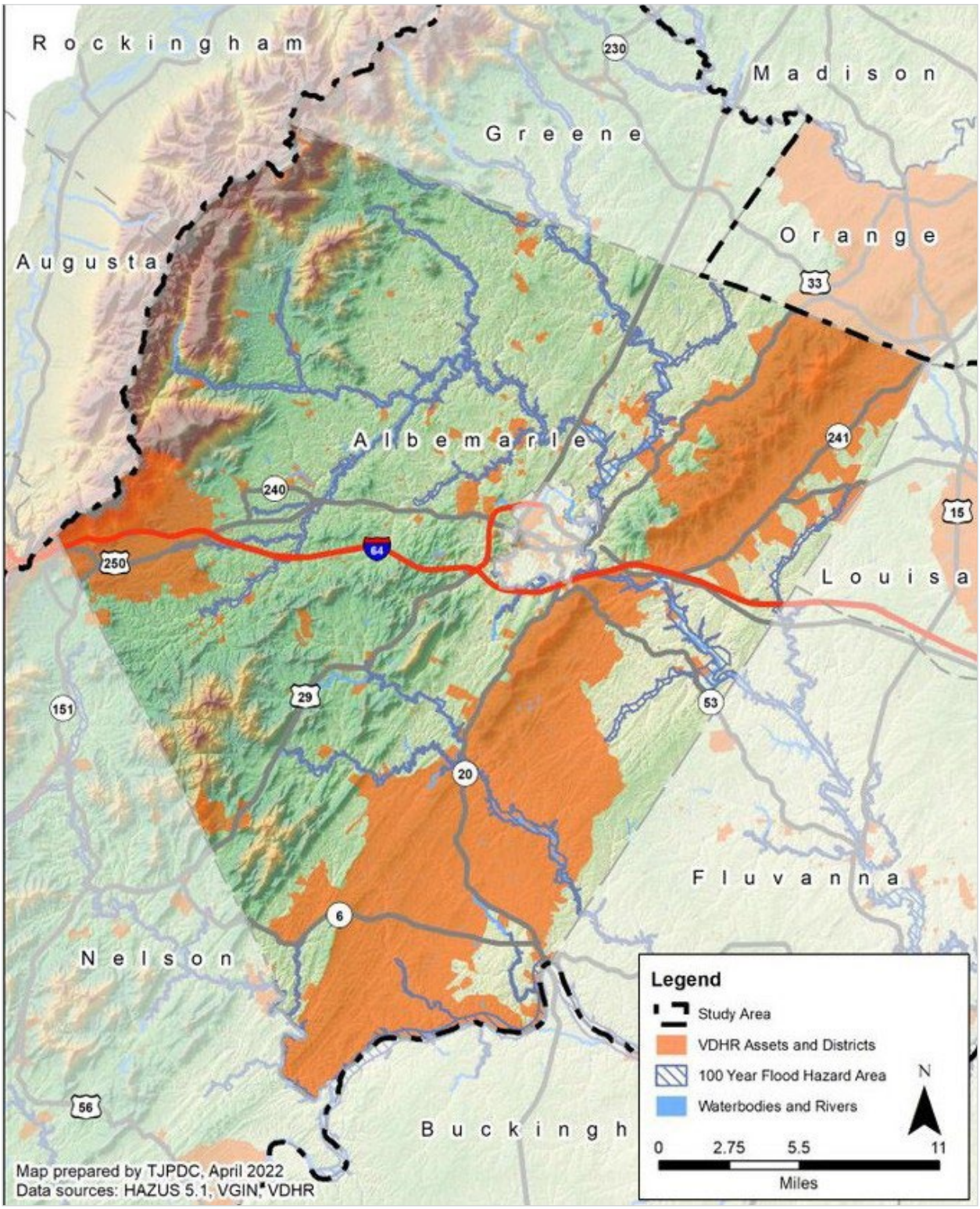
Districts in the region are:

- **Advance Mills (Fray's Mill) HD (Albemarle County)**
- **Alberene Stone Company Executive Row HD (Albemarle County)**
- **Batesville HD (Albemarle County)**
- **Covesville HD (Albemarle County)**
- **Crozet HD (Albemarle County)**
- **Proffit HD (Albemarle County)**
- **Free Union HD (Albemarle County)**
- **Southern Albemarle Rural HD (Albemarle County)**
- **Southwest Mountains Rural HD (Albemarle County)**
- **UVA Area HD (Albemarle County and Charlottesville)**
- **Greenwood-Afton HD (Albemarle and Nelson Counties)**
- **Charlottesville and Albemarle County Courthouse HD (Charlottesville)**
- **Fifeville-Castle Hill HD (Charlottesville)**
- **Fry's Spring HD (Charlottesville)**
- **Oakhurst-Gildersleeve HD (Charlottesville)**
- **Martha Jefferson HD (Charlottesville)**
- **West Main Street HD(Charlottesville)**
- **Ridge Street HD (Charlottesville)**
- **Wertland Street HD (Charlottesville)**
- **Woolen Mills Village HD (Charlottesville)**
- **Rugby Road – University Corner – Venable Neighborhood HD (Charlottesville)**
- **Bremo Plantation HD (Fluvanna)**
- **Fluvanna County Courthouse HD (Fluvanna County)**
- **Scottsville HD (Albemarle and Fluvanna Counties)**
- **Lovingston Historic District (Nelson)**
- **Stanardsville HD (Greene County)**
- **Green Springs HD - National Trust Landmark District (Louisa)**
- **Mineral HD (Louisa)**

A map showing Virginia Department of Historic Resources (VDHR) Historic Assets and Districts overlain with the 100-year flood plain is included on the following page. The Town of Scottsville experienced twenty-one floods of 20 feet or more above mean low water level between 1870 and 1990. The impoundment on Mink Creek was completed in 1975, and the A. Raymon Thacker Levee was dedicated in 1990. Scottsville has not been flooded since the levee was constructed. A stone and earthwork dam protects Bremo Plantation structures in Fluvanna County. Land in the flood plains are generally in the rural historic districts.

MAP: 100 Year Flood Events

Historic Assets and Districts



Hazard Identification and Analysis

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

201.6(c)(2)(ii): The risk assessment shall include a description of the jurisdiction's vulnerability to the hazards described in paragraph (c)(2)(i) of this section. This description shall include an overall summary of each hazard and its impact on the community.

PURPOSE

The purpose of the hazard identification process is to describe all natural hazards that affect the Thomas Jefferson Planning district and provide an analysis on their location, extent, severity, and probability of occurrence. Each individual hazard was identified, including a description of the hazard in general written from a national perspective, followed by an in-depth analysis based on the particular impact the hazard has on the Thomas Jefferson Planning District. Most of the general descriptions were updated in 2011 and have not significantly changed in the previous five years. However, new data and information on regional events that occurred between 2018 and 2023 were used to augment the analysis of hazards previously identified.

Source: TJPDC

The hazards appear in the order of relative risk posed to the Planning District. The Working Group agreed on the rating for each parameter for all potential hazards, using a risk matrix developed by Kaiser Permanente. Based on the relative threat, as determined by the Working Group, hurricanes/high winds and windstorms, flooding and winter storms posed the greatest threat. Therefore, these hazards are analyzed in greater detail in this plan. Other hazards that appear on the list do not pose a significant risk but are still accounted for in this plan. Due to varying environmental features of the localities within the planning district, there exists locality-specific differences for each hazard. Hazards not listed are considered to have no potential for direct impact on the region. Some hazards are interrelated (i.e., hurricanes can cause flooding and tornadoes), and some consist of hazardous elements that are not listed separately (i.e., severe thunderstorms can cause lightning; hurricanes can cause coastal erosion). It should also be noted that some hazards, such as severe winter storms, may impact a large area yet cause little damage, while other hazards, such as a tornado, may impact a small area yet cause extensive damage. Information regarding identifying, measuring, and predicting the frequency of each hazard included in the HIRA can be found in this section, including region and locality-specific analysis that justify that hazard's ranking in the risk assessment.

There is an emerging scientific consensus that global climate change may alter the incidence and severity of disasters in the future. Changes in weather patterns, including hotter summers and winters with greater than average snowfall, will potentially impact all sectors of the community. Agriculture may be affected by drought conditions while stormwater infrastructure can become overwhelmed with unusually heavy rainfall. Severe storms can create vulnerabilities in the energy sector, threatening power supply to homes and businesses as well as to

medical facilities. The region can expect the intensity of hazards to increase as global climate change continues to create new and exacerbate existing weather patterns.

The Hazard Assessment Tool was used to evaluate each identified hazard according to the probability of occurrence and the severity in terms of impact to human life, property, and business operations. The following table is a prioritized list of hazards for the region as determined by the Hazard Mitigation Working Group. The exercise took into account national and state-level data, the local experience of members of the group, and the results of a prior assessment made in 2017.

EVENT	PROBABILITY	HUMAN IMPACT	PROPERTY IMPACT	BUSINESS IMPACT	RISK
	Likelihood this will occur	Possibility of death or injury	Physical losses and damages	Interruption of services	Relative threat*
SCORE	0 = no possibility 1 = some possibility 2 = very high possibility 3 = certain possibility	0 = no possibility 1 = some possibility 2 = very high possibility 3 = certain possibility	0 = no possibility 1 = some possibility 2 = very high possibility 3 = certain possibility	0 = no possibility 1 = some possibility 2 = very high possibility 3 = certain possibility	0 - 100%
Hurricane/high wind/windstorms	3	2	2	2	74%
Flooding	3	1	2	2	65%
Winter storms/ weather	3	1	1	2	56%
Communicable Disease/Pandemic	2	2	1	2	30%
Lightning	2	1	1	1	22%
Wildfire	2	1	1	1	22%
Drought / Extreme Heat	2	1	1	1	22%
Dam Failure	1	2	2	2	22%
Tornado	2	1	1	1	22%
Earthquake	1	1	2	2	19%
Landslide	1	1	1	1	11%
AVERAGE SCORE	**1.88**	**1.37**	**1.5**	**1.58**	**33%**

Data Disclaimer: In all tables where the National Climate Data Center (NCDC) is listed as the primary source, it is possible that data is reported with other localities, resulting in a value that is neither different nor exclusive. NCDC, like the TJPDC uses best available data. The most recent possible data was used by TJPDC staff to make determinations about natural hazards. In some cases, that data is not current to 2023. NCDC provides this disclaimer:

Storm Data Disclaimer: 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 sufficient 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. Therefore, when using information from Storm Data, customers should be cautious as the NWS does not guarantee the accuracy or validity of the information. Further, when it is apparent information

appearing in Storm Data originated from a source outside the NWS (frequently credit is provided), Storm Data customers requiring additional information should contact that source directly. In most cases, NWS employees will not have the knowledge to respond to such requests. In cases of legal proceedings, Federal regulations generally prohibit NWS employees from appearing as witnesses in litigation not involving the United States.

However, in many cases the National Weather Service NCDC (now National Centers for Environmental Information) combine Charlottesville and Albemarle observations into either one or the other jurisdiction. This is sometime referred to the Albemarle Charlottesville Zone in the data- base. When the data was analyzed many of these events were included in the Albemarle line item that affected both jurisdictions.

It is important to note that many types of weather events affect multiple jurisdictions and therefore the same event can either show up in one county or all 6 counties covered by the plan. Anecdotally, when there is no monetary damage reported the event location tends to be vaguer.

Hurricane

Identification

Hurricanes, tropical storms, nor'easters, and typhoons, also classified as cyclones, are any closed circulation developing around a low-pressure center in which the winds rotate counter-clockwise in the Northern Hemi- sphere (or clockwise in the Southern Hemisphere) and whose diameter averages 10 to 30 miles across. A tropical cyclone refers to any such circulation that develops over tropical waters. Tropical cyclones act as a "safety- valve," limiting the continued build-up of heat and energy in tropical regions by maintaining the atmospheric heat and moisture balance between the tropics and the pole-ward latitudes. The primary damaging forces associated with these storms are high-level sustained winds heavy precipitation, and tornadoes. Coastal areas are also vulnerable to the additional forces of storm surge, wind-driven waves, and tidal flooding which can be more destructive than cyclone wind.

The key energy source for a tropical cyclone is the release of latent heat from the condensation of warm water. Their formation requires a low-pressure disturbance, warm sea surface temperature, rotational force from the spinning of the earth, and the absence of wind shear in the lowest 50,000 feet of the atmosphere. The majority of hurricanes and tropical storms form in the Atlantic Ocean, Caribbean Sea, and Gulf of Mexico during the official Atlantic hurricane season, which encompasses the months of June through November. The peak of the Atlantic hurricane season is in early to mid-September and the average number of storms that reach hurricane intensity per year in this basin is about six (6).

As an incipient hurricane develops, barometric pressure (measured in Millibars or inches) at its center falls and winds increase. If the atmospheric and oceanic conditions are favorable, it can intensify into a tropical depression. When maximum sustained winds reach or exceed 39 miles per hour, the system is designated a tropical storm, given a name, and is closely monitored by the National Hurricane Center in Miami, Florida. When sustained winds reach or exceed 74 miles per hour the storm is deemed a hurricane. Hurricane intensity is further classified by the Saffir-Simpson Scale, which rates hurricane intensity on a scale of 1 to 5, with 5 being the most intense.

Source: NOAA

Saffir-Simpson Scale

The Saffir-Simpson Scale categorizes hurricane intensity linearly based upon maximum sustained winds, barometric pressure, and storm surge potential, which are combined to estimate potential damage. Categories 3, 4, and 5 are classified as "major" hurricanes, and while hurricanes within this range comprise only 20 percent of total tropical cyclone landfalls, they account for over 70 percent of the damage in the United States. The table below describes the damage that could be expected for each category of hurricane.

Saffir-Simpson Scale			
Category	Maximum Sustained Wind Speed (MPH)	Minimum Surface Pressure (Millibars)	Storm Surge (Feet)
1	74—95	>980	3—5
2	96—110	<979—965	6—8
3	111—130	964—945	9—12
4	131—155	944—920	13—18
5	155+	<920	19+

Source: NOAA

Hurricane Damage Classification

Category	Damage Level	Description
1	MINIMAL	No real damage to building structures. Damage primarily to unanchored mobile homes, shrubbery, and trees. Also, some coastal flooding and minor pier damage.
2	MODERATE	Some roofing material, door, and window damage. Considerable damage to vegetation, mobile homes, etc. Flooding damages piers and small craft in unprotected moorings may break their moorings.
3	EXTENSIVE	Some structural damage to small residences and utility buildings, with a minor amount of curtain wall failures. Mobile homes are destroyed. Flooding near the coast destroys smaller structures with larger structures damaged by floating debris. Terrain may be flooded well inland.
4	EXTREME	More extensive curtain wall failures with some complete roof structure failure on small residences. Major erosion of beach areas. Terrain may be flooded well inland.
5	CATASTROPHIC	Complete roof failure on many residences and industrial buildings. Some complete building failures with small utility buildings blown over or away. Flooding causes major damage to lower floors of all structures near the shoreline. Massive evacuation of residential areas may be required.

Source: NOAA

A storm surge is a large dome of water often 50 to 100 miles wide and rising anywhere from four to five feet in a Category 1 hurricane up to 20 feet in a Category 5 storm. The storm surge arrives ahead of the storm's actual land- fall and the more intense the hurricane is, the sooner the surge arrives. Water rise can be very rapid, posing a serious threat to those who have not yet evacuated flood- prone areas. A storm surge is a wave that has outrun its generating source and become a long period swell. The surge is always highest in the right-front quadrant of the direction in which the hurricane is moving. As the storm approaches shore, the greatest storm surge will be to the north of the hurricane eye. Such a surge of high water topped by waves driven by hurricane force winds can be devastating to coastal regions, causing severe beach erosion and property damage along the immediate coast. Damage during hurricanes may also result from spawned tornadoes and inland flooding associated with heavy rain- fall that usually accompanies these storms.

Source: NOAA

Hurricane Floyd, as an example, was at one time a Category 4 hurricane racing towards the North Carolina coast. As far inland as Raleigh, the state capital located more than 100 miles from the coast, communities were preparing for extremely damaging winds exceeding 100 miles per hour. Floyd made landfall as a Category 2 hurricane and will be remembered for causing the worst inland flooding disaster in North Carolina's history. Rainfall amounts were as high as 20 inches in certain locales and 67 counties sustained damages.

Source: NOAA

Similar to hurricanes, nor'easters are ocean storms capable of causing substantial damage to coastal areas in the Eastern United States due to their associated strong winds and heavy surf. Nor'easters are named for the winds that blow in from the northeast and drive the storm up the East Coast along the Gulf Stream, a band of warm water that lies off the Atlantic coast. They are caused by the interaction of the jet stream with horizontal temperature gradients and generally occur during the fall and winter months when moisture and cold air are plentiful.

There is near-uniform scientific consensus that the increasing global temperature will make tropical cyclones more frequent and intense. According to scientists at NOAA, over the course of the 21st century, tropical cyclone rainfall rates are projected to increase by 10-15%, tropical cyclone intensities are projected to increase, and the global proportion of tropical cyclones that reach Category 4 or 5 status is projected to increase. This body of evidence demonstrates that globally and in the United States it can be assumed that hurricanes will continue to affect both coastal and inland regions more often and more intensely. Further, there is evidence to indicate infrastructure damage and speeds of recovery affect communities with different incomes; a study after Hurricane Michael in 2018 found these significant levels of infrastructure resilience.

Analysis

Hurricanes have affected every locality in the planning district in many different forms over time. Hurricanes produce a variety of hazards, including flash flooding, riverine flooding, high winds, and sometimes spawn tornados and landslides. Modern communications make tracking and warning for these storms much easier, allowing people to prepare for the event in advance. However, spot damage can be quite extensive and sudden, with no opportunity for advance preparation.

The most severe and remembered was Hurricane Camille, which in 1969 devastated much of the planning district. Camille produced torrential rains in the remote mountains of Nelson County, Virginia. In just 12 hours, the mountain slopes between Charlottesville and Lynch- burg received over 10 inches of rain. Nelson County recorded almost 30 inches of rainfall within 4 ½ hours. The flooding was so catastrophic that all communications were cut off. Although the eye of Hurricane Camille did not actually pass through Nelson County, the resulting rainfall proved to be devastating. As a result of the deluge of water flowing from the water-soaked mountain- sides, massive landslides occurred which swept tons of soil, boulders, and thousands of trees onto farmlands, highways, floodplains and into the normal streambed and banks of almost every stream in the area. Over 150 people died in Virginia as a result of Hurricane Camille and another 100 were injured. Damage was estimated at 113 million dollars (1969 dollars).

Hurricane Matthew was the largest storm to pass through the planning district in the last ten years. The storm achieved category 5 status over the Atlantic Ocean but had been degraded to a tropical depression before reaching Virginia. The storm impacted the region with high winds and heavy rain.

Hurricane Zeta affected the region in the fall of 2020. Significant heavy rain and localized flooding occurred but the storm moved very quickly over the planning district.

Hurricane Ivan (2004) Track

Source: Wikipedia

Virginia, on average, experiences a tropical storm or its remnants about every year. Hurricanes directly hitting the Commonwealth occur every 2.3 years. Due to the enormous range of variables that affect a hurricane's path and intensity, it is difficult to predict when or if a hurricane season will be particularly dangerous to the planning district. Although rare in number, hurricanes' ability to cause widespread damage across the planning district reflects its high rank among damaging hazards in the region.

Hurricane and Tropical Storm Record 2010-2022

Locality	#	Deaths	Injuries	Property Loss	Crop Damage
Albemarle/Cville (reported with Nelson)	**2**	**0**	**0**	**$5,000.00**	**$**
Fluvanna (reported with Louisa)	**1**	**0**	**0**	**$36,000.00**	**$**
Greene	**1**	**0**	**0**	**$1,000.00**	
Louisa (reported with Fluvanna)	**1**	**0**	**0**	**$**	**$**
Nelson (reported with Albemarle)	**2**		**0**	**$1,000.00**	**$**

Source: NOAA

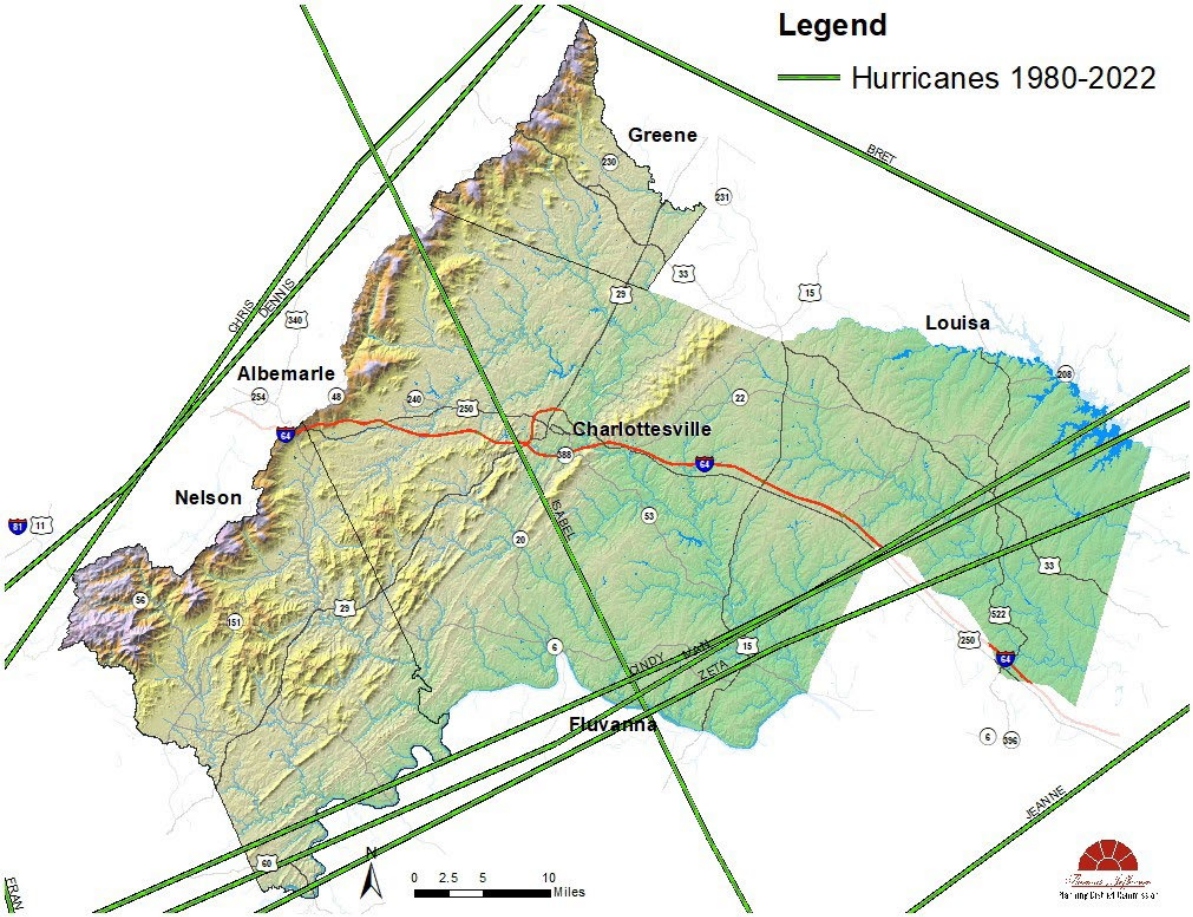
Notable Hurricanes in the Planning District

Note: Most of these storms were downgraded to tropical storms or tropical depressions by the time they reached the Planning District.

Hurricane	Specific Area	Damage	Year	Cat.
Zeta	All	Heavy rain, localized flooding	Oct. 20, 2020	3
Matthew	All	$30+ million in private + public structure damage, 2 deaths, evacuations, flooding/power outages	De. 18, 2018	5
Florence	All TJPDC localities	$200 million in damage, heavy rain/flooding/high winds/spawned tornadoes, 3 deaths	Oct. 15, 2018	4
Joaquin	All	Rain, localized flooding	Oct 2, 2015	2
Arthur	Fluvanna, Louisa, Albemarle	Power outages, rain, flooding	July 4, 2014	2
Sandy	Nelson, Greene	Power outages, rain, flooding	Oct 29, 2012	3
Cindy	Fluvanna and Louisa Counties	3 deaths in U.S.	July 7, 2005	1
Ivan	Fluvanna and Louisa Counties	Estimated $18 billion in U.S. damages and 25 deaths	Sept. 18, 2004	5
Isabel	All	Preliminary estimate of over $4 billion in damages/ costs; at least 40 deaths	Sept 18, 2003	5
Floyd	All	Flooding rains and high winds. 4 deaths; over 280,000 customers without electricity, 5,000 homes damaged.	Sep-99	4
Fran	Northwest Greene Co. was hardest hit.	$5.8 billion damage; 37 deaths, loss of electricity (state-wide)	August-September 1996	3
Agnes	Scottsville (34 feet), Howardsville and Columbia	More than 210,000 people were forced to flee for their lives and 122 were killed.	June 19-24, 1972	1
Camille	Massie Mill, Davis Creek, Scottsville, Howardsville, Schuyler, Columbia, Piney River	114 deaths in Nelson Co alone. Flooding & land-slides. $1.42 billion (unadjusted).	August 1969	5
Hazel	All	Flooding, barns leveled, roofs pulled off.	Oct 14-15, 1954	4

Source: National Climate Data Center, Albemarle Historical Newspaper Records

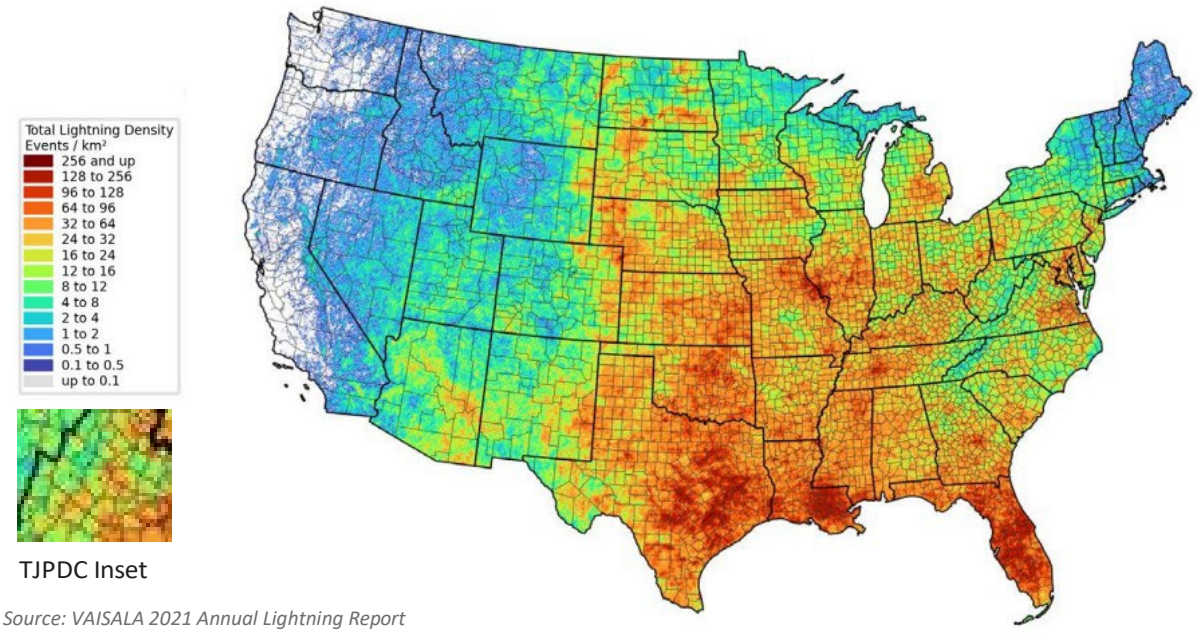
Hurricanes Between 1980 and 2022



Source: NWS

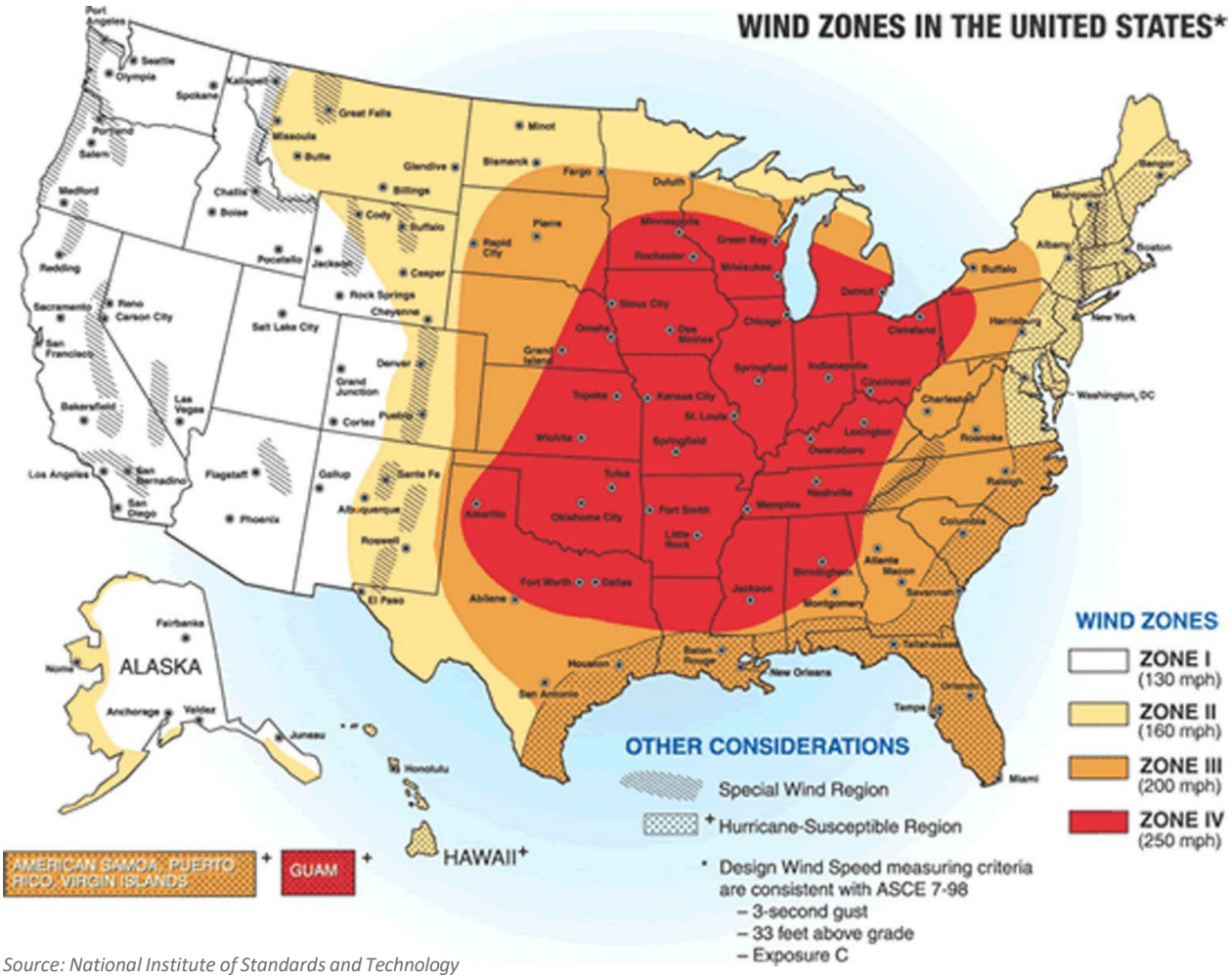
Total Lightning Density Gridded Map 2021

Cloud-to-ground strikes plus cloud pulses



TJPDC Inset

Source: VAISALA 2021 Annual Lightning Report



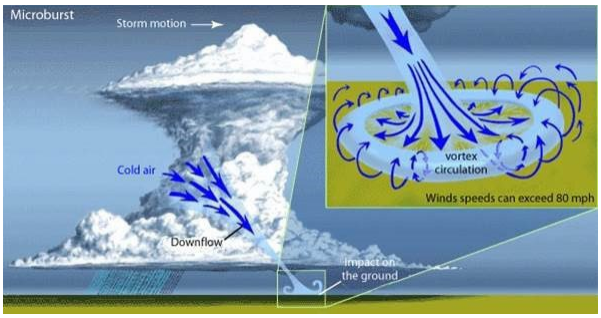
Source: National Institute of Standards and Technology

High Wind/Windstorm and Thunderstorms

Identification

High Winds: The figure below shows how the frequency and strength of extreme windstorms vary across the United States. The map was produced by the Federal Emergency Management Agency and is based on 40 years of tornado history and over 100 years of hurricane history. Zone IV, the darkest area on the map, has experienced both the greatest number of tornadoes and the strongest tornadoes. Virginia falls within the Hurricane-Susceptible region. As shown by the map key, wind speeds in Zone IV can be as high as 250 MPH.

Thunderstorms: According to the National Weather Service, more than 100,000 thunderstorms occur each year, though only about 10 percent of these storms are classified as "severe." Although thunderstorms generally affect a small area when they occur, they're danger lies in their ability to generate tornadoes, hailstorms, strong winds, flash flooding, and damaging lightning. While thunderstorms can occur in all regions of the United States, they are most common in the central and south- ern states atmospheric conditions in those regions are most ideal for generating these powerful storms.



Source: NASA

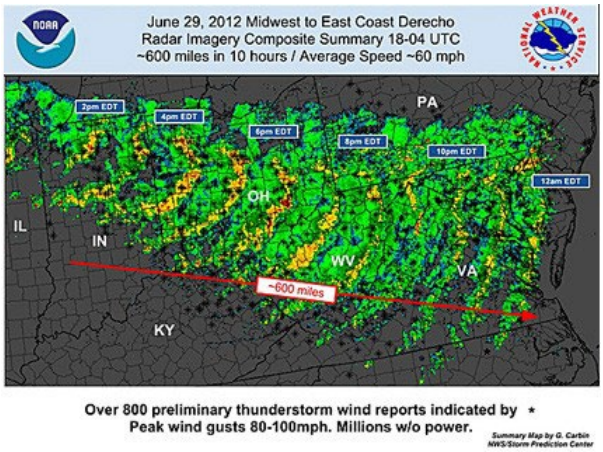
Microbursts: A microburst is a column of sinking air or downdraft that can occur during thunderstorms, extending outwards once reaching the surface. The result is strong and sometimes damaging winds usually extending 2.5 miles or less in diameter. Despite its small scale, microbursts can induce winds as strong as an EF-1 tornado, or around 100 miles per hour. A "dry microburst" is caused by evaporation cooling the air and causing it to descend abruptly. A "wet microburst" is triggered by a thunderstorm and are accompanied by a large amount of precipitation. These commonly occur in the southeast during summer months. Microbursts are a considerable aviation concern. Their sudden and severe nature can push aircraft toward the ground, and in some cases, result in crashes. They have also caused very localized damage to trees and built infrastructure.

Derecho Straight-Line Winds: A Derecho is a widespread long-lived straight-line windstorm that is associated with a land based, fast moving group of severe thunderstorms. Storms are classified as derechos if winds extend more than 240 miles and gusts reach at least 58 miles per hour throughout a majority of the storm's path. Derechos can produce hurricane force winds, tornados, heavy rains, and trigger flash floods. Seventy percent of derechos occur during May-August, making them warm weather phenomena.

Analysis

Each of the localities in the Planning District has been affected by windstorms that cause property damage and economic losses. High winds often accompany thunderstorms, hurricanes, or tornadoes; the latter two are discussed in more detail in other sections of this report. Most of the damage is a result of downed trees, road closures, and utility and communication outages. Structural damage may be sustained in poorly constructed buildings. As demonstrated by the historical data concerning high wind events and thunderstorms, continued risk, and damage from these types of weather events should be anticipated and prepared for. The variety of high wind events that the planning district is susceptible demonstrates why this hazard is potentially very damaging for the region. Derechos and microbursts can produce localized flooding and power outages that affect small portions of localities, potentially isolating them from emergency services. There is a very high probability for these events to happen regularly in the planning district.

A straight-line derecho wind caused extensive damage to properties in Louisa County in May of 2021. More than 9,000 customers were without power between the Rappahannock Electric Cooperative and Dominion Energy, and cars were overturned and displaced due to the strength of winds. In July of 2021, a microburst produced golf ball sized hail and winds over 60 miles per hour in Scottsville. Trees over 3 feet in diameter were uprooted, causing significant property damage and road blockages. Staff of Bartlett Tree Experts spent 2 days clearing roads, and stores were closed due to power outages for a day resulting from downed power lines. Intense storms such as these are likely to increase in destruction and frequency in the future throughout the region. Like hurricanes, the continued increase in global temperature will create conditions that will generate more frequent and intense storms and wind events in the planning district.



Source: National Weather Service

Damages in Louisa from Derecho in 2021

Source: NBC12 Louisa News

High Wind 2010-2020

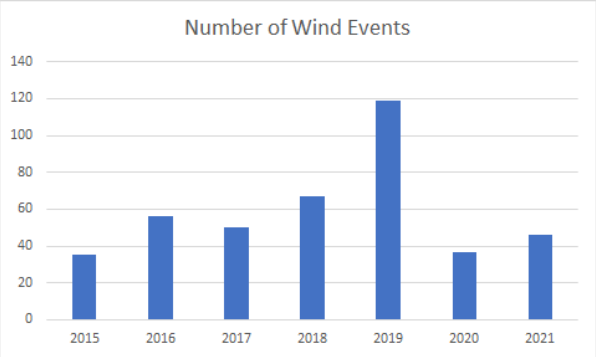
Locality	#	Death	Injuries	Property Loss	Crop Damage
Albemarle	10	0	0	$ -	$ -
Charlottesville	5	0	0	$ 1,000.00	$ 50,000.00
Fluvanna	0	0	0	$ -	$ -
Greene	6	0	0	$ -	$ -
Louisa	2	0	0	$ 50,000.00	$ -
Nelson	19	0	0	$ -	$ 20,000.00
Region	**42**		**0**	**$51,000**	**$70,000**

Source: National Climate Data Center (NOAA)

Thunderstorms with Wind 2010-2020

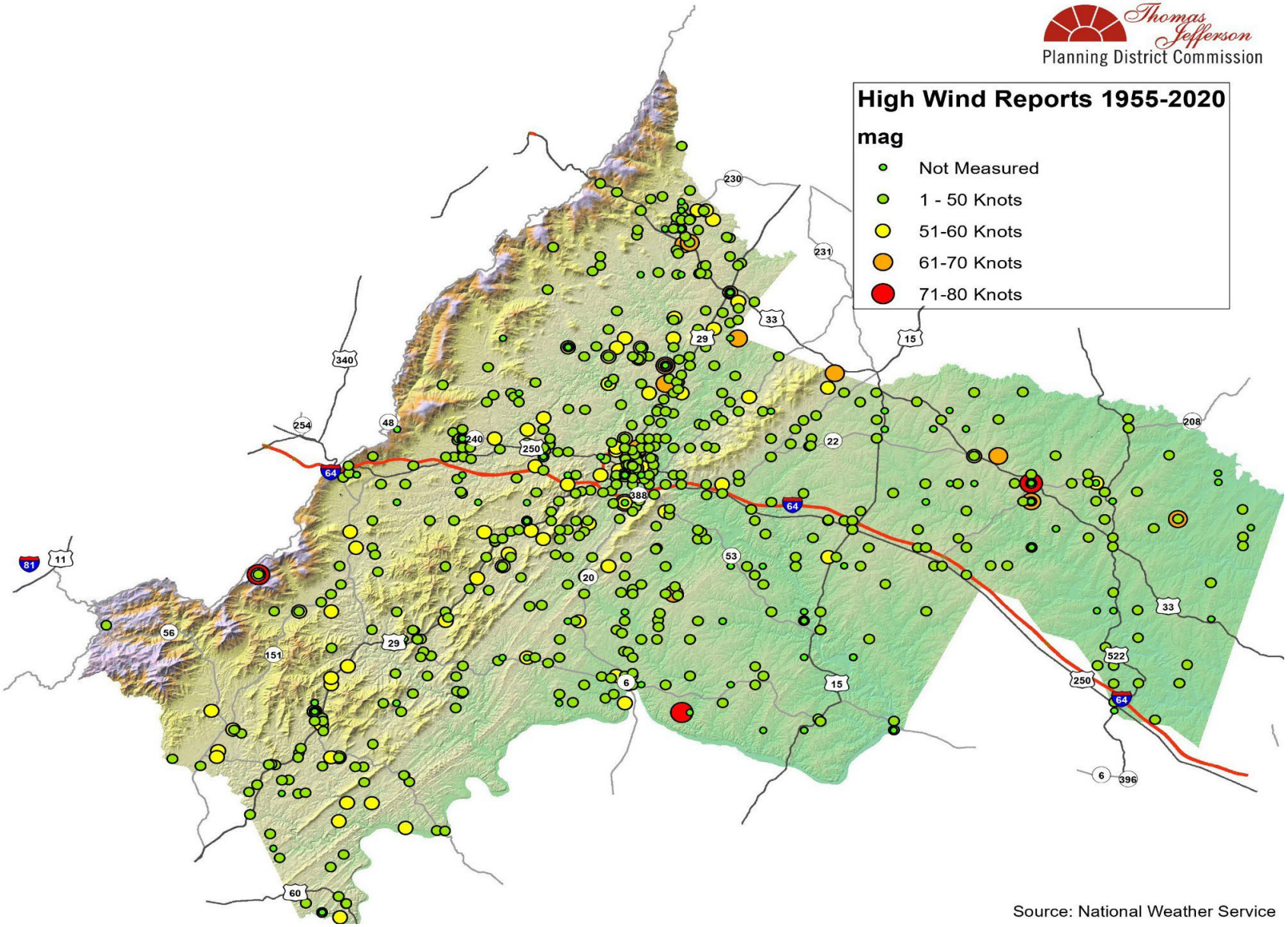
Locality	#	Death	Injuries	Property Loss	Crop Damage
Albemarle	298	0	0	$ 528,300.00	$ 24,250.00
Charlottesville	14	0	0	$ 75,500.00	$ -
Fluvanna	40	0	0	$ 390,000.00	$ -
Greene	59	0	0	$ 49,500.00	$ 7,000.00
Louisa	79	0	0	$ 597,000.00	$ -
Nelson	103	0	0	$ 133,500.00	$ 18,250.00
Region	**593**	**0**	**0**	**$1,773,800**	**$49,500**

Source: NCDC, Albemarle Historical Society archived newspapers, HMP working Group



Source: National Climate Data Center (NOAA)

Source: TJPDC


Thomas Jefferson
Planning District Commission
High Wind Reports 1955-2020
mag
Not Measured
1 - 50 Knots
51-60 Knots
61-70 Knots
71-80 Knots
Source: National Weather Service

Flooding

Identification

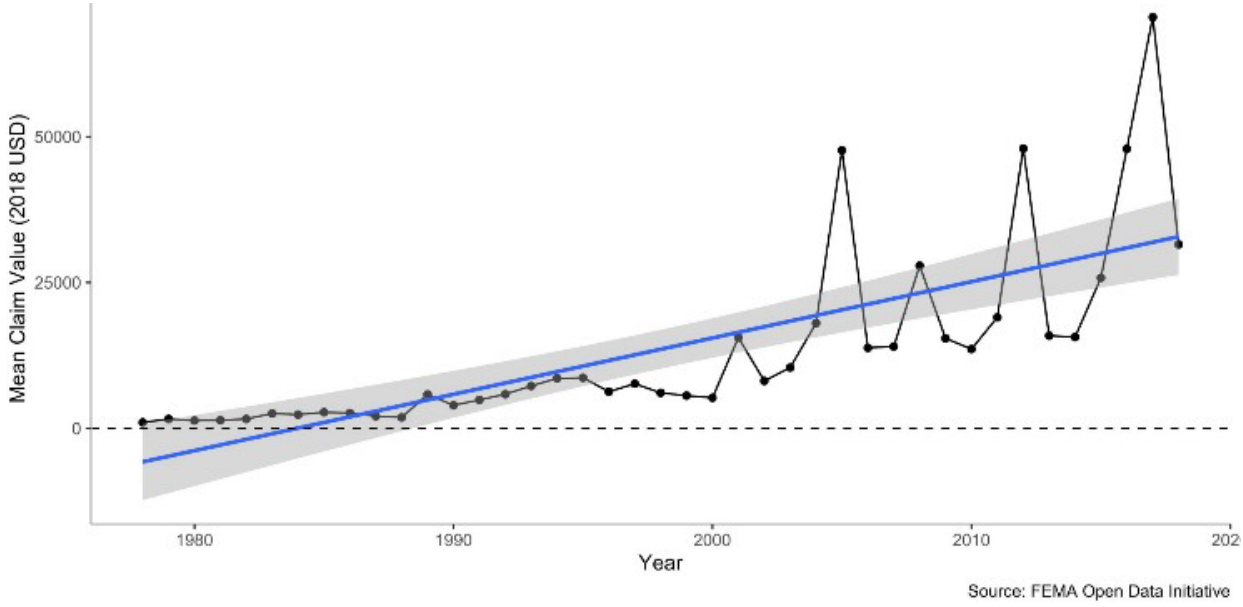
Flooding is defined as an overflow of water on normally dry land areas. In this region, they are most often the result of excessive precipitation, but dam failure or rapid snow melt can also lead to a flood event. Floods are the most frequent and widespread weather-related hazard across the world, occur in every U.S. state and territory, and kill more people than tornadoes, hurricanes, or lightning. In the United States, nearly 90 percent of presidential disaster declarations caused by natural events included flooding as a major component. The types of floods that most often impact this area and riverine flooding and flash flooding. The severity of a flooding event is determined by the following: a combination of stream and river basin topography and physiography; precipitation and weather patterns; recent soil moisture conditions; and the degree of vegetative clearing.

Riverine flooding is a function of excessive precipitation levels and water runoff volumes within the watershed of a stream or river. Weather events that can cause this type of flood are hurricanes, persisting precipitation events over a given location.

Flash flooding events usually occur from a dam or levee failure, within minutes or hours of heavy amounts of rain- fall, or from a sudden release of water held by an ice jam. Most flash flooding is caused by slow-moving thunder- storms in a local area or by heavy rains associated with hurricanes and tropical storms. Although flash flooding occurs often along mountain streams, it is also common in urbanized areas where much of the ground is covered by impervious surfaces. So called "urban flooding" occurs where man-made development has obstructed the natural flow of water and decreased the ability of natural ground cover to absorb and retain surface water runoff and often leads to flash flooding. Flash flood waters move at very high speeds. "Walls" of water can reach heights of 10 to 20 feet. Flash flood waters and the accompanying debris can uproot trees, roll boulders, destroy buildings, and obliterate bridges and roads.

The periodic flooding of lands adjacent to rivers, streams, and shorelines (land known as floodplain) is a natural and inevitable occurrence that can be expected to take place based upon established recurrence intervals. The recurrence interval of a flood is defined as the average time interval, in years, expected between a flood event of a particular magnitude and an equal or larger flood. Flood magnitude increases with increasing recurrence interval. Global alterations in weather extremity and frequency will alter designations of what a 100-year flood is. Systems and practices that mimic natural processes and allow for water to infiltrate the ground surface, absorption of water by vegetation, and reuse of stormwater help

National Mean Claim Value for Flood Insurance in dollars 1978-2018 (adjusted for inflation)



mitigate the risk of flooding. Increased riparian buffer zones, rain gardens, green roofs, and local parks are some examples.

Floodplains have traditionally been designated by the average frequency of the flood that is large enough to cover them. For example, a 100-year floodplain is the area covered by a 100-year flood. Flood frequencies such as the 100-year flood are determined by plotting a graph of the size of all known floods for an area and determining how often floods of a particular size occur. However, hydrologists prefer to express flood frequency as the probability of flooding each year. For example, the 100-year flood has a 1% chance of occurring in any given year, and a 500-year flood as a 0.2% chance of occurring in any given year. Over the years, the average value for flood insurance has increased substantially across the United States (shown below), reflecting increases in flood events and severity. There is also significant evidence that indicates flood risk is much higher for poorer communities due to historic land use decisions and lack of investment in infrastructure. An understanding of the risk of flooding in the region must account for populations living in flood-prone areas.

Flooding is the most common hazard in the Thomas Jefferson Planning District, with all localities subject to risk from flash flooding associated with hurricanes and winter storms, as well as riverine flooding of the James, Rivanna, and Conway Rivers.

Albemarle County

The James River floods in some manner nearly every year. The areas most prone to flooding in Albemarle County are the James River corridors and tributaries, and the steep slopes of the Blue Ridge Mountains along the western edge of the county. Scottsville, Howardsville and Sugar Hollow have experienced frequent flooding. In 2018, Albemarle County experienced significant flooding as remnants of Subtropical Storm Alberto swept through the region. Rain totals ranged from 7 to 9 inches after a few hours. Roads and schools were closed as a result, and residents were advised to boil water after flooding affected residential water services. A flash flood at Ivy Creek resulted in multiple individuals being swept away in their cars, resulting in some fatalities. A levee was built in 1989 and helps to protect the Town of Scottsville from flood damage. The Town maintains the

Photo 1 Marking in Scottsville showing heights of past floods
Source: TJPDC

flood control system with volunteer staffing, some County funding, and federal inspections. However, flooding remains a recurring problem in areas of town. In 2020, Scottsville was awarded grants from the Virginia Community Flood Preparedness Fund and will be using the grant to develop a survey and floodplain map amendment. Six floods from snowmelt and rainfall occurred in 2020 in Scottsville, with no flooding in 2021. Town of Scottsville staff provided significant input concerning the history of flooding in the Town and Albemarle.

Fluvanna County

The James River in Fluvanna County floods with some regularity, particularly in the Town of Columbia, located at the confluence of the Rivanna and James Rivers. At times, floods have covered 50% of the Town, including the St. James corridor running through the center of Town. The historic C&O depot was moved out of the floodplain in 1979. There are no levees protecting the Town of Columbia, and flood risks remain high. The small community of Bremo, located in the southern part of the county, is also at risk of flooding. Hurricane Camille in 1969 filled Lake Monticello, a 350-acre man-made lake, overnight, but the dam now protects residents from future floods. The portion of Scottsville in Fluvanna County is not behind the levee, representing a potential risk for property damage and loss of life.

Greene County

Major rain events threaten the county annually, and hurricanes and their remnants can cause flooding in late summer. Winter storms also contribute to flooding. The slopes of the Blue Ridge Mountains are at the highest risk for flash floods. The town of Stanardsville is protected from flooding due to its

elevation, while lower lying areas of the county are at higher risk.

Louisa County

Hurricane Camille in 1969 filled Lake Anna and destroyed the dam at Lake Louisa. According to local staff, there are still excavation vehicles at the bottom of the lake that were not removed in time before the hurricane arrived. The Towns of Louisa and Mineral sit on high ground and are generally not affected by flooding, other than flooding due to poor storm water drainage. Louisa left the National Flood Insurance Policy in 2017, and as seen in the table below, only 3 claims were filed over the course of 38 years. Dam controls protect residential development around Louisa's lakes. In 2022, flooding concerns in the Town and County of Louisa led to the creation of a working group by the County comprised of local citizens, Town representatives, state agency representatives, and TJPDC staff. The working group was tasked with identifying issues and finding solutions to the flooding issue.

Nelson County

The James River in Nelson County floods in some manner nearly every year.The slopes of the Blue Ridge Mountains are at the highest risk for flash floods due to accumulation from runoff. Howardsville, Wingina, Norwood, Gladstone, Schuyler, Nellysford and Woods

Source: CBS19

Mill are populated areas experiencing frequent flooding. During Hurricane Camille in Nelson County, rocks, trees, and landslides created temporary dams in the mountain hollows. When these dams broke, devastating flooding occurred, destroying everything in its path and causing 124 deaths countywide.

Both riverine and flash flooding present moderate risk to most of the planning district. With three major rivers, the Rivanna, James, and North Anna, bordering communities and property, extensive flooding is possible depending on the amount of rain and period it falls. As demonstrated in Scottsville, many residents of the planning district are frequently concerned about flooding.

Summary of Floods, Flood Record 2010-2021

Locality	#	Death	Injuries	Property Loss	Crop Damage
Albemarle	136	1	0	$50,000.00	$
Charlottesville	5	0	0	$	$
Fluvanna	6	0	0	$	$
Greene	79	0	0	$4,777,000.00	$312,000.00
Louisa	9	0	0	$	$
Nelson	65	0	0	$30,000.00	$
Region	300	1	0	$4,857,000.00	$312,000.00

Source: National Climate Data Center (NOAA)

Notable Floods, Flood Record 2010-2021

Locality	Location	Date	Event Type	Property Damage	Crop Damage
Albemarle	GREENWOOD	4/16/2011	Flash Flood	5.00K	
Albemarle	COVESVILLE	6/5/2016	Flood	20.00K	
Albemarle	STONY PT	5/5/2017	Flood	5.00K	
Albemarle	FARMINGTON	5/30/2018	Flash Flood	20.00K	
Greene	MARCH	5/30/2018	Flash Flood	677.00K	312.00K
Greene	LYDIA	5/31/2018	Flash Flood	4.100M	
Nelson	LOVINGSTON	6/4/2016	Flash Flood	10.00K	
Nelson	ROSELAND	6/5/2016	Flood	20.00K	

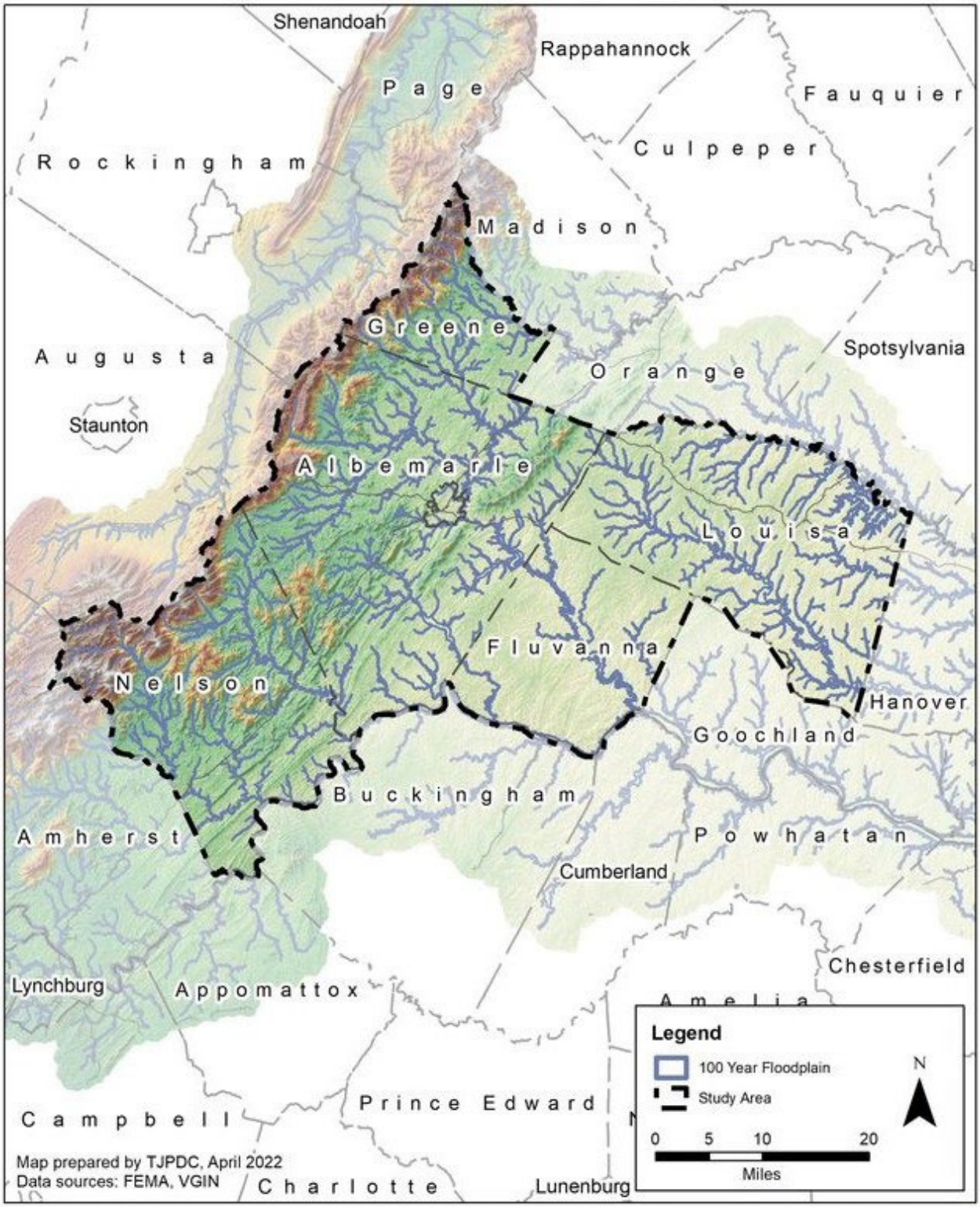
Source: National Climate Data Center (NOAA)

NFIP Policies and Claims Paid 1978-2022

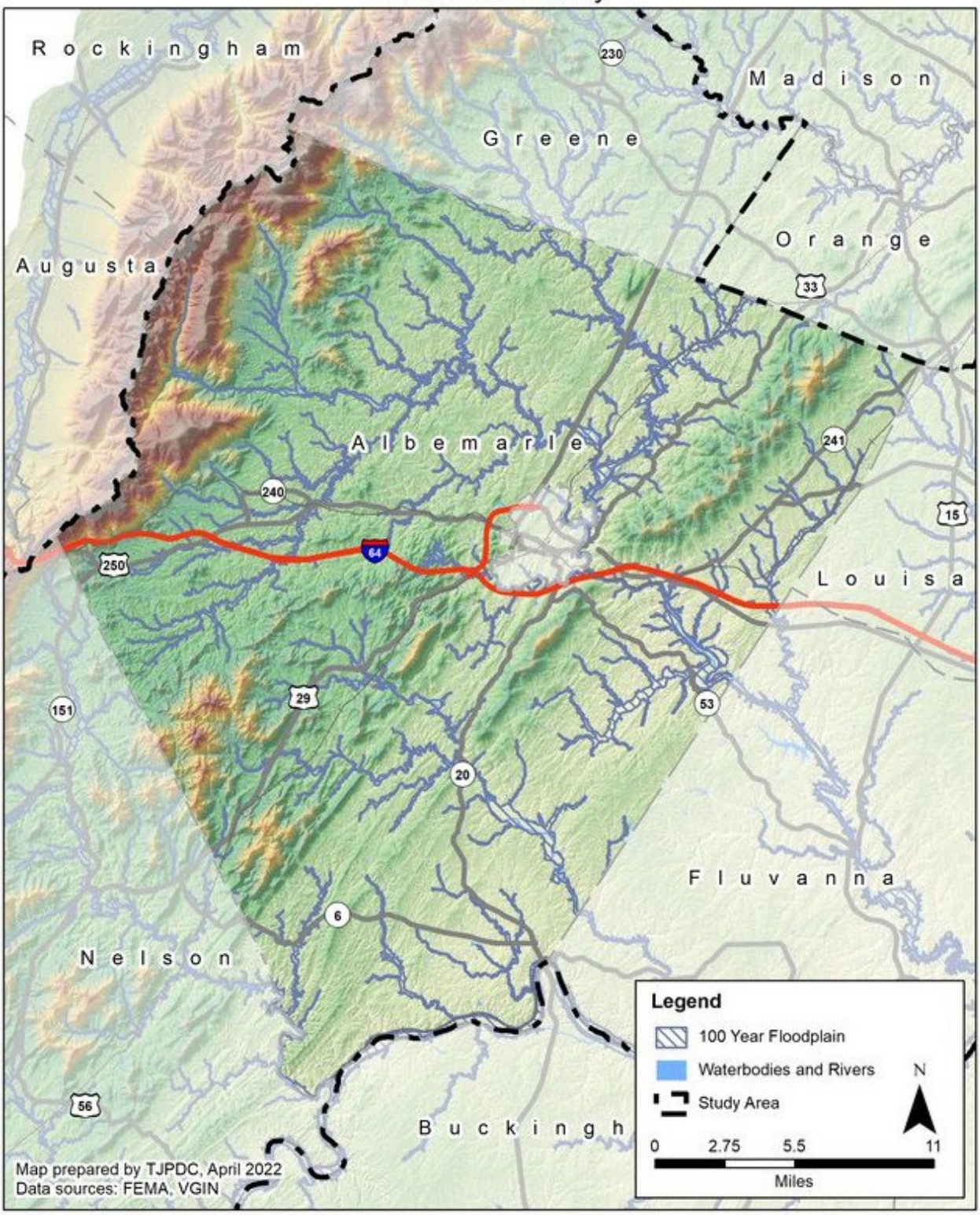
Jurisdiction	# Of Policies	Total Claims Since 1978	Total Paid since 1978
Albemarle	351	118	$1,264,602
Charlottesville	103	42	$277,226
Fluvanna	43	23	$276,616
Greene	62	26	$184,479
Louisa*	1	4	$36,477
Nelson	85	29	$14,576

Source: NFIP via VDEM
**Suspended*

FEMA Flood Hazard Areas
1% Annual Chance Flood Hazard

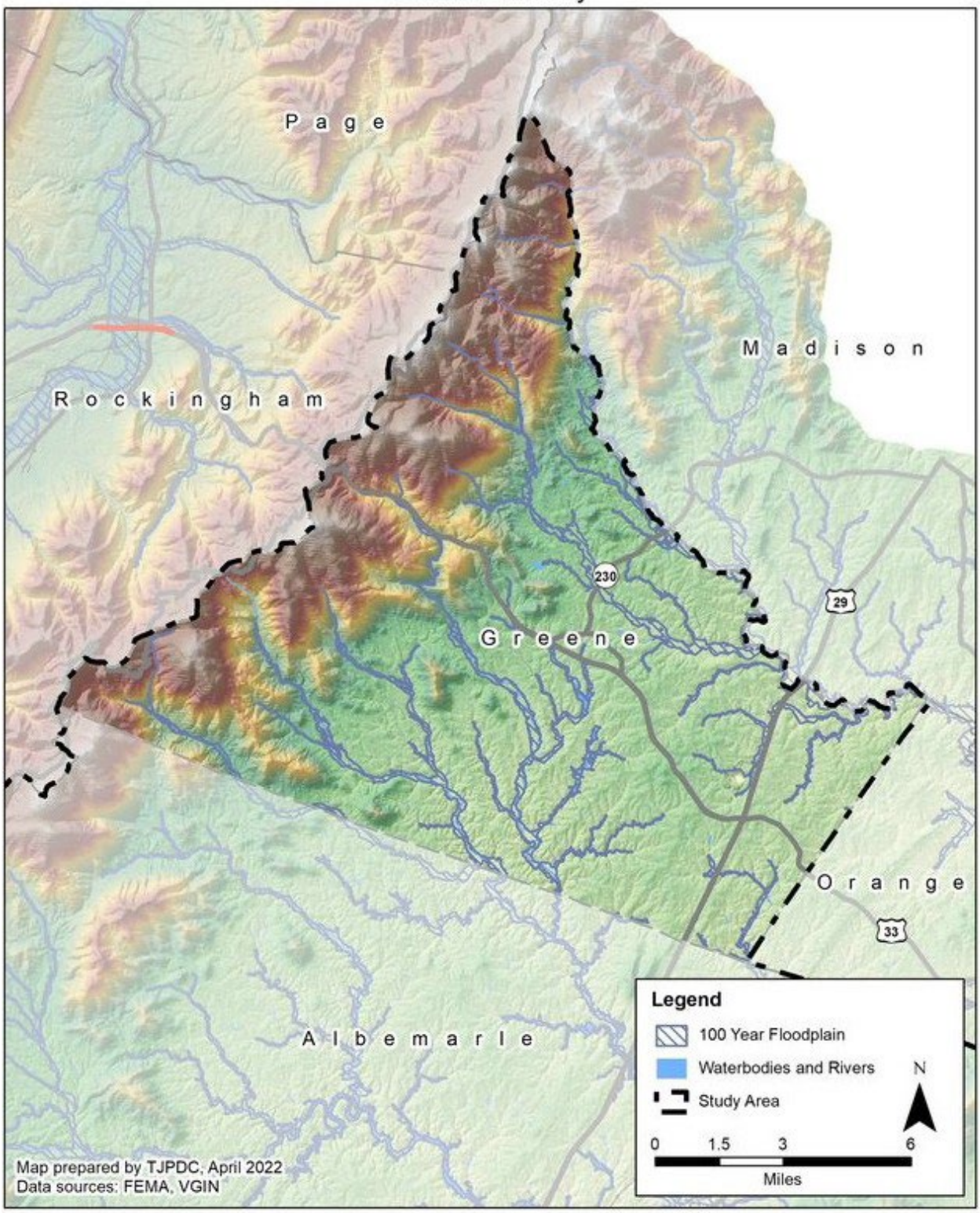


FEMA Flood Hazard Areas
Albemarle County

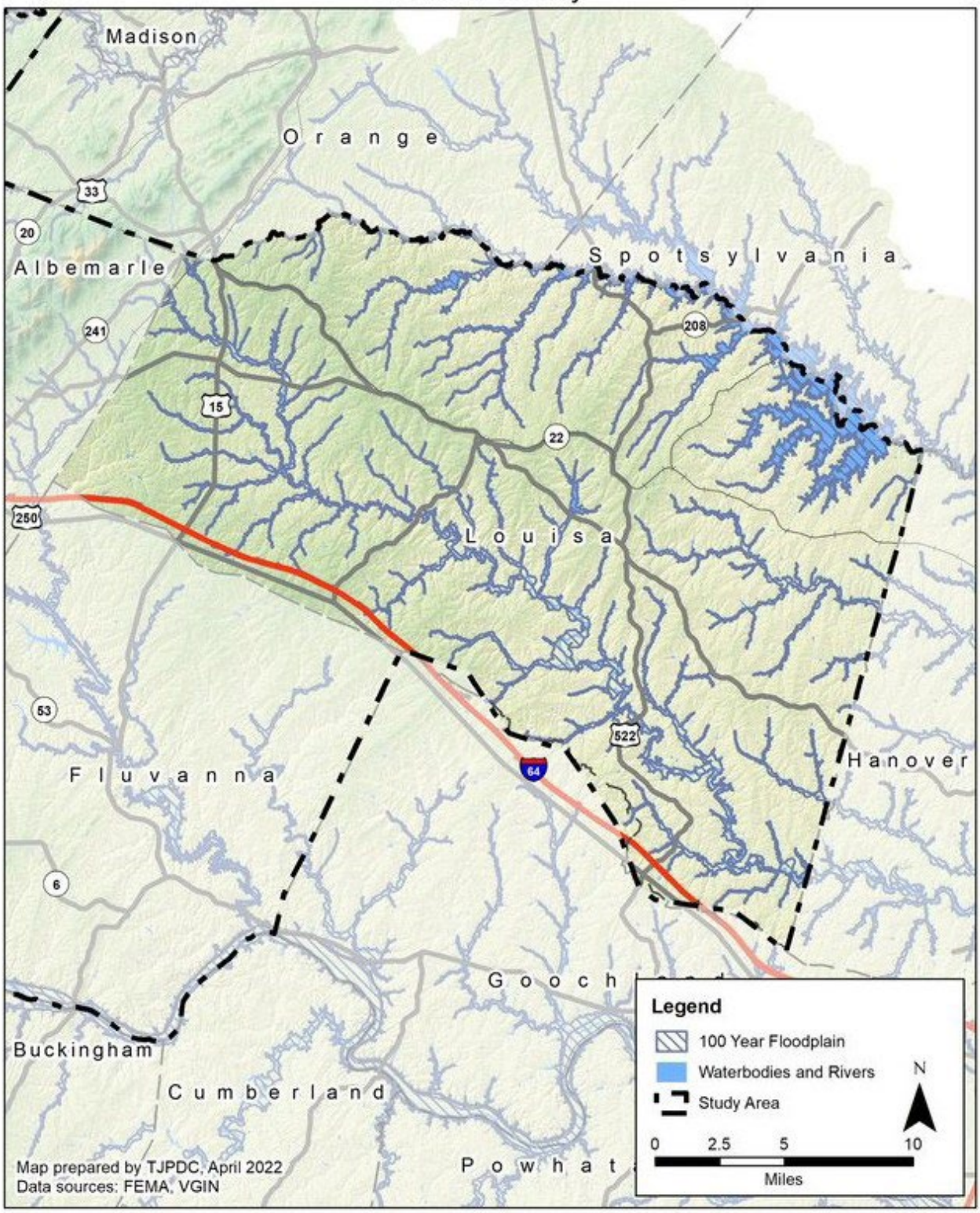


FEMA Flood Hazard Areas
Fluvanna County

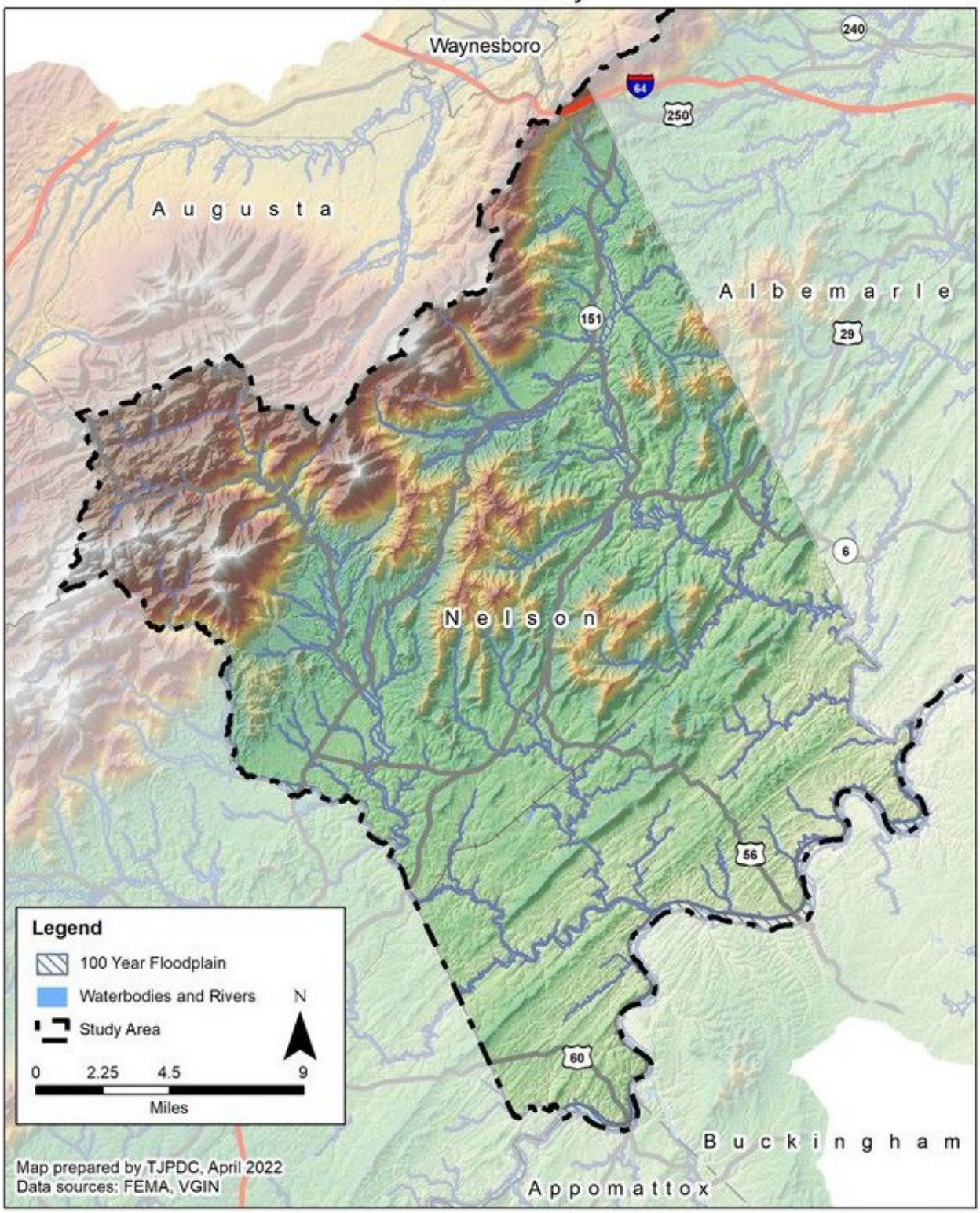
FEMA Flood Hazard Areas
Greene County



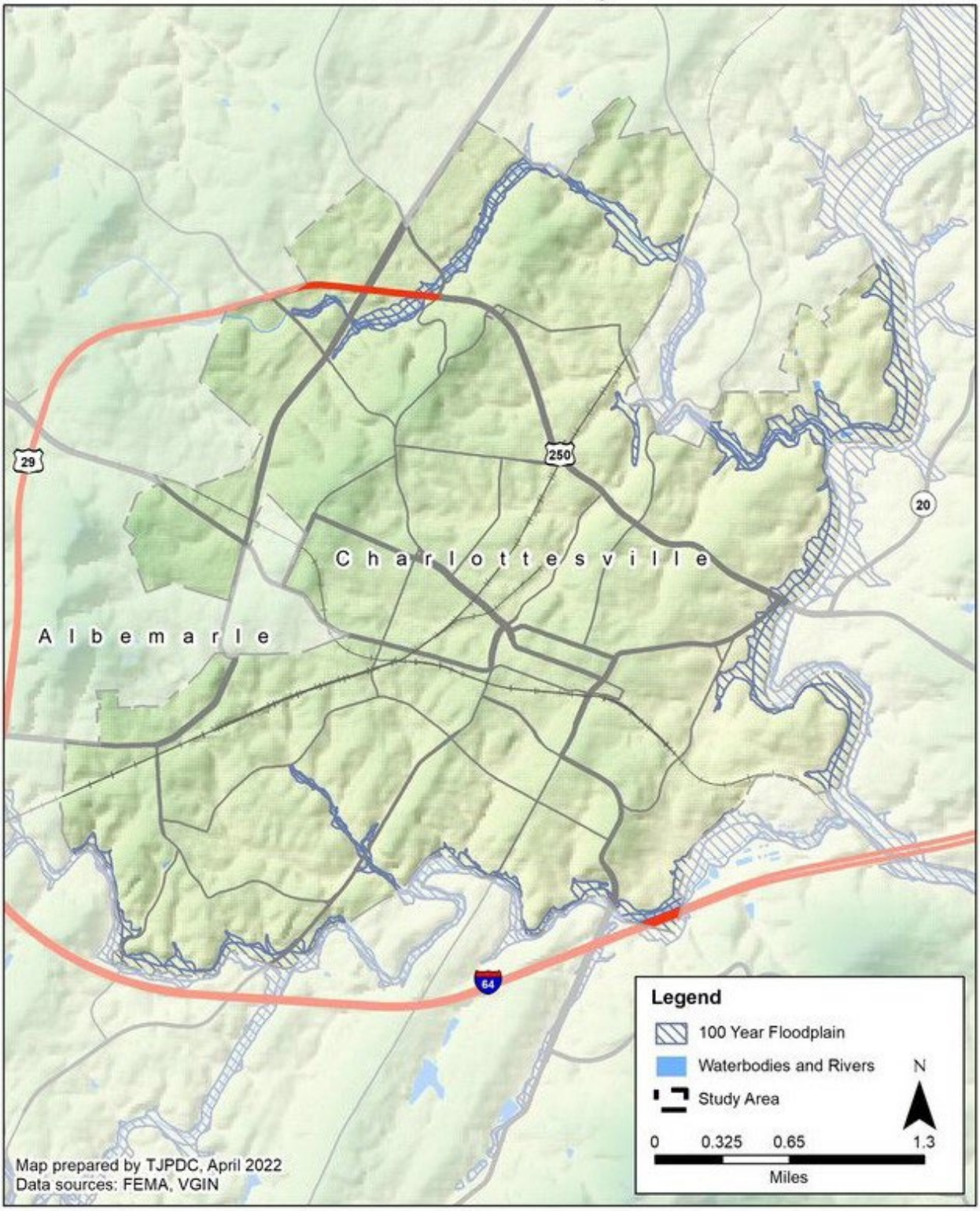
FEMA Flood Hazard Areas
Louisa County



FEMA Flood Hazard Areas
Nelson County



FEMA Flood Hazard Areas
Charlottesville City



Winter Weather

Identification

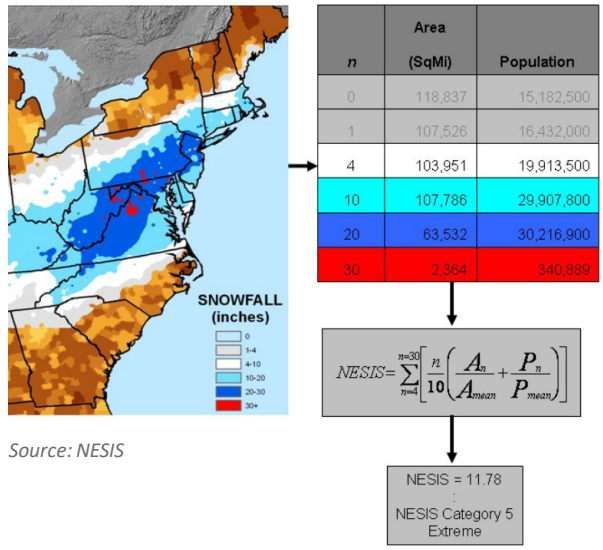
A winter storm can range from a moderate snow over a period of a few hours to blizzard conditions with blinding wind-driven snow that lasts for several days. Some winter storms may be large enough to affect several states, while others may affect only a single community. Many winter storms are accompanied by low temperatures and heavy and/or blowing snow, which can severely impair visibility, cause shutdowns, damage built and natural resources, and impede economic functioning within the region.

Winter storms include snow, sleet, freezing rain, or a combination of these wintry forms of precipitation. Sleet is formed when a temperature inversion occurs between clouds and the ground. Snow melts as it falls towards the surface and refreezes as ice pellets before reaching the ground. Usually, sleet bounces when hitting a surface and does not stick to objects, but it can accumulate on roadways creating a hazard to motorists. Freezing rain- rain that freezes before reaching the surface- develops a glaze of ice on the ground. An ice storm occurs when freezing rain falls and freezes immediately upon impact. The weight of wintry precipitation can present significant hazards to trees and built infrastructure as it accumulates.

A freeze is weather marked by low temperatures, below the freezing point (0° Celsius or 32° Fahrenheit). Agricultural production is threatened when temperatures remain below freezing point for extended periods.

The Northeasy Snowfall Impact Scale characterizes and ranks high-impact snowstorms. It has five categories: Extreme, Crippling, Major, Significant, and Notable. This index uses population data to produce a score. NESIS scores are a function of the area affected by the snowstorm, the amount of snow, and the number of people living in the path of the storm.

A sample NESIS calculation can be found to the right. The model considers amount of snow, area of study, and population to determine a score for a snowstorm that often dicates the amount damage, economic disruption, and loss of life that occurs before, during , and after a snowstorm. The associated scale can be found on the other side of the page, as well.



Source: NESIS

NESIS Values

Category	NESIS VALUE	Description
1	1-2.499	Notable
2	2.5-3.99	Significant
3	4-5.99	Major
4	6-9.99	Crippling
5	10.0+	Extreme

Analysis

Heavy Snow: Virginia's most severe winter storms are "Nor'easters". They are caused by the polar jet stream transporting cold artic air from the northeast towards the warmer air of the Gulf stream. Cold dry air becomes trapped to the east of the Appalachian Mountains, funneling down the valleys and along the coastal plain. When the dry cold air meets wetter, warmer air over the Gulf Stream, storms can develop rapidly.

Source: WTVR

The storm's speed and exact track to the north are critical in properly forecasting and warning for heavy snow across Virginia. It is quite common for the rain-snow line to fall roughly 50 miles east of the Planning District. Heavy snow often falls in a narrow 50 mile wide

swath about 150 miles northwest of the low-pressure center (see diagram above). Closer to the low center, the warmer ocean air changes the precipitation over to sleet, freezing rain, and eventually rain.

Heavy snow can block roadways and waterways, cause tree and utility damage, and lead to structural damage, such as collapsed roofs on large buildings. The Thomas Jefferson Planning District was struck by Winter Storm Frida in January of 2022, resulting in significant impairment of the roadways, disruption of business and services, some property damage, and high snow removal costs. Many households, primarily in Louisa, Nelson, Greene, Albemarle and Fluvanna were without power for more than a week, in some cases. VDOT crews cleared 229,377 cubic yards of debris in Louisa, 125,000 in Albemarle, and 50,000 in Fluvanna. The agency described the level of debris as "unprecedented". These types of storms highlight significant equity considerations, as researchers studying the 2021 Winter Storm Uri in Texas, and found that there were statistically significant associations between individuals' income, language status, and race with longer and worse power outages and recovery times.

Ice Storms: Ice storms are a common event in the valleys and foothills of the Appalachian Mountains but are generally limited to one or two per year when they occur. During the winter of 1993-1994, Virginia was struck by an unprecedented series of ice storms. Utility company records show the frequency with which fallen wires need to be repaired. The development of these storms is like that of a nor'easter (see diagram above). Damage from ice storms can be extensive. Ice on road- ways and walkways can lead to serious traffic accidents and slip and fall injuries. Ice accumulated on trees and utility wires can cause them to break, knocking out power and communication lines.

Source: University of Virginia

Ice storms can be measured by the Sperry-Piltz Ice Accumulation Index, which uses National weather Service forecast data, and can predict the projected footprint, ice accumulation, and potential damage from an ice storm. The matrix can be found below

There is considerable evidence indicating that the planning district and region are at risk of consistent winter storm events throughout the winter months. The severity of these events will be determined by the temperature, as well as weather patterns like El Nino and La e north and west parts of the country cooler and wetter while the south is warmer.

The Sperry-Piltz Ice Accumulation Index, or "SPIA Index" – Copyright, February, 2009

ICE DAMAGE INDEX	DAMAGE AND IMPACT DESCRIPTIONS
0	Minimal risk of damage to exposed utility systems; no alerts or advisories needed for crews, few outages.
1	Some isolated or localized utility interruptions are possible, typically lasting only a few hours. Roads and bridges may become slick and hazardous.
2	Scattered utility interruptions expected, typically lasting 12 to 24 hours. Roads and travel conditions may be extremely hazardous due to ice accumulation.
3	Numerous utility interruptions with some damage to main feeder lines and equipment expected. Tree limb damage is excessive. Outages lasting 1 – 5 days.
4	Prolonged & widespread utility interruptions with extensive damage to main distribution feeder lines & some high voltage transmission lines/structures. Outages lasting 5 – 10 days.
5	Catastrophic damage to entire exposed utility systems, including both distribution and transmission networks. Outages could last several weeks in some areas. Shelters needed.

(Categories of damage are based upon combinations of precipitation totals, temperatures and wind speeds/directions.)

Source: SPIA

Winter Storm Events 2010-2020

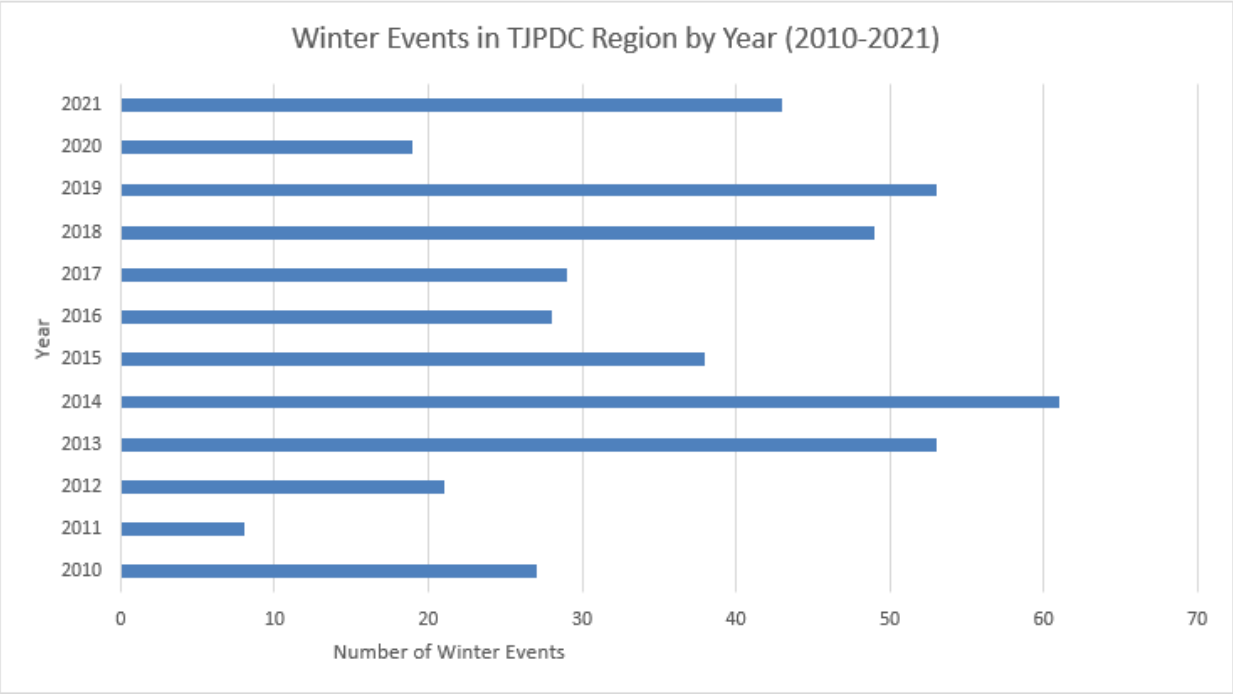
Locality	#	Death	Injuries	Property Damage
Albemarle	10	0	0	$5,000.00
Charlottesville	17	0		$ -
Fluvanna	15	0	0	$110,000.00
Greene	32	0	0	$-
Louisa	21	0	0	$160,000.00
Nelson	25	0	0	$5,000.00
Region	120	0	0	$280,000.00

Source: National Climate Data Center (NOAA)

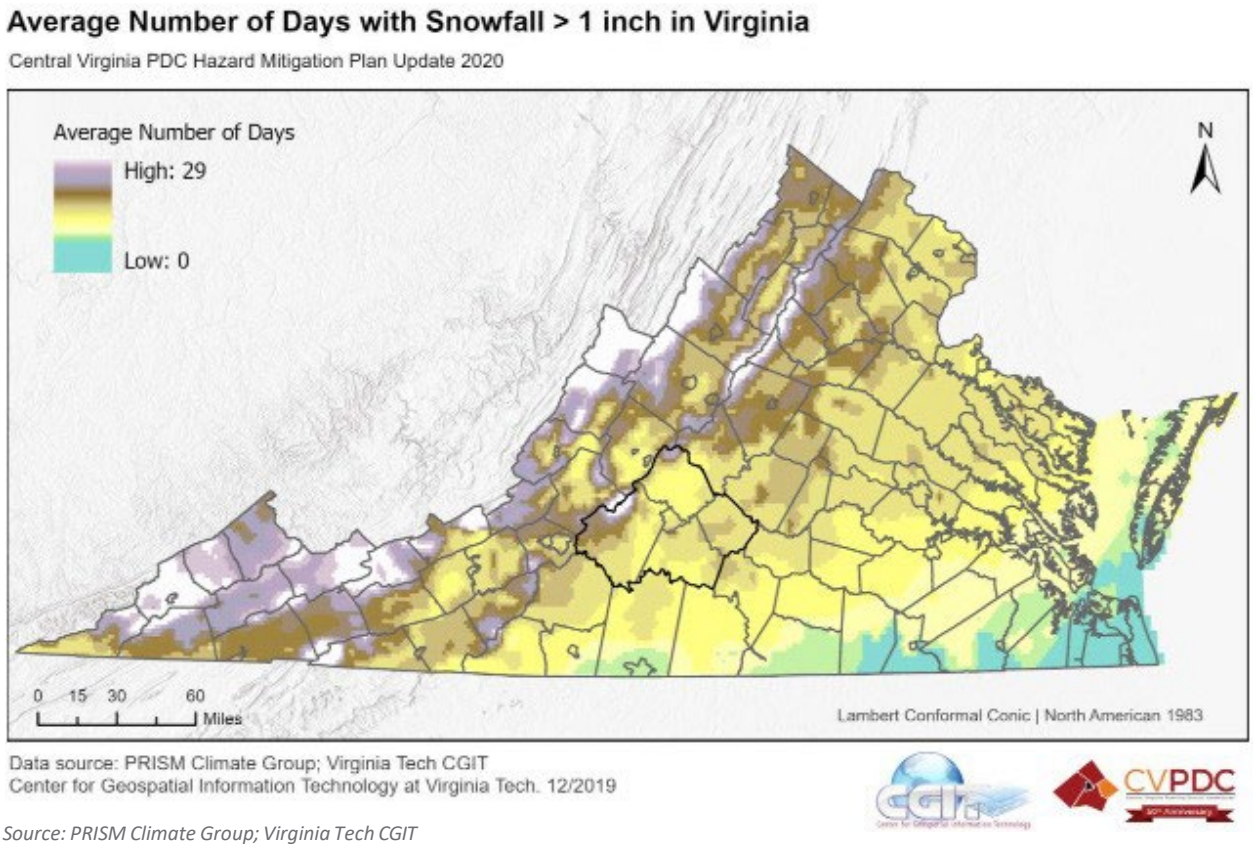
Winter Weather Events by Type 2000-2020

Locality	Blizzard	Cold/Wind Chill	Freezing Fog	Heavy Snow	Ice Storm	Winter Storm	Winter Weather	Frost/ Freeze
Albemarle	2	1	1	5	6	37	83	33
Fluvanna				1	3	48	40	3
Greene	2	4		7	7	39	79	34
Louisa				1	3	55	46	3
Nelson	2	2		5	7	34	65	33
Region	6	7	1	19	26	213	313	106

Source: National Climate Data Center (NOAA)



Data sourced from NDCD. Changes in database reporting and tags can make comparisons across years difficult.



Source: PRISM Climate Group; Virginia Tech CGIT

Wildfire

Identification

A wildfire is any fire occurring in a wildland area (i.e. grassland, forest, brush land) except for fire under pre- scription. Wildfires are part of the natural management of the Earth's ecosystems but may also be caused by natural or human factors. Changes in climate and snow melt nationwide are extending the fire season. Nationally, nearly 85 percent of forest fires are started by negligent human behavior, such as smoking in wooded areas or improperly extinguishing campfires. The second most common cause for wildfire is lightning. Impacts due to wildfire include property damage and destruction, economic impacts and displacement, decreased air and water quality, service interruptions, injury or loss of life, and negative impacts on mental health. (Community Wildfire Planning Center)

Source: VA Department of Forestry

There are three classes of wildland fires: surface fire, ground fire, and crown fire. A surface fire is the most common of these three classes and burns along the floor of a forest, moving slowly and killing or damaging trees. A ground fire (muck fire) is usually started by lightning or human carelessness and burns on or below the forest floor. Crown fires spread rapidly by wind and move quickly by spreading through tree canopies. Wildland fires are usually signaled by dense smoke that fills the area for miles around.

According to the National Wildfire Coordinating Group, wildfires are categorized as a class depending on the size of the wildfire: Class A – ¼ acre or less, Class B – more than ¼ acre, but less than 10 acres,

Class C – between 10 and 100 acres, Class D – between 100 and 300 acres, Class E between 300 and 1000 acres, Class F – between 1000 and 5000 acres, and Class G – 5000 acres or more.

State and local governments can impose fire safety regulations on home sites and developments to help curb wildfire. Land treatment measures such as fire access roads, water storage, helipads, safety zones, buffers, firebreaks, fuel breaks, and fuel management can be designed as part of an overall fire defense system to aid in fire control. Fuel management, prescribed burning, and cooperative land management planning can also be encouraged to reduce fire hazards. Avoiding and mitigating new development in high hazard wildfire areas, developing evacuation plans and disaster recovery plans, and ensuring water access in high-risk areas will help the region adapt to any potential increases in wildfires.

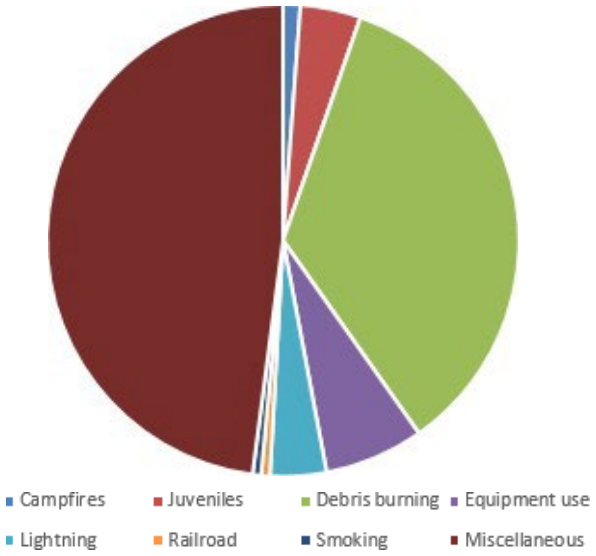
Fire probability depends on local weather conditions, outdoor activities such as camping, debris burning, and construction, and the degree of public cooperation with fire prevention measures. Drought conditions and other natural disasters (tornadoes, hurricanes, etc.) increase the probability of wildfires by producing fuel in both urban and rural settings. Forest damage from hurricanes and tornadoes may block interior access roads and fire breaks, pull down overhead power lines, or damage pavement and underground utilities.

Many individual homes and cabins, subdivisions, resorts, recreational areas, organizational camps, businesses, and industries are located within high fire hazard areas. The term wildland-urban interface refers to the zone of transition between unoccupied land and human development. The increasing demand for outdoor recreation places more people in wildlands during holidays, week- ends, and vacation periods. Unfortunately, wildland residents and visitors are rarely educated or prepared for the inferno that can sweep through the brush and timber and destroy property in a short manner of time.

Analysis

Wildfires are common in the Planning District, but are generally small and quickly controlled, creating little danger or loss. Most fires occur in the western part of the region, in sparsely populated mountainous areas, but fires have occurred in each locality. Some larger fires have occurred in the planning district – for example, a 2016 wildfire in Nelson County burned more than 1200 acres before being contained. The following pie chart displays the distribution of known causes within the region between the years of 2017-2020. Most miscellaneous fires are caused by power lines, wood stove ashes, or other unspecified events. Fires are more prevalent in periods after heavy winter storms due to excess debris and dropped branches readily available as fuel, and also tend to follow summers with droughts as natural matter on the forest floor dries creating ignition material.

Causes of Wildfires between 2017-2021



Source: VA Department of Forestry

Property loss, injury, and fatality due to wildfires have been minimal in the Planning District. Timber or crop damage is the most common loss, ranging from a few thousand to tens of thousands of dollars, though some lightning events have caused house and property damage.

Wildfire Events 2017-2021

Locality	# Of Fires	Acres
Albemarle	136	1215.9
Fluvanna	98	319.1
Greene	29	31.1
Louisa	130	1298.4
Nelson	63	412.1
TJPDC	466	3276.6

Source: VA Department of Forestry

Notable Wildfires

County	Damage	Date
Albemarle	A trash burn caused 320 acres of forest burn and 200,000 dollars of timber damage	March 9, 2020
Albemarle	Powerlines caused 258 acres of fire with 200,000 dollars' worth of timber damage	April 12, 2018
Nelson	Fire near Eades Lane in Nelson County burned more than 1200 acres	November 23, 2016
Greene	Rocky Mountain Fire complex contained within Shenandoah National Park.	April,16- 27, 2016
Louisa	$250,000 in damages over 414 acres, and $9,150,000 in property protected.	February 20, 2008
Albemarle	$25,000 in timber damage, $1,345,000 in property protected. $122,000 suppression cost, caused by arson.	November 19, 2001
Fluvanna	$139,000 in building damage, fire caused by hot ashes.	November 13, 2000
Nelson	$20,000 in timber damage, fire caused by arson.	May 3, 1999
Nelson	$10,000 in timber damage, $620,000 in property protected. Fire caused by lightning.	November 26,1998
Fluvanna	$10,000 in timber and property damage, after debris fire escaped. $500,000 in property protected.	May 8, 1997

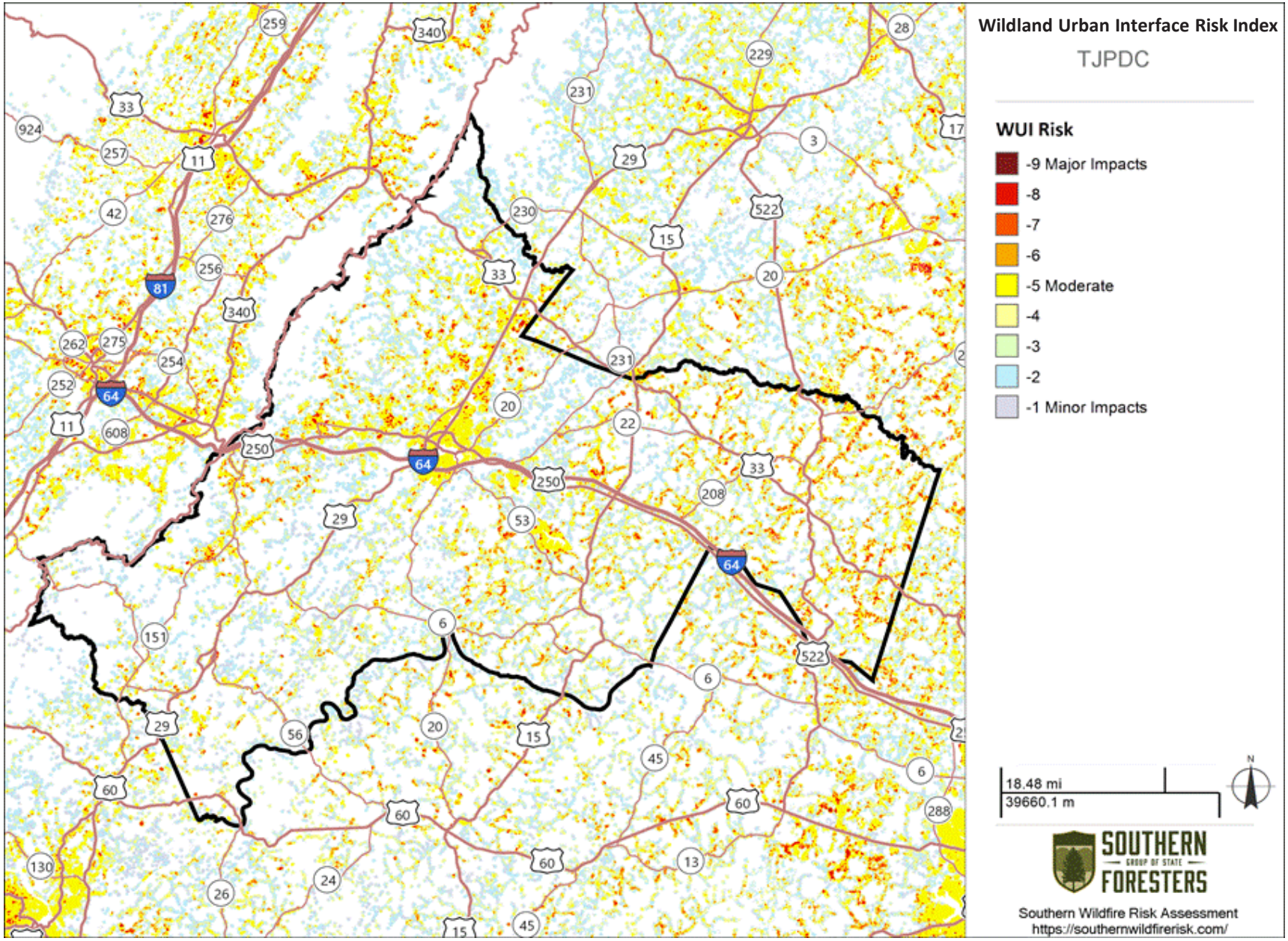
Source: VA Department of Forestry

The map on the following page displays wildfire data derived from the Southern Wildfire Risk Assessment (SWRA) project, a product developed by the Southern Group of State Foresters. The SWRA web portal allows a user to summarize wildfire related information and generate detailed risk summary reports. The summary reports and allocated mapping products provide a detailed picture about a community's risk and helps prioritize focus areas for mitigation, interventions, or other tactics to reduce the community's wildfire exposure risk. The WUI Risk Rating is derived using a Response Function modeling approach. Response functions are a method of assigning a net change in the value to a resource or asset based on susceptibility to fire at different intensity levels, such as flame length. The range of values is from -1 to -9, with -1 representing the least negative impact and -9 representing the most negative impact. For example, areas with high housing density and high flame lengths are rated -9 while areas with low housing density and low flame lengths are rated -1.

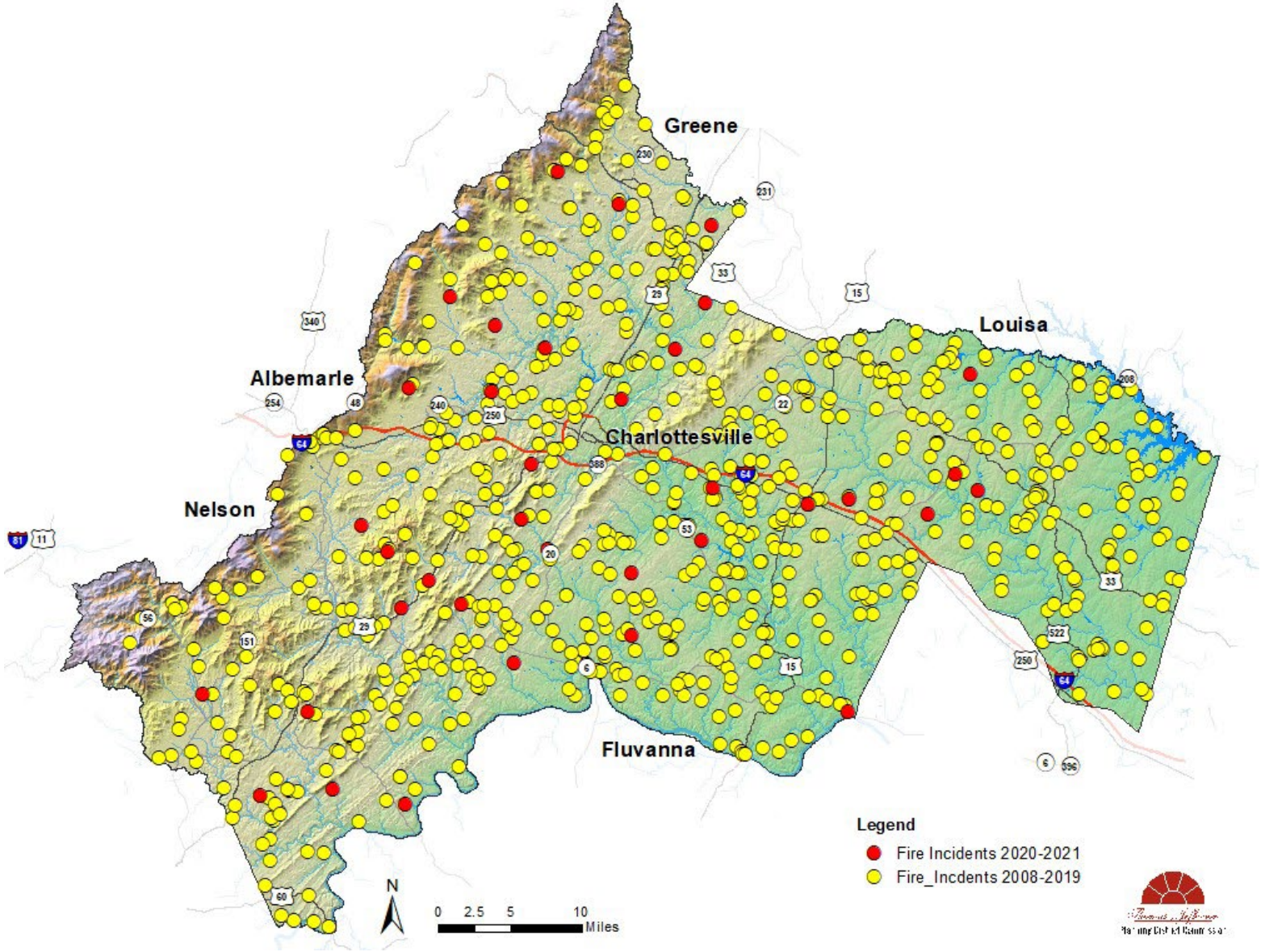
To calculate the WUI Risk Rating, the WUI housing density data was combined with Flame Length data and response functions were defined to represent potential impacts. The response functions were defined by a team of experts based on values defined by the SWRA Update Project technical team. By combining flame length with the WUI housing density data, you can determine where the greatest potential impact to homes and people is likely to occur.

The first map highlights the location of people living in the Wildland Urban Interface. This is key information for defining potential wildfire impacts to people and homes within the region. As seen below, the densest risk area is in Charlottesville and Albemarle, where most development exists within the region.The two most recent notable wildfires occurred in 2018 and 2020 in Albemarle County. Both were ignited by anthropogenic sources, causing widespread timber damage reflecting this interface between development and forested land.

The second map shows the location of fire incidents over the past thirteen years throughout the Thomas Jefferson Planning District. It highlights that wildfires are distributed throughout all of the jurisdictions, with no direct correlation to specific areas. While an area's risk of wildfire can be measured and predicted, a wildfire's intensity and duration depend on many factors including location, topography, and catalyst. This hazard still poses some risk to the planning district and should be prepared for accordingly.


Wildland Urban Interface Risk Index
TJPDC
WUI Risk
-9 Major Impacts
-8
-7
-6
-5 Moderate
-4
-3
-2
-1 Minor Impacts
18.48 mi
39660.1 m
N
SOUTHERN GROUP OF STATE FORESTERS
Southern Wildfire Risk Assessment
https://southernwildfirerisk.com/

Wildfire Locations , 2008-2021



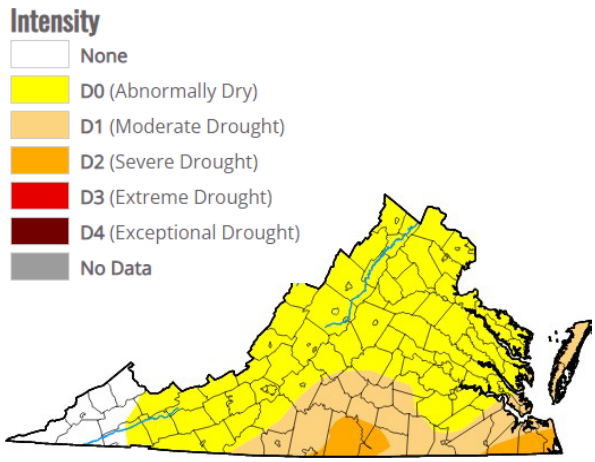
Source: VA Department of Forestry

2.1 Drought and Extreme Heat

Identification

Droughts: Drought is a natural climatic condition caused by an extended period of limited rainfall beyond that which occurs naturally in a broad geographic area. High temperatures, high winds, and low humidity can worsen drought conditions and can make areas more susceptible to wildfire. Human demands and actions can alter susceptibility to droughts, and the human impacts of drought can vary widely depending on public and private water usage.

U.S Drought Monitor: Virginia 12/20/2021



Source: The National Drought Mitigation Center

The Drought Monitor focuses on broad-scale conditions. Local conditions may vary. See accompanying text summary for forecast statements.

Droughts are frequently classified as one of the following five types:

- **Meteorological: low level of precipitation when compared to an average or normal amount of precipitation over a given period of time.**
- **Agricultural: Emphasis placed on factors such as soil water deficits, water needs based on differing stages of crop development, and water reservoir levels that impact agricultural production.**
- **Hydrological: directly related to the effect of precipitation shortfalls on surface and groundwater supplies. Human factors, particularly changes in land use, can alter the hydrologic characteristics of a basin.**
- **Socio-Economic: the result of water shortages that limit the ability to supply water-dependent products in the marketplace.**
- **Ecological: occur when ecological systems are affected by drought, causing alterations in the critical functions of healthy ecosystems, extinction of native species, or transitions in the landscape from forested land to grasslands due to lack of water resources.**

The primary impact of droughts is loss of agricultural production and disruption of business in water-related sectors; however, a severe drought can also put strains on drinking water supply and lead to more serious human impacts. Droughts are considered the second most costly disaster to the United States following Hurricanes, with estimated losses of $9.5 billion dollars per event every year. Impacts resulting from longer term droughts and absence of groundwater supply include land subsidence, seawater intrusion, and ecosystem damage, that if left unmanaged lead to costly, potentially irreversible impacts in the future.

Extreme Heat: While drought mostly impacts land and water resources, extreme heat can pose a significant risk to humans. Extreme heat can be defined as temperatures that hover 10°F or more above the average high temperature for the region, last for prolonged periods of time, and are often accompanied by high humidity. Under normal conditions, the human body's internal thermostat produces perspiration that evaporates and cools the body. However, in extreme heat and high humidity, evaporation is slowed, and the body must work much harder to maintain a normal temperature. Elderly persons, young children, persons with respiratory difficulties, and those who are sick or overweight are more likely to become victims of extreme heat. Because men sweat more than women, they are more susceptible to heat-related illness because they become dehydrated more quickly. Studies have shown that a significant rise in heat-related illness occurs when excessive heat persists for more than two days. Spending at least two hours per day in air conditioning can significantly reduce the number of heat-related illnesses. Low income and minority populations can experience adverse effects from extreme heat due to increased impacts to the Urban Heat Island Effect and less access to air conditioning.

On average, extreme heat exposure causes 1,300 deaths per year in the United States, more than floods, hurricanes, lightning, tornados, and earthquakes combined. Extreme heat in urban areas can create health concerns when stagnant atmospheric

conditions trap pollutants, thus adding unhealthy air to excessively hot temperatures. In addition, an "urban heat island effect" can produce significantly higher nighttime temperatures because asphalt and concrete (which store heat longer than soil and vegetation) gradually release heat at night. Research conducted Portland State and Science Museum of Virginia faculty revealed that microclimates within cities can have significant variation – up to 50 degrees in the most extreme cases. The variation that creates hot areas, or "heat islands", is caused by the built environment (usually presence of asphalt) and lack of tree canopy. These "heat islands" often fall in poorer neighborhoods, and in the case of Richmond, in areas that were redlined in order to promote segregation in housing.

Analysis

Drought: Although damage from a drought is rarely catastrophic, the region has experienced prolonged droughts that have impeded economic activity and quality of life for many residents. Crop damage is the primary type of damage resulting from droughts. In severe droughts, such as 2002, water usage restrictions have been put in place to preserve drinking supplies. Drought may also cause wells and groundwater supplies to go dry, causing problems for households and businesses left without running water. Fires that occur during drought are harder to combat since water may be limited and under lower pressure than normal.

Virginia Administrative Code 9 VAC 25-780 Section 120 defines the drought procedures system taken for the Commonwealth. A three-tiered warning system communicates the level of severity to the public.

- **Watch: Public outreach, raise awareness, intensify water conservation activities.**
- **Warning: At least voluntary measures –5-10% conservation.**
- **Emergency: Mandatory measures –10-15% conservation**

Localities may impose additional restrictions upon water usage when warnings and emergencies are declared. State law requires all localities to have a Drought Contingency and Response Plan, and statewide monitoring and drought-response planning is conducted by the Virginia Department of Environmental Quality.

According to NOAA, in 2021, Virginia expe- rienced its 119th hottest year out of the last 127 recorded. In Virginia, the six warmest years on record have all occurred since 2012. There is clear indica- tion that the relative temperature in the planning district is getting hotter, quicker. Extreme heat is measured not only by the air temperature, but by the National Weather Service's heat index, which is what the temperature feels like to the human body when relative humidity is combined with temperature. In a sense, it is a more accurate and realistic depiction of the temperature because it takes into account the body's ability to perspire.

The region experiences elevated temperatures every year, but injuries and fatalities attributed directly to extreme heat are rare. However, these conditions may become more frequent and can lead to health problems because heat exacerbates asthma and air pollution related breathing problems. People may overexert themselves or dehydrate while exercising as well. Elderly people are particularly susceptible to injury or death from extreme heat. Those living in "heat islands", which are sections or urban areas that are hotter as a result of land use decisions that removed an area's tree canopy, are much more likely to experience complications from extreme heat. Utility failures can also be caused by heat, and when power is lost, most people lose air-conditioning and fans to keep cool, leading to possible heat stroke. The Charlottesville Fire Department reported a sustained increase in heat exposure calls over the last 5 years from around 30 annually to consistently over 50. According to the City's Climate Hazards Projection, extreme heat events are expected to increase by over 50% between 2020 and 2100.

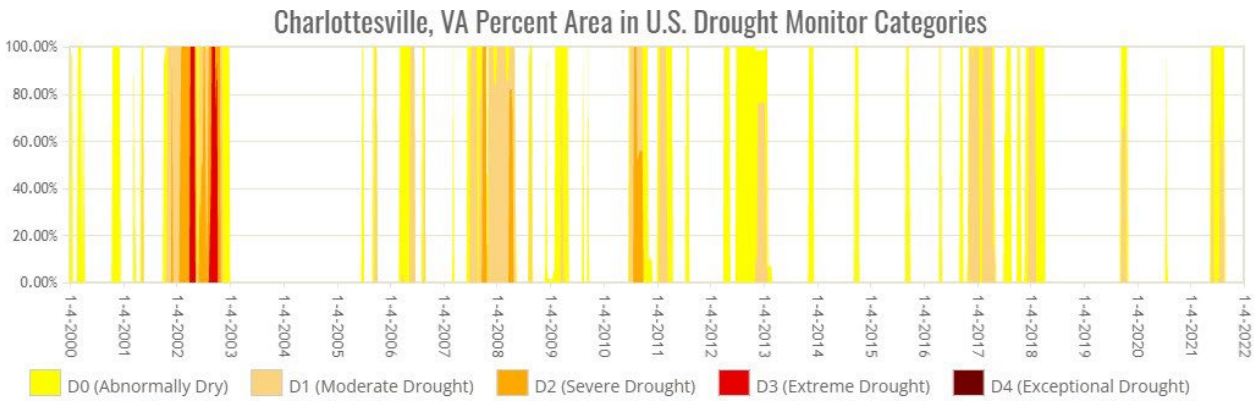
As extreme heat events become more frequent and average temperature rises, crime rates within the region may increase. More emergency response staff may be necessary to adequately respond to such changes. July 2020 was the hottest recorded in the Northern Hemisphere since records began in

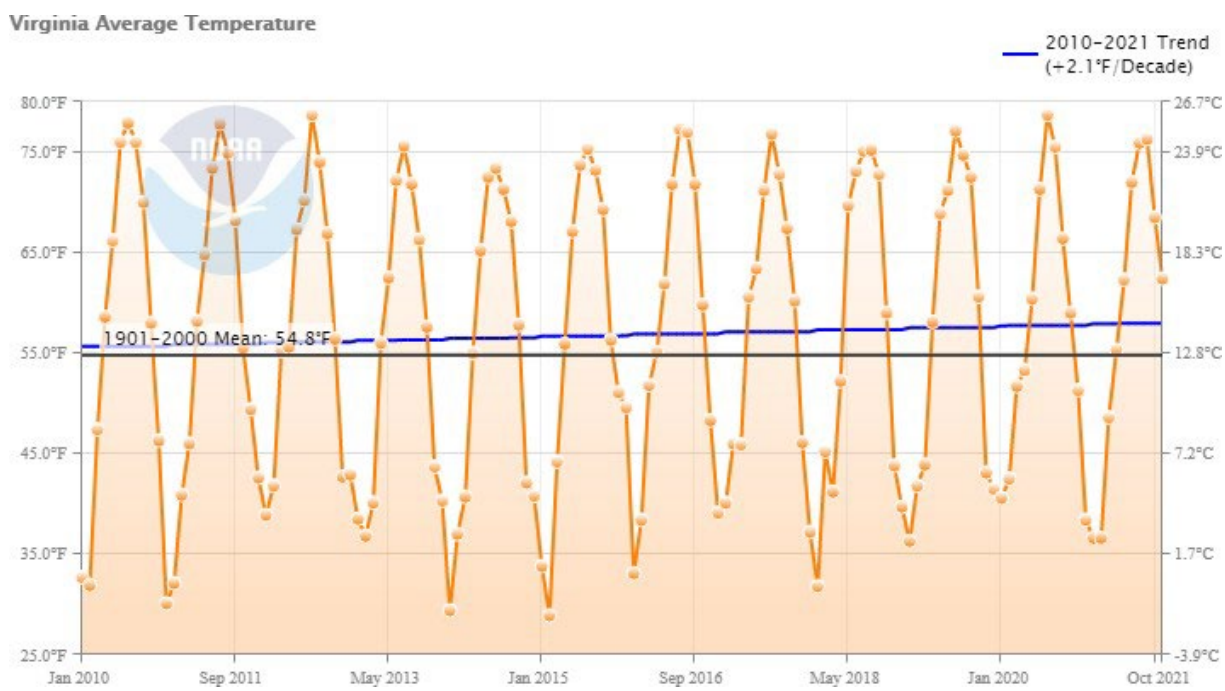
1951. In fact, the last six July's have been the hottest recorded global temperatures on record. There is clear evidence that temperatures globally are rising and will continue to rise, affecting the planning district.

Notable Historic Droughts within TJPDC

Damage	Date
La Nina conditions produced extreme and exceptional drought conditions throughout much of the US, Canada, and Mexico. Peak drought conditions in July resulted in more than 80% of the country with at least abnormally dry conditions. For this event, much of Virginia was classified as either abnormally dry or as experiencing moderate to severe drought conditions.	2012-2013
Greene, Albemarle, and Nelson were impacted by a drought in Virginia spanning 2 years, with the worst effects in 2008	2007-2009
Historically low water levels; considered "Drought of Record" for the TJPDC region. Fluvanna, Greene, Nelson, Louisa declared disaster areas. Thousands of dry wells, businesses closed, extensive water restrictions on businesses and households	2002
$129.7M crop damage	8/9/1999
$58.8M crop damage	10/11/1998
Virginia Drought Emergency Declaration made on July 23, 2007	1976-1977

Source: NCDC, Albemarle Historical Society archived papers, VA Hazard Mitigation Plan





Source: NOAA

Tornado

Identification

A tornado is a violent windstorm characterized by a twisting, funnel-shaped cloud extending to the ground. Tornadoes are most often generated by thunderstorm activity (but sometimes result from hurricanes and other coastal storms) when cool, dry air intersects and over- rides a layer of warm, moist air forcing the warm air to rise rapidly. The damage caused by a tornado is a result of the high wind velocity and wind-blown debris, also accompanied by lightning or large hail. According to the National Weather Service, tornado wind speeds normally range from 40 to more than 300 miles per hour. The most violent tornadoes have rotating winds of 250 miles per hour or more and can cause extreme destruction and turning normally harmless objects into deadly missiles.

Each year,an average of over 800 tornadoes is reported nationwide, resulting in an average of 80 deaths and 1,500 injuries (NOAA, 2002). They are more likely to occur during the spring and early summer months of March through June and can occur at any time of day but are likely to form in the late afternoon and early evening. Most tornadoes are a few dozen yards wide and touch down briefly, but even small short-lived tornadoes can inflict tremendous damage. Highly destructive tornadoes may carve out a path over a mile wide and several miles long.

The destruction caused by tornadoes ranges from light to incredible depending on the intensity, size, and duration of the storm. Typically, tornadoes cause the greatest damages to structures of light construction such as residential homes (particularly mobile homes) and tend to remain localized in impact. The Fujita-Pearson Scale for Tornadoes was developed in the 1970s to measure tornado strength and associated damages on a scale from F-0 to F-5. In the mid-2000s, the National Weather Service revised the scale to reflect better examinations of tornado damage surveys, to align wind speeds more closely with associated storm damage. Readings are taken from 28 different damage indicators, ranging from high-rise buildings to softwood trees, to determine the scale of a tornado. The “Enhanced Fujita Scale” became operational in 2007.

According to the NOAA Storm Prediction Center (SPC), the highest concentrations of tornadoes in the United States have been in Oklahoma, Texas, Kansas, and Florida respectively. Although the Great Plains region of the Central United States does favor the development of the largest and most dangerous tornadoes (earning the

designation of “tornado alley”), Florida experiences the greatest number of tornadoes per square mile of all U.S. states (SPC, 2002). The 2011 tornado season was the deadliest the United States has experienced since 1952, with major disasters recorded for Joplin, Missouri and Tuscaloosa, Alabama. The Storm Prediction Center has calculated record numbers of tornadoes in March of 2021 and 2022 across the United States; the average number of tornadoes in March has been around 80 since 1950, but 2021 and 2022 the number of tornadoes was 191 and 219. Trends show an increase in frequency of tornadoes earlier in the season.

The figure on the follow page shows tornado activity in the eastern United States based on the number of recorded tornadoes per 1000 square miles.

Tornadoes have been found to be more impactful and deadly to populations that are low-income, underserved, and/or living in mobile homes.

Analysis

Source: CBS19 news

Virginia experiences an average of seven tornadoes per year. Many occur in unpopulated areas or cause little property damage and therefore are not reported to the National Weather Service. Since 1916, when tornado related fatality record keeping began, 65 people have died from tornadoes in Virginia. A third of these deaths occurred during a Virginia’s worst tornado outbreak on May 2, 1929. The 2004 tornado

season was the most active in the state's history with over 87 tornados reported. The 2011 tornado season was among the deadliest on record for the Commonwealth. One outbreak caused four fatalities in Washington County, and one in Halifax County. Another storm killed two in Gloucester County.

The Thomas Jefferson Planning District typically experiences EF0 or EF1 tornados. One such tornado touched down in Fluvanna County on Sept. 6, 2011. An exception was a major tornado produced by Tropical Storm Ivan. The tornado struck Stanardsville in Greene County in September of 2004, causing $3 million in property damage. The most recent notable tornado touched down around Fork Union in 2016 and caused $325,000 in property damage and $155,000 in crop damage. Another touched down in Frederick Hall in Louisa and caused $200,000 in property damage in 2019.

Tornados in the region have increased in frequency and severity in the last decade. July is the most active month for tornadoes in Virginia, since it has the most thunderstorms, but no tornado deaths have occurred in Virginia in July since tornadoes spawned by afternoon storms tend to be weak (89% are F0 or F1). Tornado deaths in Virginia peak in the late spring and fall when tornadoes that occur tend to be stronger, spawned by severe winter storms and hurricanes. The Virginia Department of Emergency Management (VDEM) ranked each locality high, medium, or low based on tornado risk in 2017. Albemarle, Fluvanna, and Louisa were ranked medium risk. Greene was ranked medium-low. Charlottesville and Nelson were ranked low.

Summary of Tornados

Scale	Wind Speed	Name	Example
EF0	65-85	Gale	
EF1	86-110	Weak	
EF2	111-135	Strong	
EF3	136-165	Severe	
EF4	166-200	Devastating	

Source: NWS

Tornado Activity in the United States

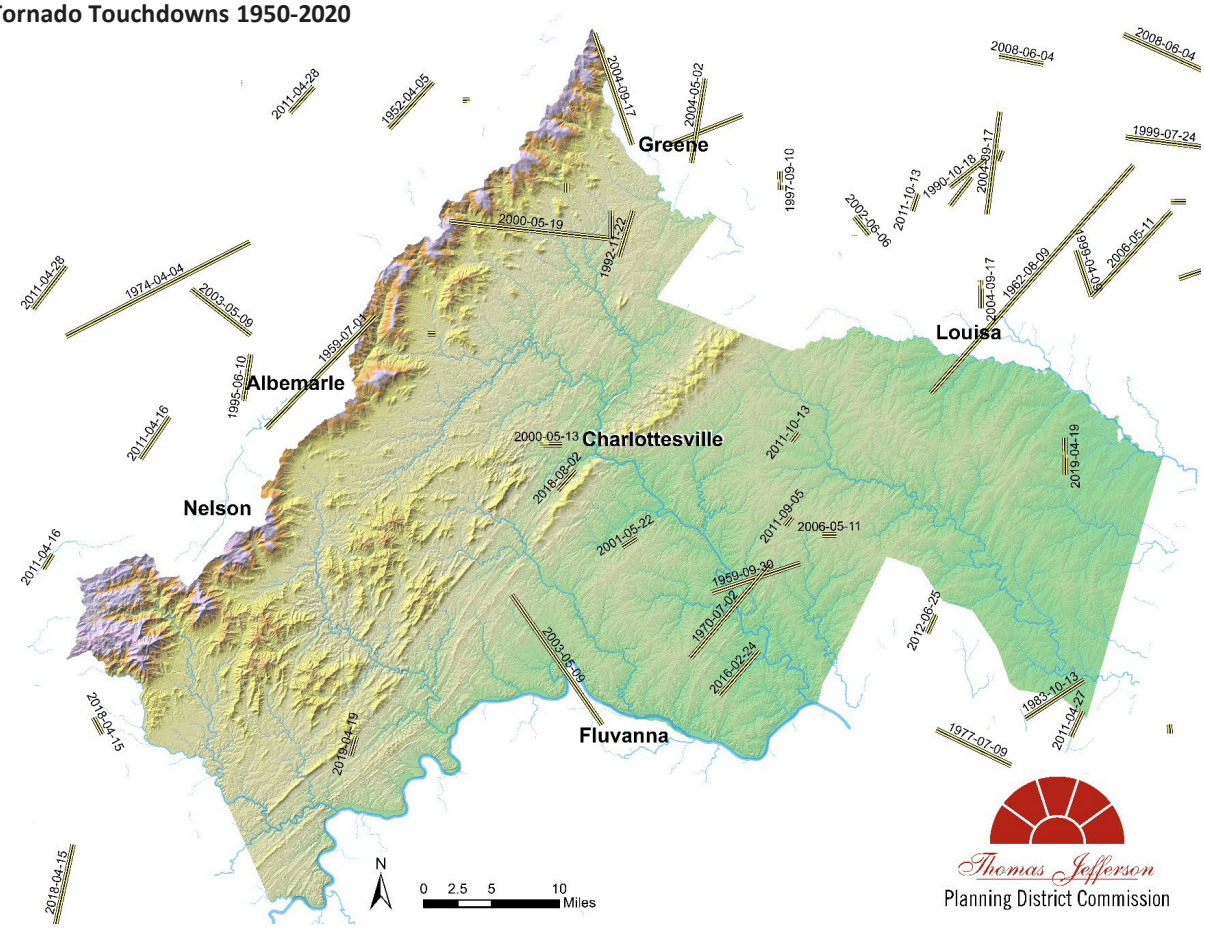
Source: NOAA

Tornado Record 1920 -2020

Class	Property Damage	Date
EF2	$200,000	4/19/2019
EF0	$325,000	2/24/2016
EF1	Historic homes damaged in Louisa County	10/9/2011
F1	$500,000	8/30/2005
F2	$3,000,000	9/17/2004
F1	$500,000	5/13/2000
F1	$250,000	5/5/1989
F3	$250,000	7/25/1985
F1	$250,000	10/13/1983
F2	$250,000	8/9/1962
N/A	11 people died and 4 were injured in Ivy/Mechum's River	1959
N/A	Leveled trees, tore off roofs, smashed buildings in Ivy	1922

Source: NCDC, Albemarle Historical Society archived newspapers

Tornado Touchdowns 1950-2020



Source: NWS

Earthquake

Identification

An earthquake is the motion or trembling of the ground produced by displacement of tectonic plates making up the Earth's crust. Earthquakes result from crustal strain along faults, volcanism, landslides, and the collapse of caverns. Earthquakes can affect hundreds of thousands of square miles; cause damage to property measured in the tens of billions of dollars; result in loss of life and injury to hundreds of thou- sands of persons; and disrupt the social and economic functioning of the affected area.

Most property damage and earthquake-related deaths are caused by the failure and collapse of structures due to ground shaking caused by movement miles below earth's surface. The level of damage depends upon the amplitude and duration of the shaking, which are directly related to the earthquake size, distance from the fault, and regional geology. Other damaging earthquake effects include landslides, the down-slope movement of soil and rock (mountain regions and along hillsides), and liquefaction, in which ground soil loses the ability to resist shear and flows much like quicksand. In the case of liquefaction, anything relying on the substrata for support can shift, tilt, rupture, or collapse.

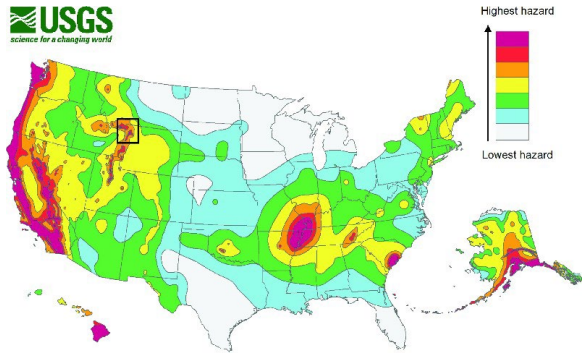
Most earthquakes are caused by the release of stresses accumulated because of the rupture of rocks along opposing fault planes in the Earth's outer crust. These fault planes are typically found along borders of the Earth's ten tectonic plates. These plate borders generally follow the outlines of the continents, with the North American plate following the continental border with the Pacific Ocean in the west but following the mid-Atlantic trench in the east. As earthquakes occurring in the mid- Atlantic trench usually pose little danger to humans, the greatest earthquake threat in North America is along the Pacific Coast.

The areas of greatest tectonic instability occur at the perimeters of the slowly moving plates, as these locations are subjected to the greatest strains from plates traveling in opposite directions and at different speeds. Deformation along plate boundaries causes strain in the rock and the consequent buildup of stored energy. When the built-up stress exceeds the rocks' strength, a rupture occurs. The rock on both sides of the fracture is snapped, releasing the stored energy and producing seismic waves, generating an earthquake.

Earthquakes are measured in terms of their magnitude and intensity. Magnitude is measured using the Richter Scale, an open-ended logarithmic scale that describes the energy release of an earthquake through a measure of shock wave amplitude (see Table below). Each unit increase in magnitude on the Richter Scale corresponds to a ten-fold increase in wave amplitude, or a 32-fold increase in energy. Intensity is most commonly measured using the Modified Mercalli Intensity (MMI) Scale based on direct and indirect measurements of seismic effects. The scale levels are typically described using Roman numerals, with a I corresponding to imperceptible (instrumental) events, IV corresponding to moderate (felt by people awake), to XII for catastrophic (total destruction). A detailed description of the Modified Mercalli Intensity Scale of earthquake intensity and its correspondence to the Richter Scale is given in the following table.

The figure below shows the probability that ground motion will reach a certain level during an earthquake. The data show peak horizontal ground acceleration (the fastest measured change in speed, for a particle at ground level that is moving horizontally due to an earthquake) with a 10 percent probability of exceedance in 50 years. The map was compiled by the U.S. Geological Survey (USGS) Geologic Hazards Team, which conducts global investigations of earthquake, geomagnetic, and landslide hazards.

Ground Motion Probability



Source: USGS

Richter Magnitude Scale	Modified Mercall 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
Defined Modified Mercalli Intensity Scale Rating	
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.
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 moderate in well-built ordinary structures; considerable damage in poorly built or badly designed structures; some chimneys broken
VIII	Damage slight in specially designed structures; considerable damage in ordinary substantial buildings with partial collapse. Damage great in poorly built structures. Fall of chimneys, factory stacks, columns, monuments, walls. Heavy furniture overturned
IX	Damage considerable in specially designed structures; well-designed frame structures thrown out of plumb. Damage great in substantial buildings, with partial collapse. Buildings shifted off foundations.
X	Some well-built wooden structures destroyed; most masonry and frame structures destroyed with foundations. Rails bent.
XI	Few, if any (masonry) structures remain standing. Bridges destroyed. Rails bent greatly
XII	Damage total. Lines of sight and level are distorted. Objects thrown into the air.

Source: USGS

Analysis

Although earthquakes have not historically posed a significant risk to the Thomas Jefferson Planning District, the district lies in the center of Virginia's largest seismic zone. There have been several recorded earthquake events, including a major earthquake in August of 2011. Virginia has had over 160 earthquakes since 1977 of which 16% were felt. This equates to an average of one earthquake occurring every month with two felt each year. The central Virginia seismic zone is an area of the Virginia Piedmont that has long been recognized as an area of seismic activity in the central Appalachians. The earthquakes occur at depths from near surface to approximately 20 km.

Source: Washington Times

Seismic activity is not uncommon in this area, but most are light or mild in magnitude. The 2011 Mineral earthquake was the largest recorded seismic activity for the zone since modern monitoring began. It resulted in millions of dollars in damage across the region, but primarily within Louisa County.

Earthquake Record 1995 -2020

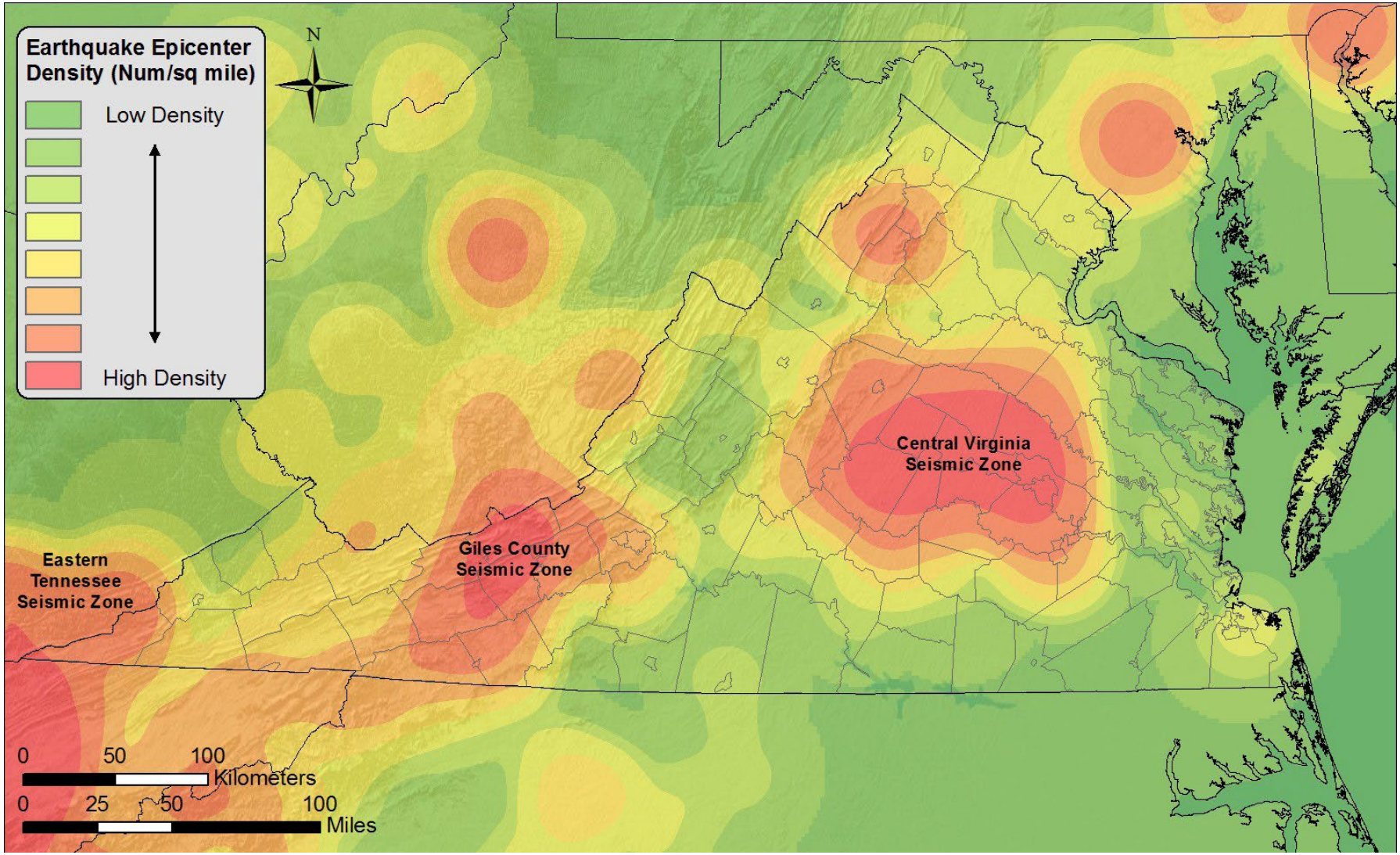
Location	Damage	Date
Mineral (Louisa County)	None, largest aftershock since the Mineral Earthquake	Mar 3, 2015
Mineral (Louisa County)	One of the largest earthquakes in Virginia history by intensity. Caused significant damage to many homes and two schools in Louisa County. Felt from North Carolina to Canada. Magnitude: 5.8, $200 Mil in damage	Aug 23, 2011
30 Miles West of Richmond	The focal depth was within a few kilometers of the surface, and this produced a strong acoustic signal that local officials attributed to an aircraft in transonic flight. Magnitude 4.5	Dec 9, 2003
Scottsville	It was felt from Washington, DC to the North Carolina border, and from Staunton, VA to Norfolk. Magnitude 4.0	Aug 17, 1984
Charlottesville	A moderate tremor at Charlottesville shook bricks from chimneys in some places. Also felt in other parts of Albemarle County.	Dec 26, 1929
Arvonia (Buckingham)	Chimneys were cracked at Ashby, about 20 km southeast of Arvonia, and a window was broken at a store at Buckingham. A "terrific" shock sent people rushing outdoors at Arvonia and displaced furniture. Felt strongly from Powhatan to Albemarle County.	Feb 11, 1907
Giles County, Va.	Very large in intensity and extent. The earthquake had a maximum Modified Mercalli Intensity of VIII, based on "many downed chimneys" and "changes in the flow of springs." Aftershocks continued through June 6, 1897. Magnitude: 5.8	May 31, 1897
Central Va.	The highest intensities from this earthquake occurred mainly at towns near the James River waterfront in Goochland and Powhatan Counties, and in Louisa County. Magnitude 4.5	Dec 23, 1875
Central Va.	Chimney damage occurred at Buckingham. This earthquake was reported to be "quite strong" at Fredericksburg, Richmond, and Scottsville. At Scottsville, where every house in the village was shaken, water in the canal was "troubled," and boats were tossed to and fro. Magnitude 4.3	Nov 2, 1852
Wytheville	A severe earthquake that was observed over a large area threw down a chimney near Wytheville, in southwest Virginia, and shook down tops of chimneys at Buckingham Courthouse. Houses were shaken violently at Staunton. Magnitude 4.9	Apr. 29, 1852
Central Va.	A rather strong shock agitated walls of buildings at Lynchburg and rattled windows violently. It was described as "severe" at Charlottesville. Two miners were killed in a panic caused by the tremor at a mine near Richmond. Magnitude 4.5	Aug 27, 1833

Source: NCDC, Albemarle Historical Society archived newspapers

FEMA uses the indicator of Peak Ground Acceleration (PGA) (%g, where g = 9.8 m/s2) to show the probability of earthquakes in the U.S. The national map of Peak Ground Acceleration (%g) indicates that parts of the Planning District have a PGA rate of 3-4%g, while others (see map) have a 4-5% PGA. Nationwide, these are relatively low PGA rates. The San Andreas fault in California induces PGA rates above 100 for a large extent of the fault line.

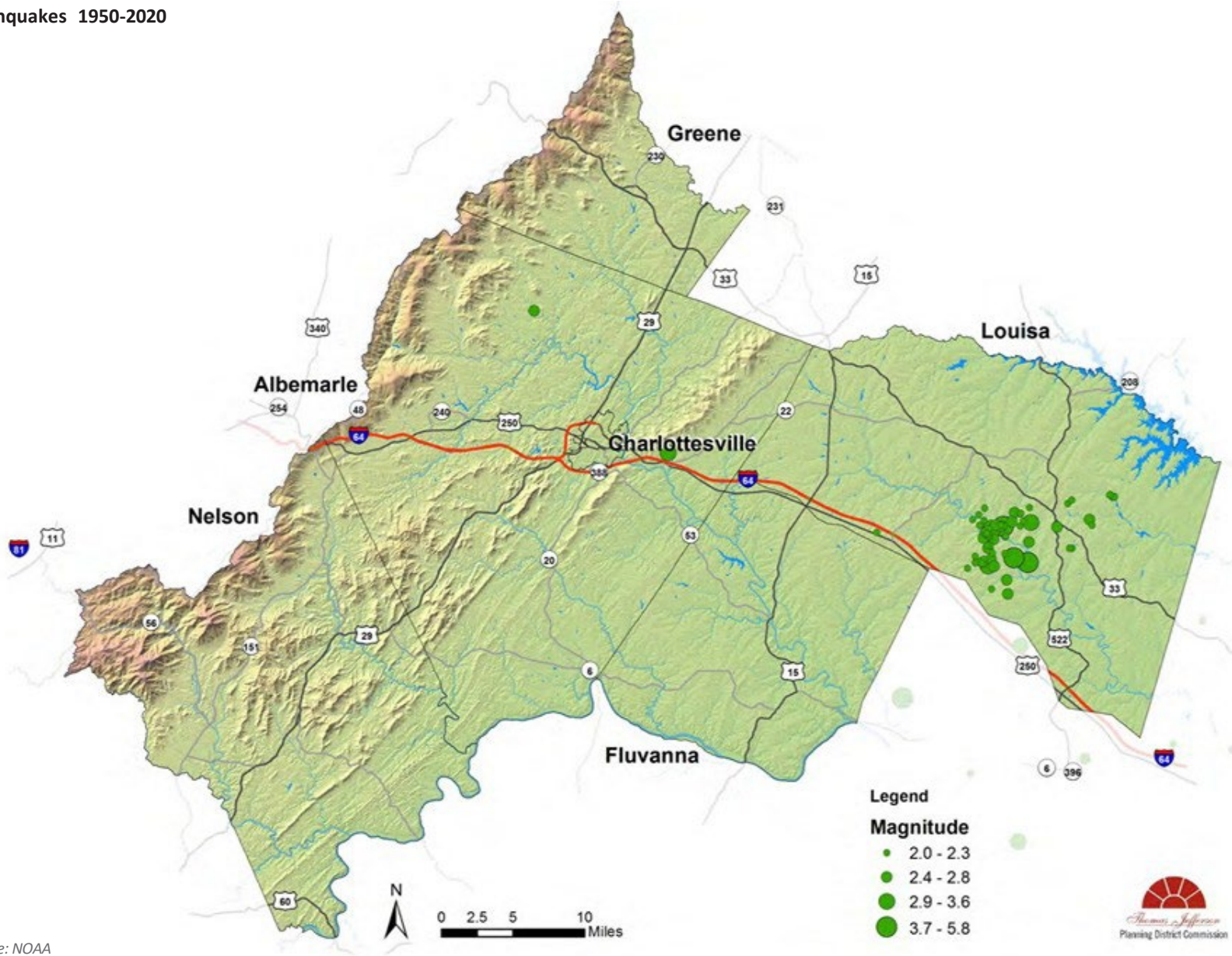
The August 2011, 5.8 magnitude earthquake near the Town of Mineral was a major event for the region. Short term prediction of earthquakes continues to be impossible with current scientific knowledge, but the U.S Geological Survey is able to make long-term predictions of seismic activity by geographic area. In 2009, the USGS gave a 0.014% probability that an earthquake of magnitude 5.8 or greater would happen in the TJPDC in any given year, which means it could be expected to occur every 7000 years. This event was extremely rare, but geologists will use the data to update models of seismic activity. While there is no clear evidence that seismic activity along the East Coast is increasing, there is a high degree of uncertainty currently.

Virginia's Seismic Zones

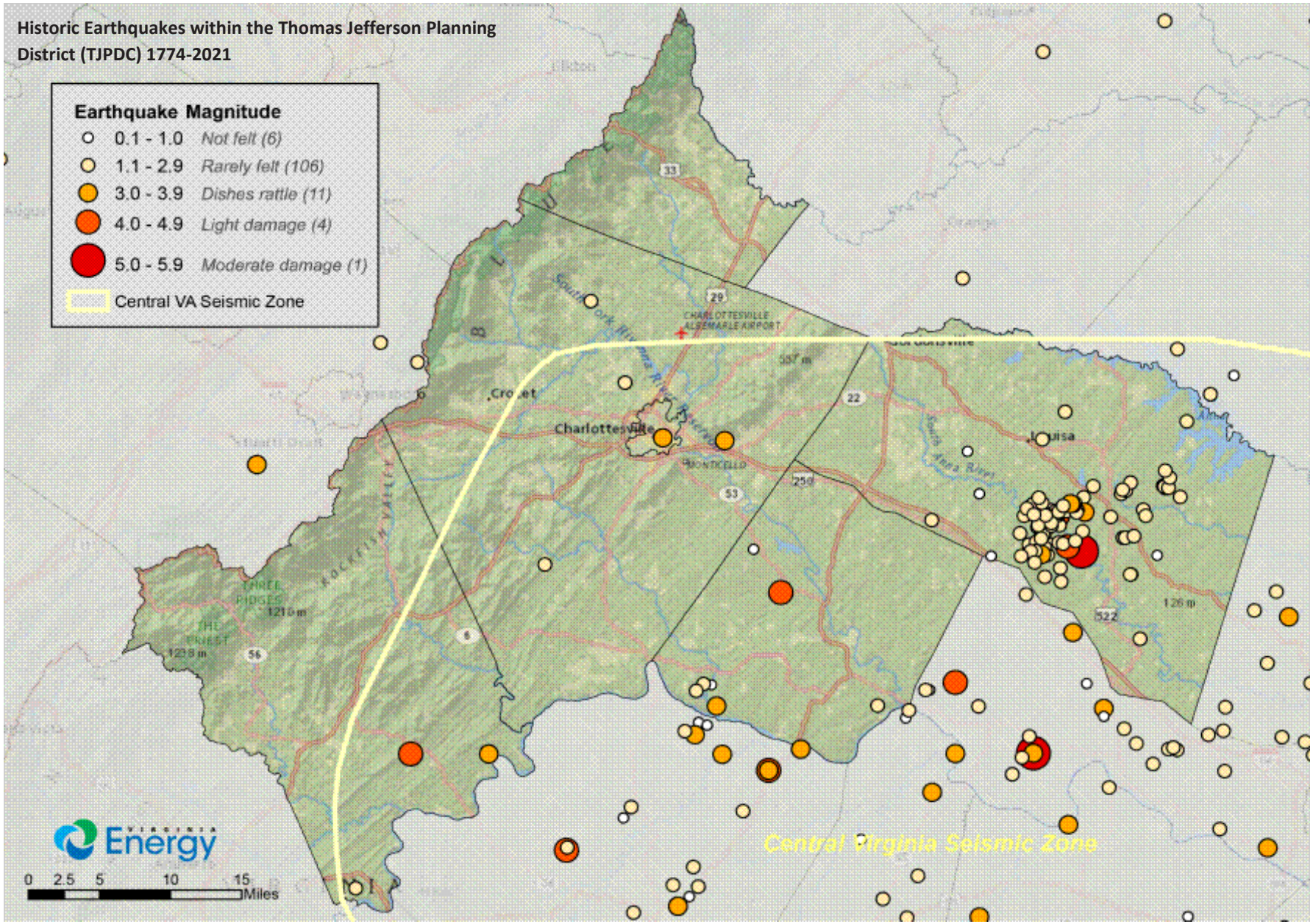


Source: UVA Today

Earthquakes 1950-2020



Source: NOAA


Historic Earthquakes within the Thomas Jefferson Planning District (TJPDC) 1774-2021
Earthquake Magnitude
0.1 - 1.0 Not felt (6)
1.1 - 2.9 Rarely felt (106)
3.0 - 3.9 Dishes rattle (11)
4.0 - 4.9 Light damage (4)
5.0 - 5.9 Moderate damage (1)
Central VA Seismic Zone
Charlottesville
Louisa
Central Virginia Seismic Zone
Energy
0 2.5 5 10 15 Miles

Landslides

Identification

A landslide is the movement of earthen material such as rock or debris, down a slope due to gravity. They typically occur in mountainous areas due to steep slopes and are triggered by both natural and human triggers. Such causes include heavy rainfall, rapid snow melt, steepening slopes from erosion or construction, earthquakes, volcanic eruptions, and changes in groundwater levels.

There are several types of landslides: rock falls, rock topple, slides, and flows. Rock falls are rapid movements of bedrock, which result in bouncing or rolling. A topple is a section or block of rock that rotates or tilts before falling to the slope below. Slides are movements of soil or rock along a distinct surface of rupture, which separates the slide material from the more stable underlying material. Mudflows, sometimes referred to as mudslides, lahars, or debris avalanches, are fast-moving rivers of rock, earth, and other debris saturated with water. They develop when water rapidly accumulates in the ground, such as from heavy rainfall or rapid snowmelt, changing the soil into a flowing river of mud or "slurry." Slurries can flow rapidly down slopes or through channels and can strike with little or no warning at avalanche speeds. Slurries can travel several miles from its source, growing in size as it picks up trees, cars, and other materials along the way. As the flows reach flatter ground, the mudflow spreads over a broad area where it can accumulate in thick deposits.

Landslides associated with periods of heavy rainfall or rapid snow melt tend to worsen the effect of flooding that often accompanies these events. In areas burned by forest and brush fires, a lower threshold of precipitation may initiate landslides. Some landslides move slowly and cause damage gradually, whereas others move so rapidly that they can destroy property and take lives suddenly and unexpectedly.

In the United States, it is estimated that landslides cause up to $4 billion in damages and from 25 to 50 deaths annually. Globally, landslides cause billions of dollars in damage and thousands of deaths and injuries each year.

The figure below shows areas where large numbers of landslides have occurred and areas that are susceptible to landslides in conterminous Virginia:

Analysis

In Virginia, landslides tend to occur more frequently in the Appalachian Mountains, which lie in the western part of the TJPDC in the Blue Ridge Mountains. The likelihood of landslides is certainly greater in the mountainous regions of Virginia than other

Landslide Overview Map

Source: USGS Landslide overview map of Coterminous United States

parts of the state as shown in the Landslide Overview Map. When torrential rains hit the slopes of mountains, unstable earth can become loose and can be washed downhill. Earthquakes may also trigger rock and landslides, but this is rare in the Planning District. In general, naturally occurring landslides tend to occur on slopes greater than 20-degrees. However, landslides can also occur on lower slopes in areas where land has been altered or steepened by human modification, like road building. The western edges of Greene and Albemarle County and much of Nelson County are most at risk of landslides in the Thomas Jefferson Planning District.

During Hurricane Camille in 1969, extensive damage was done by landslides and flooding across Nelson County. There were an estimated 286 houses and outbuildings damaged or destroyed, 2 fraternal lodges, 1 warehouse, 2 churches, 17 trailers, 175 cars and trucks, 1 school, 2 pieces of construction equipment, 2 post offices, 11 pieces of farm machinery, 5 industrial plants, one of which was a water system and about 18,500 acres of pasture and cropland. Another intense storm in June 1995 triggered landslides, including soil slips, slumps, debris slides, and debris flows, as well as associated flooding along the North Fork of the Moormans River in the northwestern portion of Albemarle County. The area immediately affected by the storm was within the boundaries of Shenandoah National Park, but flooding resulted in the Sugar Hollow Reservoir and downstream for another four miles, as far as White Hall. The Sugar Hollow Reservoir acted as an impoundment for the boulders, silt, and trees that had been dislodged upstream.

Landslide on 250 in Nelson County

Source: NBC 29 Traffic Alert

A landslide on Afton Mountain in Nelson County caused road closures for longer than a week, as depicted in the photo below. VDOT crews diverted traffic over the summer of 2022 in order to bolt steel mesh to a section of the mountain that could fall to the road.

No summary data of damage is available from the National Climate Data Center for landslides in the Planning District. However, data produced by the Virginia Department of Energy indicates that over 6,300 landslides have occurred in the planning district since 1969. Most of these landslides are very minor. A storm in June 1995 producing 673 mm of rain, caused 72 landslides in Albemarle County. This event prompted Albemarle County to commission a study by the U.S. Geological Survey (USGS) to evaluate the potential for debris flows resulting from severe storms in the county. This study, Debris-Flow Hazard Inventory and Evaluation: Albemarle County, Virginia (USGS, 2000), did not find evidence of historic debris flows other than the 1995 event and some damage from Hurricane Camille near the Nelson County border. The eastern slopes of the Blue Ridge and the North and South Forks of the Moormans River were found to have both the requisite elevation and slope for debris flows and evidence of prehistoric debris flows; these areas were therefore considered to be the most susceptible to future debris flows. Damage from landslides is often difficult to quantify, since most are smaller and may contribute only slightly to soil erosion or water quality – most landslides do not result in loss of life.

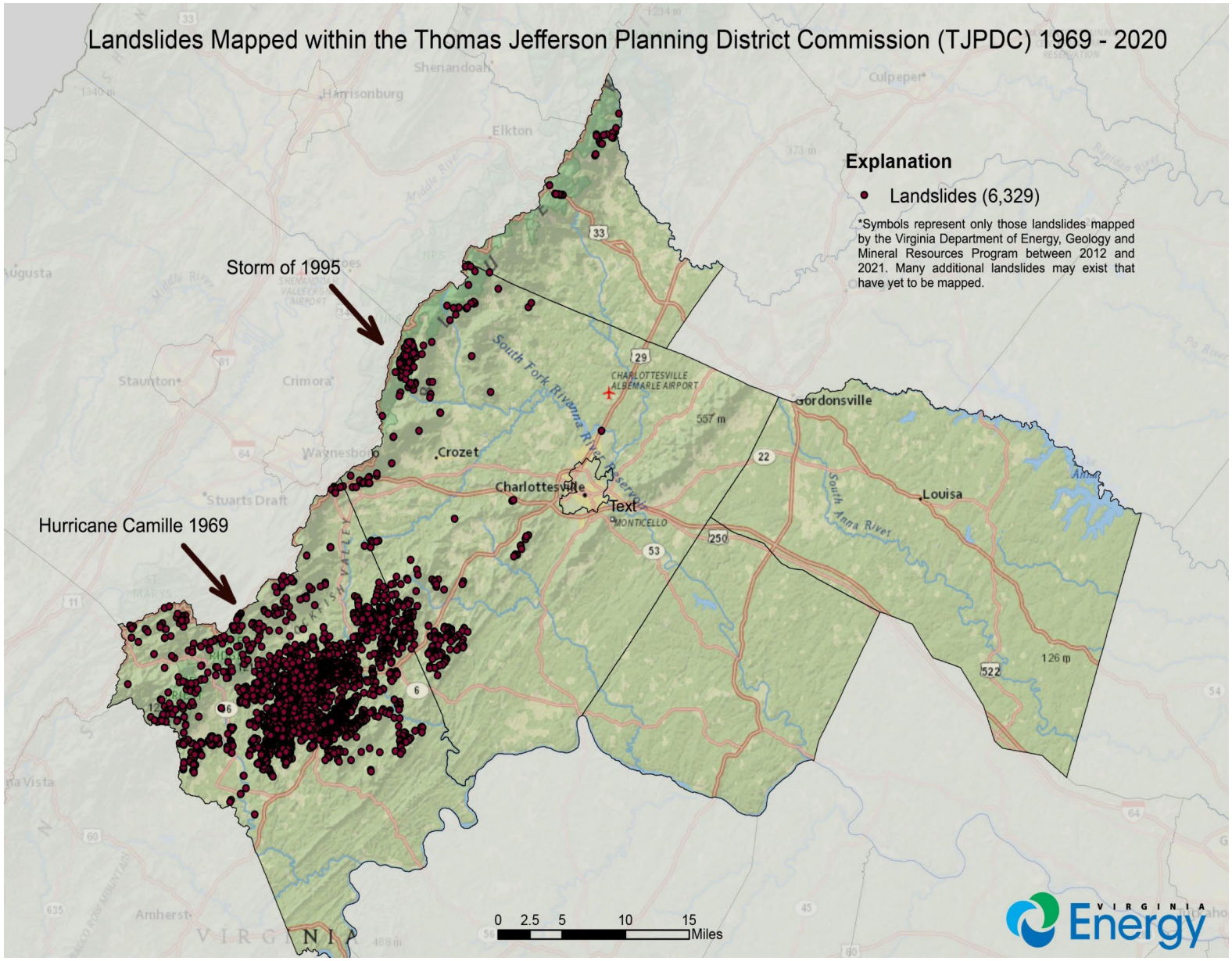
Several sites in the Covesville area, in the southern part of the county near the Nelson County border, were found to have the necessary elevation and slopes, but no evidence of debris flows other than moderate activity from Hurricane Camille along one stream. This area is therefore judged as having an intermediate susceptibility. Small areas of the Southwest Mountains and their southern extension south of Charlottesville have the requisite slope, but show no evidence of debris flows, so are rated with lower susceptibility. Carbon-14 sampling performed for the study indicates that recurrence intervals in Albemarle County for a specific site are on the order of 3,000 years, and similar sampling in Nelson County has indicated a recurrence interval of about 3,000-6,000 years; however, the historic record indicates

that a debris flow will occur somewhere within the Blue Ridge of Virginia about once per decade.

A project conducted by Virginia Energy, funded by the Federal Emergency Management Agency's Pre-Disaster Mitigation Program, was conducted between 2019 and 2021 to identify areas and infrastructure within Nelson and Albemarle Counties at risk of severe damage from landslides. The methods of study include high resolution light detection and ranging (LiDAR) data, geologic field mapping, and landslide susceptibility mapping and modeling. By communicating the findings of this study to county officials and emergency staff, preventative measures can be taken to mitigate the severity of impact. It can be expected that landslides are more prone to causing significant damage in areas that are already eroded or roads that are not properly maintained. Even weaker landslides can affect poorly maintained roads, hills, and properties.

Landslide and Hurricane Damage in Nelson County

Source: Nelson County Historical Society


Landslides Mapped within the Thomas Jefferson Planning District Commission (TJPDC) 1969 - 2020
Explanation
Landslides (6,329)
*Symbols represent only those landslides mapped by the Virginia Department of Energy, Geology and Mineral Resources Program between 2012 and 2021. Many additional landslides may exist that have yet to be mapped.
Storm of 1995
Hurricane Camille 1969
Shenandoah
Harrisonburg
Elkton
Culpeper
Staunton
Crimora
Waynesboro
Stuarts Draft
Crozet
Charlottesville
Text
MONTICELLO
CHARLOTTESVILLE ALBEMARLE AIRPORT
Gordonsville
Louisa
South Fork Rivanna Reservoir
South Anna River
Amherst
VIRGINIA
0 2.5 5 10 15 Miles
VIRGINIA Energy

Dam Failure

Identification

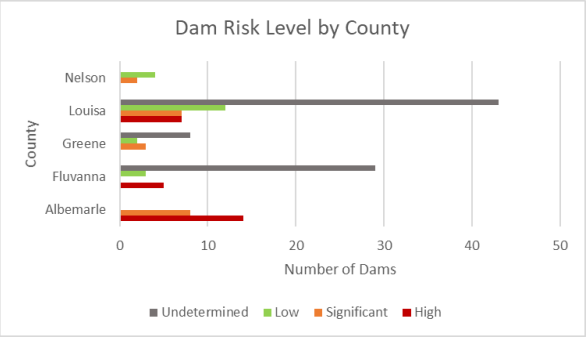
Worldwide interest in dam and levee safety has risen significantly in recent years. Aging infrastructure, new hydrologic information, and population growth in flood- plain areas downstream from dams and near levees have resulted in an increased emphasis on safety, operation, and maintenance. As of 2022, the National Inventory of Dams (NID) shows more than 92,000 dams in the United States, with at least 75% have been classified as High Hazard Potential. The federal government regulates approximately 6% of those dams, while state dam safety programs are responsible for regulating 70% of the dams within the United States.

Though dams have many benefits, they also can pose a risk to communities if not designed, operated, and maintained properly. In the event of a dam failure, the energy of the water stored behind even a small dam can cause loss of life and property damage. Dams are water retaining structures and as such are impacted by natural hydrologic events such as heavy rain, tropical storms, and droughts as well as natural events such as earthquakes.

There are a variety of risks and vulnerabilities associated with high hazard potential dams (HHPD). The consequences associated with the breach or failure of a HHPD are known as the dam's risk exposure; this generally refers to the population, restructureure, and resources at risk downstream from the dam. The risk exposure, combined with the risk probability, which incorporates features about the dam's age, construction, and location, inform the risk level of the dam.

Dam deficiencies are able to be found by engineers and dam safety inspectors, but the availability of inspection creates a limitation on how often and recent dam conditions are reported to state and federal authorities. Major weather events can suddenly and severely weaken dams that were not categorized as a HHPD. Creating opportunities for more regular and thorough inspection before and after major weather events can allows localities and dam owners to have a more realistic picture of a dam's current status.

According to the Virginia Division of Dam Safety and



Floodplain Management there are over 3,600 dams within the Commonwealth. The Virginia Dam Safety regulations changed significantly in 2016, bringing many existing but unregulated structures into regulatory oversight. As such the number of structures identified in the state database has increased significantly since the 2018 Hazard Mitigation Plan. Information about the dams in the planning district was provided to TJPDC staff and the Hazard Mitigation Working Group by local governments and the Dam Safety Program, housed within Virginia's Department of Conservation and Recreation. Representatives on the working group were well positioned to identify high-hazard dams and locality-specific information concerning dam failure of public and private dams. Staff from the state were integral in providing updated information about dams in the planning district. All information provided in the analysis section comes from local government, Hazard Mitigation Working Group members, Virginia's Dam Safety Program, and the National Inventory of Dams.

Analysis

The National Inventory of Dams (NID), maintained by the U.S. Army Corps of Engineers, is a list of all private and public dams meeting specific criteria for the definition of an "impounding structure" – based on dam height and volume of impounded water. The criteria exclude insignificant dams, natural dams, and privately-owned ponds. Each dam is ranked in accordance to its hazard potential, with high hazard dams being those where failure or maloperation will most likely cause significant economic damage or loss of human life.

It is important to note that the NID hazard rank is not a determination of structural soundness of a dam or the probability of a failure or maloperation. It ranks the severity of a hazard, in terms of loss of human

life and property, should a dam fail. Oversight of dam maintenance and operation is typically conducted at the federal level by the Federal Energy Regulatory Commission (for hydropower facilities) and at the state level through the Virginia Department of Conservation and Recreation (DCR) Dam Safety and Floodplain Management program. According to the National Inventory of Dams, there are 310 dams in the planning district. Eight dams in the region are federally-regulated, including high-hazard South Rivanna and Lake Anna dams. Three dams ranked high hazard are exempt by DCR from any regulation: Birdwood Dam, Stevens Lake Dam, and Whites Dam.

Although there has not been a significant history of dam failure in the region, a threat to property and life is possible with the failure of any of the high hazard dams. The Lake Louisa dam failed during Hurricane Camille in 1969. It is considered a rare event because of the severity of the storm and the age of the dam. For most dams in the TJPD, the land just downstream of the dam is typically sparsely or undeveloped, with most development occurring upstream of the dams around the lakes. There are however dams located in more urban areas where failure of the facility would result in significant impact to population centers and urban/suburban infrastructure. Examples of these include the two dams located upstream of the City of Charlottesville, Ragged Mountain and South Rivanna as well as structures such as Hollymead, Chris Greene, Mint Springs, Mink Creek, and Peacock Hill Dams located in Albemarle County; Twin Lakes in Greene County, and the Gordonsville Dam in Louisa County.

In March 2022, an 11-acre privately managed dam that holds back water to create McIver Lake in Fluvanna, experienced potential structural issues that almost caused the dam to fail. The dam was over 20 feet deep and held more than 60 million gallons of water, which, if breached, would have put Bremo Road under 3.5 feet of water and could have affected the Dominion power plant in Bremo under threat. These issues forced the closing of roads near Bremo Bluff, and put the Dominion Power Plant in Bremo Bluff on high alert. The dam was slated for removal and was empty for years, but began holding water after months of heavy snow and rain. The property owners

Source: County of Fluvanna

Source: County of Fluvanna

sent an engineer to look at removing the dam; the critical condition of the dam alarmed him and he called DCR, which then alerted VDEM. These two agencies coordinated with Fluvanna County emergency personnel to reach the dam and dewater it, which took a few days at about one foot per day. The dam was notched to prevent any refilling until it is dismantled. Fluvanna was able to successfully ask the state for reimbursement for charges associated with the incident.

Implementation of the adopted regional water supply plan from 2012 is expected to increase Ragged Mountainthe dam's inundation and likely increase the potential for hazard should a dam failure occur. Additionally, the South Fork Rivanna Dam could also have significant consequences if it failed – per Albemarle County's GIS map the inundation zone exceeds that of the Ragged Mountain Dam, threatening both Charlottesville and parts of Albemarle County. Finally, as Sugar Hollow and Crozet develop further as is projected, the dam at Sugar Hollow may become a larger threat.

Disclaimer: This plan does not provide a summary description of all dam risk, which consists of incremental, non-breach, and residual risk. To meet this requirement, please add narrative describing non-breach, and residual risk with respect to at least the Thomas Jefferson PDC eligible high hazard potential dams. If insufficient information is available to describe non-breach and residual risk in the Thomas Jefferson PDC, please add language explaining this limitation and include the definition of the three all dam risk component concepts. Pertinent definitions and example language that would address this revision are included below.

Definitions:

- *Incremental Risk:* The risk (likelihood and consequences) to the pool area and downstream floodplainoccupants that can be attributed to the presence of the dam should the dam breach prior or subsequent to overtopping, or undergo component malfunction or misoperation, where the consequences considered are over and above those that would occur without dam breach. The consequences typically are due to downstream inundation, but loss of the pool can result in significant consequences in the pool area upstream of the dam.
- *Non-Breach Risk:* The risk in the reservoir pool area and affected downstream floodplain due to 'normal' dam operation of the dam (e.g., large spillway flows within the design capacity that exceedchannel capacity) or 'overtopping of the dam without breaching' scenarios.
- *Residual Risk:* The risk that remains after all mitigation actions and risk reduction actions have been completed. With respect to dams, FEMA defines residual risk as "risk remaining at any time" (FEMA, 2015, p A-2). It is the risk that remains after decisions related to a specific dam safety issue are madeand prudent actions have been taken to address the risk. It is the remote risk associated with a condition that was judged to not be a credible dam safety issue.

Source: "Rehabilitation of High Hazard Potential Dams Grant Program Guidance," June 2020.

Dams in the Planning District

Dam Name	County	River or Stream Name	Owner Names	Primary Purpose	Year Completed	Dam Height (Ft)	Drainage Area (Sq Miles)	State Regulat-ed Dam
Albemarle Dam	Albemarle	SPRING CREEK	Virginia Department of Wildlife Resources	Recreation		32	3.6	Yes
Chris Greene Dam	Albemarle	JACOBS RUN	Albemarle County	Recreation		65	5.75	Yes
Middle Mint Spings Dam	Albemarle	POWELL CREEK	Albemarle County	Recreation		34.9	0.5	Yes
Hillcrest Dam	Albemarle	trib. Moores Creek	Albemarle County	Flood Risk Reduction		40.9	0.25	Yes
Forest Lakes Subdiv A	Albemarle	TR-POWELL CREEK	Albemarle County	Recreation		23.5	0.21	Yes
Upper Mint Springs Dam	Albemarle	POWELLS CREEK	Albemarle County	Recreation		30	0.2	Yes
Albemarle House Dam	Albemarle	trib. Slate Quary Dam	Trump Virginia Acquisitions LLC			25		Yes
Hollymead Dam	Albemarle		Albemarle County	Recreation	1974	42.7	1.55	Yes
Southern Re-gional Park Dam	Albemarle	Walnut Branch Hardware River	Albemarle County	Recreation		45	2.2	Yes
Virginia Farms Dam	Albemarle	trib. Mechunk Creek				23		Yes
Birdwood Gc #13 Dam	Albemarle	trib. Morey Creek	UVA Founda-tion			24		Yes
Birdwood Gc Hole #2 Dam	Albemarle	TR-MOREY CREEK	UVA Founda-tion	Irrigation		25		Yes
Pvcc Dam	Albemarle	trib. MOORES CREEK	Piedmont Virginia Community College	Recreation		38.5	0.34	Yes
Ivy Muc Irriga-tion Pond	Albemarle		Rivanna Water and Sewer Authority	Irrigation		30		Yes
Miller School Dam	Albemarle	MILLER BRANCH	Miller School of Albemarle	Recreation		29	1.15	Yes
Edgehill Dam # 4	Albemarle	trib. Camp Branch				31		Yes
Montfair West Dam	Albemarle	trib. Doyles River	Mary B. Sheri-dan Trust	Recreation		27		Yes
Jenson Dam	Albemarle	trib. Redbud Creek				25		Yes
Rockfield Dam	Albemarle	trib. Mechunk Creek				20		Yes
Edgehill Dam #7	Albemarle	trib. Barn Branch				27		Yes
Greens Dam	Albemarle	TR-NORTH FORK RIVANNA RIVER	Wendel Wood	Flood Risk Reduction		55		Yes

Mclean Dam	Albemarle	trib. Ivy Creek				28		Yes
Edgeworth Farm South Dam	Albemarle	trib. Happy Creek	Wilson, Flor-ence	Recreation		19		Yes
Baileys Dam	Albemarle	Trib. Rivanna River		Recreation		31	0.22	Yes
Mackey Dam	Albemarle	trib. Mechunk Creek				28		Yes
Albie Road Dam	Albemarle	trib. Mechums River		Recreation		30		Yes
Lickinghole Creek Dam	Albemarle	LICKINGHOLE CREEK	Rivanna Water and Sewer Authority	Flood Risk Reduction		32	13.3	Yes
Cherry Hill Dam	Albemarle	trib. Ivy Creek				23		Yes
Rogers Road Dam	Albemarle	trib. Baileys Dam Lake				26	0.43	Yes
Seabright Dam	Albemarle	trib. Chopping Branch				31		Yes
Rosemont Dam	Albemarle	trib. Ivy Creek		Recreation		39		Yes
Glenmore # 8 Dam	Albemarle	trib. Rivanna River				28		Yes
Forest Lakes Dam #2	Albemarle	trib. Powell Creek				23		Yes
Crown Orchard Upper Dam	Albemarle	trib. Stillhouse Creek Creek				38		Yes
Flordon Dam	Albemarle	trib. Ivy Creek				30		Yes
Lower Adventure Dam	Albemarle	trib. Naked Creek				31		Yes
Club Dam	Albemarle	Carroll Creek				22		Yes
Spring Valley Dam	Albemarle	Perry Creek		Irrigation		29		Yes
Murrays Dam	Albemarle	NAKED CREEK		Recreation		30		Yes
Liberty Corner Farm Dam (3)	Albemarle	Trib. ROCK CASTLE CREEK	Libety Corner Farm LLC	Recreation		29		Yes
Crown Orchard South Dam	Albemarle	TR-STILL-HOUSE CREEK		Irrigation		38		Yes
Totier Creek Dam	Albemarle	TOTIER CREEK	Rivanna Water and Sewer Authority	Water Supply		35	30	Yes
Dover Dam	Albemarle	trib. Marshall Creek				27		Yes
Sugar Hollow Dam	Albemarle	MOORMANS RIVER	Rivanna Water and Sewer Authority	Water Supply		77	17.2	Yes
Pantops Dam	Albemarle	trib. Rivanna River				52		Yes
Happy Creek Dam	Albemarle	HAPPY CREEK		Recreation		18		Yes
Farmington Dam	Albemarle	trib. Ivy Creek				30		Yes

North Fork Park Pond Dam	Albemarle	Flat Branch	University of Virginia Foundation	Flood Risk Reduction		32.5	0.66	Yes
Edgehill Se Pond Dam	Albemarle	TR-CAMP CREEK	Albemarle Edgehill LLC	Water Supply		31		Yes
Edgehill Farm Nw Dam	Albemarle	Barn Branch	Albemarle Edgehill LLC	Recreation		40		Yes
Edgehill Farm Ne Dam	Albemarle	trib. Camp Branch	Albemarle Edgehill LLC	Recreation		25		Yes
Edgehill Farm Sw Dam	Albemarle	trib. Camp Branch	Albemarle Edgehill LLC	Recreation		27		Yes
Mink Creek Dam	Albemarle	MINK CREEK	Town of Scottsville	Flood Risk Reduction		39	0.92	Yes
Broadmoor Lake Dam	Albemarle	CARROLL CREEK	Keswick Cor-poration	Recreation		25	1.86	Yes
Hurts Dam	Albemarle	RIVANNA RIVER	Charles W. Hurt	Recreation		41	2.15	Yes
Glen Lochan Dam	Albemarle	trib. Carroll Creek	Glenmore Community Association, Inc.	Recreation		33		Yes

Peacock Hill Dam	Albemarle	trib. Broad Axe Creek	Peacock Hill Community Association
Clover Dam	Albemarle	TR-IVY CREEK	West Leigh II POA
Lake Reynovia Dam	Albemarle	BUSCUIT RUN	Lake Reynovia Owners Association
James A. Strong Dam	Albemarle	TR-Burnley Branch Creek	James A. Strong
Loftlands Dam	Albemarle	TR-NAKED CREEK	Loftlands Glen Homeowners Association
Indian Springs Dam	Albemarle	trib. Beaverdam Creek	Indian Springs Home Owners Association
Ragged Mountain Dam	Albemarle		Rivanna Water and Sewer Authority
Chisholm Dam Upper Farm	Albemarle	TR-BEAVERDAM CREEK	Mary Jane Chisholm
Saponi Dam	Albemarle	TR-Preddy Creek	
Hunt Country Dam	Albemarle	TR-MECHUMPS CREEK	Wingate Homeowner Association
Henleys Dam	Albemarle	BEAVER CREEK and Beaver Creek Reservoir (00301)	Ellis Clark Henley & John Hoskins Henley II Trustees
Crown Orchard North Dam	Albemarle	trib. Stillhouse Creek	Virginia Polo Inc.
Oakey Dam	Albemarle		DAVH, LLC
Glenmore #1 Dam	Albemarle		
Ednam Drive Dam	Albemarle	Morey Creek	Virginia Polo Inc.
Lower Ragged Mountain Dam	Albemarle	MOORES CREEK	Rivanna Water and Sewer Authority
Cool Stream Farm West Dam	Albemarle	Elk Run	Virginia Polo Inc.
Campbell Road Dam	Albemarle	trib. Mechunk Creek	Virginia Polo Inc.
Brocks Mill Dam	Albemarle		Virginia Polo Inc.
Upper Ragged Mountain	Albemarle	MOORES CREEK	Rivanna Water and Sewer Authority
Preddy Creek Road	Albemarle	trib. Priddy Creek	Virginia Polo Inc.
Allmans Dam	Albemarle	trib-ROCKCASTLE CREEK	Coleman, Paul M. & Virginia R.
Pounding Dick Woods Dam	Albemarle	trib. Pounding Branch	Virginia Polo Inc.

Wildon Grove Dam	Albemarle	trib. Happy Creek	Virginia Polo Inc.
Burnt Mountain Dam	Albemarle	trib. Mechums River	Virginia Polo Inc.
Miller Lake Dam	Albemarle	Whiteside Branch	Virginia Polo Inc.
Midway Miller School Dam	Albemarle	trib. Dollins Creek	Virginia Polo Inc.
Rose Dam	Albemarle	trib. Slate Quarry Creek	Trump Virginia Acquisitions LLC
Murcielago Exempt Dams (11)	Albemarle	trib. Briery Creek	Murcielago Enterprises LLC
Murcielago Boomerang Dam	Albemarle	trib. Briery Creek	Murcielago Enterprises LLC
Steven White Dam	Albemarle		WHITE, STEVEN ANGELO TRUSTEE OF THE STEVEN WHITE LIVING TRUS
Rivanna W&S Dam	Albemarle		RIVANNA WATER & SEWER AUTHORITY
Mosby Mountain Dam #2	Albemarle	trib. Biscuit Run	Jessco LLC
Blandemar Dam	Albemarle	trib. North Fork Hardware River	Keeling, Richard D. or Johanna M.T.
Red Hill Orchard Dam	Albemarle	trib. Hardware River North Fork	R & H Partners LLC
Shelford Farm Dam	Albemarle	trib. Mechums River	Birdsall, John
Spencer Young Dam	Albemarle		YOUNG, SPENCER F
Fox Hunt Dam	Albemarle	trib- Rivanna River	Peyton, V. C.olt
Wieboldts Dam	Albemarle	trib.- So. Fork Hardware River	Stolz, Jill V.
Carrsbrook Western Pond	Albemarle		Carrsbrook Homeowners Assoc.
Gretchen Watkins Dam	Albemarle		GRETCHEN M BINARD WATKINS REV TRUST;WATKINS, GRETCHEN M BINARD TRUSTEE
Smiths Dam	Albemarle	trib. Sandy Branch	Sandy Branch Lot Owners
Glenmore # 2 Dam	Albemarle	trib. Rivanna River	Glenmore Country Club Limited Partnership
Samuel Walker Dam	Albemarle	trib. Biscuit Run	Walker, Samuel Stanhope II or Janice M.
Kimco Dam	Albemarle	trib. No. Fork Cunningham Creek	Kimco, LC
Blue Ridge Forest Dam	Albemarle	Fishing Creek	Mallard Lake Homeowners Association
Ellerslie Dam	Albemarle	Slate Quarry Creek	Trump Vinyard Estates, LLC
Ida104 Dam	Albemarle	trib. Hardware River	Murcielago Enterprises LLC
Village Dam	Albemarle	trib. Lickinghole Creek	March Mountain Properties, LLC
Leake Lane Dam	Albemarle	Limestone Creek	Glenmore Associates Limited Partnership
Upper Blandemar Dam	Albemarle	trib. N. Fk. Hardware River	Van Vranken, Margaret M.
Whites Dam	Albemarle	SLABTOWN BRANCH	William H. White
Apsara Farm North Dam	Albemarle	trib. Ballinger Creek	Carlton, Jeffrey
Martha Jefferson Retention Basin Dam	Albemarle	trib. Rivanna River	Martha Jefferson Hospital;Martha Jefferson Hospital
Mt. Amos Dam	Albemarle	trib. Morman's River	Robyn L. Burke
Murcielago Lake Dam	Albemarle	Briery Creek	Murcielago Enterprises LLC
Plain Dealing Dam	Albemarle		LINDA E A WACHTMEISTER & JAN K PARKS TRS;PLAIN DEALING LAND TRUST
Old Trail Dam #2	Albemarle	trib. Slabtown Branch	March Mountain Properties, LLC
Js Bryan Dam	Albemarle		BRYAN, JOHN RANDOLPH & SUSAN CARTER AGNOR BRYAN
Cove Creek Dam	Albemarle	trib. Cove Creek	Stollz Family Limited Partnership

Irish Langhorne Dam	Albemarle	trib. Totier Creek	Scottland Farm, LLC
Beaver Creek Dam #1	Albemarle	BEAVER CREEK	Rivanna Water and Sewer Authority
Chimney Rock Dam	Albemarle	trib. Buck Mountain Creek	Greg and Kim Breihl
Bailey Realty LLC	Albemarle		BAILEY REALTY LLC
Fr Farm Dam	Albemarle		FR FARM HOLDINGS LLC
Hallock Dam	Albemarle	trib. Carroll Creek	Ben Coolyn Corp.
Leveque Dam	Albemarle		Yvonne R. Leveque Trust
Wissel Roy Dam	Albemarle		WISSEL, ROY
Coleman Dam	Albemarle	trib. Ballinger Creek	Carlton, Jeffrey
Ivy Creek Dam # 1	Albemarle	trib. Ivy Creek	
Kinloch Farm Pond	Albemarle	trib. Mechunk Creek	Kinloch Properties LLC
Watermarks Dam	Albemarle	trib. James Rver	James River Farm, LLC
Upper Rose Dam	Albemarle	trib. Slate Quarry Creek	.Quality Properties Asset Management Co.
Paines Dam	Albemarle		Carrsbrook Homeowners Assoc.
Carroll Dam	Albemarle	trib. Mechums River	Trustees of Carroll Living Trust
Peter Jefferson Place- Lake I Dam	Albemarle	Hickman's branch	Worrell Land and Cattle Company
Atkinson Dam	Albemarle	trib. Buck Mountain Creek	Atkinson, Melba S.
James Rose Dam	Albemarle		ROSE, JAMES FREDRIC JR OR BARBARA ELLEN
Bellair Farm Dam	Albemarle	trib. Murphy Creek	Davis, Cynthia Keller
Ida103 Dam	Albemarle	trib- Hardware River	Murcielago Enterprises LLC
Colt Bower Dam	Albemarle		PEYTON, V COLT
Mgmt Srs Dam	Albemarle		CATON, DOUGLAS E C/O ELAINE MCDANIEL/ MGMT SRS CORP
Pavlosky Dam	Albemarle		PAVLOSKY, STEPHEN III OR KAREN M
Crozet Sportsman Club Dam	Albemarle	TR-DOLLINS CREEK	Crozet Sportsman Club
Van Clief Dam	Albemarle	trib. Ballinger Creek	Daniel G. Van Cliff Jr. & Bank of America Co.- TRS etal;Van Cliff, Barry R.
Ivy Farm Dam	Albemarle		Charles L. Frieden Trust
Mayo Dam	Albemarle	TR-BEAVERDAM CREEK	Mayo, William and Audrey (Allen)
Morris Dam	Albemarle	TR-FISHING CREEK	Morris, Jr., J. R.
Mont Air South Dam	Albemarle	trib. Doyles River	Keller Forty Two LLC
Chapel Springs Farm	Albemarle	Rocky Creek Branch	CS FARM LLC
Huckles Dam	Albemarle	Jacobs Run	Ann Mallek
Mcdaniel Dan	Albemarle		MCDANIEL, JAMES C JR & NANCY S TRUSTEES OF JAMES C MCDANIEL JR LIV TR ETAL
Lloyd Pond Dam	Albemarle	TR-MECHUNK CREEK	Thomas Bolender
Edgehill Farm Dam #2	Albemarle	BARN BRANCH	Ray A. Graham, Jr.
Stillfrieds Dam	Albemarle	trib. MILLER CREEK	Two Times Five LLC
Pounding Brook Dam	Albemarle	trib. Broad Axe Creek	Pounding Brook LLC
Murcielago Southwest Dam	Albemarle	trib. Briery Creek	Murcielago Enterprises LLC
Chopping Branch Dam	Albemarle	Chopping Bottom Branch	Mackey Farms Holding, LLC

Edgeworth Farm North Dam	Albemarle	trib. Happy Creek	Wilson, Florence
Doudera Pond Dam	Albemarle	trib. Beaverdam Creek	Andrea Doudera
Windsor Hill Dam	Albemarle	trib. Ivy Creek	K.K. Knickerbocker
Scogo Dam	Albemarle	Middle Branch of Hardware River	Scott, Jr., Fred
Chopin Dam	Albemarle	trib. North Fork Hardware River	Gala, Kantilal V. or Hemlata K.
Camp Faith Lake Dam	Albemarle	trib. South Fork of Rivanna R.	Cooper Industries
Red Hill Quarry Dam	Albemarle	TR-NORTH FORK HARDWARE RIVER	Martin Marietta Aggregates
Murray Lake Dam	Albemarle	TR-STOCKTON MILL CREEK	Murray Investment Group LLC, HRF
Mountain Valley Dam 4	Albemarle	trib. Biscuit Creek	Jessco LLC
Old Trail Dam #1	Albemarle	trib. Slabtown Branch	March Mountain Properties, LLC
Whistle Dam #1	Albemarle	trib. Stockton Creek	Hyatt, Elizabeth A., Trustee of the Elizabeth A. Hyatt Trust
Boaz Dam	Albemarle	trib. Cove Creek	Cove Creek Farms LLC
South Rivanna	Albemarle	South Fork Rivanna	Rivanna Water & Sewer Authority
Juiaf	Albemarle	Tributary to Rivanna River	Rivanna Station
Mountain Valley Dam 1	Albemarle	trib. Biscuit Run	Evergreen Land Company
Dam Name	County	River or Stream Name	Owner Names
Fluvanna Ruritan Dam	Fluvanna		Virginia Department of Wildlife Resources
Fluvanna Correction Ctr For Women Dam	Fluvanna	from Mechunk Creek	VA Department of Corrections
Fluvanna County Dam #5	Fluvanna		
Fluvanna County Dam #8	Fluvanna		
Fluvanna County Dam #11	Fluvanna		
Fluvanna County Dam #3	Fluvanna		
Fluvanna County Dam #2	Fluvanna		
Fluvanna County Dam #7	Fluvanna		
Fluvanna County Dam #10	Fluvanna		
Lower Dam At Fluvanna Ccw	Fluvanna	trib. Oliver Creek	VA Department of Corrections
Fluvanna County Dam #9	Fluvanna		
Fluvanna County Dam #6	Fluvanna		
Fluvanna County Dam #12	Fluvanna		
Fluvanna County Dam #4	Fluvanna		
Bremo Power Station East Ash Pond Dam	Fluvanna		Virginia Electric and Power Company
West Ash Pond Dam	Fluvanna		Virginia Electric and Power Company
Fluvanna County Dam #1	Fluvanna		
Tenaska Virginia Partners	Fluvanna	Trib. To Cunningham Creek	East Coast Transport;Tenaska Virginia Partners, L.P.
Cosner Dam	Fluvanna	MIDDLE FORK	
T. Potts Dam #2	Fluvanna		
Bowles Dam	Fluvanna	HORSEPEN CREEK	

State Prison Camp #12 Dam	Fluvanna		VA Department of Corrections
Thomas Dam	Fluvanna	TR-WOODSONS CREEK	
Michie Dam	Fluvanna	BOSTON CREEK	
Strickler & Benzinger's Dam	Fluvanna		
Bremo Power Station Dam	Fluvanna	Trib to James River	Virginia Electric and Power Company
Lake Monticello Settlement Pond Dam	Fluvanna	BOSTON CREEK	Lake Monticello Owners' Association
Mciver Dam	Fluvanna	SPRING GARDEN CREEK	Robert H. McIver
Lake Monticello Dam	Fluvanna	BOSTON CREEK	Lake Monticello Owners' Association
Wyllies Dam	Fluvanna		Wyllie, M. R. J.
Ida102 Dam	Fluvanna	trib. Briery Creek	Murcielago Enterprises LLC
Rivanna Woods Dam	Fluvanna	Rivanna	Rivanna Woods Property Owner's Association
Andersons Dam	Fluvanna	BEAVERDAM CREEK	Tarnwood Farm Corporation
Linton Dam	Fluvanna	BYRD CREEK	G. Moore;J. Regn
Mike Johnson Dam	Fluvanna	trib. Mechunk Creek	Cosner, Dillard W. and Leslie E. W.
Rivanna Woods Golf Dam	Fluvanna	TR-Rivanna River	Rivanna Woods Golf Cours, LP
T. Potts Dam #1	Fluvanna		Theodore R. Potts
Greene Acres Dam	Greene	Unnamed tributary to South River - VAHU6 RA26 Rapidan River - South River	Greene Acres Property Owners Association
Greene County Reservoir Dam	Greene	Unnamed tributary to White Run - VAHU6 RA26 Rapidan River - South River	Greene County
Greene Hills Dam	Greene	TR-Conway River	Greene Hills Club, Inc.
Greene Mountain Lake Dam	Greene	Unnamed tributary to Blue Run - VAHU6 JR10 Swift Run	Nathaniel Greene Development Company
Greene Valley Section 7 Dam	Greene	TR-Conway River	Greene Valley Section 7 Home Owners Association
Bishops Dam	Greene	trib. Preddy Creek Greene Co. (? 07907)	W. E. Bishop
Twin Lakes Dam # 1	Greene	Deep Run	Twin Lakes Community Association;Twin Lakes HOA
Ruckers Lake Dam	Greene	TR-Preddy Creek	HC Land Company
Deer Lake Dam	Greene	TR-Preddy Creek	The Glenn at Deer Lake Estates Home Owners Association, Inc.
Twin Lakes Dam No. 3	Greene	Quarter Creek	Twin Lakes HOA
Word Farm Dam	Greene	TR-Preddy Creek	Kenneth Tybursky
Wildwood Valley Lake Dam	Greene		Wildwood Valley Property Owners Association
Blue Ridge School Dam	Greene	TR-Roach River	Blue Ridge School, Inc.
Harlow Farm Dam	Greene	TR-Preddy Creek	Elaine Greims
Poplar Lake Dam	Greene	TR-Parker Branch	Danny and Janna Boyd, James Palumbo and Ellen McCree
Twin Lakes Dam # 2	Greene	Quarter Creek	Twin Lakes Community Association;Twin Lakes HOA
Teel Mt. Farm Dam	Greene	TR-South River	John P. Merrill
Belle Monte Dam	Greene		BELLE MONTE LLC

Louisa Dam	Louisa	HICKORY CREEK	Blue Ridge Property Owners Association
South Anna Dam #4	Louisa	TR-SOUTH ANNA	Thomas Jefferson Soil and Water Conservation District
South Anna No. 5	Louisa	WHEELER CREEK	Thomas Jefferson Soil and Water Conservation District
South Anna Dam #3	Louisa	FIELDING CREEK	Thomas Jefferson Soil and Water Conservation District
South Anna Dam #22	Louisa	NORTHEAST CREEK	Louisa County Water Authorty
Gordonsville Dam	Louisa	DOVE BRANCH	Louisa County Water Authorty
Little River Dam #4	Louisa	HAWKINS CREEK	Thomas Jefferson Soil and Water Conservation District
South Anna Dam #23	Louisa	DESPER CREEK	Thomas Jefferson Soil and Water Conservation District
Louisa H.S. Dam	Louisa	trib. Northeast Creek	Taylor, Peter R., TRS for Peter R. Taylor TR
South Anna Dam #6b	Louisa	CAMP CREEK	Thomas Jefferson Soil and Water Conservation District
Gum Spring Dam	Louisa	trib. Owens Creek	
Byrd Mill Dam	Louisa	SOUTH ANNA RIVER	
Dongola Dam	Louisa	trib. Jones Creek	
Old Mountain North Dam	Louisa	Campbell Creek	
Nolting Dam	Louisa	BUNCH CREEK	
Harris Dam	Louisa	trib. Harris Creek	
Cox Dam	Louisa	trib. Deep Creek	
Bearden Dam	Louisa	trib. NORTH FORK LITTLE RIVER	
Stonebridge Dam	Louisa	trib. North Prong of Beaverdam Creek	
Small Dam	Louisa	TR-SOUTH ANNA RIVER	
Bethany Dam	Louisa	trib. Hawkins Creek	
Apple Grove Dam	Louisa		
Routes 522 & 605 Dam	Louisa		
Boswell Tavern Dam	Louisa	trib. South Anna River	
Swifts Dam	Louisa	LITTLE RIVER	
Glen Beau Dam	Louisa	Cub Creek	
West Pond @ Shellhorn Dam	Louisa	trib. Negro Run	
Lake Senaham Dam	Louisa	North Prong of Beaverdam Creek	
Old Mountain South Dam	Louisa	trib. Campbell Creek	
Pink House Dam	Louisa		
Little Anna Dam	Louisa	trib. North Anna River	
Spring Valley Dam	Louisa	trib. Turners Creek	
Moorefield Cedar Dam	Louisa	trib. South Fork Little River	
South Anna Dam #7	Louisa	CENTRAL BRANCH	Thomas Jefferson Soil and Water Conservation District
Holly Grove	Louisa	trib. South Anna River	

Nininger Dam	Louisa	TR-SOUTH ANNA RIVER	
Rapidan Dam	Louisa		Rapidan Service Authority
Chisholm Dam	Louisa	TR-LONG CREEK	
Shelton Dam	Louisa	SOUTH ANNA RIVER	
Fox Pen Dam	Louisa	trib. Hollowing Creek	
Mittleman Dam	Louisa	TR-NEGRO RUN	
Little River Dam #1	Louisa	LITTLE RIVER	Thomas Jefferson Soil and Water Conservation District
Orchid Lake Dam	Louisa	Owens Creek	Orchid Lake Homeowners
Landover Road Dam	Louisa	trib. East Prong Beaverdam Creek	Hartung, White, et al
Knapp Dam	Louisa	TR-BUCK BRANCH	Linda and Peter Knapp
Lake Izac Dam	Louisa	LICKING HOLE CREEK	Shenandoah Resort Community Assoc., Inc.
Cooper Dam	Louisa	trib. East Prong Beaverdam Creek	James Carr
Purcell Dam	Louisa	TR-WHEELER CREEK	Richard Purcell
Willow Ridge Dam	Louisa	Little River trib. East Prong Beaverdam Creek	Mountain Brook of Troy, Inc.
Meyerton Dam	Louisa	FOX BRANCH	Nancy Timmons
Woolfolk Brothers Dam #2	Louisa	trib. Beaver Creek	Cosby Lee Woolfolk
Spring Creek Golf Course Irrigation Lake	Louisa	Spring Branch	Spring Creek Land Development, L.L.C.
Melanie Morgan Dam	Louisa		MORGAN, MELANIE A
Ponde Roachea Dam	Louisa	TRIB-NEGRO RUN	Hugh A. Jones and Linda Santini
Beaver Dam	Louisa	BEAVERDAM CREEK	Hudgins, Howard L.
Ferron Dam	Louisa	BEAVERDAM CREEK	Jompal, Mark
Grassdale Dam	Louisa	Bunch Creek	Henry J. Javer, Trustee
Lake Ellen Dam	Louisa	TR-SOUTH ANNA	Randolph andSusan Reynolds
Lake Sherman	Louisa	trib. NORTH FORK LITTLE RIVER	Bill Taylor
Southeast Pond @ Shellhorn Dam	Louisa	trib. Negro Run	
Lake Anna Dam and Reservoir - Dike III	Louisa	North Anna	Virginia Electric and Power Company
Lake Anna Dam and Reservoir - Dike II	Louisa	North Anna	Virginia Electric and Power Company
Lake Anna Dam and Reservoir	Louisa	North Anna	Virginia Electric and Power Company
Lake Anna Dam and Reservoir - Dike V	Louisa	North Anna	Virginia Electric and Power Company
Lake Anna Dam and Reservoir - Dike VI	Louisa	North Anna	Virginia Electric and Power Company
Lake Anna Dam and Reservoir - Dike I	Louisa	North Anna	Virginia Electric and Power Company
Woolfolks Dam No. 1	Louisa	trib. BEAVER CREEK	Goodwin
North Anna Cat I Service Water Dike	Louisa	None	Virginia Electric and Power Company

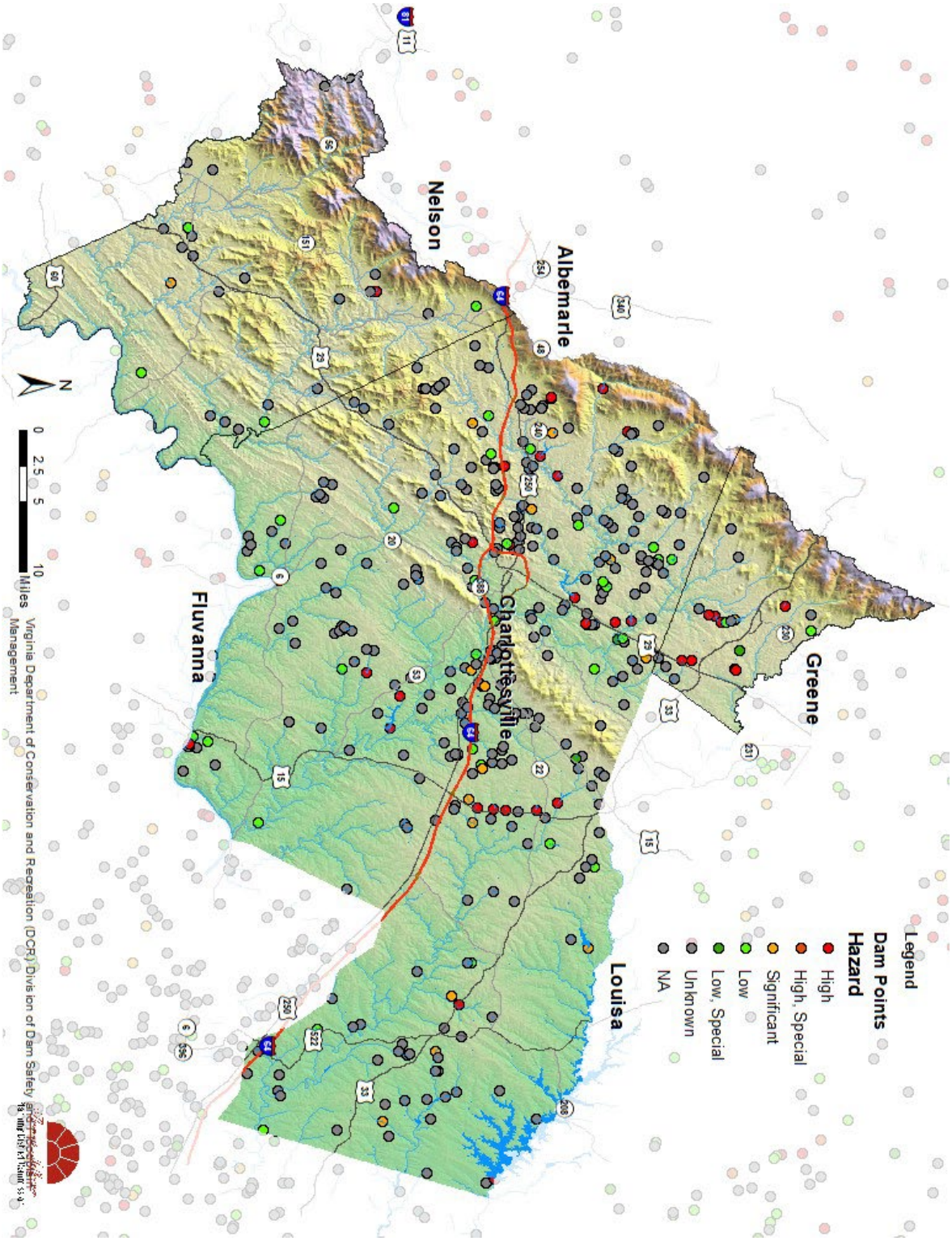
Nelson Dam	Nelson	TR-BOBS CREEK	Virginia Department of Wildlife Resources
Black Creek Impoundment	Nelson	Black Creek	Nelson County Service Authority
Nelson County Dam #6	Nelson		
Nelson County Dam #8	Nelson		
Nelson County Dam #7	Nelson		
Nelson County Dam #4	Nelson		
Nelson County Dam #2	Nelson		
Nelson County Dam #1	Nelson		
Payne Pond	Nelson		
Ramsay Knox Dam	Nelson	TR-CEDAR BRANCH CREEK	
Watts Dam	Nelson	TR-BLACK CREEK	
Black Fox Hills Dam	Nelson	UNION HILL CREEK	Jodi Johnson
Rockfish Farms Dam	Nelson	TR-WILLIAMS CREEK	Rockfish Farm Property Owners
Stevens Lake Dam	Nelson	TR-BROWN CREEK	Russel A. Stevens
Lake Monocan Dam	Nelson	Allen Creek	Wintergreen Pacific, LLC
Amelia Estates Dam	Nelson	TR-NIBBS CREEK	Irvin Horner
Walker Mill Dam	Nelson	Rockfish River, James River	Hydro-WM, LLC

High Risk Dams

Dam	County	River	Owner	Purposes	Year Completed	Height (ft.)	Drain Area (Sq. Mi.)	Regulated
Beaver Creek Dam #1	Albemarle	Beaver Creek	RWSA	Flood Control, Water Supply, Recreation	1964	60	10	State
Montfair West Dam	Albemarle	Doyles River	Joe Vincenti	Recreation	1900	24	0	State
Albemarle Dam	Albemarle	Spring Creek	Virginia Department of Wildlife Resources	Recreation	1938	32	4	State
South Rivanna	Albemarle	S Fork Rivanna	RWSA	Hydropower	1965	47	259	Federal
Chris Greene Dam	Albemarle	Jacobs Run	Albemarle County	Recreation	1967	65	6	State
Sugar Hollow Dam	Albemarle	Mormans River	RWSA	Water Supply	1950	77	17	State
Peacock Hill Dam	Albemarle	Broad Axe Creek	Peacock Hill Community Association	Fire Protection	1975	34	0	State
Upper Mint Springs Dam	Albemarle	Powells Creek	Albemarle County	Recreation, Water Supply	1961	30	0	State
Lower Ragged Mountain Dam	Albemarle	Moores Creek	RWSA	Water Supply	1908	67	2	State
Upper Ragged Mountain	Albemarle	Moores Creek	RWSA	Water Supply	1885	47	1	State

Mink Creek Dam	Albemarle	Mink Creek	Town of Scottsville	Flood Control, Water Supply, Recreation	1977	39	1	State
Whites Dam	Albemarle	Slabtown Branch	William H. White (N)	Irrigation	1971	37	0	None
Middle Mint Springs Dam	Albemarle	Powells Creek	Albemarle County	Recreation	1960	35	1	State
Mountain Valley Dam 1	Albemarle	Biscuit Run	Evergreen Land Company	Recreation	1973	28	0	State
North Fork Pond Dam	Albemarle	Flat Branch	University of Virginia	Flood Control	1900	0	1	State
Hollymead Dam	Albemarle		Albemarle County	Recreation	1974	43	2	State
Birdwood Dam	Albemarle	TR- Morey Creek	University of Virginia	Irrigation, Rec- reation	1930	24	0	None
Twin Lakes Dam	Greene	Deep Run	Twin Lakes HOA	Recreation	1978	32	2	State
Ruckers Lake Dam	Greene	Preddy Creek	HC Land Company	Recreation	1970	40	1	State
Greene County Reservoir	Greene	White Run/ Rapidan River/South River	Greene County	Water Supply	2022	73	1	State
Deer Lake Dam	Greene	Preddy Creek	Glenn at Deer Lake Estates HOA	Water Supply	1970	12	0	State
Lake Monticello Dam	Fluvanna	Boston Creek	Lake Monticello Owners' Association	Recreation	1969	85	8	State
Fluvanna Ruritan Dam	Fluvanna		Virginia Department of Wildlife Resources	Recreation	1955	43	2	State
Bremo Power Station Dam	Fluvanna	Trib to James River	Virginia Electric and Power Co.	Debris Control, Tailings	1984	102	0	State
Greene Acres Dam	Greene	TR-South River	Greene Acres Owners Assoc.	Recreation	1970-1992	37	1	State
Gordonsville Dam	Louisa	Dove Branch	Louisa County Water Authority	Recreation, Flood Control, Water Supply	1969	42	15	State
Lake Anna Dam	Louisa	N Anna River	Virginia Electric and Power Co.	Water Supply	1972	90	343	Federal
Stevens Lake Dam	Nelson	TR-Brown Creek	Russell A. Stevens	Water Supply	1960	31	0	None

Source: DCR


Legend
Dam Points
Hazard
High
High, Special
Significant
Low
Low, Special
Unknown
NA
Greene
Louisa
Albemarle
Nelson
Charlottesville
Fluvanna
N
0 2.5 5 10
Miles
Virginia Department of Conservation and Recreation (DCR) Division of Dam Safety
Management

Karst

Identification

Karst is a terrain with distinctive landforms and hydrology created from the dissolution of soluble rocks, principally limestone and dolomite. Karst terrain is characterized by springs, caves, sinkholes, and a unique hydrogeology that results in aquifers that are highly productive but extremely vulnerable to contamination. About 20% of the land surface in the U.S. is classified as karst, and about 40% of the groundwater used for drinking comes from karst aquifers.

Four geologic hazards are associated with karst. Two common karst-related geologic hazards -- cover-collapse sinkholes and sinkhole flooding -- cause the most damage to buildings. A third karst hazard is relatively high concentrations of radon, sometimes found in basements and crawl spaces of houses built on karst. Finally, the hydrogeology of karst aquifers makes the groundwater vulnerable to pollution, and this vulnerability may also be considered a type of geologic hazard.

2007 Sink Hole on US-29

Source: TJPDC

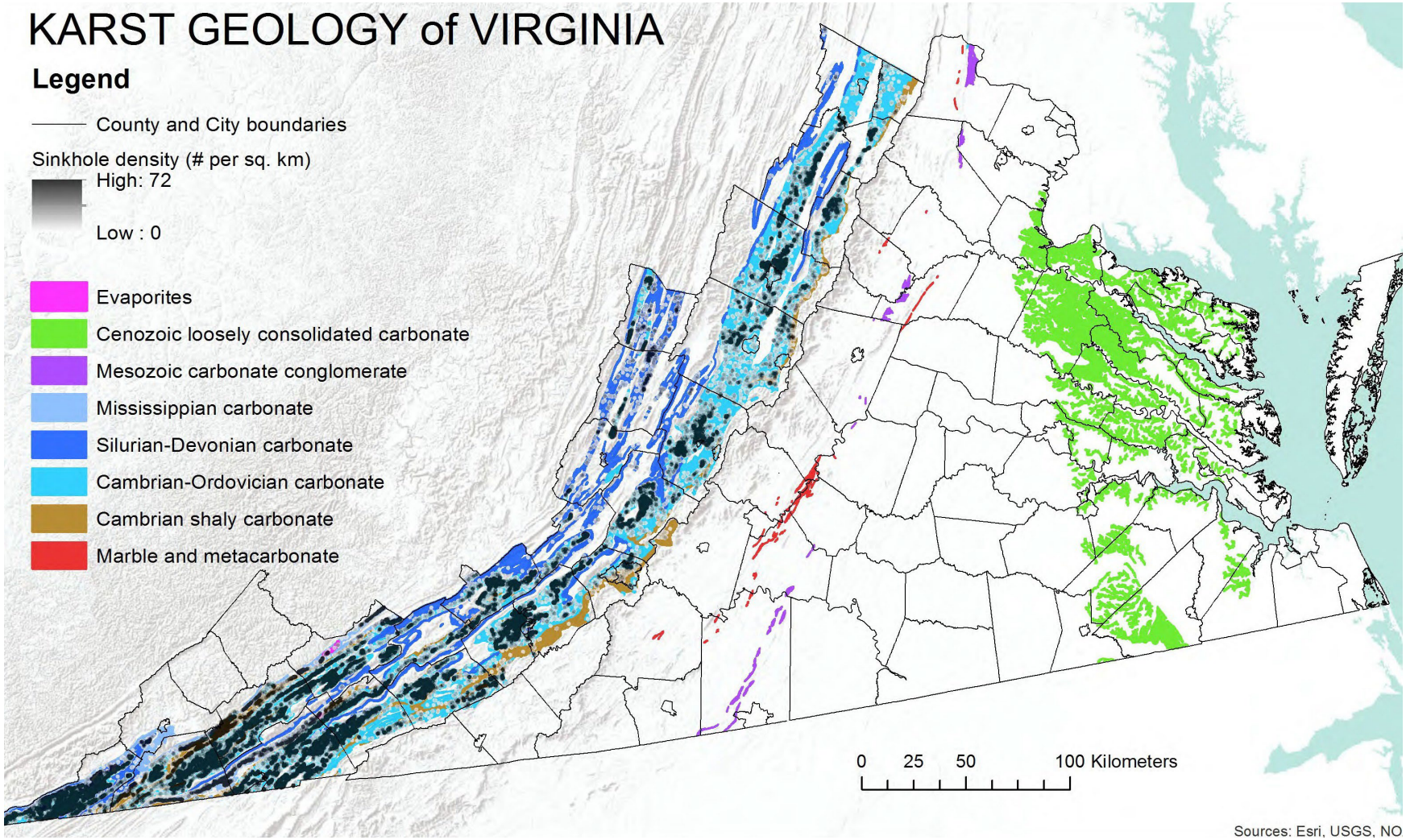
Analysis

The Thomas Jefferson Planning District contains one area with karst geology directly to the east of the South- west Mountains in Albemarle County. The area contains metamorphosed limestone, dolostone, and marble. The

U.S. Geological survey characterizes this as the "short type," defined as fissures, tubes, and caves generally less than 1000 ft. long; 50 ft. or less vertical extent. The Virginia Department of Emergency Management ranks Albemarle County with high karst vulnerability, and Fluvanna County and Louisa County as moderately vulnerable to karst- related hazards, based on the percentage of land in the county containing karst geology.

The predominate karst region in Virginia is the I-81 corridor, where several land-subsidence sinkholes have been documented in recent history. VDOT's Staunton district spent over a million dollars in 2011 on karst- related incidents triggered by high levels of precipitation. The development of roadways and other impervious ser- vices has, in some cases, increased stormwater flows and exacerbated karst-related flooding over time. Loudon County has also seen significant impacts due to land subsidence, particularly near Leesburg. Karst terrain hazards can be extensive in these parts of the state, leading to land use planning and management approaches in sensitive areas. There have been no documented historic incidents related to Karst in the Planning District. There is also no evidence that Karst will become a greater threat in the planning district in the near future. Due to the insignificant risk that Karst poses to the planning district according to consulted stakeholders, it was not considered by the Working Group as a part of the HIRA. Until more evidence indicating this hazard as a threat to the planning district, the TJPDC will not consider it as part of the HIRA. A similar but more common hazard that was instead considered was landslides.

Karst Geology



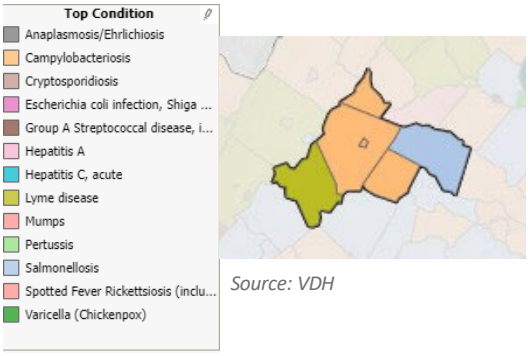
Communicable Diseases

Introduction

Communicable diseases are transmitted from a source to a susceptible person. Sources can be transmitted from infected animals, people, or arthropods to a compromised host. Communicable diseases are spread through infectious agents such as viruses, bacteria, fungi, parasites, or prions. These diseases can be transmitted through contact with an infected individual, their bodily fluids, contact with contaminated surfaces, or contact with droplets within the air.

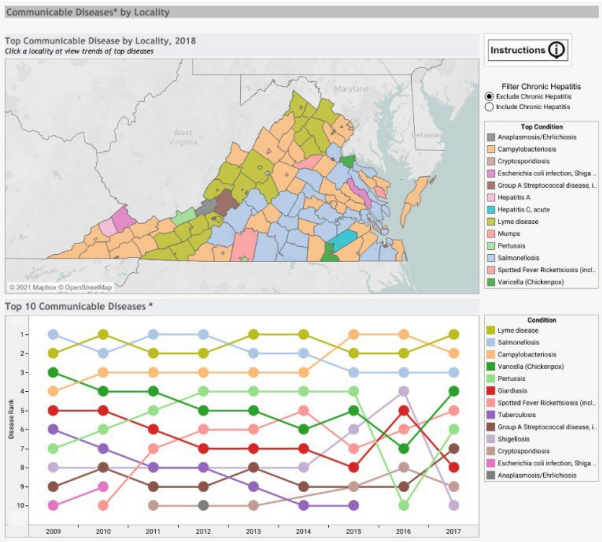
Zoonotic Diseases are spread from animals to humans. Many individuals encounter and interact with animals regularly whether it be indoors or outdoors, making zoonotic diseases quite common. For this reason, it is important to understand the ways in which infections can spread. Spread can occur by direct contact with animals' bodily fluids, through petting or touching, being bitten, or scratched, or by indirect contact of being in the habitat of an infected animal, through vectors like ticks, foodborne diseases in dairy products or undercooked meats, or waterborne illnesses.

Analysis



Source: VDH

Top Communicable Diseases in Virginia by Locality, 2018 (excluding Chronic Hepatitis)



Source: VDH

Top 10 Reportable Communicable Diseases by Incidence Rate, 2018 (Cases per 100,000)

County	Top Condition
Albemarle	Campylobacteriosis was the most frequently reported disease with 25 cases. This equates to a rate of 23.2 cases per 100,000 population.
Fluvanna	Campylobacteriosis was the most frequently reported disease with 11 cases. This equates to a rate of 41.6 cases per 100,000 population
Louisa	Salmonellosis was the most frequently reported disease with 9 cases. This equates to a rate of 25.1 cases per 100,000 population.
Greene	Campylobacteriosis was the most frequently reported disease with 10 cases. This equates to a rate of 51.0 cases per 100,000 population.
Nelson	Lyme disease was the most frequently reported disease with 8 cases. This equates to a rate of 53.5 cases per 100,000 population.
Charlottesville (city)	Campylobacteriosis was the most frequently reported disease with 15 cases. This equates to a rate of 31.2 cases per 100,000 population.

Thomas Jefferson Planning District Commission Region: Top Communicable Diseases by locality 2018 - VDH

Covid-19 Case Information from 2019- January 4, 2022

Locality	Total Cases	Cases per 100,000	Hospitalizations	Deaths
Albemarle	10,219	9,400	376	118
Charlottesville	6,518	13,546	162	64
Fluvanna	3,415	12.751	133	32
Greene	2,758	13,994	162	47
Louisa	4,410	11,991	175	54
Nelson	1,836	12,375	64	24

Source: Virginia Department of Health Covid-19 in Virginia

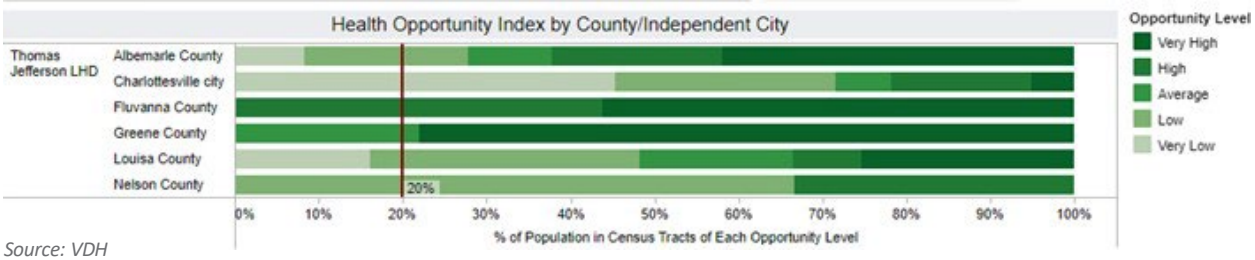
Source: University of Virginia

The Coronavirus disease was discovered in December of 2019 in Wuhan China. Evidence has shown this disease came from a zoonotic source. This highly contagious disease quickly made its way to the United States, and the US President declared on March 13th, 2020, this was a national emergency and pandemic. COVID-19 continues to cause significant risk to the safety and health of the nation.

This disease most often causes respiratory symptoms resembling a cold, flu or pneumonia. Most experience COVID with mild symptoms, but some vulnerable populations experience severe illness. These vulnerable populations include those with certain underlying medical conditions such as those suffering from chronic kidney disease, cancer, liver disease, heart conditions, diabetes, mental disabilities, and other immunocompromising conditions. Racial and ethnic inequities lead to a disproportionate number of cases and deaths within minority communities. Discrimination has led to disparities in healthcare access and use, occupation, education, income, wealth, and housing. Vulnerable populations are also most at risk of catching other communicable diseases.

The Covid-19 pandemic is the leading infectious disease in each locality, surpassing historical data from 2018 on the top reported cases of other contagious diseases. Rather than case rates ranging from 20-60 per 100,000 people, Coronavirus cases have reached 9,000-14,000 cases per 100,000 people in the Thomas Jefferson Planning District Region.

While Covid-19 is not the only disease impacting the region, it has had the most widespread impact and shown the steps to mitigate the risk of catching most other diseases. Vaccinations can train the immune system to create disease fighting proteins. Contact tracing is the process used to identify those who have been in contact with someone who contracted the infectious disease, to treat or quarantine them. Masks and social distancing are used to block the



Source: VDH

spread of droplets throughout the airspace. Frequent hand washing and cleaning of shared surfaces are practiced, reducing the spread of harmful germs.

Other than Coronavirus, the most common infectious diseases impacting the region prior to Coronavirus were Campylobacteriosis and Salmonella. Both live in the intensities of birds and are spread to humans through consumption of contaminated foods, contact with infected animals, or by drinking contaminated water. Lyme disease is commonly spread through vectors such as ticks.

Abve is the Blue Ridge Health District's Health Opportunity Index graphic provided by the Virginia Department of Health. The index is driven by social, economic, and environmental determinants of health.

Other Hazards

The following list identifies additional hazards. Some of the hazards such as lightning and hail do exist in the Planning District, but do not pose a significant threat, while others such as tsunamis have not directly affected the Planning District in the past.

Lightning: Lightning is a discharge of electrical energy resulting from the buildup of positive and negative charges within a thunderstorm, creating a "bolt" when the buildup of charges becomes strong enough. This flash of light usually occurs within the clouds or between the clouds and the ground. A bolt of lightning can reach temperatures approaching 50,000 degrees Fahrenheit. Lightning rapidly heats the sky as it flashes but the surrounding air cools following the bolt. This rapid heating and cooling of the surrounding air causes thunder. On average, 89 people are killed each year by lightning strikes in the United States. The greatest threat from lightning is the chance of starting a wildfire, discussed in the wildfire section.

Hailstorms: Hailstorms are an outgrowth of severe thunderstorms. Early in the developmental stages of a hailstorm, ice crystals form within a low-pressure front due to the rapid rising of warm air into the upper atmosphere and the subsequent cooling of the air mass. Frozen droplets gradually accumulate on the ice crystals until, having developed sufficient weight, they fall as precipitation—as balls or irregularly shaped masses of ice greater than 0.75 in. (1.91 cm) in diameter. The size of hailstones is a direct function of the size and severity of the storm. High velocity updraft winds are required to keep hail in suspension in thunderclouds. The strength of the updraft is a function of the intensity of heating at the Earth's surface. Higher temperature gradients relative to elevation above the surface result in increased suspension time and hailstone size.

Hailstorms have caused some damage to the region including softball sized hail on July 3, 1983, but in general do not pose a serious threat.

Radon: Radon is a naturally occurring radioactive gas originating from the radioactive decay of uranium. Usually found in igneous rock, soil, and sometimes well water, radon particles have the potential to become trapped within lungs when inhaled and decay into solid radioactive particles. Radioactive particles such as these break down further into small bursts of energy that can damage lung tissue and lead to lung cancer over time. Not every individual exposed will develop cancer, but the time between exposure and the onset of cancer can be many years. Radon is considered the second-best studied carcinogen, following tobacco. The chances of developing lung cancer from radon exposure depend on the amount of Radon within a household, how much time spent indoors, and whether the individual is a smoker or was once a smoker. Smoking can multiply an individual's risk to radon by 10.

Based on the map, radon levels pose a moderate to high risk for the localities within the Thomas Jefferson Planning District.

Radon Risk by Locality

Source: Virginia Department of Health EPA Radon Risk Map of Virginia

Based on data from the Virginia Department of Health, people who have never smoked exposed

to a level greater than 4 pCi/L 7 out of every 1,000 people would get lung cancer. At 2 pCi/L about 4 out of 1,000 would get lung cancer. Those who smoke at a level of 4 pCi/L 62 out of 1,000 would develop lung cancer and those exposed to 2 pCi/L about 32 of 1,000 smokers would develop lung cancer.

There are many methods to reduce radon within your home, from sealing cracks in floors and walls, to using systems of pipes and fans. Sub-slab depressurization is the most popular tactic and does not necessitate major changes to a household, while removing this harmful gas from below the foundation and preventing it from entering indoors. There are inexpensive, do it yourself test kits available online and in retail stores. For more information on how to test indoor spaces for radon and mitigate risk, visit Radon Testing and Mitigation - Radiological Health (virginia.gov) through the Virginia Department of Health Website.

Invasive Species: Invasive species refer to nonnative plants, animals, or microbial organisms that cause harm or have the potential to harm natural ecology, human health, or economic systems. Nonnative species are introduced anthropogenically, whether intentionally or accidentally, into a region outside of their natural geographic location. Increasing global integration and international trade have opened many avenues for the introduction of invasive species to Virginia from all over the globe. Some nonnative species are introduced purposefully to benefit economic systems, such as most agricultural plants produced today in the United States, ornamental garden plants, or for means of erosion control. However, many invasive species have created environmental, safety, and economic problems such as decimating forests, significantly decreasing agricultural production, threatening populations of endangered species, and harming or killing people.

The Virginia Department of Forestry has discovered an invasive species that is impacting the wooded areas in the Charlottesville greater area. Porcelain Berry, a vine that has fruits resembling grapes, is growing up Charlottesville's wooded canopy, blocking light resources from the native trees, and threatening to damage branches during winter storms due to added mass. The US Department of Agriculture has also acknowledged that new species have the potential to migrate into regions as the climate change and their ecological niche expands.

It is important to be able to identify and know how to remove invasive species from the region to prevent damages such as those mentioned above. For more information on how to locate invasive species in your area visit Virginia Department of Conservation and Recreation: Invasive Species List

Erosion: Erosion is a continuous geological process where land is broken down and transported by physical forces such as wind and water. This process has shaped earth since its formation. Natural factors impacting the level of erosion on any given landscape include climate, topography, vegetative cover, and tectonic activity. Changes to the natural environment through agricultural and infrastructure development, alter natural vegetative cover and topography resulting increased soil erosion.

Wind and water erosion are the leading type of physical erosion, both of which can cause significant soil loss. Wind erosion lifts soil particles and transports them through the air, while water erosion can occur due to precipitation events on land or in moving bodies of water such as streams and channels. Rainfall produces four types of soil erosion: splash, sheet, rill and gully erosion. Splash erosion is produced from the impact of a falling raindrop, displacing particles a few feet at a time. Sheet erosion is caused by shallow runoff. Rill erosion occurs when runoff develops into small streams called rills. Gullies transport soils through larger channels and carry particles during periods of rainfall or snowmelt. Major weather events such as floods and hurricanes cause significant erosion by combining increased water velocity, water discharge, and wind speeds.

Expansive Soils: Soils and soft rock that tend to swell or shrink due to changes in moisture content are commonly known as expansive soils. In the United States, two major groups of rocks serve as parent materials of expansive soils and occur more commonly in the West than in the East. The first group consists of ash, glass, and rocks of volcanic origin. The aluminum silicate minerals in these volcanic materials often decompose to form expansive clay minerals of the smectite group, the best known of which is montmorillonite. The second group consists of sedimentary rock containing clay minerals, examples

of which are the shales of the semiarid West-Central States. Because clay materials are most susceptible to swelling and shrinking, expansive soils are often referred to as swelling clays.

Changes in soil volume present a hazard primarily to structures built on top of expansive soils.

Most engineering problems caused by volume changes in swelling clays result from human activities that modify the local environment. They commonly involve swelling clays beneath areas covered by buildings and slabs or layers of concrete and asphalt, such as those used in construction of highways, canal linings, walkways, and airport runways.

Land subsidence: Land subsidence is the lowering of the land-surface elevation from changes that take place underground. Common causes of land subsidence from human activity are pumping water, oil, and gas from underground reservoirs; dissolution of limestone aquifers (sinkholes); collapse of underground mines; drainage of organic soils; and initial wetting of dry soils (hydro compaction). Land subsidence occurs in nearly every state of the United States but is more prevalent in the Southwestern part of the country.

Land subsidence causes many problems including: (1) changes in elevation and slope of streams, canals, and drains; (2) damage to infrastructure such as bridges, roads, railroads, storm drains, sanitary sewers, canals, and levees; (3) damage to private and public buildings; and (4) failure of well casings from forces generated by compaction of fine-grained materials in aquifer systems. In some coastal areas, subsidence has resulted in tides moving into low-lying areas that were previously above high-tide levels.

Tsunamis: The word tsunami is Japanese and means "harbor wave." A tsunami is a series of great waves that are created by undersea disturbances such as earthquakes or volcanic eruptions. From the area of disturbance, tsunami waves will travel outward in all directions. Tsunamis can originate hundreds or even thousands of miles away from coastal areas.

In the United States, tsunamis have historically affected the West Coast, but the threat of tsunami inundation is also possible on the Atlantic Coast. Pacific Ocean tsunamis are classified as local, regional, or Pacific-wide. Regional tsunamis are most common. Large-scale Pacific-wide tsunamis are much less common, with the last one being recorded in 1964, but consist of larger waves, which have high potential to cause destruction. However, the December 2004 tsunami which struck Sri Lanka, Indonesia, India, Thailand and other small countries, completely destroyed cities and towns. After a month of searching, the death toll is over 100,000 with 125,000 people still missing. The effects of this tsunami were felt even here, as relief, money, and volunteers were sent to these countries in dire need of assistance.

Volcanoes: Over 75 percent of the Earth's surface above and below sea level, including the seafloors and some mountains, originated from volcanic eruption. Emissions from these volcanoes formed the Earth's oceans and atmosphere. Volcanoes can also cause tsunamis, earthquakes, and dangerous flooding.

There are more than 500 active volcanoes in the world. More than half of these volcanoes are part of the "Ring of Fire," a region that encircles the Pacific Ocean. More than 50 volcanoes in the United States have erupted one or more times in the past 200 years. The most volcanically active regions of the nation are in Alaska, Hawaii, California, Oregon, and Washington. The danger area around a volcano covers approximately a 20-mile radius. Some danger may exist 100 miles or more from a volcano.

Large volcanic eruptions have temporarily impacted global climate in the past. Aerosols released from sizable eruptions reduce solar radiation reaching Earth's atmosphere, lowering temperatures globally and changing atmospheric circulation patterns for a few years at a time. These particles can linger in layers of Earth's atmosphere for 3-4 years at a time, potentially affecting agricultural production in Virginia and worldwide.

Avalanches: An avalanche can be defined as a large mass of snow, ice, etc., detached from a mountain slope and sliding or falling suddenly downward. To occur, they need a steep slope, snow cover, a weak layer in the snow cover, and a trigger, such as an earthquake, thermal change, blizzard, or human intervention. Most common in the mountainous western U.S., none of these conditions are found in the TJPDC area and no reported deaths from avalanches have

occurred since data recording began in 1950.

Meteorites: A meteorite is a natural piece of rock originating in outer space that survives impact with the Earth's surface. Although impact from a meteorite in the planning district is not considered to have a high probability, a large object striking earth would have a significant effect. Large meteors that enter earth's atmosphere, heat as they fall towards earth's gravity and may explode within the atmosphere producing shock waves capable of producing large scale burns and potentially death. One of the leading theories for the cause of the Cretaceous–Tertiary extinction of dinosaurs and almost every other life form on earth is a large meteorite impact.

Nuclear Radiation: Nuclear power plants utilize heat created from nuclear fission to convert water into steam, which then turn turbines, creating electricity. There is a nuclear power plant within the district in Louisa, on the northern end of Lake Anna. While nuclear energy is efficient, there are risks. The Nuclear Regulatory Commission closely monitors the construction and operations of power plants; however, accidents can occur. A nuclear power plant accident can cause exposure to high levels of nuclear radiation, threatening the wellbeing and safety of those in the surrounding area. A plume refers to dangerous levels of radiation over an area. Radioactive particles in the plume can settle on water sources, livestock, food sources, buildings, and people, contaminating them. Those who are exposed can experience adverse health effects, such as cancer.

Data Sources

American Society of Civil Engineers (ASCE)
Web site: www.windhazards.org

Bureau of Reclamation, U.S. Department of the Interior
Web site: www.usbr.gov

Federal Emergency Management Agency (FEMA)
Web site: www.fema.gov

National Climatic Data Center (NCDC), U.S. Department of Commerce, National Oceanic and Atmospheric Administration
Web site: http://lwf.ncdc.noaa.gov/oa/ncdc.html

National Drought Mitigation Center, University of Nebraska-Lincoln
Web site: www.drought.unl.edu/index.htm

National Severe Storms Laboratory (NSSL), U.S. Depart- ment of Commerce, National Oceanic and Atmospheric Administration
Web site: www.nssl.noaa.gov

National Weather Service (NWS), U.S. Department of Commerce, National Oceanic and Atmospheric Administration
Web site: www.nws.noaa.gov

Storm Prediction Center (SPC), U.S. Department of Commerce, National Oceanic and Atmospheric Administration, National Weather Service
Web site: www.spc.noaa.gov

United States Geological Survey (USGS), U.S. Department of the Interior Debris-Flow Hazard Inventory and Evaluation: Albemarle County, Virginia. USGS Karst Interest Group
Web site: www.usgs.gov

Virginia Department of Forestry (VDOF)
Web site: www.dof.virginia.gov

Virginia Department of Emergency Management (VDEM)
Web site: www.vaemergency.com

National Inventory of Dams (NID)
Web site: https://nid.sec.usace.army.mil/#/

AirChek-Radon.com
Web site: https://www.radon.com/radon_facts/

National Aeronautics and Space Administration
Web site: https://earthdata.nasa.gov/learn/sensing-our-planet/volcanoes-and-climate-change

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Virginia Invasive Species
Web site: http://www.invasivespeciesva.org/document/virginia-invasive-species-mananagement-plan-2018-final.pdf

Virginia Cooperative Extension
Web site: https://albemarle.ext.vt.edu/programs/invasive-species.html

U.S. Environmental Protection Agency
Web site: https://www.epa.gov/climate-indicators/climate-change-indicators-heat-related-deaths

The White House
Web site: Presidential Declaration-National Emergency, White House

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The Washington Times
Web site: https://m.washingtontimes.com/multimedia/collection/aftershocks-still-plague-mineral-va/?page=3

NBC 12 Richmond
Web site: https://www.nbc12.com/2021/05/05/it-was-just-unreal-tuesdays-severe-thunderstorm-leaves-damage-its-wake/

National Park Service
Web site: https://www.nps.gov/articles/wildfire-causes-and-evaluation.htm#:~:text=Nearly%2085%20percent*%20of%20wildland,and%20intentional%20acts%20of%20arson.&text=Lightning%20is%20one%20of%20the%20two%20natural%20causes%20of%20fires.

Virginia Department of Energy
Web site: https://energy.virginia.gov/geology/FEMA_landslide.shtml

University of Virginia
Web site: https://news.virginia.edu/content/earthquake-history-finding-faults-virginia

Center for Disease Control
Web site: https://www.cdc.gov/nceh/radiation/emergencies/moretypes.htm#power

Community Wildfire Planning Center
Web site: https://www.communitywildfire.org/about-cwpc/

Daily Progress
Web site: https://dailyprogress.com/news/vdot-hopes-to-prevent-another-u-s-250-rockslide/article_c34b0cb4-b474-11ec-9bc9-43444be05adf.html#tracking-source=home-top-story, https://dailyprogress.com/news/one-day-of-snow-creates-four-months-of-clean-up/article_6e246bd8-b477-11ec-8e96-9ff2eebbad15.html#tracking-source=home-top-story

Nelson County Historical Society
Web site: https://www.nelsonhistorical.org/

Virginia Department of Transportation
Web site: virginiadot.org

Multi-Resolution Land Characteritics Consortium-Enhanced Visualization and Analysis Tool (2008 & 2019 Datasets)
Web site: https://www.mrlc.gov/eva/

Understanding Infrastructure Resilience, Social Equity, and Their Interrelationships: Exploratory Study Using Social Media Data in Hurricane Michael
Sunil Dhakal, S.M.ASCE; Lu Zhang, A.M.ASCE; and Xuan Lv, A.M.ASCE

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Fluvanna Review

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TJPDC Hazard Mitigation Working Group

Locality Staff

Vulnerability Assessment

01.6(c)(2)(ii)(A): The plan should describe vulnerability in terms of: The types and numbers of existing and future buildings, infrastructure, and critical facilities located in the identified hazard areas…

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PURPOSE

The Vulnerability Assessment section provides an over- view and analysis of vulnerability in the Thomas Jefferson Planning District to the hazards listed below. While the previous Hazard Identification and Analysis section defined and described the prevalence and intensity of hazards in the region, this section combines the hazard analysis with both present and projected human settlement patterns to measure their human impact. Hazards that pose significantly less risk to the region are not covered in this section. Where appropriate, distinctions have been made regarding relative risk for each locality.

Risk contains three elements: hazard, vulnerability, and exposure. A hazard is an act or phenomenon that has the potential to produce harm or other undesirable consequences of a person or thing. Vulnerability is a susceptibility to physical injury, harm, damage, or eco- nomic loss. Exposure describes the people, property, systems, or functions that could be lost to a hazard.

This Section Includes the following

1. **Population, Social Vulnerability, and Building Exposure**
2. **Development Trends**
3. **Infrastructure**
4. **Critical Facilities**
5. **Estimating Potential Loss**

Population

According to the 2021 US Census, the total population of the Thomas Jefferson Planning District was 259,714, which is an 9.5% increase from a population of 234,988 recorded in 2015. The table below shows the population by locality, and the percent growth in population between 2015 and 2021.

Population by Locality

Locality	Population 2015	Population 2021	2015-2021 % Change
Charlottesville	45,084	47,096	4.5%
Albemarle	103,108	112,395	4.2%
Fluvanna	26,014	27,249	2.2%
Greene	18,938	20,552	4.7%
Louisa	33,986	37,591	10.6%
Nelson	14,858	14,831	-0.2%
Region	241,988	253,336	4.7%

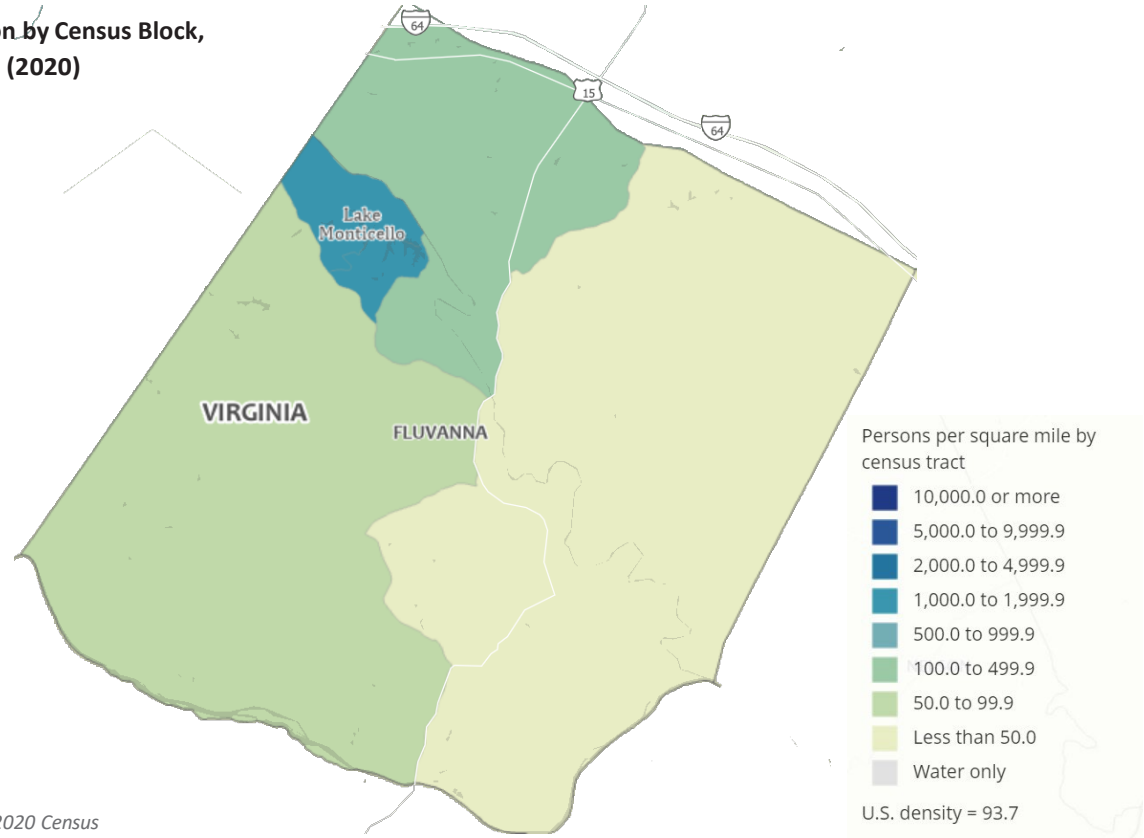
Source: ACS / US Census – January 2022

Some segments of the population are more adversely affected than others by hazards. The elderly, low-income households, people with disabilities, and families with young children may be less able to prepare for a disaster, put at high risk during a disaster, and slower to recover after a disaster.

A lower-income household may be more likely to live in a floodplain, because of depreciated land values, and less likely to hold health insurance or extra insurance on their property. They are more likely to live in older homes with more structural deficiencies susceptible to earthquake damage, or mobile homes that are less protected from windstorms. They are also more likely to lack transportation options, which may impair mobility if infrastructure or transit service is impeded. In severe disasters that remove a sizable number of housing units from the regional housing stock, a prolonged shortage of affordable housing is a common outcome.

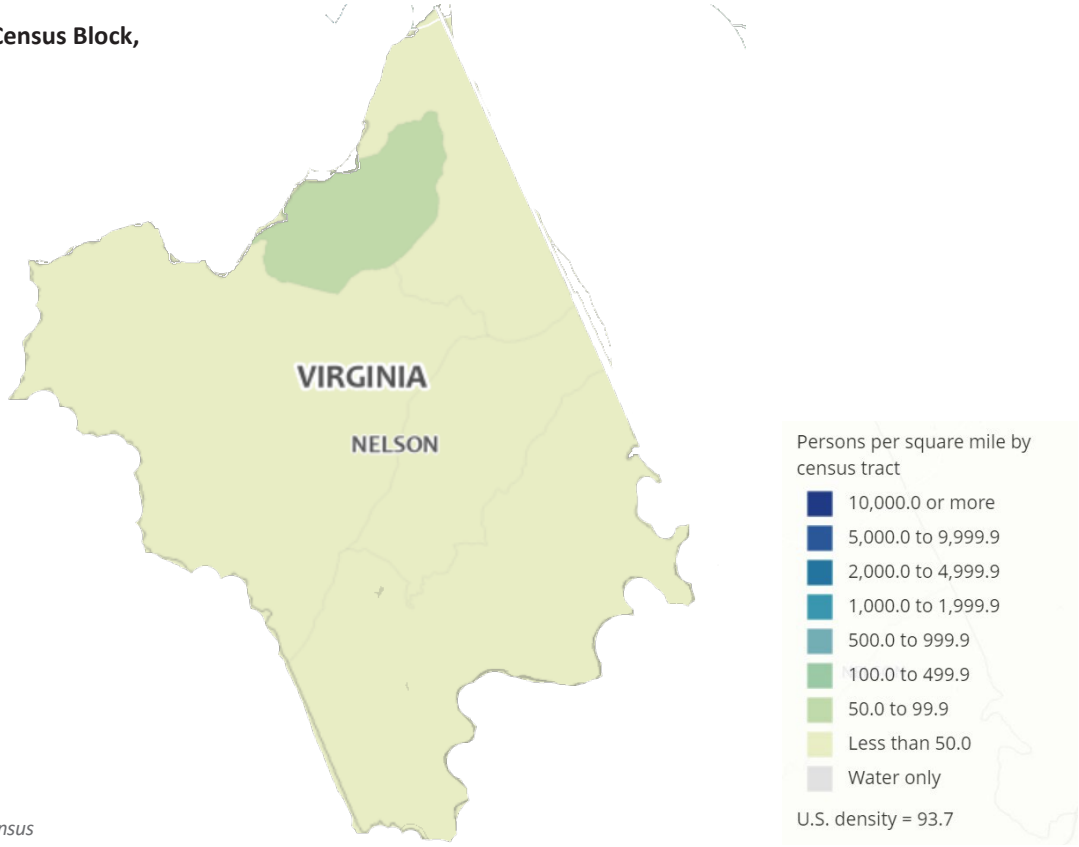
The elderly, people with disabilities, and, in some cases, young children may have impaired mobility and need special assistance during emergency operations. Stress and the general disruption of care can have serious health impacts on high-risk individuals. In event of a displacement, shelters or temporary residences may or may not be equipped to meet special needs. This is especially true, considering that many displaced individuals opt to use personal contacts to find temporary housing.

Population by Census Block, Fluvanna (2020)



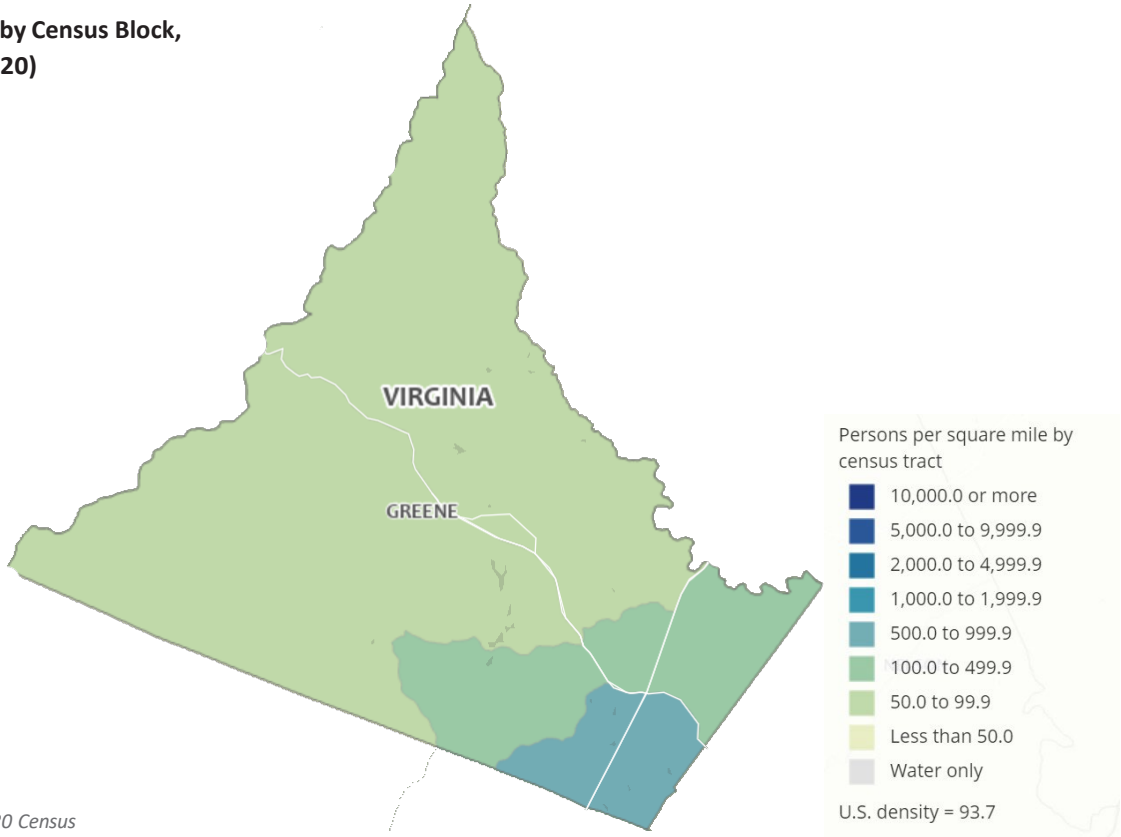
Source: US 2020 Census

Population by Census Block, Nelson (2020)



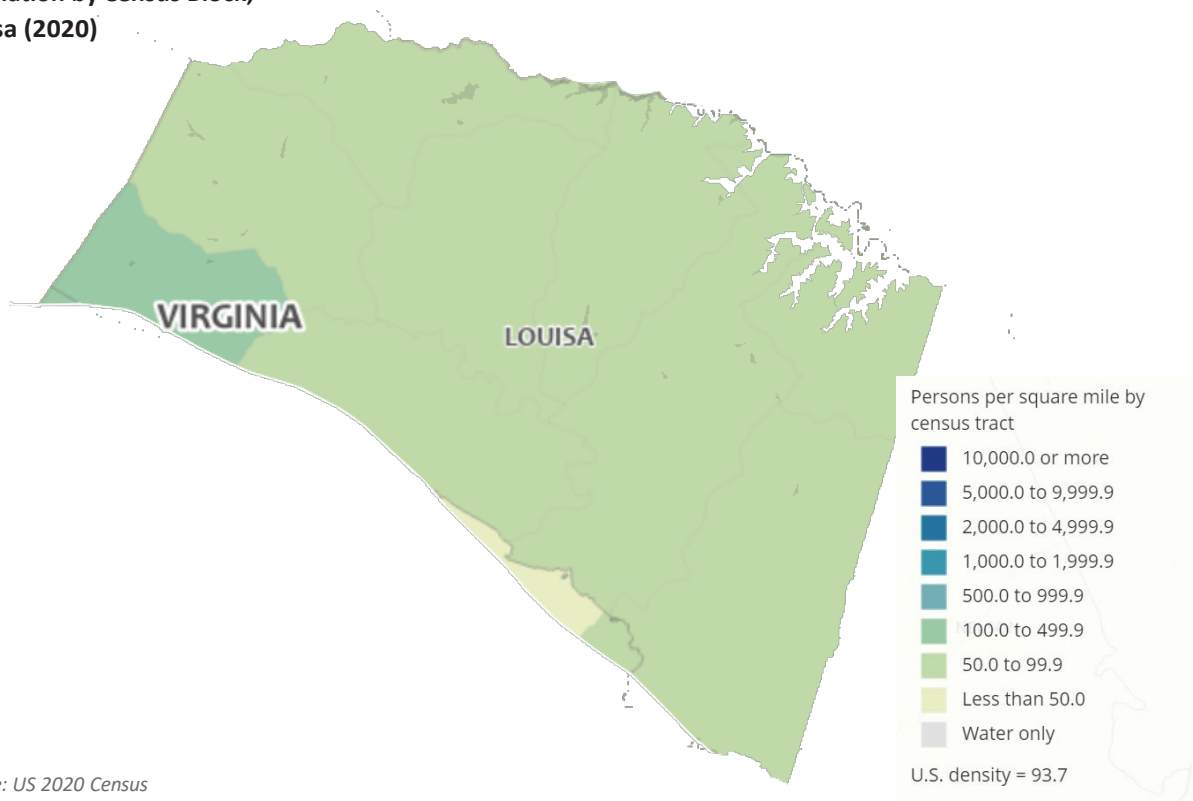
Source: US 2020 Census

Population by Census Block, Greene (2020)



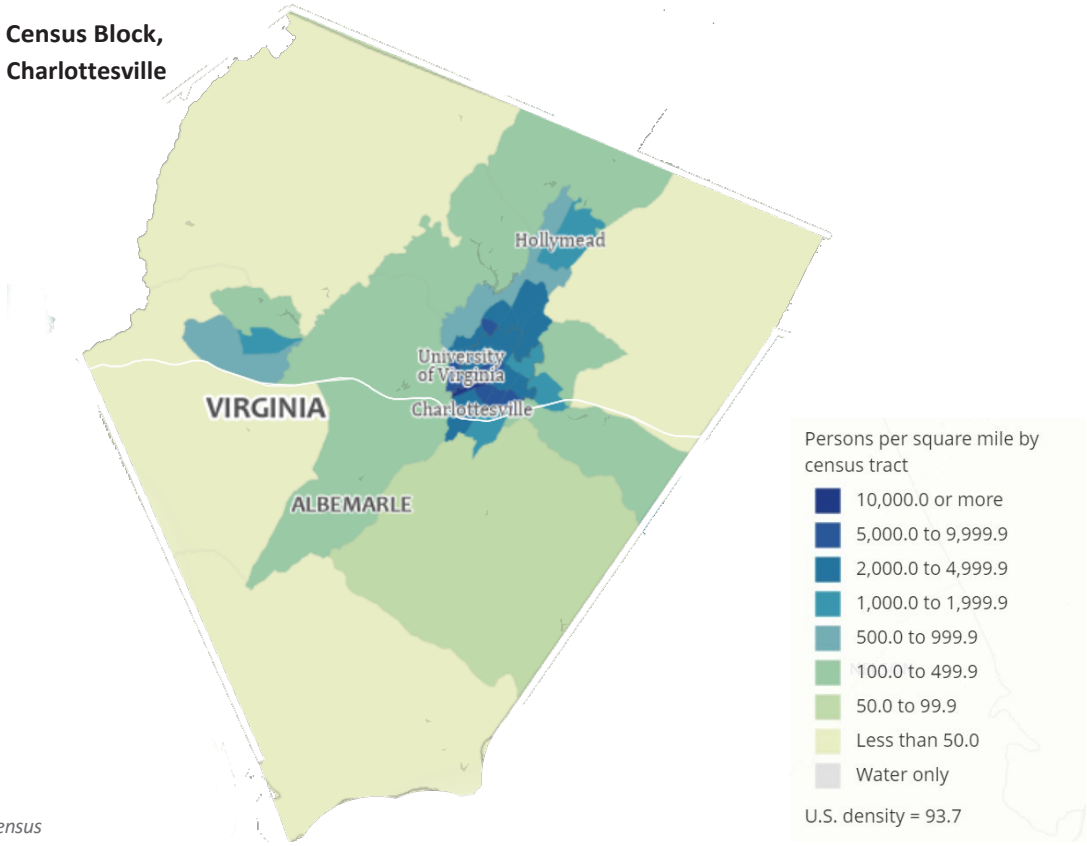
Source: US 2020 Census

Population by Census Block, Louisa (2020)



Source: US 2020 Census

Population by Census Block, Albemarle and Charlottesville (2020)



Source: US 2020 Census

Social Vulnerability

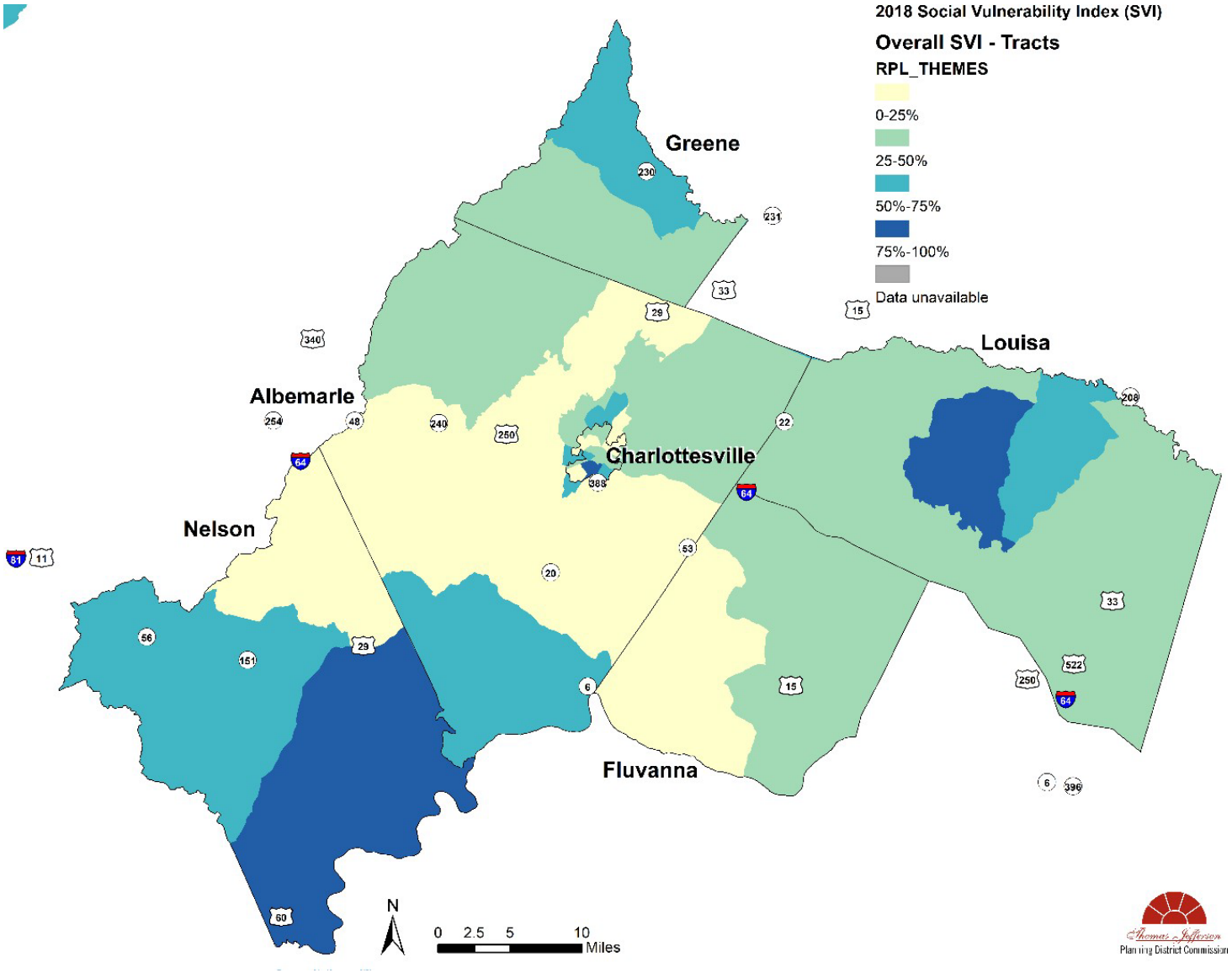
In addition to population metrics, another important tool to measure a community's vulnerability to natural disasters is the CDC/ATSDR Social Vulnerability Index (SVI). This tool was developed to help emergency planners and local, state, and federal officials determine where populations are most vulnerability, according to a variety of metrics measured by the U.S. Census. These metrics include poverty, lack of vehicle access, crowded housing, people with disabilities, and people with limited English proficiency. 15 total factors are taken into consideration, grouped into 4 separate themes: socioeconomic status, household composition and disability, minority status and language, and housing type and transportation. Each census tract receives a score for each of these categories, which are then aggregated into an overall ranking. These census tracts can be combined to determine the overall social vulnerability of a county, city, region, or state. The SVI Index is measured from 0 to 1, with 0 being the lowest vulnerability and 1 being the highest. The following table and map below display the county and census tract SVI for the planning district.

Locality	SVI Score
Albemarle	.17
Charlottesville	.41
Fluvanna	.06
Greene	.16
Nelson	.30
Louisa	.33
Region	.29

Source: CDC/ATSDR

All of the localities in the planning district received "low to moderate" scores according to the SVI index data dictionary. This indicates that while some census tracts are more vulnerable than others, there are no regions or localities in the planning district that are considered highly vulnerable per the SVI index. This, of course, does not make the region immune to natural disaster, but indicates that the baseline characteristics of the region are advantageous in terms of resiliency.

2018 Social Vulnerability Index Scores



Source: CDC/ATSDR

Buildings

The estimated numbers of buildings by locality in 2020 are as follows:

Number of Units by Locality

Locality	Total Units	Residential Units	Non-Residential Buildings	Residential Units Built since 2010	Increase in buildings 2010-2020
Albemarle	49,716	47,081	2,635	7,489	17.7%
Charlottesville	22,527	20,886	1,641	2,505	12.5%
Fluvanna	11,432	11,162	270	1,145	11.1%
Greene	9,495	8,488	1,007	1,497	18.7%
Louisa	18,815	17,916	899	2,765	17.2%
Nelson	10,834	10,240	594	566	5.5%
Region	122,819	115,773	7,046	15,967	14.9%

Source: U.S. Census 2020, US Census building permit data 2010-2020, Dun and Bradstreet 2006 - January 2022

Residential building counts were derived from 2020 U.S. Census data and augmented by residential building permits reported by individual localities between 2010 and 2020, This was further updated using annual residential permit data available from the US Census through 2021. Non- residential counts were determined by private firm Dun and Bradstreet in 2006 and acquired through FEMA. As of publication no newer data was available.

201.6(c)(2)(ii)(C): The plan should describe vulnerability in terms of providing a general description of land uses and development trends within the com- munity so that mitigation options can be considered in future land use decisions.

Land Use and Development Trends

Changes in land use over time will affect the ability to mitigate and respond to hazards, as well as provide opportunity for improvements. Each locality is growing in population and the region grew by 6.8% between 2010 and 2019. Growth is being channeled into certain areas based on several factors, including market demand, location of roads and other infrastructure, topography, and local policies. Over the last several decades, the most basic trend has been conversion of land from undeveloped forest and farmland into residential, commercial, institutional, and other more urban uses. Exurban growth has been predominately in the form of Single-family residences spreading further into the countryside outside of traditional town centers. One significant driving force is the price of housing in the urban area, leading to increased commuting from outlying counties.

Commercial uses and employment centers remain clustered in Charlottesville and the urban areas of Albemarle County, especially the US 29 corridor and Pantops. The majority of employees who live in the outlying counties continue to commute into these areas. Two major commercial exceptions are big box stores and other commercial developments that have occurred in Zions Crossroad and Ruckersville within the last ten years. Construction activity across the planning district has returned to near pre-recession levels with several major stalled developments and project phases moving forward. However, rising material costs and inflation have the potential to slow development in the region.

Citizens, planners, and public officials have sought ways to foster development of vibrant, compact, mixed-use communities while protecting the rural countryside, with varying degrees of success. Floodplain maps included in this section show targeted growth areas in each locality. Each locality defines growth areas differently and applies varying levels of incentives and/or restrictions to concentrate growth in those areas. The Virginia General Assembly has

passed legislation to require high-growth localities, including all counties in the Thomas Jefferson Planning District, to adopt Urban Development Areas into their Comprehensive Plans and create incentives to further concentrate new development into these areas. For reference purposes, the incorporated towns of Louisa, Mineral, Stanardsville and Scottsville's development trends are included in the broader discussion of their respective county's growth trends

Growth Areas

Locality	Percent of County Land that is designated for Growth	Percent of all Structures that are in Growth Area
Nelson	6.1%	14.1%
Fluvanna	10.6%	39.1%
Greene	6.7%	25.4%
Albemarle	5%	40.6%
Louisa	22.5%%	33.3%
Charlottesville	NA	NA

Source: Local Government GIS - January 2022

Because there are significant differences between localities with respect to land use and development, each locality in the region is discussed individually below:

Charlottesville

Although there is very little undeveloped land remaining in the City of Charlottesville, redevelopment and selected small-scale infill has been occurring over the last two decades and can expect to continue in the future. The population of Charlottesville remained stagnant between 1970 and 2000 but grew by 8% between 2000 and 2010 and 7% between 2010 and 2020. Much of this growth occurred around major streets in the City, because of zoning changes in 2003 that allowed higher residential densities for multifamily construction and encouraged mixed-use development. Higher residential property values have encouraged renovations and new construction across the City. The impact of this activity on traditionally lower income neighborhoods has become of great concern in the City, and discussions about land use policy center on preventing displacement and increasing the stock of housing affordable to families making less than the Area Median Income. Commercial and office growth has been robust in downtown Charlottesville, with three new large office buildings opening in 2022.

Albemarle

Albemarle's population has grown 9.3% from 2010 to 2019 according to the US Census Bureau. While growth has slowed from the previous decade, development in Albemarle continues with 35 projects on the pipeline according to Albemarle's 2019 Growth Management Report. Over the last decade, there has been a mix in the forms of residential housing built in the development areas, with single-family detached housing as the dominant housing type constructed within the county. Following second, were attached and townhouse units. While over 33% of all single family detached dwelling units being built in the Development Areas were built in Crozet, roughly 75% of all attached, townhome, or multi-family dwelling units built in the Development Areas were in the Urban Neighborhoods surrounding the City of Char- lottesville. The County has seen steady and continued growth since 2000, with Crozet and the urban neigh- borhoods of Pantops, Rio Road East area, and 5th Street Extended / Old Lynchburg Road area seeing the greatest growth during this time. Albemarle County has strict growth boundaries in place to concentrate new growth around existing commercial centers and preserve the rural countryside. The construction of the Hollymead Town Center in the northern US29 corridor was the first major

development under the auspices of the Neighborhood Model, intended to promote compact, mixed-use, and walkable neigh- borhoods. Construction of Stonefield, another major US29 development near the city, broke ground in the spring of 2011. The transfer of Martha Jefferson Hos- pital and auxiliary medical services from Charlottesville to Pantops in August 2011 and the creation of the National Ground Intelligence Center on the US 29 corridor introduces major employment centers to urban Albemarle. While none of the pipeline, or in-progress construction, is occurring in severely hazardous areas. There is discussion within the Growth Management Report that additional housing, needed to accommodate projected population growth, may be more difficult due to changing floodplains. This is a clear connection between land use, development, and hazard mitigation that Albemarle County will continue to identify as they plan growth. This is particularly true about developments near the Rivanna River, and near creeks in the Crozet area. While there is significant potential for development in these areas, further research is critical to ensure that development is not occurring in flood-prone areas.

Louisa

Louisa County's desirable location between the cities of Richmond and Charlottesville, its proximity to Interstate 64, and Lake Anna's increasing popularity as a summer vacation destination has contributed to population increases and related growth over the past decade. In 2021, Louisa was one the 11th biggest population gaining locality in the Commonwealth, with 1,091 new individuals. Louisa County contains two incorporated Towns, Louisa, and Mineral. The fastest growing portion of the County is the Zion Crossroads Area intersected by Interstate 64 and Route 15. This area contains a mix of commercial, industrial, and planned higher density residential uses. Louisa County has recently updated their Comprehensive Plan and Zoning Ordinance. The goal of the Louisa County Comprehensive Plan is maintaining the rural agricultural character of the County.

Fluvanna

Fluvanna County remains committed to rural preservation, and though it has five designated growth zones, it is currently constrained by utilities such as water and sewer, that allow for the level of condensed development that is allowed within those designated growth zones. Growth has primarily focused around Lake Monticello, the fill in of existing developments, and by-right cluster subdevelopments. The lack of infrastructure has constrained growth in zoning areas other than the Lake Monticello growth zones, however existing plans to bring water and sewer infrastructure to Zions Crossroads and the Fork Union area will allow for renewed interest in growth areas outside of the Lake. From 2010-2019, the population has increased slightly higher than 5 percent according to the American Census Bureau, as its proximity to Charlottesville and Richmond is attractive to many.

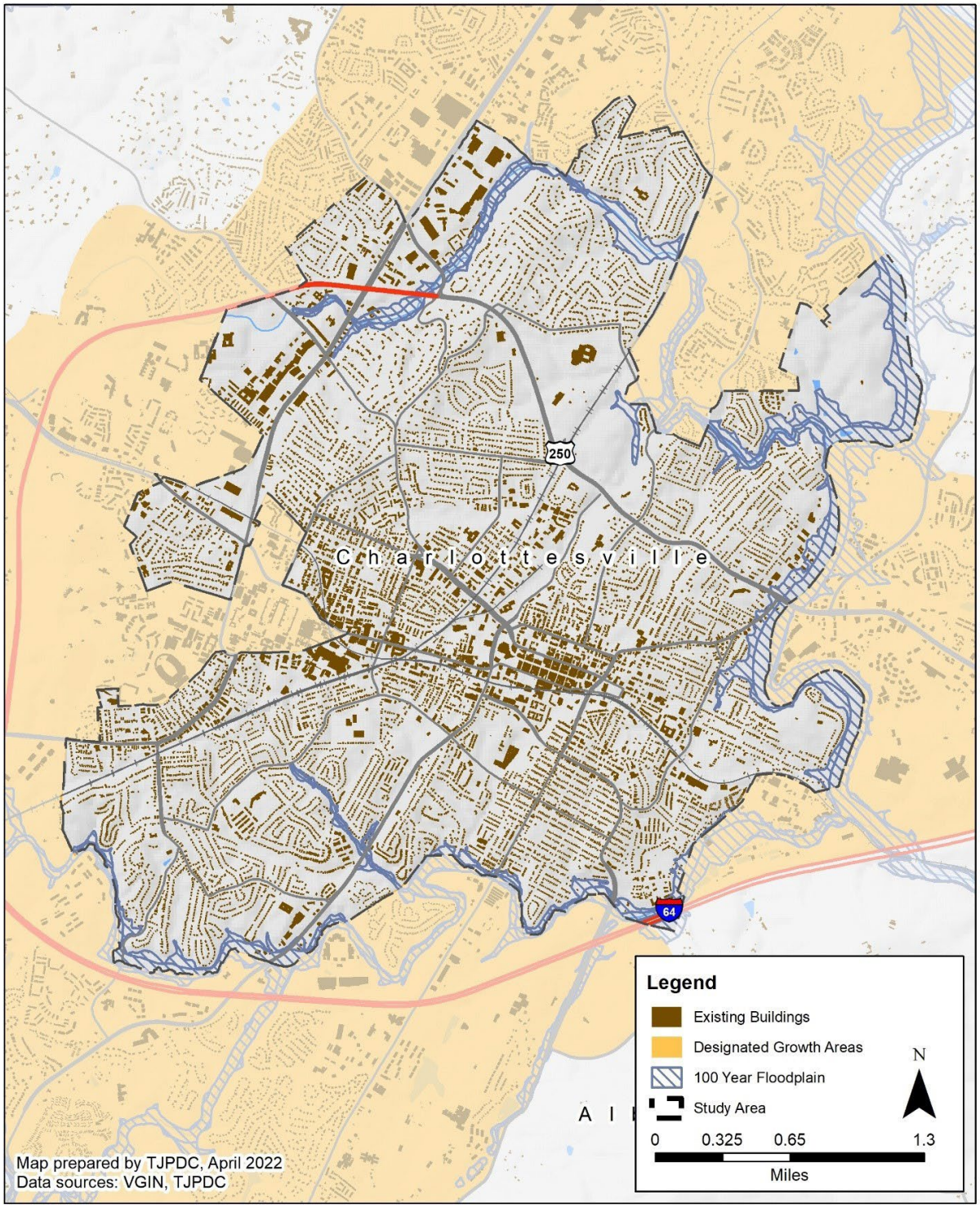
Greene

Within the last 5-year period, 42% of all structures (commercial and residential) were constructed within the designated growth area. The remaining 58% of structures were comprised of in-fill development within existing neighborhoods. However, in the last three years, over 1,600 multi-family and attached units have been approved within the County's future land use area. The current and planned infrastructure projects are designed to focus the new development into the County's future land use growth area. The Town of Stanardsville has not kept pace with growth, although revitalization efforts continue, among other things, to attract development to the Town. A newly approved planned unit development in Ruckersville is the first major multi-use place type in Greene County, which will induce further residential and commercial opportunities in the County.

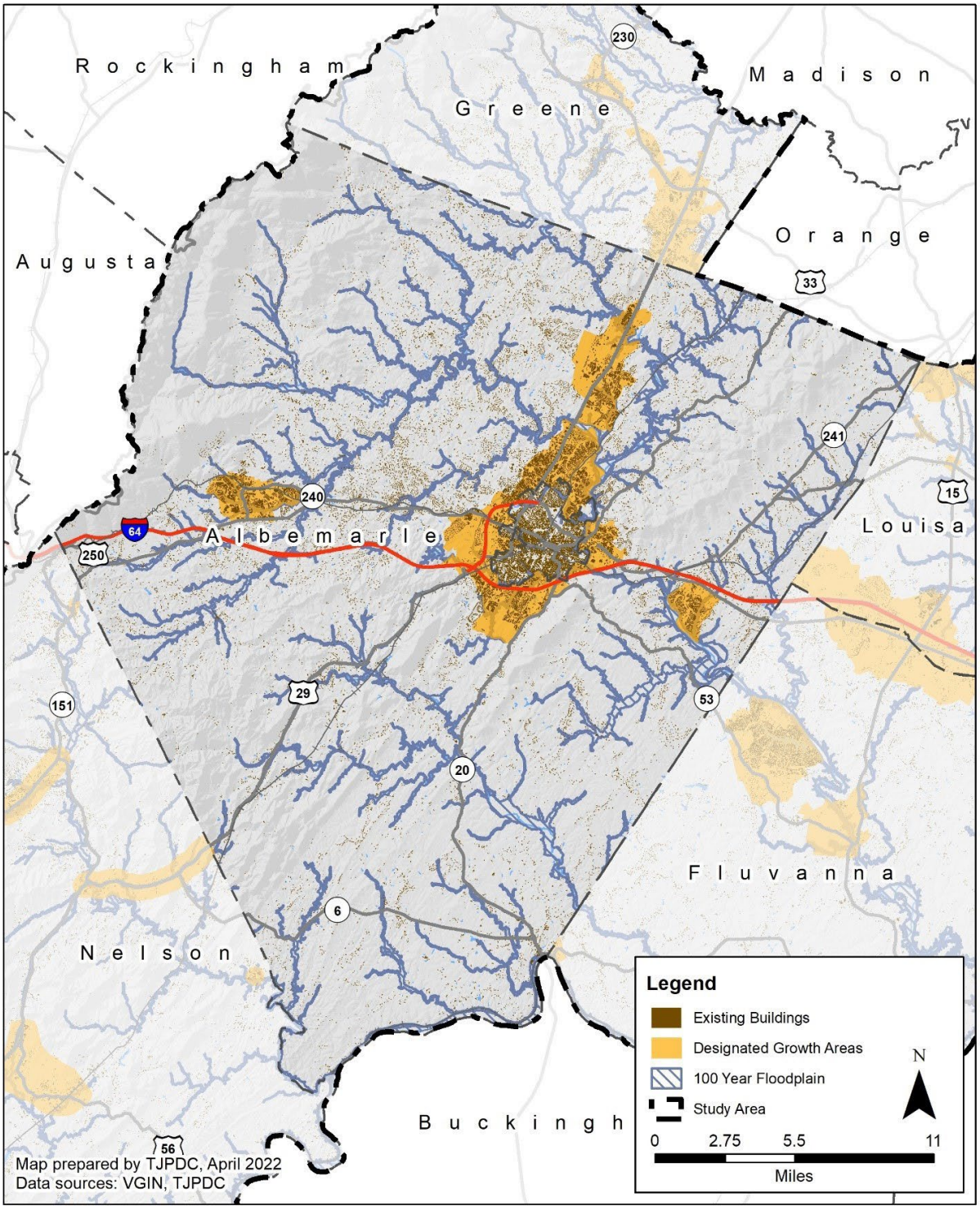
Nelson

Nelson County remains largely rural, with the slowest growth rate in the region. The major commercial corridor in the county is on SR 151, which houses significant tourism opportunities including wineries, breweries, distilleries, and Wintergreen Resort. There are currently no designated growth areas in the County. Housing stock has increased by 45% since 2010, with 42% of that in the County's village areas, while population has decreased by 1% (American Community Survey 2015-2019). The county is currently in the process of updating its Comprehensive Plan and designating growth areas will be part of the process.

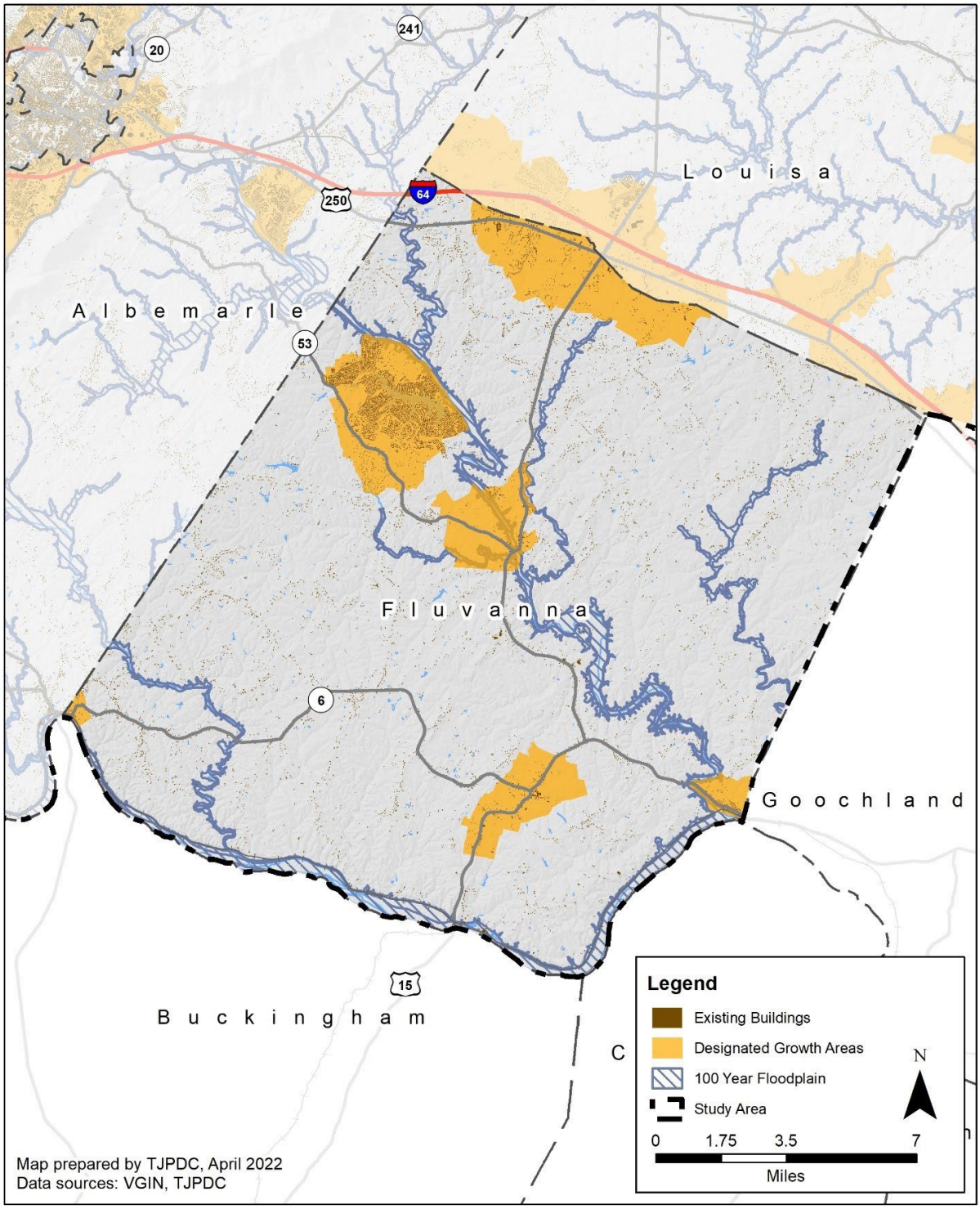
Buildings and Designated Growth Areas
Charlottesville City



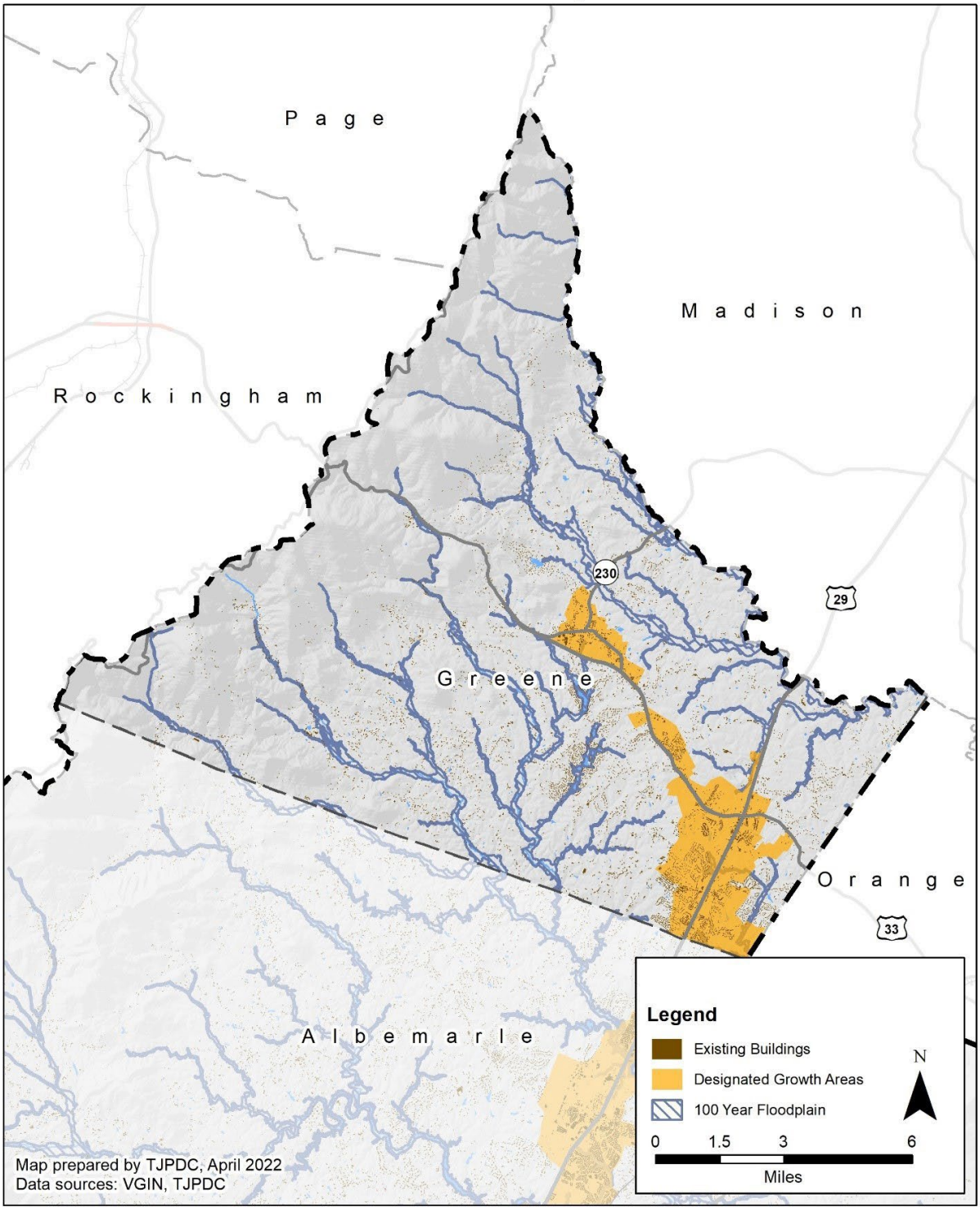
Buildings and Designated Growth Areas
Albemarle County



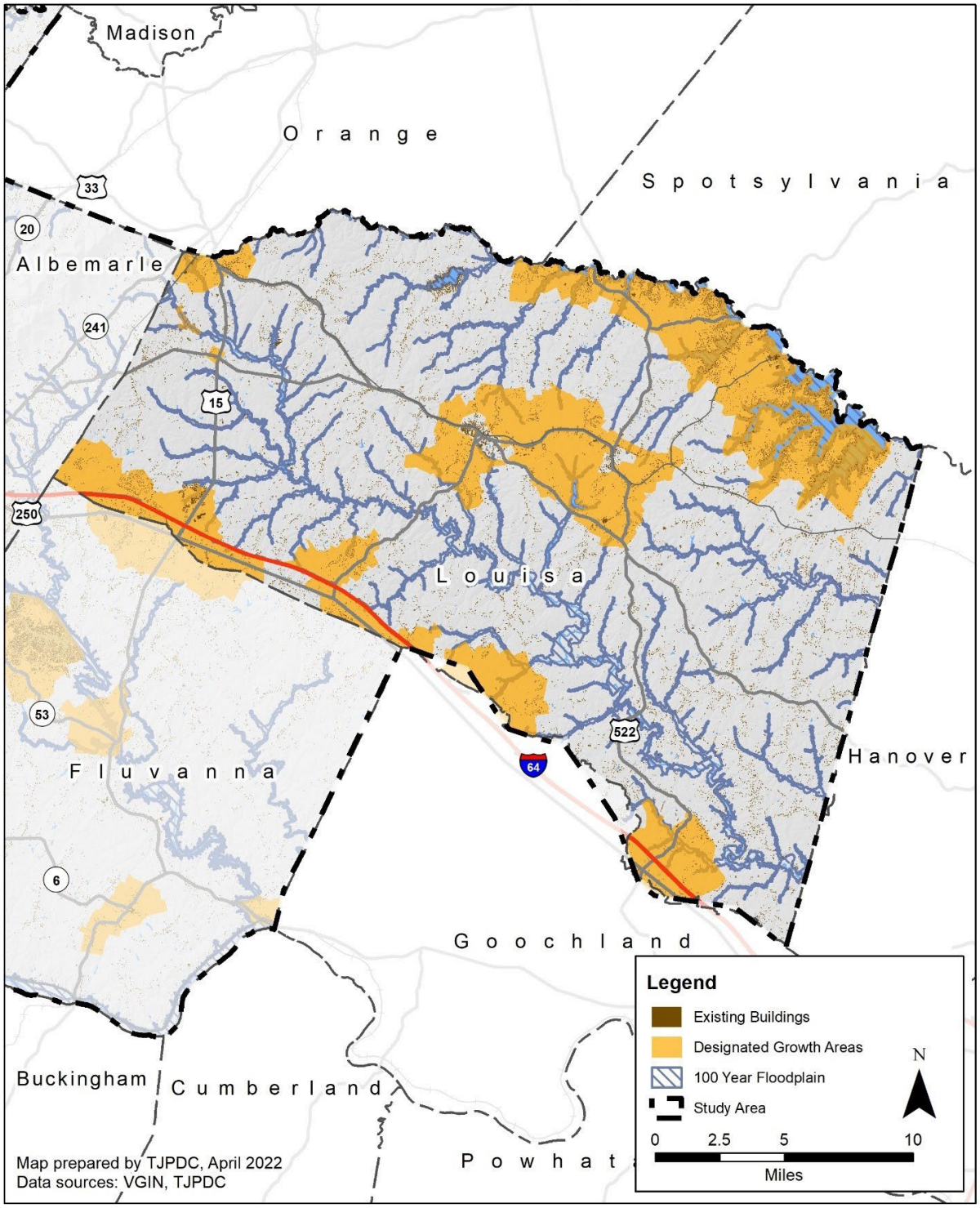
Buildings and Designated Growth Areas
Fluvanna County



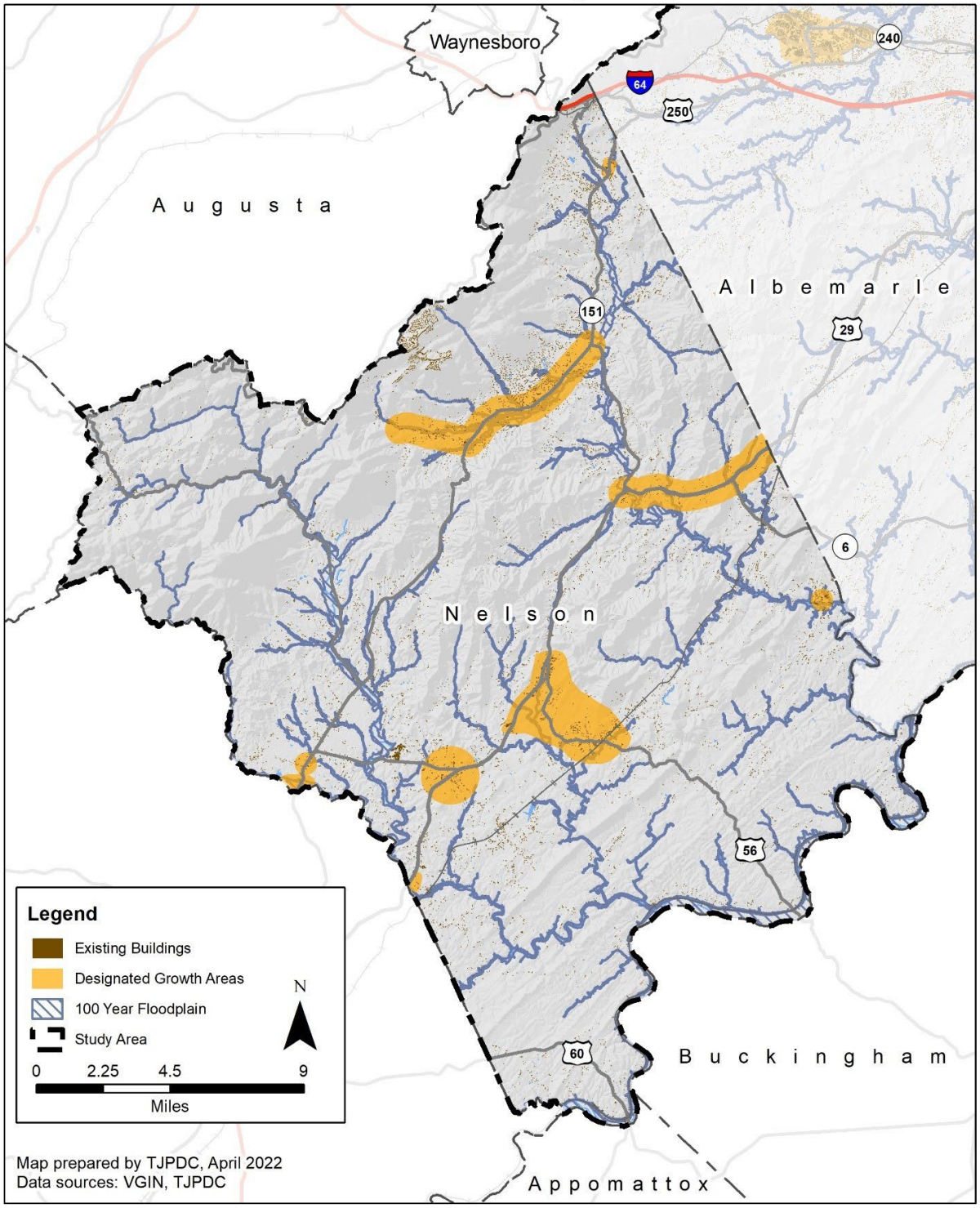
Buildings and Designated Growth Areas
Greene County



Buildings and Designated Growth Areas
Louisa County



Buildings and Designated Growth Areas
Nelson County



Infrastructure

The resilience and availability of essential infrastructure is critical to a functioning community and an effective emergency response. The table below, taken from HAZUS MH 5.1 shows the number and value of transportation and utility infrastructure in the Planning District.

Transportation Infrastructure

Transportation	Utility		
Number	Value*	Number	Value*
475.97 miles and 615 bridges	$9,406	75 facilities	$15,019

**Value in millions. Source: HAZUS MH 5.1*

Transportation includes highway, rail, and airport. Utility includes potable water, wastewater, natural gas, electric power, and communication. Includes both lines and buildings.

High Water Roads are roadways and/or bridges that can become impassable to traffic in event of a large-scale rain. The resulting road closures can be economically disruptive and can be a severe hindrance to emergency operations. Some of the roadways in Charlottesville and urban Albemarle are used by Charlottesville Area Transit, making any closure disruptive to bus service as well. Greenways are commonly located in floodplains, and heavy rain may render many trails in the region impassable. Closed roads can lead to traffic on better maintained thoroughfares and can create dangerous traffic conditions.

The following lists include high water roads in each of the localities. These lists were compiled by local emergency services staff:

High Water Roads-Albemarle, Charlottesville, UVA

- **21 Curves Road (Old Garth Road)**
- **21 Curves Road at pond 29 North at Camelot**
- **Airport Road at new post office (2 Times – doesn't close road – about to rebuild anyway)**
- **Albemarle Lake Road at Garth Road Alderman Road at Twyman**
- **Avon Street at Bridge**
- **Ballards Mill Road ¼ mile to 4024 (2 Times) Route 680 - Browns Gap Road at 240 (2 Times) Carters Bridge Route 20 South**
- **Cherry Avenue 500-700 block**
- **Cherry Avenue at Johnson School to Cleveland Clark Road just off 810**
- **Earlysville 700**
- **East High Street 1500 block) (2 Times – doesn't close road)**
- **East Market Street 1100 (3 Times)**
- **Esmont Road (old railroad trestle) (2 Times) Faulconer Drive at Railroad Bridge (2 Times) Free Union Road (4933-4920) (2 Times) Gilbert Station Road at 640 at bridge**
- **Ivy Depot Road / Route 786 at 250 (2 Times)**
- **Route 726 - James River Road at Totier Creek (2 Times) Jarmans Gap / Carter Street (2 Times – road to be rebuilt soon)**
- **Jefferson Park 1700 at Woodrow**
- **Kingston Drive at West Leigh Drive (2 Times) Meade Avenue 200**
- **Meade at Fairway over the bridge Milton Road 2100 at Milton Hills North Berkshire 2300**
- **Old Ballard Road (2 spots) Old Ivy Road at Garth Road**
- **Old Ivy Road at underpass and exit ramp (2 Times)**
- **Old Lynchburg Road 1200**
- **Polo Grounds Road east of Route 29 North**
- **Proffit Road at North Fork Rivanna**
- **Stony Point Road at Key West**
- **University Avenue east of Emmet**
- **Route 795 past Route 622**
- **Route 20 south at 708**
- **Route 240 at 680**
- **Route 240 Browns Gap Turnpike**
- **Route 250 west at UPD (clears quickly after rain) Route 250 bypass at Locust (clears quickly after rain)**
- **Route 29 north At Camelot**
- **Route 29 ¼ mile south of Red Hill (2 Times)**
- **Route 53 ¼ mile past Monticello exit**
- **Route 53 at Jefferson Vineyard (2 Times)**
- **Route 53 at Monticello**
- **Route 6 at Scotland Farm**
- **Route 600 ¼ mile from Route 22**
- **Route 600 at Route 20 (2 Times)**
- **Route 600 Watts Passage Railroad bridge Route 601 at 810 (2 Times)**
- **Route 601 at Barracks Road Route 602 and 722**
- **Route 614 1st low spot from Whitehall to Sugar Hollow Route 620 1/8 mile south of County Line**
- **Route 620 at Buck Island Creek Route 622 1 ½ mile from 795 (closed)**
- **Route 622**
- **Route 773**
- **Route 761**
- **Route 622 at Hardware River**
- **Route 626 Loan Oak Farm (2 Times) Route 627 at Albemarle Farm**

- Route 627 at View Mount Farm (3 Times) Route 631 and 706 at bridge
- Route 631 at Dudley Mountain Road Route 631 at Gentry Lane (2 Times) Route 640 at Route 20 (2 Times)
- Route 641 Advance Mills Road (little bridge - 4 Times) Route 667 (2 Times)
- Route 672 (2 Times)
- Route 674 - Slam Gate/ Heart break Road (2 Times) Route 680 – Brown's Gap from 240 to 802 (3 Times) Route 683 – Shelton's Mill (closed)
- Route 687 (2 Times)
- Route 704 between Route 715 and dead end Route 706 ½ mile off 631 (2 Times)
- Route 708 at KOA (2 Times)
- Route 708 at Nutmeg Farm (2 Times) Route 708 between 627 and 795
- Route 712 at 713
- Route 712 between 627 and 717
- Route 712 between 719 and 631
- Route 712 between Route 713 and 795
- Route 713 from 20 to dead end (3 Times)
- Route 715 between 20 South and 627
- Route 715 between 719 and Route 6
- Route 723 south of Route 6
- Route 726 – James River Road - at Totier Creek (closed) Route 729 near Route 53 (2 Times)
- Route 736 between 635 and 636 (2 Times)
- Route 737 between 726 and route 6 (3 Times)
- Route 747 Route 723 south of route 6 (closed)
- Route 761 between 622 and 620
- Route 776 off Route 667 (5 Times) Route 786 at 250 Ivy Depot Road Route 795 at 638 (Hardware River) Route 795 at Ash lawn
- Route 795 between 713 and 708 (3 Times)
- Route 795 between Route 620 and Route 708 (washed out under pavement – fixed)
- Route 795 north of Ash Lawn Route 810 Mont Fair (2 Times)
- Route 810 North 601
- Route 810 near Crozet Rescue Squad (stream to Beaver Creek)
- Route 810 north route 687
- Route 810 Nortonsville Route 628 (2 Times) Route 810 1st bridge north Garrisons Sharon Road 1/10 mile to 6 (Route 622) Sharon Road at the bridge (3 Times)
- Totier Road North of Route 626
- Watts Passage Road between bridge and railroad track West Leigh Drive/ Leigh Way (annually) (Has been fixed, but it didn't work)
- West Leigh Drive at 250 (2 Times – rare and due to poor ditches)

High Water Roads—Fluvanna County

- Hardware Road (Route 646 at HRWMA) Bremo Road
- East River Road (Route 6 – Columbia) East River Road (Route 6 – Rivanna) West River Road (Route 6 – Scottsville) West River Road (Route 6 – Hardware) North Boston Road (Route 600) Carysbrook Road (Route 615)
- Hunters Lodge Road (Route 631) Bybees Church Road (Route 613) Ridge Road (Route 632)
- James Madison Highway (Route 15 at Cunningham Creek)
- Venable Road (Route 601 at Kent Branch) Venable Road (Route 601 at Venable Branch) Route 617 between 15 & 31
- Route 630 at Byrd Creek and at Venable Creek (between 601 and 659)
- Route 649 at Middle Fork Cunningham Route 659 between 712 and 626
- Route 759 between 250 and dead-end

High Water Roads—Greene County

- Smaller Routes 605, 667, 634, 628, 621, 616, 642, 619,
- 627, 635, 643, and 810

High Water Roads—Louisa County

- Route 601 at South Anna River and Cub Creek
- Route 604 at South Anna River and at Harris Creek (between 646 and 714)
- Route 610 at South Anna River Route 611 at Flemings Creek Route 613 at Duckinghole Creek
- Route 624 at Christopher Creek (between 623 and 625) Route 635 at South Anna River
- Route 636 at Millington Creek Route 639 at North Anna River
- Route 640 at Fosters Creek (between 613 and 626), South Branch Creek (between 604 and 605), and Deep Creek (between 629 and 647)
- Route 644 between 605 and 33 Route 645 at unnamed creek Route 646 at South Anna River
- Route 647 at South Anna River (between 522 and 640) Route 651 between 669 and Orange County
- Route 660 at Happy Creek Route 663 at Owens Creek
- Route 665 at Northeast Creek branch
- Route 669 at North Anna River and Fox Branch Creek Route 683 at Fork Creek
- Route 692 at north and south forks of Hickory Creek Route 695 at South Anna River
- Route 697 at unnamed creek Route 714 at unnamed creek Route 717 at Central Branch

High Water Roads—Nelson County

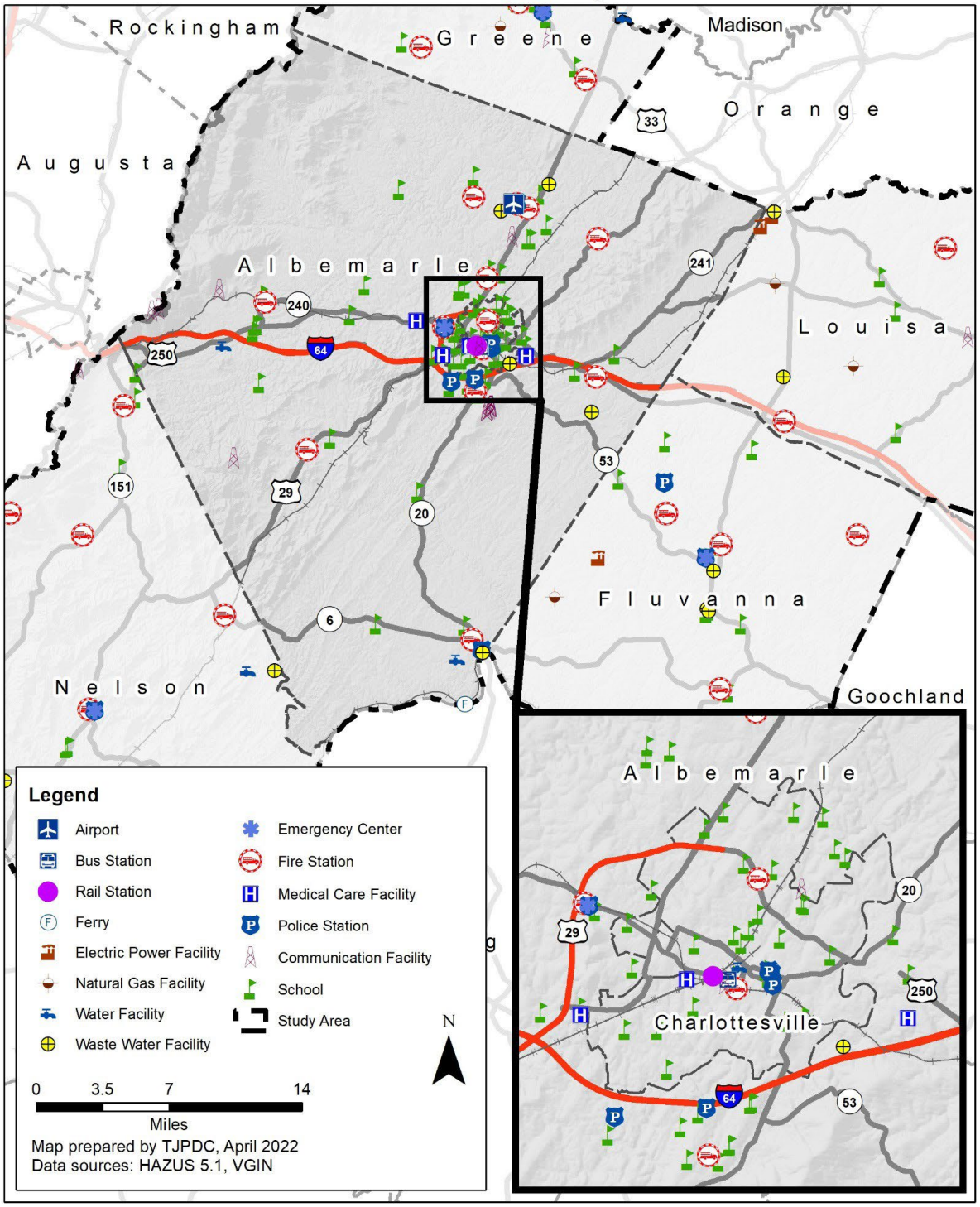
- **Rt 655 .30 miles east of Rt. 151**
- **Rt. 56 west has several spots depending on amounts of rain.**
- **Rt. 56 .10 miles west of Rt. 151**
- **Rt. 56 .15 miles east and west of Rt. 680N. Rt. 56 .30 miles west of Rt. 712**
- **Rt. 56 .40 miles west of Rt. 814**
- **Rt. 56 .60 miles west of Rt. 687**
- **Rt. 687/North Fork Tye River Road gets most damage to road in each flood due to stream crossings and stream along the roadway.**

Critical Facilities

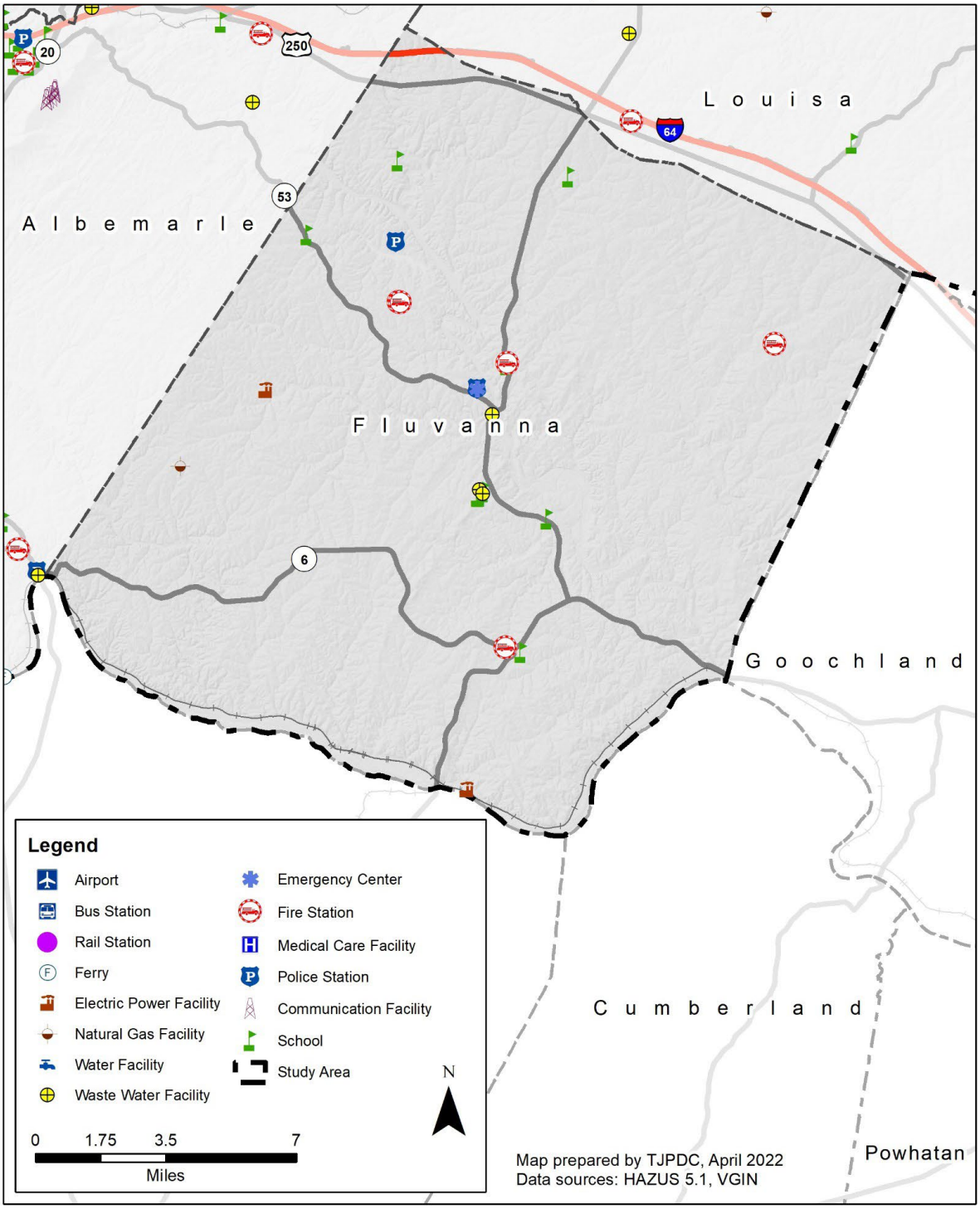
For the purposes of this plan, critical facilities were broken down into four categories: emergency facilities, essential infrastructure, important community facilities, and high potential loss facilities. Each category includes the fol- lowing facilities.

1. **Emergency facilities: should be operational directly following a disaster:**
   - Hospitals/Medical clinics
   - Police stations
   - ire stations
   - Emergency operation centers
   - Shelters
2. **Essential Infrastructure: necessary to retain operational status of community; to be restored as quickly as possible following a disaster**
   - Transportation systems—includes roads, bridges, rail, airports, bus stations, ferry
   - Potable water systems
   - Wastewater systems
   - Power—includes buildings, substations
   - Communication systems—includes towers
   - Oil and natural gas facilities
3. **Important Community Facilities: structures which may incur significant loss of life, structural damage, and eco- nomic loss to the community.**
   - Schools/Daycares – includes schools that double as shelters
   - Prisons
   - Elderly, Disabled, or Assisted Living Facilities
4. **High Potential Loss Facilities: Facilities that have the potential to cause significant loss of life, structural damage, and economic loss to the community if they sustain damage from a natural disaster.**
   - Structures housing Hazardous Materials
   - Facilities on CERCLIS (Superfund)
   - RCRA Large Quantity Generators (facilities that generate over 1000 kg of ignitable, corrosive, reactive, or toxic waste per month)
   - Facilities on Toxics Release Inventory (1987 - 2009)

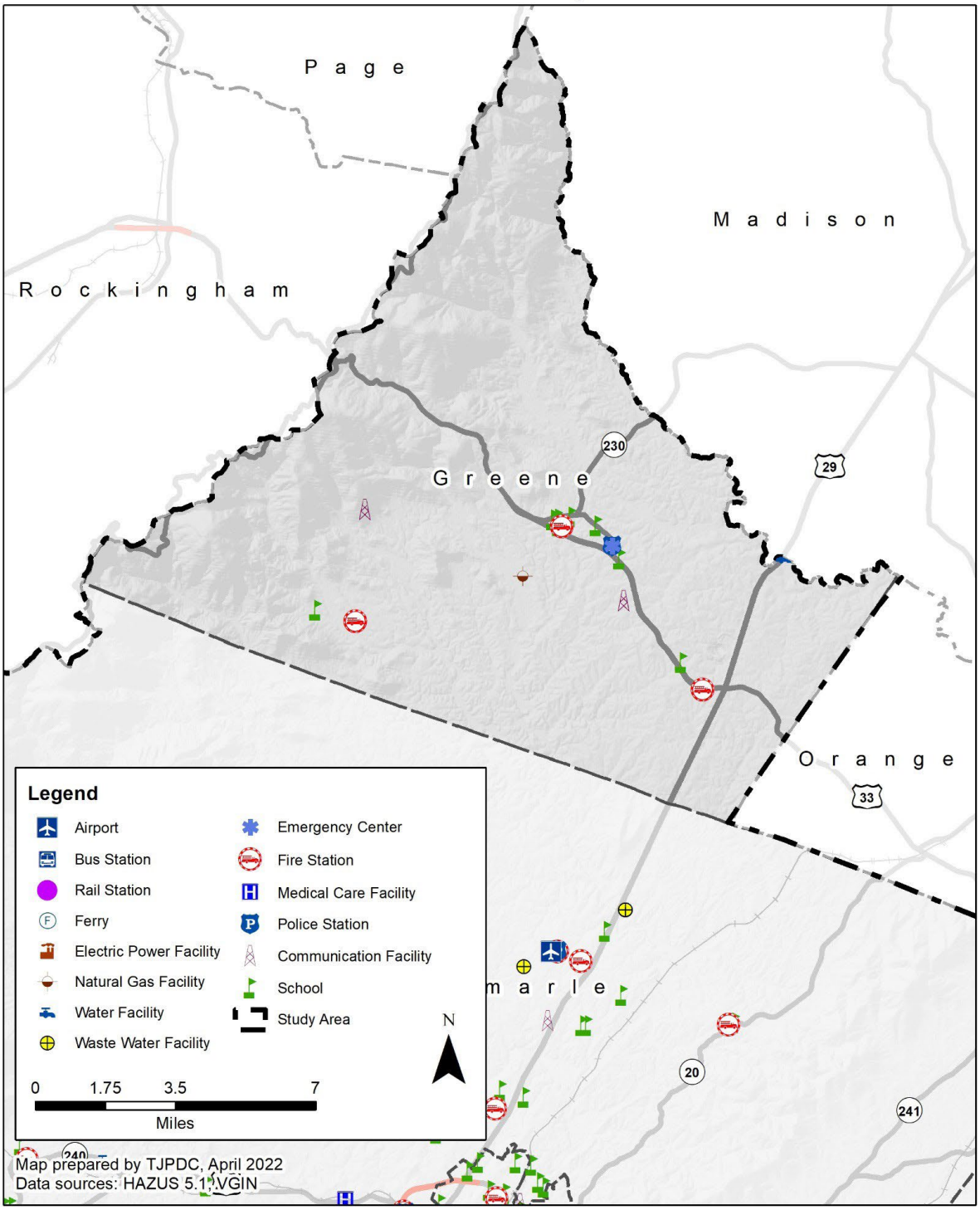
Critical and Important Facilities
Albemarle County



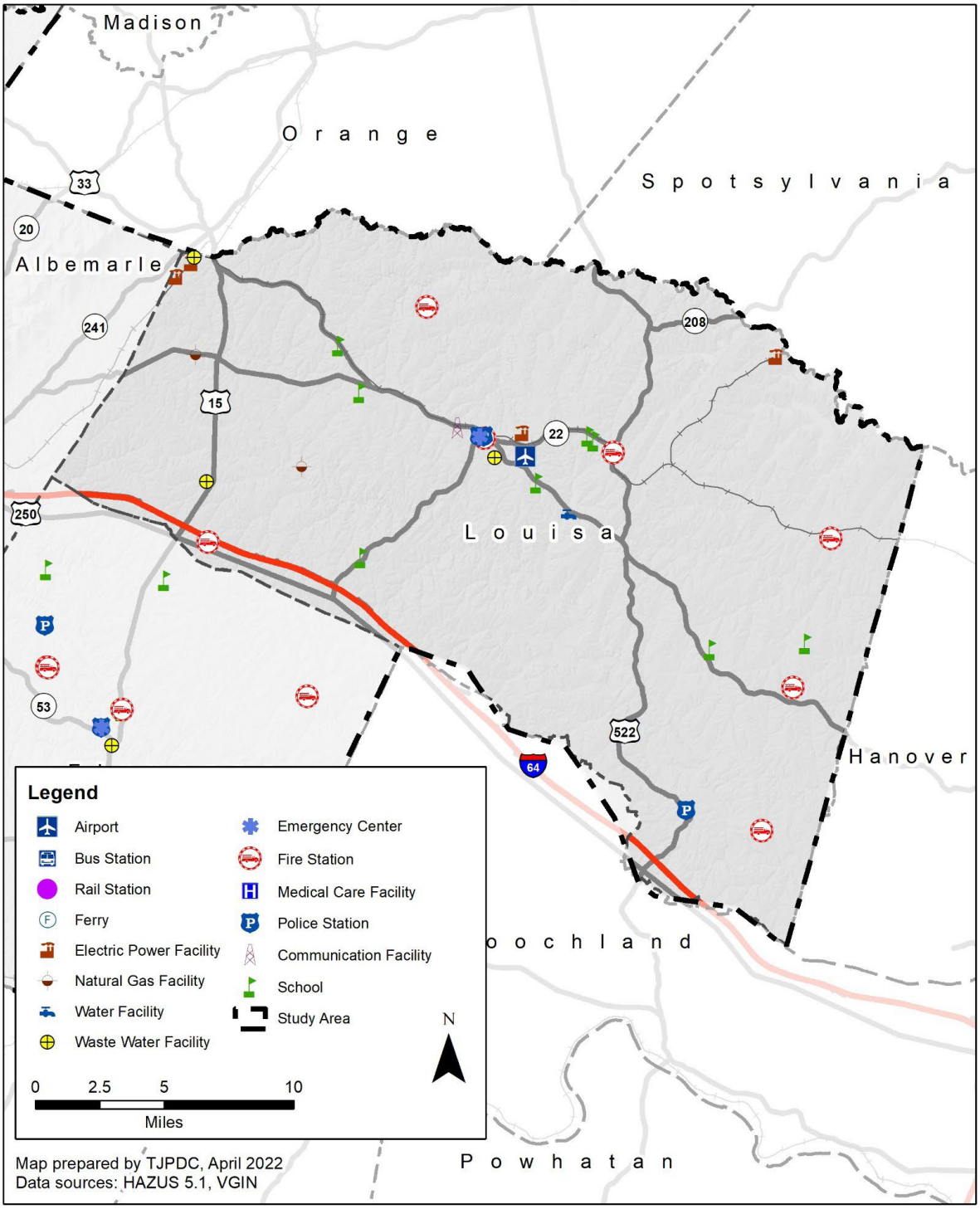
Critical and Important Facilities
Fluvanna County



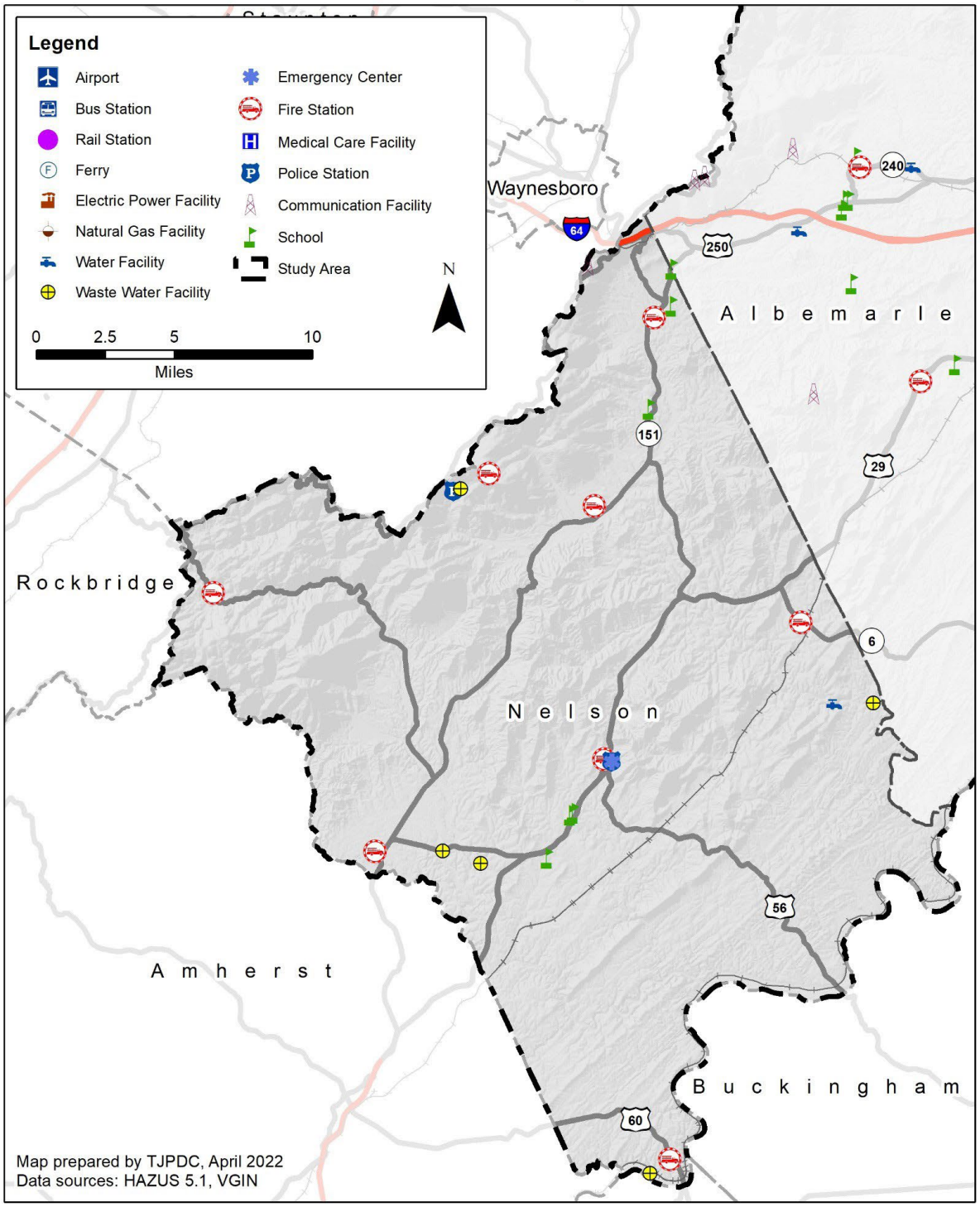
Critical and Important Facilities
Greene County



Critical and Important Facilities
Louisa County



Critical and Important Facilities
Nelson County



Estimating Potential Loss

1.1 Purpose

201.6(c)(2)(ii)(B): The plan should describe vulnerability in terms of an estimate of the potential dollar losses to vulnerable structures identified in paragraph (c)(2)(i)(A) of this section and a description of the methodology used to prepare the estimate…

The following section includes an inventory of assets and estimation of loss for the following hazards deemed to pose the most significant risk to the Planning District:

1. **Hurricane**
2. **Flood**
3. **Winter Storms**
4. **Communicable Disease**
5. **Lightning**
6. **Wildfire**
7. **Drought and Heat**
8. **Dam Failure**
9. **Tornado**
10. **Earthquake**
11. **Landslides**

Methods used to estimate losses vary by hazard, depending on data and models available, as well as the nature of the risk. Therefore, a description of methodology is included under the section for each hazard.

Source: TJPDC

Hurricane: Estimated Losses

Methodology

Hurricane losses have been estimated using HAZUS MH

5.2. The hurricane model predicts losses due to wind, including wind pressure, wind borne debris missiles, tree blow down, and rainfall. Flooding or other hazards that may be linked to hurricanes are not measured in this section. The hurricane model uses the same inventory of existing building stock and critical facilities as the flood loss estimations, although transportation and utility infrastructure are not taken into account. Tree coverage and terrain have a significant effect on the results of the model. Losses are measured for structural damage, damage to contents and inventory, and disruption of business operations.

Two types of models have been used. First, parameters from two historic storms that have affected the Planning District were modeled: Hazel in 1954, representing a major hurricane, and Fran in 1996, representing a minor hurricane. Although there have been six hurricanes of Category 3 or higher in recent history in the TJPD, these two can be seen as a representative sample. It is important to note that results do not represent the actual impact of these storms, but rather the projected impact if a storm exactly like the historic event were to occur in the future.

Results

Scenarios based on historic storms Hazel and Fran reveal the broad difference between major and minor hurricane events.

Expected Losses Modeled from Historic Storm Event Parameters

Storm	Hazel (1954)	Fran (1996)
Building Damage (Count)	409	37
Households Displaced	2	0
Debris (tons)	150,959	26,761
Direct Property Loss	$ 34,711,000	$ 3,032,000

Source: HAZUS MH 5.1

In addition to the historic events, a range of hypothetical storms were modeled based on the predicted return period. The combination of methods provides

a balance between the specificity of actual events and the generality of informed probabilistic future events.

Annualized Expected Losses to Hurricanes by Locality

Storm	Capital Stock Losses	Income Losses	Total Losses
10-Year Return	0	0	0
20-Year Return	0	0	0
50-Year Return	$ 3,444,000	0	$ 3,444,000
100-Year Return	$ 15,417,000	$ 26,000	$ 15,443,000
200-Year Return	$ 39,726,000	$ 60,000	$ 39,782,000
500-Year Return	$ 94,308,000	$ 473,000	$ 94,781,000
1000-Year Return	$ 149,649,000	$ 4,912,000	$ 154,561,000
Annualized	$836,000	$ 19,000	$855,000

Source: HAZUS MH 5.1

An annualized expect loss can be generated by combining losses from the full range of scenarios: 10-Year, 20-Year, 50-Year, 100-Year, 200-Year, and 500-Year Storms. Annualized losses, both direct and indirect, are predicted to be $855,000 for the region. The following table disaggregates this estimate by locality. As development increases, these numbers are very likely to increase. However, this may be somewhat attenuated by enhancements in hurricane prediction science and improved construction practices in newer buildings.

Source: TJPDC

Annualized Expected Losses to Hurricanes by Locality

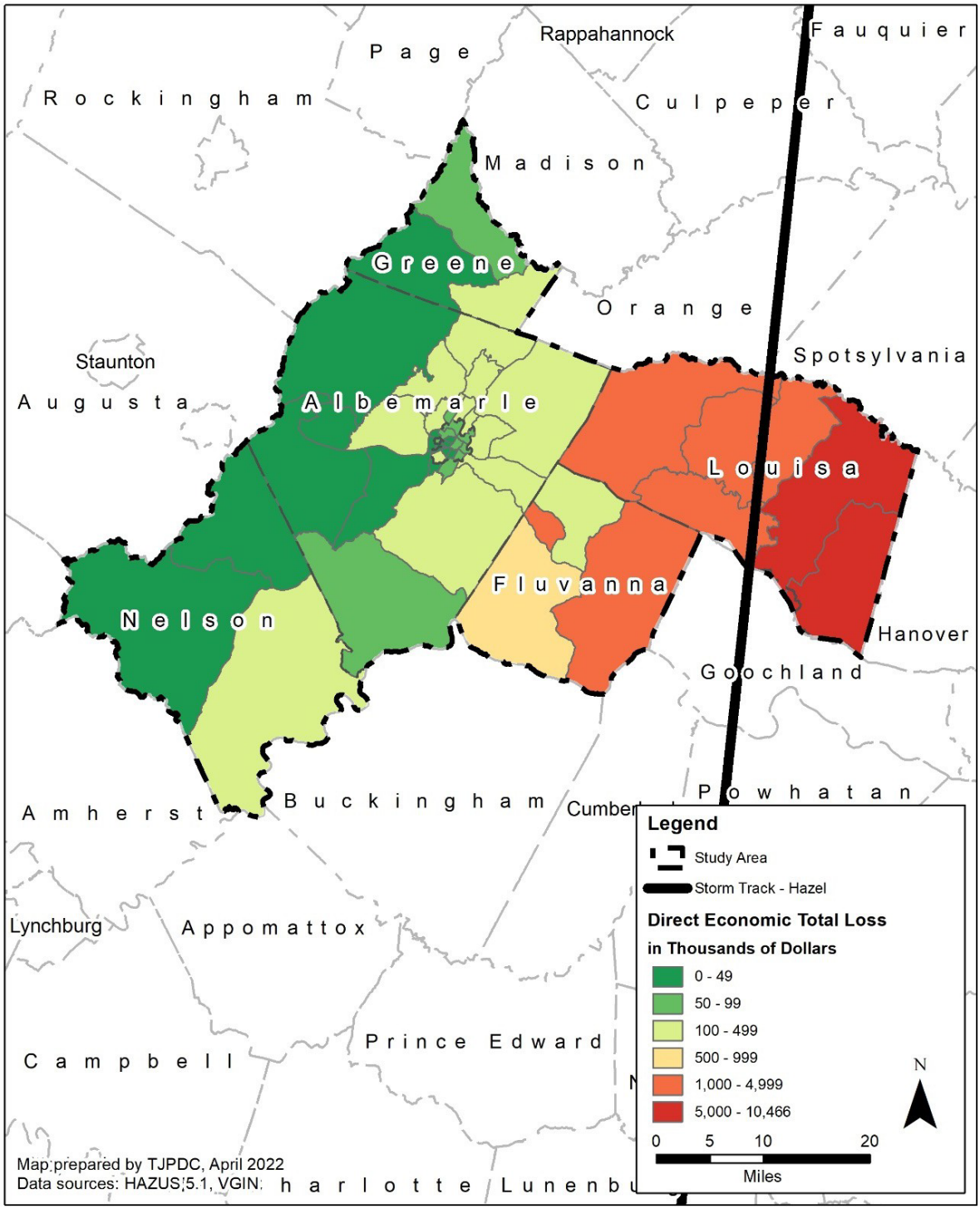
Locality	Annual Property Damage Loss	Annual Income Loss	Total Annual Losses
Albemarle	$ 301,000	$ 7,000	$ 308,000
Charlottesville	$ 94,000	$ 3,000	$ 98,000
Fluvanna	$ 140,000	$ 2,000	$ 142,000
Greene	$ 34,000	$ 1,000	$ 35,000
Louisa	$ 228,000	$ 3,000	$ 231,000
Nelson	$ 41,000	$ 2,000	$ 43,000
Region	$836,000	$ 19,000	$855,000

Source: HAZUS MH 5.1

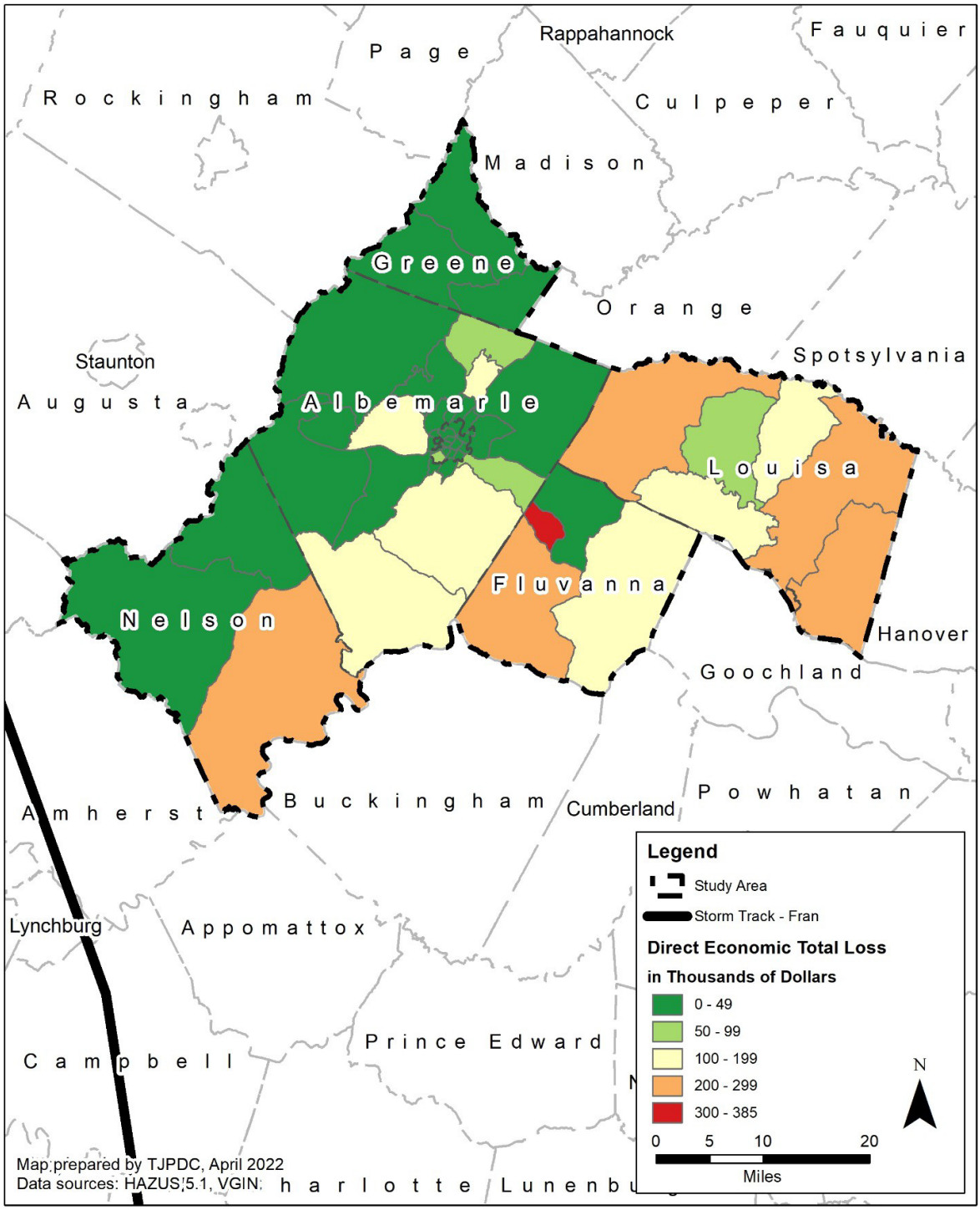
The following maps show residential, commercial, and industrial losses in thousands of dollars as determined by HAZUS MH 5.1.

Hurricane Event

Historic Hurricane Hazel Model



Hurricane Event
Historic Hurricane Fran Model



Flood: Estimated Losses

Methodology

The flood loss estimations were performed using the HAZUS MH 5.1 model developed by FEMA. The analysis is based on an inventory of estimates provided by FEMA of general building stock by census block in the region. Buildings are differentiated by occupancy type and estimates of square footage and value are derived from the type of structure. Other facilities and infrastructure, such as dams, and bridges are considered in the model, as well as the economic costs of displacement and business interruption. Losses are estimated by the proportion of the structures that would sustain damage under any particular scenario.

It should be noted that losses are estimated by census block. It is assumed that structures are distributed evenly throughout the block. Although precise planimetric data would be preferred, the census block-level data is the best available for use with the HAZUS model. For a full description of the loss estimation methodology, see the HAZUS MH 5.1 Technical Manual available from the FEMA website.

All the scenarios included below were generated for both 100-year and 500-year floods. Four separate scenarios were generated, one for each major waterway system in the region:

- **The Rivanna River and tributaries**
- **The James River and tributaries upstream from the Rivanna River**
- **North Anna River in Louisa County**

Each scenario assumes that a flood warning was issued, allowing a certain amount of time for households to remove contents and perform some emergency mitigation to protect individual structures. For purposes of agricultural losses, an assumed flood date of July 1 is used. Historically, flooding has occurred in all seasons approximately equally in the TJPDC, so the assumption is not based on any special prevalence for summer flooding.

The HAZUS MH 5.1 flood model does not estimate casualties due to flooding. National data does not reveal any per capita increase in flooding casualties over the last several decades, so it can be assumed that casualties in the region will only increase proportional to population.

Results

Direct Expected losses are a measurement of flood damage to building stock and contents of buildings within the region.

Direct economic loss to the region from a 100-Year flood is estimated to be $607,562 with 75% the total loss occurring in Albemarle and Charlottesville combined. Most of the damage, approximately 83%, is expected to be incurred by residential structures. However, notable damage to commercial and industrial sites in Albemarle County and Charlottesville is also expected. The levee in Scottsville will hold, preventing a significant increase in damage to the town. A total of 4,489 people are expected to be displaced and in need of temporary shelter, and 32,587 tons of debris are expected to be generated. The number of casualties directly attributed to a 100Year Flood can be expected to remain low, between one and zero series injuries. However, the likelihood of casualties may grow in proportion to population growth.

There are also overlaps between flooding and other hazards such as hurricanes and winter storms, which can result in springtime flooding. There are also indirect costs to consider. The following indirect costs of a flood event would be incurred, in addition to the direct costs cited above:

- **Loss of business operations impeded by flooding and recovery**
- **Costs of either temporary or permanent relocation of uses**
- **Loss of wages and rental income**
- **Devaluation of land in response to flood event**
- **Spill-over effects on business operations not direct impeded by flooding and recovery**

An updated Hazard Mitigation Plan may offer quantified estimates for these indirect costs, as data becomes available, as well as estimates for the full range of flood probabilities endemic to the region. The following tables

Direct Economic Losses after 100-Year Flood Event (In Thousands of Dollars)

Locality	Total Loss	Building Loss	Contents Loss
Nelson	50,178	38,565	11,613
Fluvanna	40,547	34,454	6,093
Albemarle	386,355	304,487	81,868
Greene	17,427	11,218	6,209
Louisa	42,777	35,130	7,647
Charlottesville	70,278	49,393	20,885
Region	607,562	473,247	134,315

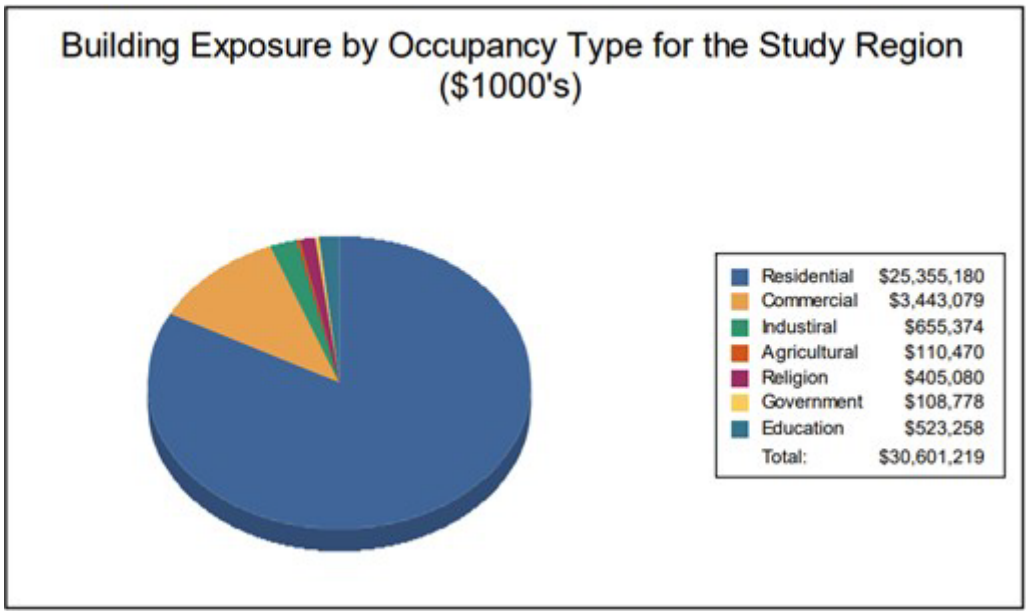
Source: HAZUS 5.1

Building exposure by occupancy type, the percent of all buildings damaged by flood ing, the number of people displaced, and the amount of debris removed.

Building Exposure by Occupancy Type for the Study Region

Occupancy	Exposure ($1000)	Percent of Total
Residential	25,355,180	82.9%
Commercial	3,443,079	11.3%
Industrial	655,374	2.1%
Agricultural	110,470	0.4%
Religion	405,080	1.3%
Government	108,778	0.4%
Education	523,258	1.7%
Total	**30,601,219**	**100%**

Source: HAZUS 5.1



Source: HAZUS 5.1

Debris after Flooding

Locality	Debris (tons)
Nelson	3,102
Fluvanna	1,822
Albemarle	18,191
Greene	612
Louisa	2,165
Charlottesville	9,695
Region	32,587

Source: HAZUS 5.1

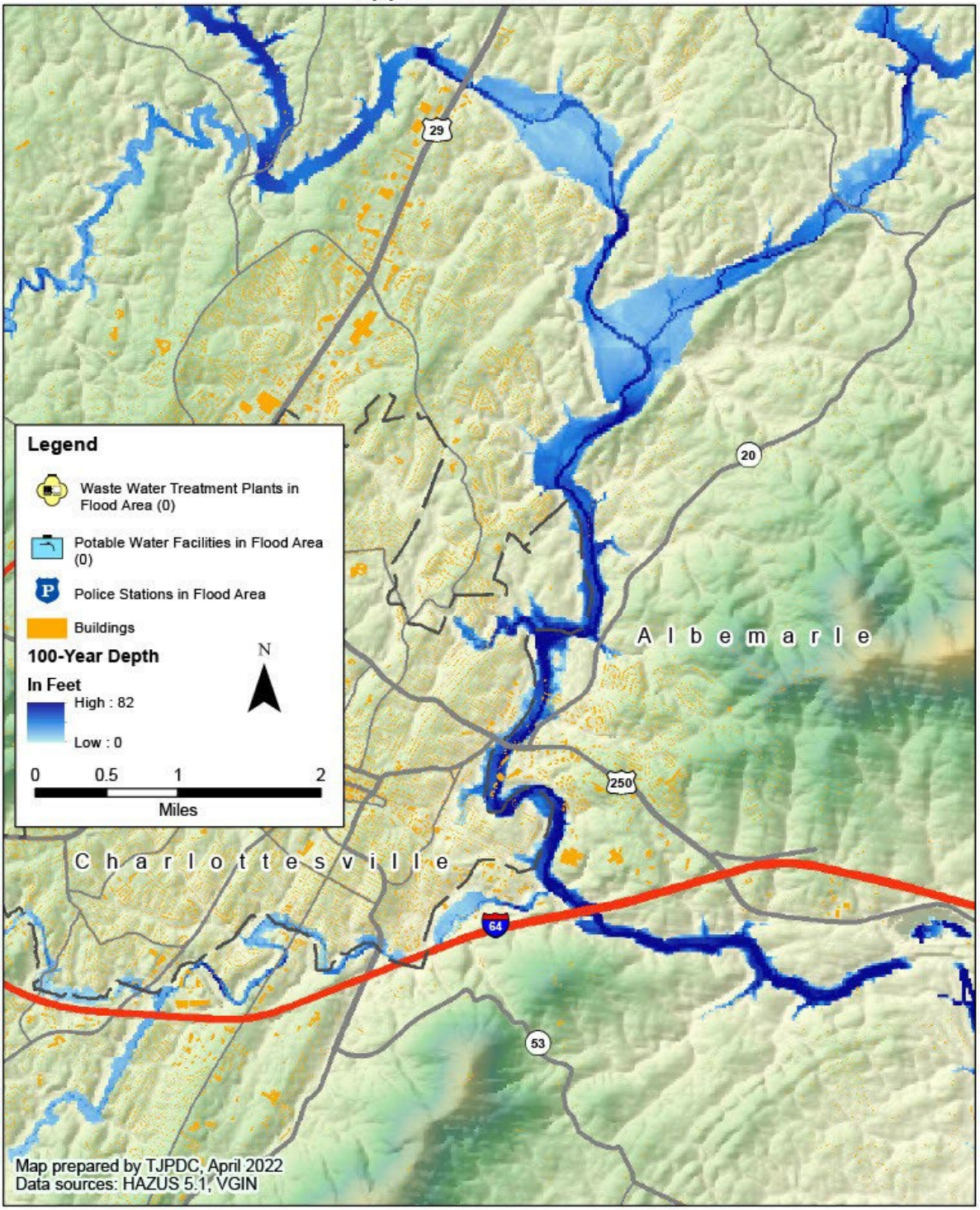
Displaced Populations

Locality	Displaced Population
Nelson	500
Fluvanna	306
Albemarle	2,312
Greene	307
Louisa	347
Charlottesville	717
Region	4,489

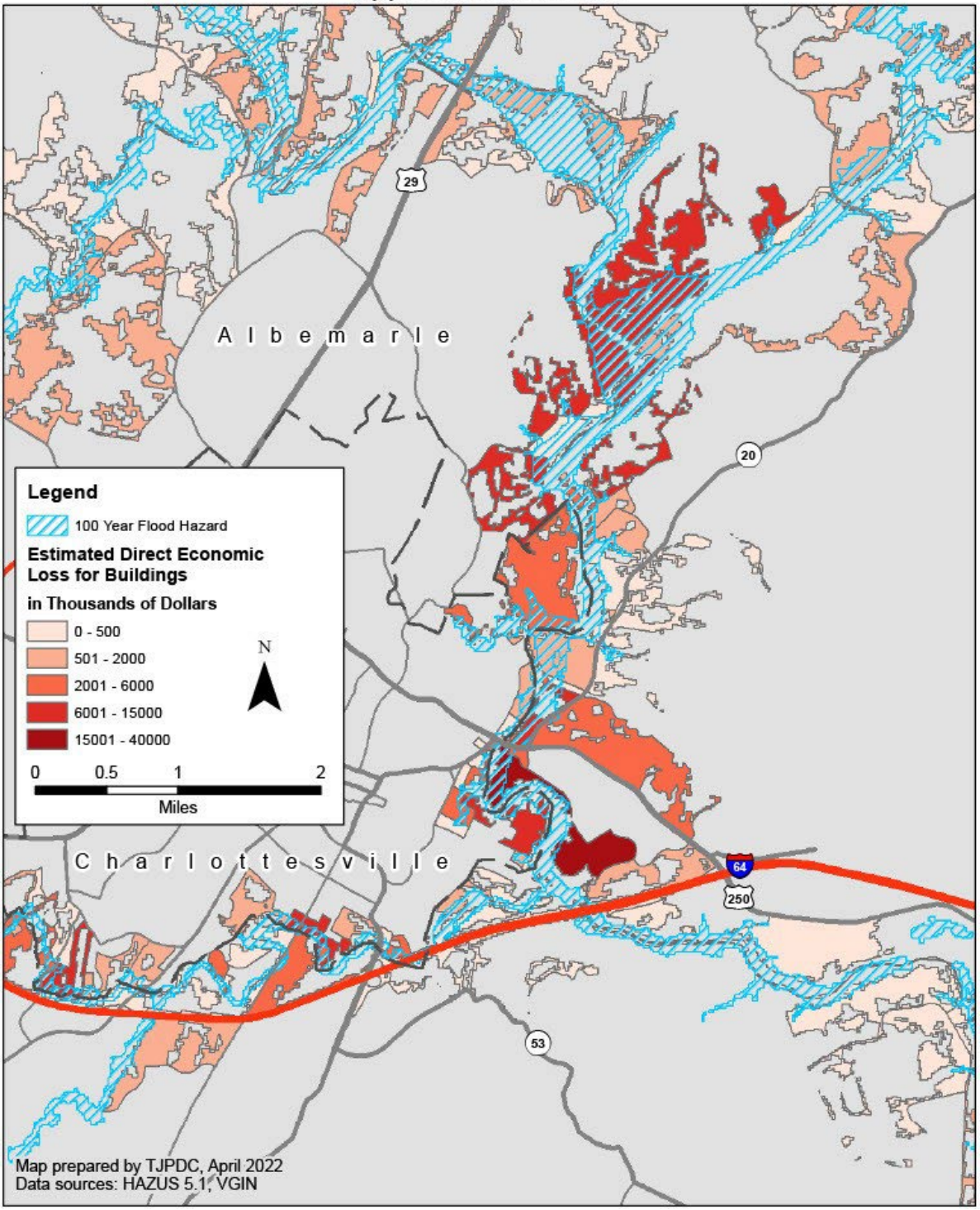
Source: HAZUS 5.1

The expected damage to residential square footage exceeds damage to all other uses combined, although on a percentage basis non-residential structures are over- represented. Most of the damage is expected to occur in basements and some first floors in the flood-plains of the Rivanna and James Rivers. Albemarle County and the City of Charlottesville are expected to receive the most damage, and Greene County and Louisa the least, although it should be noted that rivers in each of these rural counties were not included in the analysis due to insufficient data. The maps on the following pages depict more localized loss estimates along the three river systems analyzed. The first map shows the depth grid of the river at the peak of its flood stage. The second map depicts expected economic losses by block group in the flood area. Separate maps for the Town of Scottsville and the flood-prone portion of the City of Charlottesville are included. These areas are especially susceptible to flooding, and, in Scottsville's case, the existence of a levee protects the town against a 100-Year flood risk.

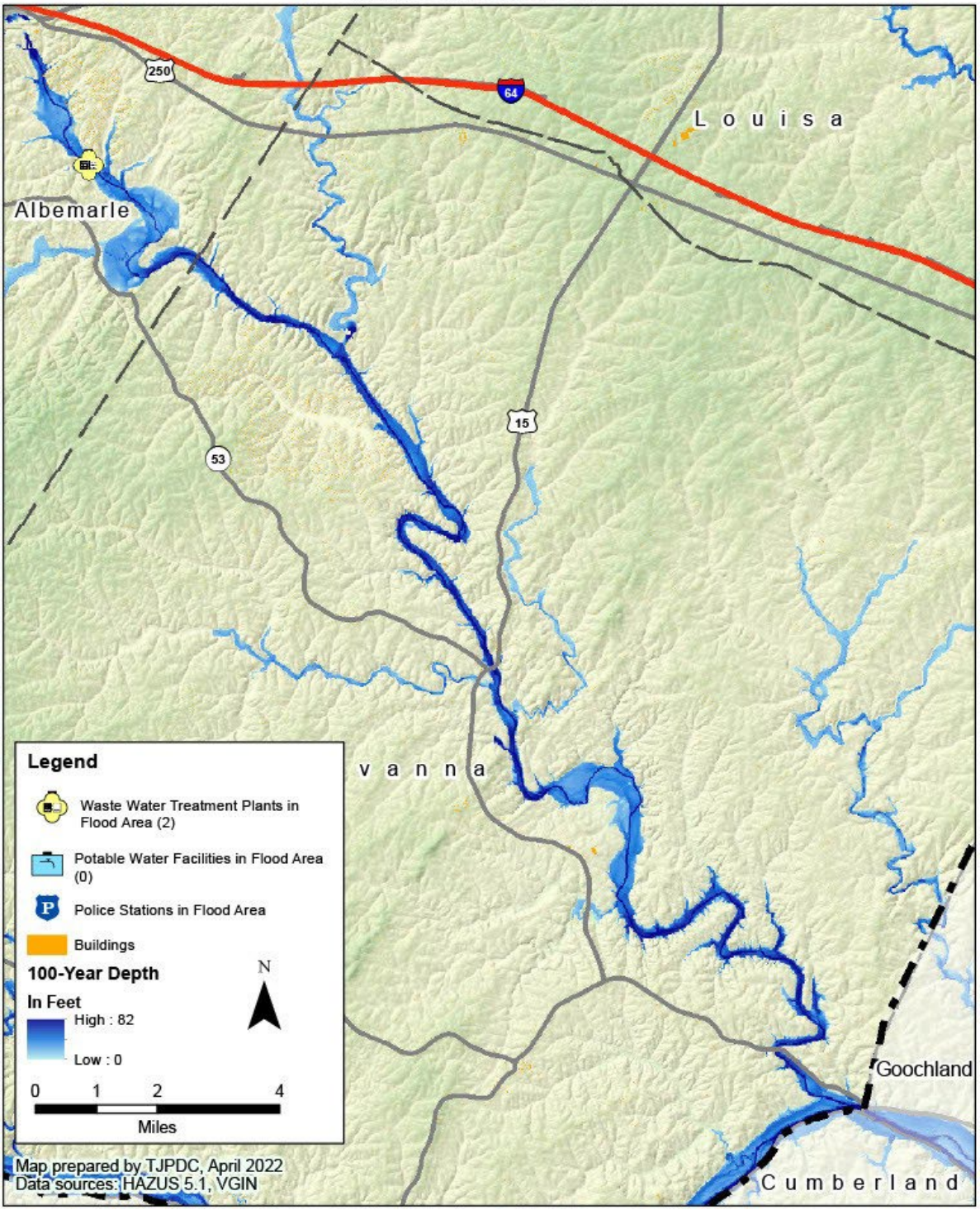
100 Year Flood Event
Upper Rivanna River



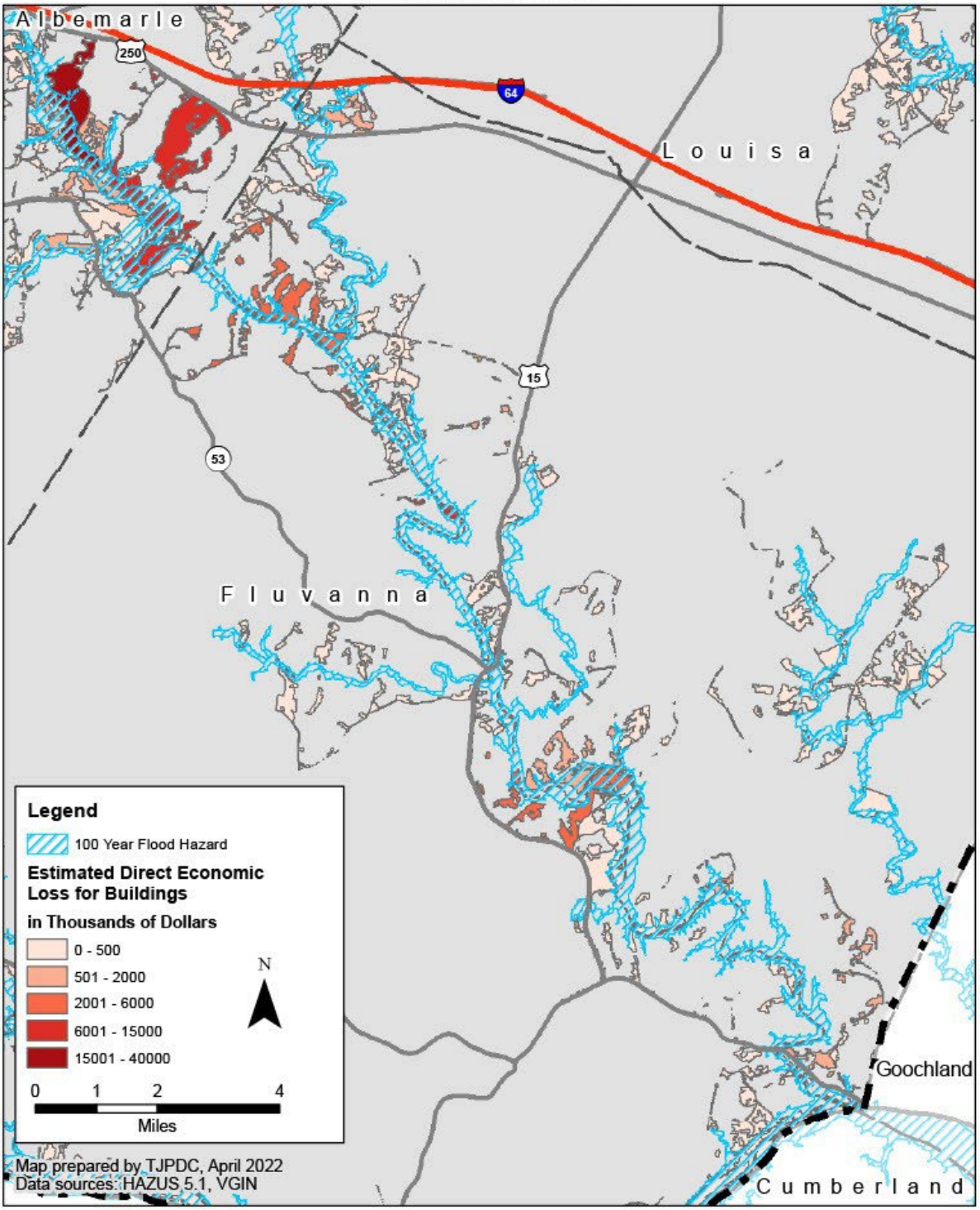
100 Year Flood Event
Upper Rivanna River



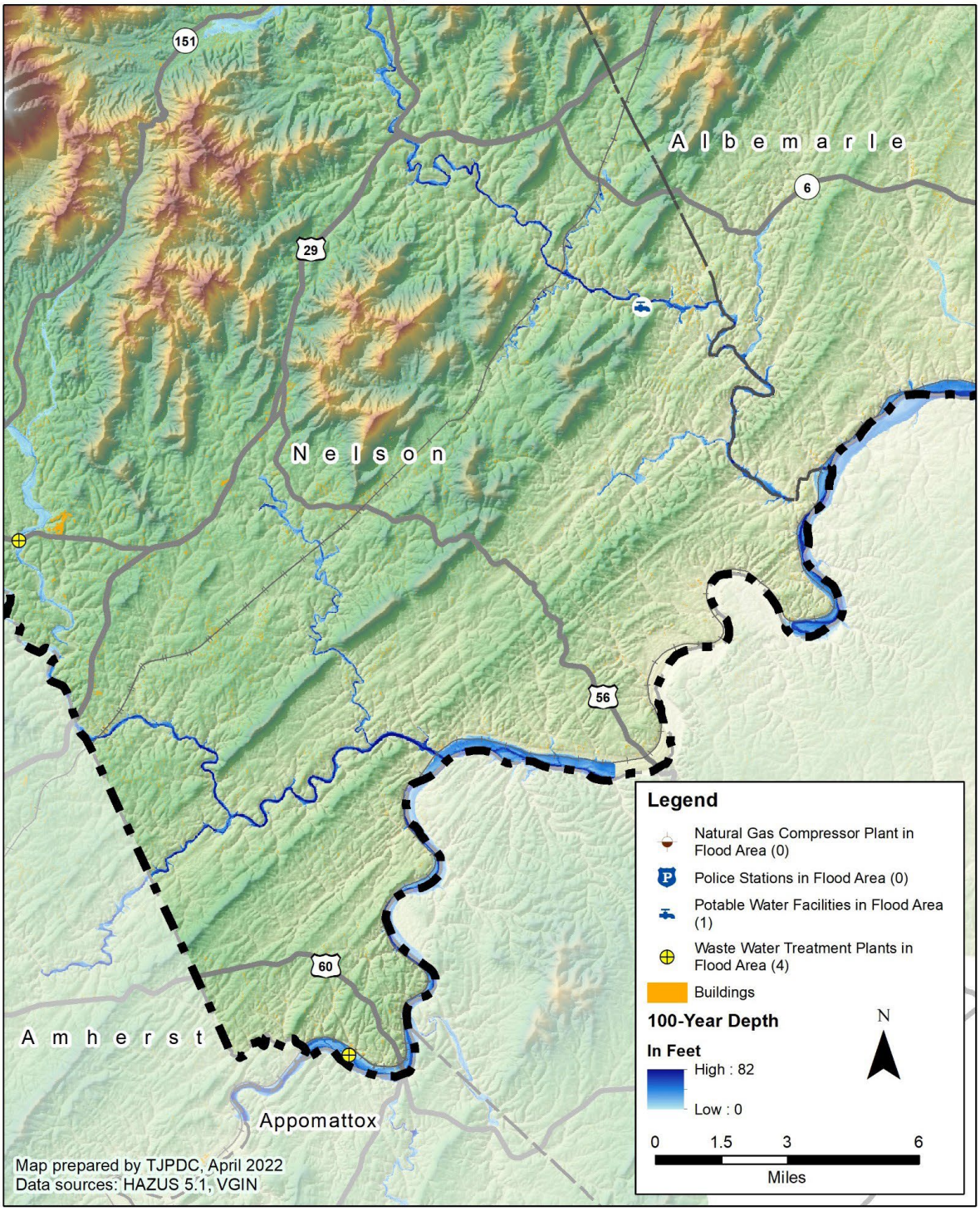
100 Year Flood Event
Lower Rivanna River



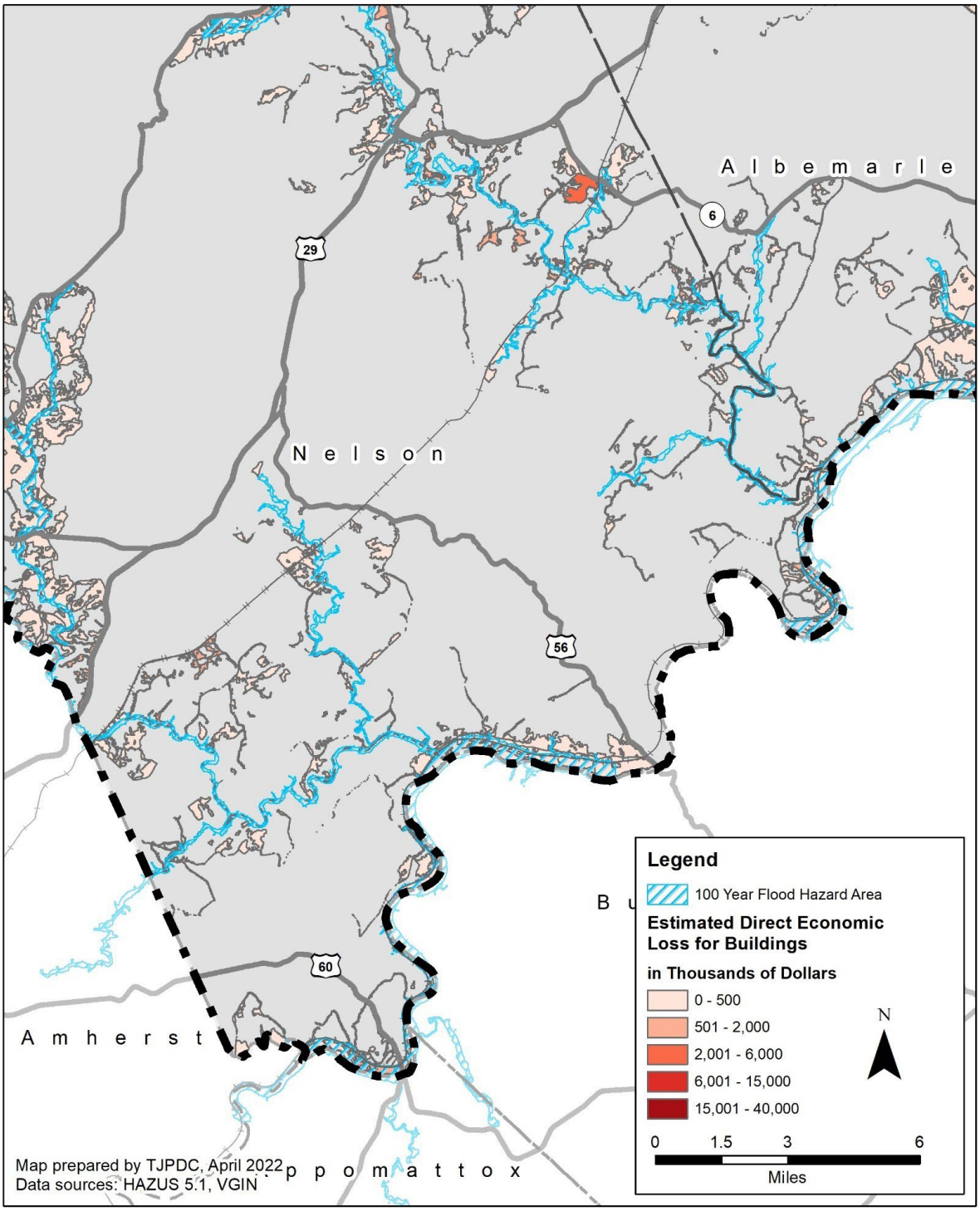
100 Year Flood Event
Lower Rivanna River



100 Year Flood Event
Upper James River



100 Year Flood Event
Upper James River



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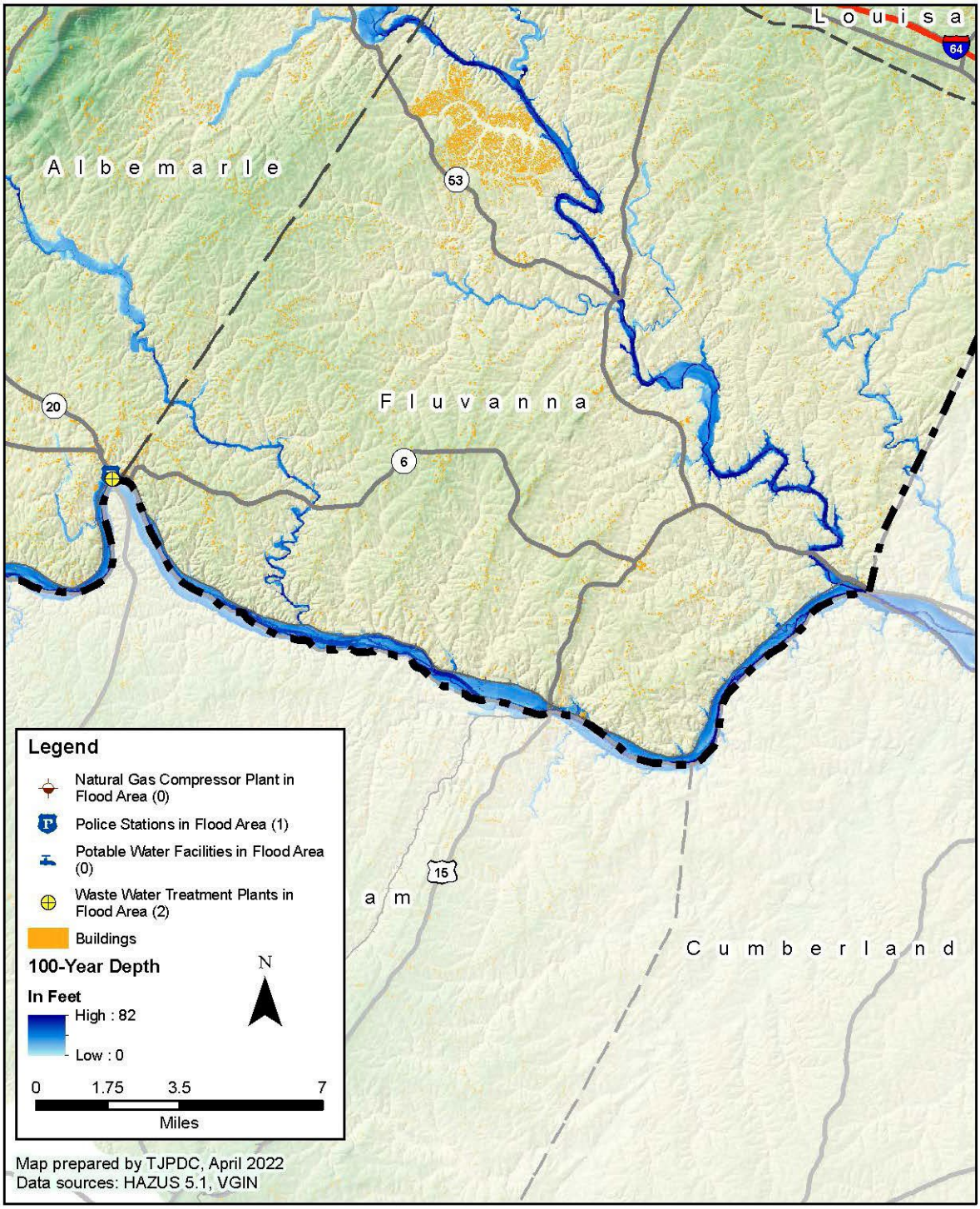
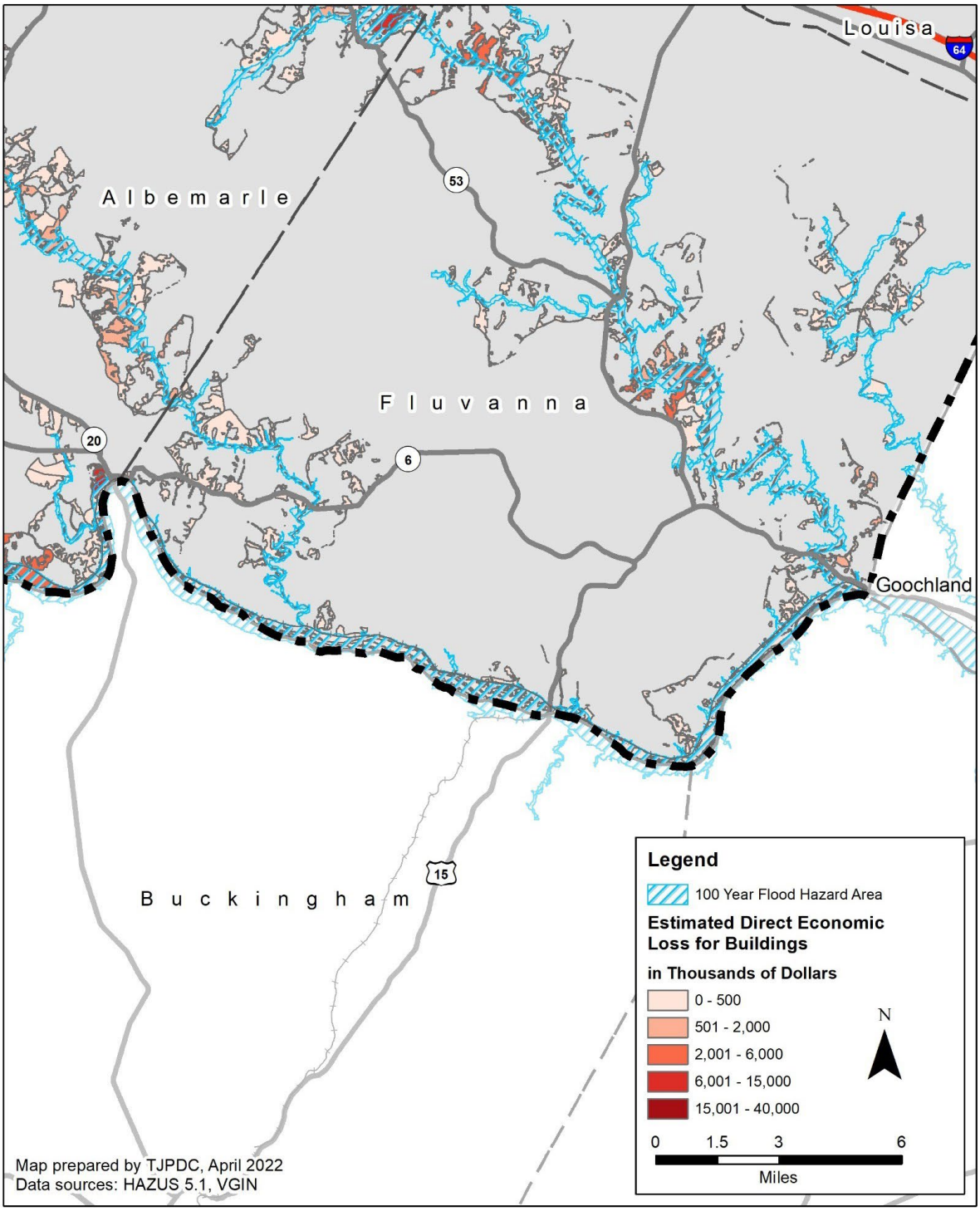
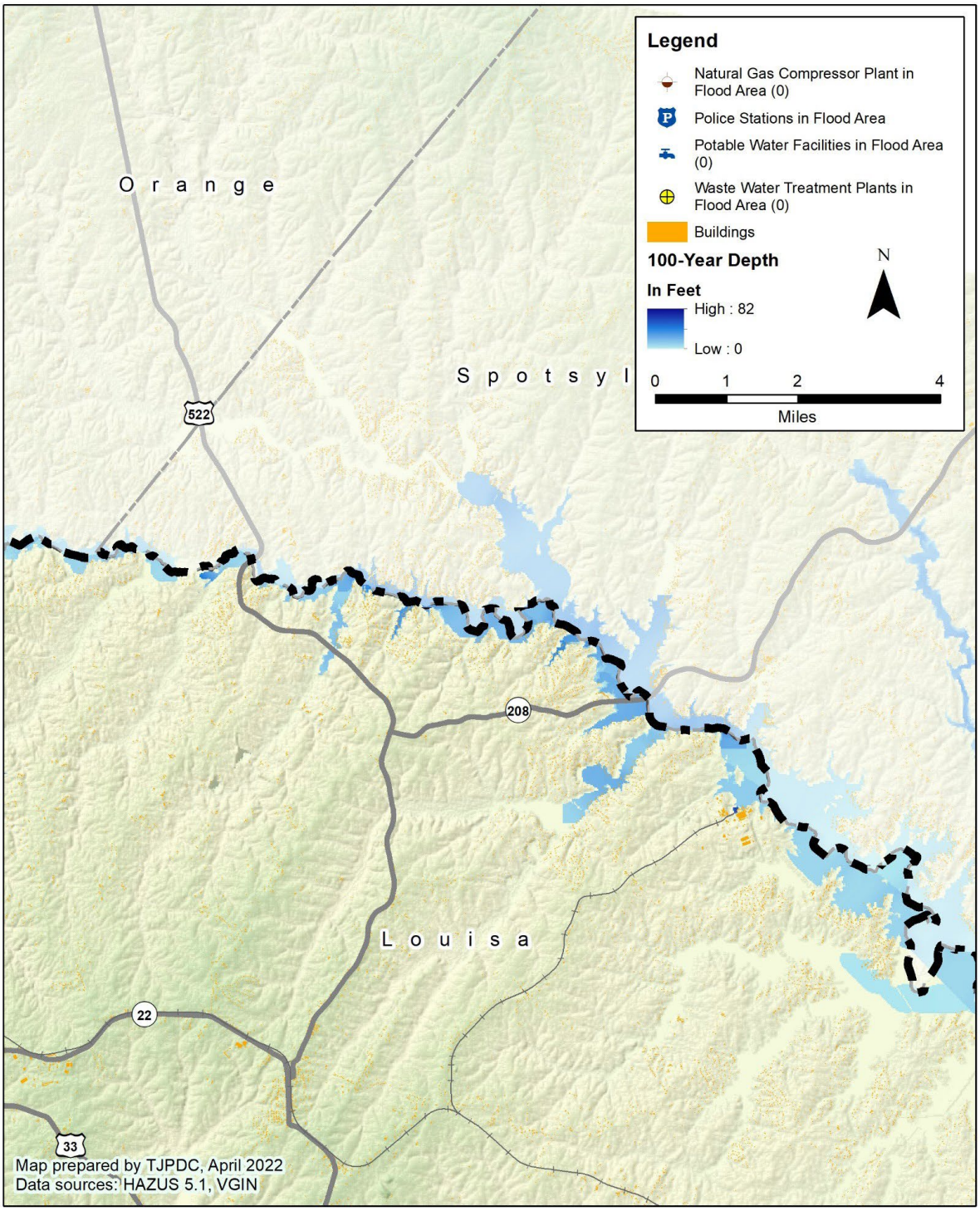
Lower James River



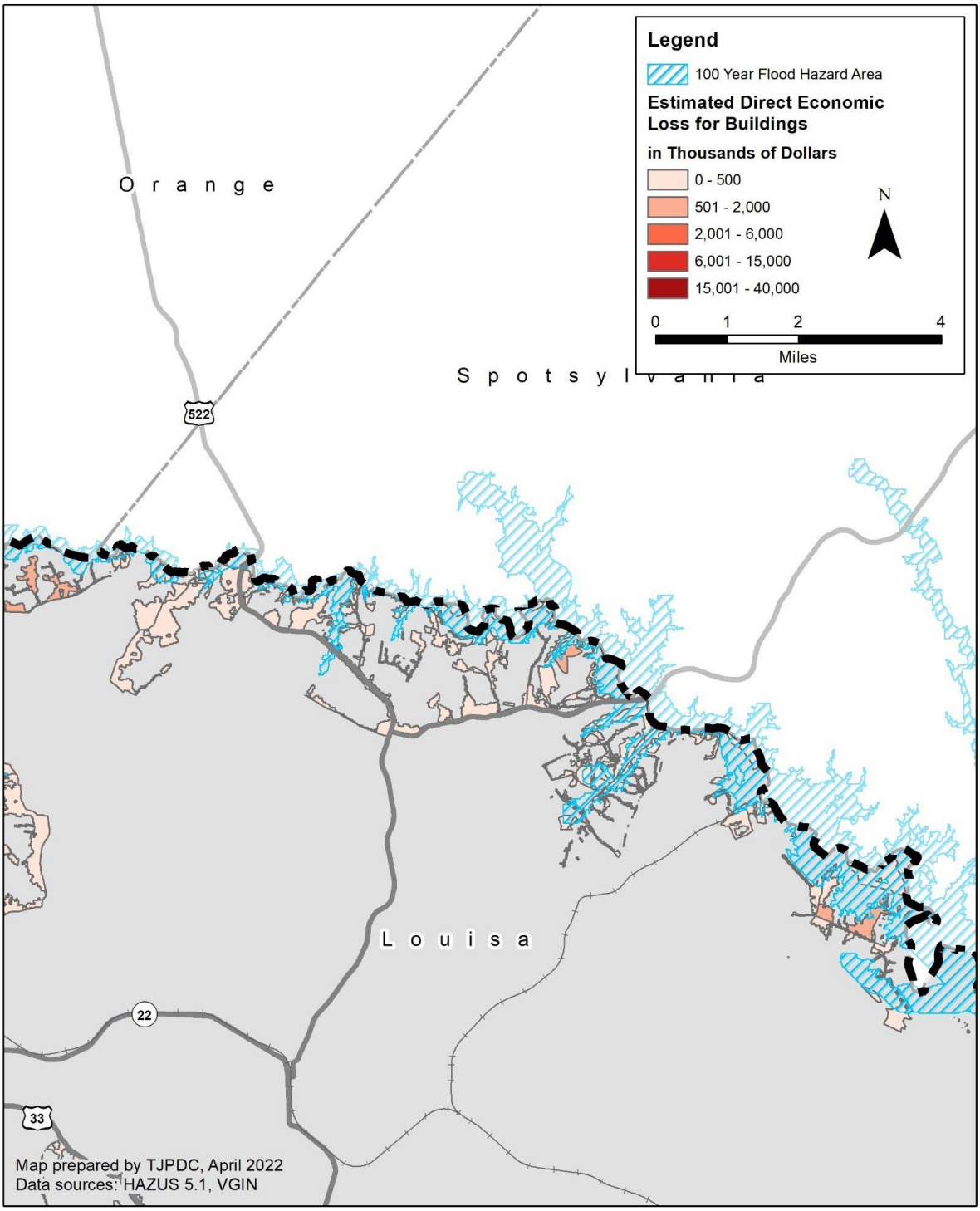
100 Year Flood Event
Lower James River



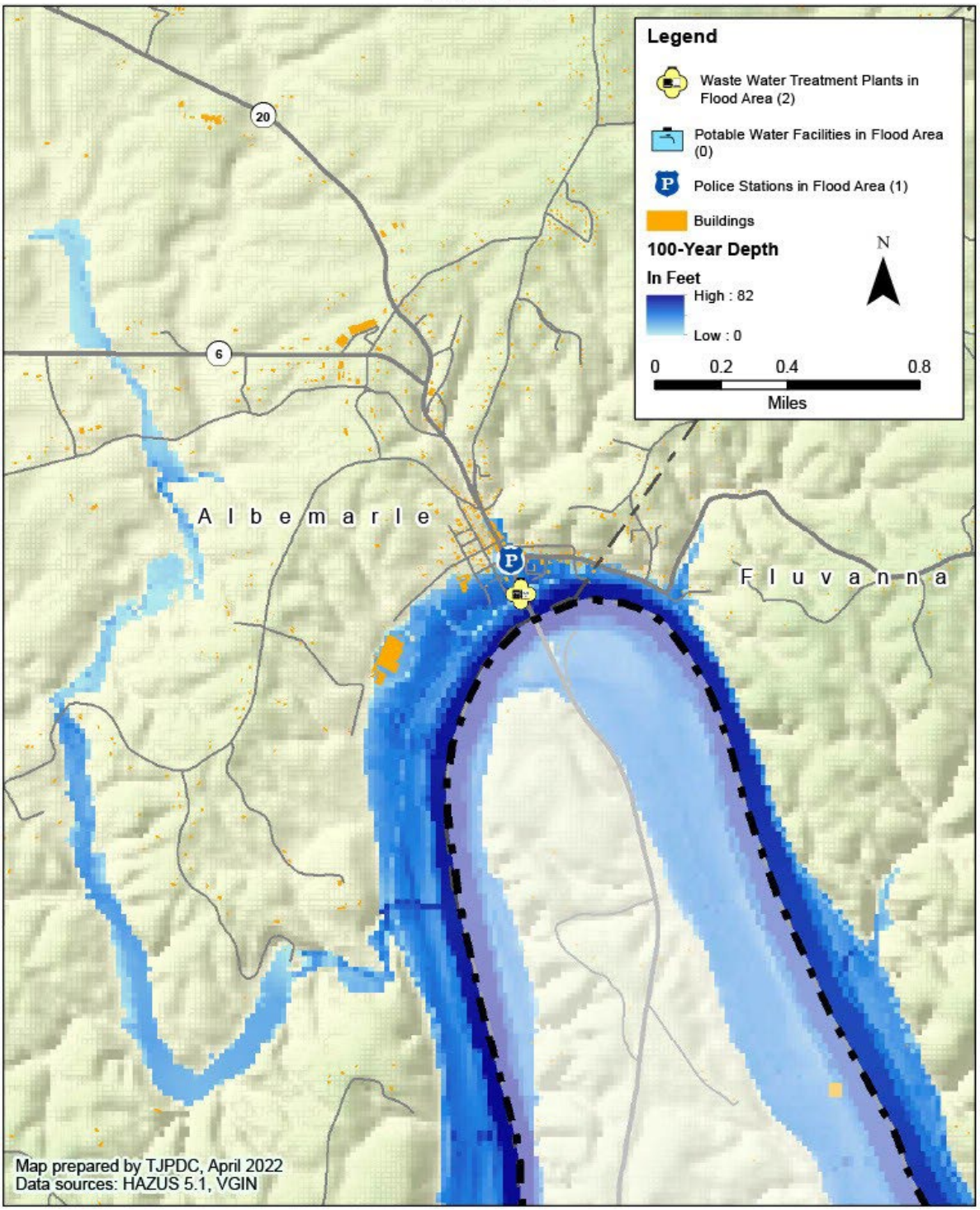
100 Year Flood Event
North Anna River



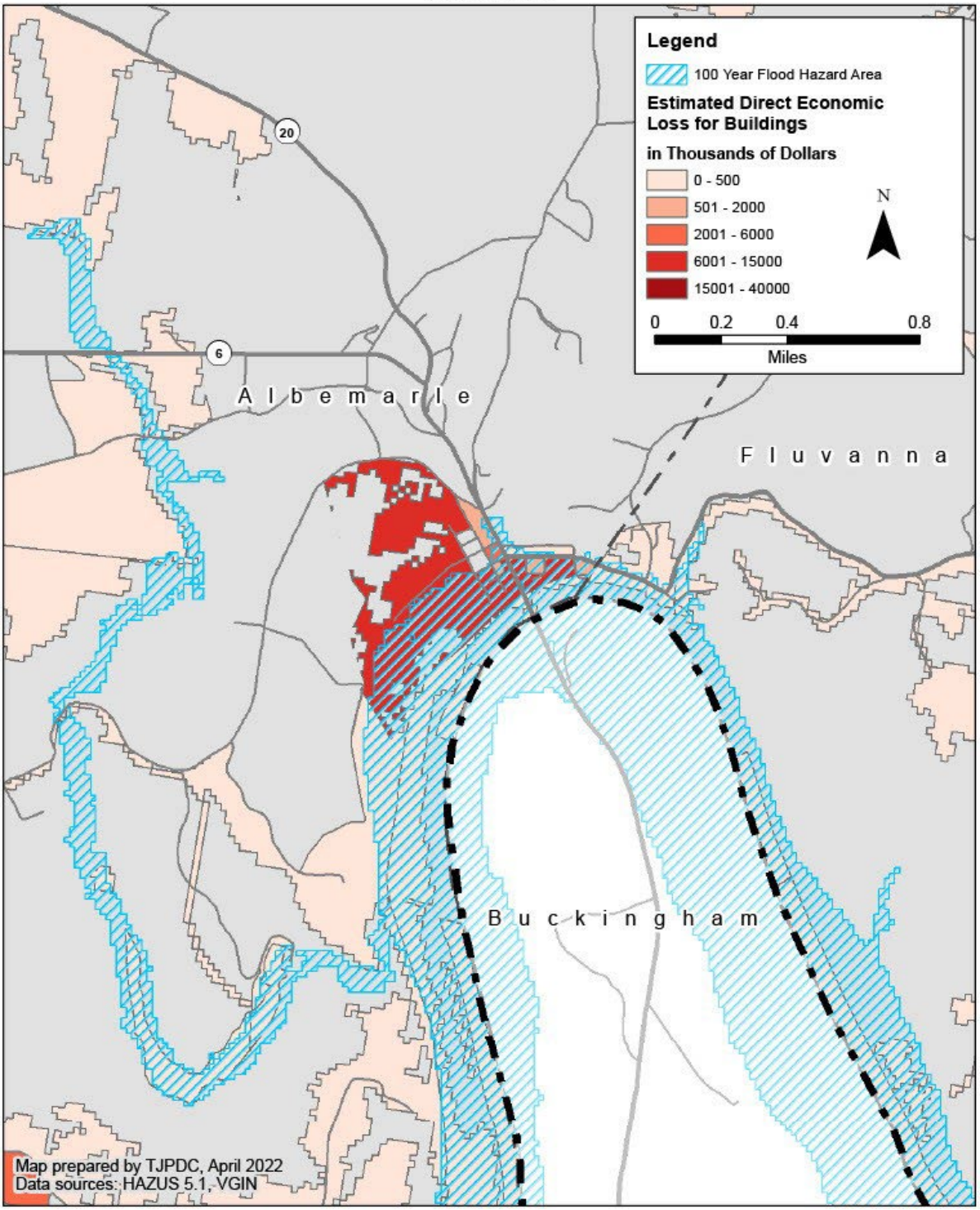
100 Year Flood Event
North Anna River



100 Year Flood Event
Scottsville



100 Year Flood Event
Scottsville



Other Flood Vulnerability Considerations

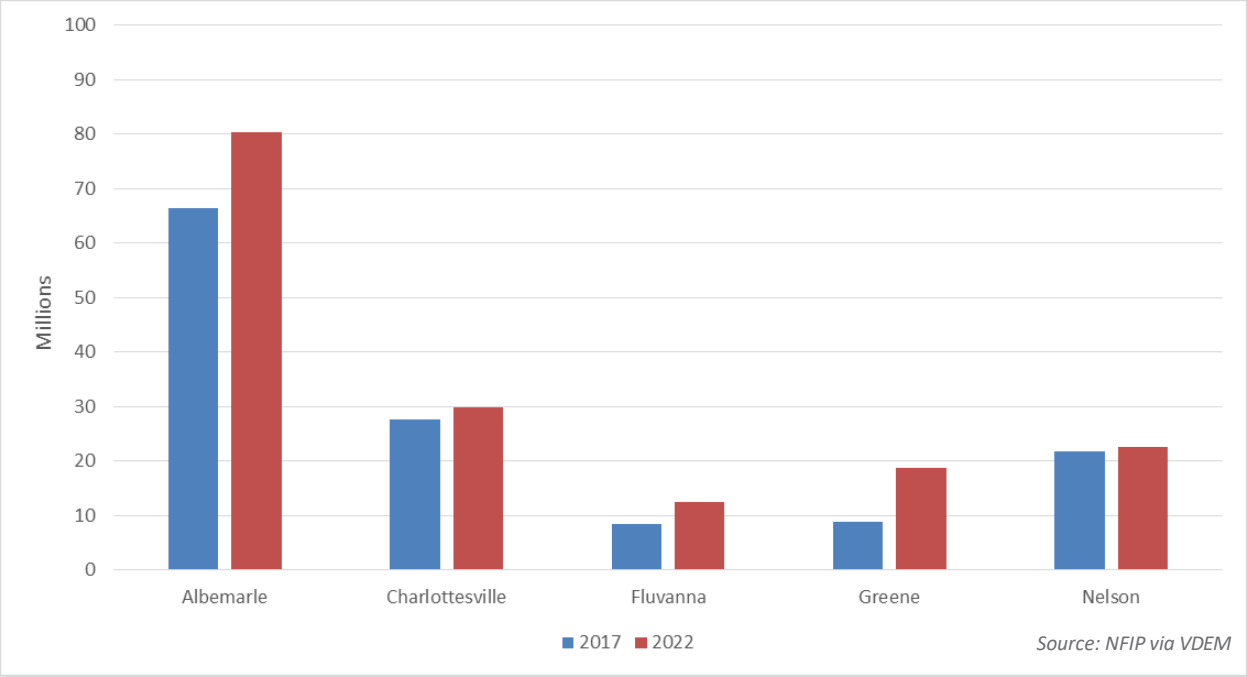
National Flood Insurance Program

Five out of six of the TJPDC localities participates in the National Flood Insurance Program (NFIP), which insures individual properties in the event of a flood, provides map- ping and technical information on flood hazards, and assists in mitigation efforts. An analysis of the insurance held and claims made can provide insight into the financial risk to property posed by floods throughout the region. As of July 2022, over $164 million in flood insurance was held in the region, with annual premiums totaling about $512 thousand. Since the inception of the program, ranging by locality between 1978 and 1989, 242 losses have been claimed for a total of a little over $2 million.

Repetitive Loss Structures:

NFIP Definition: Repetitive Loss Structure. An NFIP-insured structure that has had at least 2 paid flood losses of more than $1,000 each in any 10-year period since 1978.

Total Insurance Held in the National Flood Insurance Program



National Flood Insurance Statistics by Locality 2022

Locality	Entry into NFIP	# of Policies 2022	Change in Policies 2017-2022	Total NFIP Insurance 2022	Annual Insurance Premium 2022	Total Losses since Entry	Payments since Entry
Albemarle*	1980	351	20.9%	$80,286,500	$243,987	118	$1,264,602
Charlottesville	1979	103	7.8%	$29,871,000	$132,508	42	$277,226
Fluvanna	1978	43	12.6%	$12,573,900	$26,519	23	$276,616
Greene	1984	62	18.7%	$18,712,700	$37,694	26	$184,479
Louisa**	1989	1	N/A	$350,000	$519	4	$36,477
Nelson	1978	85	22.5%	$22,573,600	$70,978	29	$14,576
Region	-	645	11.9%	$164,367,700	$512,205	242	$2,053,976

**Includes Scottsville ^Includes Stanardsville*

^^ No new policies in Louisa County have been issued since County left the NFIP in 2017 Source: NFIP Via VDEM

Hazard Mitigation Assistance Definition:

FEMA may contribute up to 90 percent Federal cost share for RL properties. An RL property is a structure covered by a contract for flood insurance made available under the NFIP that:

(a) Has incurred flood-related damage on two 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. There are 10 structures in the region that fit this category. the type of structure and jurisdiction is listed in the adjacent table.

Severe Repetitive Loss Structures:

An SRL 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 four or more separate claims payments (includes building and contents) 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 two separate claims payments (includes only building) have been made under such coverage, with the cumulative amount of such claims exceeding the market value of the insured structure. There is one such structure in the region. It is a non residential structure located in Albemarle County. The structure has had over 7 losses and accounts for over half of all Repetitive Loss flood damage in the region, at a total cost of around $500,000 in damage to the contents of the property. This structure may be important to target for possible mitigation activities. One can also see that only some of the affected properties have been properly mitigated. These represent actions localities can take to protect against flood damage.The following chart shows selected claims data reported to the NFIP.

Repetitive Loss/ Sever Repetitive Loss Structures

County	Res	Comm.	Total
Albemarle	7	9	16
Charlottesville	6		6
Fluvanna	2	1	3
Greene	1		1
Louisa*			
Nelson	3		3
Region	19	10	29

Source: NFIP Via VDEM 2022

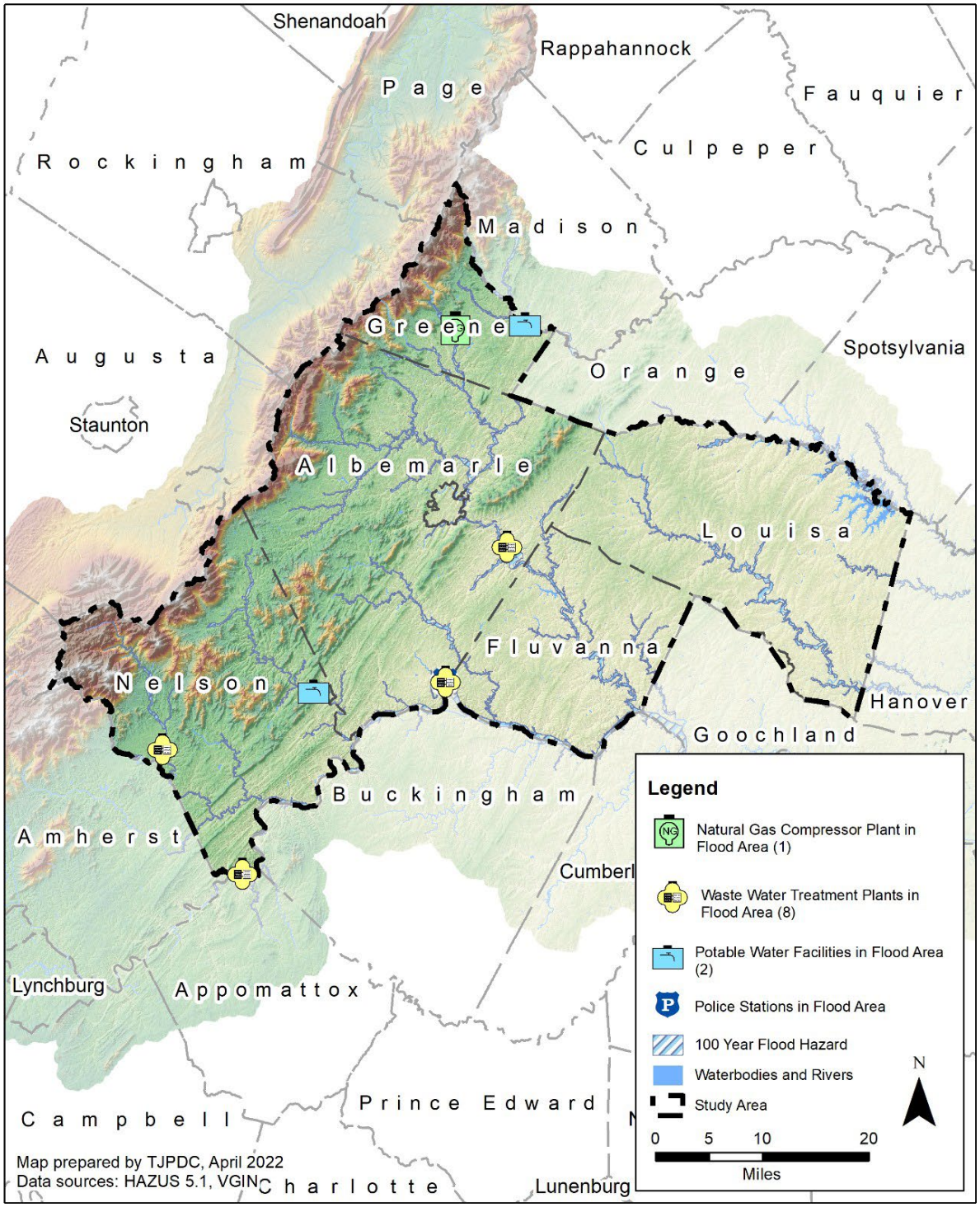
Several of the critical facilities in the region may be impacted by flooding. The HAZUS-generated results presented above take into account damage to essential infrastructure, such as roadways and utilities, as well as essential facilities such as schools and hospitals. How- ever, a more fine-grained approach to flood vulnerability is warranted, especially for facilities that are critical to emergency response. The map on the following page depicts all critical facilities identified in the region that fall within the 100-Year flood plain. Unless the vulnerability is mitigated, use of these facilities may be compromised in event of a flood.

National Flood Insurance Statistics by Locality

County	Type	Imp Value	Mitigated	Insured	# of Loss	Most Re-cent Loss	Total Building Damage	Total Contents Damage	Total Damage
Albemarle	Non Res	$43,200	No	No	2	4/17/1987	$8,609	$0	$8,609
	Non Res	$306,600	No	No	3	9/8/1987	$30,160	$0	$30,160
	Non Res		No	No	7	8/6/2005	$0	$232,123	$232,123
	Non Res		No	No	3	9/8/1987	$0	$100,449	$100,449
	Non Res		No	No	3	9/8/1987	$0	$114,515	$114,515
	Non Res	$683,200	No	No	2	4/17/1987	$21,777	$0	$21,777
	Non Res	$120,400	No	No	3	9/8/1987	$41,529	$16,976	$58,505
	Multi Fam	$1,402,000	No	No	3	9/8/1987	$50,521	$0	$50,521
	1 Fmly	$84,800	No	No	2	9/8/1987	$12,132	$3,819	$15,951
	Non Res	$55,900	No	No	2	9/8/1987	$15,035	$0	$15,035
	Non Res	$160,100	No	No	2	9/8/1987	$5,242	$2,671	$7,913
	1 Fmly	$38,036	No	No	2	9/6/1996	$36,666	$4,600	$41,266
	1 Fmly	$153,810	No	No	3	9/6/1996	$60,302	$4,624	$64,926
	1 Fmly	$51,168	No	Yes	2	9/9/2004	$19,459	$0	$19,459
	1 Fmly	$147,703	No	Yes	2	5/31/2018	$1,858	$3,029	$4,887
	1 Fmly	$405,837	No	Yes	3	7/31/2018	$29,289	$8,159	$37,448
Charlottesville	1 Fmly	$207,000	No	No	4	9/8/1987	$24,493	$9,270	$33,763
	1 Fmly	$150,714	No	Yes	3	9/21/1979	$11,481	$5,000	$16,481
	1 Fmly	$153,106	No	Yes	3	5/30/2018	$31,605	$853	$32,458
	1 Fmly	$205,021	No	Yes	2	6/3/1979	$41,213	$0	$41,213
	1 Fmly	$239,414	No	Yes	2	6/3/2018	$43,289	$0	$43,289
	1 Fmly	$75,000	No	Yes	2	6/2/1979	$12,711	$0	$12,711
Fluvanna	Non Res	$170,600	No	No	3	9/7/1996	$78,996	$330	$79,326
	1 Fmly	$50,100	No	No	2	9/8/1987	$21,688	$0	$21,688
	1 Fmly	$42,000	No	No	2	9/6/1996	$52,629	$0	$52,629
Greene	1 Fmly	$136,704	No	No	6	11/11/2020	$82,813	$0	$82,813
Nelson	1 Fmly	$70,000	No	Yes	3	9/6/1996	$16,977	$0	$16,977
	1 Fmly	$64,300	No	No	2	9/6/1996	$55,638	$11,547	$33,593
	1 Fmly	$50,000	No	Yes	3	11/29/2005	$20,832	$5,508	$26,341

Source: NFIP Via VDEM

100 Year Flood Event
Critical Facilities within Flood Area

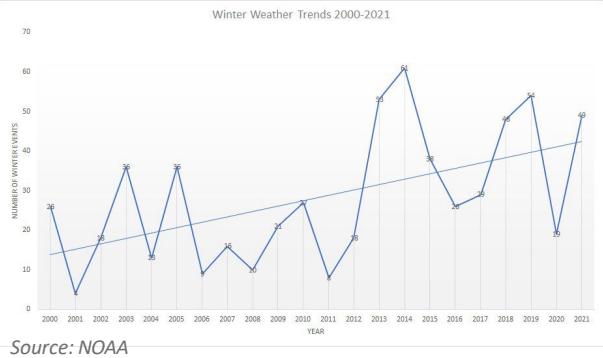


Winter Storm: Estimated Losses

Winter Storm events pose less of a direct risk to human life and property, but they can become a significant impediment to business and emergency response operations, as well as a cause for traffic accidents. In general, the western part of the Planning District at higher elevations experiences greater snowfall, but most storms affect the region. Costs of snow removal can be high for state agencies and local governments. VDOT budgets over 200 million dollars for snow removal per season. Remote homes, especially in the more mountainous areas of the Planning District, are at a greater risk of being isolated as roads become impassable.

From historical data presented in the Hazard Analysis section, a basic trend line indicates that over the next ten years the region will be hit on average by 40 winter weather events a season. This figure includes winter storms, ice storms and winter weather. Winter weather frequently cause conditions that result in injuries and death, mostly due to automobile accidents and people overexerting themselves clearing snow. Direct property loss can be expected to be minimal over the decade, under $1 million in total damages. However single season losses might be larger. for example, the winter of 2021-2022 saw multiple days of widespread power outages across the region. The single largest impact from

Winter Weather Trends 2000-2021



Source: NOAA

winter storms are the significant impedance they cause to businesses when infrastructure and services are blocked. Winter storms also present economic challenges for families who must deal with school closings. It is important to note that as the region continues to grow and spread out into low-density exurban development, the population becomes more dependent on well-functioning transportation infrastructure. The impact of winter storms can be expected to increase proportionally. There is a clear indication from weather data that winter storms are becoming more prevalent in the region.

Source: Andrew Shurtleff/The Daily Progress via AP

Note: Winter events include winter storms, ice storms, and winter weather Source: NOAA NCDC

Communicable Disease: Estimated Loss

Communicable disease events vary in their possible risk to human populations depending on the type of disease, severity of the strain or type, its contagiousness, and success of measures taken to mitigate the spread or help afflicted individuals.

COVID-19 still poses a significant health and economic risk to the planning district and nation at large. As of March 2022, over 81 million people have had confirmed COVID-19 infections, and over 998,000 people have died in the United States. The highly contagious variants of the original “alpha” COVID strain has the potential to drive cases to very high levels and can even infect vaccinated individuals. The planning district experienced this most acutely during the case surge associated with the Omicron COVID-19 variant, which drove cases to a high of 700 confirmed positives in 1 day on January 18, 2022, an increase of 872% from the 72 confirmed positives reported on December 18, 2021, just one month earlier. Although the Omicron and other COVID-19 variants are diminished by COVID-19 vaccines, individuals can still become very sick even if

they do not have to enter the hospital. Unvaccinated individuals are at even greater risk as the virus continues to create more contagious variants and more long-term health issues are discovered to be linked to contracting COVID-19. Even if most recover from COVID-19 without serious complications, hospitals filling up with those that do can create adverse consequences for those who need to access the hospital for COVID-19 treatment, or other treatment.

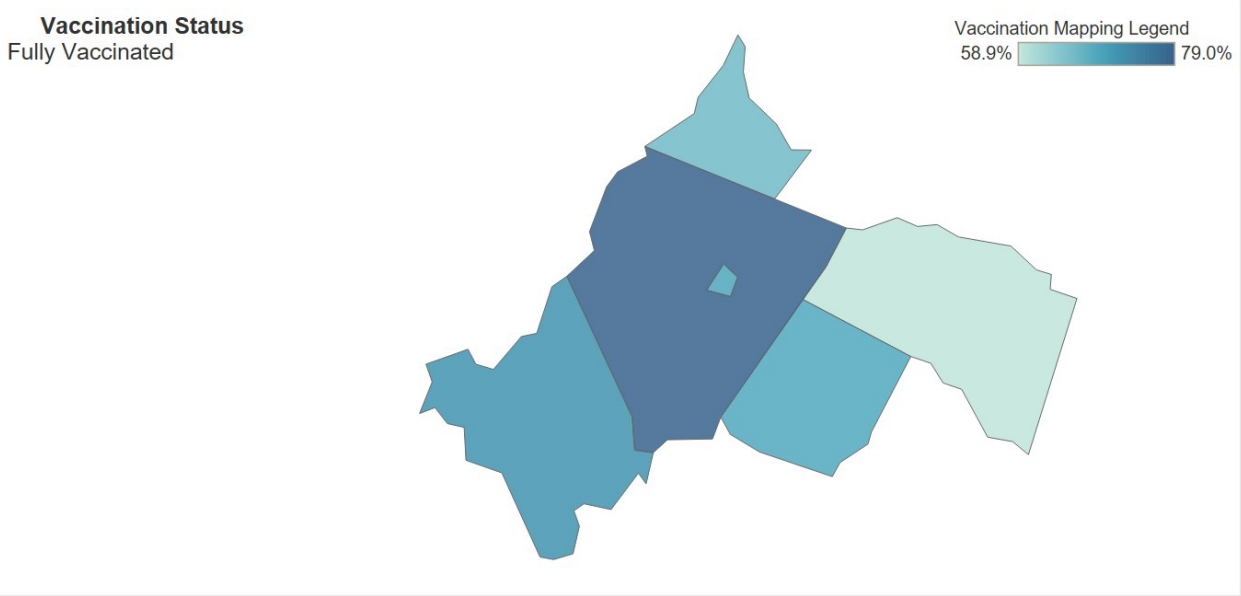
A community's vaccination rate also has major implications in determining potential losses associated with a COVID-19 outbreak. According to the Center for Disease Control, COVID-19 vaccines reduce the risk of severe illness and death among people who are fully vaccinated. They help protect against developing COVID-19 infections and are very effective at reducing the probability an individual will be admitted to the hospital. As of March 2022, 71.8% of people in the planning district are fully vaccinated. The primary risk associated with COVID-19 is for those who are unvaccinated. There is the potential

COVID-19 in Blue Ridge Health District:

Date Updated: March 21, 2022

Total doses administered: 468,403					
People with at least one dose: 198,102	**Percent with at least one dose:** 76.8%	**People fully vaccinated:** 185,153	**Percent fully vaccinated:** 71.8%	**People with booster/3rd dose:** 108,200	**Percent with booster/3rd dose:** 41.9%

Percent of People Vaccinated by Locality



Please note it can take up to 72 hours for healthcare providers to report doses to the Virginia Immunization Information System (VIIS).
Population estimates data source: 2020 National Center for Health Statistics (NCHS) Bridged-Race population estimates
Definitions to note:
People that have received at least one dose: Total number of people who received at least one dose of a COVID-19 vaccine.
People who are fully vaccinated: Total number of people who have completed the recommended series of a given vaccine (i.e., two doses of Pfizer or Moderna or one dose ofJohnson & Johnson (J&J)).
People who have received a booster or 3rd dose: Total number of people who have completed the recommended series of a given vaccine and have additionally received a booster or 3rd dose.

Source: BRHD

for continuing economic loss also associated with the continuing pandemic. School and business closures have become increasingly rare, but such interventions remain depending on the scope and size of COVID-19 outbreaks.

Other communicable diseases pose similar types of losses in terms of death and hospital admission. Campylobacteriosis, salmonellosis, and Lyme disease, the three most common communicable diseases in the planning district, are often manageable with antibiotic treatment or over-the-counter medication. Very few individuals die of these diseases annually (around 200 from Campylobacteriosis, 420 from salmonellosis, and around 10 directly from Lyme disease). These diseases can still create significant disruption to a community's day-to-day life, including keeping children out of school and parents from work. The losses associated with common communicable diseases also depend on how effectively each disease is mitigated through healthy habits like proper handwashing, staying home when sick, and early identification of contagiousness.

According to work done by Metabiota, an agency that has developed a Global Epidemic Monitoring and Modeling platform (GEMM), the annual probability of a pandemic whose scale and size is similar to COVID-19 is between 2.5 and 3% annually. This means that over the next 25 years, there is a 47 to 57% chance that another global pandemic similar to COVID-19 occurs.

Wildfire: Estimated Loss

Since the last Hazard Mitigation plan update several new tools for assessing fire risk have become widely available to planners. These include data from the Southern Group of State Foresters Southern Wildfire Risk Assessment tool and the U.S. Forest Service. These tools provide interactive mapping that allows for planners to assess fire potential based on a variety of factors. A map depicting the burn probability based on the Southern Wildfire Risk tool is included on the following pages.

For Estimating Losses the older Virginia Department of Forestry Risk maps (2003) were used. These maps pro- vide a more localized look at wildfires and wildfire risk specific to Virginia. These maps subdivide the region into areas of high, medium, and low risk for wildfires.

WUI Risk Index - Acres

	Class	Acres	Percent
	-1	79,722	12.1%
	-2	187,157	28.4%
	-3	77,961	11.8%
	-4	129,430	19.6%
	-5	129,926	19.7%
	-6	25,510	3.9%
	-7	22,748	3.5%
	-8	6,407	1.0%
	-9	35	0.0%

Source: Southern Wildfire Risk

To assess vulnerability to wildfire, the Wildland Urban Interface (WUI) Risk Index was used. The key input, WUI, reflects housing density (houses per acre) consistent with Federal Register National standards. The location of people living in the Wildland Urban Interface and rural areas is key information for defining potential wildfire impacts to people and homes.

Source: TJ Wood Via NBC29

The WUI is the area where structures and other human improvements meet and intermingle with undeveloped wildland or vegetative fuels. Population growth within the WUI substantially increases the risk from wildfire.

The WUI Risk Rating is derived using a Response Function modeling approach. Response functions are a method of assigning a net change in the value to a resource or asset based on susceptibility to fire at different intensity levels, such as flame length. The range of values is from -1 to -9, with -1 representing the least negative impact and -9 representing the most negative impact. For example, areas with high housing density and high flame lengths are rated -9

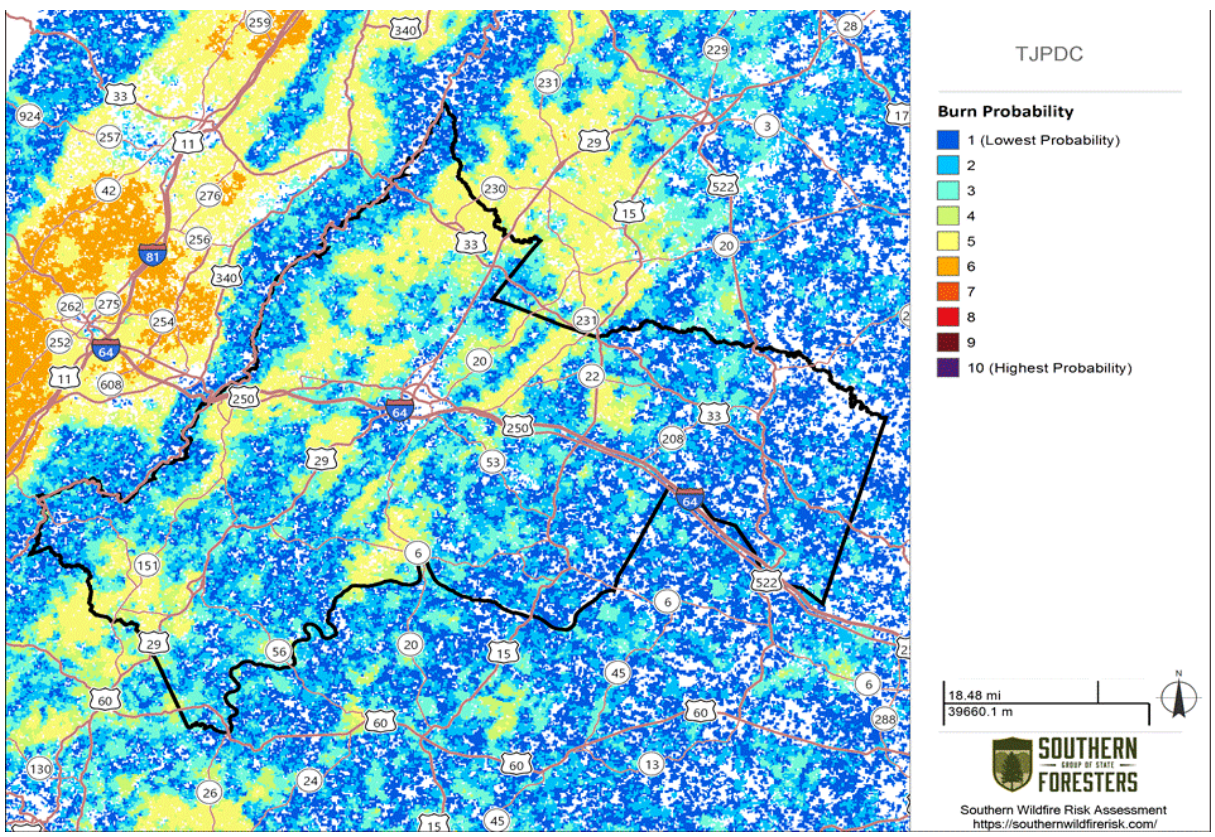
while areas with low housing density and low flame lengths are rated -1.

To calculate the WUI Risk Rating, the WUI housing density data was combined with Flame Length data and response functions were defined to represent potential impacts. The response functions were defined by a team of experts based on values defined by the SWRA Update Project technical team. By combining flame length with the WUI housing density data, you can determine where the greatest potential impact to homes and people is likely to occur.

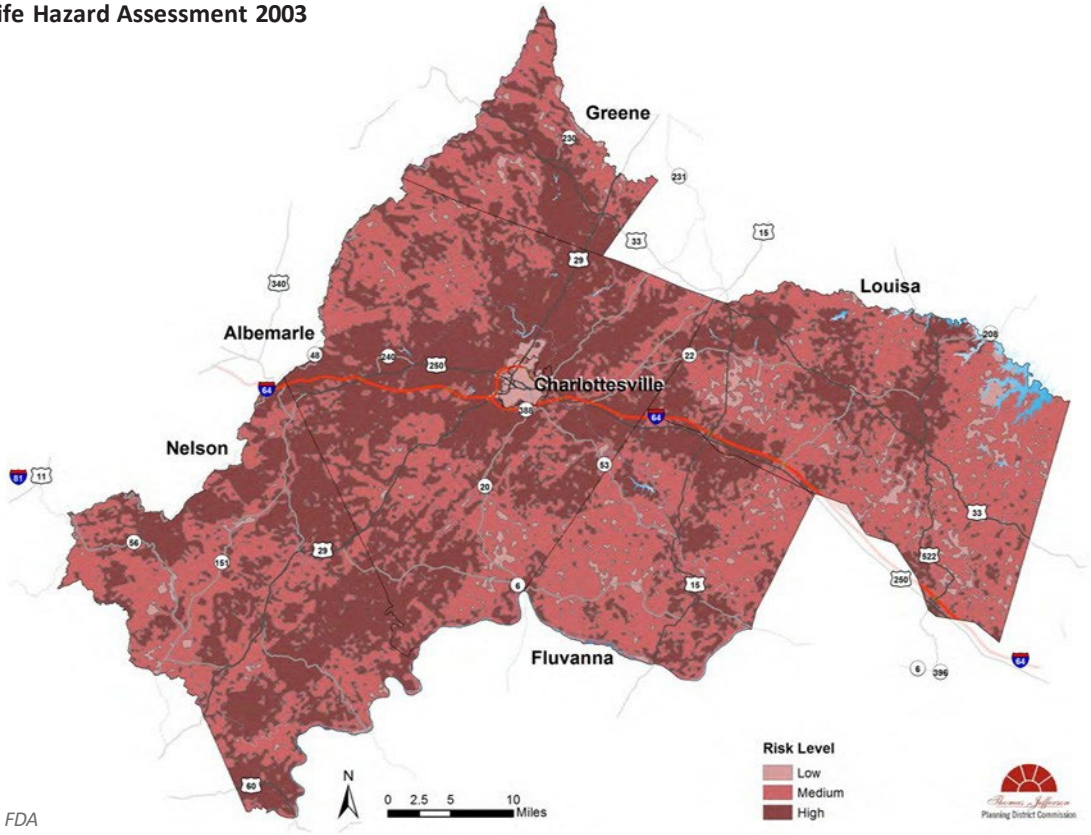
Based on the 2022 zone analyses Albemarle County has the greatest number of at-risk acres, and Fluvanna County has the highest proportion of at-risk acres. Additionally, 184,626 acres in the region are exposed to higher than moderate wildfire risk. The City of Charlottesville has by far the lowest risk of any locality. Although 11% of the land is at-risk, most of this area is park land. Only 4% of home are at-risk. For all other localities, homes are more likely to be located in high-risk areas than lower risk areas. This could be explained by the prevalence of farmland in low- risk areas that have relatively few residential buildings. The maps on the following pages compare the number of housing units at risk with units that are not at substantial risk to wildfire. This is a measure of total exposure, not a measure of expected loss, because wildfires are highly localized events that do not adhere to a predictable spa- tial pattern.

The maps on the following demonstrate the WUI risk rating for each locality. This is a measure of total exposure, not a measure of expected loss, because wildfires are highly localized events that do not adhere to a predictable spatial pattern. Note that the threat of wildfire in Charlottesville is overrepresented in these maps as the prevalence of wooden structures and trees in a concentrated space generates a higher risk, even when the fires that occur in urban areas are almost never wildfires.

Burn Probability – TJPDC

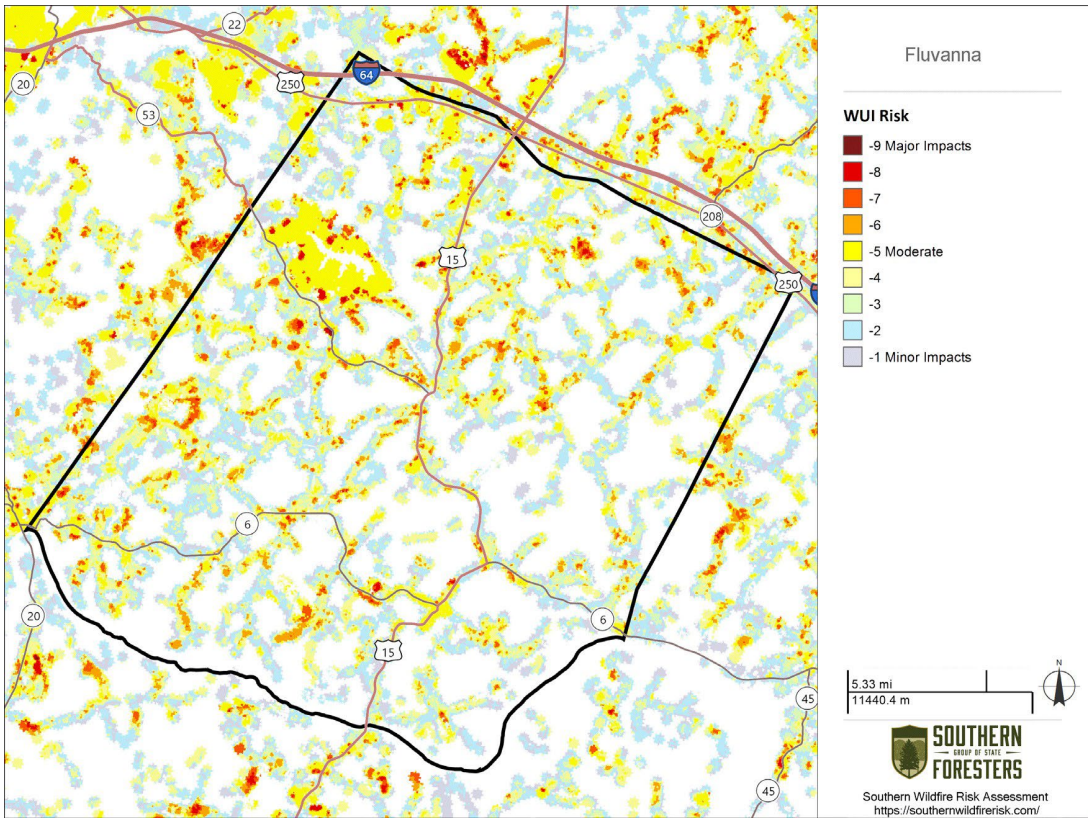


Wildlife Hazard Assessment 2003

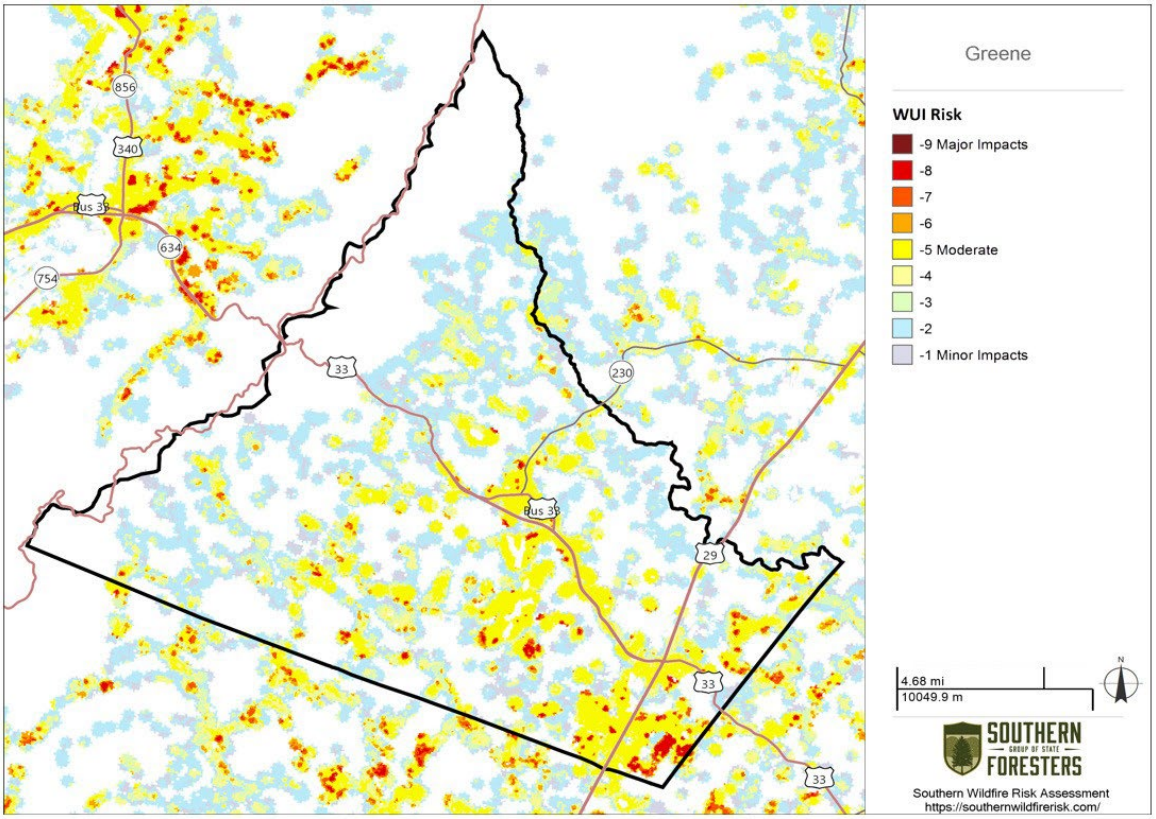


Source: FDA

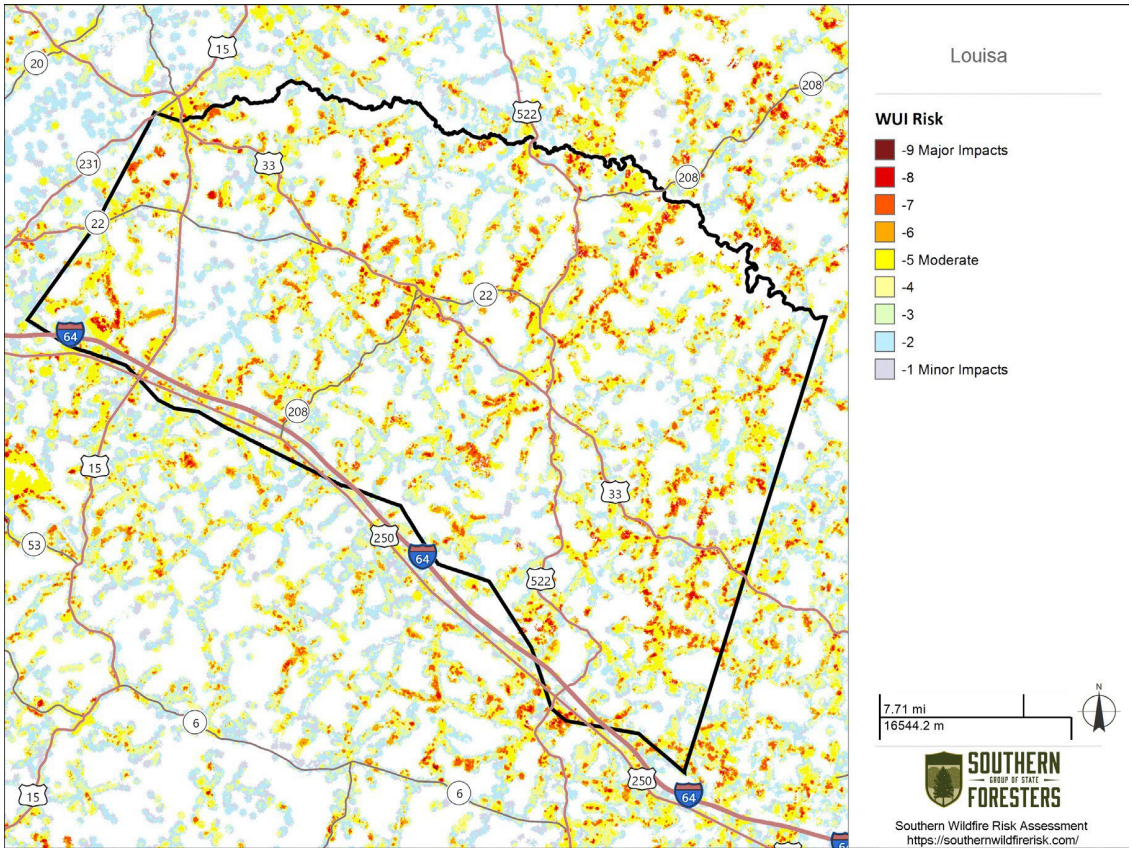
WUI Risk – Fluvanna



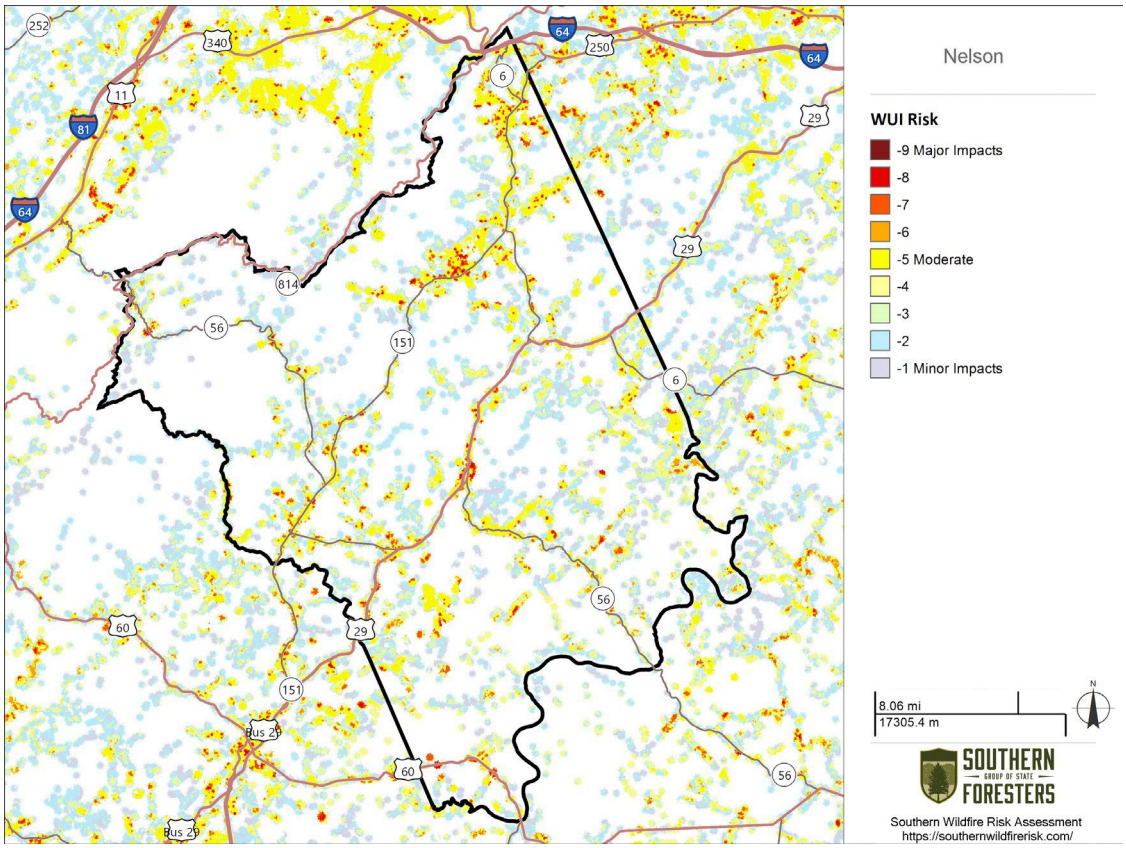
WUI Risk – Greene



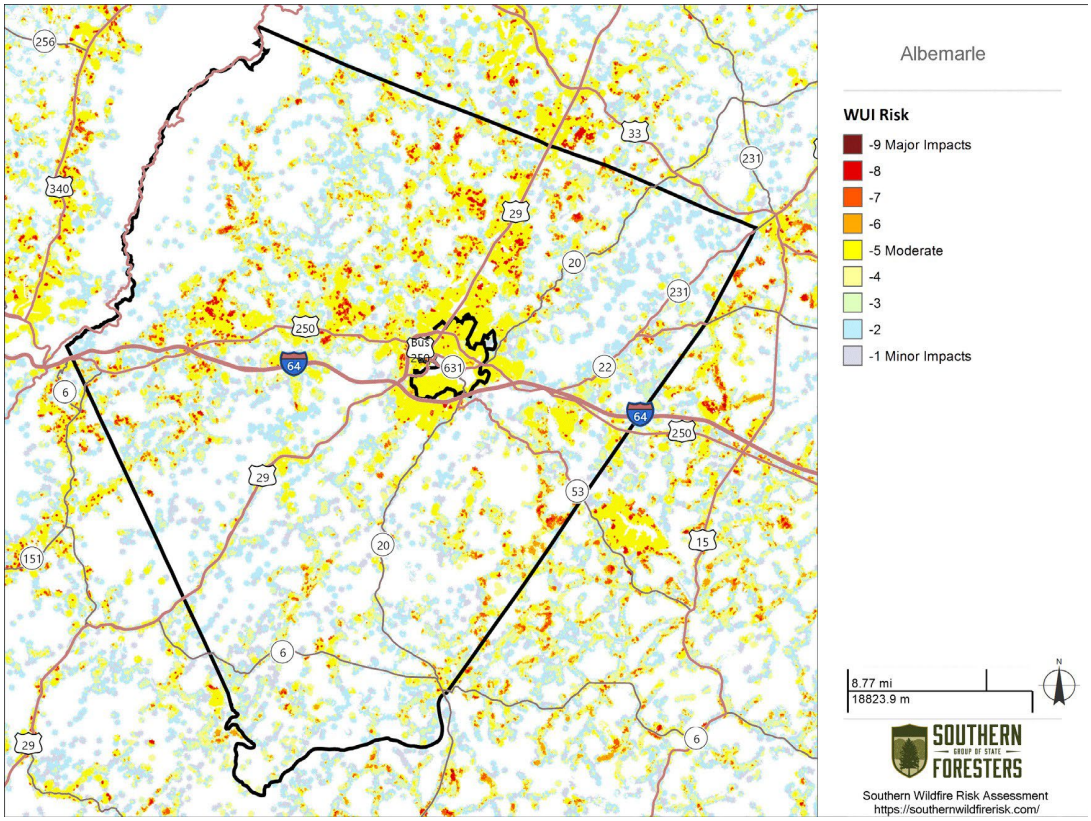
WUI Risk – Louisa



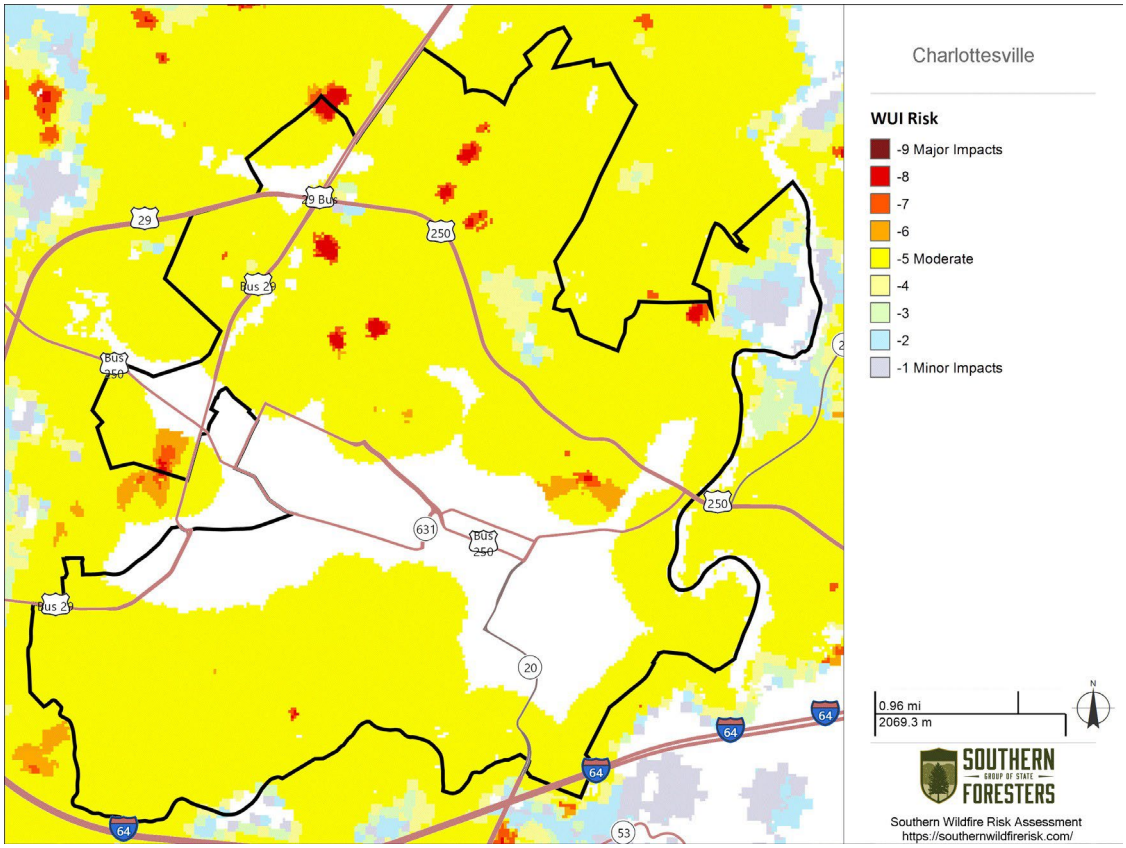
WUI Risk – Nelson



WUI Risk – Albemarle



WUI Risk – Charlottesville



Based on a trend between 2017 and 2021, the annual expected loss for the region is $121,444 in direct fire damage, not accounting for indirect damages such as displacement or loss of access. Business operations as less likely to be impeded by wildfires because commercial areas tend to occupy more urban sites.

Total Economic Losses to Wildfires by Locality from 2017-2021

Locality	2017	2018	2019	2020	2021	Annual Avg.
Albemarle	$ 12,200	$ 210,900	$ 1000	$ 208,000	$ 10,200	$88,460
Fluvanna	$ -	$ -	$ -	$ 4,500	$ 2416.74	$3,458
Greene	$ 11,500	$ 16,000	$ 100	$ -	$ -	$9,200
Louisa	$ 1,500	$ 300	$ 200	$ 16,000	$ 11,300	$5,860
Nelson	$ 9,500	$ 54,000	$ -	$ 25,950	$ 11,650	$25,275
Region	$ 34,700	$ 281,200	$ 1,300	$ 254,450	$ 35,567.74	$121,444

Source: Virginia Department of Forestry

Losses varied significantly between localities, from $3,458 per year in Fluvanna to $88,460 per year in Albemarle. However, it should be noted that two incidents in Albemarle in 2018 and 2020 accounted for around 2/3 of total loss during this time period. Wildfire damage is often difficult to predict and is dependent on many variables including wind, rainfall, and proximity to houses and businesses.

Drought: Estimated Loss

Estimated potential losses due to drought are difficult to calculate because drought causes little damage to the built environment, mostly affecting crops and farm- land. Water supply effects of droughts are also hard to project because they are based on several contingencies such as future capacity, water conservation behavior, and projected demand. By land area, most of the region is dependent on groundwater reserves that can be susceptible to falling groundwater tables during extreme drought conditions. The City of Charlottesville and urbanized Albemarle County depend on surface water storage system which includes a system of five reservoirs that provide 3.4 billion gallons of water storage. These reservoirs are fed by stream intakes that are affected by rain levels. The 2015 RWSA Drought Response and Contingency Plan includes best practices, drought management strategies, and contingency plans.

Based upon droughts over the past ten years, the region will most likely be affected by one or two droughts over the next ten years. No loss of life or injury will be caused,

and there will be no direct property damage. However, future droughts are expected to cause damage ($5 - $15 million) to crops in the region and some business operations may be impeded by water usage restrictions. These estimates vary wildly depending on the location, severity, and duration of a potential drought. This can be ascertained from the National Integrated Drought Information System's Drought Monitor resource. There have only been 2 "D4", or exceptional droughts, since 2000 statewide. There is, however, evidence of moderate to severe droughts affecting the states every few years. According to the Center for Climate and Energy Solutions, warmer temperatures can enhance evaporation, which reduces soil water and dries our soils and vegetation. This makes areas more susceptible to drought than they would be otherwise, under cool conditions. It can be expected that rising global temperatures will make droughts more damaging and more prevalent.

Tornadoes: Estimated Loss

Because it cannot be predicted where a tornado may touch down, all above-ground buildings and facilities are exposed to this hazard and could potentially be impacted. It is also not possible to estimate the number of residential, commercial, and other buildings or facilities that may experience losses.

The locations of past tornado events within the Planning District are shown on the map in Hazard Identification and Analysis section. Based on historic trends, the region is expected to experience several tornadoes (30-35) in the next fifty years, causing 10-15 deaths and several injuries. Property loss will likely total $5 to $7 million. As the population and number of structures increases in the area, the number of casualties and amount of property damage are likely to rise proportionately. These losses, if tornadoes are combined with other weather events like thunderstorms and heavy rain, could be even greater.

Earthquake: Estimated Loss

The August 23, 2011, earthquake with an epicenter near Mineral was the first in recent history to cause significant property damage. As of the end of September 2011, Louisa County reported a total of $80.6 million in damages, by far the largest amount of any county in Virginia. Of the total, $63.8 million is attributed to the Louisa County public schools. No losses of human life or injuries were reported. The Louisa County High School and

Thomas Jefferson Elementary School were damaged. The High School was replaced with a new facility that came online for the 2015/2016 School Year. Thomas Jefferson Elementary school was replaced and opened in time for the 2014/2015 school year. The rest of the TJPDC reported only limited damage. Outside of Louisa County, most damage was reported to the north along known fault lines.

Governor McDonnell requested a federal Emergency Declaration approximately one month after the event occurred, noting that much of the damage only became apparent upon inspection of homes by a qualified engineer. Damaged buildings prevent further safety concerns, especially if the damage goes undetected. Louisa County have dispatched teams of building inspectors and fire marshals to 1,000 homes in the area to inspect and install donated smoke and carbon monoxide detectors to reduce the risk of fires and poisoning once homes are heated in the winter.

All modern buildings – including critical facilities –

must adhere to the statewide building code, which has certain provisions to prevent excessive damage from earth- quakes. Therefore, many of the most impacted buildings have been the older building stock, including historic structures.

Source: Louisa County Historical Society

Methodology

HAZUS MH 5.1 was used to estimate losses of a future earthquake. Data from the August 23rd, 2011, earthquake was used as parameters for a scenario, and data for building inventory, soil type, and fault lines was supplied through HAZUS. The scenario assumes a 5.8 magnitude earthquake at a depth of 6 km, with an epicenter near Mineral in Louisa County. This is a very low-probability event, roughly equivalent to a 500-Year Flood according to current USGS predictions. All economic numbers are shown in thousands.

Results

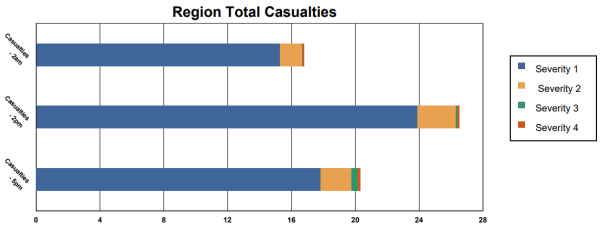
The 5.8 Magnitude earthquake modeled would result in a total of about $16 million in structural damage, $73 million in non-structural damage and income

Source: The Daily Progress

loss equivalent to $16 million. 72% of all economic loss occurring in Louisa County.

Casualties and injuries are represented on a four-tier severity level with level 1 being the lowest and representing an injury like a sprain or a severe cut. Level 2 injuries requiring x-ray or surgery but not expected to progress to life threatening. Level 3 injuries that pose an immediate life-threatening condition. Level 4 are injuries that result in instantaneous death or mortal injury. The chart below presents the expected casualties for the region at 2am, 2pm, and 5pm – around 60 total.

Regional Total Casualties



Source: HAZUS MH 5.1

Building Stock Exposure By General Occupancy

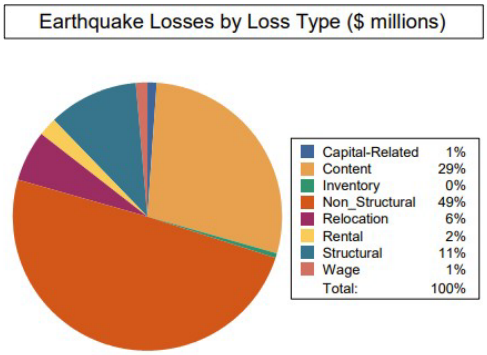
Locality	Residential	Commercial	Industrial	Agriculture	Religion	Government	Education	Total
Albemarle	$11,176,787	$1,500,043	$294,042	$56,265	$157,641	$27,979	$274,565	$13,487,322
Charlottes-ville	$3,589,878	$1,226,976	$133,037	$11,916	$124,207	$44,797	$156,144	$5,286,955
Fluvanna	$2,924,341	$100,542	$26,381	$4,808	$8,962	$5,571	$24,808	$3,095,414
Greene	$1,624,770	$127,658	$31,336	$8,237	$21,984	$6,603	$25,680	$1,846,268
Louisa	$4,067,972	$321,420	$124,532	$14,065	$50,728	$9,335	$30,225	$4,618,277
Nelson	$1,971,432	$166,439	$46,046	$15,179	$41,558	$14,493	$11,836	$2,266,983
Region	$25,355,180	$3,443,079	$655,374	$110,470	$405,080	$108,778	$523,258	$30,601,219

Source: Hazus MH 5.1

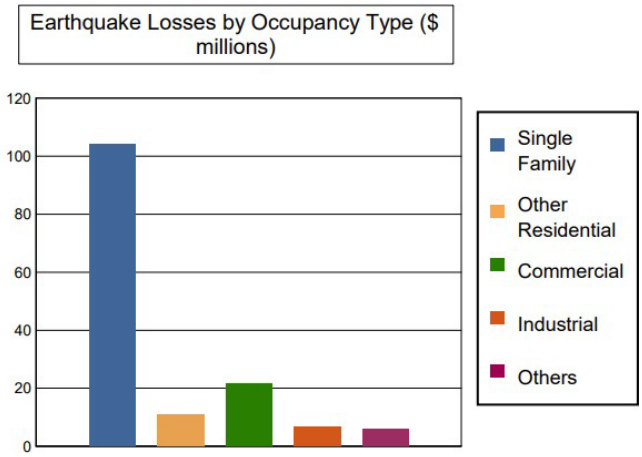
Building Related Economic Estimated Losses

Category	Area	Single Family	Other Residential	Commercial	Industrial	Others	Total
Income Losses							
	Wage	0.0000	0.1495	1.6497	0.1315	0.1653	2.0960
	Capital-Related	0.0000	0.0636	1.2936	0.0802	0.0432	1.4806
	Rental	1.4683	0.4470	1.2608	0.0491	0.0717	3.2969
	Relocation	5.0336	1.4694	1.9595	0.3151	0.6312	9.4088
	Subtotal	**6.5019**	**2.1295**	**6.1636**	**0.5759**	**0.9114**	**16.2823**
Capital Stock Losses							
	Structural	9.9511	1.7904	2.8633	0.6837	0.7495	16.0380
	Non_Structural	55.3147	5.6501	7.3361	2.9253	2.4108	73.6370
	Content	32.3644	1.4663	4.9145	2.0528	1.7588	42.5568
	Inventory	0.0000	0.0000	0.2550	0.3965	0.0323	0.6838
	Subtotal	**97.6302**	**8.9068**	**15.3689**	**6.0583**	**4.9514**	**132.9156**
	Total	**104.13**	**11.04**	**21.53**	**6.63**	**5.86**	**149.20**

Source: Hazus MH 5.1



Source: Hazus MH 5.1



Losses can be categorized as capital stock losses and income losses. Capital losses include damage to buildings. This can be damage to the building's structure or non-structural, such as damage to interior walls, ceilings, utilities, fixtures. Capital losses also include damage to the contents of a building or, in the case of businesses, inventory stock. Because total exposure data is held for each of these items, a ratio can be calculated. A total of 8.31% of all capital in Louisa County is expected to be damage, which is by far the largest amount in the region, which is expected to see 1.79% of capital dam- aged. Buildings of unreinforced masonry, including many historic structures built before enhanced building codes, are expected to receive the most damage.

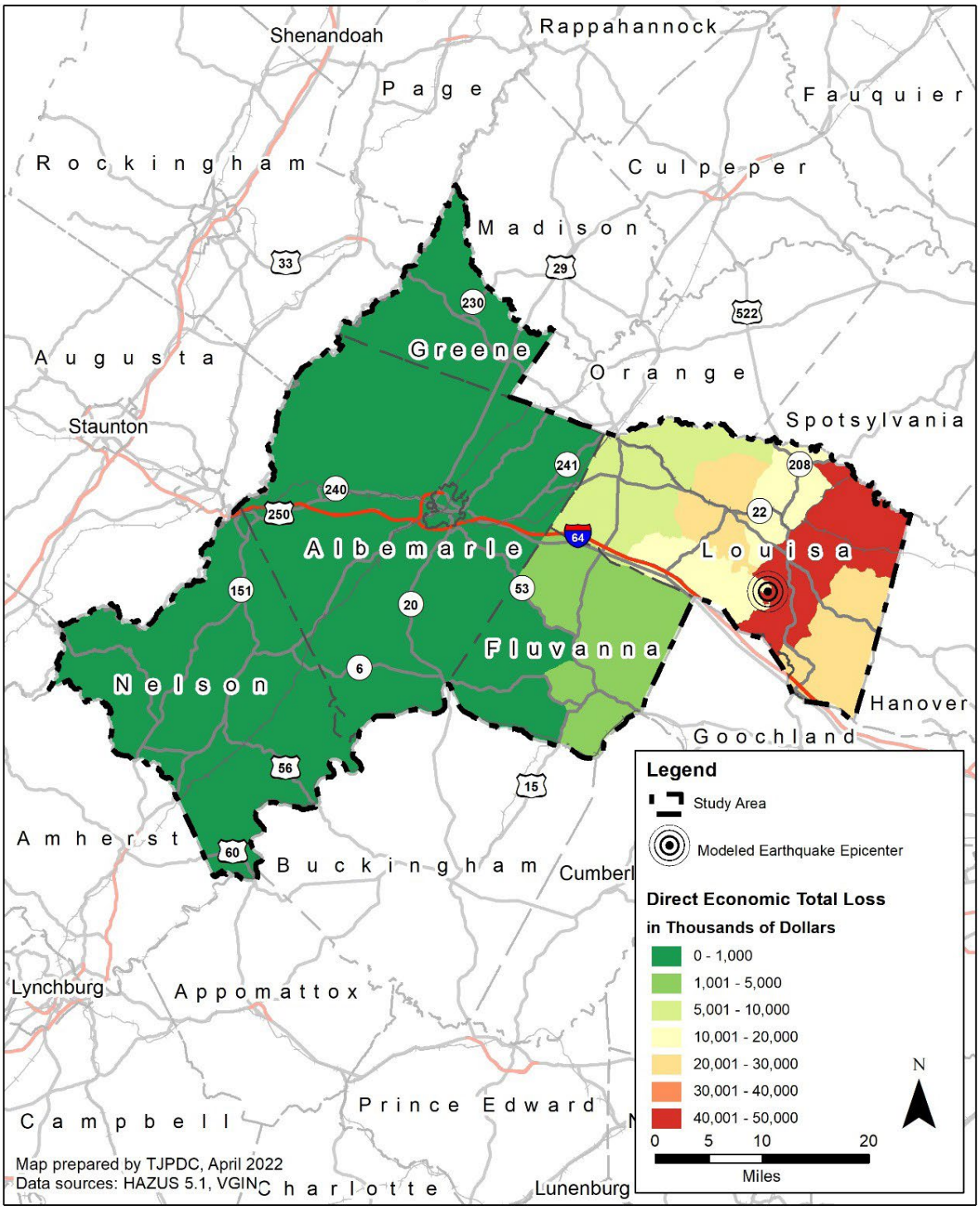
Income losses include the cost of relocating after an earthquake, capital-related losses (i.e. the loss of function of buildings during time of replacement), wage losses from unemployment and lost hours, and loss of rental income. The total losses reported take into account all of these quantified factors. The map on the following page shows the expected losses by census tract throughout the region and the spectral acceleration at 0.3 seconds, a measurement of the intensity of the earthquake.

The following losses are also expected to occur:

- **Over $5.6 million in transportation system damages including highways, railways, and airport.**
- **Over $9.4 million dollars in damages to water systems and electric systems across the region.**
- **Significant damage in the on day 1 to hospitals, schools, police stations, and fire stations, with them quickly regaining functionality.**
- **The quake would generate approximately 31,000 tons of debris.**
- **Only 5 households would be displaced as a result of the earthquake.**

Minor earthquakes are far more likely to occur in the region, but the damage curve drops off considerably as the event approaches a magnitude of 5.0 or below. Therefore, HAZUS does not model earthquakes below this level.

Earthquake Event
Scenario: M 5.8, 14 km SSE of Louisa, VA



Dam Failure: Estimated Loss

Locality	Total Dams	Hazard Potential Classification				% of High Hazard Classification with EAPs
		High	Significant	Low	Undetermined	
Albemarle	169	14	8	21	126	93%
Charlottesville	0	0	0	0	0	NA
Louisa	69	7	7	12	43	100%
Greene	18	5	3	2	8	100%
Fluvanna	37	5	0	3	29	80%
Nelson	17	0	2	4	11	NA
Region	310	26	20	42	107	93%

Data Source: National Inventory of Dams (NID)

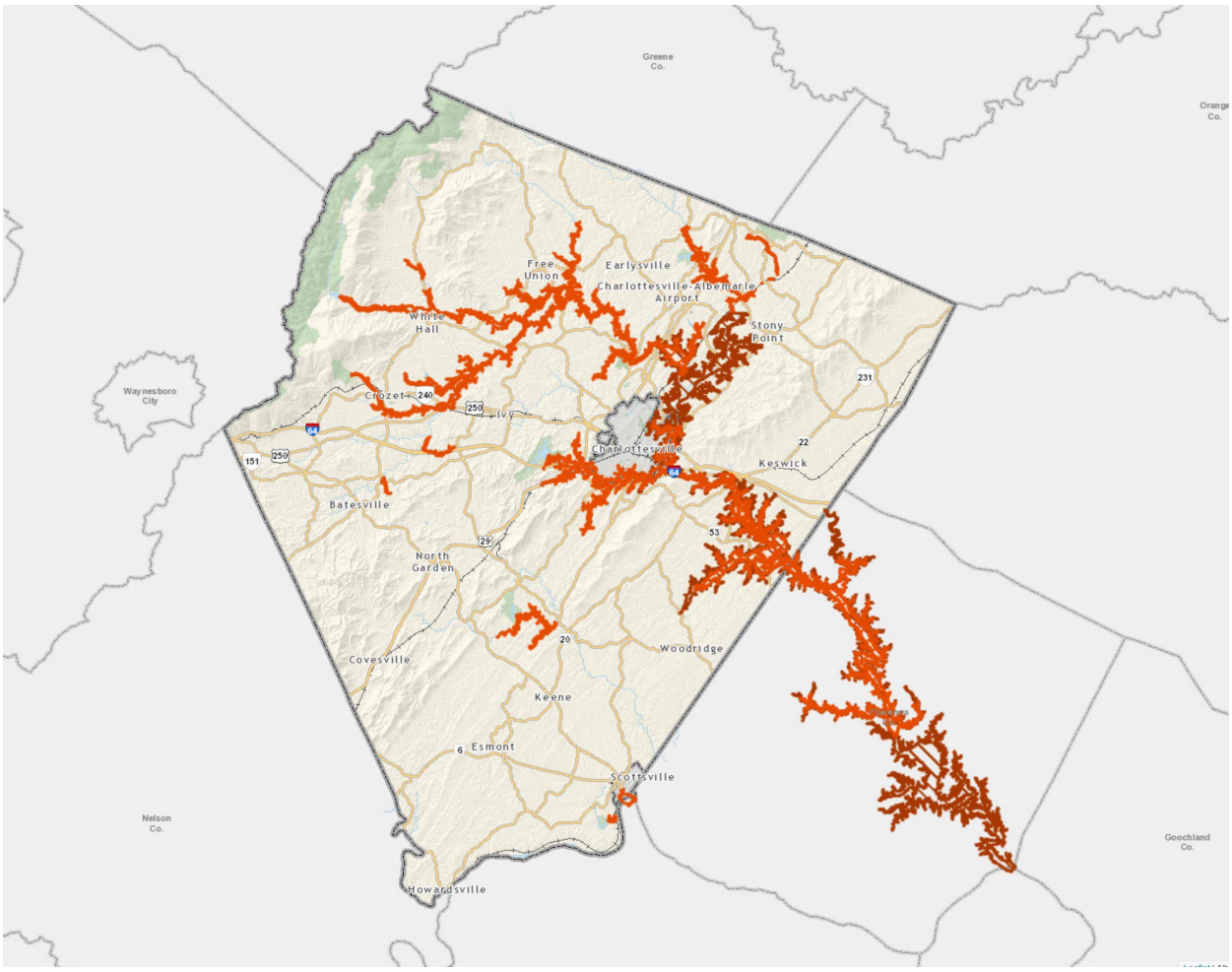
According to the National Inventory of Dams, there are approximately 310 dams within the TJPDC. Dams are generally classified based on the potential loss of human life or property damage if it were to fail. Per state and federal dam safety regulations, "classification is based on a determination of the effects that a dam failure would likely have on people and property in the downstream inundation zone. Hazard potential classifications descend in order from high to low, high having the greatest potential for adverse downstream impacts in event of failure. This classification is unrelated to the physical condition of the dam or the probability of its failure." The hazard potential classifications are:

- **High - dams that upon failure would cause probable loss of life or serious economic damage**
- **Significant - dams that upon failure might cause loss of life or appreciable economic damage**
- **Low - dams that upon failure would lead to no expected loss of life or significant economic damage. Special criteria: This classification includes dams that upon failure would cause economic damage only to property of the dam owner.**

Twenty-six dams in the TJPDC are classified as High Hazard, and as such have the potential to cause loss of life or significant property damage. Of these, twenty-four have emergency action plans in place, approximately 93%. The Emergency Action Plans outline Dam Failure Inundation Zones down stream of each dam. Areas of potential loss are identified within the inundation areas. The two dams without Emergency Action Plans are (1) Montfair West Dam in Albemarle County and (2) the Bremo Power Station East Ash Pond Dam in Fluvanna County.

Current Virginia and Federal dam safety standards require High Hazard Dams to pass 90-100% of the Probable Maximum Flood (PMF) which is typically caused by the Probable Maximum Precipitation (PMP). Not all twenty-six High Hazard Dams currently meet that standard and as such operate under conditional permitting. One of these dams, Beaver Creek Dam in western Albemarle County is undergoing design efforts to upgrade it from passing the 60% PMF to 100% PMF. Work is being performed by the Rivanna Water and Sewer Authority (RWSA) in concert with the Natural Resource Conservation Service (NRCS). In addition, Albemarle County will be upgrading the spillways at two dams at Mint Springs Valley Park, due to the hazard potential of these dams recently being reclassified as high. Other dams within the TJPDC may also be under review for hydraulic capacity improvements. Identifying these structures and ensuring the EAP reports and Dam Inundation Mapping is readily accessible to the County emergency response agencies will help mitigate the impact of a potential dam failure. The current code of Virginia allows Cities and Counties to make available to the public and development communities, the dam flood inundation areas.

Albemarle County's public GIS is shown below with the Dam Break Inundation Zones



Source: Albemarle County GIS

Landslide: Estimated Loss

There is the potential for landslides within the planning area. However, the risk is limited to the western portions of Albemarle, Greene and Nelson Counties, along the steeper slopes of the Blue Ridge. The greatest danger of landslides occur during periods of extensive heavy rain as occurred in Nelson County in during Hurricane Camille. During Camille landslides blocked creeks and rivers causing massive debris flows which rushed into narrow valleys causing extensive flooding and loss of life.

The best indicator of future landslides is where they have occurred in the past areas of risk include steep slopes, poor drainage, and erosion have a greater probability of landslides. Developed hillsides and slopes denuded by wildfires can also lead to landslides. One area in our region where rockslides are common is along Interstate 64 at Afton Mountain (Nelson County). in 2013 VDOT removed soil and rock from problem slopes to reduce the risk of future slides. Significant damage can thus occur from a combination of heavy rainfall on well-maintained, or more probably heavily eroded and steep surfaces. It can be expected that of the landslides that occur in the planning district, very few will cause significant economic disruption or loss of life. Results from the ongoing Virginia Department of Energy study will be able to predict location and severity of future landslides more accurately.

Capabilities Assessment

A capability assessment helps identify, review, and analyze current mitigation activities undertaken within the region, as well as the ability of each jurisdiction to implement future mitigation projects. Below are ratings of the six localities in the region for the technical, fiscal, and administrative capacity to implement hazard mitigation strategies. The assessment utilized the Capability Assessment Worksheets from the Local Mitigation Planning Handbook. Local staff serving on the Hazard Mitigation Plan Working Group completed the forms, which also guided the review of other local plans for actions to include in the plan.

The form included tables for the areas of Planning and Regulatory, Administrative and Technical, Financial, and Education and Outreach. The four towns in the region are considered within their respective counties, since town residents are served by relevant county services. The counties retained the same scores from their 2018 Capabilities Assessments.

	Fluvanna	Nelson	Louisa	Charlottesville	Albemarle	Greene
PLANNING and REGULATORY –plans, policies codes and ordinances	High	High	High	High	High	High
ADMINISTRATIVE and TECHNICAL: staff, skills and tools for planning and action	High	Moderate	High	High	High	High
FINANCIAL – access or eligibility for funding resources	Moderate	Moderate	High	High	High	Moderate
EDUCATION and OUTREACH – programs and methods in place to implement actions	Moderate	Moderate	High	Moderate	Moderate	High
OVERALL CAPABILITY	Moderate	Moderate	High	High	High	High

Planning and Regulatory: Most localities do not have an Economic Development Plan or Continuity of Operations Plan, but all have Local Emergency Operations Plan, Comprehensive Plans, and Capital Improvement Plans. The level of addressing hazards in locality plans varies among the jurisdictions. Transportation Planning for the urban areas is carried out by the Metropolitan Planning Organization (MPO) and coordinated for the rural areas through the Rural Long-Range Planning process. All localities have codes and ordinances in place. Some counties without Continuity of Operations plans are interested in developing them soon. Some localities have also identified climate change as a leading exacerbating factor in making natural hazards more prevalent, damaging, and unpredictable. They have thus created special plans focusing on climate change vulnerability and resilience in order to better inform policy and reduce emissions.

Administrative and Technical: All localities have Commissions, Committees, and staff in place, with some positions being part-time or having some functions shared by a single staff person. The City of Charlottesville, County of Albemarle, and University of Virginia have shared staff through the Office of Emergency Management and the Emergency Communications Center. TJPDC provided the HAZUS analysis for all localities in the Planning District. All localities have full-time emergency management staff that are housed in various departments including planning and fire rescue officies. After turnover at some of the localities, many are looking to revitalize their LEPC meetings, many of which have been inactive for a period of time.

Financial: All localities have Capital Improvements project funding, fees for utilities, and have the ability to incur debt through general obligation bonds. The City of Charlottesville is an entitlement community for Community Development Block Grant (CDBG) funds, but generally utilizes those for economic development purposes. All Counties have utilized CDBG funds, with current projects underway in

Albemarle County and the Town of Stanardsville in Greene County. Charlottesville, Albemarle County and Nelson County assess storm water fees, but the other rural counties do not. Charlottesville and Albemarle utilize federal and state funding to a greater extent than the rural counties.

Education and Outreach: All localities have active local citizen groups and non-profit organizations. Only Greene County reported having Storm Ready and FireWise certifications, though some localities have developments or sites that are FireWise certified, like Wintergreen in Nelson County. Louisa County reports that the Department of Fire and EMS conduct regular monthly public education activities in addition to ongoing preparedness information via the department web site. Charlottesville uses ad campaigns like "Flicker the Flame" and MyCville to communicate with residents on television and in print media.

Other Capability Considerations

Current local funding

The City of Charlottesville and Albemarle County have dedicated local funds to hazard mitigation, but the other counties in the region have not. Albemarle County conducts staff training on building and fire codes, citizen education on hazards, and GIS mapping products that identify hazard-related features. The county also invests in conservation easements in high-hazard areas and other open space protection measures. The City of Charlottesville has also used local funds for a stream restoration project and the rehabilitation of the stormwater system. Both of these localities are funding climate change related studies to assess emissions and promote resilience.

Intergovernmental Cooperation

Localities in the region augment their hazard mitigation and emergency response capabilities by cooperating regionally. All localities have joined a mutual aid agreement between emergency services departments. Staff from Louisa County report having used the mutual aid agreement in response to a disaster. Staff from the City of Charlottesville and Albemarle County rate the current level of intergovernmental cooperation as high. The other localities Louisa County, Nelson County, Greene, and Fluvanna County rate their intergovernmental cooperation as moderate. However, staff in the outlying localities note that the potential for cooperation in mitigation-related goals is high. The TJPDC serves these localities by providing a reliable and professional venue for best practices, concerns, and cooperative planning to occur.

Intragovernmental Organization

Within localities, a variety of departments are assigned responsibilities for handling certain hazard mitigation tasks. In most counties, planning and public works departments are the key players. Nelson County assigns most responsibility to the Emergency Management Department. Police and fire departments are integral to emergency response, and they also play a supportive role in pre-disaster mitigation. However, as demonstrated in the parties present in both the TJPDC Hazard Mitigation Working Group as well as the lead organizations assigned to many of the mitigation action items. Many localities integrate multiple departments into natural hazard mitigation planning, prevention, and response.

Land use

Local land use planning and regulations, in general, have an impact on mitigation capabilities. All localities in the region practice some form of growth management, including limiting development in hazard areas such as flood plains. Comprehensive plans delineate growth areas that are intended to absorb the majority of commercial and residential growth projected over the next planning cycle. Zoning codes, subdivision ordinances, and other regulations have been adopted to support and further the land use goals in the comprehensive plans.

Towns

Governmental services offered by counties apply to towns, including emergency response such as fire and rescue. The Town of Scottsville supplements county law enforcement with a town department, and several towns offer general public services such as water and sewer and solid waste disposal. In terms of hazard mitigation activities, towns have little additional capacity beyond the counties they are contained within. They often rely on the counties for hazard mitigation support, and that is why some were represented on the working group by county staff.

Some county-wide regulations apply to towns, but towns must adopt their own zoning and subdivision ordinances. The Town of Stanardsville adopts the Greene County ordinance as their own. The town does not hire their own staff, but shares planning and development staff with Greene County. The Town of Mineral and the Town of Louisa practice a similar approach, and each have a person on staff to administer the code and direct public works operations. The Town of Scottsville has an independent zoning ordinance that is updated regularly.

Mitigation Action Plan

This section outlines the Mitigation Action Plan including:

- **Goals and Objectives guiding the plan**
- **Hazard-specific strategies**
- **A summary of mitigation action items by locality**
- **Detailed mitigation action items by locality**

201.6(c)(3)(i): [The hazard mitigation strategy shall include a] description of mitigation goals to reduce or avoid long-term vulnerabilities to the identified hazards.

201.6(c)(3)(ii): [The mitigation strategy shall include a] section that identifies and analyzes a comprehensive range of specific mitigation actions and projects being considered to reduce the effects of each hazard, with particular emphasis on new and existing buildings and infrastructure.

201.6(c)(3)(iii): [The mitigation strategy section shall include] an action plan describing how the actions identified in section (c)(3)(ii) will be prioritized, implemented, and administered by the local jurisdiction. Prioritization shall include a special emphasis on the extent to which benefits are maximized according to a cost benefit review of the proposed projects and their associated costs.

201.6(c)(3)(iv): For multi-jurisdictional plans, there must be identifiable action items specific to the jurisdiction requesting FEMA approval or credit of the plan.

Mitigation Strategy

The following goals and objectives, grouped into five broad categories, are recommended by the plan. As stated earlier in the plan, both the Working Group and members of the public were able to suggest revisions to the 2018 Goals and Objectives. A full list of those edits can be found in the Appendix A. Edits focused primarily on broadening objectives to include activities like building retrofitting and adaption in addition to relocation, access to data, and data tracking:

Education and Outreach (E)

- **GOAL: Increase awareness of hazards and encourage action to mitigate the impacts o**
  - **OBJECTIVE: Educate families and individuals on disaster mitigation and preparedness**
  - **OBJECTIVE: Train key agency staff and volunteer groups in disaster mitigation and preparedness**
  - **OBJECTIVE: Train staff at schools and residential facilities in disaster mitigation and preparedness**
  - **OBJECTIVE: Encourage and equip employers to develop emergency action plans**

Infrastructure and Buildings (I)

- **GOAL: Reduce the short and long-term impact of hazard events on buildings and infrastructure**
  - **OBJECTIVE: Diversify the energy system to provide multiple power source and fuel supply options and promote self-sufficient buildings with multiple energy options**
  - **OBJECTIVE: Diversity the communications system to provide alternative lines for use during loss of capacity**
  - **OBJECTIVE: Diversify the transportation system by increasing connectivity and providing modal options**
  - **OBJECTIVE: Elevate, retrofit and relocate existing structures and facilities in vulnerable locations**
  - **OBJECTIVE: Construct or upgrade drainage, retention, and diversion elements to lessen the impact of a hazard on an area**

- OBJECTIVE: Protect sensitive areas through conservation practices
- OBJECTIVE: Ensure that each critical facility has a disaster plan in place

Whole Community (C)

- **GOAL: Prepare to meet the immediate functional and access needs of the population during natural hazards**
  - **OBJECTIVE: Effectively communicate with and transport people regardless of their language proficiency and physical needs.**
  - **OBJECTIVE: Make information available, accessible, and accurate to ensure the entire population can access emergency shelters in a timely manner and have functional needs met, in the event of a natural hazard**
  - **OBJECTIVE: Updating necessary information consistently and through multiple different outlets through the development an emergency information communication plan**

Mitigation Capacity (M)

- **GOAL: Increase mitigation and adaptation capacity through planning and project implementation**
  - **OBJECTIVE: Reduce property risks through planning, zoning, ordinances and regulations**
  - **OBJECTIVE: Incorporate mitigation planning concepts, climate resilience, and vulnerability planning into local plans and ordinances**
  - **OBJECTIVE: Pursue funding to implement identified mitigation and resilience strategies**
  - **OBJECTIVE: Encourage proactive management of hazard prone areas, environmental features, or infrastructure**

Information and Data Development (D)

- **GOAL: Build capacity with information and data development to refine hazard identification and assessment, mitigation targeting and funding identification**
  - **OBJECTIVE: Identify data and information needs and develop methods to meet these needs**
  - **OBJECTIVE: Utilize data to ensure proactive targeting of mitigation efforts**

Hazard-Specific Strategies

The mitigation action items are organized in this plan by jurisdiction, in order to highlight regional differences and assign ownership to local governments. However, there is also a need to explicitly link the action items determined for each locality with the hazards identified regionally in this plan, in order to determine whether the actions are properly aligned with the actual threats posed by natural hazards in the region. Hazard-specific strategies are included for those hazards ranked high or moderate.

The Hazard Mitigation Working Group identified two high-risk hazards in the region and one moderate-risk hazard in the region that necessitate special attention in this plan. With a relative threat rating of 74%, wind events (Hurricane/high wind/windstorms) was determined to be the hazard with the greatest probability of occurrence and highest impact on the community. Flooding ranked second with a relative score of 65%. These hazards are considered high-risk for all localities in the TJPD.

Winter storms/weather was considered a moderate risk, with a relative score of 56%. Communicable disease/pandemic, a new natural hazard that was examined in the plan, scored 30% as the fourth ranked hazard. Scores dropped sharply for other risks, with wildfire, lightning, drought/extreme heat, tornado, and dam failure all were scored equally with a relative threat rating of 22% as the fifth ranked hazards. Wildfire and lightning are covered under the same strategy. Drought/extreme heat is considered as a single strategy, as is dam failure. Earthquake had a relative rating of 19%, and landslide at 11%. All of these are considered low risk hazards.

Hurricane / High Wind Events | High Risk

Hurricanes, high winds and windstorms combined were ranked as the most significant hazard in the region. For the purposes of the mitigation strategies, these wind events and tornadoes are considered together.

Hurricanes and tornadoes are very different in their impact and require somewhat of a difference in preparedness. It should be noted that some of the greatest impacts of hurricanes are associated with the flooding caused by these major storms. Mitigation of water-related impacts is considered in the flooding strategy above, and this strategy will only

consider the wind related impacts. These similarities demonstrate that while each of these hazards are interrelated, distinct mitigation actions are required for each.

Similar to winter storms, high wind can disrupt the power system. There are recommendations to remove vegetation from the vicinity of power lines, with the understanding that complete removal of street trees is not desirable for many residents in urban areas. There are also action items related to keeping properties and driveways free of dangerous trees or vegetation, although this strategy is completely voluntary and implemented through educational programs. Many localities also identified the need to retain, train, and promote career emergency management officials, as well as EMT professionals within each locality. Ensuring that there is proper and appropriate capacity for this most common and high risk hazard is critical. Further, many localities highlighted a need for a consistent, developed, and rehearsed set of emergency communications plans in response to power outages caused by high wind events.

Flooding | High Risk

Flooding is the second most significant hazard in the region, and several of the mitigation action items in this plan are intended to limit its impacts. All localities in the region experience flooding, but there are important differences in the types of flood events that occur. Portions of Fluvanna County, the City of Charlottesville, and Albemarle County may be inundated in riverine flooding from the James River or the Rivanna River. Flooding the Greene County, Nelson County, and western Albemarle County are prone to flash floods and stormwater drainage from the Blue Ridge Mountains.

There are essentially three primary strategies for mitigation of flooding: 1. adjust the path of flooding either through engineering or passive restoration of natural function. 2. Limited development and/or remove objects of value from the path of floodwaters. 3. Prepare and educated the public for responding to floods. Many localities are engaging in flood mitigation, from ensuring that riparian buffers are restored along riverbanks, debris management in culverts, educational programs to educate citizens, or grant-funded studies to update floodplains and/or flood resilience infrastructure.

The most significant element of flood control currently in the region are the dams for reservoirs and the levee protecting Scottsville. No specific action items are recommended for these improvements, because the responsibility for dam monitoring and management is outside the scope of local responsibility. The levee in Scottsville was evaluated in the vulnerability assessment and determined to withstand a 1% flood. There are no improvements recommended by this plan for the levee. However, the town has indicated a desire to update its Flood Maps through grant funding, as well as improve riparian buffers around the James River to prevent flooding. A considerable amount of work is being done to make the region's dams safer and more efficient. Dam safety is critical to flood prevention as well as ensuring adequate, safe, and reliable drinking water for residents.

Several action items directly involve stormwater management, with the purpose of enhance flood control. These are especially important in more urbanized areas with more density that can be impacted. More urbanized areas also tend to have higher proportion of impervious surfaces that tend to speed up and redirect the flow of stormwater in ways that can be harmful. The Virginia Department of Environmental Quality has mandated or encouraged certain stormwater management practices, with the purpose of complying with the Chesapeake Bay Act in improving water quality. Flood control is another important factor to consider, so many of these practices are included in this plan as well. These practices include increasing the storage capacity of streams, maintenance of stormwater conveyance systems, removal of debris that may block channels, and the installation or maintenance of basins for the collection of storm water.

The second strategy is to limit human settlement in the path of waters. This can be done through policy, such as zoning codes establishing special zones for flood areas, or retroactive practices of removing structures current susceptible to flooding. Most jurisdictions in the area already have zoning codes meant to protect from flooding, but this plan does recommend strengthening those codes in some cases. Some localities want to ensure that private roads are safe from flooding since they are not regulated or maintained by VDOT.

Finally, the plan includes action items intended to assist the public and emergency responders in cases when flooding does occur. Many of the action items are intended to provide crucial information, such as signage along routes that are susceptible to flooding and high-water marks on bridges. There are recommended education campaigns targeted toward individual households with ideas for flood-smart landscaping and household practices. These types of mitigation action items are important since many flood prone areas have been settled or encompass busy roads and thoroughfares.

There are also general action items intended prepare for multiple hazards with properly equipped shelters, communications, and organization of staff and volunteers. One of the plans objectives is particularly geared toward floodplains: Elevate, retrofit and relocate existing structures and facilities in vulnerable locations. The list of potential actions prepared by TJPDC for locality use suggested several strategies under this objective, including the Identification of vulnerable structures and application for funding to implement acquisition and demolition, relocation, floodproofing, or structural retrofit projects.

§201.6(c)(3)(ii): [The mitigation strategy] must also address the jurisdiction's participation in the National Flood Insurance Program (NFIP), and continued compliance with NFIP requirements, as appropriate.

Five counties in the region and the City of Charlottesville participate in the National Flood Insurance Program (NFIP), which enables property owners to purchase federally-backed insurance to protect against losses from flooding. The towns of Stanardsville and Scottsville also participate. Louisa County was suspended from NFIP on October 31, 2016 and does not plan to pursue reinstatement. The Towns of Louisa and Mineral in Louisa County have not participated in NFIP, but are identified by this plan as very low flood-risk.

Except for the County of Louisa, all jurisdictions in the Thomas Jefferson region meet or exceed the minimum regulatory requirements by limiting the extent of development in identified floodplains. Participating in NFIP also makes localities and property owners within flood hazard areas eligible for various mitigation funds that are intended to reduce the risk of future flood losses. Several action items in

this plan take advantage of this opportunity for localities to reduce their overall exposure to flooding damage. For example, Scottsville has won grants to both prepare riparian buffers and create new floodplain maps.

The following table is from the FEMA National Flood Insurance Program Community Status Book, as of March 2022:

Community	Flood Hazard Boundary Map Identified	Flood Insurance Rate Map Identified	Current Effective Map Date	Date Community Joined Program
Albemarle County	08/25/78	12/16/80	05/16/16	12/16/80
Charlottesville City	05/24/75	06/15/79	02/04/05	06/15/79
Fluvanna County	12/13/74	08/15/78	05/16/08	08/15/78
Greene County	12/13/74	09/10/84	03/23/21	09/10/84
Louisa County	12/20/74	06/01/89	11/5/97	Suspended – 10/31/16
Nelson County	11/22/74	08/01/78	06/18/10	08/01/78
Scottsville, Town Of	09/10/76	09/05/79	05/16/16	09/05/79
Stanardsville, Town Of	02/11/77	12/26/78	03/23/21	12/26/78

Louisa County became aware that FEMA and the Virginia Department of Conservation and Recreation (DCR) required updates to the County's regulations relating to development in the Floodplain Overlay District in order to ensure continued participation in National Flood Insurance Program (NFIP) in late 2014. At the December 1, 2014 regular meeting of the Board of Supervisors (BOS), the BOS referred updates to the regulations to the Planning Commission. The resolution noted that the FEMA Flood Insurance Rate Maps for Louisa County had serious inaccuracies that should be remedied.

FEMA notified the County by letter dated February 23, 2016 that it could cut off residents' access to flood insurance and some disaster aid if the County did not strengthen its flood plain ordinance. The County's current ordinance noted that homes could not be built in a floodplain, but did not have the same restriction for commercial construction. The BOS discussed the Floodplain (FP) Zoning Overlay District at their meeting held Monday, June 6, 2016. Discussion noted that the Planning Commission discussed the draft floodplain ordinance at its February 12, 2015 meeting, but deferred the issue to the Board. FEMA directed the County to update and adopt an amended ordinance by August 31, 2016 in order to remain in good- standing in the NFIP. The June 6 discussion included questions and comments to the Board regarding the inaccuracy of the federal agency maps of Louisa County. The BOS directed staff to work closely with FEMA and DCR on making the recommended changes. FEMA published Louisa County's suspension of community eligibility in the Federal Register on September 29, 2016, effective October 31, 2016.

The Louisa County BOS held a public hearing at their October 3, 2016 meeting on repealing the Floodplain Overlay District. Forty-two people spoke in opposition of the amendments to the floodplain regulations ordinance. One person submitted written comments in favor of the amendments to the floorplan regulations notice. The BOS, on a vote of 5 to 2, voted to revoke the current floodplain ordinance in its entirety. Landowners in Louisa who were opposed to FEMA's proposed ordinance said it threatened their rights to use their property.

The Louisa BOS held a Special Public Meeting and Hearing on October 26, 2016 to accept public comment related to the adoption of a floodplain ordinance. The proposed ordinance defined the floodplain on a map prepared by the County, expressly excluded certain land that comprises or adjoins Blue Ridge Shores and Lake Anna, and provided for the appeal of any determination related to the location of land in a floodplain to the BOS and/or to the circuit court. The BOS unanimously passed the proposed ordinance, but it did not meet FEMA's requirements. The County has indicated it does not intend to pursue reinstatement in the NFIP, primarily based on input from citizens. FEMA is updating the flood plain maps. Citizens are now aware that they cannot obtain flood insurance is the County is not included in the NFIP. A letter to the editor calling for the Board of Supervisors to revisit participation in the NFIP appeared in The Central Virginia on January 18, 2018. As of 2022, Louisa continues to not participate in the NFIP.

Winter Storms | Moderate Risk

Winter storms are common in the region. The primary impacts are felt in infrastructure, both in the safety of the roadways, the disruption of business operations, and loss of power. Impedance of access is another important impact of storms. Snow can make emergency response and travel to critical services difficult, especially for vulnerable populations in rural areas. Finally, extreme cold can be harmful to vulnerable populations. Severe winter storms have the capacity to strand those who live in rural areas without power for days.

Several actions items are intended to prevent the loss of power during a snowstorm. The plan recommends for localities to partner with power companies to make sure that trees or other obstacles do not pose a threat to power lines. In some cases, the burial of utilities is recommended for urban areas. Other action items are intended to maintain the emergency response function during a power outage. It is important for localities to have multiple means for communication, and not to be overly reliant on devices that require power. Ensuring that localities have the capacity to be flexible in communication, as well as engaging in door-to-door outreach is important in cases where many are without power and roads are difficult to traverse. More comprehensive use of media outlets is suggested in some cases. Back-up generators are recommended for all shel-

ters, as well as for businesses that are critical to the community such as grocery stores. Other action items are intended to assist in locating vulnerable households that may require assistance in heating or other attention during a power outage.

Another mitigation strategy is to limit the impact on transportation infrastructure during storms. Snow removal on public roads is conducted by VDOT in all localities except for the City of Charlottesville, but there are several private communities and individual driveways that rely on other means for snow removal. All localities also include an action item to encourage address signs that are visible during winter storms. Localities, like for other hazards, are looking to be more proactive about construction and placement of buildings to ensure they are not prone to significant damage from heavy snow and/or ice.

Mitigation Actions

Mitigation actions are discrete projects, programs, or policies that are recommended for implementation in this plan. The action items differ from objectives in that they are measurable, have a party responsible for completion, and typically can be completed within a given timeframe. The action items presented in this

plan represent the aspirations of the various localities in the region, with the understanding that they may be completed as resources are made available from a variety of sources. Mitigation actions are to be implemented by the lead party, as identified in the plan, often in partnership with other agencies and organizations.

Several action items, particularly those involving the creation or revision of policy, will enhance resilience to hazards for development that occurs after implementation. Other action items are intended to retroactively improve existing structures and infrastructure to mitigation hazards. In many cases ongoing maintenance, such as clearing debris to prevent forest fires, or practices of household and business preparedness are recommended. The list of action items strikes a balance between structural, policy-oriented, and programmatic recommendations.

TJPDC staff compiled input from the Working Group into a listing of potential actions organized under each goal and objective. The list was provided to each jurisdiction and used in discussions with Local Emergency Plan Committees (LEPCs) and at Working Group meetings. Each action item in the plan is prioritized as high, moderate, or low to reflect the mitigation value of the action or the urgency it requires. Priorities were determined based on several criteria. Items that were included in the 2018 plan generally maintain the same priority. The online survey asked respondents to prioritize goals and objectives, and this information has been used to prioritize the associated action items. Locality staff considered the severity and urgency of the issue to be addressed, the locality's capacity to complete the action, and the benefit to be realized compared to the estimated cost of completion.

TJPDC staff recommended use of FEMA's cost-benefit analysis toolkit to ensure that localities were considering factors like number of people affected by hazards, area affected, property damage, loss of life, and injury, as well as economic impacts of inaction or partial action. A broad range of benefits were considered; some actions provide benefits beyond mitigating the impacts of hazards. Localities are acquainted with these types of tradeoffs, and instead of prescribing a specific process that each locality should use after creating mitigation action items, TJPDC staff instead prioritized locality-specific analysis when generating and prioritizing mitigation action items. Localities were encouraged to communicate cross-departmentally to accurately measure costs, timeline, and priority. TJPDC staff encouraged an iterative and collaborative process within each locality, as well as with other localities concerning shared hazards or facilities. The table in the appendices identifies 2018 actions removed or revised as to their priority.

Most localities chose to roll over actions that were either incomplete, delayed, or modified from the 2018 plan. There were significant revisions of actions' priorities, lead parties, and/or costs. These changes were primarily a result of localities experiencing significant staff turnover since 2018 and funding constraints. Many localities decided to revise older mitigation action items to supply a more realistic and achievable set of action items for the next 5 years. Locality staff indicated that revising goals, as well as coordinated efforts to revitalize LEPC meetings and other community engagement opportunities, serves as a realistic and operational foundational for hazard

mitigation efforts in the coming years. Some localities added new action items in order to address new goals.

Actions to include the Hazard Mitigation Plan into other community plans have been included in the 2006 plan, the 2012 plan, the 2018 plan, and this plan. Community plans would generally include the Comprehensive Plan, the Emergency Operations Plan (EOP) and the Capital Improvement Plan. The Hazard Mitigation Plan is specifically cited in the Comprehensive Plans for Charlottesville, Albemarle, Fluvanna and Greene Counties. The City of Charlottesville has recently updated its Comprehensive Plan and was adopted in November 2021. There is no specific reference to the Hazard Mitigation Plan in Comprehensive Plans for Louisa County (last amended in 2016) or Nelson County (last updated in 2014). Towns are addressed in their respective County Comprehensive Plans and all towns in the Planning district have their own Comprehensive Plans, focusing on land use and Town goals and objectives. None of the Town plans specifically reference the Hazard Mitigation Plan. TJPDC staff emphasized the inclusion of the 2023 Hazard Mitigation plan in upcoming plan updates in order to better coordinate efforts across departments within each locality and because much of the goals of hazard mitigation are related or linked to other locality goals like housing, transportation, and environmental issues. TJPDC staff will be available to provide guidance on the plan, its goals, and any necessary resources as needed. Multiple localities will be updating their Comprehensive Plans in the coming 5 years.

Emergency Operations Plans serve as a locality's guide to prepare, respond, and plan for natural hazards. The Regional Hazard Mitigation plan, and the planning process, align clearly with the EOP, which also contains information about natural hazards and their severity and frequency. Locality staff should and will use the Hazard Mitigation Plan as they update their respect EOP's.

Capital Improvement Plans (CIPs) are generally reviewed and updated on an annual basis. The integration of the HMP requirements into other planning mechanisms will be specifically addressed in annual meetings to maintain the plan to ensure that this requirement is addressed by the localities. As more counties and localities begin to engage with climate resiliency studies and efforts, the HMP can serve as a critical resource in creating economies and scale and ensuring there are not duplicative efforts. Annual meetings provide an opportunity for local governments to identify components of the HMP process that are able to be replicated or used in other plans.

Process Discussion

The action items are presented here in both in an abridged and unabridged form to facilitate ease of use. Each item is color-coded by locality and numbered sequentially with higher priority action items appearing earlier on the list. The Mitigation Action Worksheet template follows:

[Activity Code] Mitigation Action: [Jurisdiction]	
Category:	One of the goal categories listed above that is supported by the action
Action Item (Describe):	Brief description of action item
Hazard(s):	The hazard(s) the action is intended to mitigate
Lead Agency/Department Responsible:	Identify the local agency, department, or organization that is best suited to accomplish the action.
Estimated Cost:	An estimate of the costs required to complete the project or continue the project for the course of 5-years; this amount should be estimated until a final dollar amount can be determined.
Funding Method: (General Revenue, Contingency/Bonds, External Sources, etc.)	Potential sources of funds to complete the action, when applicable
Implementation Schedule:	Timeframe for which the action is expected to be completed
Priority	Placement in the order of importance and urgency

ACTIVITY CODE KEY

R H E 1 ← **Sequential number within group**

Place
R-------Thomas Jefferson Region
A ------Albemarle County
AS-----Town of Scottsville (Albemarle)
C-------City of Charlottesville
F-------Fluvanna County
G ------Greene County
GS-----Town of Stanardsville (Greene)
L-------Louisa County
LL -----Town of Louisa (Louisa)
LM ----Town of Mineral (Louisa)
N ------Nelson County

Priority
H------ High
M ----- Moderate
L ------ Low

Goal
E-------Education and Outreach
I--------Infrastructure and Buildings
C-------Whole Communities
M------Mitigation Capacity
D ------Information and Data Development

2023 Action Items for Regional Hazard Mitigation Plan

Activity Code	Activity Description
Thomas Jefferson Region	
RHE1	Provide a copy of the Regional Hazard Mitigation Plan to each library in the Jefferson-Madison Regional Library system
RME1	Conduct a public education program on disaster preparedness, leveraging existing materials and sharing resources regionally
RME2	Engage Working Group and leverage connections to continue mitigation preparedness throughout plan's duration, before next update
RMD1	Identify locations for deposit of debris after a hazard
RME3	Continue to research grant and funding opportunities for regionwide hazard mitigation efforts
RMI1	Promote and educate localities on high hazard dam vulnerability reduction including rehabilitating/removing dams, elevating structures in inundation zones, and adding flood protection, such as berms, floodwalls or floodproofing, in inundation zones

Albemarle County	
AHE1	Increase the number of trained emergency responders, both staff and volunteers. Establish a minimum ICS/emergency management training/certification requirement for essential County staff. Train/educate 70% of identified staff to minimum qualifications. Conduct disaster tabletop and/or full-scale scenarios on an annual basis to exercise skills/processes
AHI1	Implement recommendations from the urban Community Water Supply Plan and those for all other public water supplies within the County, including drought monitoring and management
AHI2	Develop an integrated regional security and monitoring system, including access control and intrusion detection
AHI3	Establish a backup Emergency Operations Center (EOC)

AHI4	Establish an Albemarle County specific basic Emergency Operations Plan and annexes for the 3 highest risk natural disasters as defined in the HIRA.
AHM1	Incorporate this Regional Hazard Mitigation Plan into local comprehensive plans and Emergency Operations Plans
AHM2	Install fire mitigation measures, including dry hydrants, fire breaks, and fire rings.
AHM3	Develop continuity-of-operations plan to ensure critical operations are maintained during power failure.
AHD1	Continue to assess resilience of existing critical facilities to natural hazards
AHD2	Mitigate Water and Wastewater System Failure or Contamination through community coordination and information/equipment sharing. Provide planning support for operational and integrated security management (including communications plan and continuity plan, emergency exercises, coordinated committee)
AHC1	Develop a debris management plan (including emergency response access and cleanup) for removal of fallen trees, etc. following a storm, such as hurricane or tornado.
AHC2	Engage in climate resilience and adaptation planning and implement initiatives to prepare for the anticipated hazards and impacts driven by climate change.
AHC3	Implement initiatives to reduce community greenhouse gas emissions as prescribed by the Climate Action Plan adopted in 2020 in order to mitigate climate change.
AME1	Ensure that all schools have regular disaster response drills
AME2	Continue to pursue conservation practices in sensitive areas, including riparian buffers and flood-prone areas.
AME3	Conduct comprehensive residential and business disaster preparedness programs focusing on the ability of residents and businesses to sustain themselves for 72 hours post emergency.
AME4	Define Neighborhoods/communities within the County and identify (using a contact management system) key residents and Non-Governmental organizations (NGOs) within each neighborhood who may connect the County and disaster services to the neighborhood during a crisis.
AMI1	Build or repair bridges so as not to minimize impacts to floodways
AMI2	Upgrade existing bridges to support emergency vehicles
AMI3	Carry out physical security improvements to water and wastewater systems, which may include fencing, door hardening, window hardening, locks, bollards, cameras, signage, lighting, access control and intrusion detection.
AMI4	Procure technology equipment for Water/Wastewater system component inspections.
AMI5	Improve the maintenance and repair of stormwater conveyance systems – in part through better coordination and cooperation with local partners
AMC1	Improve the preparedness of public and private dams within the county to withstand extreme flood events
AMC2	Maintain and update, as needed, the regional and local sheltering plans.
AMC3	Continue to assess designated community shelters for compliance with minimum specifications and best practices.
AMC4	During Comp Plan update, consider loosening restrictions on the types of County improvements in Rural Areas to accommodate community support facilities.
AMM1	Through the development process, discourage or prohibit development in flood-prone areas
AMD1	Expand GIS data and other technologies for the purposes of mitigation planning, preparedness planning, and response activities
ALE1	Encourage property owners and residents to clear storm drain inlets, channels, creek beds, and other conveyances of fallen trees and debris to minimize the potential for flow restrictions and flooding.
ALE2	Ensure all houses and businesses have clear address signs that are visible during snowstorms and other emergencies
ALE3	Continue educational campaign about the benefits of open space and sensitive area protection.
ALE4	Outdoor warning sirens for public use facilities
ALC1	Increase the capacity to shelter in place in public buildings.
ALC2	Promote biodiversity and native plant communities and control invasive species to improve the resilience of native ecosystems
ALC3	Develop communications strategy and protocols (both preparedness and response) using traditional and emerging outlets (local media, social media, etc.); consider languages besides English

ALC4	Improve ability to notify public in the event of extreme storms and/or dam failure, possibly through utilizing river level sensors and a downstream notification system
ALC5	Continue and expand the use of citizen alert systems. Explore use of Social Media platform emergency alert systems. Establish backup procedures/plans for emergency notification/alert when methods relying on power & technology are inoperable
ALI1	Implement Stormwater Management programs and initiatives to reduce flood risk throughout the community
ALI2	Improve the maintenance, repair, and upgrades to public and private stormwater management facilities and impoundments to withstand extreme storms and enhance flood control.
ALI3	Partner with utility companies to keep power lines and other utilities free of vegetation
ALI4	Implement programs and initiatives to reduce pollution discharge via stormwater systems
ALI5	Continue to upgrade security systems
ALI6	Promote increased tree canopy in urban areas to reduce heat island effect.

Town of Scottsville	
ASMM1	Update the Town's Floodplain Maps to inform decision-making.
ASMM2	Improve Riparian Buffers along parts of Mink Creek and the James River.
ASLM1	Improve Regional Transit for emergency evacuations, prevention, and resiliency.

City of Charlottesville	
CHE1	Provide training for building inspectors and code officials on mitigation techniques and hazard-resistant buildings.
CHE2	Ensure that all city schools have an emergency and disaster plan and regularly conduct disaster response drills.
CHM1	Complete Flood Resilience Plan
CHM2	Complete Climate Adaptation Plan
CHM3	Update floodplain regulations
CHM4	Incorporate hazard mitigation plan into community plans. Identify senior living/special needs residences in areas vulnerable for flooding.
CHM5	Conduct Community Emergency Response Team (CERT) classes to equip individuals and groups to assist in the event of a disaster.
CHM6	Provide incentives to institutions and homeowners for use of low-flow appliances.
CHM7	Continue to expand use of citizen alert system. (Code RED) Develop community promotion plan for Code RED.
CHM8	Inventory all shelters and public buildings to ensure emergency preparedness supplies and equipment are onsite.
CMD1	Identify vulnerable structures and apply for funding to implement acquisition and demolition, relocation, floodproofing, or structural retrofit projects
CMD2	Conduct a needs survey that identifies special needs population and residences and/or facilities needing attention in the event of emergencies or evacuations
CMI1	Ensure culverts, streams, channels, storm drains, and gutters remain clear of debris
CMI2	Build or repair roadway and pedestrian crossings so as not to impede floodwaters
CMI3	Retrofit emergency service buildings for hazard preparedness and resistance.
CMM1	Support volunteer groups and encourage collaboration on public outreach and education programs on hazard mitigation.
CMM2	Pursue conservation practices in sensitive areas (stream corridor restoration, forest management)
CMM3	Create a strategy for using existing media outlets for communications during a hazard event.
CMM4	Ensure that all critical facilities have updated shelter-in-place plans
CLE1	Provide citizens with literature about flood and drought-smart landscaping and GI. Promote VCAP.
CLE2	Create educational campaign about floodplain locations, the benefits of open space and riparian corridors.
CLI1	Improve the maintenance of stormwater infrastructure.

CLI2	Reduce pollution discharge to and erosive conditions in receiving waters.
CLI3	Increase infiltration capacity and volumetric reductions in runoff via stormwater control measures (SCMs).
CLI4	Improve capture and conveyance capacity of stormwater infrastructure.

Fluvanna County	
FHE1	Increase the number of trained emergency responders, both staff and volunteers
FHI1	Install new fire hydrants along new JRWA water line
FHC1	Conduct regular disaster response drills in schools, and with staff at Assisted Living Facilities and Nursing Homes
FHC2	Continue and expand the use of citizen alert systems
FHC3	Implement community notification protocols before, during, and after a disaster event
FHM1	Develop Continuity of Operations Plans (COOP) for locality departments and update the plans annually
FME1	Carry out a targeted educational campaign in subdivisions at high risk for fire impacts
FME2	Conduct tabletop exercises for damage assessments
FME3	Bring in experts to conduct in-house staff training in best management practices in hazard mitigation and preparedness
FME4	Offer training on post-event inspection and develop a protocol to serve as a mechanism for prioritization
FMI1	Identify vulnerable structures and apply for funding to implement acquisition and demolition, relocation, floodproofing, or structural retrofit projects
FMI2	Install warning signs and develop alternate routes for roads that flood briefly during heavy rains (e.g. Slaters Fork Road, Carysbrook, farm pond dam locations)
FMM1	Identify areas to receive debris from post-event clean-up efforts
FMD1	Expand GIS data for us in mitigation planning, preparedness planning, and response activities
FLE1	Carry out an educational campaign for businesses to develop emergency procedures and shelter-in-place plans
FLI1	Identify repetitive loss properties, develop appropriate mitigation action, and apply for funding
FLI2	Demolish and remove remains of old surface water treatment plant located on TM 58 A 26 & 27(County-owned property)
FLI3	Remove +/-20,000 gallon water storage tank from James River.
FLC1	Develop County agreements (possibly with women's prison) for food services for county-supported shelters (including high school)
FLM1	Develop evacuation plans for dam breaches from Charlottesville-area dams
FLM2	Develop a comprehensive fire safety communication strategy, addressing open space, burn permit, FireWise, and dry hydrants
FLM3	Adopt fire code
FLM4	Incorporate this Regional Hazard Mitigation Plan into local comprehensive plans and Emergency Operations Plans
FLD1	Develop a disaster plan for the Fork Union Sanitary District (FUSD)

Greene County	
GHE1	Conduct Firewise workshops
GHI1	Partner with utility companies to keep power lines free of vegetation
GHI2	Conduct structural evaluations of current and proposed shelters
GHI3	Implement recommendations from Greene County Water Supply plan
GHI4	Enhance dam safety; table tops/exercises
GHI5	Install backup generators in shelters and critical facilities
GHI6	Enhance public safety emergency communications to provides reliable, dependable coverage
GHI7	Enhance access to broadband countywide

GHC1	Assist the schools with regular disaster response drills and disaster planning
GHM1	Conduct CERT classes to equip individuals and groups to assist in the event of a disaster
GHM2	Routinely inspect public and private fire hydrants
GHM3	Ensure all critical facilities have updated shelter-in-place plans
GHM4	Increase number of trained emergency responders and establish recruitment and retention program
GME1	Develop cooperative agreements between all agencies involved in emergency management, provide methods of communication between agencies responsible for being present at the Emergency Operations Center following a disaster, and conduct joint exercises
GME2	Create a community toolbox with tools and information for local homeowners
GMI1	Add signage to roads in locations that frequently flood
GMM1	Develop and implement a drought management plan
GMM2	Create a strategy for using existing media outlets for communications during a hazard event
GMM3	Provide career fire staff
GMI2	Upgrade all area bridges to support emergency vehicles
GMD1	Conduct channel improvement study
GMD2	Create a needs survey that identifies special needs population and residences and/or facilities needing attention in the event of emergencies or evacuations
GLE1	Provide citizens with literature about flood and drought-smart landscaping
GLI1	Build and repair bridges so as not to impede floodwaters
GLI2	Ensure culverts, streams, channels, storm drains, and gutters remain clear of debris
GLI3	Install more dry hydrants in high wildfire risk areas
GLI4	Repair, replace, or relocate septic and drainage fields that leak sewage into bodies of water during flooding events
GLI5	Bury utilities in the county
GLM1	Ensure all structures have clear address signs that are visible

Town of Stanardsville	
GSHM1	Increase water capacity and pressure for the Town of Stanardsville to enable optimal emergency response
GSMM1	Ensure all houses have clear address signs that are visible

Louisa County	
LHI1	Enhance access to broadband internet in rural areas
LHI2	Install backup generators in shelters and critical facilities
LHI3	Implement recommendations from Water Supply Plan
LHC1	Ensure that all schools have regular disaster response drills
LHM1	Provide training for building inspectors and code officials on mitigation techniques and hazard-resistant building
LHM2	Continue and expand use of citizen alert systems countywide, including within Towns
LHM3	Increase number of trained emergency responders
LHM4	Develop driveway codes to allow emergency vehicle access
LHM5	Work to prevent stormwater and wastewater flooding in water bodies across the County
LMI1	Put high water marks on bridges
LMI2	Investigate, plan, and implement repairs and/or upgrades to Bowlers Mill dam to preserve flood control benefits for the historic Green Springs area.
LMM1	Investigate safety and maintenance of roads in private communities

LMM2	Conduct Community Emergency Response Team (CERT) classes to equip individuals and groups to assist in the event of a disaster
LMM3	Ensure all houses have clear address signs that are visible during storms events
LMM4	Incorporate hazard mitigation plans into community plans
LMM5	Incorporate special needs populations into Hazard Mitigation and Emergency Operations Plans
LLE1	Provide educational outreach about the burn permit process
LLE2	Create an educational program to help residents understand the benefits and costs of earthquake insurance
LLI2	Add signage to roads in locations that frequently flood
LLD1	Track and map space available for pets at local SPCA and other animal shelters. Install generator and place shelter on snow removal priority list.

Town of Louisa	
LLHI1	Install backup generators in shelters and critical facilities – the Town Hall generator will be upgraded to serve as a shelter during emergencies
LLHM1	Incorporate hazard mitigation plans into community plans
LLMM1	Ensure all houses have clear address signs that are visible during snowstorms

Town of Mineral	
LMHM1	Incorporate hazard mitigation plans into community plans
LMMM1	Ensure all houses have clear address signs that are visible during snowstorms
LMMM2	Work with the Louisa County to designate a representative for the County's Emergency Operations Committee
LMMM3	Develop a system for alerts and other communication with citizens
LMMI1	Mark the fire hydrants with reflective markers for large snow storms
LMMI2	Install emergency generator for wells
LMLI1	Bury utilities underground in town of Mineral

Nelson County	
NHM1	Continue and expand use of citizen alert systems
NHM2	Provide training for building inspectors and code officials on mitigation techniques and hazard-resistant building
NME1	Conduct Firewise Workshops
NME2	Provide educational instruction and materials to school age youth and their teachers on proper procedures for respond-ing to natural disasters
NMI1	Investigate safety and maintenance of roads in private communities
NMM1	Ensure all houses have clear address signs that are visible during snowstorms
NLE1	Ensure that all homeowners and businesses located in areas prone to landslides are aware of the risks and appropriate responses to an event
NLI2	Maintain and add more fire rings in camping areas for controlled fires

2023 Detailed Action Items

[Activity Code] Mitigation Action: [Jurisdiction]	
Goal:	One of the goal categories listed above that is supported by the action
Action Item Description:	Brief description of action item
Hazard(s):	The hazard(s) the action is intended to mitigate
Lead Party:	Identify the local agency, department, or organization that is best suited to accomplish the action

Estimated Cost:	An estimate of the costs required to complete the project or continue the project for the course of 5 years; this amount should be estimated until a final dollar amount can be determined
Funding Method:	Potential sources of funds to complete the action, when applicable
Implementation Schedule:	Timeframe for which the action is expected to be completed
Priority	Placement in the order of importance and urgency

RHE1 Mitigation Action: Thomas Jefferson Region	
Goal:	Education and Outreach
Action Item Description:	Provide a copy of the Regional Hazard Mitigation Plan to each library in the Jefferson-Madison Regional Library system
Hazard(s):	Multiple
Lead Party Responsible:	TJPDC
Estimated Cost:	Minimal
Funding Method:	Regional Hazard Mitigation Planning Funds
Implementation Schedule:	6 months
Priority:	High

RME1 Mitigation Action: Thomas Jefferson Region	
Goal:	Education and Outreach
Action Item Description:	Conduct a public education program on disaster preparedness, leveraging existing materials and sharing resources regionally
Hazard (s):	Multiple
Lead Party Responsible:	Local Emergency Management Departments
Estimated Cost:	Unknown
Funding Method:	General Revenue
Implementation Schedule:	Ongoing
Priority:	Moderate

RME2 Mitigation Action: Thomas Jefferson Region	
Goal:	Education and Outreach
Action Item Description:	Engage Working Group and leverage connections to continue mitigation preparedness throughout plan's duration, before next update
Hazard (s):	Multiple
Lead Party Responsible:	TJPDC
Estimated Cost:	Staff time
Funding Method:	General funds
Implementation Schedule:	Ongoing
Priority:	Moderate

RMD1 Mitigation Action: Thomas Jefferson Region	
Goal:	Information and Data Development
Action Item Description:	Identify locations for deposit of debris after a hazard
Hazard (s):	Multiple
Lead Party Responsible:	VDEM, UVa

Estimated Cost:	$5,000
Funding Method:	General funds
Implementation Schedule:	1-3 Years
Priority:	Moderate

RME3 Mitigation Action: Thomas Jefferson Region	
Goal:	Information and Data Development
Action Item Description:	Continue to research grant and funding opportunities for regionwide hazard mitigation efforts
Hazard (s):	Multiple
Lead Party Responsible:	TJPDC
Estimated Cost:	Unknown
Funding Method:	General Revenue
Implementation Schedule:	Ongoing
Priority:	Moderate

RMI1 Mitigation Action: Thomas Jefferson Region	
Goal:	Infrastructure and Buildings
Action Item Description:	Promote and educate localities on high hazard dam vulnerability reduction including rehabilitating/removing dams, elevating structures in inundation zones, and adding flood protection, such as berms, floodwalls or floodproofing, in inundation zones
Hazard (s):	Dam Failure, Flooding
Lead Party Responsible:	TJPDC
Estimated Cost:	Unknown
Funding Method:	General Revenue
Implementation Schedule:	Ongoing
Priority:	High

AHE1 Mitigation Action: Albemarle County	
Goal:	Mitigation Capacity
Action Item Description:	Increase the number of trained emergency responders, both staff and volunteers. Establish a minimum ICS/emergency management training/certification requirement for essential County staff. Train/educate 70% of identified staff to minimum qualifications. Conduct disaster tabletop and/or full-scale scenarios on an annual basis to exercise skills/processes
Hazard(s):	Multiple
Lead Party Responsible:	Community Development Dept., Police Dept., Fire Rescue Dept., ACOEM
Estimated Cost:	unknown
Funding Method:	N/A
Implementation Schedule:	1-3 years
Priority:	High

AHI1 Mitigation Action: Albemarle County	
Goal:	Infrastructure and Buildings
Action Item Description:	Implement recommendations from the urban Community Water Supply Plan and those for all other public water supplies within the County, including drought monitoring and management
Hazard (s):	Drought, adequate potable water
Lead Party Responsible:	RWSA, Dept. of Community Development, other County agencies
Estimated Cost:	Variable
Funding Method:	RWSA ratepayers, state and federal grants
Implementation Schedule:	3-5 years
Priority:	High

AHI2 Mitigation Action: Albemarle County	
Goal:	Infrastructure and Buildings
Action Item Description:	Develop an integrated regional security and monitoring system, including access control and intrusion detection
Hazard (s):	Multiple (including outsider physical threat and terrorism)
Estimated Cost:	$4 Million
Funding Method:	Hazard Mitigation Grant Program, Utility Revenue, General Revenue
Implementation Schedule:	1-3 years
Priority:	High
Lead Party Responsible:	Albemarle County Service Authority, RWSA

AHI3 Mitigation Action: Albemarle County	
Goal:	Infrastructure and Buildings
Action Item Description:	Establish a backup Emergency Operations Center (EOC)
Hazard (s):	Multiple
Lead Party Responsible:	ACOEM, FES
Estimated Cost:	
Funding Method:	County Operational Budget
Implementation Schedule:	1-3 years
Priority:	High

AHI4 Mitigation Action: Albemarle County	
Goal:	Infrastructure and Buildings
Action Item Description:	Establish an Albemarle County specific basic Emergency Operations Plan and annexes for the 3 highest risk natural disasters as defined in the HIRA.
Hazard (s):	Multiple
Lead Party Responsible:	ACOEM, FES
Estimated Cost:	
Funding Method:	County Operational Budget
Implementation Schedule:	1-3 years
Priority:	High

AHC3 Mitigation Action: Albemarle County	
Goal:	Information and Data Development
Action Item Description:	Implement initiatives to reduce community greenhouse gas emissions as prescribed by the Climate Action Plan adopted in 2020 in order to mitigate climate change.
Hazard (s):	Multiple
Lead Party Responsible:	FES
Estimated Cost:	Variable
Funding Method:	County funds; grants
Implementation Schedule:	Ongoing
Priority:	High

AHM1 Mitigation Action: Albemarle County	
Goal:	Mitigation Capacity
Action Item Description:	Incorporate this Regional Hazard Mitigation Plan into local comprehensive plans and Emergency Operations Plans
Hazard (s):	Multiple
Lead Party Responsible:	Community Development Dept., Thomas Jefferson Planning District Comm., ACEOM
Estimated Cost:	None (other than staff costs)

Funding Method:	County operational budget (for staff time)
Implementation Schedule:	3-5 years
Priority:	moderate

AHM2 Mitigation Action: Albemarle County	
Goal:	Mitigation Capacity
Action Item Description:	Install fire mitigation measures, including dry hydrants, fire breaks, and fire rings.
Hazard (s):	Wildfire
Lead Party Responsible:	Fire Rescue Dept., Community Development Dept., Building Official, Dept. of Forestry
Estimated Cost:	Unknown; based on need
Funding Method:	Grant programs (Va. dry hydrant grant program)
Implementation Schedule:	Ongoing
Priority:	High

AHM3 Mitigation Action: Albemarle County	
Goal:	Mitigation Capacity
Action Item Description:	Develop continuity-of-operations plan to ensure critical operations are maintained during power failure.
Hazard (s):	Multiple
Lead Party Responsible:	
Estimated Cost:	$50,000
Funding Method:	County General fund, grant opportunities
Implementation Schedule:	1-3 years
Priority:	High

AHD1 Mitigation Action: Albemarle County	
Goal:	Information and Data Development
Action Item Description:	Continue to assess new and existing critical facilities for resilience
to/preparedness for natural hazards	
Hazard (s):	Multiple
Lead Party Responsible:	ACEOM, Dept. of Facilities and Environ. Services, Community Development Dept.
Estimated Cost:	Varies
Funding Method:	General Revenue; possible grant sources
Implementation Schedule:	Ongoing
Priority:	High

AHD2 Mitigation Action: Albemarle County	
Goal:	Information and Data Development
Action Item Description:	Mitigate Water and Wastewater System Failure or Contamination through community coordination and information/equipment sharing. Provide planning support for operational and integrated security management (including communications plan and continuity plan, emergency exercises, coordinated committee)
Hazard (s):	All
Lead Party Responsible:	Albemarle County Service Authority and RWSA

Estimated Cost:	$500,000
Funding Method:	Hazard Mitigation Grant Program, Utility Revenue
Implementation Schedule:	1-2 years
Priority:	High

AHC1 Mitigation Action: Albemarle County	
Goal:	Information and Data Development
Action Item Description:	Develop a debris management plan (including emergency response access and cleanup) for removal of fallen trees, etc. following a storm, such as hurricane or tornado.
Hazard (s):	Multiple
Lead Party Responsible:	VDOT, ACOEM, Community Development, Park and Rec, RSWA, other landfills in region
Estimated Cost:	N/A
Funding Method:	N/A
Implementation Schedule:	1-2 years
Priority:	High

AHC2 Mitigation Action: Albemarle County	
Goal:	Information and Data Development
Action Item Description:	Engage in climate resilience and adaptation planning and implement initiatives to prepare for the anticipated hazards and impacts driven by climate change.
Hazard (s):	Multiple
Lead Party Responsible:	FES
Estimated Cost:	Variable
Funding Method:	County funds; grants, including VA DCR Community Flood Preparedness Fund
Implementation Schedule:	Ongoing
Priority:	High

AME1 Mitigation Action: Albemarle County	
Goal:	Education and Outreach
Action Item Description:	Ensure that all schools have regular disaster response drills
Hazard (s):	Multiple
Lead Party Responsible:	Dept. of Schools and Education; independent private school
Estimated Cost:	N/A
Funding Method:	N/A
Implementation Schedule:	Ongoing
Priority:	Moderate

AME2 Mitigation Action: Albemarle County	
Goal:	Mitigation Capacity
Action Item Description:	Continue to pursue conservation practices in sensitive areas, including riparian buffers and flood-prone areas.
Hazard (s):	Multiple
Lead Party Responsible:	Virginia Outdoors Foundation, Nature Conservancy, Thomas Jefferson Soil and Water Conservation District, Albemarle Conservation Easement Authority, CDD, FES
Estimated Cost:	Based on individual property assessments and/or practices implemented

Funding Method:	Various
Implementation Schedule:	Ongoing
Priority:	Moderate

AME3 Mitigation Action: Albemarle County	
Goal:	Mitigation Capacity
Action Item Description:	Conduct comprehensive residential and business disaster preparedness programs focusing on the ability of residents and businesses to sustain themselves for 72 hours post emergency.
Hazard (s):	Multiple
Lead Party Responsible:	ACOEM, CAPE
Estimated Cost:	$20,000
Funding Method:	County general fund
Implementation Schedule:	Ongoing
Priority:	Moderate

AME4 Mitigation Action: Albemarle County	
Goal:	Mitigation Capacity
Action Item Description:	Define Neighborhoods/communities within the County and identify (using a contact management system) key residents and Non-Governmental organizations (NGOs) within each neighborhood who may connect the County and disaster services to the neighborhood during a crisis.
Hazard (s):	Multiple
Lead Party Responsible:	ACOEM, CAPE, OEI
Estimated Cost:	Unknown
Funding Method:	Unknown
Implementation Schedule:	1-3 years
Priority:	Moderate

AMI1 Mitigation Action: Albemarle County	
Goal:	Infrastructure and Buildings
Action Item Description:	Build or repair bridges and culverts so as not to minimize impacts to floodways
Hazard (s):	Flood
Lead Party Responsible:	Virginia Dept. of Transportation, CDD, P&R
Estimated Cost:	Unknown-based on individual projects
Funding Method:	VDOT State of Good Repair program, State transportation funding; federal bridge funds/highway funds, Hazard Mitigation Grant Program, 406 Public Assistance Program (after disaster), private foundation funding
Implementation Schedule:	Ongoing (as bridges and culverts are maintained, repaired, replaced or newly built)
Priority:	Moderate

AMI2 Mitigation Action: Albemarle County	
Goal:	Infrastructure and Buildings
Action Item Description:	Upgrade bridges to support emergency vehicles
Hazard (s):	Multiple
Lead Party Responsible:	VDOT, Railroads
Estimated Cost:	Unknown-based on individual projects

Funding Method:	VDOT State of Good repair program; State transportation funding; federal bridge funds/highway funds, Hazard Mitigation Grant Program, 406 Public Assistance Program (after disaster)
Implementation Schedule:	Ongoing (as bridges are maintained, repaired, replaced or newly built
Priority:	Moderate

AMI3 Mitigation Action: Albemarle County	
Goal:	Infrastructure and Buildings
Action Item Description:	Carry out physical security improvements to water & wastewater systems, which may include fencing, door hardening, window hardening, locks, bollards, cameras, signage, lighting, access control and intrusion detection.
Hazard (s):	Multiple (including outsider physical threat)
Lead Party Responsible:	Albemarle County Service Authority & Rivanna Water and Sewer Authority
Estimated Cost:	$2 Million
Funding Method:	Hazard Mitigation Grant Program, Utility Revenue
Implementation Schedule:	1-3 years
Priority:	Moderate

AMI4 Mitigation Action: Albemarle County	
Goal:	Infrastructure and Buildings
Action Item Description:	Procure technology equipment for Water/Wastewater system component
inspections.	
Hazard (s):	Multiple (including natural disasters and contamination)
Lead Party Responsible:	Albemarle County Service Authority & Rivanna Water and Sewer Authority
Estimated Cost:	$100,000
Funding Method:	Hazard Mitigation Grant Program, Utility Revenue
Implementation Schedule:	1-2 years
Priority:	Moderate

AMI5 Mitigation Action: Albemarle County	
Goal:	Infrastructure and Buildings
Action Item Description:	Improve the maintenance and repair of stormwater conveyance systems – in part through better coordination and cooperation with local partners
Hazard (s):	Flood
Lead Party Responsible:	Facilities and Environmental Services Dept., VDOT
Estimated Cost:	Unknown
Funding Method:	406 Public Assistance (following a federal declared disaster), County funding (CIP), Hazard Mitigation Grant Program
Implementation Schedule:	Ongoing
Priority:	Moderate

AMC1 Mitigation Action: Albemarle County	
Goal:	Infrastructure and Buildings
Action Item Description:	Improve the preparedness of public and private dams within the county to withstand extreme flood events
Hazard (s):	Flood
Lead Party Responsible:	Facilities and Environmental Services Dept, CDD, RWSA

Estimated Cost:	Unknown
Funding Method:	DCR dam safety grants and Community Flood Preparedness Fund
Implementation Schedule:	Ongoing
Priority:	Moderate

AMC2 Mitigation Action: Albemarle County	
Goal:	Infrastructure and Buildings
Action Item Description:	Maintain and update, as needed, the regional and local sheltering plans
Hazard (s):	Multiple
Lead Party Responsible:	ACOEM, DSS
Estimated Cost:	Unknown
Funding Method:	County general fund
Implementation Schedule:	Ongoing
Priority:	Moderate

AMC3 Mitigation Action: Albemarle County	
Goal:	Infrastructure and Buildings
Action Item Description:	Continue to assess designated community shelters for compliance with minimum specifications and best practices
Hazard (s):	Multiple
Lead Party Responsible:	Facilities and Environmental Services Dept, CDD, ACOEM, DSS< Red Cross
Estimated Cost:	Unknown
Funding Method:	County general fund
Implementation Schedule:	1-3 years
Priority:	Moderate

AMC4 Mitigation Action: Albemarle County	
Goal:	Infrastructure and Buildings
Action Item Description:	During Comprehensive Plan update, consider loosening restrictions on the types of County improvements in Rural areas to accommodate community support facilities
Hazard (s):	Multiple
Lead Party Responsible:	CDD, FES
Estimated Cost:	N/A
Funding Method:	N/A
Implementation Schedule:	1-3 years
Priority:	Moderate

AMM1 Mitigation Action: Albemarle County	
Goal:	Mitigation Capacity
Action Item Description:	Through the development process, discourage or prohibit development in flood-prone areas
Hazard (s):	Flood
Lead Party Responsible:	Community Development Dept.
Estimated Cost:	None
Funding Method:	N/A

Implementation Schedule:	Ongoing
Priority:	Moderate

AMD1 Mitigation Action: Albemarle County	
Goal:	Information and Data Development
Action Item Description:	Expand GIS data and capabilities and other technologies for the purposes of mitigation planning, preparedness planning, and response activities
Hazard (s):	Multiple
Lead Party Responsible:	Community Development Dept., TJPDC., FES, ECC
Estimated Cost:	Unknown
Funding Method:	General Revenue, Hazard Mitigation Grant Program, ESRI, Pre-Disaster Mitigation Grant, Dept. of Interior Geologic Mapping Program
Implementation Schedule:	Ongoing
Priority:	Moderate

ALE1 Mitigation Action: Albemarle County	
Goal:	Education and Outreach
Action Item Description:	Encourage property owners and residents to clear storm drain inlets, channels, creek beds, and other conveyances of fallen trees and debris to minimize the potential for flow restrictions and flooding.
Hazard (s):	Flood
Lead Party Responsible:	Facilities and Environmental Services Dept., ACOEM, CAPE
Estimated Cost:	Unknown, based on need
Funding Method:	General Revenue
Implementation Schedule:	Ongoing
Priority:	Low

ALE2 Mitigation Action: Albemarle County	
Goal:	Education and Outreach
Action Item Description:	Ensure all houses and businesses have clear address signs that are visible during snowstorms and other emergencies
Hazard (s):	Multiple
Lead Party Responsible:	Community Development Dept, Fire-Rescue Dept., County Executive's Office, IT, ECC, ACPD, CAPE
Estimated Cost:	$4,000
Funding Method:	General Revenues
Implementation Schedule:	Ongoing
Priority:	Low

ALE3 Mitigation Action: Albemarle County	
Goal:	Education and Outreach
Action Item Description:	Continue educational campaign about the benefits of open space and
sensitive area protection.	
Hazard (s):	Multiple
Lead Party Responsible:	Virginia Outdoors Foundation, Nature Conservancy, Thomas Jefferson Soil and Water Conservation District, Albemarle Conservation Easement, Community Development Dept., CAPE
Estimated Cost:	Variable
Funding Method:	County funding, State funds for farmland and open space preservation (VDACS Farmland Preservation)

Implementation Schedule:	Ongoing
Priority:	Low

ALE4 Mitigation Action: Albemarle County	
Goal:	Education and Outreach
Action Item Description:	Outdoor warning sirens for public use facilities
Hazard (s):	Multiple
Lead Party Responsible:	AC Parks and Rec, ACOEM
Estimated Cost:	Unknown
Funding Method:	County general fund, CIP, Grants
Implementation Schedule:	Ongoing
Priority:	Low

ALC1 Mitigation Action: Albemarle County	
Goal:	Whole Community
Action Item Description:	Increase the capacity to shelter in place in public buildings
Hazard (s):	Multiple
Lead Party Responsible:	ACOEM
Estimated Cost:	Unknown
Funding Method:	General Revenue, FEMA funds/grants
Implementation Schedule:	Ongoing
Priority:	Low

ALC2 Mitigation Action: Albemarle County	
Goal:	Whole Community
Action Item Description:	Promote biodiversity and native plant communities and control invasive species to improve the resilience of native ecosystems
Hazard (s):	Flood, drought, extreme heat
Lead Party Responsible:	CDD, FES
Estimated Cost:	Unknown
Funding Method:	County funding and grants
Implementation Schedule:	Ongoing
Priority:	Low

ALC3 Mitigation Action: Albemarle County	
Goal:	Whole Community
Action Item Description:	Develop communications strategy and protocols (both preparedness and response) using traditional and emerging outlets (local media, social media, etc.); consider languages besides English
Hazard (s):	Multiple
Lead Party Responsible:	CDD, ACOEM
Estimated Cost:	N/A
Funding Method:	N/A
Implementation Schedule:	1 year
Priority:	Low

ALC4 Mitigation Action: Albemarle County	
Goal:	Whole Community
Action Item Description:	Improve ability to notify public in the event of extreme storms and/or dam failure, possibly through utilizing river level sensors and a downstream notification system
Hazard (s):	Flood
Lead Party Responsible:	RWSA FES
Estimated Cost:	Unknown
Funding Method:	Various
Implementation Schedule:	3-5 years
Priority:	Low

ALC5 Mitigation Action: Albemarle County	
Goal:	Whole Community
Action Item Description:	Continue and expand the use of citizen alert systems. Explore use of Social Media platform emergency alert systems. Establish backup procedures/plans for emergency notification/alert when methods relying on power & technology are inoperable
Hazard (s):	Multiple
Lead Party Responsible:	ACEOM, CAPE, ECC
Estimated Cost:	$5,000
Funding Method:	General Revenue
Implementation Schedule:	Ongoing
Priority:	Low

ALI1 Mitigation Action: Albemarle County	
Goal:	Infrastructure and Buildings
Action Item Description:	Implement Stormwater Management programs and initiatives to reduce flood risk throughout the community
Hazard (s):	Flood
Lead Party Responsible:	Facilities and Environmental Services Dept.
Estimated Cost:	Unknown, based on need
Funding Method:	County funding (CIP)
Implementation Schedule:	Ongoing
Priority:	Low

ALI2 Mitigation Action: Albemarle County	
Goal:	Infrastructure and Buildings
Action Item Description:	Improve the maintenance, repair, and upgrades to public and private stormwater management facilities and impoundments to withstand extreme storms and enhance flood control.
Hazard (s):	Flood
Lead Party Responsible:	Facilities and Environmental Services Dept.
Estimated Cost:	Unknown, based on individual projects
Funding Method:	County funding (CIP)
Implementation Schedule:	Ongoing
Priority:	Low

ALI3 Mitigation Action: Albemarle County	
Goal:	Infrastructure and Buildings
Action Item Description:	Partner with utility companies to keep power lines and other utilities free of vegetation
Hazard (s):	Multiple
Lead Party Responsible:	County Executive's Office, ACOEM
Estimated Cost:	Unknown
Funding Method:	N/A
Implementation Schedule:	Ongoing
Priority:	Low

ALI4 Mitigation Action: Albemarle County	
Goal:	Education and Outreach
Action Item Description:	Implement programs and initiatives to reduce pollution discharge via stormwater systems
Hazard (s):	Flood
Lead Party Responsible:	Community Development Dept., Facilities and Environmental Services
Estimated Cost:	Unknown, based on need
Funding Method:	EPA – Water Quality Cooperative Agreements, EPA-Nonpoint Source Grant Program, 406 Public Assistance (following a federally declared disaster), USDA-Watershed Protection and Flood Prevention Program, USDA-Environmental Quality Incentives Program, Stormwater Utility Fee
Implementation Schedule:	Ongoing
Priority:	Low

ASHC1 Mitigation Action: Town of Scottsville	
Goal:	Whole Community
Action Item Description:	Improve Regional Transit. Elderly and disabled residents need better transit options for emergency evacuations, as well as for prevention and resiliency.
Hazard (s):	Flooding
Lead Party Responsible:	JAUNT and CAT
Estimated Cost:	Dependent on improvements
Funding Method:	Unknown
Implementation Schedule:	Ongoing
Priority:	High

ASDM1 Mitigation Action: Town of Scottsville	
Goal:	Information and Data Development
Action Item Description:	Update the Town's Floodplain Maps. The maps date to 1996 and have several apparent errors from the current field truth. Using modern models and surveys, more accurate maps will inform many other decisions.
Hazard (s):	Flooding
Lead Party Responsible:	Town of Scottsville
Estimated Cost:	$123,000
Funding Method:	DCR Grant Funding
Implementation Schedule:	Work begins in 2022 and will be completed in 2023
Priority:	Moderate

ASEM1 Mitigation Action: Town of Scottsville	
Goal:	Education and Outreach
Action Item Description:	Improve Riparian Buffers. Healthy vegetative buffers are a very cost-effective way to mitigate flooding impacts. The Town has poor buffers along parts of Mink Creek and the James River.
Hazard (s):	Flooding
Lead Party Responsible:	Scottsville Town Administration
Estimated Cost:	$10,000
Funding Method:	Town general funds and grants from James River Association and VA Dept. of Forestry
Implementation Schedule:	Starts in 2022 and then ongoing
Priority:	Moderate

CHE1 Mitigation Action: City of Charlottesville	
Goal:	Education and Outreach
Action Item Description:	Provide training for building inspectors and code officials on mitigation
techniques and hazard-resistant building.	
Hazard (s):	Multiple
Lead Party Responsible:	Neighborhood Development Services, Public Works
Estimated Cost:	$10,000
Funding Method:	Hazard Mitigation Grant Program, General Revenue
Implementation Schedule:	Ongoing
Priority:	High

CHE2 Mitigation Action: City of Charlottesville	
Goal:	Education and Outreach
Action Item Description:	Ensure that all city schools have an emergency and disaster plan and regularly conduct disaster response drills.
Hazard (s):	Multiple
Lead Party Responsible:	Public School System, independent private schools
Estimated Cost:	N/A
Funding Method:	N/A
Implementation Schedule:	Ongoing
Priority:	High

CHM1 Mitigation Action: City of Charlottesville	
Goal:	Mitigation Capacity
Action Item Description:	Complete Flood Resilience Plan
Hazard (s):	
Lead Party Responsible:	
Estimated Cost:	
Funding Method:	
Implementation Schedule:	
Priority:	

CHM2 Mitigation Action: City of Charlottesville	
Goal:	Mitigation Capacity
Action Item Description:	Complete Climate Adaptation plan
Hazard (s):	
Lead Party Responsible:	
Estimated Cost:	
Funding Method:	
Implementation Schedule:	
Priority:	

CHM3 Mitigation Action: City of Charlottesville	
Goal:	Mitigation Capacity
Action Item Description:	Update floodplain regulations
Hazard (s):	
Lead Party Responsible:	
Estimated Cost:	
Funding Method:	
Implementation Schedule:	
Priority:	

CHM4 Mitigation Action: City of Charlottesville	
Goal:	Mitigation Capacity
Action Item Description:	Incorporate hazard mitigation plan into community plans. Identify senior living/special needs residences in areas vulnerable for flooding.
Hazard (s):	Multiple
Lead Party Responsible:	Neighborhood Development Services
Estimated Cost:	None
Funding Method:	N/A
Implementation Schedule:	3-5 years
Priority:	High

CHM5 Mitigation Action: City of Charlottesville	
Goal:	Mitigation Capacity
Action Item Description:	Conduct Community Emergency Response Team (CERT) classes to equip individuals and groups to assist in the event of a disaster.
Hazard (s):	Multiple
Lead Party Responsible:	Emergency Services Coordinator
Estimated Cost:	$10,000
Funding Method:	FEMA Community Emergency Response Teams, FEMA Emergency
Management Performance Grant	
Implementation Schedule:	Ongoing
Priority:	High

CHM6 Mitigation Action: City of Charlottesville	
Goal:	Mitigation Capacity
Action Item Description:	Provide incentives to institutions and homeowners for use of low-flow appliances.
Hazard (s):	Drought
Lead Party Responsible:	Neighborhood Development Services
Estimated Cost:	None
Funding Method:	N/A
Implementation Schedule:	Ongoing
Priority:	High

CHM7 Mitigation Action: City of Charlottesville	
Goal:	Mitigation Capacity
Action Item Description:	Continue to expand use of citizen alert system. (Code RED) Develop community promotion plan for Code RED.
Hazard(s):	Multiple
Lead Party Responsible:	Regional Emergency Management Coordinator, City OEM
Estimated Cost:	$5,000
Funding Method:	General Revenue
Implementation Schedule:	6-12 months
Priority:	High

CHM8 Mitigation Action: City of Charlottesville	
Goal:	Mitigation Capacity
Action Item Description:	Inventory all shelters and public buildings to ensure emergency preparedness supplies and equipment are onsite.
Hazard (s):	Multiple
Lead Party Responsible:	Emergency Services Coordinator
Estimated Cost:	$40/location
Funding Method:	General Revenue
Implementation Schedule:	Ongoing
Priority:	High

CMI1 Mitigation Action: City of Charlottesville	
Goal:	Infrastructure and Buildings
Action Item Description:	Build or repair roadway and pedestrian crossings so as not to impede floodwaters
Hazard (s):	Flood
Lead Party Responsible:	VDOT
Estimated Cost:	Unknown
Funding Method:	Hazard Mitigation Grant Program, 406 Public Assistance Program
Implementation Schedule:	When bridges are repaired/replaced
Priority:	Moderate

CMI2 Mitigation Action: City of Charlottesville	
Goal:	Infrastructure and Buildings
Action Item Description:	Retrofit emergency service buildings for hazard resistance.
Hazard (s):	Structural
Lead Party Responsible:	Emergency Services Coordinator
Estimated Cost:	Unknown
Funding Method:	All hazards Emergency Operations Planning, Assistance to Local Firefighters Grant, Local Hurricane Grant Program, Pre-Disaster Mitigation Grant, Hazard Mitigation Grant Program
Implementation Schedule:	3-5 years
Priority:	Moderate

CMI3 Mitigation Action: City of Charlottesville	
Goal:	Infrastructure and Buildings
Action Item Description:	Retrofit emergency service buildings for hazard resistance.
Hazard(s):	Structural
Lead Party Responsible:	Regional Emergency Management Coordinator, City OEM
Estimated Cost:	Unknown
Funding Method:	All hazards Emergency Operations Planning, Assistance to Local Firefighters Grant, Local Hurricane Grant Program, Pre-Disaster Mitigation Grant, Hazard Mitigation Grant Program
Implementation Schedule:	3-5 years
Priority:	Moderate

CMM1 Mitigation Action: City of Charlottesville	
Goal:	Mitigation Capacity
Action Item Description:	Support volunteer groups and encourage collaboration on public outreach and education programs on hazard mitigation.
Hazard (s):	Multiple
Lead Party Responsible:	All City Departments, Emergency Services Coordinator
Estimated Cost:	None
Funding Method:	N/A
Implementation Schedule:	Ongoing
Priority:	Moderate

CMM2 Mitigation Action: City of Charlottesville	
Goal:	Mitigation Capacity
Action Item Description:	Create a strategy for using existing media outlets for communications
during a hazard event.	
Hazard (s):	Flood
Lead Party Responsible:	Office of Communications
Estimated Cost:	None
Funding Method:	N/A
Implementation Schedule:	Ongoing
Priority:	Moderate

CLE1 Mitigation Action: City of Charlottesville	
Goal:	Education and Outreach
Action Item Description:	Provide citizens with literature about flood and drought-smart landscaping.
Hazard (s):	Drought, Flooding
Lead Party Responsible:	Neighborhood Development Services, Public Works
Estimated Cost:	$5,000
Funding Method:	Pre-Disaster Mitigation Grant, Hazard Mitigation Grant Program, Annual DCR Flood Awareness Week
Implementation Schedule:	3-5 years
Priority:	Low

CLE2 Mitigation Action: City of Charlottesville	
Goal:	Education and Outreach
Action Item Description:	Create educational campaign about floodplain locations, the benefits of open space and riparian corridors.
Hazard (s):	Multiple
Lead Party Responsible:	Public Works
Estimated Cost:	$50,000
Funding Method:	Hazard Mitigation Grant Program, Community Flood Preparedness grant , Citywide Floodplain Management NFIP
Implementation Schedule:	Ongoing
Priority:	Low

CLI1 Mitigation Action: City of Charlottesville	
Goal:	Infrastructure and Buildings
Action Item Description:	Improve the maintenance of stormwater infrastructure.
Hazard(s):	Flood
Lead Party Responsible:	Public Works
Estimated Cost:	Unknown
Funding Method:	Environmental Protection Agency – Water Quality Cooperative Agreements, EPA-Nonpoint Source Grant Program, 406 Public Assistance (following a federally declared disaster), USDA-Watershed Protection and Flood Prevention Program, USDA-Environmental Quality Incentives Program, Stormwater Utility Fee, Community Flood Preparedness Grants
Implementation Schedule:	Ongoing
Priority:	Low

CLI2 Mitigation Action: City of Charlottesville	
Goal:	Infrastructure and Buildings
Action Item Description:	Reduce pollution discharge to and erosive conditions in receiving waters.
Hazard(s):	Flood
Lead Party Responsible:	Public Works
Estimated Cost:	Unknown, based on need
Funding Method:	Environmental Protection Agency – Water Quality Cooperative Agreements, EPA-Nonpoint Source Grant Program, 406 Public Assistance (following a federally declared disaster), USDA-Watershed Protection and Flood Prevention Program, USDA-Environmental Quality Incentives Program, Stormwater Utility Fee, Stormwater Local Assistance Fund

Implementation Schedule:	Ongoing
Priority:	Low

CLI3 Mitigation Action: City of Charlottesville	
Goal:	Infrastructure and Buildings
Action Item Description:	Retrofit stormwater management basins
Hazard(s):	Flood
Lead Party Responsible:	Public Works
Estimated Cost:	Unknown, based on individual projects
Funding Method:	EPA – Water Quality Cooperative Agreements, EPA-Nonpoint Source Grant Program, 406 Public Assistance (after a federally declared disaster), USDA-Watershed Protection and Flood Prevention Program, USDA-Environmental Quality Incentives Program, Stormwater Utility Fee
Implementation Schedule:	Ongoing
Priority:	Low

CLI4 Mitigation Action: City of Charlottesville	
Goal:	Infrastructure and Buildings
Action Item Description:	Retrofit stormwater management basins
Hazard(s):	Flood
Lead Party Responsible:	Public Works
Estimated Cost:	Unknown, based on individual projects
Funding Method:	EPA – Water Quality Cooperative Agreements, EPA-Nonpoint Source Grant Program, 406 Public Assistance (after a federally declared disaster), USDA-Watershed Protection and Flood Prevention Program, USDA-Environmental Quality Incentives Program, Stormwater Utility Fee
Implementation Schedule:	Ongoing
Priority:	Low

FHE1 Mitigation Action: Fluvanna County	
Goal:	Education and Outreach
Action Item Description:	Increase the number of trained emergency responders, both staff and volunteers
Hazard (s):	Multiple
Lead Party Responsible:	Emergency Services Coordinator
Estimated Cost:	$3,000
Funding Method:	
Implementation Schedule:	1-3 years
Priority:	High

FHI1 Mitigation Action: Fluvanna County	
Goal:	Infrastructure and Buildings
Action Item Description:	Install new fire hydrants along new JRWA water line
Hazard (s):	Multiple
Lead Party Responsible:	Public Works
Estimated Cost:	$200,000
Funding Method:	Grants, Fund balance

Implementation Schedule:	1-3 years
Priority:	High

FHC1 Mitigation Action: Fluvanna County	
Goal:	Whole Community
Action Item Description:	Conduct regular disaster response drills in schools, and with staff at Assisted Living Facilities and Nursing Homes
Hazard (s):	Multiple
Lead Party Responsible:	Emergency Services Coordinator, Schools
Estimated Cost:	Staff time
Funding Method:	n/a
Implementation Schedule:	Annual
Priority:	High

FHC2 Mitigation Action: Fluvanna County	
Goal:	Whole Community
Action Item Description:	Continue and expand the use of citizen alert systems
Hazard (s):	Multiple
Lead Party Responsible:	Public Safety
Estimated Cost:	$10,000
Funding Method:	
Implementation Schedule:	Ongoing
Priority:	High

FHC3 Mitigation Action: Fluvanna County	
Goal:	Whole Community
Action Item Description:	Implement community notification protocols before, during, and after a disaster event
Hazard (s):	Multiple
Lead Party Responsible:	Public Safety
Estimated Cost:	
Funding Method:	
Implementation Schedule:	1-3 years
Priority:	High

FHM1 Mitigation Action: Fluvanna County	
Goal:	Mitigation Capacity
Action Item Description:	Develop Continuity of Operations Plans (COOP) for locality departments and update the plans annually
Hazard (s):	Multiple
Lead Party Responsible:	Emergency Services Coordinator
Estimated Cost:	Staff time
Funding Method:	n/a
Implementation Schedule:	3-5 years
Priority:	High

FHM2 Mitigation Action: Fluvanna County	
Goal:	Mitigation Capacity
Action Item Description:	Develop Continuity of Operations Plans (COOP) for locality departments and update the plans annually
Hazard (s):	Multiple
Lead Party Responsible:	Emergency Services Coordinator
Estimated Cost:	Staff time
Funding Method:	n/a
Implementation Schedule:	3-5 years
Priority:	High

FME1 Mitigation Action: Fluvanna County	
Goal:	Education and Outreach
Action Item Description:	Carry out a targeted educational campaign in subdivisions at high risk for
fire impacts	
Hazard (s):	Multiple
Lead Party Responsible:	Emergency Services Coordinator and Fire-Rescue Association
Estimated Cost:	Staff time
Funding Method:	n/a
Implementation Schedule:	Ongoing
Priority:	Moderate

FME2 Mitigation Action: Fluvanna County	
Goal:	Education and Outreach
Action Item Description:	Conduct tabletop exercises for damage assessments
Hazard (s):	Multiple
Lead Party Responsible:	Emergency Services Coordinator; Public Works; Building Inspections
Estimated Cost:	Staff time
Funding Method:	n/a
Implementation Schedule:	1-3 years
Priority:	Moderate

FME3 Mitigation Action: Fluvanna County	
Goal:	Education and Outreach
Action Item Description:	Bring in experts to conduct in-house staff training in best management practices in hazard mitigation and preparedness
Hazard (s):	Multiple
Lead Party Responsible:	Emergency Services Coordinator, Public Works, Building Inspections
Estimated Cost:	$5,000
Funding Method:	grants
Implementation Schedule:	Ongoing
Priority:	Moderate

FME4 Mitigation Action: Fluvanna County	
Goal:	Education and Outreach
Action Item Description:	Offer training on post-event inspection and develop a protocol to serve as a mechanism for prioritization
Hazard (s):	Multiple
Lead Party Responsible:	Emergency Services Coordinator; Public Works; Building Inspections
Estimated Cost:	
Funding Method:	
Implementation Schedule:	In Progress
Priority:	Moderate

FMI1 Mitigation Action: Fluvanna County	
Goal:	Infrastructure and Buildings
Action Item Description:	Identify vulnerable structures and apply for funding to implement acquisition and demolition, relocation, floodproofing, or structural retrofit projects
Hazard (s):	Multiple
Lead Party Responsible:	Building Inspections, Emergency Services Coordinator
Estimated Cost:	
Funding Method:	
Implementation Schedule:	In Progress
Priority:	Moderate

FMI2 Mitigation Action: Fluvanna County	
Goal:	Infrastructure and Buildings
Action Item Description:	Install warning signs and develop alternate routes for roads that flood briefly during heavy rains (e.g. Slaters Fork Road, Carysbrook, farm pond
dam locations)	
Hazard (s):	Multiple
Lead Party Responsible:	VDOT
Estimated Cost:	$5,000
Funding Method:	Grants
Implementation Schedule:	1-3 years
Priority:	Moderate

FMM1 Mitigation Action: Fluvanna County	
Goal:	Mitigation Capacity
Action Item Description:	Identify areas to receive debris from post-event clean-up efforts
Hazard (s):	Multiple
Lead Party Responsible:	Public Works
Estimated Cost:	
Funding Method:	
Implementation Schedule:	1-3 years
Priority:	Moderate

FMD1 Mitigation Action: Fluvanna County	
Goal:	Information and Data Development
Action Item Description:	Expand GIS data for use in mitigation planning, preparedness planning,
and response activities	
Hazard (s):	Multiple
Lead Party Responsible:	Planning Administrator
Estimated Cost:	
Funding Method:	
Implementation Schedule:	Quarterly
Priority:	Moderate

FLE1 Mitigation Action: Fluvanna County	
Goal:	Education and Outreach
Action Item Description:	Carry out an educational campaign for businesses to develop emergency procedures and shel-ter-in-place plans
Hazard (s):	Multiple
Lead Party Responsible:	Emergency Services Coordinator
Estimated Cost:	Staff time
Funding Method:	n/a
Implementation Schedule:	1-3 years
Priority:	Low

FLI1 Mitigation Action: Fluvanna County	
Goal:	Infrastructure and Buildings
Action Item Description:	Identify repetitive loss properties, develop appropriate mitigation action, and apply for funding
Hazard (s):	Multiple
Lead Party Responsible:	Building Inspections, Emergency Services Coordinator
Estimated Cost:	
Funding Method:	
Implementation Schedule:	1-3 years
Priority:	Low

FLI2 Mitigation Action: Fluvanna County	
Goal:	Infrastructure and Buildings
Action Item Description:	Demolish and remove remains of old surface water-treatment plant located on TM 58 A 26 & 27(County-owned property)
Hazard (s):	Multiple, but primarily: 1) Property is in flood plain – materials, including a +/- 20,000 gallon water storage tank, could be washed downstream by flood waters. 2) Attractive nuisance.
Lead Party Responsible:	Public Works, FUSD, Building Inspections, Emergency Services Coordinator
Estimated Cost:	$25,000 (SWAG)
Funding Method:	Unknown
Implementation Schedule:	1-3 years
Priority:	Low

FLI3 Mitigation Action: Fluvanna County	
Goal:	Infrastructure and Buildings
Action Item Description:	Remove +/-20,000 gallon water storage tank from James River.
Hazard (s):	Multiple, but primarily flooding: 1) Future floods could dislodge it from its current resting place and wash it further down stream. 2) Attractive nuisance.
Lead Party Responsible:	Public Works, FUSD, Building Inspections, Emergency Services Coordinator
Estimated Cost:	$50,000 (SWAG)
Funding Method:	Unknown
Implementation Schedule:	1-3 years
Priority:	Low

FLM1 Mitigation Action: Fluvanna County	
Goal:	Mitigation Capacity
Action Item Description:	Develop a comprehensive fire safety communication strategy, addressing open space, burn permit, FireWise, and dry hydrants
Hazard (s):	Multiple
Lead Party Responsible:	Fire & Rescue Association, Emergency Services Coordinator
Estimated Cost:	Staff time
Funding Method:	
Implementation Schedule:	1-3 years
Priority:	Low

FLM2 Mitigation Action: Fluvanna County	
Goal:	Mitigation Capacity
Action Item Description:	Adopt fire code
Hazard (s):	Multiple
Lead Party Responsible:	Fire & Rescue Association, Emergency Services Coordinator
Estimated Cost:	Staff time
Funding Method:	n/a
Implementation Schedule:	1-3 years
Priority:	Low

FLM1 Mitigation Action: Fluvanna County	
Goal:	Mitigation Capacity
Action Item Description:	Develop evacuation plans for dam breaches from Charlottesville-area dams
Hazard (s):	Multiple
Lead Party Responsible:	Emergency Services Coordinator
Estimated Cost:	Staff time
Funding Method:	n/a
Implementation Schedule:	1-3 years
Priority:	Low

GHE1 Mitigation Action: Greene County	
Goal:	Education and Outreach
Action Item Description:	Conduct FireWise workshops
Hazard (s):	Wildfire
Lead Party Responsible:	Virginia Department of Forestry, Emergency Services Coordinator
Estimated Cost:	$1,000
Funding Method:	Virginia FireWise grant
Implementation Schedule:	1-3 Years
Priority:	High

GHI1 Mitigation Action: Greene County	
Goal:	Infrastructure and Buildings
Action Item Description:	Partner with utility companies to keep power lines free of vegetation
Hazard (s):	Multiple
Lead Party Responsible:	Department of Community Development, Emergency Services Coordinator
Estimated Cost:	Unknown
Funding Method:	N/A
Implementation Schedule:	Ongoing
Priority:	High

GHI2 Mitigation Action: Greene County	
Goal:	Infrastructure and Buildings
Action Item Description:	Conduct structural evaluations of all current and proposed shelters
Hazard (s):	Multiple
Lead Party Responsible:	Emergency Services Coordinator, Department of Community Development - Building Code and Inspections
Estimated Cost:	Staff time and resources; Red Cross provides technical assistance and
design criteria	
Funding Method:	N/A
Implementation Schedule:	Ongoing
Priority:	High

GHI3 Mitigation Action: Greene County	
Goal:	Infrastructure and Buildings
Action Item Description:	Implement recommendations from the Greene County Water Supply Plan
Hazard (s):	Drought, Flood, adequate potable water
Lead Party Responsible:	Department of Community Development, County Administrator
Estimated Cost:	$65 Million
Funding Method:	General Funds, BRIC, USDA, VDH
Implementation Schedule:	1-3 years
Priority:	High

GHI4 Mitigation Action: Greene County	
Goal:	Infrastructure and Buildings
Action Item Description:	Enhance dam safety; table tops/exercises
Hazard (s):	Multiple
Lead Party Responsible:	DCR, Department of Community Development, Emergency Services Coordinator
Estimated Cost:	Minimal
Funding Method:	N/A
Implementation Schedule:	1-2 years
Priority:	High

GHI5 Mitigation Action: Greene County	
Goal:	Infrastructure and Buildings
Action Item Description:	Install backup generators in shelters and critical facilities.
Hazard (s):	Multiple
Lead Party Responsible:	County Administrator, Emergency Services Coordinator
Estimated Cost:	$450,000 total
Funding Method:	Hazard Mitigation Grant Program, Pre-Disaster Mitigation Grant, All Hazards Emergency Operations Planning Grant
Implementation Schedule:	1-5 Years
Priority:	High

GHI6 Mitigation Action: Greene County	
Goal:	Infrastructure and Buildings
Action Item Description:	Enhance public safety emergency communications to provide reliable, dependable coverage
Hazard (s):	Multiple
Lead Party Responsible:	Emergency Services Coordinator
Estimated Cost:	$7,500,000
Funding Method:	General Revenue, Grants
Implementation Schedule:	In Progress – Target Completion date of Winter 2022
Priority:	High

GHI7 Mitigation Action: Greene County	
Goal:	Infrastructure and Buildings
Action Item Description:	Enhance access to broadband county-wide
Hazard (s):	Multiple
Lead Party Responsible:	County Administration
Estimated Cost:	Unknown
Funding Method:	General Revenue, Grants
Implementation Schedule:	Ongoing
Priority:	High

GHC1 Mitigation Action: Greene County	
Goal:	Whole Community
Action Item Description:	Assist the schools with regular disaster response drills and disaster planning
Hazard (s):	Multiple
Lead Party Responsible:	Public School System, Individual private schools
Estimated Cost:	N/A
Funding Method:	N/A
Implementation Schedule:	Ongoing
Priority:	High

GHM1 Mitigation Action: Greene County	
Goal:	Mitigation Capacity
Action Item Description:	Conduct CERT classes to equip individuals and groups to assist in the event of a disaster
Hazard (s):	Multiple
Lead Party Responsible:	Sheriff's Office
Estimated Cost:	Unknown
Funding Method:	FEMA CERT Grants
Implementation Schedule:	Ongoing
Priority:	High

GHM2 Mitigation Action: Greene County	
Goal:	Mitigation Capacity
Action Item Description:	Routinely inspect public and private fire hydrants
Hazard (s):	Wildfire
Lead Party Responsible:	Fire Departments, Rapidan Service Authority, responsible private parties
Estimated Cost:	None
Funding Method:	N/A
Implementation Schedule:	Ongoing
Priority:	High

GHM3 Mitigation Action: Greene County	
Goal:	Mitigation Capacity
Action Item Description:	Ensure all critical facilities have updated shelter-in-place plans
Hazard (s):	Multiple
Lead Party Responsible:	Building, Planning, Emergency Services Coordinator
Estimated Cost:	Minimal / Staff Time
Funding Method:	N/A
Implementation Schedule:	1-3 years
Priority:	High

GHM5 Mitigation Action: Greene County	
Goal:	Mitigation Capacity
Action Item Description:	Increase number of trained emergency responders and create recruitment and retention program
Hazard (s):	Multiple
Lead Party Responsible:	Office of Emergency Services, Volunteer fire and rescue agencies
Estimated Cost:	Unknown
Funding Method:	General Revenue
Implementation Schedule:	Ongoing
Priority:	High

GME1 Mitigation Action: Greene County	
Goal:	Education and Outreach
Action Item Description:	Develop cooperative agreements between all agencies involved in emergency management, provide methods of communication between agencies responsible for being present at Emergency Operations Center
following disaster, and conduct joint emergency exercises	
Hazard (s):	Multiple
Lead Party Responsible:	Emergency Services Coordinator
Estimated Cost:	None – Staff time
Funding Method:	N/A
Implementation Schedule:	Ongoing
Priority:	Moderate

GME2 Mitigation Action: Greene County	
Goal:	Education and Outreach
Action Item Description:	Create a community toolbox with tools and information for local homeowners
Hazard (s):	Multiple
Lead Party Responsible:	Office of Emergency Services, Department of Community Development
Estimated Cost:	$5,000
Funding Method:	Hazard Mitigation Grant Program, Pre-Disaster Mitigation Grant Program
Implementation Schedule:	3-5 years
Priority:	Moderate

GMI1 Mitigation Action: Greene County	
Goal:	Infrastructure and Building
Action Item Description:	Add signage to roads in locations that frequently flood
Hazard (s):	Flood
Lead Party Responsible:	Virginia Department of Transportation
Estimated Cost:	Unknown
Funding Method:	Public Assistance Program, Grants, General Revenue
Implementation Schedule:	1-3 years
Priority:	Moderate

GMI2 Mitigation Action: Greene County	
Goal:	Infrastructure and Buildings
Action Item Description:	Upgrade all area bridges to support emergency vehicles
Hazard (s):	Multiple
Lead Party Responsible:	VDOT
Estimated Cost:	Unknown
Funding Method:	Hazard Mitigation Grant Program, VDOT
Implementation Schedule:	As repairs are made
Priority:	Moderate

GMM1 Mitigation Action: Greene County	
Goal:	Mitigation Capacity
Action Item Description:	Develop and implement a Drought Management Plan
Hazard (s):	Drought
Lead Party Responsible:	Office of Emergency Services, Planning, Engineering Firm
Estimated Cost:	Unknown
Funding Method:	General Funds
Implementation Schedule:	Ongoing
Priority:	Moderate

GMM2 Mitigation Action: Greene County	
Goal:	Mitigation Capacity
Action Item Description:	Create a strategy for using existing media outlets for communications during a hazard event
Hazard (s):	Multiple
Lead Party Responsible:	Office of Emergency Services
Estimated Cost:	None
Funding Method:	N/A
Implementation Schedule:	Ongoing
Priority:	Moderate

GMM3 Mitigation Action: Greene County	
Goal:	Mitigation Capacity
Action Item Description:	Create a strategy for using existing media outlets for communications during a hazard event
Hazard (s):	Multiple
Lead Party Responsible:	Office of Emergency Services
Estimated Cost:	None
Funding Method:	N/A
Implementation Schedule:	Ongoing
Priority:	Moderate

GMD2 Mitigation Action: Greene County	
Goal:	Information and Data Development
Action Item Description:	Conduct channel improvement study
Hazard (s):	Floods
Lead Party Responsible:	Army Corps of Engineers, VMRC
Estimated Cost:	$50,000
Funding Method:	External Sources, grants
Implementation Schedule:	Watershed Protection and Flood Prevention Program (Department of Agriculture, National Resource Conservation Service)
Priority:	Moderate

GMD3 Mitigation Action: Greene County	
Goal:	Information and Data Development
Action Item Description:	Create a need survey that identifies special needs population and residences and/or facilities needing attention in the event of emergencies or evacuations
Hazard (s):	Multiple
Lead Party Responsible:	Emergency Services Coordinator, Social Services
Estimated Cost:	$3,000
Funding Method:	Hazard Mitigation Grant Program, Pre-Disaster Mitigation Grant, General
Revenue, All-Hazards Emergency Operations Planning	
Implementation Schedule:	1-3 years
Priority:	Moderate

GLE1 Mitigation Action: Greene County	
Goal:	Education and Outreach
Action Item Description:	Provide citizens with literature about flood and drought-smart landscaping
Hazard (s):	Multiple
Lead Party Responsible:	Department of Community Development
Estimated Cost:	$5,000
Funding Method:	Hazard Mitigation Grant Program, Pre-Disaster Mitigation Grant Program
Implementation Schedule:	3-5 years
Priority:	Low

GLI1 Mitigation Action: Greene County	
Goal:	Infrastructure and Buildings
Action Item Description:	Build and repair bridges so as not to impede floodwaters.
Hazard (s):	Flood
Lead Party Responsible:	Department of Community Development, VDOT
Estimated Cost:	Dependent upon number and type of structures.
Funding Method:	VDOT primary road funds, County secondary road funds, 406 Public Assistance Program (following a disaster), Hurricane Local Grant Program
Implementation Schedule:	5+ years
Priority:	Low

GLI2 Mitigation Action: Greene County	
Goal:	Infrastructure and Buildings
Action Item Description:	Ensure culverts, streams, channels, storm drains, and gutters remain clear of debris.
Hazard (s):	Flood
Lead Party Responsible:	Department of Community Development, VDOT, ACE, VMRC
Estimated Cost:	Minimal – staff time & labor
Funding Method:	General Revenue, EPA Chesapeake Bay Act
Implementation Schedule:	Ongoing
Priority:	Low

GLI3 Mitigation Action: Greene County	
Goal:	Infrastructure and Buildings
Action Item Description:	Install more dry hydrants in high wildfire risk areas
Hazard (s):	Wildfire
Lead Party Responsible:	Virginia Department of Forestry, Greene County Office of Em. Services
Estimated Cost:	Unknown
Funding Method:	Virginia Dry Hydrant Grant Program
Implementation Schedule:	3-5 years
Priority:	Low

GLI4 Mitigation Action: Greene County	
Goal:	Infrastructure and Building
Action Item Description:	Repair, replace, or relocate septic and drainage fields that leak sewage into bodies of water during flooding events
Hazard (s):	Flood
Lead Party Responsible:	Department of Community Development, Emergency Services Coordinator, RSA, DEQ
Estimated Cost:	Unknown
Funding Method:	General Fund, DEQ, USDA, VDH, Culpeper Soil and Water
Implementation Schedule:	5+ years
Priority:	Low

GLI5 Mitigation Action: Greene County	
Goal:	Infrastructure and Buildings
Action Item Description:	Bury utilities in the County
Hazard (s):	Multiple
Lead Party Responsible:	County Administrator, Department of Community Development, Emergency Services Coordinator
Estimated Cost:	Unknown
Funding Method:	CDBG, Pre-Disaster Mitigation Grant Programs
Implementation Schedule:	5+ years
Priority:	Low

GLM1 Mitigation Action: Greene County	
Goal:	Mitigation Capacity
Action Item Description:	Ensure all houses have clear address signs that are visible
Hazard (s):	Multiple
Lead Party Responsible:	Planning Department
Estimated Cost:	None
Funding Method:	N/A
Implementation Schedule:	Ongoing
Priority:	Low

GSHM1 Mitigation Action: Town of Stanardsville	
Goal:	Mitigation Capacity
Action Item Description:	Increase water capacity and pressure for the Town of Stanardsville to enable optimal emergency response
Hazard (s):	Multiple
Lead Party Responsible:	Rapidan Service Authority
Estimated Cost:	$12 million
Funding Method:	RSA funds, Community Development Block Grant, BRIC, EPA, USDA, VDH
Implementation Schedule:	2-4 years
Priority:	High

GSMM1 Mitigation Action: Town of Stanardsville	
Goal:	Mitigation Capacity
Action Item Description:	Ensure all houses have clear address signs that are visible
Hazard (s):	Multiple
Lead Party Responsible:	Town Manager
Estimated Cost:	None
Funding Method:	N/A
Implementation Schedule:	Ongoing
Priority:	Moderate

LHI1 Mitigation Action: Louisa County	
Goal:	Infrastructure and Buildings
Action Item Description:	Enhance access to broadband internet in rural areas
Hazard (s):	Multiple
Lead Party Responsible:	Louisa County Broadband Authority
Estimated Cost:	Unknown
Funding Method:	Partnership Firefly Fiber Broadband, Dominion Energy, TJPDC, REC, CVEC
Implementation Schedule:	Ongoing
Priority:	High

LHI2 Mitigation Action: Louisa County	
Goal:	Infrastructure and Buildings
Action Item Description:	Install backup generators in shelters and critical facilities.
Hazard (s):	Multiple
Lead Party Responsible:	General Services Department
Estimated Cost:	$15,000-$25,000/generator
Funding Method:	Hazard Mitigation Grant Program, Pre-Disaster Mitigation Grant, All Hazards Emergency Operations Planning Grant
Implementation Schedule:	1-5 Years
Priority:	High

LHI3 Mitigation Action: Louisa County	
Goal:	Infrastructure and Buildings
Action Item Description:	Implement recommendations from the Water Supply Plan
Hazard (s):	Drought, Flood
Lead Party Responsible:	County Administration (Support: Community Development Department, LCWA)
Estimated Cost:	$150 - $200 million
Funding Method:	General Revenue, Flood control, and dam safety program funds
Implementation Schedule:	Ongoing
Priority:	High

LHC1 Mitigation Action: Louisa County	
Goal:	Whole Community
Action Item Description:	Ensure that all schools have regular disaster response drills
Hazard (s):	Multiple
Lead Party Responsible:	Public School System & Individual private schools
Estimated Cost:	Staff Time and Resources
Funding Method:	N/A
Implementation Schedule:	Ongoing
Priority:	High

LHM1 Mitigation Action: Louisa County	
Goal:	Mitigation Capacity
Action Item Description:	Provide training for building inspectors and code officials on mitigation techniques and hazard-resistant building.
Hazard (s):	Multiple
Lead Party Responsible:	Community Development Department / Building
Estimated Cost:	$10,000
Funding Method:	Hazard Mitigation Grant Program, General Revenue
Implementation Schedule:	1-3 years
Priority:	High

LHM2 Mitigation Action: Louisa County	
Goal:	Mitigation Capacity
Action Item Description:	Continue and expand use of the citizen alert system, including with towns.
Hazard (s):	Multiple
Lead Party Responsible:	Emergency Coordinator
Estimated Cost:	$10,000
Funding Method:	General Revenue
Implementation Schedule:	Ongoing
Priority:	High

LHM3 Mitigation Action: Louisa County	
Goal:	Mitigation Capacity
Action Item Description:	Increase number of trained emergency responders
Hazard (s):	Multiple
Lead Party Responsible:	Fire & EMS Department
Estimated Cost:	Unknown
Funding Method:	Unknown
Implementation Schedule:	Ongoing
Priority:	High

LHM4 Mitigation Action: Louisa County	
Goal:	Mitigation Capacity
Action Item Description:	Develop driveway codes to allow access for emergency vehicles.
Hazard (s):	Multiple
Lead Party Responsible:	Community Development Department / Building & Fire & EMS Department
Estimated Cost:	Staff time
Funding Method:	Unknown
Implementation Schedule:	1-3 years
Priority:	Moderate

LHM5 Mitigation Action: Louisa County	
Goal:	Mitigation Capacity
Action Item Description:	Work to prevent stormwater and wastewater flooding in water bodies across the County
Hazard (s):	Flooding
Lead Party Responsible:	County of Louisa
Estimated Cost:	Staff time and resources
Funding Method:	BRIC, HMGP, DEQ Preparedness Grants, other state and federal funding sources
Implementation Schedule:	Ongoing
Priority:	High

LMI2 Mitigation Action: Louisa County	
Goal:	Infrastructure and Buildings
Action Item Description:	Investigate, plan and implement repairs and/or upgrades to Bowlers Mill dam to preserve flood control benefits for the historic Green Springs area.
Hazard (s):	Flood
Lead Party Responsible:	Louisa County Water Authority
Estimated Cost:	$3 to $4 million
Funding Method:	Natural Resources Conservation Service (NRCS), Hazard Mitigation Grant Program, Pre-Disaster Mitigation Grant, County funds
Implementation Schedule:	4-15 years
Priority:	Moderate

LMM1 Mitigation Action: Louisa County	
Goal:	Mitigation Capacity
Action Item Description:	Investigate safety and maintenance of roads in private communities.
Hazard (s):	Multiple
Lead Party Responsible:	Fire & EMS Department, Community Development Department / Planning / Building
Estimated Cost:	Staff Time and Resources
Funding Method:	Unknown
Implementation Schedule:	2-5 years
Priority:	Moderate

LMM2 Mitigation Action: Louisa County	
Goal:	Mitigation Capacity
Action Item Description:	Conduct Community Emergency Response Team (CERT) classes to equip individuals and groups to assist in the event of a disaster.
Hazard (s):	Multiple
Lead Party Responsible:	Emergency Coordinator
Estimated Cost:	$10,000
Funding Method:	FEMA Community Emergency Response Teams, FEMA Emergency Management Performance Grant
Implementation Schedule:	Ongoing
Priority:	Moderate

LMM4 Mitigation Action: Louisa County	
Goal:	Mitigation Capacity
Action Item Description:	Incorporate hazard mitigation plan into community plans
Hazard (s):	Multiple
Lead Party Responsible:	Department of Community Development / Planning
Estimated Cost:	None
Funding Method:	N/A
Implementation Schedule:	1-2 years
Priority:	Moderate

LMM5 Mitigation Action: Louisa County	
Goal:	Mitigation Capacity
Action Item Description:	Incorporate Special Needs Populations into Mitigation and Emergency Operations Plans
Hazard (s):	Multiple
Lead Party Responsible:	Department of Human Services and Fire & EMS Department
Estimated Cost:	Staff time and resources.
Funding Method:	N/A
Implementation Schedule:	1-3 years
Priority:	Moderate

LLE2 Mitigation Action: Louisa County	
Goal:	Education and Outreach
Action Item Description:	Create an educational program to help residents understand the benefits and costs of earthquake insurance.
Hazard (s):	Earthquake
Lead Party Responsible:	Insurance Companies (Support Staff: County Administration)
Estimated Cost:	None
Funding Method:	Unknown
Implementation Schedule:	Ongoing
Priority:	Low

LLHI1 Mitigation Action: Town of Louisa	
Goal:	Infrastructure and Buildings
Action Item Description:	Install backup generators in shelters and critical facilities – the Town Hall generator will be upgraded to serve as a shelter during emergencies
Hazard (s):	Multiple
Lead Party Responsible:	Town of Louisa
Estimated Cost:	$5,000-$7,000 – the generator is currently installed at the Town Hall location, upgrades will be performed to accommodate an emergency shelter
Funding Method:	General Revenue/Reserves
Implementation Schedule:	2023
Priority:	High

LLMM1 Mitigation Action: Town of Louisa	
Goal:	Mitigation Capacity
Action Item Description:	Ensure all houses have clear address signs that are visible during snowstorms
Hazard (s):	Winter Storms, Multiple
Lead Party Responsible:	Town Manager
Estimated Cost:	None
Funding Method:	N/A
Implementation Schedule:	Ongoing
Priority:	Moderate

LLHM1 Mitigation Action: Town of Louisa	
Goal:	Mitigation Capacity
Action Item Description:	Incorporate hazard mitigation plan into community plans
Hazard (s):	Multiple
Lead Party Responsible:	Department of Community Development - Planning
Estimated Cost:	None
Funding Method:	N/A
Implementation Schedule:	1-2 years
Priority:	High

LMHM1 Mitigation Action: Town of Mineral	
Goal:	Mitigation Capacity
Action Item Description:	Incorporate hazard mitigation plan into community plans
Hazard (s):	Multiple
Lead Party Responsible:	Town Manager
Estimated Cost:	Staff time only
Funding Method:	Local funds
Implementation Schedule:	1-2 years
Priority:	High

LMMM1 Mitigation Action: Town of Mineral	
Goal:	Mitigation Capacity
Action Item Description:	Ensure all houses have clear address signs that are visible during snowstorms
Hazard (s):	Winter Storms, Multiple
Lead Party Responsible:	Town Manager
Estimated Cost:	None
Funding Method:	N/A
Implementation Schedule:	Ongoing
Priority:	Moderate

LMMM2 Mitigation Action: Town of Mineral	
Goal:	Mitigation Capacity
Action Item Description:	Work with the Louisa County to designate a representative for the County's Emergency Operations Committee
Hazard (s):	Multiple
Lead Party Responsible:	Town Manager
Estimated Cost:	Staff Time only
Funding Method:	N/A
Implementation Schedule:	1-2 years
Priority:	Moderate

LMMM3 Mitigation Action: Town of Mineral	
Goal:	Mitigation Capacity
Action Item Description:	Develop a system for alerts and other communication with citizens
Hazard (s):	Multiple
Lead Party Responsible:	Town Manager
Estimated Cost:	Unknown
Funding Method:	Local Funds, All Hazards Emergency Operations Planning Grant
Implementation Schedule:	2-6 years
Priority:	Moderate

LMMI1 Mitigation Action: Town of Mineral	
Goal:	Infrastructure and Buildings
Action Item Description:	Mark the fire hydrants with reflective markers for large snow storms
Hazard (s):	Winter Storms
Lead Party Responsible:	Town Manager
Estimated Cost:	$1,000
Funding Method:	Local Funds
Implementation Schedule:	1-2 years
Priority:	Moderate

LMMI2 Mitigation Action: Town of Mineral	
Goal:	Infrastructure and Buildings
Action Item Description:	Install emergency generator for wells
Hazard (s):	Multiple
Lead Party Responsible:	Town Manager
Estimated Cost:	$5,000-$15,000/generator
Funding Method:	Hazard Mitigation Grant Program, Pre-Disaster Mitigation Grant, All Hazards Emergency Operations Planning Grant
Implementation Schedule:	2-4 years
Priority:	Moderate

LMLI1 Mitigation Action: Town of Mineral	
Goal:	Infrastructure and Buildings
Action Item Description:	Bury utilities underground in Town of Mineral
Hazard (s):	Winter Storms, Multiple
Lead Party Responsible:	Town Manager
Estimated Cost:	Unknown
Funding Method:	Community Development Block Grant, Pre-hazard mitigation funds
Implementation Schedule:	5+ Years
Priority:	Low

NHM1 Mitigation Action: Nelson County	
Goal:	Mitigation Capacity
Action Item Description:	Continue and expand use of the citizen alert system.
Hazard (s):	Multiple
Lead Party Responsible:	Emergency Services Coordinator
Estimated Cost:	$5,000
Funding Method:	General Revenue
Implementation Schedule:	Ongoing
Priority:	High

NHM2 Mitigation Action: Nelson County	
Goal:	Mitigation Capacity
Action Item Description:	Provide training for building inspectors and code officials on mitigation techniques and hazard-resistant building.
Hazard (s):	Multiple
Lead Party Responsible:	Department of Public Works
Estimated Cost:	$10,000
Funding Method:	Hazard Mitigation Grant Program, General Revenue
Implementation Schedule:	1-3 years
Priority:	High

NME1 Mitigation Action: Nelson County	
Goal:	Education and Outreach
Action Item Description:	Conduct FireWise workshops.
Hazard (s):	Wildfire
Lead Party Responsible:	Virginia Department of Forestry, Emergency Services Coordinator
Estimated Cost:	$2,000
Funding Method:	Virginia FireWise Grant, General Revenue
Implementation Schedule:	2-5 years
Priority:	Moderate

NME2 Mitigation Action: Nelson County	
Goal:	Education and Outreach
Action Item Description:	Provide educational instruction and materials to school age youth and their teachers on proper procedures for responding to natural disasters
Hazard (s):	Multiple
Lead Party Responsible:	Emergency Services Coordinator, Public Schools
Estimated Cost:	$5,000
Funding Method:	General Revenue
Implementation Schedule:	3-5 Years
Priority:	Moderate

NMM1 Mitigation Action: Nelson County	
Goal:	Mitigation Capacity
Action Item Description:	Ensure all houses have clear address signs that are visible during snowstorms
Hazard (s):	Winter Storms, Multiple
Lead Party Responsible:	County Administrator
Estimated Cost:	None
Funding Method:	N/A
Implementation Schedule:	Ongoing
Priority:	Moderate

NLE1 Mitigation Action: Nelson County	
Goal:	Education and Outreach
Action Item Description:	Ensure that all homeowners and businesses located in areas prone to landslides are aware of the risks and appropriate responses to an event
Hazard (s):	Landslides
Lead Party Responsible:	Planning Department
Estimated Cost:	Staff Time
Funding Method:	N/A
Implementation Schedule:	Ongoing
Priority:	Low

NLI2 Mitigation Action: Nelson County	
Goal:	Infrastructure and Building
Action Item Description:	Maintain and add more fire rings in camping areas for controlled fires.
Hazard (s):	Multiple
Lead Party Responsible:	Nelson Recreation Department, Private Campground Owners, National Park Service
Estimated Cost:	$50,000
Funding Method:	General Revenue, Hazard Mitigation Grant Program
Implementation Schedule:	5+ years
Priority:	Low